DILLON CONSULTING

HAMLET OF KIMMIRUT

New Wastewater Treatment Facility

Design Development Report

January 2023 – 20-2790

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Tables

1.0 Introduction

Dillon Consulting Limited (Dillon) was retained by the Government of Nunavut (GN) on behalf of the Hamlet of Kimmirut (Kimmirut) to provide design and construction administration services for a new wastewater treatment facility (WWTF) in Kimmirut. This memorandum will build upon the previous site specific work completed by Dillon and other Parties and the conclusions drawn from that previous work. Primarily:

- Kimmirut Wastewater Treatment Feasibility Study, Final Report (Nunami Stantec, 2015)
- Topographic Survey (Williams Nutter, 2019)
- Geotechnical Investigation New Wastewater Treatment Facility, Final Report R1 (Canadrill, 2020)
- Kimmirut Wastewater Treatment Facility, Pre-Design Report (Dillon, 2022)

In addition to review and preparation of the above, Dillon has undertaken two site visits to Kimmirut and has had numerous meetings with Kimmirut, GN, and other stakeholders. Based on all efforts to date, we understand that design of the new WWTF will proceed in accordance with the below key criteria:

- The site of the WWTF is Site 9 identified in the Stantec Feasibility Study, and the sole site contemplated in the Dillon Pre-Design Report (Site).
- The WWTF will be comprised of a new Lagoon which will be decanted annually to a secondary treatment system such as the existing wetland or a new second treatment cell.
- The quality of treated effluent shall conform to new, proposed limits based on upcoming changes to Kimmirut's water license, including a maximum limit of 1 x 106 CFU/100 mL for fecal coliforms.

2.0 Lagoon Design Criteria

The lagoon will be designed to meet the long-term needs of Kimmirut, the regulatory requirements of Kimmirut's water license, as well as the required safeguards to prevent impacted groundwater flow towards Fundo Lake. Design standards will be based on Planning, design, operation and maintenance of wastewater treatment in northern communities using lagoon and wetland systems (CSA Group [CSA] W203:19). According to this standard, the lagoon will be designed for a 20 year design horizon, to the year 2043. The lagoon system will be designed to contain 12 months of storage, prior to being decanted to the receiving environment.

The treatment facility will be designed to meet the effluent water quality parameters set out in the proposed revisions to the community's water licence (3BM-KIM1929). The system will be constructed at the same area as the existing pond located at Site 9 and will be designed based on the CSA Standard W203:19. The proposed effluent quality criteria were developed and adjusted according to communication with the Government of Nunavut subsequent to the pre-design report. The revised effluent quality at the compliance point are summarized in **Table 1**.

Table 1: Proposed Effluent Quality at Compliance Point

Parameter	Effluent Quality	Units
$cBOD_5$	100	mg/L
TSS	120	mg/L
pH	6.0 - 9.0	-
Oil and Grease	No visible sheen	-
Fecal Coliforms	1×10^6	CFU/100 mL
NH_3	1.25	Mg/L

The lagoon system will be sized to accommodate storage of wastewater, sludge accumulation, precipitation and surface runoff for a 12 month storage period. The inflow volumes, including annual precipitation accumulation, were developed in prior stages of the design process and are summarized in **Table 2** as anticipated lagoon inflow volumes.

Table 2: Lagoon Inflow Volumes

Source	Volume (m^3)
Annual wastewater generation (year 2043)	19,200
Annual precipitation volume (snow and rain)	6,300
Cumulative sludge accumulation by year 2043	1,400
Minimum Design Lagoon Working Volume:	***26,900***

The treatment system was considered as a whole, using the published literature values for $cBOD_5$¬ in northern trucked raw wastewater. Although the lagoon cells will hold sewage for one year, the effective treatment time used in these calculations only accounts for the length of time sewage is completely thawed to facilitate biological treatment during the summer months. Since freeze-up can vary and occur anytime from October – December, a design sensitivity range of 80-100 days of treatment are understood to be available for the lagoon location. During the design development a minimum of 90 days has been conservatively applied for lagoon schematic sizing, and is based on a treatment window from mid-May to mid-August, with negligible winter treatment allowance for the purpose of conservative volume estimation. These were chosen to provide an overall conservative effluent modelling approach.

At an operating depth of nominally 2 m, the lagoon is at the deeper range of a facultative lagoon and the shallower end of an anaerobic lagoon. Based on this, the lagoon may operate similar to a facultative lagoon, which allows for aerobic treatment near the top of the lagoon with the bottom of the lagoon being treated similar to anaerobic. Although the cell may operate as a facultative lagoon for the preliminary design we have assumed conservative behaviour consistent with an anaerobic lagoon in the treatment kinetics.

The raw inflow quality is derived from the CSA standard and remain unchanged from the pre-design report. The inflow quality is summarized in **Table 3** below.

Table 3: Typical Raw Wastewater Quality for Trucked Wastewater System

Parameter	Typical Raw Wastewater Quality	Units	Source
$cBOD_5$	450	mg/L	CSA Standard W203:19
TSS	400	mg/L	CSA Standard W203:19
TAN	100	mg/L	CSA Standard W203:19
TP	15	mg/L	CSA Standard W203:19
E. coli	1×10^8	CFU/100 mL	CSA Standard W203:19

The lagoon sizing is based on achieving the effluent quality identified in **Table 1** above. All working volume sizing and treatment kinetics are conservatively applied as described above to arrive at the schematic lagoon configuration to achieve the intended effluent criteria during decant and prior to wetland polishing.

3.0 Wetland Treatment Area

3.1 Wetland Flow Attenuation Berms

The schematic design includes the addition of fifteen (15) flow attenuation structures in the wetland to enhance treatment performance. The use of berms within the wetland will increase hydraulic retention, improve aeration, prevent hydraulic scouring and disperse liquid more widely. The rocks within the berm will provide surface area for biofilm to grow and provide additional biological treatment. Flow attenuation devices can be as simple as shallow coarse rock berms placed across flow paths in strategic locations.

The berms are placed perpendicular to the natural flow path downstream of the lagoon discharge location. A common berm design features an arc shape with the peak of the arc situated on the upstream side of the flow path**.** In the flow path, a second rock structure may be attached similar to a bulbous bow on a ship. Such a structure breaks up wind driven waves, slows the flow and causes the water to divert to either side encouraging it to spread across the length of the berm. Further, during breakup, ice is diverted to either side with the wet side toward the berm; this helps to reduce ice damage.

By increasing hydraulic retention, the wetland treatment area (WTA) is able to hold the effluent longer. The increase in retention time allows for increased degradation of contaminants by natural organisms and processes. Further, a slower flow reduces erosion and scouring of the soil. By diverting the flow, the berms spread the effluent more widely across the WTA which further reduces the flow and makes use of soil organisms and plants outside the natural flow path to assist in the treatment process.

The berms themselves may be partially permeable**.** This design encourages flow through and over the rock. As this happens, a community of organisms is created within the void space between the rocks and these, in turn, also assist in the treatment process.

Flow attenuation devices such as berms require annual maintenance to provide optimal performance and treatment. Examples of annual maintenance activities include the following:

- Re-grade attenuation devices as required;
- Repair cuts and channels in attenuation devices with pit run or larger rock;
- Address water velocities by installing additional attenuation dams and/or silt fences as appropriate;
- Add rock to Scree slopes as required; and
- Address channeling throughout the wetland with attenuation dams and/or silt fences.

3.2 Modified Tanks-In-Series Model

A modified tanks-in-series (TIS) model was used to gain a better understanding of the treatment performance of the WTA following primary and secondary treatment through the lagoon system. The modified TIS model was validated by Hayward and Jamieson (2015) for performance modeling of surface and subsurface flow wetlands in the North (CSA W203.19).

The modified TIS model is based on a conventional TIS chemical reactor model, and uses a series of completely mixed tanks with equivalent retention times to hydraulically represent the study wetland. The model utilizes a general mass balance, rearranged by Hayward and Jamieson (2015), to solve for the contaminant concentrations leaving each wetland cell. External hydrologic contributions from the surrounding watershed are cumulatively added along the length of the wetland.

$$C_{out} = \frac{\left(\frac{Q_{in}}{Q_{out}}\right) C_{in} + \left(\frac{\frac{Q_{ws}}{N}}{Q_{out}}\right) C^* + \frac{k\tau C^*}{Nd}}{1 + \frac{\tau}{Nd}(I + \alpha ET + k)}$$

Where:

- C_{in} = Concentration into tank 'N' (CFU/100 mL);
- C* = Background concentration (CFU/100 mL);
- Q_{out} = Flow out of tank 'N' (m^3/d);
- Q_{in} = Flow into tank 'N' (m^3/d);
- Q_{ws} = External hydrologic contribution into the wetland segment (m^3/d);
- N = Number of tanks;
- k = First order areal rate constant (m/d);
- d_w = Water depth (m);
- I = Infiltration (m);
- ET = Evapotranspiration (m); and
- α = Transpiration Fraction.

To represent the WTA, a model consisting of 15 wetland cells, each with a series of three (3) completely mixed tanks, was developed. The model includes the addition of 15 flow attenuation devices to increase hydraulic retention time (HRT), prevent hydraulic scouring and disperse liquid more widely. Each wetland cell represents the treatment area upstream of an attenuation device and range in surface area from 227 to 732 m^2, with the model representing a total WTA of 6,965 m^2.

3.2.1 Assumptions

To initiate the model, a number of assumptions regarding the WTA were applied. The assumptions are as follows:

- Influent loading characteristics of the WTA corresponded with the contaminant concentrations leaving the lagoon.

- External hydrologic contributions to the WTA from watershed runoff (Q_{ws}) were assumed to be negligible, as the lagoon decant is anticipated to occur after spring freshet;
- Water depths throughout the WTA were assumed to reach maximum of 1 m based on the design height of the attenuation berms (1 m); water depth will vary with flow;
- Average daily evapotranspiration and precipitation, and background water quality was based on information available in the *Kimmirut Wetland Planning Study* completed by Kadlec and Johnson (2008);
- Infiltration was assumed to be negligible based on site characteristics; and
- Wastewater loading of the WTA was assumed to occur during the acceptable treatment season, when air temperatures are above 5°C; the treatment season begins with the disappearance of snow, beginning of plant growth, and ends with the appearance of ice, plant die-off or dormancy, and temperatures below 5°C. Within this climatological window, wetland plants and microbiota assist nutrient removal processes along with physical removal processes.

3.2.2 Areal Rate Constants

Site-specific areal rate constants (k) derived by Hayward and Jamieson (2015) were compared to values suggested by literature for treatment wetlands (Kadlec & Knight, 1996); areal rate constants from Kadlec & Knight (1996) were applied to the TIS model as they proved most conservative. Parameter specific temperature correction factors were used to adjust the rate constants to the lowest suggested temperature during the treatment period (5°C). The final values applied to the model are shown in **Table 4.**

Table 4: Areal Rate Constants and Temperature Correction Factors

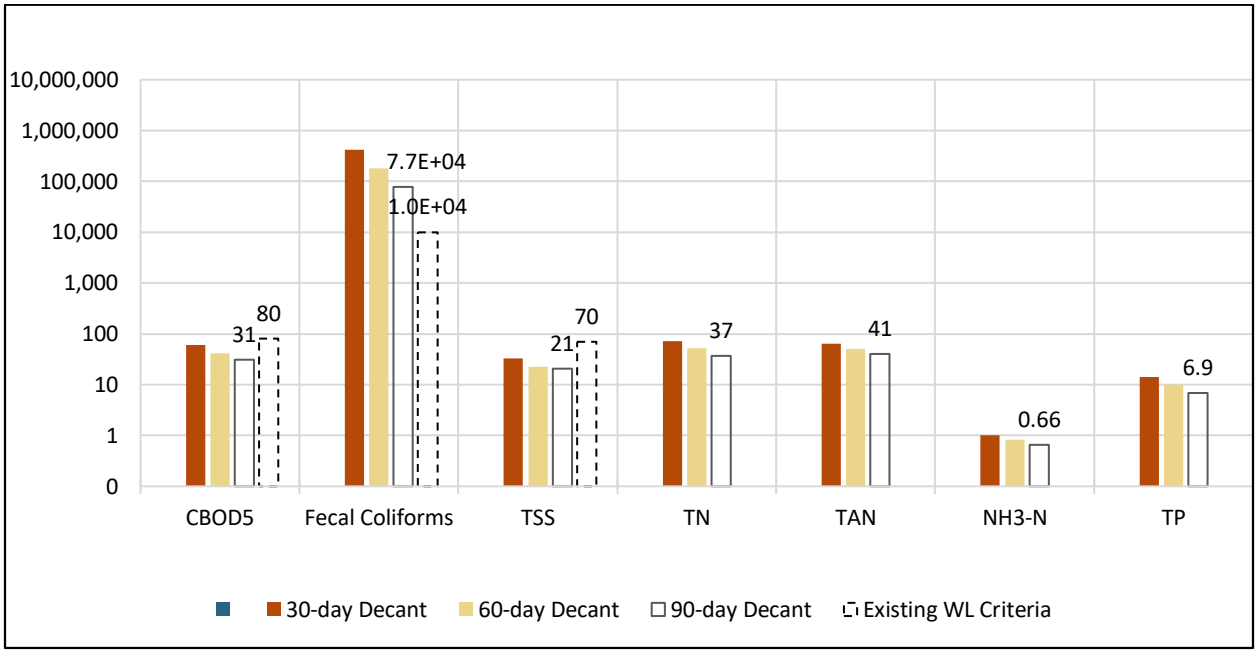
Parameter	Areal Rate Constant (k) at 20°C (m/year)	Temperature Correction Factor
$CBOD_5$	34	1.012
Fecal Coliforms	103	1.070
TSS	35	1.000
TAN	20	1.053
NH_3-N	18	1.050

3.2.3 Loading Scenarios

An appropriate management strategy for WTAs is to avoid wastewater treatment during spring freshet when runoff from the watershed results in increased flows through the treatment area that provide dilution but not treatment. Further, a controlled decant scenario is desirable to avoid a large spring flow of lagoon wastewater, which may potentially contain large volumes of frozen wastewater and have insufficient detention for treatment. Therefore, a continuous discharge of wastewater into the wetland which is slowly decanted throughout the summer months is preferable.

For the purpose of this assessment, the total lagoon working volume (25,000 m^3), disbursed over the following three decant scenarios has been compared:

- 30-day decant = approximately 833 m^3/day;
- 60-day decant = approximately 417 m^3/day; and
- 90-day decant = approximately 278 m^3/day.



**WL criteria for TAN is based on an environment with a pH of 8 and a temperature of 5°C*

Figure 1: Treatment Performance Comparison based on Decant Period

Figure 1 demonstrates that following lagoon treatment, the WTA should be capable of reducing $cBOD_5$, *E. coli* and TSS to concentrations below the proposed water license criteria, when a 30-, 60-, or 90-day decant period is considered (and in accordance with the assumptions outlined in **Sections3.2.1** through **3.2.2**). While the model demonstrates that a longer decant period will improve the treatment performance of the WTA, TAN concentrations at the wetland outlet may still result in NH_3-N concentrations that exceed the suggested effluent quality standards if a pH of 8 or a temperature of 5°C is exceeded.

The addition of wetland attenuation berms will increase hydraulic retention and overall wetland nitrification. Based upon recommendations from Alberta Environment (2000) and Kadlec and Knight (1996), CSA W203.19 suggests a minimum nominal HRT of 14 days for WTA. While the modelled HRT for a 30-day decant was approximately 8 days, the nominal HRTs for both the 60- and 90-day decant periods were greater than 14 days. Modelled HRTs and contaminant concentrations throughout the treatment process are included in **Table 5**.

Table 5: Modelled HRTs and Contaminant Concentrations

Parameter	Units	WTA Effluent by Decant Scenario		
		30-day	60-day	90-day
HRT	days	8.4	17.0	25.6
CBOD5	mg/L	61	41	31
Fecal Coliforms	CFU/100 mL	$4.2x10^5$	$1.8 x10^5$	$7.7 x10^4$
TSS	mg/L	20	20	20
TAN	mg/L	64	51	41
NH_3-N	mg/L	1.01	0.82	0.66

It is noted that the prediction of contaminant removal across the lagoon and WTA is dependent on specific site conditions including retention time, settling rates and temperature. Variations in these parameters, or others such as an increased WTA and external hydrologic contributions, will impact the treatment performance of the WTA.

While Dillon recognizes that due to the nature of treatment, no model can accurately predict the continuing performance of a wetland. Each wetland is as different and unique as its environment and the biological culture that it supports; this assessment is intended to provide valuable information regarding the potential for contaminant fate and transport throughout the WTA according to pre-design conditions.

Furthermore, the specific arrangement of berms required to achieve the necessary treatment in Kimmirut is more complex than is typical of other locations. Complexities include a high longitudinal gradient (requiring 15 berms to provide storage), high ponding depths which may discourage aquatic plant establishment, and covering a large amount of area which is currently non-wetland and must be established. These complexities introduce significant uncertainty in our analysis of the WTA and Dillon recommends that additional Options for secondary treatment be evaluated.

4.0 Site Infrastructure

The overall facility will be comprised of three main components: Access road and inlet structure, lagoon and appurtenances, and Wetland Treatment Area.

4.1 Lagoon and Berms

Lagoon construction will be comprised of constructed embankments (berms) as well as fill sections placed directly against native soils and bedrock. The depth of the lagoon is determined by the volumetric requirements of the working zones. **Table 6** provides a summary of Lagoon depth requirements to meet the requirements of sludge accumulation, facultative treatment, freeboard, and emergency spill depth.

Table 6: Lagoon Depth Requirements

Source	Depth (m)
Sludge Accumulation and Dead Storage	0.3m
Active Storage and Treatment	2.7m
Freeboard to Emergency Spillway Invert	0.3m
Freeboard From Spillway Invert to Berm Crest	0.7m
Design Lagoon Depth:	***4.0m***

We understand that Canadrill has previously analyzed the slope stability for berms up to 4.0m in height, when measured from the toe of the berm to the crest of the berm. Portions if the berm may exceed 4.0m in height due to topography, and Canadrill should be re-engaged to confirm slope stability. Following Canadrill's recommendations, the berms will be constructed with a maximum of 3.5H:1.0V internal side slope with a maximum of 3.0H1.0V exterior side slope.

The berm will be constructed using locally available Type 1 or Type 2 crushed gravel or Select Subgrade Fill. Materials will be placed in maximum 300mm lifts compacted to a minimum of 95% SPMDD. Refer to **Table 7** for recommended material gradations.

Table 7: Berm Material Gradations

Sieve Size (mm)	Type 1 Gravel (% Passing)	Type 2 Gravel (% Passing)	Select Subgrade (% Passing)
150	-	-	100
75.0	-	100	-
37.5	-	-	-
25.0	100	50 – 100	50 – 100
19.0	75 – 100	-	-

Sieve Size (mm)	Type 1 Gravel (% Passing)	Type 2 Gravel (% Passing)	Select Subgrade (% Passing)
9.5	50 – 85	-	-
4.75	35 – 65	20 – 55	20 – 100
2.0	25 – 50	-	-
0.425	15 – 30	5 – 35	-
0.3	-	-	5 – 95
0.15	-	-	2 – 65
0.075	5 - 8	0 - 8	0 - 25

The interior slope will be surfaced with exposed HDPE liner and will not be susceptible to surface erosion. The exterior slope will be armoured with stone to provide sufficient surface erosion control.

Canadrill recommends that the exterior of the berm be provided with a toe drain to prevent the phreatic surface from daylighting on the downstream berm face, which unless prevented would cause erosion from water exfiltrating the berm. The toe drain will consist of a minimum of a 2.0m rock buttress underlain by nonwoven geotextile.

The top of the berm will be constructed to support operations and maintenance access to the full perimeter of the lagoon. The width of the berm crest will be 4.0m and all curves will have a minimum centreline radius of 9.0m. The anticipated design vehicle is a TAC-2017 (CA) LSU and Dillon will provide vehicle simulation drawings to confirm access. Refer to **Figure 2** for vehicle characteristics.

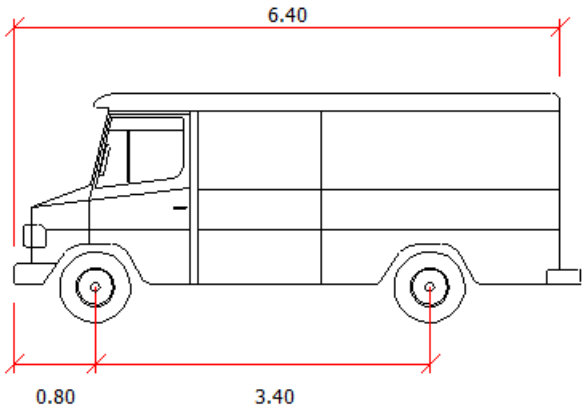


Figure 2 - TAC-2017 (CA) LSU Dimensions

The access road will be designed to support the loading from infrequent, light vehicles such as ATVs and pick-up trucks. The light-duty road structure will be surfaced with 200mm of Type 1 Gravel underlain by 300mm of Type 2 Gravel.

4.2 Arctic Rated Liner System

Geomembrane liners have been proven to be successful for use in Arctic environments as impermeable membranes. They are highly durable, resistant to the intense stresses of weather extremes and resilient to chemicals that are typically found in municipal wastewater. A suitable liner will be specified for use at the Naujaat WWTF, taking into consideration cold crack, installation slack to accommodate future settlement, brittleness failure and low-temperature impact. As with any lining system, the materials must be installed properly, following the manufacturer's guidelines to ensure the overall integrity of the system is maintained.

Dillon looked into several liner options that are available on the market for extreme weather applications: reinforced polyethylene (RPE), high density polyethylene (HDPE), linear low-density polyethylene (LLDPE), geosynthetic clay liner (GCL) and bituminous geomembrane (BGM). Low density polyethylene (LDPE) was not included within the options as LLDPE has improved tensile strength and resistance of harsh environments over the LDPE. Pros and cons of each liner options are described below:

- **RPE** geomembranes will retain flexibility at extremely low temperatures but are most commonly used for seepage control applications opposed to impermeable applications. The RPE geomembranes have UV resistance but only for short term exposed use and are recommended to include backfill over the liner.
- **HDPE** geomembranes have a high tensile strength, puncture resistance and are highly durable in extreme weather conditions. HDPE geomembranes have proven to be successful for use in Arctic environments as impermeable membranes and do not require a layer of backfill over the liner after installation.
- **LLDPE** geomembranes are able to be exposed to the environments similar to an HDPE geomembranes (no backfill required) but due to the low density of the geomembrane and reduced UV resistance in comparison to an HDPE liner, has a reduced warranty when exposed.
- **GCL and coated GCL** alternatives provide an impermeable liner and are typically the easiest to install compared to the other provided options. Although in order for either of the GCL options to work as designed, backfill is required to provide a confining pressure to the liner. This would require a minimum of 150 mm of backfill to be compacted over the GCL. The required backfill could potentially cause problems once municipal wastewater is added to the lagoon as the backfill layer could deteriorate, causing the backfill material to be also removed during the yearly decant process and reduce the available storage capacity. The GCL alternatives have high transportation costs due to the weight of the clay liner.
- **BGM**'s are another alternative that are simple to install as they only require propane to seam the impermeable layers together. BGM's are typically more expensive per square meter with respect to any of the other options but the BGM's do not require a 150 mm base layer of sand underneath the geomembrane.

HDPE, RPE and LLDPE are the typically toughest to install as they require a specialized crew for the installation. Backfill is recommended to be provided over RPE, LLDPE, GCL and coated GCL which would require a layer of rip-rap on the inside face of berms and will lead to complications with desludging of the lagoon in the future. A sand layer is required underneath RPE, LLDPE and HDPE liners, meaning that the underdrain system will be embedded in sand and may clog over time. A GCL or BGM liner can be placed on a rougher surface such as a screened stone allowing for improved drainage conditions.

Of the alternative liner options investigated, Dillon recommends an HDPE Liner (100 mil). HDPE liners are used frequently in northern Canada and provide cost savings compared to other types of liners. An RPE liner could also be considered as it is more puncture resistant than HDPE, can withstand very low temperatures and is highly resistant to chemicals. A liner such as RPE, which has fewer proven installations in Nunavut, may introduce additional risk to the project.

4.3 Inlet Structure

As recommended in CSA Standard W203:19, the inlet structure will include a discharge chute, constructed from a section of corrugated steel pipe and secured on the inside berm of the lagoon over rip-rap to protect the berm from erosion. A truck turn-around pad above the discharge chute will be levelled and identified by bollards. The discharge chute will extend through the fence so that the truck operator does not have to open a gate to discharge the truck contents.

4.4 Decant Pump

Effluent from the lagoon will be discharged annually to the existing wetland area east of the site, prior to entering the receiving marine body of Lake Harbour. Decant from the lagoon will be completed with the use of a portable pump and generator that is to be situated on the top of the east berm during decant. This simple, reliable, and low-cost decanting method was chosen to allow the community to control the time and rate of discharge. A self-priming suction lift pump complete with a foot valve will be transported to the discharge location on top of the berm and monitored throughout the decant process. A dispersion pipe will be used downstream of the pumping system to evenly disperse the effluent over the wetland area.

It is recommended that the decanting operations take place over a 90 day interval to not overwhelm the wetland treatment area. It is also recommended to start the decanting process near the end of summer to early fall to allow for the freshet to take place through the wetland and allow for biological treatment to occur within the lagoon through the warmer summer months.

4.5 Emergency Overflow Channel

An emergency overflow channel will be included in the lagoon berm design. This will consist of a shallow, open channel located at the top of the berm. The channel will be protected from erosion and

should divert effluent to a specified release point that minimizes impacts on downstream infrastructure and receiving environments.

4.6 Drainage/Venting System

Gas formation under the liner is unusual, but it occurs when a liner is placed over a surface previously covered with decomposable organic material. Biogas formation will also readily form if minor amounts of wastewater flow through small pin holes or imperfect seams in the liner during construction or during operation. Biogas pockets may lead to the creation of large gas bubbles under the liner, which results in "whale backs" extending beyond the surface of liquid in HDPE lined cell and stressing the material. Hydraulic uplift potential must also be considered in areas where the excavated cell or portions of the excavated cell are at a depth where a phreatic surface of groundwater is present or piezometric pressures are present.

To mitigate this risk, a pipe vent will be installed to promote passive ventilation and will be large enough to allow the introduction of a submersible pump, should water accumulation become a problem. The vent pipe will consist of a 250 mm pipe extending from underneath the liner along the height of the berm and will daylight at the east end of the lagoon.

4.7 Access Road

Construction of the lagoon will require an access road from the existing road to the north of the site. The access road will connect the east side of the lagoon to the existing road. The access road must meet the following conditions:

- The access road width will be 4 m;
- The maximum grade will be 5.0%;
- Road side delineators will be install to assist in snow clearing; and
- Side slopes of the road will be governed by the stability of the granular material used for the road construction. Geotechnical recommendation will be used to determine the minimum side slope. For safety reasons, a minimum slope of 3:1 will also govern.

4.8 Truck Turnaround Pad

The truck turning access pad will need to be constructed to the east of the lagoon to allow for gravity discharge from the truck into the lagoon. The location of the pad must provide for a cost effective construction that balances earthworks and allows for safe operation of the truck in winter conditions. The truck pad will have the following elements:

- A turning radius of 17.5 m;
- 3:1 (H:V) side slopes;
- Discharge culvert at discharge location;
- Stop logs at the discharge location to give the truck driver a physical indicator to stop the truck;

- Delineators along the edge of the truck pad to indicate the edge of the embankment in winter conditions; and
- The side slopes of the truck pad will be protected against erosion with a layer of granular material. The erosion protection will have a minimum gradation of a 50 mm minus material. Coarser material may be used, if economically available.

4.9 Signage and Access Control

The lagoon should be provided with a suitable fence placed at the top of the berm, with a locked access gate. The truck discharge into the primary cell will be designed to penetrate through the site fence to allow for sewage truck operators to access the site and discharge into the lagoon, without requiring an access gate.

It is recommended that warning signs be placed along the perimeter of the site and at least one per side in local languages to designate the nature of facility, the risk to human health, and advise against trespassing. Signs should also be posted at appropriately spaced intervals along the perimeter of the proposed wetland treatment area (WTA) and at the final discharge compliance point of the WWTF.

4.10 Upstream Flow Diversion

Based on the site location, there will be minimal upstream flow diversion required, but all upstream runoff will be diverted around the lagoon footprint using ditches, and directed towards the valley and existing wetland area. A factor of safety will be applied to the sizing of ditching and culverts to account for future climate change conditions and changing precipitation patterns for the lifespan of the sewage treatment system.

5.0 Schematic Design

5.1 Preliminary Design Drawings

Dillon has completed preliminary design drawings for a lagoon at Site 9. The preliminary design drawings include a proposed footprint for the lagoon system with the cell configuration to be determined within the schematic design phase. Treatment would be achieved within the proposed footprint, prior to the effluent reaching the existing wetland system and receiving water body. The following has also been included within the design drawings found in **Appendix A**:

- Site plan of the development showing locations of the proposed lagoon, berm, approach road and truck turn area;
- Total volume, working volume, sludge allowance and freeboard;
- Cross-sections; and
- Contours developed from DEM data and associated elevations of berms, lagoon bed, and access road.

5.2 Class D Cost Estimate

Dillon has prepared a Class D, Order of Magnitude cost estimate for a single cell lagoon at Site 9, in Kimmirut NU. Prices are based on an elemental cost estimate prepared by Altus Group based upon the 25% review drawings. Notable exclusions at this time are any construction contingencies. The estimated cost of **$XXX** includes all direct and indirect construction costs and is intended to reflect fair market value of the work and is not intended to reflect bid prices.

6.0 Next Steps

Throughout the preparation of the schematic design documents, Dillon has identified items which require additional stakeholder discussion and investigation. Below is a summary of next steps to build upon this report and which will help to refine future designs:

6.1 25% Drawing Comments

Dillon has reviewed the comments provided by the Owner regarding our submission of 25% drawings. Dillon incorporated some of those comments in the schematic design package, but many comments pertained to very detailed aspects of the design. Dillon will review the 25% comments with the Owner in conjunction with the Schematic Design comments and will determine how to best consolidate all comments into following submissions.

6.2 Wetland Treatment Area

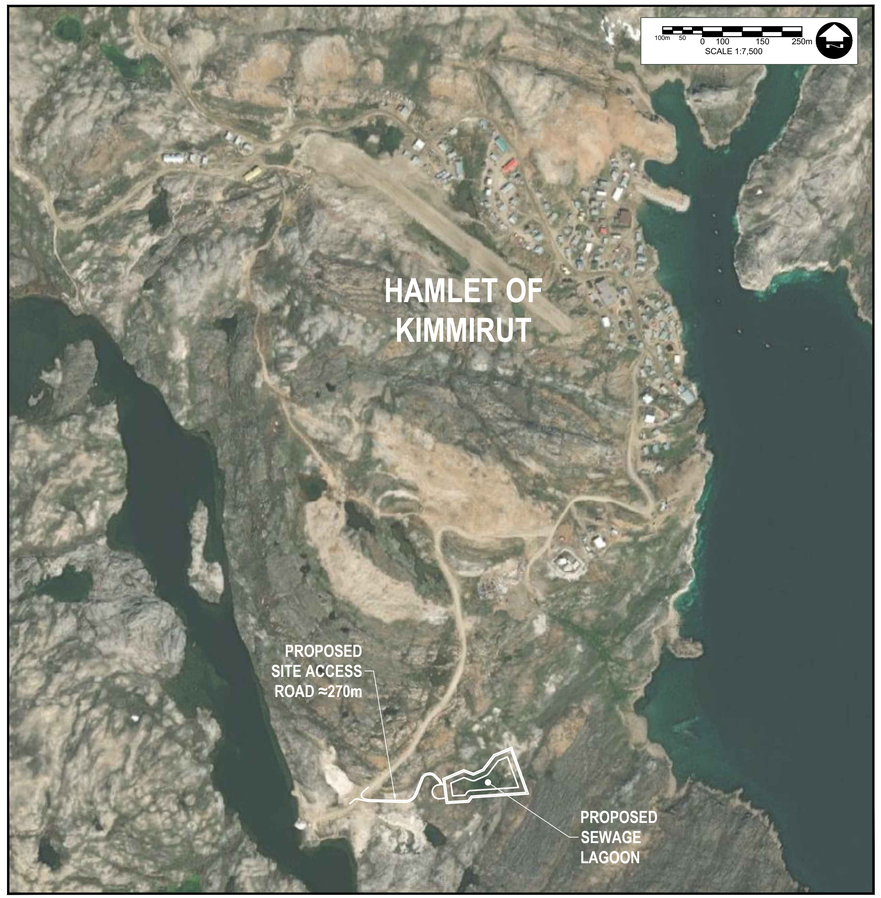
Dillon has identified concerns with the feasibility of wetland treatment and we are studying multiple options to provide effective and efficient treatment. Dillon will prepare a memorandum of options, and will review the preferred option with the Owner for incorporation into following submissions.

6.3 Geotechnical

Constraints such as topography and subsurface conditions at the site of the proposed lagoon required that certain details of the lagoon, such as maximum embankment height, exceeded the recommendations of the geotechnical report. The geotechnical consultant should be engaged to review the proposed lagoon design and comment on the suitability of the proposed design.

Appendix B

Design Drawings



DRAWING INDEX	
DRAWING NUMBER	DRAWING DESCRIPTION
	COVER
100	EXISTING CATCHMENTS AND PROPOSED SITE OVERVIEW
101	SITE DESIGN AREA
102	LAGOON CELL DESIGN PLAN
103	TYPICAL LAGOON CELL DESIGN SECTIONS
104	LAGOON CELL SECTIONS
105	SITE DRAINAGE PROFILES
106	ACCESS ROAD PLAN AND PROFILE
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109	WTA ATTENUATION BERMS
200	TYPICAL BERM DETAILS
201	ACCESS ROAD TURNAROUND AND CULVERT DETAILS
202	LINER VENT AND DRAIN PIPE DETAILS
203	DISCHARGE FLUME DETAILS
204	EMERGENCY OVERFLOW WEIR AND FENCE DETAILS
205	FENCING AND BOLLARD DETAILS
206	PUMP AND DEWATERING DETAILS
207	WETLAND ATTENUATION BERM DETAILS

THE GOVERNMENT OF NUNAVUT
COMMMUNITY AND GOVERNMENT SERVICES

KIMMIRUT WASTE WATER TREATMENT CELL

ISSUED FOR SCHEMATIC DESIGN REPORT

JANUARY 2023

GN PROJECT NO. 11325-#####
DILLON PROJECT NO. 20-2790

DILLON CONSULTING

4920 47TH STREET, YELLOWKNIFE NT, X1A 2P1, PHONE 867.920.4555

FileName:c:\pw working directory\projects 2020\41\pw\dms6594\6202790 cover.dwg,January 5, 2023

DILLON CONSULTING LIMITED 4920 47TH STREET, YELLOWKNIFE, NORTHWEST TERRITORIES, X1A 2P1, PHONE (867) 920-4555, FAX (867) 873-3328

25m 20 15 10 5 0 10 20 30 40 50m
SCALE 1:1,000

LEGEND:

- EXISTING CONTOUR
- PROPOSED MAJOR CONTOUR (1.0m)
- PROPOSED MINOR CONTOUR (0.5m)
- CATCHMENT BOUNDARY

NOTES:
1. EXISTING CONTOURS ARE BASED FROM TOPO SURVEY AND NUNAVUT GOV'T PLANNING AND LANDS.
2. PROPOSED CONTOUR INTERVALS ARE 0.5m AND 1.0m.

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FOR REVIEW

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DILLON CONSULTING

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2	ISSUED FOR SCHEMATIC DESIGN REPORT	01/09/23	KB
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DESIGN	TC
REVIEWED BY	KB
DRAWN	TPW
CHECKED BY	TC
DATE	JANUARY 2023
SCALE	AS SHOWN

KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

EXISTING CATCHMENTS AND PROPOSED SITE

PROJECT NO. 20-2790

SHEET NO. 100

DILLON CONSULTING LIMITED 4920 47TH STREET, YELLOWKNIFE, NORTHWEST TERRITORIES, X1A 2P1, PHONE (867) 920-4555, FAX (867) 873-3328

10 7.5 5 2.5 0 5 10 15 20 25m
SCALE 1:600

LEGEND:

- EXISTING CONTOUR
- PROPOSED MAJOR CONTOUR (1.0m)
- PROPOSED MINOR CONTOUR (0.5m)
- CATCHMENT BOUNDARY
- BOREHOLE LOCATION

NOTES:
1. EXISTING CONTOURS ARE BASED FROM TOPO SURVEY AND NUNAVUT GOV'T PLANNING AND LANDS.
2. PROPOSED CONTOUR INTERVALS ARE 0.5m AND 1.0m.
3. BOREHOLES RESULTS (BH##), SEE GEOTECHNICAL REPORT BY CANADRILL LIMITED GEOTECHNICAL DIVISION DATED MAY 3, 2021.

BH01
BH02
BH03
BH04
BH05
BH06

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KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

SITE DESIGN AREA

PROJECT NO. 20-2790

SHEET NO. 101

GENERAL NOTES:

1. ALL DIMENSIONS IN METERS UNLESS NOTED OTHERWISE.
2. ALL DIMENSIONS TO BE CHECKED AND VERIFIED IN THE FIELD PRIOR TO ANY CONSTRUCTION. ANY DISCREPENCIES TO BE REPORTED TO THE ENGINEER BEFORE PROCEEDING.
3. QUANTITIES SHOWN ARE APPROXIMATE AND FOR TENDERING PURPOSES ONLY.
4. ALL CONSTRUCTION WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
5. EXISTING UTILITIES ARE NOT TO BE DISTURBED. ANY CONFLICTS WITH EXISTING UTILITIES SHALL BE IMMEDIATELY REPORTED TO THE ENGINEER.
6. THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE ENTIRE DRAWING SET AND CONTRACT DOCUMENTS.
7. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS AS WELL AS ANY APPLICABLE TERRITORIAL STANDARD SPECIFICATIONS AND STANDARD DRAWINGS.
8. ANY SURVEY FOR THE PURPOSE OF LAYOUT, QUANTITY CALCULATIONS, OR RECORD DRAWING TO BE CONDUCTED WITH REFERENCE TO A CANADA LANDS AND SURVEY MONUMENT.
9. DESIGN CONTOURS SHOWN ARE FINAL GRADE AND REPRESENT SAND AND TYPE II GRANULAR OR EXCAVATED SURFACE.

TYPE I MATERIAL: 50mm MINUS GRANULAR
TYPE II MATERIAL: 20mm MINUS GRANULAR
TYPE III MATERIAL: SAND/SAND BEDDING
BORROW MATERIAL: 150mm MINUS LOCAL SOURCE OR EXCAVATED FROM SITE (AS APPROVED BY ENGINEER)

10 8 6 4 2 0 5 10 15 20 25m
SCALE 1:500

LEGEND:

- MAJOR CONTOUR (2.5m)
- MINOR CONTOUR (0.5m)
- TOE OF SLOPE
- TOP OF BERM
- CONTAINMENT LEVEL
- HDPE AIR VENT PIPING
- CSP DRAINAGE PIPE
- BARRIER FENCE
- DRAINAGE

PRIMARY SEWAGE LAGOON CELL
27,000 m3 EFFLUENT VOLUME

SEE ACCESS ROAD PLAN AND PROFILE ON DWG #106

SEE NORTH DRAINAGE 1.0m CHANNEL PROFILE 1/105

1/103

1/204 SEE OVERFLOW WEIR PLAN

PERIMETER FENCE MAN GATE 1/205

SEE DISCHARGE CHUTE PLAN 2/203

2/103

1/107 SEE PERIMETER BERM SECTIONS

SEE SOUTH DRAINAGE 1.0m CHANNEL PROFILE 2/105

PERIMETER FENCE 600m LENGTH 4/205

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SCALE: AS SHOWN

KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

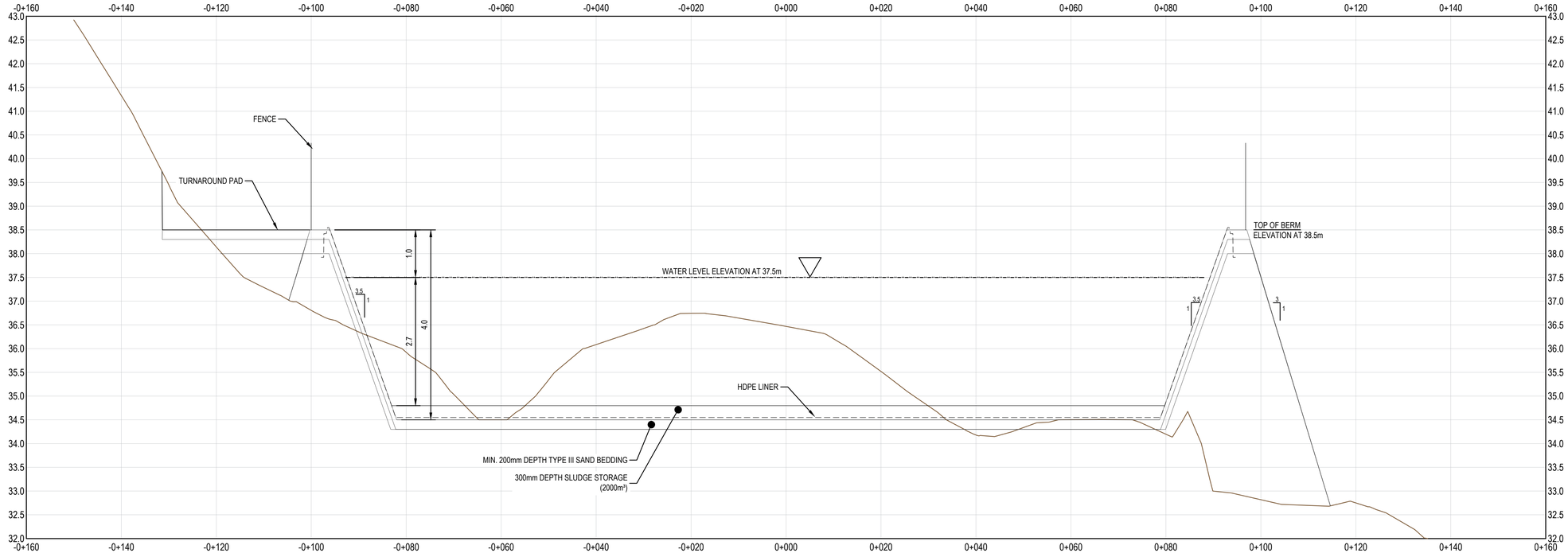
PROJECT NO. 20-2790

ISSUED FOR SCHEMATIC DESIGN REPORT

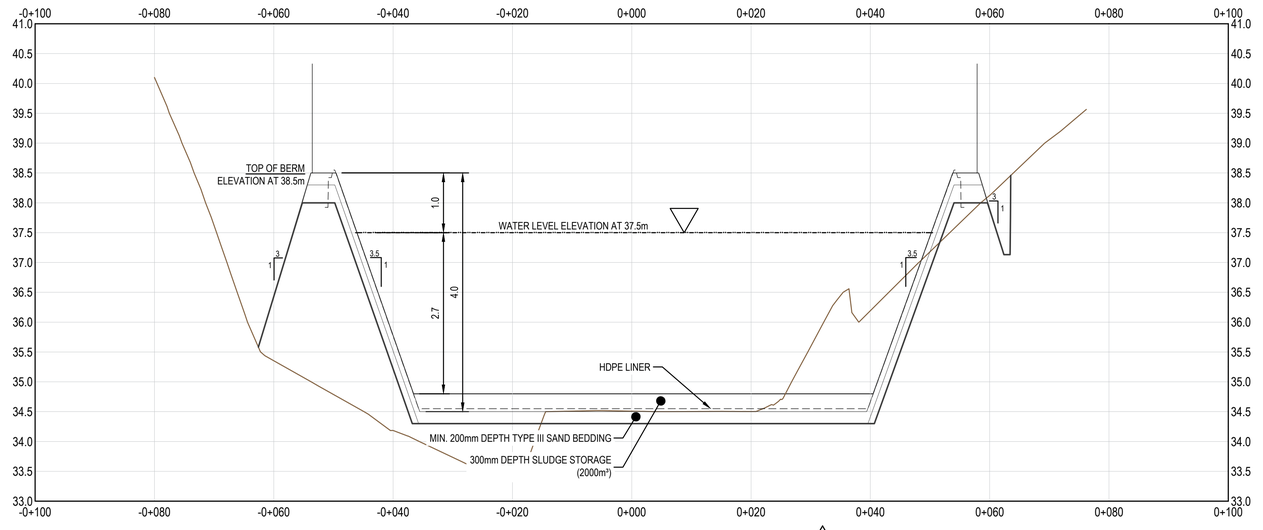
LAGOON CELL DESIGN PLAN

SHEET NO. 102

DILLON CONSULTING LIMITED 4920 47TH STREET, YELLOWKNIFE, NORTHWEST TERRITORIES, X1A 2P1, PHONE (867) 920-4555, FAX (867) 873-3328



SEWAGE LAGOON (NORTH - SOUTH PROFILE) 1/102
SCALE: 1:500h 1:50v



SEWAGE LAGOON (WEST - EAST PROFILE) 2/102
SCALE: 1:500h 1:50v

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KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

TYPICAL LAGOON CELL DESIGN SECTIONS

PROJECT NO. 20-2790

SHEET NO. 103

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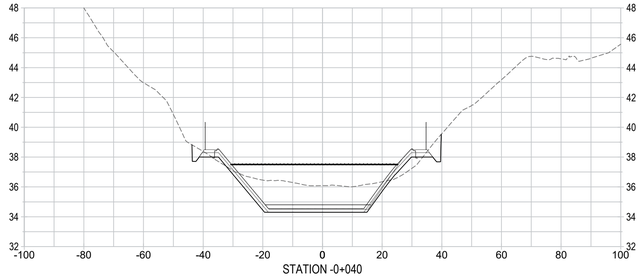

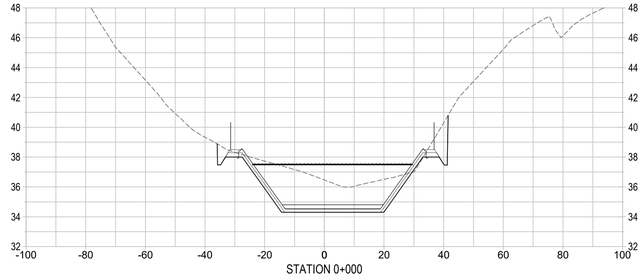

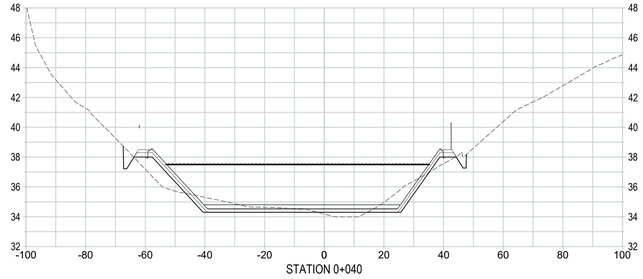

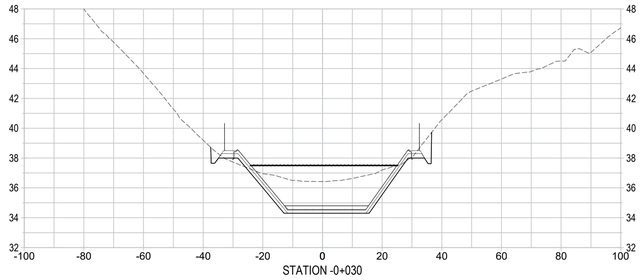

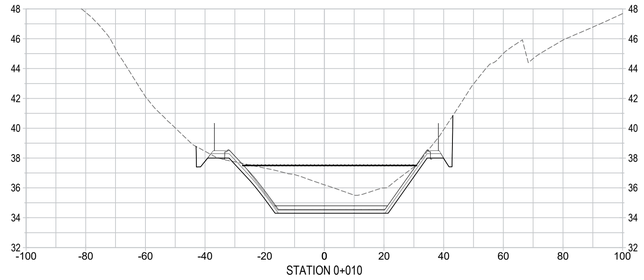

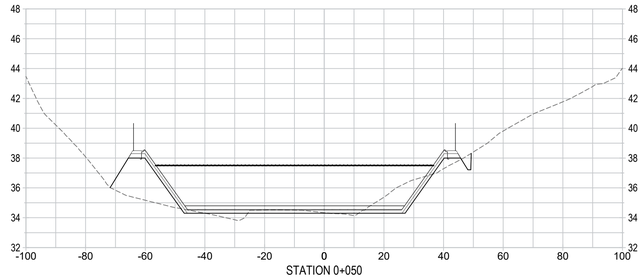

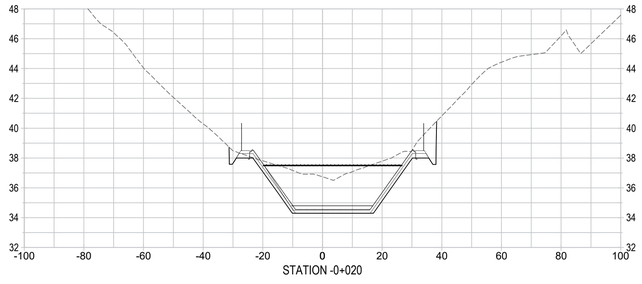

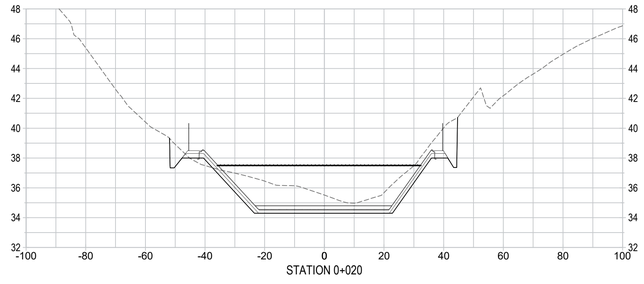

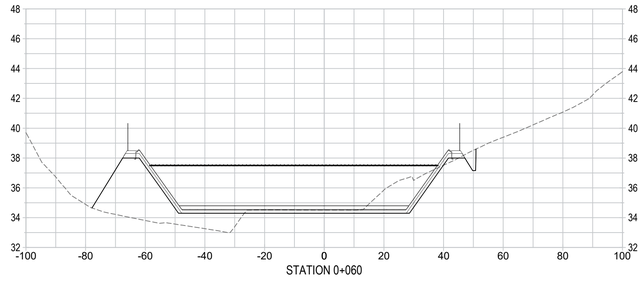

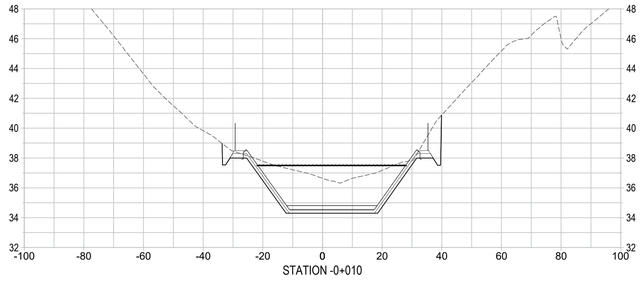

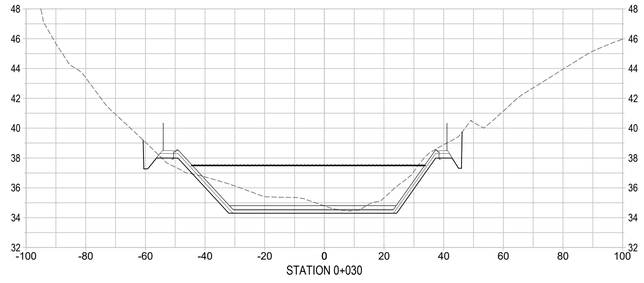

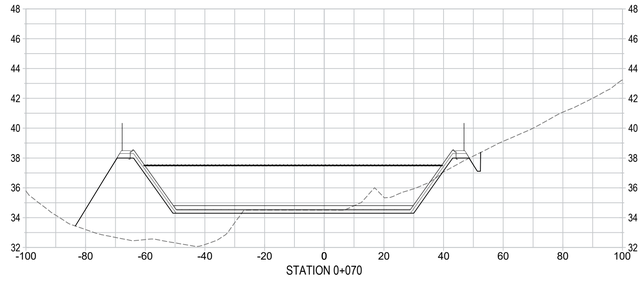

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SCALE: 1:1000 1:200

KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

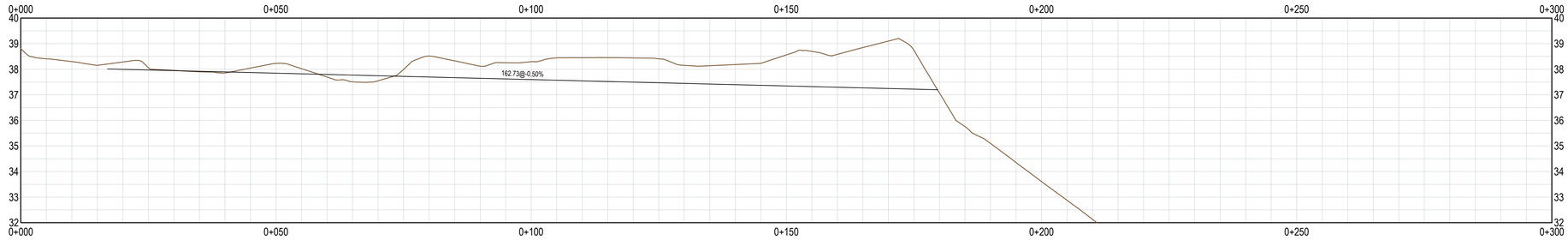
LAGOON CELL SECTIONS

PROJECT NO. 20-2790

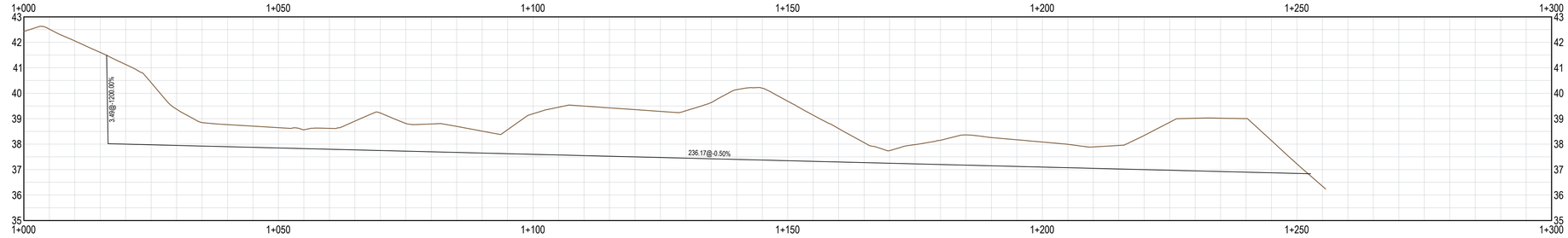
SHEET NO. 104

LEGEND:

EXISTING GROUND
PROPOSED DRAINAGE



NORTH LAGOON PERIMETER DITCH 1/102
SCALE: 1:500H 1:50V



SOUTH LAGOON PERIMETER DITCH 2/102
SCALE: 1:500H 1:50V

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KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

SITE DRAINAGE PROFILES

PROJECT NO. 20-2790

SHEET NO. 105

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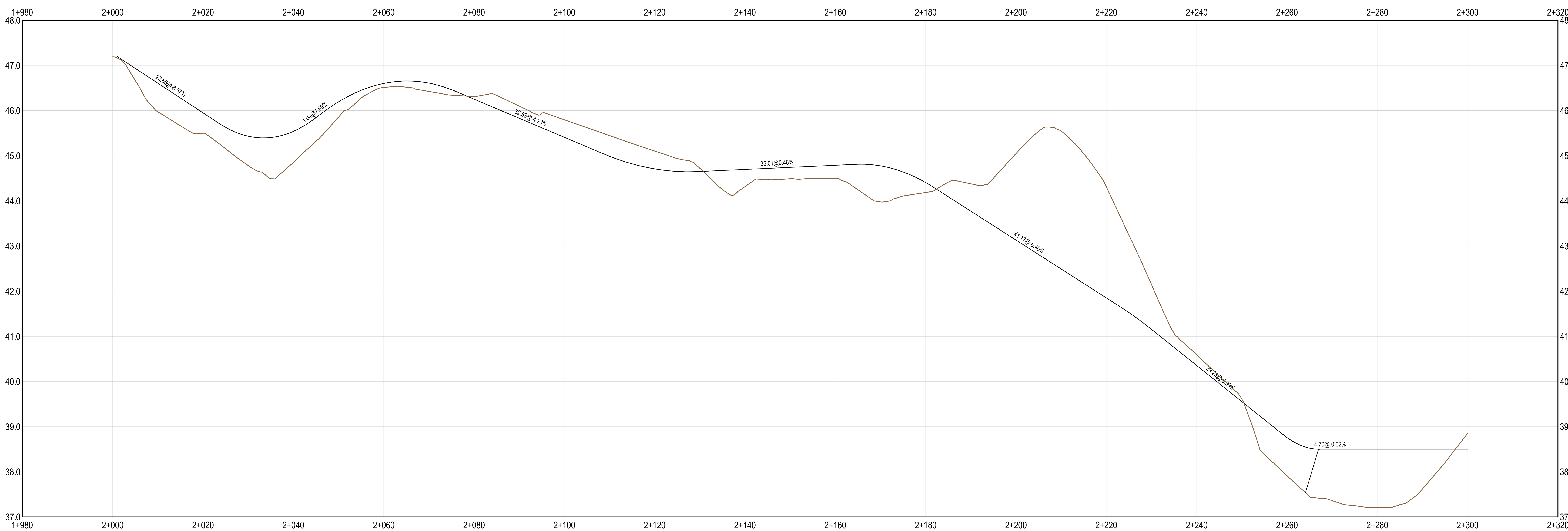
SEWAGE LAGOON ROAD ACCESS PLAN 1/104
SCALE: 1:1000



SEWAGE LAGOON ROAD ACCESS PROFILE 2/104
SCALE: 1:1000

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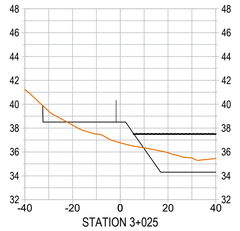
KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

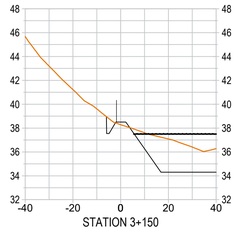
ISSUED FOR SCHEMATIC DESIGN REPORT

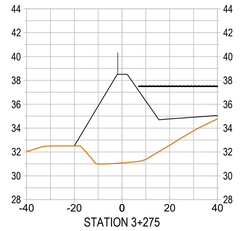
ACCESS ROAD PLAN AND PROFILE

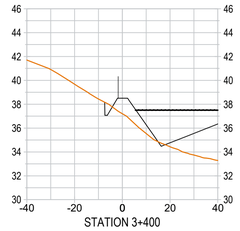
PROJECT NO. 20-2790

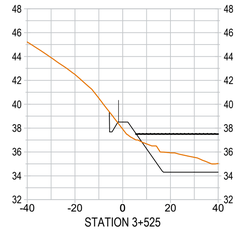
SHEET NO. 106

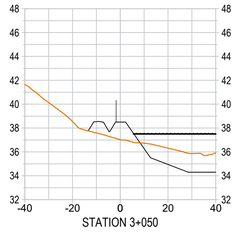


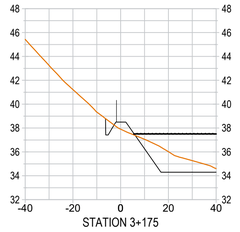


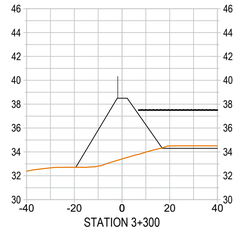


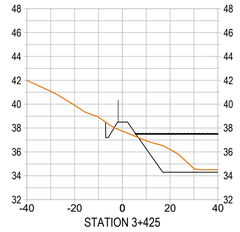


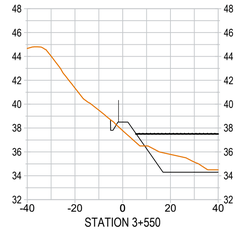


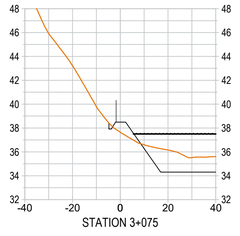


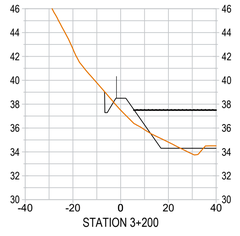


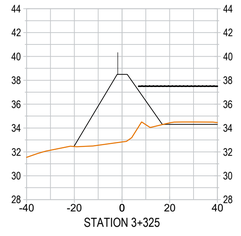


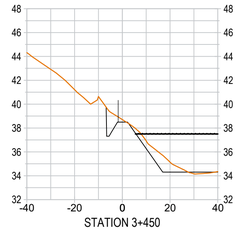


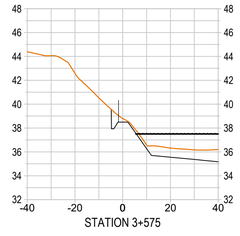


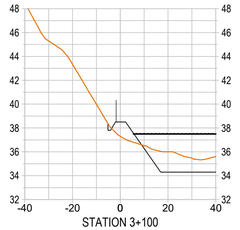


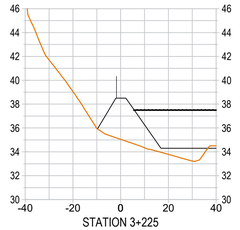


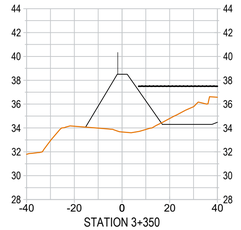


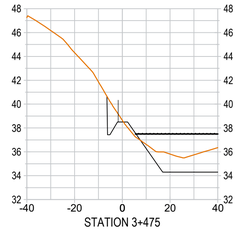


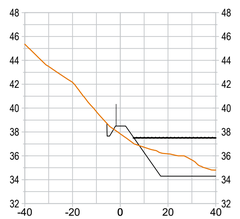


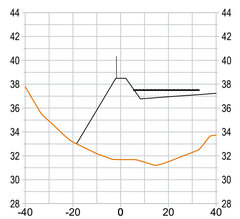


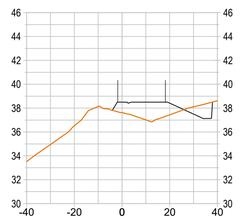


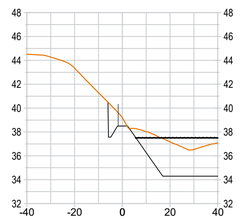












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NOT FOR CONSTRUCTION

FOR REVIEW

Nunavut

DILLON CONSULTING

No.	ISSUED FOR	DATE	BY
2	ISSUED FOR SCHEMATIC DESIGN REPORT	01/09/23	KB
1	ISSUED FOR 25% REVIEW	11/01/22	KB

DESIGN: TC	REVIEWED BY: KB
DRAWN: TPW	CHECKED BY: TC
DATE: JANUARY 2023	
SCALE: AS SHOWN	

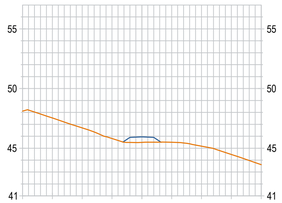
KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

PERIMETER BERM SECTIONS

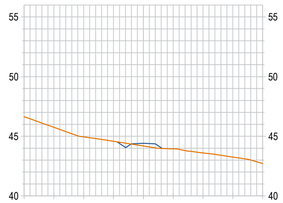
PROJECT NO. 20-2790

SHEET NO. 107



STATION 2+020

STATION 2+100



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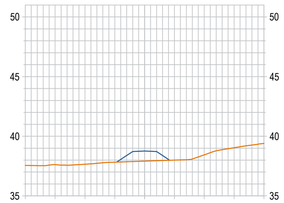

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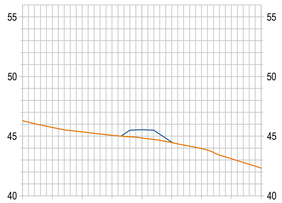

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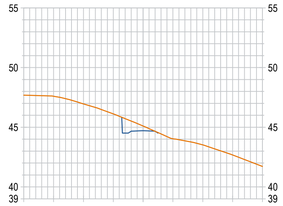

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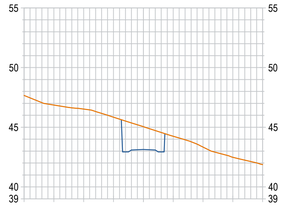

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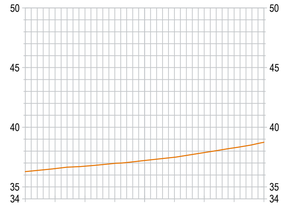

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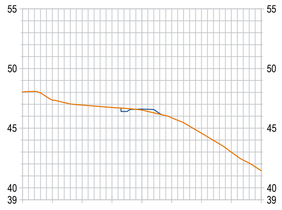

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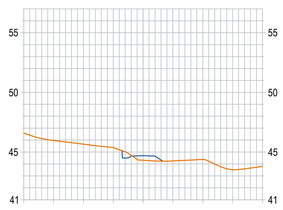

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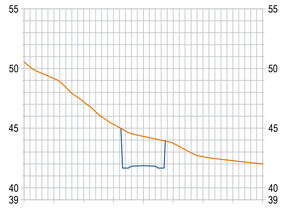

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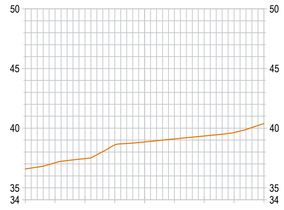

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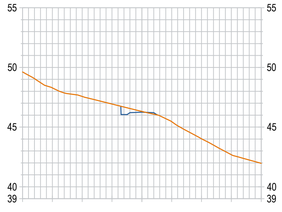

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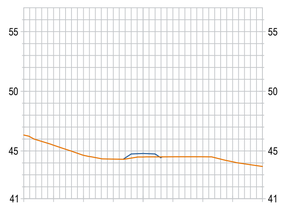

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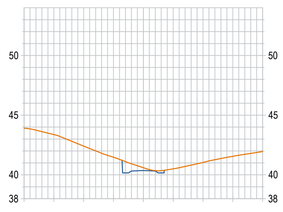

STATION 2+240

Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

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2	ISSUED FOR SCHEMATIC DESIGN REPORT	01/09/23	KB
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DESIGN: TC | REVIEWED BY: KB
DRAWN: TPW | CHECKED BY: TC
DATE: JANUARY 2023
SCALE: 1:500 1:250

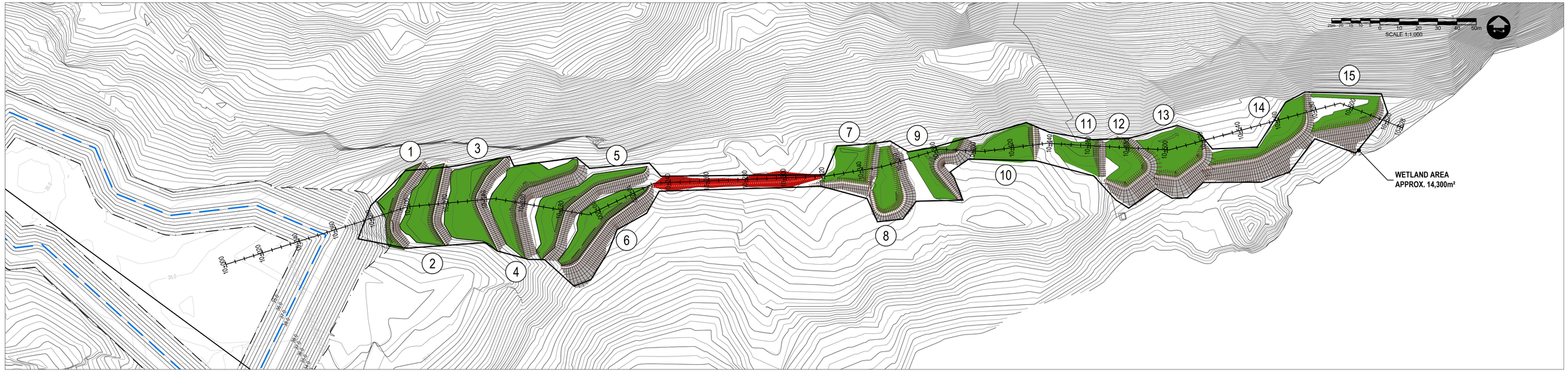
KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

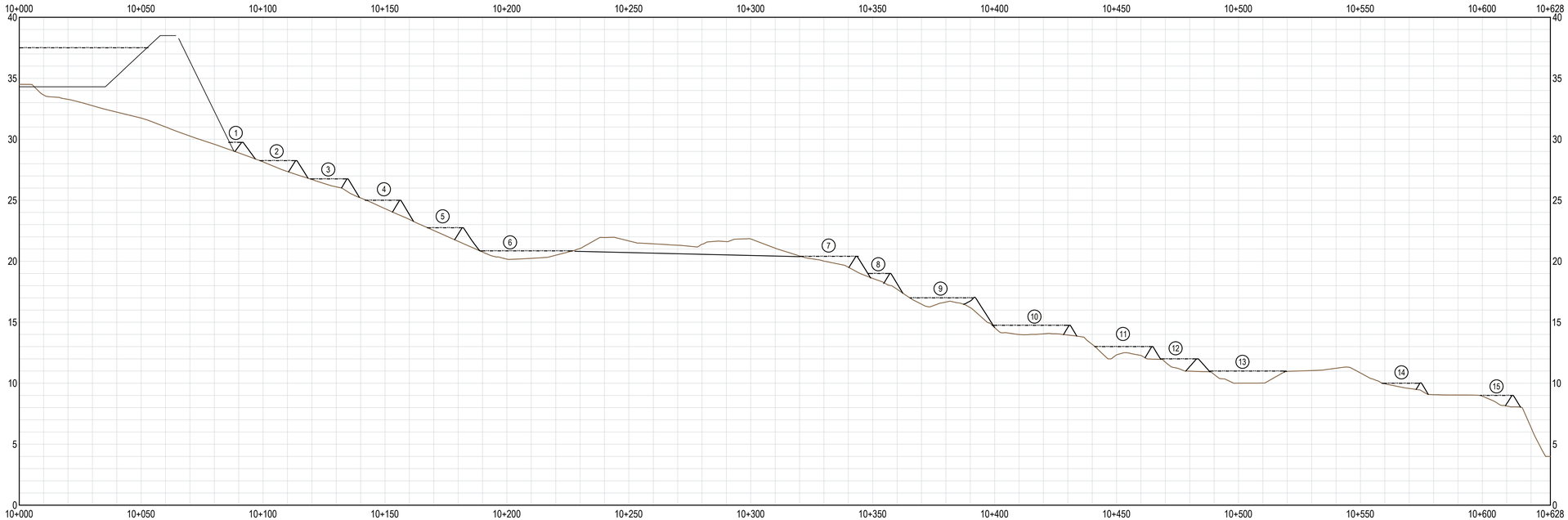
ACCESS ROAD SECTIONS

PROJECT NO. 20-2790

SHEET NO. 108



1 WETLAND CL FINAL PROFILE



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REVIEWED BY	KB
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CHECKED BY	TC
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SCALE	1:1000 1:200

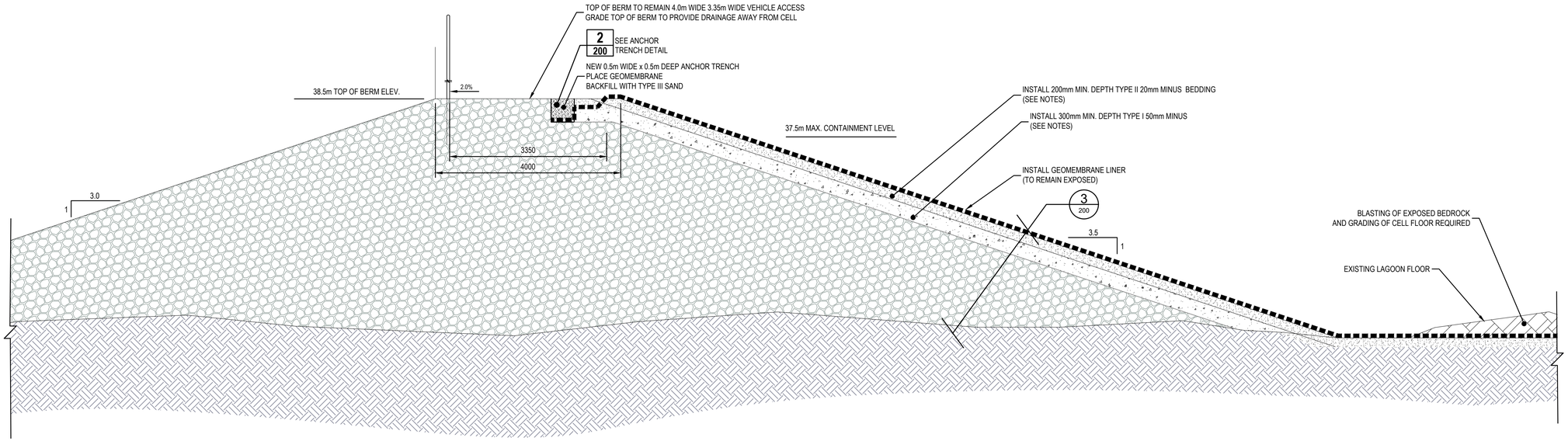
KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

PROJECT NO. **20-2790**

ISSUED FOR SCHEMATIC DESIGN REPORT

WTA ATTENUATION BERMS

SHEET NO. **109**



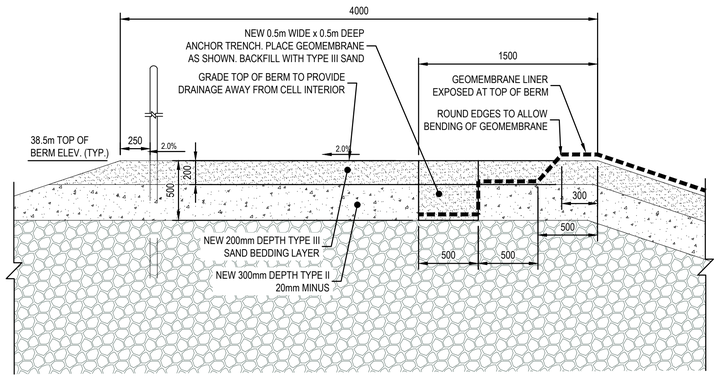
TYPICAL BERM SECTION 1/102
SCALE: 1:50

GENERAL NOTES:

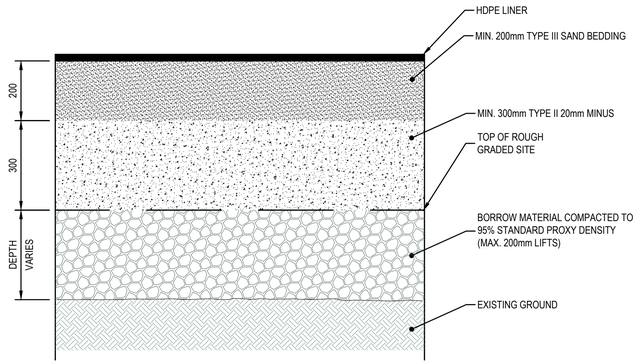
1. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL DIMENSIONS TO BE CHECKED AND VERIFIED IN THE FIELD PRIOR TO ANY CONSTRUCTION. ANY DISCREPENCIES TO BE REPORTED TO THE ENGINEER BEFORE PROCEEDING.
3. ALL CONSTRUCTION WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
4. EXISTING UTILITIES ARE NOT TO BE DISTURBED. ANY CONFLICTS WITH EXISTING UTILITIES SHALL BE IMMEDIATELY REPORTED TO THE ENGINEER.
5. THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE ENTIRE DRAWING SET AND CONTRACT DOCUMENTS.
6. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS AS WELL AS ANY APPLICABLE TERRITORIAL STANDARD SPECIFICATIONS AND STANDARD DRAWINGS.

NOTES:

1. THE SUBBASE SHALL BE UNIFORM AND FREE OF SHARP ROCK FRAGMENTS OR STONES, LARGE STONES AND OTHER DELETERIOUS MATTER SUCH AS CONSTRUCTION DEBRIS AND METALLIC OBJECTS. THE SURFACE SHALL NOT HAVE ANY NATURAL OR FOREIGN OBJECT THAT PROTRUDES ABOVE THE SURFACE OF THE SUBBASE.
2. COMPACT SUBBASE TO 95% SPD.
3. ANCHOR TRENCH TO HAVE ROUNDED EDGES TO ACCOMMODATE LINER BENDING/INSTALLATION.
4. LINER INSTALLERS TO APPROVE SAND BASE PREPARATION.
5. LINER MANUFACTURER TO PROVIDE LINER LAYOUT PLAN.
6. LINER MANUFACTURER TO APPROVE LINER PENETRATION.

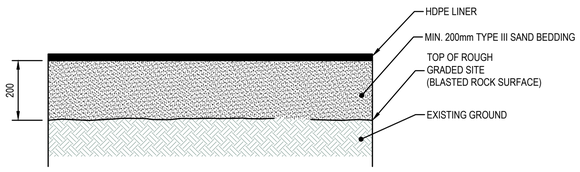


ANCHOR TRENCH DETAIL 2/200
SCALE: 1:25

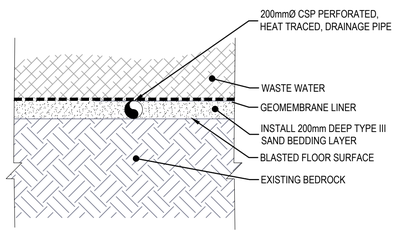


LAGOON LINER SECTION (FILL AREA) 3/200
SCALE: 1:10

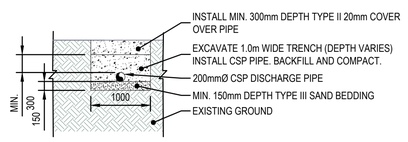
NOTE:
1. TYPE II MATERIAL TO BE 20mm MINUS OR SCREENED 12mm MINUS AS APPROVED BY ENGINEER



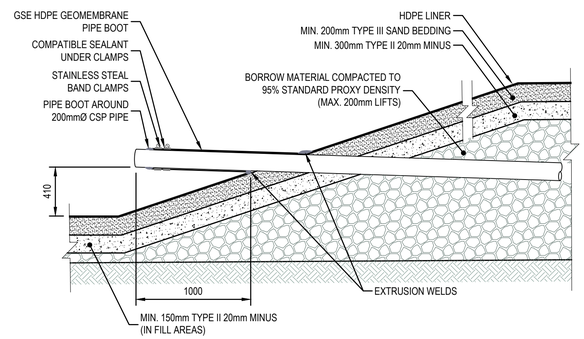
LAGOON LINER SECTION (EXCAVATED AREA) 4/200
SCALE: 1:10



DRAINAGE PIPE LINER SECTION 5/200
SCALE: 1:25



DRAINAGE PIPE IN CHANNEL SECTION 6/200
SCALE: 1:50



DRAINAGE PIPE LINER PENETRATION DETAIL 7/200
SCALE: 1:25

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SCALE	AS SHOWN

KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

TYPICAL BERM DETAILS

PROJECT NO. 20-2790

SHEET NO. 200

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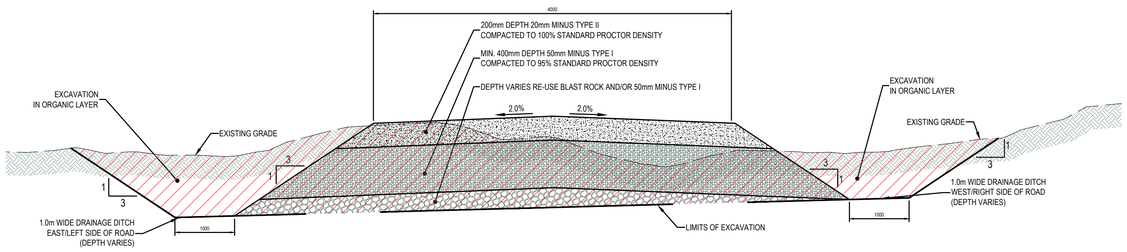
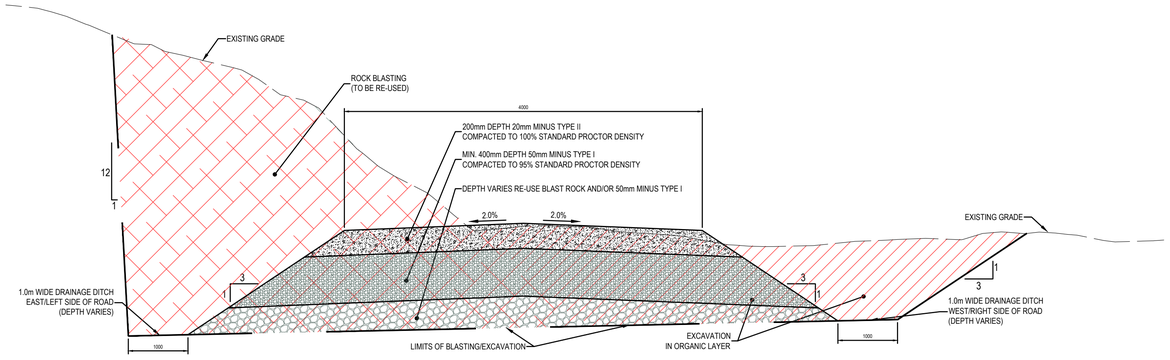
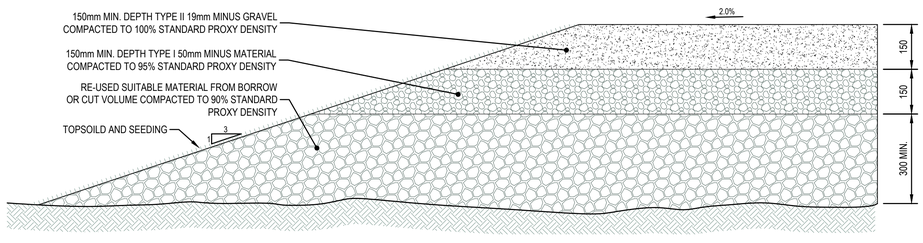


TYPICAL ROAD SECTION 1/201
SCALE: 1:50



NOTE:
THIS SECTION APPLIES TO ROCK BLASTING REQUIRED ON BOTH SIDES OF ROAD
AS WELL AS ROCK BLASTING ON THE WEST/RIGHT SIDE OF ROAD ONLY

TYPICAL ROAD SECTION (BLAST AREA) 2/201
SCALE: 1:50



TYPICAL ROAD SECTION (BLAST AREA) 2/201
SCALE: 1:50

GENERAL NOTES:
1. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
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3. ALL CONSTRUCTION WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
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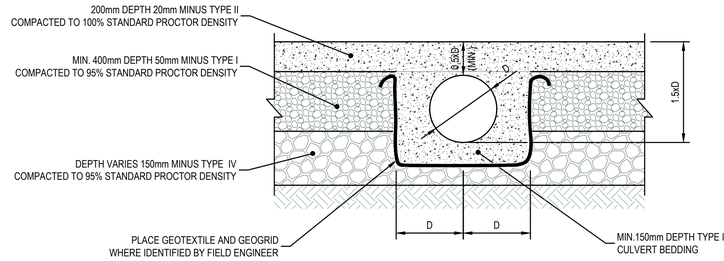
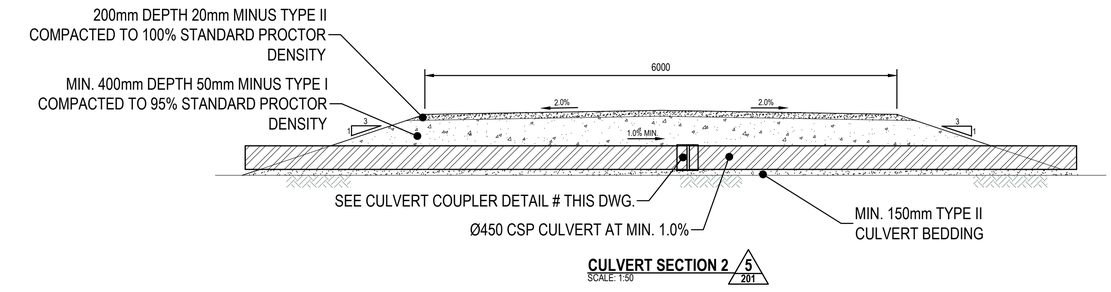
5. THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE ENTIRE DRAWING SET AND CONTRACT DOCUMENTS.
6. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS AS WELL AS ANY APPLICABLE TERRITORIAL STANDARD SPECIFICATIONS AND STANDARD DRAWINGS.

NOTES:
1. SCARIFY AND COMPACT SITE AREA PRIOR TO SUBBASE PREPARATION..
2. THE SUBBASE SHALL BE COMPRISED OF TYPE I 50mm MINUS MATERIAL OR ENGINEER APPROVED BORROW MATERIAL.
3. THE SUBBASE SHALL BE UNIFORM AND FREE OF DELETERIOUS MATTER SUCH AS CONSTRUCTION DEBRIS AND METALLIC OBJECTS. THE SURFACE SHALL NOT HAVE ANY NATURAL OR FOREIGN OBJECT THAT PROTRUDES ABOVE THE SURFACE OF THE SUBBASE.
4. COMPACT SUBBASE TO 95% SPD.

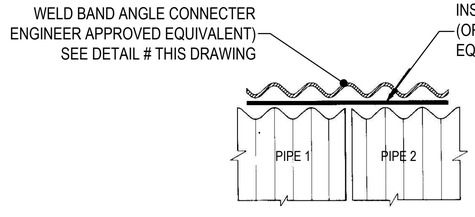


NOTE: D = CULVERT PIPE DIAMETER

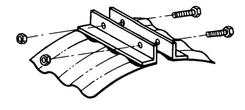
CULVERT SECTION 1 4/201
SCALE: 1:50



CULVERT SECTION 2 5/201
SCALE: 1:50



CSP CULVERT COUPLER DETAIL 6/201
SCALE: 1:50



CSP BAND ANGLE CONNECTOR DETAIL 201
SCALE: 1:50

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FOR REVIEW

DILLON CONSULTING

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DESIGN: TC | REVIEWED BY: KB
DRAWN: TPW | CHECKED BY: TC
DATE: JANUARY 2023
SCALE: AS SHOWN

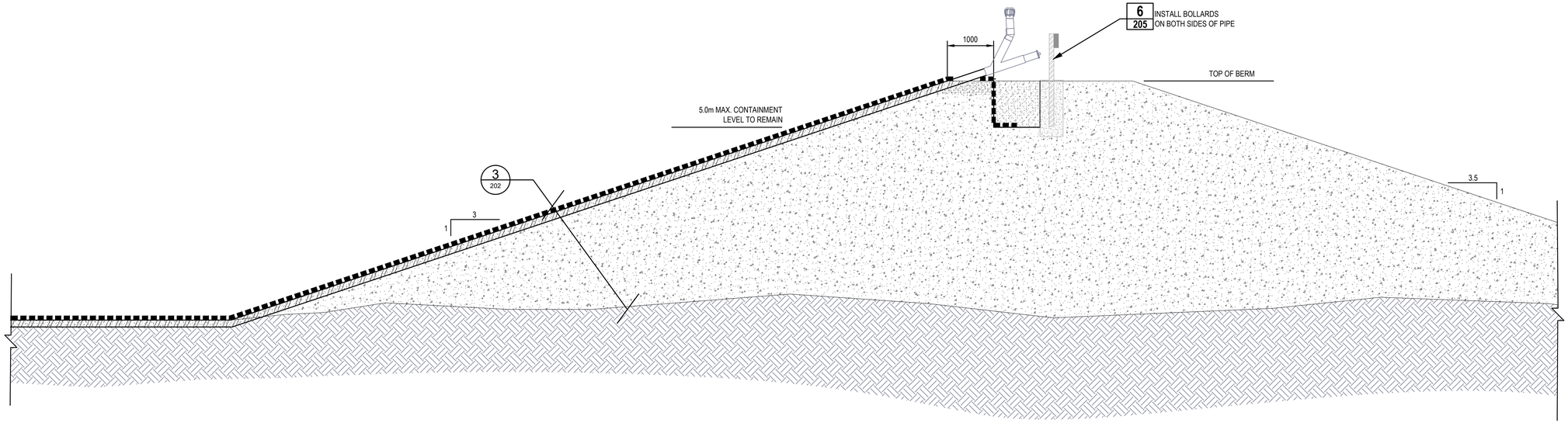
KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

PROJECT NO. 20-2790

ISSUED FOR SCHEMATIC DESIGN REPORT

ACCESS ROAD TURNAROUND AND CULVERT DETAILS

SHEET NO. 201



AIR VENT PIPE DETAIL 1 / 202
SCALE: 1:50

GENERAL NOTES:
1. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
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NOTES:
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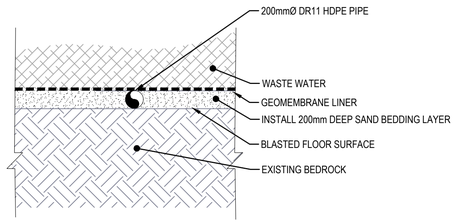
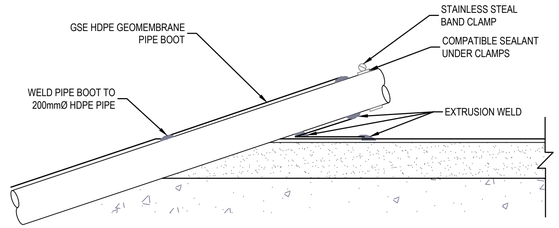
2. COMPACT SUBBASE TO 95% SPD.
3. ANCHOR TRENCH TO HAVE ROUNDED EDGES TO ACCOMMODATE LINER BENDING/INSTALLATION.
4. LINER INSTALLERS TO APPROVE SAND BASE PREPARATION.
5. LINER MANUFACTURER TO PROVIDE LINER LAYOUT PLAN.
6. LINER MANUFACTURER TO APPROVE LINER PENETRATION.
7. VENT PIPING INSTALLED IS UPONOR 6" DR11.

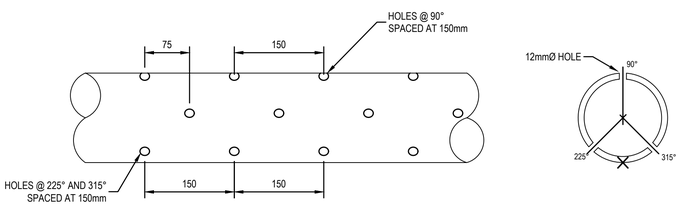


AIR VENT LINER SYSTEM SECTION 3 / 202
SCALE: 1:50

AIR VENT PIPE SECTION 2 / 202
SCALE: 1:50



LINER PENETRATION DETAIL 4 / 202
SCALE: 1:50



VENT PIPE PERFORATION DETAIL 5 / 202
SCALE: 1:50

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DESIGN	TC
REVIEWED BY	KB
DRAWN	TPW
CHECKED BY	TC
DATE	JANUARY 2023
SCALE	AS SHOWN

KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

LINER VENT AND DRAIN PIPE DETAILS

PROJECT NO. 20-2790

SHEET NO. 202

DILLON CONSULTING LIMITED 4920 47TH STREET, YELLOWKNIFE, NORTHWEST TERRITORIES, X1A 2P1, PHONE (867) 920-4555, FAX (867) 873-3328

FILENAME: C:\PW WORKING DIRECTORY\PROJECTS 2020\411PW\DM595646\202790 DETAILS.DWG
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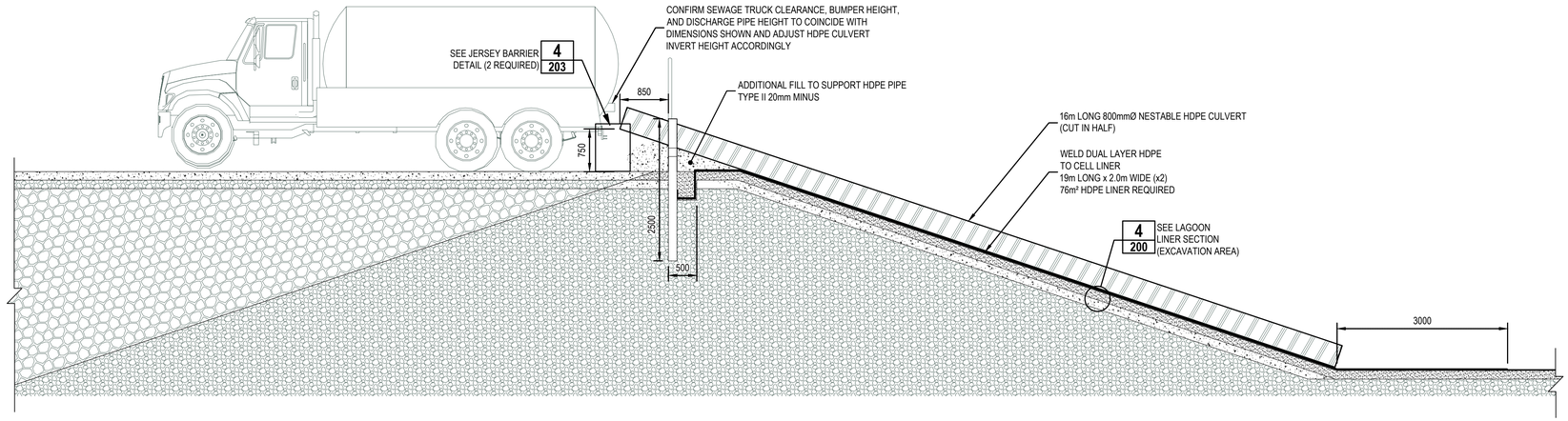
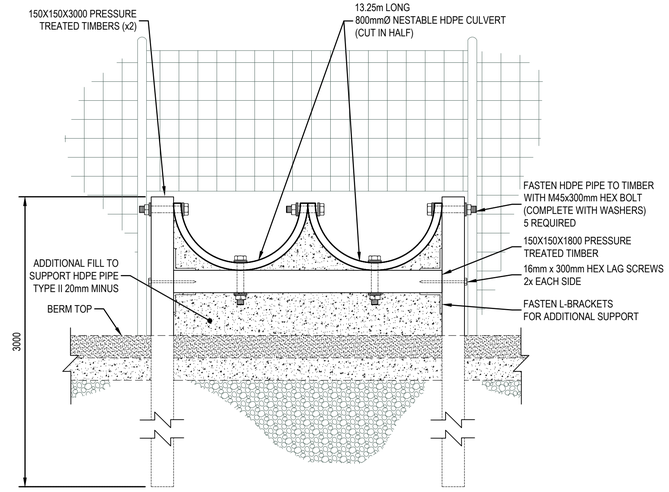
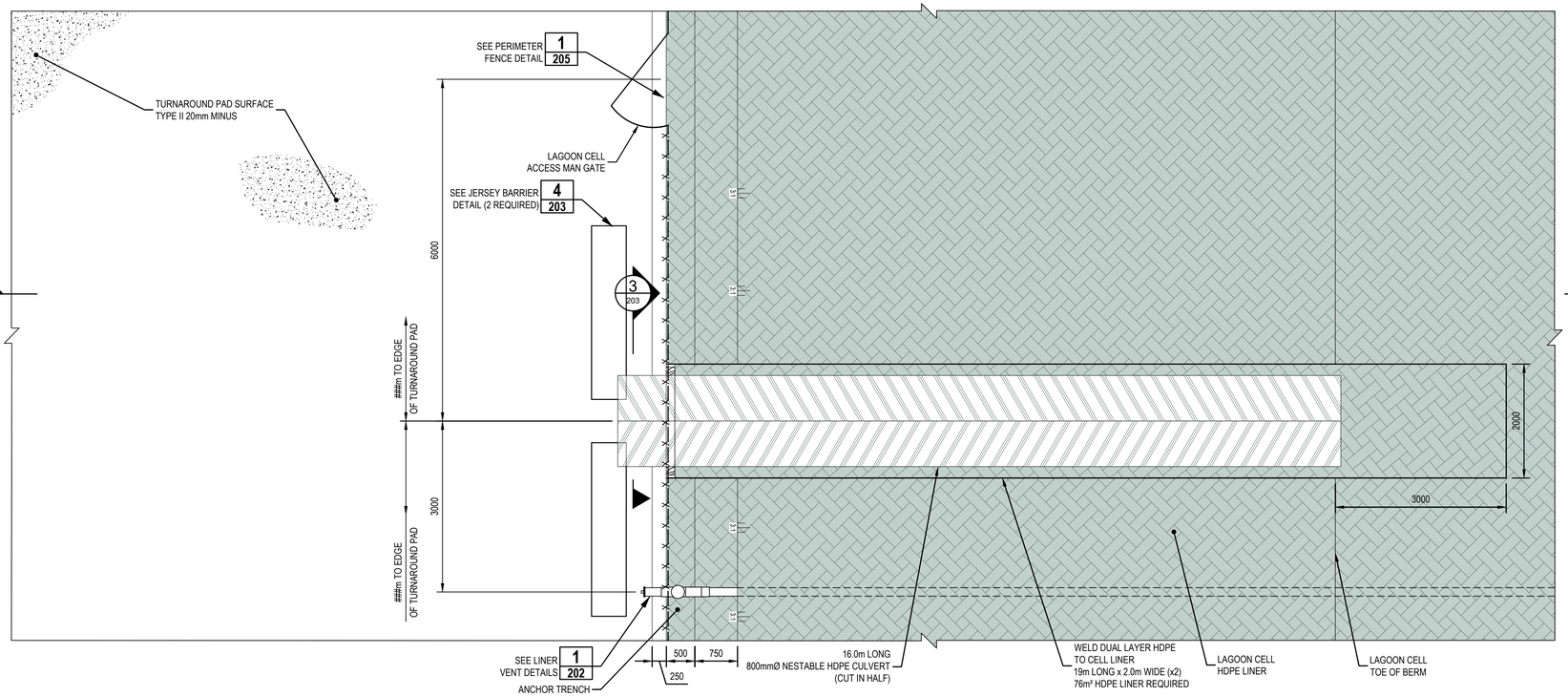


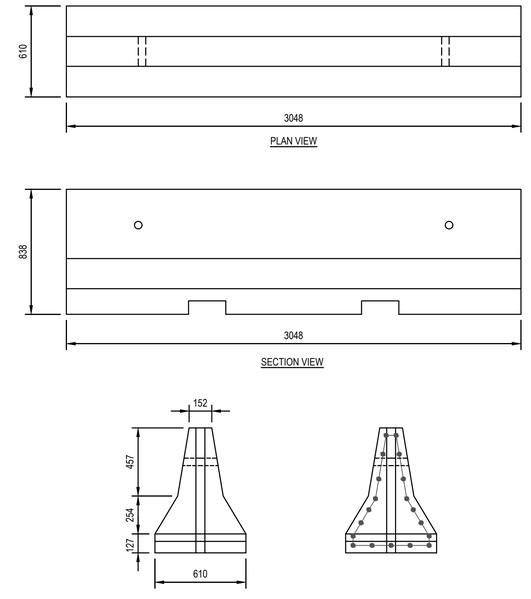
DISCHARGE CHUTE PROFILE 1/203
SCALE: 1:50



DISCHARGE CHUTE SECTION 3/203
SCALE: 1:50



DISCHARGE CHUTE PLAN 2/203
SCALE: 1:50



CONCRETE JERSEY BARRIER DETAILS 4/203
SCALE: 1:20

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DESIGN	TC
REVIEWED BY	KB
DRAWN	TPW
CHECKED BY	TC
DATE	JANUARY 2023
SCALE	AS SHOWN

KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

DISCHARGE FLUME DETAILS

PROJECT NO. 20-2790

SHEET NO. 203

DILLON CONSULTING LIMITED 4920 47TH STREET, YELLOWKNIFE, NORTHWEST TERRITORIES, X1A 2P1, PHONE (867) 920-4555, FAX (867) 873-3328

FILENAME: C:\PW WORKING DIRECTORY\PROJECTS_2020\41TPW\DMS956461\202790_DETAILS.DWG
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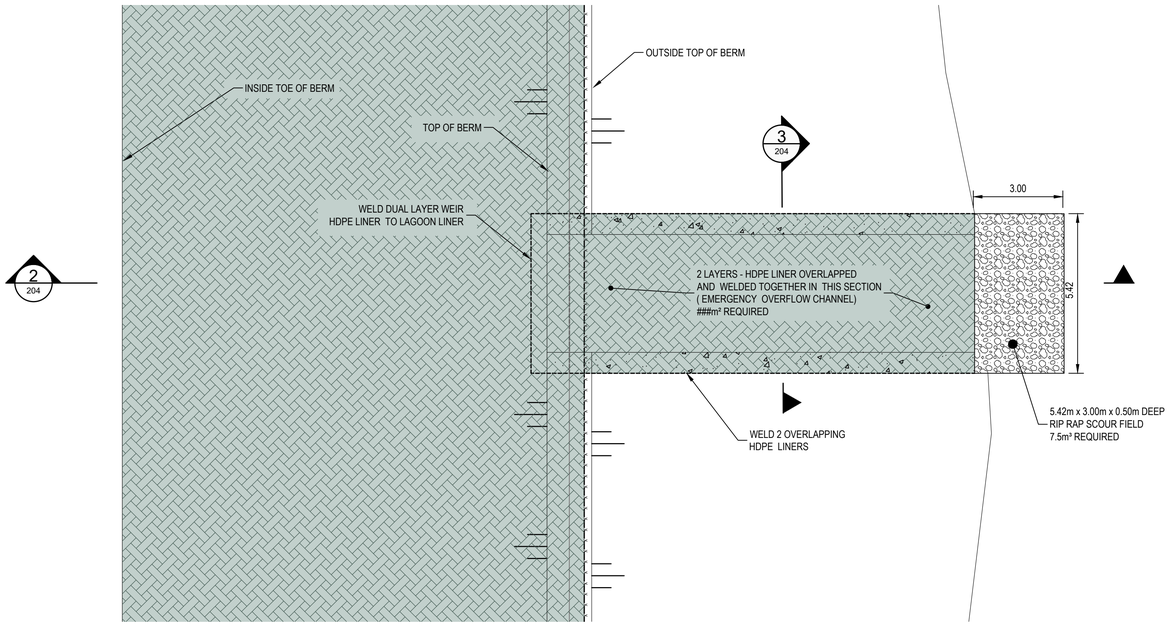
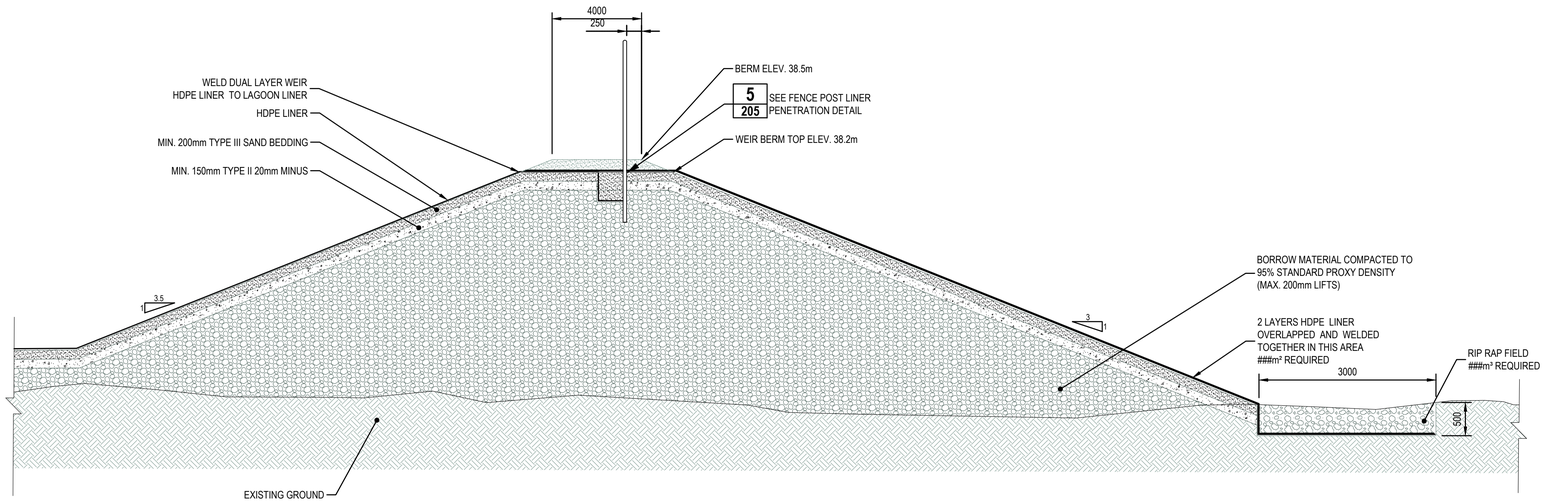
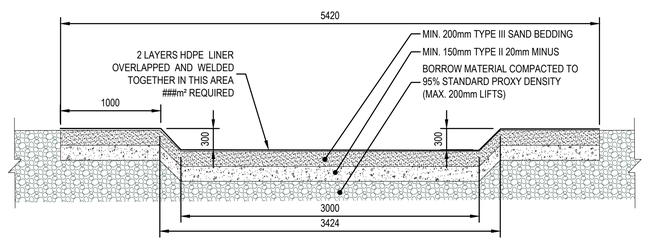


EMERGENCY OVERFLOW - DECANT WEIR PLAN 1/204
SCALE: 1:100



EMERGENCY OVERFLOW - DECANT WEIR PROFILE 2/204
SCALE: 1:30



EMERGENCY OVERFLOW - DECANT WEIR SECTION 3/204
SCALE: 1:50

DILLON CONSULTING LIMITED 4920 47TH STREET, YELLOWKNIFE, NORTHWEST TERRITORIES, X1A 2P1, PHONE (867) 920-4555, FAX (867) 873-3328

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REVIEWED BY	KB
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DATE	JANUARY 2023
SCALE	AS SHOWN

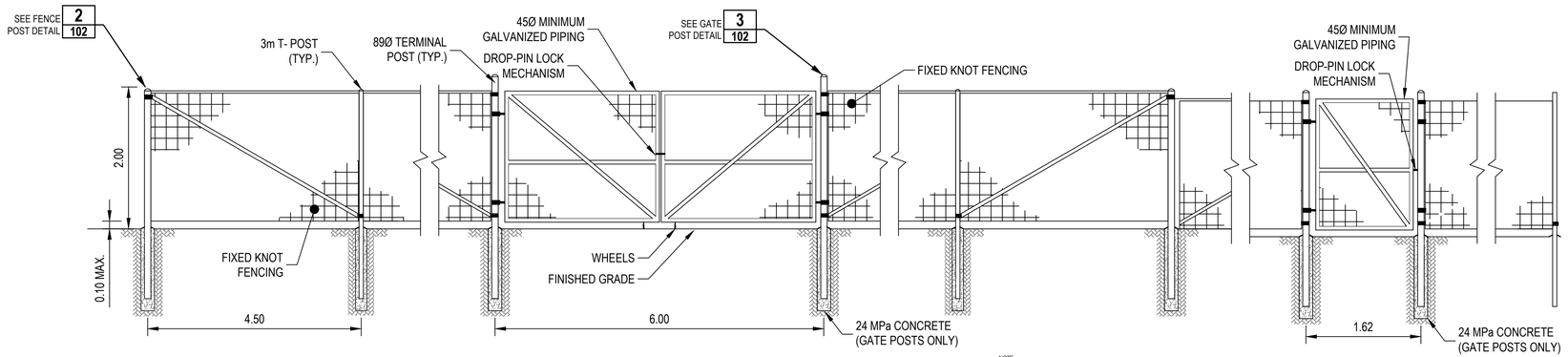
KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

EMERGENCY OVERFLOW WEIR AND FENCE DETAILS

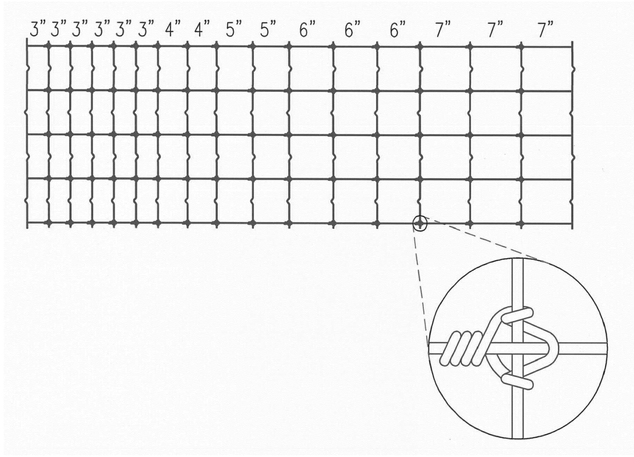
PROJECT NO. 20-2790

SHEET NO. 204

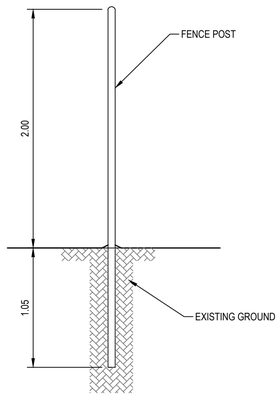


NOTE:
FIXED KNOT FENCING IS 17/75/6 WIRE FABRIC, PHOENIX FENCE OR APPROVED ALTERNATIVE

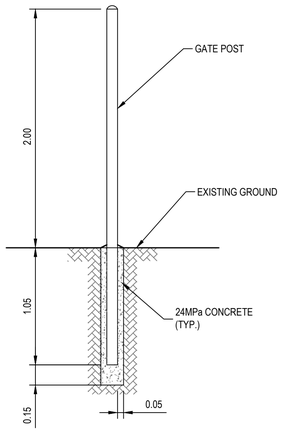
PERIMETER FENCE DETAIL 1 / 102
SCALE: 1:40



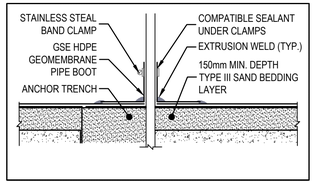
FIXED NOT FENCING DETAIL 2 / 205
SCALE: 1:10



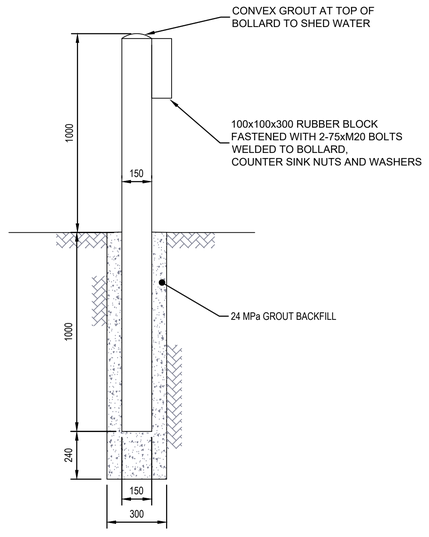
FENCE POST DETAIL 3 / 205
SCALE: 1:25



GATE POST DETAIL 4 / 205
SCALE: 1:25



FENCE POST LINER PENETRATION DETAIL 5 / 205
SCALE: 1:25



BOLLARD DETAIL 6 / 205
SCALE: 1:15

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KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

FENCING AND BOLLARD DETAILS

PROJECT NO. 20-2790

SHEET NO. 205

DILLON CONSULTING LIMITED 4920 47TH STREET, YELLOWKNIFE, NORTHWEST TERRITORIES, X1A 2P1, PHONE (867) 920-4555, FAX (867) 873-3328

FILENAME: C:\PW_WORKING_DIRECTORY\PROJECTS_2020\41TPW\DM595646\202790_DETAILS.DWG
PLOT DATE: 2023-01-05 @ 8:40:10 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON.CTB

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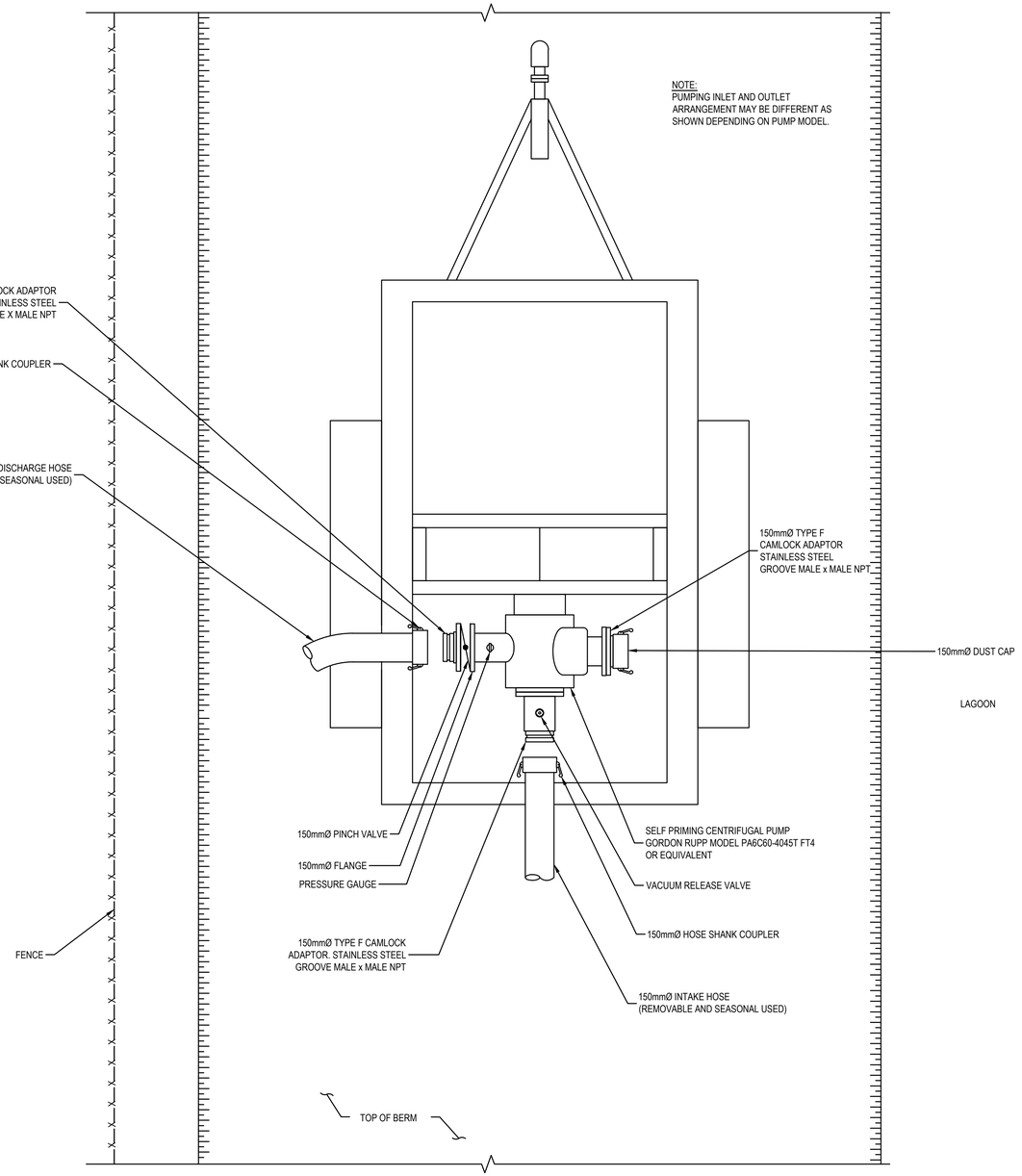
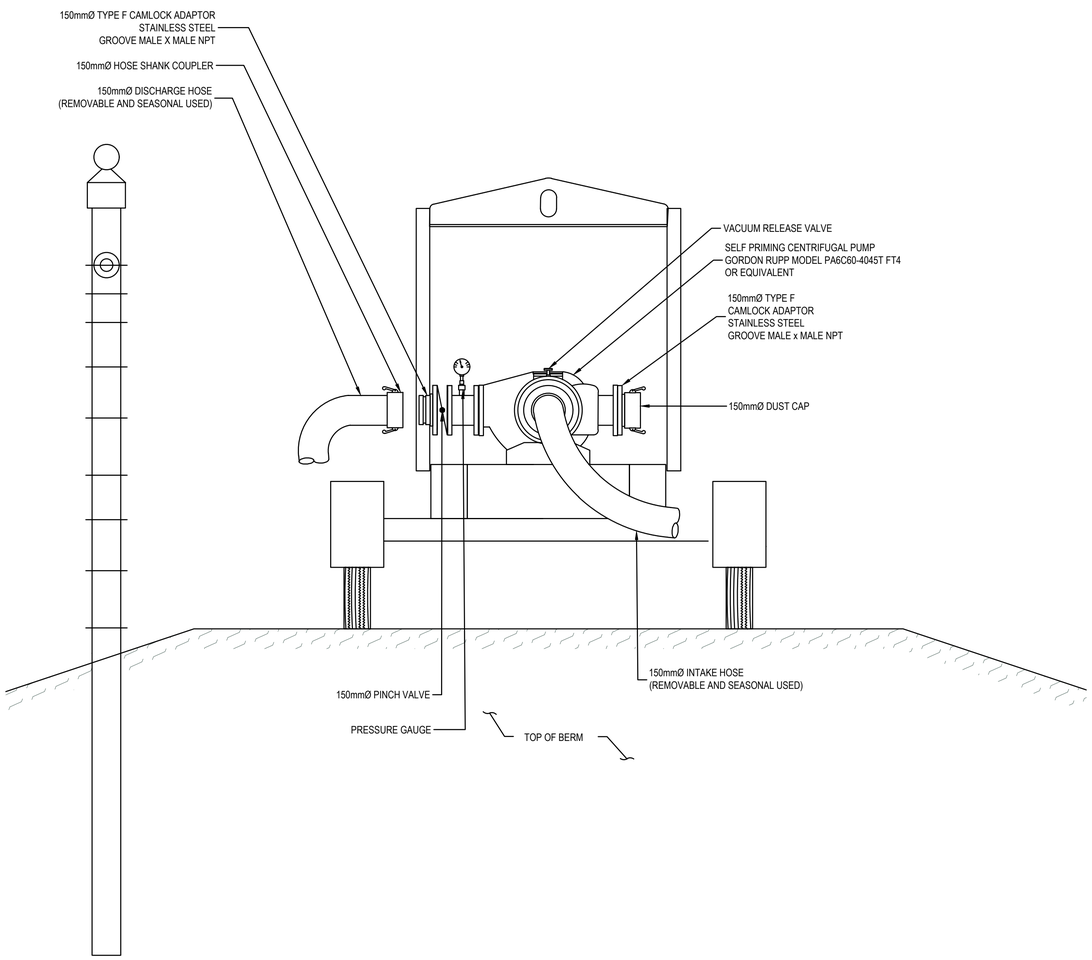


LAGOON DEWATERING PUMP PLAN 1
SCALE: 1:15 206



LAGOON DEWATERING PUMP SECTION 2
SCALE: 1:15 206

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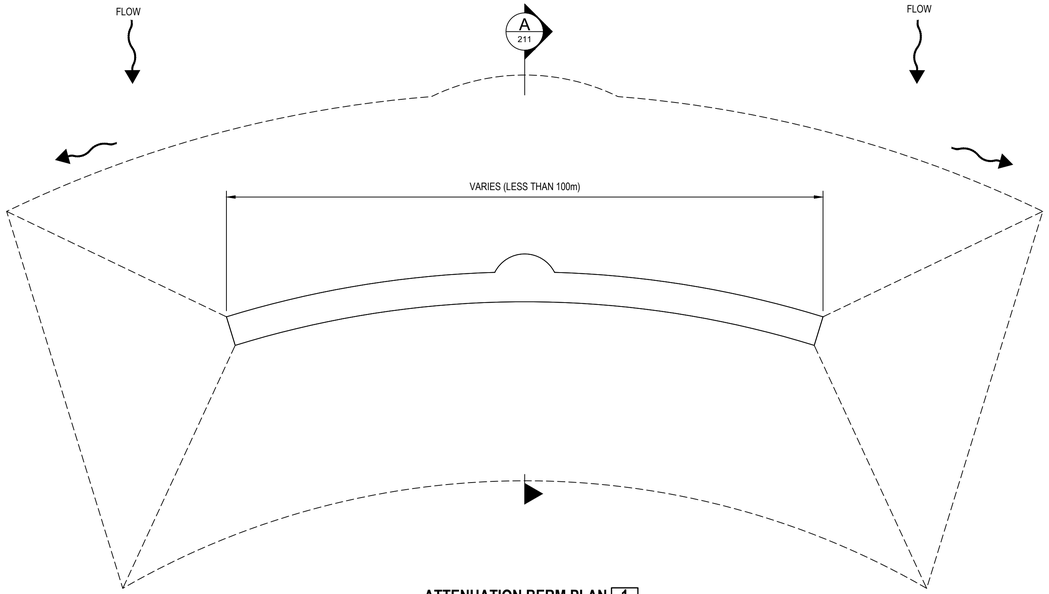
KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

PROJECT NO. 20-2790

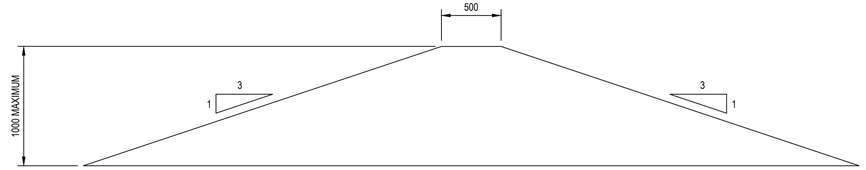
ISSUED FOR SCHEMATIC DESIGN REPORT

PUMP AND DEWATERING DETAILS

SHEET NO. 206

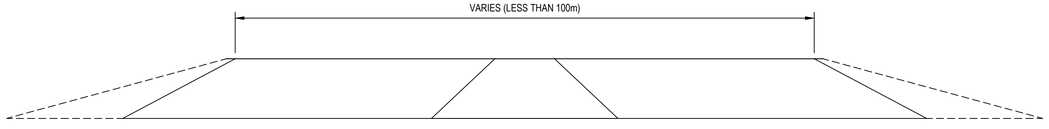


ATTENUATION BERM PLAN 1/207
SCALE: 1:50

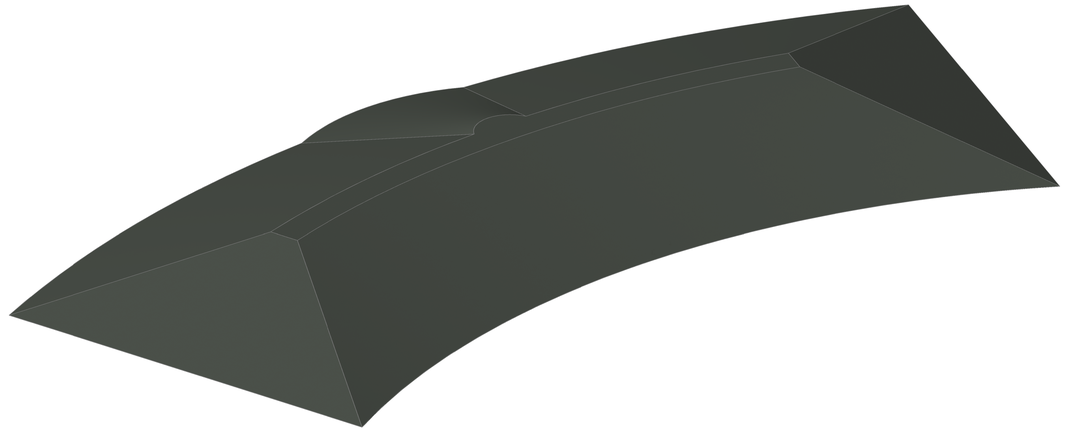


ATTENUATION BERM PLAN 1/207
SCALE: 1:50

NOTE:
- MATERIALS TO BE PIT RUN OR 200mm MINUS GRAVEL



ATTENUATION BERM ELEVATION 2/207
SCALE: 1:50



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KIMMIRUT WASTE WATER TREATMENT CELL
GOVERNMENT OF NUNAVUT

ISSUED FOR SCHEMATIC DESIGN REPORT

WETLAND ATTENUATION BERM DETAILS

PROJECT NO. 20-2790

SHEET NO. 207