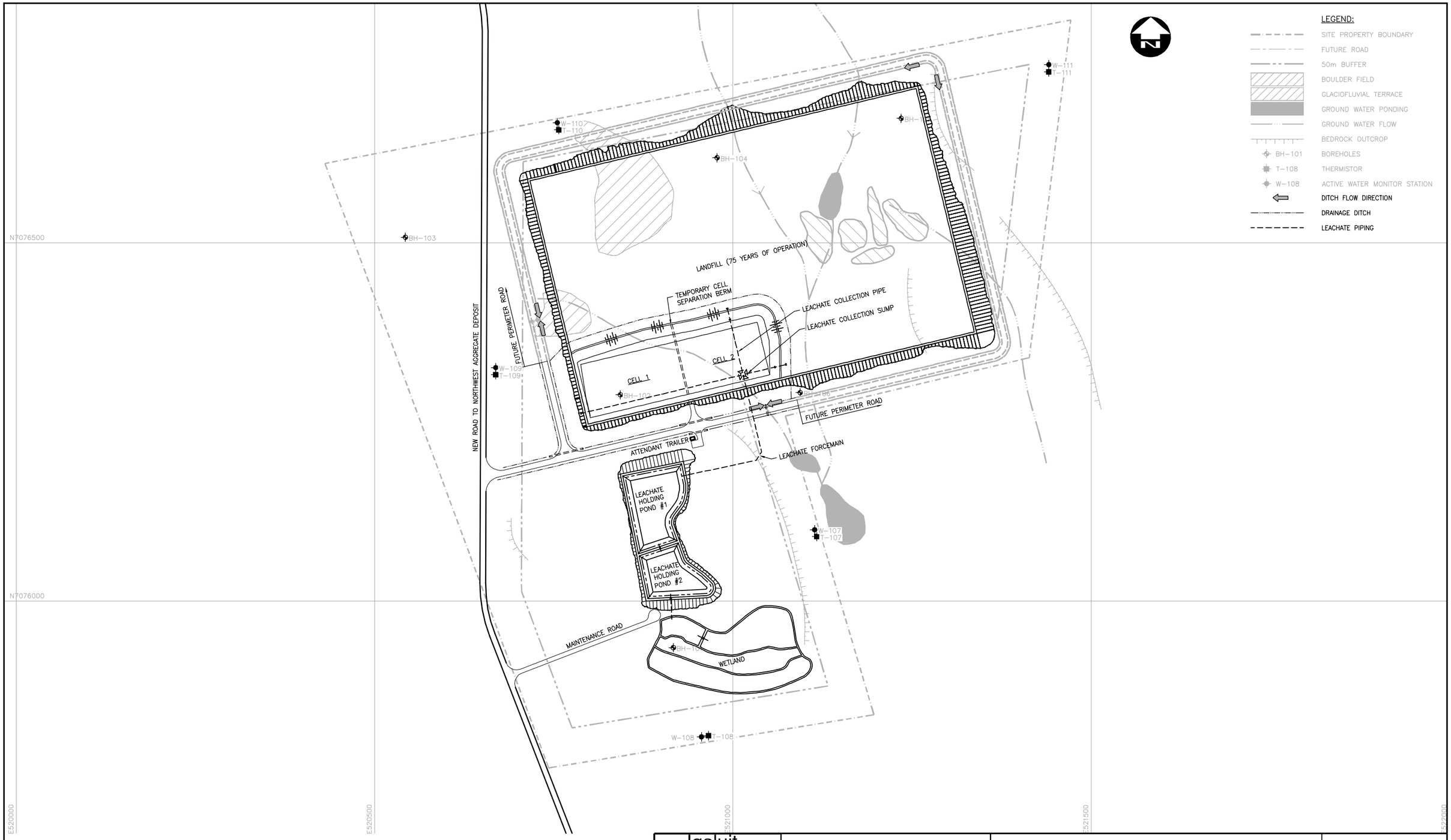

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Iqaluit

DILLON CONSULTING

DATE JUNE 2019

PROJECT
IQALUIT LANDFILL AND WASTE TRANSFER STATION

PROJECT NO.
19-9543

TITLE
LANDFILL LAYOUT PLAN

FIGURE NO.
1-3

1.2 Content

The Operations and Maintenance Manual addresses the following topics:

- Days and hours of operation
- Security and access control
- Staff and equipment
- Waste quantities and types
- Waste control
- Daily bale/waste placement
- Adverse weather conditions
- Initial life construction
- Nuisance control protocols, including litter, dust, noise, odour, birds, vector, vermin and wildlife
- Complaint response protocol
- Traffic control
- Fire prevention and response
- Surface water management
- Leachate management
- Landfill gas (LFG) management
- Inspection and maintenance program
- Record keeping
- Reporting
- Operations monitoring program
- Sample site logs and forms

The development of the site will be consistent with applicable regulations and policies for environmental protection. The facility has been designed with a composite liner system, leachate management system, surface drainage control and an environmental monitoring network.

It is noted that equipment-specific manufacturer's documentation, providing details on specific operational and maintenance requirements, is to be referred to along with the attached Operations and Maintenance Manual.

2.0 Facility Operations

2.1 Access Control

2.1.1 Hours of Operation

The City of Iqaluit Landfill and WTS is open Monday through Saturday, excluding holidays. The site is open to receive waste from 8:00 am to 4:00 pm Monday through Friday, and 8:00 am to 12:00 pm Saturday. Only the WTS will be accessible by the general public.

The site will be closed on the following holidays:

- New Year's Day
- Good Friday
- Easter Monday
- Victoria Day
- Canada Day
- Nunavut Day
- Civic Day (first Monday in August)
- Labour Day
- Thanksgiving
- Remembrance Day
- Christmas Day
- Boxing Day

Site equipment may operate beyond posted hours. The additional time may be necessary for processing of materials at the WTS preparation of the working area receiving waste and for other work defined by management personnel.

The operating hours are clearly posted on the entrance signs for both the Landfill and WTS, which also identifies the site name and the site telephone number.

2.1.2 Site Security

Due to the nature of the work undertaken at the Landfill and WTS, site security and safety is an important feature of the overall operation. Lockable gates are situated at various locations throughout both properties.

Keys/electronic access cards will be provided to persons employed by the City and directly involved with the operation of the WTS and/or Landfill, at the discretion of the Director of Engineering and Public Works or Manager of Solid Waste (Manager). A record shall be kept at the Scale House relating to who has keys, including contact name and phone number. A general visitor log (**Appendix A**) shall also be maintained at the Scale House.

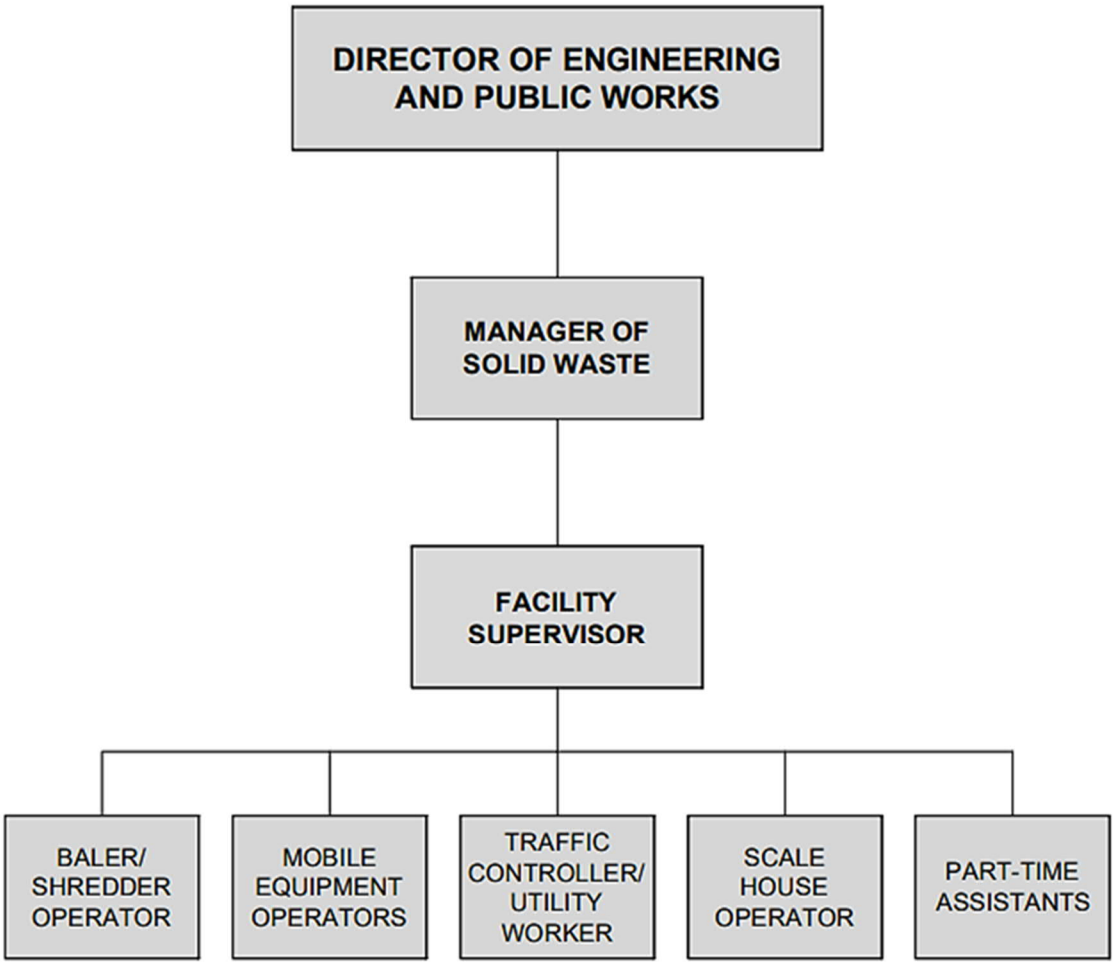
When either site is unattended, the gates will be closed and locked.

3.0 Personnel

3.1 Staffing

The Landfill and WTS will require full and part-time staff. In general, the facility requires a Manager, Facility Supervisor, Baler Operator, Mobile Equipment Operators, Scale House Operator, Traffic Controller/Utility Worker and Part-Time Assistants. An organization chart defining staffing and reporting responsibilities at the Landfill and WTS is presented in **Figure 3-1**. All employees will be properly trained in accordance with the tasks that they will be expected to complete.

Figure 3-1: Facility Organization Chart



A general outline of the minimum duties and responsibilities of each position follow. It is not intended to be comprehensive or to limit the employee's opportunity to expand their capabilities beyond this scope. It is also not intended to limit the employer's right to assign other duties.

3.1.1 Director of Engineering and Public Works

The Director of Engineering and Public Works assists the City's Chief Administrative Officer (CAO) and the Manager of Solid Waste in planning and coordinating operation at the Landfill and WTS, as they relate to:

- Developing operational budgets.
- Preparation of annual reports.
- Technical operation.
- Environmental monitoring.

3.1.2 Manager of Solid Waste

The Manager of Solid Waste is responsible to the Director of Engineering and Public Works for the operation of the facility. The Manager oversees and coordinates day-to-day operations at the site.

Reporting Relationships

Reports to: Director of Engineering and Public Works
Supervises: Landfill and WTS Personnel

Maintains Liaison with: CAO
Municipal Engineer
Citizen's Monitoring Committee (as applicable)
Purchasing Manager
Accounting Personnel
Payroll Clerk
Suppliers
Contractors

Duties and Responsibilities

The Manager shall:

1. Perform operations at the facility in accordance with the Operations and Maintenance Manual (latest approved version), applicable Engineering Drawings and the Water License issued by Nunavut Water Board (NWB), and in consultation with the CAO.
2. Ensure that only acceptable wastes, as indicated on the approved list for disposal, are permitted at the site, in consultation with the CAO and regulatory agencies.
3. Prepare regularly scheduled reports on progress and planning at the facility.
4. With the assistance of the CAO, prepare facility operating budgets and undertake staffing selections.
5. Communicate (as required) with NWB, including the forwarding of monitoring results.
6. Deal directly with the public, responding to disposal requests.
7. Coordinate site visits/tours.
8. Provide overall direction for daily site activities, including equipment and staff utilization.
9. Maintain the environmental monitoring program.
10. Coordinate the environmental sampling programs.
11. Ensure that site staff receive the required training.
12. Make recommendations to the CAO for major and minor repair work required for site equipment, as well as replacement of same.
13. Ensure that the site is maintained and operated in a clean and safe manner at all times, including regular collection of litter.

14. Ensure that solid waste bales and C&D debris materials are placed at the Landfill in accordance with the Operations and Maintenance Manual (latest approved version), and in consultation with the Municipal Engineer.
15. Coordinate the preparation of balefill areas for operation, including stockpiling cover material, and identifying the requirement for composite liner installation and the establishment of surface water control measures.
16. Ensure that there is no open burning of solid waste at the facility.
17. Perform other related duties, as may be assigned periodically by the CAO.

3.1.3 Facility Supervisor

Under the direction of the Manager, the Facility Supervisor is responsible for equipment and general site maintenance requirements at the facility.

Reporting Relationships

The Facility Supervisor reports directly to the Manager.

Duties and Responsibilities

The Facility Supervisor shall:

1. Perform operations at the facility in accordance with the Operations and Maintenance Manual (latest approved version), applicable Engineering Drawings and the Water License issued by NWB, and in consultation with the Manager.
2. Ensure that only acceptable wastes as indicated on the approved list for disposal are permitted at the site, in consultation with the Manager and regulatory agencies.
3. Be responsible for the maintenance of the facility machinery, including mobile equipment, the solid waste baler unit, material shredder/pelletizer, vehicle logger and related systems.
4. Make recommendations to the Manager for major and minor repair work required for facility equipment, as well as replacement of the same.
5. Ensure that the facility is maintained and operated in a clean and safe manner at all times, including regular collection of litter.
6. In coordination with the Manager, ensure that solid waste bales and C&D debris materials are placed at the Landfill, in accordance with the Operations and Maintenance Manual (latest approved version).
7. Be responsible for snow removal on the access roads within the site and other areas, as necessary.
8. Maintain the access roads to ensure there is reasonable access within the site and to the active Landfill at all times.
9. Be responsible for operating and maintaining the leachate handling equipment, and surface water control structures and facilities at the Landfill and WTS.
10. Undertake site security checks and report any problems to the Manager.

11. Inspect the public roads/areas surround the WTS, the Landfill access road, and the Landfill to recover any accumulation of garbage or other debris.
12. Recommend to the Manager the need for bird control, rodent, animal and odour control.
13. Ensure that there is no open burning of solid waste at the site.
14. Maintain records of site equipment usage and maintenance.
15. In coordination with the Manager, maintain the integrity of completed landfill cells and borrow areas.
16. Perform such other related duties, as may be assigned from time to time by the Manager.

3.1.4 Baler/Shredder Operator

Under the direction of the Facility Supervisor, the Baler/Shredder Operator is responsible for operating and maintaining the solid waste baler unit, material shredder/pelletizer, vehicle logger and related systems.

Reporting Relationships

The Baler/Shredder Operator reports directly to the Facility Supervisor.

Duties and Responsibilities

The Baler/Shredder Operator shall:

1. Perform operations at the facility in accordance with the Operations and Maintenance Manual (latest approved version), applicable Engineering Drawings and the Water License issued by NWB, and in consultation with the Facility Supervisor.
2. Ensure that only acceptable wastes as indicated on the approved list for disposal are permitted at the site, in consultation with the Facility Supervisor.
3. Make recommendations to the Facility Supervisor for major and minor repair work required for the solid waste baler, material shredder/pelletizer, vehicle logger, and related systems.
4. Maintain an operational record for the solid waste baler, material shredder/pelletizer, vehicle logger and related systems.
5. Ensure that the tipping floor and baling floor is maintained, and operated in a clean and safe manner at all times.
6. Periodically operate mobile equipment associated with site operations.
7. Perform such other related duties, as may be assigned from time to time by the Facility Supervisor and/or the Manager.

3.1.5 Mobile Equipment Operators

Under the direction of the Facility Supervisor, the Mobile Equipment Operators are responsible for operating and maintaining mobile equipment utilized for waste handling and disposal operations. At least two Mobile Equipment Operators will be on-site every day the facility is open to the public.

Reporting Relationships

Mobile Equipment Operators report directly to the Facility Supervisor.

Duties and Responsibilities

The Mobile Equipment Operators shall:

1. Perform operations at the facility in accordance with the Operations and Maintenance Manual (latest approved version), applicable Engineering Drawings and the Water License issued by NWB, and in consultation with the Facility Supervisor.
2. Ensure that only acceptable wastes as indicated on the approved list for disposal are permitted at the site, in consultation with the Facility Supervisor.
3. Be responsible for the operation and routine maintenance of the site machinery.
4. Make recommendations to the Facility Supervisor for major and minor repair work required for site equipment.
5. Ensure that the site is maintained, and operated in a clean and safe manner at all times.
6. Ensure that solid waste bales and C&D debris materials are placed at the Landfill, in accordance with the instructions of the Facility Supervisor.
7. Carry out activities for the maintenance and repair of access roads, snow removal, preparation of balefill areas, excavation and stockpiling of cover material, and the installation and/or repair of leachate collection and surface water control structures, as directed by the Facility Supervisor.
8. Advise the Facility Supervisor of the need for pest control.
9. Remove freon from refrigerators (and similar equipment) and specified liquids from vehicles, in accordance with applicable regulations.
10. Operate the HHW drop off facility.
11. Ensure that there is no open burning of solid waste at the site.
12. Perform such other related duties, as may be assigned from time to time by the Facility Supervisor and/or the Manager.

3.1.6 Traffic Controller/Utility Worker

Under the direction of the Facility Supervisor, the Traffic Controller/Utility Worker is responsible for directing the movement of vehicles delivering waste materials to the tipping floor within the WTS.

Reporting Relationships

The Traffic Controller/Utility Worker reports directly to the Facility Supervisor.

Duties and Responsibilities

The Traffic Controller/Utility Worker shall:

1. Direct incoming vehicles to the location on the tipping floor where solid waste is to be deposited.

2. Ensure that adequate signage and traffic control devices are in place in coordination with the Manager.
3. Direct the movements of waste delivery vehicles and their personnel within the transfer station compound in order to prevent conflicts with facility equipment operations.
4. Ensure that only acceptable wastes as indicated on the approved list for disposal are permitted at the site, in consultation with the Manager.
5. Segregate banned and salvageable materials noted on the tipping floor to designated storage areas.
6. Periodically operate mobile equipment associated with site operations.
7. Ensure that the area around the building and the tipping floor are operated in a clean and safe manner at all times, including regular collection of litter.
8. Perform such other related duties, as may be assigned from time to time by the Facility Supervisor and/or the Manager.

3.1.7 Scale House Operator

Under the direction of the Facility Supervisor, the Scale House Operator performs all duties related to the operation of the facility's scale component.

Reporting Relationships

The Scale House Operator reports directly to the Facility Supervisor or a designated member of staff.

Duties and Responsibilities

The Scale House Operator shall:

1. Identify and register vehicles within the computerized site data base.
2. Manage the customer billing system.
3. Collect tipping fees from customers on-site.
4. Inspect incoming waste in accordance with the Operations and Maintenance Manual (latest approved version).
5. Answer incoming telephone calls and requests for information, directing such requests as required.
6. Monitor use of the public drop off door at the WTS.
7. Clean and maintain the scale.
8. Perform such other related duties as may be assigned from time to time by the Facility Supervisor and/or the Manager.

3.1.8 Part-Time Assistants

Under the direction of the Facility Supervisor, the Part-Time Assistants are responsible for tasks assigned to them by a designated member of staff. These positions would typically serve to address periodic site maintenance requirements.

Reporting Relationships

The Part-Time Assistant reports directly to the Facility Supervisor or a designated member of staff.

Duties and Responsibilities

The Part-Time Assistant shall:

1. Perform duties as assigned by the Manager, Balefill Supervisor or a designated member of staff.

3.2 Training

Every Landfill and WTS employee will be trained to perform his or her job in a safe and environmentally responsible manner, in accordance with applicable regulations and City policy. Employees will be kept current with changes in regulations and technology through ongoing, comprehensive training courses, in such areas as regulations and the technical aspects of landfill operation. Specific training topics may include surface water control, leachate and LFG management, spill prevention, special wastes control, environmental monitoring and safety. A municipal employee's health and safety committee serves as a forum to identify potential concerns and define appropriate actions.

Continuing on-the-job training will be provided for all employees. The training will emphasize the safe and environmentally sound operation of the Landfill. A review of this Operations and Maintenance Manual will be a prerequisite for any employee before being declared eligible for work at the Landfill and WTS. All employees will be given safety training covering all equipment and systems, with which they will be expected to operate on a daily basis. The dangers associated with the use of protective equipment, methane (CH_4)gas and leachate handling, and the handling and precautions associated with special wastes, will also be included in the safety training. Documentation of the employee's participation in the safety and environmental training will be maintained in the employee's personnel file.

A training program for more specific tasks, such as those of the baler, shredder and mobile equipment operators, will be documented with written records of meetings and types of instruction. This instruction will include identification of special wastes and unacceptable wastes; emergency procedures in case of fire, spill or injury; confined space entry; respirator use and fit testing; and other issues that will periodically arise. All individuals must be trained in confined space entry and practice proper safety procedures, in accordance with applicable legislation and the requirements of the Nunavut Labour Standards Office. Documentation will also be kept on file at the Manager's office and reviewed annually for any necessary updates.

A general outline of some of the training that employees will require is found in **Table 3-1**. It is not intended to be a comprehensive list or to limit additional staff training, should legislation change, or limit the employer's or employee's right to require additional training.

Table 3-1: Staff Training Recommendations

Program	Position					
	Manager of Solid Waste	Facility Supervisor	Mobile Equipment Operators	Traffic Control/Utility Worker	Scale House Operator	Part-Time Assistants
WHMIS	✓	✓	✓	✓	✓	✓
Emergency First Aid	✓	✓	✓	✓	✓	✓
Confined Space Entry	✓	✓				

4.0 Site Structures

Primary structures associated with operations at the Landfill and WTS are illustrated on **Figures 1-2** and **1-3**. Infrastructure descriptions are subdivided as follows: 1) structures at/in proximity to the WTS are discussed in **Section 4.1**; and 2) structures associated with the Landfill are described in **Section 4.2**.

4.1 Waste Transfer Station

4.1.1 Facility Roads

The road network serving the WTS includes: 1) Kakivak Court, acting as the main access route and connecting the site to Federal Road; 2) parking and maneuvering areas around the perimeter of the WTS; and 3) a dedicated access to from the WTS compound to Qaqqamiut Road (as associated with the transport of baled waste to the Landfill). The perimeter of the WTS property is fenced with lockable access gates, situated at the Kakivak Court and Qaqqamiut Road entrances.

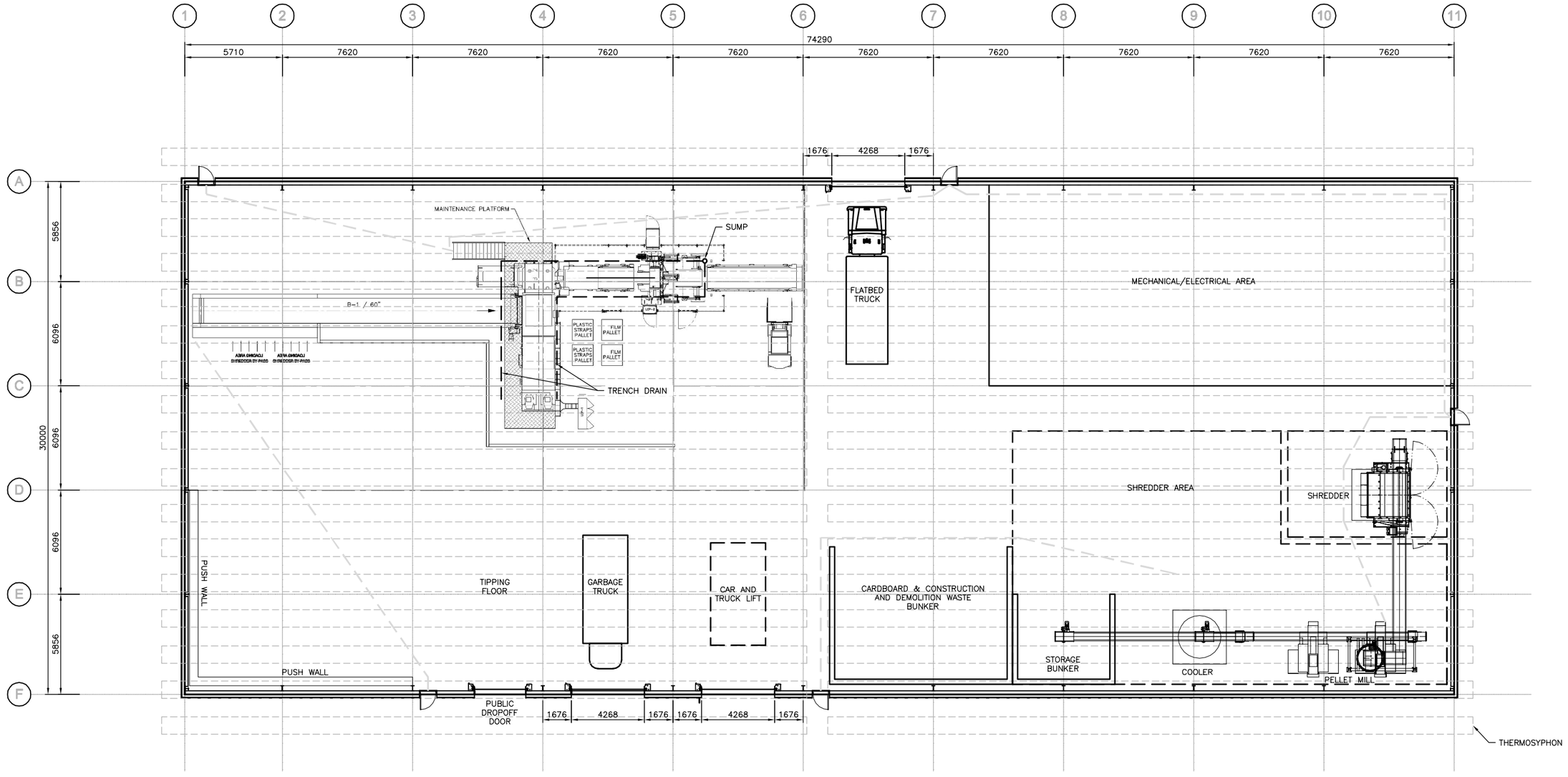
The facility roads/yard areas are private and their maintenance will be the responsibility of the City. Maintenance of the facility roads includes, but is not limited to, dust and mud tracking control, and snow removal/ice control.

4.1.2 Scale and Scale House

The Scale and Scale House are located southeast of the WTS Building. As described in **Section 8.2.1**, all vehicles entering the site are required to report to the Scale House. The Scale House, a premanufactured wood frame structure with electric heating, includes an elevated load inspection video camera and PC-based scale control/invoicing equipment. The Scale House entrance and exit ramps will have an asphalt surface.

4.1.3 WTS Building

The WTS Building is a pre-engineered steel, slab on grade structure with a total floor area of approximately 2200 m^2. With reference to **Figure 4-1**, the interior of the building is divided into five primary areas: 1) the **tipping floor** is used to allow haulage vehicles to discharge their loads within an enclosed area – it also includes a wall opening to allow for public drop off of refuse materials; 2) the **baling/bale loading area** is where the waste is compressed into wire-tied bales and transferred to the flatbed transport truck; 3) select materials are processed and stored in the **shredder/pelletizer area**; 4) end of life vehicles are prepared for compaction at the **car and truck lift area**; and 5) a variety of control systems and equipment, including a biomass boiler, are located in the **mechanical/electrical area**.



FLOOR PLAN
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Iqaluit	DILLON CONSULTING	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
	DATE: JUNE 2019	TITLE: WTS INTERIOR LAYOUT	FIGURE NO.: 4-1

Due to the nature of operations, the concrete walls extend upward from the slab in the tipping floor portion (southwest corner) of the building. The tipping floor's concrete walls are 2.4 m high, permitting storage of solid waste against the inside of the building and allowing for a smooth durable surface to work against. The concrete walls around the remainder of the interior perimeter are 1.2 m in height to provide impact protection to the building structure from mobile equipment.

Due to issues associated with clogging and an objective to minimize the number of slab penetrations, there are no floor drains within the interior of the WTS; interior slab slopes are typically towards exterior overhead doors. Liquid on the floor (primarily from incoming waste and hauling vehicles) is continuously monitored by facility staff, using the absorbent capacity of the waste, as required. Cleaning of the floor via sweepers and other means is conducted, as required.

A primary source of liquid generation at the WTS, the waste baler (resulting from the compaction of the waste mass), includes a perimeter shallow trench in the slab around the unit. Liquid from the baler collects in the trench and is pumped to an adjacent tank for subsequent collection and transfer to the City's wastewater treatment plant (WWTP).

Mechanical and electrical features of the WTS building include the following:

- Interior heating requirements (using a hydronic system) are met using a biomass boiler that uses wood and cardboard pellets as a fuel. Back up requirements for the Site Office and select area interior areas of the WTS provided by a No.2 fuel fired hydronic heating unit. A 4880 L double wall aboveground tank situated outside the building provides fuel for the back up unit.
- Exhaust fans serving the interior of the WTS to provide general ventilation and achieve interior air quality requirements.
- Select use of radiant heaters in defined locations to address equipment requirements and to prevent the freezing of waste.
- Provision of interior fire protection, using a dry chemical system.
- Water requirements for interior building maintenance and equipment requirements addressed with an on-site storage tank. Staff washroom and shower facilities are located at the Site Office.

4.1.4 Site Office

A wood framed, premanufactured building, situated adjacent to the Scale House, serves as the Site Office. The building incorporates staff facilities, including the Facility Supervisor's office, a lunch room, a locker room and washroom/shower facilities. The building will be heated using the WTS's biomass boiler, and will be serviced with a water and wastewater tank.

4.1.5 Household Hazardous Wastes Depot and Storage

Steel intermodal containers, modified to address storage requirements for HHW materials, are situated in the southwestern area of the WTS yard. One 12 m (40 ft) container serves as a public drop off location, where a trained staff member records incoming quantities and directs the materials to an

appropriate initial storage location. As required, materials from the Drop Off Container are directed to one of three 12 m storage containers. Arrangements are made by the City for subsequent shipping to approved management facilities in the south, as quantities warrant.

4.1.6 Exterior Material Process and Storage Areas

The exterior yard area (gravel surface) includes equipment and locations for the processing and temporary segregated storage of select materials, including:

- Vehicle Baler/Logger unit (trailer-based).
- End of life vehicles awaiting decommissioning/crushing, crushed vehicles and salvageable metals.
- End of life vehicle and equipment tires.
- Baled waste (to address short-term instances when direct transport to the Landfill is not possible).
- A dedicated area for the potential future installation/operation of an in-vessel organics composting unit (including a curing area allowance).
- A dedicated area for the potential future development of a greenhouse.
- Snow storage areas to support yard clearing efforts.

4.2 Landfill

4.2.1 Landfill Access Road

A two lane, gravel surfaced road connecting the existing Qaqqamiut Road to the Landfill site is being established by the City, as a component of the Landfill and WTS project. The road will also provide access to the Northwest Aggregate Deposit, situated to the west of the landfill property.

With reference to **Figure 1-3**, two roads will extend off of the Northwest Aggregate Deposit road to access features of the Landfill;

- Main Landfill access and perimeter road.
- Leachate management system access road.

Lockable security gates are situated at the entrance of each access road, complete with identification signage. As new landfill cells are established, the perimeter road will be extended, as necessary. All site roads are two lane and gravel surfaced.

4.2.2 Landfill

A 22 ha area on a property approximately 5.5 km north of the WTS has been designated to serve as the disposal location for the City's baled municipal solid waste (MSW), select processed materials (e.g., tires, bulky items) and non-divertible C&D waste materials for 75 years. A primary design feature of the Landfill is the use of a membrane liner system with a dedicated leachate collection layer within the defined landfill footprint. The liner is scheduled to be installed in 15 (number to be refined during the

operational life of the facility) sequential sections or "cells" throughout the operational life of the site. As part of the initial construction effort for the Landfill (scheduled for the 2020 and 2021 construction seasons), the first two landfill cells, with a total area of approximately 2 ha, are to be installed. They have been designed to address the City's disposal requirements for the first 10 years of operation.

Detailed discussion on the Landfill liner system is provided in **Section 7.0**. A description of waste placement procedures at the Landfill is presented within **Section 8.3**.

4.2.3 Cover Borrow Area

Cover material required to support Landfill operations, including bale/waste covering and final grading, is scheduled to be acquired from the Northwest Aggregate Deposit.

4.2.4 Attendant Trailer

A premanufactured, wood frame trailer will serve as a shelter for site personnel, while they are at the Landfill. The trailer will include a wood stove and a composting toilet. No equipment will be stored within the trailer due to the remoteness of the location, and the potential for theft and/or vandalism.

4.2.5 Leachate Management System

The Landfill's leachate management system includes a leachate collection layer/piping within the cell liner, a collection sump with pump station manhole, a forcemain, two holding ponds and a wetland treatment area. Details on the leachate management system are presented in **Section 12**.

4.2.6 Monitoring Network

The Landfill includes defined monitoring locations for surface water and active layer water. With regards to potential impacts of landfill infrastructure to permafrost, a thermistor array is situated in the base of the liner systems for both the landfill and the two leachate lagoons.

<Monitoring program to be developed during Phase II – Preliminary Design.>

5.0 Mobile Equipment

Mobile equipment selection has been based on the evaluation of the operational functions to be performed, including activities within the WTS, within the WTS yard and at the Landfill. Beyond waste handling related activities, other mobile equipment use requirements include access road maintenance, snow removal and dust control. Equipment used as part of site operations is owned by the City. The listing of recommended site equipment is as follows:

1. Wheel Loader
    - 150 - 160 HP, diesel.
    - Provided with quick-detach forks, grapple bucket, plow blade, general-purpose bucket and landfill package.
    - For waste handling in the WTS yard, bale/waste placement at the Landfill, snow removal and road/yard maintenance.
2. Compact Wheel Loader
    - 110 – 120 HP, diesel.
    - Provided with quick-detach forks, grapple bucket, waste handling bucket (complete with rubber leading edge), plow blade, solid tires, transfer station package.
    - Waste/bale handling within the WTS, snow removal and yard maintenance.
3. Forklift
    - Electric.
    - 2500 kg lifting capacity.
    - Bale handling within the WTS including loading of the Bale Truck.
4. Bale Truck
    - 350 HP, diesel.
    - Tandem straight truck, flatbed.
5. Vehicle Baler/Logger
    - 175 – 215 HP, diesel.
    - Trailer-based unit.
    - Provided with hydraulic landing gears, knuckle boom material handler, bale density 400 to 1300 kg/m^3.
    - Crushing and baling end-of-life vehicles, white goods and miscellaneous metals.
6. Staff Truck
    - 4 x 4 Crew Cab, Super Heavy Duty.
    - Provided with snow plow attachment.

In addition, back up equipment will be available from local rentals and contractors, should anomalous situations dictate need for additional equipment. Routine maintenance and cleaning will be performed (as necessary) to keep equipment in good operating order.

A maintenance program exists for all on-site equipment and is to be performed in accordance with equipment manufacturer's guidelines. The City holds contracts with heavy equipment suppliers to provide all scheduled maintenance. Daily routine maintenance activities will be the responsibility of the mobile equipment operators. Routine activities will include (but not be limited to) the following:

Tires

- Check for debris imbedded in the tire, repairing or replacing, as necessary.
- Check tire wear condition.

Air Filters

- Check for dust clogging and replace, as necessary.

Radiators

- Check for dust and debris clogging and clean, as required.
- Check for punctures and repair or replace, as necessary.

Undercarriage

- Check for damage and repair, as required.

Hydraulic Lines

- Check for wear points, cracks and fitting leaks, replacing, as necessary.

6.0 Stationary Equipment

The following list identifies stationary equipment associated with waste processing activities within the WTS. Descriptions including maintenance requirements for other equipment/systems supporting WTS operation (e.g., biomass boiler/heating system, ventilation system, fire suppression system, electrical/control systems) are provided in manufacturer documents.

1. Waste Baler
    - Two ram configuration.
    - Peak throughput = 20 tonnes/hour.
    - Dual hydraulic pumps, 600 VAC 60 Hz electric TEFC motors.
    - Dedicated above floor conveyor.
    - Automatic wire tier.
    - Complete with bale wrap system.
2. Waste Shredder
    - Stationary, slow feed, shear-type unit.
    - Peak throughput > 10 tonnes/hour.
    - Twin drives, 600VAC 60 Hz electric TEFC motors.
    - Dedicated above floor conveyor.
    - Suitable for MSW including tires, wood pallets, furniture, C&D materials and old corrugated cardboard (OCC).
    - Direction of processed material to either the Pelletizer (wood and OCC) or to the Waste Baler for disposal at the Landfill.
3. Pelletizer
    - Accepts processed wood and OCC from the Waste Shredder.
    - Compresses processed material into a pelletized fuel suitable for the on-site biomass boiler.

7.0 Liner Development and Sequencing

7.1 Landfill Liner System

The four primary components of the landfill liner system, from the top down, consist of a **cushion layer**, **leachate collection layer**, a **geomembrane liner** and a **base layer**. These components are described below. Refer to **Figure 7-1** for a typical schematic of the composite liner system.

Cushion Layer
The cushion layer, 300 mm of 75 mm clear stone, provides the top working surface of the landfill cell and offers protection (e.g., vehicle/equipment movements, waste puncture hazards) to the underlying Leachate Collection Layer.

Leachate Collection Layer
The leachate collection layer consists of a granular layer (75 mm clear stone) with a total thickness of 300 mm and perforated HDPE collection piping. The perforated collection piping is placed at the bottom of the collection layer to collect and direct leachate to the collection sump.

Geomembrane Liner
A flexible geomembrane liner (80 mL textured HDPE) is situated under the leachate collection layer, as the primary barrier to leachate migration. The top and bottom of the flexible membrane liner is protected with a non-woven geotextile.

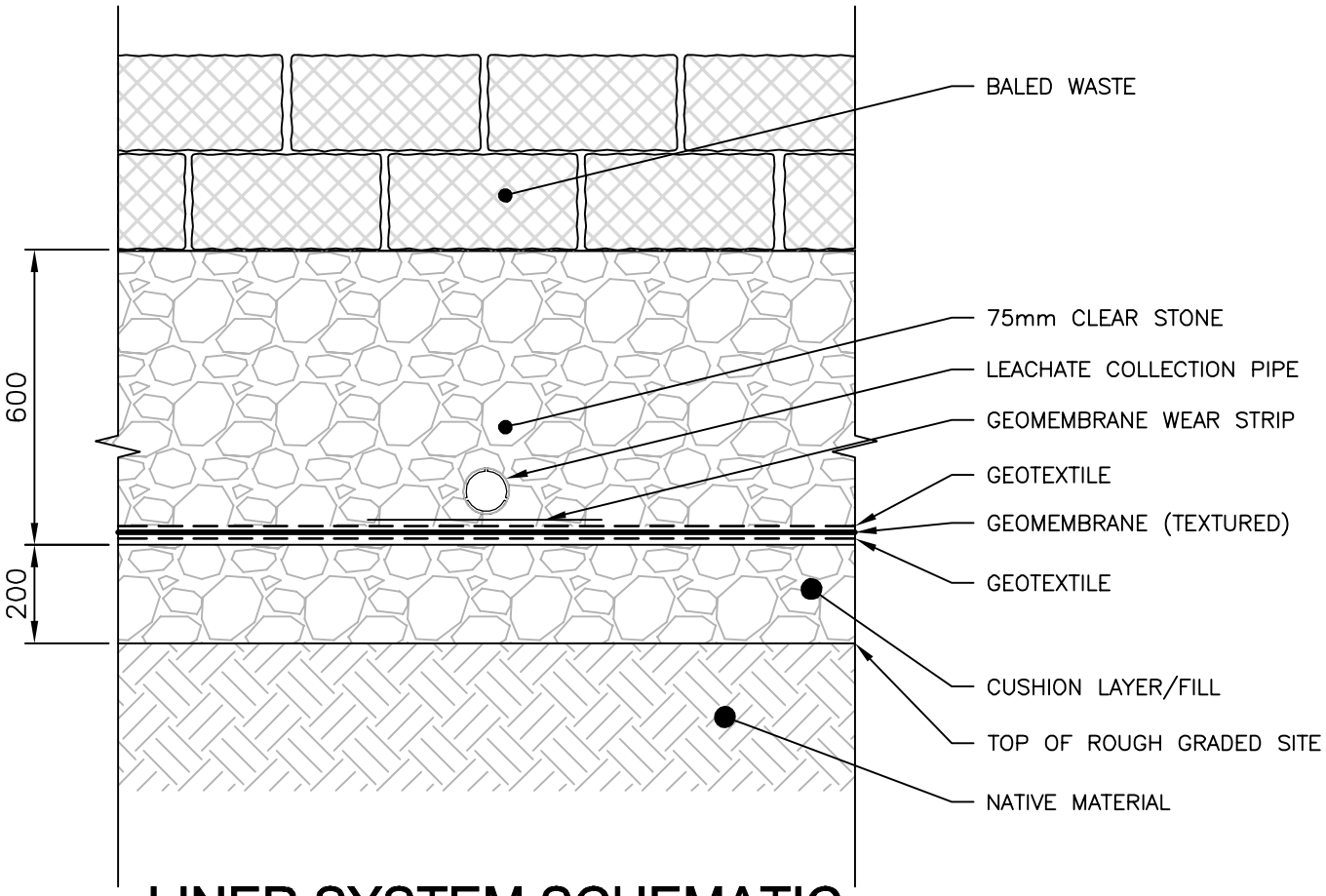
Base Layer
The entire liner system is constructed on an engineered base. The native material at the site will be graded, and a 200 mm thick granular grading pad will be placed over the native material. Additional compacted soils will be placed at the site, where required for grading. Where possible, a 1.5 m separation distance from the underside of the geomembrane and the seasonal high groundwater table.

To monitor potential impacts of the liner system to permafrost, a thermistor array is situated within the base layer.

Where required for soil separation, a geotextile will be placed below the base.

7.2 Liner Installation Sequence

The overall defined landfill footprint to accommodate 75 years of operation is approximately 22 ha in size. Within that footprint, a total of 15 disposal areas or cells (to be confirmed during the course of site development) have been identified. The first two designated cells in the overall sequence, Cells 1 and 2, are scheduled for installation during the 2020 and 2021 constructions seasons.



LINER SYSTEM SCHEMATIC

N.T.S.

DILLON CONSULTING	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
DATE: JUNE 2019	TITLE: LANDFILL LINER SCHEMATIC	FIGURE NO.: 7-1

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Timing the installation requirement for the next lined area in the sequence is critical. Installation can only be practically completed during the non-winter months and adequate time must be allotted for the development of design documents, tendering and delivery of construction materials. The calculation to determine this timing is linked to defined bale placement requirements. Specific aspects of bale placement are discussed in detail in **Section 8.3**.

Tracking of disposal area utilization is the responsibility of the Manager. The primary elements of the installation timing calculation are as follows:

1. Referring to the Engineering Drawings, determine the remaining space (volume) available for the placement of bales. This estimate must incorporate bale placement requirements including perimeter side slopes and the pre-defined lift installation sequence. For example:
    - Remaining Volume (Vr) = 6,240 m^3
2. Confirm the number of bales of waste per week currently requiring disposal. If significant changes to the current volume of incoming waste are anticipated (i.e., accepting material from a new service area), then this value should be adjusted accordingly. Based on an average bale volume of 1.5 m^3, calculate the weekly bale disposal volume requirement. For example:
    - Bale Volume Requirement (Vbr) = 120 m^3/week
3. Divide the estimate of remaining balefill volume (1) by the weekly bale disposal volume requirement (2) to determine the number of remaining weeks of disposal space. For example:
    - Vr/Vbr = 6,240 m^3 / (120 m^3/week)
    - = 52 weeks

If it is determined that inadequate space is available to serve operations until late the following summer (i.e., August), then actions will need to be initiated towards the design and installation of the next lined disposal area in the sequence. For example, if the above sample calculation was completed in January 2022, the expectation would be that available balefilling space would be exhausted 52 weeks later in January 2023. Therefore, construction of the next disposal area would be necessary during the summer of 2022.

8.0 Waste Receiving, Placement and Sequencing

8.1 Types of Waste

8.1.1 Acceptable Wastes

Any waste disposal option has limitations with respect to the waste streams which may be handled in an environmentally safe manner. Limits must be placed on the types of waste accepted at a municipal disposal site, in order to protect the environment, the employees, the users and neighbours, as well as the equipment from damage, while simultaneously providing adequate levels of service.

The Manager shall allow only those materials to be accepted (for processing and/or disposal) at the Landfill and WTS, with the exception of unique circumstances reviewed in consultation with NWB, for which the facility has been designed to accommodate, namely, MSW. With reference to the Environment and Climate Change Canada (ECCC) document Solid Waste Management for Northern and Remote Communities, Planning and Technical Guidance Document, MSW is defined to include *"reusables, recyclables, compostables, and residual waste (i.e., garbage) from homes, businesses, schools, and other institutions."* With respect to the IWMF, this definition includes end-of-life vehicles, large appliances, salvageable metals, furniture, passenger vehicle tires, and C&D materials

The following materials may be received at the site; although, none of the items listed are considered suitable for routine baling/disposal. As a result, the Manager will specify in each case an appropriate disposal method and location. The Manager reserves the right to limit the amount of these materials received at any one time, or to define the material as non-acceptable waste and to specify management requirements.

1. Contaminated soils meeting the acceptance requirements of NWB Analytical test results for all candidate materials will be evaluated by the City and NWB. No material will be accepted for disposal until this evaluation has been completed. Subsequent management requirements for accepted soils will be defined on a case-by-case basis, in consultation with NWB.
2. Non-hazardous incinerator ash, fly ash and wood ash, when properly quenched and cooled. **Large quantities of ash may require special pre-treatment before being accepted at the site and may require special disposal methods**.
3. Electrical transformer casings on the condition that all oils have been removed consistent with applicable regulations and that the units have been rendered free of potentially hazardous materials. Salvageable casings will subsequently be held at the site's dedicated metals storage area.
4. Biomedical waste originating from human and animal health care facilities, providing it has been autoclaved or incinerated, and is packaged according to the Government of Nunavut Environmental Guideline for Biomedical and Pharmaceutical Waste (dated March 2014 or as amended).

5. Carcasses of animals weighing less than 25 kg.

All wastes not specifically fitting into the above categories, and not specified as unacceptable, will be referred to the Manager and NWB for recommendations as to their acceptability and appropriate disposal methods.

8.1.2 Non-Acceptable Wastes

Wastes, which present a danger to the public, staff, infrastructure or the environment at the WTS or Landfill, which require special disposal techniques, and which may interfere with the level of service to the public or are in contravention with regulatory stipulations, are not acceptable for disposal. In some cases, wastes which are acceptable in small quantities may not be acceptable in large quantities from a single generator because they may cause the level of service to other users to deteriorate and cause handling problems at the site, and increased environmental liability. To some extent, the acceptability of large quantity wastes must be at the Manager's discretion, depending on the ability to accommodate disposal without deterioration in the level of service. In cases where unacceptable wastes are identified, site staff will attempt to identify allowable management alternatives to material haulers.

All wastes which pose potential safety or environmental problems cannot be listed in their entirety. The Manager and site personnel, in general, must be wary of accepting wastes which could cause future operational problems and must watch for the inclusion of unacceptable wastes in regular loads of refuse.

A list of materials which **MAY NOT** be accepted at the Landfill or the WTS are as follows:

1. Explosives or highly combustible materials of any nature.
2. Gas cylinders, unless the valve has been removed and the cylinder properly drained by a professional trained in handling gas cylinders.
3. Radioactive materials.
4. Chemicals and chemical wastes, including sludges from water and wastewater treatment plants and other generators.
5. Any hazardous materials, which may be classed as corrosive, reactive, toxic or flammable.
6. Carcasses of animals weighing more than 25 kg.
7. Liquid wastes, including herbicides, insecticides or other sprays, paints, oils, and solvents.
8. Septic tank waste and sewage treatment plant sludges, unless a facility is specifically designed for their disposal or they have been pre-treated in accordance with the requirements of the Nunavut Water Board and/or other relevant regulatory authority.
9. Fish processing wastes.
10. Hot ashes.
11. Any liquids, or liquid waste, of a quantity greater than 5 L in any one load.
12. Dangerous goods as defined by the *Nunavut Consolidation of Transportation of Dangerous Goods Act* (e.g., poisonous substances, infectious substances, oxidizing substances).

13. Biomedical wastes that are not treated prior to disposal according to the Government of Nunavut Environmental Guideline for Biomedical and Pharmaceutical Waste (dated March 2014 or as amended).
14. Any other materials not listed as acceptable or conditionally acceptable with the approval of the Manager.

8.2 Waste Receiving and Processing

8.2.1 Waste Inspection and Control

All waste arriving at the WTS is subject to inspection for unacceptable materials (see **Section 8.1.2**). Inspection shall be conducted at the Scale House and on the tipping floor of the WTS. It is the responsibility of employees at the Landfill and WTS to be aware of wastes which are acceptable, and those that are unacceptable or hazardous to the staff and the general public.

The first opportunity for waste inspection and control at the WTS occurs at the Scale House, where the following procedures shall be employed:

- All incoming vehicles are required to report to the Scale House. Small, private residential haulers (i.e., cars or ½ ton pickup trucks) are directed to the small vehicle drop-off area located on the south wall of the tipping floor. Larger residential-source loads (i.e., ¾ ton pickup trucks, trailers) and all commercial waste haulers are weighed, charged based on the standard per tonne tip fee, and directed to the tipping floor for disposal.
- At the Scale House, all incoming loads are recorded using a computer-based tracking and billing system. Information collected includes waste type, origin and weight. Scale information is collected for materials destined for the WTS tipping floor, WTS material segregation areas and the Landfill.
- Incoming waste is subject to visual checking at the Scale House at the direction of the Facility Supervisor. A high-mounted video camera is provided at the Scale House for spot checks.
- The Scale House Operator shall advise the Facility Supervisor of any observed unacceptable waste.

The second opportunity for waste inspection control exists on the WTS tipping floor:

- Equipment operators and other staff will remain vigilant for unacceptable or potentially hazardous wastes during unloading, conveyor loading, and baling.
- All site operations personnel shall receive training to assist in recognizing unusual, un-acceptable and hazardous wastes.
- When a staff member encounters suspect waste on the tipping floor, baling shall cease until the material is segregated and appropriate action (as identified in the **Section 8.2.2**) is taken. The procedures outlined in the facility's Emergency Response Plan (ERP) (see **Appendix B**) may apply, if the waste is suspected to be hazardous.

In addition to these methods, thorough random checks may be performed on the tipping floor at the discretion of the Facility Supervisor:

- The Scale House Operator will inform the hauler that a random check is to be performed. If the hauler refuses, the vehicle will not be permitted entry to the site and will be selected for a check on its next visit. The Scale House Operator will record, as much information as possible, about haulers who refuse a random check.
- The selected hauler will be directed to an area on the tipping floor that is separate from all other incoming waste. Prior to dumping, the driver of the inspected vehicle will confirm the absence of unacceptable materials. An inspector (the Facility Supervisor or a designate) will examine the load for hazardous or unacceptable wastes.

8.2.2 Handling Unacceptable Waste

Unacceptable wastes may be classified as non-hazardous, potentially hazardous or unacceptable, and, depending on the time of discovery, may or may not be associated with a known hauler. The following outlines appropriate procedures for handling unacceptable waste:

- Non-hazardous, unacceptable waste delivered by a known hauler will be reloaded by the hauler, if necessary, and removed from the site.
- Non-hazardous, unacceptable waste delivered by an unknown hauler may be removed from the site, processed to render it acceptable, or accepted as a special circumstance at the discretion of the Manager.
- Suspected hazardous (and therefore unacceptable) waste delivered by a known hauler will be reloaded by the hauler, if necessary, and removed from the site. The responsible site staff will complete a Waste Inspection/Attempted Delivery of Hazardous Waste Form, included in **Appendix A**, and inform NWB of the attempted delivery.
- If reloading or further transporting of the suspected hazardous waste is considered unsafe, NWB will be contacted for direction. Costs associated with the attempted delivery will be borne by the hauler and they shall be notified that they will be financially responsible for removal of the waste.
- Suspected hazardous waste delivered by an unknown hauler (i.e., discovered at the site) will be transferred, as directed by the Manager to a portion of the tipping floor designed for storage of suspected hazardous waste. The waste will be tested by a qualified firm at the discretion of NWB and the final disposal options determined based on the results.

Depending on the nature and condition of the suspected waste, safe transfer to the holding area, may not be possible. NWB is to be contacted for direction. The costs will be borne by the City.

Further procedures for handling unacceptable and/or suspected hazardous wastes are provided in the ERP for the Landfill and WTS (see Appendix B).

Once a waste is suspected to be hazardous, the onus is on the hauler to demonstrate otherwise or remove the waste, at their expense. Repeat deliverers of unacceptable or hazardous wastes may be banned from the site at the discretion of, and for a period determined by the Manager and/or the City.

8.2.3 Waste Baling

Following the completion of inspection procedures, material on the tipping floor is pushed using a front end loader to the conveyor infeed. The rate of material transfer from the conveyor to the baler hopper is regulated by the Baler Operator. Similarly, the Baler Operator controls the hydraulic rams, wire tying device and bale wrapper associated with the baler.

Following ejection from the baler, the bales are transferred (utilizing a forklift) to a flatbed truck for transport to the balefill.

8.3 Waste Placement and Covering

8.3.1 Waste Placement

Utilizing the Landfill's access road, bales of municipal solid waste will be delivered by site personnel from the WTS to the active disposal area. With the possible exception of loads of unique or difficult wastes, waste delivery vehicles and/or the general public will not have access to the Landfill area.

The Landfill is constructed from a series of individual lifts. Bales are removed from the flatbed truck via a fork-equipped front end loader. A lift is constructed by stacking bales three to four high; the height limit being set by the reach limit of the front end loader. The total height of a four bale lift is approximately 3 m. During bale stacking, the bales are placed with their widest dimension perpendicular to the direction of balefilling. Processed (shredded) C&D materials can be placed in bale voids on perimeter side slopes with granular fill subsequently being placed to develop a base for the final landfill cap.

In order to allow for a minimum 4 (horizontal) to 1 (vertical) side slopes for the fill area, the bales must be staggered during placement, utilizing the arrangements shown on **Figure 8-1**. The required side slope is attained, while still providing efficient usage of the available disposal volume. The staggered arrangement should be maintained until the final design elevation is reached.

The horizontal top cover should be placed to provide between 2% and 4% grade. A minimum side slope of 1% should also be established on the horizontal surface towards the passive vertical faces to direct runoff away from the working face.

Elements relating to the progression of solid waste balefilling at the facility are illustrated on the Engineering Drawings. The Landfill area development basically follows a sequence of composite liner installation within a specified disposal area, the orderly placement (or stacking) of cells of baled solid

waste within the disposal area, installation of composite liner in the next required disposal area, and the repeat of the process until final grades are reached and the area is capped.

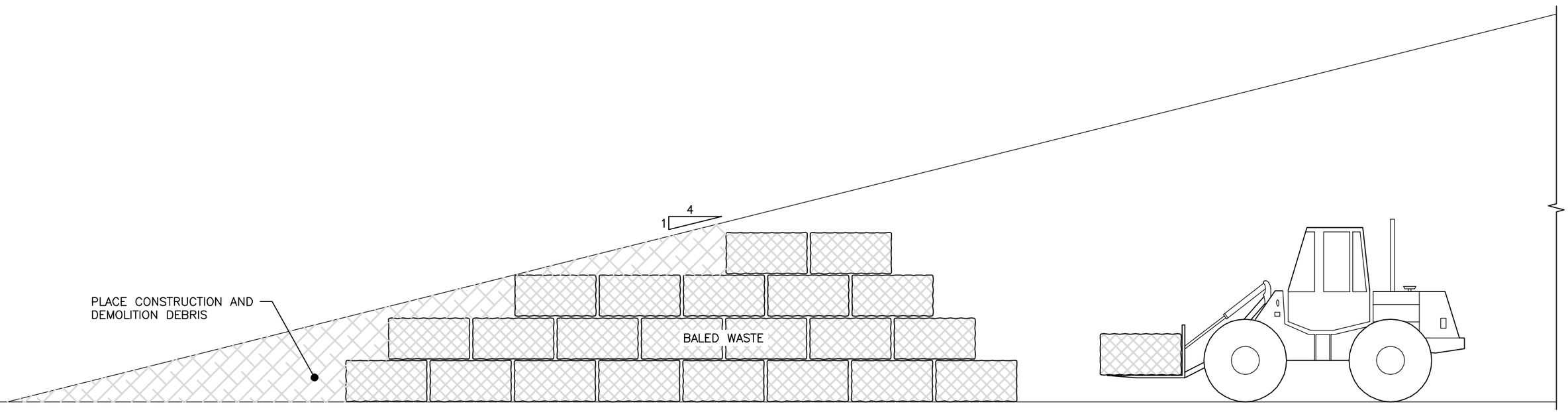
The staged, sequential development of the individual cells within the balefill area serves as the primary organizing factor in the facility's operation. The sequence established as part of the facility design is based on four main operational requirements:

1. To install the liner sequentially as defined cells.
2. To allow mobile site equipment access to all levels of the fill area.
3. To limit the height of vertical bale faces.
4. To achieve final design height (to allow for the installation of the landfill cap), as soon as possible.

Additional information relating to site development is included on the Engineering Drawings.

As the balefill reaches the final grades proposed on the Engineering Drawings, settlement can be expected. The completed areas should be inspected on a regular basis, and any cracks in daily/intermediate cover or areas of ponding water should be regraded to maximize surface runoff. If necessary, additional cover material should be added to ensure positive surface drainage.

CH_4 gas is a by-product of solid waste anaerobic degradation. **Section 11.0** describes LFG vent installation and the Engineering Drawings present the proposed location of the vents.



TYPICAL LIFT DETAIL

1:75

DILLON CONSULTING	PROJECT: IQALUIT LANDFILL AND WAASTE TRANSFER STATION	PROJECT NO.: 19-9543
DATE: JUNE 2019	TITLE: STAGGERED BALE PLACEMENT	FIGURE NO.: 8-1

8.3.2 Waste Covering

Acknowledging the baled and wrapped condition of the waste materials, the relatively limited amount of annual precipitation and a lack of available low permeability soil cover, the placement of locally-sourced aggregate cover over the waste bales is required only as a precursor to final capping. In select instances, at the discretion of the Manager, the placement of aggregate cover over a non-typical waste material (e.g., presenting a blowing litter, animal/vector attraction and/or litter generation risk) may be deemed appropriate.

8.3.3 Cover Borrow Areas

As noted in **Section 4.2.3**, cover material required to support the Landfill's operations, including bale/waste covering and final grading, is scheduled to be acquired from the Northwest Aggregate Deposit.

8.3.4 Inclement Weather

Wet weather operation may require the use of stockpiled crushed rock and (potentially) demolition rubble to maintain road access to the Landfill working face. This function should be undertaken to ensure reasonable access at all times, as required.

During the winter season, snow clearing of the Qaqqamiut Road, Northwest Aggregate Deposit access road and the two landfill infrastructures (Landfill and Leachate Management System) will be required. Similarly, ongoing snow removal the WTS access routes, as well as the general yard area, will be necessary. It is acknowledged that extreme snowfall/blizzard events could result in a temporary discontinuation of operations at the WTS and/or Landfill.

8.4 Surveying and Horizontal/Vertical Control

The landfill cell and footprint limits will be clearly defined in the field. To aid in the construction of the Landfill, permanent benchmarks have been established for horizontal and vertical control. The locations of these benchmarks are defined as a component of the Engineering Drawings.

As construction of the Landfill progresses, the Manager will utilize grades stakes to ensure that the construction is in accordance with the approved plans. The frequency of the staking is controlled by the size of the site and the volume of waste received. Due to settlement, stakes set on previously filled areas should not be used as temporary benchmarks for future staking. If the stakes are required for a long period, they will be checked and reset frequently.

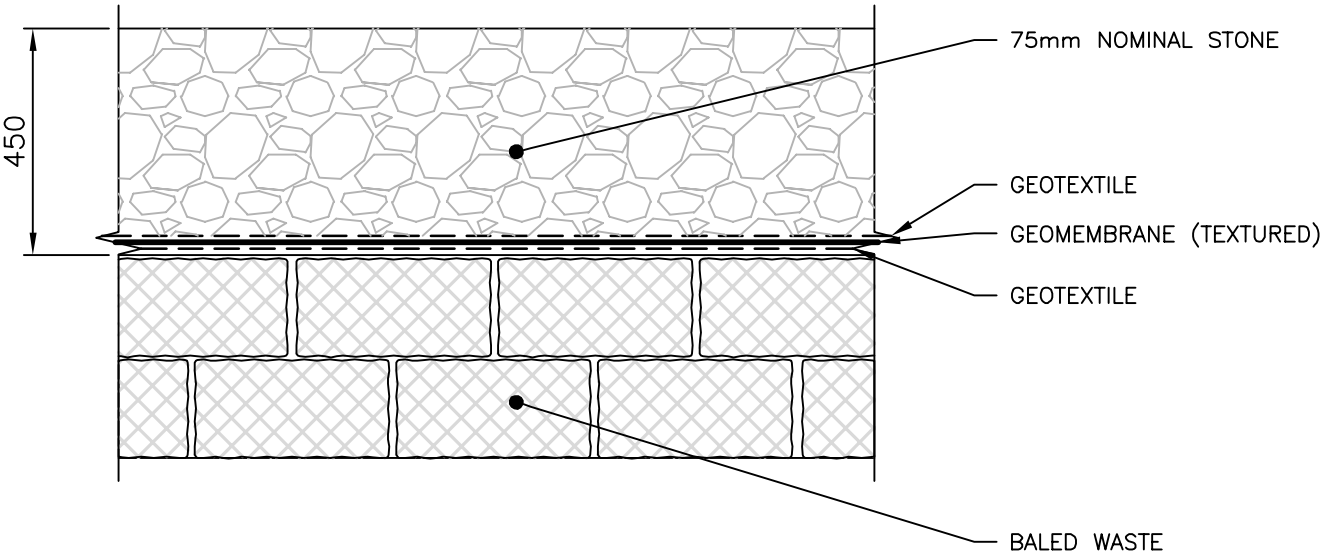
During application of final cover, elevation control will be established daily. The required thickness of final cover will be monitored using settlement plates placed at the top of the waste with painted gradations indicating the required layer thicknesses.

It is the Manager's responsibility to see that all necessary construction staking is accomplished and to apprise the equipment operators of their presence. The Manager will employ or engage the services of a qualified individual(s) to perform the day-to-day operational surveying needs of the site.

8.5 Landfill Cap

Upon achieving final design grades, future infiltration of precipitation into the waste mass (and thus the leachate collection system) will be mitigated through the installation of a landfill cap. The cap, as illustrated in **Figure 8-2**, consists of a surface drainage layer (450 mm of 75 mm clear stone) geomembrane barrier (60 mil textured LLDPE) and a base grading layer. A nonwoven geotextile is positioned above and below the geomembrane to provide protection during construction and closure activities.

As described in **Section 11**, vents will be installed at select locations in the final cap to allow for the release of LFG.



CAP SYSTEM SCHEMATIC

N.T.S.

DILLON CONSULTING	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
DATE: JUNE 2019	TITLE: LANDFILL CAP SCHEMATIC	FIGURE NO.: 8-2

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9.0 Nuisance Control

9.1 Litter Control

Litter can be a significant problem at municipal solid waste disposal sites. At the facility, two factors will serve to reduce the problem significantly:

1. All incoming waste (with the exception of periodic bulky materials) will be handled within the WTS.
2. Waste arriving at the working face will be in high-density, wire-tied and plastic wrapped bales, with deposition occurring in an orderly "stacking" manner.

Acknowledging that a notable reduction in litter generation is expected at the City's site (over that associated with a standard landfill), a litter control program will still be maintained at this location. Litter control is best accomplished by a combination of proper disposal operations, litter retaining fences and a litter picking program. A clean, litter-free appearance will be maintained at the site at all times, not only for public relations, but also for efficient operation of the Landfill. Poor litter control would attract unwanted wildlife and contribute to surface drainage problems by blocking ditches and culverts.

In summary, litter control measures to be implemented at the Landfill and WTS include:

- Semi-permanent litter collection fencing shall be positioned around the active area to catch blowing litter (see Engineering Drawings).
- A vigorous litter collection and patrol program shall be directed by the Manager.
- Litter on fencing, on-site roadways, in ditches, in the WTS yard, and adjacent properties shall be monitored and collected on a minimum weekly basis.
- The arriving waste must be covered according to applicable City bylaws. Vehicles arriving uncovered shall be turned away.

9.2 Odour Control

Odours will be controlled at the facility by implementation of the following daily measures:

- Timely removal of waste from the WTS tipping floor (e.g., baled and delivered to the Landfill).
- Short-term storage of waste bales at the designated location within the WTS yard only in exceptional circumstances (e.g., extreme weather events or landfill access issues).
- Gas venting and collection systems (if necessary) shall be established and maintained in good working order (see **Section 11.2**).
- Leachate springs at the Landfill shall be promptly repaired.
- Complaints regarding odour shall be recorded (see **Appendix A**) and acted upon. Complaints shall also be correlated to relevant whether information.

Odour control will also be achieved by routine site inspections to identify and eliminate localized surface water ponding and/or surface water drainage problems. Should odours become a problem, an on-site evaluation will be performed and appropriate remedial actions taken based on results of the evaluation.

9.3 Dust Control

Due to transport and placement activities at the site, as well as the number of gravel surface roadways, dust control will be an important operational consideration. Dust control measures to be implemented at the Landfill and WTS include the following:

- The site shall be monitored daily during dry weather.
- Vehicle speeds shall be limited on-site to 10 kph within the WTS compound and at the Landfill, particularly during dry periods. Adequate signage shall be posted and limits enforced.
- On-site roads shall be maintained to minimize dust emissions.
- Asphalt surfaces (e.g., scale ramps) shall be routinely swept.
- Calcium chloride shall be applied to roads, as necessary. The rate of application shall be recorded, using the daily checklists (see **Appendix A**).

9.4 Vector and Bird Control

Solid waste disposal facilities can attract rodents and birds due to the availability of food and the potential for breeding habitats in the waste. Limiting the availability of food and void space, resulting from the compacted nature of the baled waste, will discourage their habitation.

9.4.1 Vector and Animal Control

Control measures include the following:

- Litter collection shall be conducted daily to mitigate the attraction of vectors and animals.
- If a baiting program is required for rodents, it shall comply with regulatory requirements regarding the use of pesticides.
- If burrowing animals utilize the leachate holding ponds as habitat, contact Nunavut Department of Natural Resources to determine the safest manner of removing the animals.

Acknowledging the potential risks, all staff assigned to duties at the Landfill shall be properly trained in bear safety.

9.4.2 Bird Control

Control measures include the following:

- Minimize potential roosting areas within the WTS (e.g., using netting and/or landing surface spikes).
- Litter collection shall be conducted daily.
- If the problem is persistent, a more intensive program shall be initiated, which may involve the use of noise generating devices.

9.5 Noise Control

All equipment powered by internal combustion engines have mufflers installed and will be maintained in accordance with manufacturer's recommendations.

Regular hours of operation at the WTS shall be restricted to a posted schedule acknowledging the use of back up alarms/indicators on mobile equipment.

9.6 Open Burning

Open burning of any material will not be permitted at the Landfill or WTS.

9.7 Indiscriminate Dumping

Waste is to be disposed at designated areas at the facility (i.e., WTS tipping floor, material storage areas or Landfill) only. When indiscriminately dumped materials are discovered, they are to be immediately relocated to the appropriate designated area.

10.0 Surface Water Management

10.1 General Description

Surface water at the Landfill is conveyed primarily via overland and sheet flow, ultimately concentrating into channel flow to the east of Sylvia Grinnell Territorial Park, at which point it flows southerly toward the Iqaluit Airport, ultimately discharging to the Koojesse Inlet at Frobisher Bay. Runoff from the WTS site follows the City's drainage network in a southerly direction and into Koojesse Inlet.

Surface water for the Landfill and WTS is classified in two categories:

Stormwater from Developed (Disturbed) Areas

- Includes any surface water from the WTS compound, active and non-active portions of the constructed Landfill, outside slopes of berms, access roads and capped areas. This water is collected in ditches and directed prescribed discharge points, as indicated on the Engineering Drawings.

Stormwater from Non-Developed (Undisturbed) Areas

- Surface water from undeveloped areas or right-of-way areas. This water is discharged directly off-site.

It is noted that precipitation coming in contact with waste materials (e.g., baled waste and C&D materials) will be captured within the Landfill's leachate collection system and will enter the site's surface water ditching.

10.2 Control Ditching

Surface water control is provided through permanent WTS compound/Landfill perimeter ditching, as well as interim/temporary ditching. All permanent ditching is designed to accommodate the peak 100 year return period stormwater flow condition. Permanent culverts are designed to accommodate peak 10 year return period stormwater flows. The interim ditching and culverts are capable of handling the peak five year return period stormwater flows generated on the site.

Noting the anticipated lack of fine grained, erodible soils at the Landfill or WTS, sedimentation control has not been identified as an issue of concern for the design of surface water management features. General operational procedures to limit the potential for negative impacts associated with erosion and sedimentation are incorporated in the Construction and Operations, Closure and Post-Closure Environmental Protection Plans for the Landfill and WTS project.

Primary operational requirements relating to the surface water control ditching include the following:

- Stable aggregate cover shall be maintained in the ditches and on other site surfaces.
- Positive flow shall be maintained away from all buildings.
- Ditches shall be maintained to prevent side slopes from sloughing.
- Ditches shall be kept free of debris, as required.
- Culvert headwalls shall be maintained.

11.0 Landfill Gas Management

11.1 General Description

CH_4 and carbon dioxide (CO_2) are the primary constituents of LFG and are produced by microorganisms within the balefill, under anaerobic conditions. Carbohydrates from paper, cardboard and similar materials are decomposed initially to sugars, mainly to acetic acid, and finally to CH_4 and CO_2. Other components of LFG include non-methane organic compounds (NMOC) and inorganic compounds. NMOC originate from the disposal of aerosols, paints, oils, solvents and similar products in the Landfill. Inorganic compounds, such as hydrogen sulphide, originate from the decomposition of reactive waste products.

LFG generation, including rate and composition, proceeds through four characteristic phases throughout the lifetime of a Landfill. The first phase is aerobic (e.g., with oxygen available) and the primary gas produced is CO_2. The second phase is characterized by O_2 depletion, resulting in an anaerobic environment where large amounts of CO_2 and some hydrogen are produced. In the third anaerobic phase, CH_4 production begins, with an accompanying reduction in the amount of CO_2 produced. Nitrogen (N_2) content is initially high in the balefill gas in the aerobic first phase, and declines sharply as the Landfill proceeds through the anaerobic second and third phases. In the fourth phase, gas production of CH_4, CO_2 and N_2 becomes fairly steady. LFG is typically described as comprised of 50% CH_4 and 50% CO_2; although, the percentage of each may vary considerably.

The phase duration and time of gas generation varies with site conditions (e.g., waste composition, cover materials, design, anaerobic state), and may also vary with climatic conditions such as precipitation rates and temperatures. Because CH_4 is combustible, it poses a greater risk to safety than CO_2. If vented in an uncontrolled manner, CH_4 can accumulate in enclosed spaces on, or close to, the disposal site. CH_4 gas is odourless, and because its density, is less dense than air. It rises until its movement is restricted by some impermeable medium. For example, in winter, the frozen surface of the ground may block the vertical escape of CH_4, forcing it to move laterally. Also, CH_4 is insoluble in water; therefore, it will not move below the groundwater table. This presents the risk of fire or explosion. Concentrations of CH_4 between 5 and 15% in air are explosive. With proper venting; however, CH_4 gas should not pose an unacceptable hazard. Research has shown that the rate of decomposition in landfills, as measured by CH_4 gas production, reaches a peak within the first two years and then slowly tapers off; although, continuing in many cases, for periods up to 25 years or more. Therefore, CH_4 venting must be accommodated during and after balefill completion.

It is expected that the low average annual temperature, relatively limited amount of annual precipitation, and the baled and wrapped configuration of the waste will tend to reduce the intensity of LFG generation at the City's site. Further, migration of permafrost into the waste mass overtime at the Landfill may serve to deter waste degradation all together. However, it is acknowledged that ongoing

effects associated with climate change (e.g., warmer and wetter weather in the north) could result in increased LFG generation rates in the future.

11.2 Landfill Gas Vents

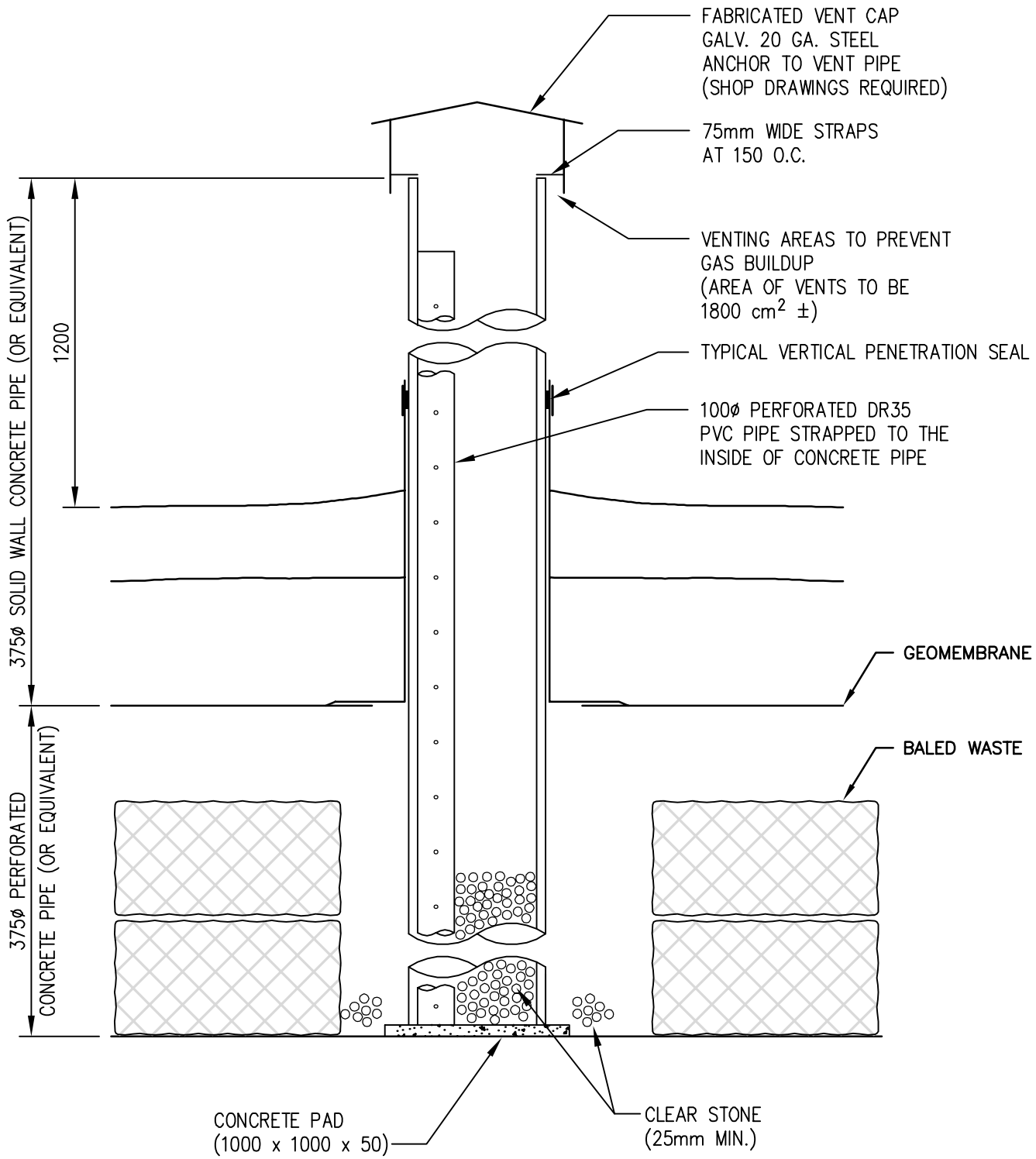
LFG vents will be installed, as specified throughout the fill area, to allow for the controlled discharge of this gas. Suggested locations for these vents are shown on the Engineering Drawings. The vents should be extended in height as the site is developed. Recommended construction details for a typical gas vent are provided in **Figure 11-1**.

If explosive concentrations of CH_4 are detected during the monitoring program, the ventilation capability of the vent itself, as well as the overall spacing of vents, should be investigated. It may become necessary to consider a positive type ventilation system (such as gas extraction), if the problem is not easily remedied.

CO_2 gas is not considered to present a high risk to safety with regards to above ground operations. However, since it is heavier than air, CO_2 will collect in the bottom of manholes, poorly vented trenches, and other below-ground areas. Therefore, site personnel should take appropriate precautions, such as the use of a respirator or forced ventilation, prior to entering these areas.

Primary operational requirements relating to LFG control include the following:

- LFG vents shall be installed in the Landfill area, according to spacing identified on the Engineering Drawings.
- CH_4 gas detection levels shall be monitored at each vent semi-annually and recorded within a database.
- The area immediately surrounding vents shall be checked periodically for surface water ponding. Regrading shall be conducted, as necessary.
- The structural integrity of the exposed portion of vents shall be monitored periodically to ensure they are maintained.



DILLON CONSULTING	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
DATE: JUNE 2019	TITLE: TYPICAL LANDFILL GAS VENT	FIGURE NO.: 11-1

FileName:c:\projectwise\working directory\projects 2019\50dbc\dms12727\11-199543-02-site-con-liner.dwg

- The gas vents shall be inspected to ensure that the vent caps are properly fitted and maintained.
- The height of the vents shall be checked to ensure that vents extend a minimum of 1200 mm above grade at all times.
- If measured gas concentrations are within the explosive range, venting capacity shall be evaluated for those vents with explosive readings; alternatively, additional passive vents should be installed.
- If the measured gas concentrations are within the explosive range and the condition is not remedied by modifying the passive vent system, the use of a positive venting system shall be evaluated.

12.0 Leachate Management

As discussed in **Section 4.0**, leachate is created as a result of operations at the Landfill and WTS. Dedicated collection and storage systems serve each location. Management requirements for both locations are discussed in the following sections. Sampling and analysis requirements associated with leachate management are presented in **Section 13.**

12.1 Waste Transfer Station

Leachate within the WTS is generated during the waste baling process, as liquid is squeezed out of the waste mass. This liquid is collected via a shallow trench in the slab around the perimeter of the baling unit, with the effluent subsequently being pumped to a holding tank on the WTS floor. As required, this liquid is collected and transported to the City's WWTP for treatment.

12.2 Landfill

The Landfill's leachate collection and treatment system, as described in **Section 4.2**, incorporates several components, including the leachate collection layer/perforated pipe system within the disposal area liner system, collection sumps/manholes, two holding ponds and an engineered wetland.

> WARNING!
>
> LEACHATE IS POTENTIALLY HAZARDOUS.
>
> Take appropriate safety precautions when handling or working near leachate or when entering confined spaces, such as the use of protective clothing, breathing apparatus, and ventilation.

Primary operational requirements relating to leachate management at the Landfill include the following:

- The leachate collection manhole includes a removable, rail-mounted submersible pump, complete with connection piping to a forcemain. One pump will be the duty pump with the second as a back up. The manhole includes a float system (complete with a control panel) to trigger pump operation, when leachate depths warrant.
- The forcemain will direct leachate to Holding Pond #1, with subsequent flow through Holding Pond #2 and final discharge to a defined wetland treatment area south of the ponds.
- The pump will be powered by a small portable generator. Staff will bring the generator to the site each morning and energize the system. Prior to leaving the site at the end of the day, the generator will be disconnected and returned to the WTS for storage.
- The manhole pump system will be operated during the period of the year when leachate is being generated and flows into the manhole (e.g., June 1 to October 1). Upon the confirmation of freeze up conditions in the fall, the pump will be removed from the manhole and the forcemain will be decommissioned (drained) for the winter. Assessment of leachate generation

status (e.g., observations within the manhole) shall commence in the late spring, confirming when active pumping efforts should be initiated.

- A complete inspection of the leachate collection system elements (manhole, pump, holding ponds and wetland) shall be conducted on an annual basis.

13.0 Site Monitoring

13.1 Surface Water and Active Layer Water

<To be developed during Phase II – Preliminary Design.>

13.2 Leachate

<To be developed during Phase II – Preliminary Design.>

13.3 Landfill Gas

Once vents have been installed, LFG samples shall be collected on a semi-annual basis. Analysis shall be limited to CH_4 concentration. Additional parameters may be identified at a future date, in consultation with NWB.

13.4 Permafrost Condition

<To be developed during Phase II – Preliminary Design>

14.0 Facility Records

Maintaining facility records is important for operational decisions related to both daily activities and long-term facility management. Copies of all records shall be kept at the WTS Office and up-to-date for inspection subsequent reporting purposes. The following records should be maintained as a minimum. It is noted that the daily and weekly checklists discussed in this section (and presented in **Appendix A**) provide an efficient and concise means to maintain an operational record:

1. Incoming Material Quantities – All materials entering the WTS are weighed prior to subsequent handling. A computerized data base serves to consolidate all collected information by source and material type allowing for subsequent reporting. Weigh scale information can be used for determining waste compaction values, soil to waste ratios, trends in waste generation and general quantification of the waste stream.
2. Site Visitor Log – All visitors accessing the Landfill or WTS are to be registered in the site visitor log (see **Appendix A**). The log book will be held at the Scale House.
3. Correspondence – A filing system shall be maintained to keep any correspondence associated with site operation.
4. Financial – Complete records of budget forecasts and actual expenditures must be maintained for the operation. This information is to be summarized in an annual report, as well as forecasts for the upcoming year.
5. Site Operations Log – The site log will consist of the daily and weekly checklists (see **Appendix A**), as well as periodic print-offs (i.e., monthly) of Scale House records. Other operations forms, including weather logs, waste inspection forms, complaint forms, can also be incorporated into the site log. It is recommended that the log itself take the form of a binder, allowing for the easy addition of documentation. The landfilling log will be held and maintained by the Manager.
6. Weather – Records relating to temperature, wind conditions and precipitation shall be recorded daily, using a standardized form (see **Appendix A**).
7. Liner – When landfill cell liner installation is required, a topographic survey of the base area shall be performed prior to liner construction. The area to receive the liner shall be graded according to the dimensions and elevations shown on the Engineering Drawings. Installation of the liner system shall be undertaken by personnel/firms experienced in the application of the specified materials. Installed sections of liner shall be tested for quality control, as indicated in the specification. Record engineering drawings of the area shall be prepared each time the liner is installed. Inspection records documenting quality control during liner installation shall be maintained by the City. A section of liner capable of accommodating one year of landfilling shall be installed at a minimum. The determination of timing requirements associated with installation of the liner system is discussed in **Section 7.2**. A sketch of the location of landfilling, with respect to the liner, shall be developed on an annual basis.
8. Compaction Control – To monitor site operations on a yearly basis, overall compaction of the balefill shall be examined. A topographic survey of the active soil borrow area and the active Landfill area, shall be conducted annually to determine the volume occupied. Survey drawings

generated, as part of this undertaking, shall provide an annual record of site development. Using the weigh scale records, as well as the overall degree of compaction of the balefill, shall be determined.

9. Landfill Cap – When an area reaches final design elevation, a topographic survey shall be conducted to establish final grade. Similar to the disposal area liner, the landfill cap installation shall be undertaken by experienced, qualified personnel with quality control testing being completed, as noted in the specification. All landfill cap installations shall include the completion of record engineering drawings. Other features that shall be noted on the record drawings include locations of CH_4 vents, leachate collection system elements and surface water runoff ditches. The requirement to install or cap an area shall be forecasted at least 12 months in advance of design and construction for the cap.
10. Leachate Control – Documentation shall include leachate quality test results, sketches showing the progress of installation of the leachate collection network, leachate pumping and volumes.
11. LFG Control – Documentation associated with the development of the gas vents within the Landfill area, including location of the gas vents/gas recovery infrastructure and data on periodic gas sampling, shall be maintained.
12. Surface and Active Layer Water Monitoring – A database of all surface and active layer monitoring results, including water quality and monitoring point integrity information, shall be maintained.
13. Bird/Pest Control – If control measures are undertaken, all activities are to be recorded on the daily and weekly checklists.
14. Reports – As directed by the Director of Engineering and Public Works, written facility reports shall be prepared by the Manager. Annual material disposal/diversion reports, based on site weigh scale records and in accordance with the requirements of NWB, shall also be prepared.

15.0 Summary Schedule of Activities

<To be developed during Phase II – Preliminary Design.>

16.0 Emergency Response Plan

An ERP applicable to operations at the Landfill and WTS is attached as **Appendix B**.

Appendix A

Forms

City of Iqaluit - Iqaluit Waste Management Facility
Landfill and Waste Transfer Station

Complaint Response Form[1]

Complainant: _____ **Date Received:** _____

Repeat Complainant[2] (Y/N): _____

Address: _____ **Time Received:** _____

_____ **Received By:** _____

Phone No.: _____ **Form Completed By:** _____

Date of Complaint: _____

Time of Complaint and Noted Weather Conditions: _____

_____

Delivery of Complaint: ☐Phone Call ☐Letter ☐Personal Visit ☐Email/text

Nature of Complaint: _____

_____

_____

_____

_____

_____

_____

Suggested Response: _____

_____

_____

_____

Actions Taken: _____

_____

_____

_____

_____

_____

Complaint Received By (Sign & Date): _____

Written Acknowledgement By (Sign & Date): _____

Notes:

1) A blank complaint response form is to be provided to a complainant upon request. The form can then be completed by the complainant and distributed as desired.

City of Iqaluit - Iqaluit Waste Management Facility
Landfill and Waste Transfer Station
VISITORS LOG

Date	Visitor's Name	Company Name	Reason for Visit	Time In	Time Out

City of Iqaluit - Iqaluit Waste Management Facility
Landfill and Waste Transfer Station

WASTE INSPECTION/ATTEMPTED DELIVERY OF UNACCEPTABLE WASTE FORM

PART A – INSPECTION

Date/Time of Delivery: _____

Date/Time of Inspection: _____

Hauling Firm/Vehicle Owner: _____

Driver's Name: _____

Contact Phone Number: _____

Vehicle License Plate: _____

Size of Load (i.e., tonnes, cubic metres): _____

Source of Waste (as stated by Driver): _____

_____

Type of Waste (as stated by Driver): _____

_____

Inspection Location: _____

Inspection Observations: _____

_____

Suspected Unacceptable Wastes? (Yes/No; **If Yes, complete Part B**) _____

PART B – SUSPECTED UNACCEPTABLE WASTE

Suspected Type of Unacceptable Waste: (as stated by Inspector): _____

Action Taken: _____

_____

Comments: _____

_____

	Inspector	**Driver**
Signature:	_____	_____
Date:	_____	_____

Inspector: Write "refused" in space for driver's signature if driver refuses to sign form.

City of Iqaluit - Iqaluit Waste Management Facility
Landfill and Waste Transfer Station

FACILITY WEEKLY OPERATIONS CHECKLIST
to be completed with reference to the Daily Facility Checklists

Checklist for Week Ending: _____ Completed by: _____

Date Completed: _____

Item	Acceptable Condition? (Y/N)	Comments/Action
1. Mobile Equipment		
2. Litter Control		
3. Pest Control		
4. Dust Control		
5. Site Entrances		
6. Site Roads		
7. Scale/Scale House		
8. Office Building		
9. WTS Tipping Floor		
10. WTS Stationary Equipment		
11. WTS General Interior/Exterior		
12. WTS Yard and Ditching		
13. WTS Yard and Ditching		
14. Active Landfill Disposal Cell		
15. Landfill Staff Shelter		
16. Fire Safety Equipment		
17. Health and Safety Procedures		
18. Waste Placement (incl. cell location)		
19. Landfill Perimeter Berms		
20. Leachate Management System		
21. Landfill Surface Water Ditches		
22. Surface/Active Layer Monitoring		
23. Odour Control		
24. Completed Area		
25. Weekly Landfilled Tonnage		
26. Weekly Diverted Tonnage		
27. Unacceptable Loads		
28. Personnel		
29. Complaints		
Other Issues/General Comments:		

Notes:
1. Acceptable Condition – Item/Issue is within guidelines established by the Operations Manual and/or Operating Authorization and/or good practice.

City of Iqaluit - Iqaluit Waste Management Facility
Landfill and Waste Transfer Station

FACILITY DAILY OPERATIONS CHECKLIST
***to be completed daily with Daily Weather Log**

Date: _____

(A) Morning (Beginning of Working Day) Completed by: _____

	Item	Acceptable Condition? (Y/N)	Comments/Action
1.	Mobile Equipment		
2.	Stationary Equipment		
3.	Landfilling Cell		
4.	Site Entrances		
5.	Site Roads		
5.	WTS Buildings		
6.	WTS Yard Area		
7.	WTS Heating Fuel		
8.	Leachate Management System		

Other Issues/General Comments:

Notes:

1. Acceptable Condition – Item/Issues within guidelines established by the Operations Manual and/or Operating Authorization and/or good practice.

(B) Afternoon (End of Working Day) Completed by: _____

	Item	Information
1.	Working Cell Location (note sequence number)	
2.	Total Baled/Landfilled Tonnage	
3.	Major Haulers (names)	
4.	Number of Private Loads	
5.	Number of Commercial Loads	
6.	Total Diverted Tonnage	

Other Issues/General Comments:

City of Iqaluit - Iqaluit Waste Management Facility
Landfill and Waste Transfer Station
DAILY WEATHER LOG

Log Completed on: _____ _____ _____ Time: _____
Day Month Year

Log Completed by: _____

Weather Record for: _____ Next Day Forecast

Temperature: High___C Low___C Temperature: High___C Low___C

Wind Velocity: _____km/h Wind Velocity: _____km/h

Precipitation	Accumulation	Cloud Cover	Precipitation	Predicted Accumulation
☐ Rain	_mm	☐ Sunny	☐ Rain	_mm
☐ Freezing Rain	_mm	☐ Partly Sunny	☐ Freezing Rain	_mm
☐ Snow	_mm	☐ Partly Cloudy	☐ Snow	_mm
☐ Other	_units	☐ Cloudy	☐ Other	_units

Action Required Due to Weather Conditions		
	Personnel Required	**Comments**
☐ Snow Removal		
☐ Road Sanding/Salting		
☐ Dust Control		
☐ Litter Control		
☐ Slope Stabilization		
☐ Ditching		
☐ Equipment Servicing Description _____		
Other (Specify) _____		

Appendix B

Emergency Response Plan
(to be attached when finalized)

DILLON CONSULTING

Appendix C

Facility Approval
(to be attached when provided)

DILLON CONSULTING

Appendix G

Facility Risk Assessment Report

DILLON CONSULTING

DILLON CONSULTING

CITY OF IQALUIT

Facility Risk Assessment (Draft)

Landfill and Waste Transfer Station

June 2019 | 19-9543

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1.0 Purpose of the Facility Risk Assessment

1.1 Background

In the Request for Proposal (RFP) under Phase I – Pre-Design, a Facility Risk Assessment (FRA) is to be completed that "identifies risk and potential mitigation measures for environmental, health & safety (H&S), geotechnical, facility infrastructure, and operational aspects of the landfill and waste transfer station (WTS) and their operations." As part of the pre-design stage, the underlying objective of the FRA is to inform decision making when it comes to the various deliverables in Phase I as shown in **Figure 1 –1Error! eference source not found.**.

Figure 1-1: Goal of Facility Risk Assessment

1.2 Assumptions

Information was obtained from the following sources to complete the FRA:

- Discussions with the Design Team Leads;
- Facilitated BowTie workshop session held on May 8, 2019; and
- Publically available databases, documents and records, as identified and referenced within this submission.

1.3 Facility Risk Assessment Team

The FRA Team consisted of the following individuals:

- Dave Poole – Certified Risk Manager (CRM) with over 25 years of experience developing risk management strategies and providing strategic advisory services.
- Farhad Shams – Risk Analyst with four years of experience conducting project risk assessments and business analysis.

The FRA Team was supported by the Senior Review/Technical Advisors.

1.4 Limitations

To complete the FRA, information was obtained from the following sources:

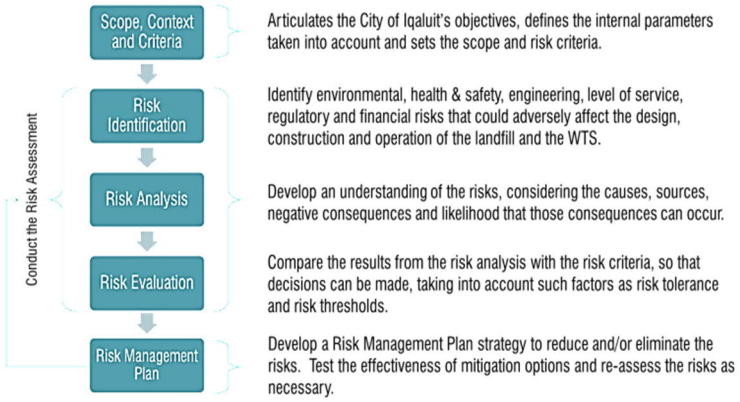
1. Solid waste, building and facility, leachate management, water resources/hydrology, hydrogeology, and environmental and regulatory subject matter experts; and
2. Publically available documents and records at the time the FRA was completed.

While every effort was made to minimize potential errors and omissions, there are some limitations. These limitations are noted, where applicable in the report.

2.0 Risk Management Framework and Process

Dillon employed a standardized, systematic and transparent risk assessment and management process from ISO3100:2018 Risk Management – Guidelines, as shown in **Figure 2 –1**, which is both a step-wise and iterative process. In the beginning, Dillon worked with the City of Iqaluit (the City) to define the scope, context and criteria, which formed the basis to conduct the risk assessment. Conducting the risk assessment was designed as a collaborative and facilitated process to ensure that all the relevant risks are identified, properly analyzed and evaluated.

Figure 2-1: Outline of ISO31000:2018 Risk Management Guidelines



The objective of the FRA is to assess the risks associated with the design, construction, and operation/maintenance of the solid waste landfill and the WTS facility. In addition, closure and post-closure of the solid waste landfill were taken into consideration. Based on discussions with the City, the FRA will look at risk from the following perspectives (herein called Risk Receptors):

- Public and employee Safety
- Financial Loss (Capital and Operational)
- Reputation
- Business Interruption/Level of Service
- Environmental
- Legal
- Technical

Risk is calculated as:

Risk Score = Likelihood x Impact

In order to calculate the "Risk Score", the following Risk Criterion was developed for each of the above-referenced Risk Receptors, taking into consideration both Likelihood and Impact, as shown in **Figure 2 –2**. The one exception is with "Technical" – which is a risk factor that we used to categorize the overall technical risks associated with the design and construction of the solid waste landfill and the WTS. There is no "likelihood" component to quantifying the Technical risk; therefore, a corresponding Risk Score – Technical was not calculated.

Figure 2-2: Risk Assessment Criterion

RISK ASSESSMENT CRITERION

Likelihood/Vulnerability

The likelihood is used to analyze the vulnerability level. The likelihood or the probability that an asset will be impacted based on current conditions.

Score	Descriptor	Probability	Frequency	Likelihood
1	Remote	0% - ≤ 20%	May occur less than once in 35 years	May happen in only exceptional circumstances
2	Unlikely	> 20% - ≤ 40%	May occur once in 25 to 35 years	Could happen sometimes, but not likely.
3	Possible	> 40% - ≤ 60%	May occur once in 15 to 25 years	Might occur.
4	Likely	> 60% - ≤ 80%	May occur once in 5 to 15 years	Likely to occur.
5	Almost Certain to Occur	> 80% - ≤ 100%	May occur once in 1 to 5 years	Expected to occur.

Criticality/Impact

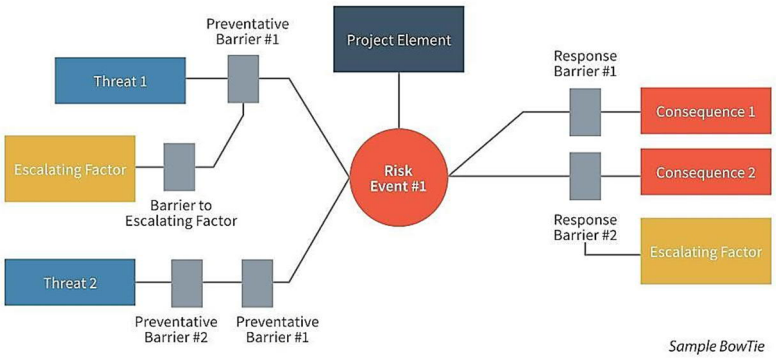
		Risk Receptors							
Score	Descriptor	Public and Employee Safety	Financial Loss (Capital)	Financial Loss (Operational)	Reputation or image	Business Interruption / Level of Service	Environmental	Legal	Technical
1	Low	No injuries - Near miss	≤ $ 200K	≤ $ 2K	No external attention	1-2 days	Short term no impact offsite	Legal action not likely	Proven technical approach; meets applicable standards; commonly applied technology
2	Moderate	Minor injuries to small number of staff or public	>$ 200K - ≤ $1.5M	>$ 2K - ≤ $15K	Individual complaint	3 days - 1 week	May impact offsite and ecosystem – Small scale < 1 month	Minor legal issues, non-compliances and breaches of regulation	Proven technical approach; meets applicable technical standards; previously applied in Northern Canada
3	Significant	Medical treatment / Employee Reportable Injury	>$1.5M - ≤ $5M	>$15K - ≤ $50K	Multiple individual complaints.	1 week - 2 weeks	Offsite and ecosystem impacted – Duration up to 1 year – Repairable	Serious breach of regulation with investigation with prosecution or moderate fine	Proven technical approach; meets applicable technical standards; never been applied in North Canada
4	Serious	Partial disability, hospital treatment (i.e. surgery)	>$5M - ≤ $10M	>$50K - ≤ $100K	Frequent complaints	2 weeks - 1 month	Extended range – Long-term impact – May regenerate in ten years	Major breach of regulation Major litigation	Proven technical approach; meets applicable technical standards; not commonly applied technology
5	Severe	Death or permanent total disability	> $10M	> $100K	Media attention	> 1 month	Long-term severe irreparable environmental impact - Over extended range beyond site	Significant prosecution and fines Very serious litigation including class action	New, untested, and unique technical approach

Figure 2-3: Risk Matrix

Likelihood					
	low 5	medium 10	high 15	very high 20	very high 25
	low 4	medium 8	high 12	high 16	very high 20
	very low 3	low 6	medium 9	high 12	high 15
	very low 2	low 4	low 6	medium 8	medium 10
	very low 1	very low 2	very low 3	low 4	low 5
	Impact				

The BowTie methodology was utilized to "Conduct the Risk Assessment", where the design, construction, operation/maintenance and the closure/post-closure Project Elements were defined, from which various Risk Events were identified.

Figure 2-4: Sample BowTie



Taking into consideration the Threats, Preventative and Response Barriers, each Risk Event can result in one or more "Consequences". For each Consequence, the Total Risk Score is calculated by summing the individual Risk Scores for each of the seven Risk Receptors (excluding Technical). This will allow the FRA to risk-rank each Consequence based on the Total Risk Score. The higher the Total Risk Score, the higher priority for that specific Consequence.

3.0 Project Description

3.1 Overview

The City is in the process of implementing its Solid Waste Management Strategy to service their near and long-term (75 years) municipal solid waste disposal requirements. Founded on a previously completed conceptual design and facility siting exercise, key elements of the project include a solid WTS within the immediate urban area of the City, where residential and commercial waste will be hauled to, processed, and compacted in bales or in the case of waste wood and cardboard, shredded and pelletized for use as a fuel source for an on-site biomass boiler. Tires, metal, and some construction and demolition (C&D) wastes will also be shredded and or baled for landfilling, or transported south for recycling. The resulting solid waste bales, and possibly a smaller amount of unbaled construction and demolition waste, will be trucked to an engineered balefill landfill site (Landfill) located approximately 6 km from the WTS. The vehicles transferring the waste bales will access the road leading to the Landfill site from the WTS to avoid having the transfer vehicle travel through the City.

Other planned features of the WTS include a public drop-off area for Household Hazardous Wastes and a vehicle logger/compactor unit; in both instances allowing for the preparation of waste materials prior to shipping to an approved management facilities in the south.

The access road that will be used to reach the new Landfill site has been designed by EXP Services Inc., who will also be providing Construction Contract Administration services for the construction of the road. It is anticipated that the construction of the road will be included in the new Landfill and WTS contractor's scope of work.

The engineered Landfill will be designed for 75 years of operation but for the construction/ build portion of the project, only the first stage of the Landfill (Stage 1 Operational Landfill) will be constructed (e.g., first two cells and ancillary components to meet five and 10 year operational requirements [i.e., five years per cell]).

Development of the proposed facilities is scheduled to occur during the 2020 and 2021 construction seasons, with facility commissioning in the fall of 2021.

3.2 Hazard Identification – Solid Waste Landfill

A summary of the primary project elements for the solid waste Landfill that fall under the design, construction and operational categories are provided in **Table 3 –1**, which formed the basis for defining the Hazards in the BowTies.

Table 3-1: Cross Reference Landfill Project Elements with Identified Hazards

List of Project Elements	Hazards Used in BowTies
Design and Construction	
Access Road	**Ancillary infrastructure** – not brought forward to risk assessment. Apply standard design and construction practices to monitor and mitigate risk of impact to cost and/or schedule.
Equipment Storage Building	
Staff Shelter – Trailer	
Landfill Liner System	**Landfill Liner System**
Water Monitoring System	
Landfill Cells	
Landfill Leachate Collection System	**Leachate Treatment System**
Leachate Holding Pond (outside of Landfill)	
Leachate Treatment System	
Temporary Power from Portable Generator	**Landfill Liner System** **Leachate Treatment System** **Ancillary Infrastructure**
Operations, Maintenance, Closure and Post-Closure	
Placing Waste in the Balefill on a Periodic Basis	**Landfill Liner System**
Filling Cell with Waste Bales	
Permanent Cap Placed on the Filled Cell(s)	**Leachate Treatment System** **Landfill Liner System**
Building New Cells	**Landfill Liner System**
Leachate Collected and Pumped to Holding Pond	**Leachate Treatment System**
Treatment Process of Leachate	
Placement and Maintenance of Closure Cap	**Closure/Post-Closure** – at the pre-design stage, these project elements were grouped under this general hazard category.
Closure Cap – Surface Drainage System	
Water Monitoring System	**Landfill Liner System**

3.3 Hazard Identification – Waste Transfer Station

A summary of the primary project elements for the WTS that fall under the design, construction and operational categories are provided in **Table 3 –2**, which formed the basis for defining the Hazards in the BowTies.

Table 3-2: Cross Reference Waste Transfer Station Project Elements with Identified Hazards

List of Project Elements	Hazards used in BowTie
Design and Construction	
Pre-Engineered Steel Building	Waste Transfer Station (WTS) – at the pre-design stage, these project elements were grouped under this general hazard category.
Exterior Office/Trailer	
Scale House Kiosk	
Building Cooling System - under slab	
Water Monitoring System	
Water Tank and Septage Tank	
Fire Protection System	
Baling Equipment	
Shredder and Pelletizer	
Building Heating System	
Weigh Scale	
Household Hazardous Waste - Temporary Storage	
End of Life and Metal Logger (crushes metal in to a cube)	
Mechanical Ventilation	
Electrical Systems	
Communications/Alarm, Internet Systems	
Operations and Maintenance	
Collecting and Hauling Municipal Solid Waste and Cardboard to WTS	Waste Transfer Station (WTS) – at the pre-design stage, these project elements were grouped under this general hazard category.
Weighing Waste	
Shredding and Pelletizing Waste Wood and Cardboard	
Shredding and Baling Tires, Metal, and C&D Waste	
Delivering Waste to the Pre-Engineered Building for Temporary Storage	
Waste Delivered to Baling Unit	
Compressing Waste and Plastic Wrapping	
Transfer to Balefill	
Processing End of Life Vehicles	
Pelitized Wood and Cardboard Deliverd to Biomas Boiler	

4.0 Risk Assessment Results

4.1 Solid Waste Landfill

4.1.1 Development of Risk Events

Based on the Hazards identified in **Table 3 –1**, the following Risk Events (or Top Events using BowTie terminology) were identified (see **Table 4 –1**).

Table 4-1: List of Top Events – Solid Waste Landfill

List of Top Events - Landfill	Hazard	Rationale for Inclusion in FRA
Liner system failure	Landfill Liner System	The failure of the liner system is typically viewed as being a plausible "worst-case" scenario for the ongoing operation and management of solid waste landfills.
Not meeting regulatory requirement for discharge	Leachate Treatment System	There is a degree of uncertainty regarding the regulatory requirements that need to be met and the potential for discharge requirements to change over time.
Delay in regulatory approval of the Landfill	Landfill Liner System	There is a degree of uncertainty regarding the regulatory requirements that need to be met when it comes to the approval of the liner design. Given the lack of clarity, there is the risk of delays.
Not meeting regulatory approval requirements	Closure/Post-Closure	There is a degree of uncertainty regarding the regulatory requirements that need to be met and the potential for closure/post-closure requirements to change over time.

4.1.2 Findings – Top Events

A total of four BowTies were generated, one for each of the four Top Events, which are appended to the report (see **Appendix A**). Based on the analysis of both the Threats and the Consequences, the Total Risk Scores for each of the four Top Events are summarized in **Table 4 –2**.

Table 4-2: Summary of Total Risk Scores for Top Events – Solid Waste Landfill

Top Event – Solid Waste Landfill	Total Risk Score
Liner system failure	84
Not meeting regulatory requirement for discharge (Leachate Treatment System)	58
Delay in regulatory approval of the Landfill	44

Top Event – Solid Waste Landfill	Total Risk Score
Not meeting regulatory approval requirements (Closure/Post-Closure of the Landfill)	40
Total =	**226**

The highest risk to the design, construction, operation and closure/post-closure of the solid waste landfill is "Liner System Failure". Combined with the Top Event – *Delay in Regulatory Approval of Landfill* for the liner system, the highest overall risk for the solid waste Landfill is the liner system.

4.1.3 Findings – Consequences

A total of 10 individual Consequences were identified and analyzed based on the four Top Events that were identified. **Table 4 –3** shows these ranked in order of Total Risk Score, from highest to lowest. Three Consequences scored the highest, two of which are associated with the Top Event – *Liner System Failure*. The third Consequence – Contamination of Surface Water is associated with the Top Event – *Not Meeting Regulatory Requirement for Discharge* [Leachate Treatment System].

Table 4-3: Summary of Risk Scores per Consequence – Solid Waste Landfill

Consequences	Reputation or image	Financial Loss (Capital)	Financial Loss (Operational)	Environment	Business Interruption /Level of Service	Legal	Total Risk Score
Active layer water contamination	6	6	6	6	6		30
Leachate bypasses the monitoring system	6	6	6	6	6		30
Contamination of surface water	6	6	6	6	6		30
Additional leachate treatment and monitoring required	4	6	6	6	6		28
Regulatory intervention	6	6	6		6		24
Delays in construction	9	9				6	24
Contamination of surface water and active water	4	6	6	4			20
Modifications to existing leachate treatment system	4	6	6	4			20
Need to redesign (Liner System)	6	6					12
Need to divert waste to existing landfill	8						8
Grand Total	**59**	**57**	**42**	**32**	**30**	**6**	**226**

The Risk Receptor that had the greatest influence on the Risk Profile for the solid waste Landfill is "Reputation or Image", followed closely by Financial Loss (Capital). This reflects the greatest exposure to the City, as it applied to all 10 Consequences. No exposure to "Public and Employee Safety" over and above what would be considered an inherent risk to operating a solid waste Landfill was identified.

4.2 Waste Transfer Facility

4.2.1 Development of Risk Events

Based on the Hazards identified in **Table 2**, the following Risk Events (or Top Events using BowTie terminology) were identified (see **Table 4 –4**).

Table 4-4: List of Top Events – Waste Transfer Station

List of Top Events - WTS	Hazard	Rationale for Inclusion in FRA
Unintentional Interaction between People, Equipment and Waste	WTS	Concentration of mobile equipment, stationary equipment and employees within the main building presents a safety risk.
Equipment Failure	WTS	Given the remoteness of Iqaluit and ability to mobilize equipment, there are challenges to ensure level of service and operational readiness is maintained.
Foundation Issues	WTS	Due to the structural requirements for the foundation to support the equipment combined with the geotechnical and permafrost challenges, there are unique risks and challenges to designing and constructing the foundation.

4.2.2 Findings – Top Events

A total of three BowTies were generated, one for each of the three Top Events, which are appended to the report (see **Appendix B**). Based on the analysis of both the Threats and the Consequences, the Total Risk Scores for each of the three Top Events are summarized in **Table 4 –5**.

Table 4-5: Summary of Total Risk Scores for Top Events – Waste Transfer Station

Top Event – WTS	Total Risk Score
Unintentional Interaction between People, Equipment and Waste	102
Equipment Failure	64
Foundation Issues	61
Total =	227

The highest risk to the design, construction and operation of the WTS is "Unintentional Interaction between People, Equipment and Waste".

4.2.3 Findings – Consequences

A total of four individual Consequences were identified and analyzed based on the three Top Events that were identified, ranked in order of Total Risk Score, from highest to lowest in **Table 4 –6**. One Consequence (Facility Shutdown) scored the highest.

Table 4-6: Summary of Risk Scores per Consequence – Waste Transfer Station

Consequences	Business Interruption/ Level of Service	Reputation or image	Legal	Financial Loss (Operational)	Public & Employee Safety	Financial Loss (Capital)	Environment	Total Risk Score
Facility Shutdown	28	18	19	18	8	14	8	113
Injury/Fatality	12	15	15	6	15			63
Direct Waste to Landfill	8	8		8			4	28
Building Replacement	5	5	5	4		4		23
Grand Total	53	46	39	36	23	18	12	227

The Risk Receptor that had the greatest influence on the Risk Profile for the WTS is “Business Interruption/Level of Service", followed closely by “Reputation or Image”. This reflects the greatest exposure to the City, as it applied to all four Consequences. However, “Financial Loss (Operational)” is also applicable to all four Top Events.

4.3 Common Hazards for Solid Waste Landfill and Waste Transfer Station

4.3.1 Development of Risk Events

Four common Top Events were identified (see **Table 4 –7**) to both the solid waste Landfill and the WTS; therefore, they were grouped together and analyzed.

Table 4-7: List of Top Events – Common Hazards for Solid Waste Landfill and Waste Transfer Station

List of Top Events	Rationale for Inclusion in FRA
Fire	The final facility must minimize the chances of fires. Based on historic challenges at the City’s existing disposal site, fire management is a concern.
Vectors and Wildlife Nuisance	Vectors and wildlife nuisances are ongoing challenges and the risk associated with them need to be properly identified, analyzed, and mitigated within the design, construction, and operation of both the Landfill and the WTS.
Litter/Unmanaged Debris	Buffer zones and litter/debris management are critical elements within the closure and decommissioning plan for the Landfill, but also an operational risk for both the Landfill and the WTS.
Unacceptable Off-Site Odour	Sensitivity of Iqaluit residents to odours is a risk that needs to be mitigated.

4.3.2 Findings – Top Events

A total of four BowTies were generated, one for each of the four Top Events, which are appended to the report (see **Appendix C**). Based on the analysis of both the Threats and the Consequences, the Total Risk Scores for each of the four Top Events are summarized in **Table 4 –8**.

Table 4-8: Summary of Total Risk Scores for Top Events – Solid Waste Landfill/Waste Transfer Station

Top Event	Total Risk Score
Fire	228
Vectors and Wildlife Nuisance	119
Litter/Unmanaged Debris	90
Unacceptable Off Site Odour	58
Total =	**495**

The highest risk is associated with Fires, followed by Vectors and Wildlife Nuisance.

4.3.3 Findings – Consequences

A total of nine individual Consequences were identified and analyzed based on the four Top Events that were identified. **Table 4 –9** shows these ranked in order of Total Risk Score, from highest to lowest. One Consequence (Injury/Fatality) was ranked the highest.

Table 4-9: Summary of Risk Scores per Consequence – Waste Transfer Station/Solid Waste Landfill

Consequences	Reputation or image	Financial Loss (Operational)	Legal	Business Interruption /Level of Service	Financial Loss (Capital)	Environment	Public & Employee Safety	Total Risk Score
Injury/Fatality	30	10	25	20			25	110
Resident Complaints	45	10	16			15	5	91
Regulatory Intervention	19	16	15		15	6		71
LF Liner Damage	12	9	6	9	9	9		54
Facility Shutdown	15	12		12				39
Equipment Damage	9	9		9	9			36
Building Damage	9	9		9	9			36

Consequences	Reputation or image	Financial Loss (Operational)	Legal	Business Interruption /Level of Service	Financial Loss (Capital)	Environment	Public & Employee Safety	Total Risk Score
Unknown Waste Material Requiring Management		10	10	5		5	5	35
Damage to Leachate Management System	3	6		2	6	6		23
Grand Total	142	91	72	66	48	41	35	495

The Risk Receptor that had the greatest influence on the Risk Profile is “Reputation or Image”, even though it only applies to seven of the nine Consequences.

5.0 Risk Management Plan

In order to develop a robust Risk Management Plan, the outputs from the BowTies were analyzed based on the preventative and response barriers that were identified for the Threats and Consequences. The idea is to determine which barriers are referenced and utilized to most often. The top three specific risk management measures for the solid waste Landfill, WTS and combined WTS/solid waste Landfill are provided in **Table 5 –1**.

Table 5-1: Top 3 Specific Risk Management Measures – By Hazard/Top Event

Risk Management Measures	Hazard/Top Event
Solid Waste Landfill	
Proactive communication with regulators	• Closure/Post-Closure/Not meeting regulatory approval requirements • Landfill Liner System/Liner system failure • Landfill Liner System-Design/Delay in regulatory approval of the Landfill • Leachate Treatment system/Not meeting regulatory requirement for discharge
Incorporate climate change in design criteria	• Closure/Post-Closure/Not meeting regulatory approval requirements • Leachate Treatment system/Not meeting regulatory requirement for discharge
Installation of groundwater treatment system, enhanced groundwater monitoring system & additional safety considerations in design.	• Closure/Post-Closure/Not meeting regulatory approval requirements • Landfill Liner System/Liner system failure • Leachate Treatment system/Not meeting regulatory requirement for discharge
Waste Transfer Station	
Additional spare parts	• WTS/Equipment failure
Routine Maintenance	• WTS/Equipment failure
O&M Procedures & Isolation from the Public	• WTS/Unintentional interaction between people, equipment, and waste
Waste Transfer Station/Solid Waste Landfill	
Divert waste to the existing landfill	• LF/WTS/Fire
Proactive communication with regulators	• LF/WTS/Litter/Unmanaged debris • LF/WTS/Unacceptable off site odour • LF/WTS/Vectors and wildlife nuisance
Establish a citizens liaison committee	• LF/WTS/Litter/Unmanaged debris • LF/WTS/Unacceptable off site odour • LF/WTS/Vectors and wildlife nuisance

A summary of all specific risk management measures is presented in **Tables 5 –2** to **5 –4**, ranked in order of importance based on the number of times it is referenced in the individual BowTies.

Table 5-2: List of Risk Management Measures - Solid Waste Landfill

List of Specific Risk Management Measures	Preventative Barrier No. of Times Referenced	Response Barrier No. of Times Referenced	Total
Proactive communication with regulators	2	7	9
Incorporate climate change in design criteria	3		3
Installation of a ground water treatment system		2	2
Enhanced ground water monitoring system		2	2
Additional safety considerations in design	1	1	2
Additional research	1		1
Define operations process	1		1
Initial placement of bales	1		1
Design considerations for permafrost	1		1
Surcharge new cells with bales during winter	1		1
Additional safety considerations in treatment system design	1		1
Animal control procedures	1		1
Installation QA/QC	1		1
C&D waste handling procedure	1		1
QA/QC definition in contract	1		1
Site security measures	1		1
O&M procedures	1		1
Fire response plan	1		1
Regular inspection of cap	1		1
Geotechnical investigation		1	1
Structural reinforcement of liner design	1		1
Geothermal analysis	1		1
Waste inspection procedures	1		1
Ground water monitoring system		1	1
Include surface water diversion elements in the Landfill design	1		1
Grand Total	**24**	**14**	**38**

Table 5-3: List of Risk Management Measures – Waste Transfer Station

Row Labels	Preventative Barrier No. of Times Referenced	Response Barrier No. of Times Referenced	Total
Adequate spare parts	3		3
Routine maintenance	3		3
O&M procedures	2		2
Isolation from the public	2		2
Backup oil-fired boiler	1		1
Design consideration for insulation to handle heat from concrete	1		1
Capacity to be considered in design	1		1
Design of site traffic flow	1		1
Identification of design modification opportunities	1		1
Direct delivery to the Landfill		1	1
Mitigative procedures considered in design	1		1
Discontinue collection		1	1
Public education campaign	1		1
Regular inspection	1		1
Waste inspection procedures	1		1
Extended operation time	1		1
Life expectancy considered in design	1		1
H&S plan		1	1
Having H&S equipment in place		1	1
Grand Total	**21**	**4**	**25**

Table 5-4: List of Risk Management Measures – Waste Transfer Station/Solid Waste Landfill

Row Labels	Preventative Barrier No. of Times Referenced	Response Barrier No. of Times Referenced	Total
Divert waste to the existing the Landfill		3	3
Proactive communication with regulators		3	3
Establish a citizens liaison committee		3	3
Personnel training	2		2

Row Labels	Preventative Barrier No. of Times Referenced	Response Barrier No. of Times Referenced	Total
On-site extinguishers	2		2
H&S plan		2	2
Waste inspection procedures	2		2
Fire response plan	2		2
Define operations process	2		2
Provide dumpster at the WTS gate for after hours delivery	1		1
Installation of a landfill gas management system	1		1
Site security measures	1		1
Waste segregation covering procedures	1		1
Direct delivery to the Landfill	1		1
Modifying leachate management system	1		1
Repair liner (as practical)		1	1
Fencing	1		1
Standing contract with hazardous waste management firm		1	1
Ongoing litter collection program		1	1
Installation of bird control features	1		1
Equipment maintenance schedule	1		1
LF inspection and maintenance protocols	1		1
Grand Total	**20**	**14**	**34**

6.0 Conclusions

6.1 Conclusions – Top Events

The highest overall risk is operational-based associated with the management of Fire, Vectors and Wildlife Nuisance, as shown in **Table6 – 1**. More specifically for the WTS, the highest risk is safety – Unintentional Interaction between People, Equipment and Waste. More specifically for the Landfill, the highest risk is Liner System Failure.

Table 6-1: Ranking of Top Events based on Total Risk Score

Top Events	Total Risk Score
Fire (at the solid waste Landfill and WTS)	228
Vectors and wildlife nuisance (at the solid waste Landfill and WTS)	119
Unintentional interaction between people, equipment, and waste (at the WTS)	102
Litter/Unmanaged debris (at the solid waste Landfill and WTS)	90
Liner system failure (at the solid waste Landfill)	84
Equipment failure (at the WTS)	64
Foundation issues (at the WTS)	61
Unacceptable off-site odour (at the solid waste Landfill and WTS)	58
Not meeting regulatory requirement for discharge (at the solid waste Landfill)	58
Delay in regulatory approval of the Landfill	44
Not meeting regulatory approval requirements (closure/post-closure)	40

6.2 Conclusions – Consequences

As shown in **Table 6 –2**, the highest risk to the City, from a Consequence perspective is "Injury/Fatality" followed by "Facility Shutdown", driven by the following Top Events:

- Injury/Fatality
  - Top Event – Unintentional interaction between people, equipment, and waste
  - Top Event – Fire
  - Top Event – Vectors and Wildlife Nuisance
- Facility Shutdown
  - Top Event – Unintentional interaction between people, equipment, and waste
  - Top Event – Fire
  - Top Event – Foundation Issues
  - Equipment Failure

Table 6-2: Ranking of Consequences by Total Risk Score

Consequences	Total Risk Score
Injury/Fatality	173
Facility shutdown	152
Regulatory intervention	95
Resident complaints	91
LF liner damage	54
Building damage	36
Equipment damage	36
Unknown waste material requiring management	35
Leachate bypasses the monitoring system	30
Active layer water contamination	30
Contamination of surface water	30
Direct waste to the Landfill	28
Additional leachate treatment and monitoring required	28
Delays in construction	24
Damage to leachate management system	23
Building replacement	23
Contamination of surface water and active water	20
Modifications to existing leachate treatment system	20
Need to redesign	12
Need to divert waste to the existing Landfill	8
Grand Total	**948**

6.3 Conclusions – Risk Criteria

Based on the individual Risk Scores per Consequence category, the risk profile for the City is outlined in this section. It needs to be kept in mind that the Risk Scores take into consideration the existing and proposed specific Risk Management measures; therefore, the Risk Scores reflect the remaining "Residual Risks" that the City can utilize to determine appropriate risk acceptance levels going forward.

Public and Employee Safety – is ranked "Medium", mainly driven by:

- Serious injury to a fatality due to close proximity of employees with mobile and fixed equipment at the WTS.
- Public safety risk at the solid waste Landfill due to litter and debris issues.
- Fire at either the WTS or the solid waste Landfill.

Financial Loss (Capital) – is ranked "Medium", mainly driven by:

- Potential for delay in regulatory approval of liner system design.
- Equipment failure at the WTS and delays in getting spare parts.
- Fire at either the WTS or the solid waste Landfill.

Financial Loss (Operational) – is ranked "Medium", mainly driven by:

- Equipment failure at the WTS and delays in getting spare parts.
- Odour and litter complaints by residents.
- Fire at either the WTS or the solid waste Landfill.

Reputation or Image – is ranked "Medium", mainly driven by:

- Equipment failure at the WTS and delays in getting spare parts.
- Potential for delay in regulatory approval of liner system design.
- Regulatory intervention to address unacceptable off site odours at either the WTS or the solid waste Landfill.

Business Interruption/Level of Service – is ranked "Medium", mainly driven by:

- Equipment failure at the WTS and delays in getting spare parts.
- Foundation issues resulting in the WTS building being replaced.
- Fire at either the WTS or the solid waste Landfill.

Environmental – is ranked "Low", mainly driven by:

- Fire resulting in damage to the liner system.
- Failure in the liner system.
- Discharge requirements not being met at the leachate treatment system.

Legal – is ranked "Medium", mainly driven by:

- Serious injury to a fatality due to close proximity of employees with mobile and fixed equipment at the WTS.
- Fire resulting in serious injury or fatality at either the WTS or the solid waste Landfill.

6.4 Conclusions – Technical Risk

Based on the current 30% design of the solid waste Landfill and the WTS, the Technical Risks range between "Significant" to "Serious" due to the following:

- Limited regulatory direction and/or relevant precedent facilities in arctic climates to support the definition of landfill liner and leachate treatment system design requirements.
- Uncertain impacts (e.g., reduction and/or delay) to the generation of landfill gas and leachate due to the wrapping of solid waste bales with plastic prior to placement in the landfill, as well as potential migration of permafrost into the placed waste mass.

- Challenges designing the landfill liner foundation given uncertain future interactions with underlying permafrost (e.g., migration into the waste mass or heating/melting by the decomposing waste mass).
- Uncertainties associated with climate change, with noted emphasis on the melting of permafrost and resulting impacts to Landfill and WTS stability.

Appendix A

BowTies – Solid Waste Landfill

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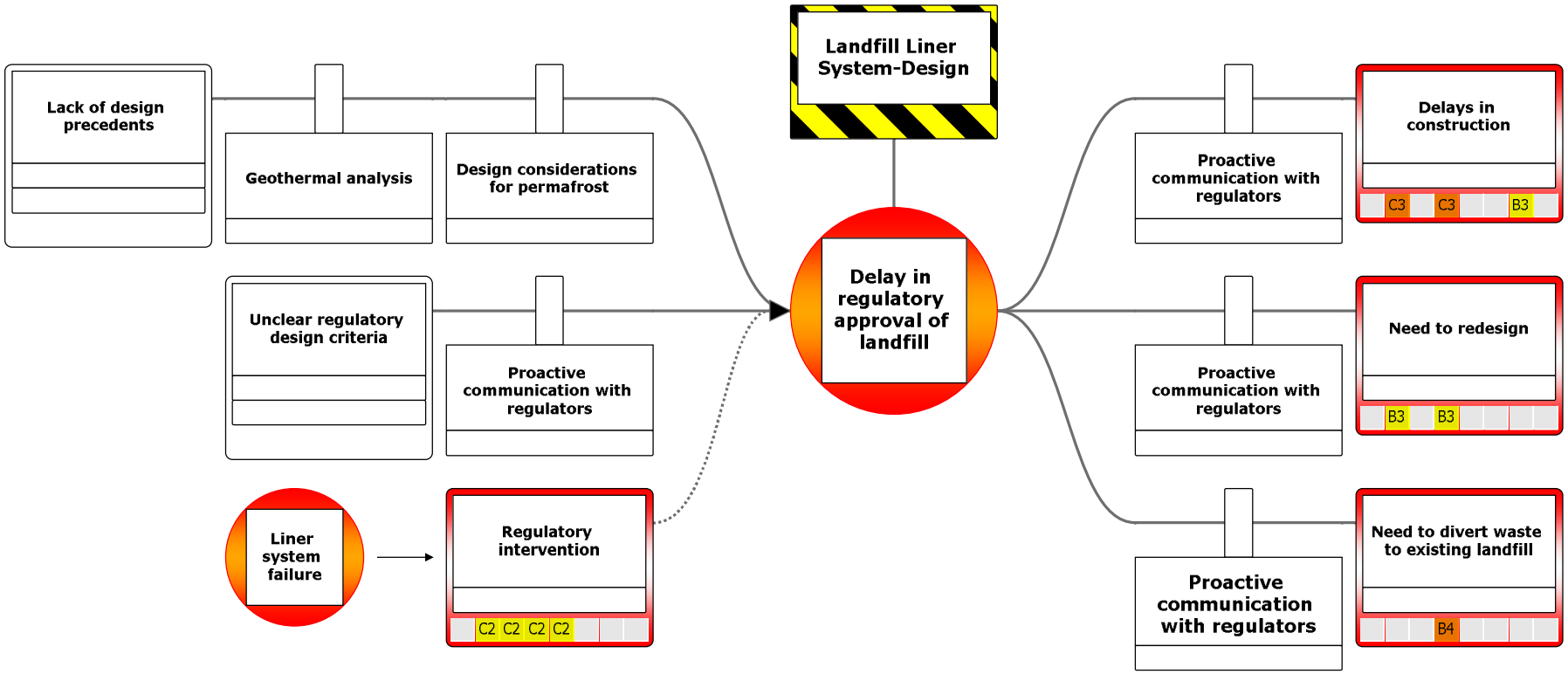
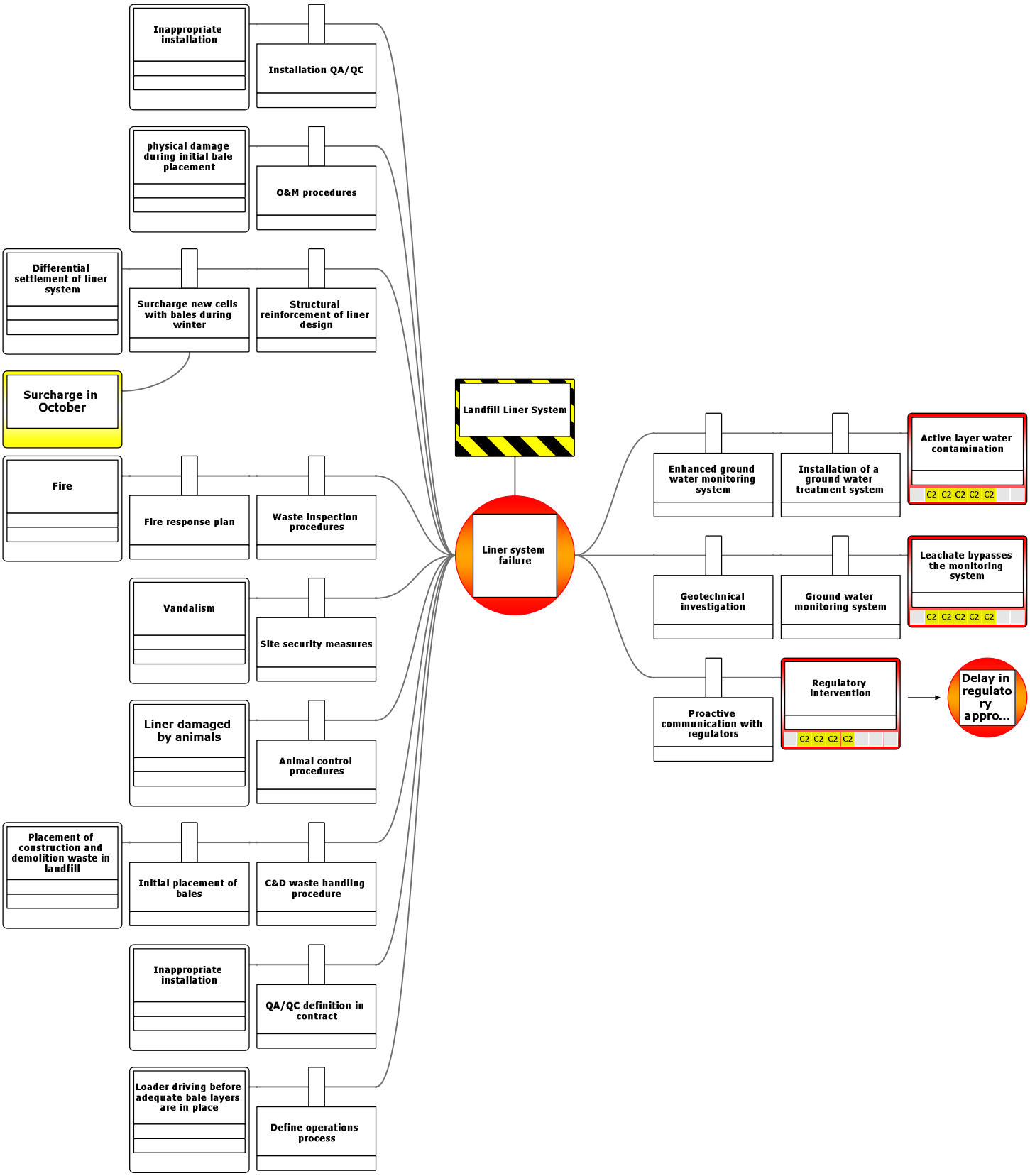
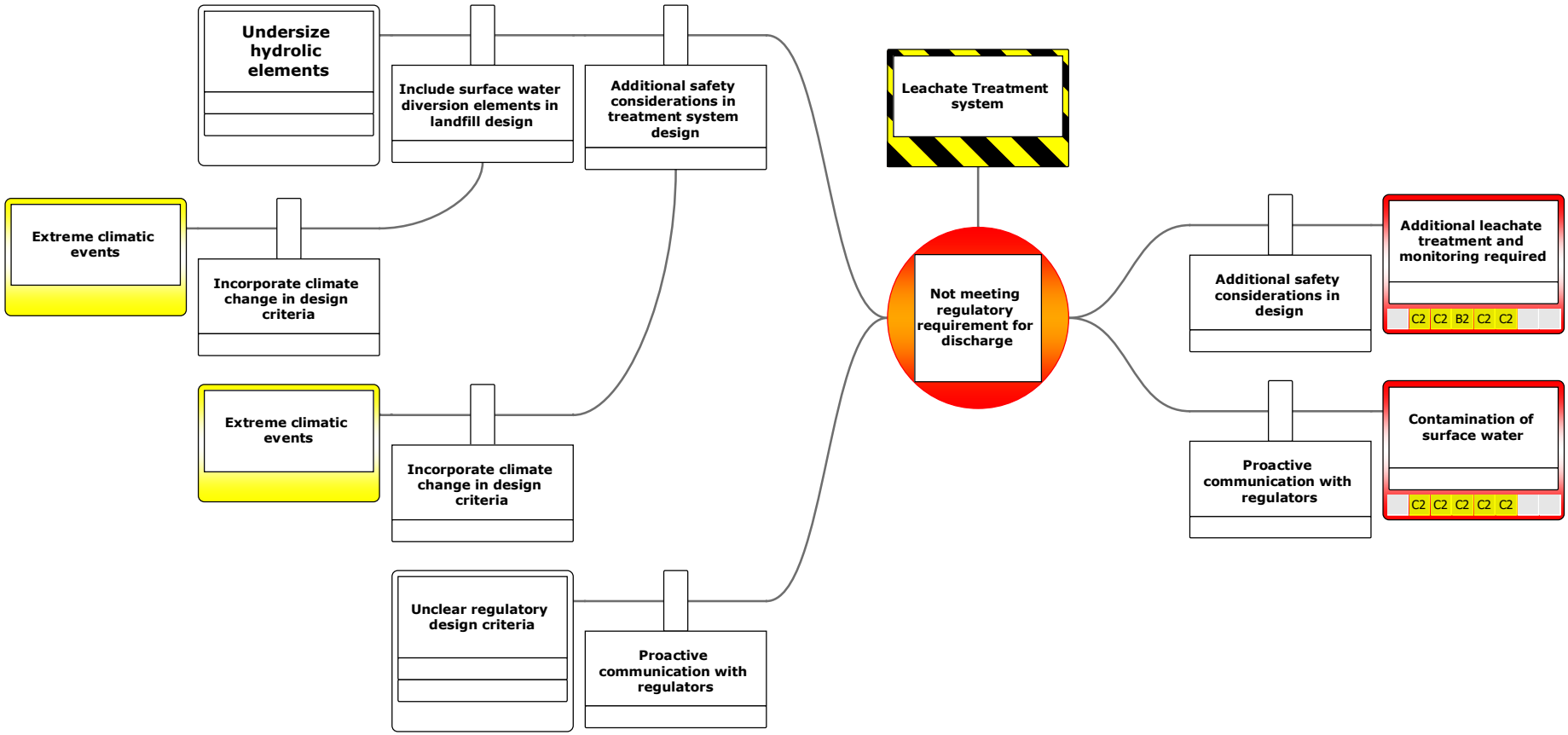
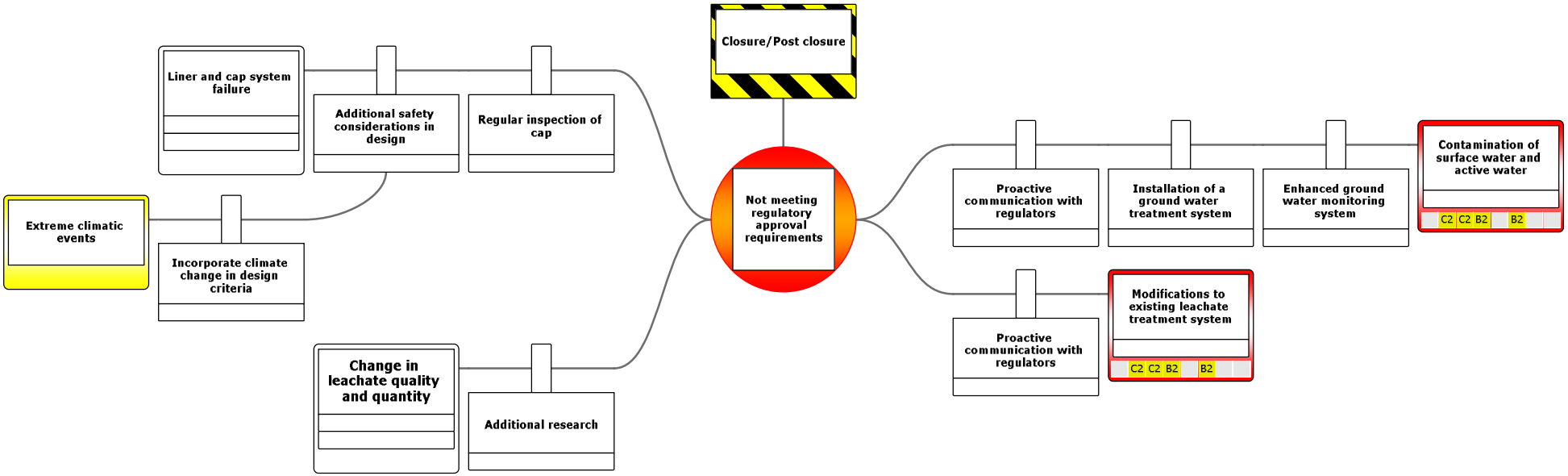
Bowties – Solid Waste Landfill




Landfill Liner System
Liner system failure
Inappropriate installation
Installation QA/QC
physical damage during initial bale placement
O&M procedures
Differential settlement of liner system
Surcharge new cells with bales during winter
Structural reinforcement of liner design
Surcharge in October
Fire
Fire response plan
Waste inspection procedures
Vandalism
Site security measures
Liner damaged by animals
Animal control procedures
Placement of construction and demolition waste in landfill
Initial placement of bales
C&D waste handling procedure
Inappropriate installation
QA/QC definition in contract
Loader driving before adequate bale layers are in place
Define operations process
Enhanced ground water monitoring system
Installation of a ground water treatment system
Active layer water contamination
C2 C2 C2 C2 C2
Geotechnical investigation
Ground water monitoring system
Leachate bypasses the monitoring system
C2 C2 C2 C2 C2
Proactive communication with regulators
Regulatory intervention
C2 C2 C2 C2
Delay in regulatory appro...


Undersize hydrolic elements
Include surface water diversion elements in landfill design
Additional safety considerations in treatment system design
Leachate Treatment system
Extreme climatic events
Incorporate climate change in design criteria
Not meeting regulatory requirement for discharge
Additional safety considerations in design
Additional leachate treatment and monitoring required
C2 C2 B2 C2 C2
Extreme climatic events
Incorporate climate change in design criteria
Proactive communication with regulators
Contamination of surface water
C2 C2 C2 C2 C2
Unclear regulatory design criteria
Proactive communication with regulators


Closure/Post closure
Liner and cap system failure
Additional safety considerations in design
Regular inspection of cap
Extreme climatic events
Incorporate climate change in design criteria
Change in leachate quality and quantity
Additional research
Not meeting regulatory approval requirements
Proactive communication with regulators
Installation of a ground water treatment system
Enhanced ground water monitoring system
Contamination of surface water and active water
C2 C2 B2 B2
Proactive communication with regulators
Modifications to existing leachate treatment system
C2 C2 B2 B2

Appendix B

BowTies – Waste Transfer Station

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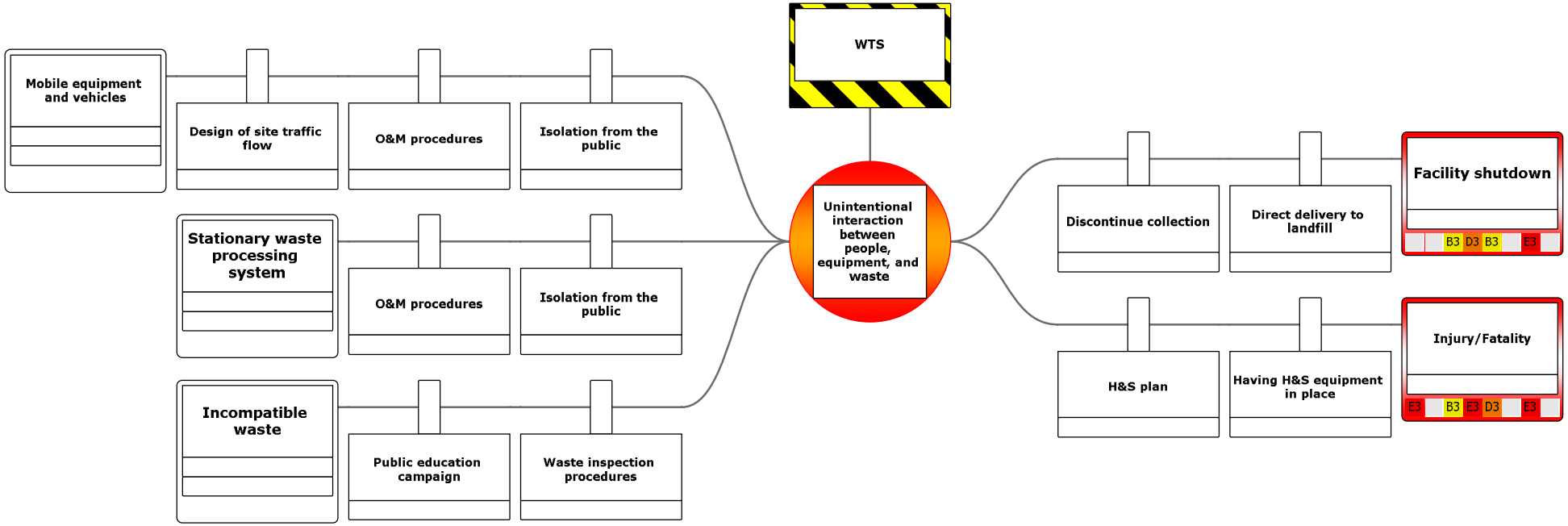
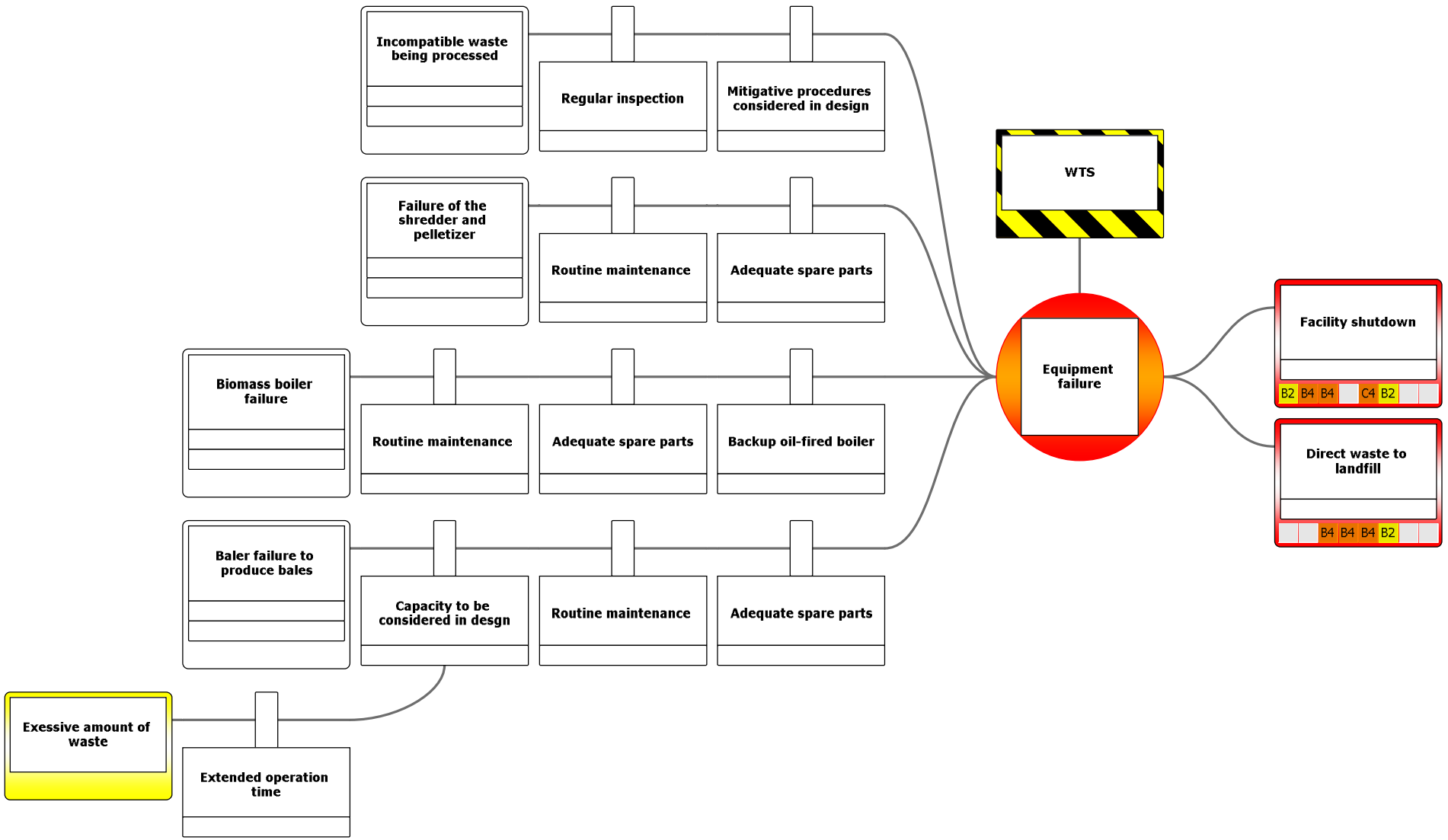
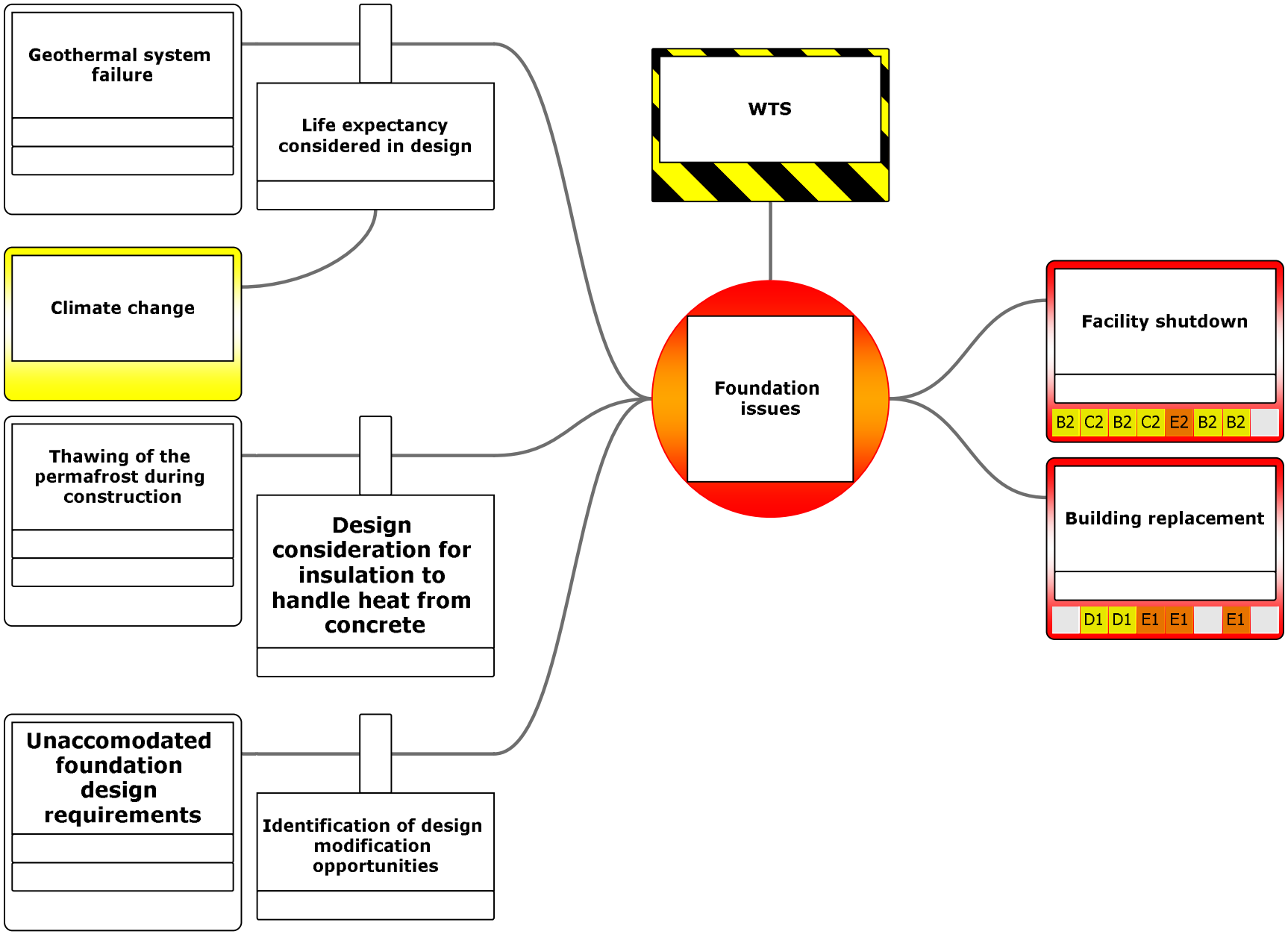
Bowties – Waste Transfer Station




Incompatible waste being processed
Regular inspection
Mitigative procedures considered in design
Failure of the shredder and pelletizer
Routine maintenance
Adequate spare parts
Biomass boiler failure
Routine maintenance
Adequate spare parts
Backup oil-fired boiler
Baler failure to produce bales
Capacity to be considered in desgn
Routine maintenance
Adequate spare parts
Exessive amount of waste
Extended operation time
WTS
Equipment failure
Facility shutdown
B2 B4 B4 C4 B2
Direct waste to landfill
B4 B4 B4 B2


Geothermal system failure
Life expectancy considered in design
Climate change
WTS
Thawing of the permafrost during construction
Design consideration for insulation to handle heat from concrete
Foundation issues
Facility shutdown
B2 C2 B2 C2 E2 B2 B2
Building replacement
D1 D1 E1 E1 E1
Unaccomodated foundation design requirements
Identification of design modification opportunities

Appendix C

BowTies – Common Hazards for Solid Waste Landfill and Waste Transfer Station

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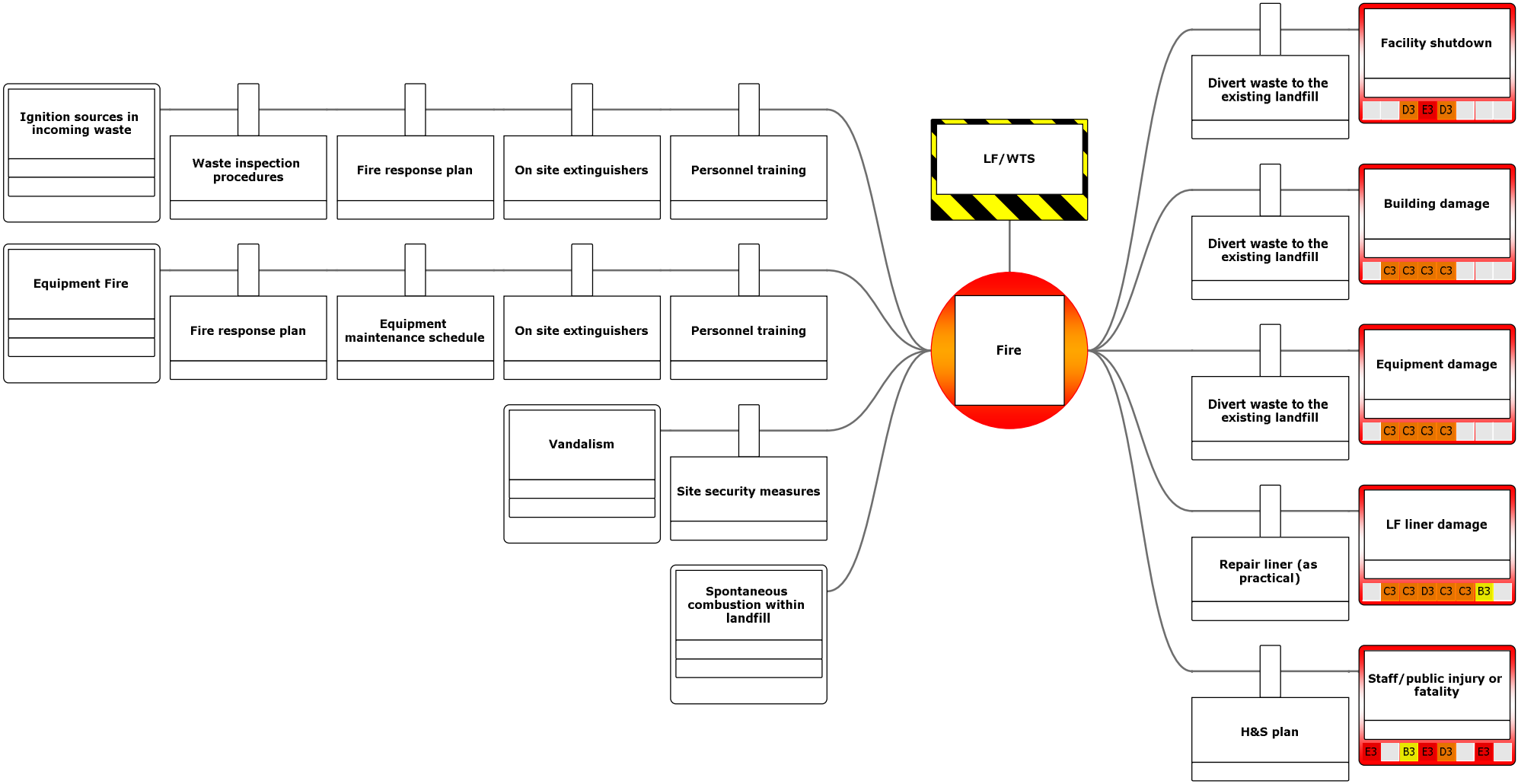
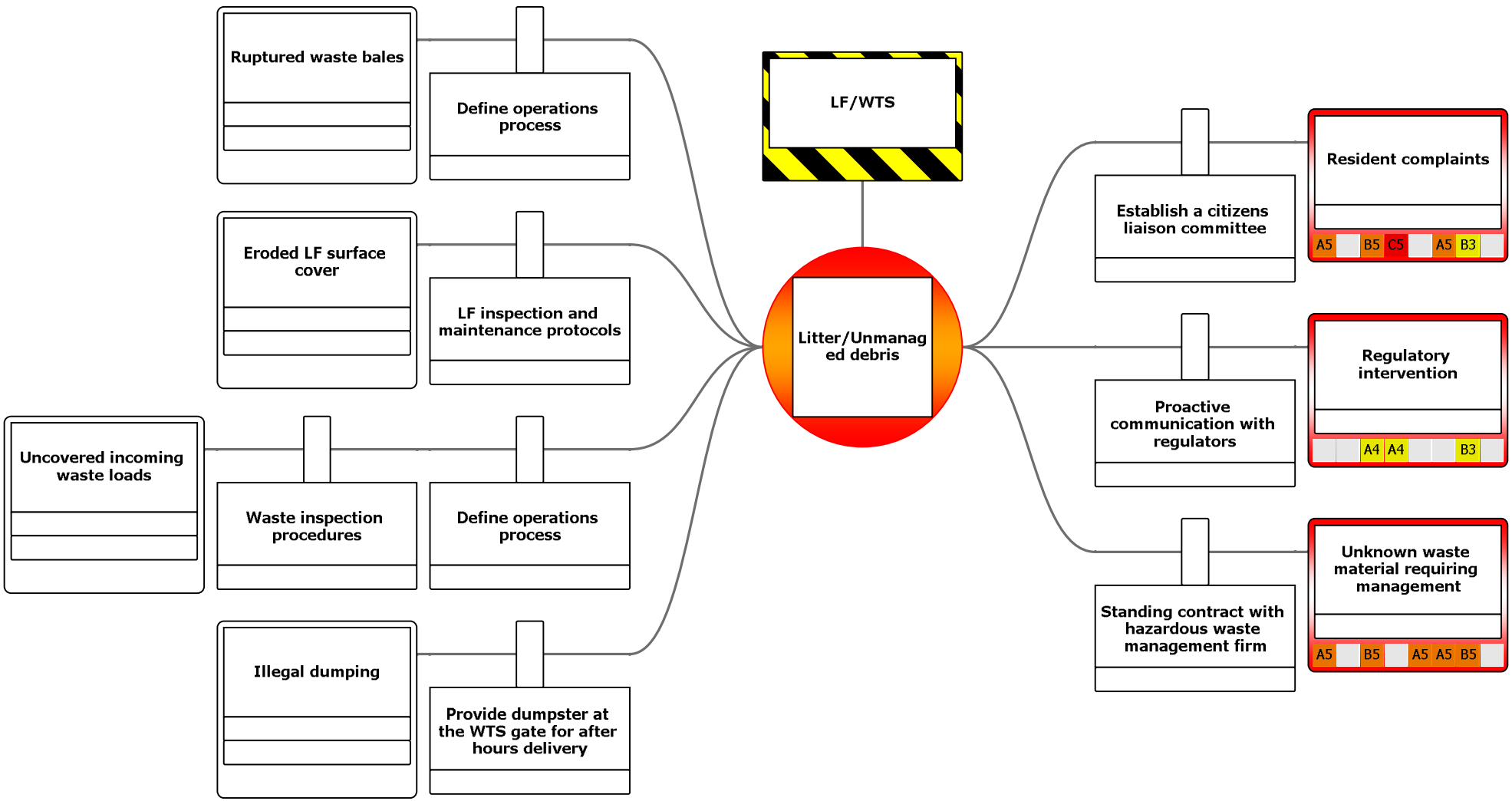
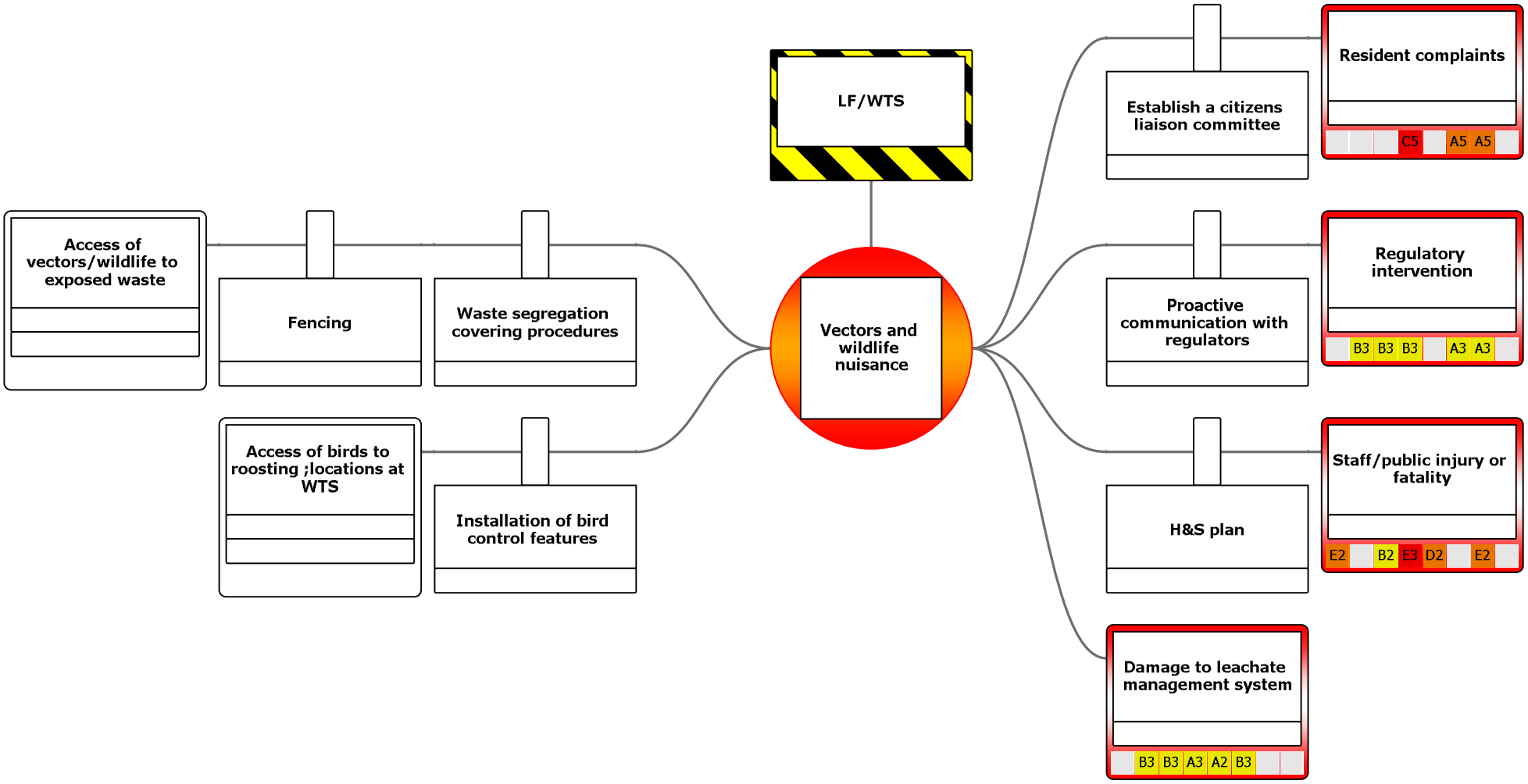
BowTies – Common Hazards for Solid Waste Landfill




LF/WTS
Litter/Unmanaged debris
Ruptured waste bales
Define operations process
Eroded LF surface cover
LF inspection and maintenance protocols
Uncovered incoming waste loads
Waste inspection procedures
Define operations process
Illegal dumping
Provide dumpster at the WTS gate for after hours delivery
Establish a citizens liaison committee
Resident complaints
A5 B5 C5 A5 B3
Proactive communication with regulators
Regulatory intervention
A4 A4 B3
Standing contract with hazardous waste management firm
Unknown waste material requiring management
A5 B5 A5 A5 B5


LF/WTS
Vectors and wildlife nuisance
Access of vectors/wildlife to exposed waste
Fencing
Waste segregation covering procedures
Access of birds to roosting ;locations at WTS
Installation of bird control features
Establish a citizens liaison committee
Resident complaints
C5 A5 A5
Proactive communication with regulators
Regulatory intervention
B3 B3 B3 A3 A3
H&S plan
Staff/public injury or fatality
E2 B2 E3 D2 E2
Damage to leachate management system
B3 B3 A3 A2 B3

Appendix H

Investing in Canada Infrastructure Program Reports

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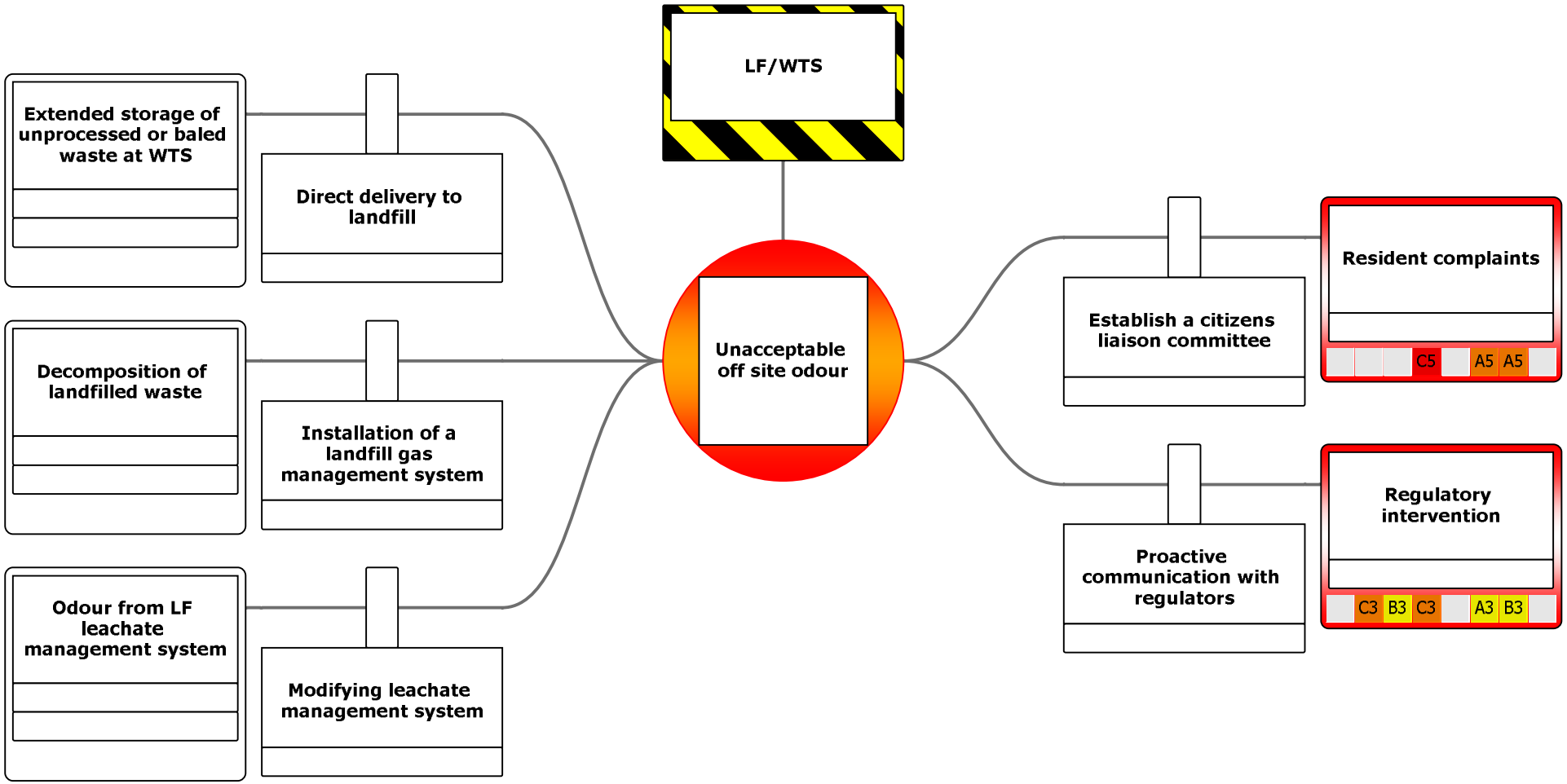
LF/WTS
Extended storage of unprocessed or baled waste at WTS
Direct delivery to landfill
Decomposition of landfilled waste
Installation of a landfill gas management system
Odour from LF leachate management system
Modifying leachate management system
Unacceptable off site odour
Establish a citizens liaison committee
Resident complaints
C5
A5
A5
Proactive communication with regulators
Regulatory intervention
C3
B3
C3
A3
B3

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CITY OF IQALUIT

Climate Change Resilience Assessment Investing in Canada Infrastructure Program (Draft)

Landfill and Waste Transfer System

May 2019

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Appendices

Attestation of Completeness

I/we the undersigned attest that this Resilience Assessment was undertaken using recognized assessment tools and approaches (i.e., ISO 31000:2009 Risk Management—Principles and Guidelines) and complies with the General Guidance and any relevant sector-specific technical guidance issued by Infrastructure Canada for use under the Climate Lens.

Prepared by: _____ _____

[Name and credentials] [Date]

Validated by*: _____ _____

[Name and credentials] [Date]

*Resilience Assessment must be prepared, or at a minimum validated by, a licenced professional engineer, certified planner, or appropriately specialized biologist or hydrologist.

1.0 Introduction

The City of Iqaluit recently underwent a procurement process for the design of a new landfill and transfer station (the Project), as the existing landfill is nearing full capacity. The Project will include the construction of a new landfill, including new access to the location, a new recycling and eco-centre, an area for the future construction of a composting facility, new methods of waste collection and a leachate collection and treatment system. The Project is being designed with a 75 year service life.

The landfill site is located approximately 8 km northwest of the City of Iqaluit and occupies an approximate area of 19 hectares. Access to the landfill will be via a new road to the location.

The waste transfer station is located at the end of Kakivak Court cul-de-sac. The site will comprise of an office building (i.e., portable trailer), a scale kiosk, a large waste packaging and transfer station, and shipping container to hold hazardous waste.

A constructed lagoon made up of a two holding ponds in series will receive pumped leachate from the landfill collection system. The lagoon will serve to store leachate that is pumped out from the landfill to provide biological treatment before discharging to an engineered wetland area downstream. In the wetland, native plants will provide a surface for biofilm to grow, which filters the water naturally as semi-treated leachate passes through it. An area of approximately 2.5 ha for the lagoon holding ponds and wetland is anticipated to be used.

A screening-level climate change resilience assessment was conducted on the development area to determine climate change related impacts on the project infrastructure and develop potential resilience options. The following sections outline, in detail, the risks identified, the climate change hazards that exacerbate these risks, and possible mitigation measures.

2.0 Methodology

The methodology employed follows the approach described in Section 3 and Annex G of the Climate Lens General Guidance Document issued by Infrastructure Canada. The methodology and associated details are provided in the following sub-sections.

2.1 Scope and Timescale of Assessment

The assessment focused mainly on the infrastructure and assets related to the construction of the new landfill. The Project was assessed for the 75 year service life, although climate change impacts were assessed at two timeframes, specifically for the years 2050 and 2100.

2.2 Data Gathering

Infrastructure data was initially gathered based on the preliminary design during project conceptualization, and then further refined as the detailed design progressed. Assets and specific components were then divided into categories, which helped to guide the resilience assessment. The following categories and associated asset components are listed in **Table 1**, below.

Table 1: Infrastructure and Asset Component by Category

General Category	Specific Category	Asset Component
Landfill	Liner and Cover	• HDPE membrane liner • Geotextile liner • Granular fill • LDPE membrane cap • Geotextile cap
	Conveyance	• Leachate collection manholes • Leachate collection piping • Storm water culverts • Leachate pumping equipment
	Asphalt Surfaces	• Roadways • Parking lots
	Treatment Elements	• Lagoon (holding ponds) • Engineered wetland • Leachate pumping equipment

General Category	Specific Category	Asset Component
Equipment	Scale	• Concrete ramp with foundation/slab • Scale deck • Load cells
	Equipment	• Baler • Wrapper • Car crusher • Shredder • Pelletizer • Pellet furnace
Building Foundation	Concrete slab	• Scale deck and scale kiosk • Transfer station building
	Gravel pad	• Hazardous waste shipping container • Office building (trailer) • Attendant's kiosk
Building siding	Metal liner panel and pre-finished metal siding	• Transfer station building
	Metal siding	• Office building (trailer) • Scale kiosk • Attendant's kiosk
	Shipping container	• Hazardous waste shipping container
Metal roof	Metal panel roof	• Transfer station • Scale kiosk • Office building (trailer) • Attendant's kiosk
Electrical components	Wiring and outlets Communication equipment	• Transfer station building • Office building (trailer) • Scale kiosk • Hazardous waste storage shipping container
Mechanical components	HVAC Plumbing	• Transfer station building • Office building (trailer) • Scale kiosk • Hazardous waste storage shipping container

2.3 Climate Risk Assessment

The following sections outline the methodology used in identifying climate change risks as related to The Project infrastructure. The vulnerability assessment encompasses the following steps:

1. Identification and Assessment of Climate Hazards;
2. Identification of Impacts on the Asset; and
3. Definition of Consequences of the Impacts.

This section also includes the methodology used to analyze the risk by incorporating likelihood and severity ratings into the assessment. Likelihood ratings were applied during the identification of the impacts on the asset, and severity ratings were identified during the definition of consequences of the impacts.

2.3.1 Identification and Assessment of Climate Hazards

Through the use of Environment Canada's Climate Data Viewer and the Climate Atlas of Canada, climate data was collected for the City of Iqaluit. Observed historical climate data was assembled from the Climate Atlas of Canada for the years between 1950 and 2005 and from Environment Canada's Climate Data Viewer for the years between 1971 and 2000. Climate change projections for the City of Iqaluit were created for the time period between 2021-2100 using an ensemble of Global Climate Models (GCM). Climate change projections were collected for two emission scenarios, the RCP 4.5 and RCP 8.5, however only the projections from the RCP 8.5 scenario was used for this analysis, as it can be considered to be a more conservative scenario.

From the data available for the area, select climate parameters were identified to represent the Climate Hazards. The climate parameters identified are:

- changing temperatures (high and low);
- changing precipitation;
- snow depth;
- freeze-thaw cycles;
- high winds; and
- permafrost melt.

The following sub sections present the specific climate change data used for the resilience analysis.

2.3.1.1 Changing Temperatures (high and low)

High and low temperatures in Iqaluit are predicted to change throughout the lifespan of The Project. An increase in high annual temperatures and a decrease in low annual temperatures, on average, are expected in the future.

Low Temperatures

Very Cold Days are defined as the average number of days in a year when the temperature is below -30°C. The Minimum Temperature variable is the minimum temperature of the day, averaged over the year for the historic timescale, while the Coldest Minimum Temperature variable is the coldest temperature of the year, averaged over the timescale (i.e., historic); these variables are recoded in degrees Celsius (°C). Frost Days are the number of days in a year where the temperature is measured to be below 0 °C, while Icing Days are the number of days in a year where the temperature does not go above 0 °C; these variables are recorded as occurrences per year. As shown in **Table 2**, by 2100 it is expected that zero days on average will have temperatures below -30 °C, and the temperature is

expected to increase overall. Frost Days and Icing Days are predicted to decrease, indicating a shorter winter season.

Table 2: Low Temperatures

Climate Parameter	Very Cold Days	Minimum Temperature	Coldest Minimum Temperature	Frost Days	Icing Days
Unit/Frequency	Annual - # Days	Annual - Mean (°C)	Annual - Mean (°C)	Annual - # Days	Annual - # Days
Historic[1]	32	-11.7	-37.26	250	208
Predicted 2050[2]	7	-8.39	-34.27	244	186
Predicted 2100[2]	0	-3.4	-29.16	195	143

1 Historic average from 1976-2005 from Climate Atlas of Canada (2018)
2 Climate Atlas of Canada (2018) predictions

Cold temperatures have an impact on the growing season, energy use, and animal life in the area. Frost Days and Icing Days are indicators of the severity and length of the winter season.

High Temperatures

The Warmest Maximum Temperature variable is defined as the highest temperature of the year, averaged over the timescale, while the Mean Temperature is the average temperature of the day, averaged over the year; these variables are recorded in degrees Celsius (°C). The Frost Free Season is defined as days in a year where the temperature does not go below 0 °C and is the approximate length of the growing season; this variable is recorded as occurrences per year. As shown in **Table 3**, Warmest Maximum Temperatures and the annual Mean Temperature are expected to increase by 2100. Additionally, the Frost Free Season is expected to increase, leading to a longer growing season.

Table 3: High Temperatures

Climate Parameter	Warmest Maximum Temperature	Mean Temperature	Frost Free Season
Unit/Frequency	Annual - Mean (°C)	Annual - Mean (°C)	Annual - # Days
Historic[1]	20.27	-8.24	93
Predicted 2050[2]	20.91	-5.07	68
Predicted 2100[2]	20.71	-0.28	141

1 Historic average from 1976-2005 from Climate Atlas of Canada (2018)
2 Climate Atlas of Canada (2018) predictions

2.3.1.2 Changing Precipitation

Heavy Precipitation occurrences are predicted to increase throughout the lifespan of this project. An increase in heavy rainfall events may impact storm drains and cause storm water systems to become

overloaded. An increase in heavy snowfall events may disrupt transportation and may cause an increased load on roofs, causing damage to buildings.

Precipitation includes rain, drizzle, snow, and sleet. The Annual Precipitation variables were recorded in mm, while Heavy Precipitation days were recorded in occurrences per year. As shown in **Table 4**, the Annual Precipitation and Heavy Precipitation days are expected to increase by 2100. The Precipitation in Winter Months is expected to provide an indication on snowfall for the region.

Table 4: Total Precipitation

Climate Parameter	Annual Precipitation	Heavy Precipitation Days (10mm)	Heavy Precipitation Days (20mm)	Precipitation in Winter Months (December to February)[4]
Unit/Frequency	Annual (mm)	Annual - # Days	Annual - # Days	Seasonal (mm)
Historic	446.63[1]	6.5[1]	1.33[1]	54.3[2]
Future 2050	509.88[3]	10[3]	2[3]	65.54[2]
Future 2100	637.29[3]	12.4[3]	2.58[3]	79.28[2]

[1] Historic average from 1976-2005 from Climate Atlas of Canada (2018)
[2] Historic average from 1971-2000 from Environment Canada's Climate Data Viewer
[3] Climate Atlas of Canada (2018) predictions
[4] Winter months used as an indication of snowfall

2.3.1.3 Snow Depth

Snow Depth is predicted to decrease by 2100. Annual mean snow depths are expected to decrease by approximately 3 cm, while seasonally the changes appear more significant, as shown in **Table 5**. A decrease in snow depth is expected to impact the infrastructure, as well as flora and fauna in the area, in a positive manner (i.e., a reduced snow load on buildings may result in decreased stress on roofs and structures).

Table 5: Snow Depth

Climate Parameter	Snow Depth	Snow Depth	Snow Depth	Snow Depth	Snow Depth
Unit/Frequency	Annual - mean (cm)	Winter - mean (cm)	Spring - mean (cm)	Summer - mean (cm)	Autumn - mean (cm)
Historic[1]	13	21.7	24	0.67	7.33
Future 2041-2060[2]	11.54	20.18	22.68	0.19	4.31
Future 2100[2]	10.05	17.29	21.02	0.042	2.28

[1] Historic average from 1971-2000 from Environment Canada's Climate Data Viewer
[2] Environment Canada Climate Data Viewer predictions

2.3.1.4 Freeze-thaw Cycles

Freeze-thaw Cycles occur when the air temperature fluctuates between freezing and non-freezing temperatures. During these cycles, infrastructure may be substantially impacted and significant damage to roadways, underground piping, and other structures due to water freezing, melting, and re-freezing. As shown in **Table 6**, freeze-thaw cycles are expected to increase by 2100.

Table 6: Freeze-thaw Cycles

Climate Parameter	Freeze-thaw Cycles
Unit/Frequency	Annual - # Days
Historic[1]	34
Future 2050[1]	36
Future 2100[1]	47

[1] Historic average from 1976-2005 from the Climate Atlas of Canada (2018)
[2] Climate Atlas of Canada (2018) predictions

2.3.1.5 Wind Speed

High wind speeds are common in Iqaluit, specifically from the northwest and southeast, and can have an effect on other climate parameters, such as precipitation. High wind speeds can cause extensive damage to existing infrastructure. As shown in **Table 7**, wind speeds are predicted to slightly decrease in the years 2050 and 2100.

Table 7: Changes in Wind Speed

Climate Parameter	52 km/hr	63km/hr	90km/hr
Unit/Frequency	Average - # days	Average - # days	Average - # days
Historic	29.1[1]	9.5[1]	1[2]
Future 2050[3]	wind speed change = -0.3%		
Future 2100[3]	wind speed change = -0.9%		

[1] Historic average from 1971-2000 from Environment Canada's Climate Data Viewer
[2] Nawari and Stewart (2006 and 2008)
[3] Environment Canada Climate Data Viewer and Climate Norms

Unfortunately, there were no projections available to determine the occurrences of wind gusts (i.e., number of days with wind speed greater than 52 km/hr). For this analysis, the project team considered the impacts associated with high wind gusts as a constant Climate Change Hazard. Although the wind speed is expected to decrease overall, this does not provide any details on wind gusts, which can be the most damaging to Project infrastructure.

2.3.1.6 Permafrost

Infrastructure in Canada's north heavily relies on permafrost, snow, and ice for stability and utility. Permafrost is a major influence on natural processes and human activities, and has significant impacts on infrastructure design, construction, and maintenance. Due to climate change (i.e., warmer temperatures) and land development, permafrost is melting, damaging building foundations and threatening roads, pipelines, and communication infrastructure. Additionally, communities in Northern Canada are showing rapid rates of permafrost melt, affecting nearly all built structures in Iqaluit (Canada, 2009).

2.3.2 Identification of Impacts on the Asset

The specific categories, as developed during the Data Gathering phase, were used to help guide the initial risk identification exercise. The infrastructure components were assessed against the climate hazards to determine if there was a justifiable interaction. If an interaction was deemed possible, the impact on the asset was identified until all potential impacts were listed. This exercise continued for the remainder the categories listed and evolved into list of preliminary risks. These risks are presented in **Table 8** below.

Table 8: Risks Associated With Landfill Components

Category	Risk
Liner and Cover	• Damage and/or deterioration to HDPE/Geotextile liner. • Displacement of HDPE/Geotextile liner. • Damage and/or deterioration to LDPE cover/cap.
Conveyance	• Concrete deterioration within manhole. • Leachate overflowing landfill liner system. • Break in leachate piping. • Damage and/or deterioration to storm water culverts and structures. • Impact to functionality (i.e., blockage) of storm water culverts and structures. • Granular layer at the base of the landfill becomes plugged. • Pump failure from liner system to holding ponds.
Roadway and Parking Area	• Damage and/or deterioration to gravel area. • Damage and/or deterioration to roadway access to site.
Treatment Elements	• Treatment inefficiencies in engineered wetland. • Leachate overflowing from holding ponds. • Pump failure from lagoon to wetland. • Damage and/or deterioration to structural integrity of holding ponds.
Scale	• Damage and/or deterioration to concrete ramp. • Steel scale cracked or damaged. • Load cell digital and/or mechanism failure. • Scale and ramp foundation failure.
Equipment	• Vehicle/mobile equipment failure. • Unable to operate mobile equipment. • Leak in generator fuel tank.

Buildings associated with the landfill development were assessed as a separate general category. Building components were subdivided into five categories: foundation, building exterior, roof, electrical components, and mechanical components. Risks for each category are outlined in **Table 9**.

Table 9: Risks Associated With Building Components

Category	Risk
Slab/Foundation	• Significant structural damage to slab/foundation. • Crack in slab/foundation.
Building Exterior	• Damage or failure to metal cladding.
Roof	• Roof collapse or failure. • Damage and/or failure of metal roof panels.
Electrical components	• Electrical component failure/shortage/spikes. • Communication system failure (SCADA for treatment elements).
Mechanical components	• Heating and Cooling system overload. • Rupture of septic/sewage tank. • Breach of potable water storage tank.

The risks were populated based on infrastructure and known asset components at the 30% design phase. The Project design may change throughout the detailed design phase.

2.3.2.1 Likelihood of Risk

Upon the initial identification of the risks, the likelihood of the event occurring was established based on how likely the event will occur in the lifespan of the project (i.e., 75 years). **Table 10** displays the scale used to rank the likelihood of interaction occurring, as modeled after the Climate Lens guiding document.

Table 10: Likelihood of Risk Occurring

Score	Descriptor	Likelihood
1	Remote or Positive Impact	Not likely to occur in period
2	Unlikely	Likely to occur once between 50 and 75 years
3	Possible	Likely to occur once between 30 and 50 years
4	Likely	Likely to occur once between 10 and 30 years
5	Almost Certain to Occur	Likely to occur at least once a decade (1/10 years)

A likelihood rating was assigned to each interaction identified, therefore for each risk, multiple likelihood ratings were identified based on the likelihood for individual Climate Hazards to cause the risk. **Table 11** shows the likelihood ratings for the landfill infrastructure components, and **Table 12** shows the likelihood ratings for the building components, based on the initial risk list identified above.

Table 11: Likelihood Rating of Risks Associated with Landfill Infrastructure

Risks	Low Temperatures	Changing Precipitation	Snow Depth	Freeze-thaw Cycles	High Winds	High Temperatures	Permafrost
Liner and Cover							
Damage and/or Deterioration to HDPE/Geotextile liner	1		1	3			3
Displacement of HDPE/Geotextile liner		2		3			3
Damage and/or Deterioration to LDPE cover/cap	1		1		2		
Conveyance							
Concrete deterioration within manhole		1		2			3
Pump capacity compromised leading to leachate overflow within landfill liner system		2				1	
Break in leachate piping				3			3
Physical Damage to Storm water culverts and structures		1	1	3			
Impact on functionality of storm water culverts and structures		3	3	3			
Granular layer at the base of the landfill becoming overloaded or plugged	2	2		1			
Pump capacity compromised leading to longer pumping times and strain on pumps	1	2				1	
Roadway and Parking Area							
Damage and/or deterioration to gravel area		2	1	3			3
Roadway access to site		2	1	3			3

Risks	Low Temperatures	Changing Precipitation	Snow Depth	Freeze-thaw Cycles	High Winds	High Temperatures	Permafrost
Treatment Elements							
Treatment inefficiencies in engineered wetland	2	3	1			1	3
System becoming overloaded causing overflows	2	1	1			1	
Pumping from lagoon to wetland compromised		1	1		2		
Structural integrity of lagoon				1			1
Scale							
Damage and/or deterioration to concrete ramp		1	1				
Steel scale cracked or damaged	1		1	2			1
Mechanism of load cell failure	1		1	2			1
Scale and ramp foundation failure				3			3
Equipment							
Vehicle/mobile equipment failure	1						
Unable to operate mobile equipment	1		1		2		
Generator fuel tank	1				1		

Table 12: Likelihood Rating of Risks Associated with Building Components

Risks	Low Temperatures	Changing Precipitation	Snow Depth	Freeze-thaw Cycles	High Winds	High Temperatures	Permafrost
Slab/Foundation							
Significant structural damage to slab/foundation				2			3
Crack in slab/foundation				3			3
Building Siding							
Damage or failure of Metal Cladding					2		
Building Roof (metal)							
Roof collapse or failure			1				
Damage or failure of Metal roof panels			1		2		
Electrical Components (wiring, lighting, communications)							
Electrical component failure/shortage/spikes				1	2		1
Communication system failure					2		
Mechanical Components (HVAC, plumbing, heating)							
Stresses on heating and cooling causing system overloads	1					1	
Sewage tank ruptured	2			2			3
Storage Tank breached				2			3

2.3.3 Definition of Consequences of Impacts

The consequences of the impacts were discussed in conjunction with assigning a severity rating to the event. A workshop was conducted with the project design team to assign a severity score to each risk, as well as discuss the potential consequences of the event. The severity was assessed using three guiding categories: public and employee (social) safety as well as operational risk, environmental risk, and financial (economic) risk. **Table 13** displays the scale used to rank the severity of the interaction:

Table 13: Consequence of Risk Occurring

Score	Descriptor	Public and Employee	Environmental	Economic/Financial
1	N/A or Negligible impact	No injuries – near miss	Short term – no impact offsite	Negligible impact
2	Minor impact	Reputation impacted, loss of confidence	May impact offsite and ecosystem – small scale < 1 month	Minor maintenance and repair required
3	Moderate impact	Displacement to public inconvenience, and reputation impacted	Repairable impact offsite and ecosystem – duration up to 1 year	Significant maintenance and repair required
4	Major impact	Loss of livelihood, significant displacement, and reputation impacted	Extended range – long-term impact – may regenerate in ten years	Financial impact on proponent and stakeholders, significant capital costs to bring infrastructure to working order
5	Loss of asset or service	All of the above, an health and safety risk for staff and public	Long-term severe irreparable environmental impact – over extended range beyond site	Complete loss of the asset repairing full replacement

Professional assessment and judgement were critical elements used in assigning severity scores, and developing expected consequences. The workshop was made up of a multidisciplinary team of individuals who were knowledgeable about solid waste management, landfill infrastructure, and climate change vulnerability assessments. **Table 14** and
Table 15 below shows the results of the workshop, identifying a severity rating and consequence for each risk.

Table 14: Severity Rating and Consequence of Risks Associated with Landfill

Category	Risk	Severity Rating	Consequence
Liner and Cover	Damage and/or deterioration to HDPE/Geotextile liner	2	• Environmental impact – leachate discharge.
	Displacement of HDPE/Geotextile liner	2	• Potential environmental impact – leachate discharge.
	Damage and/or deterioration to LDPE cover/cap	1	• Potential operational and economic impact to complete maintenance and upkeep.
	Concrete deterioration within manhole	2	• Minor economic impact to complete maintenance and upkeep.
	Leachate overflowing landfill liner system	4	• Environmental impact – leachate overflows out of the liner system within landfill, impacting the soil in the surrounding environment. • Economic impact to remedy the operational and environmental impacts.
	Break in leachate piping	3	• Environmental impact – leachate discharge.
Conveyance	Damage and/or deterioration to storm water culverts and structures	3	• Impact to employee access (employee safety). • Operational and economic impact to remedy issue.
	Impact to functionality (i.e., blockage) of storm water culverts and structures	2	• Impact to employee access (employee safety). • Operational and economic impact to remedy issue.
	Granular layer at the base of the landfill becomes plugged	2	• Leachate not able to drain to intended manhole causing leachate to build up in some areas.
	Pump failure from liner system to holding ponds	2	• Economic and operational impact due to replacement of the pump and potential need for trucked services in the meantime.
Roadway and Parking Area	Damage and/or deterioration to gravel area	1	• Economic impact. • Employee safety impact – gravel area becomes deformed, causing pooled water, ice spots, etc.
	Damage and/or deterioration to roadway access to site	1	• Economic impact. • Employee safety impact – gravel area becomes deformed, causing pooled water, ice spots, etc..

Category	Risk	Severity Rating	Consequence
Treatment Elements	Treatment inefficiencies in engineered wetland	4	• Environmental impact – Effluent not meeting intended targets and could result in contaminants release.
	Leachate overflowing from holding ponds	3	• Environmental impact, operational impact – Untreated effluent can overflow beyond the lagoon berm walls into the surrounding environment, or could backlog into the landfill liner system and overflow in the surrounding environment.
	Pump failure from lagoon to wetland	1	• Minor economic impact. Portable pump from lagoon to wetland fails.
	Damage and/or deterioration to structural integrity of holding ponds	4	• Major economic impact to drain the holding pond and reconfigure lagoon. • Environmental impact. • Changes in the shape and liner system in the lagoon may impact hydraulic capacity, which would impact treatment efficiency.
Scale	Damage and/or deterioration to concrete ramp	1	• Economic impact to repair the concrete ramp.
	Steel scale cracked or damaged	1	• Economic impact to repair the steel scale.
	Load cell digital and/or mechanism failure	1	• Economic impact to repair the digital load cells.
	Scale and ramp foundation failure	3	• Significant economic impact and personnel strain to repair damage to the foundation of the steel ramp. • Repairs may involve a crane.
Equipment	Vehicle/mobile equipment failure	1	• Economic impact to repair equipment and rent similar equipment in the meantime.
	Unable to operate mobile equipment	1	• Operational impact, may lose 1-2 days of work due to inability to operate.
	Leak in generator fuel tank	2	• Economic impact, employee safety impact, environmental impact, but minimal because it will become apparent very quickly.

Table 15: Severity Rating and Consequences of Risks Associated with Building Components

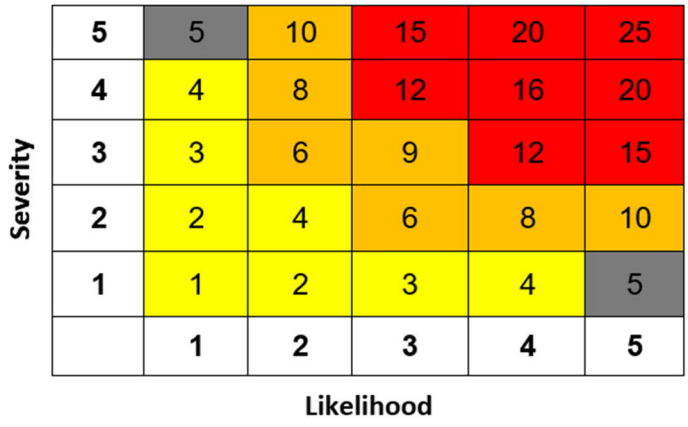
Category	Risk	Severity Rating	Consequence
Slab/ Foundation	Significant structural damage to slab/foundation	4	• Employee safety risk. Major economic impact, not only to repair the foundation, but potential repairs to the structure, roof, equipment inside, etc.
	Crack in slab/foundation	2	• Minor economic impact to repair.

Category	Risk	Severity Rating	Consequence
Building exterior	Damage and/or failure of metal cladding	2	• Minor economic impact to repair.
Roof	Roof collapse	5	• Major economic impact, employee safety impact, operational impact in the event that the roof collapse results in interior equipment damage.
	Damage and/or failure of metal roof panels	2	• Minor economic impact to repair.
Electrical components	Electrical component failure/shortage/spikes	3	• Operational impact, minor economic impact to repair or replace damaged infrastructure due to electrical spikes.
	Communication system failure	2	• Economic impact when the communication system cannot notify attendants of a fire hazard or other hazards. • Could be catastrophic in the event of a fire (equipment, personnel, etc.).
	Heating and cooling system overload	2	• Operational impact, economic impact to repair or remedy.
Mechanical components	Rupture of septic/sewage tank	1	• Minimal environmental impact.
	Breach of potable water storage tank	1	• Minimal operational and economic impact.

2.4 Climate Risk Results

From the proceedings of the workshop, the final risk score was calculated based on standard risk assessment principles. Risk is defined as the possibility of injury, damage, loss, loss of function, or negative impact created by a climate hazard. Risk is a function of likelihood and severity, where Risk = Likelihood x Severity. Error! Reference source not found. shows the risk tolerance threshold used in evaluating the risk score.

Figure 1: Risk Evaluation Matrix



A low score (i.e., yellow square) signifies a low or negligible risk where controls are likely not required, and where the project design will not require alterations. A medium score (i.e., orange square) signifies a moderate risk where some controls may be required to control or lower risks. These are typically the areas of "known" risks, where the risk is simply identified for consideration during the design of the project. A high score (i.e. red square) signifies a high or extreme risk where high priority or immediate controls are required. **Table 16** and **Table 17** below briefly display the risk scores for the landfill infrastructure and building components respectively.

Table 16: Risk Scores Calculated for Landfill Components

Category	Climate Hazard Interactions (Total)	Moderate Risks	High Risks
Liner and Cover	10	4	0
Conveyance	19	8	0
Roadway and Parking Area	8	0	0
Treatment Elements	14	2	2
Scale	12	2	0
Equipment	6	0	0
Total	69	16	2

Table 17: Risk Scores Calculated for Building Components

Category	Climate Hazard Interactions (Total)	Moderate Risks	High Risks
Slab/Foundation	4	3	1
Building Exterior	1	0	0
Roof	3	0	0
Electrical Components	4	1	0
Mechanical Components	7	0	0
Total	19	4	1

In total, the calculated risks amounted to 20 moderate risks and 3 high risk interactions. From the climate hazards used for the assessment, Freeze Thaw Cycles and Permafrost Melt were found to produce the most moderate and high risk interactions.

3.0 Analysis of Resilience Options

3.1 Identification of Resilience Measures Identified for Each Impact

Resilience measure were identified for moderate and high risk scores, as informed by the risk tolerance threshold scale. Risks and their contributing climate change hazards are shown in **Table 18** and **Table 19** for the high or extreme risks and moderate risks, respectively.

Table 18: High Risk Resilience Measures

Risk Event	Contributing Climate Change Parameter(s)	Resilience Measure
Treatment inefficiencies in engineered wetland	Changing precipitation Permafrost melt	• Monitor the effluent from the wetland and create a buffer zone/ensure buffer zone of the design lagoon does not encroach on waterways.
Significant structural damage to slab/foundation	Permafrost melt	• Include thermosiphon technology to control temperature below slab/foundation. • Complete regular checks for cracks. • Complete regular maintenance.

The high risk event related to treatment inefficiencies in the engineered wetland is a known risk, and one that is expected to improve as warmer temperatures in the north will contribute to effective biological treatment. Although this risk may be amplified by climate change, it is not expected to be different or changed as a result of an alternate design.

The high risk event related to structural damage in the slab or foundation structure is a known risk for foundation construction in the north. The design team has already considered permafrost melt into their foundation/slab design.

Table 19: Moderate Risks Resilience Measures

Risk Event	Contributing Climate Change Parameter(s)	Resilience Measure
Damage and/or deterioration to HDPE/geotextile liner	Freeze-thaw cycles Permafrost melt	• Liner manufacturer is expected to provide products suitable for intended application based on expected lifespan and future climate conditions. • Monitor leachate production over time to help identify gaps.
Displacement of HDPE/geotextile liner	Freeze-thaw cycles Permafrost melt	• Liner manufacturer is expected to provide products suitable for intended application based on expected lifespan and future climate conditions. • Monitor leachate production over time to help identify gaps.

Risk Event	Contributing Climate Change Parameter(s)	Resilience Measure
Concrete deterioration within manhole	Permafrost melt	• Concrete manholes are expected to be designed for the intended application based on expected lifespan and future climate conditions.
Pump capacity compromised	Changing precipitation	• Pump leachate back into system (if possible). • Truck leachate away for treatment and disposal. • Pump leachate into on-side holding tank for treatment at a later date.
Break in leachate piping	Freeze-thaw cycles Permafrost melt	• Underground piping is expected to be properly insulated to reduce impacts from freeze-thaw cycles and permafrost melt. • Piping manufacturer to provide products suitable for intended application based on expected lifespan and future climate conditions.
Physical damage to storm water culverts	Freeze-thaw cycles	• Have spare materials on hand, or use what is available. • Build alternative access road.
Impact on functionality of stormwater culverts and structures	Changing precipitation Snow depth Freeze-thaw cycles	• Schedule operators and attendants to frequently check culverts and clear physical debris.
Treatment inefficiencies in engineered wetland	Low temperature	• Monitor the effluent from the wetland and create a buffer zone/ensure buffer zone of the design lagoon does not encroach on waterways
System becoming overloaded causing overflows	Low temperature	• Pump leachate back into system (if possible). • Truck leachate away for treatment and disposal. • Pump leachate into on-side holding tank for treatment at a later date.
Scale and ramp foundation failure	Freeze-thaw cycles Permafrost melt	• Complete regular maintenance and upkeep scale and concrete ramp.
Significant structural damage to slab/foundation	Freeze-thaw cycles	• Include thermosiphon technology to control temperature below slab/foundation. • Complete regular checks for cracks. • Complete regular maintenance.
Crack in slab/foundation	Freeze-thaw cycles Permafrost melt	• Include thermosiphon technology to control temperature below slab/foundation. • Complete regular checks for cracks. • Complete regular maintenance.
Electrical component failure/storage/spikes	High wind gusts	• Adequately secure antennas and electrical equipment.

From the moderate risks, the resilience measures are mainly related to operational protocols and policy measures that are expected to be undertaken in order to lower the risk. There are no physical changes to the design that are expected to eliminate or further reduce these risks. The moderate risks are known risks to this Project.

3.2 Cost/Benefit Analysis

Based upon the results discussed above, the high risks resilience measures are being considered into the detailed design of the engineered wetland and landfill infrastructure. Currently, it is anticipated that the final design will address the risk identified with respect to the foundation as a standard expectation of designing infrastructure components to adapt to conditions in Canada's North. As such, no additional or unique adaptive measures have been identified for further analysis and consideration.

4.0 Conclusion

The City of Iqaluit underwent a procurement process for the design of a new landfill and transfer station, as the existing landfill is nearing full capacity. The Project included a Climate Lens Assessment to understand the production of greenhouse gases, as well as to complete a preliminary review of climate change vulnerabilities to the project infrastructure. The Project included the construction of a new landfill, including new access to the location, a new recycling and eco-centre (i.e., Transfer Station), an area for the future construction of a composting facility, new methods of waste collection and a leachate collection and treatment system.

A climate change resilience assessment was conducted on the development area to determine climate change related impacts on the Project infrastructure and develop potential resilience options. The assessment concluded with 20 moderate risks and 3 high risks identified. From the high risk items, two were related to the functionality of the engineered wetland and quality of the wetland effluent. Climate change data for the region suggests that an increase in average annual temperatures will increase the functionality of the engineered wetland by providing favourable conditions for biological treatment. This is a positive climate impact. The third high risk item was identified as the risk of crack or completed failure of slab/foundation construction. This risk is exacerbated by permafrost melt and more frequent events of freeze-thaw cycles. This is a known risk to the project team, and as per the report entitled "Geothermal Modelling and Geotechnical Recommendations" produced by Wood May 14, 2019, the design team chose to incorporate thermosiphon technology into the slab/foundation design of the Transfer Station. The Wood report investigated the impact of the thermosiphon on the expected temperature below the slab/foundation over 70 years. The assessment found that temperatures below the slab/foundation are expected to decrease over time, which suggests that the permafrost is not expected to melt in this area over the lifespan of the building.

Moderate risks resilience measures were mainly related to procedural and policy measures to implement with operational staff. Some examples included leachate monitoring to help identify leaks or issues in the leachate collection system, while others included having extra storm water infrastructure on hand (i.e., inventory) to be prepared in the event of a failure. These risks are being incorporated into the final design of the project through additional considerations.

5.0 References

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Appendix A

Geothermal Modelling and Geotechnical Recommendations Report

DILLON CONSULTING

Appendix I

Closure and Decommissioning Plan

DILLON CONSULTING

DILLON CONSULTING

CITY OF IQALUIT

Closure and Decommissioning Plan (Draft)

Landfill and Waste Transfer Station

June 2019 | 19-9543

Table of Contents

Figures

Tables

1.0 Introduction

Dillon Consulting Limited (Dillon) has prepared this Draft Closure and Decommissioning Plan (Plan) for the City of Iqaluit's (City's) Landfill and Waste Transfer Station (WTS). This Plan has been prepared using the following key guidance documents:

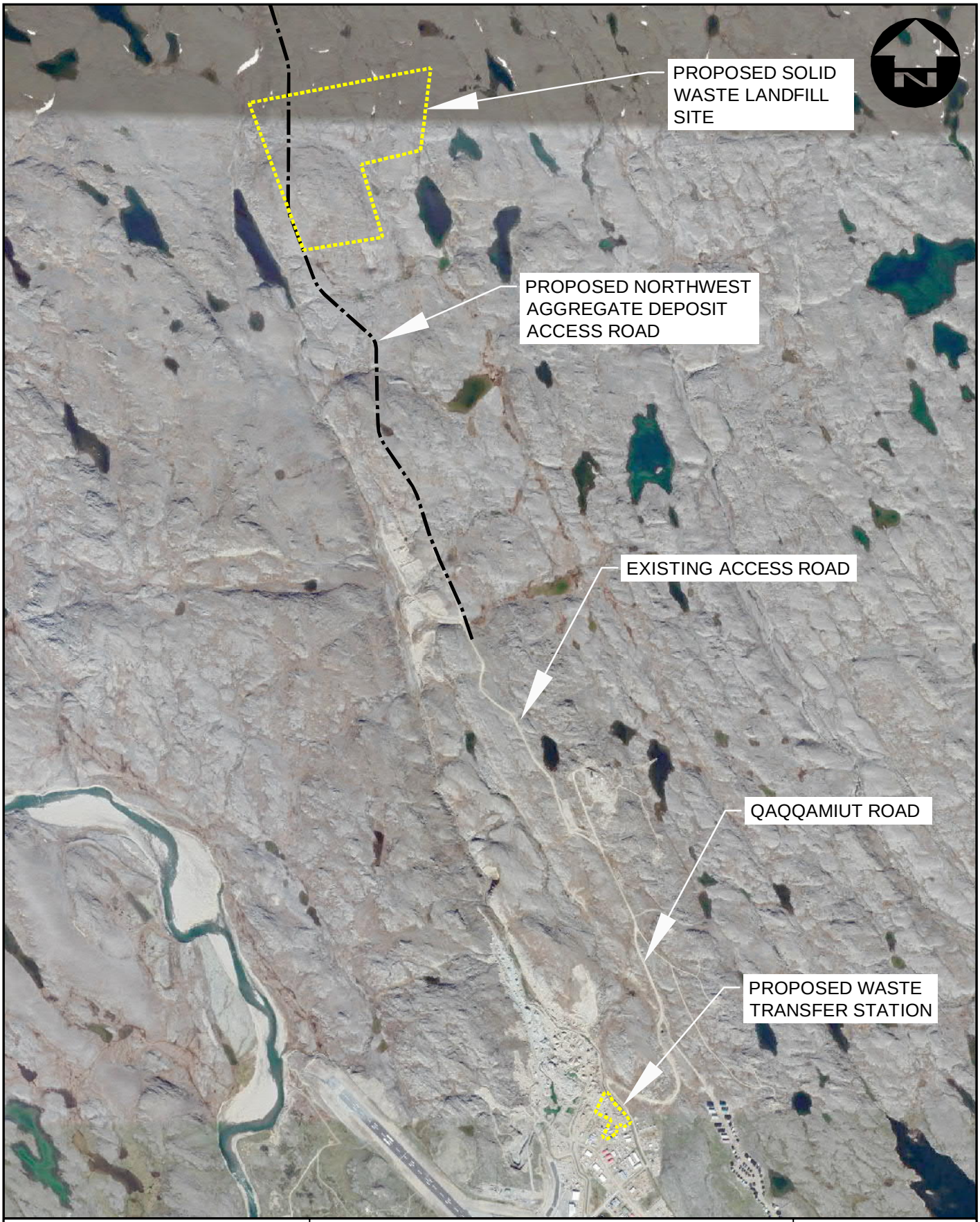
- *Solid Waste Management for Northern and Remote Communities, Planning and Technical Guidance Document*, Environment and Climate Change Canada, March 2017.
- *Consolidation of General Sanitation Regulations, Public Health Act*, Revised Regulations of the Northwest Territories. 1990, c.P-16, 1990.
- *Nunavut Solid Waste Management Plan,* Government of Nunavut, October 2014.
- *Nunavut Water Regulations*, SOR/2013-69, April 2013.

2.0 Site Description

2.1 General

The City is the Capital of Nunavut and is its largest community, along with being the Territories only city. Iqaluit is located at the south end of Baffin Island, on Frobisher Bay at 64° 44' N latitude and 68° 31' E longitude. Access to the City is limited as the only year-round access is provided by commercial aircraft, while during the summer month's access is also provided by sea-lift.

The locations of the two sites addressed by the Plan are presented on **Figure 2-1**.



DILLON CONSULTING

DATE: JUNE 2019	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
	TITLE: SITE LOCATIONS	FIGURE NO.: 2-1

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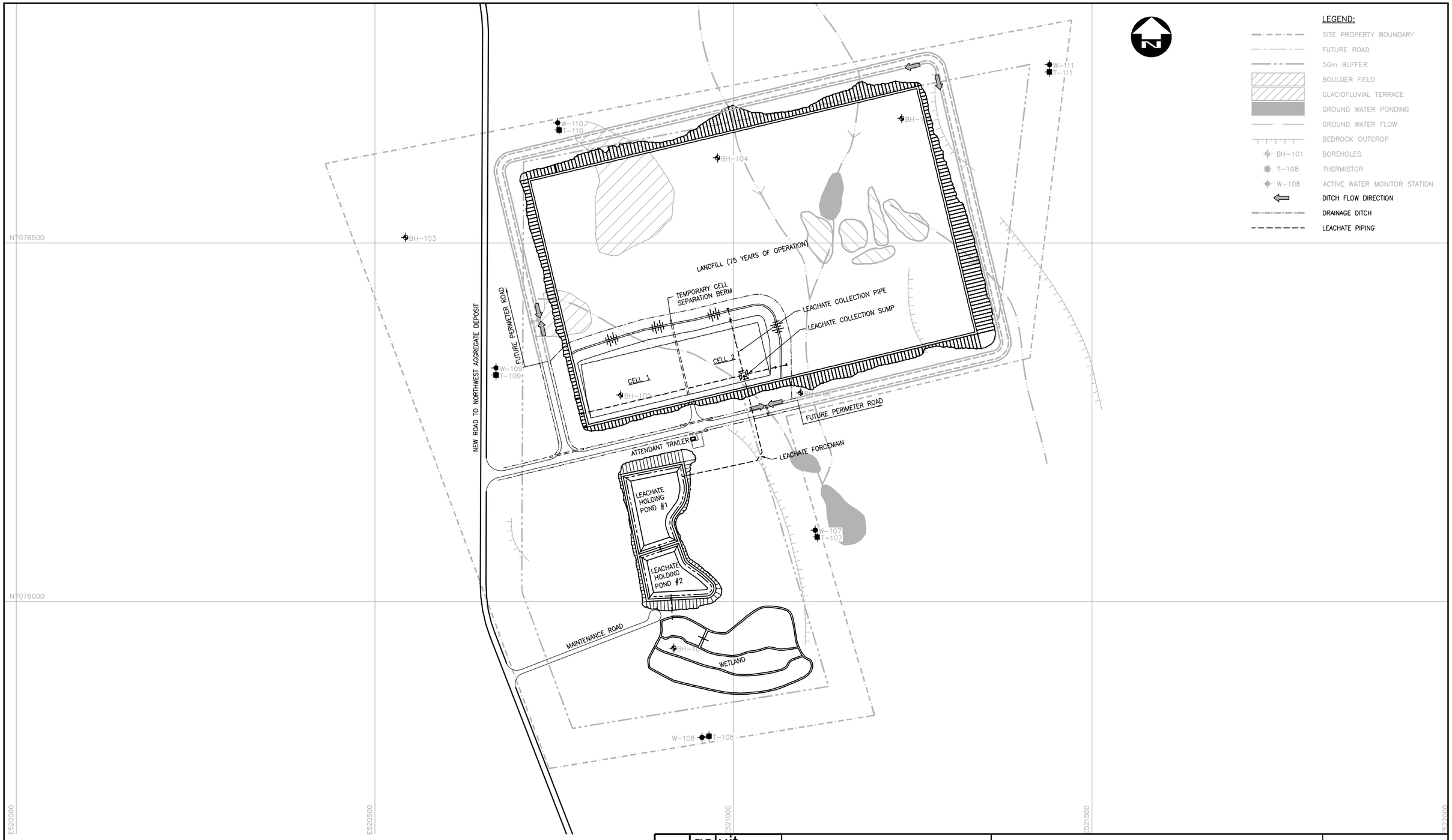
2.2 Landfill

The City's Landfill site (Landfill) is located approximately 6 km northwest of the City. The overall Landfill property is approximately 64 ha, with the Landfill occupying 22 ha of the property. The Landfill footprint was designed to allow for a minimum of a 30 m buffer from the property line. The current Landfill layout is presented in **Figure 2-2**.



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Iqaluit

DILLON CONSULTING

DATE	JUNE 2019	PROJECT	IQALUIT LANDFILL AND WASTE TRANSFER STATION
		TITLE	LANDFILL SITE PLAN
		PROJECT NO.	19-9543
		FIGURE NO.	2-2

The Landfill is scheduled to commence operations in 2021 and is designed to be in operation for 75 years, with a planned closure in 2096. Prior to delivery to the Landfill, all waste materials are directed to the WTS for weighing and initial inspection. With the exception of periodic mixed loads of construction and demolition debris materials, all waste materials at the WTS will be processed into wire and plastic wrapped bales, prior to transfer and placement at the Landfill.

Leachate generated within the cells will be collected in the base granular layer and pumped via HDPE riser(s) to the surface holding pond, with the intent that the leachate will either evaporate or be discharged to a treatment wetland. The site is unserviced, requiring the use of portable generators for any electrical requirements. The Landfill will also have an attendant trailer, complete with a wood stove and composting toilet.

Stormwater at the site is intercepted and directed around the Landfill. Any stormwater generated on site is collected in on-site ditches and directed off-site to the access road ditch network. Runoff concentrates into channel flow to the east of Sylvia Grinnell Territorial Park, at which point it flows southerly toward the Iqaluit Airport, ultimately discharging to the Koojesse Inlet at Frobisher Bay. Leachate generated within the Landfill is pumped to leachate holding ponds, with the flow continuing to a treatment wetland area.

2.3 Waste Transfer Station

The WTS is located south of Qaggamiut Road, at the end of the Kakivak Court. The WTS site is on a 2.4 ha parcel, City Lots 3586 228/17/18/20 and 3480 220 1, located approximately 1-2 km north of Iqaluit Airport.

The WTS was designed for a 75 year lifespan. Throughout that period, it is expected that ongoing maintenance and/or technology upgrades will be required. The facility will include the WTS building, complete with municipal solid waste baler, a scale house, office trailer and a household hazardous waste depot. The site layout is provided in **Figure 2-3**.

BALE STORAGE AREA

CONSTRUCTION AND DEMOLITION DEBRIS PAD

SNOW STORAGE

BALES TO LANDFILL

CULVERT

SLIDING GATE

QAQQAMIUT ROAD

EMERGENCY GENERATOR

LIMIT OF SURVEY

SNOW STORAGE

MISCELLANEOUS METALS/WHITE GOODS STORAGE PAD

TIRE STORAGE

END OF LIFE VEHICLE AND MISCELLANEOUS METALS STORAGE

BALER LOGGER

APPROX. PROPERTY LINE

0+200

5.0m

5.0m

WASTE TRANSFER STATION

PUBLIC DROP-OFF

PUSH WALL

0+100

TO PUBLIC DROP-OFF

0+300

0+340

TO COMMERCIAL DROP-OFF

20.0m

HHW DEPOT

HHW STORAGE CONTAINERS

REUSE CONTAINER

20.0m

SITE OFFICE

22.9 x 3.0m

SCALE HOUSE

SCALE

SLIDING GATE (2 REQUIRED)

PERIMETER FENCE

PARKING AREA (10 SPACES)

SNOW STORAGE

1.0 c.m. BOULDER SPACED AT 5.0m (TYP.)

GREENHOUSE (FUTURE)

25.0m

10.0m

COMPOST PAD (FUTURE)

15.0m

0+000

KAKIVAK COURT

SNOW STORAGE

AREA FOR POTENTIAL COMPOST AND BIO-MASS EQUIPMENT

N7070900

N7070800

N7070700

E522400

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Iqaluit

DILLON CONSULTING

DATE	JUNE 2019	PROJECT	IQALUIT LANDFILL AND WASTE TRANSFER STATION
		TITLE	WTS SITE PLAN
		PROJECT NO.	19-9543
		FIGURE NO.	2-3

Municipal solid waste is collected and sorted at the WTS. Material quantities are weighed using the truck scale on the outbound trucks heading to the Landfill. The material is sorted manually by site operators on the tipping floor. Scrap metal, tires, white goods, wood, household hazardous waste, and end of life vehicles are collected and stored in designated areas of the WTS. Residual waste is collected, compressed into bales, wrapped in plastic and transferred to the site. Being situated in the industrial area of the town, the building will have access to electricity. There will be a water tank and septic tank at the WTS to provide amenities such as a lunch room, washroom, locker room and an office.

Stormwater is directed around the WTS in on-site ditches and directed off-site to the access road ditch network. Runoff from the WTS site follows the City's drainage network in a southerly direction and into Koojesse Inlet. Effluent generated from waste materials within the building are collected in a shallow floor trench and pumped to a holding tank, with subsequent delivery to the City's Wastewater Treatment Plant.

2.4 Groundwater and Surface Water Monitoring

The Landfill and the WTS have active layer monitoring wells installed that are monitored in accordance with their associated approvals. Surface water monitoring stations have also been selected.

<To be finalized during Phase II – Preliminary Design>

3.0 Environmental Protection Plan

As a component of the Environmental Management Plan (EMP) for the overall City's waste management project (as associated with the original development and subsequent operation of the Landfill and WTS), two Environmental Protection Plans (EPPs) were developed; one addressing requirements during the Construction Phase and one applicable to the Operations, Closure and Post-Closure Phase. It is anticipated that revised versions of both of these documents (as well as the overall Environmental Management Plan) will be prepared during the proposed 75 year operational life of the two facilities.

Definition of detailed requirements for Closure and Post-Closure are to be developed consistent with the latest version of the Operations, Closure and Post-Closure Phase EPP. Should the Contractor be engaged to complete select activities associated with the closure/post-closure effort, the Construction Phase EPP should also be referenced.

4.0 Closure and Decommissioning

The closure program has been developed to provide a cost effective and environmentally responsible plan for closure of the Landfill and WTS. The closure plan, including scheduled dates and relevant procedures, should undergo a detailed design and be submitted to the Nunavut Water Board (NWB) for comment and approval, prior to its implementation.

The closure plan has four distinct stages:

1. Planning.
2. Public Information and Education.
3. Implementation.
4. Monitoring and Maintenance.

The **initial planning stage** is used to assess the existing situation and to develop a process or plan to ensure the closure objectives can be met in an effective and safe manner, while striving to satisfy the objectives of all parties involved.

The **second stage**, public information and education, is an important component of a closure program and should be introduced early in the plan. The education program is outlined in this report; however, the development of specific materials will be completed closer to the closure timing.

The **third stage**, implementation, includes closure activities such as demolition, decommissioning, final grading, compacting and capping of the Landfill, as well as vector and wildlife control programs.

Stage four, monitoring and maintenance, is the post-closure period during which the site is periodically inspected. This section focuses on the assessment of the existing site, and the preparation of procedures for the implementation and maintenance phases.

4.1 Regulator Notification

As the facilities are nearing the end of their useful lives, the regulator will be notified, as per the requirements of the Approval. Final documentation on the proposed plan for closure, including designs, will be prepared for review and approval, prior to commencing closure.

4.2 Public Education and Notification

The closure of the Landfill and the WTS should be proactively communicated to the public so that members of the community are aware of the potential changes to their solid waste management services, in addition to the possibility of increased traffic as a result of construction activities. This is an important aspect in reducing the likelihood of illegal dumping and confusion about the location of services. Notice may be given in the form of flyers, e-notices, educational/outreach campaigns,

community gatherings, etc. All content should be accessible, with content being available in multiple languages and in various forms of media (i.e., electronic or print media).

4.3 Signage and Access Restrictions

Fully enclosed fence systems that restricts access to the Landfill and WTS must remain and be maintained during closure and post-closure. Signage stating the permanent closure of the facilities, as well as the new location(s) for waste disposal, will be clearly posted on the fence.

Durable signage should be established around the perimeter of the former Landfill area, confirming that disposal activities have ceased and are prohibited in this location. Suggested wording is presented below:

NO DUMPING
AUTHORIZED PERSONNEL
ONLY
FORMER LANDFILL AREA
By Order of the City of Iqaluit

4.4 Structure Disassembly and Storage

The only planned building at the Landfill will be the Attendant's Trailer. This building (noting that is anticipated that it will be replaced several times during the 75 year operational period) is mobile in design and will be potentially relocated to the new disposal site or re-purposed within the City.

It is expected that the WTS building will have reached its useful life after 75 years, and will be decommissioned and disassembled. The resulting materials will be disposed and/or reused, as per current regulations.

Where observed, hazardous materials (including wastes) and unidentified substances stored on-site after operations cease, shall be listed and relative quantities of material, types of containers, and storage conditions described. The area below, and immediately surrounding the derelict vehicle area, should be tested for possible soil contamination. If a hazard is identified, additional assessment may be required.

4.5 Equipment Decommissioning and Salvage

Mobile and stationary equipment at the Landfill and WTS will be assessed for future use or for end-of-life disposal/salvage value. As necessary, equipment will be cleaned, temporarily stored, and then removed from the Landfill and WTS. Auxiliary equipment will include but not be limited to:

- Truck scale
- Baler
- Waste Shredder
- Pelletizer
- Forklift
- Wheel Loader
- Compact Wheel Loader
- Bale Truck
- Vehicle Baler/Logger
- Staff Truck

4.6 Site Grading and Surface Restoration

Any loose municipal solid waste (MSW) will be collected and managed prior to closure. This includes materials that may be located at either the Landfill or WTS. If there is not sufficient capacity at the Landfill, the materials will be disposed of at an approved facility, depending on the types of waste. Soil stockpiles will be utilized to form a smooth final grade on the Landfill, prior to placement of the final cap (see **Section 4.12**). Excess soils will also be disposed of at an alternative approved disposal facility.

At the WTS, remaining household hazardous waste and special waste, end-of-life vehicles, bulky waste, and unclaimed items from the free store will be sorted and disposed of according their material type. As part of building decommissioning activities, the final site will be graded to suit the future proposed use.

As the waste disposal face is filled above grade to the proposed final elevations at the Landfill, the perimeter slopes and surfaces are reclaimed. In this way, the Landfill is closed and reclaimed progressively throughout the active landfill life. The placement of soil will fill any gaps between bales and will make for a smooth continuous surface, in which the final capping materials may be placed.

The proposed final grades of the Landfill maintain a minimum slope of 5 % across the top of the waste fill area to allow surface water drainage off of the Landfill, while maintaining integrity and stability of the soils and final cover. The side slopes will be maintained at a minimum 4:1 slope, consistent with the original engineering design.

A detailed final grading plan must be completed within the final year leading to closure and this Plan must be approved by the NWB.

4.7 Buffer Zone and Litter/Debris Management

A properly developed buffer zone provides visual screening and wind protection. The 30 m buffer area around the Landfill should; therefore, be maintained. While the principal requirement for the buffer zone relates to an active operating site, it is desirable to maintain an area around former sites after

closure to provide a physical barrier. It is recommended that the entire buffer area be designated a "No Hunting Area".

The City should implement measures to collect and consolidate scattered litter and debris around the perimeter of the former Landfill and WTS area. Prior to the installation of the final cover, the overall landfill footprint itself, as well as the access roadways, should be inspected and cleaned of remnant litter.

4.8 Surface Water Management

Acknowledging the local surficial soil conditions, and noting design elements of the Landfill and WTS, surface water management and sediment generation is not expected to be an ongoing challenge. The surface water management system used during operations will continue to be operational post-closure. Surface run on will be intercepted and diverted around the site. Site ditching will gather any stormwater collected on-site and carry the water to the discharge location away from the open waste face to avoid any leachate generation.

4.9 Vector and Wildlife Management

Birds, rodents and other wildlife frequent municipal waste management sites because of the availability of food sources in the waste. Once delivery of waste stops, the final cover has been placed on the Landfill and the food source has been eliminated, these populations tend to decrease adjacent to the waste management facilities.

Prior to closure, a rodent baiting program could be implemented by a professional pest control company to effectively determine the presence and quantities of rodents, and to prevent migration, if necessary.

4.10 Landfill Gas Management

Landfill gas (LFG) will be generated throughout the life of the Landfill. Methane (CH_4) and carbon dioxide (CO_2) are the primary constituents of LFG, and are produced by microorganisms within the buried waste. Carbohydrates from materials such as paper and cardboard are decomposed initially to sugars, acetic acid, and finally to CH_4 and CO_2. Other components of LFG include non-methane organic compounds and inorganic compounds.

The amount of LFG generation varies with site conditions (e.g., waste composition, cover materials, design, anaerobic state), and may also vary with climatic conditions such as precipitation rates and temperatures. Due to the design and local climactic conditions of the Landfill, it is anticipated that the rate of LFG generation, as compared to traditional unprocessed MSW landfills in more southern locations, will be quite limited. The fact that the bales are wrapped will limit the amount of moisture that will come in contact with the waste and the temperatures for most of the year are not conducive to LFG generation.

Because $CH_4$is combustible, it poses a greater risk to safety than CO_2. If vented in an uncontrolled manner, CH_4 can accumulate in enclosed spaces on, or close to, the disposal site. CH_4 gas is odourless and because its density is less than that of air, it rises until its movement is restricted by some impermeable medium. Concentrations of CH_4 between 5 and 15% in air are explosive. However, with proper venting, CH_4 gas should not pose an unacceptable hazard. Research has shown that the rate of decomposition in landfills, as measured by CH_4 gas production, reaches a peak (within the first two years and then slowly tapers off; although continuing in many cases, can continue for periods up to 25 years or more. Therefore, CH_4 venting must be accommodated during and after disposal completion. Passive LFG vents, as depicted in the Landfill Engineering Drawings, are proposed to allow for the controlled discharge and periodic monitoring of this gas.

A post-closure LFG monitoring program developed for this site is discussed in **Section 5.5**.. If explosive concentrations of CH_4 are detected during the program, the ventilation capability of the vent itself, as well as the overall spacing of vents, should be investigated. It may become necessary to consider a positive type ventilation system (such as gas extraction), if the problem is not easily remedied.

CO_2 gas is not considered to present a high risk to safety with regards to above ground operations. However, since it is heavier than air, carbon dioxide will collect in the bottom of manholes, poorly vented trenches and other below-ground areas. Therefore, site personnel should take appropriate precautions, such as the use of a respirator or forced ventilation, prior to entering these areas.

4.11 Leachate Management

The Landfill's leachate collection and treatment system incorporates several components and will be required to remain operational after closure. Leachate will continue to be collected from inside the Landfill, which will flow to an on-site manhole. From the manhole, the leachate will continue to be pumped to holding ponds, with flow continuing to an engineered treatment wetland. Similar to normal operations, upon the confirmation of freeze up conditions in the fall, the pump will be removed from the manhole and the forcemain will be decommissioned (drained) for the winter. Assessment of leachate generation status (e.g., observations within the manhole) shall commence in the late spring, confirming when active pumping efforts should be initiated. Once the Landfill is closed and completely capped (noting that the cap will be installed in sections during the 75 year operational life, as landfill cells reach final design elevations), the amount of leachate generated should decrease significantly.

4.12 Landfill Cap

The final cover design provides a protective cap over the waste fill area. The objectives of the final cover design are to:

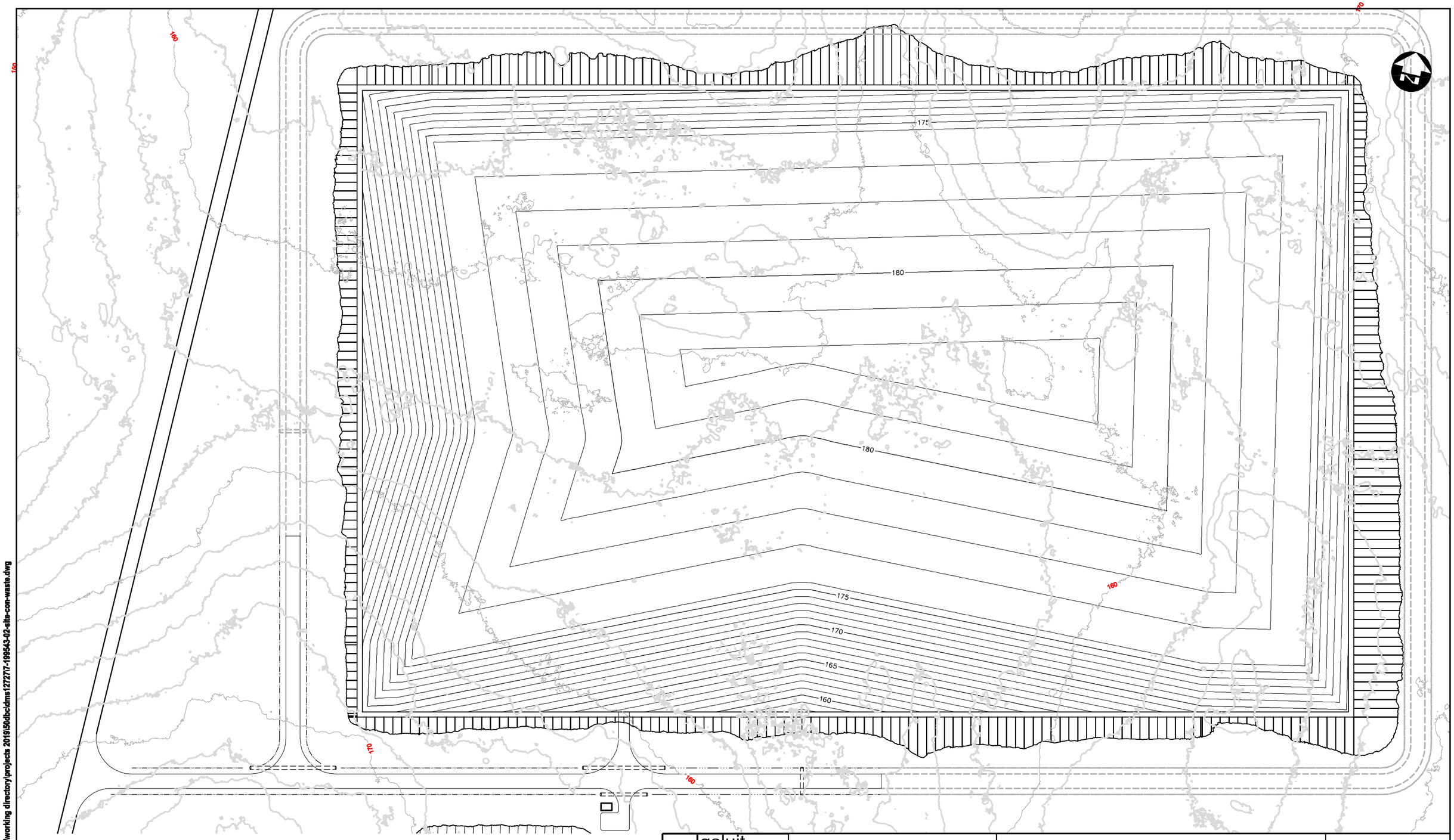
- Provide a barrier layer over the waste to minimize infiltration of precipitation into the landfill cells to minimize leachate generation.

- Create and maintain positive drainage of precipitation off of the landfill cells and minimize erosion.
- Provide a layer of soil/gravel on which to establish an acceptable level of vegetative cover.

For the purpose of the Landfill closure, the final active portion of the Landfill at the end of the 75 year operational period will require capping (assuming all previously filled portions of the Landfill have a final cap in place). If the undisturbed ground identified throughout the site (under roads, areas not surveyed, etc.) is not filled prior to regrading, it will be included within the cover design, in order to ensure proper drainage off of the cap. Otherwise, areas left uncapped within the final covered footprint may collect surface water and compromise the final cover system.

The final contours of the Landfill (see **Figure 4-1**) have been selected to promote drainage away from the site to discourage infiltration and leachate production, while also preventing erosion. To suit these criteria, a 4H:1V slope is proposed for the side slopes with a 5% grade upwards to the crown of the Landfill, directing drainage away from the Landfill to the adjacent surface water system

The construction of final cover, or cap, needs to be constructed to satisfy the future management and integrity of the waste fill area. Due to the lack of availability of soil, the top of the Landfill will include a granular layer. The purpose of the cap is to prevent erosion of the Landfill and maintain the integrity of the site. A cross section of the proposed cap is provided in **Figure 4-2**.



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Iqaluit

DILLON CONSULTING

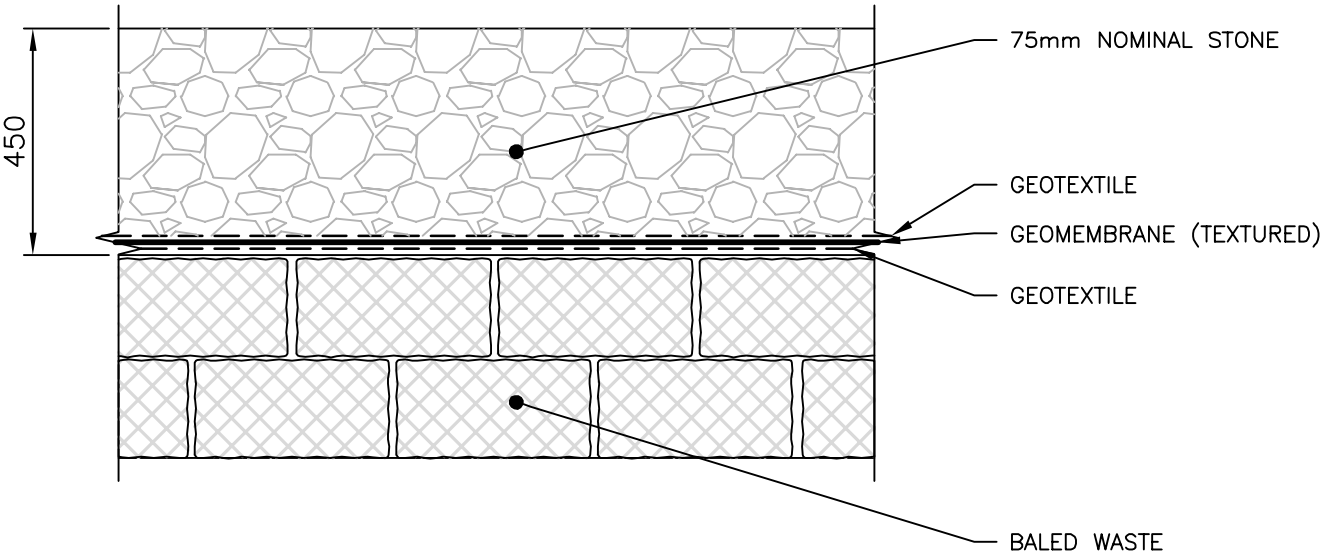
DATE JUNE 2019

PROJECT
IQALUIT LANDFILL AND WASTE TRANSFER STATION

PROJECT NO.
19-9543

TITLE
FINAL CAP CONTOURS

FIGURE NO.
4-1



CAP SYSTEM SCHEMATIC

N.T.S.

DILLON CONSULTING	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
DATE: JUNE 2019	TITLE: LANDFILL CAP SCHEMATIC	FIGURE NO.: 4-2

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4.13 Landfill Settlement

Settlement of MSW landfills is caused by primary consolidation and secondary compression of the soil/waste matrix. Primary consolidation occurs when the voids in the site decrease as fluids are forced out of the material under pressure. Secondary compression occurs as the number of voids decrease and the site material deforms to fill the voids. Additionally, biological decay, oxidation, combustion and corrosion can cause voids to form in the site.

Consolidation settlement generally occurs during the Operational Phase of the site and should not affect the integrity of the cover system. Settlement due to the compression of the waste layers, caused by the decrease in voids occurs over time (i.e., months to years), can cause the cover system to subside. This could lead to depressed areas and "cracking" of the top cover, which in turn will create easy access for rainwater infiltration.

In an effort to determine the degree to which the disposal site is settling, a grid survey of spot elevations tied into an established grid should be documented at known locations upon completion of site closure activities. This will provide a basis to gauge the rate of settlement and degradation, and the data will provide a baseline for which to assess future changes. As a result of bale filling operations at the site, it is anticipated that a high degree of compaction will be achieved resulting in little settlement.

Additional surveys should be initially conducted on a five year basis and spot checks undertaken, if settlement at the site is observed during the routine surveys. The process of settlement, coupled with the elastic nature of the disposal site and ability to trap gases, may cause buoyant items, particularly past landfilled tires, to migrate up through the Landfill and re-emerge through the cover system. If this occurs, the items should be collected, reburied and the final cover repaired.

4.14 Waste Transfer Station Closure

When the closure of the WTS is imminent, it is expected that an environmental assessment will be necessary to confirm future usage for the site. A Phase I Environmental Site Assessment (ESA) would include, at a minimum:

- Evaluation of all historical information and current land use.
- Assessment of the site for contamination of potential concern or any unsafe conditions.
- Review facility documentation including operation and company records.
- Site reconnaissance.
- Interviewing the facility operator and facility attendants.
- Reporting.

Upon completion of the Phase I ESA, additional efforts may be necessary to clarify the potential extent of environmental concerns. Additional efforts may include:

- Initial intrusive screening level sampling.

- Determination of the presence or absence of contamination of potential concern at the site.
- If present, the type, extent, degree and approximate volume of contamination.
- Comprehensive delineation of contaminated areas.
- Remediation of contamination.
- Confirmatory sampling investigation after remediation.

4.15 Closure Activity Schedule

The closure schedule is contingent on the timing for the development of the City's future waste management facility and the waste filling option(s) selected from by the City. The closure of the Landfill may be initiated within two years of schedule final closure, but is subject to confirmation by additional surveying of the area. Once the closure timing has been determined, a number of activities must be undertaken. Below is a list of the primary activities, this list should be completely in consecutive steps:

- Finalize Closure Plan Documentation in consultation with the NWB.
- Communicate with stakeholders the plan for closure.
- Commence initial closure activities (weather permitting), focusing on leachate spring repair, slope stabilization and diversion of runoff from stabilized areas.
- Prepare detailed design documents to support the implementation of the Landfill Closure Plan in consultation with NWB.
- Complete tendering activities to support implementation of the Landfill Closure Plan.
- Complete closure activities, as presented on the detailed design documents and within the Landfill Closure Plan.
- Ongoing: Conduct overall site monitoring activities, as required.

5.0 Post-Closure Plan

Post-closure is defined as the period of time after the Landfill is closed for active use when ongoing monitoring and maintenance is required. The proposed post-closure period for the Landfill is 25 years. Post-closure activities include:

- Definition of potential property use.
- Periodic site inspections and maintenance.
- Ongoing environmental effects monitoring.

5.1 Post-Closure Property Use

The ongoing decomposition of the buried waste mass could influence the character of the site and potentially cause adverse effects to the environment for some time into the future.

First, differential settlement over time could cause damage to the final cover, increasing surface water infiltration, and ultimately enhancing the generation of leachate and the eruption of leachate springs. Second, it is possible that gases will be generated by the decomposition of the organic waste portion in the disposal site. Third, the exposure of debris at the surface due to slope erosion could result in physical and/or chemical hazards, due to exposure of debris at surface. Fourth, the release of contaminants directly associated with the waste mass could cause impact to the surface and/or groundwater regimes.

For these reasons, and until post-closure monitoring indicates site stability, the area within the Landfill footprint should not, under any circumstances, be used for recreational, industrial/commercial, or any other purpose including material or equipment storage. The determination of site stability should be made by a qualified professional engineer or geoscientist. The landfill cover should have a well established grass cover and there should be no indication of differential settlement, surface erosion, gas generation, or leachate springs. Water chemistry data should indicate either general improvement or no significant change, over several consecutive sampling events. Once these conditions are achieved, use of the property may be re-evaluated.

5.2 Post-Closure Site Inspection and Maintenance

During the post-closure care period, the City should inspect the final cover system at least once per year, and complete an annual report that includes a record of:

- Continue regular operations of the leachate treatment system.
- Visit the site to visually confirm that the Landfill remains in compliance with the Closure Plan Documentation.
- Assess any impact to the final cover system. This is usually present as leachate springs, erosion, subsidence or cracking in the final cap.

- Provide repairs to the final cover system, as necessary, to correct settlement, subsidence, erosion, and leachate break-out.
- Assess structural integrity of any infrastructure, such as LFG vents and provide corrective measures, as necessary.

Given the nature of the original facility design and proposed decommissioning activities, post-closure inspection and maintenance activities are not expected to be necessary at the former WTS site.

5.3 Contingency Plan for Emergency Response

The Contingency Plan for Emergency Response during the post-closure period will be consistent with requirements presented in:

- Operations and Maintenance Manual (latest revision).
- Emergency Response Plan (latest revision).

5.4 Closure Cost Estimate

Closure costs for the Landfill consist of the capital costs required to grade the active face of the existing site to meet minimum slope guidelines and construct the necessary final cap. It is expected that the Landfill will be closed as in sections over time and only a small remaining face will be left to cap.

Table 5-1: Preliminary Cost Estimate for Common Closure Items

Item	Description	Estimated Budget
1	Public Education	$10,000
2	Signage and Site Security	$20,000
3	Buffer Zone and Litter Management	$15,000
4	Vector and Bird Management	$15,000
5	Site Settlement	$10,000
6	General Site Maintenance Allowance	$15,000
7	LFG Wells	$30,000
8	Subtotal	$115,000
	Total	$138,000

Table 5-2: Soil Cap Preliminary Cost Estimate

Item	Description	Units	Estimated Quantity	Unit Price	Budget
1	Site Grading	m^2	10,000	$2	$20,000
2	Geotextile	m^2	20,000	$3	$600,000
3	Geomembrane	m^2	10,000	$30	$300,000
				Subtotal	$920,000
				Contingency (20% of Subtotal)	$184,000
				Engineering and Construction (10% of Subtotal)	$92,000
				Total	**$1,196,000**

5.5 Post-Closure Environmental Effects Monitoring

During post-closure, it is anticipated that ongoing environmental effects monitoring will be required. The level of monitoring will be defined by the monitoring required during operations.

<To be finalized during Phase II – Preliminary Design>

It is anticipated that this will include surface water monitoring and active layer water monitoring.

Appendix J

Environmental Management Plan

DILLON CONSULTING

DILLON CONSULTING

CITY OF IQALUIT

Environmental Management Plan (Draft)

Landfill and Waste Transfer Station

June 2019 | 19-9543

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Figures

Appendices

1.0 Introduction

1.1 Background

The City of Iqaluit (City) is in the process of implementing its Solid Waste Management Strategy to service their near and long term (75 years) municipal solid waste disposal requirements. Founded on a previously-completed conceptual design and facility siting exercise, key elements of the project include a solid waste transfer station (WTS) within the immediate urban area of the City where residential and commercial waste will be hauled to, processed, and compacted in bales or in the case of waste wood and cardboard, shredded and pelletized for use as a fuel source for an on-site biomass boiler. Tires, metal and some construction and demolition (C&D) wastes will also be shredded and or baled for landfilling or transported south for recycling. The resulting solid waste bales and possibly a smaller amount of unbaled construction and demolition waste will be trucked to an engineered balefill landfill site located approximately six kilometres from the WTS. The vehicles transferring the waste bales will access the road leading to the landfill site from the waste transfer station to avoid having the transfer vehicle travel through the City.

Other planned features of the WTS include a public drop off area for Household Hazardous Wastes (HHW) and a vehicle logger/compactor unit; in both instances allowing for the preparation of waste materials prior to shipping to approved management facilities in the south.

The access road that will be used to reach the new landfill site has been designed by EXP Services Inc. who will also be providing Construction Contract Administration services for the construction of the road. It is anticipated that the construction of the road will be included in the new landfill and waste transfer station contractor's scope of work.

To address their objectives, and following a competitive proposal process, the City engaged Dillon Consulting Limited (Dillon) to provide design and construction contract administration services to support the establishment of the transfer station/baling facility and the engineered landfill site. The engineered landfill will be designed for 75 years of operation but for the construction/build portion of the Project only the first stage of the landfill (Stage 1 Operational Landfill) will be constructed (e.g., first two cells and ancillary components to meet five and 10 year operational requirements, e.g., five years per cell).

Development of the proposed facilities is scheduled to occur during the 2020 and 2021 construction seasons, with facility commissioning in the fall of 2021.

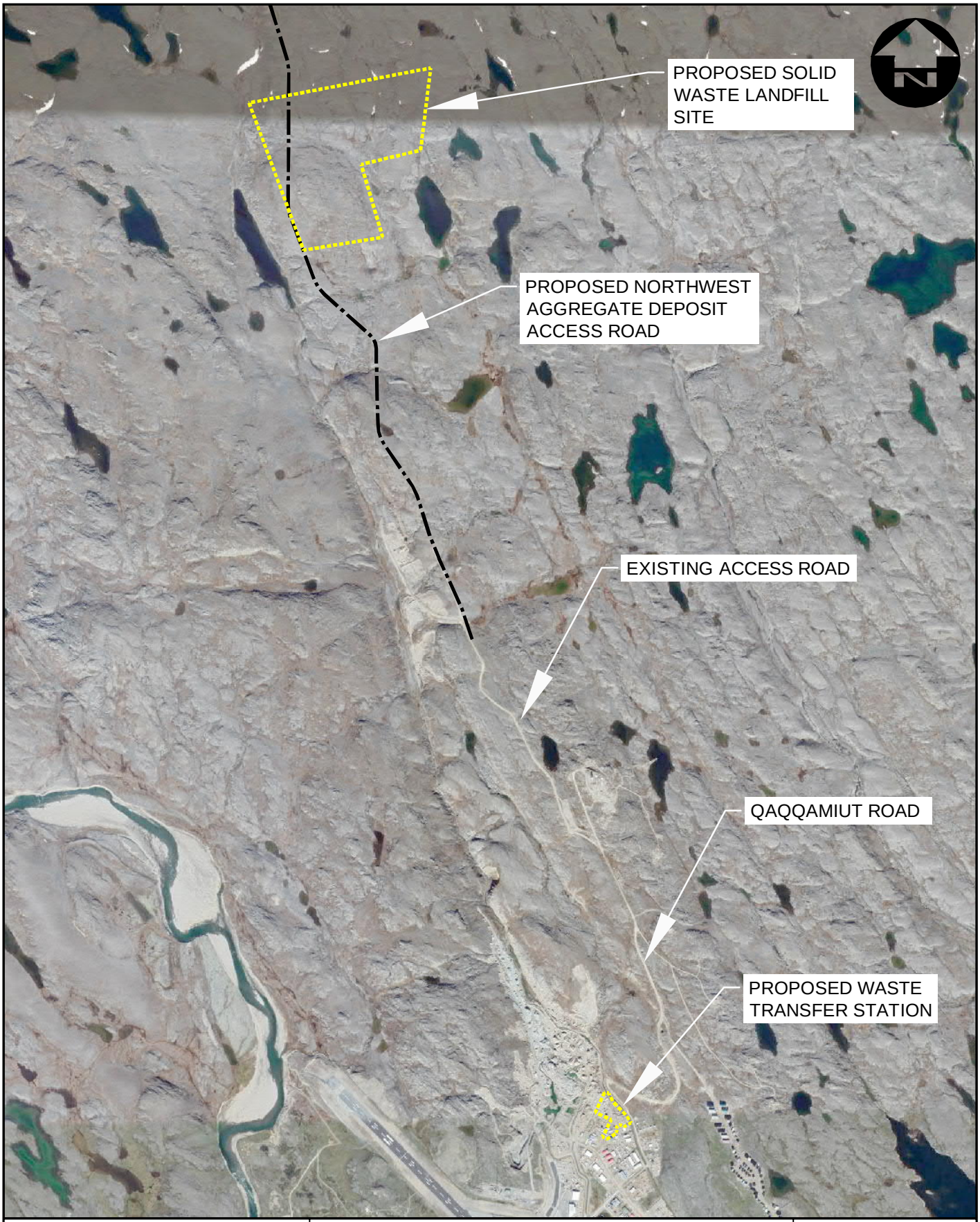
1.2 Site Description

This ERP applies to the Iqaluit Waste Management Facility (IWMF), including the Waste Transfer Station (WTS) and Landfill, Iqaluit, Nunavut. Iqaluit is located at the south end of Baffin Island, on Frobisher Bay

at 64° 44’ N latitude and 68° 31’ E longitude. Access to the City is limited, with the only year-round access provided by commercial aircraft; sealift can also be utilized during the summer months.

The Landfill site is located approximately six kilometres northwest of the Iqaluit and occupies an approximate area of 22 ha. The WTS is located at the end of Kakivak Court. The site occupies an area of approximately 2.4 ha and comprises an office building, scale house, transfer station and contaminant storage area.

The overall site locations are presented on **Figure 1-1**, with the layouts for the WTS and the Landfill being provided on **Figures 1-2** and **1-3**, respectively.



DILLON CONSULTING

DATE: JUNE 2019	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
	TITLE: SITE LOCATIONS	FIGURE NO.: 1-1

FileName:c:\projectwise\working directory\projects 2019\50dbc\dms12727\199543-02-site-con-cover.dwg

BALE STORAGE AREA

CONSTRUCTION AND DEMOLITION DEBRIS PAD

SNOW STORAGE

BALES TO LANDFILL

CULVERT

SLIDING GATE

QAQQAMIUT ROAD

EMERGENCY GENERATOR

LIMIT OF SURVEY

SNOW STORAGE

MISCELLANEOUS METALS/WHITE GOODS STORAGE PAD

TIRE STORAGE

END OF LIFE VEHICLE AND MISCELLANEOUS METALS STORAGE

BALER LOGGER

APPROX. PROPERTY LINE

0+200

5.0m

5.0m

WASTE TRANSFER STATION

PUBLIC DROP-OFF

PUSH WALL

0+100

TO PUBLIC DROP-OFF

5.0m

5.0m

0+300

0+340

TO COMMERCIAL DROP-OFF

20.0m

HHW DEPOT

HHW STORAGE CONTAINERS

REUSE CONTAINER

20.0m

SITE OFFICE

22.9 x 3.0m

5.0m

5.0m

SCALE HOUSE

SCALE

SLIDING GATE (2 REQUIRED)

PERIMETER FENCE

PARKING AREA (10 SPACES)

SNOW STORAGE

1.0 c.m. BOULDER SPACED AT 5.0m (TYP.)

GREENHOUSE (FUTURE)

25.0m

10.0m

COMPOST PAD (FUTURE)

15.0m

0+000

KAKIVAK COURT

SNOW STORAGE

AREA FOR POTENTIAL COMPOST AND BIO-MASS EQUIPMENT

30.48 BM

BH

OH

N7070900

N7070800

N7070700

E522400

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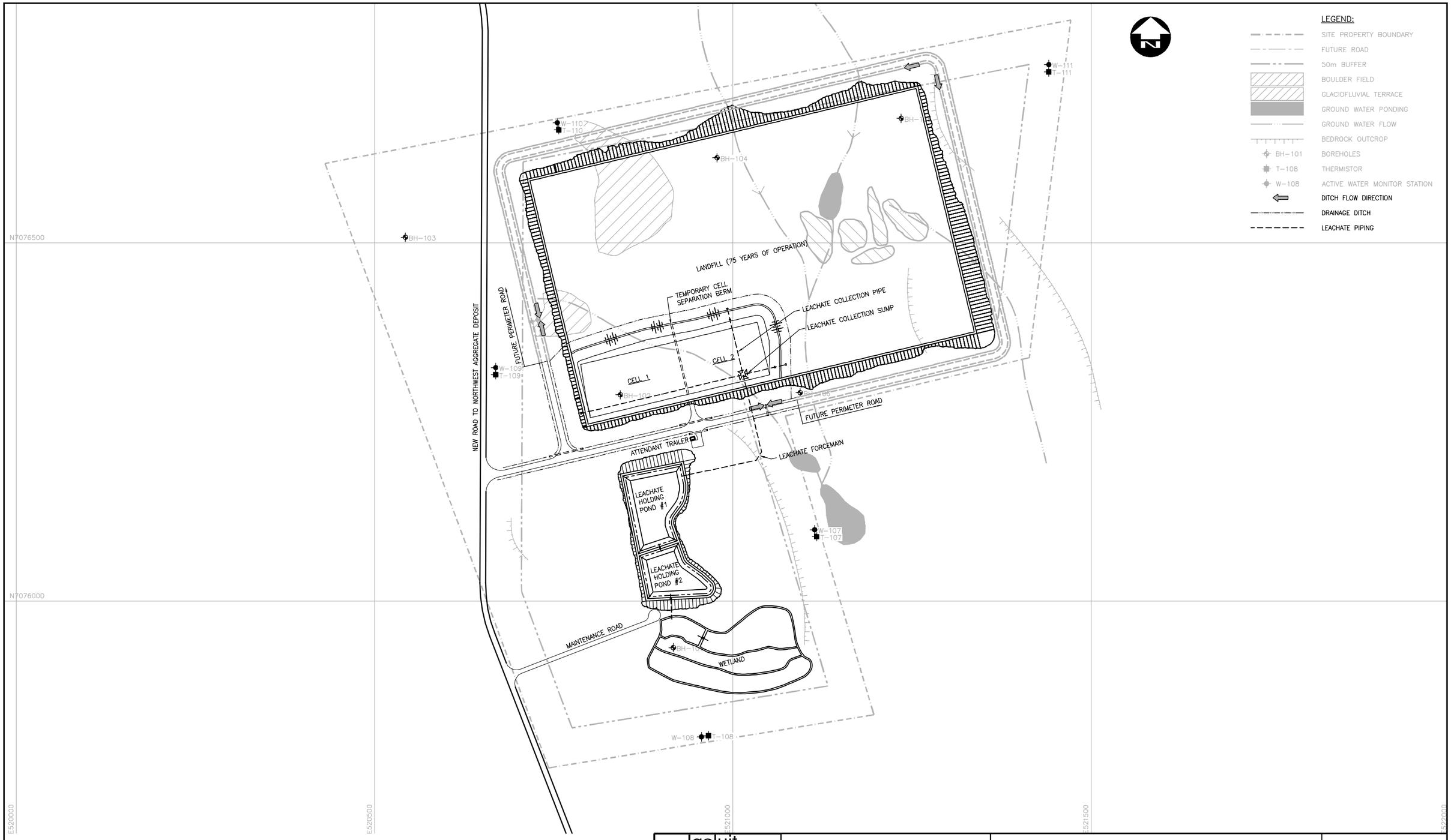
Iqaluit	DILLON CONSULTING	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
	DATE: JUNE 2019	TITLE: WTS SITE LAYOUT PLAN	FIGURE NO.: 1-2



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Iqaluit

DILLON CONSULTING

DATE JUNE 2019

PROJECT
IQALUIT LANDFILL AND WASTE TRANSFER STATION

PROJECT NO.
19-9543

TITLE
LANDFILL LAYOUT PLAN

FIGURE NO.
1-3

1.3 Purpose of the Environmental Management Plan

This Environmental Management Plan (EMP) provides a framework by which to assess, track and document the project's environmental compliance requirements and provides a basis for the systematic management of environmental risks. The EMP is designed to implement, and form a basis for, the environmental protection and mitigation measures described in the Environmental Protection Plan (EPP) for this project.

The EMP acts as the overarching document for both the EPP and Emergency Response Plan (ERP) by outlining the roles and responsibilities for project personnel for both documents, and describes the legislation governing these documents. The EPP describes the environmental protection measures to be implemented throughout the project, and acts as a resource for the City and its contractors to avoid or mitigate potential adverse environmental effects to receptors. The ERP provides guidance to project personnel for responding to an emergency situation, as well as it covers all aspects of emergency planning and response.

The EMP Describes:

- The City's environmental commitments to regulatory agencies, stakeholders, the natural environment and the general public;
- Roles and responsibilities of project personnel regarding environmental protection and mitigation, inspection, and reporting during the construction of the Landfill and WTS;
- Environmental protection and mitigation measures to be implemented during construction to ensure compliance with regulatory requirements; and
- Procedures to deal with environmental contingencies that may arise during construction.

The EMP describes the environmental protection procedures to be implemented for each of the environmental features/parameters identified in the EPP, and associated correspondences for this project to maintain environmental compliance by the Operator and its contractors. The EMP will serve as a procedural document to support the objective that all environmental compliance requirements are met, tracked and documented. The EMP will also serve as an educational tool for the orientation and training of project personnel.

2.0 Project Personnel, Roles and Responsibilities

The following sections of the EMP outline the roles and responsibilities of the City and its assigned contractors. These responsibilities include reporting, notifications, guidelines on documentation and incident reporting.

It is the responsibility of project personnel to ensure that the environmental commitments outlined in this EMP, as well as the Environmental Impact Assessment (EIA) and associated follow-up correspondence, are adhered to.

The EMP will be incorporated into the orientation and training exercise for applicable on-site personnel working on the project. A copy of this EMP will be available at a location designated on the construction site at all times during construction. Project personnel working on the site are to be aware of the existence of this EMP, its requirements and where it is located on-site.

The ERP portion of the EMP contains vital information on project personnel, roles and responsibilities, and procedures involved in emergency situations at the Landfill and WTS. It is imperative that the ERP be reviewed by all project personnel before commencing the Operations Phase of the project, as well as at regular intervals during operation.

2.1 Owner – City of Iqaluit

As the Operator of the Landfill and WTS, the City will be responsible for ensuring its third party representative and the Contractor's Site Supervisor are made aware of the EMP and its requirements, and that the commitments contained therein are implemented. The City of Iqaluit is responsible for ensuring that construction requirements, and associated regulations, are followed. The City of Iqaluit will also provide guidance and technical support to on-site personnel with respect to environmental compliance.

2.2 Owner's Representative – Dillon Consulting Limited

During the construction phase, the Owner's representative will be a third party consultant (Dillon Consulting Limited) responsible for ensuring the EMP is implemented in accordance with procedures outlined in this document and compliance obligations are satisfied. The Owner's representative will be responsible for supervising the activities of the Contractor to ensure all required environmental protection and mitigation measures are implemented. The Owner's representative will ensure that reporting and documentation procedures and requirements stipulated in the EMP are completed.

The Owner's representative will, at a minimum:

- Serve as an independent (third party); and
- Provide technical services associated with the completion of the project.

2.3 Contractor's Site Supervisor

The Contractor's Site Supervisor will ensure that the requirements of the Landfill and WST EMP, applicable to its work, are implemented to ensure environmental compliance. The Contractor will also ensure that a separate ERP for work associated with the Construction Phase of the project is completed and approved before construction operations commence. In the event of a spill during the Construction Phase of the project, the Site Supervisor will ensure that the City and Environmental Protection (Government of Nunavut) are made aware of the spill and any clean-up measures taken.

2.4 Contact Information

Appendix A provides contact information for key project contacts as of May 2019. This listing is to be reviewed and revised on a regular basis, acknowledging City personnel changes as well as future construction projects.

2.5 Documentation Procedures

Continuous and effective communication and documentation is a key component of the environmental protection and mitigation process. Consistent with regulatory requirements, it will serve to support the reliable dissemination of pertinent documents and manuals for project personnel during the completion of site activities.

During the initial construction phase of the project (as well as during future contractor construction activities at either the Landfill or WTS), the Owner's representative and Contractor's Site Supervisor will maintain project documents and updates/revisions of documents (including this EMP), drawings and manuals, permits, and approvals at a designated location on the project site. During Operational, Closure and Post Closure activities (e.g., activities led by the City of Iqaluit), the Owner will be responsible for addressing the requirements of the EMP. Applicable project personnel will be advised of the location(s) of these documents, and will be required to comply with the practices and procedures outlined therein.

3.0 Regulatory Requirements

The EMP has been developed in consideration of relevant legislative requirements. The Owner's representative and the Contractor will ensure that work associated with the project is undertaken in accordance with the items outlined in the scope of work for the project. The following legislation is applicable to the Landfill and WTS development for the City.

3.1 Federal Legislation

Fisheries Act

This Act prohibits the unregulated deposit of a deleterious substance into waters frequented by fish. It protects both the marine environment and freshwater features.

Canadian Environmental Protection Act (CEPA)

Through this Act, any activity that may alter, disrupt or destroy fish habitat, as defined in the Fisheries Act, may trigger a federal environmental assessment under CEPA. Relevant Regulations under this Act include the PCB Regulations (2008), which provide guidance for disposal of polychlorinated biphenyls (PCBs) and/or PCB waste; the Ozone-Depleting Substances and Halocarbon Alternatives Regulations (ODSHAR), which was released in 2016, and provides guidance and regulations surrounding manufacturing, import, export, use, sale, and transfer of these substances.

Migratory Birds Convention Act

This Act protects birds crossing provincial and international borders, working with other countries to ensure safe flyways for migratory birds.

Transportation of Dangerous Goods Act

This Act creates regulations to monitor and ensure safe practices for the handling, storage, and transportation of designated dangerous goods.

Workplace Hazardous Materials Information System Act (WHMIS)

This Act regulates all WHMIS requirements. Any personnel working with or near hazardous materials shall have WHMIS training.

3.2 Territorial Legislation

Nunavut Wildlife Act

This Act protects all wildlife in Nunavut and requires an assessment to ensure this project will not harm sensitive species within Nunavut.

Nunavut Environmental Protection Act

Among other matters, this Act ensures that environmental assessments are completed before construction related to new projects in Nunavut can commence. Contravention of the Act could lead to fines and/or imprisonment.

Nunavut Planning and Project Assessment Act

This Act regulates the planning of new projects and the processes required for project assessment. It promotes one assessment for one project.

Nunavut Waters and Nunavut Surface Rights Tribunal Act

This Act governs land use and permitting for new projects and developments within Nunavut.

Nunavut Safety Act

This Act ensures safe work practices are in place and followed by all project personnel at work sites. Punishment of fines and/or imprisonment could be administered through the authority of this Act.

3.3 Municipal Legislation

No municipal legislation applicable to the proposed project activities or implementation of this EMP has been identified.

3.4 Permits and Approvals

Iqaluit Building Bylaw

Permits to construct buildings must be obtained from the Building Inspector within the City. If construction is not started within a year of permit approval, the permit becomes invalid.

4.0 Environmental Protection Plans

A separate plan has been prepared for both the Construction Phase and the Operations, Closure and Post Closure Phase of the project. These plans are included as **Appendix B** and **Appendix C,** respectively. The EPPs describe the environmental protection measures to be implemented for the various relevant environmental considerations, during each phase of the project. The EPP for each project phase acts as a resource for the City or its contractors to avoid or mitigate potential adverse environmental effects to receptors.

4.1 Construction Phase Outline

The Construction Phase EPP consists of the following information:

- Introduction
  - Purpose of This Document
  - Regulatory Context
- Project Roles and Responsibilities
- Environmental Considerations
  - Vegetation
  - Wetlands and Watercourses
  - Wildlife and Wildlife Habitat
  - Fish and Fish Habitat
  - Species at Risk or Species of Special Status
  - Heritage and Cultural Resources
- Environmental Protection Measures
- Monitoring and Inspection
- Contingency and Emergency Response Plan
  - Spill Response Plan
    - Small Spills/Leaks
    - Large Spills/Leaks
  - Incidental Discovery of Sensitive or Protected Species Contingency Plan

4.2 Operations, Closure and Post Closure Phase Outline

The Operations, Closure and Post Closure Phase EPP consists of the following information:

- Introduction
  - Purpose of This Document
  - Regulatory Context
- Project Roles and Responsibilities
- Environmental Considerations
  - Species at Risk or Species of Special Status
- Environmental Protection Measures

- Monitoring and Inspection
- Contingency and Emergency Response Plan
    - Spill Response Plan
        - Small Spills/Leaks
        - Large Spills/Leaks
    - Incidental Discovery of Sensitive or Protected Species Contingency Plan

5.0 Emergency Response Plan

The ERP has been included as **Appendix D** and provides guidance to Operations Phase project personnel for responding to an emergency situation.

The ERP consists of the following information:

- Introduction
  - Scope of Plan
- Types of Emergencies Covered by Plan
- Emergency Response Coordinators
  - Emergency Service Contacts

  Notification Procedures
- On-Site Emergency Equipment
- Emergency Response Procedures
  - Medical Emergencies
  - Vehicle Fires
  - Building Fires
  - Landfill Fires
  - Liquid/Chemical Spills
  - Gas Leaks/Suspicious Odours
  - Explosions
  - Extreme Weather Events
  - Power Outages
  - Dangerous Animal Encounters
  - Violent/Criminal Behaviour
- Evacuation Plan
  - Evacuation Routes
- ERP Distribution and Updating
- Post Emergency Review and Plan Assessment
- Readiness Review
  - Emergency Reporting
  - Simulation Exercises

Appendix A

Project Contact List

DILLON CONSULTING

Table 1: Contact Information for Key Project Contacts

CITY OF IQALUIT			
CONTACT	PAGER #	WORK #	CELL #
Dispatch	N/A	979-5650	-
Chief Administrative Officer (CAO)	N/A	979-5666	222-2953
Director of Public Works and Engineering	N/A	975-8509	222-2965
Operations Superintendent, Public Works	N/A	979-5631	222-2956
Manager of Engineering (Vacant)	-	-	-
Utilidor Manager	N/A	979-5632	222-2966
Utilidor on-call	32	N/A	222-3243
Garage/Roads Foreman	N/A	979-5668	N/A
Trucked Services Foreman	N/A	979-5612	222-2947
Owner's Third Party Representative- Dillon Consulting Limited (Keith Barnes)	-	(403)215-8885 ext. 4310	(403)827-6299

EMERGENCY SERVICES		
CONTACT	WORK #	CELL #
Dispatch	979-5650	-
Duty Officer (Fire/Ambulance)	979-4422	-
Fire Chief	979-5657	222-5073
Deputy Fire Chief	979-5650	222-2955
Deputy Fire Chief	979-5650	222-3981
Chief Municipal Enforcement Officer	979-5670	222-5521
RCMP	979-1111 979-0123	
GOVERNMENT RESOURCES- SPILL LINE		
24-Hour Spill Line	Telephone #	(867)920-8130

EXTERNAL ASSISTANCE- GOVERNMENT RESOURCES	
DEPARTMENT	CONTACT #
Environmental Protection, Government of Nunavut	975-5900
Indian and Northern Affairs Canada, Nunavut District Manager	975-4295
Indian and Northern Affairs, Baffin Sub-District	975-4295
Environment and Climate Change Canada, Iqaluit	975-4636
Department of Fisheries and Oceans, Iqaluit	979-8000
Regional Public Health Officer, Government of Nunavut	979-7652

CONTRACTOR	CONTACT #
Baffin Building Systems	979-5903
Kudlik Construction Ltd	979-1166

CONTRACTOR	CONTACT #
Nunavut Excavating Ltd	975-3320
RL Hanson	979-6004
Tower Arctic Ltd.	979-6465
Qikiqtaaluk Environmental	
Nunatta Environmental	

Appendix B

Environmental Protection Plan – Construction Phase
(under separate cover)

DILLON CONSULTING

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CITY OF IQALUIT

Environmental Protection Plan (Draft) Construction Phase

Landfill and Waste Transfer Station

June 2019 | 19-9543 – Version 1.0

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Appendices

1.0 Introduction

1.1 Purpose of This Document

This Environmental Protection Plan (EPP) has been prepared as part of an overarching Environmental Management Plan (EMP) and describes the environmental protection measures to be implemented during construction of the City of Iqaluit's (the City's) proposed Waste Transfer Station (WTS) and Landfill. The purpose of the EPP is to be a resource for the City and its contractors during the construction phase to avoid or mitigate potential adverse environmental effects to various receptors. This EPP is based on a desktop review of publically available records and site assessments conducted for the Landfill and Transfer Station locations, completed by EXP Services Inc. (Delvin, 2018a; Delvin 2018b; EXP, 2018).

This EPP includes instructions for carrying out construction activities, outlines environmental protection measures (as they relate to the project activities) and provides a reference for environmental inspection staff to support decision-making during the construction phase of the project. **Once the construction phase of the project is complete, refer to the Operations, Closure, and Post-Closure Phases Environmental Protection Plan for phase-specific protection and mitigation measures**.

Key project contacts (as of May 2019) are provided in **Appendix A**.

1.2 Regulatory Context

The environmental regulatory framework that the project falls under includes:

1. *Fisheries Act;*
2. *Species at Risk Act;*
3. *Canadian Environmental Protection Act;*
4. *Nunavut Wildlife Act;*
5. *Nunavut Environmental Protection Act;* and
6. *Nunavut Waters and Nunavut Surface Rights Tribunal Act.*

2.0 Project Roles and Responsibilities

The following section outlines the roles and responsibilities of the City and its assigned contractors. These responsibilities include reporting, notifications, guidelines on documentation and incident reporting. The responsibilities of all parties are outlined below.

City of Iqaluit – Owner (All Project Phases)
As the Operator of the Landfill and Transfer Station, the City will be responsible for ensuring that its employees and third party representatives are made aware of the EPP and associated plans, and that the commitments contained therein are implemented. The City is responsible for ensuring that the requirements of construction and associated regulations are met. The City will also provide guidance and technical support to on-site personnel with respect to environmental compliance.

Contractor (Construction Phase Only)
As a component of its contractual obligations, the Contractor (for initial and future construction initiatives) will be responsible for developing and implementing an Environmental Protection Plan specific to its personnel and project activities. In the event of a spill during construction phases of the project, the Contractor's site supervisor will ensure that the City and Environmental Inspector (EI) are made aware of the spill and measures are taken to address the environmental impacts.

Dillon Consulting Limited - Owner's Representative (Construction Phase Only)
The Owner's representative will be a third party consultant (e.g., Dillon Consulting Limited), responsible for corroborating that the EPP is implemented by the Contractor, in accordance with procedures outlined in this document, and compliance obligations are met. The Owner's representative will confirm that reporting, documentation procedures and requirements stipulated in the EPP are completed by the Contractor.

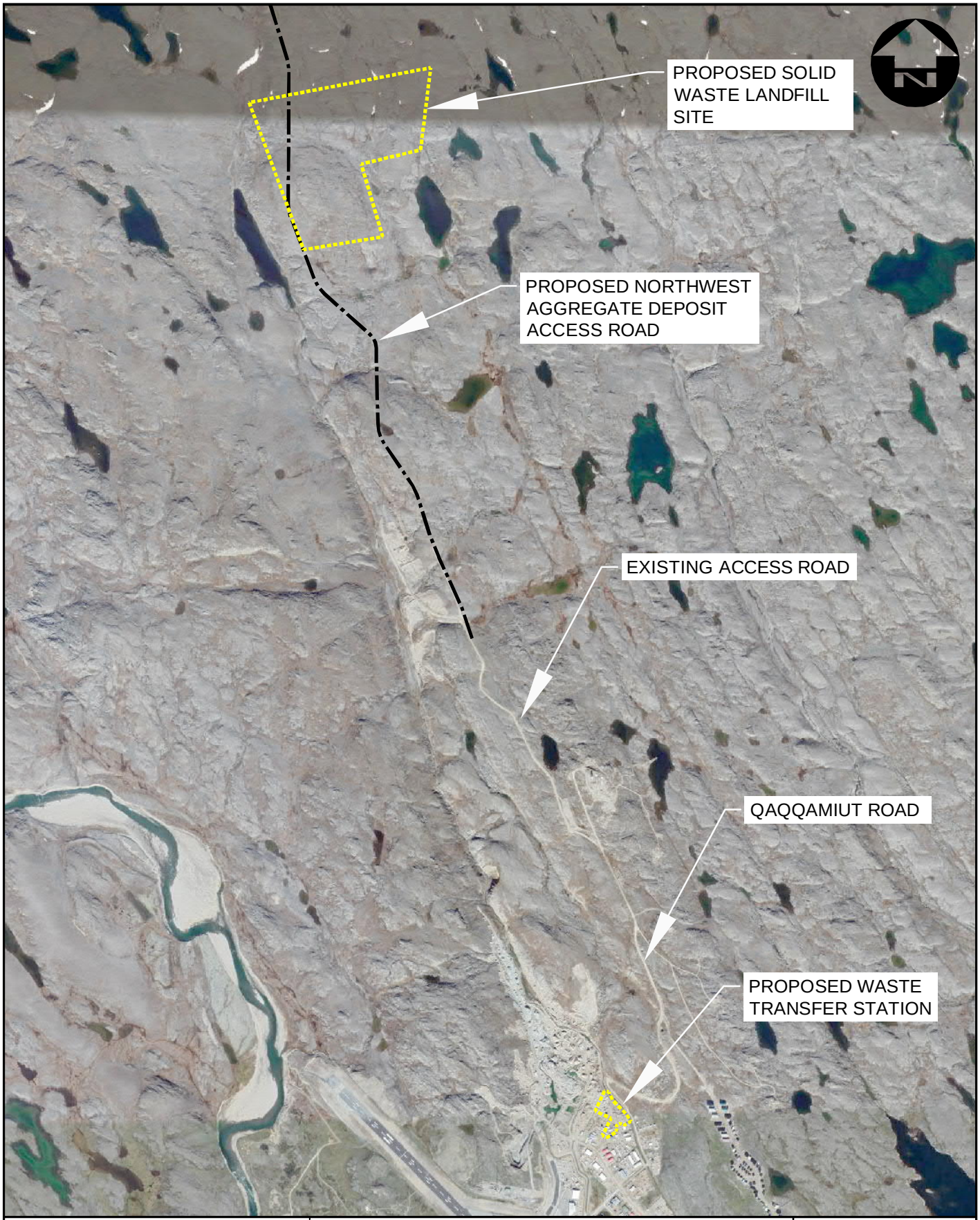
The Owner's representative will, at a minimum, and as directed by the Owner:

- Serve as an independent (third party); and
- Provide technical services associated with the completion of the project.

3.0 Environmental Considerations

The environmental setting of the project areas (**Figure 3-1**) was assessed using a desktop review of publically-available records and site assessments completed by EXP Services Inc. (Delvin, 2018a; Delvin 2018b; EXP, 2018). The two sites are located in the Meta Incognita Peninsula Ecoregion, which is characterized by rock outcroppings interspersed with sandy morainal veneers and frozen organic deposits, static cryosols with turbic and organic cryosol soils, and continuous permafrost with mainly medium ice content (Ecological Framework of Canada, 2019).

The Landfill site is approximately 22 ha in size, consisting predominantly of rolling hills with some bedrock outcrops in the south central region, small glacio-fluvial terraces in the northwest region, and boulder fields in the northwest and central portions of the site (EXP, 2018). The Transfer Station location is an industrial site, within the City, and is approximately 2.4 ha in size, covered by fill consisting of sand and gravel with boulders and cobbles (Delvin, 2018a, Delvin 2018b).



DILLON CONSULTING

DATE: JUNE 2019	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
	TITLE: SITE LOCATIONS	FIGURE NO.: 3-1

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3.1 Vegetation

The landscape of the Meta Incognita Peninsula Ecoregion is dominated by tundra shrub vegetation, consisting of Dwarf Birch (*Betula nana)*, Willow (*Salix spp.*), Labrador Tea (*Ledum spp.)*, *Dryas spp.* and *Vaccinium spp* (Ecological Framework of Canada, 2019). The nearby landscape, as characterized by Sylvia Grinnell Territorial Park reports, contains shallow, low-nutrient soils and continuous dwarf vegetation, meaning that vegetation growth is generally less than 30 cm tall (Nunavut Parks, 2019). Traditionally-important plant species found nearby include Mountain Sorrel (*Oxyria digyna*), Crowberry (*Empetrum spp.*), Blueberry (*Vaccinium spp.*), Mountain Cranberry (*Vaccinium spp.*), Arctic Willow (*Salix arctic*), Arctic Cotton (*Eriophorum callitrix*) and Labrador Tea (*Ledum spp.*). Other vegetation includes rock lichens, drought-tolerant vegetation, sedge grasses and the official flower of Nunavut - the Purple Mountain Saxifrage (*Saxifraga oppositifolia*).

Landfill

Twenty-three plant species were observed at the site location, none of which are protected under the federal *Species at Risk Act* (SARA) (EXP, 2018). The dominant and sub-dominant plant species observed included Arctic Willow (*Salix arctica*), Net-vein Willow (*Salix reticulata*), Bog Bilberry (*Vaccinium uliginosum*), Arctic Bell Heather (*Cassiope tetragona*) and Reindeer Lichen (*Cladina spp*.) (EXP, 2018).

Waste Transfer Station

The site is predominately covered with fill but some vegetation, such as grasses, exist along the northern perimeter and along the creek adjacent to the north site boundary (Delvin, 2018a).

3.2 Wetlands and Watercourses

Landfill

There are a number of small ephemeral drainages that cross the site, and discharge into a small pond and lake southeast of the site boundary (EXP, 2018). The pond and lake drain into Carney Creek, approximately 200 m west of the site, before discharging into the Koojesse Inlet of Frobisher Bay (EXP, 2018).

Waste Transfer Station

There are no waterbodies reported on the site location; however, there are a few small bodies of water 30 m west of the site, as well as a stream contained within a road ditch located along the north eastern boundary (Delvin, 2018a; Delvin, 2018b). The stream drains into Koojesse Inlet, which is located approximately 2 km southeast of the site.

3.3 Wildlife and Wildlife Habitat

Wildlife that frequent the region, as characterized by species found in Sylvia Grinnell Territorial Park, include Caribou (*Rangifer tarandus)*, Arctic Foxes (*Vulpes lagopus*), Arctic Hares (*Lepus arcticus*), other small mammals; and although infrequent; Polar Bears (*Ursus maritimus*) (Nunavut Parks, 2019). Migratory bird species known to occur within the region include the Common Ringed Plover (*Charadrius*

hiaticula), Lapland Longspur (*Calcarius lapponicus*), Snow Bunting (*Plectrophenax nivalis*), Northern Wheatear (*Oenanthe oenanthe*), Red-Throated Loon (*Gavia stellate*), Peregrine Falcon (*Falco peregrinus*), Gyrfalcon (*Falco rusticolus*), Lesser Golden Plover (*Pluvialis dominica*), Semipalmated Sandpiper (*Calidris pusilla*) and Horned Lark (*Eremophila alpestris*) (Nunavut Parks, 2019).

Landfill

Eleven wildlife species were observed at the site location – three mammals, five birds and three insects – but none are protected under SARA legislation (EXP, 2018). The wildlife species observed at the site included: Lemming (*Lemmus trimucronatus*), Fox (*Vulpes sp.*), Caribou (*Rangifer tarandus*), Savannah Sparrow (*Passerculus trimucronatus*), Red-throated Loon (*Gavia stellate*), Common Raven (*Corvus corax*), Falcon (*Falco sp.*), American Pipit (*Anthus rubescens*), American Copper (*Lycaena phlaeas*), Forest Bumblebee (*Bombus sylvicola*) and Wolf Spider (*Hogna lenta*).

Waste Transfer Station

No reports were found that indicated wildlife populations or wildlife habitat are present within the site boundary.

3.4 Fish and Fish Habitat

Landfill

The waterbodies within the site boundary are unlikely to be accessible to fish; however, the stream that collects surface drainage from the Landfill site contributes to Carney Creek, which connects to a small lake west of the site reportedly providing habitat for Arctic Char (EXP, 2018).

Waste Transfer Station

No reports were found that indicated fish populations or fish habitat are present within the site boundary.

3.5 Species at Risk or Species of Special Status

The following Species at Risk (SAR) or species of special status (see **Table 3-1**) have the potential to be impacted by the proposed project.

Table 3-3-1: Wildlife Species at Risk

Common Name	Scientific Name	COSEWIC Status	SARA Status	Schedule 1
Caribou (barren-ground population)	Rangifer tarandus	Threatened	No Status	No
Harlequin Duck	Histrionicus histrionicus	Special Concern	Special Concern	Yes
Polar Bear	Ursus maritimus	Special Concern	Special Concern	Yes
Red Knot (rufa subspecies)	Calidris canutus rufa	Endangered	Endangered	Yes
Red-necked Phalarope	Phalaropus lobatus	Special Concern	No Status	No
Ross's Gull	Rhodostethia rosea	Threatened	Threatened	Yes
Wolverine	Gulo gulo	Special Concern	Special Concern	Yes

While not all of the listed species were identified at the time the surveys were conducted at the sites, these species are known to live in the area, and could be present or visit the sites during the lifespan of this project.

3.6 Heritage and Cultural Resources

Landfill

There are no designated cultural heritage or archaeological/paleontological features identified within the site boundary; however, the proposed site and adjacent landscape is used for outdoor recreational and traditional activities (EXP, 2018). These reported activities include hunting, fishing, berry picking, camping, winter skiing, picnicking and dog walking (EXP, 2018).

Waste Transfer Station

No reports were found that indicated cultural heritage or archaeological/paleontological features are present within the site boundary.

4.0 Environmental Protection Measures

The purpose of this section is to provide specific mitigation measures for the project team to implement or confirm implementations, in order to avoid or reduce potential environmental impacts. Mitigation measures for the Contractor to implement are outlined for various components of the project in **Tables 4-1** to **4-3** below. Within each table, the mitigation measures are sorted by issue/activity. Revision of specific mitigation measures outlined in the EPP may be required to address unforeseen site-specific conditions or as a result of ongoing consultation.

Applicable Orders, Permits and Licenses for the project are provided in **Appendix B**.

Table 4-1: Mitigation Measures for Planning and Regulatory Requirements

Issue/Activity	Mitigation Measures
Work Progress Schedule **Discipline**	1. Works must be conducted according to regulatory approvals, permits, and licenses obtained for the work. These documents shall be displayed at each work site. 2. Adhere to planned project scheduling as outlined in the applicable regulatory permits and approvals. 3. Schedule and conduct activities to adhere to applicable timing windows and avoid restricted activity periods, where feasible, as follows: • Where possible, pre-clear shrubs and tall grasses prior to the onset of migratory bird nesting period (May 6 – September 1) to discourage nesting on the construction footprint. 4. A copy of this EPP and its included plans, regulatory approvals, permits and/or licenses will be available on-site at all times. 5. As part of pre-construction survey marking, conduct the following: • Clearly flag or stake the boundaries of the project area before construction, including the corners of the work areas. Maintain the corner markings until the work areas are reclaimed. • Clearly flag or stake the boundaries of temporary access roads. • Maintain survey markings until construction and clean-up activities are complete. 6. Workers who shows careless or wanton neglect of the environment, or disregard requirements put forward in the EPP will be identified, the incident recorded, and the Contractor will take appropriate action.
Environmental Training	7. Prior to the beginning of construction, a pre-job meeting will be held with relevant project personnel (e.g., engineering, safety and environment employees, observers, contractor supervisors) where this EPP, environmental concerns, mitigation measures, and regulations specific to the work, corporate policies and procedures, specific stakeholder conditions, specific conditions on associated permits, and contingency measures will be reviewed with the Contractor. 8. Environmental training will be provided to field level project personnel, as part of the site orientation, prior to starting work. This training, reviewed by the Owner and their representative, will be provided by the Contractor.

Table 4-2: Mitigations Measures for Construction

Issue/Activity	Mitigation Measures
Work Areas	1. Project activities must occur within the approved workspace. 2. Where necessary, the applicable work area boundaries must be clearly staked or marked with flagging tape.
Erosion and Sediment Control* ***: see Appendix C***	3. Erosion and sediment controls shall be installed prior to commencing excavations or work in areas susceptible to erosion. 4. If activities involve ground disturbance within 100 m of any watercourse or wetland, erosion control structures must be installed between the natural areas and the work areas to create separation of the work area, as required. 5. Erosion and sediment control measures are to be left in place, where feasible, until all work is complete. 6. Erosion and sediment control measures are to be routinely inspected and maintained in proper working order. 7. Erosion and sediment control measures are not static and may need to be upgraded and/or amended as directed by the Regulators, Owner, or their representative, as site conditions change. 8. The Contractor shall repair failed erosion and sediment control measures as soon as possible. 9. If drifting soil or topsoil loss is evident in areas prone to wind erosion, conduct the following: • Suspend topsoil stripping operations during high winds; • Apply a tackifier to the stripped topsoil pile; and/or • Install wind barriers. 10. Topsoil handling will be suspended during high winds when soil erosion is evident and during heavy rains if soil becomes saturated. Topsoil will not be handled until winds have decreased and/or topsoil has drained and dried. 11. After final grading, stabilize disturbed steep slopes with permanent erosion control structures, especially if heavy runoff or heavy storms are likely, and there is a risk of substantial erosion. 12. Remove silt fence and erosion control measures only after the site has been stabilized.
Equipment Cleaning and Condition	13. Construction equipment, including tracked equipment and rubber-tired vehicles, shall arrive on the job site clean (i.e., free of soil and vegetative debris) and in good working order with no oil, hydraulic, or other fluid leaks. 14. Machinery and equipment shall be inspected for leaks throughout the duration of construction.
Clearing, Grubbing, and Grading	15. Construction work will be confined to the defined workspace. 16. Soil disturbance will only occur within the designated areas of the project required for surface or subsurface work. 17. Limit the extent of clearing, grubbing and grading to the minimum extent feasible. 18. Store material in discrete piles or windrows. 19. Ensure that stripped or graded soil does not spread outside of the project area. 20. Segregate topsoil from subsoil fill. 21. Consult with the Owner's representative prior to clearing or removing vegetation near watercourses. 22. Prior to any vegetation clearing or soil stripping, the appropriate wildlife and birds nest surveys must be completed prior to the start of clearing operations.

Issue/Activity	Mitigation Measures
Drainage Control	23. Ensure construction activities do not obstruct natural drainage, where possible, and facilitate drainage around the work area when avoidance is not possible. 24. Following construction, grade to re-establish surface drainage patterns and maintain existing site grades. 25. Leave gaps in windrows, at obvious drainages, on side-hill terrain and wherever seepage occurs, to reduce interference with natural drainage patterns. 26. Interceptor ditches and sumps are to be maintained free of accumulated sediment. Inspections are to be carried out regularly; cleaning to occur as required.
Dust and Noise Control	27. Vehicle use on public roads and project access routes will be in accordance with applicable laws and road use agreements (e.g., load restrictions). 28. Vehicles will not exceed speed limits established for the area and will lower speeds in specific conditions, such as areas of high erosion hazard. 29. Personnel will avoid unnecessary wheel spin when traveling or operating on soil. 30. Personnel will not unnecessarily idle vehicles or equipment. 31. Ensure equipment and machinery is in good working order with proper noise abatement equipment (i.e., mufflers or enclosures). 32. Locate stationary equipment, such as compressors and generators, away from noise receptors to limit the transmission of noise off-site. 33. Notify the Owner or their representative of any noise complaints that may be received by project personnel, public agencies, or individuals.
Fuel and Hazardous Material Storage	34. Hazardous materials must be labeled, stored and handled according to Workplace Hazardous Materials Information System regulations. 35. Fuel storage containers and tanks will be appropriately labeled. 36. Adequate spill response materials are available and accessible at the site. 37. Fuel containers and filters must be stored in secondary containment. 38. Jerry cans and other mobile fuel containers must always be stored in secondary containment while being used and returned to the storage area, as soon feasible following use. 39. Refueling points and fuel storage tanks, including secondary containment and gas cans, will be inspected regularly. All leaks must be repaired immediately.
Equipment Refueling and Servicing	40. Regularly inspect and maintain all heavy equipment and vehicles used for the project, including fuel transfer hoses and fuel/oil lines, to ensure that the systems are in good condition and free of leaks. Equipment or vehicles with deficiencies will be taken out of service and repaired. 41. Refueling equipment will be attended at all times while refueling. 42. Refueling of equipment will not take place within 30 m of any wetland or watercourse. 43. Drip trays are to be in place while refueling occurs to contain overfilling, drips and spills. 44. All vehicle servicing with the potential for accidental spills shall take place above an impervious tarp, and servicing will not take place within 30 m of wetlands or watercourses. 45. Spill kits should be accessible while refueling. 46. Spill mats and/or drip pans/trays will be placed under all mobile fueling containers, equipment, and vehicles, when not in use or parked for longer than two hours.

Issue/Activity	Mitigation Measures
Spill Response, Reporting and Notification	47. The Contractor will notify the Owner or their representative, as soon possible, following the discovery of a spill of any volume. 48. The Contractor will notify Regulatory agencies and community liaisons, where required, to notify them of the spill. 49. A written spill report must be submitted to the Owner and their representative by the Contractor within 24 hours of any spill.
Air Emissions	50. Do not unnecessarily idle vehicles or equipment. 51. Ensure equipment is well maintained. 52. Notify the Owner or their representative of any odour complaints that may be received by project personnel, public agencies, or individuals.
Light Emissions	53. Lighting will be restricted to the minimum required to complete the works safely. 54. Lighting will be directed to the work area to reduce light pollution during dark hours to the extent feasible.
Wildlife Encounters and Sightings	55. Feeding or harassing wildlife is prohibited. 56. Travel within posted speed limits and yield to wildlife. 57. Report incidents of collisions or close calls with wildlife to the Owner or their representative. 58. The Contractor will notify the Owner and/or their representative of the following wildlife sightings: • Any suspected SAR or suspected species of special status, which are listed in **Table 3-1**; • Any dead or sick/diseased wildlife; and • Any food caches, dens, or nests found within or close to the site. 59. The Government of Nunavut will be notified of wildlife encounters by the Owner, when required. 60. If previously unidentified listed or sensitive wildlife species or their site-specific habitat (e.g., dens, nests) are identified during construction, the Contractor will report the sighting to the Owner or their representative and implement the Wildlife Species of Concern Discovery Contingency Plan (**Section 6.2**).
Water Management	61. Water taking/withdrawal can only be carried out while personnel are on-site or nearby, allowing for regular inspection and maintenance of the pumping and discharge system. 62. Prior to discharging any water to the environment, the water must be inspected for any signs of contaminants. If signs of contaminants are present, the water must be collected and hauled to a disposal facility or sampled and analyzed to determine if the water meets Canadian Council of Ministers of the Environment water quality guidelines for the protection of aquatic life. 63. Water is to be discharged using pumps that will be directed to sediment removal materials (i.e., filter bag) or water settlement areas, in low-lying, vegetated areas at least 30 m away from a watercourse or wetland. At no time shall water be discharged directly into a watercourse or wetland. Dewatering volumes are to be monitored and recorded daily. 64. Where possible, discharge locations should be chosen that are near the dewatered area to maintain the local water table elevation. 65. Suitable discharge locations will be reviewed and confirmed by the Construction Manager and the EI.

Issue/Activity	Mitigation Measures
Discovery of Heritage Resources, Sites, or Artifacts	66. Avoid impacts on lands outside of the work areas, including vegetation clearing. 67. If any artifacts or signs of archaeological artifacts are encountered, all work in the area will be stopped immediately and the Owner and their representative will be immediately notified. Work will not resume until the Regulator has approved mitigation measures are implemented. Do not operate vehicles or equipment within 30 m of a known or suspected archaeological site, or burial ground. 68. The Owner will notify the following, as soon as possible, upon the discovery of an archaeological or historical site: • Government of Nunavut Territorial Archaeologist 867 934-2040 and include the following information: o Name and contact information of the person who made the discovery; o The date of discovery; o The nature of the object or fossil; o A description of the site and any artifacts/fossils noted; o A few photographs of the artifact/fossil and/or site; o A GPS reading of the location, if possible; o Any other relevant information; and o Regulations: subsection 51 (1) of the *Nunavut Act* and the Nunavut Archaeological and Palaeontological Sites Regulations. 69. No one shall knowingly remove, disturb, or displace any archaeological specimen or site.

Issue/Activity	Mitigation Measures
Watercourse Protection	70. Install effective erosion control and sediment control measures before starting work to prevent sediment from entering any waterbody or spreading outside of the work site. 71. Wash, refuel, and service machinery, and store fuel and other materials for the machinery in such a way that prevent any deleterious substances from entering the water. 72. Schedule work to avoid wet, windy, and rainy periods that may cause erosion and sedimentation. 73. Apply the following mitigation measures to ensure fish habitat is maintained when crossing waterbodies: • Install a temporary bridge structure over the waterbody. The temporary bridge will be placed above the ordinary high water mark so that instream works are not required. Use matting to cross non-fish bearing watercourses and wetlands. • Use temporary crossing structures or other practices to cross watercourses with steep and/or highly erodible (e.g., dominated by organic materials and silts) banks and beds. • Design and construct approaches to the watercourse or waterbody, such that they are perpendicular to the watercourse or waterbody to minimize loss or disturbance to riparian vegetation. • The banks of the watercourses are not to be cut unless otherwise authorized by the Regulators. • Do not remove naturally occurring material from the bed and banks of any watercourse below the ordinary high water mark. • Do not store material on the ice surface of a watercourse, unless required for immediate use. • Minimize the disturbance of riparian vegetation within the immediate boundary of watercourse crossings to the extent practical. • Install suitable erosion and sediment controls measures around work areas near watercourses and wetlands to prevent resuspension of sediment into waterbodies. • If works around watercourse or wetland crossings cause exposed soils and/or bank stability issues, remediate the exposed banks upon completion of the work. • Do not ford wet streams. • Remove all construction materials from site upon crossing completion. 74. Notify the Owner's representative if any suspected contamination is discovered in or near a waterbody, who will initiate the applicable investigation and sampling to be completed to confirm suspect soil or water: • Soil or slurry material should be considered contaminated, if any of the following are found: o Oil residue; o Gaseous odour; o Discoloured soil; and/or o Sheen on water. • Upon discovery of potential impacted soil or water, the site observer and their Project Manager will consult with the Owner to determine proper sampling requirements. • If required, the Owner will notify the applicable regulators of the newly discovered impacts. • Contaminated materials will be disposed of in accordance with the Waste Management Plan. • Consult with the Owner prior to disposing of any contaminated waste. requirements are met and an approved facility has been arranged to receive the waste.

Table 4-3: Waste Management Procedures

Issue/Activity	Mitigation Measures
Waste Handling and Disposal	1. Appropriate waste disposal facilities for each waste type to be produced by the project must be identified by the Contractor, prior to starting work. 2. All waste leaving the site must be accompanied with an appropriate waybill, bill of lading or waste manifest. Consult with the Owner or their representative to determine what type of paperwork is required. 3. Notify waste disposal facilities of waste shipments prior to leaving the site and determine if any there are facility sampling requirements. 4. No wastes may be disposed of on-site. 5. If wastes, including wastewater, are to be disposed of at a local municipal waste facility, agreements should be in place between the receiving local municipal waste facility and the Contractor, prior to any wastes being hauled. 6. All sewage and solid waste will be contained and sealed in watertight containers. 7. Tanks used for transporting greywater will be watertight, and will be regularly and properly inspected and maintained by the operator.

5.0 Monitoring and Inspection

As a defined Contractor responsibility, monitoring and inspection activities are to be conducted during the construction phase of the project, to assess any impacts to the surrounding environment and habitat. Environmental monitoring and inspections are important during this phase because the potential for negative impacts to the environment and habitats occurring within and outside the site area is high. It is imperative that spills and other incidents, which impact the environment and wildlife in the area, such as the discovery of a nesting bird in the construction zone, are reported immediately. If a site characteristic is deemed problematic, appropriate mitigations measures are to be implemented. There may be a need to revise specific monitoring and inspection activities outlined below to address unforeseen site-specific conditions.

6.0 Contingency and Emergency Response Plans

6.1 Spill Response Plan

The following sections contain spill response plans for small and large spills. Mitigation measures pertaining to Fuel and Hazardous Material Storage, Equipment Refueling and Servicing and Spill Response, Reporting, and Notification is found in **Section 4.0 - Environmental Protection Measures**.

6.1.1 Small Spills/Leaks

Spills or leaks less than 20 L are considered a small spill and the following procedure must be followed:

1. The first observer will check the immediate area for any affected or injured personnel, and will inform the Contractor, as soon as possible.
2. The Contractor will:
    a. Ensure activity in the area is restricted to guarantee the safety of the personnel cleaning up the spill.
    b. Direct staff to take appropriate emergency environmental protection measures such as placing booms, barrier, or absorbent pads around the spill to prevent liquid escape into the environment or into surface waterbodies.
    c. Shovel the spilled material and clean-up debris into a drum, bin, or bag;
    d. Label the container(s) as “Spill Material” along with the spilled substance and date. Place it in a safe storage area.
    e. Notify the Department of Environment for the Government of Nunavut and take their direction as appropriate.
    f. Complete a *Spill Report Form* detailing the following:
        i. Amount of product spilled;
        ii. Name of material spilled if known. If the material is unknown, indicate as such in the log;
        iii. Person who discovered the spill;
        iv. Date and time of the spill;
        v. Estimated volume of spill clean-up material used; and
        vi. Any other relevant details.
    g. Forward the incident report/memo to the supervisor for review; and
    h. Attempt to determine the cause of the release, if risk to further release exists, and if feasible, mitigate the cause to prevent further releases.

6.1.2 Large Spills/Leaks

Spills or leaks greater than 20 L are considered a large spill. For a large spill, the following procedure must be followed:

1. The first observer will check the immediate area for any affected or injured personnel, and will inform the Emergency Coordinator, as soon as possible.

2. The Contractor will take control of the emergency and complete the remaining steps:
    a. Clear all personnel out of the area.
    b. Notify the Department of Environment for the Government of Nunavut and take direction from the Department or their designated authority.
    c. If over 100 L of fuel is spilled, or the spill volume is unknown, by law it must be reported to the Government of Nunavut. Report a spill in one of the following two ways:
        i. Call the 24-Hour Spill Report Line at 867-920-8130; or
        ii. Complete the *Spill Report Form* from the Nunavut Government (found in **Appendix E** of this report) and fax it to 867-873-6924, or email it to spills@gov.nt.ca.
3. For other Schedule B Contaminants (NWT Reg, 2006), if greater than the reference amount of contaminant was spilled or you are unaware of how much was spilled, by law it must be reported to the Government of Nunavut. To report a spill of Schedule B Contaminants, phone the 24-Hour spill Report Line at 867-920-8130. A list of Schedule B Contaminants and the reference spill volumes (NWT Reg, 2006) are presented in **Table 6-1**.

Table 6-1: Schedule B Contaminant Reference Spill Amounts

TDGA Class	Description of Contaminant	Amount Spilled
1	Explosives	Any amount
2.1	Compressed gas (flammable)	Any amount of gas from containers with a capacity greater than 100 L
2.2	Compressed gas (non-corrosive, non-flammable)	Any amount of gas from containers with a capacity greater than 100 L
2.3	Compressed gas (toxic)	Any amount
2.4	Compressed gas (corrosive)	Any amount
3.1, 3.2, 3.3	Flammable liquid	100 L
4.1	Flammable solid	25 kg
4.2	Spontaneously combustible solids	25 kg
4.3	Water reactant solids	25 kg
5.1	Oxidizing substances	50 L or 50 kg
5.2	Organic peroxides	1 L or 1 kg
6.1	Poisonous substances	5 L or 5 kg

4. Use appropriate personal protective equipment (PPE) for proper handling of material;
5. If there is danger due to exposure, fire, explosion, or if public safety, the Contractor will suspend operation. All personnel should evacuate to the Emergency Muster Area. If the Emergency Muster Area is an unsafe area due to the conditions, personnel must proceed to an Alternative Muster Area.
    a. Contractors should take attendance from preprinted list.
    b. Phone and seek guidance from the 24-Hour Spill Report Line at (867-920-8130).

6. If the chemical spill is too dangerous or toxic to handle with equipment on-site or if it appears to be dangerous, reactive, or unknown, contact the 24-Hour Spill Report Line (867-920-8130) for guidance and assistance.
7. If safe to do so, direct staff to take appropriate emergency environmental protection measures such as placing booms, barrier, or absorbent pads around the spill to prevent liquid escape into the environment or into surface waterbodies. If necessary, create a ditch around the area of the spill or leak, or build a berm to minimize the movement of the spilled product.
8. Shut off all valves to utilities in the area, if they pose a potential risk to the spill clean-up personnel.
9. Block any sewers or drains in the area if they pose a potential risk to the spill clean-up personnel.
10. Place the spill clean-up material into an open top drum or lugger bin, including disposable PPE used in the spill clean-up.
11. Complete a *Spill Report Form* detailing the following:
    a. Amount of product spilled;
    b. Name of material spilled if it is known; if the material is unknown, indicate that it is unknown in the log;
    c. Person who noted the spill;
    d. Date and time of the spill;
    e. Estimated volume of spill clean-up material use; and
    f. Any other relevant details.
12. Forward the incident report/memo to the supervisor for review.
13. Supervisor will make arrangements for proper disposal of spill and spill clean-up material.
14. Attempt to determine the cause of the release and if there is a risk of a future release.
15. Assess and potentially upgrade the level of emergency, if necessary.

6.2 Incidental Discovery of Sensitive or Protected Species Contingency Plan

In the event that wildlife species of concern or their specific habitat are discovered on-site during construction, the following mitigation steps will occur:

1. Suspend work immediately in the vicinity of the newly discovered wildlife species of concern. Work may not resume until the measures below are complete.
2. Notify the Contractor, who will notify the Owner and/or their representative.
3. The Owner, engaging specialist advice as necessary, will assess the potential discovery and either allow construction to resume or proceed by notifying:
    a. Applicable government agencies, as required; and
    b. Wildlife Consultants (i.e., Dillon Consulting Limited).
4. The wildlife consultant may deem it necessary to visit the site to develop an appropriate mitigation plan. The mitigation measures available may include:
    - Abiding by seasonal timing constraints within the recommended set back distances;
    - Abiding by daily timing restrictions on construction activities;

- Narrowing the proposed area of disturbance, and protect the site using fencing and signage;
- Altering or delaying construction activities to avoid sensory disturbance (e.g., avoid burning, loud noises, bright lights, etc.);
- Extending road or watercourse bores to avoid or minimize site-specific effect;
- Informing all users of access restrictions in the fenced sites;
- Altering the route to avoid the site;
- Installing nest boxes/platforms and/or replace/enhance habitat during reclamation or restoration; and
- Relocating nests, habitat features, or individuals if practical and monitor post-construction response.

The wildlife or wildlife habitat will be assessed based on the following criteria:

1. The location of the wildlife or wildlife habitat with respect to the proposed construction site;
2. The presence of topographic features or vegetation to effectively screen the wildlife or habitat from the construction activities;
3. The species critical timing restraints in relation to the timing of construction; and
4. The potential to alter construction activities to minimize or avoid sensory disturbance.

7.0 References

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Nunavut Parks. 2019. Sylvia Grinnell Territorial Park. Retrieved from https://nunavutparks.com/parks-special-places/sylvia-grinnell-territorial-park/ (accessed 08.05.2019).

Appendix A

Project Contact List

Table 1: Contact Information for Key Project Contacts

CITY OF IQALUIT			
CONTACT	PAGER #	WORK #	CELL #
Dispatch	N/A	979-5650	-
Chief Administrative Officer (CAO)	N/A	979-5666	222-2953
Director of Public Works and Engineering	N/A	975-8509	222-2965
Operations Superintendent, Public Works	N/A	979-5631	222-2956
Manager of Engineering (Vacant)	-	-	-
Utilidor Manager	N/A	979-5632	222-2966
Utilidor on-call	32	N/A	222-3243
Garage/Roads Foreman	N/A	979-5668	N/A
Trucked Services Foreman	N/A	979-5612	222-2947
Owner's Third Party Representative- Dillon Consulting Limited (Keith Barnes)	-	(403)215-8885 ext. 4310	(403)827-6299

EMERGENCY SERVICES		
CONTACT	WORK #	CELL #
Dispatch	979-5650	-
Duty Officer (Fire/Ambulance)	979-4422	-
Fire Chief	979-5657	222-5073
Deputy Fire Chief	979-5650	222-2955
Deputy Fire Chief	979-5650	222-3981
Chief Municipal Enforcement Officer	979-5670	222-5521
RCMP	979-1111 979-0123	
GOVERNMENT RESOURCES- SPILL LINE		
24-Hour Spill Line	Telephone #	(867)920-8130

EXTERNAL ASSISTANCE- GOVERNMENT RESOURCES	
DEPARTMENT	CONTACT #
Environmental Protection, Government of Nunavut	975-5900
Indian and Northern Affairs Canada, Nunavut District Manager	975-4295
Indian and Northern Affairs, Baffin Sub-District	975-4295
Environment and Climate Change Canada, Iqaluit	975-4636
Department of Fisheries and Oceans, Iqaluit	979-8000
Regional Public Health Officer, Government of Nunavut	979-7652

CONTRACTOR	CONTACT #
Baffin Building Systems	979-5903
Kudlik Construction Ltd	979-1166

CONTRACTOR	CONTACT #
Nunavut Excavating Ltd	975-3320
RL Hanson	979-6004
Tower Arctic Ltd.	979-6465
Qikiqtaaluk Environmental	
Nunatta Environmental	

Appendix B

Orders, Permits and Licenses
(to be added when available)

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Appendix C

Erosion and Sediment Control Plan
(to be added when added)

Appendix C

Environmental Protection Plan – Operations, Closure and Post-Closure Phase
(under separate cover)

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CITY OF IQALUIT

Environmental Protection Plan (Draft) Operations, Closure and Post-Closure Phases

Landfill and Waste Transfer Station

June 2019 | 19-9543 – Version 1.0

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1.0 Introduction

1.1 Purpose of This Document

This Environmental Protection Plan (EPP) has been prepared as part of an overarching Environmental Management Plan (EMP) and describes the environmental protection measures to be implemented during the operation, closure, and post-closure phases of the City of Iqaluit's (the City's) proposed Waste Transfer Station (WTS) and Landfill. The purpose of the EPP is to be a resource for the City to utilize to avoid or mitigate potential adverse environmental effects to various receptors. This EPP is based on a desktop review of publically available records and site assessments conducted for the Landfill and Transfer Station locations, completed by EXP Services Inc. (Delvin, 2018a; Delvin 2018b; EXP, 2018).

This EPP outlines environmental protection measures, as they relate to facility activities, and provides a reference for environmental inspection staff to support decision-making **during the operations, closure, and post-closure phases of the project**.

Key project contacts (as of May 2019) are provided in **Appendix A**.

1.2 Regulatory Context

The environmental regulatory framework that the project falls under includes:

1. *Fisheries Act;*
2. *Species at Risk Act;*
3. *Canadian Environmental Protection Act;*
4. *Nunavut Wildlife Act;*
5. *Nunavut Environmental Protection Act;* and
6. *Nunavut Waters and Nunavut Surface Rights Tribunal Act.*

2.0 Project Roles and Responsibilities

The following section outlines the roles and responsibilities of the City. These responsibilities include reporting, notifications, guidelines on documentation and incident reporting.

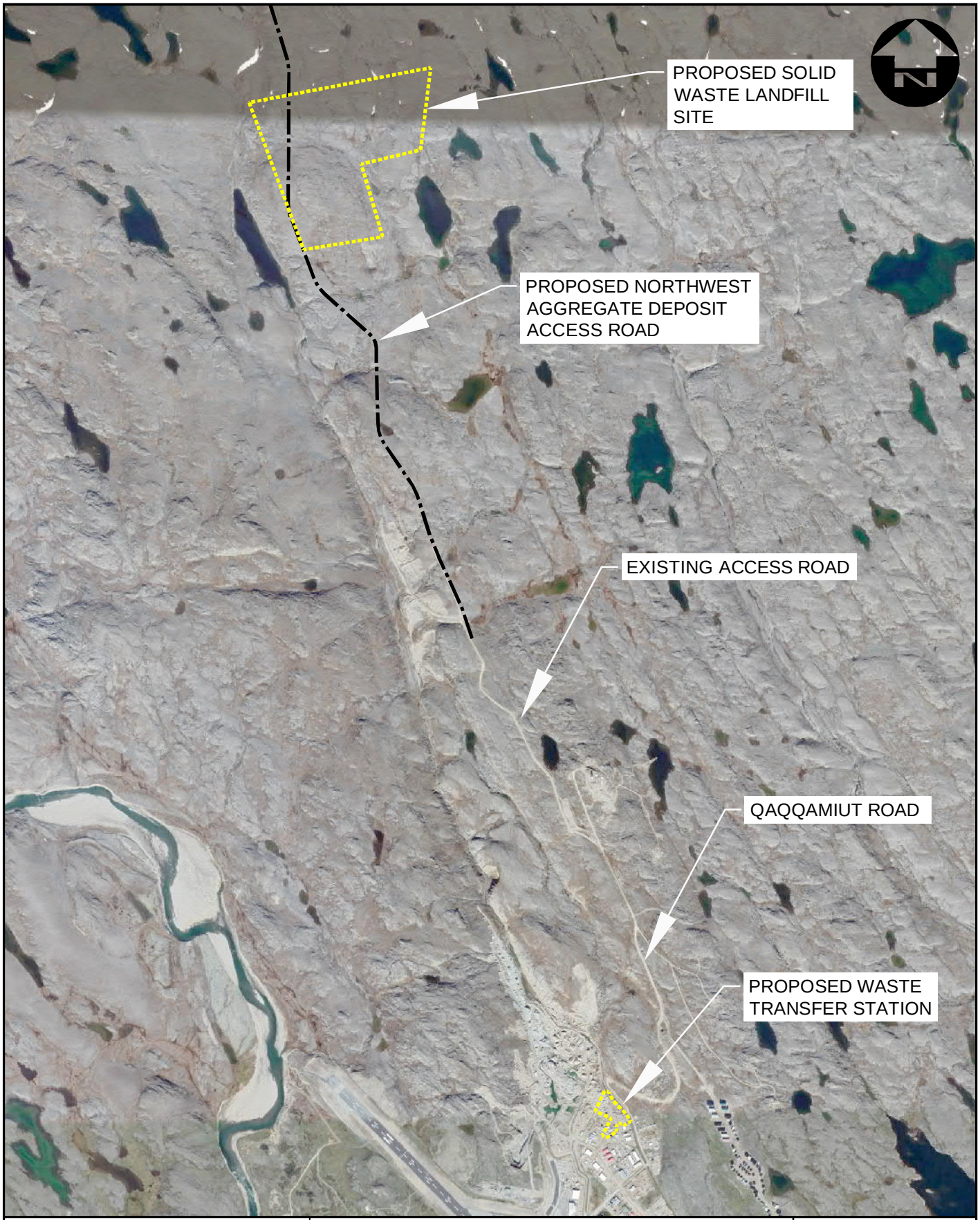
City of Iqaluit - Owner

As the Operator of the Landfill and Transfer Station, the City will be responsible for ensuring that employees are made aware of the EPP and associated plans, and that the commitments contained therein are implemented. The City is responsible for ensuring that associated regulations are met, and providing guidance and technical support to on-site personnel with respect to environmental compliance.

3.0 Environmental Considerations

The environmental setting of the project areas (**Figure 3-1**) was assessed using a desktop review of publically-available records and site assessments completed by EXP Services Inc. (Delvin, 2018a; Delvin 2018b; EXP, 2018). The two sites are located in the Meta Incognita Peninsula Ecoregion, which is characterized by rock outcroppings interspersed with sandy morainal veneers and frozen organic deposits, static cryosols with turbic and organic cryosol soils, and continuous permafrost with mainly medium ice content (Ecological Framework of Canada, 2019).

The Landfill site is approximately 22 ha in size, consisting predominantly of rolling hills with some bedrock outcrops in the south central region, small glacio-fluvial terraces in the northwest region, and boulder fields in the northwest and central portions of the site (EXP, 2018). The Transfer Station location is an industrial site, within the City, and is approximately 2.4 ha in size, covered by fill consisting of sand and gravel with boulders and cobbles (Delvin, 2018a; Delvin 2018b).



DILLON CONSULTING

DATE: JUNE 2019	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
	TITLE: SITE LOCATIONS	FIGURE NO.: 3-1

FileName:c:\projectwise\working directory\projects 2019\50dbc\dms1272\199543-02-site-con-cover.dwg

3.1 Species at Risk or Species of Special Status

The following Species at Risk (SAR) or species of special status (see **Table 3-1**) have the potential to be impacted by the proposed project:

Table 3-3-1: Wildlife Species at Risk

Common Name	Scientific Name	COSEWIC Status	SARA Status	Schedule 1
Caribou (barren-ground population)	Rangifer tarandus	Threatened	No Status	No
Harlequin Duck	Histrionicus histrionicus	Special Concern	Special Concern	Yes
Polar Bear	Ursus maritimus	Special Concern	Special Concern	Yes
Red Knot (rufa subspecies)	Calidris canutus rufa	Endangered	Endangered	Yes
Red-necked Phalarope	Phalaropus lobatus	Special Concern	No Status	No
Ross's Gull	Rhodostethia rosea	Threatened	Threatened	Yes
Wolverine	Gulo gulo	Special Concern	Special Concern	Yes

While not all of the listed species were identified at the time the surveys were conducted at the sites, these species are known to live in the area, and could be present or visit the sites during the lifespan of this project.

4.0 Environmental Protection Measures

The purpose of this section is to provide specific mitigation measures for the City to implement or confirm implementations, in order to avoid or reduce potential environmental impacts. The mitigation measures outlined in **Table 4-1** are to be implemented in the operations, closure and post-closure phases of the project. The operations phase describes the time from when normal operations begin, following construction, until the closure and decommissioning begins. Mitigation measures for the City to implement during the operations phase of the project are outlined in **Table 4-2** below. The mitigation measures to implement during the closure phase of the project, which describes the point in time when normal operations cease until when the closure and decommissioning activities end, are outlined in **Table 4-3**. The mitigation measures to implement during the post-closure phase are outlined in **Table 4-4.** Within each table, the mitigation measures are sorted by issue/activity. Revisions of specific mitigation measures outlined in the EPP may be required to address unforeseen site-specific conditions or as a result of ongoing operations.

Applicable Orders, Permits and Licenses for the project are provided in **Appendix B**.

Table 4-1: Mitigation Measures for Post-Construction Phases

Issue/Activity	Mitigation Measures
Work Progress Schedule	1. Works must be conducted according to regulatory approvals, permits and licenses obtained for the work. These documents shall be displayed at each work site. 2. Adhere to planned project scheduling as outlined in the applicable regulatory permits and approvals. 3. Schedule and conduct activities to adhere to applicable timing windows and avoid restricted activity periods, where feasible. 4. A copy of this EPP and its included plans, regulatory approvals, permits, and/or licenses will be available on-site at all times.
Documentation	5. Maintain an up-to-date documentation record of all site activities related to monitoring, site inspections, maintenance, repairs and remedial actions. 6. Document all incidences of nuisance activity, including illegal dumping, nuisance animals and fires. 7. Document complaints received from individuals, public agencies and project staff.
Nuisance Control	8. Report incidences of illegal dumping to the Manager of Solid Waste and the appropriate legal personnel. 9. Report incidences of nuisance animals to the Manager of Solid Waste and take the appropriate avoidance/deterrence measures. 10. Report incidences of fires on-site to the Manager of Solid Waste and contact the appropriate emergency services
Discipline	11. Workers who shows careless or wanton neglect of the environment or disregards requirements put forward in the EPP will be identified, the incident recorded and the Manager of Solid Waste will take appropriate action.
Environmental Training	12. Environmental training will be provided to facility staff, as part of the site orientation, prior to starting work.

Table 4-2: Mitigations Measures for Site Operations

Issue/Activity	Mitigation Measures
Work Areas	1. Project activities must occur within the approved workspace.
Drainage Control	2. Ensure operation activities do not obstruct natural drainage, where possible. If avoidance is not possible, facilitate drainage around the work area. 3. Interceptor ditches and sumps are to be maintained free of accumulated sediment. Inspections are to be carried out regularly; cleaning to occur as required.
Erosion and Sediment Control* ***: see Appendix C**	4. Erosion and sediment controls shall be installed prior to activities in areas susceptible to erosion. 5. If activities involve ground disturbance within 100 m of any watercourse or wetland, erosion control structures must be installed between the natural areas and the work areas to create separation of the work area, as required. 6. Erosion and sediment control measures are to be left in place, where feasible, until all work is complete and the site has been stabilized. 7. Erosion and sediment control measures are to be routinely inspected and maintained in proper working order. 8. Erosion and sediment control measures are not static and may need to be upgraded and/or amended as directed by the Regulators, as site conditions change. 9. The City shall repair failed erosion and sediment control measures as soon as possible. 10. If drifting soils or topsoil loss is evident in areas prone to wind erosion, conduct the following, as appropriate: • Suspend topsoil stripping operations during high winds; • Apply a tackifier to the stripped topsoil pile; and/or • Install wind barriers. 11. Topsoil handling will be suspended during high winds when soil erosion is evident and during heavy rains, if soil becomes saturated. Topsoil will not be handled until winds have decreased and/or topsoil has drained and dried.
Fuel and Hazardous Material Storage	12. Hazardous materials must be labeled, stored, and handled according to Workplace Hazardous Materials Information System (WHMIS) regulations. 13. Fuel storage containers and tanks will be appropriately labeled. 14. Adequate spill response materials are available and accessible at the site. 15. Fuel containers and filters must be stored in secondary containment. 16. Jerry cans and other mobile fuel containers must always be stored in secondary containment while being used and returned to the storage area, as soon as feasible following use. 17. Refueling points and fuel storage tanks, including secondary containment and gas cans, will be inspected regularly. All leaks must be repaired immediately.

Issue/Activity	Mitigation Measures
Equipment Refueling and Servicing	18. Regularly inspect and maintain all heavy equipment and vehicles used during site operation, including fuel transfer hoses and fuel/oil lines, to ensure that the systems are in good condition and free of leaks. Equipment or vehicles with deficiencies will be taken out of service and repaired. 19. Refueling equipment will be attended at all times while refueling. 20. Refueling of equipment will not take place within 30 m of any wetland or watercourse. 21. Drip trays are to be in place while refueling occurs to contain overfilling, drips and spills. 22. All vehicle servicing with the potential for accidental spills shall take place above an impervious tarp, and servicing will not take place within 30 m of wetlands or watercourses. 23. Spill kits should be accessible while refueling. 24. Spill mats and/or drip pans/trays will be placed under all mobile fueling containers.
Spill Response, Reporting and Notification	25. Staff will notify the Facility Supervisor, as soon possible, following the discovery of a spill of any volume. The Facility Supervisor will subsequently contact the Manager of Solid Waste with the information. 26. The Manager of Solid Waste will notify regulatory agencies and community liaisons, where required, to notify them of the spill. 27. A written spill report must be submitted to the Manager of Solid Waste within 24 hours of any spill. Inspect hydraulic, fuel and lubrication systems of equipment on a regular basis to ensure that the systems are in good condition and free of leaks. 28. All fuel containers or filters must be stored in secondary containment. 29. Refueling equipment will be attended at all times while refueling. 30. Refueling of equipment will not take place within 30 m of any wetland or watercourse. 31. Drip trays are to be in place while refueling occurs to contain overfilling, drips and spills. 32. All vehicle servicing with the potential for accidental spills shall take place above an impervious tarp, and servicing will not take place within 30 m of wetlands or watercourses. 33. Spill kits should be accessible while refueling. 34. Regular inspection and maintenance will be conducted for all heavy equipment and vehicles used for the project, including fuel transfer hoses and fuel/oil lines. Equipment or vehicles with deficiencies will be taken out of service and repaired. 35. Hazardous materials must be labeled, stored and handled according to WHMIS regulations. 36. Spill mats and/or drip pans/trays will be placed under all mobile fueling containers, equipment, and vehicles, when not in use or parked for longer than two hours.
Air Emissions	37. Ensure equipment and vehicles are well maintained. 38. Notify the Manager of Solid Waste of any odour complaints that may be received by project personnel, public agencies or individuals.
Noise	39. Ensure equipment and vehicles are in good working order with proper noise abatement equipment (i.e., mufflers or enclosures).
Light Emissions	40. Lighting will be restricted to the minimum required to complete the works safely. 41. Lighting will be directed to the work area to reduce light pollution during dark hours to the extent feasible.

Issue/Activity	Mitigation Measures
Wildlife Encounters and Sightings	42. Feeding or harassing wildlife is prohibited. 43. Travel within posted speed limits and yield to wildlife. 44. Report incidents of collisions or close calls with wildlife to the Manager of Solid Waste. 45. Notify the Manager of Solid Waste of the following wildlife sightings: • Any suspected species at risk or suspected species of special status, which are listed in **Table 3-1**; • Any dead or sick/diseased wildlife; and • Any food caches, dens, or nests found within or close to the site. 46. The Government of Nunavut will be notified of wildlife encounters by the Manager of Solid Waste when required. 47. If previously unidentified listed or sensitive wildlife species or their site-specific habitat (e.g., dens, nests) are identified during operation, report the sighting to the Manager of Solid Waste and implement the Wildlife Species of Concern Discovery Contingency Plan (**Section 6.2**).
Water Management	48. Water taking/withdrawal can only be carried out while personnel are on-site or nearby, allowing for regular inspection and maintenance of the pumping and discharge system. 49. Prior to discharging any water to the environment, the water must be inspected for any signs of contaminants. If signs of contaminants are present the water must be collected and hauled to a disposal facility or sampled and analyzed to determine if the water meets Canadian Council of Ministers of the Environment water quality guidelines for the protection of aquatic life. 50. Water is to be discharged using pumps that will be directed to sediment removal materials (i.e., filter bag) or water settlement areas, in low-lying, vegetated areas at least 30 m away from a watercourse or wetland. At no time shall water be discharged directly into a watercourse or wetland. Dewatering volumes are to be monitored and recorded daily. 51. Where possible, discharge locations should be chosen that are near the dewatered area to maintain the local water table elevation. 52. Suitable discharge locations will be reviewed and confirmed by the Manager of Solid Waste.

Issue/Activity	Mitigation Measures
Watercourse Protection	53. Install effective erosion control and sediment control measures before starting work near a waterbody. 54. Wash, refuel, and service machinery, and store fuel and other materials for the machinery in such a way that prevent any deleterious substances from entering the water. 55. Schedule work to avoid wet, windy, and rainy periods that may cause erosion and sedimentation. 56. Notify the Manager of Solid Waste if any suspected contamination is discovered in or near a waterbody, who will initiate the applicable investigation and sampling to be completed to confirm suspect soil or water: • Soil or slurry material should be considered contaminated if any of the following are found: o Oil residue; o Gaseous odour; o Discoloured soil; and/or o Sheen on water. • Upon discovery of potential impacted soil or water, staff will consult with the Manager of Solid Waste to determine proper sampling requirements. • If required, the Manager of Solid Waste will notify the applicable regulators of the newly discovered impacts. • Contaminated materials will be disposed of in accordance with the Waste Management Plan.
Leachate Management	57. Complete leachate management activities in accordance with the Operations and Maintenance Manual (under separate cover).
Landfill Gas Management	58. Complete landfill gas management activities in accordance with the Operations and Maintenance Manual (under separate cover).
Waste Handling and Disposal	59. Appropriate waste disposal facilities for each waste type to be produced by the project must be identified by the Manager of Solid Waste. 60. All waste leaving the site must be accompanied with an appropriate waybill, bill of lading or waste manifest. Consult with the Manager of Solid Waste to determine what type of paperwork is required. 61. Notify waste disposal facilities of waste shipments prior to leaving the site and determine if any there are facility sampling requirements. 62. All sewage and solid waste will be contained and sealed in watertight containers. 63. Tanks used for transporting greywater will be watertight, and will be regularly and properly inspected and maintained by the operator.

Issue/Activity	Mitigation Measures
Transportation	64. Vehicle use on public roads and project access routes will be in accordance with applicable laws and road use agreements (e.g., load restrictions). 65. Regularly inspect and maintain vehicles to keep them in proper working order. 66. Drivers must maintain an up-to-date transportation documentation system and carry the appropriate transportation documents (e.g., drivers licence, bill of lading, waybill, log book, etc.). 67. Vehicles will not exceed speed limits established for the area and will lower speeds in specific conditions such as areas of high erosion hazard. 68. Vehicles must yield to wildlife. 69. Personnel will avoid unnecessary wheel spin when traveling or operating on soil. 70. Do not necessarily idle vehicles or equipment. 71. Secure all loads with the appropriate tie-down equipment or load covers, and inspect the load immediately prior to commencing driving and once arriving at the destination. 72. If the load becomes unstable, immediately cease driving and re-secure the load 73. If a loss-of-load occurs, report the incident to the Manager of Solid Waste and seek guidance about the appropriate procedures moving forward. 74. If a vehicle or equipment breaks down during transportation, report the incident to the Manager of Solid Waste and seek assistance to fix the broken machinery. Do not operate the broken vehicle or equipment until it is in proper working order again. 75. If a vehicle or equipment get into an accident or encounters an accident during transportation, immediately contact the appropriate emergency services and report the incident to the Manager of Solid Waste. 76. Notify the Manager of Solid Waste of any noise complaints that may be received by project personnel, public agencies, or individuals.

Table 4-3: Mitigation Measures for Closure

Issue/Activity	Mitigation Measures
Work Areas	1. Project activities must occur within the approved workspace.
Work Schedule	2. Schedule closure and decommissioning activities to reduce interference with migratory bird restrictions and fish habitat timing restriction, as much as practical.
Reclamation	3. Complete reclamation of the work areas in accordance with the Closure and Decommissioning Plan (under separate cover). 4. Restore any trails used by traditional land users that were impacted by the project.
Debris Removal	5. Remove all debris and bins from the work area.
Drainage Control	6. Ensure activities do not obstruct natural drainage, where possible. If avoidance is not possible, facilitate drainage around the work area. 7. Grade to establish a minimum slope of 3% across the top of the waste fill area to allow surface water drainage off-site and to discourage infiltration, leachate production, and erosion.

Issue/Activity	Mitigation Measures
Erosion and Sediment Control* ***: noted as a low potential activity of concern given local soil conditions.**	8. Soil disturbance will only occur within the designated areas of the project. 9. Erosion and sediment control measures shall be installed prior to commencing excavations or work in areas susceptible to erosion. 10. If activities involve ground disturbance within 100 m of any water course or wetland, erosion control structures must be installed between the natural areas and the work areas to create separation of the work area, as required. 11. Erosion and sediment control measures are to be left in place, where feasible, until all work is complete and the site has been stabilized. 12. Erosion and sediment control measures are to be routinely inspected and maintained in proper working order. 13. The City shall repair failed erosion and sediment control measures, as soon as possible. 14. Erosion and sediment control measures are not static and may need to be upgraded and/or amended, as directed by the Regulators, as site conditions change. 15. Topsoil handling will be suspended during high winds when soil and erosion is evident, and during heavy rains if soil becomes saturated. Topsoil will not be handled until winds have decreased and/or topsoil has drained and dried. 16. If drifting soils or topsoil loss is evident in areas prone to wind erosion, conducting the following, as appropriate: • Suspend topsoil disturbed activities during high winds; • Apply a tackifier to the disturbed topsoil; and/or • Install wind barriers.
Fuel and Hazardous Material Storage	17. Hazardous materials must be labeled, stored, and handled according to WHMIS regulations. 18. Fuel storage containers and tanks will be appropriately labeled. 19. Adequate spill response materials are available and accessible at the site. 20. Fuel containers and filters must be stored in secondary containment. 21. Jerry cans and other mobile fuel containers must always be stored in secondary containment while being used and returned to the storage area, as soon feasible following use. 22. Refueling points and fuel storage tanks, including secondary containment and gas cans, will be inspected regularly. All leaks must be repaired immediately.
Equipment Refueling and Servicing	23. Regularly inspect and maintain all heavy equipment and vehicles used during site operations, including fuel transfer hoses and fuel/oil lines, to ensure that the systems are in good condition and free of leaks. Equipment or vehicles with deficiencies will be taken out of service and repaired. 24. Refueling equipment will be attended at all times, while refueling. 25. Refueling of equipment will not take place within 30 m of any wetland or watercourse. 26. Drip trays are to be in place while refueling occurs to contain overfilling, drips and spills. 27. All vehicle servicing with the potential for accidental spills shall take place above an impervious tarp, and servicing will not take place within 30 m of wetlands or watercourses. 28. Spill kits should be accessible while refueling. 29. Spill mats and/or drip pans/trays will be placed under all mobile fueling containers.

Issue/Activity	Mitigation Measures
Spill Response, Reporting and Notification	30. Staff will notify the Facility Supervisor, as soon possible, following the discovery of a spill of any volume. 31. The Manager of Solid Waste will notify regulatory agencies and community liaisons where required to notify them of the spill. 32. A written spill report must be submitted to the Manager of Solid Waste within 24 hours of any spill. Inspect hydraulic, fuel and lubrication systems of equipment on a regular basis to ensure that the systems are in good condition and free of leaks. 33. All fuel containers or filters must be stored in secondary containment. 34. Refueling equipment will be attended at all times while refueling. 35. Refueling of equipment will not take place within 30 m of any wetland or watercourse. 36. Drip trays are to be in place while refueling occurs to contain overfilling, drips and spills. 37. All vehicle servicing with the potential for accidental spills shall take place above an impervious tarp, and servicing will not take place within 30 m of wetlands or watercourses. 38. Spill kits should be accessible while refueling. 39. Regular inspection and maintenance will be conducted for all heavy equipment and vehicles used for the project, including fuel transfer hoses and fuel/oil lines. Equipment or vehicles with deficiencies will be taken out of service and repaired. 40. Hazardous materials must be labeled, stored, and handled according to WHMIS regulations. 41. Spill mats and/or drip pans/trays will be placed under all mobile fueling containers and under equipment and vehicles when not in use or parked for longer than two hours.
Air Emissions	42. Do not unnecessarily idle vehicles or equipment. 43. Ensure equipment is well maintained. 44. Notify the Manager of Solid Waste of any odour complaints that may be received by project personnel, public agencies, or individuals.
Noise	45. Ensure equipment and machinery is in good working order with proper noise abatement equipment (i.e. mufflers or enclosures).
Light Emissions	46. Lighting will be restricted to the minimum required to complete the works safely. 47. Lighting will be directed to the work area to reduce light pollution during dark hours to the extent feasible.
Wildlife Encounters and Sightings	48. Feeding or harassing wildlife is prohibited. 49. Travel within posted speed limits and yield to wildlife. 50. Report incidents of collisions or close calls with wildlife to the Manager of Solid Waste. 51. Notify the Manager of Solid Waste of the following wildlife sightings: • Any suspected species at risk or suspected species of special status, which are listed in **Table 3-1**; • Any dead or sick/diseased wildlife; and • Any food caches, dens, or nests found within or close to site. 52. The Government of Nunavut will be notified of wildlife encounters by the Manager of Solid Waste when required. 53. If previously unidentified listed or sensitive wildlife species or their site-specific habitat (e.g., dens, nests) are identified during operation, report the sighting to the Manager of Solid Waste and implement the Wildlife Species of Concern Discovery Contingency Plan (**Section 6.2**).

Issue/Activity	Mitigation Measures
Transportation	54. Vehicle use on public roads and project access routes will be in accordance with applicable laws and road use agreements (e.g., load restrictions). 55. Drivers must maintain an up-to-date transportation documentation system and carry the appropriate transportation documents (e.g., drivers licence, bill of lading, waybill, log book, etc.). 56. Vehicles will not exceed speed limits established for the area and will lower speeds in specific conditions such as areas of high erosion hazard. 57. Personnel will avoid unnecessary wheel spin when traveling or operating on soil. 58. Do not necessarily idle vehicles or equipment. 59. Ensure equipment and machinery is in good working order. 60. Secure all loads with the appropriate tie-down equipment or load covers, and inspect the load immediately prior to commencing driving and once arriving at the destination. 61. If the load becomes unstable, immediately cease driving and re-secure the load 62. If a loss-of-load occurs, report the incident to the Manager of Solid Waste and seek guidance about the appropriate procedures moving forward. 63. If a vehicle or equipment breaks down during transportation, report the incident to the Manager of Solid Waste and seek assistance to fix the broken machinery. Do not operate the broken vehicle or equipment until it is in proper working order again. 64. If a vehicle or equipment get into an accident or encounters an accident during transportation, immediately contact the appropriate emergency services and report the incident to the Manager of Solid Waste. 65. Notify the Manager of Solid Waste of any noise complaints that may be received by project personnel, public agencies, or individuals.
Leachate Management	66. Monitor and maintain the leachate collection and removal systems regularly. 67. Implement appropriate system updates/upgrades, as necessary.
Gas Management	68. Monitor and maintain landfill gas collection and controls regularly. 69. Implement appropriate system updates/upgrades, as necessary.
Waste Handling and Disposal	70. Appropriate waste disposal facilities for each waste type to be produced by the project must be identified by the Manager of Solid Waste. 71. All waste leaving the site must be accompanied with an appropriate waybill, bill of lading or waste manifest. Consult with the Manager of Solid Waste to determine what type of paperwork is required. 72. Notify waste disposal facilities of waste shipments prior to leaving the site and determine if any there are facility sampling requirements. 73. All sewage and solid waste will be contained and sealed in watertight containers. 74. Tanks used for transporting greywater will be watertight, and will be regularly and properly inspected and maintained by the operator.
Vegetation	75. Prepare the site in such a manner as to facilitate natural vegetation establishment.
Hazardous Material Monitoring	76. Before final grading and the installation of the site cover occurs, conduct a hazardous material assessment to determine if there is contamination on-site. The assessment should include air, soil, surface water and groundwater sampling. 77. Report any contamination to the Manager of Solid Waste and in the report describe the type, extent, degree, and approximate volume of the contamination. 78. Wear the appropriate personal protective equipment (PPE) while conducting the hazardous material assessment.

Table 4-4: Mitigation Measures for Post-Closure

Issue/Activity	Mitigation Measures
Drainage Control	1. Monitor the final cover integrity and make repairs/additions, as appropriate. 2. Monitor the site for low areas resulting from soil settlement or subsidence of the site. Fill these areas with soil to restore the desired site topography, where appropriate.
Erosion and Sediment Control	3. Monitor for erosion of top soils and implement erosion control measures, where appropriate. 4. Monitor long-term erosion and sediment control structures and make repairs, as necessary.
Leachate Management	5. Monitor and maintain the leachate collection and removal systems regularly. 6. Implement appropriate system updates/upgrades, as necessary.
Gas Management	7. Monitor and maintain landfill gas collection and controls regularly. 8. Implement appropriate system updates/upgrades, as necessary.
Vegetation	9. Maintain site vegetation and implement vegetation additions, removals, and cutting activities, where appropriate.
Hazardous Material Monitoring	10. Monitor surface water annually and report all incidences of contamination to the Manager of Solid Waste. 11. Monitor groundwater (active layer) for leachate and site contamination. Report all incidences of contamination to the Manager of Solid Waste. 12. Wear the appropriate PPE while conducting the site monitoring activities.

5.0 Monitoring and Inspection

As a responsibility of the City of Iqaluit, monitoring and inspection activities are to be conducted during the operations, closure, and post-closure phases of the project to assess any impacts to the surrounding environment and habitat. It is imperative that spills and other incidents, which negatively impact the environment and wildlife, are reported immediately. If a site characteristic is deemed problematic, appropriate mitigation measures will be implemented. There may be a need to revise specific monitoring and inspection activities outlined below to address unforeseen site-specific conditions or as a result of ongoing operations.

6.0 Contingency and Emergency Response Plan

6.1 Spill Response Plan

The following sections contain spill response plans for small and large spills. Mitigation measures pertaining to Fuel and Hazardous Material Storage, Equipment Refueling and Servicing and Spill Response, Reporting, and Notification is found in **Section 4.0 - Environmental Protection Measures**.

6.1.1 Small Spills/Leaks

Spills or leaks less than 20 L are considered a small spill and the following procedure must be followed:

1. The first observer will check the immediate area for any affected or injured personnel, and will inform the Manager of Solid Waste as soon as possible.
2. The Manager of Solid Waste will:
    a. Ensure activity in the area is restricted to guarantee the safety of the personnel cleaning up the spill.
    b. Direct staff to take appropriate emergency environmental protection measures such as placing booms, barrier, or absorbent pads around the spill to prevent liquid escape into the environment or into surface waterbodies.
    c. Shovel the spilled material and clean-up debris into a drum, bin, or bag;
    d. Label the container(s) as “Spill Material” along with the spilled substance and date. Place it in a safe storage area.
    e. Notify the Department of Environment for the Government of Nunavut and take their direction as appropriate.
    f. Complete a *Spill Report Form* detailing the following:
        i. Amount of product spilled;
        ii. Name of material spilled if known. If the material is unknown, indicate as such in the log;
        iii. Person who discovered the spill;
        iv. Date and time of the spill;
        v. Estimated volume of spill clean-up material used; and
        vi. Any other relevant details.
    g. Forward the incident report/memo to the supervisor for review; and
    h. Attempt to determine the cause of the release, if risk to further release exists, and if feasible, mitigate the cause to prevent further releases.

6.1.2 Large Spills/Leaks

Spills or leaks greater than 20 L are considered a large spill. For a large spill, the following procedure must be followed:

1. The first observer will check the immediate area for any affected or injured personnel and will inform the Emergency Coordinator as soon as possible.

2. The Manager of Solid Waste will take control of the emergency and complete the remaining steps:
3. Clear all personnel out of the area.
4. Notify the Department of Environment for the Government of Nunavut and take direction from the Department or their designated authority.
5. If over 100 L of fuel is spilled, or the spill volume is unknown, by law it must be reported to the Government of Nunavut. Report a spill in one of the following two ways:
    a. Call the 24-Hour Spill Report Line at 867-920-8130, or
    b. Complete the *Spill Report Form* from the Nunavut Government in **Appendix E** and then fax it to 867-873-6924 or email it to spills@gov.nt.ca.
6. For other Schedule B Contaminants (NWT Reg, 2006), if greater than the reference amount of contaminant was spilled or you are unaware of how much was spilled, by law it must be reported to the Government of Nunavut. To report a spill of Schedule B Contaminants, phone the 24-Hour spill Report Line at 867-920-8130. A list of Schedule B Contaminants and the reference spill volumes (NWT Reg, 2006) are presented in **Table 6-1**.

Table 6-1: Schedule B Contaminant Reference Spill Amounts

TDGA Class	Description of Contaminant	Amount Spilled
1	Explosives	Any amount
2.1	Compressed gas (flammable)	Any amount of gas from containers with a capacity greater than 100 L
2.2	Compressed gas (non-corrosive, non-flammable)	Any amount of gas from containers with a capacity greater than 100 L
2.3	Compressed gas (toxic)	Any amount
2.4	Compressed gas (corrosive)	Any amount
3.1, 3.2, 3.3	Flammable liquid	100 L
4.1	Flammable solid	25 kg
4.2	Spontaneously combustible solids	25 kg
4.3	Water reactant solids	25 kg
5.1	Oxidizing substances	50 L or 50 kg
5.2	Organic peroxides	1 L or 1 kg
6.1	Poisonous substances	5 L or 5 kg

1. Use appropriate personal protective equipment (PPE) for proper handling of material;
2. If there is danger due to exposure, fire, explosion, or if public safety, the Manager of Solid Waste will suspend operation. All personnel should evacuate to the Emergency Muster Area. If the Emergency Muster Area is an unsafe area due to the conditions, personnel must proceed to an Alternative Muster Area.
    a. The Facility Manager should take attendance from preprinted list.
    b. Phone and seek guidance from the 24-Hour Spill Report Line at (867-920-8130).

3. If the chemical spill is too dangerous or toxic to handle with equipment on-site or if it appears to be dangerous, reactive, or unknown, contact the 24-Hour Spill Report Line (867-920-8130) for guidance and assistance.
4. If safe to do so, direct staff to take appropriate emergency environmental protection measures such as placing booms, barrier, or absorbent pads around the spill to prevent liquid escape into the environment or into surface waterbodies. If necessary, create a ditch around the area of the spill or leak, or build a berm to minimize the movement of the spilled product.
5. Shut off all valves to utilities in the area, if they pose a potential risk to the spill clean-up personnel.
6. Block any sewers or drains in the area if they pose a potential risk to the spill clean-up personnel.
7. Place the spill clean-up material into an open top drum or lugger bin, including disposable PPE used in the spill clean-up.
8. Complete a *Spill Report Form* detailing the following:
    a. Amount of product spilled;
    b. Name of material spilled if it is known; if the material is unknown, indicate that it is unknown in the log;
    c. Person who noted the spill;
    d. Date and time of the spill;
    e. Estimated volume of spill clean-up material use; and
    f. Any other relevant details.
9. Forward the incident report/memo to the Manager of Solid Waste for review.
10. The Manager of Solid Waste will make arrangements for proper disposal of spill and spill clean-up material.
11. Attempt to determine the cause of the release and if there is a risk of a future release.
12. Assess and potentially upgrade the level of emergency, if necessary.

6.2 Incidental Discovery of Sensitive or Protected Species Contingency Plan

In the event that wildlife species of concern or their specific habitat are discovered on-site during construction, the following mitigation steps will occur:

1. Suspend work immediately in the vicinity of the newly discovered wildlife species of concern. Work may not resume until the measures below are complete.
2. Notify the Manager of Solid Waste, who will notify the Director of Engineering and Public Works.
3. The Manager of Solid Waste, engaging specialist advice as necessary, will assess the potential discovery and either allow construction to resume or proceed by notifying:
    a. Applicable government agencies, as required; and
    b. Wildlife Consultants.
4. The wildlife consultant may deem it necessary to visit the site to develop an appropriate mitigation plan. The mitigation measures available may include:
    - Abiding by seasonal timing constraints within the recommended set back distances;
    - Abiding by daily timing restrictions on construction activities;

- Narrowing the proposed area of disturbance, and protect the site using fencing and signage;
- Altering or delaying construction activities to avoid sensory disturbance (e.g., avoid burning, loud noises, bright lights, etc.);
- Extending road or watercourse bores to avoid or minimize site-specific effect;
- Informing all users of access restrictions in the fenced sites;
- Altering the route to avoid the site;
- Installing nest boxes/platforms and/or replace/enhance habitat during reclamation or restoration; and
- Relocating nests, habitat features, or individuals if practical and monitor post-construction response.

The wildlife or wildlife habitat will be assessed based on the following criteria:

1. The location of the wildlife or wildlife habitat with respect to the proposed construction site;
2. The presence of topographic features or vegetation to effectively screen the wildlife or habitat from the construction activities;
3. The species critical timing restraints in relation to the timing of construction; and
4. The potential to alter construction activities to minimize or avoid sensory disturbance.

7.0 References

Delvin, M. 2018a. Phase I Environmental Site Assessment, New Waste Transfer Station, Iqaluit, NU. Prepared for City of Iqaluit, Project: New Waste Transfer Station, OTT-00248813-A0 by EXP Services Inc.

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EXP Services Inc. (EXP). 2018. Physical and Biological Assessment, Proposed New Landfill Site, Iqaluit, NU. Prepared for City of Iqaluit, Project: New Landfill Site, OTT-00248813-A0 by EXP Services Inc.

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Nunavut Parks. 2019. Sylvia Grinnell Territorial Park. Retrieved from https://nunavutparks.com/parks-special-places/sylvia-grinnell-territorial-park/ (accessed 08.05.2019).

Appendix A

Project Contact List

Table 1: Contact Information for Key Project Contacts

CITY OF IQALUIT			
CONTACT	PAGER #	WORK #	CELL #
Dispatch	N/A	979-5650	-
Chief Administrative Officer (CAO)	N/A	979-5666	222-2953
Director of Public Works and Engineering	N/A	975-8509	222-2965
Operations Superintendent, Public Works	N/A	979-5631	222-2956
Manager of Engineering (Vacant)	-	-	-
Utilidor Manager	N/A	979-5632	222-2966
Utilidor on-call	32	N/A	222-3243
Garage/Roads Foreman	N/A	979-5668	N/A
Trucked Services Foreman	N/A	979-5612	222-2947
Owner's Third Party Representative- Dillon Consulting Limited (Keith Barnes)	-	(403)215-8885 ext. 4310	(403)827-6299

EMERGENCY SERVICES		
CONTACT	WORK #	CELL #
Dispatch	979-5650	-
Duty Officer (Fire/Ambulance)	979-4422	-
Fire Chief	979-5657	222-5073
Deputy Fire Chief	979-5650	222-2955
Deputy Fire Chief	979-5650	222-3981
Chief Municipal Enforcement Officer	979-5670	222-5521
RCMP	979-1111 979-0123	
GOVERNMENT RESOURCES- SPILL LINE		
24-Hour Spill Line	Telephone #	(867)920-8130

EXTERNAL ASSISTANCE- GOVERNMENT RESOURCES	
DEPARTMENT	CONTACT #
Environmental Protection, Government of Nunavut	975-5900
Indian and Northern Affairs Canada, Nunavut District Manager	975-4295
Indian and Northern Affairs, Baffin Sub-District	975-4295
Environment and Climate Change Canada, Iqaluit	975-4636
Department of Fisheries and Oceans, Iqaluit	979-8000
Regional Public Health Officer, Government of Nunavut	979-7652

CONTRACTOR	CONTACT #
Baffin Building Systems	979-5903
Kudlik Construction Ltd	979-1166

CONTRACTOR	CONTACT #
Nunavut Excavating Ltd	975-3320
RL Hanson	979-6004
Tower Arctic Ltd.	979-6465
Qikiqtaaluk Environmental	
Nunatta Environmental	

Appendix B

Orders, Permits and Licenses
(to be added when available)

DILLON CONSULTING

Appendix C

Erosion and Sediment Control Plan
(to be added when available)

DILLON CONSULTING

Appendix D

Emergency Response Plan
(under separate cover)

DILLON CONSULTING

DILLON CONSULTING

CITY OF IQALUIT

Emergency Response Plan (Draft)

Landfill and Waste Transfer Station

June 2019 – 19-9543

Table of Contents

Figures

TELEPHONE LISTING

To be posted at the Site Office, Scale House, Waste Transfer Station and Landfill Attendant Trailer
Revision Date: May 2019

EMERGENCY:

General Emergency (RCMP) 867 979 1111

GENERAL:

Fire/Ambulance: 867 979 4422
Police: RCMP (general inquiry and assistance) 867 979 0123

Government Agencies:
Nunavut Department of Environment:
Environmental Emergencies 867 920 8130
Nunavut Department of Community and Government Services:
Emergency Management 867 975 5320
Nunavut Water Board (NWB) 867 360 6338

Administration:
Director of Engineering and Public Works (Matt Hamp) ..... office: 867 975 8509
cell: 897 222 2965
Manager of Solid Waste (TBA) ..... 867 979 XXXX
Facility Supervisor (TBA) ..... 867 979 XXXX
Public Works Operations Superintendent ..... office: 867 979 5631
cell: 867 222 2956

1.0 Introduction

The purpose of this Emergency Response Plan (ERP) is to provide guidance to facility personnel for responding to an emergency. This document has been prepared as part of an overarching Environmental Management Plan for the City of Iqaluit Landfill and Waste Transfer Station (WTS); this document provides further guidance on responding to environmental emergencies and can be used in conjunction with this ERP. These policies and procedures define how the City of Iqaluit (the City) will protect human health and the environment during the Operations and Closure Phases of the project. The ERP covers all aspects of emergency planning and response including types of emergencies, key contact information, notification processes, emergency procedures, and reporting. Mechanisms for updating the ERP have also been incorporated.

This plan must be reviewed by all employees, as part of their training, and at regular intervals during operations.

During initial and future construction efforts at the Landfill and WTS, the primary contractor in charge of construction activities will be obliged to prepare a separate ERP outlining construction-specific hazards and related emergency procedures to be followed by site personnel. Due to changing conditions and the nature of construction operations, the hazards and procedures outlined in the construction phase ERP will differ significantly from those during the Operations Phase.

1.1 Scope of Plan

Location

This ERP applies to the Iqaluit Waste Management Facility (IWMF), including the Waste Transfer Station (WTS) and Landfill, Iqaluit, Nunavut.

Definitions

For the purposes of the ERP, an emergency is defined as any accident, incident, or unplanned event or situation that requires immediate and urgent action to prevent or minimize harm to persons, the environment, or property.

Individuals referred to by their titles, including the Chief Administrative Officer (CAO), Director of Engineering and Public Works (Director), Manager of Solid Waste (Manger), Facility Supervisor and Health and Safety Officer, are all employees of the City of Iqaluit.

Philosophy

No emergency response plan can identify every type of emergency, or predict the details of a given situation. This ERP will provide guidance for specific occurrences at the landfill site, and is designed to be

adaptable for future requirements. The procedures provided here should be implemented with due diligence, based on sound judgement and experience.

Prevention

Proper preventative measures, close monitoring, training, and effective management are the best lines of defence against accidents and emergencies. The most effective method for mitigating accidents and emergencies is through best management practices to reduce the likelihood of an occurrence.

Readiness

All personnel working at the site should be aware of and prepared for events covered in the ERP.

Priorities

The foremost priority of site personnel in the event of an emergency is the protection of themselves and other individuals, as well as the environment. The next priority is the protection of property.

Definition of an Emergency

For the purposes of this ERP, an emergency is defined as any accident, incident, unplanned event, or situation that requires immediate and urgent action to prevent or minimize harm to persons, the environment, or property.

1.2 Individual Responsibilities

It is the responsibility of all site personnel to follow safe practices, and to be vigilant and prepared for potential emergencies. Management and individuals in designated roles have further responsibility to enable and monitor readiness.

It is the responsibility of the **Manager** to:

- Ensure the ERP is accessible and ready to be implemented in the event of an emergency;
- Ensure all staff are trained in the ERP contents and procedures;
- Prepare incident reports in the event of an emergency; and
- Assign the responsibilities of the **Emergency Response Coordinator (ERC)** to the designated individual or alternative employee.

It is the responsibility of the **ERC** to:

- Determine the urgency of an identified situation and whether it constitutes an emergency;
- Implement the elements of the ERP;
- Direct the activities of site personnel;
- Delegate responsibility to other site personnel, as required;
- Contact the relevant authorities;
- Inform and consult with the Manager and any other internal stakeholders; and
- Allocate the necessary resources to adequately respond to the emergency.

It is the responsibility of **all site personnel** to:

- Be familiar with the provisions of the ERP;
- Take direction from the ERC and his/her delegate (as applicable) during an emergency; and
- Be alert for and report the initial signs of potential.

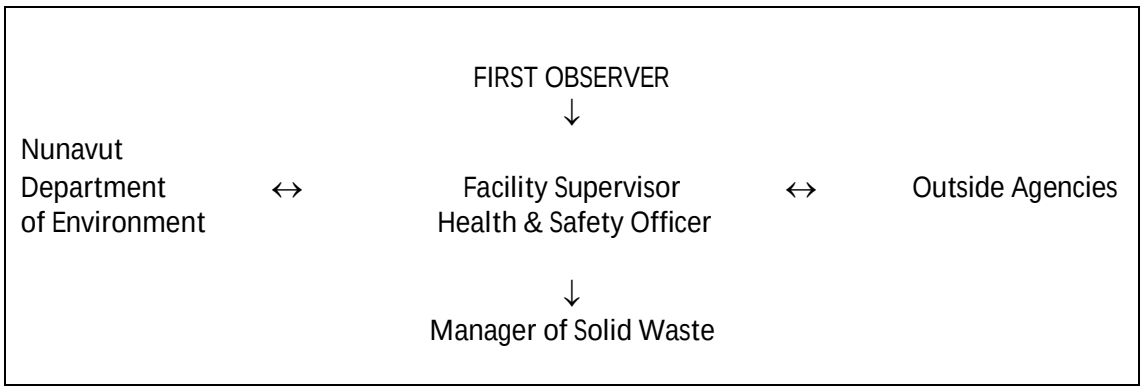
It is the responsibility of the **first observer** of a potential emergency to:

- Rapidly assess any details that may be useful in describing the potential emergency;
- Take any immediate steps that may be safely performed to protect themselves, other persons and the environment, and to protect property, where possible;
- Notify a supervisor, the Landfill Manager and/or the ERC; and
- Wait for further instructions.

For all emergencies, day or night, all employees and contractors should report to the designated Muster Point (see **Section 5**). The Visitor Log, maintained at the Scale House, can be used to verify all employees, contractors and visitors are accounted for.

1.3 Notification Procedures

During an emergency or potential emergency, the chain of authority for designating the Emergency Coordinator is as follows:



If one of these individuals cannot be contacted immediately, the next highest person on the chain of authority should be contacted. Efforts should continue to be made to contact any unavailable individuals even if someone higher in the chain has been notified.

Emergency Coordinator
The Emergency Coordinator is that person highest in the chain of authority who is aware of the emergency and is present at the site. He or she will serve as Emergency Coordinator until succeeded by a person higher in the chain of authority.

If contacted while away from the site during an emergency, all individuals in the chain of authority will take reasonable steps to travel to the site immediately, and remain there until the situation is considered under control.

1.4 Emergency Numbers

The contacts and telephone numbers **provided at the front of this document** shall be posted near all telephones at the site, and are identical to those found prior to the Operations and Maintenance Manual Table of Contents. These numbers should also be stored on the cellular phones of all site personnel. The numbers are to be confirmed, updated, and reposted annually, with the revision date prominently indicated.

1.5 Levels of Response

Once an emergency has been confirmed and declared by the Emergency Coordinator, the steps outlined in this section will be implemented.

Based on the available information, the Emergency Coordinator will declare a **Level III**, a **Level II**, or a **Level I** emergency as defined below:

Level III: Continue Working and Monitor Communications
All personnel are to continue with their duties unless otherwise directed by the Emergency Coordinator, and shall constantly monitor communications for changes in the status of the emergency.

The ERC is to establish contact with all personnel on the site and inform them of the Level III status.

Level II: Gather at Designated Area
All personnel will abandon their duties in a controlled manner, and gather on-site at an area designated by the ERC.

Unless otherwise directed, personal property, including vehicles, is not to be collected.

Level I: Evacuate
All personnel will evacuate at the direction of the ERC, using the designated exit route and meeting at the designated gathering area beyond the site.
The existing communications network used during normal operations at the site will be used in the event of an emergency, including direct contact, two-way radio, or telephone (fixed, mobile, and

cellular). Once an emergency is declared, all site personnel are to maintain an open communication line with the ERC at all times.

The on-site gathering areas used during a Level II emergency will normally be located at:

- Landfill:
    - At the intersection of the landfill access road and the Northwest Aggregate Deposit Access Road.
- WTS:
    - Either outside the Scale House or at the main site entrance gate. Any evacuation from the site will normally be conducted via the Kakivak Court with the Qaqqamiut Road gate as an optional evacuation route.

If a Level I emergency is called before a Level II is called or completed, the ERC will announce the evacuation, the exit route and outside gathering area. Personnel will proceed directly to the outside gathering area, while avoiding travel over the landfill or near the site of the emergency during the evacuation.

After evacuation, personnel are to remain at the off-site gathering area to be accounted for, and shall wait until directed to re-enter the site or to leave.

The primary evacuation routes shall be the following:

- From the Landfill;
    - Via the landfill access road to the Northwest Aggregate Deposit Access Road, continuing to the Qaqqamiut Road.
- From the WTS;
    - Via the main gate to the Kakivak Court, continuing to Federal Road.

During Level II and Level I emergencies, and for as long as the situation is safe, a Gate Monitor will be posted at the main WTS and/or Landfill entrance gate. Non-site or non-emergency personnel (e.g., waste haulers, contractors, visitors, media) will NOT be permitted entry to the site during the emergency. The Emergency Coordinator may also choose to prevent any entry to the site during a Level III emergency. If conditions require the Gate Monitor to abandon the gate, the gate will be closed but not locked.

During Level II and Level I emergencies, the Emergency Coordinator will appoint a Site Clearer to direct non-site personnel to leave the site. The Site Clearer will contact all non-site personnel, record their names and/or license plate numbers, and direct them to leave immediately and to check with the Gate Monitor as they leave. The Site Clearer will then crosscheck the list of names and license plates with the Gate Monitor to ensure that all non-site personnel have left the site.

1.6 Public Relations

All communications with the public concerning the emergency, including media contact, will be conducted by the Manager or designate.

2.0 Types of Emergencies Covered by ERP

This ERP addresses the following emergencies at the City's facilities:

- Medical Emergencies;
- Vehicle Fires;
- Building Fires;
- Landfill Fires;
- Liquid/Chemical Spills;
- Gas Leaks/Suspicious Odours;
- Explosions;
- Extreme Weather Events;
- Power Outages;
- Dangerous Animal Encounters; and
- Violent Criminal Behaviour.

Other emergencies or other occurrences including environmental spills, stormwater impacts, and erosion/sediment control issues are included in the Environmental Protection Plan (EPP).

3.0 On-Site Emergency Equipment

As a minimum, the following emergency equipment and supplies are to be kept at the site at the indicated locations. All personnel are to familiarize themselves with their location and be trained in their operation.

- First aid kits - All mobile equipment and buildings;
- Fire extinguishers - All mobile equipment and buildings;
- Eye wash stations – Waste Transfer Station, Landfill Attendant Trailer;
- Respirators – Waste Transfer Station; and
- Oil absorbent materials - All mobile equipment and buildings.

The Manager is responsible for maintaining emergency equipment and supplies. Equipment Operators are responsible for reporting any deficiencies with safety equipment and supplies associated with vehicles they operate. All site personnel are responsible for reporting observed deficiencies with any safety equipment and supplies.

4.0 Emergency Response Procedures

The following sections identify the recommended response to several contingency situations and emergencies. It can be expected that situations other than those described below may arise from time to time, and should be responded to in a manner appropriate for the emergency situation at that time.

4.1 Medical Emergencies

It is required that at least one member of the Landfill or WTS staff has been trained, and is current in Emergency First Aid and CPR.

In the case of a medical emergency, the staff member with Emergency First Aid Training will be informed and will generally follow the PRIORITY ACTION APPROACH outlined below for life-threatening situations:

- Take charge of the situation.
- Call out for help to attract bystanders.
- Assess the hazards.
- Make the area safe for the First Aiders and others.
- Identify himself or herself as a First Aider and ask the injured party if they can help.
- Assess the casualty for life-threatening conditions.
- Provide first aid for life-threatening conditions.
- Send someone to call for help and notify the ERC.
- Organize bystanders to:
    - Help make the area safe.
    - Ensure that all casualties have been discovered.
    - Call ambulance, police, and other emergency personnel.
    - Assist with first aid, as directed.

If the casualty has a suspected head or spinal injury, do not move the victim, but carefully steady and support the head and neck without moving the head before establishing responsiveness.

4.2 Vehicle Fires

All collection vehicles and landfill equipment shall be supplied with a fire extinguisher, as well as fire suppression systems in major landfill equipment.

The equipment operator will follow the procedure below in the case of an equipment/vehicle fire:

- Notify the ERC;
- Try to move the machine to an isolated area, but only if it is safe to do so from a personnel perspective;
- Shut down the machine; and

- ONLY IF THE OPERATOR DETERMINES THAT IT IS SAFE TO DO SO, use the supplied fire extinguisher to put out the fire.

The ERC will follow the procedure below in the case of vehicle fire:

- Take direction from the Emergency Services in responding to the fire; and
- Alert the Department of the Environment in the event that the vehicle has the potential to release contaminants to the environment, as a result of the fire and/or contains waste.

4.3 Building Fires

Fire extinguishers are strategically located in all buildings. If the fire is small, persons identifying the fire should try to put it out with a fire extinguisher. If the fire cannot be controlled or is severe when identified, the below procedure below should be followed:

- Notify the ERC and/or the closest Supervisor;
- Evacuate to the designated assembly area or muster point;
- ERC or Supervisor will report the fire to the local Emergency Services;
- Ensure clear access for arrival of Fire Department;
- Inform the Fire Department of any pertinent details of the fire (location, extent, cause, combustible materials, actions taken) and on-site firefighting resources (water supply, heavy equipment); and
- Assist only if, and as directed by, firefighting personnel.

4.4 Landfill Fires

Landfill fires can result from undetected hot loads that are landfilled. The following procedures will be followed upon identification of a fire and notification of the Emergency Coordinator.

Assess the Situation. The employee first observing the potential or actual fire will:

- Determine the number, location, extent and possible cause of the landfill fire;
- Notify the ERC and all on-site Landfill staff;
- The ERC will contact the Fire Department, as necessary;
- Provide the Fire Department with as much information relating to the fire and its cause(s), as possible, to assist them in responding appropriately to the situation; and
- If multiple fire locations exist, the ERC will determine, as best as possible, the priority fires for fighting first. In this regard, the ERC will take direction once the Fire Department has arrived.

Prepare for Firefighting. The ERC will assign staff to:

- Prepare an area away from the working face to be clear of vegetation and waste (preferably virgin ground);
- Excavate soil nearby for use in smothering the fire, if insufficient cover material is at hand; and
- Assemble portable pumps and hoses.

Contain the Fire: The ERC will, in conjunction with direction from the Fire Department, assign staff to:

- Construct a fire break, as close to the burning area as possible, to limit surface spreading of the fire;
- Suppress flames with water;
- Push smouldering material to the clear area, while continuing to spray with water; and
- Smother the fire by adding soil and compacting.

Monitor the Situation: The ERC will assign staff to:

- Continue to monitor the fire site and smothered material following the apparent extinguishing of the fire; and
- Leave burnt material isolated and exposed for two days after extinguishing to ensure no subsequent outbreak of fire.

4.5 Liquid/Chemical Spills

The first observer will check the immediate area for any affected or injured personnel, and will inform the ERC, as soon as possible.

The ERC will:

- Direct staff to take appropriate emergency environmental protection measures, such as placing booms or barriers around the spill to prevent liquid escape into the environment or into surface water bodies.
- Call the Nunavut Department of Environment – Environmental Emergencies (867 920 8130), if the spilled substance quantity exceeds the minimum notification requirements (refer to the EPP).
- Notify the Department of Environment for the Government of Nunavut.
- In the event that liquids have reached surface water bodies, attempt to prevent further release to minimize the potential effects of the release.
- Take direction from the Department of Environment or their designated authority.
- Attempt to determine the cause of release and whether a risk of a further release exists.
- Assess and potentially upgrade the level of the emergency, as necessary.

For additional information on spills and releases, please consult the EPP (Section 6.0).

4.6 Gas Leaks/Suspicious Odours

In the event you smell gas and suspect a leak immediately cease all operations. **DO NOT SWITCH ON LIGHTS OR ANY ELECTRICAL EQUIPMENT. Do not turn switches on or off; leave them in the position they are in, as this action can generate sparks.**

- Notify dispatch or the ERC.

- Evacuate the building/equipment by the nearest exit. Notify other building occupants to do so as well.
- Once outside, move away from the building and head to the designated waiting area to await further instructions.
- Contact the Fire Department, as necessary.

4.7 Explosions

In the event of an explosion in a building, staff should take the following actions:

- Immediately take cover under tables, desks, or other such objects providing protection against flying glass or debris.
- Evacuate the immediate area of the explosion.
- Notify dispatch of the occurrence.
- Seek out and assist injured and disabled persons in evacuating the building. Exit via the nearest safe exit.
- Once outside, move to the designated assembly area.
- Await further instructions. Do not return to the building unless instructed to do so by the ERC.
- Ensure clear access for arrival of Fire Department. Keep roadways and walkways clear for emergency vehicles.
- The ERC will inform emergency response personnel of any pertinent details of the explosion, such as location, extent, cause, combustible, or flammable materials in the area of the explosion and what actions are to be taken.

4.8 Extreme Weather Events

Extreme weather events might include snow storms, extreme cold warnings, ice storms or extremely high winds. If extreme weather events occur, the following actions will be taken:

- When a weather warning is issued by Environment Canada, the Superintendent of Public Works will consult with the appropriate authorities at Environment Canada to determine the anticipated severity and duration of the weather event.
- The Facility Supervisor will hold a planning meeting prior to a foul weather event to prepare and implement a foul weather action plan.
- Loose materials that can be blown around or damaged will be moved inside or tied down.
- Doors and windows will be secured.
- Communication equipment will be checked.

4.9 Power Outages

Power outages will affect the operation of any weigh scales, pumping stations and ventilation systems for buildings, in addition to any normal operating systems therein. The loss of power does not necessarily constitute an emergency. Indoor gas detection and alarm systems (such as carbon monoxide

monitors on tipping floors) will not be functional during a power outage. The procedure below will be followed if a power outage exceeds five minutes and alternative ventilation cannot be activated (such as opening truck access doors):

- Staff will evacuate the buildings and gather at the designated assembly area; and
- Building re-entry will be allowed after power has been restored and indoor gas detection alarms are silenced.

It is acknowledged that the WTS is equipped with an emergency generator that should serve to mitigate issues associated with power outages.

4.10 Dangerous Animal Encounters

Certain animals can pose a danger to landfill staff or the public. In particular, polar bears and other bear species can cause serious injury or death as a result of contact with humans, and extreme care should be exercised when a bear is in the area. Bears are attracted to garbage and will readily enter landfills and other areas where garbage is stored in search of food. They can also become habituated to areas where food sources have been previously available.

In the event of a bear encounter, the following measures should be undertaken:

- Notify any and all personnel working in the area, as well as the ERC, of the presence of a bear.
- Contact the relevant authorities, if necessary.
- **Do not approach bears for photography or any other reason!** This leads to habituation and encourages more frequent encounters with humans.
- If a bear approaches, a number of deterrents can be used to startle or frighten the bear away:
    - Rubber bullets;
    - Bean bag round;
    - Cracker shells;
    - Scare cartridges;
    - Pen launcher;
    - Pepper spray;
    - Noisemakers; and
    - Warning shots.
- Electric fencing and vehicles can also be effective deterrents to bear encounters.

4.11 Violent/Criminal Behaviour

If you observe a crime in progress or behaviour that you suspect is criminal, immediately notify police at 867 979 1111.

DO NOT APPROACH OR ATTEMPT TO APREHEND THE PERSON(S) INVOLVED!

The following items are recommendations for dealing with robbery/assault:

- Cooperate, give the person exactly what they are looking for, nothing more.
- Try to notice distinguishing traits, such as clothing, race, height, weight, age, eye colour, facial hair, or other identifying features such as scars, moles, tattoos, eyewear, etc.
- Pay attention to the type of weapon used, if applicable.
- Listen carefully to their voice for distinguishing characteristics (i.e., an accent, lisp, stutter)
- Record what direction they go after the confrontation. If they use a vehicle, record the licence plate number, and make and model of the vehicle.
- Notify the police by calling **867 979 1111** immediately after the person leaves. Stay on the telephone with the police dispatcher and provide additional information as changes in the situation occur, until the first police officer arrives at your location.
- Cooperate fully with the police investigation.

5.0 Evacuation Plan

5.1 Evacuation Routes

Figures 5-1 and 5-2 identify evacuation routes and muster points for both the WTS and Landfill. In the event of an emergency where evacuation is required, move quickly and orderly to the muster point or designated assembly area, and await further instruction. Look around at the assembled people to determine if anyone is missing and inform the ERC, emergency services, or others, as applicable.

SECONDARY EVACUATION ROUTE

BALE STORAGE AREA

CONSTRUCTION AND DEMOLITION DEBRIS PAD

SNOW STORAGE

CULVERT

SLIDING GATE

QAQQAMIUT ROAD

EMERGENCY GENERATOR

LIMIT OF SURVEY

SNOW STORAGE

MISCELLANEOUS METALS/WHITE GOODS STORAGE PAD

TIRE STORAGE

WASTE TRANSFER STATION

PUBLIC DROP-OFF

PUSH WALL

0+200

0+100 TO PUBLIC DROP-OFF

0+300

0+340 TO COMMERCIAL DROP-OFF

MUSTER POINT

END OF LIFE VEHICLE AND MISCELLANEOUS METALS STORAGE

HHW DEPOT

HHW STORAGE CONTAINERS

REUSE CONTAINER

SITE OFFICE

22.9 x 3.0m SCALE

SCALES HOUSE

SLIDING GATE (2 REQUIRED)

BALER LOGGER

APPROX. PROPERTY LINE

SNOW STORAGE

PERIMETER FENCE

PARKING AREA (10 SPACES)

1.0 c.m. BOULDER SPACED AT 5.0m (TYP.)

PRIMARY EVACUATION ROUTE

GREENHOUSE (FUTURE)

25.0m

10.0m

COMPOST PAD (FUTURE)

15.0m

0+000

KAKIVAK COURT

SNOW STORAGE

AREA FOR POTENTIAL COMPOST AND BIO-MASS EQUIPMENT

N7070900

N7070800

N7070700

E522400

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Iqaluit	DILLON CONSULTING	PROJECT: IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.: 19-9543
	DATE: JUNE 2019	TITLE: EMERGENCY RESPONSE PLAN WTS - MUSTER POINT AND EVACUATION ROUTE	FIGURE NO.: 5-1

LEGEND:

- SITE PROPERTY BOUNDARY
- FUTURE ROAD
- 50m BUFFER
- BOULDER FIELD
- GLACIOFLUVIAL TERRACE
- GROUND WATER PONDING
- GROUND WATER FLOW
- BEDROCK OUTCROP
- BH–101 BOREHOLES
- T–108 THERMISTOR
- W–108 ACTIVE WATER MONITOR STATION
- DITCH FLOW DIRECTION
- DRAINAGE DITCH
- LEACHATE PIPING

N7076500

N7076000

E520000

E520500

E521000

E521500

E522000

BH–103

BH–104

BH–

W–110
T–110

W–111
T–111

W–109
T–109

W–107
T–107

W–108
T–108

LANDFILL (75 YEARS OF OPERATION)

TEMPORARY CELL SEPARATION BERM

LEACHATE COLLECTION PIPE

LEACHATE COLLECTION SUMP

CELL 1

CELL 2

FUTURE PERIMETER ROAD

FUTURE PERIMETER ROAD

NEW ROAD TO NORTHWEST AGGREGATE DEPOSIT

NEW ROAD

ATTENDANT TRAILER

LEACHATE FORCEMAIN

LEACHATE HOLDING POND #1

LEACHATE HOLDING POND #2

MAINTENANCE ROAD

WETLAND

EVACUATION ROUTE

MUSTER POINT

*

Iqaluit

DILLON CONSULTING

DATE JUNE 2019

PROJECT
IQALUIT LANDFILL AND WASTE TRANSFER STATION

PROJECT NO.
19-9543

TITLE
EMERGENCY RESPONSE PLAN
LANDFILL - MUSTER POINT AND EVACUATION ROUTE

FIGURE NO.
5-2

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6.0 Emergency Response Plan Distribution and Updating

This ERP will be used as a training tool for all new staff upon hire. The ERP will be easily accessible at both the WTS Office and the Landfill Attendant Trailer. The ERP will be reviewed annually and updated for changes that have occurred over the previous year.

7.0 Post Emergency Review and Plan Assessment

Following an accident or incident outlined within the ERP, a review of the effectiveness of this plan will be conducted to identify any areas of improvement, if applicable. This assessment should be conducted by the Director of Engineering and Public Works, the Manager of Solid Waste and any other affected parties. Any improvements identified during this meeting should be made to the ERP, as soon as practicable, to ensure more effective emergency response if future incidents occur.

8.0 Readiness Review

8.1 Emergency Reporting

Brief but accurate records will be kept during an emergency situation by the ERC. This will assist in later analyses, reporting and plan revisions. Within five working days of the resolution of the event (i.e., when the event is no longer an emergency), the Director of Engineering and Public Works will provide the Nunavut Impact Review Board with a brief written report concerning the emergency. This report will include:

- An account of the circumstances that caused the emergency.
- An account of events during the emergency, including chronology.
- The current status of the site with respect to the emergency.
- Measures to be taken to minimize similar occurrences.

An evaluation of the performance of coordinators, site personnel and the ERP during an emergency, and planned measures to address and identified inadequacies of the ERP shall be undertaken.

8.2 Simulation Exercises

A simulation exercise will be designed by the Manager of Solid Waste and conducted at intervals of 12 months. The purpose of the simulation exercise is to provide opportunity for training and reiteration, and test the readiness of the site, equipment, and associated personnel in the event of an emergency situation.

Each exercise may include any or all of the following, at the discretion of the Superintendent of Public Works:

- Establishing lines of authority.
- Arranging coordination and communication.
- Mobilizing personnel and equipment.
- Deploying personnel and equipment under controlled conditions (e.g., mock injuries, contained fires).
- Contacting external agencies.
- Evacuation.

Each exercise will be arranged and executed in conjunction with the appropriate agencies. All efforts will be made to reduce the risk to personnel, environment and property to a minimum.

Each exercise may include simulation of one of the situations covered in this ERP. No exercise needs be duplicated within a five year period.