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November 6, 2009 Project Number: 2940-352-00-4.6.1

Paul Clow
Project Officer
Engineering Department
City of Iqaluit
Box 460, Iqaluit, NU, X0A 0H0

Dear Mr. Clow:

Re: Iqaluit Landfill Water Management Improvements

1 Introduction

The City of Iqaluit previously retained Earth Tech in 2006 to plan and design improvements for the management of surface water at the Iqaluit landfill; these improvements were completed in October 2006. Of particular note, the design included perimeter berms to divert offsite surface water from the landfill site, preventing it from being contaminated by contacting landfill waste. In doing so the amount of surface water that comes in contact with the landfill waste (Run-off) is minimized.

The Run-off on the site is temporarily stored in four onsite ponds, which are each pumped offsite to the runoff retention pond for testing and controlled discharge as shown in Figure 1.1. The two northern onsite Run-off control ponds and the offsite Run-off retention pond are well defined without identified issues and therefore do not require water management improvements; these ponds are outside the scope of this analysis.

In August 2009 there was an uncontrolled discharge from the two southern Run-off control ponds and the Run-off that had collected along the berm between them. The uncontrolled discharges were the result of run-off diffusing through the berms to the perimeter ditch and the culvert that controls the discharge from the south pond failing. In response to these incidents, the City of Iqaluit has retained AECOM to propose water management improvements for the landfill.

2 Water Management Improvements

The purpose of this storm water management report is to identify the actions necessary to prevent future uncontrolled discharges of landfill Run-off by ensuring that there is sufficient Run-off storage capacity and an appropriate conveyance system. The following two sections propose conveyance system improvements and onsite Run-off storage improvements.

2.1 Conveyance System Improvements

Run-off cannot drain to the offsite Run-off retention pond by gravity, so it is pumped from a series of onsite Run-off control ponds. A sump pump is placed in the onsite Run-off control pond and it is connected to a pipe that has to be manually laid across the road east of the site to the Run-off detention pond. The Run-off is pumped from the onsite run-off control ponds to the offsite run-off detention pond for testing prior to discharge. As the process is labour intensive the ponds are not emptied frequently. The following recommendations are made to better manage the Run-off:

- Reduce the number of control ponds that need to be emptied. The contours for the Iqaluit landfill indicate that a ditch can be installed from the south pond to the south east pond. Therefore, a ditch should be installed from the south Run-off control pond to the south east Run-off control pond, which will eliminate the need to pump one pond. The ditching is proposed to run along the perimeter fence inside the existing berm at a minimum slope of 0.5% as shown in Figure 2.1. The extent of ditching will be confirmed during detailed design in order to ensure all runoff is directed to the south-east run-off control pond. The ditching should be lined with a geotextile to prevent seepage. As all the collected Run-off water will flow along the ditch to the south-east pond, the south pond could then be filled in to allow extra room to store garbage. However it is important to ensure that new waste storage areas do not block drainage towards the south east pond.
- Permanently install 100 mm (4 in) diameter pipe above ground from the south east Run-off control pond to the offsite Run-off retention pond. The pipe can be placed above the adjacent berm and through the existing culvert under the roadway south of the site to the offsite Run-off retention pond as shown in Figure 2.1. Irrigation hose is proposed as the pipe for this application as it is easy to drain before winter; however it must be rated for a minimum of 50 psi and the intake hose must be contractor suction hose. Additionally, the piping will need to be visually inspected during operation to confirm that it is in suitable operating condition and free of leaks.
- Select a portable pump with a minimum flow rate of 10 L/s at 10 m of head with a 100 mm (4 in) discharge (an example of a suitable pump is the CAD75MA5 Godwin Dri-Prime Pump). The pump will connect to the aforementioned piping and drain the ponds with minimal setup required.
- After emptying the Run-off control ponds, remove any debris that has built up in the pond bottom to reduce the probability of large solids damaging the pump.
- Instead of pumping all Run-off to the offsite Run-off retention pond, it can be sprayed back on the waste during the summer months. This is a treatment technique which promotes evaporation thereby reducing the volume of water that is sent to the offsite Run-off retention pond. Spraying the Run-off on the waste also has the added benefit of consolidating the waste material for better compaction.

These improvements to the Run-off conveyance system will make the process of emptying the ponds less cumbersome. As a result, the probability of emptying the ponds when needed will be greater.

The conveyance of the perimeter ditches can also be improved. Garbage has been observed in the exterior perimeter ditches which decreases the ditch conveyance capacity and can potentially contaminate the surface water. In addition, Run-off from the landfill has been released into the perimeter ditches through the failure of the culvert in the berm adjacent to the south pond (runoff has also diffused through the berms and that is further identified in section 3.2). The following recommendations are made to better manage surface water in the existing perimeter ditches:

- Collect bags and other nefarious debris that periodically builds up in the onsite perimeter ditches. This will enhance the conveyance capacity of the perimeter ditches and prevent offsite migration of waste material. See the attached pictures in Appendix A.
- Place fillcrete in the culvert that is located in the berm adjacent to the south pond. The fillcrete will permanently plug the culvert which will prevent the uncontrolled release of Run-off through the culvert in the future.

2.2 Onsite Storage Improvements

2.2.1 Design Criteria

As previously mentioned in Section 2.1, the onsite Run-off control cannot discharge to the offsite Run-off detention pond by gravity. As a result, the onsite Run-off control ponds must be designed to store all Run-off for a period of time prior to discharge. In Alberta, the storm water management facilities must at all times have capacity to store a 25 year return period rainfall event; this standard is proposed to be adopted as the design rainfall event for the improvements to the Iqaluit Landfill. In addition, it is not realistic to assume that the ponds will be emptied after every rainfall event, so additional storage capacity must be provided in the ponds to account for snow melt and rainfall between discharges. In order to determine the required onsite storage volume, it was assumed that the onsite ponds will be emptied twice a year. Therefore, the ponds will be sized to store the design rainfall event plus the sum of the long term precipitation averages for the months between planned discharges.

2.2.2 Run-off Storage Requirements

Ditching is proposed to connect the south pond to the south east pond so that only the southeast pond has to be manually emptied (see Section 2.1). As a result, the south east pond will require sufficient capacity to store the sum of the long term precipitation averages for the months between planned discharges. Based on the National Climate Data and Information Archive, it is feasible to empty the south east pond at the end of May following the snowmelt and at the end of September prior to freeze up. Therefore, the south east pond must have capacity for the design rainfall event plus the greater of the sum of the long term precipitation averages from October to May or the sum of the long term precipitation averages from June to September.

The basins that currently contribute flow to the two southern ponds were delineated. The total basin area that currently contributes Run-off to the two southern ponds is approximately 1.11 ha. For the purpose of determining the Run-off generated during the design rainfall event, an impervious value of 50% was assigned to the basin. During detailed design, the impervious value may be adjusted to more accurately reflect the area the garbage covers and how the method used to compact the garbage impacts the infiltration of rainfall into the garbage.

From the Iqaluit Intensity Duration Frequency (IDF) curves, a 25 year 24 hour duration design rainfall event is expected to produce 58 mm of rain. Utilizing the rational equation the total volume of Run-off that must be stored in the south east pond from the design event is approximately 340 m^3.

Based on the Environment Canada National Climate Data and Information Archives precipitation data for Iqaluit, 1,200 m^3 of storage is required to store snow melt resulting from the average monthly precipitation between October and May and 1,250 m^3 is required to store the average monthly precipitation between June and September.

As a result the south east pond should be designed to accommodate the average monthly precipitation between June and September plus the design rainfall event; the south east pond requires a storage capacity of 1,600 m^3.

The existing volume of the south east pond is unknown; however, based on a maximum storage depth of 1 m from the pond bottom to the point at which the pond would overflow, the existing volume of the pond was approximated to be 180 m^3. Table 3.1 summarizes the existing and required storage volumes for the south east pond.

Table 3.1 – Summary of Storage Volumes in South East Pond

Available Storage Volume (m^3)	Required Storage Volume (m^3)	Surplus / Deficient Volume (+/- m^3)
180	1,600	-1,420

Based on the results shown in Table 3.1, it appears that the south east pond does not have sufficient storage capacity.

2.2.3 Recommended Storage Improvements

To address the storage capacity deficiency at the southeast pond, it is recommended that a new perimeter berm around the south east pond be built out of impermeable materials to the same elevation as the berm adjacent to the south pond. Clay is not readily available in the Iqaluit area, so geosynthetic materials will be utilized to construct the berms. Geosynthetic materials, such as geomembranes, can be specified during detailed design based on available materials. The perimeter berm will be installed adjacent to the southeast Run-off control pond and extend to the extent of the ponding area, which may require some of the existing, permeable berm, to be replaced (see Figure 2.2). The new impermeable berm will allow the Run-off to rise up the side of the berm without the risk of overtopping or diffusing through the berm. Adding the berm will also reduce the amount of garbage that can be blown offsite.

It should be noted that although this berm will increase the storage volume of the southeast pond, it may be beneficial to dig the south east pond deeper so that the Run-off pond is a smaller well defined area, which limits exposure to workers.

Due to higher water depths in the south east pond and in order to accommodate berm construction, some of the scrap metal around this pond may have to be moved. These issues will be examined in greater detail during detailed design. A picture of the area can be seen in Appendix A.

If you have any questions comments or concerns please contact the undersigned at 780-486-5903.
Sincerely,

AECOM Canada Ltd.

Shawn Olson, P.Eng.
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SRO:sw
Encl.
cc:

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Signature Page

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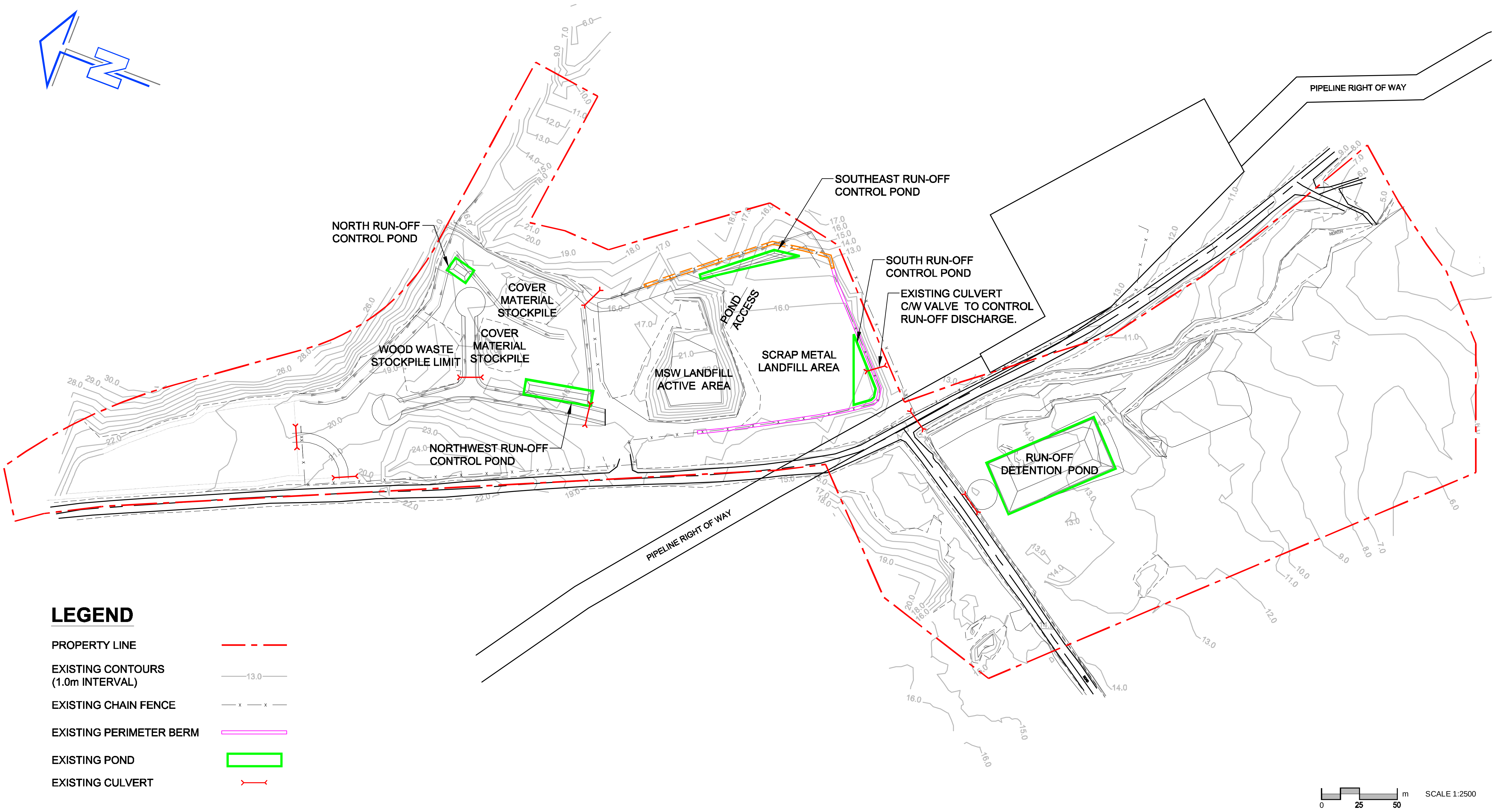

City of Iqaluit
Iqaluit Landfill Water Management Planning Study
Preliminary Design

Existing Storm Water Management

Figure 1.1

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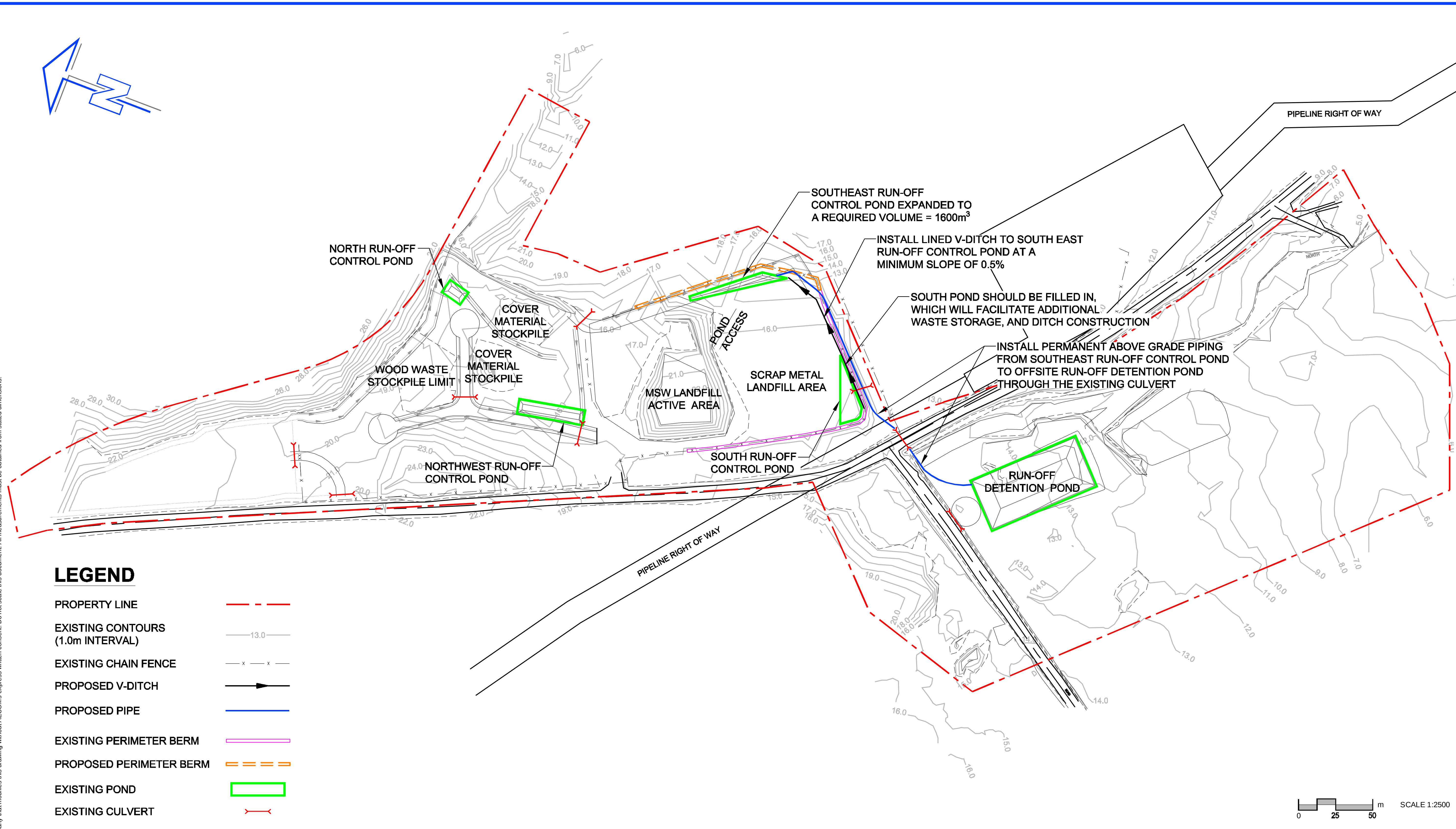

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City of Iqaluit
Iqaluit Landfill Water Management Planning Study
Preliminary Design

Conveyance System Improvements

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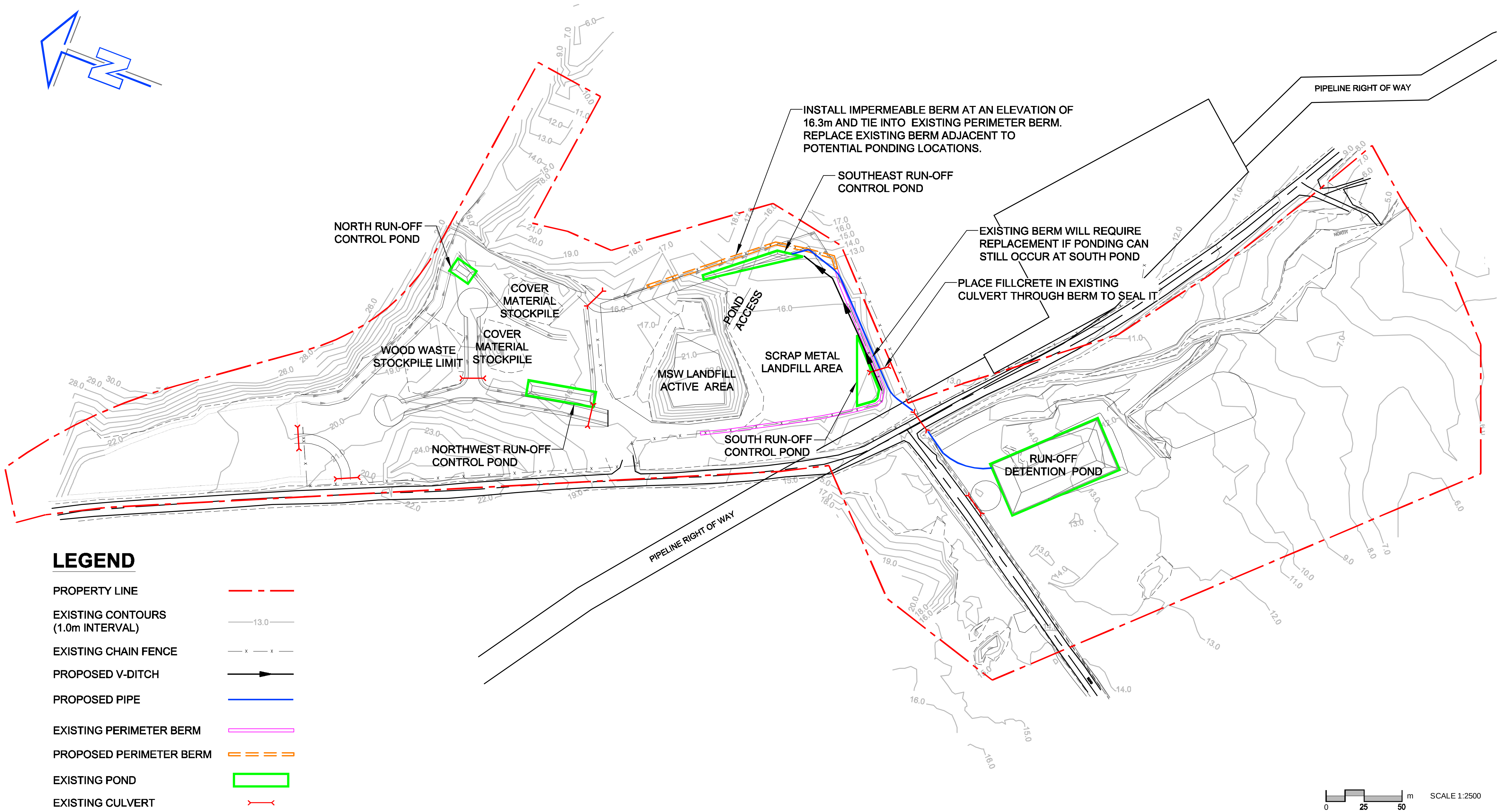
Figure 2.1



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City of Iqaluit
Iqaluit Landfill Water Management Planning Study
Preliminary Design

Storage Improvements

Figure 2.2

Appendix A:
Site Photographs

Picture 1 – Looking south at the south east pond – Berm to be constructed in this location

Picture 2 – Berm adjacent to South pond – Culvert to be sealed with fillcrete

Picture 3 – Culvert crossing road south of site – New piping to be laid through this culvert to Run-off

Picture 4 – Looking South – Garbage in perimeter ditch east of site

Picture 5 – Looking North – Garbage in perimeter ditch east of site