



Norman Wells Operations Interim Closure and Reclamation Plan *Plain Language Summary*



Norman Wells Operations
Current View



Norman Wells Operations
Post-Reclamation View
(Artistic Rendering)

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ACRONYMS

AEMP	Aquatic Effects Monitoring Program
BIT	Bear Island Terminal
C&R	Closure and Reclamation
CCME	Canadian Council of Ministers of the Environment
CPF	Central Processing Facility
D&D	Dismantling and Demolition
DPE	Dual Phase Extraction
GIT	Goose Island Terminal
LTMA	Long Term Management Area
LTMF	Long Term Management Facility
MPE	Multi-Phase Extraction
MVLWB	Mackenzie Valley Land and Water Board
MVRMA	<i>Mackenzie Valley Resource Management Act</i>
NTPC	Northwest Territories Power Corporation
NWT	Northwest Territories
SLWB	Sahtu Land and Water Board
SSA	Sahtu Settlement Area

1.1 INTRODUCTION

This Plain Language Summary describes the current Closure and Reclamation (C&R) Plan for Imperial’s Norman Wells Operations (referred to from here on as “Operations”).

The Operations C&R Plan deals with concepts that hold value for different groups of stakeholders, including regulators, communities, Aboriginal governments/organizations, and other interested parties. This summary aims to communicate the C&R planning process and key features of the plan in a clear, direct manner that speaks to all stakeholder groups.

The C&R Plan itself is a detailed technical document. It is referred to in this summary and is available as a resource for more details and technical information (see Section 17).



Why is a C&R Plan Required?

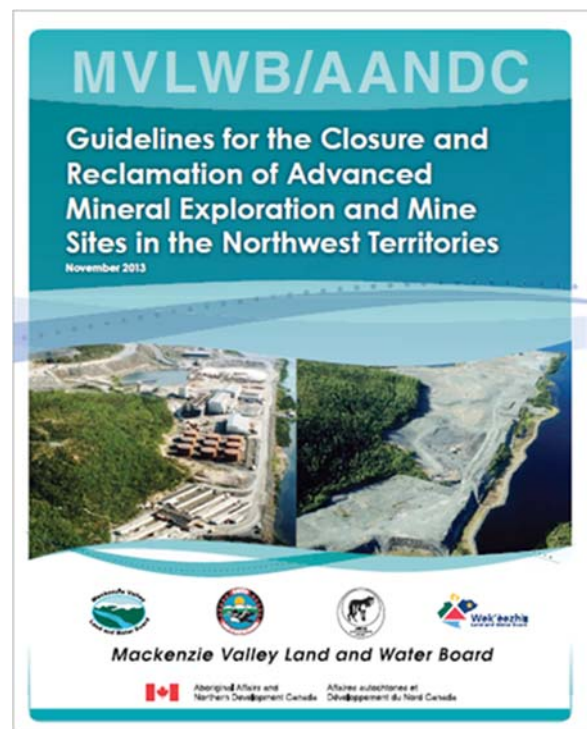
Imperial is committed to conducting its operations in compliance with regulatory requirements that apply to its Operations. There are a number of licences and permits that regulate activities for the Operations. A primary one is the Water Licence issued by the Sahtu Land and Water Board (SLWB) under the *Mackenzie*

Valley Resource Management Act (MVRMA). The current version of the Water Licence requires that Imperial submit a Closure and Reclamation (C&R) Plan for the Operations to the SLWB by 5 March 2016.

Because the Water Licence itself does not specifically say what the C&R Plan should cover or what it should look like, Imperial consulted with regulators early in the process on the best source of guidance for planning and a general template.

General guidance for the C&R Plan has been adopted from the Mackenzie Valley Land and Water Board’s (MVLWB’s) “*Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories*” (MVLWB 2013).

The guidelines were not developed for oil and gas facilities. However, they provide a coordinated and consistent approach to closure planning that reflects the regional and community setting and can be adapted well to the Operations.



What is a C&R Plan?

A C&R Plan describes activities to be planned and completed prior to and following the end of the operational life of a facility to make sure that it is closed and reclaimed in a manner that matches up with goals for closure.

For the Operations, the C&R Plan describes the coordinated actions planned to return the site and affected areas to established settings that are compatible with a healthy environment and with safe human activities.

What's in the C&R Plan?

The C&R Plan lines up with the template provided in the MVLWB Guidelines. Because the guidelines have been developed for mineral exploration and mine sites (versus oil and gas operations), there are a few areas where the template has been adapted, with the input of regulators, to reflect the nature and scale of the Operations.

Norman Wells Operations Interim C&R Plan Table of Contents
• Introduction
• Project Environment
• Project Description
• Permanent Closure and Reclamation
• Progressive Reclamation
• Temporary Closure
• Integrated Schedule of Activities
• Post Closure Site Assessment
• Financial Security
• Closure
• References
• Appendices (e.g., Record of Engagement)

The C&R Plan is an *Interim* plan which will be reviewed during the remaining life of the Operations (see Section 16). Interim status notwithstanding, the plan describes the C&R activities that Imperial expects to implement for the Operations.

A more defined version of this plan will be developed closer to the scheduled closure of the Operations. This final plan will reflect ongoing stakeholder engagement as well as the technical, community, environmental and economic conditions that exist at that time. This final plan will also reflect the continuous improvement processes that will be applied to the definition of specific closure activities between now and closure.

The Working Group

The Interim C&R Plan has been developed by Imperial along with local community stakeholders, the regulatory community and with the technical assistance of Imperial's consulting partners.

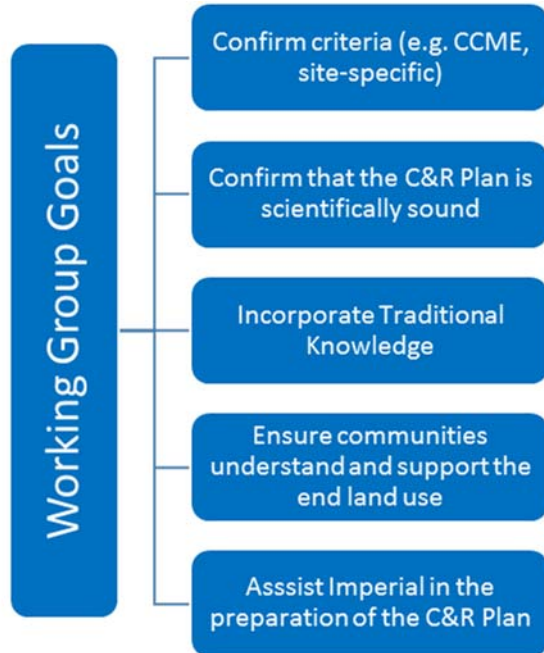
In 2014, the SLWB requested that a Working Group come together to provide a formal way for meeting with stakeholders interested in the development of Imperial's C&R Plan for the Operations.

The Working Group represents a chance to engage with regulators, communities, Aboriginal governments/organizations, and other interested parties. Imperial has participated in the Working Group to obtain guidance and feedback, and to resolve issues before the review of the C&R Plan for approval by the SLWB.

Imperial's participation in the Working Group is consistent with the company's Sahtu Settlement Area (SSA) Community Engagement Plan for the Operations.

Working Group Goals

Goals for the Working Group, as set out by the SLWB are:



Community Engagement

The Working Group has been the primary vehicle for ensuring that community perspectives are reflected in the C&R Plan. As a member of the local and regional communities, Imperial also routinely communicates with local stakeholders that may not have a formal involvement in the Working Group. Imperial will continue to consult with regulatory and community stakeholders following the submission of this Interim C&R Plan.

Local Opportunities

The C&R Plan includes some facilities and processes that will be in place over a long period of time to ensure that the closed site remains compatible with a healthy environment and with human activities.

These facilities and processes will require people and equipment to manage and monitor their operation; and there is also work involved in putting these requirements in place.

There is a variety of possible commercial arrangements that could be developed using local or regional businesses and skills to address these, and potentially other, C&R requirements. Imperial anticipates that the scope of these potential opportunities, along with prospective training and capacity building opportunities, will be an important part of the discussions and engagements that will occur as the C&R Plan evolves in the years leading up to facility closure.



For more information, see Section 2.4 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

1.2 NORMAN WELLS OPERATIONS

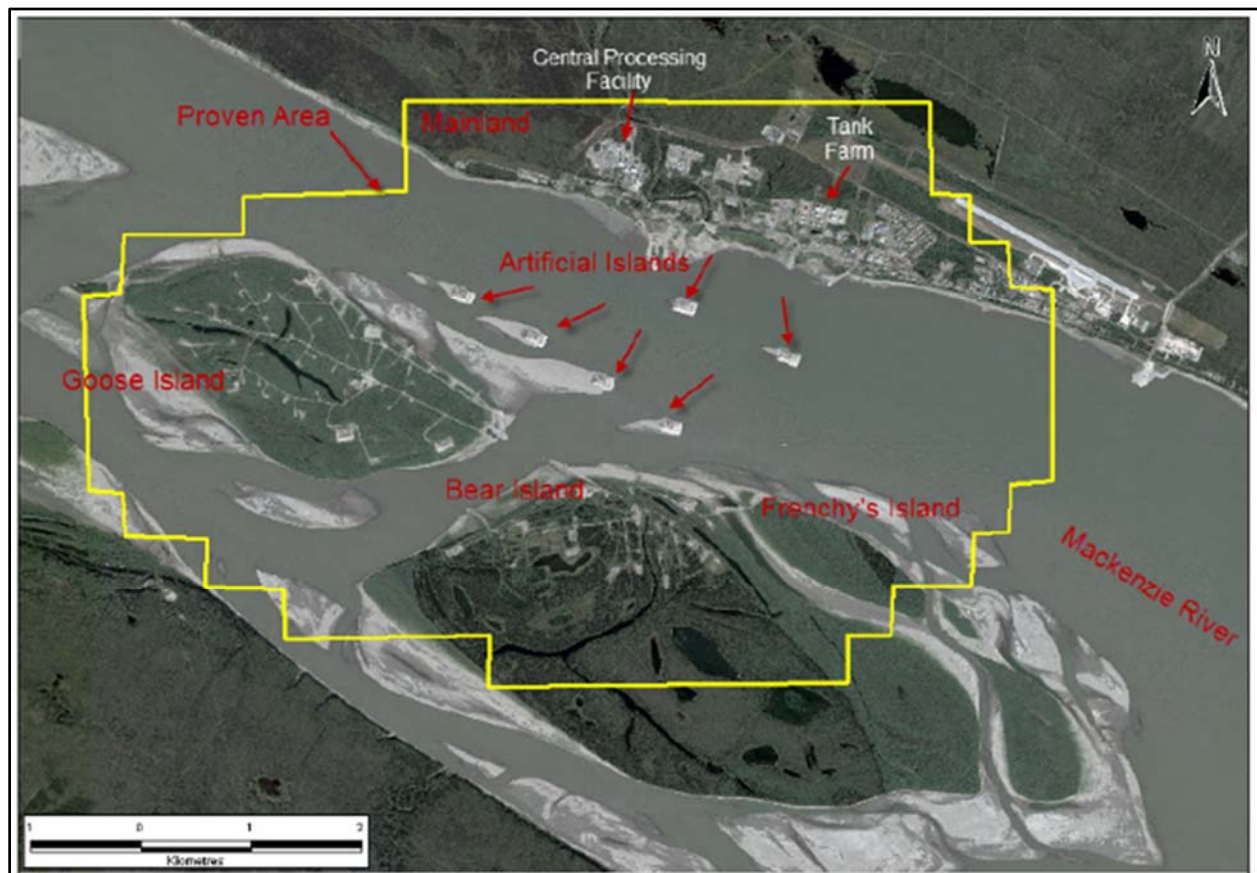
Imperial has been conducting operations at Norman Wells since the 1920s when the first well on the banks of the Mackenzie River east of the Bosworth Creek delta was drilled.

Imperial's Operations are located within the municipal boundary of the Town of Norman Wells and within an area called the Proven Area. The Proven Area is situated on Federal Crown Lands, Territorial Lands and lands owned by Imperial and other private landowners, and covers an area of 7,939 acres or 32 km². The actual size of the geographical footprint of the Operations is approximately 11 km².

Oil and gas production facilities (collectively called "the Field") include operations on the Mainland, the three Natural Islands (Bear, Goose and Frenchy's), and six Artificial Islands (1-Rayuka, 2-Rampart, 3-Dehcho, 4-Ekwe, 5-Itch K'ee and 6-Little Bear). A Central Processing Facility (CPF) is also located on the Mainland. Collectively, the Field and CPF are referred to as the Operations (see figure below).

Currently, the Operations produce approximately 1,900 m³ (12,000 bbl or barrels) of oil per day from 353 operating wells. These include oil producers and water injectors. In addition to producing oil, Imperial generates electricity for internal use and for the Northwest Territories Power Corporation (NTPC) to supply the Town of Norman Wells.

For more information, see Section 4.0 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.



Local Environment

The Norman Wells Operations is located along the Mackenzie River (“the River”) - the largest and longest river system in Canada.

The soil and water in the Sahtu region are unique because they contain naturally occurring metals, salts and oils. The area is also known to have natural oil and gas seeps along the River.

The Operations lies in a zone of discontinuous permafrost. Discontinuous means that permafrost in the area is common but it isn't found everywhere; or at the same thickness or depth. The layer of soil above the bedrock at the Operations is typically shallow. Groundwater on the north side of the River generally flows toward the south.

There are various terrestrial (land) and aquatic (water) wildlife species in the Norman Wells area which are important local resources.

For more information, see Section 3.0 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

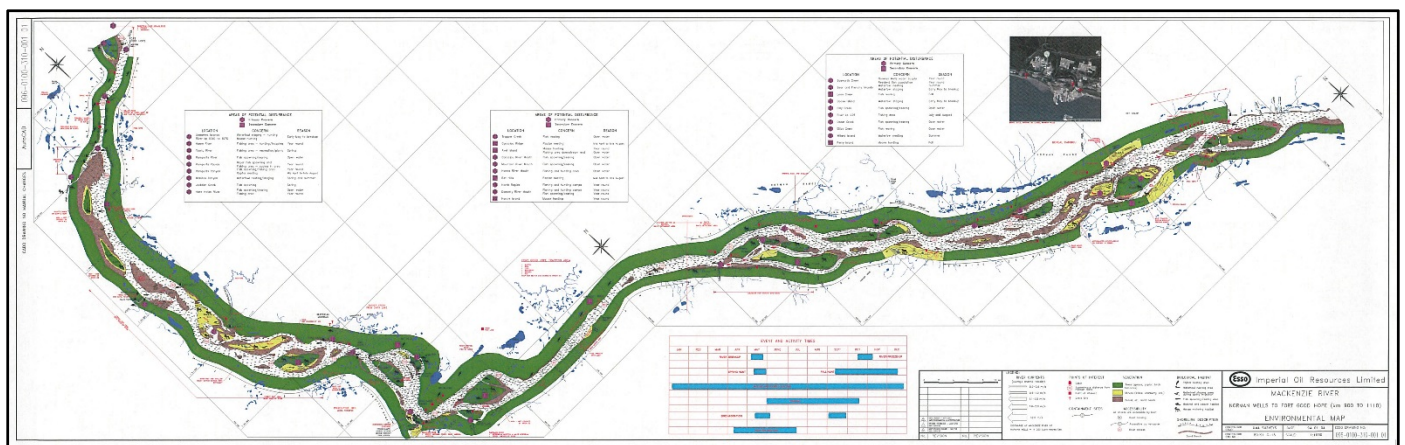
Community Setting

Norman Wells is located within the boundaries of the Sahtu Settlement Area (SSA). There are five communities in the SSA. These are Colville Lake, Déline, Fort Good Hope, Norman Wells, and Tulita.

The Operations is located within the limits of the Town of Norman Wells. The Town is the transportation hub for the SSA. Norman Wells' establishment and growth closely followed the exploration and development of hydrocarbons in the area. However, Norman Wells features a wide variety of businesses and economic development opportunities in addition to major oil and gas production and operating facilities.

Traditional Knowledge

Imperial hosted Traditional Knowledge workshops in Fort Good Hope and Norman Wells in 2013 as part of the Water Licence Renewal Application process, and to build on the knowledge base assembled during previous studies in the communities. Local Elders who regularly use the River were asked to share their knowledge of the River and the surrounding area, and to update the River map that was made in 1993 (below).



1.3 C&R PLANNING APPROACH

Imperial has followed the Objectives-Based approach that is recommended in the MVLWB guidelines to develop the C&R Plan.

Imperial, along with the Working Group, agreed to adopt the overall closure goal from the guidelines for the Operations. Closure principles, also adopted from the guidelines, were used to guide the selection of clear and measurable closure objectives.

Next, the specific actions and measures (activities) required to meet each closure objective were selected from a set of options. Criteria were identified to measure the success of selected closure activities in meeting the objectives.

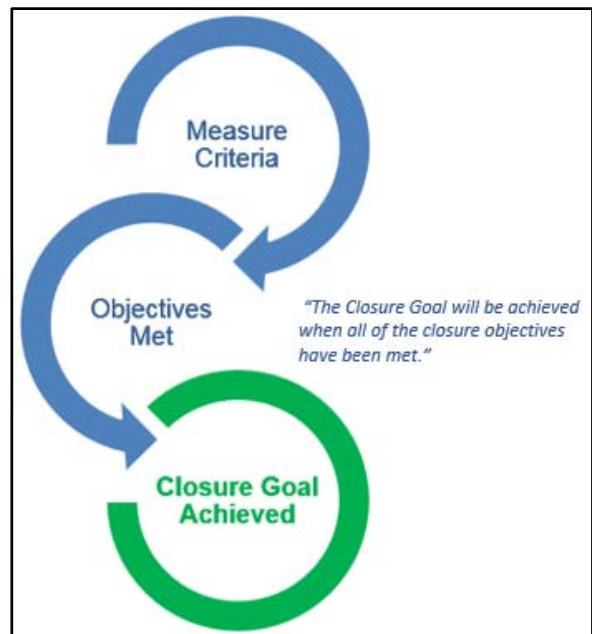


Closure Goal & Principles

The overall closure goal establishes overall vision and purpose of closure for the Operations.

Closure Goal: "To return the site and affected areas to viable and wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities."

As a general statement, the closure goal can't be measured directly. It is considered achieved when all of the closure objectives have been met.



The Working Group also agreed on a set of guiding closure principles that are specified in the MVLWB guidelines and that support the closure goal. The principles were considered in the selection of closure objectives and include: Physical Stability, Chemical Stability, No Long Term Active Care, and Future Use. Imperial has accommodated the "No Long Term Active Care" principle in the Interim C&R Plan by limiting post closure management activities to those required to sustain the property in its reclaimed state. Post

closure management will not involve activities that indefinitely defer the closure and reclamation of facilities or lands on the Proven Area.

Closure Objectives

Closure Objectives were developed to describe what the selected closure activities should aim to achieve. The objectives set measurable, achievable targets to guide the selection of what activities will be implemented to achieve closure.

Site-Wide Objectives

Site-wide Closure Objectives apply property-wide and set the stage for the next planning steps.

These objectives address overarching values as established by the Working Group; as well as key environmental components or 'media', including air, land, water and wildlife.

- Landscape closed and reclaimed in a manner that reflects consultation with community members and associated Traditional Knowledge and use.
- Removal or mitigation of physical and chemical hazards.
- Incremental disturbance of land required to support closure and reclamation activity minimized.
- Compliance with legal, regulatory and corporate obligations.
- Archaeological and historically significant sites identified by entities such as the Prince of Wales Northern Heritage Centre, Norman Wells Historical Society, regional Land Corporations and Secretariat are protected and preserved.

Site-Wide Objectives Overarching Values



- Dust levels at the closed and reclaimed site safe for people, vegetation, wildlife, and aquatic life.
- Soil that is safe for people and the environment.
- Closed and reclaimed landscape that is physically stable, safe, and consistent and compatible with the surrounding natural area.
- Below ground facilities and infrastructure are abandoned or removed as appropriate for safe utilization of the defined future land use.
- Above-ground facilities, infrastructure and debris are removed.
- Water quality that is safe for humans, wildlife and aquatic life; and does not compromise the ecology of natural watercourses such as the Mackenzie River and Bosworth Creek.
- Hydrology and drainage of the reclaimed land surface generally consistent with the character of the local watershed and appropriate to the defined land use.
- Terrain restoration to allow safe utilization and passage by terrestrial wildlife.

Site-Wide Objectives Air, Land, Water, and Wildlife



Component-Specific Objectives

As a next level of detail, Component-Specific Closure Objectives were developed for smaller, more manageable sections of the Operations, called Closure Components.

Some of these component-specific objectives match the site-wide objectives. This overlap, where it exists, lines up with the MVLWB Guidelines.

Many of the site-wide closure objectives also apply to individual project closure components – so they have been adopted at that level.

In some cases, there are closure factors that are unique to a project component. In these cases, distinct component closure objectives were developed.

These distinct objectives, where they exist, are described in the component-specific sections later in this summary. They are also described in detail in Section 5.0 of the C&R Plan.

Component Objectives – Common Themes

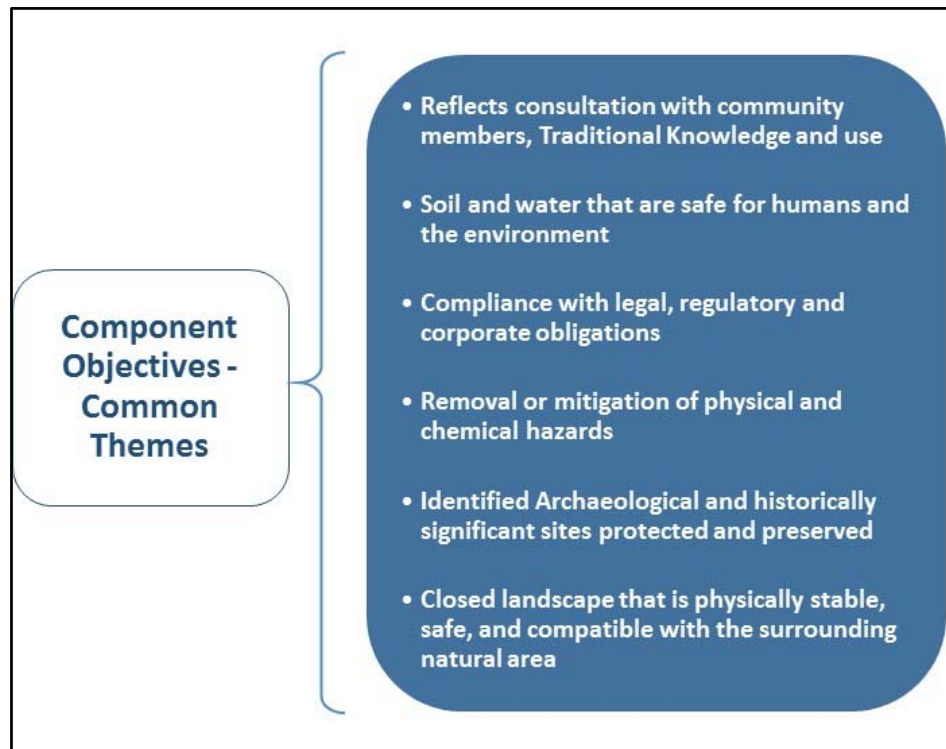
There is a common set of themes in the component-specific objectives. These common themes mirror the overarching site-wide objective values and are highlighted in the figure below.

Closure Components

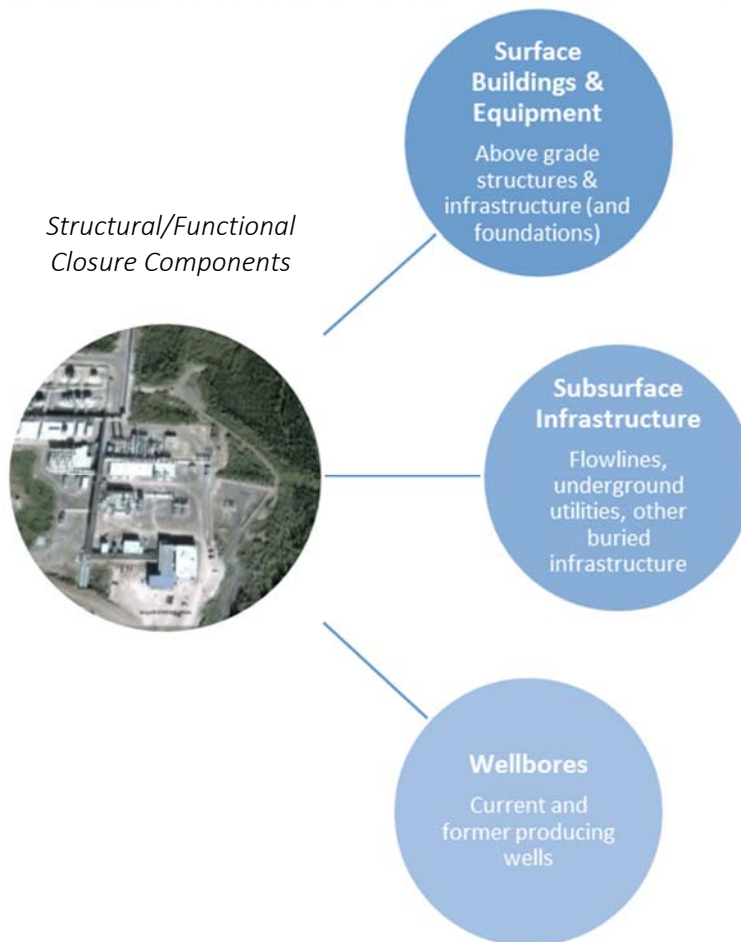
Closure Components were selected to provide a coordinated and consistent approach to closure planning. Project components include the following, which are illustrated on the next page:

- four distinct geographic areas (Mainland, Natural Islands, Artificial Islands and Natural Watercourses); and
- three different types of major infrastructure/functional features (Surface Buildings & Equipment, Subsurface Infrastructure, Wellbores).

For more information, see Section 5.2.3 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.



Geographic Closure Components



1.4 CLOSURE ACTIVITIES

ACTIVITIES

Closure Activities are specific actions and measurements that are planned and completed to meet closure objectives. At an operations-wide level, the order of closure activities for the Operations will follow the sequence shown in the figure on the right.

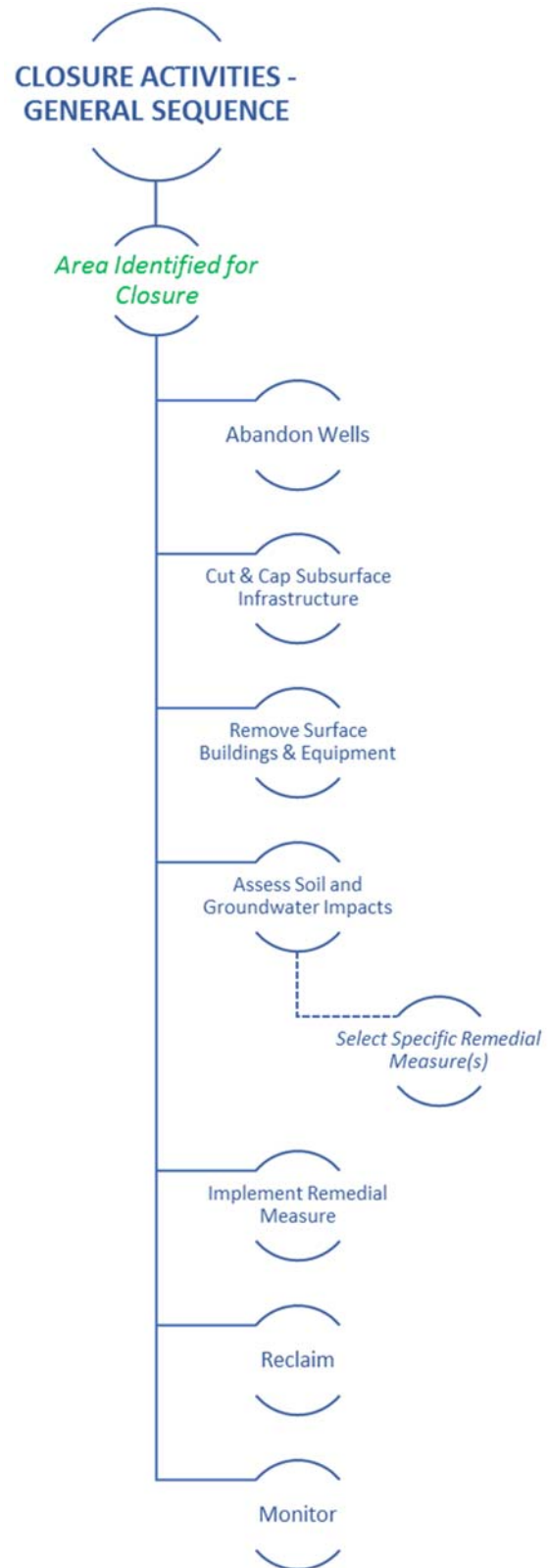
When an area is scheduled for closure, the Wellbores and below ground (subsurface) infrastructure are either cleaned and abandoned in place following proven protocols, or removed. Surface buildings, equipment and infrastructure are then decommissioned, dismantled and removed.

The quality of groundwater and soil in the area(s) are assessed to determine the nature and scale of any remaining impacts. This information is used to determine the best strategies (or remedial measures) to neutralize, reduce or remove impacted soil and groundwater. Once the remedial measure(s) are complete, the area is reclaimed and monitored according to the C&R Plan.

Closure Options

Closure options are a set of proposed alternatives for closing each project component. Closure options for the Operations were evaluated to determine the selected closure activity for the component. Evaluation was based on how well each option will meet the closure objective(s).

Options were also reviewed based on how well each is expected to perform and how well each addresses potential safety and environmental risks associated with putting the option in place. Options were also reviewed for possible benefits to the community (e.g., commercial benefits).



Property-Wide/Central Closure Activities

Due to a significant link to the closure objectives, property-wide level closure options focused on strategies to remediate the impacted soil materials that are present across the Proven Area. Remedial strategies assessed included removing and gathering impacted soils together for disposal (on-site and off-site were considered), in situ (in place) containment, as well as options for soil treatment.

The primary option selected involves the removal of soils that cannot practically be treated and consolidation in a central on-site Long Term Management Facility (LTMF). This option was selected because:

1. It is expected to meet closure objectives (i.e., to limit post closure land use restrictions by keeping materials in one central place);
2. It can be predicted to perform well (i.e., there is certainty that it will function as expected and required);
3. There are associated local employment and commercial opportunities; and
4. It is economically possible.

For more information, see Section 5.0 (Table 5-4: Comparative Rankings of C&R Remedial Strategy Alternatives) of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

Long Term Management Facilities (LTMF)

Long Term Management Facilities (LTMF) are enclosed earthen structures - similar to secure landfills and are designed to contain impacted materials over open-ended timeframes. They are

typically the most practical and adaptable options, particularly for relatively remote locations like Norman Wells. As the preferred alternative for the Operations, an LTMF will be used for the impacted soils and structure dismantling/demolition debris produced during remediation.

Impacted soils throughout the Proven Area will be removed and treated, or consolidated into a single LTMF. The LTMF will have features in place to ensure proper containment of these materials. These features will be similar to those used in modern secure landfills.

The LTMF will be sited in a dedicated portion of the Mainland Central area and is described in detail in Section 5 (*Mainland Component*).

Long Term Management Areas (LTMA)

The proposed C&R approach also includes Long Term Management Areas (or LTMA). LTMA are sources or zones of impacted materials which will require long term management in their current location.

There will be a few LTMA for the Operations. LTMA will be limited to a small number of source areas located primarily in the Mainland Central/East areas and are described in Section 5 (*Mainland Component*).

Component Closure Activities

The following sections provide a summary of the closure activities that have been selected from options for each project component. These are specific actions and measurements that have been selected to meet closure objectives for each component.

1.5 MAINLAND COMPONENT

The Mainland component of the Operations is one of the primary focus areas for closure activity because of its scale and because of its location at the centre of both the Proven Area and Imperial’s historical operations. Component objectives for the Mainland are aligned with the site-wide closure options.

The Mainland component contains much of the Proven Area’s inventory of impacted soil. In addition, the Long Term Management Areas (LTMA) that have been identified on the Proven Area to date are located in this component. The central location of the Mainland also makes it the best location for the Long Term Management Facility (LTMF) which is a key element of the C&R Plan.

Long Term Management Areas (LTMA)

LTMA are sources or zones of impacted materials which will require long term management in their current location. This is because they can’t be reliably or permanently remediated using currently available technology and/or at a realistic cost.

Candidate LTMA are identified, and their status regularly reviewed, on the basis of the monitoring and site characterization data that is routinely compiled during site operations. The final schedule of LTMA at closure will be dependent on site conditions and technology capabilities relevant at the time. Current information suggests that impacts identified in the Refinery Bank area and the former Flare Pit north of Battery 3 could be designated as LTMA following closure.

Refinery Bank: A groundwater containment and hydrocarbon recovery system is in place on the Refinery Bank to mitigate hydrocarbon impacts from previous operations of the old refinery. The nature and location of these impacts is such that product recovery efforts may require long term management.

Former Flare Pit: The former Flare Pit north of Battery 3 contains salt from previous operations which extends into the underlying fractured bedrock. Removing the salt impacted soil above the rock would still leave a significant portion of the total salt in the area. Therefore, the former Flare Pit area may be identified as an LTMA.



LTMA - Refinery Bank Gathering System

For more information, see Section 5 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

Long Term Management Facility (LTMF)

The Mainland component area was considered as the location for a Long Term Management Facility (LTMF) because of its central location on the Proven Area and because it contains the largest proportion of the Proven Area’s impacted soil inventory.

*Impacted soil volumes on the Mainland that do not meet CCME Industrial criteria will be excavated and treated, or consolidated within the LTMF.
See Section 12 for discussion on CCME Criteria.*

LTMF Description

The LTMF will be used to contain impacted soil that cannot practically be treated and reused, as well as waste and debris from the dismantling of buildings, equipment and infrastructure. It is currently anticipated that only a limited portion of the soil inventory will be treatable, and that most of the soils will be directed to the LTMF.

The completed LTMF footprint area will be a little over 10 ha and has a design capacity of 720,000 m³. Completion of the LTMF will be staged to support the sequence of closure and align with progressive reclamation activities for the Operations (see Section 13).

The shape of the final LTMF is rounded with slight curves so that it appears similar to a natural landform. The top and the side slopes have also been designed with a natural landform in mind. The LTMF cap will be seeded with grass similar to those on the surrounding lands.

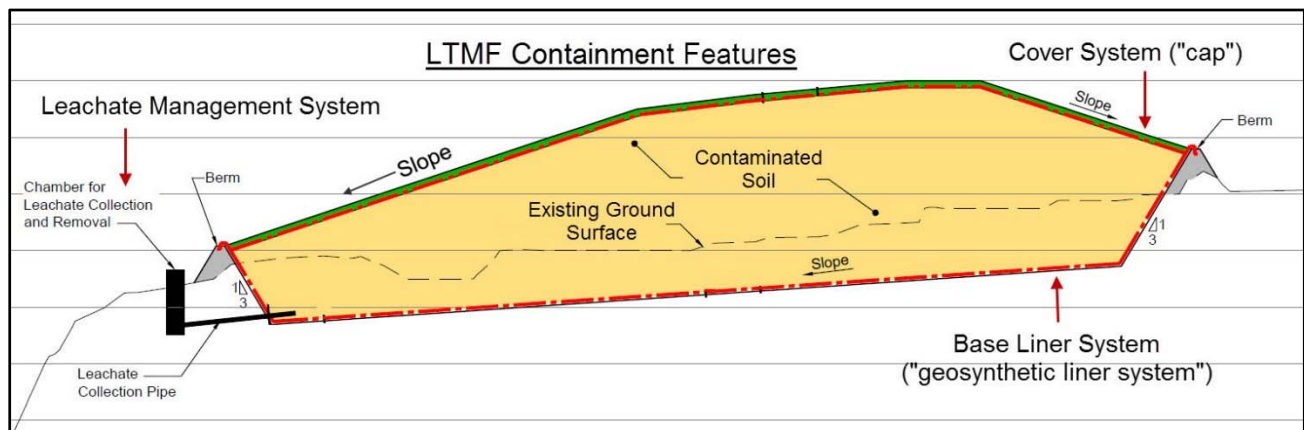
LTMF Containment Features

To provide reliable containment, the LTMF will include key features specifically designed for the proposed use to northern conditions. These are proven containment features similar to those used in modern secure landfills including:

- A “geosynthetic” base liner system – the bottom and sides of the LTMF will be a barrier comprised of a flexible plastic geomembrane over a manufactured soil bentonite material. Together these function to prevent liquid seeping out of the structure.
- A cover system – an LTMF ‘cap’ made from geomembrane materials similar to those used in the base liner system.
- Leachate Management System – a system to collect, remove, and treat or dispose of any excess liquids in the LTMF and to prevent any liquids from leaving the structure.

An important component of LTMF development will be the operational monitoring capabilities to be implemented and maintained, to ensure proper performance of the LTMF containment system.

For more information, see Section 5.5.1 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.



LTMF Location

Different locations were considered for a Mainland LTMF. The preferred (selected) site is the current location of the Mainland Drilling Sumps.

The reasons for choosing this site included:

- The site is an existing impacted area;
- Early LTMF development will not interfere with pre-closure operations, or the operation of existing soil treatment facilities (see Section 13);
- The site provides extended physical and visual buffers between the LTMF and the Mackenzie River and Bosworth Creek;

- LTMF development in this area matches an existing local land use (i.e., for waste management) that is accepted by the community; and
- The site footprint avoids overlaps with existing Operations facilities and well sites.

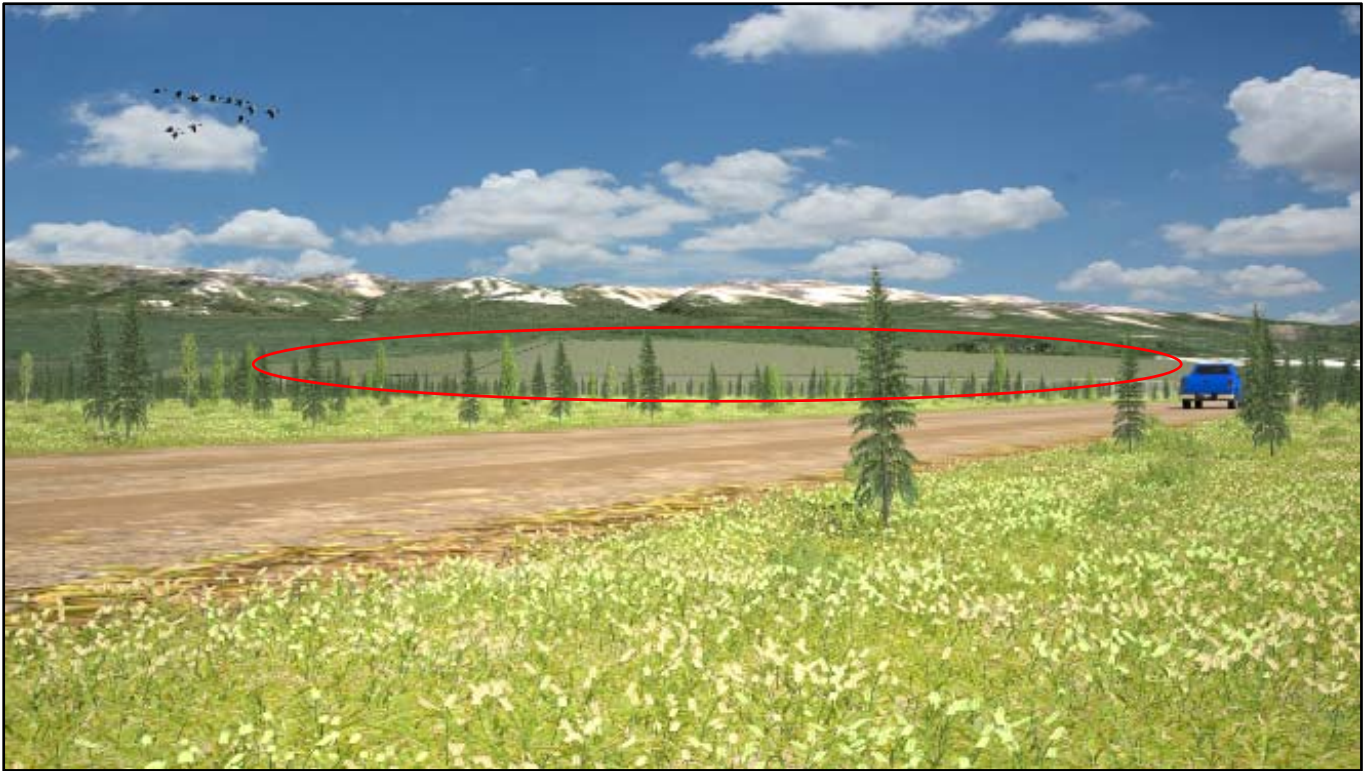
For more information, see Section 5.5.1 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

What will the LTMF Look Like?

Artistic representations of the completed LTMF are provided on the following pages. These include views of the LTMF from the air, road and River.

See the following pages for views of the final LTMF from the air, road and River.

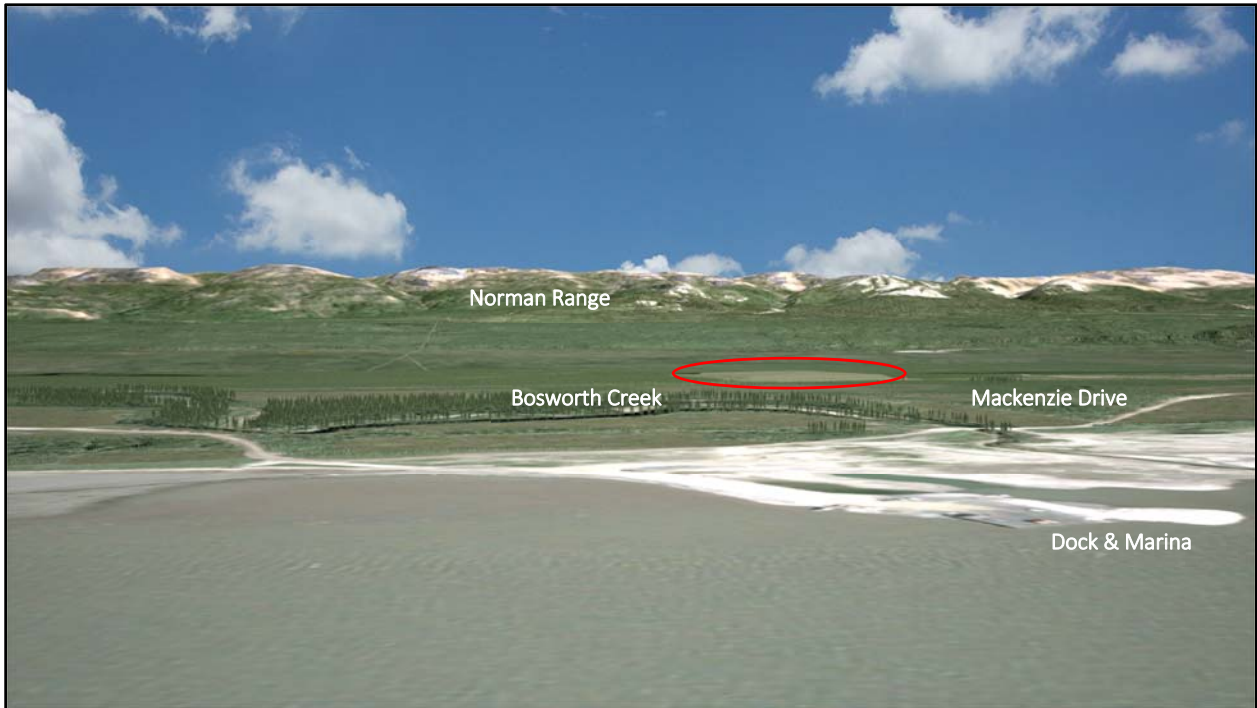




Completed LTMF looking Northeast: Driving east along Canol Drive with a view of the south side of the proposed LTMF (circled) and Discovery Ridge on the south slopes of the Norman Range.



Completed LTMF looking northwest: Driving west along Canol Drive with a view of the east side of the proposed LTMF and water treatment facility.



Completed LTMF view from River: Approaching the reclaimed Mainland from the Mackenzie River with a view of the proposed LTMF (circled) located between Bosworth Creek and the Norman Range on the horizon. The dock and marina are visible in the foreground. Mackenzie Drive meanders over Bosworth Creek towards the marina and the reclaimed former Central Processing Facility on the left.



Completed LTMF aerial view: Approaching the proposed LTMF and water treatment facility (circled) in the foreground with a view towards the Town of Norman Wells and the airport. The reclaimed former tank farm and refinery area is visible on the right. (Note that this figure assumes the entire Mainland tank farm is removed following closure. In practice, there may be some tanks retained to support community requirements after facility shutdown.)

Reclamation Elements

Reclamation elements for the Mainland will involve backfilling the areas where impacted soil materials have been removed with locally available soils. This is described in more detail in Section 5.6 of the Interim Norman Wells Operations C&R Plan (*Materials Management Plan*). A general arrangement of the post reclamation Mainland land surface is shown below.

Land surfaces and capabilities will be re-established to meet applicable reclamation objectives. Most disturbed areas will be revegetated. Some areas will have shaped and contoured accumulations of shale areas that, based on observations of natural vegetation regrowth on the Operations to date, are expected to revegetate naturally over time.

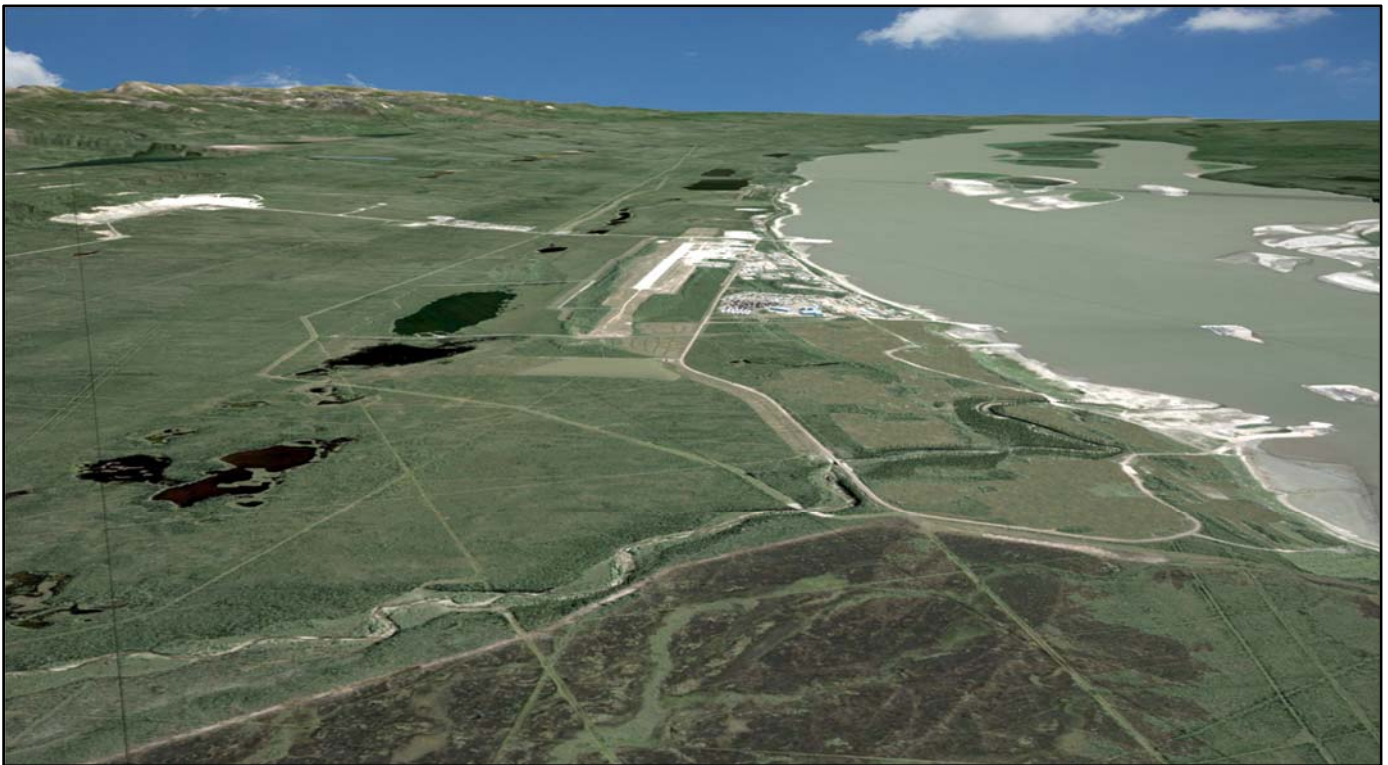
An artistic representation of the post reclamation Mainland component is provided on the next page.

For more information, see Section 5.5.1 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.





Current Norman Wells Operations Mainland



Mainland Component Post-Reclamation (Artistic Rendering)

(Note that this figure assumes the entire Mainland tank farm is removed following closure. In practice, there may be some tanks retained to support community requirements after facility shutdown.)

1.6 NATURAL ISLANDS

This component focusses on the remediation and reclamation activities proposed for Bear, Goose and Frenchy’s Islands. Closure activities related to the Buildings and Equipment, Wellbores and Subsurface Infrastructure on these islands is described in Sections 9, 10 and 11.

Remediation

The main closure activity for the Natural Islands component is focused on remediation of impacted soil materials.

Impacted soils on the Natural Islands that do not meet CCME Parkland Criteria will be removed, relocated and treated, or consolidated within the Mainland LTMF. See Section 12 for discussion on CCME Criteria.

The additional component specific option that was considered was the possibility of developing a separate LTMF for impacted soils from the Natural Islands, most likely in the general vicinity of the Bear Island drilling sumps. This approach was not adopted because:

- It does not fit with the general closure planning principle to limit the footprint of a post-closure landscape; and
- It would create separate requirement for post closure operations and maintenance.

For more information, see Sections 5.6 (Materials Management Plan) and Section 8.0 (Integrated Schedule of C&R Activities) of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

Reclamation Elements

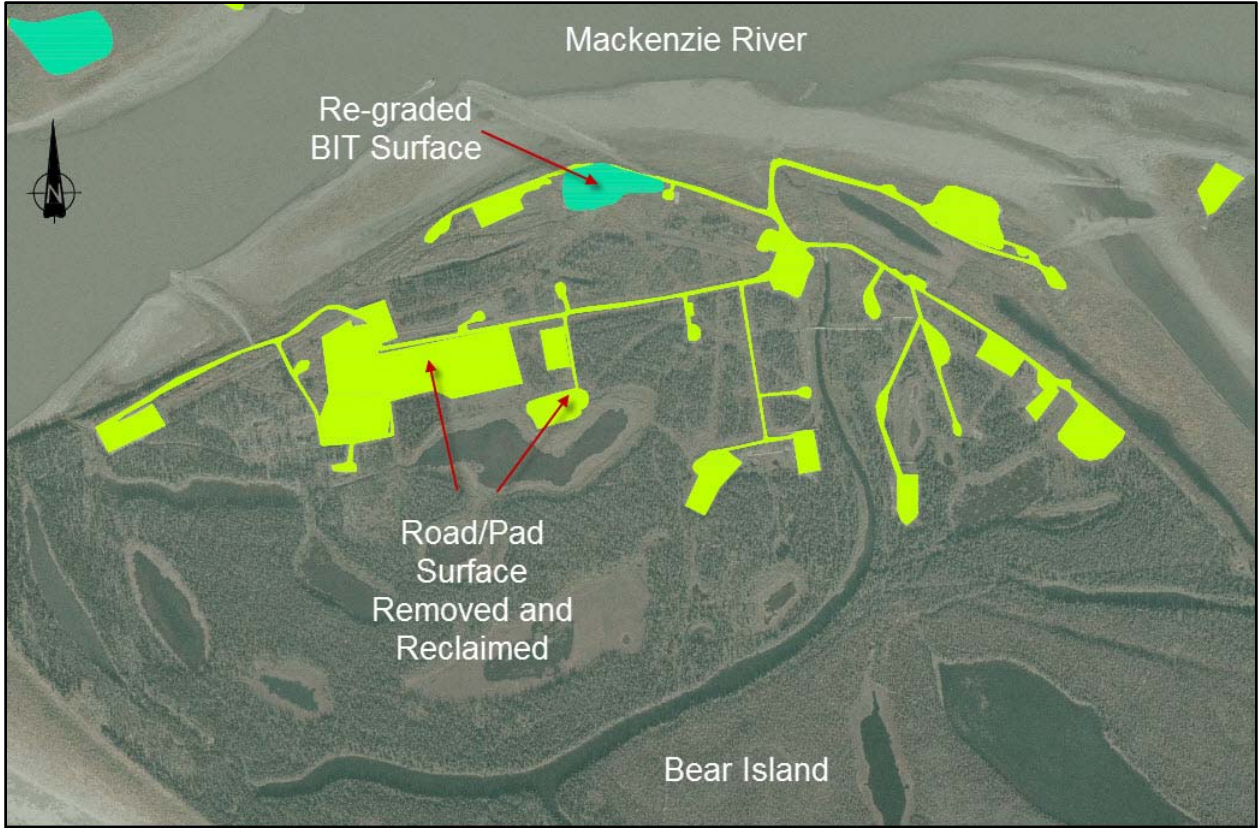
The main elements of the proposed reclamation activity for the Natural Islands are:

1. The areas where impacted soil materials have been removed (i.e., for relocation to the Mainland LTMF) will be filled in with shales taken from existing island roadways and terminal sites;
2. This layer of shales will then be covered with a layer of locally sourced soil;
3. The remaining shale on island roads will be removed to grade level, gathered together and relocated to respective Goose Island Terminal (GIT) and Bear Island Terminal (BIT) sites;
4. These gatherings of shale at the GITs/ BITs will be contoured (shaped) so that final land slopes and features will be physically stable and compatible with the surrounding landscape;
5. Finished land surfaces (i.e., on backfilled soil excavations and reclaimed roads) will be seeded (or left to revegetate where this is expected to be more effective); and
6. Select areas around the GITs/BITs and some road alignments will receive tree or shrub plantings to provide an aesthetic transition between reclaimed grass areas and the surrounding lands.

The general arrangements of reclaimed landscapes on Goose and Bear Islands are illustrated on the next page.

For more information, see Section 5.5.2 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

On the following page are artistic representations of a reclaimed terminal (GIT) at Goose Island as seen from the Mainland and as seen from the River.



Natural Islands – General Reclamation Arrangements



GIT view from Mainland: Approaching Goose Island from the north with the Mackenzie River in the foreground & Mackenzie Mountains on horizon. Reclaimed access roads & contoured former Terminal pads are visible on the island (circled).



GIT view from River: Goose Island in the foreground with a view towards the Mackenzie River and the Norman Range on the horizon. The contoured former Goose Island Terminal pads are visible on the island (circled).

1.7 ARTIFICIAL ISLANDS

This component focusses on the remediation and reclamation activities proposed for the six Artificial Islands in the Mackenzie River Channel ((1 (Rayuka), 2 (Rampart), 3 (Dehcho), 4 (Ekwe), 5 (Iteh K’ee), and 6 (Little Bear)).

Closure activities related to the Buildings and Equipment, Wellbores and Subsurface Infrastructure on these islands is described in Sections 9, 10 and 11.

The islands were constructed between 1983 and 1984 and are located in relatively shallow water near the edge of the main river channel. The islands are constructed with a sand core dredged from the river channel contained with a rock berm sourced from the local quarry.

The rock berm is protected by “armour” comprised of riprap (rubble), stone and/or gabions (cages containing rocks). The slope of the islands that faces upstream is constructed with a shallow sloped ledge, called an ice pile-up storage berm.



Artificial Island 6

Remediation

Similar to the Natural Islands, the main closure activity for the Artificial Islands is focused on remediation of impacted soil materials.

Impacted soils on the Artificial Islands that do not meet CCME Parkland Criteria or background will be removed, relocated and treated, or consolidated within the Mainland LTMF. See Section 12 for discussion on CCME Criteria.

For more information on the Artificial Islands, see Sections 5.6 & 8.0 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

Reclamation Elements

Imperial is examining various alternatives for the post closure fate of the Artificial Islands. One approach is to let the natural erosion processes and movement of the Mackenzie River return the sands in the core of the islands to the riverbed after all or portions of the existing island armour is removed.

The armour material (i.e., riprap, gabions, and large gravels) would be returned to the Mainland at closure and incorporated into surface reclamation plans or returned to the source quarry owned by the Town of Norman Wells. The island berms below the armour would be left in place once confirmed to be free of impact and displaced over time by the combined actions of ice and river flows.

Decisions on the effectiveness of this and other possible reclamation approaches will be made following the outcomes of upcoming technical studies and stakeholder engagement and consultations. These studies will examine the nature and scale of natural soil relocation processes and the long term impacts on local fish habitat and navigation on the Mackenzie River.

For more information, see Section 5.5.3 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

1.8 NATURAL WATERCOURSES

The Natural Watercourses component is made up mainly of the surface waters and sediments in the Mackenzie River and Bosworth Creek, but consideration is also given to smaller, local waterbodies on the Natural Islands and other areas across the Proven Area.

The conditions of surface waters and sediments in the Mackenzie River and Bosworth Creek were described in the discussion of baseline conditions provided in Section 3.3.1 of the C&R Plan. These conditions are routinely monitored and reviewed with community stakeholders under the Aquatic Effects Monitoring Program (AEMP) that Imperial undertakes and manages.

The water and sediment quality data compiled over the years for local watercourses provides no indication of any significant human-caused impact that can be associated with the Operations.

For more information, see Section 3.0 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

C&R Scope & Activities

Given the lack of human-caused impact, there are no C&R activities proposed that focus specifically on objectives under the Natural Watercourses Component. That said, it is important to note that a number of the C&R activities proposed for other components are ultimately intended to reduce long term risks to surface water and sediment quality, in line with component objectives related to:

- Stable River and creek banks that are compatible with surrounding lands
- River water sediment quality that is safe for humans, aquatic life, and fish habitat

This includes a central element of the C&R Plan, that being removal followed by treatment or containment of all impacted soils in a centralized Long Term Management Facility (LTMF) and the designation of Long Term Management Areas (LTMA). A primary feature of these is the long term protection of downstream environmental media.

For more information, see Section 5.5.4 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.



Mackenzie River at the Norman Wells Operations

1.9 BUILDINGS, EQUIPMENT & SURFACE INFRASTRUCTURE

This component focusses on all of the above grade buildings and equipment on the Proven Area, and their subsurface foundations. C&R activities related to the downhole portion of production and injection wells and other subsurface (underground) infrastructure are described in Sections 10 and 11.

Above grade buildings and equipment are present on the Mainland, the Natural Islands, and includes the infrastructure on the Artificial Islands.

The Central Processing Facility (CPF) is the primary functional area on the Mainland. The CPF is made up of various facilities, buildings and surface infrastructure and also includes a flare stack and tank farm.

Other related above grade Mainland infrastructure includes terminals, facilities, storage areas, tank farms, as well as a road network, helicopter pad and two docks.

Above grade facilities on Bear and Goose Islands include terminals, production terminals, fuel and methanol storage areas, as well as helicopter pads and docks. There are no facilities, apart from production wells and their associated flow lines, present on Frenchy's Island. Buildings and equipment on the Artificial Islands are included in the Natural Islands inventory. This is consistent with the definitions of project components.

For more information on the buildings and equipment inventory, see Section 5.5.5 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.



Mainland Surface Buildings, Infrastructure

C&R Scope & Activities

The scope of C&R activity for the buildings and equipment component consists of decommissioning, dismantling and/or demolition of facilities following shut-down, and the management and final disposition of all associated materials and wastes.

Decommissioning

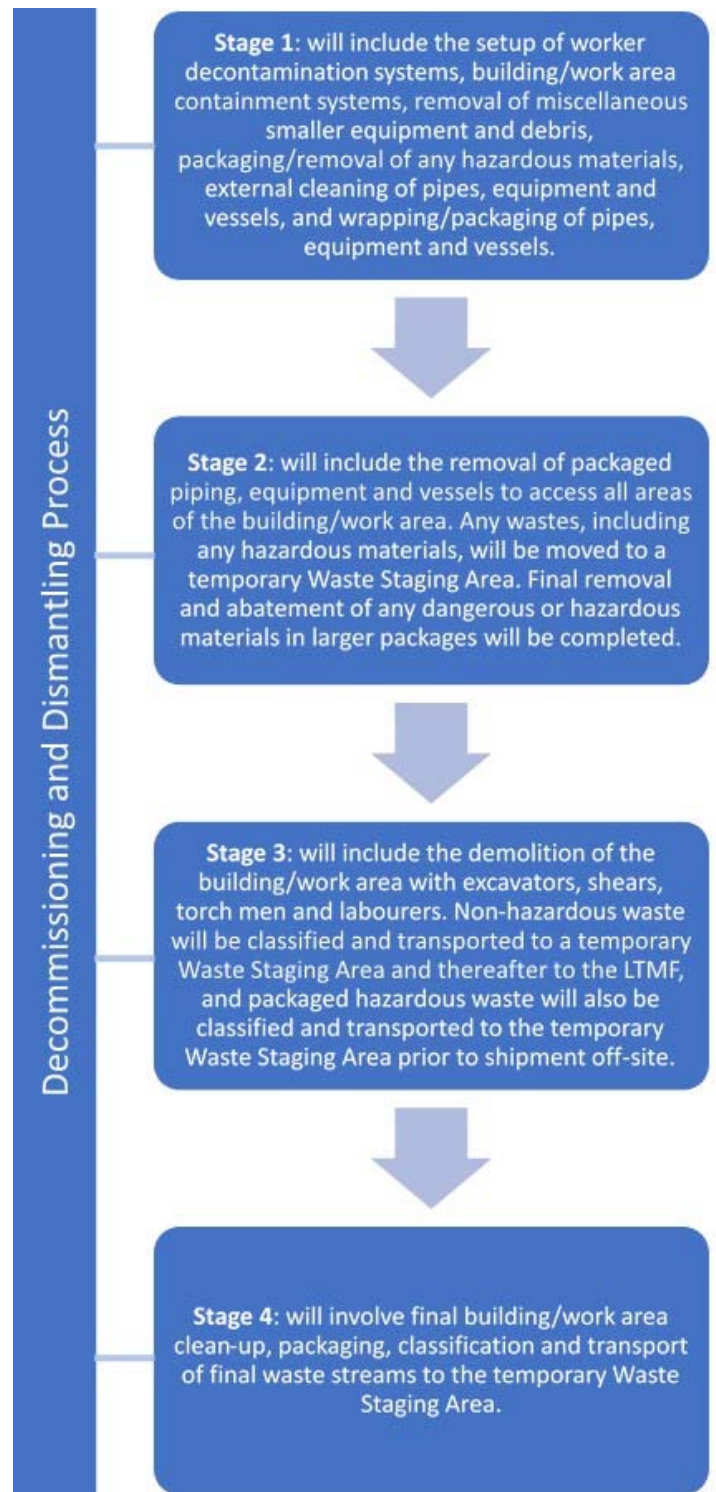
Decommissioning refers to taking processes and their associated equipment permanently out of service at closure. It includes the removal (or purging) of process chemicals. These equipment shut-downs are typically required from time to time during operations, and the proven operational protocols for these shut-downs in place at the time of closure will be applied.

The chemicals, residuals and/or wastes generated during these activities will be managed in accordance with the approved facility waste management plan in place at the time.

Dismantling and Demolition (D&D)

Above Grade Structures and Equipment

D&D of above grade structures and equipment will follow detailed plans developed at the time of closure. Individual plans will be structure or area specific, but will likely include general stages similar to the one on the right:



Foundation Elements

Uncontaminated foundation elements (e.g., concrete slabs, pedestals, grade beams and/or footings, and steel pipe piles) will be cut and removed to depths established on an area specific basis.

Foundation elements with surfaces known or suspected to have contaminants (e.g., oiled concrete slabs), will be excavated and removed entirely, and managed thereafter as contaminated rubble (i.e., directed to the LTMF).

What will happen with the Materials?

Dismantling and Demolition (D&D) activities for buildings and equipment at the Operations will generate several general material categories.

Disposition strategies for these materials (i.e., reuse, recycling or disposal) will be different depending on the material category (see below).

The one significant alternative considered for this component was the option of directing D&D waste and rubble to third party commercial waste management facilities outside the community (most likely in northern BC or Alberta). This approach was discounted due to potential safety risks, environmental (emissions) considerations and cost.

For more information, see Section 5.5.5 of the Interim Norman Wells Operations Closure and Reclamation Plan.



1.10 WELLBORES

The Wellbores Component includes C&R activity related to the downhole abandonment of production and injection wells to prevent the possibility of oil coming to the surface; as well as the reclamation of local excavations or disturbances that might be made in order to complete abandonment activity. There are 353 wells at the Operations. These are located throughout the Proven Area and include:

- 179 wells used for production;
- 168 wells used for injection;
- five suspended wells; and
- one well is listed as 'other'.



Norman Wells Operations Wellsite Equipped with a Pumpjack

C&R Scope & Activities

There are three primary C&R activities that will be associated with the Wellbores component. These are described in the figure to the right.

For more information, see Section 5.5.6 of the Interim Norman Wells Operations Closure and Reclamation Plan.

1 - Downhole Abandonment

- Follow proven protocols and methods to permanently separate the underground layer that the wellbores went into from the reclaimed surface of the land.
- *Downhole abandonment is conducted to prevent the possibility of oil coming to the surface; it will be guided by well-defined and proven regulatory procedures that are routinely updated on the basis of both facility specific and corporate experience.*

2 - Cutting & Capping

- Remove all wellbore hardware above a certain underground depth and put a physical cap on the wellbores at that depth (i.e., permanently close the wellbore underground).
- *Standard regulatory procedures for cutting and capping wells following Alberta Energy Regulatory Directive 20.*

3 - Backfilling & Reclamation

- Fill in, shape and revegetate the land surface directly around of the former wellbore.
- *Following capping, the excavations will be filled in by pushing in locally available soil (grading). If the excavations do not meet criteria, they will go to the LTMF. Backfilled excavations will be revegetated using the seed mix for the area, or left to revegetate naturally if this is expected to be more effective. Deeper cut and caps (i.e., on the Artificial Islands) will use drilling processes that will not cause major surface disturbances. So post capping will generally be followed by local grading and contouring followed by seeding.*

1.11 SUBSURFACE INFRASTRUCTURE

This component includes flowlines (both overland and under the Mackenzie River); and various utilities (i.e., electrical lines, communications lines and potable water and septic service).

C&R Scope & Activities

Flowlines

The network of flowlines that service the Operations facilities are the most significant element of the subsurface component.

Flowlines are used to connect the Field Operations with the CPF. A number of flowlines (oil, water and gas) run under the Mackenzie River. Flowlines between the Field and CPF are used for:

- Production (oil, produced water and gas) from the producing wells in the Field to the CPF;
- Injection (fresh water, produced water and propane) from the CPF to injection wells in the field; and
- Natural gas (fuel gas, artificial lift) from the CPF to gas lift wells and field facilities.

The sequence of closure activity for flowlines is illustrated below:



Flowline Abatement and Management

All flowlines will be cleaned prior to removal or abandonment. Imperial’s operational flowline cleaning protocols will be updated to include cleaning procedures specific to the features and conditions of each of the flowlines.

“Pigging” technologies will be used to remove wax deposits in flowlines. Pigging involves inserting a full line-size ball or scraper into the flowline at the wellhead or facility. As the “pig” blocks the flow in the line, backpressure behind the pig increases, and the pigging device is pushed down the flowline. Waxy deposits are scraped off of the inside walls by the pig as it is ‘squeezed’ down the flowline. The pigs are launched into the line by pig senders and retrieved by pig receivers.

Management of wastes from cleaning processes will follow Imperial flowline integrity and facility waste management plans.

Flowline Abandonment

Flowline ends will be removed to below the root zone (the specific depths involved may vary by area) and the rest of the flowline will be capped. Flowline sections will be completely removed in areas where post-closure erosion or movement may occur. These will be capped in the spot that they have been removed.

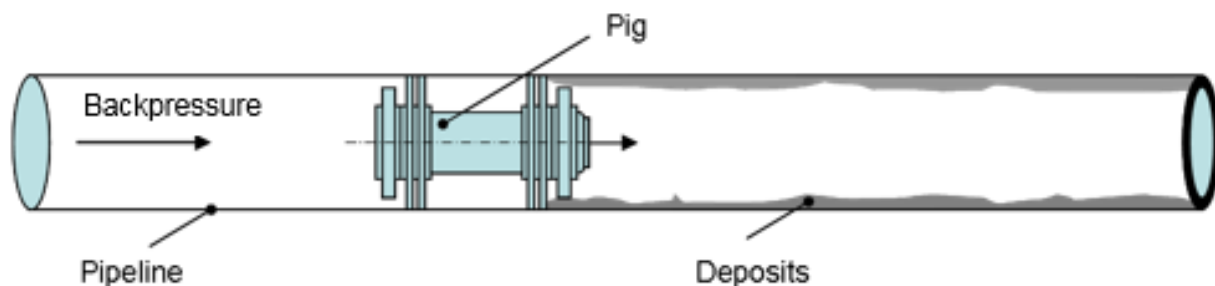
Most cleaned and capped flowlines will be left, unfilled in place. If they cross significant roadways or other transportation routes, they will be filled with material such as sand or grout to make them structurally stable.

Flowline sections left under the Mackenzie River will be filled with water or grout (specialized concrete) to prevent them from moving or floating.

Subsurface Utilities

Utilities within the root zone of the surface will be removed and directed to the LTMF. Removal schedules will be area and utility specific. Utilities that contain or may contain leftover impacts will be excavated and removed entirely, and directed to the LTMF.

For more information, see Section 5.5.7 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.



Flowline Cleaning with “Pigging” Technology

1.12 CLOSURE CRITERIA

The MVLWB guidelines define closure criteria as:

“...standards that measure the success of selected closure activities in meeting closure objectives...”

Depending on the closure objective, criteria can be numerical values (e.g., soil or water quality parameters) or statements that describe a standard to measure against (e.g., ...“compliance with applicable regulatory requirements...”). The Interim Norman Wells Operations C&R Plan includes both types of criteria.

Closure criteria can be site-specific or adopted from territorial/federal or other standards.

Closure criteria have been expanded upon for each closure objective during the development of the Interim C&R Plan and will be finalized in the final C&R Plan.

For more information on closure criteria, see Section 5.2.4 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

CCME Criteria

The C&R Plan includes specific closure objectives related to the safety of soils and water for people and the environment.

Environmental assessments of soil and water quality will be completed to demonstrate that these objectives have been met. The soil and water test results will be compared with specific criteria. These will include established Canada-wide standards as defined by the Canadian Council of Ministers of the Environment (CCME) – called “CCME criteria” from here on. Where available, criteria will also include background conditions (i.e., samples obtained from nearby areas that have not been impacted).

The CCME is made up of the environment ministers from the federal, provincial and territorial governments. The CCME has developed a set of Canadian Environmental Quality Guidelines (CEQG) to provide specific tools for reliable and scientifically defensible remediation of contaminated sites. These include:

- *Water Quality Guidelines for the Protection of Freshwater Aquatic Life;*
- *Soil Quality Guidelines for the Protection of Environmental and Human Health; and*
- *Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil.*

Soil Quality Guidelines

The Government of the Northwest Territories has adopted the soil criteria established by the CCME. The CEQG Soil Quality Guidelines include concentration limits for various substances typically produced by oilfield operations (e.g., petroleum hydrocarbons, salts).

For each of these parameters, the guidelines outline what levels are safe for the environment and for people under several different land use categories. This is because the definition of safe levels depends on what the land will be used for, how, and for how long. The Soil Quality Guidelines include criteria under four land use categories:

1. Agricultural
2. Residential/Parkland
3. Commercial
4. Industrial

CCME Land Use Criteria for the Operations

The Mainland and Natural Island components of the Operations have been zoned as “Industrial Lands” by the Town of Norman Wells.

According to the *Community Plan Bylaw (#13-01)* (the Bylaw), this means these lands are intended for hydrocarbon, light and heavy industrial uses. Examples of permitted uses in the Bylaw include processing of hydrocarbons, as well as construction operations, trucking companies and manufacturing or warehousing and equipment storage.

The Operations Mainland and Natural Island areas have been zoned as “Industrial Lands” by the Town of Norman Wells (Community Plan Bylaw (#13-01)).

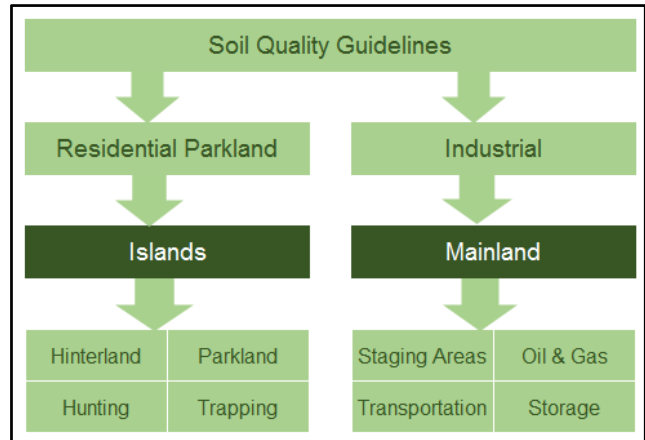
The C&R Plan proposes Mainland closure criteria for land use (CCME) that lines up with this zoning. For the Natural and Artificial Islands the C&R Plan provides for land use above and beyond this industrial definition.

The current C&R Plan proposes closure criteria for the Mainland that is consistent with the zoning in the Bylaw. For the Natural Islands and Artificial Islands, the C&R Plan provides for additional potential land use above and beyond the industrial definition.

Specifically:

- Mainland – CCME Industrial criteria: This means that soil analyses at the Mainland will be compared with CCME Industrial criteria to demonstrate the safety of soils for that designated land use. This will be used to demonstrate that the objective of soils safe for the environment and people has been met.

- Natural Islands and Artificial Islands – CCME Parkland criteria: This means that soil analysis at the Natural and Artificial Islands will be compared with CCME Parkland criteria to demonstrate the safety of soils for that designated land use, which includes uses such as hinterland, natural parkland and hunting and trapping.



What does Industrial vs. Parkland Look Like?

Reclaimed landscapes on top of soils remediated to Industrial or Parkland will not necessarily look different. This is because, from an environmental and human safety standpoint, the criteria (CCME) are related to the quality of the soil underneath the surface, not the shape or vegetation planted on the top.

In fact, an area remediated to Industrial criteria may look exactly the same as an area remediated to Parkland once reclamation is complete – even though they are not zoned for the same land uses.

1.13 PROGRESSIVE RECLAMATION

Imperial has undertaken various C&R initiatives and activities over the years and will continue to do so in the lead up to facility closure. These *Progressive Reclamation* activities are described and reported in annual progress reports submitted to the SLWB.

“Progressive reclamation takes place prior to permanent closure to reclaim components and/or decommission facilities that no longer serve a purpose. These activities can be completed during operations with the available resources to reduce future reclamation costs, minimize the duration of environmental exposure and enhance environmental protection. Progressive reclamation may shorten the time for achieving closure objectives and may provide valuable experience on the effectiveness of certain measures that might be implemented during permanent closure.” (MVLWB 2013)

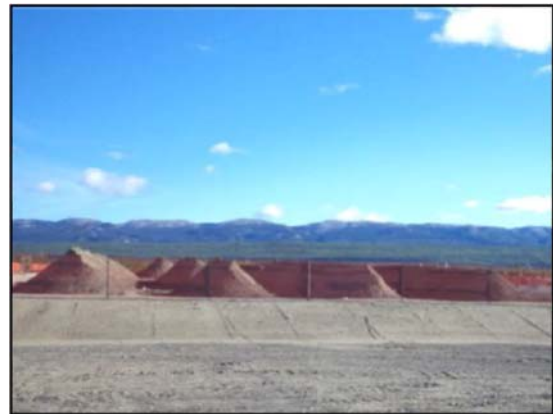
Generally, progressive reclamation activities for the Operations have focused on:

1. Site assessments to identify and define impacted source areas;
2. Monitoring activities (particularly for ground and surface waters);
3. Soil remediation (i.e., excavation & treatment on-site, in-situ vapour extraction, ex-situ bioremediation, or interim containment and capping in place);
4. Groundwater remediation in high priority areas;
5. Surface restoration and revegetation in select areas; and
6. Completion of downhole abandonment activities for decommissioned production wells and groundwater wells no longer needed.

Current Facilities for Progressive Reclamation

Imperial maintains, or is in the process of developing, treatment facilities that are used to manage the impacted soils generated by progressive reclamation efforts. These include:

- A biological treatment facility (“biocell”) located in the Mainland area north of the former Battery 3 site. Soils are directed to the biocells from various locations across the Proven Area, after they have been characterized and deemed suitable for bioremediation; and
- A soil washing facility that is currently being constructed in the area south of the biocells, immediately northeast of the former Battery 3. The facility is designed to treat salt impacted soils resulting from progressive reclamation efforts on the Operations.



Biocell in Operation

One key focus of Imperial’s progressive reclamation efforts in the period before closure will be to use these existing treatment facilities to better understand how much of the soil inventory can practically be treated and reused after the facility shuts down. Efforts will be made to quantify treatable soil volumes and to understand the required features and operating characteristics of treatment facilities required after closure to support the final C&R Plan.

Pre-Closure LTMF Development

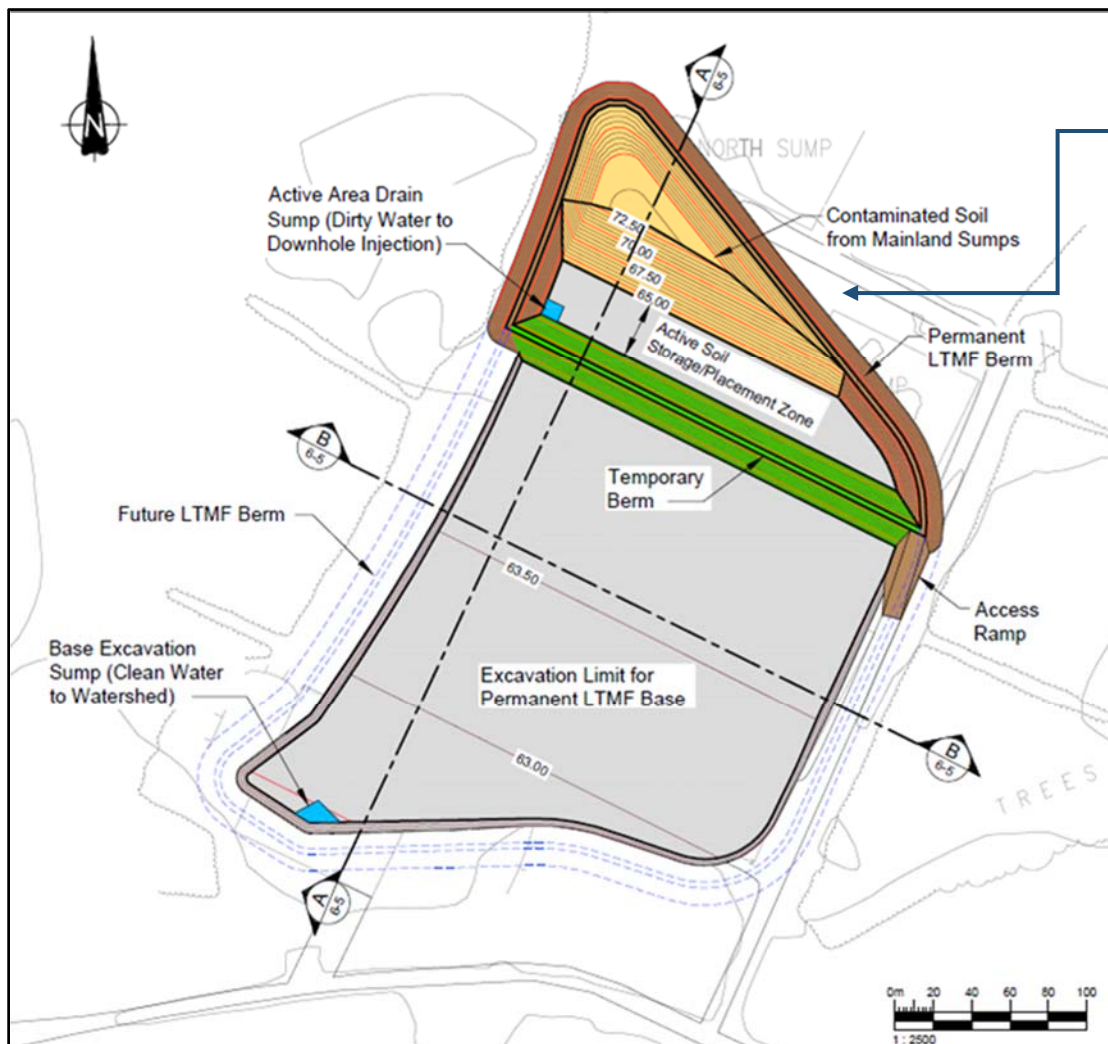
Imperial anticipates that some LTMF capacity will be required to support remediation and reclamation activities prior to closure.

The pre-closure LTMF will be developed as the initial stage of the permanent LTMF described in Section 5 (*Mainland Component*). The specific features, shape and size of this LTMF will be determined during closure planning.

The pre-closure LTMF will be developed within the footprint of the permanent LTMF. The first stage will be sized for all of the contaminated soils in the Mainland sumps area.

The pre-closure LTMF will start with a smaller portion of the full permanent LTMF base footprint and will grow within the permanent footprint as needed to accommodate contaminated material volumes generated prior to Operations closure.

The following figure shows the potential pre-closure LTMF configuration:



Pre-closure LTMF Footprint

Pre-Closure LTMF Features

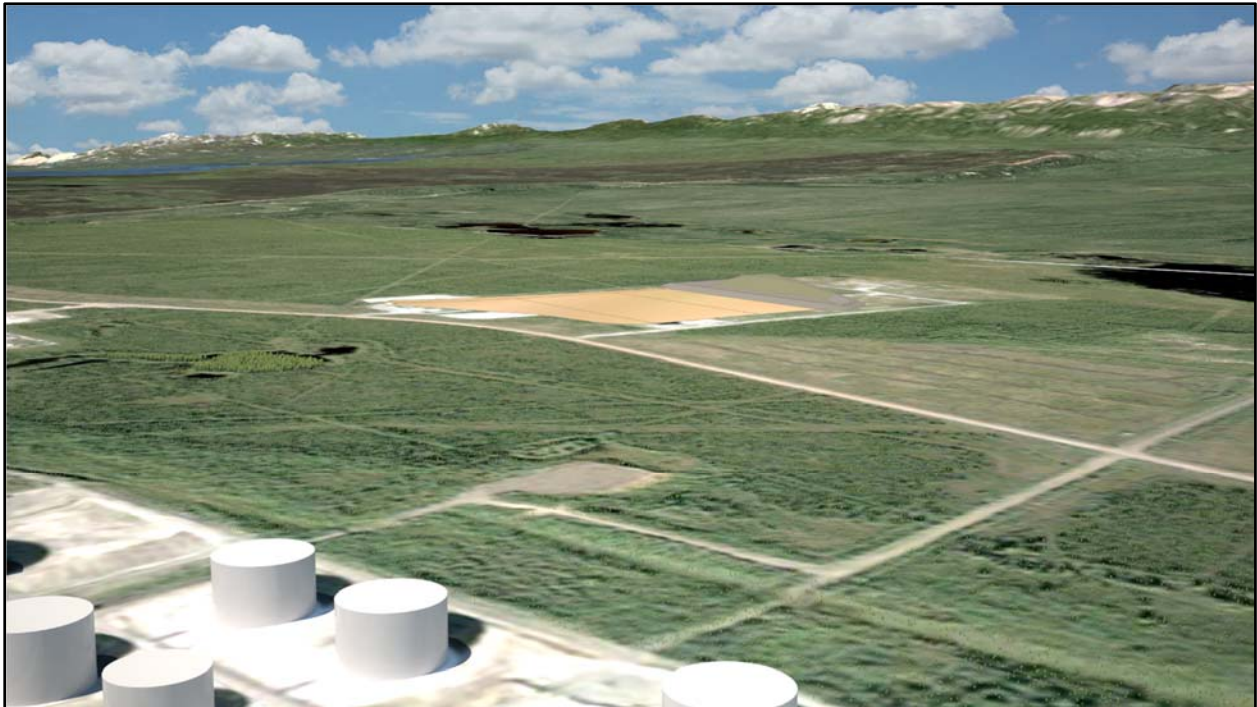
At the start, the pre-closure facility will take up a minor piece of the full LTMF footprint. It will be built up to the full permanent height, then the footprint will be expanded. This will minimize the operating LTMF footprint at any given time, reducing water management requirements. The pre-closure LTMF will have an interim cover structure.

Removing all of the existing sump materials as part of the first stage of LTMF development will create a low spot between the pre-closure LTMF footprint and the edge of the permanent LTMF

which will capture clean rain/snow. Drainage from active areas of the pre-closure LTMF will be contained and kept out of this depression and directed to existing wastewater management systems as part of regular operations prior to closure.

An artistic rendering of the pre-closure LTMF is provided below

For more information, see Section 6.0 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.



Pre-Closure LTMF aerial view: Approaching the proposed LTMF from the southeast with a view of the Imperial Oil tank farm on the lower left. The proposed LTMF is visible on the north side of Canol Drive in the centre of this image. Seepage Lake is visible north and east of the LTMF.

1.14 CLOSURE SEQUENCE & SCHEDULE

Completing all of the activities that have been outlined in this plan will involve two distinct time periods - before and after the Norman Wells Operation shuts down.

Final planning of the work will be undertaken during the three years prior to shut down. Over this period, the field investigations needed to support detailed plans and designs will be completed, and the associated detailed engineering and work packages will be developed. This work will essentially involve taking the general plans outlined in the version of this C&R Plan available at shut down, and refining and detailing them to the degree needed to complete the work.

The actual remediation and reclamation work called for in the C&R Plan will be completed over an approximately ten year period after the facility ceases operations. This time will be needed because the capacity of the specialized equipment to abandon the wells will be limited by the physical challenges associated with the Operations' configuration and size. In addition, it will not be efficient or effective to complete the excavation of contaminated soils until this well infrastructure has been dealt with, and this will extend the timelines required for final site reclamation.

The current estimates of timelines for all of the activities proposed for C&R planning and execution will be reviewed with each update of this interim plan. The resulting schedule updates will reflect the influence of any new developments in well abandonment processes and technology, and in the predictions of contracting resources likely to be available at facility shut down.

For more information, see Section 8.0 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

1.15 POST CLOSURE ASSESSMENT

There will be a variety of initiatives and activities undertaken before, during and after execution of a final C&R Plan focused on confirming that the objectives set for the Plan have been met.

Pre-execution Review of Final C&R Plan

This review refers to the technical and stakeholder reviews of the Final C&R Plan applicable at the time of facility closure and immediately prior to C&R Plan execution.

Testing & Monitoring During C&R Plan Execution

Various testing and monitoring activities will be undertaken during C&R Plan execution to evaluate criteria which directly relate to the scope, duration and scale of C&R activities (e.g., confirmatory sampling in excavations).

Ongoing Post Closure Monitoring

These are the testing and monitoring activities that will continue, at least in some form, indefinitely following completion of the C&R Plan.

One Time Post Closure Assessment

This program will be a dedicated, point in time assessment undertaken at the conclusion of C&R Plan execution to evaluate conditions relating to the remediated and reclaimed landscape that are not subject to change or variation post closure.

For more information, see Section 9.0 of the *Interim Norman Wells Operations Closure and Reclamation Plan*.

1.16 NEXT STEPS

Ongoing Community Engagement

Imperial will continue to proactively engage with local stakeholders and regulatory agencies as this interim plan is refined.

As discussed in Section 1, the Interim C&R Plan includes some facilities and processes that will be in place over a long period of time. These facilities and processes will require people and equipment to manage and monitor their operation; and there is also work involved in putting them in place.

There is a variety of possible commercial arrangements that could be developed using local or regional businesses and skills to address these, and potentially other, C&R requirements. Imperial anticipates that the scope of these potential opportunities will be an important part of the discussions and engagements that will occur as the C&R Plan evolves in the years leading up to facility closure.

Interim C&R Plan Review and Update

This is the first of an expected series of interim C&R Plans for the Operations. These will be reviewed and updated in the operational period prior to closure at a frequency and through a process determined in conjunction with the SLWB.

1.17 FOR MORE INFORMATION

A complete copy of the Norman Wells Operations Closure and Reclamation Plan can be found on the Sahtu Land and Water Board Public Registry Website (www.slwb.com).

The registry also includes other publicly available information related to the closure and reclamation planning process, as well as documentation associated with the Imperial Water Licence (S03L1-001) for the Norman Wells Operations.

Additional information on the Imperial Norman Wells Operations can be found at: www.imperialoil.ca.