February 24, 2017

Mining Authorizations
Alberta Energy Regulator
9915 Franklin Avenue
2nd Floor Provincial Building,
Box 15, Fort McMurray, AB T9H 2K4

Attention: Erik Kuleba, Director, Mining Authorizations

RE: **Fort Hills Mine Amendment Application**
OSCA Approval No. 9241
EPEA Approval No. 151469
Water Act Approval No. 151636

Dear Mr. Kuleba:

Suncor Energy Operating Inc. submits on behalf of the Fort Hills Energy Corporation, the *Fort Hills Mine Amendment (FHMA)* Application to the Alberta Energy Regulator to amend *Oil Sands Conservation Act* (OSCA) Approval No. 9241E, *Environmental Protection and Enhancement Act* (EPEA) Approval No. 151469-01-00, and Water Act Approval No. 151636-01-00 (as amended) pursuant to Sections 10 and 13 of OSCA, Sections 66 and 70 of EPEA, and pursuant to Section 40 subsection 1b(i) of the Water Act.

As a new mine in the oil sands region, Fort Hills has had the opportunity to apply the knowledge acquired from past mining, tailings and reclamation operations while not being burdened by legacy constraints. Throughout this work, the following principles have been used to guide our planning efforts to:

- Establish outcomes that consider and incorporate the interests of Aboriginal communities and stakeholders;
- Establish a stable closure landscape integrated into the regional ecosystem;
- Facilitate progressive reclamation by integrating mine, tailings and reclamation planning to ensure land is reclaimed permanently as early as practicable;
- Manage lifecycle costs and net environmental impacts; and
- Recognize the importance of flexibility and choices in order to incorporate innovations throughout the mine life.

Development work at Fort Hills has continued in several key areas in accordance with these guiding principles. As well, in 2015, the Government of Alberta issued the *Tailings Management Framework for the Mineable Athabasca Oil Sands* (TMF) as policy direction to the Alberta Energy Regulator (AER). The policy's objective is that "fluid tailings accumulation is minimized by ensuring that fluid tailings are treated and reclaimed progressively during the life of a project, while balancing environmental, social and economic needs." In 2016 the Alberta Energy Regulator released Directive 085: *Fluid Tailings Management for Oil Sands Mining Projects* (TD). These activities have culminated in the development of a plan that integrates the management of saline basal water, mining, tailings, with reclamation and closure and is in alignment with the objectives of the TMF.

To execute this integrated plan, Fort Hills has made changes to its mine and closure plans; these changes are requested in the attached FHMA Application, which details the changes to the Project area, saline basal water management, and includes an updated Reclamation and Closure Plan. This submission was developed in concert with the Fort Hills Oil Sands Project Tailings Management Plan which aligns with the objectives of TMF and the requirements of the TD. This document has been submitted under separate cover.

Please contact Mike Robinson at (403) 296-6120 or mrrobinson@suncor.com should you have questions regarding this application, or myself at (403) 296-3608.

Yours truly,

SUNCOR ENERGY INC.

Jason Heisler
Manager EH&S, Regulatory Approvals, Oil Sands
Suncor Energy Services Inc.

Cc: Rob Cruickshank, Tania de Silva, Stacy MacDonald (AER)

FORT HILLS ENERGY L.P.

FORT HILLS OIL SANDS PROJECT

2017 Fort Hills Mine Amendment Application

February, 2017

Operated by SUNCOR ENERGY

EXECUTIVE SUMMARY

Fort Hills is committed to the balanced and responsible development of the oil sands resource and this is important to the communities in which we operate. Based upon prior approvals, the Fort Hills Oil Sands Project (the Project) is currently under construction and is expected to begin production later in 2017.

Since approval, Fort Hills has continued development work in several key areas, including:

- saline basal water management (SBWM);
- tailings management;
- optimization of the common lease boundary with Syncrude; and
- reclamation and closure planning.

As a new mine in the oil sands region, the project has the opportunity to apply the knowledge acquired from past mining, tailings and reclamation operations while not being burdened by legacy constraints. Fort Hills has invested significant effort, time and resources to develop an integrated plan that leverages these learnings and which considers the opportunities and interdependencies existing between SBWM, mining, tailings and reclamation and closure in an effort to improve the overall plan. This approach has resulted in a plan with decreased risk and increased confidence in closure. This approach is also in alignment with the Government of Alberta's Tailings Management Framework for the Mineable Oil Sands (TMF). Throughout this work, the following principles have been used to guide our planning efforts:

- To establish outcomes that consider and incorporate the interests of Aboriginal communities and other stakeholders;
- To establish a stable closure landscape integrated into the regional ecosystem;
- To facilitate progressive reclamation by integrating mine, tailings and reclamation planning to ensure land is reclaimed permanently as early as practicable;
- To manage life-cycle costs and net environmental impacts; and
- To recognize the importance of flexibility and choices in order to incorporate innovations throughout the mine life.

Through ongoing engagement, collaboration has continued with Aboriginal communities and stakeholders to better understand their issues and concerns with our operations and the short and long-term impacts on the environment. These issues, concerns and opportunities include the following:

- Integrity of tailings dykes;
- Impacts to surface water, groundwater and surrounding waterbodies;
- Impacts to land disturbance and wildlife; and
- Reclamation timelines and land access.

By considering the concerns of Aboriginal communities and stakeholders, and following the guiding principles outlined above, Fort Hills proposes the following improvements to this integrated plan through the Fort Hills Mine Amendment Application (FHMA).

Saline Basal Water Management

Saline basal water is natural ground water with high salt content that is found immediately below a small portion of the oil sands resource at the south end of the Fort Hills development area. Fort Hills recognizes the challenge SBWM poses, and over the past fifteen years of development has conducted detailed exploration, modelling, testing and pilots to understand how to best manage it in an effort to maximize resource recovery and minimize risk.

The proposed approach to manage most of the saline basal water is to leave a portion of the oil sands resource in the ground. In doing so, the geology in the first mining location acts as a natural barrier to isolate a significant portion of the saline basal water and allow for the safe and environmentally responsible recovery of the remaining resource.

As a result, Fort Hills will now recover 3.1 billion barrels of bitumen compared to the 3.4 billion barrels currently approved. These recovered barrels are approximately 0.9 billion barrels above regulated recovery requirements. This change will advance commencement of mining in the northern portion of the lease by 5 years.

This smaller initial mining area resulting from the proposed solution to manage SBWM has created an opportunity in the tailings plan for an immediate below grade tailings storage area early in the life of the operation. This has been a key consideration in the development of the tailings management plan as described below and has allowed mining and tailings activities to be decoupled.

Tailings Management

Using the guiding principles in alignment with the TMF objective and outcomes and considering the concerns of Aboriginal communities and stakeholders, Fort Hills has updated the tailings management plan. This plan has been improved from the current approved basis by factoring in site specific conditions including the smaller initial mining area resulting from SBWM and knowledge gained on tailings treatment to reduce risk and improve outcomes.

The revised integrated plan is based on several fundamentals:

- Use of the most recent, best available technology;
- Leverage existing/committed assets;
- The placement of treated fluid tailings (FT) below grade is inherently more safe;
- Minimize the footprint of treated FT in the closure landscape to improve confidence in closure;
- Decouple mining and tailings activities where possible to reduce risk;
- Reduce reliance on weather for treatment of FT to improve confidence in treatment;

- Treat FT from the start of production, using multiple technologies/approaches to reduce FT accumulation; and
- Apply learnings to increase confidence in closure outcomes.

This plan continues to manage FT from the start of production with thickeners as a part of the extraction process, providing the benefit of reduced energy requirements and a lower FT inventory. Some FT will continue to be generated, and will be stored in the Out of Pit Tailings Area (OPTA) until completion of the first mining area. This mining area will then be used as a below-grade dedicated disposal area (DDA) and the FT stored in the OPTA will receive additional treatment prior to being placed within the DDA. The additional treatment is based on commercially proven methods and rates, and produces a stable deposit by dewatering and limiting the mobility of materials such as bitumen and fines. The single DDA will contain all treated FT generated during the life of the project and serves to reduce the footprint of treated FT to approximately 5% of the closure landscape. Sand will be placed above-grade in an extension to the east of the OPTA. Once mining is complete in the second mining area sand deposition will move to below-grade placement. This approach decouples mining and tailings activities, decreases risk and increases confidence in closure.

The FHMA plan involves the following changes from the currently approved basis to realize these improvements. Sand will be stored east of OPTA in the location of one of the above grade DDAs and requires an increase in the project footprint. A single below grade DDA will replace several above grade DDAs and treatment of FT utilizing this DDA will commence in 2024 when mining is complete in the first mining area.

Project Footprint Optimization

Fort Hills has continued to optimize the lease boundary shared with Syncrude's Aurora North Mine, to the south. Syncrude and Fort hills have successfully established several commercial agreements by working collaboratively to resolve technical, timing and commercial issues associated with the common project boundary. The FHMA seeks to update the Fort Hills approval to align it with current commercial agreements. Changes proposed include:

- Increasing the footprint required east of OPTA to facilitate the tailings management plan. Providing sufficient above-grade sand storage to allow for the decoupling of mining and tailings activities in order to lower overall risk.
- Development of an in-situ pillar at the common mining pit boundary shared at the south end of the Fort Hills initial mining area to replace the prior approved mining and dyke construction scheme.

Reclamation and Closure Planning

Fort Hills has advanced the required submission of an updated Reclamation and Closure Plan and has included it as an attachment to this application. This submission is included to ensure the FHMA and Tailings Directive (TD) applications are supported by the information necessary to understand and address gaps as a result of changes to SBWM and tailings management.

Timelines to final closure of the site are consistent with the previous 2011 Reclamation and Closure Plan showing most of the site being reclaimed by 10 years after the end of mine life. This updated plan incorporates the changes to SBWM and tailings management to provide more confidence in reclamation timelines and outcomes. The approved Fort Hills plan involved the terrestrial closure of above grade DDAs. The FHMA plan is proposing a below grade DDA which would be capped with water for closure. The aquatic closure of the DDA is the best solution for Fort Hills based on current research and data. A benefit of this plan is that treated tailings are now distributed over less than 5% of the disturbed area and weak material prone to settlement are now being placed below grade and water capped for closure. This results in a plan where greater than 95% of the disturbed area does not involve the reclamation of treated FT reducing the closure risk in comparison to prior plans. In addition, the changes to SBWM minimize the amount of salt requiring management in the closure landscape. This integrated approach has leveraged site specific conditions to provide more confidence around reclamation timelines and outcomes.

Fort Hills will continue to improve and adapt the approach to reclamation and closure over the next fifty or more years of operation. Improvements specific to closure of the DDA will also be incorporated. Given this long duration of operations, a series of updates will be provided as progress is made. The first update will be prior to treated tailings placement in the DDA and others will occur as major milestones are reached.

The updated Reclamation and Closure Plan represents minimal change to the final closure outcome for the Project. One outlet is maintained to the Athabasca River to return surface drainage flows to the Athabasca River and the amount of terrestrial, wetland and aquatic ecosites at closure is consistent with prior plans and approvals.

Benefits of this approach

This integrated plan combines the best information on SBWM, mining, tailings, reclamation and closure to reduce risk and to provide several benefits over the approved basis for Fort Hills. These benefits include:

- Significantly less salt to manage during operations;
- Shorter closure timelines and more confidence in closure outcomes due to:
    - Less salt to manage in the closure landscape;
    - More of the surface for reclamation being solid materials such as sand and overburden due to the one focused below grade placement area for treated tailings;
    - The aquatic reclamation of material that will settle; and
- Fewer concerns with dyke integrity as low strength material is being treated and placed below grade;
- Reduced risk by taking an integrated approach that decouples mining and tailings activities to improve operability and increase confidence in outcomes; and

- Flexibility to adapt to site specific conditions and best positions Fort Hills to deliver improvements.

While this plan represents a significant improvement over the approved plan, Fort Hills will continue to invest and innovate to continue to improve this plan.

Environmental Effects Summary

The process for assessment of environmental changes associated with the FHMA plan focused on identification and evaluation of changes from the environmental conditions or residual environmental effects as approved for the Project. The FHMA Application area is located within a land use area currently or previously designated for development as part of the approved Project. The land use activities proposed under the FHMA are the same as currently approved. Implementation of the FHMA plan does not change the predicted effects to terrestrial resources, including soils, vegetation and wildlife.

The activities in the FHMA area are not predicted to have any material change on previously assessed and approved air emissions or noise levels associated with the Project. The air assessment conducted included an evaluation of changes in emissions from the approved operation, including the mine fleet activities and potential emissions from tailings areas.

The potential was assessed for the FHMA plan to have an effect on surface water and groundwater. The result of the assessment indicates that the FHMA plan does not change previous groundwater or surface water predictions for the Fort Hills project. Fort Hills has approved surface water and groundwater monitoring programs in place for the project and will continue to monitor water in accordance with these programs. There are no effects to fisheries as a result of the FHMA plan.

An updated Reclamation and Closure Plan has been developed for the FHMA area. This conceptual Reclamation and Closure Plan is consistent with the methods and approach detailed in the previous 2011 Reclamation and Closure Plan such that the developed lands will be reclaimed to develop into self-sustaining biologically diverse ecosystems and sees a closure topography composed primarily of terrestrial landforms with some wetland and aquatic features.

Required Amendments

The FHMA plan continues to use proven truck shovel mining methods to develop the oil sands resource, attains the same production levels as in prior approvals, utilizes the same extraction process and includes a less than 1% change in disturbed area to support operations as has been approved.

To execute this plan, Fort Hills will have to make some changes due to SBWM, tailings management, project footprint augmentation, and reclamation and closure. The FHMA details the changes to this integrated plan and the disturbed area and describes the requested approval amendments for the construction, operation, reclamation and closure of planned modification to the approved mine, tailings, and reclamation and closure plans as part of the Oilsands Commercial Scheme Approval 9241E (as amended), Environmental Protection and Enhancement Act (EPEA) Approval No. 151469-01-00 (as amended), and Water Act Approval No. 151636-01-00(as amended). The FHMA Application ensures the changes required have the necessary approvals in place for execution.

In 2015, the Government of Alberta issued the *Tailings Management Framework for the Mineable Athabasca Oil Sands* (TMF) as policy direction to the Alberta Energy Regulator (AER). The policy's objective is that "fluid tailings accumulation is minimized by ensuring that fluid tailings are treated and reclaimed progressively during the life of a project, while balancing environmental, social and economic needs." In 2016 the Alberta Energy Regulator released Directive 085: *Fluid Tailings Management for Oil Sands Mining Projects (TD).* The Fort Hills tailings management plan has been developed to be consistent with the objective and outcomes of the TMF and is aligned with the requirements of the TD. Fort Hills has submitted to the AER under separate cover, additional information regarding the tailings management approach in the Fort Hills Directive 85 Application for the Fort Hills Oil Sands Project Tailings Management Plan.

2017 FORT HILLS MINE AMENDMENT APPLICATION

TABLE OF CONTENTS

Page No.

LIST OF TABLES

Page No.

LIST OF FIGURES

Page No.

LIST OF APPENDICES

1. INTRODUCTION

1.1. Background

This Fort Hills Oil Sand Project Mine Amendment Application (FHMA) is submitted by Fort Hill Energy Corporation (FHEC), as the general partner of Fort Hills Energy L.P. (Fort Hills). Fort Hills is comprised of Suncor Energy Inc. (Suncor), Total E&P Canada Limited (TOTAL), Teck Resources Limited (Teck), and FHEC to approximate interests of 50.8% (Suncor), 29.2% (TOTAL), and 20% (Teck). FHEC holds Oil Sands Leases 7404080933, 7400120008 and 7404080932 on the east side of the Athabasca River, on behalf of FHELP, upon which the Fort Hills Oil Sands Project (the Project) footprint is situated. The Project, located approximately 90 km north of Fort McMurray (Figure 1-1), is a 190,000 barrel per calendar day open pit oil sands mine and bitumen extraction facility that is expected to begin commissioning activities in the latter half of 2017. Suncor Energy Operating Inc. (SEOI), a wholly-owned subsidiary of Suncor, is the contract operator for the Project. For the purposes of this Application, all references to SEOI are to be interpreted as SEOI acting as the agent of FHEC, as general partner for Fort Hills.

1.2. Regulatory History and Existing Approvals

The Project received initial regulatory approval in 2002 following submission by TrueNorth Energy L.P. (TrueNorth) then owner of the Project, of an Environmental Impact Assessment (EIA) and a subsequent public hearing. In 2005, Petro-Canada purchased a majority interest in FHELP and FHEC, holder of the Project Oil Sands Leases and regulatory approvals, and established Petro Canada Oil Sands Inc. (PCOSI) as contract operator of the Project.

In August 2007, PCOSI submitted a Mine Amendment Environmental Assessment (EA) to amend the mine plan and consolidate the planned tailings facility for the Project into a single larger Out-of-Pit-Tailings Area (OPTA). The 2007 application to amend the mine plan maximized resource recovery and increased the recovered bitumen from 2.8 to 4.0 billion barrels and also extended the mine life to 2084. In 2008, ERCB approved some components of the amended mine plan with the exception of the increase in recovered bitumen. The 2008 ERCB decision report requested further detail be provided in a subsequent project update application which was submitted by FHEC in 2010.

In August 2009, Petro-Canada merged its assets and operations with those of Suncor. In 2010, a Project update was submitted by FHEC (2010) to provide further information in support of PCOSI's 2007 request to increase resource recovery. The 2010 project update (FHEC 2010) also included technical information to meet Energy Resources Conservation Board (ERCB) newly mandated Directive 074 requirements to establish Dedicated Disposal Areas (DDA). ERCB issued an amended commercial scheme approval for the Project in January 2013.

Fort Hills has also submitted applications to renew its Environmental Protection and Enhancement Act (EPEA) Approval, Water Act Approval, and Water Act Licence. A renewed EPEA approval was issued by Alberta Energy Regulator (AER) in November 2014, and a renewed Water Act Approval and Water Act Licence to Divert Water were issued by AER in December 2015.

Key existing Regulatory approvals for the Project are:

- Approval 9241E issued under the *Oil Sands Conservation Act* by ERCB, now AER;
- Approval 151469-01-00 (and subsequent amendments / renewals) issued under the *Environmental Protection and Assessment Act* by AER;
- Approval 00151636-01-00 (and subsequent amendments) issued under the Alberta *Water Act* by AER;
- Water Licence 00190012-01-00 (and subsequent amendments) issued under the Alberta *Water Act* by AER; and,
- Authorization AB00-517-2013 issued under the *Fisheries Act* by Fisheries and Oceans Canada (DFO).

1.3. Overview

Suncor has established guiding principles for mine, tailings, reclamation and closure planning. These principles are aligned with the TMF objective and outcomes, balancing environmental, social and economic considerations. A commitment to the balanced and responsible development of the oil sands is important to Fort Hills and the communities in which we operate.

Fort Hills shares this commitment with Suncor and has invested significant effort, time and resources to improve the integrated plan and uses the following principles to guide the planning efforts for the Project:

- To establish outcomes that consider and incorporate the interests of Aboriginal communities and stakeholders
- To establish a stable closure landscape integrated into the regional ecosystem
- To facilitate progressive reclamation by integrating mine, tailings and reclamation planning to ensure land is reclaimed permanently as early as practicable
- To manage life-cycle costs and net environmental impacts
- To recognize the importance of flexibility and choices in order to incorporate innovations throughout the mine life.

Building on the knowledge gained through continued work in several key areas, saline basal water management, tailings management, optimization of the common lease boundary with Syncrude and reclamation and closure planning, and following our principles Fort Hills has updated its integrated plan.

Summaries of these key areas are provided below for Basal Water Management (Section 1.3.1), Tailings Management (Section 1.3.2), and Reclamation and Closure Planning (Section 1.3.3). The optimization of the common lease boundary is incorporated in Section 2.9 (South Pit Recoverable Resource Summary), and Section 3.3.1.1 (South Pit). The integrated plan, which is outlined in the technical section of the FHMA, improves closure outcomes, reduces risk and provides a solution which is further optimized to our site specific conditions. Specific items requested for approval in the FHMA are outlined in Section 1.5 (Amendments Requested).

1.3.1. Basal Water Management

The Basal Aquifer that underlies Fort Hills contains fresh and saline water. Portions of this aquifer need to be depressurized prior to mining to allow for safe resource recovery. To develop the Approved South Pit, Fort Hills would need to manage 34 Mm^3 of saline water and 1.9 Mt of associated salt as a result of aquifer depressurization. If this water and the resulting salt were to be incorporated in an unmitigated fashion to the process water inventory it would exceed the process water design specifications by several times and result in an unsustainable closure landscape.

Fort Hills has developed an approach to manage the majority of the saline basal water based on the local geology. This approach uses Devonian features to isolate saline basal water from the mining area, which reduces the volume of saline waters by approximately 70% (to 9 Mm^3), associated salts by approximately 85% (to 0.3 Mt), and reduces the size of Approved South Pit by approximately 330 Mbbls. This approach results in a volume of saline basal water and salt which can be effectively managed. As context, the overall recoverable resource from the Project, incorporating these changes is approximately 900Mbbls higher than that required under AER Directive 082.

Fort Hills has developed a suite of alternatives to manage the residual saline basal water volume and salt. All of these alternatives will require the construction of a sump to temporarily contain this saline water. This sump will act as buffer capacity to decouple the treatment alternative from variability in the depressurization rate and to account for seasonality. As Fort Hills acquires operational data, alternatives and their timing will be selected and the appropriate regulatory applications will be submitted for approval.

Section 2 (Saline Basal Water Management), outlines the background and history of this issue, our improved understanding of the geology and hydrogeology, an evaluation of the alternatives to manage the saline basal water volumes, and outlines the path forward.

Utilizing the Devonian High and developing the smaller South Pit design to leave the majority of the saline basal water in the ground results in a balanced solution that aligns well with our guiding principles for mine and tailings planning. This approach is a practical solution to this complex issue and reduces the risk posed by saline water to a manageable level. Fort Hills will continue to explore opportunities to improve this plan as additional information becomes available.

This smaller initial mining area (South Pit) resulting from the solution to manage SBWM has created an opportunity in the tailings plan for an immediate below grade tailings storage area early in the life of the operation. This has been a key consideration in the development of the tailings management plan as described below and has allowed mining and tailings activities to be decoupled.

1.3.2. Tailings Management

Using the guiding principles in alignment with the TMF objective and outcomes and considering the concerns of Aboriginal communities and stakeholders, Fort Hills has updated the tailings management plan to improve upon the approved basis by factoring in site specific conditions including the smaller initial mining area resulting from SBWM and knowledge gained on tailings treatment to reduce risk and improve outcomes.

The revised integrated plan is based on several fundamentals;

- Use of the most recent, best available technology
- Leverage existing/committed assets
- The placement of treated fluid tailings (FT) below grade is inherently more safe;
- Minimize the footprint of treated FT in the closure landscape to improve closure confidence;
- Decouple mining and tailings activities where possible to reduce risk;
- Reduce reliance on weather for treatment of FT;
- Treat FT from the start of production, using multiple technologies / approaches to reduce FT accumulation and;
- Apply learnings to increase confidence in closure outcomes

This plan continues to manage FT from the start of production with thickeners as a part of the extraction process, providing the benefit of reduced energy requirements and a lower FT inventory. Some FT will continue to be generated, and will be stored in the Out of Pit Tailings Area (OPTA) until completion of the first mining area (South Pit). This mining area will then be used as a below-grade dedicated disposal area (DDA) and the FT stored in the OPTA will receive additional treatment prior to being placed within the DDA. This additional treatment step is based on commercially proven methods and rates. In addition to dewatering this treatment is also being designed to produce a stable deposit which limits the mobility of materials such as bitumen and fines. This DDA will contain all treated FT for the life of the project and serves to significantly reduce the footprint of treated FT in the closure landscape. Sand will be placed above-grade in an extension to the east of the OPTA. Once mining is complete in the second mining area (Centre Pit) sand deposition will move to below-grade placement. This approach decouples mining and tailings activities, decreases risk and increases confidence in closure.

The FHMA plan involves the following changes from the currently approved basis to realize these improvements. Sand will be stored east of OPTA in the site of the prior DDA's, one below grade DDA will

replace several above grade DDAs and treatment of FT utilizing this DDA will commence in 2024 when mining is complete in the first mining area (South Pit). Minor changes have been made to the mine advance and pit design in the Northern portion of the development area to facilitate this tailings plan. Pit 2 has been replaced with two pits (Centre and North Pits). The main changes are a resequence of the North Pit and the minor pit optimizations involving the selective use of high TV:BIP areas (>12:1) to establish In-situ pillars to simplify tailings containment in the Centre Pit.

These changes can be seen in the high-level schematic below showing the changes from the approved 2010 plan to the proposed plan (Figure 1-2).

This optimized approach offers several advantages to the FHMA plan by:

- Increasing the reliability of FT treatment by reducing the reliance on weather-dependent processes.
- Decouples mining and tailings activities reducing risk (two small pit areas (South Pit and Centre Pit) are available early in the mine life to facilitate the early below grade deposition of tailings)
- Addressing long term settlement associated with treated FT through aquatic reclamation resulting in more confidence in reclamation outcomes.
- Less concerns with dyke integrity due to treated FT being placed below grade.
- Less treated tailings footprint on the landscape due to one focused DDA.
- Reduces risk, improves operability and provides more confident outcomes by leveraging site specific conditions, the best available information and operating experience from industry
- Flexibility to adapt and deliver improvements by incorporating advancements.

This integrated plan involves a series of inter-related projects to manage mine production, FT, sand and overburden storage for the Project through End of Mine Life (EML). Key components of this plan are:

- Treatment of fines from the start of production with thickeners to reduce FT volume;
- Deposition of coarse sand tailings (CST) in areas containing FT to improve fines capture;
- Collection of FT in the OPTA, which serves as the long-term storage and dewatering area for FT that is the DDA feedstock;
- Commencement of treatment of FT from the OPTA once mining in the South Pit is complete. Treated tailings will be placed below grade in the DDA located in the South Pit starting in 2024;
- Placing sand in the OPTA East, preserving the OPTA fluid storage capacity and below grade space for treated FT;
- Augment the OPTA East area (OPTA East Stage 2) to add an additional 262 ha to the approved project footprint (a footprint increase of less than 1 %)

- Operation of the Centre Pit Tailings Area (CPTA) when mining in center pit is complete and the OPTA East sand storage space is depleted between 2031-2035; and
- Operation of the North Pit Tailings Area (NPTA) when the CPTA sand storage space is depleted between 2051 and 2055.

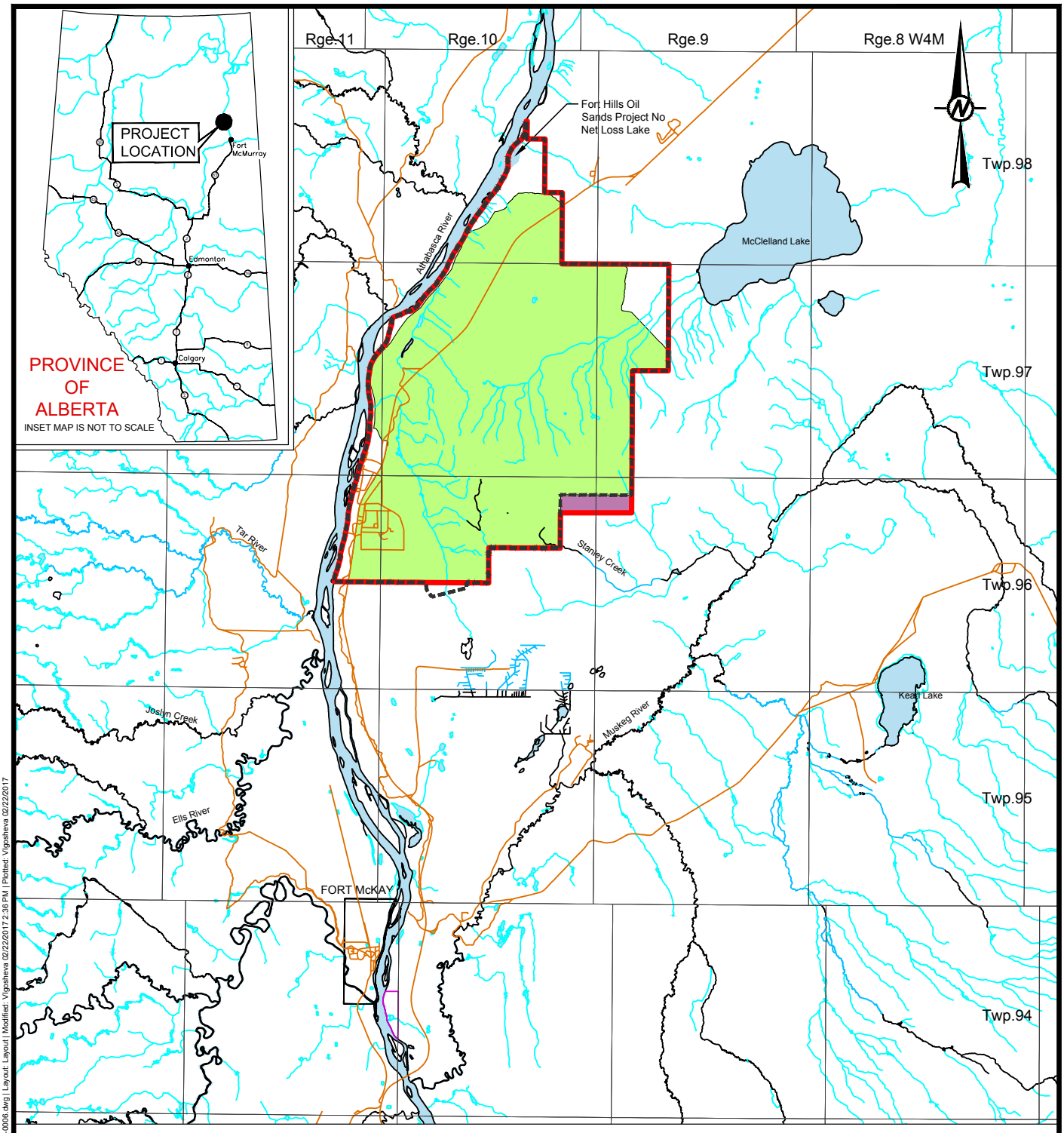
1.3.3. Reclamation and Closure

The *Fort Hills Oil Sands Project (the Project) 2017 Reclamation and Closure Plan* (Appendix A) integrates the 10-year Mine Reclamation Plan (2017-2026) and conceptual Life of Mine Closure Plan projecting to mine closure and certification. This Reclamation and Closure Plan is written and submitted in support of this Application (FHEC 2017a) and the Tailings Directive (TD) Application (FHEC 2017b), and in accordance with *Environmental Protection and Enhancement Act* (EPEA) Approval No. 151469-01-00, Condition 7.2.5 (Mine Reclamation Plan) and Condition 7.2.7 (Life of Mine Closure Plan). The 2017 Reclamation and Closure Plan also considers the Life of Mine Closure Plan Table of Contents provided by Alberta Energy Regulator (AER) by way of letter on November 19, 2015.

The Reclamation and Closure Plan for Fort Hills has been updated to incorporate the changes to saline basal water management and tailings management and to provide more confidence in reclamation timelines and outcomes. As part of this Reclamation and Closure Plan, Fort Hills is modifying the closure plans for the Project to accommodate changes to the mine. The approved Fort Hills plan involved the terrestrial closure of above grade DDA's. This plan is proposing a below grade DDA which would be capped with water for closure. TheAquatic reclamation and closure of the DDA is the best solution for Fort Hills based on current research and data. Confidence in the final closure outcome and Fort Hills' ability to progressively reclaim the site has improved over previous plans. Treated tailings are now distributed over a far smaller portion of the lease and weak materials prone to settlement are now placed below grade and water capped for closure. Further details on tailings management and alternatives considered can be found in the TD Application (FHEC 2017a). The changes to saline basal water management have the added benefits of minimizing the amount of salt which must be managed in the final closure landscape.

The Reclamation and Closure Plan is consistent with the previously submitted *2014 Mine Reclamation Plan* (SEOI 2014) and represents minimal change to the final closure outcome presented in the *2011 Reclamation and Closure Plan* (SEOI 2011), including:

- One outlet to the Athabasca River;
- Similar terrestrial and wetland ecosites at closure; and
- Three Pit Lakes.



LEGEND

- APPROVED PROJECT AREA
- AUGMENTED PROJECT AREA
- AMENDED PROJECT AREA
- PROJECT DEVELOPMENT FOOTPRINT
- ROAD
- WATERCOURSE
- WATERBODY

0 5 10
1:250,000 KILOMETRES

REFERENCE

ALBERTA NTDB DIGITAL DATA OBTAINED FROM ALTALIS LTD. (SEPTEMBER 2004), USED UNDER LICENSE. DATUM: NAD83 PROJECTION: UTM ZONE 12

PROJECT

FORT HILLS OIL SANDS PROJECT

TITLE

FORT HILLS OIL SANDS PROJECT FOOTPRINT

FORTHILLS

PROJECT No.		1649222	FILE No.	1649222-1000-CH-0006
DESIGN	NG	2017-02-22	SCALE	SCALE
CADD	VI	2017-02-22		
CHECK	CM	2017-02-22		**FIGURE 1-1**
REVIEW	ZG	2017-02-22		

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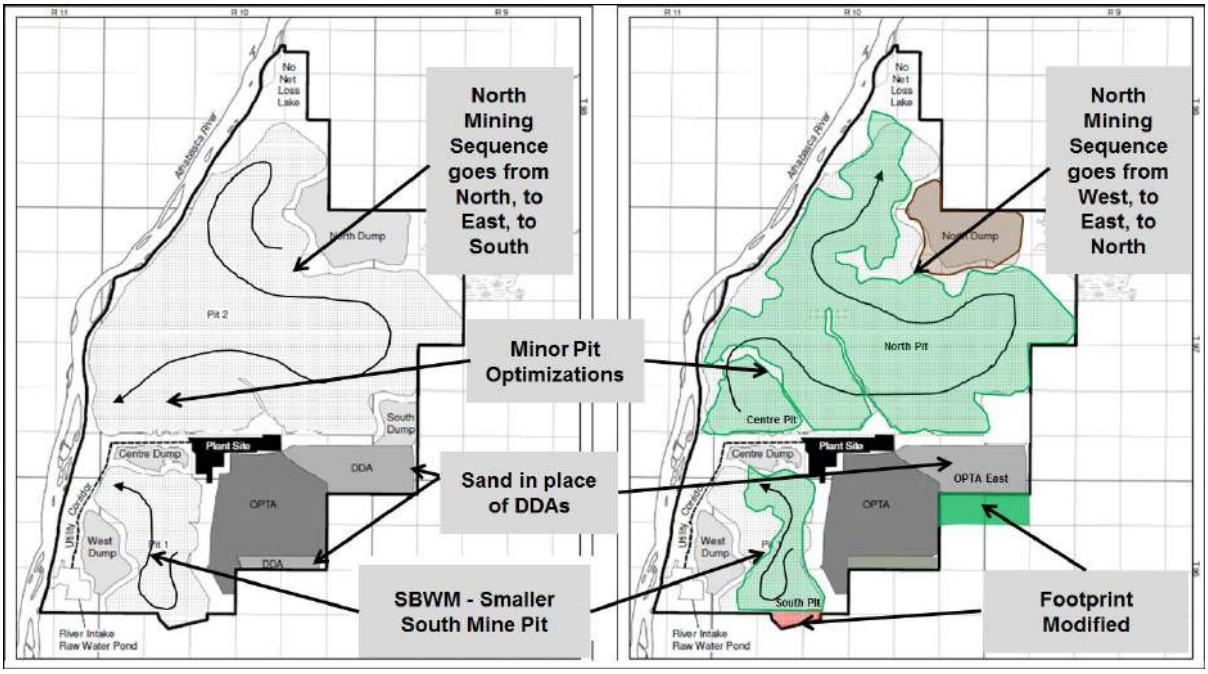
FIGURE 1-2: 2010 APPROVED MINE PLAN AND 2017 FHMA MINE PLAN OVERVIEW



1.4. Supporting Environmental Assessment Overview

1.4.1. Assessment Overview

This Application (the 2017 Fort Hills Oil Sands Project Mine Amendment Application) is supported by updated environmental assessment information that was developed to assess the integrated plan. An overview of the assessment methodology is provided in Section 7 (Environmental Assessment for the Fort Hills Oil Sands Project Mine Amendment Application).

The process for assessment of environmental changes associated with the FHMA plan focused on identification and evaluation of changes from the environmental conditions or residual environmental effects as approved for the Project. The FHMA Application area is located within a land use area currently or previously designated for development as part of the approved Project. The land use activities proposed under the FHMA are the same as currently approved.

Further detailed information is provided in subsequent sections pertaining to Air Quality (Section 8), Noise (Section 9), Aquatic Resources (Section 10), and Terrestrial Resources (Section 11). Environmental outcomes associated with the FHMA integrated plan are as follows:

- No increase in air emissions and therefore no changes to ambient air quality relative to previous assessment and predictions
- No material change to previously predicted noise impacts, compliance with AER Directive 038 maintained

- Comparable (slightly smaller) seepage rates and water quality to approved project
- No changes to surface water or aquatic health relative to previous predictions
- No changes to previous fish and fish habitat predictions
- No change to previous terrestrial predictions

1.4.2. McClelland Lake Watershed

Fort Hills is required to maintain ecosystem diversity and function of the non-mined portion of the McClelland Lake fen during operation and reclamation of the Project. Two years prior to mine pit preparations in the watershed, Fort Hills is required to have an Operational Plan in place to demonstrate how the non-mined portion of the fen will be maintained during the operation and reclamation of the project. As described further in Section 3 (Mine Planning and Design), mine pit development in the McClelland Lake watershed is expected to commence in 2027. To support the ongoing development of the Operational Plan, Fort Hills has continued to advance functional understanding of the McClelland Lake Wetland Complex, which includes the fen, through ongoing hydrological, hydrogeological, and biological studies. A Sustainability Committee, composed of representatives from the Project, Aboriginal Communities, and regulators, continues to evaluate progress on plan development and support incorporation of Traditional Knowledge into the program. The results from these studies, along with input from the Sustainability Committee, will be used to inform the development of an integrated surface water-groundwater model for the watershed that will support the development and optimization of the Operational Plan. Fort Hills expects that the development of the Operational Plan and the associated modelling work may result in the need to update a number of compliance submissions for the Project; including the Reclamation and Closure Plan, the Surface Water Management Plan, and the Groundwater Monitoring Program. Currently, Fort Hills expects to submit the Operational Plan to AER in 2021; approximately 6 years prior to mining preparations In the McClelland Lake watershed

1.5. Amendments Requested

To support the improvements to the integrated mine and tailings plan requested in this application, Fort Hills is applying for a number of minor amendments to EPEA Approval No. 151469-01-00 (pursuant to Section 70 of EPEA), to Water Act Approval No. 151636-01-00 (pursuant to Section 40 subsection 1b(i) of the Alberta *Water Act*), and to OSCA Scheme Approval No. 9241E (pursuant to Section 13 of OSCA). Fort Hills is also requesting an extension to MSL 06222 under the Public Lands Act.

1.5.1. Augmented Project Footprint

For the purpose of the FHMA, the term Fort Hills Approved Project Area is used to refer to the project boundary that was included within the Fort Hills *Environmental Protection and Enhancement Act* (EPEA) Renewal Application (FHEC 2012). The Approved Project Area covers a total area of 18,001 ha. The Approved Project Area will need to be increased to accommodate the tailings management plan, as discussed above in Section 1.3.2 and in greater detailed in Section 4 (Tailings Management). The

footprint modification consists of the addition of 262 ha to the Project footprint. Throughout the FHMA this 262 ha area is referred to as the Augmented Project Area. The modified footprint required for the Project is referred to as the Fort Hills Amended Project Area, covers 18,171 ha, and includes the Approved Project Area and the Augmented Project Area. The Augmented Project Area was originally included as part of the 2001 Project Application and Environmental Impact Assessment (EIA) for the Project (TrueNorth Energy 2001), and as such, was included within the *Oil Sands Conservation Act* (OSCA) Scheme Approval approved project area and *Water Act* fenceline. During subsequent project amendments, the Augmented Project Area was removed from the project footprint.

Since the Project was first approved in 2002, Fort Hills has continued to optimize the south lease boundary of the Project that is shared with Syncrude's Aurora North Mine. Syncrude and Fort hills have successfully established several commercial agreements by working collaboratively on issues related to development timing and boundaries associated with the two mining projects. This Amendment Application served to amend the current Fort Hills approvals to align them with current commercial agreements. A small portion of land along the south boundary of the Project will also be returned to Syncrude as part of an in-situ pillar which will separate pits between the two operators. Further detail on the in-situ pillar is provided in Section 3 (Mine Design and Planning). The in-situ pillar between Fort Hills' South Pit and the Aurora North Centre Pit and its associated resource sterilization is being applied for under separate cover (2017 In-Situ Pillar Application) later in 2017. The joint lease boundary pillar application is a result of the co-operative effort of both operators to establish a workable boundary strategy.

Formalized approval boundaries for the Project are currently defined by Appendix A to OSCA Scheme Approval No. 9241E (Approved Project Area) and by *Water Act* Approval No. 151636-01 Plan No. 00151636-P005 (Water Act Fenceline Map). Although EPEA Approval No. 151469-01-00 does not reference a specific approval area in the context of an EPEA Approval Boundary, it is generally considered to be applicable to those leases that are defined within the EPEA Approval and the supporting application material upon which the approval is based. The OSCA Scheme Approved Project Area and the *Water Act* fenceline boundary will need to be amended to accommodate the tailings management plan, as discussed in Section 1.3.2.

1.5.2. Summary of Requested Amendments

A summary of the requested amendments is as follows:

OSCA Scheme Approval No. 9241E

- Authorization for changes to resource recovery and modified South Pit design resulting from saline basal water management (South Pit)
- Authorization for updated tailings management plan
- Authorization for proposed changes to mine pits (Center and North Pits)_
- Authorization for proposed changes to mining sequence

- Incorporation of augmented project area into OSCA approved project boundary
- Removal of scheme conditions specific to rescinded AER Directive 074

EPEA Approval No. 151469-01-00

- Incorporation of augmented project area into legal land description
- Authorization of additional conceptual runoff ponds and outlet structures to support surface water management in OPTA East
- Authorization of updated 2017 Reclamation and Closure Plan
- Revise Subsection 1.1.2 (t) to read: “"Dedicated Disposal Area" (DDA) means a location(s) that is used for the treatment of fluid tailings;
- Revise Subsection 1.1.2 (y) to read: "Treated Fluid Tailings" means the materials processed at the Dedicated Disposal Areas and are in their final landscape position. This material results from the in-line treatment process and is comprised primarily of fines with water content reduced to levels less than 55% through water expression, evaporation and freeze-thaw.

Water Act Approval No. 151636-01-00

- Incorporation of augmented project area into Water Act approval fenceline boundary
- Authorization of conceptual water management features proposed for saline basal water (temporary basal storage sump) and OPTA East water management (industrial runoff sedimentation ponds)

1.6. Submission Requirements and Concordance

Fort Hills has developed the technical and supporting environmental assessment content of the FHMA Application with consideration to Draft AER Directive 023 and the amendments section of the Guide to Content for Energy Project Applications. To facilitate the review of this application material concordance tables have been prepared (Appendix B) to provide concordance between the FHMA, Draft Directive 023, and the Guide to Content for Energy Project Applications.

1.7. Application Overview

The FHMA submission is organized as a single integrated application document that is intended to provide sufficient information for amendment requests to existing approvals under OSCA, Water Act, and EPEA. Fort Hills will also be requesting disposition under the Public Lands Act for the Augmented Project Area – and will be submitting survey information later in 2017 to support this request. The FHMA document is organized into 12 sections as follows:

- Section 1 (Introduction) provides a general introduction and overview to the amendment application and introduces the main components of the submission.

- Section 2 (Basal Water Management) introduces a revised approach to basal water management for the Project including details associated with the FHMA South Pit design.
- Section 3 (Mine Design and Planning) provides mine plan and status map information.
- Section 4 (Tailings Management) provides a detailed overview of the tailings management.
- Section 5 (Water Management) outlines the approach for Project water management. Water management status maps and an updated water balance are also provided.
- Section 6 presents an outline of Fort Hills's ongoing approach to general consultation for the Project and engagement activity specific to FHMA.
- Section 7 provides an overview of the Environmental Assessment that was completed to support the amendment application and outlines the linkage analysis that was used to steer technical assessment activities.
- Section 8 and Section 9 provide summaries of the assessment associated with Air Quality and Noise respectively.
- Section 10 provides environmental information associated with aquatics environmental components including Hydrogeology (Section 10.2), Hydrology (Section 10.3), Water Quality and Aquatic Health (Section 10.4), and Fish and Fish Habitat (Section 10.5).
- Section 11 provides environmental information associated with terrestrial components including updated baseline conditions (Section 11.2) and change assessment (Section 11.3).
- Section 12 lists all primary references used in the application.

2. BASAL WATER MANAGEMENT

2.1. Introduction

The Basal Aquifer that underlies Fort Hills contains fresh and saline water. Portions of this aquifer need to be depressurized prior to mining to allow for safe resource recovery. To develop the Approved South Pit, Fort Hills would need to manage 34 Mm^3 of saline water and 1.9 Mt of associated salt as a result of aquifer depressurization. If this water and the resulting salt were to be incorporated in an unmitigated fashion to the process water inventory it would be prohibitive to extraction operations and result in an unsustainable closure landscape.

Fort Hills has developed an approach to manage the majority of the saline basal water based on the local geology. This approach uses Devonian features to isolate saline basal water from the mining area, which reduces the volume of saline waters by approximately 70% (to 9 Mm^3), associated salts by approximately 85% (to 0.3 Mt), and reduces the size of Approved South Pit by approximately 330 Mbbls. This approach results in a volume of saline basal water and salt which can be effectively managed. As context, the overall recoverable resource from the Project, incorporating these changes is approximately 900Mbbls higher than that required under AER Directive 82.

Fort Hills has developed a suite of alternatives to manage the residual saline basal water volume and salt. All of these alternatives will require the construction of a sump to temporarily contain this saline water. This sump will act as buffer capacity to decouple the treatment alternative from variability in the depressurization rate and to account for seasonality. As Fort Hills acquires operational data, alternatives and their timing will be selected and the appropriate regulatory applications will be submitted for approval.

This section outlines the background and history of this issue, our improved understanding of the geology and hydrogeology, an evaluation of the alternatives to manage the saline basal water volumes, and outlines the path forward.

Throughout this section two South Pit designs are referenced; the Approved South Pit and the FHMA South Pit. The Approved South Pit is the South Pit design referenced as Pit 1 in OSCA Scheme Approval No. 9241E. The FHMA South Pit is the new proposed pit which is delineated and developed based on the local geology as described above and forms the basis of this Application. In instances which reference the general South Pit area, independently from the Approved South Pit or the FHMA South Pit, the term South Pit area is used.

2.2. Background - Fort Hills Basal Water Management Evolution

The basal water management strategy has evolved as our understanding of the geology and hydrogeology has improved, however the challenges associated with saline basal water management have been recognized since the beginning of the Project. Incorporating all of the saline water associated

with Approved South Pit development into the process water inventory would be prohibitive to extraction operations, and also would add risk to the sustainability of the closure landscape.

In the initial 2001 application for the Project (True North 2001), the management of saline basal water was proposed to be addressed through recycling and reinjection. Development of this initial strategy continued until the Shell Muskeg River Mine (MRM) Devonian inflow event occurred in late 2010. During this event, piezometric response in both the basal aquifer and the Devonian Keg River Formation at Fort Hills indicated that the aquifers were not as isolated from each other as previously believed. After the MRM inflow event it was apparent that reinjection into the Keg River Formation could result in increased aquifer pressure and elevated risk of an uncontrolled inflow at Fort Hills or the surrounding operations.

In 2013, two studies were conducted to further evaluate approaches for managing potential inflows from the basal aquifer. Freeze wall technology was piloted at Fort Hills to test its potential to isolate the saline portion of the basal aquifer, and a Devonian inflow mitigation strategy was developed.

The Devonian inflow mitigation strategy defines how mining will be managed in areas where there is a risk of Devonian inflow. It is a comprehensive scheme including a hydrogeological monitoring plan and a strategic mining plan classified by pressures and pit depths. This strategy is further described in Section 3.5 (Devonian Inflow Mitigation Strategy).

The 2013 freeze wall pilot test was developed to test the concept of creating an in situ wall of frozen groundwater which would limit the movement of saline water into the mine pit. The test was comprised of a 75 m diameter ring of wells drilled into the basal aquifer with a series of pumping wells inside the ring. The pilot was designed to determine if the freeze wall technology could isolate the inside of the ring from groundwater flows outside the ring. The pilot was largely successful inside the limited size of the test. Leakage experienced under the frozen zone was believed to be due to locally fractured upper Devonian limestone. The pilot program led to a plan to engineer a freeze wall system for installation along the west side of the pit and to conduct a more detailed evaluation of the hydrogeological model for the Approved South Pit.

By 2015 an engineering project had been developed for the freeze wall and an improved hydrogeological model had been completed which incorporated updated learnings from geological investigations. Updated modeling demonstrated that the freeze wall would only be 21% effective by volume (26% effective by salt mass) at reducing the inflow of saline water into the Approved South Pit at a capital cost of $600 - $900 Million. Based on the results of this work, Fort Hills began to develop and evaluate other alternatives that would more effectively manage saline basal water at the mine.

2.3. Geological and Hydrogeological Assessment

Fort Hills' understanding of the geology and hydrogeology has improved through 2015 and 2016 due to analysis of newly acquired geophysical data and subsequent reinterpretation of existing data. The results of these analyses were used to enhance existing geological and hydrogeological models.

Prior to these analyses, geological models for the site were based on the assumption that the majority of fault movement resulted from mid-Cretaceous uplift caused by deep intrusion of plutons in the basement beneath the existing sediments. These movements were interpreted as being responsible for the overall morphology and spatial distribution of the ore body. Recent work indicates that in localized areas uplift of Devonian rocks was considerable. In these areas Continental McMurray sediments are absent and younger Lower and Upper Estuarine and Marine McMurray sediments directly overly Devonian limestone. This reinterpretation notes the displacement of younger Lower and Upper Estuarine and Marine McMurray sediments, but with considerably less offset and without the selective absence of beds in the younger sediments. This indicates that a major tectonic event occurred during and/or after the deposition of the Continental beds followed by significant erosion of Continental material. It is interpreted that deposition of the Upper Estuarine McMurray sediments likely occurred on a landscape of Continental sediments with some exposed Devonian limestone.

Collectively these events resulted in the formation of a Devonian structural top that is defined by a complex series of topographic highs and lows (Figure 2-1). The most complex structural evolution of Devonian rocks and overlying sediments occurred in the South Pit area where offsets in the Devonian top can exceed 50 m. In the South Pit areas these offsets, herein referred to as the "Devonian High", are defined by north-south trending morphologies (Figure 2-2).

FIGURE 2-1: CROSS SECTIONAL VIEW OF STRUCTURAL COMPLEXITY OF THE SOUTH PIT

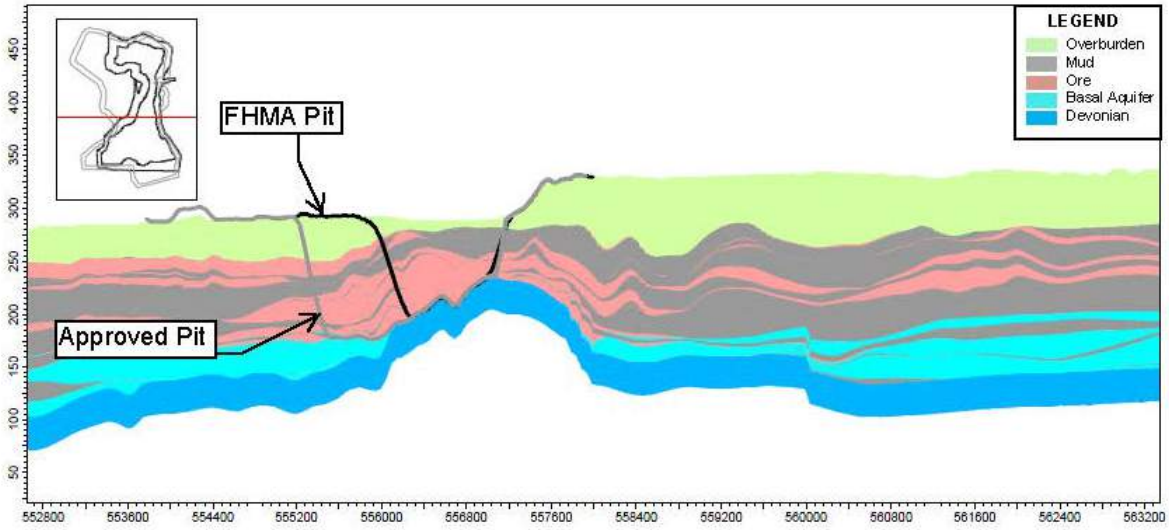
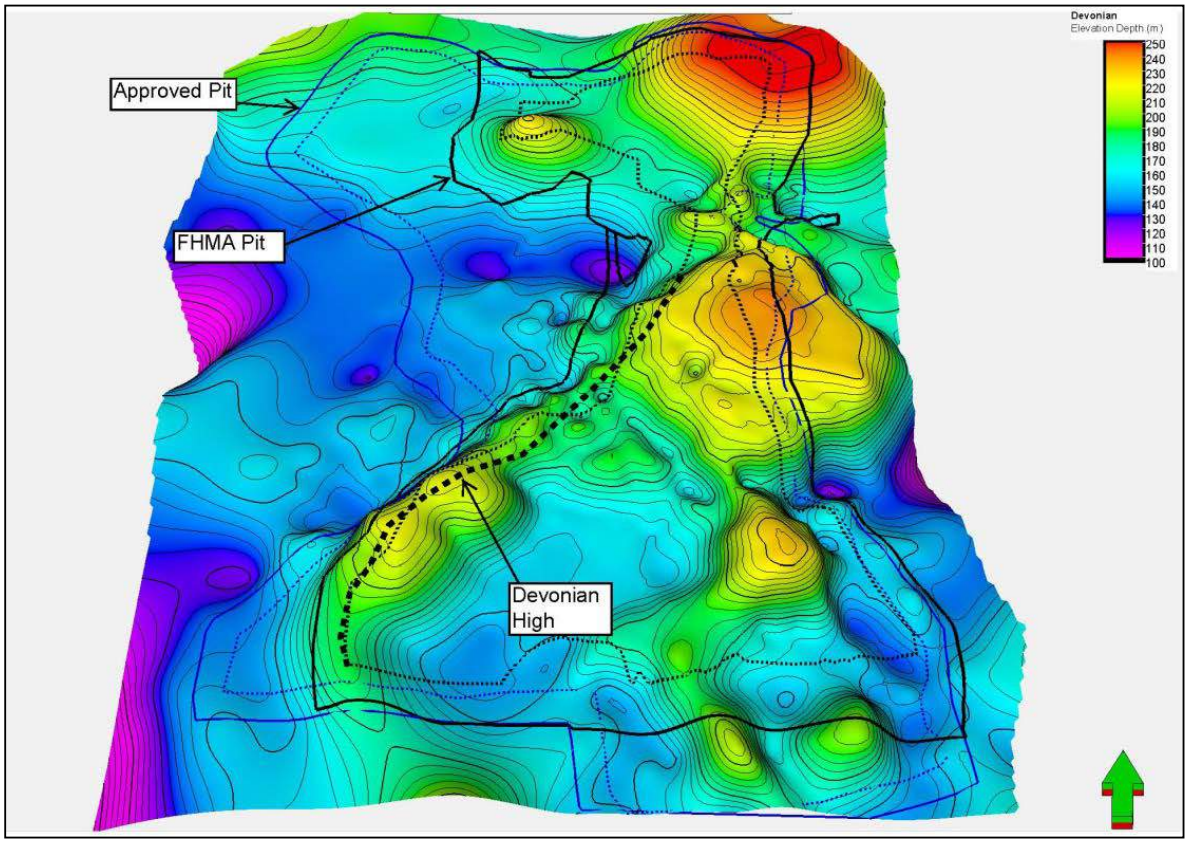


FIGURE 2-2: SOUTH PIT DEVONIAN STRUCTURAL TOP

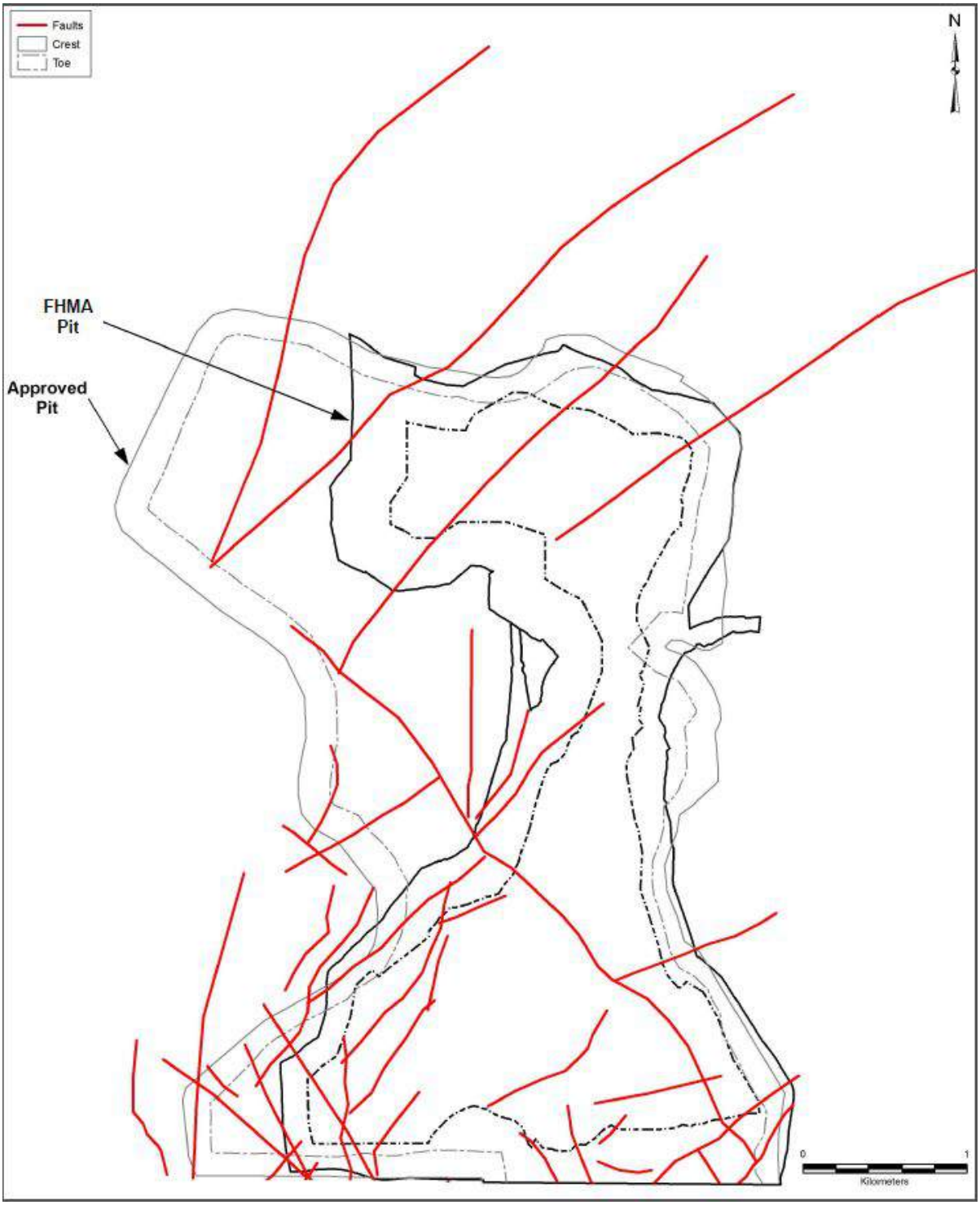


2.3.1. Fracture Mapping

Fracture mapping in the South Pit area was completed through the use of seismic data, downhole geophysical data and borehole logs. This was completed to better define the location of active and/or dormant fractures that may act as migration pathways for saline basal waters (Figure 2-1). The Devonian structural top surface was used as the focal point for construction of the fracture interpretations during modeling. A contour map was completed from the well penetrations showing the probable shape of the Devonian top surface. This map provided approximate alignments of fractures and approximate offsets along the alignments where penetrations provided direct measurement from the data. The alignments determine the best location for the fractures between data points where the alignment placement was defined as between specific data points. This work resulted in an updated fracture map for the Devonian structural top that estimates the spatial distribution, morphology, size (width and length) and timing of fractures (active versus non-active) in the South Pit area. Figure 2-3 shows the spatial location of these fractures in relation to the South Pit.

The transition to the FHMA South Pit from the Approved South Pit reduces the risk of encountering an active fracture or potential migration pathway for saline water. How the avoidance of some of these fractures reduces this risk is further described in Section 2.3.3.

FIGURE 2-3: FRACTURE MAP FOR THE SOUTH PIT



As more data becomes available through completion of exploration wells in advance of mining, further interpretation to refine the spatial distribution of fractures, verify displacements and perhaps identify additional fracturing will be an on-going exercise to improve understanding.

2.3.2. Basal Aquifer

The Basal Aquifer is an unconsolidated, dissected, water-bearing hydrostratigraphic unit that typically marks the lowermost contact of the ore body in the Project. As part of the enhancement work to the existing geological model the spatial distribution and thickness of the Basal Aquifer has also been updated. The Basal Aquifer is absent on Devonian Highs (Figure 2-4 and Figure 2-5) but is present in topographic lows in the Devonian. Figure 2-6 shows the spatial distribution of the basal aquifer and its thickness in relation to the South Pit.

FIGURE 2-4: SOUTH PIT GEOLOGY NORTH SOUTH CROSS SECTION

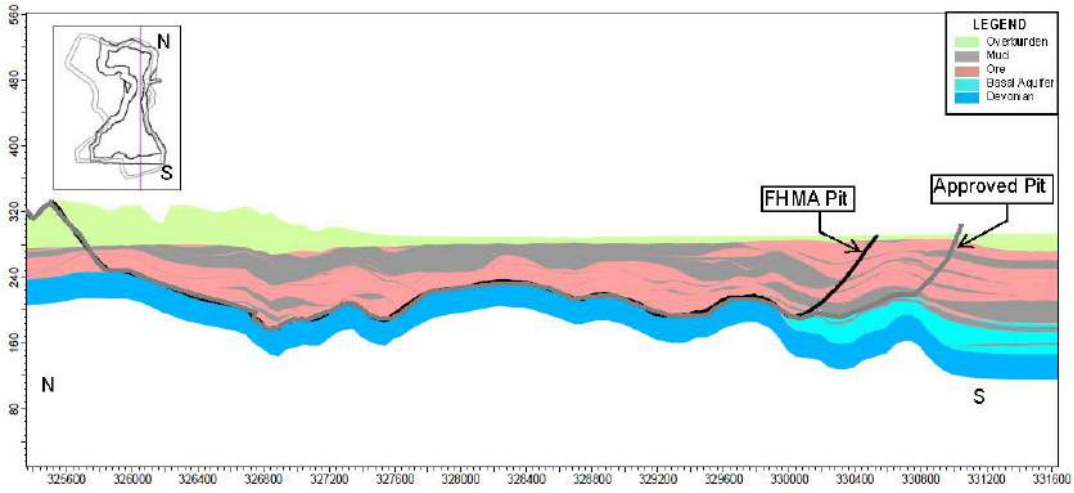


FIGURE 2-5: SOUTH PIT GEOLOGY WEST EAST CROSS SECTION

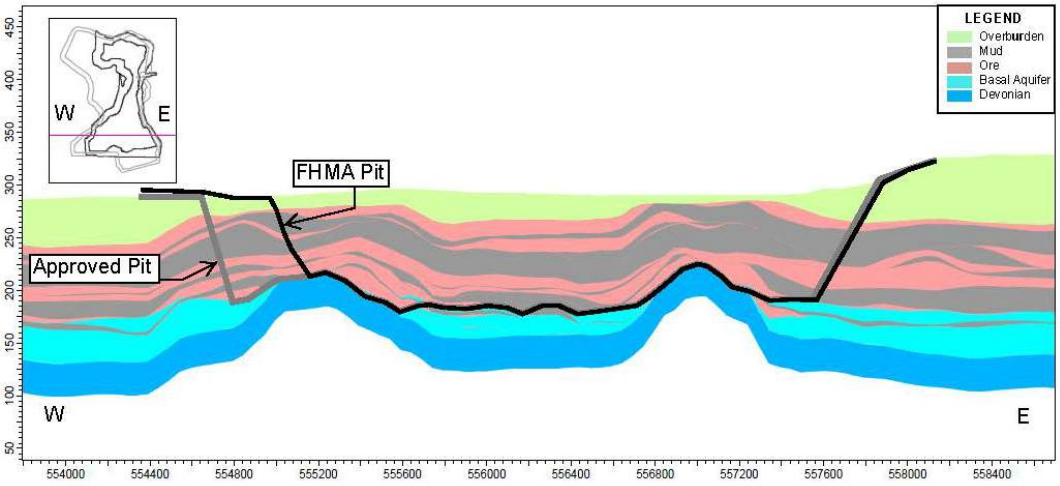
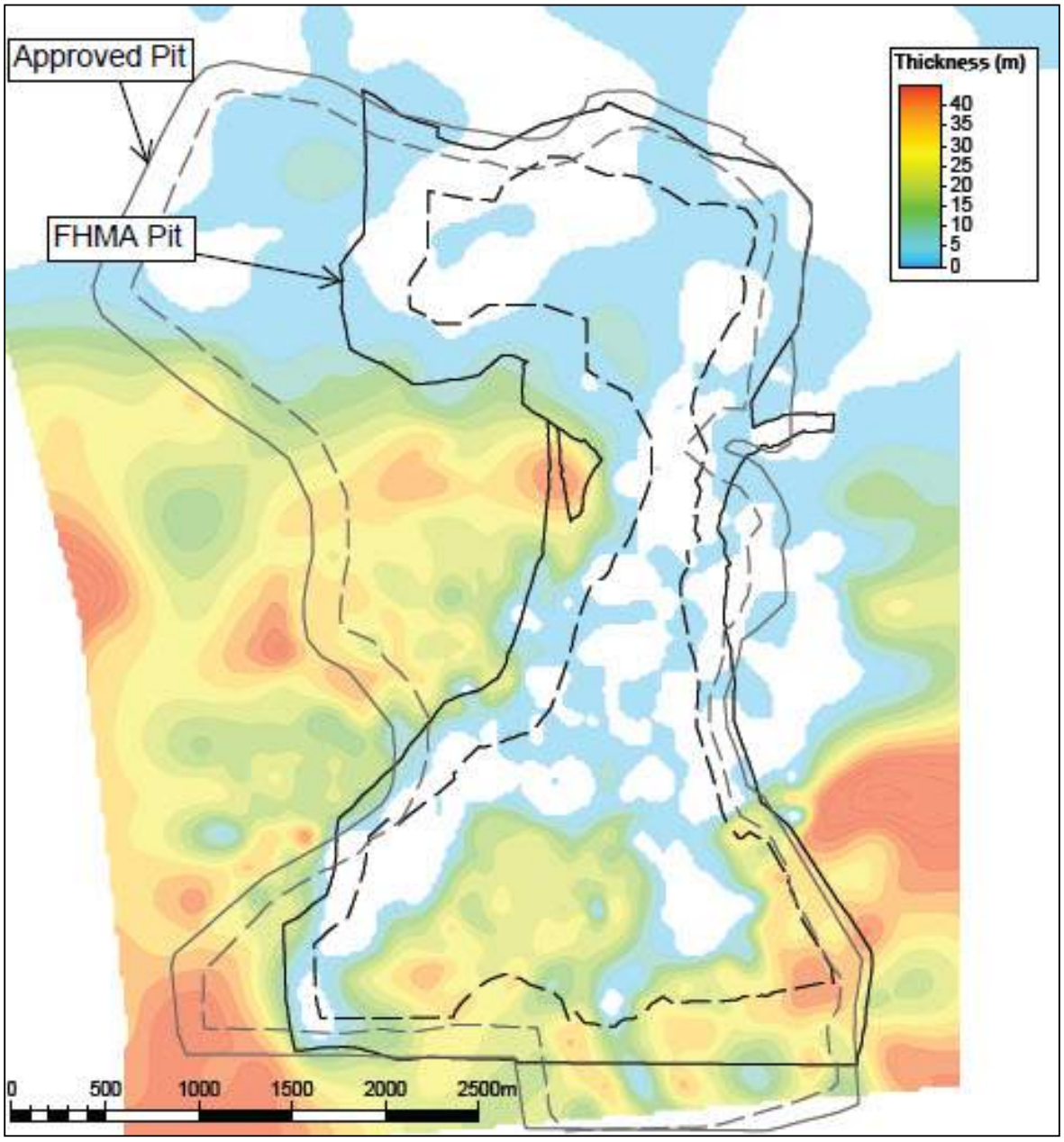


FIGURE 2-6: BASAL AQUIFER THICKNESS



2.3.3. Saline Basal Water

For the context of this application saline water is defined as water that has Total Dissolved Solids (TDS) exceeding 4,000 mg/L (Province of Alberta 2015) and Fresh Water is defined as water containing less than 4,000 mg/L of TDS.

Below the Approved South Pit, TDS concentrations, as defined by the analysis of water samples, illustrate a definitive subdivision between fresh and saline water. This subdivision is associated with topographic variance of the Devonian Structural Top. Water in the Basal Aquifer located west of the north-south trending Devonian High are saline, whereas those located east of the Devonian High are fresh. This distribution of saline and fresh water suggests that:

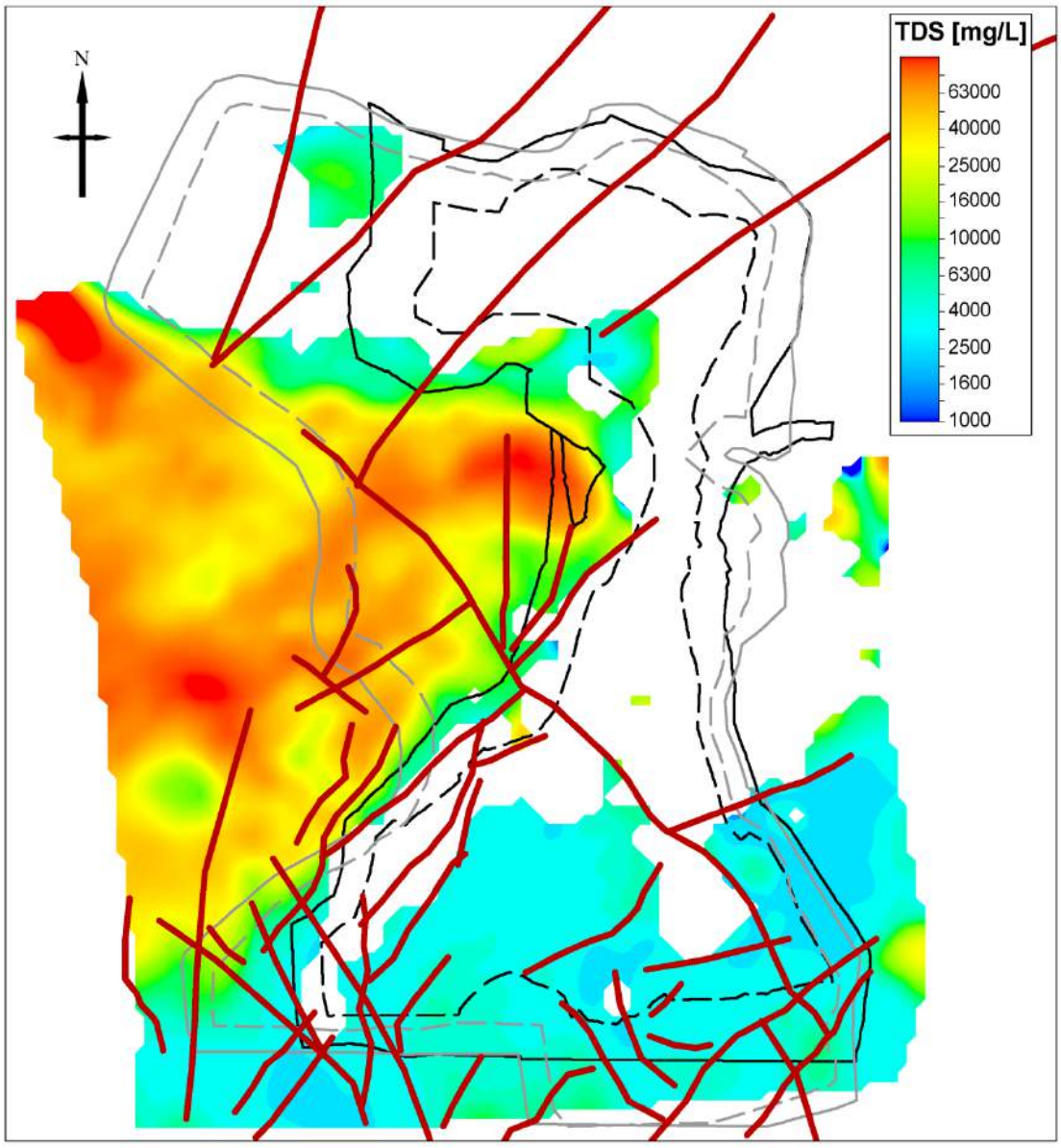
- rocks that compose the north-south trending Devonian High act as a natural barrier
- migration pathways (fractures) connecting the Basal Aquifer to the Keg River Formation exist west of the Devonian High.

As illustrated in Figure 2-7 the transition from the Approved South Pit design to the FHMA South Pit design eliminates exposure to the most saline portions of the Basal Aquifer and the most significant migration pathways (fractures) connecting the Basal Aquifer to the Keg River Formation.

This strategy does not avoid all of the fracturing in the South Pit area. Fractures still exist throughout the FHMA pit as can be seen in Figure 2-7. This does pose some risk for inflow from the Devonian. To mitigate this risk Fort Hills has developed a Devonian inflow mitigation strategy. The Devonian inflow mitigation strategy defines how mining will be managed in areas where there is a risk of Devonian inflow. It is a comprehensive scheme including a hydrogeological monitoring plan and a strategic mining plan classified by pressures and pit depths. This strategy is further described in Section 3.5 (Devonian Inflow Mitigation Strategy).

Fort Hills plans to manage the remaining saline water are further described in Section 2.5 (Saline Water Management Alternatives).

FIGURE 2-7: BASAL AQUIFER TDS CONCENTRATIONS AND FRACTURES IN THE SOUTH PIT



2.3.4. Devonian High

2.3.4.1. Background

Three sets of evidence led to the initial hypothesis that the Devonian High could be used to isolate portions of the basal aquifer:

- aquifer performance testing completed at the Project by Fort Hills in 2008 and 2009
- piezometric response measured at the Project by Fort Hills to Aurora North's Basal Aquifer depressurization programs between 2009 and 2015 and
- salinity gradient that naturally exists across the Devonian High.

In 2008 and 2009, aquifer performance tests were completed in the Basal Aquifer west of the Devonian High as part of the Keg River Pilot Injection Test. The objective of the tests was to assess the degree of local hydraulic connection between the pumping wells and the Athabasca River. In addition to this assessment, test data suggested that the Basal Aquifer on the western and eastern sides of the Devonian High were hydraulically isolated.

In 2009, depressurization of the Basal Aquifer began at Syncrude's Aurora North Mine (The Aurora North Mine is immediately south of Fort Hills and shares a common lease boundary). During this program 12 depressurization wells were actively depressurizing the Basal Aquifer in the Center Pit of Aurora North Mine. During depressurization (from 2009 through 2015), hydraulic head data was obtained at Fort Hills from groundwater monitoring wells located west and east of the Devonian High. Results obtained from these wells also suggest that the Basal Aquifer located west and east of the Devonian High is hydraulically isolated.

TDS data obtained from the Project also suggests the presence of a naturally occurring hydraulic barrier below the South Pit area. High TDS levels indicative of saline water are concentrated west of the Devonian High, whereas low levels of TDS are apparent east of the Devonian High (Figure 2-7). As the Basal Aquifer exists on either side of the Devonian High (Figure 2-4 and Figure 2-5), rocks which form the Devonian High act as natural barriers separating fresh from saline waters. This hypothesis is further supported by the absence of a gradual TDS or salinity gradient across the Devonian High from west to east.

2.3.4.2. 2015 Devonian High Investigation and Results

To assess the ability of the Devonian High to act as a barrier to isolate saline basal water during mining operations an investigation was completed in 2015. Although existing data allowed for the formation of a hypothesis that the Devonian High is natural barrier, the magnitude of hydraulic connectivity within the Devonian High, the extent and distribution of fine-grained rocks that act as aquitards to separate fresh waters from saline waters and the location of potential migration pathways was never assessed. A summary of the 2015 investigation is described below and additional detail provided in Appendix C (Devonian High Investigation).

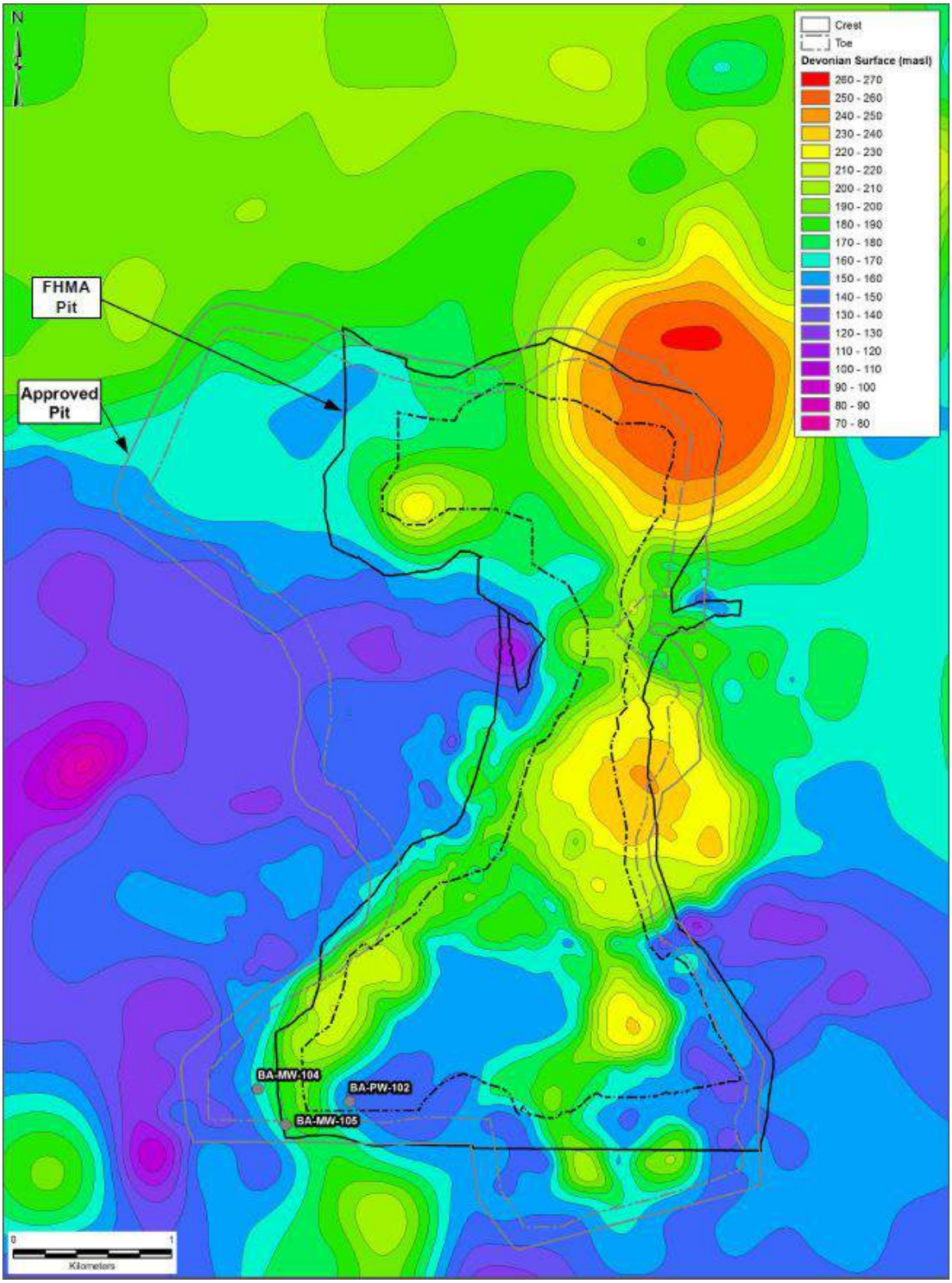
To improve the understanding of the geology of the Devonian High and the spatial distribution of fine-grained rock formations that form a portion of the Devonian High, four continuously-cored, inclined boreholes were drilled through the Devonian High. Boreholes were located in areas where potential migration pathways or fractures were located as interpreted from geophysical data. Overall, thick accumulations of fine-grained rocks averaging 30 m in thickness were apparent in all four boreholes. Fractures that were intersected through drilling were deemed as dormant and did not indicate the presence of saline water.

To assess the hydraulic connectivity across the Devonian High two aquifer performance tests were completed. Performance tests involved extracting groundwater from each pumping well located east of the Devonian High over a 10 day period. Hydraulic responses at 19 wells located east and west of the Devonian High were monitored during the tests. Overall no drawdown was measured west of the Devonian High with the exception of a muted drawdown of 0.1 m measured in observation wells 0.4 km (BA-MW-105) and 0.6 km (BA-MW-104) from pumping well BA-PW-102 (Figure 2-8). In comparison, drawdowns of several meters were measured in observation wells located at similar distances from the pumping well but east of the Devonian High.

In addition to monitoring hydraulic data during performance testing, natural and artificial tracer tests were completed during both performance tests to further characterize the vertical and lateral hydraulic conductivities and connectivity of the Basal Aquifer and the Devonian. There was no detection of natural or artificial tracer in either of the pumping wells during or following performance testing.

Based on the results of the Devonian High investigation it was concluded that the Devonian High provides adequate hydraulic isolation and will act as an effective barrier to isolate saline basal water in the Basal Aquifer during mining operations in the South Pit. A full description of the Devonian High Investigation and Results is included in Appendix C (Devonian High Investigation).

FIGURE 2-8: LOCATION OF PUMPING AND OBSERVATION WELLS



2.4. Basal and Devonian Water Modelling

In 2015 the hydrogeological model was applied to address two primary objectives. The first objective was to assess the potential impact that the freeze wall could have on saline water inflows during mining in order to help refine the extent and timing of freeze wall implementation. The second objective was to predict the volumes and salinities of water produced during depressurization of the basal aquifer underlying the Approved South Pit, which would be required to allow mining to progress.

Updates to the hydrogeological model in 2015 improved Fort Hills' understanding in the following areas:

- Hydrostratigraphy: Improved resolution of Continental Mud and Basal Water Sand sub-units within the Basal Aquifer.
- Structure: Recognition of fractures and sinkholes that occur below the South Pit area and also regionally. The locations and extents of these features were updated based on the interpretation of seismic data obtained in the lower two-thirds of the Approved South Pit (Appendix D: Fort Hills Oil Sands Project Depressurization Plan).
- Model Calibration and Uncertainty Analysis: Calibration focused on improving the ability of the model to reproduce observed local and regional scale aquifer performance tests, including performance tests completed in or near the Approved South Pit and the MRM inflow event in late 2010 (Appendix D: Fort Hills Oil Sands Project Depressurization Plan). Model accuracy was quantified using a technique called Null Space Monte Carlo.

Three scenarios were completed with the hydrogeological model to simulate the efficiency of a freeze wall during mining activities in the South Pit. These scenarios were:

- Approved South Pit with a freeze wall
- Approved South Pit without a freeze wall and
- FHMA South Pit without a freeze wall.

The uncertainty analysis work discussed above was completed on these scenarios. The scenario results are summarized below:

- The Approved South Pit without a freeze wall scenario predicted approximately 34 Mm^3 of saline water was produced as the mine was depressurized from 2017-2028 and 1.9 million tonnes of salt were extracted.
- The Approved South Pit with a freeze wall scenario predicted approximately 27 Mm^3 of saline water was produced as the mine was depressurized from 2017-2028 and 1.4 million tonnes of salt were extracted.
- The FHMA South Pit without a freeze wall scenario predicted approximately 9 Mm^3 of saline water was produced as the mine was depressurized from 2017-2024 and 0.3 million tonnes of salt were extracted.

Hydrogeological work completed prior to 2015 assumed that the bulk of saline water seeping into the basal aquifer would do so laterally, and that any vertically upward saline water flows through fractures/sinkholes would be negligible. This assumption formed the basis of the freeze wall mitigation plan. Modelling results discussed above show that this assumption was incorrect. The model results indicate that, instead of being negligible, vertically upward flows represent approximately 70% of the salinity entering the basal aquifer.

Fort Hills will continue to update and improve its modelling of the geology and hydrogeology in and surrounding the South Pit area. Section 3.2 (Geology) describes some of the upcoming exploration activities that will be used to update this modelling work. In addition, as operations and mine depressurization begins, additional information will be available that will be used to further enhance model calibration and our overall understanding of geology and hydrogeology at the Project site.

2.5. Saline Water Management Alternatives

With an improved understanding of the subsurface geology and hydrogeology in the South Pit area and the inefficiency of a Freeze Wall to effectively manage this issue, Fort Hills began work to evaluate possible alternatives to manage saline basal water. Without any mitigation and with the Approved South Pit design Fort Hills would have to manage approximately 34 Mm^3 of saline basal water containing approximately 1.9 M tonnes of salt. If this water and the resulting salt were to be incorporated in an unmitigated fashion to the process water inventory, the process water design specification for sodium would be exceed by over four times and for chloride by nearly nine times. It is also estimated that the release water quality threshold at closure of 1,000 mg/L TDS would be exceeded by a factor of more than two times (to 2,200 mg/L TDS).

Fort Hills evaluated numerous saline water management alternatives to mitigate the impact of salinity on the process and closure water chemistry. The following three alternatives were evaluated and subsequently dropped from further consideration:

- Re-injection to the Keg River
    - As discussed above (Section 2.2) this option was previously considered to manage this issue and was subsequently abandoned given the risk for other inflow events at Fort Hills and at other operations.
- Water Treatment
    - This option is based on building a water treatment facility to manage the water and salinity. Due to the high cost and energy intensity of this option and the fact that it results in a saline waste product that must still be managed in the closure landscape, this option was excluded from further evaluation.

- Mechanical Isolation (freeze wall or grout wall)
    - As discussed above (Section 2.2), the freeze wall was estimated to be only 21% (by volume, 27% by salt mass) effective at reducing the inflow of saline water into the South Pit at a high capital cost. The operation of the freeze wall would also be energy intensive and would require continued ongoing operation of a refrigeration facility. Given the high cost and the inability of the solution to manage the problem this option was excluded from further consideration.

Fort Hills evaluated numerous saline water management alternatives to mitigate the impact of salinity on the process and closure water chemistry. Alternatives evaluated include (For clarity the volumes described below outline the volume of salt water / amount of salt each alternative could manage in a typical year):

- Recycling to the Basal Aquifer
    - This alternative involves recycling saline water back into the aquifer in an area that is geographically and hydraulically isolate from the FHMA South Pit during mining. The premise of this technique is to utilise the assimilative capacity of the basal water sands that form the aquifer, Current estimates are that this alternative is capable of managing up to 1 M m^3/yr.
- Release to the Athabasca
    - This alternative is to release the saline water in volumes that can be assimilated by the flow capacity of the Athabasca River. This alternative may have some viability but can only manage a relatively small amount of salt (order of magnitude of thousands of tonnes per year).
- In-pit disposal - Water misting, evaporation and incorporation into in-pit waste areas
    - This alternative involves misting and or distributing saline water in the in-pit mine waste dumps. The salt is then sequestered in the in-pit waste material allowing for the successful management of this material through to final closure of the site. Current estimates are that this alternative is capable of managing up to 4 M m^3/year once in-pit dumps are available in approximately 2021.
- Road water - Use of saline water for select road water (in-pit roads, below grade)
    - This alternative would use saline water for in-pit road dust suppression. Initial estimates have approximately 90% of the saline water deposited in this manner sequestered to the road surface and foundation and not reporting to the closed circuit drainage system. Current estimates are that this alternative is capable of managing up to 0.5 M m^3/yr.

The ability of these alternatives to manage the volume of basal water and salinity involved in the Approved South Pit and FHMA South Pit cases is compared below (Table 2-1).

Storage options were evaluated for the Approved and FHMA Pit cases (Table 2-2). For the FHMA pit case this would involve construction of a temporary storage facility to facilitate other alternative management methods. For the Approved Pit case it would involve permanent storage for long term management.

TABLE 2-1: SALINE BASAL WATER MANAGEMENT ALTERNATIVES

Alternative	Estimated Annual Volume Handled	Applicability to Approved Pit (34 M m^3)	Applicability to FHMA Pit based on Devonian High (9 M m^3)
Recycling to the Basal Aquifer	Up to 1 M m^3/yr	<=3% of total volume per yr	<=11% of total volume per yr
Release to the Athabasca	~ thousands of tonnes of salt per year	<1% per yr	<5% per year
In-pit disposal	Up to 4 M m^3/yr 2021+	<=10% of total volume per yr	<=44% of total volume per yr
Road Water	Up to 0.5 M m^3/yr	<=2% of total volume per yr	<=6% of total volume per year

TABLE 2-2: SALINE BASAL WATER MANAGEMENT STORAGE OPTIONS

Storage	Estimated Volume	Applicability to Approved Pit (34 M m^3)	Applicability to FHMA Pit based on Devonian High (9 M m^3)
On site storage in dedicated sump or pond	Size depends on Pit Size and Alternatives utilized	Not feasible for volumes expected (environmental risk associated with long term storage of large volumes of saline water)	Feasible as temporary storage to provide buffer capacity to manage alternatives described above

As can be seen from this analysis, alternatives contemplated for saline basal water management can only manage a fraction of the basal water and salinity associated with the Approved South Pit case.

For the FHMA South Pit case and its smaller associated volumes, alternatives contemplated in conjunction with temporary storage provide a viable path forward to manage the saline basal water at the Project. If all of the alternatives described were utilized to manage the saline basal water associated with the development of the FHMA Pit (9 M m^3) it would be possible to manage about 65% of the total volume expected in only one year. As the depressurization schedule (Table 2-3) peaks at about 3 M m^3 of saline basal water in any one given year (33% of the total volume) the combination of storage and one or more of the alternatives will have the capacity to manage the volume of saline water generated. Furthermore, as seen in Table 2-3, volumes of saline water generated through depressurization are not expected to reach peak levels until 2019 / 2020 giving some time to gather additional information from depressurization activities to inform the selection of alternatives.

Therefore, a combination of the alternatives described above will be used to manage the residual saline basal water and salt associated with the mining of the FHMA Pit. All of these alternatives require the

construction of a sump to temporarily contain this saline water. This sump will act as buffer capacity to decouple the treatment alternative from variability in the depressurization rate and to account for seasonality. As Fort Hills acquires operational data, alternatives will be selected and the appropriate regulatory applications will be submitted for approval. As part of this work, Fort Hills is contemplating a saline basal water recycle pilot study in 2017, further details on this pilot will be provided later in 2017 through a separate pilot study application. Fort Hills also expects to submit a detailed design for the temporary basal sump in Q2 2017 to request authorization pursuant to *Water Act* Approval No. 151636-01-00. Fort Hills will continue to engage stakeholders and Aboriginal communities as appropriate with respect to the chosen alternatives to manage this remaining saline basal water.

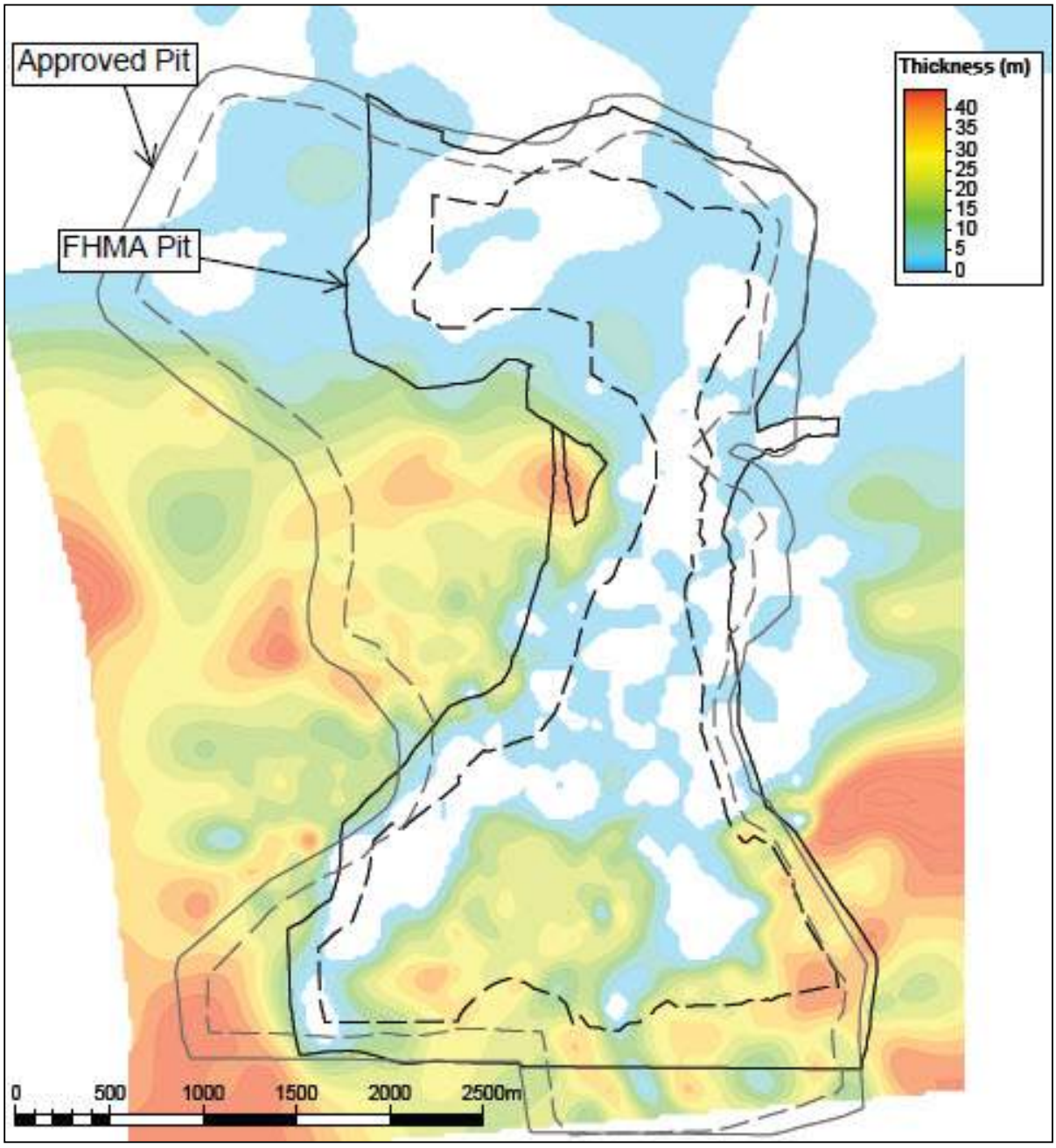
These alternatives will allow Fort Hills to manage the remaining saline basal water in a manner that is not prohibitive to the extraction process and is within acceptable water chemistry thresholds in the closure landscape.

2.6. Redesign of South Pit Based on the Devonian High as a Natural Barrier

The FHMA South Pit design is limited on its west side by the saline basal water isolation strategy rather than by the TV:BIP 12 guidance from AER Directive 082: Operating Criterial: Resource Recovery Requirements for Oil Sands Mine and Processing Plant Operations (AER 2016). The FHMA South Pit design was generated by establishing the pit toe approximately 100 m east of the edge of the saline basal aquifer on the Devonian High. The pit highwall is established by projecting up at the appropriate design slopes from this toe to topography (Figure 2-9). Figure 2-9 shows the Approved South Pit and FHMA South Pit designs overlaying a map of the underlying Basal Aquifer. Representative cross sections above (Figure 2-4 and Figure 2-5) demonstrate how the FHMA South Pit design is tied to the Devonian high east of the saline Basal Aquifer.

The FHMA South Pit design sterilizes approximately 330 Mbbls from the Approved South Pit design, and shortens the life of the Approved South Pit by approximately 5 years. The shorter mine life of the FHMA South Pit results in an accelerated mining schedule for Center Pit and North Pit. Further detail on mine sequencing is provided in Section 3 (Mine Design and Planning) and Appendix A (Reclamation and Closure Plan).

FIGURE 2-9: APPROVED SOUTH PIT AND FHMA SOUTH PIT DESIGNS OVERLAYING THE BASAL AQUIFER



2.7. Depressurization Plan and Schedule

The FHMA South Pit basal water depressurization plan (Appendix B) is comprised of pumping wells and passive wells designed to draw down pressure in the Basal Aquifer in advance of mining. Expected timing (Figure 2-10) and anticipated depressurization volumes (Table 2-3) are included below.

FIGURE 2-10: DEPRESSURIZATION WELL LOCATIONS, MINE ADVANCE AND BASAL AQUIFER ISOPACH

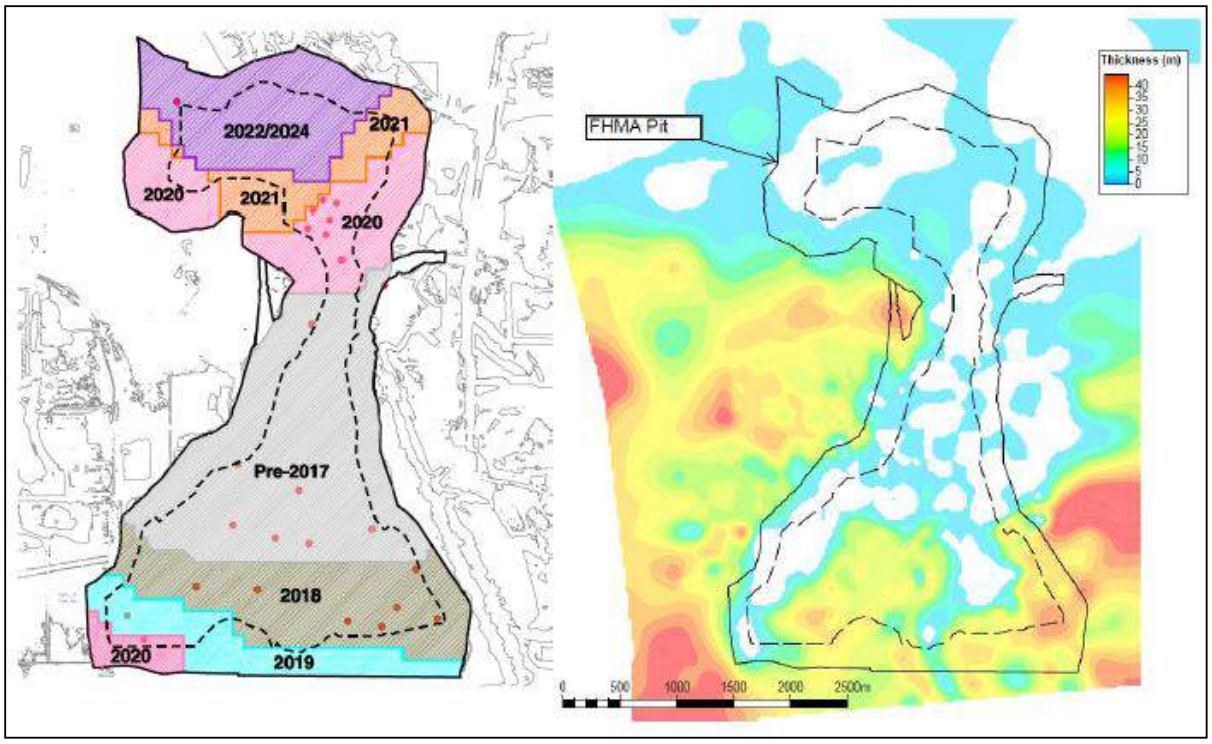


TABLE 2-3: EXPECTED SALINE BASAL WATER DEPRESSURIZATION VOLUMES

Year	Saline Basal Water ($M m^3$)
2017	0.0
2018	0.2
2019	1.4
2020	3.0
2021	2.5
2022	1.1
2023	0.8
2024	0.0

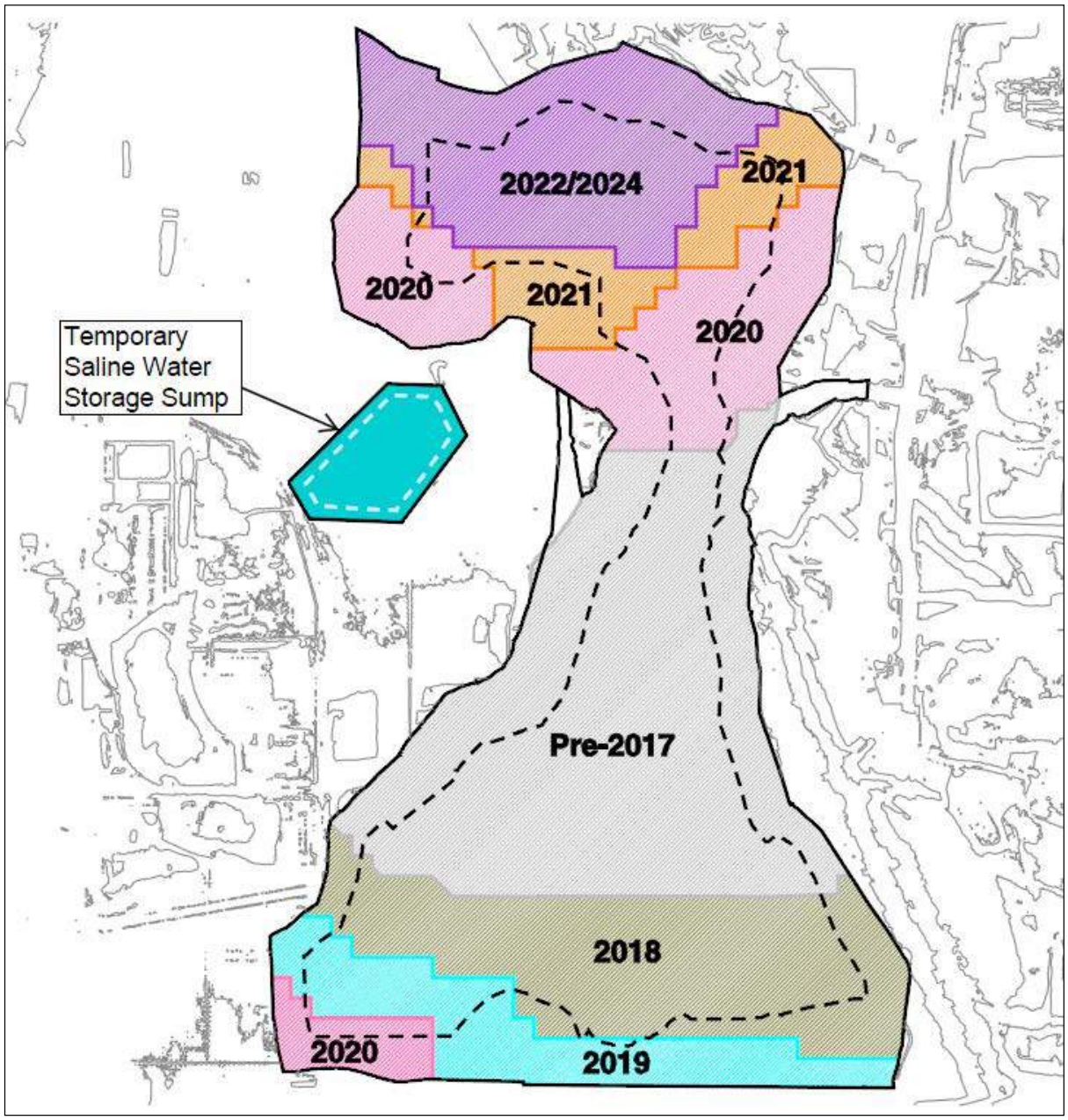
2.8. Temporary Saline Water Storage

As described above (Section 2.5), Fort Hills is currently developing a suite of alternatives to manage the residual saline basal water and to prevent it from entering the process water inventory. Each of the alternative technologies being contemplated requires storage capacity as a buffer to decouple the technology from variability in the depressurization rate and account for seasonality.

A temporary storage sump will be constructed west of the FHMA South Pit crest to serve as initial buffer capacity for saline water (Figure 2-11), which may be required in early 2018 (Table 2-2). The conceptual design for the sump, which will be constructed below topography, provides approximately 2 Mm^3 of storage. Additional space is available to construct up to two additional sumps of similar design to account for water volume variance versus the model and performance of the residual treatment method should they be required.

Fort Hills will be submitting a depressurization plan for the FHMA South Pit shortly as per EPEA Approval No. 151469-01-00 Condition 4.5.11 (p). Fort Hills will also be requesting AER Authorization of a detailed design for the temporary saline storage sump as per existing Water Act Approval and EPEA Approval conditions. These items will also be included as appropriate in future compliance plan submissions for the project including the Surface Water Management Plan and the Groundwater Monitoring Program.

FIGURE 2-11 TEMPORARY SALINE WATER STORAGE SUMP LOCATION



2.9. South Pit Recoverable Resource Summary

Fort Hills has evaluated four South Pit designs to quantify resource sterilization as part of the basal water management strategy. These four designs are:

- the Approved South Pit, referenced as Pit 1 in *OSCA* Scheme Approval No. 9241E
- the South Pit as defined by the 12:1 TV:BIP contour at the pit crest as per D082, hereafter called "Unrestricted 12:1 TV:BIP Pit Design"
- the D082 South Pit less the areas of sterilization previously approved or applied for under separate cover, hereafter called "Restricted 12:1 TV:BIP Pit Design"
    - Sterilization areas approved as per of *OSCA* Scheme Approval No. 9241E; including areas from the utility corridor in the northwest corner of the Approved South Pit and the Athabasca River
    - The in-situ pillar between the Approved South Pit and Syncrude's Aurora North Mine Centre Pit. This pillar will be further described in a pending submission (2017 Boundary In-Situ Pillar Application).
- the FHMA South Pit as proposed, as the primary mitigation to ingress of saline basal water

Details of these pits and resource evaluation for each are shown below in Figure 2-12 and Table 2-4 respectively.

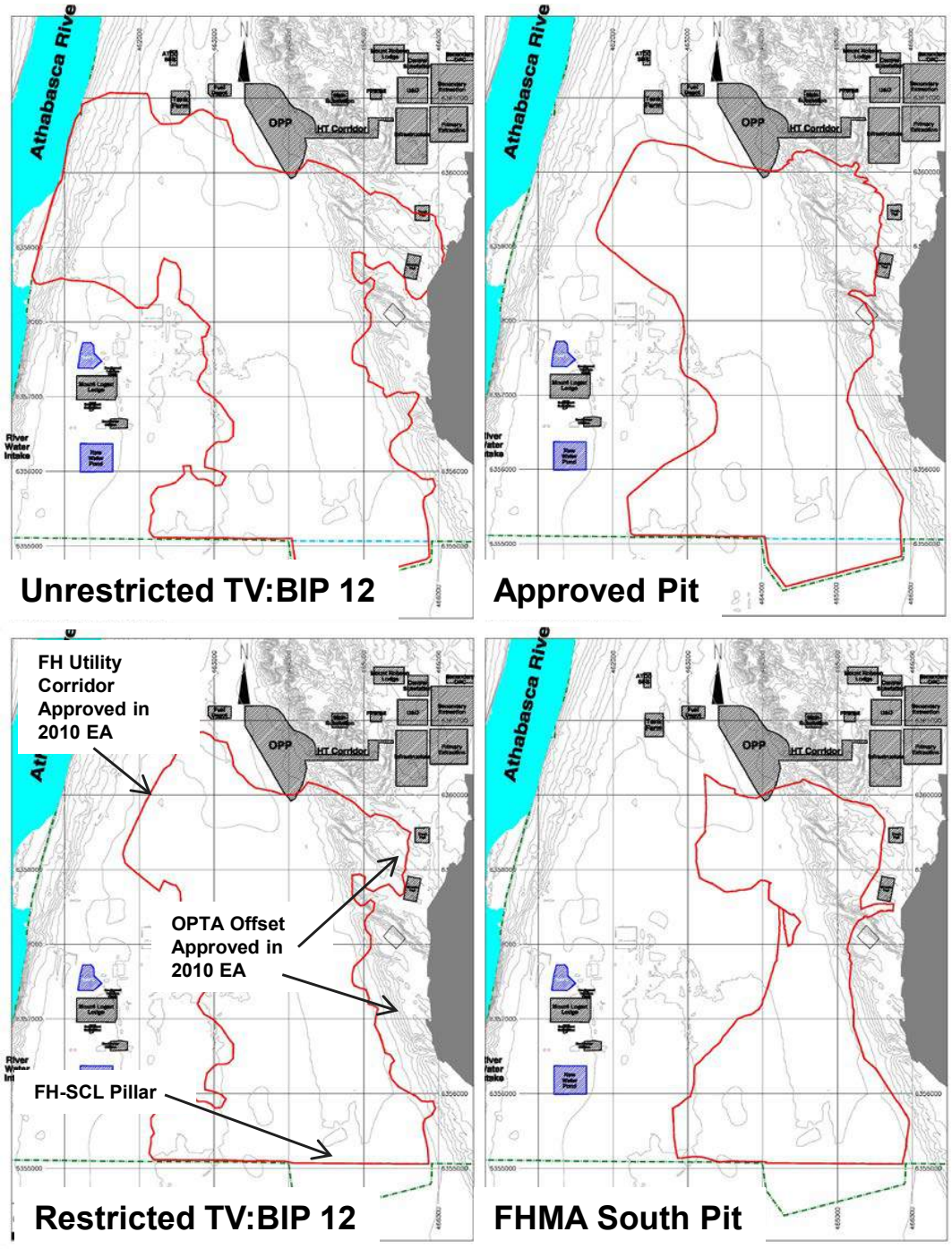
TABLE 2-4: RECOVERABLE RESOURCE BY PIT DESIGN

	Ore Tonnes	Diluted Ore Grade	Recoverable Bbls	Delta vs FHMA South Pit Design
	(Mt)	(%)	(Mbbls)	(Mbbls)
Unrestricted TV:BIP 12	1,310	11.2	800	430
Approved South Pit	1,140	11.2	700	330
Restricted TV:BIP 12	990	11.1	600	230
FHMA South Pit	600	11.2	370	N/A

The FHMA South Pit design sterilizes 330 Mbbls relative to the Approved South Pit design, and sterilizes 230 Mbbls relative to the 12:1 TV:BIP pit adjusted for the approved sterilization areas as per OSCA Scheme Approval No. 9241E. For additional context, the overall recoverable resource from the Project, incorporating changes associated with the FHMA South Pit is approximately 900 Mbbls higher than that required under AER Directive 82. Additional details are provided in Section 3 (Mine Design and Planning).

As demonstrated, Fort Hills has evaluated an exhaustive list of alternatives to manage the saline basal water associated with the development of the Approved Pit. A technically feasible economic means to recover the resource sterilized by moving to the FHMA Pit has not been identified. It is Fort Hills' opinion that this analysis meets the intent of AER Directive 82 and Resource Recovery Economics in justifying the resource sterilization associated with this approach.

FIGURE 2-12: SOUTH PIT DESIGN EVOLUTION



2.10. Summary

As discussed in Section 1, Fort Hills uses guiding principles to aid in decision making. These guiding principles have been considered throughout the evaluation of alternatives for saline basal water management. Table 2-5 summarizes the selected alternative for saline basal water management against these guiding principles.

TABLE 2-5: COMPARISON OF MANAGEMENT STRATEGY TO GUIDING PRINCIPLES

Principles	Utilize Devonian High to Isolate Saline Basal Water
Stakeholders and Aboriginal Communities	• Reduces volume of Saline Basal water which must be stored in the environment
Closure landscape	• Small residual salt volume allows for viable closure water chemistry
Progressive Reclamation	• Elimination of large amounts of salt allow for earlier reclamation than higher salt volume alternatives (eliminates storage requirements)
Balanced Approach	• Negatively impacts economics by sterilizing valuable ore but reduces risk related to closure and process water chemistry to a manageable level • Leverages 15 years of development and learning
Operations Flexibility	• Reduces risk posed by Saline Basal Water to a manageable level and sets Fort Hills up with a solid base upon which to explore improvements.

Multiple alternatives for Saline Basal Water Management have been assessed at Fort Hills through 15 years of research and development and have evolved as our understanding of this complex issue has improved. Utilizing the Devonian High and developing the FHMA South Pit design to leave the majority of the saline basal water in the ground results in a balanced solution that aligns well with our guiding principles for mine and tailings planning. This approach is a practical solution to this complex issue and reduces the risk posed by saline water to a manageable level. Fort Hills will continue to explore opportunities to improve this plan as additional information becomes available.

3. MINE DESIGN AND PLANNING

3.1. Introduction

Fort Hills is proposing to amend the Project mine plan to address key changes in the areas of saline basal water management, tailings management and closure planning. The mine life is projected to be approximately 45 years. Pre-stripping of reclamation materials, mining of overburden, and construction of the Out-of-Pit-Tailings-Area (OPTA) have already commenced, and bitumen production is scheduled for Q4 2017. Fort Hills will continue to use proven truck and shovel mining methods to excavate and transport overburden, interburden and ore. The opening cut has already been executed for the Project in the South Pit area, and remains unchanged from the 2010 EA. The planned production rate, plant site, production method, and mining fleet remain unchanged.

The plan supports a production rate of 190,000 barrels of bitumen per calendar day. The mine plan presented below is consistent with the basal water management strategy (Section 2), the tailings plan (Section 4), the water management plan (Section 5), and the reclamation and closure plan (Appendix A).

In 2010, Fort Hills submitted an Environmental Assessment Update Application for the Project (FHEC 2010). This application was subsequently reviewed by the Energy Resources and Conservation Board (now AER), and resulted in an amended OSCA Scheme Approval for the Project (OSCA Scheme Approval No. 9241E) that authorized the mine plan as presented in 2010 (hereafter referred to as the Approved Mine Plan). The Approved Mine Plan included pit design modifications, an updated mining sequence, a Directive 074 compliant tailings scheme based on FT Drying technology, and an overall recoverable resource of approximately 3.4 billion barrels of bitumen.

The integrated mine and tailings plan presented below is referred to as the FHMA Plan, and has been modified relative to the Approved Mine Plan to reduce the risks associated with saline basal water management, tailings management, and to improve closure outcomes. Changes from the Approved Mine Plan to the FHMA Mine Plan include the following:

- A revised strategy for management of saline basal water which results in a redesigned South Pit, which reduces the recoverable resource by 330 Mbbls and accelerates completion in this pit by approximately 5 years. The South Pit limit utilizes the local geology (Devonian high) to act as a barrier to reduce the ingress of saline basal water and allows for the safe and environmentally responsible recovery of the remaining resource (see Section 2, Basal Water Management, for additional detail);
- A reduction in size of the South Pit (compared to the Approved South Pit), is leveraged to reduce tailings risk by decoupling mining, sand tailings and fluid tailings operations. Mining in the FHMA South Pit design is complete prior to the placement of treated fluid tailings and sand tailings are not placed in the pit.
- The FHMA South Pit design includes an in-situ pillar between Fort Hills and Syncrude's Aurora North Mine operations to decouple mining and tailings operations between the two

operations. This pillar will be further described in a pending submission (2017 Boundary In-Situ Pillar Application).

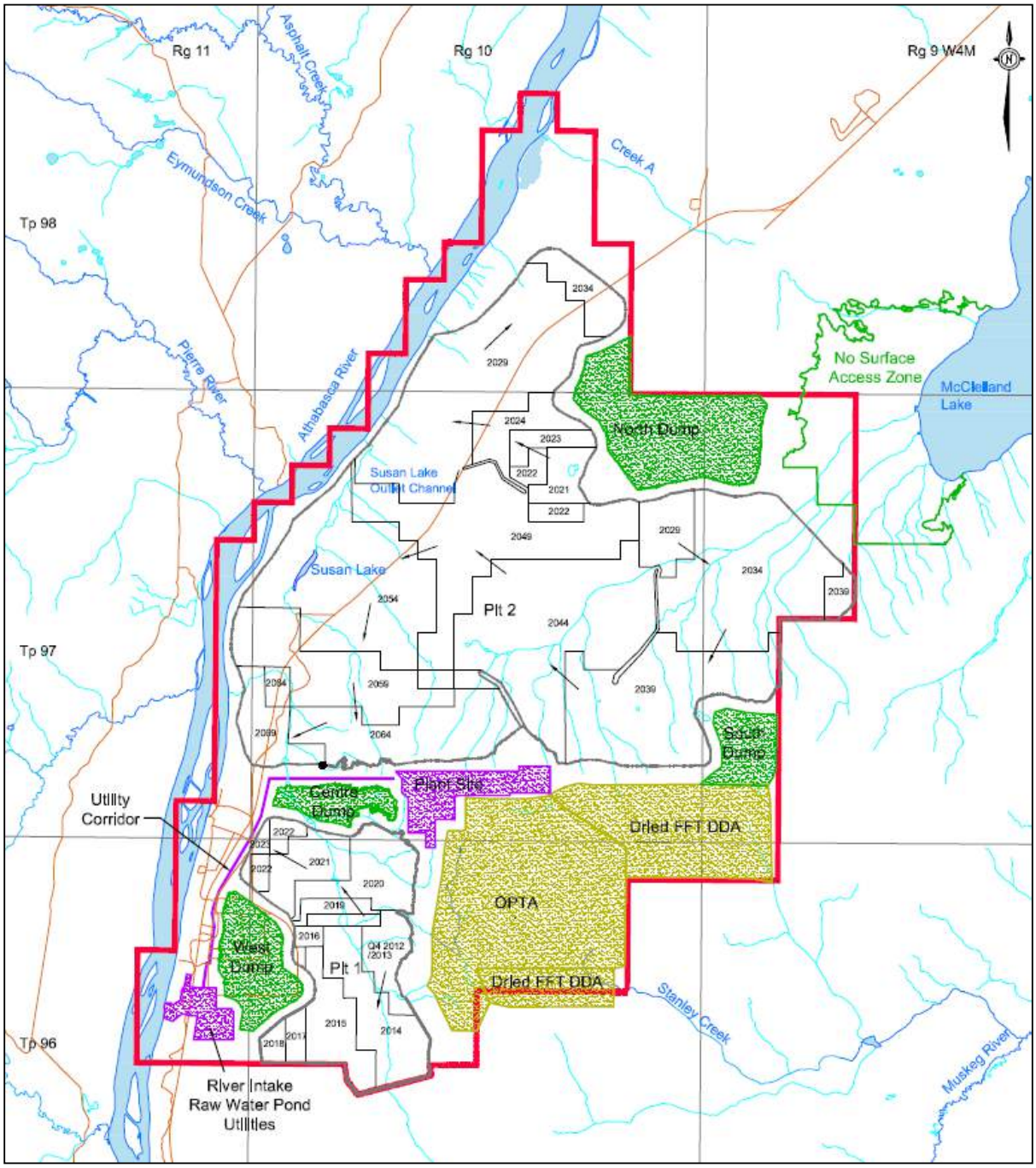
- The Fort Hills Centre Pit and North Pit (formerly referred to as Pit 2) have been re-sequenced to simplify tailings management and reduce risk and cost associated with tailings infrastructure. These pits are referred to as Centre Pit and North Pit in this document.
- The Centre Pit and North Pit have been modified to selectively use 12:1 and 16:1 TV/BIP limits to improve the in-pit tailings management plan and further decouple mining from tailings operations;
- Modification of the FHMA Mine Plan to align with and support desired closure outcomes.

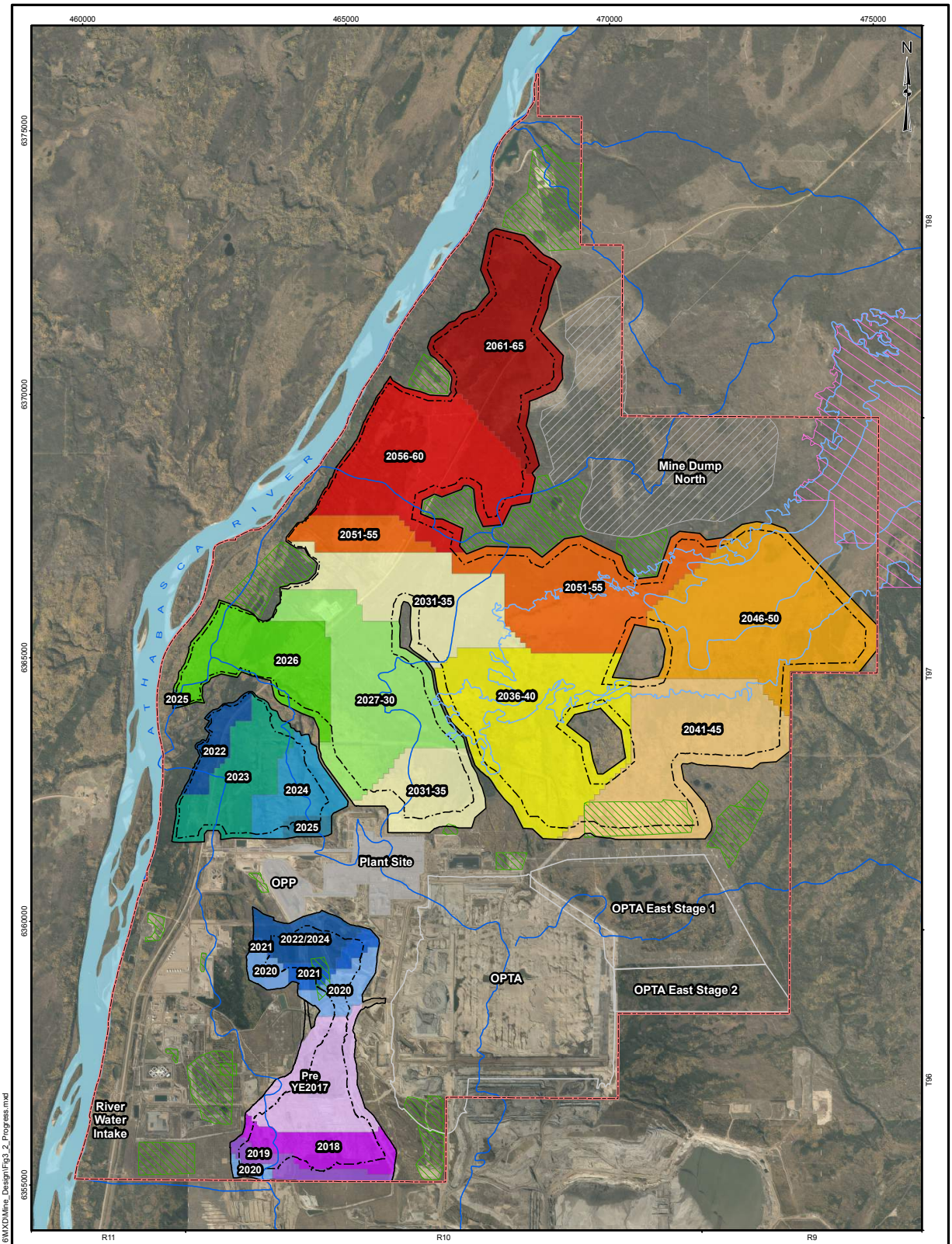
The Approved Mine Plan layout (FHEC 2010) and the FHMA Mine Plan layout (this Application) are illustrated below in Figure 3-1 and Figure 3-2 respectively. Table 3-1 summarizes major activities by pit and facility over the life of mine according to the FHMA Mine Plan. As illustrated, mining and tailings activities are staged to be decoupled to not share the same space at the same time, wherever possible.

TABLE 3-1: OVERALL INTEGRATED MINE AND TAILINGS ACTIVITY SCHEDULE

	2017-2019	2020-2025	2026-2030	2031-2035	2036-2040	2041-2045	2046-2050	2051-2055	2056-2060	2061-2063	2064-2073	2074 +
OPTA (Including OPTA East Stage 1 and 2)												
Mine Waste Construction/ Disposal	■	■										
Coarse Tailings Deposition	■	■	■	■								
Thickened Tailings Deposition	■	■	■	■								
TSRU Tailings Deposition	■	■	■	■	■	■	■	■	■	■		
Reclamation											■	■
South Pit												
Active Mining	■	■										
Mine Waste Backfill	■	■										
Treated FT Deposition		■	■	■	■	■	■	■	■	■	■	
Reclamation											■	■
Centre Pit												
Active Mining		■	■									
Mine Waste Backfill		■	■									
Coarse Tailings Deposition				■	■	■	■	■				
Thickened Tailings Deposition				■	■	■	■	■				
Reclamation									■			
North Pit												
Active Mining			■	■	■	■	■	■	■	■		
Mine Waste Backfill			■	■	■	■	■	■	■	■		
Coarse Tailings Deposition								■	■	■		
Thickened Tailings Deposition								■	■	■		
Reclamation											■	■

FIGURE 3-1: 2010 APPROVED MINE PLAN PROGRESS MAP





LEGEND

- Pre YE2017
- 2018
- 2019
- 2020
- 2021
- 2022
- 2022/2024
- 2023
- 2024
- 2025
- 2026
- 2027-30
- 2031-35
- 2036-40
- 2041-45
- 2046-50
- 2051-55
- 2056-60
- 2061-65
- Fen Boundary
- Watersheds
- Lease Boundary
- Stockpiles
- Mine Dump North
- No Surface Access Zone

1 0 1 2 3 4
Kilometers

PROJECT:
FORT HILLS OIL SANDS PROJECT

TITLE:
CURRENT MINE PLAN PROGRESS

AIR PHOTO DATE: SEPT 2015			DATUM / PRJ:	NAD83 UTM Z12N
DESIGN	JAB	10-JAN-2017	SCALE: 1:70,000	REV: 0
GIS	JA	10-JAN-2017	**Figure 3-2**	
REVIEW	JAB	10-JAN-2017		
APPD	DC	10-JAN-2017		

Path: \\file084\corp\gis\Projects\Oilsands\FortHills\OS\0478_Mine_Amendment_2016\MXD\Mine_Design\Fig3_2_Progress.mxd

3.1.2. Application of Guiding Principles

The following section summarizes features of the mine plan as they relate to the guiding principles for the Project:

Establish outcomes that consider and incorporate the interests of Aboriginal communities and stakeholders

- Mine the portion of the MLWC that is located within the pit limits far enough into the mine life to allow the development of a robust management strategy, but mine the area early enough to ensure MLWC reclamation and closure progress can be monitored prior to the end of the mine life;

Establish a stable closure landscape integrated into the regional ecosystem

- Sequence mining and backfilling strategically to ensure in-pit landforms created by mining and tailings comply with the reclamation and drainage strategy for closure;
- Provide below grade storage for the treated tailings deposit
- Minimize the environmental impact on disturbed area by reducing the footprint of the external waste dumps.

Facilitate progressive reclamation by integrating mine, tailings and reclamation planning to ensure land is reclaimed permanently as early as practicable

- Sequence mine and tailings activities to achieve final designs and progress to another region in the project area to allow permanent reclamation

Manage life-cycle costs and net environmental impacts

- Establish a safe and cost effective mine plan and schedule that supports bitumen production of 190,000 barrels per calendar day;
- Sequence mining and backfilling strategically to minimize the risk of Devonian water inflows;
- Design and sequence the mine to minimize the ingress of saline basal water and its associated risks;
- Design and sequence the mine to de-couple mining from tailings sand management and also from fluid tailings management activities to minimize risk;

Recognize the importance of flexibility and choices in order to incorporate innovations throughout the mine life

- Sequence mining and backfilling strategically to ensure there is enough in-pit space for tailings containment. Decoupling of mining and tailings activity and integration of the pit design with the fluid tailings storage requirements (FHMA South Pit design) removes competition for containment capacity and facilitates future flexibility;

3.2. Geology

Fort Hills has not conducted any additional exploration to change its view of the resources and regional geology since 2010 (FHEC 2010) with the exception of some additional exploration in the South Pit area to better understand the subsurface hydrogeology. Details of this work are included in Section 2 (Basal Water Management) and Appendix C (Devonian High Investigation).

Fort Hills is proposing some minor revisions to pit limit changes in the North Pit and Centre Pit to aid with tailings management. Details of these changes are further outlined below in Section 3.3.

3.2.1. Drilling Status

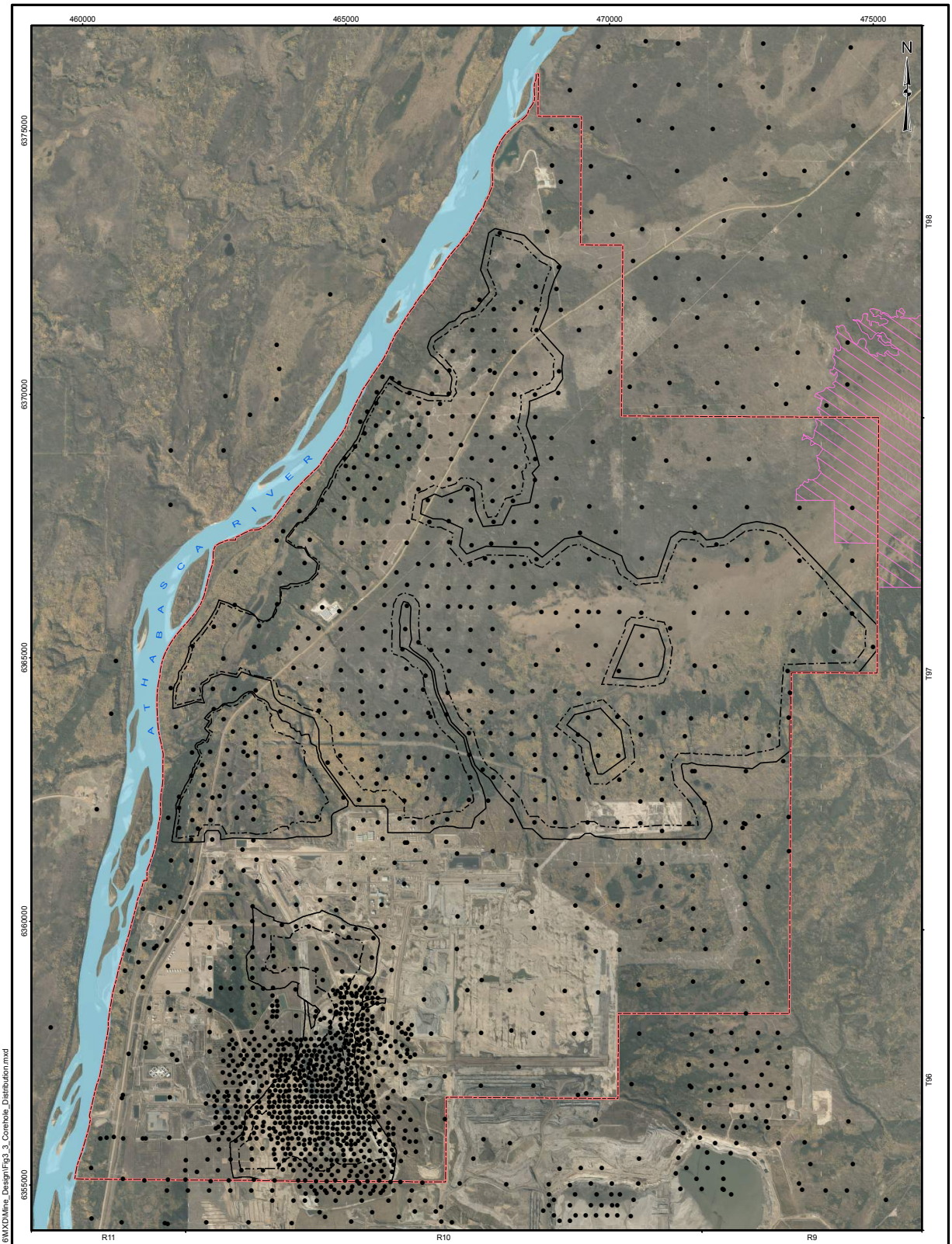
Figure 3-3 illustrates the existing core hole distribution for the Project.

With the changes described in this FHMA Mine Plan with respect to the smaller South Pit size, mining activities in the Centre and North Pits have been accelerated. To ensure that Fort Hills has adequate information and to meet requirements of AER Directive 082, Fort Hills will be undertaking an extensive drilling program in the coming years.

Oil sand delineation coring is performed annually for a number of reasons including:

- Increasing the drill density to production spacing within the 3 year operating window
- Legacy well replacement for more complete analytical and geophysical data
- Exploration to confirm pit boundaries and condemnation areas
- Increasing the drill density to improve reserve certainty

Figure 3-4 depicts the planned 5 year drilling strategy and Table 3-2 describes the locations and types of drilling. Focus shifts between the Centre and South Pits balancing the need for mining production spacing and exploration. Additional drilling is required around the west wall of the North Pit and Centre Pit to investigate potential connectivity between the basal water sands and the river. As per the conditions of the Water Act Approval (Water Act Approval No. 151636-01-00) for the project, Fort Hills is required to maintain ecosystem diversity and function of the non-mined portion of the McClelland Lake fen during operation and reclamation of the Project. Two years prior to mine pit preparations in the watershed, Fort Hills is required to have an Operational Plan (OP) in place to demonstrate how the non-mined portion of the fen will be maintained during the operation and reclamation of the project. To support the development of the OP, the McClelland Lake watershed will continue to be investigated to better understand the geology and hydrogeology of the area, and how it will potentially interact with mining activity.



LEGEND

- Model Wells
- Lease Boundary
- No Surface Access Zone

1 0 1 2 3 4
Kilometers

PROJECT:
FORT HILLS OIL SANDS PROJECT

TITLE:
EXISTING CORE HOLE DISTRIBUTION

AIR PHOTO DATE: SEPT 2015			DATUM / PRJ:	NAD83 UTM Z12N
DESIGN	DF	2-NOV-2016	SCALE: 1:70,000	REV: 0
GIS	JA	2-NOV-2016		
REVIEW	JAB	2-NOV-2016		
APPD	DC	2-NOV-2016		

Figure 3-3

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Approximately 1,000 wells are scheduled to be drilled in the next 5 years, and these will have a complete suite of wireline logs (gamma ray, resistivity, porosity, sonic, density, dipmeter) in concert with a full suite of core analysis (dean stark, PSD, MBI, SI). Further details regarding upcoming drilling plans will be communicated annually to AER through OSCR Section 30 Annual Mine Plan Submissions, and may differ to what is illustrated here. Wells drilled at Fort Hills will be licenced, if required, in accordance with Section 4 of the *Oil Sands Conservation Rules* (OSCR), which provides an exhaustive list of licensing requirements that Oilsands operators must comply with at an approved oil sands mine, notwithstanding any potential discrepancies with AER Directive 56.

TABLE 3-2: 5 YEAR DRILLING PLAN SUMMARY

Program Year	Area (Pit)	Subtotal	Total
2017	South	280	457
	Centre	68	
	OPTA/ OPTA East	57	
	MLWC	52	
2018	South	77	82
	OPTA/ OPTA East	5	
2019	South	54	66
	Centre	12	
2020	South	93	235
	Centre	82	
	North	10	
	OPTA/ OPTA East	50	
2021	South	4	214
	Centre	194	
	OPTA/ OPTA East	16	

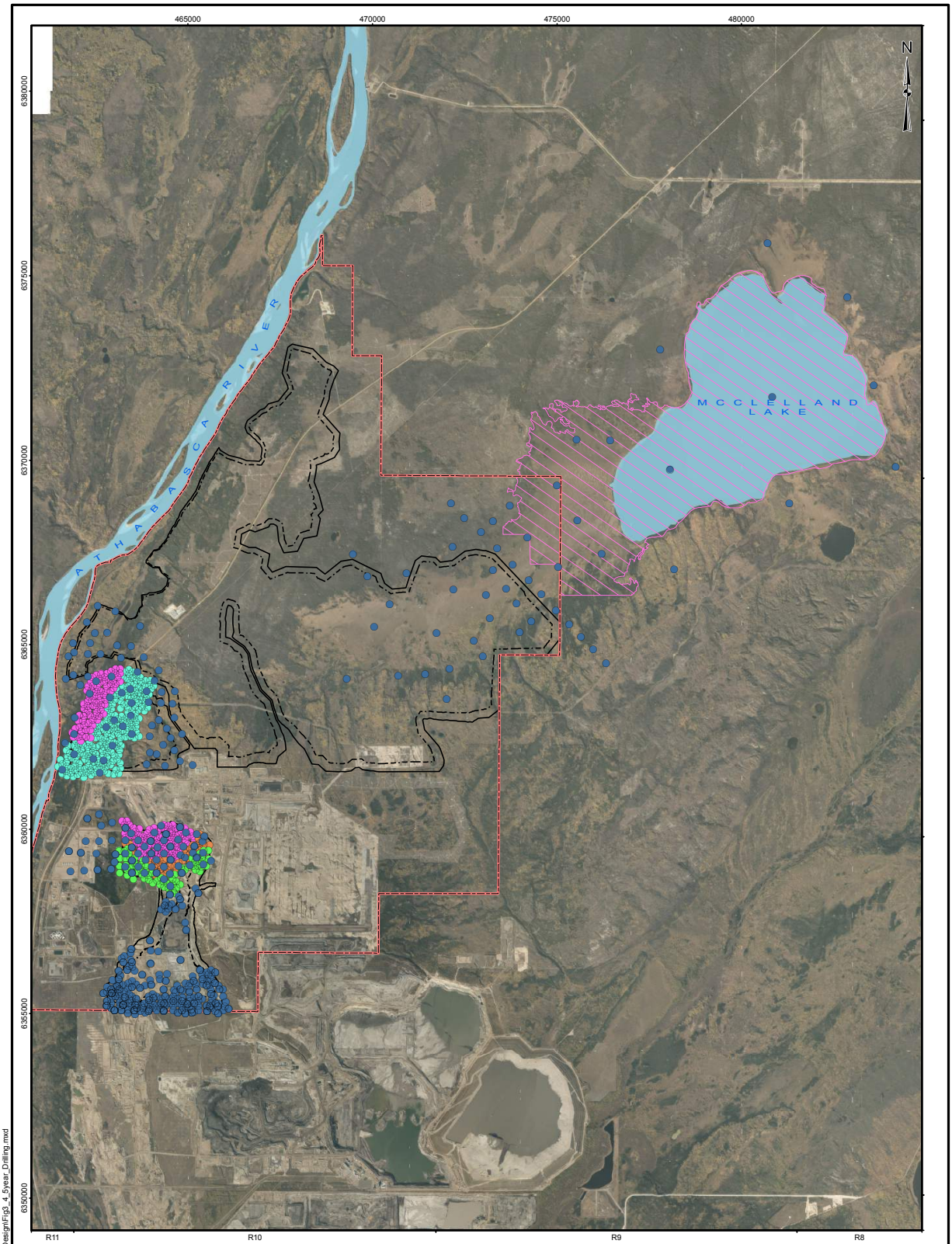
3.2.2. Modelling

The remaining geological information and interpretation has not materially changed from prior applications. Detailed geological information can be found in Section 2 (Geology) of FHEC (2010).

3.3. Mine Overview

3.3.1. Pit Design and Progression

The Fort Hills deposit is separated into three mine pits: South Pit, Centre Pit and North Pit. The pit outlines are illustrated in Figure 3-5. Figure 3-6 shows a TV:BIP map for the Fort Hills project area. The outlines provided in this section for South Pit reflect the FHMA South Pit design as discussed in Section 2.6 (Redesign of South Pit Based on the Devonian High as a Natural Barrier).



LEGEND

- 2017 Wells
- 2018 Wells
- 2019 Wells
- 2020 Wells
- 2021 Wells
- Lease Boundary
- No Surface Access Zone

1 0 1 2 3 4
Kilometers

PROJECT:
FORT HILLS OIL SANDS PROJECT

TITLE:
5 YEAR DRILLING STRATEGY

AIR PHOTO DATE: SEPT 2015			DATUM / PRJ:	NAD83 UTM Z12N
DESIGN	DF	2-NOV-2016	SCALE: 1:100,000	REV: 0
GIS	JA	2-NOV-2016	**Figure 3-4**	
REVIEW	JAB	2-NOV-2016		
APPD	DC	2-NOV-2016		

FORT HILLS
Operated by Suncor Energy

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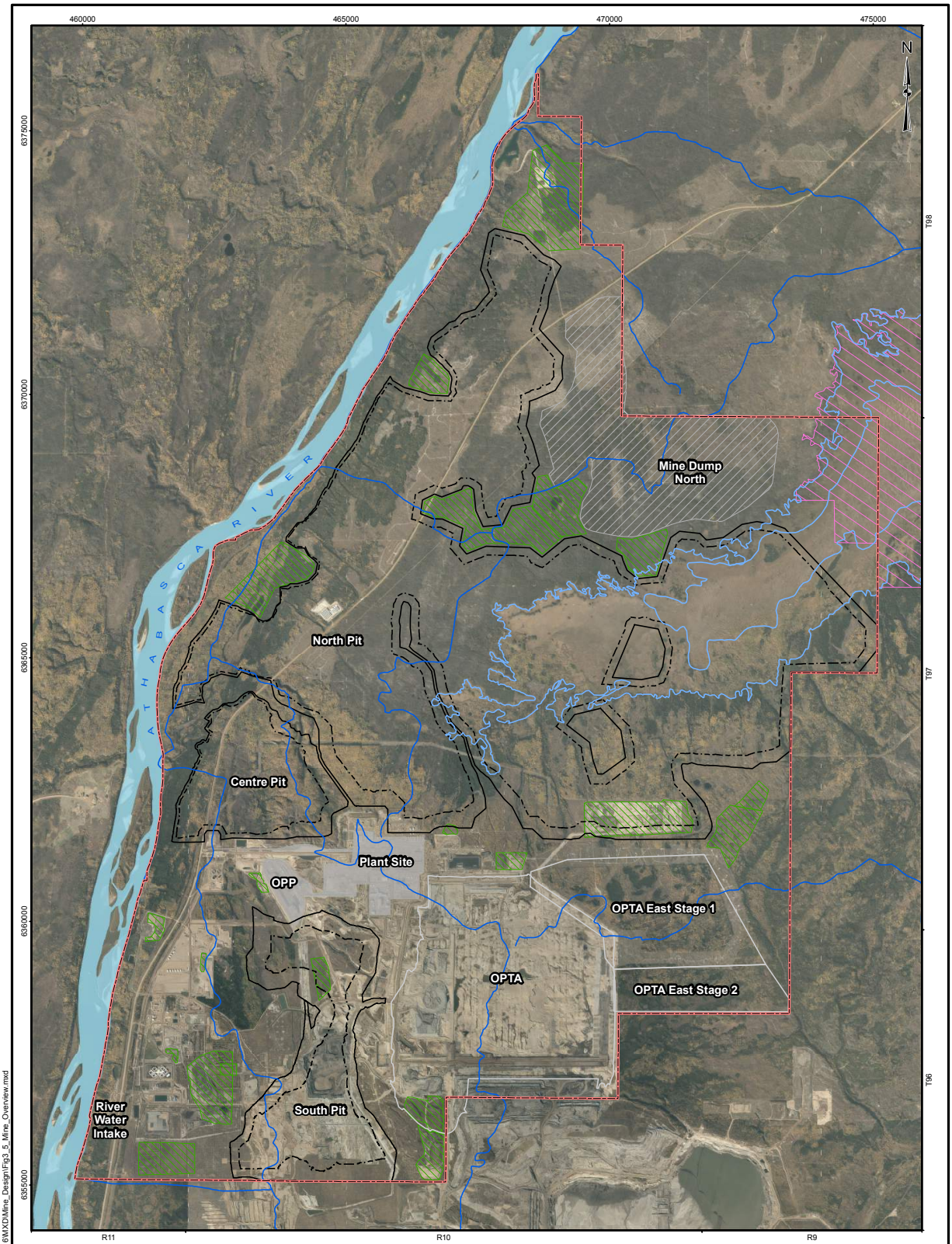

LEGEND

- Fen Boundary
- Watersheds
- Lease Boundary
- Stockpiles
- Mine Dump North
- No Surface Access Zone

1 0 1 2 3 4
Kilometers

PROJECT:
FORT HILLS OIL SANDS PROJECT

TITLE:
MINE PITS OVERVIEW

			AIR PHOTO DATE: SEPT 2015	DATUM / PRJ: NAD83 UTM Z12N
DESIGN	JAB	10-JAN-2017	SCALE: 1:70,000	REV: 0
GIS	JA	10-JAN-2017		
REVIEW	JAB	10-JAN-2017		**Figure 3-5**
APPD	DC	10-JAN-2017		

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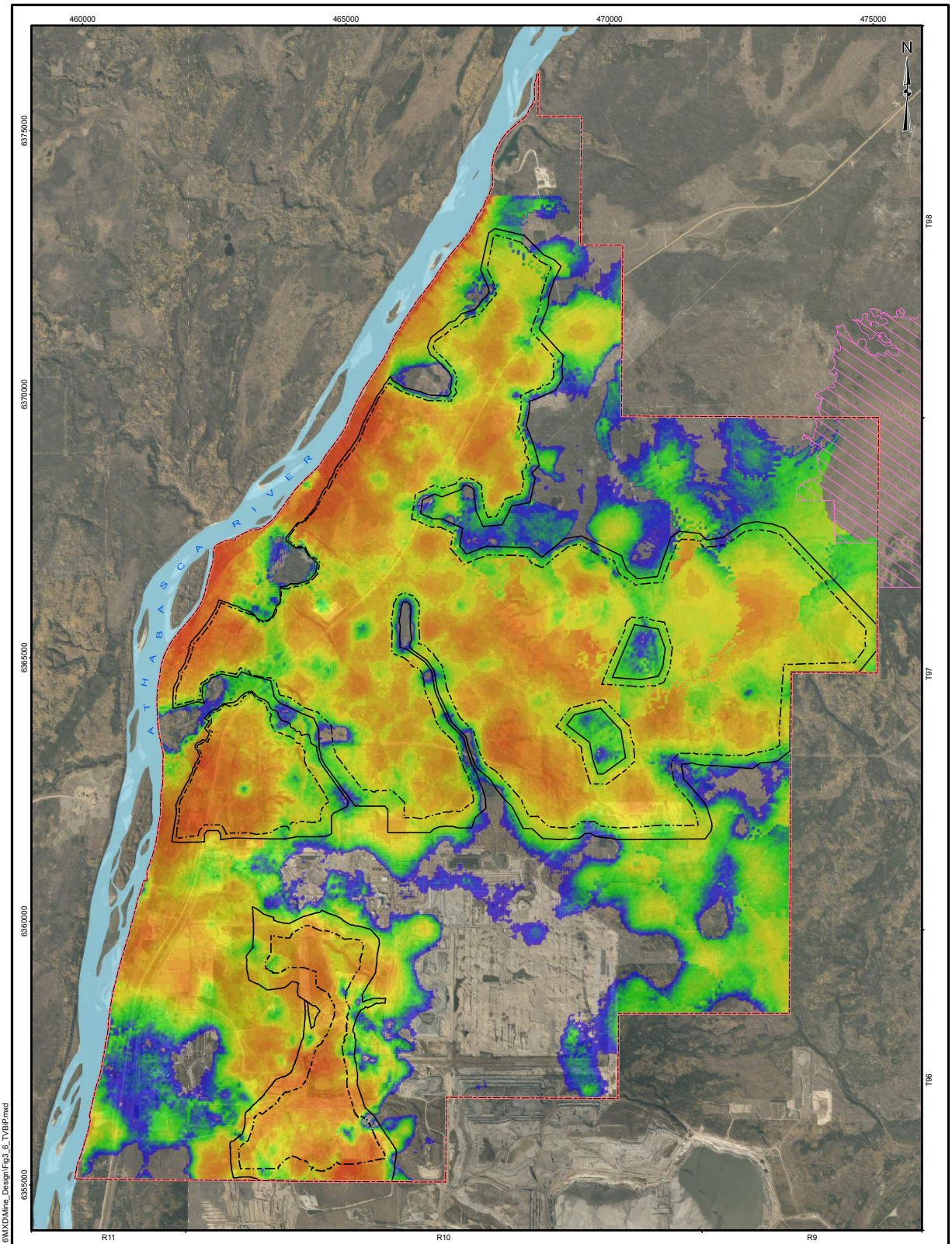

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PROJECT:

FORT HILLS OIL SANDS PROJECT

TITLE:

TV:BIP CONTOURS FOR THE FORT HILLS PROJECT AREA

			AIR PHOTO DATE: SEPT 2015	DATUM / PRJ: NAD83 UTM Z12N
DESIGN	DF	2-NOV-2016	SCALE: 1:70,000	REV: 0
GIS	JA	2-NOV-2016		
REVIEW	JAB	2-NOV-2016		
APPD	DC	2-NOV-2016		

Figure 3-6

3.3.1.1. South Pit

The Fort Hills South Pit is boundaries are set by:

- The OPTA design and a nominal TV:BIP 12:1 on its east side. The OPTA toe alignment and sterilization of 2 small pockets of 12:1 TV:BIP resource were approved by ERCB (now AER) as part of the most recent OSCA Scheme Approval for the Project (OSCA Scheme Approval No. 9241E), following the 2010 update application (FHEC 2010).
- The lease boundary in-situ pillar on its south. The in-situ pillar between Fort Hills' South Pit and the Aurora North Centre Pit and its associated resource sterilization is being applied for under separate cover (2017 In-Situ Pillar Application) later in 2017. The in-situ pillar decouples mining and tailings activity on either side of the joint lease boundary and reduces the risk and costs associated with integrating operating tailings facilities. The joint lease boundary pillar application is a result of the co-operative effort of both operators to establish a workable boundary strategy.
- TV:BIP 12:1 to its north.
- The west toe (and associated highwall) is set at 100 m east of the saline basal aquifer zero edge as described in Section 2 (Basal Water Management)

The South Pit is mined from 2017 through 2024 advancing from the opening cut towards the south establishing final highwalls on both the east and west sides of the pit. Transition of overburden mining activity to the Centre Pit begins in 2022.

The initial mine opening location is unchanged from the Approved Mine Plan (FHEC 2010) and is premised on release of quality construction materials for pre-production OPTA construction, startup ore quality, haul distance for construction and initial mine production and ore quality and strip ratio for the initial production years.

Primary haul roads and ramps are incorporated within the east and west highwall designs. Ore haulage is primarily up the west highwall going north toward the OPP and waste haulage to OPTA occurs up the east highwall to minimize interaction and congestion.

Key considerations while mining the South Pit include:

- Saline Basal Water Management – Saline basal water management as it pertains to the FHMA South Pit design and the suite of alternatives to handle residual saline water volumes is described Section 2 (Basal Water Management). The South Pit mine advance is constructed in accordance with this strategy.
- Devonian inflow mining and backfill strategy. The Devonian inflow mitigation strategy (Section 3.5), is fully integrated into the South Pit development and backfill plan.
- In-situ pillar development – The south in-situ pillar with Syncrude's Aurora North Mine pit will ultimately separate Syncrude's tailings deposit from the Fort Hills treated tailings

deposit. The in-situ pillar will be applied for under separate cover (2017 In-Situ Pillar Application) later in 2017.

- OPTA construction – The OPTA construction plan and geotechnical design is aligned with the South Pit development plan and material balance. Mine waste used for OPTA construction is sourced exclusively from the South Pit.
- Spec Material Utilization for Construction – spec material utilization for construction purposes begins in 2018-2019 at approximately 90% of the lean oil sand mined from the mine advance and decreases to less than 40% of the lean oil sand mined by 2024 as OPTA overburden construction is complete.

The South Pit development sequence is included in Appendix E.

3.3.1.2. Centre Pit

The Fort Hills Centre Pit boundaries are set by:

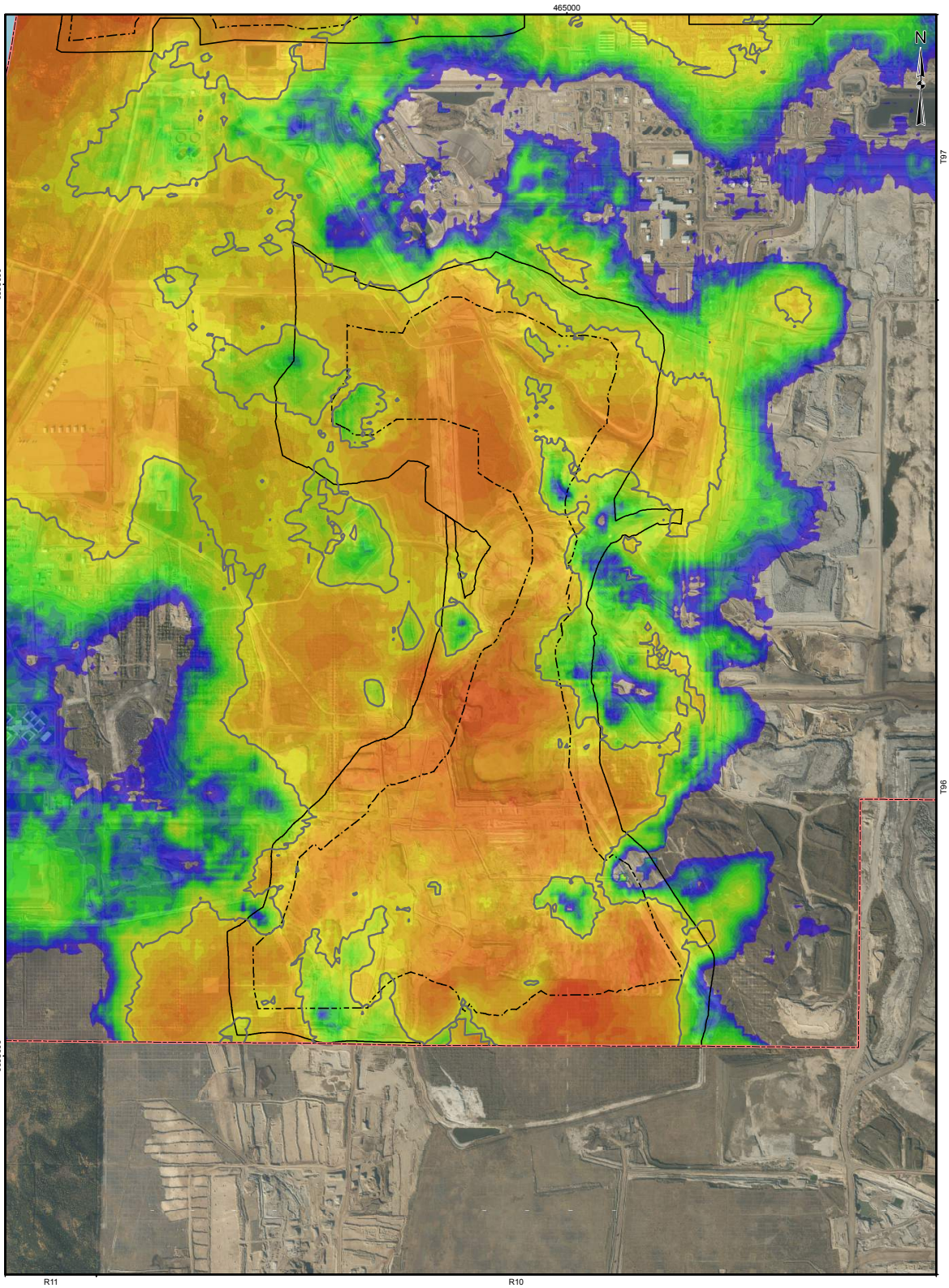
- The Athabasca River escarpment on its west side. The pit crest location was chosen to isolate the pit from a flood event in the Athabasca River.
- The plan selectively uses high TV:BIP areas (>12:1) to establish in-situ pillars to simplify tailings containment in Centre Pit.

Centre Pit development activities start in 2019 with tree clearing, ditching and reclamation material stripping in 2020 and overburden mining starting in 2022. Ore is mined from the pit from 2023 through 2026. Overburden mining to begin the North Pit transition commences in 2025.

First disturbance in the Susan Lake surface watershed occurs in 2019 with reclamation material stripping and stockpile foundation development.

The Centre Pit development sequence is included in Appendix E.

The primary waste haul road is established in 2022 to take waste to the North Dump. An ore haulage road network is established to the OPP access at the south Centre Pit highwall. The overpass is required to facilitate mine haulage from the Centre and North Pits across the main access and utility corridor to the extraction facility. The OPP access road starts as a road and jump ramp down into the advancing mine and then transitions to an east highwall ramp and a west highwall ramp.



LEGEND

TVBIP

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

TV:BIP 12

Lease Boundary

0 1

Kilometers

PROJECT:

FORT HILLS OIL SANDS PROJECT

TITLE:

SOUTH PIT DESIGN BOUNDARIES

AIR PHOTO DATE: SEPT 2015			DATUM / PRJ:	NAD83 UTM Z12N
DESIGN	DF	2-NOV-2016	SCALE: 1:25,000	REV: 0
GIS	JA	2-NOV-2016		
REVIEW	JAB	2-NOV-2016		
APPD	DC	2-NOV-2016		

Figure 3-7

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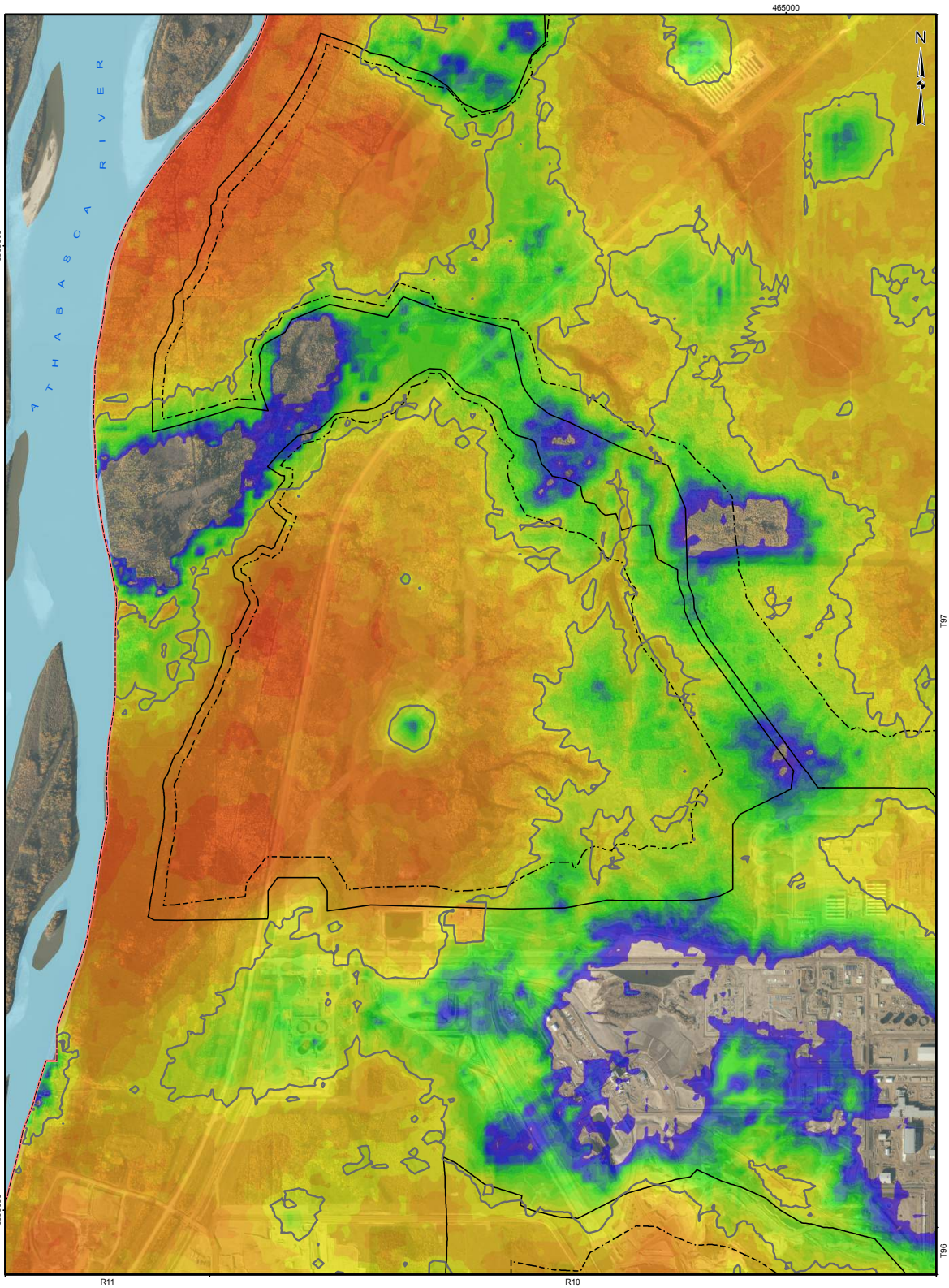


Path: \\file084\corp\gis\Projects\Oilsands\FortHills\OS0478_Mine_Amendment_2016\MXD\Mine_Design\Fig3_8_TVBIP_Centre.mxd

PROJECT:

FORT HILLS OIL SANDS PROJECT

TITLE:

CENTRE PIT DESIGN BOUNDARIES

			AIR PHOTO DATE: SEPT 2015	DATUM / PRJ: NAD83 UTM Z12N
DESIGN	DF	2-NOV-2016	SCALE: 1:20,000	REV: 0
GIS	JA	2-NOV-2016		
REVIEW	JAB	2-NOV-2016		
APPD	DC	2-NOV-2016		

Figure 3-8

The primary mine considerations while mining the Centre Pit include:

- Ore Quality – The primary ore quality issue in mining the Centre Pit is fines content. The mine plan utilizes a blending strategy that strips sufficient overburden to provide blending opportunities to maintain the fines content below the plant technical operating envelope of 20%. Additional fines avoidance techniques are being considered to manage fluid tailings make and improve ore quality and may be the subject of future discussions with AER.
- Waste Dump Strategy –Initial waste from Centre Pit is long hauled to Mine Dump North at approximately a 9 km haul distance. Haulage of Centre Pit mine waste to the South Pit is not currently considered to minimize haulage congestion through the OPP area and preserve South Pit tailings storage capacity.

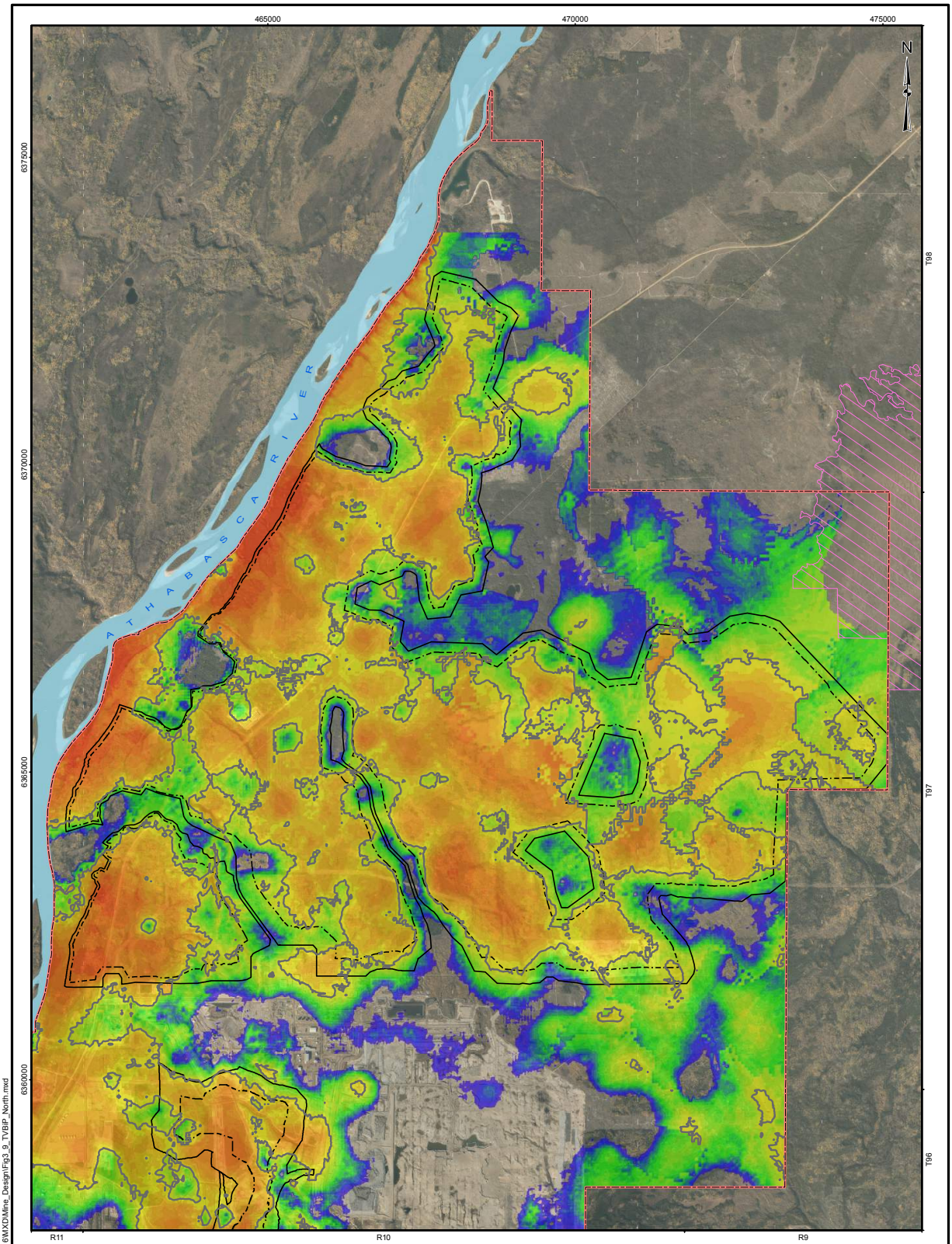
3.3.1.3. North Pit

The Fort Hills North pit boundaries are set by:

- The Athabasca River escarpment on its west side. The pit crest location was chosen isolate the pit from a flood event in the Athabasca River.
- The McClelland Lake Wetland Complex No Surface Access Zone (NSAZ) Offset on its east side. A 500 m minimum offset from the MLWC NSAZ sets the pit crest adjacent to that area. This offset will be further evaluated in the OP, which is required to be in place two years prior to mine pit development activity in the surface watershed.
- The plan selectively uses high TV:BIP areas (>12:1) to establish in-situ pillars to simplify tailings containment in the North Pit.

The North Pit has pit development activities starting in 2023 with tree clearing, ditching and reclamation material stripping in 2024 and overburden mining starting at the end of 2025. Ore is mined from the pit from 2026 through 2063. Ore haulage for the first 20 years from the North Pit is comprised of a series of primary feeder roads that ramp up the two in-situ pillars in the North Pit to a main truck road along the south highwall running toward the OPP. After 2055, as the mine reaches its northern extent, the main ore haul route will come up the west pit highwall adjacent to the Athabasca River, south toward the OPP.

The North Pit development sequence is included Appendix E.



Path: \\file084\corp\gis\Projects\Oilsands\FortHills\OSG478_Mine_Amendment_2016\MXD\Mine_Design\Fig3_9_TVBIP_North.mxd

PROJECT:

FORT HILLS OIL SANDS PROJECT

TITLE:

NORTH PIT DESIGN BOUNDARIES

			AIR PHOTO DATE: SEPT 2015	DATUM / PRJ: NAD83 UTM Z12N
DESIGN	DF	2-NOV-2016	SCALE: 1:60,000	REV: 0
GIS	JA	2-NOV-2016		
REVIEW	JAB	2-NOV-2016		**Figure 3-9**
APPD	DC	2-NOV-2016		

The primary mine considerations while mining the North Pit include:

- McClelland Lake watershed – The mine plan strategy for development inside this watershed provides sufficient time for development and implementation of the required OP (Section 3.2.1). Mining activity advances out of the McClelland Lake area sufficiently early enough in the operational period to validate mitigation plans associated with closure in this part of the mine project prior to the end of the mine life.
- Closure landforms – The North Pit mine waste placement strategy intentionally shapes landforms to meet the preliminary closure intent for the lease in the areas. For example, the plan shapes the foundation beneath the MLWC area, the Athabasca river escarpment and the extreme north end of the pit backfill. In general, this lengthens the average waste haul distance.

3.3.1.4. Mine Planning Parameters

Material and design parameters used in mine planning are summarized in Table 3-3.

TABLE 3-3: MINE PLANNING MATERIAL AND DESIGN PARAMETERS

Material Properties		
Ore	SG	Variable – based on bitumen, mineral and water content, approximately 2.1 t/m^3
Bitumen	SG	1.0 t/m^3
Waste (dump)	SG	2.1 t/m^3
	Swell	15%
Waste (structural)	SG	2.1 t/m^3
	Swell	0%
Reclamation Material	SG	1.0-1.8 t/m^3
	Swell	30%
Mining		
Bench Height (ore & waste)	3-18m	
Working Face Width	100m minimum, 200m planned	
Max Bench Gradient	5%	
Roads		
Running Width	40m	
Safety Berms	3m	
Max Gradient	5%	

3.3.2. Recoverable Resource Summary

The FHMA mine plan recovers 3.1 billion barrels of paraffinic bitumen through the mine life, 900 million barrels in excess of the initial TV:BIP 12:1 project approval.

TABLE 3-4: OVERALL RECOVERABLE RESOURCE SUMMARY

Plan	Pit Design Basis	Recoverable Bitumen
2002 EIA	12:1 TV:BIP	2.2billion rbbl
2010 Mine Amendment	12:1 – 16:1 TV:BIP variable	3.4billion rbbl
FHMA Plan	South Pit to Isolate Basal, North/Centre Pits 12:1-16:1 variable	3.1billion rbbl

3.4. Production Plan and Material Balances

The overall Fort Hills production plan is included in Table 3-5.

TABLE 3-5: LIFE OF MINE PRODUCTION PROFILE

Period	Days in Period	Ore Tonnage	Waste Tonnage	Total Tonnage	Bitumen Content	Fines Content	Daily Production
		(MT)	(MT)	(MT)	(wt%)	(%)	(kbbls)
2017	36	0	61	61	10.5	19.4	0
2018	365	90	98	188	11.2	15.8	134
2019	365	106	103	209	11.5	14.9	181
2020	366	107	124	231	11.5	15.2	184
2021	365	102	150	252	11.5	16.4	174
2022	365	116	141	257	11.1	15.4	190
2023	365	122	166	288	10.6	18.9	190
2024	366	119	166	285	10.8	19.3	190
2025	365	124	188	312	10.6	18.6	190
2026	365	117	192	308	10.9	19.3	190
2027	365	119	198	317	10.9	18.6	190
2028	366	121	195	317	10.8	17.0	190
2029	365	116	201	317	11.2	19.1	190
2030	365	116	201	317	11.1	18.6	190
2031-35	1,826	556	977	1,533	11.5	18.5	190
2036-40	1,827	537	919	1,457	11.9	14.9	190
2041-45	1,826	535	922	1,457	11.9	13.7	190
2046-50	1,826	507	823	1,330	12.4	13.5	190
2051-55	1,826	514	689	1,203	12.4	13.0	190
2056-60	1,827	535	610	1,145	11.8	17.3	190
2061-65	758	220	146	366	11.9	14.9	190
Total	**16,500**	**4,879**	**7,269**	**12,149**	**11.7**	**15.9**	**188**

Extraction recovery averages approximately 86% over the life of the project.

Table 3-6 describes the structures at the Project and their construction timing.

TABLE 3-6: CONSTRUCTION DATES FOR OVERBURDEN CONSTRUCTED STRUCTURES IN THE FORT HILLS MINE AMENDMENT APPLICATION

Structure Name	Construction Start	Construction End
OPTA	Started	2024
OPTA East Stage 1	2019	2019
OPTA East Stage 2	2023	2023
South In Pit Dump (SIPD)	2018	2024
Centre In Pit Dump (CIPD)	2023	2030
Mine Dump North	2022	2040
North In Pit Dump	2030	2063

The overall Fort Hills waste material balance is included in Table 3-7.

TABLE 3-7: MINE WASTE MATERIAL BALANCE

Period	Days in Period	Waste Tonnage[1]	OPTA Spec	OPTA Waste	OPTA East Spec	OPTA East Waste	South Pit Spec	South Pit Waste	Centre Pit Spec	Centre Pit Waste	North Pit Spec	North Pit Waste	North External Dump	Roads, Buttress, Etc.
		(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)
2017	36	61	17	40	0	0	0	0	0	0	0	0	0	4
2018	365	98	28	49	0	0	5	10	0	0	0	0	0	7
2019	365	104	23	54	6	4	1	11	0	0	0	0	0	5
2020	366	124	17	45	0	0	16	37	0	0	0	0	0	8
2021	365	150	22	42	0	0	20	62	0	0	0	0	0	4
2022	365	141	23	65	0	0	3	23	0	0	0	0	20	6
2023	365	166	0	0	6	7	7	24	5	5	0	0	92	20
2024	366	166	0	0	0	0	8	41	5	12	0	0	95	4
2025	365	188	0	0	0	0	0	0	19	73	0	0	91	4
2026	365	192	0	0	0	0	0	0	15	93	2	2	77	4
2027-30	1,461	795	0	0	0	0	0	0	12	126	50	463	124	19
2031-35	1,826	977	0	0	0	0	0	0	0	0	77	798	80	19
2036-40	1,827	919	0	0	0	16	0	0	0	0	44	408	432	19
2041-45	1,826	922	0	0	0	0	0	0	0	0	65	838	0	19
2046-50	1,826	823	0	0	0	0	0	0	0	0	89	715	0	19
2051-55	1,826	689	0	0	0	0	0	0	0	31	88	551	0	19
2056-60	1,827	610	0	0	0	0	0	0	0	0	73	518	0	19
2061-65	758	146	0	15	0	0	0	0	0	0	0	115	0	12
Total	**16,500**	**7,270**	**130**	**310**	**12**	**27**	**59**	**209**	**57**	**341**	**488**	**4,407**	**1,012**	**210**

Notes: 1. Includes 3% plant rejects, 2. "Spec" material refers to material used for geotechnical structure construction, 3. Table values represent mined materials and do not include tailings sand construction.

Status maps representing the mine and tailings advance through the life of the Fort Hills project are included in Appendix E.

3.5. Devonian Inflow Mitigation Strategy

As described in Section 2 (Basal Water Management), the Devonian inflow mitigation strategy describes how mining will be managed in areas where there is a risk of Devonian Inflow. It is a comprehensive scheme including a hydrogeological monitoring plan and a strategic mining plan classified by pressures and pit depths.

The Fort Hills project has a number of complexities that indicate a risk of an inflow event if unmitigated. These items include the known Devonian fracture network identified through geophysical programs, the high salinity basal aquifer (an indicator of an active or recently active connection) and the depth of the planned pit floor. More details on Devonian geology are provided in Section 2.3 (Geological and Hydrogeological Assessment).

3.5.1.1. Problem Specific to Fort Hills

The Keg River formation head level at Fort Hills ranges from 216 m to 252 m and the pit floor ranges from 170 m to 235 m. Existing fractures have been identified through geophysical investigations in the Devonian underlying the Fort Hills pits. Additional details on this can be found in Section 2.6 (Redesign of South Pit Based on the Devonian High as a Natural Barrier) as it pertains to the South Pit.

In the Centre Pit and North Pit, Keg River heads generally range in elevation from 236 m to 252 m. In the South Pit, Keg River heads range from 220 m to 236 m. Pit floor elevation ranges from 200 m to 235 m in Centre Pit and North Pit, and from 200 m to 230 m in South Pit.

3.5.1.2. Hydrogeological Monitoring

As mine pits are developed a hydrogeological monitoring network will be established through installation of wells in the Devonian bedrock. The Devonian monitoring system will be able to measure early indications of Devonian features opening well in advance of increased basal aquifer pressure allowing for prompt response.

3.5.1.3. Strategic Mining and Backfilling Plan

Below certain elevations in the South, Centre, and North pits (defined by the Keg River Aquifer head), the risk of mining is elevated due to potential inflow. Where the weight of unmined oil sand equals the upward force of the head in the aquifer, a Monitoring and Strategic Mining (MSM) surface has been defined and will be used by the mine. The MSM surface defines the elevation at a given location in the pit below which there exists sufficient head in the Keg River aquifer such that real-time monitoring is required to identify inflow indicators and strategic mining is required to manage risk and be prepared to mitigate inflow.

The MSM surface is defined as:

$$\text{MSM Elevation} = [(\text{Keg River Head} - \text{Pit Floor Elevation}) / 2.1\ t/m^3] + \text{Pit Floor Elevation}$$

The MSM surface through the South Pit is illustrated below in Figure 3-10. Resource A is defined as the resource above the MSM surface, and Resource B is defined as the resource below the MSM surface.

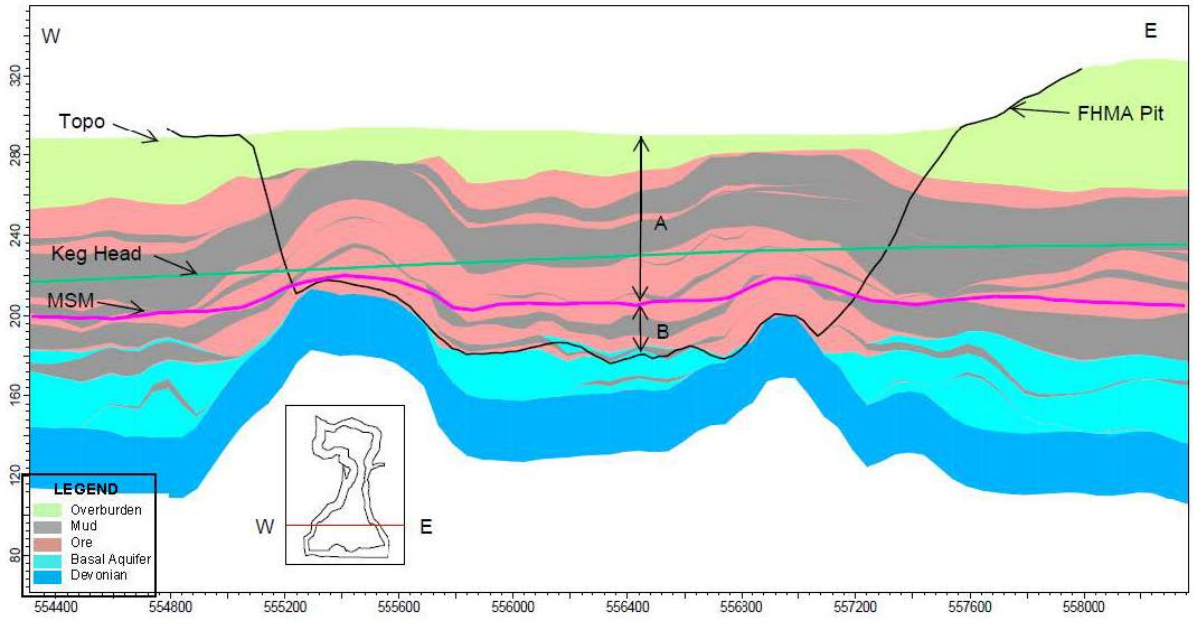
3.5.1.4. Strategic Mining Plan

Mining in Resource A will occur as per normal Fort Hills Operations.

Mining in Resource B will be more strategic and will be carried out in a manner to effectively manage risks posed by Devonian inflow. Mining in Resource B will still occur via truck / shovel methods but will incorporate various increasingly strategic mining methods with increasing depth which consider potential failure mechanisms and their associated risks. The strategic mine plan considers reduced equipment and operator exposure, access and egress of equipment and quick and effective reactions (cap and backfill).

Once mining of the ore is complete the pit will be backfilled behind the mining face as soon as practicable. The purpose of the backfill is to re-establish the weight or load on top of the Devonian. This load counteracts the pressure of the Keg Aquifer and prevents an inflow event. In-pit backfill will prioritize filling to the MSM elevation at a minimum. Within this backfill, the bottom layer will be compacted and constructed with impermiable material (lean oil sand, clay or clay-till) to provide a seepage barrier during operations and at closure.

FIGURE 3-10: SOUTH PIT SECTION – MONITORING AND STRATEGIC MINING SURFACE DEFINITION



3.6. Geotechnical Structure Design

The key mine structures are:

- the OPTA and OPTA East (Stages 1 and 2);
- the in-situ pillar between Fort Hills and the Aurora North Pit (Syncrude)
- in-pit structures; mine dumps; and
- reclamation soil stockpile areas.

There are no changes to the strategy or design basis for overburden constructed structures or geological information previously presented. Detailed designs for structures are prepared prior to operation, and submitted to the regulator as required prior to construction. The conditions before initial material placement around the structure footprint are considered at the time of detailed design to ensure location-specific conditions are understood and will be supplied with detailed designs. Fort Hills' standard practice continues to require necessary foundation preparation to be specified in the geotechnical engineering design and included with detailed designs.

This plan does not propose changes to the methods and laboratory tests that are used to collect information where structures are planned.

The mine highwall design basis is developed from conceptual-level to issued-for-construction-level (IFC) approximately 2 years before development in a given area.

The conceptual level highwall design was developed for the entire South, Centre and North pits with consideration to overburden structural dipping planes, the presence of Clearwater formation clays and dominating dip directions for McMurray formation slopes. Overburden slopes in the conceptual design are 3H:1V where there is favourable structure dips or 4H:1V where dipping beds are less favourable. Where Clearwater formation clays are present, a lean oil sand (LOS) buttress is constructed on the McMurray formation contact to support the overburden slope above. The overall highwall angle below the McMurray contact is either 1H:1V, where dip-meter data shows dipping planes into the wall, or 2H:1V where dipping planes are found sloping towards the pit

3.6.1. Out of Pit Tailings Area (OPTA)

The Fort Hills OPTA is a hybrid tailings sand and mine waste constructed facility which provides water and fluid tailings containment capacity to the plan for most of the life of the mine. The OPTA design has been described in detail and authorized under Water Act Approval 151636-01-00 (as amended).

3.6.2. OPTA East Stages 1 and 2

OPTA East Stage 1 and Stage 2 are upstream tailings sand constructed tailings ponds containing water and fluid tailings that receive initial production tailings sand in 2020 and 2025 respectively as illustrated in Appendix E.

The conceptual design for OPTA East Stage 1 has its downstream slopes of 10V:1H on all sides. The geotechnical design for OPTA East Stage 1 will be submitted for authorization under Water Act Approval No. 151636-01-00 as early as Q4 2017. Planned early development activities in the OPTA East Stage 1 footprint area include reclamation material salvaging commencing in Q4 2017 and starter dyke construction with overburden materials commencing in Q4 2018. Fort Hills will also be commencing soil windrowing in the Stage 1 footprint in Q1 2017.

The conceptual design for OPTA East Stage 2 has its downstream slopes at 10V:1H. The geotechnical design for OPTA East Stage 2 is expected to be submitted for authorization under Water Act Approval No. 151636-01-00 in 2022.

3.6.3. External Mine Dumps

External mine waste dumps built are subject to subject to AER approval prior to construction as per *Oil Sands Conservation Rules* (Alberta Regulation 76/1988). Where there is no Clearwater formation present, external dumps are constructed with preliminary side slopes of 5H:1V pending final geotechnical design. Where there is Clearwater formation present in the foundation, external mine dumps are designed with a minimum of 9H:1V pending final geotechnical design.

3.6.4. Reclamation Material Stockpiles

Reclamation material stockpiles are subject to AER approval prior to construction as per *Oil Sands Conservation Rules* (Alberta Regulation 76/1988). Reclamation material stockpiles are designed with preliminary side slopes of 4H:1V pending final geotechnical design.

Reclamation material stockpile placement and development is reflected in the status maps for mine and tailings advance through the life of the Fort Hills project (Appendix E). Shorter term development of and placement within reclamation material stockpiles is provided in the annual Fort Hills Mine Plan Submissions, submitted annually as per Section 30 of the *Oil Sands Conservation Rules* (Alberta Regulation 76/1988).

4. TAILINGS MANAGEMENT

4.1. Introduction

In 2015, the Government of Alberta issued the *Tailings Management Framework for the Mineable Athabasca Oil Sands* (TMF) as policy direction to the Alberta Energy Regulator (AER) to "manage fluid tailings volumes during and after mine operation in order to manage and decrease liability and environmental risk resulting from the accumulation of fluid tailings on the landscape." The TMF is aligned with resource and environmental management outcomes established in the Lower Athabasca Regional Plan (LARP). The objective of the TMF is to "minimize fluid tailings accumulation by ensuring that fluid tailings (FT) are treated and reclaimed progressively during the life of a project and all FT associated with a project are ready to reclaim within 10 years of the end of mine life of that project" while "balancing environmental, social and economic needs" (Government of Alberta 2015).

In July 2016, the AER issued *Directive 085: FT Management for Oil Sands Mining Projects* under the *Oil Sands Conservation Act* (OSCA) outlining FT management requirements for oil sands mining operations in the Lower Athabasca Region, including the Fort Hills Oil Sands Project (the Project), operated by Suncor Energy Operating Inc. (SEOI). For the purpose of this Application, TD is used to refer to *Directive 085: FT Management for Oil Sands Mining Projects* issued by AER on July 14, 2016.

4.2. Fort Hills Tailings Management Development

Fort Hills has been on a journey of optimization, continually incorporating the most recent learnings from Suncor and industry into the tailings management plan. The prior plan was based on a stacked above grade dedicated disposal area (DDA). This was aligned with the requirements of Directive 74.

Knowledge of FT and its management has evolved since the last plan revision. This plan builds on several years of commercial operation and billions of dollars of investment to alleviate the challenges with above grade treatment and storage of treated tailings. Specific learnings include:

- FT can be dewatered by in-line treatment and placed in a DDA;
- Above grade DDA based plans require significant land area for FT treatment due to the challenges in controlling lift thickness, seasonal operation and the limited evaporation potential in the oil sands region;
- Stacked deposits must be operated at lower rates due to the time required to achieve sufficient strength resulting in a large treatment areas and substantial costs; and
- FT can reliably be dewatered through treatment at commercial rates (proven rates of 15 M m^3 per year at Suncor operations) to about 0.5 clay to water ratio (CWR).

Suncor and industry operations have demonstrated the challenges faced when tailings deposition and mining activities are tightly linked. These challenges include; operability issues with maintaining treated tailings quality when the FT treatment process is tied to production, developing adequate in-pit space to

permit dyke construction, requiring more overburden material to build tailings containment and the requirement for additional containment contingency to manage the complexity associated with the execution of tightly integrated large projects within the confines of a producing mine. An ideal development plan mitigates these issues by decoupling mining and tailings activities both physically and temporally, reducing risk and increasing the probability of achieving outcomes. This approach also creates operational flexibility permitting the incorporation of improvements and new technologies more effectively in the future.

Fort Hills has committed infrastructure which must be considered in the evaluation of alternatives. The infrastructure components relevant to the tailings technology alternative selection which have been committed are:

- OPTA; and
- Extraction Plant with Thickeners

Through engagement with Aboriginal communities and stakeholders, Suncor has received positive feedback that a plan focusing on the placement of treated tailings below grade results a more favorable outcome than a plan requiring larger FT treatment areas and the placement of material above grade.

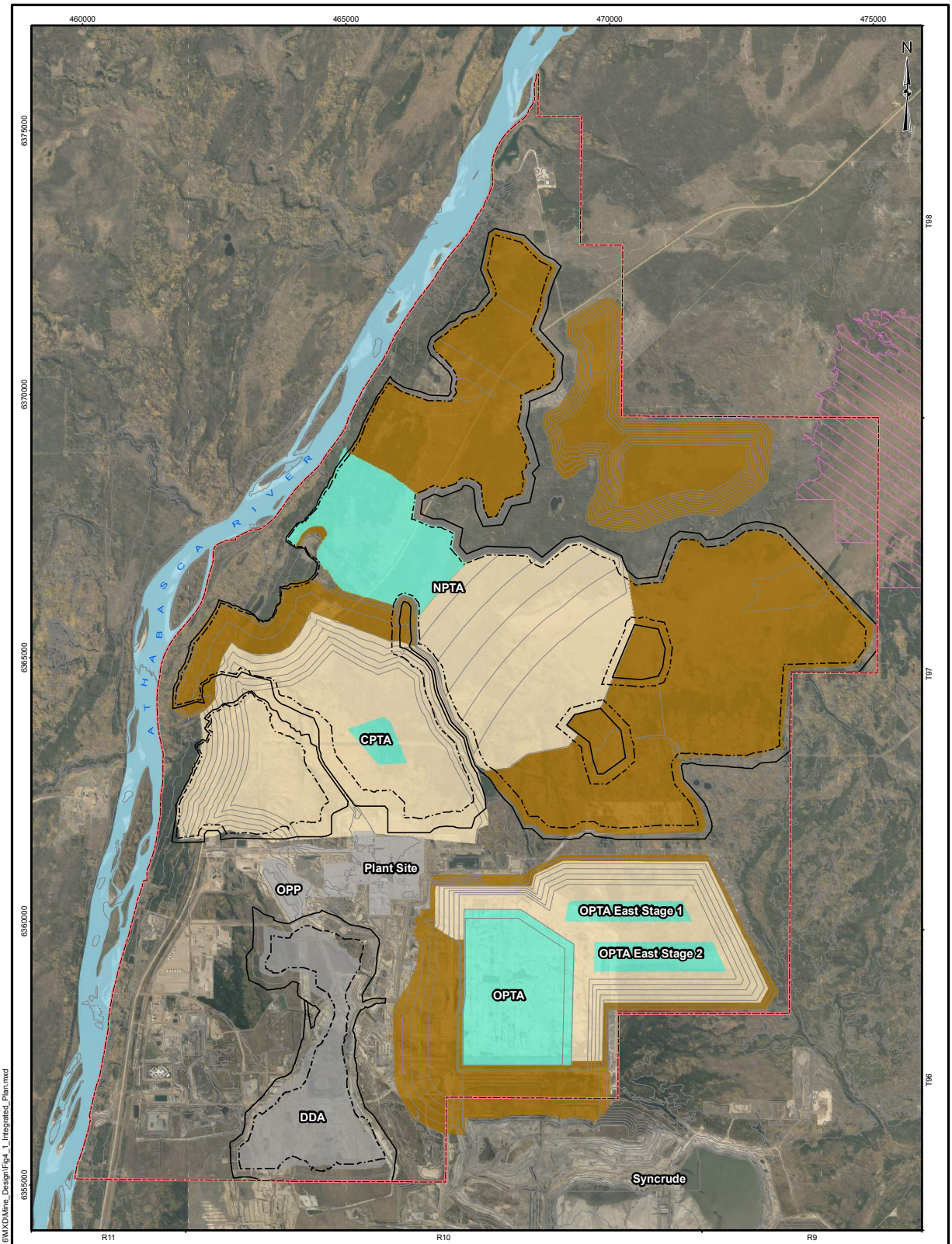
As discussed in Section 2, in order to manage Saline Basal Water at Fort Hills the size of the South Pit has been reduced from prior approved plans. This change in pit size alters the site-specific conditions which must be considered in the Fort Hills tailings management plan.

This integrated plan is based on several fundamentals:

- Use of the most recent, best available technology and leverage existing/committed assets;
- Deposition of treated tailings below grade;
- Minimize the footprint of treated tailings in the closure landscape;
- Decouple mining and tailings activities where possible;
- Reduce reliance on weather for FT treatment;
- Manage FT from the start of production, using multiple technologies/approaches to reduce FT accumulation; and
- Increase confidence in closure outcomes.

Using the development approach outlined in Section 1, Fort Hills has prepared an integrated plan that addresses the requirements of the TD and incorporates our learnings from industry as described in the fundamentals above.

The tailings areas and DDA locations referenced in this application are shown in Figure 4-1.



LEGEND

- Treated FT
- Sand
- Overburden
- FT
- No Surface Access Zone
- Lease Boundary

NOTES

Elevation (EL.) in meters above sea level

OPP	Ore Preparation Plant
OPTA	Out-of-Pit Tailings Area
DDA	Dedicated Disposal Area

1 0 1 2 3 4
Kilometers

PROJECT:
FORT HILLS OIL SANDS PROJECT

TITLE:
TAILINGS AREAS AND TREATED TAILINGS DEPOSITS

AIR PHOTO DATE: SEPT 2015			DATUM / PRJ:	NAD83 UTM Z12N
DESIGN	JGB	2-NOV-2016	SCALE: 1:70,000	REV: 0
GIS	JA	2-NOV-2016	**Figure 4-1**	
REVIEW	JAB	2-NOV-2016		
APPD	DC	2-NOV-2016		

FORT HILLS
Operated by Suncor Energy

Path: \\file084\corp\gis\Projects\OilSands\FortHills\OSG478_Mine_Amendment_2016\MXD\Mine_Design\Fig4_1_Integrated_Plan.mxd

4.2.1. Tailings Technology

4.2.1.1. Alternatives Considered

In developing a site-specific plan for the management of FT a range of alternatives secondary treatment technologies were assessed. Fort Hills has already installed tailings management assets, including thickeners, the OPTA and associated tailings and water transfer systems. The thickeners reduce energy consumption and reduce the volume of FT generated from the start of operations by accelerating the FT dewatering process resulting in a decrease in FT volumes, effectively reducing the amount of FT generated from the start of production. As well, enhanced beach capture has been incorporated within the plan by placing sand in tailings areas that contain FT which improves beach fines capture. These two "Primary Treatment" processes manage FT growth from the start of production and reduce the FT generated from about 1,000 M m^3 to about 600 M m^3 (the remaining FT generated) as shown in Figure 4-3. The assessment of alternatives for FT Management is focused on the management of the remaining FT generated after primary treatment.

4.2.1.2. Secondary Treatment Technologies

The following treatment technologies were assessed:

- In-line treatment;
- Consolidated Tailings (CT) and Non-Segregating Tailings (NST);
- Direct placement of primary thickener underflow; and
- Solids-liquid separators as secondary treatment.

Fort hills will continue to pursue advancement of other tailings treatment technologies, the following assessment is based on current knowledge of commercially ready technologies and their potential use for the site specific conditions of the Project.

4.2.1.3. In-line Treatment

In-line treatment of FT followed by dewatering in the deposit has been a critical component of Suncor Base Plant's TRO operations. It has also been successfully applied in commercial operations by Shell Canada Ltd. (Shell) and field-piloted by Syncrude Canada Ltd. (Syncrude). Considerable effort has been and continues to be applied to refinements and improvements to the technology for application over a range of FT properties and a variety of below-grade and above-grade deposit locations. In-line treatment can be expanded if required, providing flexibility during operations.

This technology has the advantage of being able to utilize operating experience available from Suncor's operations, flexibility gained from decoupling tailings treatment from bitumen production and lower cost to implement and operate. In addition, the technology has proven commercial performance in dewatering and has comparable treated tailings properties to alternative treatment technologies.

4.2.1.4. CT and NST

CT and NST consist of mixing FT with dewatered CST to produce a mixture that then consolidates to a sand-dominated deposit. There has been considerable effort applied in the industry over the past two decades to successfully deploy this technology including extensive experience at Suncor Base Plant operations.

CT and NST deposits require containment while self-weight consolidation is underway. Figure 4-2 represents the NST and associated dyke construction (depicted in coral in Figure 4-2) from the NST based mine plan included in the 2007 Fort Hills Oil Sands Project Amendment Application (FHEC 2007).

This NST based plan requires a large footprint to treat FT and uses most of the sand available, leaving limited sand for construction and capping. This results in a mine plan that is prohibitively reliant on construction of numerous interconnected overburden dykes following immediately behind the mine advance to contain the NST due to the site specific overburden availability. In addition, the operating process is directly connected to bitumen production. This can lead to operability issues with maintaining treated tailings quality and the plan results in reclaiming numerous soft deposits that dominate the reclamation landscape. The combination of these restrictions produces a site specific plan with high execution risk, longer reclamation timelines and for these reasons Fort Hills is no longer pursuing this approach.

4.2.1.5. Direct Placement of Primary Treatment Thickener Underflow

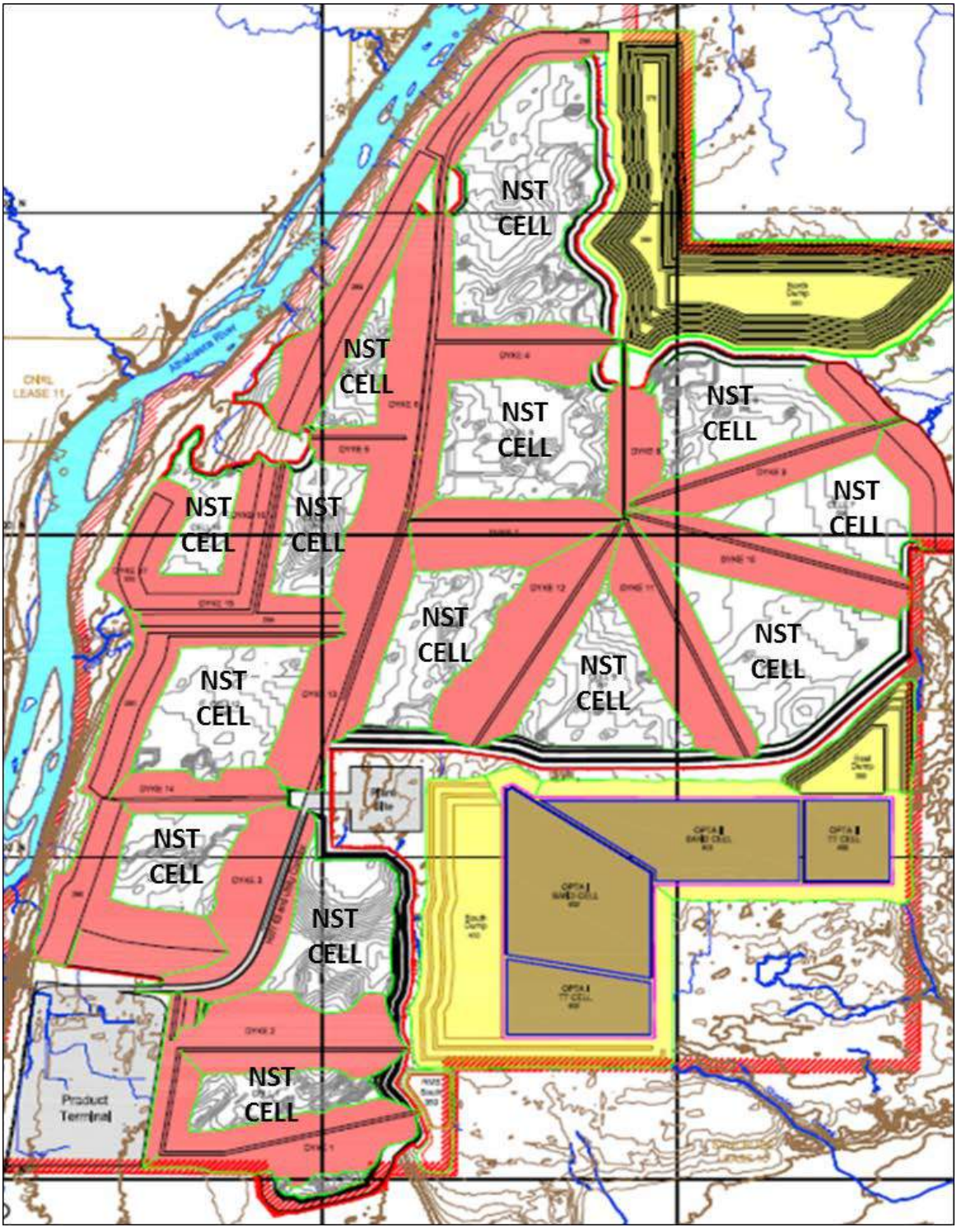
Direct placement of thickened tailings from the existing thickeners in the bitumen production facility into the DDA with and without secondary in-line treatment was considered.

The current tailings plan assumes that the TT stream will segregate and form a beach deposit and the remaining material will contribute to the FT inventory. Direct placement of the existing TT is not a desired solution without a secondary treatment as it is not expected to dewater sufficiently to support timely reclamation.

Direct placement with secondary in-line treatment may be possible to improve the dewatering. This alternative is not the plan basis as it:

- Connects secondary treatment with the bitumen production facility, which adds additional operability challenges that can impact performance
- The sand within the TT stream would displace treated tailings capacity in the DDA
- Removal of the TT stream from tailings areas would reduce some of the benefit of enhanced beach capture

FIGURE 4-2: NST CELL CONFIGURATION FROM NST BASED 2007 FORT HILLS AMENDMENT APPLICATION



4.2.1.6. Solids-Liquid Separators as Secondary FT Treatment

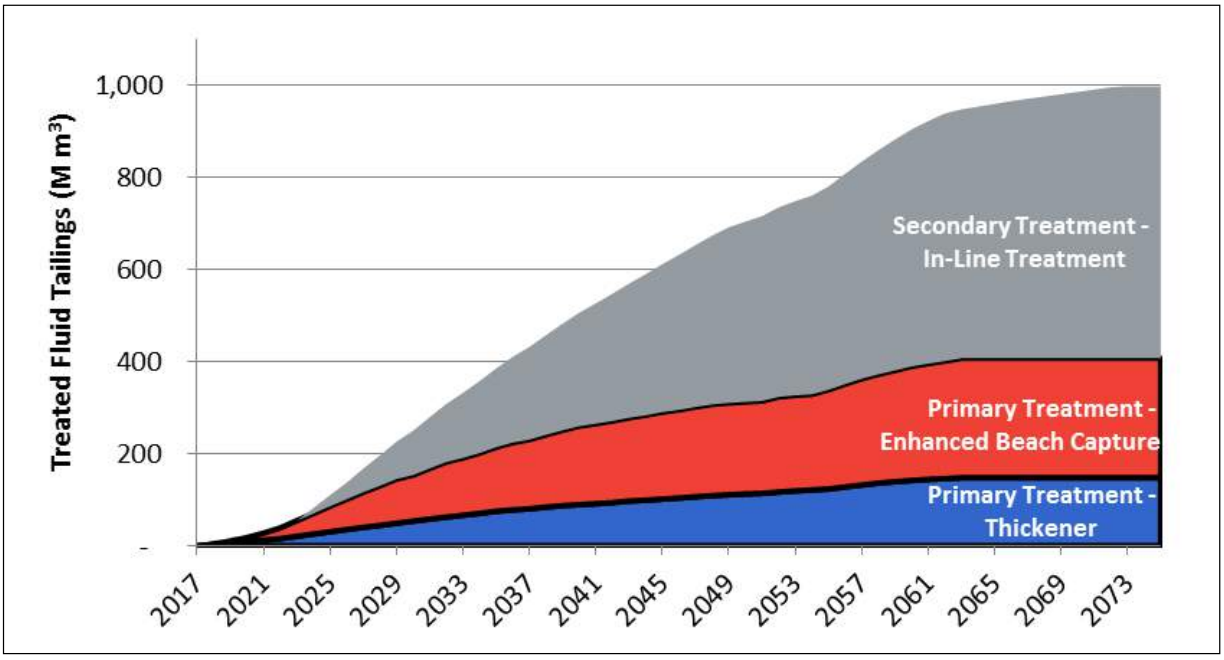
Solid-liquid separators (e.g. centrifuge) are mechanical methods to remove water within a processing facility. The methods combine the use of in-line treatment and mechanical dewatering as described above with the application of gravity separation to rapidly dewater FT.

The use of solid-liquid separators as a secondary FT treatment method is expected to deliver a product with similar qualities when compared to in-line treatment. For this reason this technology has not been included as the basis of the plan.

4.2.2. Secondary Treatment Technology Summary

Given Suncor's substantial experience in operating DDAs employing in-line treatment, the challenges expressed and lack of conclusive benefits with implementation of the other alternative technologies, in-line treatment has been chosen for the secondary treatment technology basis in the plan. This approach has the added benefits of decoupling FT treatment from bitumen production, mining and other tailings activities. However, other tailings treatment technologies, including solid liquid separators, will be monitored through COSIA to assess improvements in FT treatment performance as progress is made. Figure 4-3 illustrates the fluid tailings reduction from the various technologies utilized within the tailings plan.

FIGURE 4-3: FT TREATMENT



4.3. Tailings Process Summary

Mining operations at the Project are truck-shovel based. Ore is delivered to the Ore Preparation Plant (OPP). Mine waste is used for construction of tailings facilities and placed in mine dumps.

Ore is sized with crushers, run through rotary breakers to remove oversize material that is then placed in mine dumps. Additional water is added to the remaining material to transport to extraction as a slurry.

The extraction process separates the slurry into froth and tailings streams. The tailings streams are coarse sand tailings (CST) and thickened tailings (TT).

The froth is sent to froth treatment where light hydrocarbon solvent is used to decarbonize the bitumen and separate it from the froth. The light hydrocarbon is recovered in the tailings and solvent recovery unit (TSRU) in order to recycle it for reuse. The remaining water, mineral and residual hydrocarbon forms TSRU tailings. The final product is marketable decarbonized bitumen.

CST are used for construction of tailings areas and beaching operations. Runoff fines from CST contribute to the FT inventory.

The TT is deposited in the tailings areas where it segregates into a non-structural beach and contributes to the FT inventory. The TSRU tailings stream is deposited in the tailings area.

Water from the tailings streams is stored in OPTA and recycled to the extraction facility.

The FT inventory is harvested from OPTA for treatment and placed in the DDA

4.4. Tailings Management Strategy

Fort Hills' integrated plan involves a series of inter-related projects to manage mine production, FT, sand and overburden storage for the Project through End of Mine Life (EML). Key components of this plan are:

- Primary Treatment of fines from the start of production with thickeners to reduce FT volume;
- Deposition of coarse sand tailings in areas containing FT to improve fines capture;
- Collection of beach runoff in OPTA, which serves as the long term storage and dewatering area of FT and the primary source of DDA feedstock;
- Commencement of secondary treatment of FT from OPTA once mining in the South Pit is complete. Treated tailings will be placed below grade in the DDA located in the South Pit starting in 2024;
- Placing sand in OPTA East starting in 2020, preserving OPTA fluid storage capacity and below grade space for treated FT;

- Operation of the CPTA when OPTA East sand storage space is depleted between 2031-2035; and
- Operation of the NPTA when CPTA sand storage space is depleted in between 2051-2055.

The plan is developed such that mining, tailings, and closure are fully integrated, considering implications that the mine design and advance have on the tailings storage plan, closure plan, and vice versa. The integrated plan decouples mining and sand tailings and fluid tailings management activities as much as practical by having those activities not share or compete for the same space at the same time. A key example of mine and tailings plan integration and the resulting decoupling is represented in the following components of the plan:

- The South Pit design has been modified to isolate saline basal water, but also accelerates mine completion to 2024
- OPTA's fluid holding capacity has been preserved to hold FT inventory until 2024 prior to FT treatment commencing by allocating sand to OPTA East Phase 1 starting in 2020
- FT treatment commences in 2024 depositing treated FT into the South Pit
- The accelerated South Pit mining schedule coupled with the Centre Pit pillar design and resulting Centre Pit mine schedule allow for the orderly transition of sand placement from OPTA East Phase 1 and 2 directly into Centre Pit once mining is complete.

The result of the above components is an integrated plan that has the DDA in the South Pit for the placement of treated tailings that is not competing with mine development activity or sand storage capacity requirements. Likewise, the mine is not required to construct schedule driven overburden dykes to contain either fluid tailings or sand due to the mine design strategy and development timing. Furthermore, OPTA East Phases 1 and 2 are designed to remove sand from the system for enough time to enable decoupling sand placement from the mine advance timing. This strategy has been developed with closure in mind allowing for the placement of treated fluid tailings below grade in one location representing less than 5% of the disturbed area. The remainder of the Fort Hills site now involves the reclamation of sand and overburden substrates resulting in more confidence in closure outcomes.

4.4.1. OPTA Tailings Deposition Strategy

OPTA is a hybrid mine waste and tailings sand constructed tailings pond that acts as the primary FT containment area and process recycle water clarification area for most of the mine life. The west and south dykes of OPTA are constructed with mine waste using a centerline construction method. The north and east dykes of OPTA are constructed with CST using an upstream construction method.

Mine waste construction activity in OPTA is currently ongoing and will continue until OPTA reaches its final design height of 406 masl in 2024.

CST tailings deposition in OPTA commences with first production and is focused on cell construction and beaching operations on the north and east dykes from first production through to 2024 when OPTA

reaches its full height. Sand volumes above those required for upstream construction (to meet the required containment design and geotechnical requirements) are diverted to OPTA East Phase 1 starting in 2020 to preserve OPTA fluid containment capacity. After 2024, all CST streams transition to OPTA East Phase 1 or 2. Runoff fines from the CST streams contributes to the FT inventory in OPTA.

TT is deposited in the northwest corner of OPTA off the centerline constructed dyke. The TT stream segregates into a non-structural beach (off the centerline constructed dyke) and contributes to the FT inventory. The TT stream is deposited in OPTA from first production through to the end of 2024 when it transitions to OPTA East Phase 1.

The TSRU tailings stream is co-deposited beside the TT stream and also forms a non-structural beach with runoff fines contributing to the FT inventory in OPTA. TSRU tailings are deposited in OPTA throughout the mine life with the non-structural beach that it forms slowly displacing FT containment capacity as the FT inventory is drawn down.

Enhanced beach capture is accounted for in the tailings plan when CST beaches are deposited into an FT inventory. Below the FT mudline, fines that were in the FT layer become entrained in the CST pore space. The plan leverages this mechanism in the plan whenever possible, including in OPTA.

OPTA is infilled with sand by 2063 to prepare for reclamation activities.

The tailings progression is represented in the mine and tailings status maps included in Appendix E.

4.4.2. OPTA East Phase 1 and 2 Deposition Strategy

OPTA East Phases 1 and 2 are upstream constructed tailings ponds constructed with the CST tailings lines.

CST deposition in OPTA East Phase 1 commences in 2020. From 2020 through 2024, OPTA East Phase 1 is constructed with surplus sand which is not required in OPTA for fluid containment construction or for geotechnical requirements.

In 2025, first CST is deposited in the OPTA East Phase 2 footprint. CST is placed in OPTA East Phases 1 and 2 through to 2033. CST deposition begins transitioning to CPTA in 2028.

TT is deposited in the OPTA East Phase 1 from 2025 through 2031. As in OPTA, the TT stream forms a non-structural beach with runoff fines contributing to the FT inventory in OPTA East Phase 1. Transitioning TT deposition to OPTA East Phase 1 both prevents the non-structural beach that it forms from using up fluid containment capacity in OPTA and also provides an FT inventory to enable the enhanced beach capture mechanism to increase the net captured fines in CST beaches.

Water and FT from OPTA East Phases 1 and 2 are transferred to OPTA. OPTA acts as the process recycle water clarification area and as the FT dewatering and storage pond for future FT treatment.

OPTA East Phases 1 and 2 are infilled with sand by 2035 to prepare for reclamation activities. This facility will contain a small remnant amount of FT that will be managed in the closure landscape.

The tailings progression is represented in the mine and tailings status maps included in Appendix E.

4.4.3. CPTA Deposition Strategy

CPTA is an upstream constructed tailings pond.

CST deposition in CPTA begins its transition from OPTA East in 2028. CST deposition continues in CPTA until 2055.

TT is co-deposited with CST in CPTA to provide an FT inventory to enable enhanced beach capture mechanism to increase the net captured fines in CST beaches in CPTA.

Water and FT from CPTA are transferred to OPTA. OPTA acts as the process recycle water clarification area and as the FT dewatering pond for future FT treatment.

CPTA is infilled with sand by 2055 to prepare for reclamation activities. This facility will contain a small remnant amount of FT that will be managed in the closure landscape.

The tailings progression is represented in the mine and tailings status maps included in Appendix E.

4.4.4. NPTA Deposition Strategy

NPTA is a beaching operation into the mined out North Pit to form a tailings pond.

CST deposition in NPTA begins its transition from CPTA in 2051. CST deposition continues in NPTA until the end of the mine life.

TT is co-deposited with CST in NPTA to provide an FT inventory to enable enhanced beach capture mechanism to increase the net captured fines in CST beaches in NPTA.

Initially, water and FT from NPTA are transferred to OPTA. OPTA acts as the process recycle water clarification area and as the FT dewatering pond for future FT treatment.

As OPTA begins to be infilled with sand for closure FT are transferred directly to the DDA. NPTA functions during this period of time as the process recycle water clarification area.

As FT is transferred out, a portion of NPTA will be filled with fresh water for reclamation activities. This facility will contain a small remnant amount of FT that will be managed in the closure landscape.

The tailings progression is represented in the mine and tailings status maps included in Appendix E.

4.4.5. Conceptual DDA Deposition Strategy

FT is sourced from FT supply dredges inside OPTA. The FT supply is pumped to the centrally located treatment infrastructure area on the east pit crest of the South Pit where that infrastructure will be located throughout the mine life. Treated tailings will be pumped down the east highwall ramp system to the initial treated tailings beaching area in the southwest corner of the South Pit. Treated tailings will be beached sub-aerially over placed mine waste that slopes toward the southwest corner. Water will be recycled from the DDA back to the OPTA.

The plan is for treated tailings to be beached sub-aerially, however sub-aqueous deposition is also possible without negatively impacting the treated tailings if necessary. The treated tailings will continue to dewater at the same rate with or without a water cap.

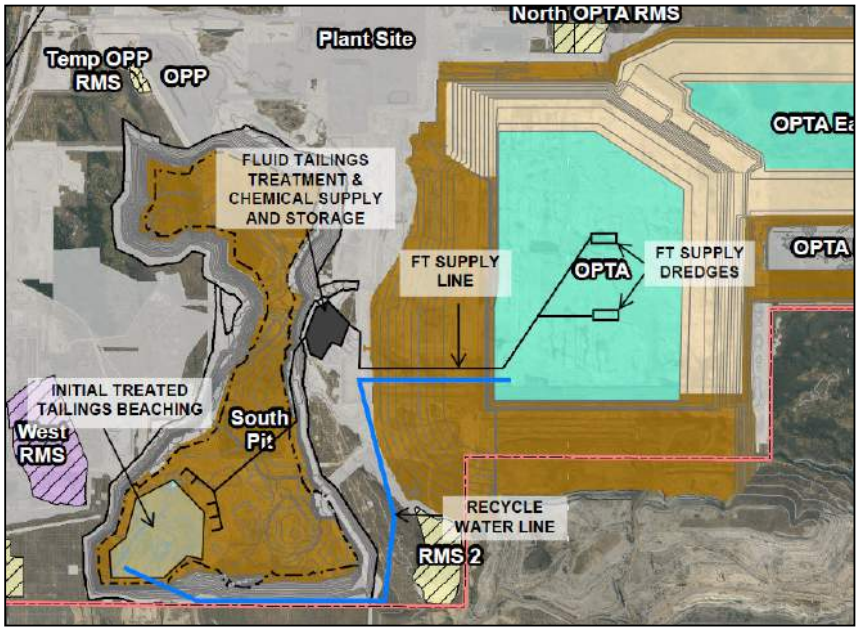
As treated tailings continues to be deposited, the placement piping system will retreat up the slope of the placed mine waste towards the east highwall, and ultimately up the highwall. The rate of rise of placed treated tailings is expected to be in the range of 1 to 2m per year.

This treatment is based on commercially proven methods and rates. This type of operation has been proven at Suncor's Base Plant through the continued operation of DDA1. The treatment of the FT will result in treated tailings that flow and continue to dewater after placement. This treatment is also designed to produce a stable deposit which limits the mobility of materials such as bitumen and fines.

In-pit treated tailings deposition at Fort Hills is scheduled to commence in 2024. Deposition of treated tailings at DDA3 at Suncor's Base Plant operations will have approximately 6 years of operational performance by the time that the technology is implemented at Fort Hills. The Fort Hills plan and process design for fluid tailings treatment will be calibrated and optimized in accordance with performance at Base Plant's DDA3.

The treated FT deposition plan is illustrated in Figure 4-4.

FIGURE 4-4: CONCEPTUAL DDA DEPOSITION PLAN



4.5. Tailings Plan Assumptions and Criteria

Bulk material planning parameters used for tailings planning are provided in Table 4-1.

TABLE 4-1: PROPERTIES OF TAILINGS MATERIALS

Source Material	Specific Gravity (t/m³)	Notes
Sand	2.60	Particles larger than 44 micron
Fines	2.62	Particles smaller than 44 micron

Differences between each tailings type described in the following sections is dictated by composition in terms of the primary components. The composition and density of each tailings type is provided in Table 4-2. Solids in the tailings are broken into sand (particles larger than 44 micron) and fines (particles smaller than 44 micron) so inferences regarding particle size distribution can be made.

TABLE 4-2: TAILINGS COMPOSITION

Tailings Type	Sand Content (wt% of mineral)	Fines Content (wt% of mineral)	Dry Density (t/m³)	Beach Angle
CST Cell	96%	4%	1.59	n/a
CST Beach	87%-96%	4-13% (deposition dependant)	1.53	2% BAW, 6% BBW
TT Beach	86%	14%	1.51	n/a
TSRU Beach	40%	60%	0.95	n/a
Fluid Tailings	0%	100%	n/a	n/a

The properties of the treated tailings used in the tailings plan are provided in Table 4-3. Treated tailings composition is variable and dependent upon FT being treated.

TABLE 4-3: PLANNING CRITERIA FOR FLUID TAILINGS TREATMENT

Location	Mineral Content (wt%)	Water Content (wt%)	Bitumen Content (wt%)
DDA	54	46	Not Modelled

The volume of water within the tailings area system is managed to ensure required freeboard and water cap thickness is maintained for water clarification. The assumed water cap for each pond is shown in Table 4-4.

TABLE 4-4: ASSUMED WATER CAP THICKNESS

Tailings Area	Assumed Operational Water Cap Thickness	Notes
OPTA	3 m	Supports water clarification and FT management
OPTA East Phase 1	1 m	Supports FT intake system operation
OPTA East Phase 2	1 m	Supports FT intake system operation
CPTA	1 m	Supports FT intake system operation
NPTA	3 m	Supports water clarification and FT management
DDA	Not applicable	Deposition of treated material, water will run off to a collection area and operate similar to the tailings areas

Tailings deposits will be monitored in accordance with approval requirements as well as in compliance with the requirements included within the TD.

Predictions of the quality of ore feed to the bitumen recovery process are based on a geological model in the mine plan that reflects core hole data. The mine plan generates the material characteristics and volumes used in the tailings model. Ore feed characteristics, including fines distribution are included in Section 3.4.

4.6. Tailings Plan Milestones

The planned construction, operation and decommissioning dates for the tailings structures in this plan area shown in Table 4-5. Fluid capacities listed in the table represent structure design capacity; operating volumes are represented in Table 4-15.

TABLE 4-5: PLANNED CONSTRUCTION, OPERATION AND DECOMMISSIONING OF TAILINGS FACILITIES

Facility	Structure Design Fluid Capacity	Planned Construction Start Date	Planned Operation Start Date	Estimated End of Operations Date	Estimated Start of Closure Activity
OPTA	170 M m^3	Started	2017	2063	2030
OPTA East Phase 1	20 M m^3	2019	2020	2031	2035
OPTA East Phase 2	10 M m^3	2023	2024	2033	2040
CPTA	40 M m^3	2028-2030	2028-2030	2051-2055	2060
NPTA	90 M m^3	2051-2055	2051-2055	2073	2073
DDA	360 M m^3	2024	2024	2073	2073

The function of the tailings areas within the Project and the key activities associated with their management are described in Table 4-6.

Tailings areas are expected to have a small remnant volume of FT left behind due to the nature of removal of this material. This remnant volume of FT will be managed through reclamation and closure activities on a case-by-case basis. The expected remnant volumes are provided in Table 4-6.

Table 4-7 to Table 4-11 describe the volume and elevations of each structure, description of material types used for construction and a list of tailings types entering the structure. The mine waste material balance representing mine materials used for construction is included in Section 3.4.

TABLE 4-6: FT AREAS SUMMARY

Deposit	Function	Approach in Tailings Management Plan	Rationale for Approach	FT Treatment	Forecast Remnant Volume (M m^3)	Primary Closure Outcome
OPTA	• Recycle water storage and supply • FT dewatering, storage and supply • Sand storage	• OPTA is the primary storage area for FT • Enhanced capture of fines in the structures as built • Receives TSRU tailings until EML • FT from OPTA EAST and CPTA operations are transferred to the OPTA • FT transferred to DDA • Infill commences between 2056-2060in order to be completed by EML, with FT transferred to DDA for treatment and process water transferred to NPTA as infilled	• Required through EML to provide recycle water and dewater and store FT for further treatment • CST placement ceases at EML	• Secondary Treatment required to manage containment begins once South Pit mining is complete	10	Terrestrial
OPTA East Phase 1	• Sand storage • FT transfer to OPTA	• CST and TT placement • Enhanced capture of fines in the structures as built • FT pond managed for safe operation	• CST placement ceases in between 2031-2035 when full, with final transfer of FT to OPTA occurring in that year	• Required to manage containment • FT transfer complete between 2031-2035	6	Terrestrial
OPTA East Phase 2	• Sand storage • FT transfer to OPTA	• CST placement • Enhanced capture of fines in the structures as built • FT pond managed for safe operation	• CST placement ceases between 2031-2035 when full, with final transfer of FT to OPTA occurring in that year	• Required to manage containment • FT transfer complete between 2031-2035	2	Terrestrial
CPTA	• Sand storage • FT transfer to OPTA	• CST and TT placement • Enhanced capture of fines in the structures as built • FT pond managed for safe operation	• CST placement ceases between 2051-2055 when full, with final transfer of FT to OPTA occurring in that year	• Required to manage containment • FT transfer complete by between 2051-2055	3	Terrestrial
NPTA	• Sand storage • FT transfer to OPTA • FT dewatering, storage and supply upon closure of OPTA	• CST and TT placement • Enhanced capture of fines in the structures as built • FT pond managed for safe operation • FT transferred to DDA for treatment • Operates 10 years post EML with FT treated and transferred to DDA. Process water transferred to DDA water cap.	• CST placement ceases at EML • Treatment of FT required to manage containment and completed within 10 years of EML	• Required to manage containment and closure • Continue to treat until 10 years after EML	4	Sand – Terrestrial Pit Lake (No Treated Tailings)

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TABLE 4-7: COARSE TAILINGS DEPOSITION IN OPTA

Year	Cumulative Volume (M m³)	Elevation (m EL)
2017	1	352
2018	44	360
2019	95	367
2020	141	376
2021	176	384
2022	215	392
2023	257	400
2024	292	406
2025	295	406
2026	297	406
2030	306	406
2035	318	406
2040	329	406
2045	341	406
2050	352	406
2055	363	406
2060	425	406 (Infill)
2063	461	406 (infill)
Material Types used for Construction	Starter Dyke: Overburden West and South Dyke: Overburden North and East Dyke: Tailings Sand	
Tailings Types Entering Structure	CST, TT, TSRU FT (from other tailings areas)	

TABLE 4-8: COARSE TAILINGS DEPOSITION IN OPTA EAST PHASE 1

Year	Cumulative Volume (M m³)	Elevation (m EL)
2017	0	N/A
2018	0	N/A
2019	0	N/A
2020	7	348
2021	21	352
2022	38	356
2023	53	360
2024	72	364
2025	110	371
2026	143	377
2030	259	406
2035	267	406 (infill)
2040	267	406
2045	267	406
2050	267	406
2055	267	406
2060	267	406
2063	267	406
Material Types used for Construction	Starter Dyke: Overburden Tailings Sand	
Tailings Types Entering Structure	CST, TT	

TABLE 4-9: COARSE TAILINGS DEPOSITION IN OPTA EAST PHASE 2

Year	Cumulative Volume (M m³)	Elevation (m EL)
2017	0	N/A
2018	0	N/A
2019	0	N/A
2020	0	N/A
2021	0	N/A
2022	0	N/A
2023	0	N/A
2024	0	N/A
2025	17	353
2026	35	361
2030	110	393
2035	145	406 (infill)
2040	145	406
2045	145	406
2050	145	406
2055	145	406
2060	145	406
2063	145	406
Material Types used for Construction	Starter Dyke: Overburden Tailings Sand	
Tailings Types Entering Structure	CST	

TABLE 4-10: COARSE TAILINGS DEPOSITION IN CPTA

Year	Cumulative Volume (M m³)	Elevation (m EL)
2017	0	N/A
2018	0	N/A
2019	0	N/A
2020	0	N/A
2021	0	N/A
2022	0	N/A
2023	0	N/A
2024	0	N/A
2025	0	N/A
2026	0	N/A
2030	21	251
2035	228	284
2040	479	344
2045	732	344/297
2050	971	344/322
2055	1077	344 (infill)
2060	1077	344
2063	1077	344
Material Types used for Construction	Tailings Sand	
Tailings Types Entering Structure	CST, TT	

TABLE 4-11: COARSE TAILINGS DEPOSITION IN NPTA

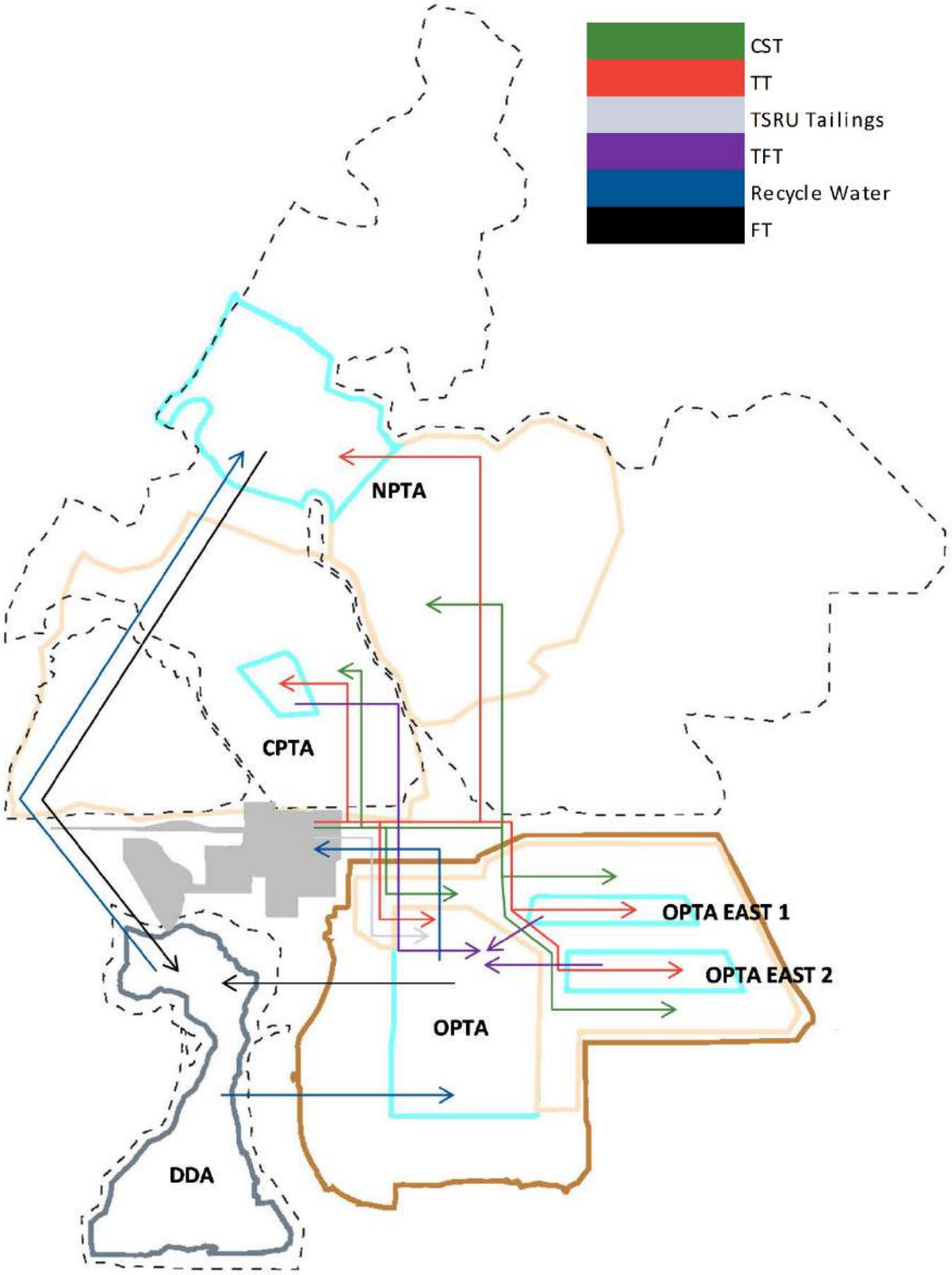
Year	Cumulative Volume (M m³)	Elevation (m EL)
2017	0	N/A
2018	0	N/A
2019	0	N/A
2020	0	N/A
2021	0	N/A
2022	0	N/A
2023	0	N/A
2024	0	N/A
2025	0	N/A
2026	0	N/A
2030	0	N/A
2035	0	N/A
2040	0	N/A
2045	0	N/A
2050	0	N/A
2055	135	250
2060	328	270
2063	399	295
Material Types used for Construction	Tailings Sand	
Tailings Types Entering Structure	CST, TT	

Figure 4-5 provides a process flow diagram indicating typical calendar-day, volume transfers between the FT treatment process, FT ponds and treated tailings deposits are provided in Table 4-12.

TABLE 4-12: TYPICAL VOLUME TRANSFERS

Period	Ore		FT Transfers			Water Balance			
	ROMt	Connate Water	OPTA to DDA	NPTA to DDA	TFT to OPTA	Surface and Groundwater Collection	Recycle Water	River Water Import	DDA Recycle Water
	ktpd	k m³/d	k m³/d	k m³/d	k m³/d	k m³/d	k m³/d	k m³/d	k m³/d
2017 - 2024	246 - 335	11 - 17	N/A	N/A	N/A	19 - 34	201 - 263	45 - 72	N/A
2024 - EML	194 - 335	10 - 17	27 - 41	N/A	22-49	22 – 36	178 - 286	16 - 49	9 - 22
EML - 2073	N/A	N/A	N/A	14 - 16	N/A	3 - 22	N/A	5 - 24	4 - 9

FIGURE 4-5: PROCESS FLOW DIAGRAM - FT MANAGEMENT PLANPROCESS FLOW DIAGRAM - FT MANAGEMENT PLAN



4.6.1. FT Treatment

Fort Hills' tailings management plan provides the treatment capacity necessary to manage FT in accordance with containment and TD requirements. The function of the treated tailings deposit and the key activities associated with its management are described in Table 4-13.

TABLE 4-13: TREATED TAILINGS DEPOSITS SUMMARY

Deposit	Description	FT Source	Treated Tailings Final Location	Primary Closure Outcome	Planned Operational Life
DDA	Represents a future in-pit asset, employing FT treatment with deposition below grade, located in the South Pit. The availability of the DDA is dependent on the completion of mining in the South Pit.	OPTA and NPTA	DDA	Aquatic	2024-2073

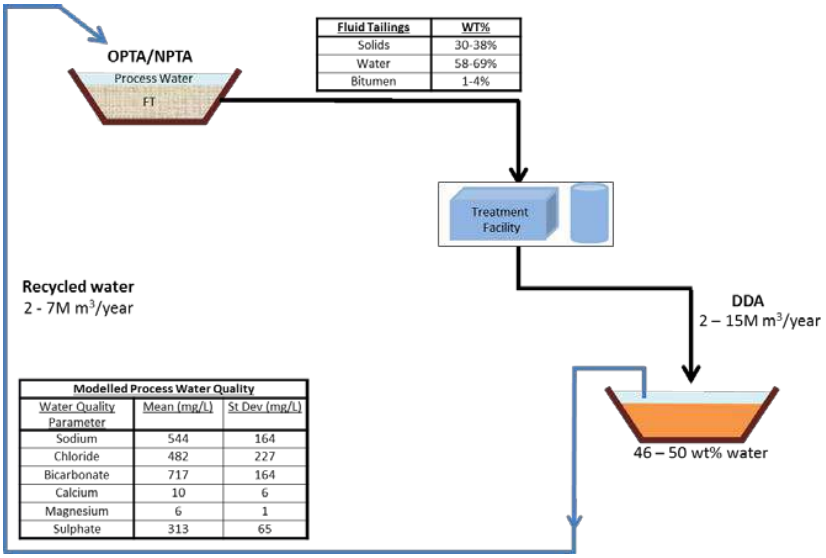
Table 4-14 provides a summary of the forecast FT management volumes by period.

TABLE 4-14: PLANNED FT MANAGEMENT BY PERIOD

Period End	DDA	Remnant
	M m^3	M m^3
2017	0	0
2018	0	0
2019	0	0
2020	0	0
2021	0	0
2022	0	0
2023	0	0
2024	12	0
2025	12	0
2026	12	0
2027-2030	60	0
2031-2035	75	8
2036-2040	75	0
2041-2045	75	0
2046-2050	70	0
2051-2055	50	3
2056-2060	73	0
2061-2063	26	10
2064-2068	28	0
2069-2073	22	4
TOTAL	**590**	**25**

Figure 4-6 provides a process flow diagram for the treated tailings deposits.

FIGURE 4-6: PROCESS FLOW DIAGRAM - TREATED TAILINGS DEPOSIT



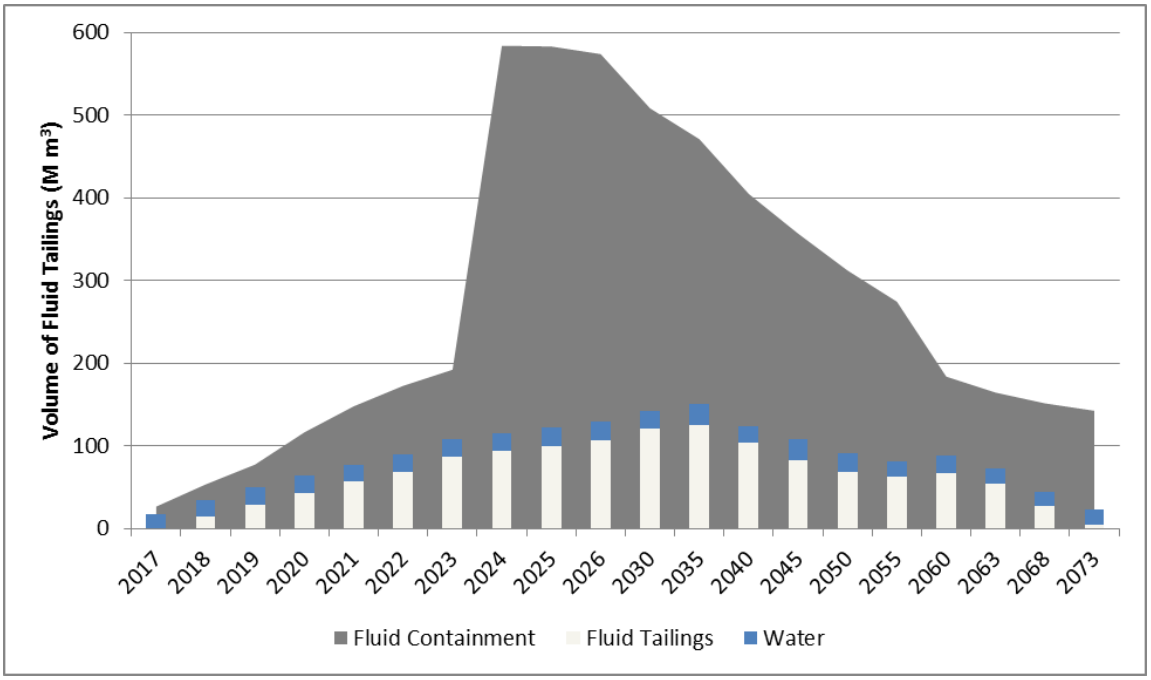
4.6.2. Containment

Table 4-15 shows total fluid tailings volume and water volume in each tailings structure for the Project. Figure 4-7 illustrates adequacy of tailings containment.

TABLE 4-15: FLUID TAILINGS AND WATER ACCUMULATION

Period End	OPTA		OPTA East 1		OPTA East 2		CPTA		NPTA		DDA
	FT	Water	FT	Water	FT	Water	FT	Water	FT	Water	Water
	M m³	M m³	M m³	M m³	M m³	M m³	M m³	M m³	M m³	M m³	M m³
2017	0	17	0	0	0	0	0	0	0	0	0
2018	15	20	0	0	0	0	0	0	0	0	0
2019	29	20	0	0	0	0	0	0	0	0	0
2020	42	19	1	1	0	0	0	0	0	0	0
2021	54	19	2	2	0	0	0	0	0	0	0
2022	64	19	4	3	0	0	0	0	0	0	0
2023	80	18	7	3	0	0	0	0	0	0	0
2024	83	18	11	3	0	0	0	0	0	0	0
2025	88	18	11	3	1	1	0	0	0	0	0
2026	94	18	10	3	2	1	0	0	0	0	0
2030	108	18	5	1	4	1	4	2	0	0	0
2035	105	18	0	0	0	0	21	8	0	0	0
2040	93	18	0	0	0	0	11	2	0	0	0
2045	82	18	0	0	0	0	1	7	0	0	0
2050	65	18	0	0	0	0	2	5	0	0	0
2055	45	18	0	0	0	0	0	0	18	0	0
2060	31	18	0	0	0	0	0	0	36	3	0
2063	0	0	0	0	0	0	0	0	54	18	0
2068	0	0	0	0	0	0	0	0	26	18	0
2073	0	0	0	0	0	0	0	0	4	0	18

FIGURE 4-7: ANNUAL AVAILABLE FLUID CONTAINMENT AND STORAGE REQUIREMENTS



5. WATER MANAGEMENT

5.1. Introduction and Application of Guiding Principles

Suncor believes that water is a shared and precious resource that must be managed wisely using a balanced, sustainable approach to integrated water management. This holistic approach includes optimizing water withdrawal practices, reuse of water already in our system, and the return of water to the watershed. We continue to invest in research and development to increase information, expertise, technological innovations and practices in an effort to sustainably manage water and reduce overall environmental impacts.

5.2. Surface Water Management

A life of mine surface water management plan has been developed for the project consistent with the guiding principles and the annually updated Surface Water Management Plan as per EPEA Approval No. 151469-01-00 (as amended). The plan intentionally segregates industrial runoff water for return to the environment from industrial wastewater to manage site water inventory and minimize environmental impact. Industrial runoff and industrial wastewater are defined as per Section 1.1.2 of EPEA Approval No. 151469-00-01 (as amended) as follows:

"Industrial runoff" is defined as precipitation that falls on, or traverses, disturbed areas of the Plant and; diverted groundwater associated with mine dewatering from aquifers above the top of the bituminous (sand) deposits (McMurray Formation). Industrial runoff handling systems:

- Industrial runoff may be returned to the environment when the water quality satisfies the limits defined in the EPEA Approval;
- Before releasing to environment, runoff shall be collected in sedimentation ponds to provide adequate retention time to remove 15 micron and greater sized particles for all precipitation events up to and including 1:10 years, 24 hour rainfall event(s);
- Discharge of runoff from sedimentation ponds to the environment shall only occur at outfall locations as approved by the AER.

"Industrial wastewater" is defined as the composite of liquid wastes and water carried wastes, any portion of which results from any industrial process and; diverted groundwater associated with mine dewatering below the top of the bituminous (sand) deposits. Industrial wastewater handling:

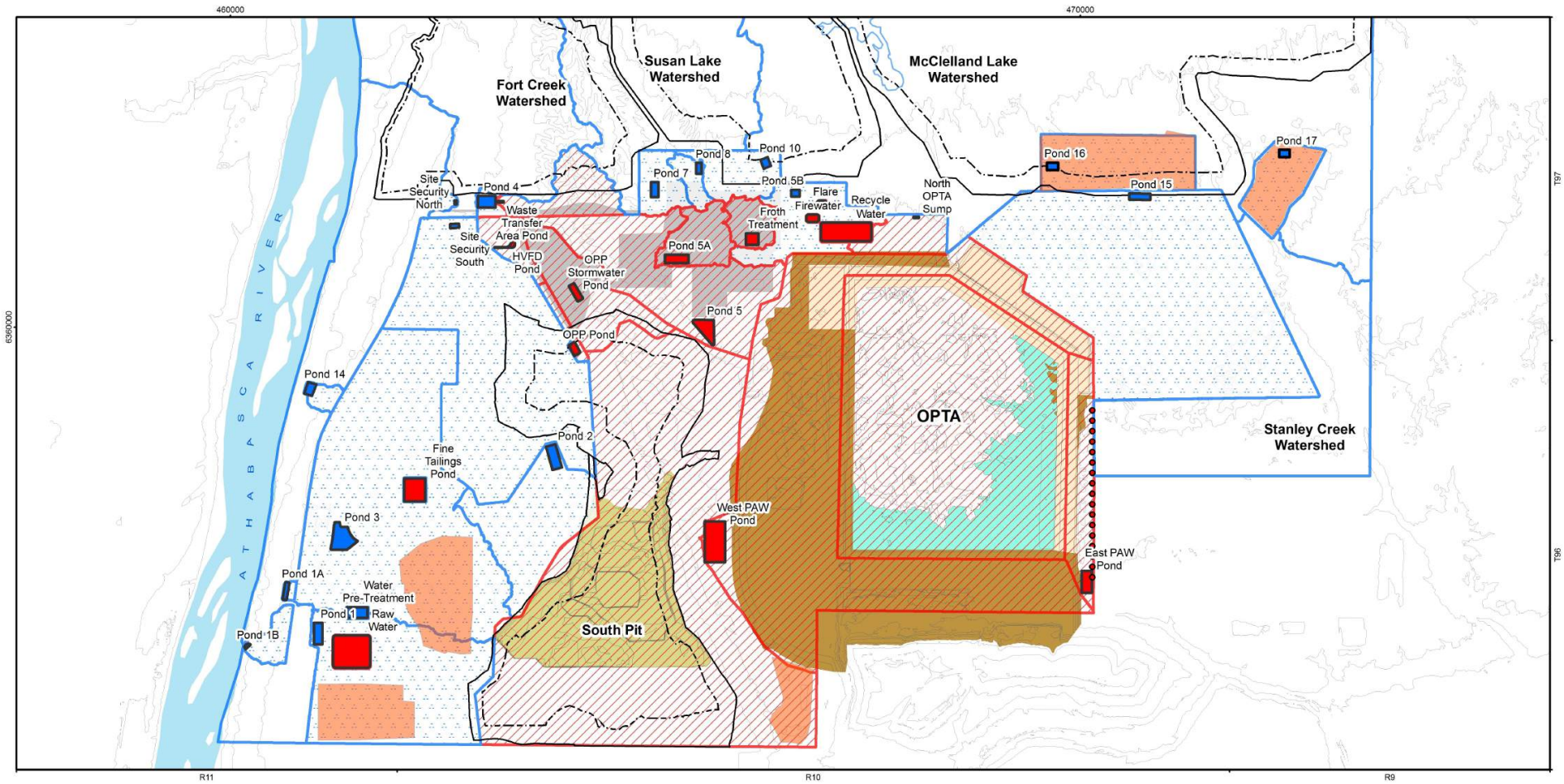
- Industrial wastewater shall be contained in a closed-circuit system and contents shall be recycled where possible for the extractions and tailings process;
- Industrial wastewater shall not be conveyed to industrial runoff sedimentation ponds;
- Plant Developed Area drainage systems shall be designed to convey and/or contain a 1:100 year, 24-hour rainfall event.

Table 5-1 provides examples of areas with the above water quality classifications.

TABLE 5-1: WATER QUALITY CLASSIFICATION

Water Quality Classification	Source Areas
Industrial Runoff	Cleared areas and construction areas.
	Camp areas, raw water pond area, southwest utilities area, river water intake area, main substation area, emergency medical services building area, and infrastructure area, general infrastructure area, and clean snow dumps.
	Muskeg drainage, overburden dewatering (collected in ditches or wells), reclamation material stockpile areas and active mine pit areas when mining overburden (above the McMurray Formation).
Industrial Wastewater	OPTA, including water cap, tailings pore water, and tailings seepage.
	In-pit tailings storage areas including associated seepage and surface runoff.
	Active mine pit areas affected by bituminous sands, including surface runoff and groundwater seepage.
	Mine haul roads.
	Active out-of-pit mine waste storage areas (i.e. mine dumps).
	Primary and secondary extraction areas, OPP area (including the hydro-transport area), area under flares (i.e. flare stack pads and associated corridor, flare knock out drum and flare area pond) and waste transfer area.
	Dirty snow dump(s) (i.e. snow from haul road and process affected areas).
	Any other water in contact with oil sands.

The life of mine surface water management plan is illustrated in Figure 5-1 through Figure 5-7, and includes defined areas of closed circuit collection of industrial wastewater, and industrial runoff areas that will be collected and returned when practical through sedimentation ponds. The maps also include locations of existing and planned sedimentation ponds, major sumps, ditches and water transfer pipelines. The life of mine water balance including surface water management activities is included in Section 5.4.



LEGEND

- Minor Contour Elevation Interval 5m
- No Surface Access Zone
- Fen Boundary
- Active Mining
- Treated Tails/Water
- Sand
- Dump/Dyke
- Plant
- RMS
- Seepage Wells

Catchments

- Industrial Runoff
- Industrial Wastewater
- Natural Drainage

Management Ponds

- Industrial Runoff Ponds
- Industrial Wastewater Pond

NOTES

Elevation (EL.) in meters above sea level

OPP Ore Preparation Plant
OPTA Out-of-Pit Tailings Area
RMS Reclamation Material Stockpile

1 0 1 2 3 4
Kilometers

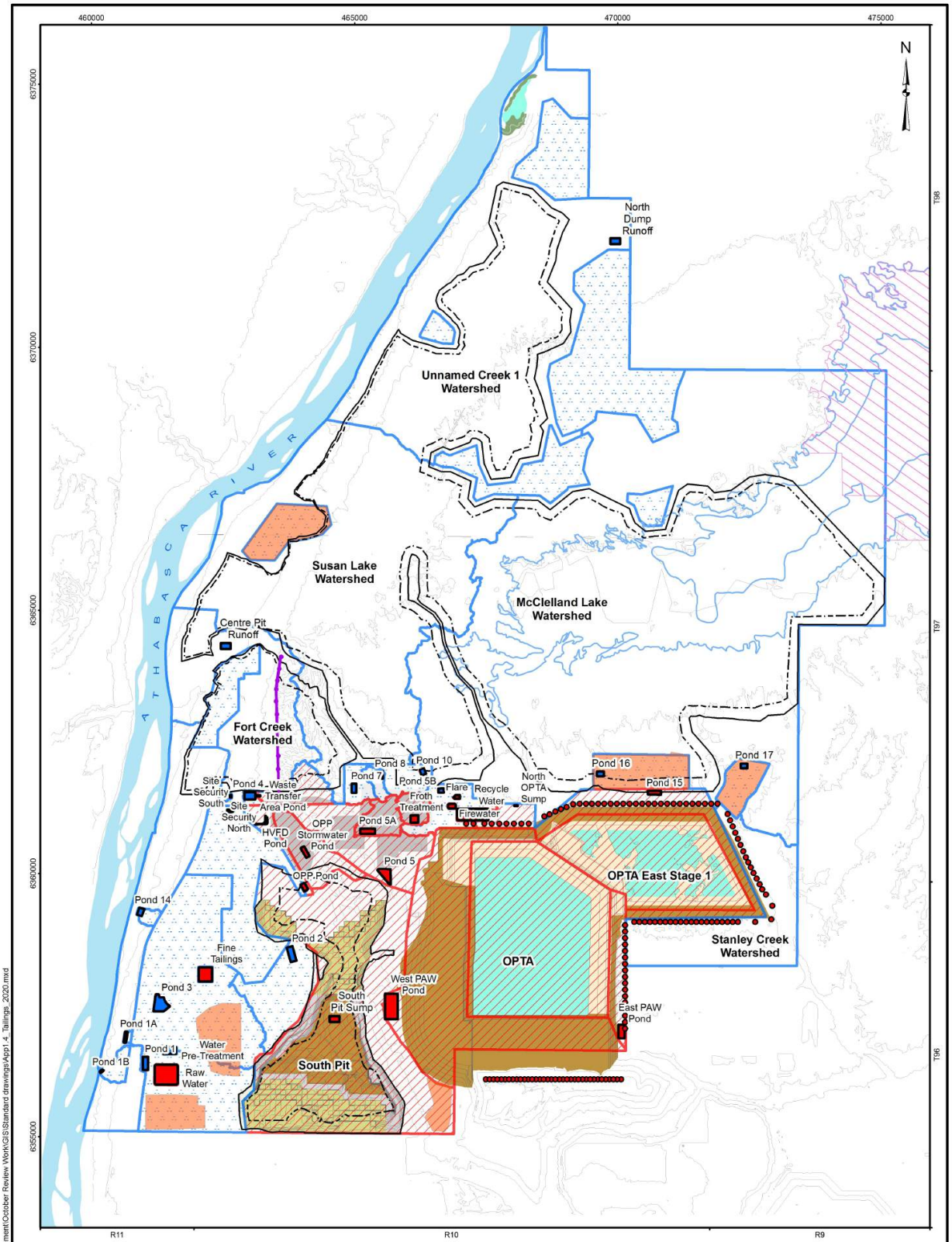
PROJECT:
FORT HILLS OIL SANDS PROJECT

TITLE:
SURFACE WATER MANAGEMENT
2017 CATCHMENT DELINEATIONS

DATUM / PRJ: NAD83 UTM Z12N
SCALE: 1:100,000 REV: 0

Figure 5-1

Path: X:\14 Water Models Material\00-Active Project Folders\Fort Hills SW Management\October Review Work\GIS\Standard drawings\App1.1_Tailings_2017v3.mxd



LEGEND

- Minor Contour Elevation Interval 5m
- No Surface Access Zone
- Fen Boundary
- Plant
- Active Mining
- Dump/Dyke
- Sand
- Treated Tails/Water
- Reclaimed
- RMS
- Quaternary Dewatering Wells
- Seepage Wells

NOTES

Elevation (EL.) in meters above sea level

OPP Ore Preparation Plant
OPTA Out-of-Pit Tailings Area
RMS Reclamation Material Stockpile

Catchments

- Industrial Runoff
- Industrial Wastewater
- Natural Drainage

Management Ponds

- Industrial Runoff Ponds
- Industrial Wastewater Ponds

1 0 1 2 3 4
Kilometers

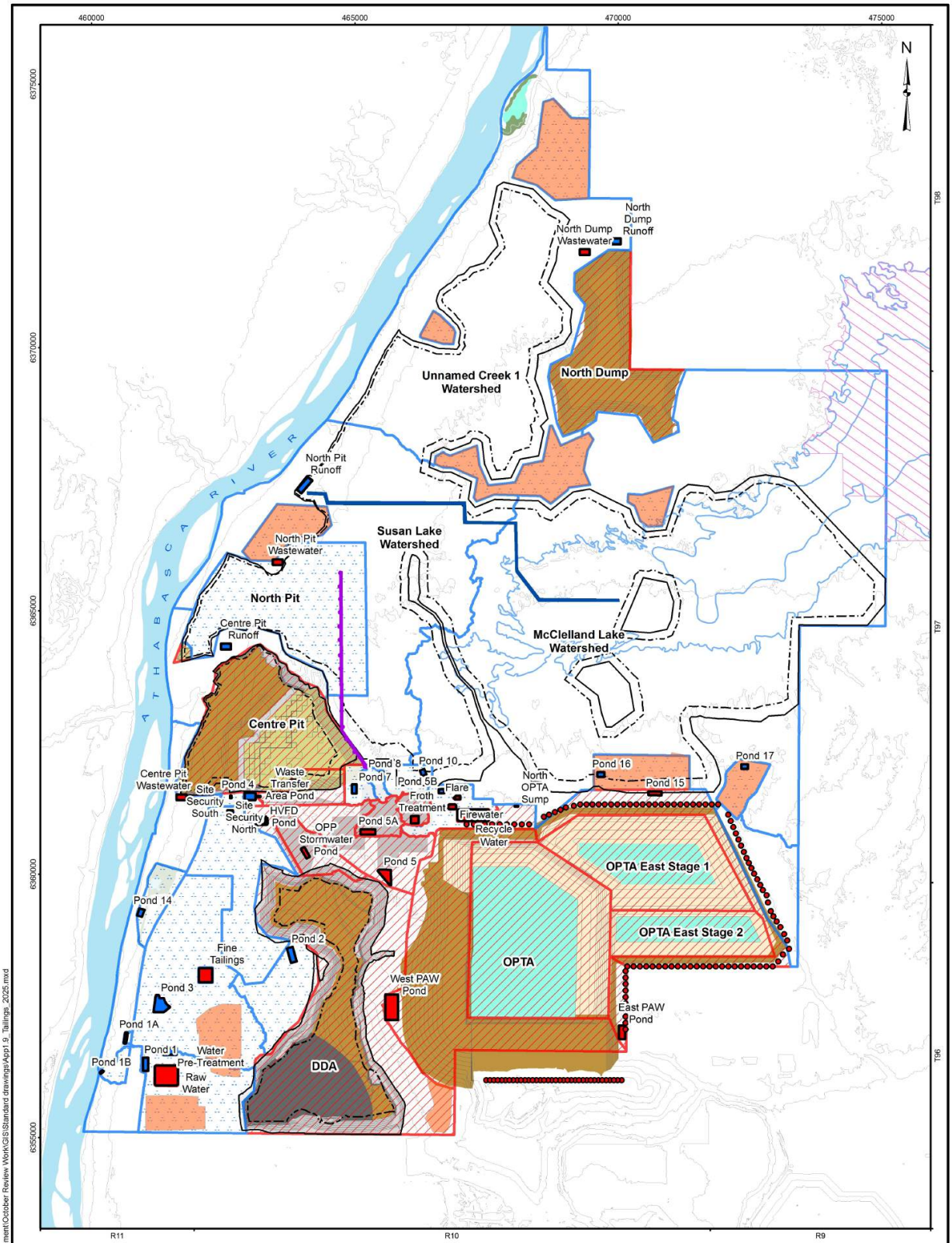
PROJECT:
FORT HILLS OIL SANDS PROJECT

TITLE:
SURFACE WATER MANAGEMENT 2020 CATCHMENT DELINEATIONS

DATUM / PRJ: NAD83 UTM Z12N
SCALE: 1:70,000 REV: 0

Figure 5-2

Path: X:\14 Water Models Material\00-Active Project Folders\Fort Hills SW Management\October Review Work\GIS\Standard drawings\App1.4_Tailings_2020.mxd



LEGEND

- Minor Contour Elevation Interval 5m
- No Surface Access Zone
- Fen Boundary
- DDA
- Plant
- Active Mining
- Dump/Dyke
- Sand
- Treated Tails/Water
- Reclaimed
- RMS
- Quaternary Dewatering Wells
- Seepage Wells
- Ditch

NOTES

Elevation (EL.) in meters above sea level

OPP Ore Preparation Plant
OPTA Out-of-Pit Tailings Area
RMS Reclamation Material Stockpile
DDA Designated Disposal Area

Catchments

- Industrial Runoff
- Industrial Wastewater
- Natural Drainage

Management Ponds

- Industrial Runoff Ponds
- Industrial Wastewater Ponds

1 0 1 2 3 4
Kilometers

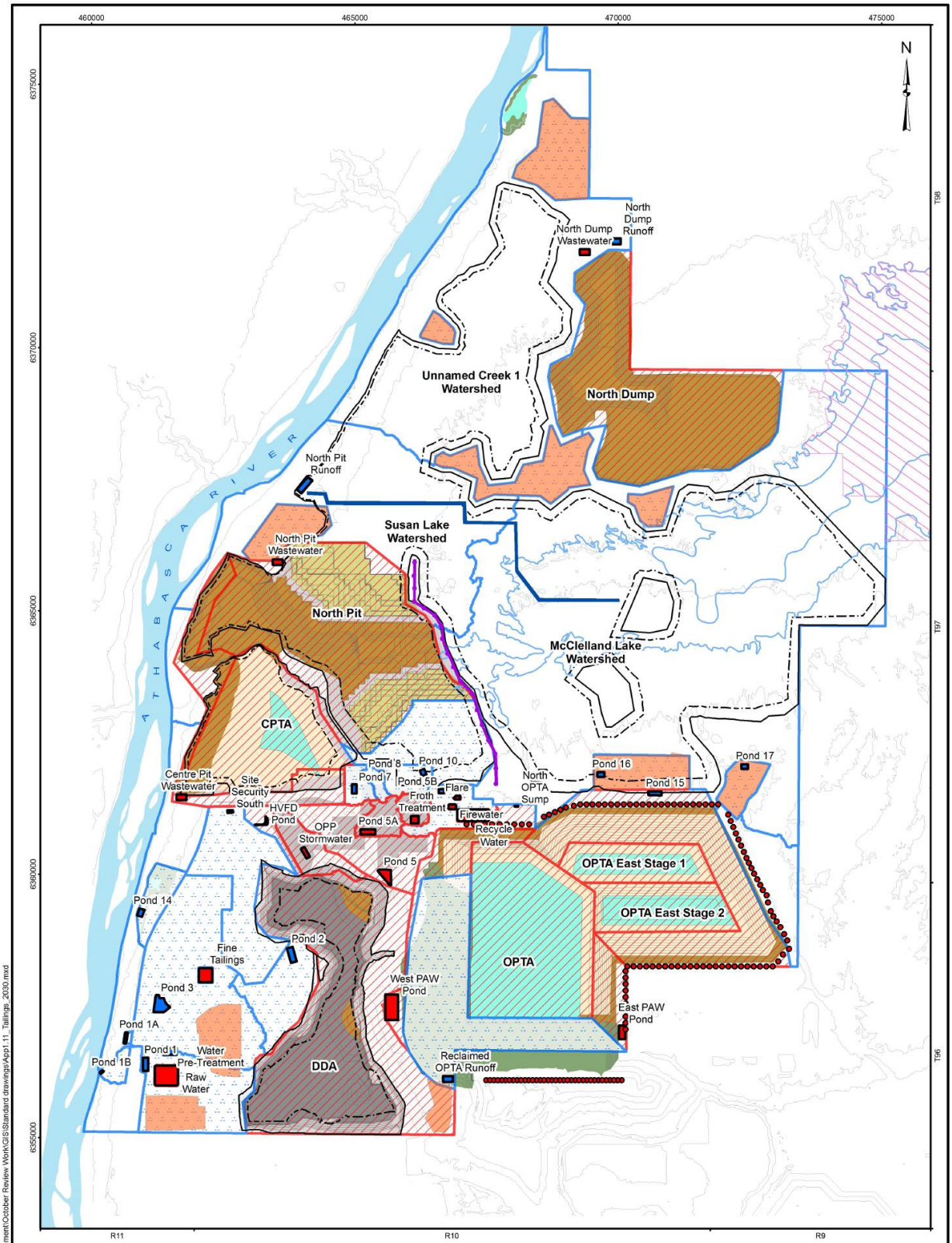
PROJECT: FORT HILLS OIL SANDS PROJECT

TITLE: **SURFACE WATER MANAGEMENT 2025 CATCHMENT DELINEATIONS**

DATUM / PRJ: NAD83 UTM Z12N
SCALE: 1:70,000 REV: 0

Figure 5-3

Path: X:\14 Water Models Material\00-Active Project Folders\Fort Hills SW Management\October Review Work\GIS\Standard drawings\App1.9_Tailings_2025.mxd



LEGEND

- Minor Contour Elevation Interval 5m
- No Surface Access Zone
- Fen Boundary
- DDA
- Plant
- Active Mining
- Dump/Dyke
- Sand
- Treated Tails/Water
- Reclaimed
- RMS
- Quaternary Dewatering Wells
- Seepage Wells
- Ditch

NOTES

Elevation (EL.) in meters above sea level

OPP Ore Preparation Plant
OPTA Out-of-Pit Tailings Area
RMS Reclamation Material Stockpile
DDA Designated Disposal Area

Catchments

- Industrial Runoff
- Industrial Wastewater
- Natural Drainage

Management Ponds

- Industrial Runoff
- Industrial Wastewater

1 0 1 2 3 4
Kilometers

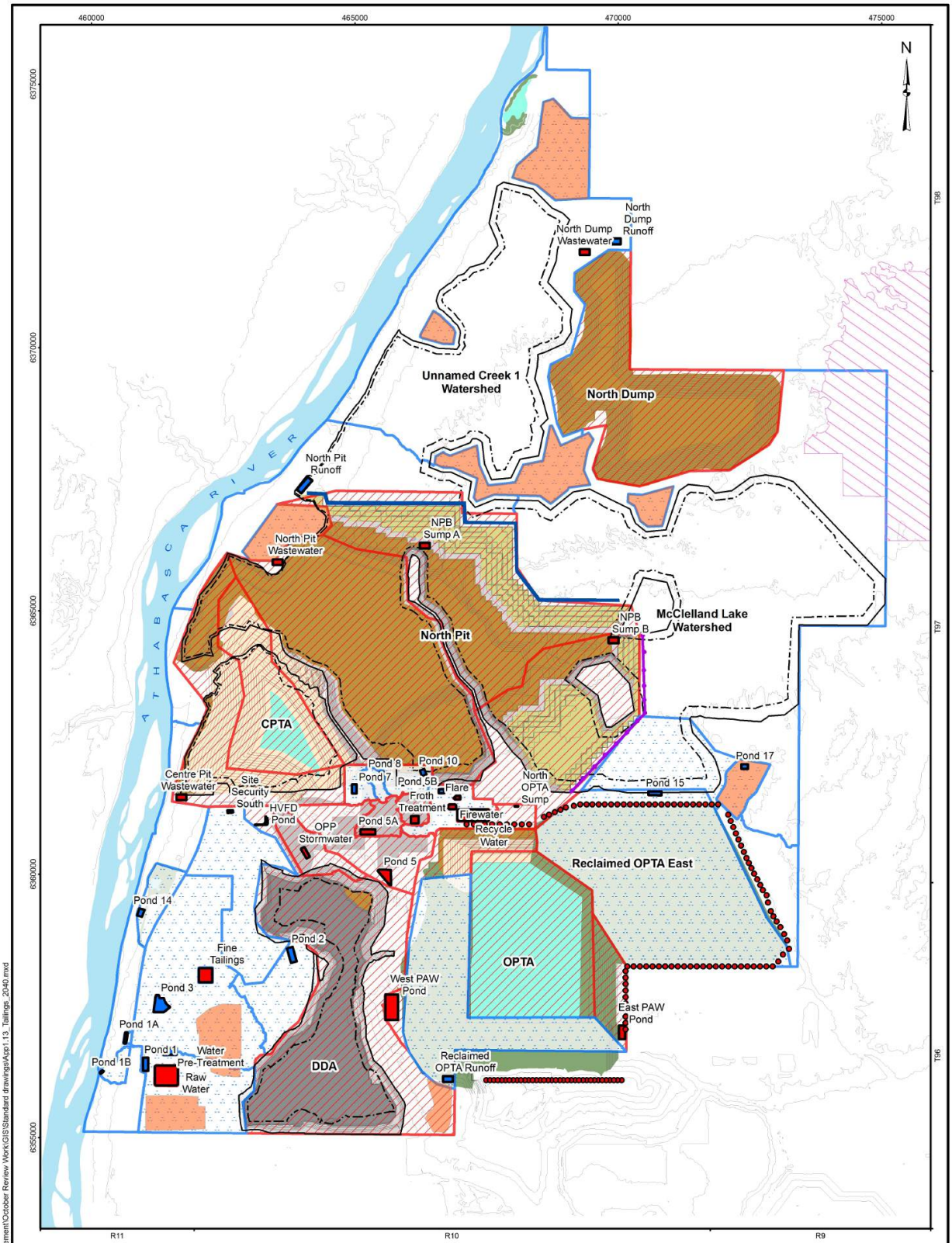
PROJECT: FORT HILLS OIL SANDS PROJECT

TITLE: **SURFACE WATER MANAGEMENT 2030 CATCHMENT DELINEATIONS**

DATUM / PRJ: NAD83 UTM Z12N
SCALE: 1:70,000 REV: 0

Figure 5-4

Path: X:\14 Water Models Material\00-Active Project Folders\Fort Hills SW Management\October Review Work\GIS\Standard drawings\App1.11_Tailings_2030.mxd



LEGEND

- Minor Contour Elevation Interval 5m
- No Surface Access Zone
- DDA
- Plant
- Active Mining
- Dump/Dyke
- Sand
- Treated Tails/Water
- Reclaimed
- RMS
- Quaternary Dewatering Wells
- Seepage Wells
- Ditch

NOTES

Elevation (EL.) in meters above sea level

OPP	Ore Preparation Plant
OPTA	Out-of-Pit Tailings Area
RMS	Reclamation Material Stockpile
DDA	Designated Disposal Area

Catchments

- Industrial Runoff
- Industrial Wastewater
- Natural Drainage

Management Ponds

- Industrial Runoff
- Industrial Wastewater

1 0 1 2 3 4
Kilometers

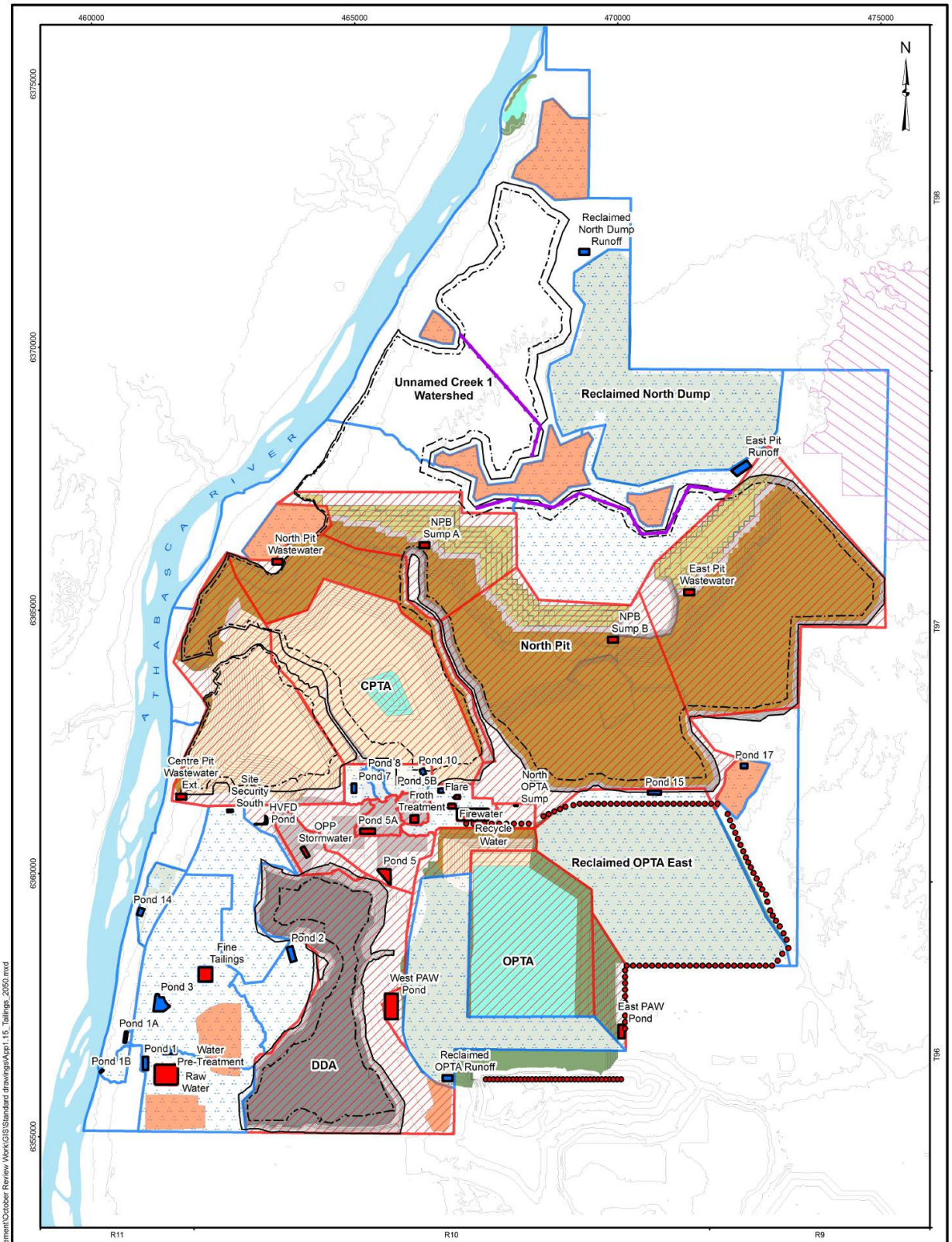
PROJECT: FORT HILLS OIL SANDS PROJECT

TITLE: **SURFACE WATER MANAGEMENT 2040 CATCHMENT DELINEATIONS**

DATUM / PRJ: NAD83 UTM Z12N
SCALE: 1:70,000 REV: 0

Figure 5-5

Path: W:\14 Water Models Material\00-Active Project Folders\Fort Hills SW Management\October Review Work\GIS\Standard drawings\Appx1.13_Tailings_2040.mxd



LEGEND

- Minor Contour Elevation Interval 5m
- No Surface Access Zone
- DDA
- Plant
- Active Mining
- Dump/Dyke
- Sand
- Treated Tails/Water
- Reclaimed
- RMS
- Quaternary Dewatering Wells
- Seepage Wells

NOTES

Elevation (EL.) in meters above sea level

OPP Ore Preparation Plant
OPTA Out-of-Pit Tailings Area
RMS Reclamation Material Stockpile
DDA Dedicated Disposal Area

Catchments

- Industrial Runoff
- Industrial Wastewater
- Natural Drainage

Management Ponds

- Industrial Runoff
- Industrial Wastewater

1 0 1 2 3 4
Kilometers

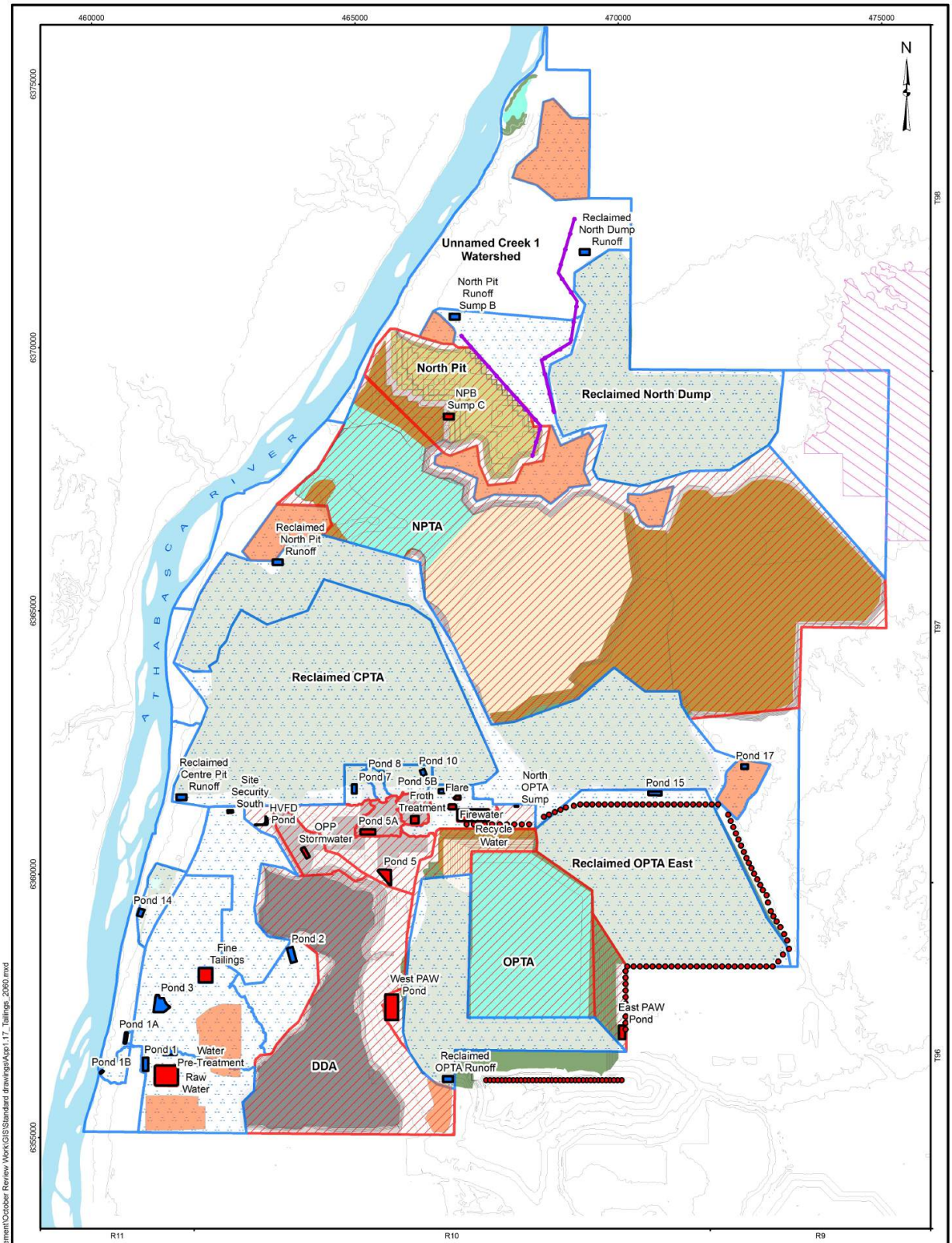
PROJECT: FORT HILLS OIL SANDS PROJECT

TITLE: **SURFACE WATER MANAGEMENT 2050 CATCHMENT DELINEATIONS**

DATUM / PRJ: NAD83 UTM Z12N
SCALE: 1:70,000 REV: 0

Figure 5-6

Path: W:\14 Water Models Material\00-Active Project Folders\Fort Hills SW Management\October Review Work\GIS\Standard drawings\Appx1.15_Tailings_2050.mxd



LEGEND

- Minor Contour Elevation Interval 5m
- No Surface Access Zone
- DDA
- Plant
- Active Mining
- Dump/Dyke
- Sand
- Treated Tails/Water
- Reclaimed
- RMS
- Quaternary Dewatering Wells
- Seepage Wells

NOTES

Elevation (EL.) in meters above sea level

OPP	Ore Preparation Plant
OPTA	Out-of-Pit Tailings Area
RMS	Reclamation Material Stockpile
DDA	Dedicated Disposal Area

Catchments

- Industrial Runoff
- Industrial Wastewater
- Natural Drainage

Management Ponds

- Industrial Runoff
- Industrial Wastewater

1 0 1 2 3 4
Kilometers

PROJECT: FORT HILLS OIL SANDS PROJECT

TITLE: **SURFACE WATER MANAGEMENT 2060 CATCHMENT DELINEATIONS**

DATUM / PRJ: NAD83 UTM Z12N
SCALE: 1:70,000 REV: 0

Figure 5-7

Path: W:\14 Water Models Material\00-Active Project Folders\Fort Hills SW Management\October Review Work\GIS\Standard drawings\Appx1.17_Tailings_2060.mxd

5.3. Groundwater Management

The Fort Hills groundwater system is comprised of groundwater flow through the shallow granular aquifers in the Quaternary deposits and the Basal aquifer. The McMurray formation oil sands units function to separate the Quaternary and Basal aquifers and they function independently of one another.

5.3.1. Basal Water Management

Basal water management is described in Section 2 and includes both the strategy to minimize saline basal water ingress as well as discussion of alternatives to manage residual saline water volumes.

Saline basal water ingress is minimized by the mine pit design modification that partially isolates the saline aquifer west of the Devonian high in the pit bottom. Water handling alternatives are outlined in Section 2 (Basal Water Management).

Non-saline basal water is depressurized using pumping wells with water being transferred to the recycle water inventory (see Appendix D for further detail).

5.3.2. Quaternary Groundwater Management

Quaternary groundwater flows have contributions sourced from natural quaternary flows and seepage flows from tailings storage areas (example OPTA).

The quaternary groundwater management strategy is to keep clean natural quaternary groundwater separate from the seepage groundwater contribution whenever practical to maintain the ability to return clean water back to the environment and manage the overall site water inventory. An example of this strategy is the quaternary dewatering well network planned for the Centre and North Pits (Appendix E) from which natural quaternary groundwater is planned to be transferred from collection wells to a sedimentation pond for return to the environment.

When segregation of seepage water from naturally flowing quaternary groundwater is not practical (example OPTA perimeter seepage collection system), this water will be pumped to the recycle water inventory. In the OPTA example, seepage from the tailings area into the quaternary sands as well as naturally occurring quaternary groundwater will be collected in seepage wells and transferred into the recycle water inventory. The OPTA seepage collection system is illustrated in Figure 5-1 through Figure 5-7.

Design development for OPTA East is ongoing and submissions for authorization will be made to AER as per existing EPEA and Water Act approval requirements. The detailed design submission for OPTA East will include updates on the operational seepage management system (SMS) for groundwater seepage.

5.3.3. Groundwater Monitoring

A Groundwater Water Monitoring Plan (GMP) was submitted to AER as per the requirements of EPEA Approval No. 151469-01-00 (as amended). The GMP was authorized by AER in November 2016.

Compliance monitoring wells are included in the GMP along the periphery of the site, in each of the four major water-bearing units: Unconfined Quaternary Sands Aquifers, Confined Quaternary Sands Aquifers, the Basal Aquifer and the Upper Devonian Limestone.

As the detailed design for OPTA east is progressed, the GMP will be updated as appropriate to reflect location and installation depth of monitoring and SMS wells. Conceptual location of individual wells is provided in Figure 5-1 through Figure 5-7.

5.4. Site Wide Water Balance

The life of mine site wide water balance for Fort Hills is included in Table 5-2. The water balance is categorized by "imports" to the closed circuit inventory, sinks or "exports" from the closed circuit inventory and items that have no impact on the closed circuit inventory (recirculating volumes, catch and return through sedimentation pond volumes). The overall site water inventory is also tracked in the water balance table (Table 5-2).

The water balance provided in Table 5-2 combines expected volume imports from mine, tailings, and plant wastewater as these sources will be combined through the approved surface and groundwater management system for OPTA into a single input stream. Some of these volumes will be largely indistinguishable from one another with respect to measurement of water quantity and quality. Fort Hills will provide reporting for diversion volumes as per EPEA and Water Act approval requirements according to the sources defined in Table 5-2.

Fort Hills is not requesting changes to the approved *Water Act* license diversion limits. Fort Hills will manage Athabasca River withdrawals in compliance with its *Water Act* license and in accordance with the *Lower Athabasca Region Surface Water Quantity Framework for the Lower Athabasca River* (Government of Alberta 2015).

TABLE 5-2: SITE WIDE WATER BALANCE

Year	Imports						Export			No Effect on Import/Export					Inventory				
	Athabasca River Withdrawal	Ore Connate Water	Non-Saline Basal Water	OPTA Seepage Wells - Fresh Component	Mine, Tailings and Plant Wastewater (Surface + Groundwater Collection)	Treated Tailings Expressed Water	Pond Bottom Wetting from OPTA Initial Fill	Tailings Sand Pore Loss	Pond Evaporation	OPTA Seepage Wells Process Component (Loop)	Quaternary Dewatering Well Runoff (Returned)	Basal Water Saline Component	Reclaimed Area Runoff (Returned)	Natural Ground Runoff (Returned)	Water in Fluid Tailings	Water in Treated Tailings	Pit Lake Inventory	Tailings Area Water Cap Inventory	Other Pond Water Inventory
	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3	M m^3
2017	26.1	0.3	0.7	0.0	6.1	0.0	9.5	0.9	3.9	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	17.5	1.4
2018	24.5	4.0	0.3	1.0	5.8	0.0	0.0	17.1	3.9	1.0	0.0	0.2	0.0	3.6	12.3	0.0	0.0	19.8	1.4
2019	22.7	4.5	0.7	2.2	6.6	0.0	0.0	20.5	3.9	2.7	0.0	1.4	0.0	2.1	24.3	0.0	0.0	20.2	1.4
2020	22.2	4.5	1.4	2.2	8.4	0.0	0.0	20.3	6.3	4.1	0.0	3.0	0.0	4.7	35.8	0.0	0.0	20.8	1.4
2021	21.0	4.6	1.5	3.5	7.2	0.0	0.0	20.2	6.3	6.5	0.0	2.5	0.0	5.4	46.9	0.0	0.0	21.0	1.4
2022	18.7	5.3	1.7	3.6	7.2	0.0	0.0	19.4	6.3	9.7	0.8	1.1	0.0	5.1	57.1	0.0	0.0	21.6	1.4
2023	24.5	6.1	1.9	2.6	8.0	0.0	0.0	21.5	6.4	13.8	3.0	0.8	0.0	3.7	72.6	0.0	0.0	21.2	1.4
2024	16.4	6.1	1.8	2.4	7.9	4.1	0.0	20.7	6.5	11.4	0.8	0.0	0.1	4.2	78.6	5.2	0.0	21.5	1.4
2025	18.0	6.1	1.6	2.0	8.3	4.8	0.0	21.6	8.7	12.2	1.1	0.0	0.1	4.8	83.4	9.6	0.0	22.6	1.4
2026	15.9	5.6	0.7	1.5	8.8	4.8	0.0	19.0	8.7	9.6	1.2	0.0	0.1	4.1	88.9	14.0	0.0	22.3	1.4
2030*	13.9	5.9	1.0	0.8	9.3	6.8	0.0	19.8	9.3	12.1	0.7	0.0	0.7	3.8	105.3	31.7	0.0	22.4	1.4
2035*	10.6	5.7	2.2	0.6	9.6	6.8	0.0	19.8	8.5	12.9	1.6	0.0	0.7	4.3	109.4	60.4	0.0	25.7	1.4
2040*	6.1	4.6	2.8	0.4	9.8	6.8	0.0	19.0	8.6	11.6	0.7	0.0	1.6	3.5	92.6	87.7	0.0	29.6	1.4
2045*	6.2	4.7	2.8	0.4	9.8	6.8	0.0	18.2	8.4	10.4	2.1	0.0	1.9	3.4	81.5	109.8	0.0	38.9	1.4
2050*	6.0	4.7	2.7	0.4	8.5	8.2	0.0	17.4	8.7	10.6	2.4	0.0	2.7	4.0	72.2	132.6	0.0	47.4	1.4
2055*	6.2	4.3	2.2	0.3	7.9	3.2	0.0	18.1	8.6	11.8	4.7	0.0	4.0	3.6	60.0	158.2	0.0	20.4	1.4
2060*	15.5	5.1	2.9	0.3	5.9	5.4	0.0	20.0	8.8	12.3	6.1	0.0	5.8	3.5	65.4	184.2	0.0	20.6	1.4
2065*	3.3	0.9	1.9	0.3	6.0	3.2	0.0	3.8	8.4	3.4	3.9	0.0	6.4	2.9	41.9	199.5	28.0	18.0	1.4
2070*	1.7	0.0	0.3	0.1	4.0	3.0	0.0	0.0	7.5	2.0	0.0	0.0	6.7	1.2	18.3	208.7	50.0	18.0	1.4
2075+*	8.6	0.0	0.0	0.0	1.0	1.3	0.0	0.0	6.4	0.0	0.0	0.0	9.7	0.4	0.0	216.3	102.1	0.0	0.0

*annualized volumes

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6. CONSULTATION

Fort Hills is comprised of Suncor Energy Inc. (Suncor), Total E&P Canada Limited, Teck Resources Limited, and FHEC. The Project is operated by Suncor Energy Operating Inc. (SEOI), a wholly owned subsidiary of Suncor. Fort Hills adheres to Suncor's policies and management systems for social, economic and environmental performance.

Fort Hills recognizes that the trust and support of stakeholders – individuals and groups who could be affected by Fort Hills' operation or who could, through their actions, affect Fort Hills' business – are foundational to successful energy development. Fort Hills works hard to build and maintain relationships with local communities and stakeholders to meaningfully consider their issues and concerns about the effect of development and operations on the land and resources, including working together to mitigate potential environmental and social impacts, and ensuring that local communities benefit from development.

Suncor has a Stakeholder and Aboriginal Relations team that is dedicated to the Wood Buffalo region, including Fort Hills. The focus of the team is to make sure that Suncor and Fort Hills are part of the community, listening and actively engaging with Stakeholders and Aboriginal communities to ensure they are informed about the issues and opportunities affecting them. This team operates through a stakeholder centered approach rather than on a project-by-project basis to ensure a holistic perspective in various areas of engagement whether it's regulatory consultation, community development or ongoing relationship building.

6.1. Stakeholder and Aboriginal Relations Framework

Fort Hills follows Suncor's comprehensive management framework that guides a consistent engagement approach with stakeholders and Aboriginal communities. It outlines responsibilities and commitments, and is intended to guide business decisions on a day-to-day basis. The framework is implemented via standards and guidelines and supported by procedures, practices and tools. The following section outlines this management framework, the general approach to Stakeholder and Aboriginal Relations and summarizes the ongoing and planned engagement activities to meet regulatory requirements in relation to this Mine Amendment Application.

6.1.1. Stakeholder Engagement Process

The management framework details the Stakeholder Engagement Process Fort Hills will follow and provides the required tools to implement the process with stakeholders. The process is based on a plan-do-check-act cycle that is grounded in the belief that those affected by Fort Hills' business have a right to be informed about the project and be involved in the issues and opportunities affecting them.

Engagement involves a spectrum of approaches and activities that are dependent on the level of stakeholder interest and impact. The Stakeholder Engagement Process includes the following elements:

- Stakeholder identification: All stakeholders and other parties that may express concerns, complaints or interest, or be impacted by Fort Hills' activities are proactively identified.
- Stakeholder engagement planning: Engagement strategies and action plans for identified stakeholders are designed and developed.
- Identification, investigation and resolution of stakeholder complaints: The process includes a grievance mechanism, a formal process to prevent, track and resolve stakeholder complaints or grievances about Fort Hills, its contractors and employees.
- Documentation of stakeholder engagement: Stakeholder engagement activities are documented to ensure that regulatory requirements and commitments are met and a clear and accurate record is kept.
- Monitoring, review and revision: Ongoing evaluation of the engagement process ensures modifications are made where appropriate and that lessons learned are applied to future engagement.

6.1.2. Consultation and Engagement Activities

Fort Hills encourages stakeholders to define how they wish to be engaged. Recognizing that not all stakeholders have the same needs or are equally affected by Fort Hills' activities, we endeavor to engage with each in a way that best fits the scope of activities and nature of the relationship.

To fully implement the formal management framework, a long-term stakeholder engagement plan has been developed for the Fort Hills project. This plan, updated regularly, outlines how Fort Hills will continue to engage with stakeholders and Aboriginal communities through the lifetime of its operations.

As one of the most effective ways to foster mutual understanding and to support resolution of issues and concerns, we remain committed to having dialogue. Some of the ongoing engagement activities and opportunities with stakeholders in the Wood Buffalo region include:

- Distributing published updates on operations and growth plans for Fort Hills.
- Maintaining and updating the Fort Hills web site (www.forthills.com).
- Attending trade shows and community open houses.
- Meeting with stakeholders on both a project-specific and an ongoing consultation basis.
- Participating on regional committees.
- Providing site tours so stakeholders can see Fort Hills operations and plans.
- Hosting or participating in community events.
- Providing public access to Stakeholder and Aboriginal Relations staff in Fort McMurray.

- Maintaining proactive relationships to convey understanding and information on Fort Hills activities.
- Ensuring resources are available for stakeholders to provide feedback, such as a toll-free telephone number and email address for residents in the Regional Municipality of Wood Buffalo.

Beyond ongoing engagement activities in the region, we actively take into account the specific interests and concerns of Aboriginal communities regarding the opportunities and impact of development. For example, regular meetings are held with two First Nations Advisory Committees in the region. Advisory Committee members represent a broad cross-section of the community. The meetings are an opportunity to discuss Fort Hills operations and areas of interest or concern to the community. In addition, we provide the opportunity for Advisory Committee members to participate in site tours of operating sites, such as Fort Hills, at minimum annually. Other community focused engagement activities may include Elders' meetings, open houses, and technical review meetings.

Ongoing work with Aboriginal communities throughout Wood Buffalo continues to improve Fort Hills' understanding of the concerns and interests of impacted stakeholders. Beyond regulatory consultation, we seek to identify, with communities, opportunities to build shared understanding and solutions around key issues of concern. For example, we are working with impacted land users and trapline holders to develop access protocols and opportunities for staff and contractors to meet with traditional land users. The work supports opportunities to enhance cultural exchanges, build mutual respect and find safe mutually agreeable access to land for traditional practices. The Fort Hills project actively participates in the engagement with stakeholders and Aboriginal communities with respect to these types of initiatives.

6.2. Consultation for the Mine Amendment

6.2.1. Early Engagement

As part of ongoing engagement activities, the following First Nation communities were notified about the Fort Hills Mine Amendment intent and timelines:

- Fort McKay First Nation;
- Mikisew Cree First Nation;
- Athabasca Chipewyan First Nation; and
- Fort McMurray No. 468 First Nation.

Discussions have also been held with the Regional Municipality of Wood Buffalo Industry Relations Department.

The discussions on this application were included within the regulatory updates regularly held with these stakeholders and First Nation communities.

In-depth information sessions were also held with a number of Aboriginal communities and stakeholders from December 2015 to February 2016. The purpose of these sessions was to explain changes and technical components associated with tailings management, including the new Tailings Management Framework (TMF) (Government of Alberta 2015a) and draft Directive*: Fluid Tailings Management for Oil Sands Mining Projects* (AER 2015a). While the focus was on Suncor's Base Plant operations, many of the concepts, issues and challenges discussed in these sessions are also applicable to the Fort Hills project.

Through ongoing engagement with stakeholders and Aboriginal communities, we know that impacts to water, air, land and wildlife are of key concern. Through current engagement with stakeholders and Aboriginal communities, we have also heard specific concerns being expressed. Table 6-1 shows some of the concerns heard to date, and how Fort Hills plans to address them.

TABLE 6-1: STAKEHOLDER CONCERNS AND MITIGATIONS

Specific Concerns	Mine Amendment Plan Features
Integrity of tailings dykes	• Treated tailings are placed below grade, reducing the risk of future dyke breaches.
Impacts to surface water, groundwater and surrounding waterbodies	• Water released from tailings treatment is collected and recycled in Fort Hills operations. • The closure landscape is designed to ensure the safe return of water to the environment.
Impact to land disturbance and wildlife	• Accelerates fluid tailings treatment with a small amount of additional land disturbance (less than 1%). • Closure outcome is equivalent to the previous closure plan. Primarily terrestrial with some wetland and aquatic features.
Reclamation timelines and land access	• Water capping of treated tailings is designed to accelerate closure as compared to other options. • Saline Basal Water Management reduces the amount of salt which needs to be managed in the closure landscape. • Maintains opportunity to incorporate alternatives for Fluid Tailings treatment and closure.

6.2.2. Consultation Plan

Regular updates will be provided to stakeholders and Aboriginal communities about progress on the Fort Hills Mine Amendment application as it is reviewed by the AER.

Engagement will follow the Government of Alberta's Guidelines on Consultation with First Nations on Land and Natural Resource Management (Government of Alberta 2014a) as it applies to the Fort Hills Mine Amendment. Engagement will also follow the Stakeholder Involvement guidelines outlined in the Alberta Energy Regulator (AER) draft Directive 023 (ERCB 2013a).

We will work with interested stakeholders and Aboriginal communities on reviews of the Fort Hills Mine Amendment. Additional consultation techniques, such as technical review workshops, site tours, open houses and community meetings may also be considered as part of the consultation plan.

Other interested stakeholders that are identified before or during the AER Public Notice and Statement of Concern process (ERCB 2013a) will also be responded to. This will involve working with interested parties to identify issues and concerns and identify potential mitigations, wherever possible.

Consultation on the Fort Hills Mine Amendment will continue throughout the application review and approval process and thereafter as a part of ongoing engagement activities.

Ongoing consultation with stakeholders and Aboriginal communities related to applications under the *Lower Athabasca Region – Tailings Management Framework for the Mineable Athabasca Oil Sands* (TMF) (Government of Alberta 2015a) is still occurring. Where possible, stakeholders and Aboriginal communities will be kept informed of the relationship between applications under the TMF and the Mine Amendment.

6.2.3. Ongoing Traditional Land Use / Traditional Knowledge Data Gathering

Various Traditional Land Use (TLU) and Traditional Knowledge (TK) data has been collected on behalf of Fort Hills. The original proponent of the Fort Hills project, True North Energy, sponsored the collection of TLU and TK data from Fort McKay First Nation and Fort McKay Métis community members and this information (TrueNorth 2001) continues to be referenced by Fort Hills today.

Fort Hills continues to sponsor the collection of TLU and TK data for the project area. As part of the recent EPEA and Water Act renewals for the project, a commitment was made to provide funding to the following communities for the gathering of further TLU / TK data in the project area:

- Athabasca Chipewyan First Nation (ACFN)
- Mikisew Cree First Nation (MCFN)
- Fort McKay First Nation (FMFN)

To date, one study is nearing completion, with the FMFN. Fort Hills sponsored a Traditional Plants Workshop. This activity consisted of an 'on the land' visit in August 2016 to the Fort Hills area to observe / discuss the plants that were present, with Fort McKay community members as the guides. The primary objective was to respect the interests of community members and engage in discussion about the plants that "caught their eye." For each plant identified, facilitators guided discussion toward topics of traditional names, uses, methods of harvest, and plant features. The workshop was documented with notebooks, audio recordings and photographs. A photobook will be assembled, based on the information collected in part from this workshop. This information can be referenced for Closure and Reclamation planning for Fort Hills.

Opportunities are also being explored with ACFN and MCFN to gather TLU / TK information for the Fort Hills area that is relevant to each community and helps to fulfill wider goals and objectives.

6.2.3.1. Culturally Significant Wetland Plant Study

We have initiated a wetland plant study that works collaboratively with Elders from the five First Nation communities in Wood Buffalo to develop a list of ten culturally significant wetland plants to be used in reclamation planning activities.

The culturally significant wetland plant study (CSWPS), at its core, is the delivery on our commitment to listen to First Nations communities and incorporate their feedback into reclamation. This approach ultimately enabled us to successfully engage and unite the five First Nations communities in the Wood Buffalo region in a first-of-its-kind initiative to build a list of wetland plants that reflects and respects their TK, increases biodiversity and advances the sustainability of our closure landscape. The valuable information gathered from the CSWPS can be referenced for Closure and Reclamation planning for Fort Hills.

6.2.3.2. McClelland Lake Wetland Complex Sustainability Committee

Fort Hills is required to maintain ecosystem diversity and function of the non-mined portion of the McClelland Lake fen during operation and reclamation of the Project. A proposal for an operational plan for the MLWC is being developed as per Water Act Approval No. 00151636-01-00 (as amended). As per the Approval, Fort Hills is participating as part of the MLWC Sustainability Committee. This multi-stakeholder committee, directed by a third-party chair, includes participation from local Aboriginal communities and provides input and direction with respect to the development of the proposal, operational plan and monitoring activities for the MLWC.

At the recommendation of the SC, new direction was sought on how to build a structure that would allow for TK to be heard and understood and to make scientific and technical information relevant and accessible to all contributors. The purpose of the recently revised SC structure is to demonstrate the process by which TK and western-based science will be reflected in plans to protect the NSAZ of the MLWC. Fort Hills and the SC draw on the principles of the Two Roads Approach to accomplish this:

- Two Roads in Communication – cross cultural learning, integrated review of knowledge collected from both worlds. Working together to make information from both approaches accessible, supporting collaborative learning.
- Two Roads in Decision Making – outlining how both forms of knowledge are accommodated, reflected in decision points, where the inputs from both roads are reflected in outcomes.

7. ENVIRONMENTAL ASSESSMENT FOR THE FORT HILLS OIL SANDS PROJECT MINE AMENDMENT APPLICATION – OVERVIEW AND LINKAGE ANALYSIS

7.1. Introduction

This Environmental Assessment (EA) has been prepared to support the Fort Hills Oil Sands Project Mine Amendment Application (hereinafter referred to as the FHMA) for the Fort Hills Oil Sands Project (the Project). This Section provides an overview of the EA methodology and associated linkage analysis. The Air Quality assessment and Noise Assessment are provided in Section 8 (Air Quality) and Section 9 (Noise Assessment). The Aquatic Resources Assessment is provided in Section 10 (Aquatic Resources), and Terrestrial Resources are considered in Section 11 (Terrestrial Resources). Supporting appendices are included for additional baseline information (Appendix F), Noise Impact Assessment (Appendix G), Groundwater Flow Modelling (Appendix H), and Hydrological Modelling (Appendix I).

The FHMA is based on an integrated mine and tailings plan developed through to closure, and reflects knowledge gained through continued work in three key areas, saline basal water management, tailings management and reclamation and closure planning. Summaries of these three key areas are provided in Section 1 (Introduction) for Basal Water Management (Section 1.3.1), Tailings Management (Section 1.3.2), and Reclamation and Closure Planning (Section 1.3.3); with further technical detail provided in Section 2 (Basal Water Management), Section 3 (Mine Design and Planning), and Section 4 (Tailings Management). An updated Reclamation and Closure Plan for the Project is provided in Appendix A. This EA considers changes to the Approved Project Area, the addition of an Augmented Project Area as described in Section 1.5.1 and Section 7.1.1, as well as an updated Reclamation and Closure Plan (Appendix A), Mine Plan (Section 3), and Tailings Management Plan (Section 4).

This EA includes the review of existing EA information from previous regulatory applications for the Project, including:

- TrueNorth Energy (2001) - *Application for Approval of the Fort Hills Oil Sands Project*. Application Nos. 1096587 and 2001202. Five Volumes: Volume 2 – Environmental Baseline Study, Volume 3 – Environmental Impact Assessment. June 22, 2001.
- Fort Hills Energy Corporation (FHEC) 2007 - *Fort Hills Oil Sands Project Amendment Application*. Application No. 1520897. Volume 1: Project Description, Volume 2: Environmental Effects Update. July 2007.
- Fort Hills Energy Corporation (FHEC) 2010 - *Fort Hills Oil Sands Project Environmental Assessment Update*. Application No. 1642643. Volumes 1: Project Description, Volume 2: Environmental Assessment Update. December 15, 2010.
- Fort Hills Energy Corporation (FHEC) 2012 - *Fort Hills Oil Sands Project (FHOSP) Application for Renewal of Environmental Protection and Enhancement Act (EPEA) Approval No. 151469-00-01 and 216594-00-00.* Application No. 003-216954 and 007-151469. December 15, 2012.

Additional information on the Augmented Project Area, as described in Section 1.5.1 and 7.1.1, is considered in the EA. Further supplemental baseline information for the Augmented Project Area is provided in Appendix F. With the exception of soil surveys for the Augmented Project Area footprint, no new environmental field data were collected for the FHMA. However, for some components there is additional data available or collected since the 2010 EA Update (FHEC 2010), including wildlife and fisheries information. There is also updated information from Environment Canada (2016) on daily and monthly air temperature statistics, and wind and precipitation data that were considered in modelling completed for the hydrogeology and hydrology components.

This EA identifies potential changes to the predictions from the approved Fort Hills Project environmental assessments, in association with changes to the Project area and the integrated mine and tailings plan.

The EA considers:

- air emissions and air quality;
- noise;
- aquatic resources;
- terrestrial resources;
- 10 year mine reclamation plan and life of mine closure plan (Reclamation and Closure Plan);
- human and wildlife health; and
- human environment.

The FHMA focuses on Project changes that are described in detail in Section 2 (Basal Water Management), Section 3 (Mine Design and Planning), and Section 4 (Tailings Management). The EA focuses on key changes during early mine life, including:

- basal water management and redesigned South Pit (Section 2);
- update to the tailings management plan and alignment with Directive 085 (AER 2016) requirements (Section 4);
- augmentation of the approved Project area (Section 1.5.1), as per current approvals (*Oil Sands Conservation Act* (OSCA) Scheme Approval and *Water Act* fenceline);
- update to the Reclamation and Closure Plan (Appendix A) for the Project.
- re-sequence in the progression of mining within the North Pit in association with the updated tailings strategy (Section 3);

Additional details on each of these changes are provided in Sections 7.1.1 to 7.1.4.

7.1.1. Project Area

For the purpose of this EA, the term Fort Hills Approved Project Area refers to the project boundary that was included within the Fort Hills *Environmental Protection and Enhancement Act* (EPEA) Renewal Application (FHEC 2012). The Approved Project Area covers a total area of 18,001 ha.

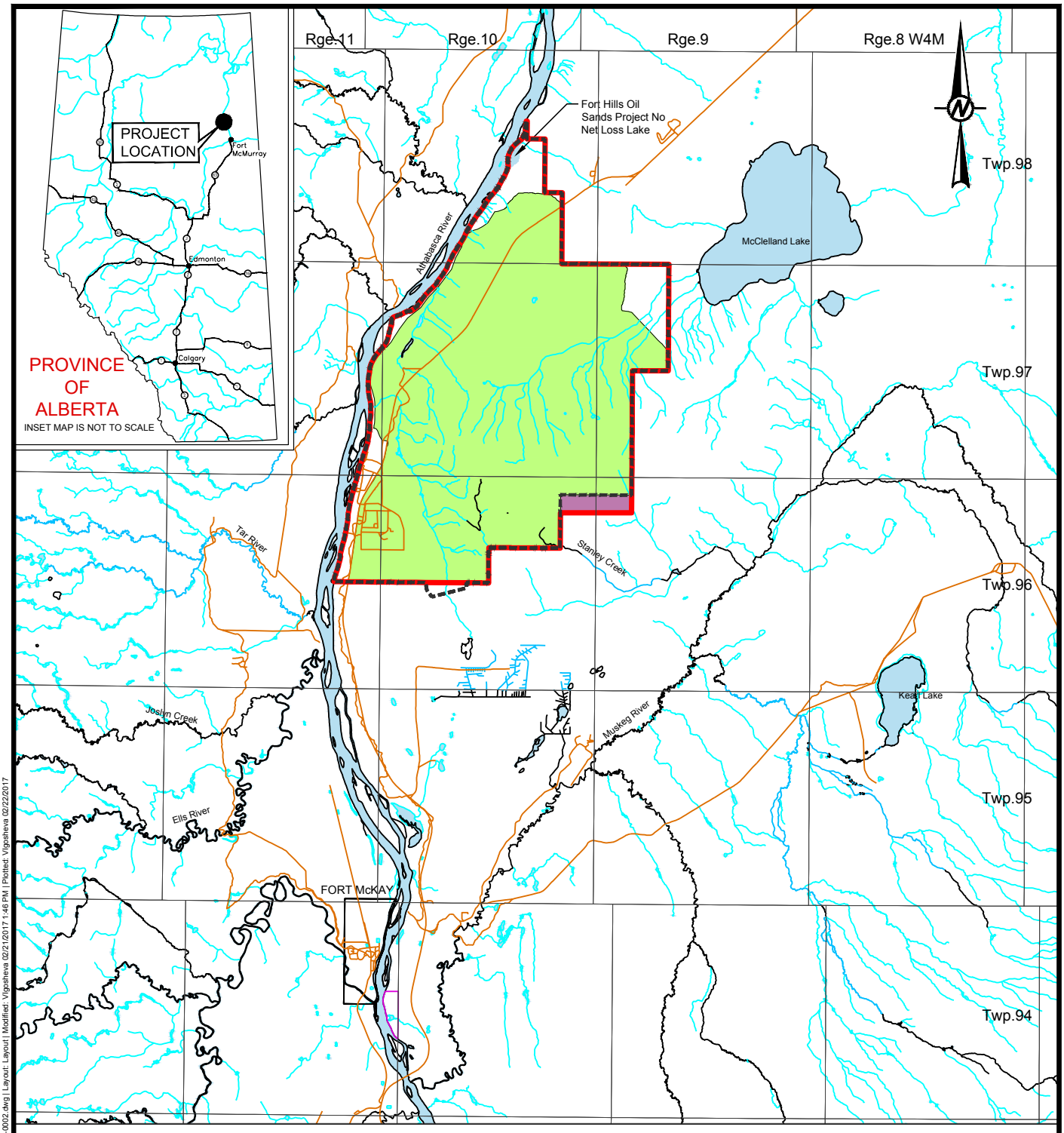
The Approved Project Area will be changed through removal of a 93 ha area returned to Syncrude (see Section 3.3.1.1 for further detail on the lease boundary in-situ pillar) and the augmentation of a 263 ha area (the Augmented Project Area) to accommodate the tailings management plan as discussed in Section 1.5.1 and in Section 4 (Tailings Management). The modified footprint for the Project is referred to as the Fort Hills Amended Project Area, covering 18,171 ha, and includes the Approved Project Area plus the Augmented Project Area, minus the portion of land that is being returned to Syncrude. The Fort Hills Oil Sands Project footprint is shown in Figure 7-1.

The Augmented Project Area was included as part of the 2001 Project Application and Environmental Impact Assessment (EIA) for the Project (TrueNorth Energy 2001), and as such, was included within the *Oil Sands Conservation Act* (OSCA) Scheme Approval approved project area and *Water Act* fenceline. During subsequent project amendments, the Augmented Project Area was removed from the project footprint and is no longer within the Approved Project Area. The Augmented Project Area was subsequently identified for reincorporation back into the Fort Hills Project footprint in a 2014 commercial agreement with Syncrude to address the shared boundaries between the Fort Hills Oil Sands Project and the Aurora North Mine.

Formal approval boundaries for the Project are currently defined by Appendix A (Approved Project Area) of OSCA Scheme Approval No. 9241E and by *Water Act* Approval No. 151636-01 (Plan No. 00151636-P005 *Water Act* Fenceline Map). Although EPEA Approval No. 151469-01-00 does not reference a specific approval area in the context of an EPEA Approval Boundary, it is generally considered to be applicable to the leases and legal land descriptions that are defined within the EPEA Approval and the supporting application material upon which the approval is based. For the purpose of this Application and EA, the term Approved Project Area refers to the combined project boundary that is captured by the existing OSCA Approved Project Area and *Water Act* fenceline. The OSCA Scheme Approved Project Area and the *Water Act* fenceline boundary will require adjustment to accommodate the integrated mine and tailings plan, as discussed in Section 1.3.2 and Section 4 (Tailings Management).

A regional map that includes the FHMA area is provided in Figure 7-2, which shows the following:

- urban centres;
- major industrial operations;
- waterbodies;
- road, pipeline, power and utility corridors and other significant infrastructure; and
- public works.



LEGEND

- APPROVED PROJECT AREA
- AUGMENTED PROJECT AREA
- AMENDED PROJECT AREA
- PROJECT DEVELOPMENT FOOTPRINT
- ROAD
- WATERCOURSE
- WATERBODY

0 5 10
1:250,000 KILOMETRES

REFERENCE

ALBERTA NTDB DIGITAL DATA OBTAINED FROM ALTALIS LTD. (SEPTEMBER 2004), USED UNDER LICENSE. DATUM: NAD83 PROJECTION: UTM ZONE 12

PROJECT

FORT HILLS OIL SANDS PROJECT

TITLE

FORT HILLS OIL SANDS PROJECT FOOTPRINT

FORTHILLS

PROJECT No.		1649222	FILE No.	1649222-1000-CH-0002
DESIGN	DV	2017-02-21	SCALE	SCALE
CADD	VI	2017-02-21		
CHECK	CM	2017-02-21		**FIGURE 7-1**
REVIEW	ZG	2017-02-21		

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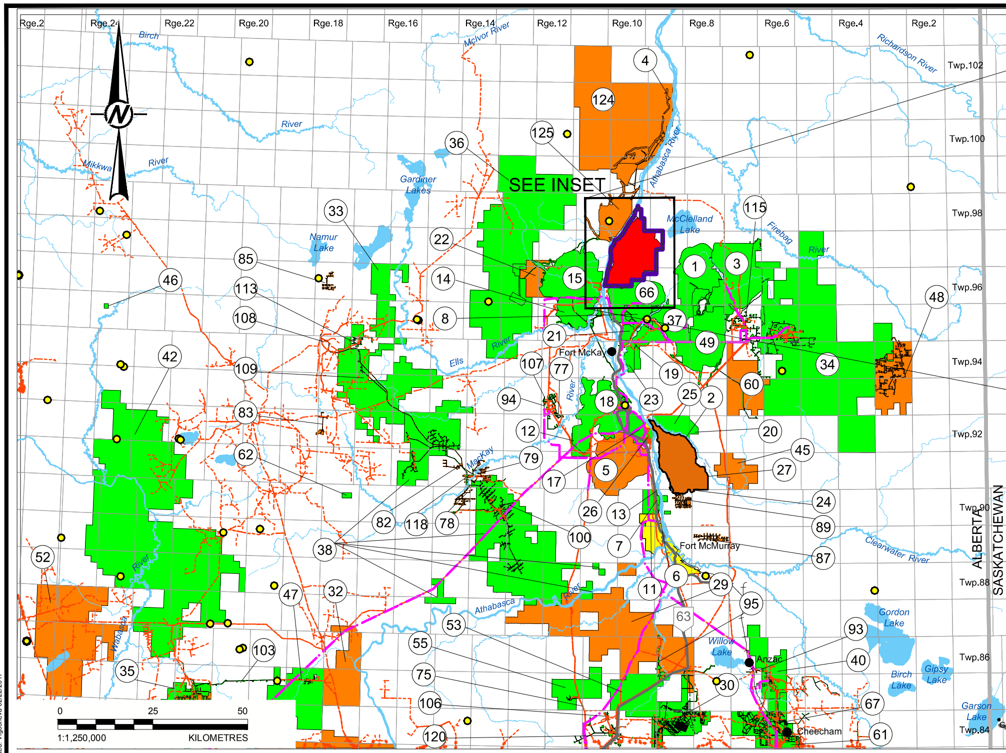
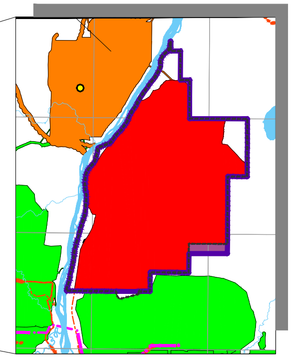


NAME	OWNER	REF #
Jackpine Mine Expansion and Pierre River Mine Project	Shell Canada Limited (Shell)	1
Millennium Mine	Suncor Energy Inc.	2
Kearl Oil Sands Project	Imperial Oil Resources Limited	3
Redclay Compensation Lake North	Shell Canada Limited (Shell)	4
Voyageur South Update	Suncor Energy Inc.	5
Parsons Creek Aggregates - part B	Graymont Western Canada Inc. and Lehigh Hanson Materials Limited	6
Parsons Creek Aggregates - Part C	Graymont Western Canada Inc. and Lehigh Hanson Materials Limited	7
Muskeg River Mine	Shell Canada Limited (Shell)	8
Poplar Creek ET-DSP Experimental Scheme	ET Energy Ltd.	11
South West Sand Storage Conversion Project	Syncrude Canada Ltd.	12
Sand and Gravel	Graymont Western Canada Inc. and Lehigh Hanson Materials Limited	13
Joslyn North Mine Project	Total E&P Canada Ltd.	14
Horizon Oil Sands Project	Canadian Natural Resources Limited	15
Lease 86/17	Suncor Energy Inc.	17
Mildred Lake	Syncrude Canada Ltd.	18
Muskeg Valley Quarry	Hammerstone Corporation	19
North Stepbank Mine Amendment	Suncor Energy Inc.	20
Muskeg River Mine Expansion	Shell Canada Limited (Shell)	21
Birch Mountain	Canadian Natural Resources Limited	22
Hammerstone Project	Hammerstone Corporation	23
South Tailings Pond	Suncor Energy Inc.	24
North Steepbank Mine Extension	Suncor Energy Inc.	25
Fee Lot 2	Suncor Energy Inc.	26
Mine Dump 9	Suncor Energy Inc.	27

NAME	OWNER	REF #
Hangingstone Expansion	Athabasca Oil Corp.	29
Meadow Creek In-situ	Suncor Energy Inc.	30
Sepiko Kesik Project	Osum Oil Sands Corp.	32
Dover Commercial Project	Brion Energy Corporation	33
Firebag In-Situ Oil Sands Project	Suncor Energy Inc.	34
Germain Commercial Demonstration Project (Phase 1)	Laricina Energy Ltd.	35
Terre de Grace Pilot Project	Value Creation Inc.	36
Jackpine Mine - Phase 1	Shell Canada Limited (Shell)	37
Mackay River Commercial Project	Brion Energy Corporation	38
Fort Hills Oil Sands Project	Suncor Energy Inc.	39
Long Lake Project Phase 1 and 2	CNOOC Limited	40
Grosmont Ventures	Shell Canada Limited (Shell)	42
Lewis SAGD Project	Suncor Energy Inc.	45
Harper Pilot Project	Sunshine Oilsands Ltd.	46
Saleski Phase 1	Laricina Energy Ltd.	47
Telephone Lake Project	Cenovus Energy Inc.	48
Aurora South Mine	Syncrude Canada Ltd.	49
Muskwa Pilot	Koch Exploration Canada L.P.	52
Meadow Creek Expansion SAGD Project	Suncor Energy Inc.	53
Algar Lake Pilot	Grizzly Oil Sands ULC	55
Aspen Project	Imperial Oil Resources Limited	60
Surmont - In-situ Oil Sands Project - Phase 1 and Phase 2	ConocoPhillips Canada Limited	61
Thickwood SAGD Project Phase 1	Sunshine Oilsands Ltd.	62
Aurora North Mine	Syncrude Canada Ltd.	66
Kinosis	CNOOC Limited	67

INSET



LEGEND

- AIRFIELD
- COMMUNITY
- AUGMENTED PROJECT AREA
- HIGH PRESSURE PIPELINE
- ROAD, PAVED
- ROAD, UNPAVED
- TRANSMISSION LINE
- WATERCOURSE
- WATERBODY
- EXISTING AND APPROVED DEVELOPMENT
- PLANNED DEVELOPMENT
- APPROVED PROJECT AREA
- AUGMENTED PROJECT AREA
- AMENDED PROJECT AREA
- PROJECT DEVELOPMENT FOOTPRINT

0 10 20
1:400,000 KILOMETRES

NAME	OWNER	REF #
Algar Lake SAGD Project Phase 1 and Phase 2	Grizzly Oil Sands ULC	75
MacKay River In-Situ Project	Suncor Energy Inc.	77
Thickwood	Grizzly Oil Sands ULC	78
STP MacKay Thermal Project Phase 2	Southern Pacific Resources Corp.	79
Birchwood Demonstration Oil Sands Project	Marathon Oil Canada Corporation	82
Dover West Sands	Athabasca Oil Corp.	83
Legend Lake SAGD Project	Sunshine Oilsands Ltd.	85
Advanced TriStar Project	Value Creation Inc.	87
Tamarack Project	Ivanhoe Energy Inc.	89
Gregoire Lake	Canadian Natural Resources Limited	93
Dover Pilot	Suncor Energy Inc.	94
Hangingstone Commercial SAGD Project	Athabasca Oil Corp.	95
MacKay River Pilot Project	Brion Energy Corporation	100
Saleski SAGD Pilot Project	Laricina Energy Ltd.	103
JACOS Hangingstone Expansion Project	Japan Canada Oilsands Limited	106
BEST Pilot Plant	N-Solv Corporation	107
Dover West Carbonates Phase 2	Athabasca Oil Corp.	108
Dover Central Pilot Project	Brion Energy Corporation	109
West Ells SAGD Project Phase A1 and A2	Sunshine Oilsands Ltd.	113
Sunrise Energy Project	Husky Energy Inc.	115
STP MacKay SAGD Project Phase 1	Southern Pacific Resources Corp.	118
JACOS Hangingstone SAGD Demonstration Project	Japan Canada Oilsands Limited	120
Frontier Oil Sands Mine Project	Teck Resources Limited	124
Pierre River Mine Project	Shell Canada Limited (Shell)	125

REFERENCES

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DATUM: NAD83 PROJECTION UTM ZONE 12.

PROJECT
FORT HILLS OIL SANDS PROJECT

TITLE
REGIONAL MAP

FORT HILLS

PROJECT No.		1649222	FILE No. 1649222-1000-CH-0001
DESIGN	DV	2017-02-21	SCALE AS SHOWN
CADD	RFM	2017-02-21	
CHECK	CM	2017-02-21	FIGURE:7-2
REVIEW	ZG	2017-02-21	

L:\SUNCOR\FortHills\99_PROJECTS\1649222\02_PRODUCTION\1000\DWG\1649222-1000-CH-0001.dwg | Layout: Layout | Modified: Vtgosheva 02/21/2017 2:10 PM | Plotted: Vtgosheva 02/22/2017

7.1.2. Tailings Management

The Fort Hills Tailings Management Plan (Section 4) has been revised to incorporate proven industry best practices and will be compliant with the Government of Alberta's *Tailings Management Framework (TMF) for the Mineable Athabasca Oil Sands* that was released in March 2015 (AER 2015) and the AER Directive 085: *Fluid Tailings Management for Oil Sands Mining Projects* released in July 2016 (AER 2016). A detailed description of the modifications to the tailings management plan that will be employed by the Project is provided in Section 4 (Tailings Management).

Specific to the EA, the new tailings management plan will change the water usage by the Project and will require changes to existing and planned surface drainage systems (Section 5.2). These changes will be assessed in the aquatic resources component sections (Section 10).

7.1.3. Mine Plan Modifications

The modifications to the mine plan in terms of sequencing and facility placement are described in Section 3 (Mine Design and Planning). The integrated mine and tailings plan is referred to as the FHMA Plan and has been modified relative to the Approved Mine Plan to reduce the risks associated with saline basal water management, tailings management, and to improve closure outcomes. Changes from the Approved Mine Plan to the FHMA Mine Plan are detailed in Section 3. The mine plan modifications are considered in the air quality (Section 8), noise (Section 9), aquatic (Section 10) and terrestrial (Section 11) resource component assessments.

7.1.4. Closure Landscape

The *Fort Hills Oil Sands Project 2017 Reclamation and Closure Plan* ('Reclamation and Closure Plan') (Appendix A) integrates the 10-year Mine Reclamation Plan (2017-2026) and conceptual Life of Mine Closure Plan projecting to mine closure and certification. The Reclamation and Closure Plan for Fort Hills has been updated to incorporate the changes to saline basal water management and tailings management and to provide more confidence in reclamation timelines and outcomes. The updated Reclamation and Closure Plan is consistent with the previously submitted *2014 Mine Reclamation Plan* (SEOI 2014) and represents minimal change to the final closure outcome presented in the *2011 Reclamation and Closure Plan* (SEOI 2011).

7.2. Assessment Focus and Methodology

This EA evaluates the integrated mine and tailings management plan through to closure, as well as other information, to provide an appropriate understanding of the environmental outcomes associated with the FHMA. The integrated mine and tailings management plan is provided in further detail in Section 3 (Mine Design and Planning) and Section 4 (Tailings Management). An updated Reclamation and Closure Plan (Appendix A) was developed for the Project to reflect the integrated mine and tailings management plan.