

Appendix E

Design and Construction Options Technical Brief



MEMO

TO: File
FROM: Dillon Consulting Limited
DATE: May 31, 2019
SUBJECT: Design and Construction Options Technical Brief
OUR FILE: 19-9543

Introduction

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 (MSW) 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 C&D waste will be trucked to an engineered balefill landfill site 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 (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.

There are no specific landfill standards for MSW disposal facilities in Nunavut. The documents "Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories, April 2003", "Solid Waste management for Northern and Remote Communities Planning and Technical Guidance Document, Environment and Climate Change Canada, March 2017", and "Nunavut Solid Waste Management Plan, October 2014" have been utilized as a representative for this project.

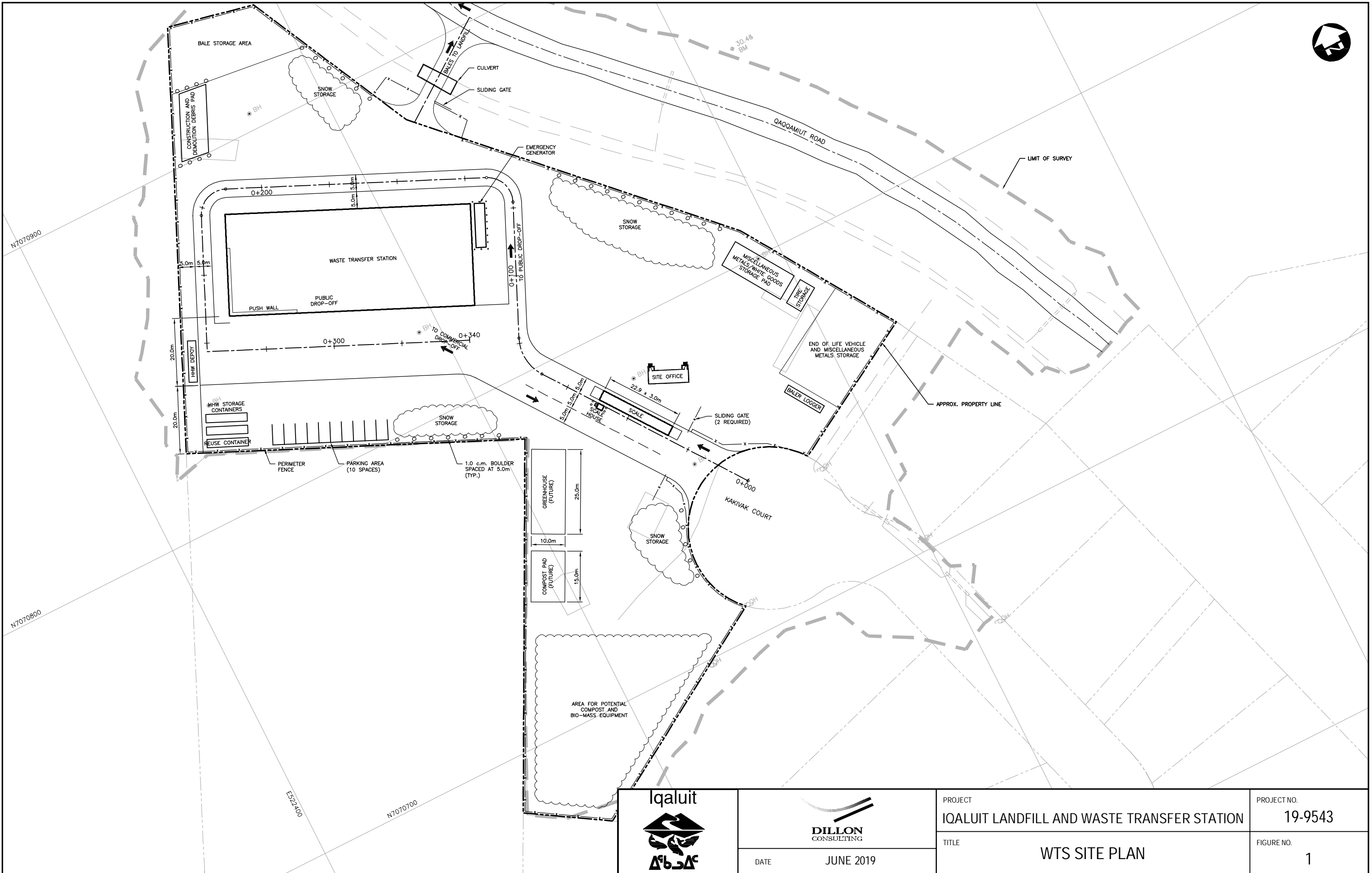
Waste Transfer Station



The WTS will receive municipal waste from residential, commercial and institutional sources. The WTS is located off of Kakivak Court on approximately 2.2 ha of land owned by the City. Figure 1 identifies the property and the general layout of the site. Arriving municipal waste vehicles will be directed to the weight scale. Signage at the site entrance will identify acceptable and unacceptable materials, along with hours of operation, contact names and phone numbers. To control access to the site, a chain link fence will be located at the property line with two horizontal electrical gates control by a security card. The first gate will be for public usage, with the second gate providing exit and entrance for the bale haulage truck.

Depending on the material on the vehicle, visitors will be directed to one of the following:

- Tipping floor of the WTS
- Public drop off
- C&D debris pad
- Miscellaneous metals and white goods pad
- HHW depot
- Reuse depot

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		PROJECT IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO. 19-9543
		TITLE WTS SITE PLAN	FIGURE NO. 1

Site Development

The site is currently a gravel property. Additional granular material will be placed (as required) for site development/fill, to establish elevation for the WTS building and to promote drainage. Site lighting will be provided by LED dark sky friendly compliant fixtures complete with photo cell control. The fixtures will be mounted on 6 m galvanized steel poles. The lighting will be designed to illuminate the site with an average of 10 lux.

Weigh Scale

All vehicles carrying MSW will be required to use the scale to enter the site. The portable scale will be approximately 3 m x 23 m, with a steel deck and digital load cells. The scale will be raised off of the ground approximately 500 mm to allow access under the scale. This will also require the installation of inbound and outbound asphalted ramps. For the scale to be used for commercial purposes, the scale must be calibrated to the requirements of Measurement Canada, requiring the shipment of 10 tonnes of weight. Digital load cells can be calibrated prior to shipment and checked during installation. To record transactions, a terminal and software on a computer in the scale kiosk will record the weight of the vehicle and if they have a registration number. If a tare weight is not available for a vehicle, either a fixed amount (e.g., \$10.00 for 100 Kg) can be charged or the vehicle would be instructed to exist the site by travelling over the scale, where the difference in weight can be determined. The scale is not contained in a building.

Scale Kiosk

A building, raised off of the ground, will be located near the end of the scale, where the Scale House Operator could interact with all vehicles entering the site. The building, approximately 1.5 m x 2.0 m, would have windows on all four sides, such that the Operator could view incoming and outgoing vehicles. Security bars and a viewing monitor would allow the Operator to observe the tipping floor and a two-way radio to keep in contact with staff at the WTS.

The building will be serviced with a 100 amp, 120/240 VAC single phase power supply from the main distribution, located in the WTS electrical room. The service will be by direct buried teck cables. The 120/240 VAC panel board will contain circuit breakers for the building loads. Interior lighting will be LED. A dark sky friendly LED exterior fixture will be installed over the main door and controlled via an integral photocell.

Telephone and data will be provided to the building with buried telephone cable and fibre optic cable. Phone and data jacks will be located at the workstation location. A standalone security consisting of door contacts, motion detectors, entry keypad and autodialler will be installed.

Controls for red and green traffic lights located at each end of the truck scale will be provided. A remote scale display will be mounted on the exterior in view of the vehicle operator. An intercom system will be provided on the driver's side of the truck scale when exiting to enable communication between the Scale Operator and the vehicle operator.

Site Office

The site office will be remote from the WTS to minimize the potential for dust and mold to be present. The building will be approximately 4 m x 12 m, sit on a gravel pad with blocking, tie downs and ventilated skirt. The building roof panel will be 24 gauge and insulated with R-40 fiberglass batt insulation. Exterior wall panels will be 26 gauge 38 mm profile insulated with fiberglass batt insulation, and completed with vapor barrier and drywall. The floor shall be insulation with R-11 fiberglass insulation.

This building will contain the office for the Facility Supervisor, unisex barrier free washroom, locker room (nine lockers), lunchroom and maintenance closet. Heating will be electric baseboard and roof mounted cooling with LED lighting. Water and sanitary services are remote; therefore, the water supply will be a 250 gallon storage tank within the building and the heated septic tank will be located in the crawlspace.

The building will be serviced with a 100 amp, 120/208 VAC 3 phase power supply from the main distribution, located in the WTS electrical room. The service will be provided through direct buried teck cables. The 120/208 VAC panel board will contain circuit breakers for the office trailer building loads. Interior lighting will be LED. A dark sky friendly LED exterior fixture will be installed over the mandors and controlled via an integral photocell.

Telephone and data will be provided to the building with buried telephone cable and fibre optic cable. Phone and data jacks will be located in the office and lunchroom locations. A standalone security consisting of door contacts, motion detectors, entry keypad and autodialler will be installed.

Waste Transfer Station

Commercial vehicles delivering MSW will exit the weigh scale, turn to the left and proceed to the tipping floor, located in the western portion of the building. The overhead door (4.3 m W x 5.2 m H), normally closed, will be raised and vehicles will back into the building to deposit the material into the tipping floor. Vehicles will then drive out of the building, turn to the right and exit the site. Private vehicles will exit the weigh scale and drive straight, circling the building. On the southern side of the building, just before the commercial overhead doors (3.0 m W x 3.0 m H) will function as public drop off, allowing the general public to exit their vehicle and place material on the tipping floor. Figure 2 depicts the WTS.

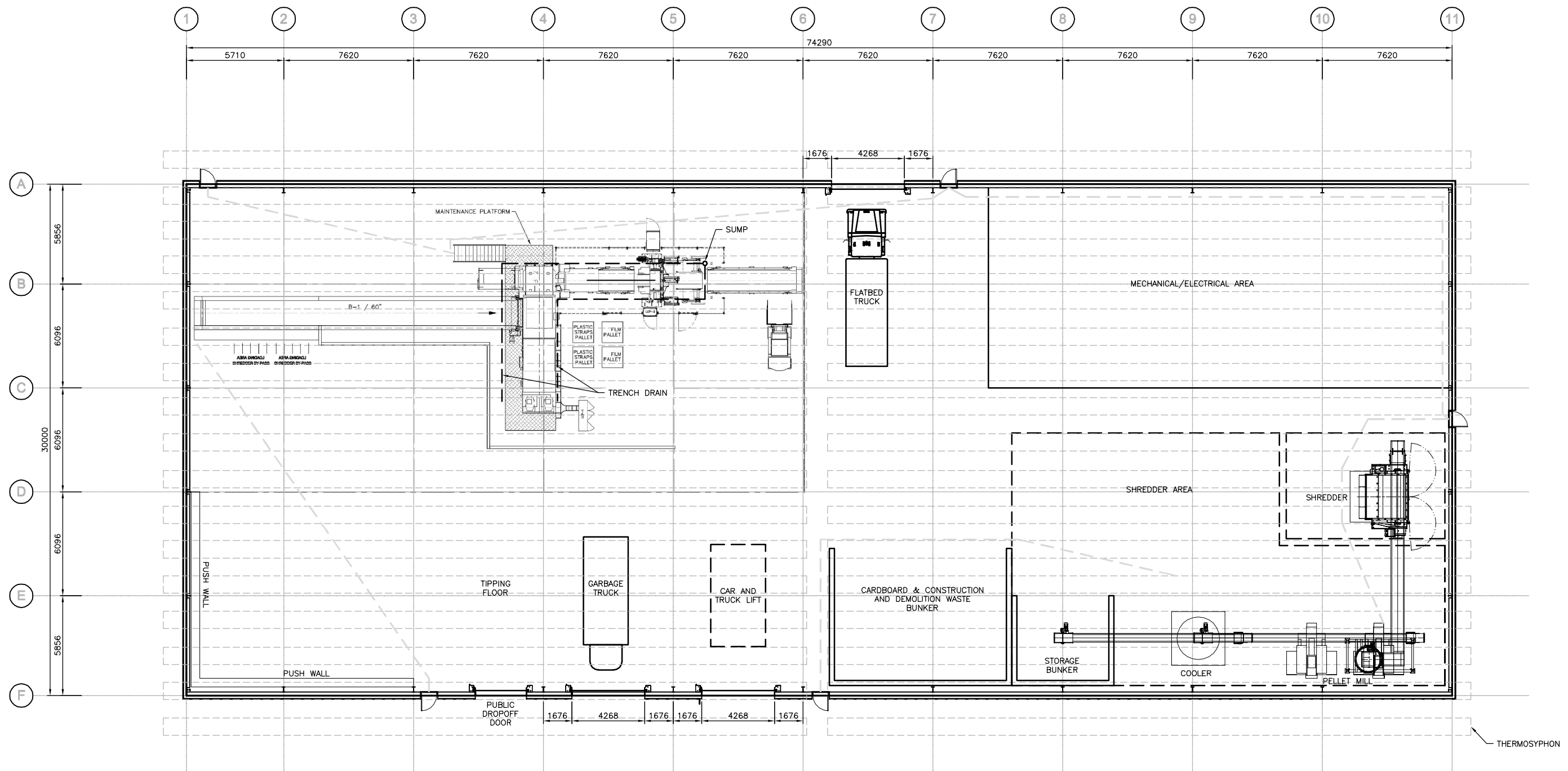
On the tipping floor, a wheel loader with a bucket thumb (approximately 110-120 Hp) will sort the material into MSW for baling, and clean wood/cardboard for shredding. Tires delivered to the site will be stockpiled near the metal storage and until a sufficient volume is achieved to be shredded.

The MSW will be placed onto the two ram baler in-feed steel belt conveyor, and the material baled and wrapped. A forklift with a material handling clamp will collect the wrapped bale and place the bale on a flatbed truck, normally parked in the building. The deck of the truck will consist of a series of angles welded to the bed of the truck, to allow the bales to be removed from the truck at the landfill by the wheel loader equipped with forklifts.



Clean C&D wood waste and cardboard will be separately stockpiled on the tipping floor. The wheel loader will remove the material from the stockpile and place the material into the in-feed hopper for the shredder.

The shredder, approximately 330 HP and a capacity of 6 tonnes/hour, will shred the material and send the shredded material to the pelletizer via a conveyor. The pelletizer will produce pellets that will be conveyed to the cooler for cooling, stockpiled, and then directed to the biomass boiler.

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FLOOR PLAN
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	 DILLON CONSULTING	PROJECT IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO. 19-9543
		TITLE WTS BUILDING PLAN	FIGURE NO. 2

Structural

The WTS building will be a pre-engineer rigid-frame steel building of 30.0 m x 74.3 m, with an 8.5 m eave height. The building will be gable frame. The building roof panel will be 24 gauge standing seam with galvalume finish, completed with concealed fasteners to provide a weather-tight system. The roof will be insulated with R40 semi-rigid insulation or fiberglass batt insulation, and completed with 26 gauge liner. Exterior wall panels will be 26 gauge 38 mm profile insulated with R19 semi-rigid insulation or fiberglass batt insulation, and completed with vapor barrier and 16 mm profile metal liner. Rainwater gutters and downspouts will be pre-finished with color matching the exterior wall. The building will be designed in accordance with the National Building Code 2015.

Push walls (3.5 m) will be located along the southwest corner of the building. The push walls will be designed to withstand a point load from the application of the loader, a uniform distributed load from the application of the loader and the active stockpile pressure. The design will be based on CSA-S6-14: Canadian Highway Bridge Design Code; CSA A23.3-14: Design of Concrete Structures.

The building will be supported on a concrete mat foundation, as specified in the geotechnical report , over 10 mil poly on a 150 mm extruded polystyrene insulation with maximum compressive strength of 415 kPa , thermal resistance (typical 5-year aged R value) of 0.87 per 25 mm, and maximum water absorption by volume of 0.7%. The insulation will be over 300 mm well graded granular, as specified in the geotechnical report, "City of Iqaluit Geotechnical Investigation Proposed Waste Transfer Station Lots 3586 228/17/18/20 and 3480 220 1 Iqaluit, Nunavut, October 2018." A 100 mm layer of sand compacted to 98% Standard Proctor Modified Dry Density will be placed under the granular.

Thermosyphon

Flat loop thermosyphon evaporator will be placed within this sand layer. The thermosyphon will be designed based on the geotechnical investigation and a thermal analysis "Geothermal Modelling and Geotechnical Recommendations Transfer Station and Landfill in Iqaluit, Nunavut May 2019", and will be designed in accordance with the CAN/CSA-S500-14: National Standard of Canada for Thermosyphon foundations for buildings in permafrost regions. According to the thermal analysis, the temperature at permafrost elevation would remain at -2 °C, after the first year of operation.

The thermosyphon will be designed to have redundancy (i.e., if one fails) so the system remains functioning. During operation, thermosyphon temperature will need to be measured to protect against leakage and that the system functions as designed.

Electrical

The main electrical service for the WTS will be located in the dedicated electrical room of the building. The service will be a 1,200 amp, 347/600 VAC 3 phase supply from the utility. The owner of the oil filled pad mounted transformer will be either the utility or the City. This will be determined by the utility during detailed design. Cost for the transformer is not carried in the 30% submission. The main switchgear will have breakers for supplying power to the other buildings on-site. Dry type transformers and 120/208 VAC panel boards will be located in the electrical room.

A diesel generator will be designed to enable the facility to continue operations in the event of a utility power failure. A 1.2MW generator located in a pre-manufactured walk-in enclosure will be located near

the building. An open transition automatic transfer switch will provide automatic switching between the utility and generator. The generator will be specified with a 24 hour sub-base double walled fuel tank.

Interior lighting will be LED. Dark sky friendly LED exterior fixtures will be installed over the exterior doors and controlled via an integral photocell. A fire alarm system will monitor the sprinkler system and provide notification to the community fire station. Wiring to the fixed equipment will be installed in conduits cast into the floor slab. Lighting and other power distribution will utilize a combination of armoured teck cable and emt conduit.

Telephone and data will be provided to the building with buried telephone cable and fibre optic cable. Phone and data jacks will be located in the electrical and fire pump rooms. A standalone security consisting of door contacts, motion detectors, entry keypad and autodialler will be installed.

Mechanical

Sprinkler System

Based on the current National Building Code of Canada, the WTS building will need an automatic sprinkler system throughout as part of its fire protection. As none of the City's water mains are located near the WTS, the sprinkler system will need to have its own on-site water storage system and associated fire pump with dual power sources. The water storage tank for the sprinkler system will be located in its own fire-rated room. The fire pump will be located in this room as well, complete with back up power provided by the on-site generator. The sprinkler system will be considered a wet system charged with water throughout.

Heating System

The heating system for the WTS will consist of a combination of biomass and oil-fired hydronic boilers, as its central plant in the mechanical room. Both the biomass boiler system and the oil-fired boiler will each be sized for approximately 75% of the capacity of the building's designed heating load. The boilers will operate in a lead/lag sequence with the biomass boilers leading to fully utilize the base-loading characteristics of the biomass boilers and maximize biomass usage. The oil-fired boiler will serve as a back up boiler and to provide for peak heating loads. Hydronic supply and return lines using a glycol solution will be distributed throughout the WTS to provide heating to unit heaters and an air handling unit to heat and ventilate the WTS. The minimum heat loss for the building will be based on the following criteria:

- National Building code Climatic Design Data for the 1% January design temperature in Iqaluit of 41°C.
- Interior winter design temperature of 10°C.
- The overall thermal transmittance of the building assemblies, along with adequate infiltration rates.

The fuel source for the biomass boiler will be provided from the biomass waste stream. Waste stream cardboard, wood, and furniture will be converted into pellets by the on-site shredder and pelletizer system. It is estimated that the biomass boiler system will require approximately 200 tonnes/year of biomass pellets to provide heating to the WTS.

The fuel for the backup oil-fired boiler will be located outside in a double-walled aboveground storage tank close to the proximity of the WTS mechanical room. Fuel oil will be conveyed to the oil-fired boiler

via carbon steel piping to a day-tank located inside the mechanical room. It is estimated the oil-fired boiler will require approximately 2500 US gallons/year of fuel oil to provide peak heating to the WTS.

Ventilation System

The WTS will be provided with ventilation during the occupied periods of operation. The ventilation system will be sized to help with the odour control mitigation strategies of the WTS, as well as for ventilation for internal combustion engine vehicles being operated inside the WTS, in accordance with ASHRAE 62.1 standards. Carbon monoxide and nitrogen oxide detectors will be located in the WTS and interlocked with the ventilation system. The ventilation system will consist of an air unit with hydronic preheat and reheat coils, and an exhaust system with heat/energy recovery. The hydronic heating coils will help to temper the outside air, required by code, to make up the air that is exhausted from the WTS. The heat or energy recovery system will help to recover energy lost from the air being exhausted from the WTS.

End-of-Life Vehicles / Miscellaneous Metals /White Goods

A storage area in the eastern area of the site is designated for the storage of vehicles, metals and white goods. Processing of end-of-life vehicles and removal of chlorofluorocarbons in white goods (by a certified staff member) will occur in the WTS building. Portable column lifts will be utilized to raise the vehicles for processing. A portable drip pan will be located under the vehicles to collect drippings. Collected material will be transferred to the HHW depot for bulking and disposal. When not in use, the column lifts and drip pan will be stored in the WTS.

The processed vehicles, along with miscellaneous metals and white goods, will be periodically compacted in a baler/logger vehicle (175 – 220 Hp). A baler/logger allows different metals to be compacted separately (e.g., vehicles, white goods) to maximize sale value. The bales would be stored outside or in a shipping container for transportation.

Snow Storage

Areas for the storage of snow are located throughout the site. The areas are defined by the placement of 1 m³ boulders in front of the perimeter fence, for fence protection.

Bale Storage

While bales of MSW will be produced daily, weather conditions, staff shortages or bale truck out of service may result in bales not being able to be delivered to the landfill or stored in the WTS. A dedicated storage area is provided in the northern part of the site.

Household Hazardous Waste and Reuse

A modified 8 ft. x 40 ft. shipping container will be used as a HHW depot, with two additional shipping containers used to store HHW prior to removal from the City. Residential generated material will be accepted at the depot. Design of the facility will follow the requirements of the General Management of Hazardous Wastes (2010) and Guideline for Hazardous Waste Management, October 2017.

The HHW Depot will be serviced with a 100 amp, 120/240 VAC single phase power supply from the main distribution located in the WTS electrical room. The electrical service will be direct buried teck cables. The 120/240 VAC panel board will contain circuit breakers for the building loads. Interior lighting will be

LED. A dark sky friendly LED exterior fixture will be installed over the main door and controlled via an integral photocell.

The Reuse Storage Area container will be used to store donated items include windows, doors, paint, hardware, tools, lumber, lighting fixtures, furniture and appliances. The container will not be electrically serviced but will be provided with a solar powered light, with integral photocell.

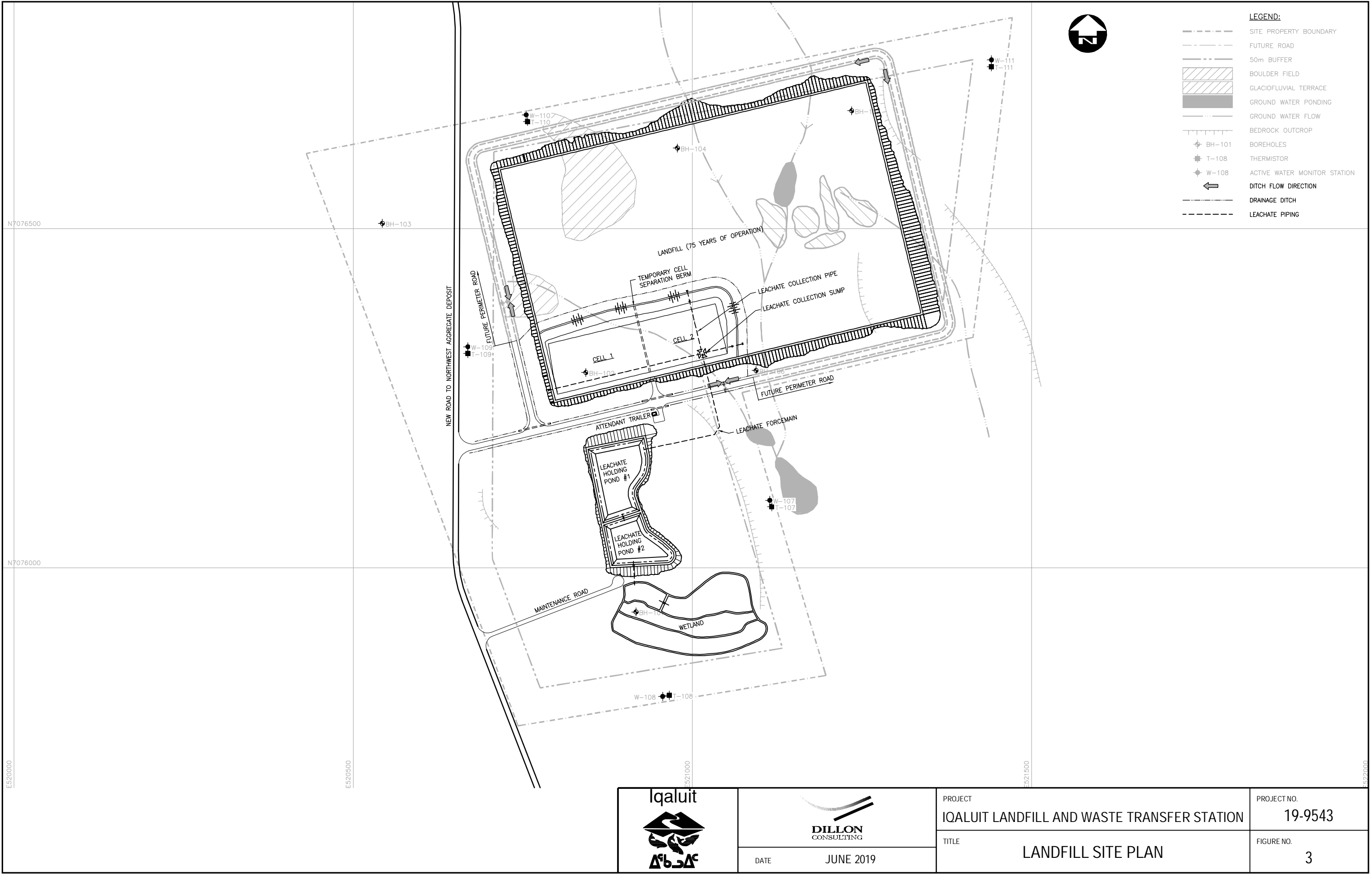
Drainage and Erosion Control



The proposed WTS is located on a formerly developed site. Construction and operations at the WTS are not expected to significantly impact existing drainage patterns. The site will be graded to drain predominately to the drainage ditch, along the eastern property boundary and Qaqqamiut Road, and to the northern boundary, along the unnamed road. Stormwater management, and erosion prevention and control will be implemented during construction and operation, in accordance with the City's and Government of Nunavut's stormwater management, and control bylaws and guidelines.

Landfill

The landfill is located on approximately 64 ha of land owned by the City, and will accept MSW and C&D debris within the same landfill and cell in the landfill. The MSW will typically be baled and wrapped in plastic. However, the design of the landfill will allow for the placement of unbaled MSW if there are operational issues at the WTS. C&D debris, potentially shredded, will be placed in the landfill to "fill in" areas as the bales are placed, as presented in Figure 3.

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 Iqaluit	 DILLON CONSULTING	PROJECT IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO. 19-9543
		TITLE LANDFILL SITE PLAN	FIGURE NO. 3

The “Geothermal Modelling and Geotechnical Recommendations for the Transfer Station and Landfill in Iqaluit, Nunavut, May 2019” examined the placement of baled waste in the landfill, and the time for freezing of the waste. This report identifies that two or three years after one lift of bales have been placed the soil, under the landfill will be frozen. Also, the bales will continue to freeze and by Year 5 or 6, the bales will be completely frozen.

A monitoring network is proposed between the bottom of the landfill liner and the top of the permafrost to record changes in temperature. A thermistor array, consisting of five thermistor beads on a thermistor cable, is proposed and will remain in situ for the lifetime of the landfill. Two arrays would be required to measure temperature in areas of the landfill that have received and are going to receive waste. Temperature readings will be stored in a solar powered data logger station. Cables would extend from the data logger station, and extend approximately 75 m under Cell 1 and Cell 2.

Liner System

The liner system will consist of a barrier(s) to minimize the migration of generated leachate into the environment, and a leachate collection layer placed above the barrier to intercept and transfer the leachate to a storage or treatment system.

For the landfill, the following components of the proposed liner system leachate collection and transfer system are described in the following sections, from the top down. Figure 4 presents the proposed liner for the landfill, with Figure 6 illustrating the proposed liner for the leachate lagoons.

Cushion Layer

A cushion layer, 300 mm thick and composed of 75 mm clear stone with a hydraulic conductivity of at least 1×10^{-2} cm/sec is proposed, immediately below the baled waste. This layer protects the underlying layers of the liner system, while allowing the passage of leachate. A geotextile is not included above this layer, as the baled and wrapped waste is anticipated to mitigate the potential for MSW and C&D waste debris to migrate into the stone.

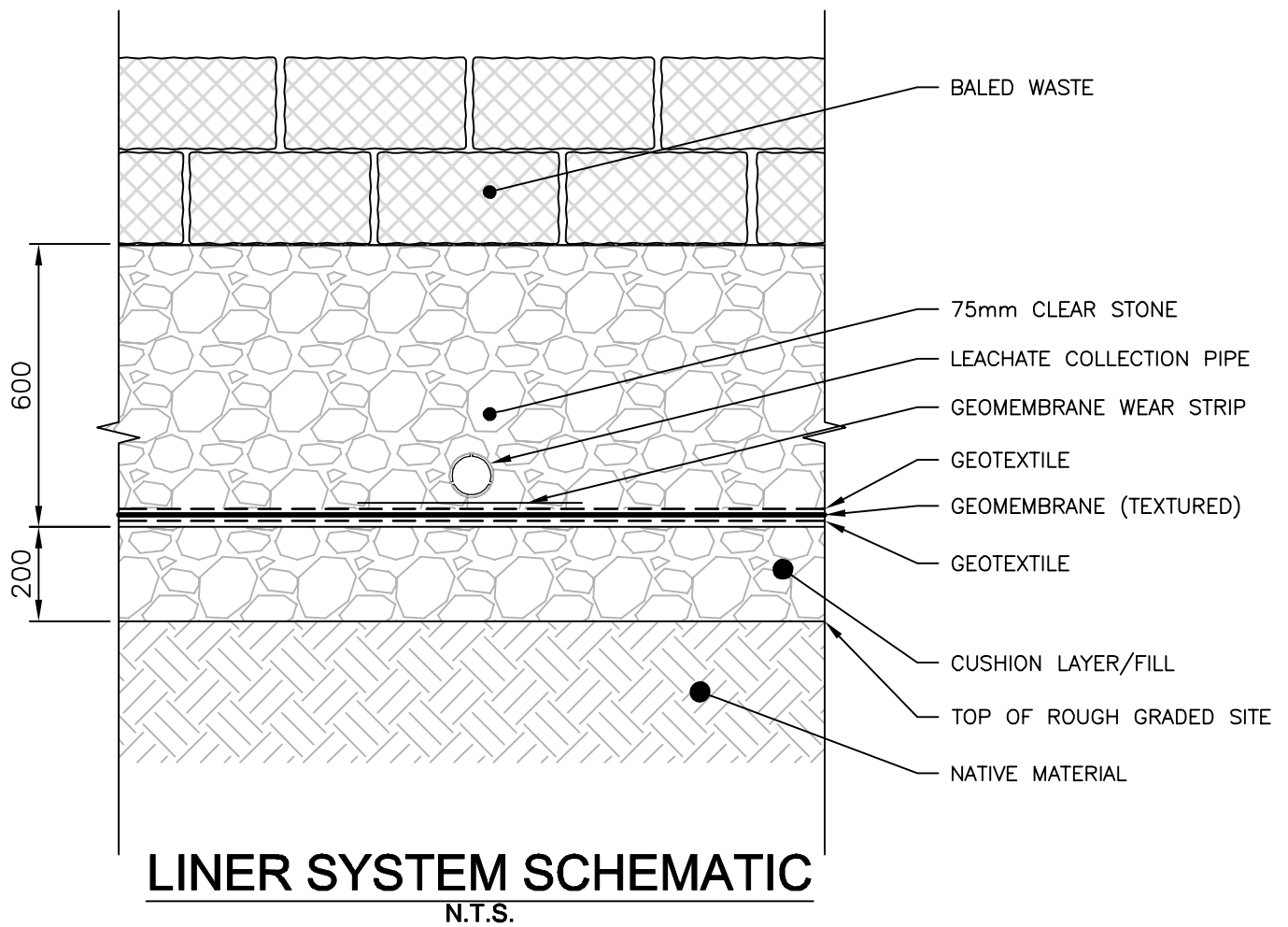
Leachate Collection Layer


The proposed leachate collection layer comprises a granular layer and piping. Its total thickness is 300 mm, with a hydraulic conductivity of at least 1×10^{-2} cm/sec. A geotextile is provided at the bottom of the leachate collection layer and immediately above the barrier, to protect the barrier from damage. A geotextile is not required to separate the cushion layer from the collection layer because of the compatibility of the two layers.

Leachate Collection Pipe

A network of leachate collection piping is placed at the bottom of the leachate collection layer. Where piping is placed, the granular layer extends to the area around the pipe. To protect the underlying barrier a wear strip of high density polyethylene (HDPE) is provided under the collection pipe.

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

Geomembrane Barrier

An 80 mil textured HDPE geomembrane liner (geomembrane) is provided under the leachate collection layer, as the primary barrier to leachate migration. A geotextile is positioned above the geomembrane to provide protection during construction and operation. The textured geomembrane is assumed based on the proposed base slopes of the landfill.

Base

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. The base grades have been selected to minimize the removal of rock, but “knobs” of rock will periodically have to be removed, as cells are developed. 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 should be achieved.

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

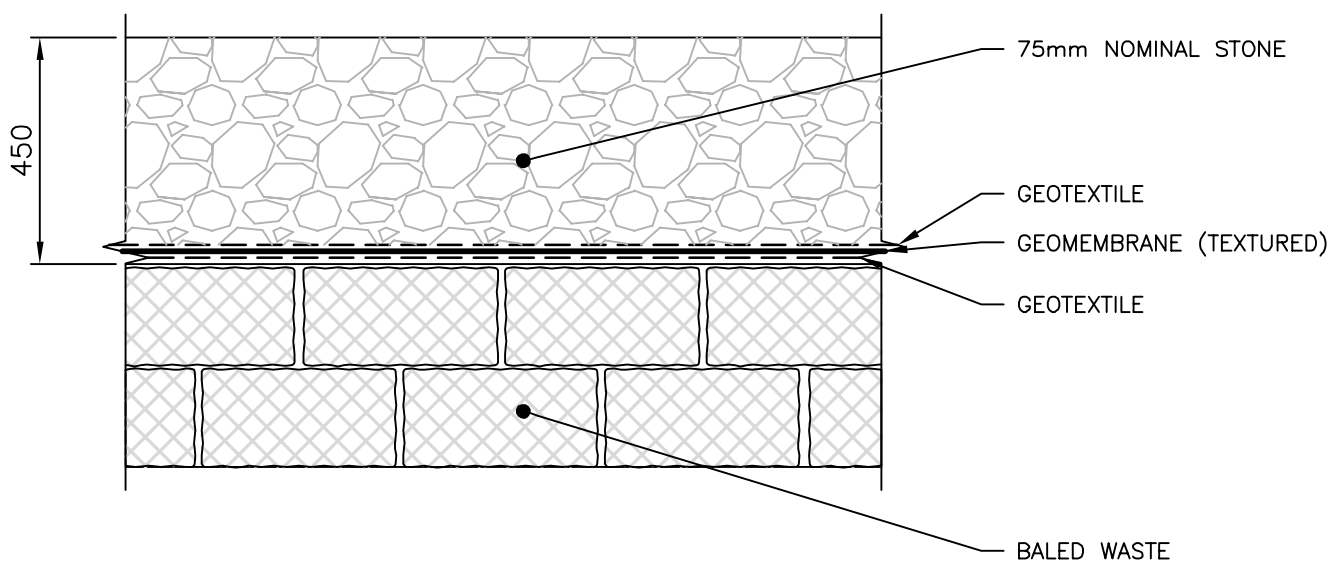
Cover

Covering of the placed waste (i.e., bales and C&D material) typically occurs on a daily, intermediate and final basis. The cover material, typically a soil based product, is placed to:

- Reduce wind-blown debris
- Provide a barrier for odour migration
- Control the migration of landfill gas
- Promote surface runoff;
- Minimize the presence of vectors (i.e., insects, birds, rodents)


Daily and Intermediate Cover

The plastic wrapping of the bales function as an alternative cover, eliminating the requirement for a soil based daily or intermediate cover. As such, borrow material stockpile areas are not required. Figure 5 presents the proposed cover.



CAP SYSTEM SCHEMATIC
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	PROJECT IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO. 19-9543
	TITLE LANDFILL CAP	FIGURE NO. 5
DATE JUNE 2019		

Final Cover

After the waste reaches the final design elevations, a series of layers that minimize the percolation of precipitation into the waste and promotes the runoff of the precipitation, is placed. Similar to the landfill liner, the following the components of the proposed cover system are described in the following sections, from the top down.

Surface Drainage Layer

This layer protects the underlying layers from erosion, and promotes the interception and transmission of precipitation off of the top and sides of the landfill. A granular layer with nominal particle size of 75 mm permeability and slope stability, will be reviewed for the 50% submission, and approximately 450 mm thick will be placed on the 5% top slope of the landfill. To provide drainage, a geocomposite with 4:1 side slopes will be used.

Geomembrane Barrier

A 60 mil textured Linear Low Density Polyethylene geomembrane liner (geomembrane) is provided under the surface drainage layer, as the primary barrier to leachate migration. A geotextile is positioned above and below the geomembrane to provide protection during construction and closure. The textured geomembrane is assumed based on the proposed slopes of the landfill.

Base

A granular grading layer will be placed between the top of the bales and the barrier.

Leachate Collection System

The leachate collection system consists of:

- Base grades of the landfill
- Collection granulars
- Collection piping
- Sump(s)
- Pumping station
- Forcemain

Base Grades

The general topography of the site dictates that leachate will flow by gravity from the north side to the west side of the site. To direct the leachate toward the sump(s), the top of the grading pad will be based on minimizing the cut of existing material, with the exception that “knobs” will be removed either by excavation or blasting. With the grading required to achieve the required grades, the fill layer under the geomembrane liner will vary in thickness’ from a minimum of approximately 200 mm to 1700 mm.

Collection Piping/Granular Layer

The leachate collection system is located above the 80 mil HDPE geomembrane liner. The system will consist of a series of perforated collection pipes placed in a layer of 75 mm clear stone granular material. As leachate percolates downward through the bales, it will be intercepted by the collection system and removed from the cell area for treatment.

The drainage layer consists of two 300 mm granular layers, which serves to protect the HDPE geomembrane, and transmit and direct the leachate to the collection pipes. The perforated collection

pipes consist of 150 mm and 200 mm HDPE. These pipes are connected to a perforated header pipe, which directs the collected leachate to the collection sump. A geomembrane “stormwater” barrier will be included in the cell, to separate areas where baled waste is not placed; hence, not generating leachate. This allows water in these areas to be pumped directly to the environment and to by-pass the lagoons.

At the end of each collection pipe, a non-perforated clean out riser will extend up the inner slope of the perimeter berm. This riser will provide access to the collection pipe for inspection equipment and for cleaning purposes.

We have assumed that the freezing of the bales in the landfill will also result in the freezing of precipitation as it migrates between the bales, and that the granular leachate collection layer under the bales will also freeze by Year 5 or 6. To ensure that leachate can be collected, the bales will be setback from the “Limit of Waste” line on the perimeter berm to provide a corridor to the sump. Lightly compacted C&D material can be placed in the corridor, provided that leachate can reach the granular layer.

Pumping Station/Forcemain

To remove leachate from within each cell a sump(s) and pumps will be utilized. The cells will be graded to direct the flow of leachate toward the collection pipes and toward a sump from which the leachate can be removed from the cell, by using the pumping equipment. By utilizing the pumping system, penetration of the geomembrane are eliminated, as the components of the pumping system rest on top of the liner.

The leachate pump station(s) receives leachate through the leachate collection granular and perforated collection pipes discharging to a sump in the landfill. The pump station, located in the sump, consists of a 2400 mm diameter perforated concrete manhole and two submersible pumps on rails. One pump will be the duty pump with the second a back up. As leachate enters the manhole and reaches a pre-determined level. Floats in the manhole will turn a pump on and the pump will run until the leachate level drops to a set elevation, where a second float will turn the pump off.

The pump station(s) will discharge into a forcemain, which directs flows to the leachate lagoon.

Leachate Treatment System

Introduction

Leachate is water that percolates through solid waste and leaches constituents out of the waste material. The resulting liquid is then considered industrial wastewater and must be managed appropriately. The quality and quantity of leachate produced will vary from site to site, and can even change at the same landfill over the course of months or years. It is strongly influenced by the amount of precipitation the area receives, the nature and placement method of the solid waste material, and landfill design. Leachate will be collected via the landfill’s liner system and then pumped to the ultimate treatment and disposal system.

Design Criteria

Design criteria were established for the 30% stage based on proposed landfill footprint, historical precipitation data, comparison to other municipal landfill sites and discussions with the baler equipment

manufacturer. Typically, leachate is characterized as low flow but very high strength, with heavy metals, dissolved/suspended solids and biological demand driving the treatment focus. This can present a both capittally-expensive and operationally-intensive treatment system, often with several levels of treatment to condition the water to a state that is considered non-deleterious to the receiving environment. In some cases, it is partially treated at the landfill site and then hauled to a nearby municipal wastewater treatment facility.

The ultimate size of the landfill is approximately 22 ha at the end of its 75 year anticipated life. Environment Canada meteorological data indicated the area historically has received an average of 404 mm/year of precipitation. It was assumed that 50% of the annual precipitation would become runoff and not contribute to leachate generation, while the other 50% would percolate through the landfill. As the waste bales will be wrapped in several layers of plastic, it was further assumed that only 10% of this infiltration would generate leachate (through perforations or cuts in the bale wraps). This results in an annual leachate generation of approximately 4,400 m³.

Raw influent quality was developed based on estimated concentrations of biological oxygen demand (BOD), total ammonia nitrogen (NH₃-N), total suspended solids (TSS) and heavy metals. Limited raw leachate data is available for northern landfill sites and even less for northern balefills. The used of plastic-wrapped balefills is not common in North America, so in the absence of in situ data, conservative estimates were applied for the 30% stage.

Discussions with regulators suggested that an appropriate reference material for effluent quality requirements would be the Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities (2011), which provides criteria for process effluents and non-point discharges from industrial facilities. Discussions with the Nunavut Water Board suggested that “non-point source discharges” (NPSD) may be applicable to the City’s landfill leachate, which defines NPSD as “non-specific or diffuse source of effluent entering the environment including run-off from an industrial compound or storage yard”. These limits were compared to the Canadian Council for Ministers of the Environment (CCME) guidelines for Freshwater Aquatic Life. Estimated influent quality and proposed effluent quality is summarized in Table 1.

Table 1: Estimated Influent and Effluent Quality

Parameter	Influent Design Value ¹	CCME ²	Government of Nunavut Dept. of Environment ³	Design Effluent Objective ⁴
Carbonaceous BOD (5 day)	100 mg/L	25 mg/L	15 mg/L	15 mg/L
pH	6 – 9	6.5 – 9.0	6 – 10.5	6.5 – 9
Total Ammonia (NH ₃ -N)	40 mg/L	Varies (10.3 mg/L used) ⁶	10 mg/L	10 mg/L
TSS	100 mg/L	Varies (typ. 25 mg/L)	15 mg/L	15mg/L
Total Phosphorus	10 mg/L	-	1.0 mg/L	1.0 mg/L
Chloride	200 mg/l	120 mg/L	-	-
Cadmium ⁵	10 ug/L	0.09 ug/L	100 ug/L	100 ug/L
Chromium ⁵	50 ug/L	1 – 8.9 ug/L	100 ug/L	100 ug/L

Copper ⁵	1000 ug/L	4.0 ug/L	1000 ug/L	1000 ug/L
Iron	20 mg/L	0.3 mg/L	1.0 mg/L	0.3 mg/L
Lead	100 ug/L	7 ug/L	50 ug/L	50 ug/L
Arsenic ^b	10 ug/L	5 ug/L	1000 ug/L	1000 ug/L
Nickel ⁵	25 ug/L	25 ug/L	1000 ug/L	1000 ug/L
Zinc	75 ug/L	7.0 ug/L	50 ug/L	50 ug/L

Notes:

- 1) Estimated based on limited data.
- 2) CCME Water Quality Guidelines for the Protection of Aquatic Life.
- 3) Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Treatment Facilities, Table 1.
- 4) Proposed effluent objective to be confirmed.
- 5) Preliminary influent quality estimated to be below effluent objectives but impacts to treatment process still considered.
- 6) Assuming a pH of 7.0 and temperature of 10° C. As temperature and pH increase, the Canadian Council of Ministers of the Environment total ammonia-nitrogen discharge limit decreases due to the relationship between un-ionized and ionized ammonia.

Technology Discussion

Appendix D of the main report presents an introduction and Triple Bottom Line Assessment of the three main treatment options considered:

1. Lined lagoon and wetland treatment area (WTA).
2. Pre-treat and haul to the City's wastewater treatment plant (WWTP).
3. Full-scale onsite mechanical treatment.

An important characteristic of that assessment is that it assumes each of the options is viable and will meet the requirements of the project, in this case providing adequate treatment. Aerated lagoons and wetland treatment for industrial wastewaters is a relatively new and unique concept in northern Canada. While commonly used for municipal wastewater treatment in both Nunavut and the Northwest Territories, the characteristics of leachate often vary significantly compared to municipal wastewater. The performance for parameters, such as heavy metal removals in northern wetlands, would be largely theoretical, as there are limited case studies that have similar conditions.

One of the closest comparisons to Iqaluit would be passive wetland-based treatment systems studied in the Yukon for mining impacted waters. The study found that while passive treatment systems can provide considerable levels of heavy metals removal, they generally require several factors that present challenges for the Iqaluit landfill:

- Constant flow year round
- Liquid carbon sources

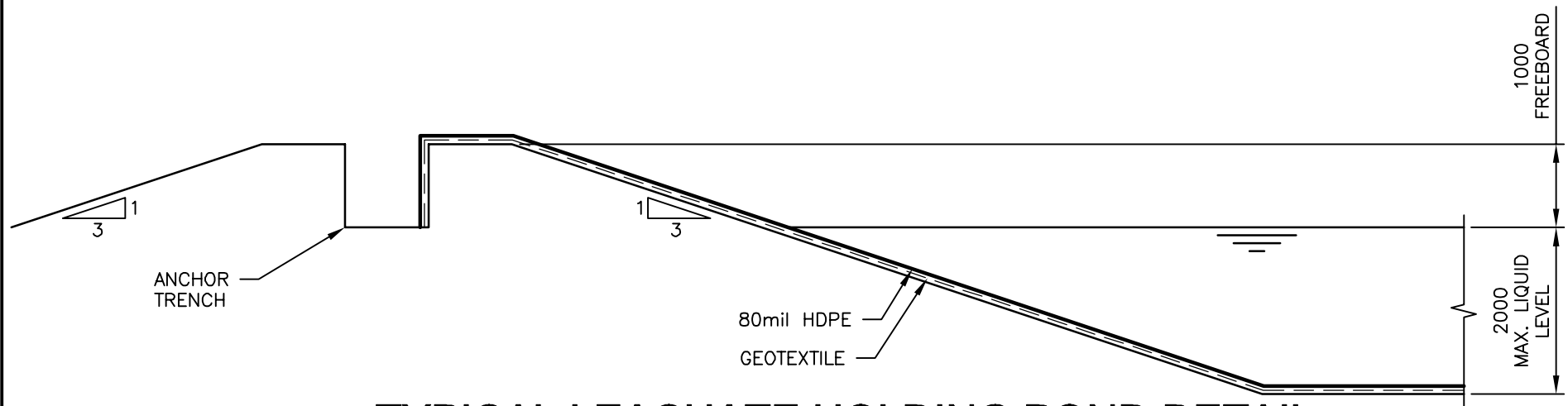
The second issue can be overcome through a chemical feed system or raw-wastewater recycling, but constant flow is not something that is expected since the only wastewater contribution to the treatment system will be precipitation and runoff in the warmer months. However, the raw leachate strength is expected to be relatively weak compared to that from a traditional landfill site due to the plastic bale liners and relatively small footprint of the active landfill cells. As the proposed landfill is several kilometers away from any significant receiving waters, the treated effluent will also likely need to be land applied downstream of the landfill site as well.

Construction Details

Both lagoons will require an engineered liner to prevent them from leaking into the surrounding environment, as no clay or similar materials are readily available in sufficient quantities in Iqaluit. The proposed lagoons are expected to be 3.0 m deep (liquid level), with an additional 1.0 m freeboard and 3:1 side slopes. A berm, approximately 2.0 m in width at a minimum, will be provided around the ponds to allow for installation of aeration equipment and maintenance access. Leachate will be pumped from the landfill sump to the cascade aerator which will then flow by gravity to the first pond, which will have capacity to store approximately 60% of the estimated annual leachate production. The second pond is designed to store approximately 40% of the annual leachate, for a total of 1 year's worth of storage between the two ponds; this will allow for balancing and buffer space during the spring freshet. The primary treatment purpose of the two lagoons will be for preliminary solids removal, BOD reduction and partial oxidation and removal of select metals. At the end of lagoon #2, there will be a level control structure and pump station, which will transfer lagoon effluent to the vertical flow wetland. The vertical flow wetland will be sized for additional BOD and TSS removal, along with ammonia nitrification. The last treatment step will be a WTA that is anticipated to occur naturally over the first few years of the landfill's life. The WTA will provide general effluent polishing and further reduction of BOD, TSS, ammonia and some metals.


Conclusion

Dillon Consulting Limited's recommendation at the 30% stage is to proceed with an aerated lagoon and wetland treatment system as shown on the 30% drawing set, with provisions for a future mechanical treatment system, if it is determined that the lagoon and WTA is inadequate at treating leachate to regulatory requirements. During the first year of operation, the leachate quality and quantity should be monitored, and if necessary, hauled to the City's new WWTP (if effluent standards are not being met), where there is reported short and medium-term capacity. This will help manage potential risks associated with leachate strength and treatment performance, while balancing capital costs and delaying a potentially unnecessary and financially significant investment in a mechanical treatment plant.



TYPICAL LEACHATE HOLDING POND DETAIL

1:75

 DILLON CONSULTING	PROJECT	IQALUIT LANDFILL AND WASTE TRANSFER STATION	PROJECT NO.
	TITLE	LAGOON HOLDING POND LINER	FIGURE NO.
DATE	JUNE 2019		19-9543
			6

Drainage and Erosion Control

The drainage area of the proposed landfill site is located to the east of the Sylvia Grinnell River watershed. The site drains predominately to the west and to the south by overland and sheet flow, concentrating to channelized flow. The channelized flow moves south toward the City, ultimately outletting to the Koojesse Inlet of Frobisher Bay.

The proposed landfill site will be approximately 22 ha at completion. Throughout the course of construction, water from two wetland areas will need to be relocated and directed around the facility. Drainage and erosion control on-site will be managed through perimeter ditching and flow control structures per the City's stormwater management guidelines and Government of Nunavut's water protection requirements. Perimeter ditching and roadway culverts will be designed to convey flows associated with major design event storms.

Drawings

Drawings for the Solid Waste Landfill, Waste Transfer Station and Northwest Aggregate Deposit Road – 30% Submission are attached to this memorandum.

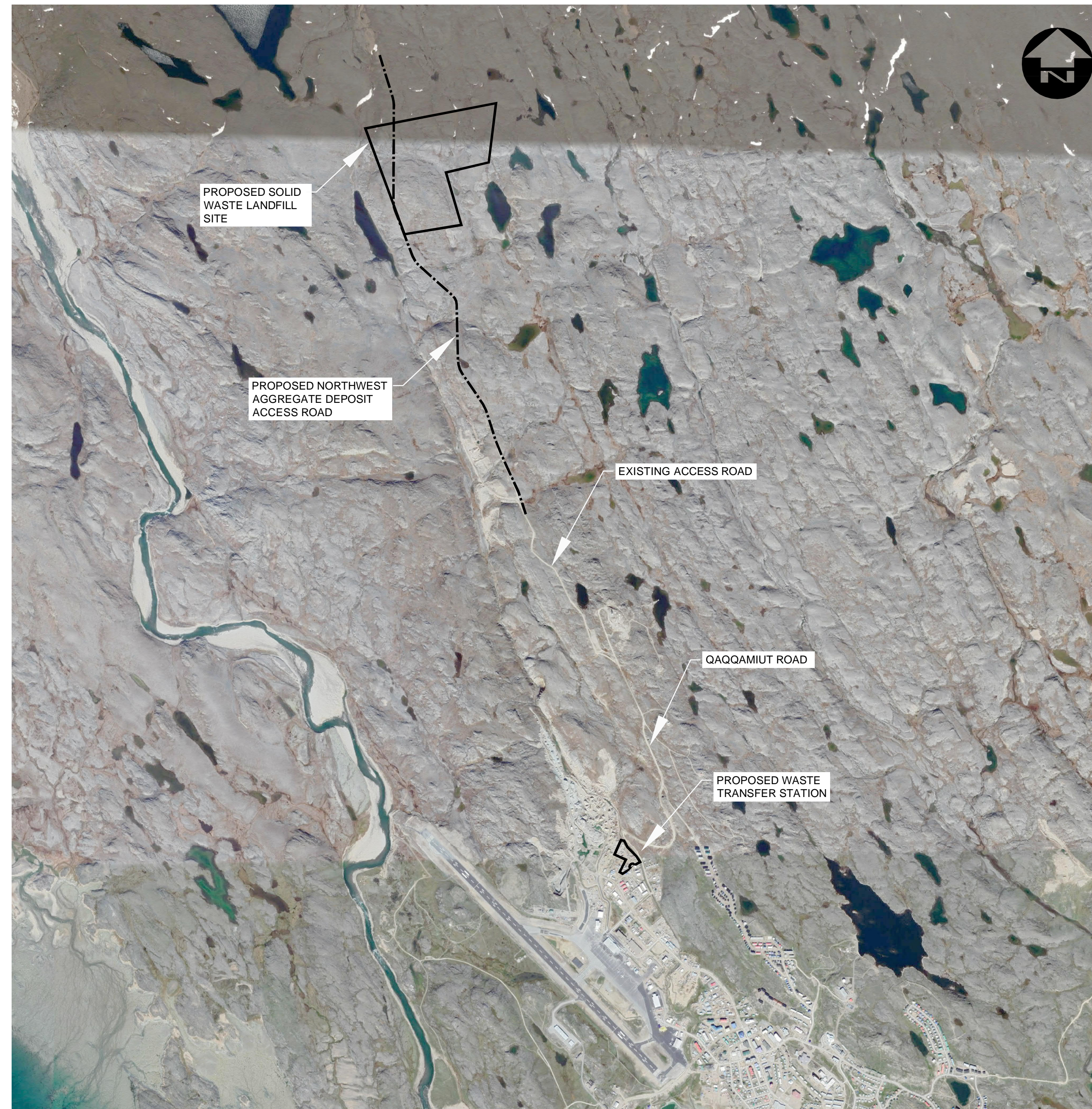
Drawings

Iqaluit



CITY OF IQALUIT

SOLID WASTE LANDFILL, WASTE TRANSFER STATION AND NORTHWEST AGGREGATE DEPOSIT ROAD - 30% SUBMISSION



KEY PLAN

DILLON PROJECT: 19-9543
DATE: JUNE 04, 2019





CITY OF IQALUIT

SOLID WASTE LANDFILL, WASTE TRANSFER STATION & NORTHWEST AGGREGATE DEPOSIT ROAD

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INDEX OF INCLUDED DRAWINGS

DRAWING NO.	REVISION	DESCRIPTION
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OTT-00219428-A0-SP-1	3	SITE PLAN-1
OTT-00219428-A0-SP-2	3	SITE PLAN-2
OTT-00219428-A0-SP-3	3	SITE PLAN-3
OTT-00219428-A0-LP-1	3	LAYOUT PLAN-1
OTT-00219428-A0-LP-2	3	LAYOUT PLAN-2
OTT-00219428-A0-LP-3	3	LAYOUT PLAN-3
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OTT-00219428-A0-DET-2	3	GUIDERAIL DETAILS
OTT-00219428-A0-DET-3	3	MISC. DETAILS

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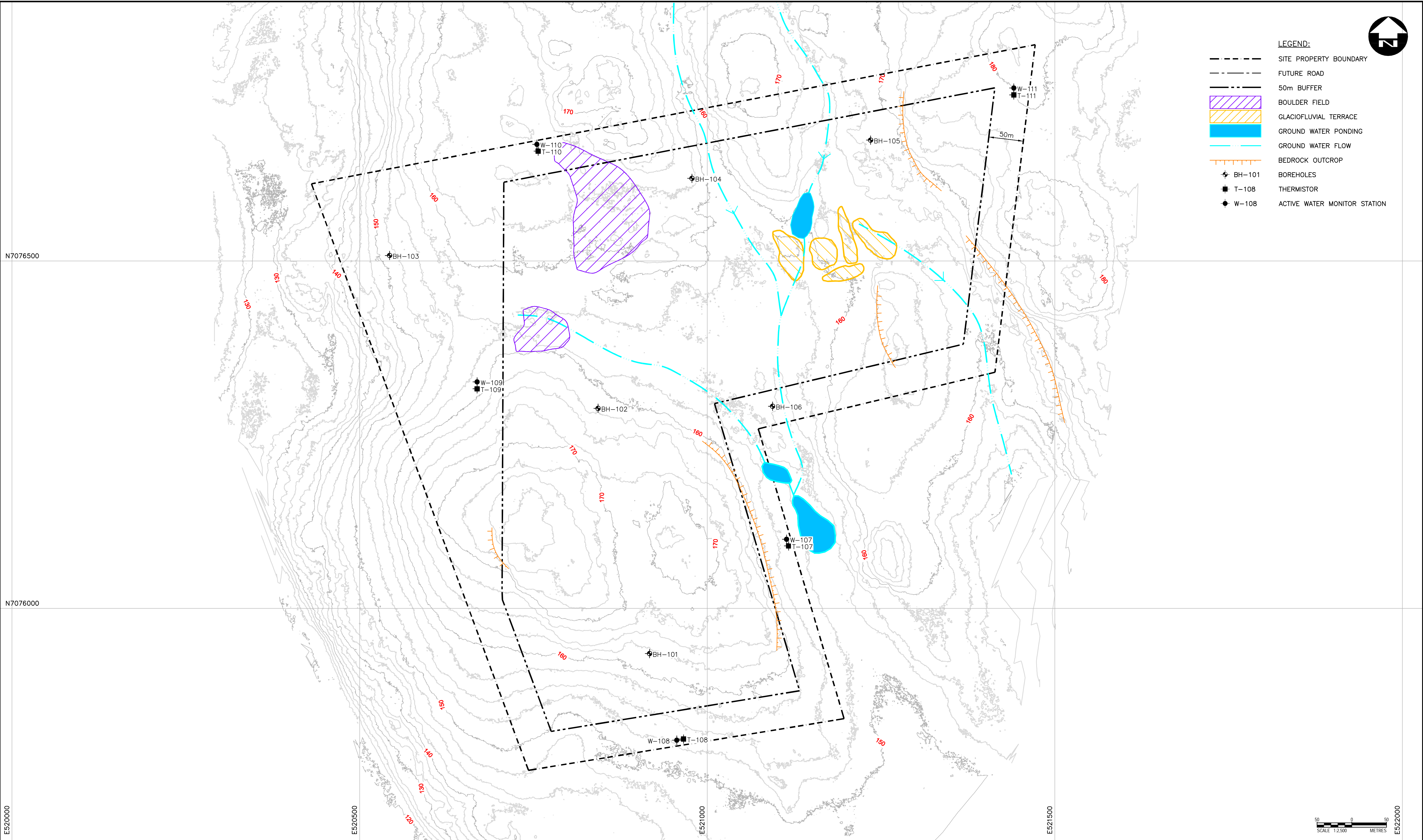


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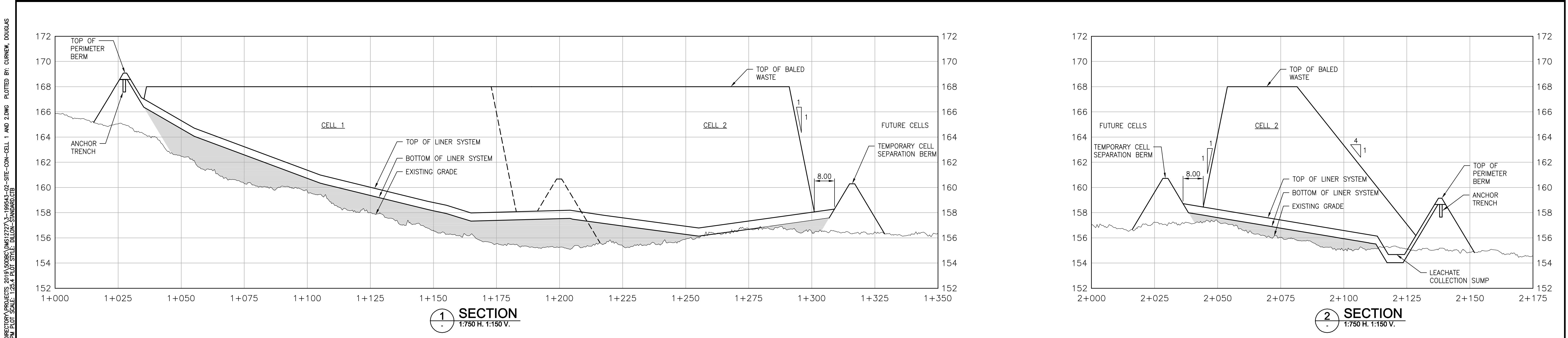
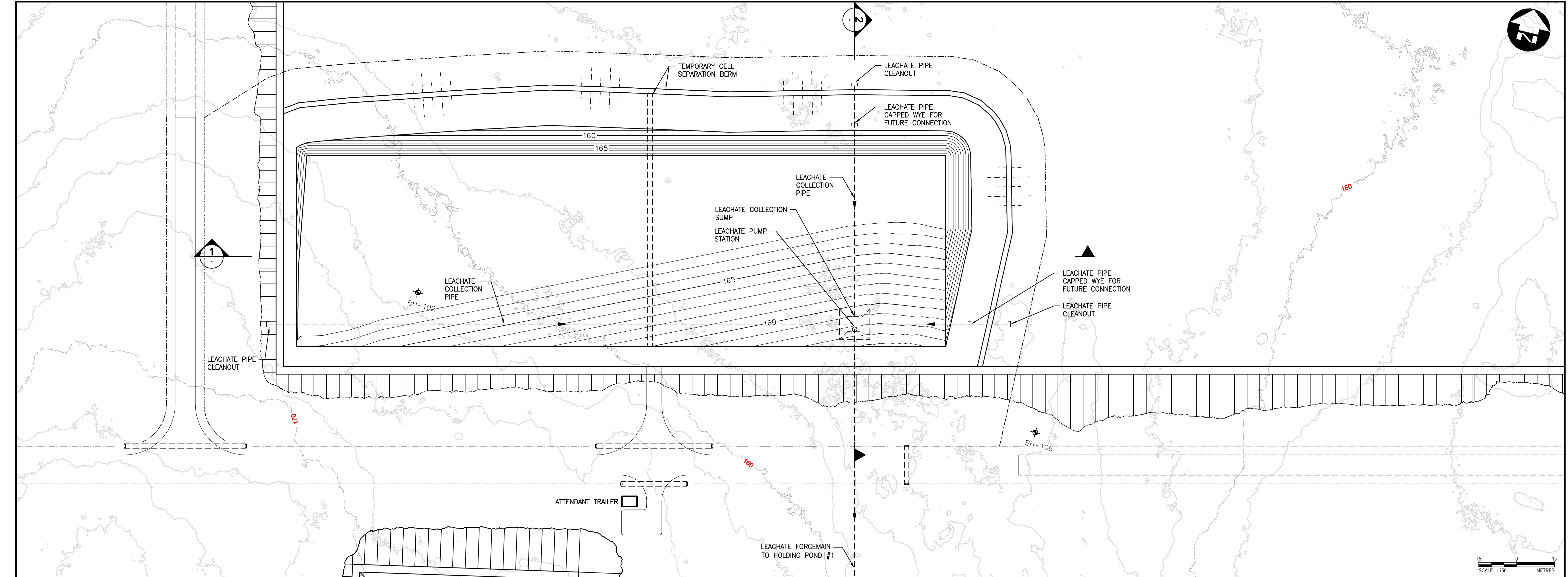
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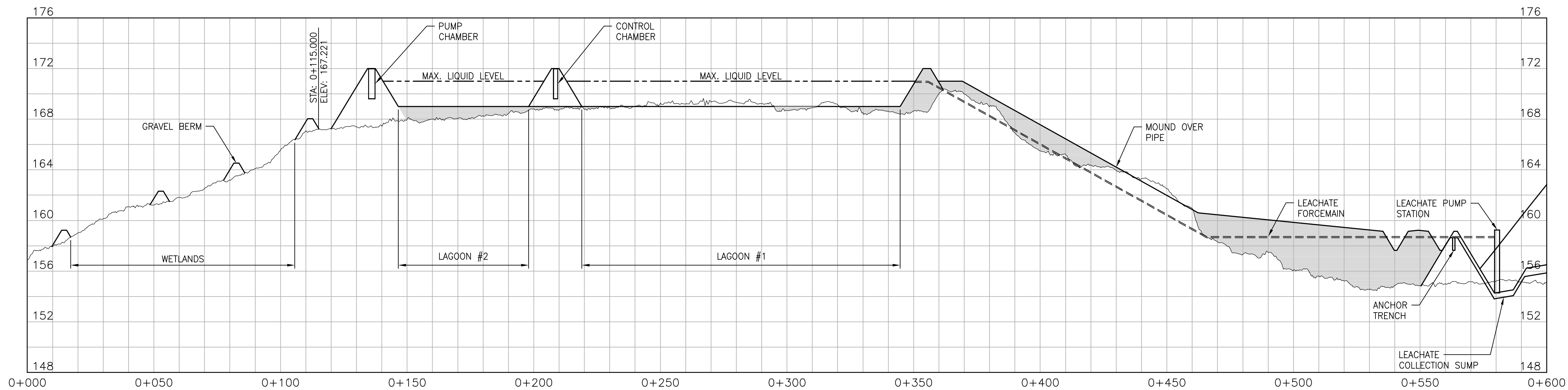
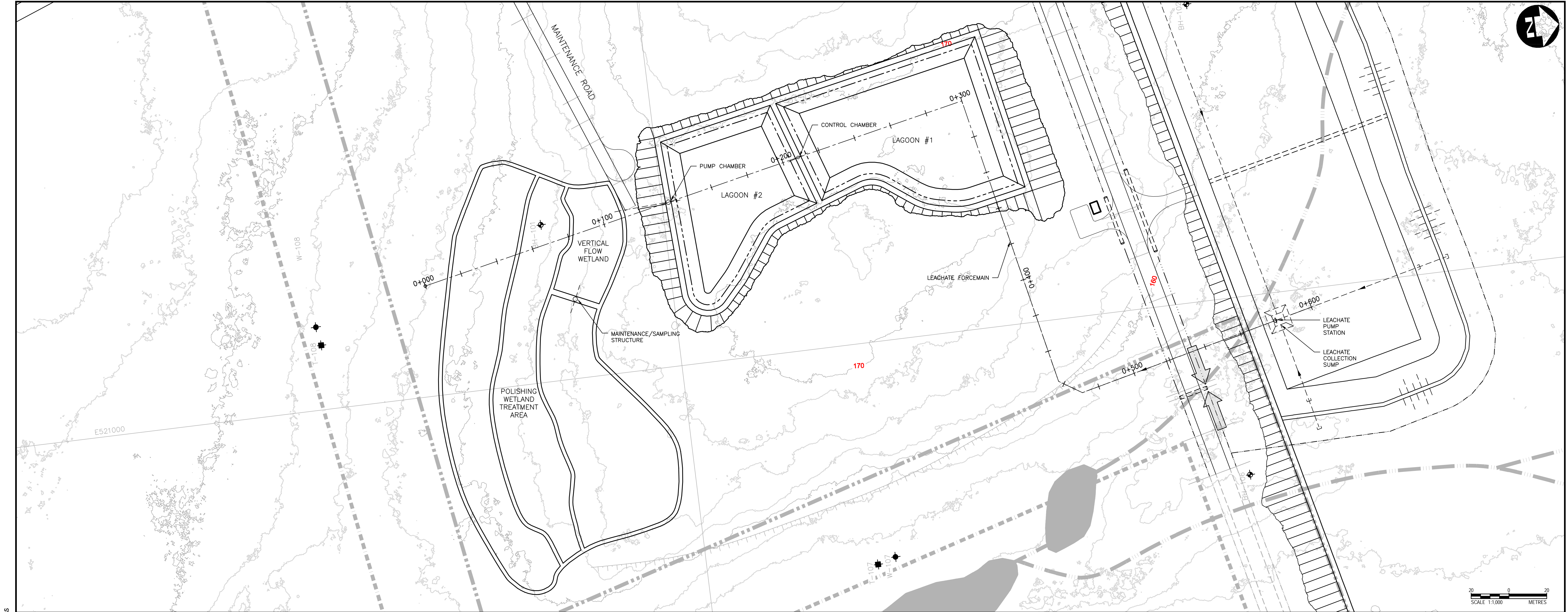
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Iqaluit



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DESIGN	K.R.M.	REVIEWED BY	S.D.K.
DRAWN	D.B.C.	CHECKED BY	K.B.
DATE	MAY 2019	SCALE	1:1000 (22x34) 1:2000 (11x17)
1	30% REVIEW	20190604	K.B.
NO.	ISSUED FOR	DATE	BY

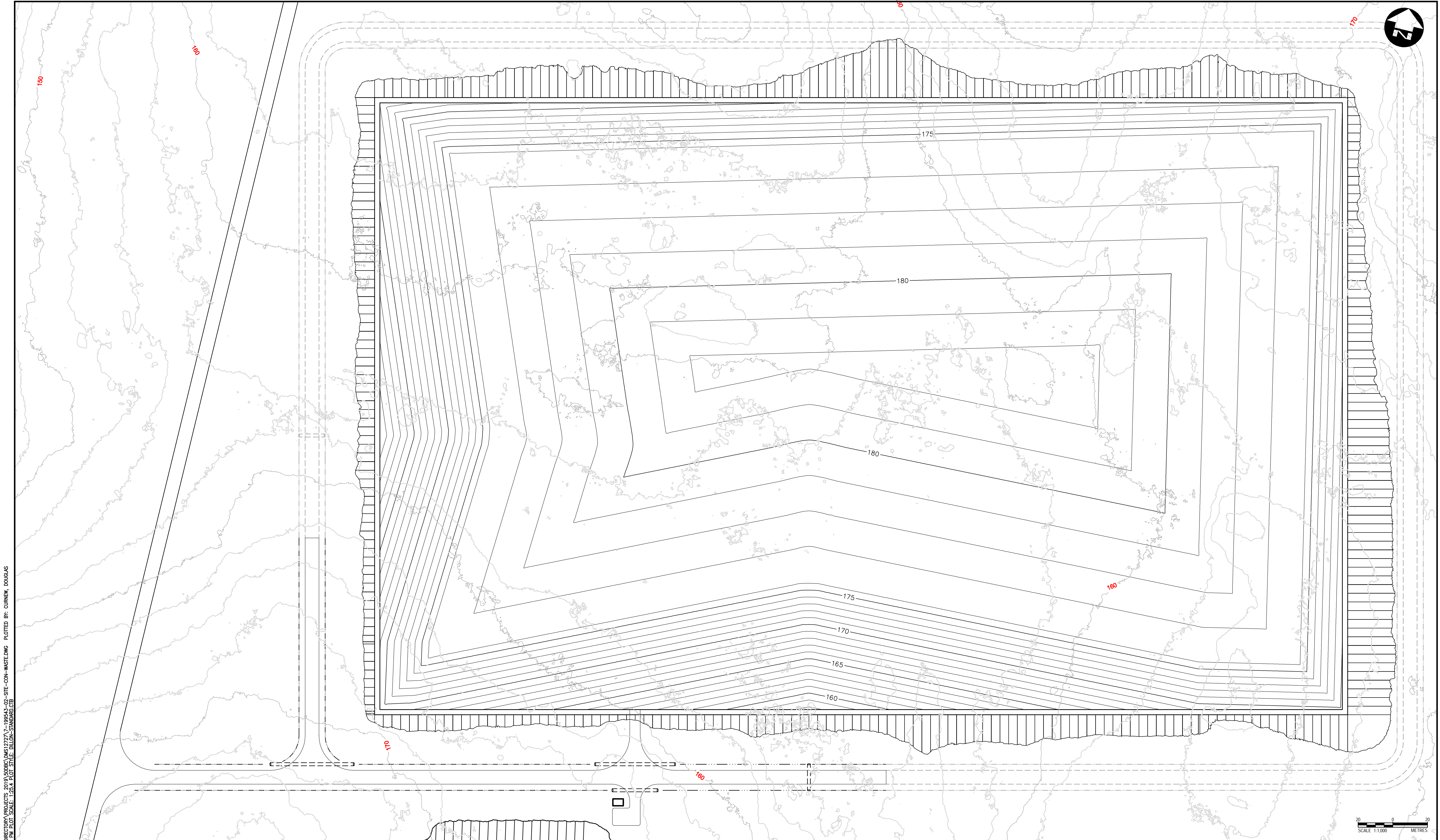
CITY OF IQALUIT
SOLID WASTE LANDFILL

PROJECT NO.
19-9543

SHEET NO.

LF-C05

LEACHATE LAGOONS AND WETLAND
PLAN AND PROFILE



FILENAME: C:\PROJECTS\WORKING DIRECTORY\PROJECTS 2019\5008\DWG\12727\19-9543-02-SITE-CON-WASTE.DWG PLOTTED BY: CURNEW DOUGLAS
PLOT DATE: 2019-06-05 12:52:07 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON-STANDARD.CTB

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						DESIGN C.R.S.	REVIEWED BY S.D.K.
						DRAWN D.B.C.	CHECKED BY K.B.
						DATE MAY 2019	
						SCALE 1:1000 (22x34) 1:2000 (11x17)	
1	30% REVIEW		20190604	K.B.			
No.	ISSUED FOR		DATE	BY			

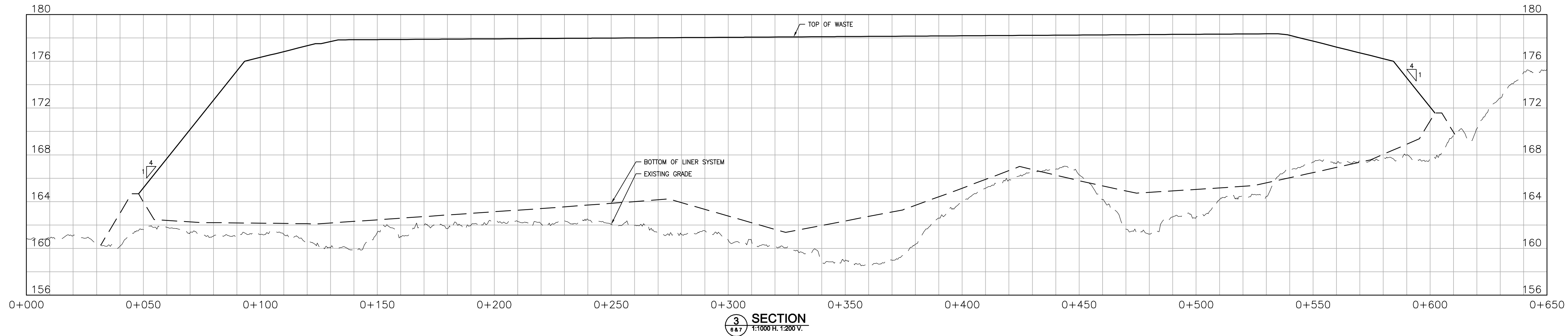
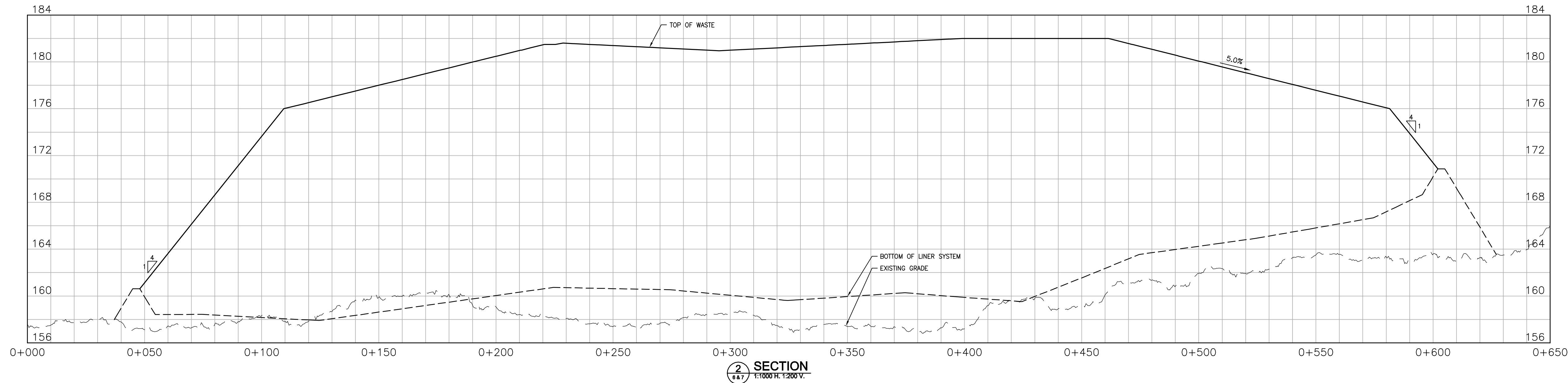
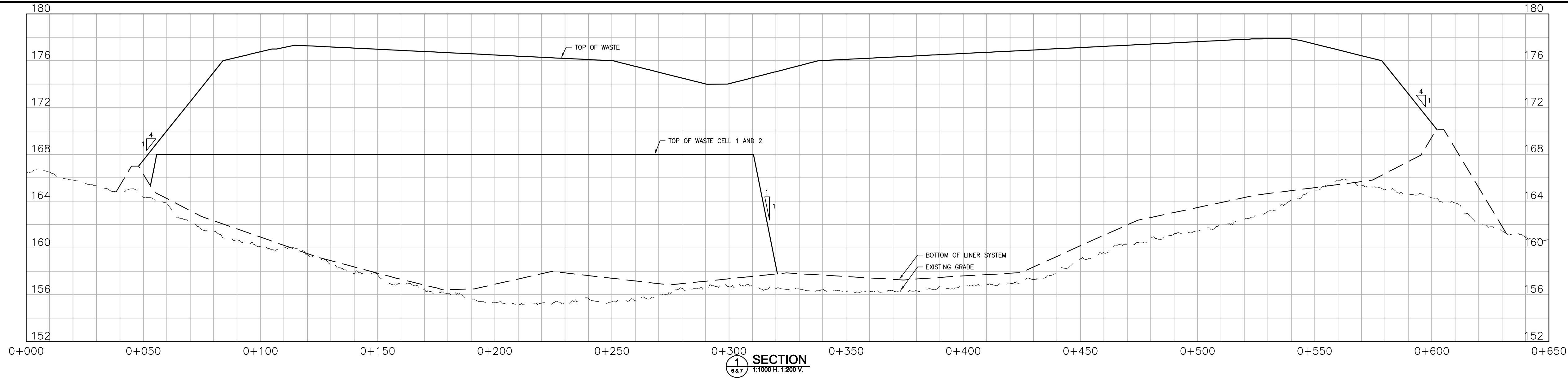
CITY OF IQALUIT
SOLID WASTE LANDFILL

PROPOSED TOP OF FINAL WASTE

PROJECT NO.
19-9543

SHEET NO.
LF-C07

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PLOT DATE: 2019-06-05 1:55:50 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON-STANDARD.CTB



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Iqaluit



DESIGN	C.R.S.	REVIEWED BY	S.D.K.
DRAWN	D.B.C.	CHECKED BY	K.B.
DATE	MAY 2019	SCALE	1:1000 (22x34) 1:2000 (11x17)
1	30% REVIEW	20190604	K.B.
DATE	BY	ISSUED FOR	

CITY OF IQALUIT
SOLID WASTE LANDFILL

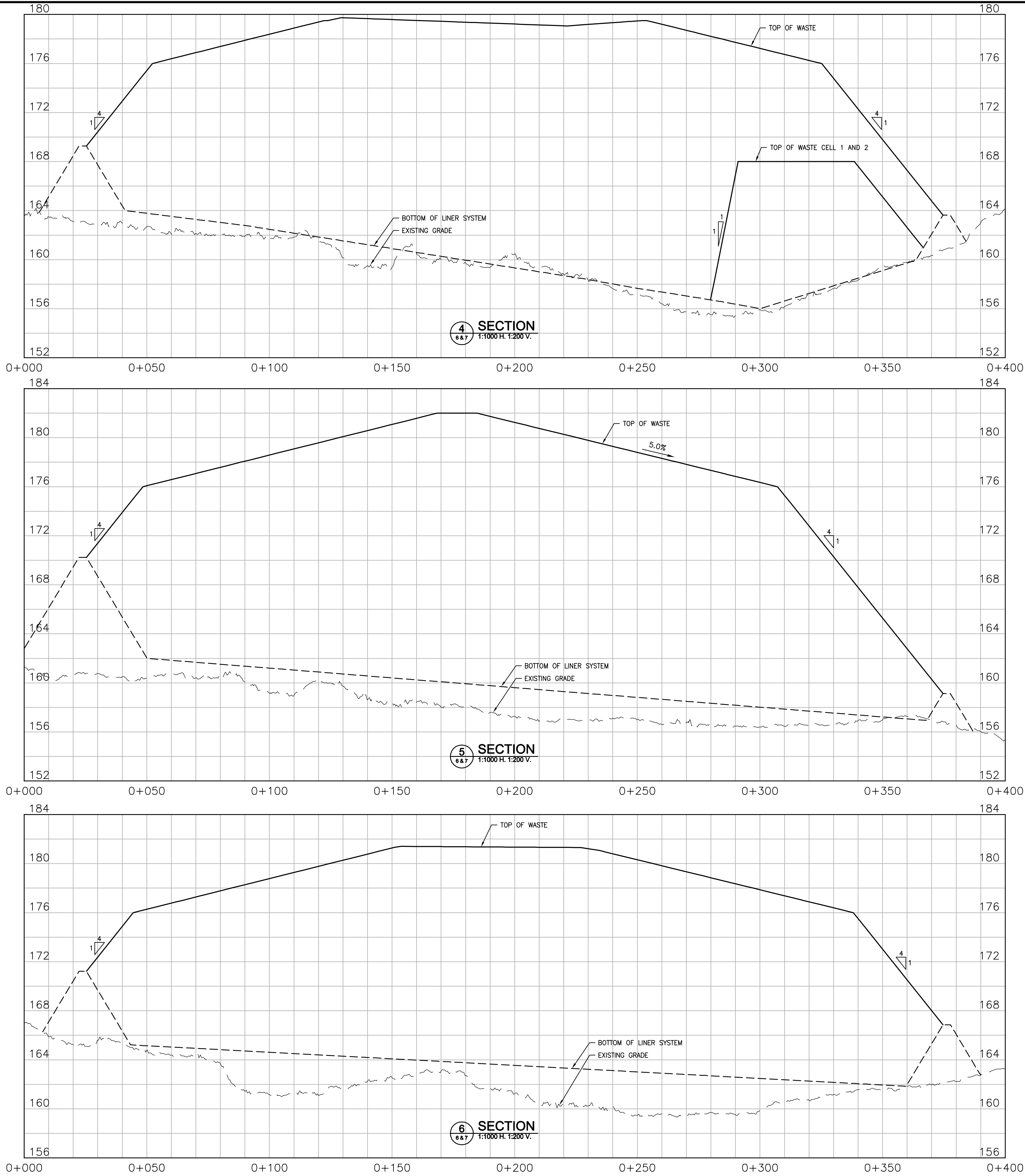
PROJECT NO.
19-9543

SHEET NO.

LF-C08

LANDFILL SECTIONS 1 TO 3

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PLOT DATE: 2019-06-05 @ 12:53:39 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON-STANDARD.CTB



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DRAWN	D.B.C.	CHECKED BY	K.B.
DATE	MAY 2019	SCALE	AS NOTED
1	30% REVIEW	2019/06/04	K.B.
No.	ISSUED FOR	DATE	BY

CITY OF IQALUIT
SOLID WASTE LANDFILL

PROJECT NO.

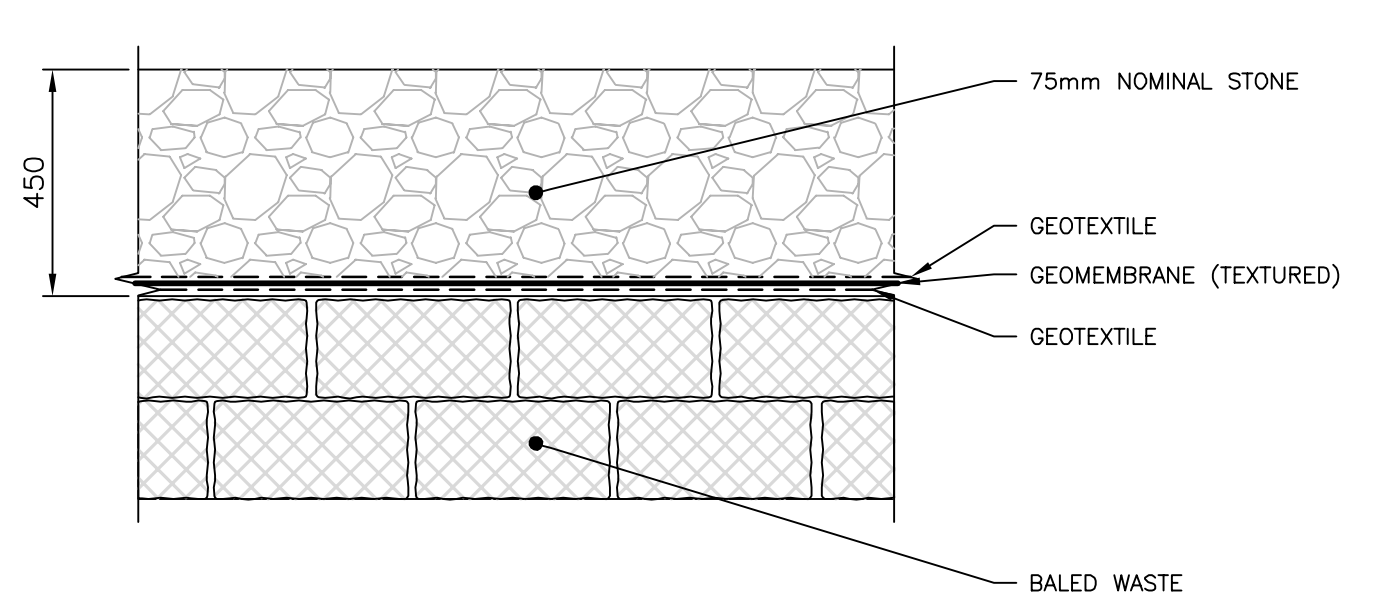
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SHEET NO.

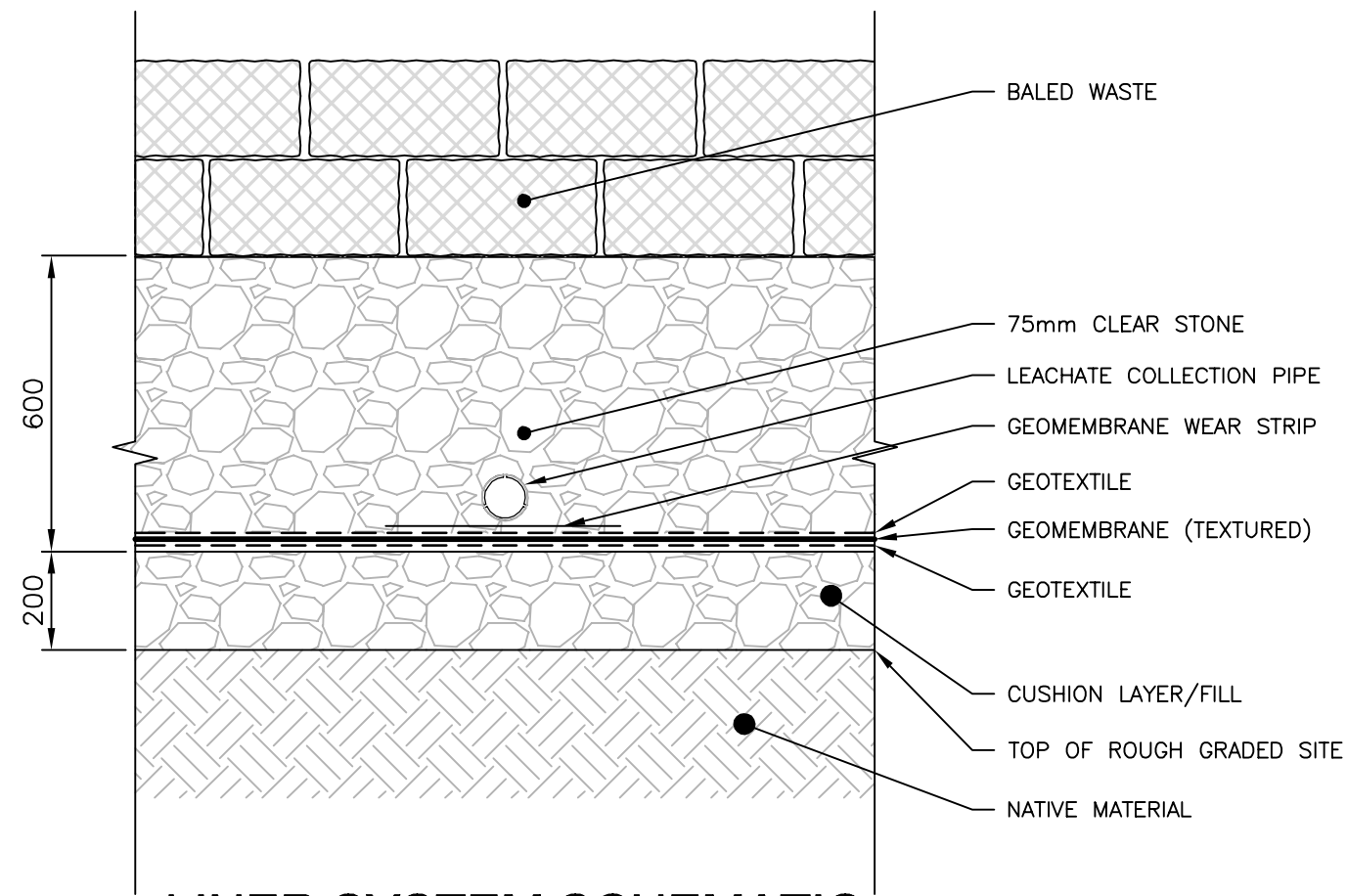
LANDFILL SECTIONS 4 TO 6

LF-C09

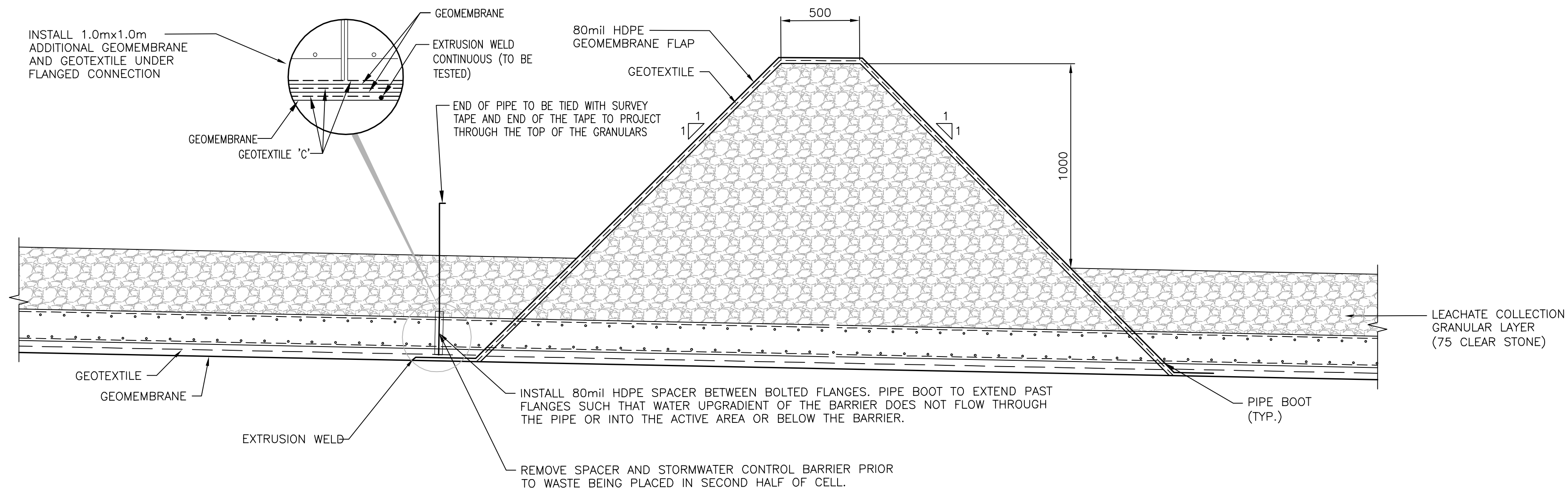
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PLOT DATE: 2019-06-05 12:40:12 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON-STANDARD.CTB



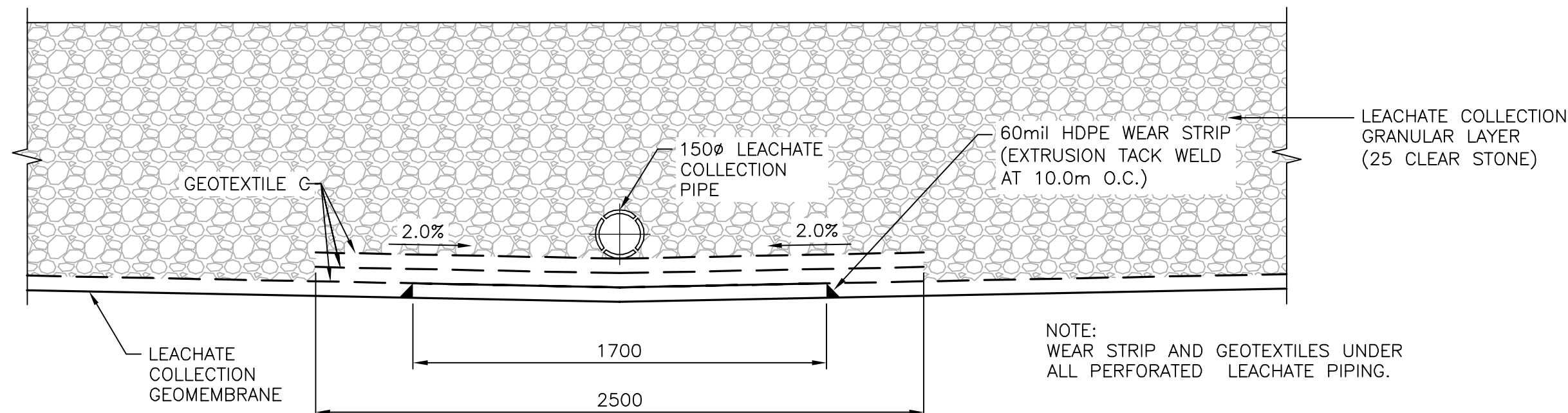
CAP SYSTEM SCHEMATIC
N.T.S.



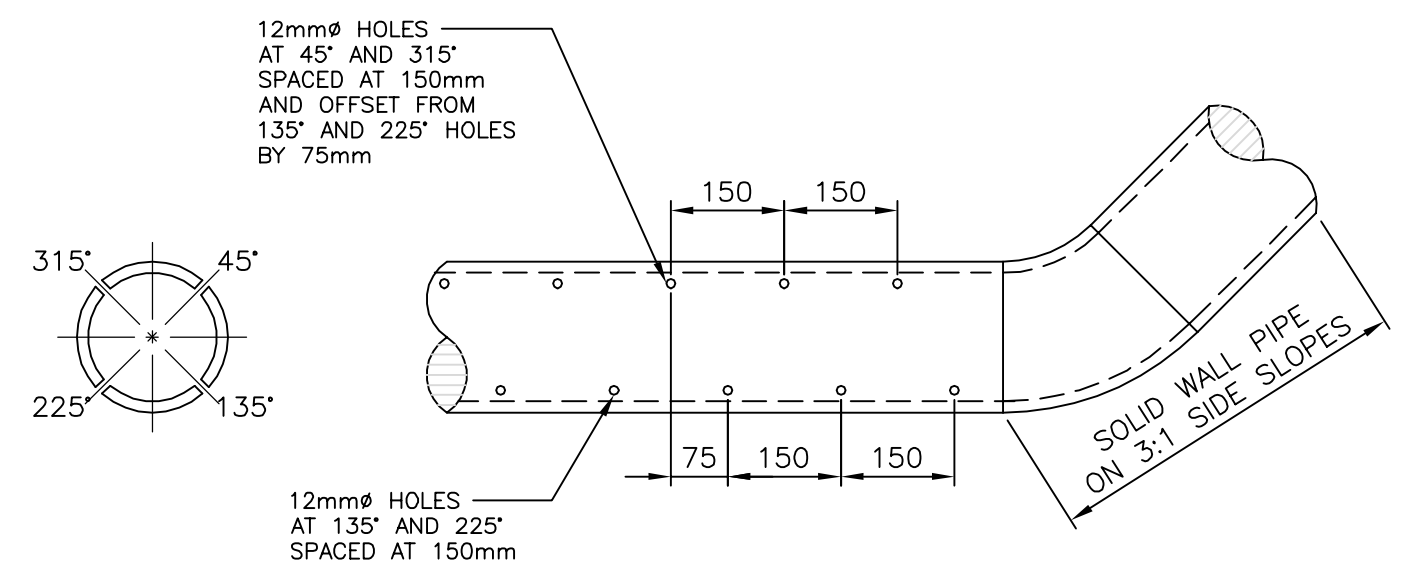
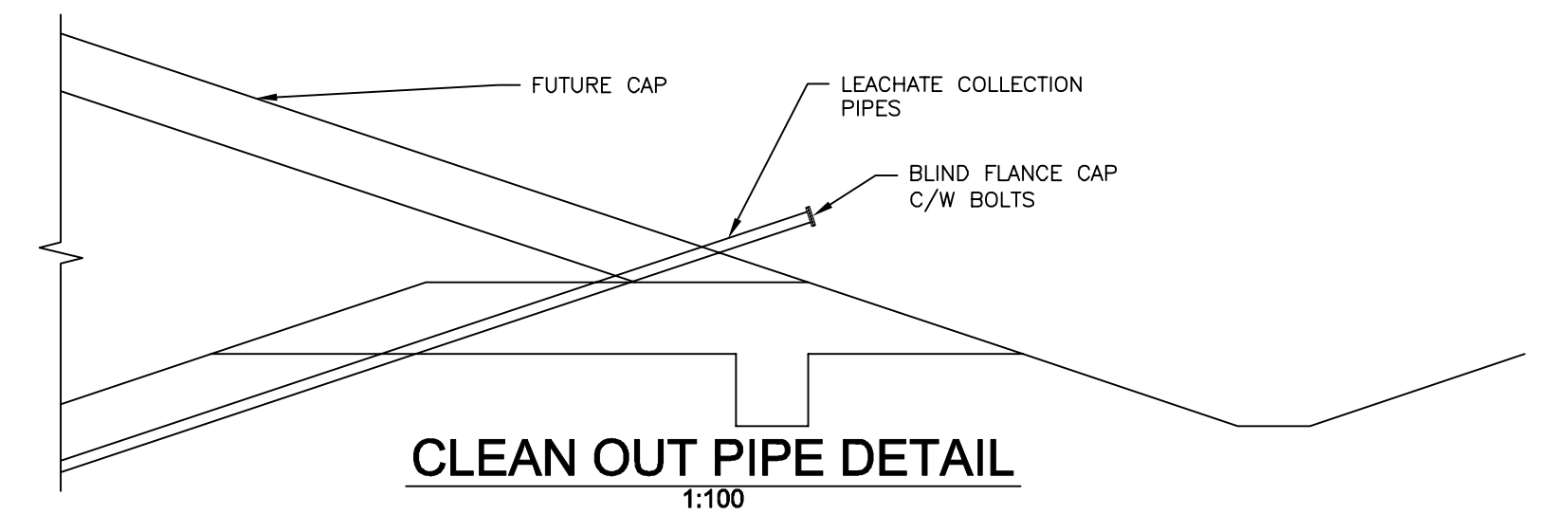
LINER SYSTEM SCHEMATIC
N.T.S.



STORMWATER CONTROL BARRIER
N.T.S.



LEACHATE COLLECTION PIPE DETAIL
1:20



150 DIA. LEACHATE COLLECTION PIPE - PERFORATION DETAIL
1:10

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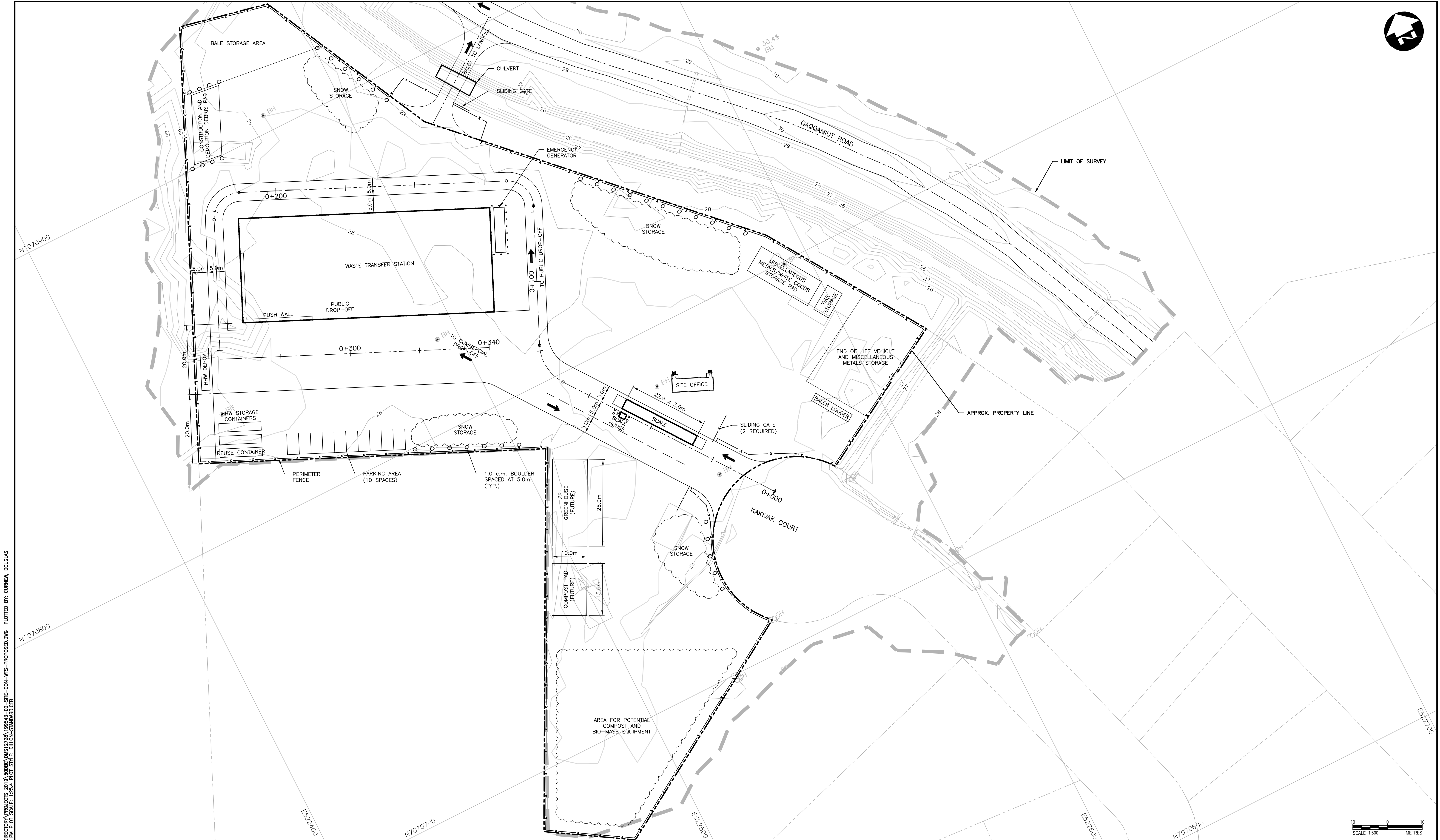
DESIGN	C.R.S.	REVIEWED BY	S.D.K.
DRAWN	D.B.C.	CHECKED BY	K.B.
DATE	MAY 2019	SCALE	AS NOTED
1	30% REVIEW	20190604	K.B.
NO.	ISSUED FOR	DATE	BY

CITY OF IQALUIT
SOLID WASTE LANDFILL

LINER DETAILS

PROJECT NO.
19-9543

SHEET NO.
LF-C11



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							DESIGN	REVIEWED BY
							C.R.S.	S.D.K.
							DRAWN	CHECKED BY
							D.B.C.	K.B.
							DATE	
							MAY 2019	
							SCALE	1:500
1		30% REVIEW			2019/06/04	K.B.		
No.		ISSUED FOR			DATE	BY		

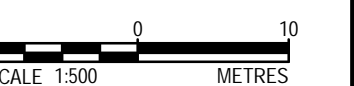
CITY OF IQALUIT
WASTE TRANSFER STATION

PROPOSED CONDITIONS SITE PLAN

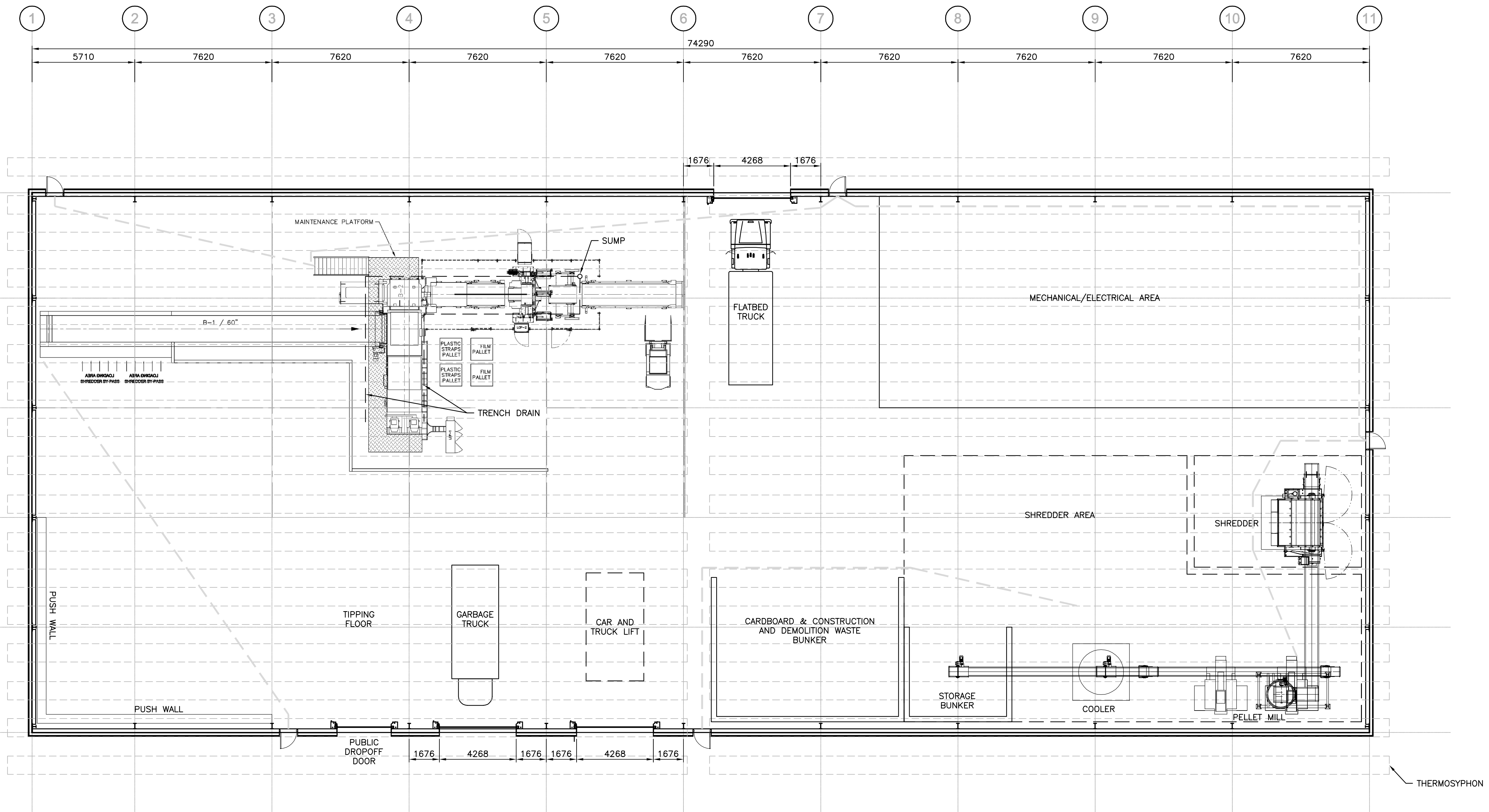
SUBJECT NO.
19-9543

ET NO.

TS-C02

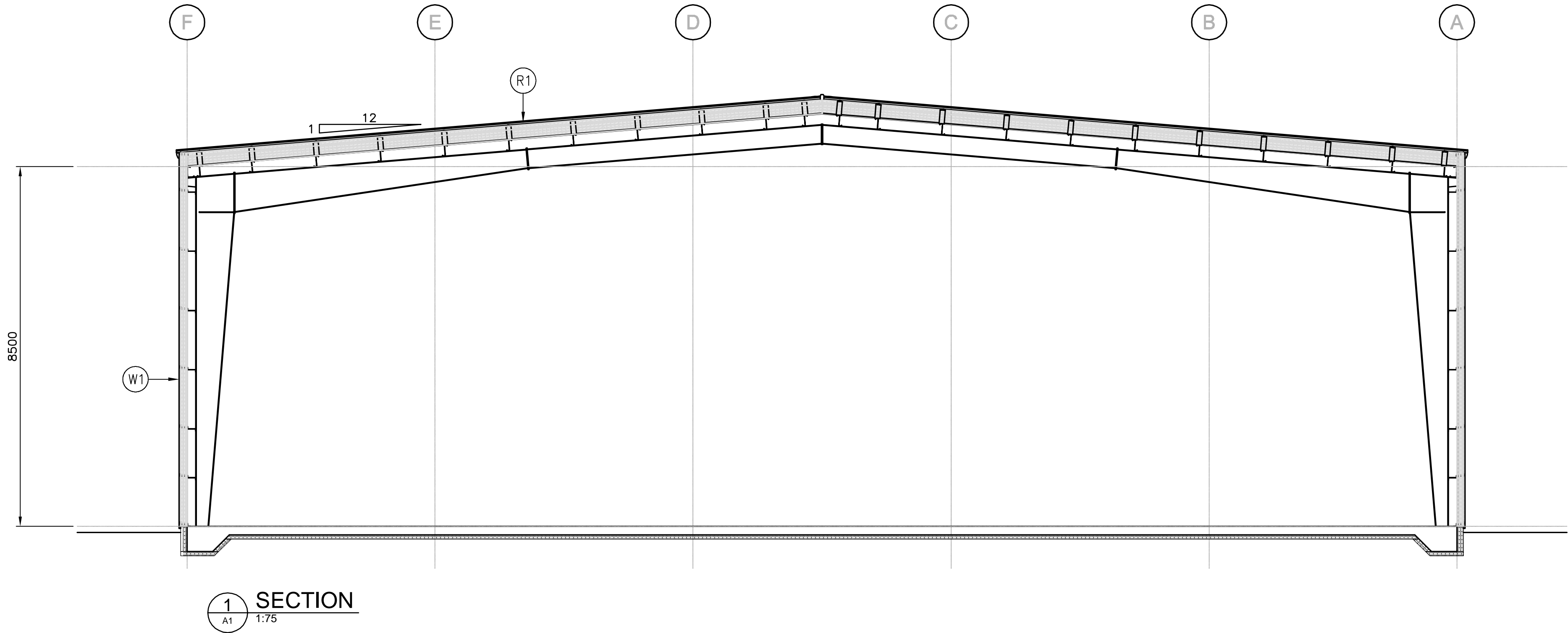


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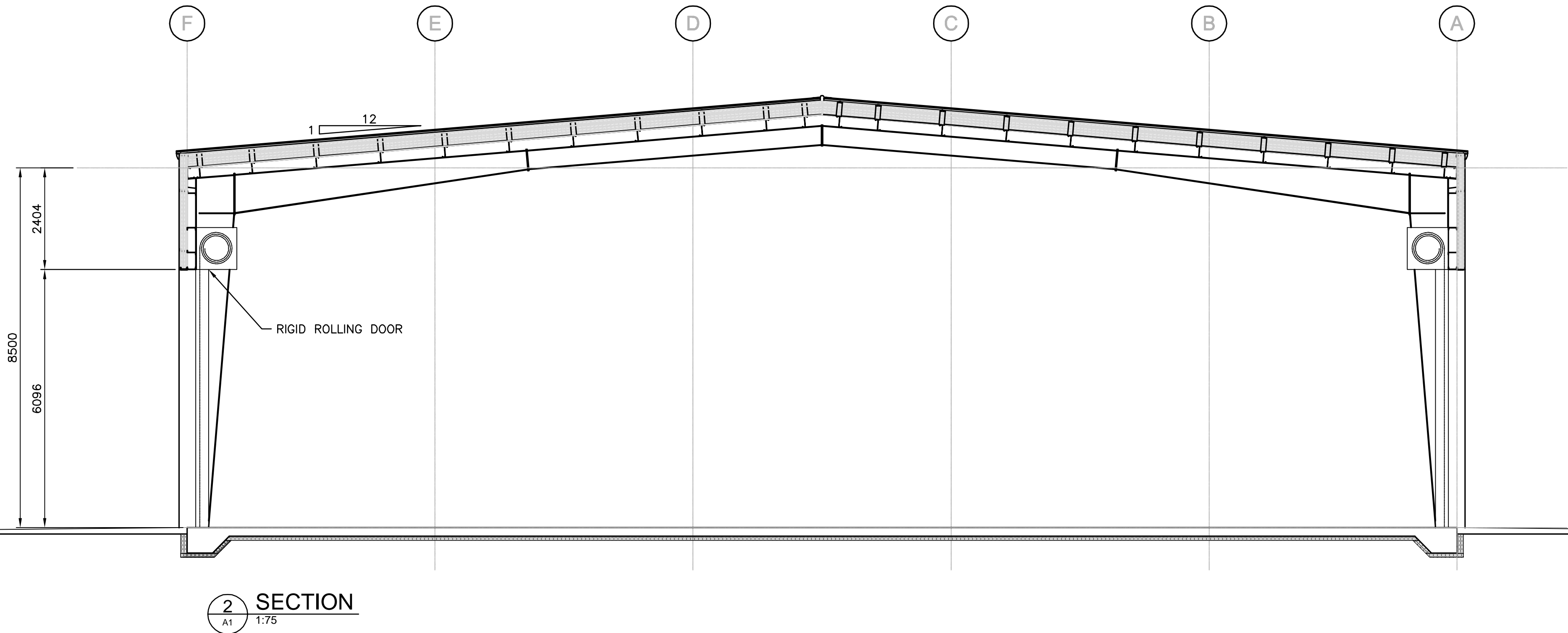


MTS-A01

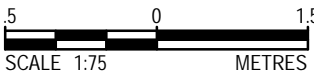
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PLOT DATE: 2019-06-05 @ 12:00:49 PM PLOT SCALE: 1:25.4 PLOT STYLE: DILLON-STANDARD.CTB



WALL AND PARTITION SCHEDULE	
TYPE	DESCRIPTION
W1	38 PREFINISHED METAL SIDING 152 SEMI RIGID INSULATION (R19) WITH NOTCHED Z SUB GIRTS 16 METAL LINER PANEL / VAPOUR BARRIER 203 Z GIRTS
P1	TO BE DETERMINED



ROOF SCHEDULE	
TYPE	DESCRIPTION
R1	38 STANDING SEAM ROOF PANELS 51 HAT CHANNELS THERMAL HAT CLIPS TO PROVIDE DEPTH FOR R40 INSULATION R40 SEMI RIGID INSULATION 16 LINER PANE / VAPOUR BARRIER 254 ROOF PURLINS



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DESIGN	JAA	REVIEWED BY	
DRAWN	PDR	CHECKED BY	
DATE	MAY 2019	SCALE	NOTED
1	30% REVIEW	20190604	K.B.
No.	ISSUED FOR	DATE	BY

CITY OF IQALUIT
WASTE TRANSFER STATION

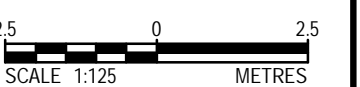
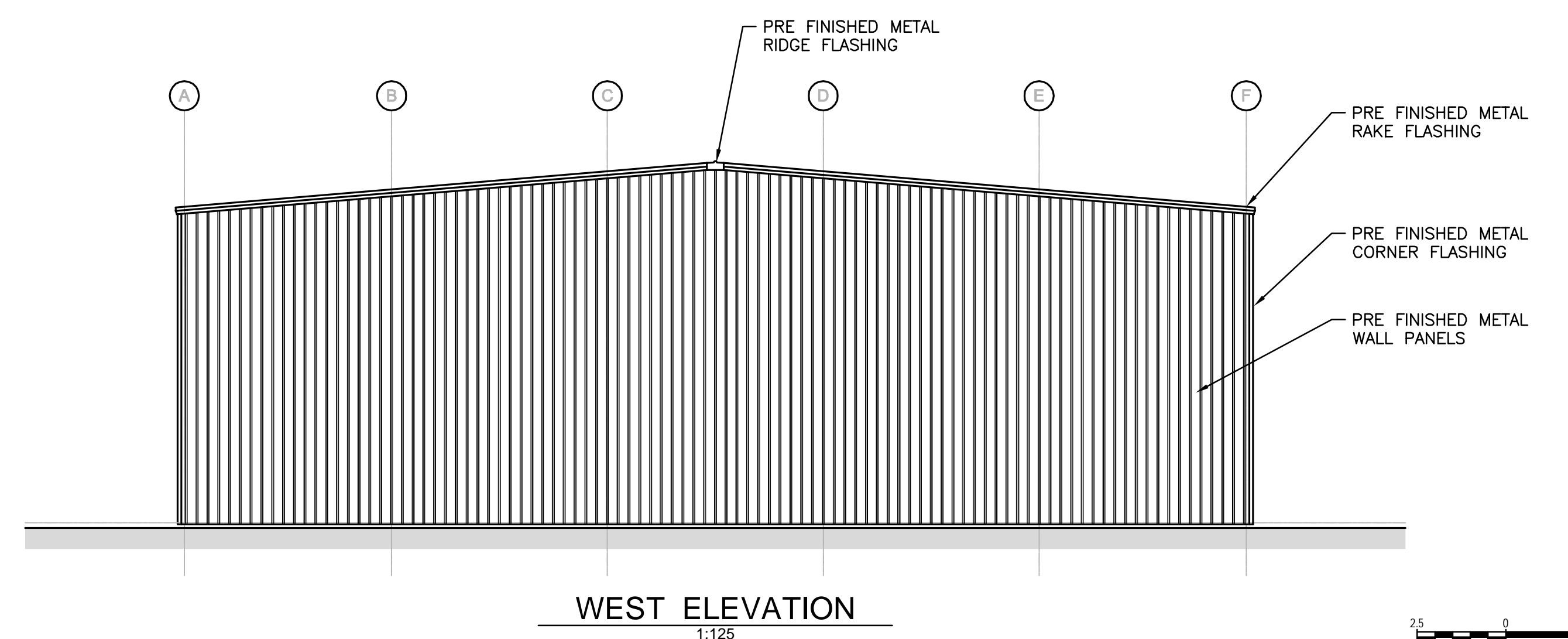
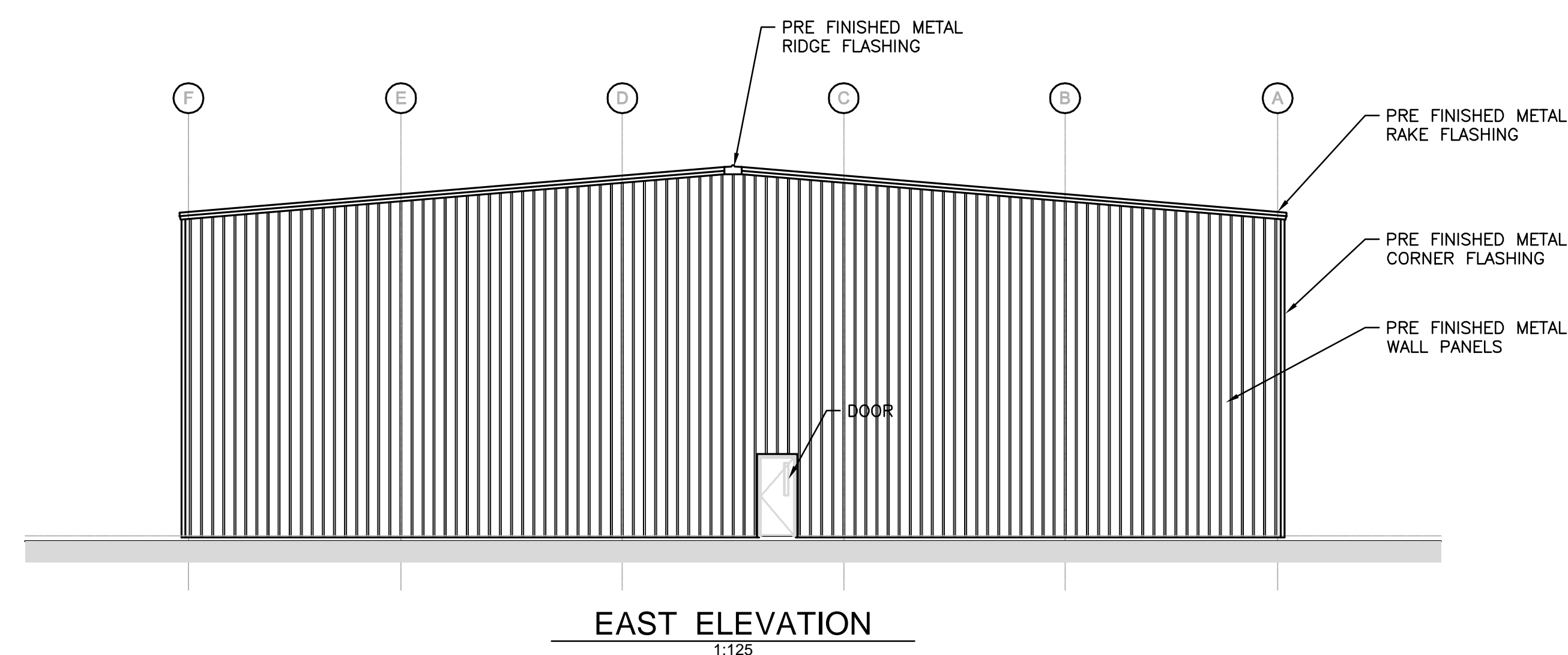
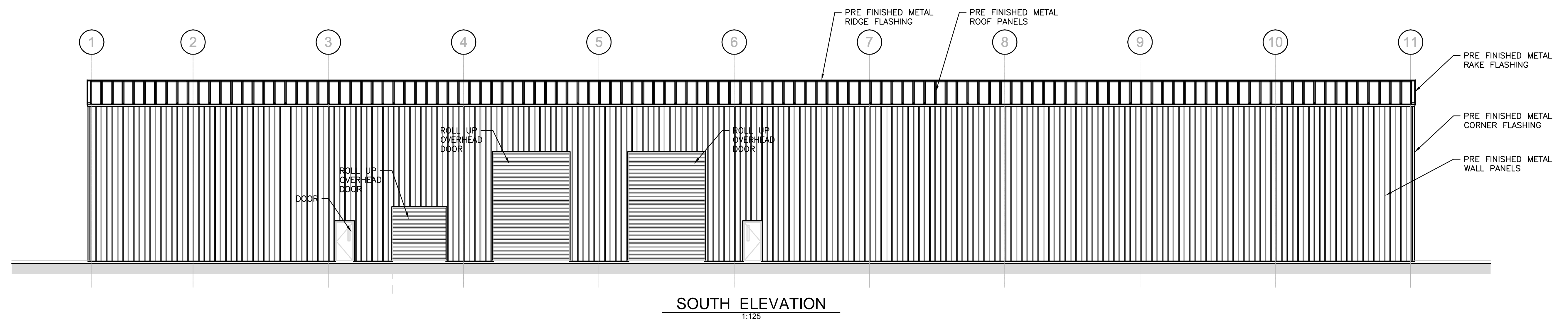
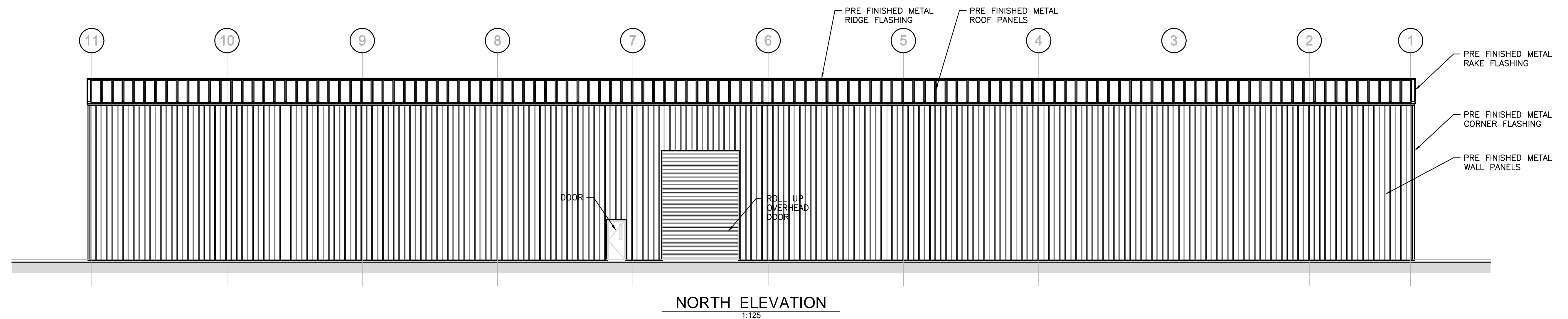
PROJECT NO.

19-9543

SHEET NO.

WTS-A02

CROSS SECTIONS



Conditions of Use

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								DESIGN JAA	REVIEWED BY	CITY OF IOALUIT WASTE TRANSFER STATION	PROJECT NO. 19-9543
								DRAWN PDR	CHECKED BY	BUILDING ELEVATIONS	SHEET NO.
								DATE MAY 2019			WTS-A03
								SCALE	NOTED		
1	30% REVIEW			2019/06/04	K.B.						
No.	ISSUED FOR			DATE	BY						

- GENERAL NOTES:
- CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS ON SITE PRIOR TO COMMENCING WITH CONSTRUCTION WORKS.
 - DO NOT SCALE FROM THE DRAWINGS.
 - THESE DRAWINGS TO BE READ IN CONJUNCTION WITH THE CONTRACT SPECIFICATIONS, CIVIL DRAWINGS, ARCHITECTURAL DRAWINGS, MECHANICAL DRAWINGS, AND ELECTRICAL DRAWINGS.
 - ALL WORK SHALL CONFORM TO THE LATEST NATIONAL BUILDING CODE 2015. ALL REFERENCES TO CODES, STANDARDS, SPECIFICATIONS, GUIDELINES, ETC. SHALL MEAN THE LATEST EDITION APPLICABLE.
 - DO NOT CONSTRUCT FROM THIS DRAWING UNLESS MARKED "ISSUED FOR CONSTRUCTION".
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR SITE PREPARATION AS PER DRAWINGS
 - TEMPORARY SUPPORT AND BRACING FOR CONSTRUCTION LOADING AND CONDITIONS IS THE RESPONSIBILITY OF THE CONTRACTOR.
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR APPLYING AND SECURING ALL NECESSARY PERMITS.
 - THE CONTRACTOR SHALL BE PRESENT AT SITE REVIEW MEETINGS.

DESIGN LOADS	
CLIMATIC DATA:	CITY OF IQALUIT
IMPORTANCE FACTOR:	NORMAL
WIND LOAD	
REFERENCE HOURLY WIND PRESSURE (1/10)	0.45 kPa
REFERENCE HOURLY WIND PRESSURE (1/50)	0.58 kPa
SNOW LOAD	
S _s	2.9 kPa
S _r	0.2 kPa
SEISMIC DATA	
S _a	0.087
S _a	0.065
S _a	0.043
S _a	0.023
S _a	0.0058
S _a	0.0025
PGA	0.051
PGV	0.052
DEAD LOAD	
BUILDING	
SHREDDER	
LIVE LOAD	
STORAGE AREA	4.8 kPa

- GEOTECHNICAL NOTES
- GEOTECHNICAL INVESTIGATION WAS CONDUCTED BY EXP. SERVICES INC. AND THE GEOTECHNICAL REPORT HAS BEEN PREPARED FOR THE PROJECT DATED OCTOBER 19, 2018 ENTITLED "CITY OF IQALUIT GEOTECHNICAL INVESTIGATION" PROJ # OTT-00248813-A0.
 - GEOHERMAL ANALYSIS WAS CONDUCTED BY WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS, DATED MAY 14, 2019, ENTITLED "GEOHERMAL MODELLING AND GEOTECHNICAL RECOMMENDATIONS TRANSFER STATION AND LANDFILL IN IQALUIT, NUNAVUT PROJECT # CG14359.
 - SHORING IS THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE DESIGNED BY OTHERS.

- BACKFILL AND COMPACTION
- A GEOTECHNICAL ENGINEER OR QUALIFIED PERSONNEL SHALL BE RETAINED TO INSPECT & CONFIRM THE COMPACTION AND THE FEE BE PAID FOR BY THE OWNER OR COMPACTION TESTS TO BE ARRANGED AND PAID FOR BY THE OWNER.
 - ALL BACKFILL MATERIALS AND BACKFILL PLACEMENT SHALL BE REVIEWED BY QUALIFIED GEOTECHNICAL PERSONNEL.

- SITE REVIEW AND SHOP DRAWING REVIEW
- NOTIFY THE ENGINEER 24 HOURS PRIOR TO POURING CONCRETE FOR SITE REVIEW.
 - PREPARE AND SUBMIT ALL REQUIRED SHOP DRAWINGS FOR REVIEW 7 DAYS PRIOR TO FABRICATION.
 - THE REVIEW IS ONLY FOR THE WORK SHOWN ON THE STRUCTURAL DRAWINGS AND IS TO ASCERTAIN THAT THE WORK IS IN GENERAL CONFORMANCE WITH THE DRAWINGS.
 - THE REVIEW DOES NOT RELIEVE THE CONTRACTOR RESPONSIBILITY TO PERFORM THE WORK IN CONFORMANCE WITH THE CONTRACT DOCUMENTS.
 - THE REVIEW DOES NOT RELIEVE THE CONTRACTOR RESPONSIBILITY FOR THE OMISSIONS OF THE CONTRACTOR, SUBCONTRACTORS OR TRADES PERFORMING THE WORK.

- REINFORCING STEEL
- ALL REINFORCING SHALL BE BLACK STEEL CONFORMING TO CSA G30.18, GRADE 400W.
or REINFORCING STEEL SHALL CONFORM TO CSA G30.18-09 GRADE 400. USE GRADE 400W WHERE WELDING IS REQUIRED OR NOTED.
 - ALL REBAR SHALL BE STORED ON WOOD BLOCKING AT THE SITE.
 - REINFORCEMENT SHALL BE FREE OF CLAY, DIRT AND FORM OIL OR OTHER DELETERIOUS MATERIAL WHICH WOULD REDUCE THE BOND TO CONCRETE.
 - CONCRETE COVER SHALL CONFORM TO THE FOLLOWING LIST:

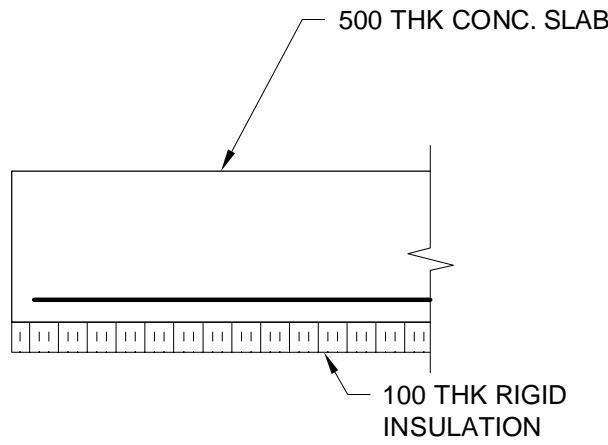
SLAB BOTTOM & SIDES	75 mm
TOP OF SLAB	100 mm
 - LAP SLICE LENGTH FOR 20M SHALL BE 1200 mm.
 - CLEAR SPACING SHALL BE GREATER THAN 2 TIMES BAR DIAMETER.
 - CONTRACTOR SHALL PREPARE AND SUBMIT DETAILED REINFORCING STEEL DRAWINGS FOR REVIEW PRIOR TO COMMENCING FABRICATION.
 - DO NOT FIELD BEND REINFORCEMENT EXCEPT WHERE INDICATED AND WHERE AUTHORIZED BY THE ENGINEER.
 - REPLACE BARS WHICH DEVELOP CRACKS OR SPLITS.
 - PLACE REINFORCING STEEL IN ACCORDANCE WITH CAN/CSA-A23.1.
 - NOTIFY THE ENGINEER 24 HOURS PRIOR TO POURING CONCRETE FOR SITE REVIEW. THE REVIEW IS ONLY FOR THE WORK SHOWN ON THE STRUCTURAL DRAWINGS AND IS TO ASCERTAIN THAT THE WORK IS IN GENERAL CONFORMANCE WITH THE DRAWINGS.

- CONCRETE FORMWORK
- FORM WORK TO CONFORM TO CSA A23.1/A23.2. or THE LATEST BUILDING CODE.
 - FORM STRIPPING AGENT - COLORLESS MINERAL OIL, NON-TOXIC, BIODEGRADABLE, FREE OF KEROSENE.
 - PROVIDE BRACING TO ENSURE STABILITY OF FORMWORK.
 - DO NOT PLACE SHORES AND MUD SILLS ON FROZEN GROUND.
 - FORM WORK SHALL BE CLEANED OF DEBRIS BEFORE PLACING CONCRETE.
 - REMOVE ALL LOOSE CONCRETE FROM TOPS OF PILES.
 - ENSURE TOPS OF PILES ARE SOUND CONCRETE.
 - FORMWORK TO FOLLOW THE MAXIMUM TOLERANCES:

HORIZONTAL AND VERTICAL LINES	3/8" in 65' 0"
WALLS	¼"
CROSS SECTIONAL DIMENSION BEAMS	±1/8"
CAMBER, BEAMS	0.2% OF SPAN
CAMBER, SLABS	0.1% OF SPAN FOR ALL SPAN ≥ 10' 0"
 - LEAVE FORM WORK IN PLACE FOR THE FOLLOWING MINIMUM OF 7 DAYS FOR GRADE BEAMS AND 5 DAYS FOR SLABS OR UNTIL THE CONCRETE HAS REACHED 70% OF ITS DESIGN STRENGTH.
 - DO NOT WEDGE PRY BARS OR HAMMERS AGAINST CONCRETE SURFACES.

- CAST-IN-PLACE CONCRETE
- CONCRETE MATERIAL, QUALITY, MIXING, PLACING, FORMWORK AND OTHER CONSTRUCTION PRACTICES TO CONFORM TO CSA A23.1/A23.2.
 - CONCRETE FALSE WORK/FORMWORKS SHALL CONFORM TO CSA A269.1.
 - ALL CONCRETE SHALL BE NORMAL WEIGHT CONCRETE.
 - ADMIXTURES CONTAINING CALCIUM CHLORIDE ARE NOT ALLOWED.
 - ALL EXPOSED CORNERS SHALL HAVE A 1" CHAMFER OR FILLET UNLESS NOTED OTHERWISE.
 - CONCRETE STRENGTH AND MIX SPECIFICATIONS ARE AS FOLLOWED, UNLESS NOTED OTHERWISE:

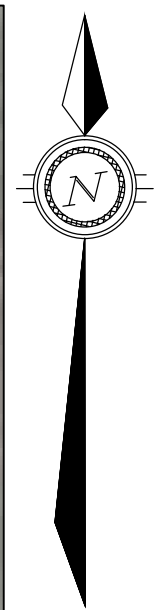
EXP. CLASS	SUPPLY AND USE	MAX. W/C	STRENGTH	CEMENT TYPE	SLUMP	MAX. AGG. SIZE	AIR ENTRAINMENT	MAX. FLY ASH CONTENT
C-1	STRUCTURAL SLAB	0.40	35 MPa @ 28 DAYS	GU	120mm ± 25mm	19mm	5% -8%	25%
 - FINISH CONCRETE IN ACCORDANCE WITH CAN/CSA-A23.1
 - REJECT ALL CONCRETE IF BATCHING TIME AND PLACING TIME EXCEEDS TWO HOURS.
 - CONTRACTOR SHALL PREPARE AND SUBMIT CONCRETE MIX DESIGN SHOP DRAWINGS FOR REVIEW 7 DAYS PRIOR TO COMMENCING RELATED WORK.
 - PROVIDE CERTIFICATION FOR PLANT, EQUIPMENT, AND MATERIAL TO BE USED IN CONCRETE COMPLY WITH REQUIREMENTS OF CAN/CSA-123.1
- HOT WEATHER REQUIREMENTS
- WHEN THE AMBIENT TEMPERATURE IS AT OR ABOVE 25°C OR WHEN THERE IS A PROBABILITY OF THE AMBIENT TEMPERATURE RISING TO OR ABOVE 25°C DURING CONCRETE PLACEMENT, THE TEMPERATURE OF CONCRETE WHEN PLACED IS NOT TO BE MORE THAN 25°C. TO ACCOMPLISH THIS, THE MIXING WATER, IF NECESSARY THE AGGREGATES, IS TO BE COOLED.
 - WHEN POURS ARE MASSIVE OR WHERE SURFACES ARE TO BE TROWEL FINISHED, OR WOOD FLOATED, USE A RETARDER THAT WILL SLOW THE INITIAL SET OF THE CONCRETE.
 - WHEN THE AMBIENT TEMPERATURE IS AT OR ABOVE 25°C, EXPOSED SURFACES OF THE CONCRETE ARE TO BE SHADED FROM DIRECT SUN RAY AND SHELTERED FROM DIRECT WIND.
 - MOIST CURE CONCRETE WHEN THE AMBIENT TEMPERATURE IS AT OR ABOVE 25°C INSTEAD OF USING CURING COMPOUNDS.
- COLD WEATHER REQUIREMENTS
- WHEN THE AMBIENT TEMPERATURE IS AT OR BELOW 5°C OR WHEN THERE IS A PROBABILITY OF THE AMBIENT TEMPERATURE DROPPING TO OR BELOW 5°C DURING CONCRETE PLACEMENT, THE TEMPERATURE OF CONCRETE DURING PLACING SHALL BE BETWEEN 15°C AND 25°C.
 - PLACED CONCRETE SHALL BE PROTECTED AND MAINTAINED AT A TEMPERATURE OF AT LEAST 10°C FOR NOT LESS THAN 3 DAYS OR NOT LESS THAN 20°C FOR 2 DAYS AND ALL CONCRETE TO BE MAINTAINED ABOVE FREEZING FOR A MINIMUM OF 7 DAYS.
 - CONCRETE SHALL BE PROTECTED FROM ALTERNATE FREEZING AND THAWING FOR A MINIMUM OF 14 DAYS.
 - PROTECTED AND HEATED CONCRETE TO BE BROUGHT GRADUALLY TO AMBIENT AIR TEMPERATURE AT A DROP NOT MORE THAN 15°C PER 24 HOUR PERIOD.
 - HEATING ENCLOSURE SHALL BE CLEAR OF CONCRETE AND FORMING SURFACES FOR AIR CIRCULATION.
 - FROZEN CONCRETE WILL BE REJECTED.




SLAB SECTION
1:125

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PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

TITLE

LOCATION PLAN

design by	A.B.Z	project no.	OTT-00219428-A0
drawn by	A.B.Z	drawing no.	LOC-1
checked by	S.L.B.		
date	30/05/14		
scale	NTS		



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No.	DESCRIPTION	DATE	BY	APP'D	
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PROJECT

PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

TITLE

SITE PLAN

design by	A.B.Z	project no.	OTT-00219428-A0
drawn by	A.B.Z	drawing no.	SP-1
checked by	S.L.B.		
date	30/05/14		
scale	1:2000		



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BENCH MARK

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No.	DESCRIPTION	DATE	BY	APP'D
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NORTHWEST AGGREGATE DEPOSIT**

TITLE
SITE PLAN

design by	A.B.Z	project no.	OTT-00219428-A0
drawn by	A.B.Z	drawing no.	SP-2
checked by	S.L.B.		
date	30/05/14		
scale	1:2000		



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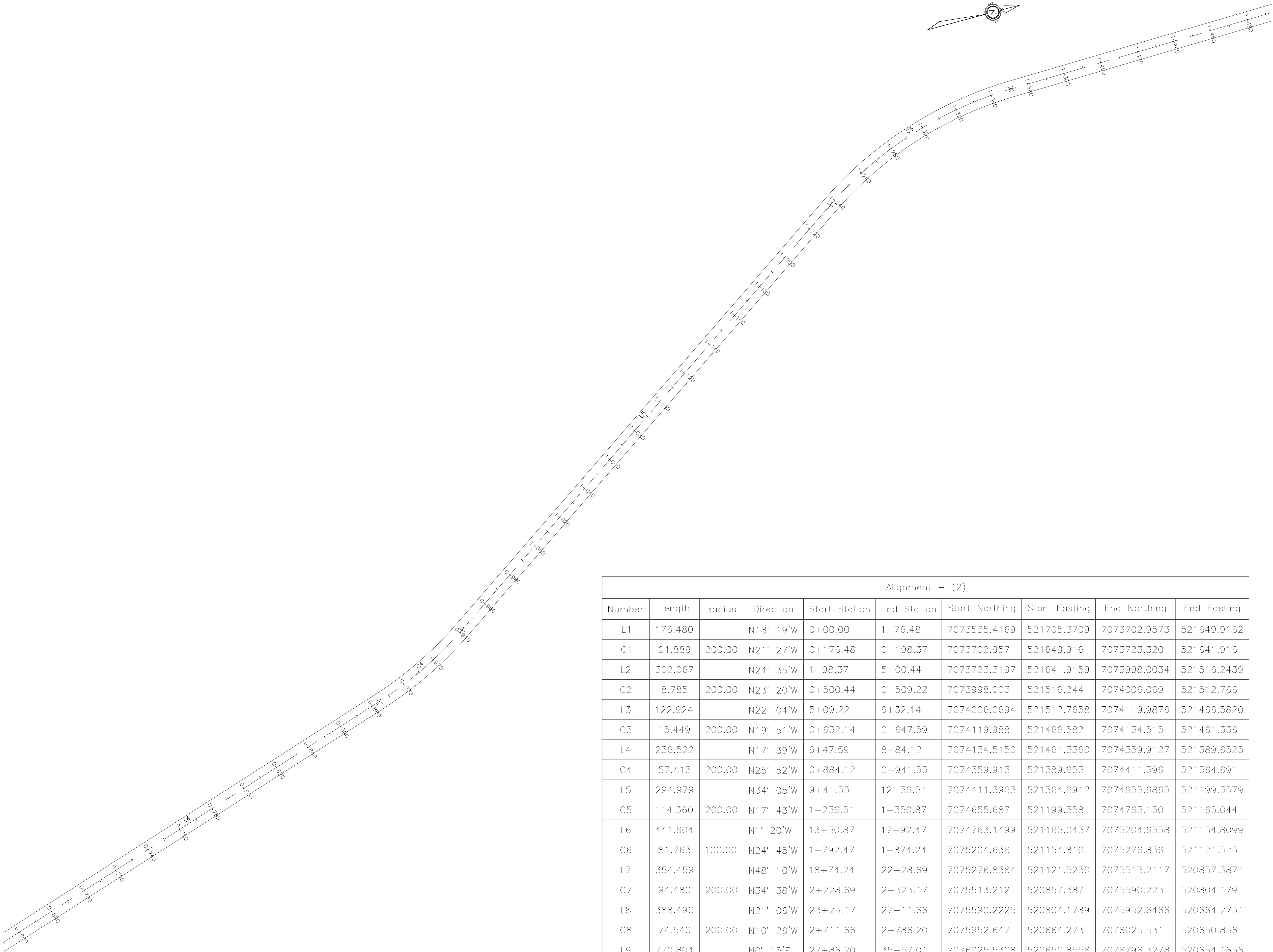
TITLE

SITE PLAN

design by	A.B.Z	project no.	OTT-00219428-AQ
drawn by	A.B.Z	drawing no.	SP-3
checked by	S.L.B.		
date	30/05/14		
scale	1:2000		

Alignment – (2)									
Number	Length	Radius	Direction	Start Station	End Station	Start Northing	Start Easting	End Northing	End Easting
L1	176.480		N18° 19'W	0+00.00	1+76.48	7073535.4169	521705.3709	7073702.9573	521649.9162
C1	21.889	200.00	N21° 27'W	0+176.48	0+198.37	7073702.957	521649.916	7073723.320	521641.916
L2	302.067		N24° 35'W	1+98.37	5+00.44	7073723.3197	521641.9159	7073998.0034	521516.2439
C2	8.785	200.00	N23° 20'W	0+500.44	0+509.22	7073998.003	521516.244	7074006.069	521512.766
L3	122.924		N22° 04'W	5+09.22	6+32.14	7074006.0694	521512.7658	7074119.9876	521466.5820
C3	15.449	200.00	N19° 51'W	0+632.14	0+647.59	7074119.988	521466.582	7074134.515	521461.336
L4	236.522		N17° 39'W	6+47.59	8+84.12	7074134.5150	521461.3360	7074359.9127	521389.6525
C4	57.413	200.00	N25° 52'W	0+884.12	0+941.53	7074359.913	521389.653	7074411.396	521364.691
L5	294.979		N34° 05'W	9+41.53	12+36.51	7074411.3963	521364.6912	7074655.6865	521199.3579
C5	114.360	200.00	N17° 43'W	1+236.51	1+350.87	7074655.687	521199.358	7074763.150	521165.044
L6	441.604		N1° 20'W	13+50.87	17+92.47	7074763.1499	521165.0437	7075204.6358	521154.8099
C6	81.763	100.00	N24° 45'W	1+792.47	1+874.24	7075204.636	521154.810	7075276.836	521121.523
L7	354.459		N48° 10'W	18+74.24	22+28.69	7075276.8364	521121.5230	7075513.2117	520857.3871
C7	94.480	200.00	N34° 38'W	2+228.69	2+323.17	7075513.212	520857.387	7075590.223	520804.179
L8	388.490		N21° 06'W	23+23.17	27+11.66	7075590.2225	520804.1789	7075952.6466	520664.2731
C8	74.540	200.00	N10° 26'W	2+711.66	2+786.20	7075952.647	520664.273	7076025.531	520650.856
L9	770.804		N0° 15'E	27+86.20	35+57.01	7076025.5308	520650.8556	7076796.3278	520654.1656
C9	60.585	200.00	N8° 26'W	3+557.01	3+617.59	7076796.328	520654.166	7076856.029	520645.315
L10	352.661		N17° 07'W	36+17.59	39+70.25	7076856.0293	520645.3154	7077193.0810	520541.5580





Alignment – (2)									
Number	Length	Radius	Direction	Start Station	End Station	Start Northing	Start Easting	End Northing	End Easting
L1	176.480		N18° 19'W	0+00.00	1+76.48	7073535.4169	521705.3709	7073702.9573	521649.9162
C1	21.889	200.00	N21° 27'W	0+176.48	0+198.37	7073702.957	521649.916	7073723.320	521641.916
L2	302.067		N24° 35'W	1+98.37	5+00.44	7073723.3197	521641.9159	7073998.0034	521516.2439
C2	8.785	200.00	N23° 20'W	0+500.44	0+509.22	7073998.003	521516.244	7074006.069	521512.766
L3	122.924		N22° 04'W	5+09.22	6+32.14	7074006.0694	521512.7658	7074119.9876	521466.5820
C3	15.449	200.00	N19° 51'W	0+632.14	0+647.59	7074119.988	521466.582	7074134.515	521461.336
L4	236.522		N17° 39'W	6+47.59	8+84.12	7074134.5150	521461.3360	7074359.9127	521389.6525
C4	57.413	200.00	N25° 52'W	0+884.12	0+941.53	7074359.913	521389.653	7074411.396	521364.691
L5	294.979		N34° 05'W	9+41.53	12+36.51	7074411.3963	521364.6912	7074655.6865	521199.3579
C5	114.360	200.00	N17° 43'W	1+236.51	1+350.87	7074655.687	521199.358	7074763.150	521165.044
L6	441.604		N1° 20'W	13+50.87	17+92.47	7074763.1499	521165.0437	7075204.6358	521154.8099
C6	81.763	100.00	N24° 45'W	1+792.47	1+874.24	7075204.636	521154.810	7075276.836	521121.523
L7	354.459		N48° 10'W	18+74.24	22+28.69	7075276.8364	521121.5230	7075513.2117	520857.3871
C7	94.480	200.00	N34° 38'W	2+228.69	2+323.17	7075513.212	520857.387	7075590.223	520804.179
L8	388.490		N21° 06'W	23+23.17	27+11.66	7075590.2225	520804.1789	7075952.6466	520664.2731
C8	74.540	200.00	N10° 26'W	2+711.66	2+786.20	7075952.647	520664.273	7076025.531	520650.856
L9	770.804		N0° 15'E	27+86.20	35+57.01	7076025.5308	520650.8556	7076796.3278	520654.1656
C9	60.585	200.00	N8° 26'W	3+557.01	3+617.59	7076796.328	520654.166	7076856.029	520645.315
L10	352.661		N17° 07'W	36+17.59	39+70.25	7076856.0293	520645.3154	7077193.0810	520541.5580

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PROJECT
PROPOSED ROAD TO
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TITLE
LAYOUT PLAN

design by A.B.Z	project no. OTT-00219428-A0
drawn by A.B.Z	drawing no.
checked by S.L.B.	
date 30/05/14	
scale 1:1000	

LP-2



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DATE: AUGUST 13, 2014

BENCH MARK

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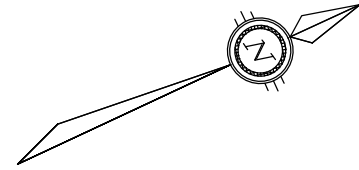
PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

LAYOUT PLAN

design by	A.B.Z	project no.	OTT-00219428-A0
drawn by	A.B.Z	drawing no.	LP-3
checked by	S.L.B.		
date	30/05/14		
scale	1:1000		



Alignment – (2)									
Number	Length	Radius	Direction	Start Station	End Station	Start Northing	Start Easting	End Northing	End Easting
L1	176.480		N18° 19'W	0+00.00	1+76.48	7073535.4169	521705.3709	7073702.9573	521649.9162
C1	21.889	200.00	N21° 27'W	0+176.48	0+198.37	7073702.957	521649.916	7073723.320	521641.916
L2	302.067		N24° 35'W	1+98.37	5+00.44	7073723.3197	521641.9159	7073998.0034	521516.2439
C2	8.785	200.00	N23° 20'W	0+500.44	0+509.22	7073998.003	521516.244	7074006.069	521512.766
L3	122.924		N22° 04'W	5+09.22	6+32.14	7074006.0694	521512.7658	7074119.9876	521466.5820
C3	15.449	200.00	N19° 51'W	0+632.14	0+647.59	7074119.988	521466.582	7074134.515	521461.336
L4	236.522		N17° 39'W	6+47.59	8+84.12	7074134.5150	521461.3360	7074359.9127	521389.6525
C4	57.413	200.00	N25° 52'W	0+884.12	0+941.53	7074359.913	521389.653	7074411.396	521364.691
L5	294.979		N34° 05'W	9+41.53	12+36.51	7074411.3963	521364.6912	7074655.6865	521199.3579
C5	114.360	200.00	N17° 43'W	1+236.51	1+350.87	7074655.687	521199.358	7074763.150	521165.044
L6	441.604		N1° 20'W	13+50.87	17+92.47	7074763.1499	521165.0437	7075204.6358	521154.8099
C6	81.763	100.00	N24° 45'W	1+792.47	1+874.24	7075204.636	521154.810	7075276.836	521121.523
L7	354.459		N48° 10'W	18+74.24	22+28.69	7075276.8364	521121.5230	7075513.2117	520857.3871
C7	94.480	200.00	N34° 38'W	2+228.69	2+323.17	7075513.212	520857.387	7075590.223	520804.179
L8	388.490		N21° 06'W	23+23.17	27+11.66	7075590.2225	520804.1789	7075952.6466	520664.2731
C8	74.540	200.00	N10° 26'W	2+711.66	2+786.20	7075952.647	520664.273	7076025.531	520650.856
L9	770.804		N0° 15'E	27+86.20	35+57.01	7076025.5308	520650.8556	7076796.3278	520654.1656
C9	60.585	200.00	N8° 26'W	3+557.01	3+617.59	7076796.328	520654.166	7076856.029	520645.315
L10	352.661		N17° 07'W	36+17.59	39+70.25	7076856.0293	520645.3154	7077193.0810	520541.5580



Alignment - (2)									
Number	Length	Radius	Direction	Start Station	End Station	Start Northing	Start Easting	End Northing	End Easting
L1	176.480		N18° 19'W	0+00.00	1+76.48	7073535.4169	521705.3709	7073702.9573	521649.9162
C1	21.889	200.00	N21° 27'W	0+176.48	0+198.37	7073702.957	521649.916	7073723.320	521641.916
L2	302.067		N24° 35'W	1+98.37	5+00.44	7073723.3197	521641.9159	7073998.0034	521516.2439
C2	8.785	200.00	N23° 20'W	0+500.44	0+509.22	7073998.003	521516.244	7074006.069	521512.766
L3	122.924		N22° 04'W	5+09.22	6+32.14	7074006.0694	521512.7658	7074119.9876	521466.5820
C3	15.449	200.00	N19° 51'W	0+632.14	0+647.59	7074119.988	521466.582	7074134.515	521461.336
L4	236.522		N17° 39'W	6+47.59	8+84.12	7074134.5150	521461.3360	7074359.9127	521389.6525
C4	57.413	200.00	N25° 52'W	0+884.12	0+941.53	7074359.913	521389.653	7074411.396	521364.691
L5	294.979		N34° 05'W	9+41.53	12+36.51	7074411.3963	521364.6912	7074655.6865	521199.3579
C5	114.360	200.00	N17° 43'W	1+236.51	1+350.87	7074655.687	521199.358	7074763.150	521165.044
L6	441.604		N1° 20'W	13+50.87	17+92.47	7074763.1499	521165.0437	7075204.6358	521154.8099
C6	81.763	100.00	N24° 45'W	1+792.47	1+874.24	7075204.636	521154.810	7075276.836	521121.523
L7	354.459		N48° 10'W	18+74.24	22+28.69	7075276.8364	521121.5230	7075513.2117	520857.3871
C7	94.480	200.00	N34° 38'W	2+228.69	2+323.17	7075513.212	520857.387	7075590.223	520804.179
L8	388.490		N21° 06'W	23+23.17	27+11.66	7075590.2225	520804.1789	7075952.6466	520664.2731
C8	74.540	200.00	N10° 26'W	2+711.66	2+786.20	7075952.647	520664.273	7076025.531	520650.856
L9	770.804		N0° 15'E	27+86.20	35+57.01	7076025.5308	520650.8556	7076796.3278	520654.1656
C9	60.585	200.00	N8° 26'W	3+557.01	3+617.59	7076796.328	520654.166	7076856.029	520645.315
L10	352.661		N17° 07'W	36+17.59	39+70.25	7076856.0293	520645.3154	7077193.0810	520541.5580

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DATE: AUGUST 13, 2014

BENCH MARK

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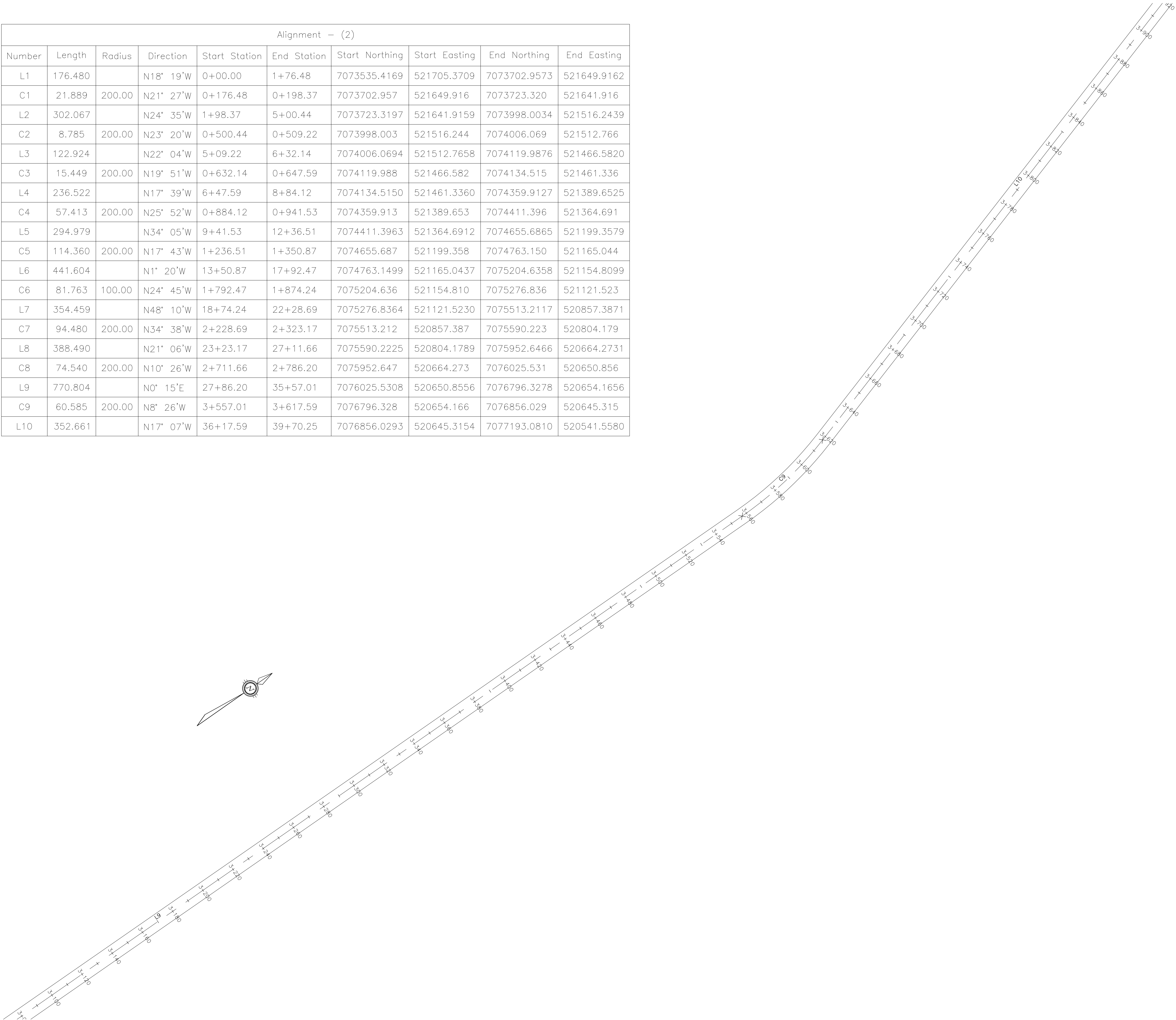
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CITY OF IQALUIT

PROJECT
PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

TITLE
LAYOUT PLAN

design by	A.B.Z	project no.	OTT-00219428-AQ
drawn by	A.B.Z	drawing no.	LP-4
checked by	S.L.B.	date	
date	30/05/14	scale	
scale	1:1000		

Alignment — (2)									
Number	Length	Radius	Direction	Start Station	End Station	Start Northing	Start Easting	End Northing	End Easting
L1	176.480		N18° 19'W	0+00.00	1+76.48	7073535.4169	521705.3709	7073702.9573	521649.9162
C1	21.889	200.00	N21° 27'W	0+176.48	0+198.37	7073702.957	521649.916	7073723.320	521641.916
L2	302.067		N24° 35'W	1+98.37	5+00.44	7073723.3197	521641.9159	7073998.0034	521516.2439
C2	8.785	200.00	N23° 20'W	0+500.44	0+509.22	7073998.003	521516.244	7074006.069	521512.766
L3	122.924		N22° 04'W	5+09.22	6+32.14	7074006.0694	521512.7658	7074119.9876	521466.5820
C3	15.449	200.00	N19° 51'W	0+632.14	0+647.59	7074119.988	521466.582	7074134.515	521461.336
L4	236.522		N17° 39'W	6+47.59	8+84.12	7074134.5150	521461.3360	7074359.9127	521389.6525
C4	57.413	200.00	N25° 52'W	0+884.12	0+941.53	7074359.913	521389.653	7074411.396	521364.691
L5	294.979		N34° 05'W	9+41.53	12+36.51	7074411.3963	521364.6912	7074655.6865	521199.3579
C5	114.360	200.00	N17° 43'W	1+236.51	1+350.87	7074655.687	521199.358	7074763.150	521165.044
L6	441.604		N1° 20'W	13+50.87	17+92.47	7074763.1499	521165.0437	7075204.6358	521154.8099
C6	81.763	100.00	N24° 45'W	1+792.47	1+874.24	7075204.636	521154.810	7075276.836	521121.523
L7	354.459		N48° 10'W	18+74.24	22+28.69	7075276.8364	521121.5230	7075513.2117	520857.3871
C7	94.480	200.00	N34° 38'W	2+228.69	2+323.17	7075513.212	520857.387	7075590.223	520804.179
L8	388.490		N21° 06'W	23+23.17	27+11.66	7075590.2225	520804.1789	7075952.6466	520664.2731
C8	74.540	200.00	N10° 26'W	2+711.66	2+786.20	7075952.647	520664.273	7076025.531	520650.856
L9	770.804		N0° 15'E	27+86.20	35+57.01	7076025.5308	520650.8556	7076796.3278	520654.1656
C9	60.585	200.00	N8° 26'W	3+557.01	3+617.59	7076796.328	520654.166	7076856.029	520645.315
L10	352.661		N17° 07'W	36+17.59	39+70.25	7076856.0293	520645.3154	7077193.0810	520541.5580



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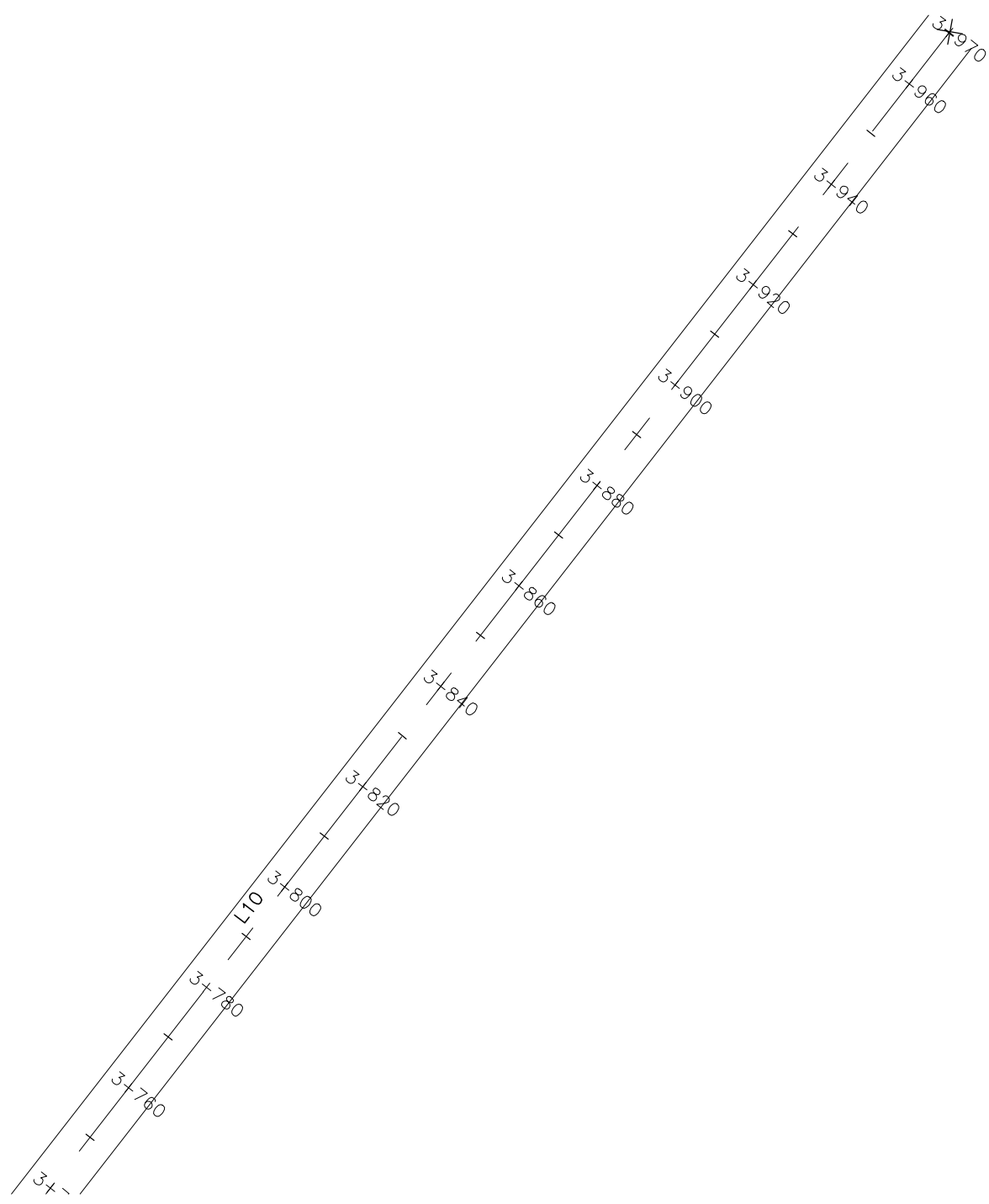
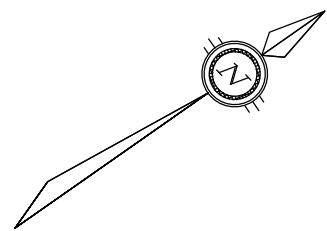
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PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

LAYOUT PLAN

design by	A.B.Z	project no.	OTT-00219428-AQ
drawn by	A.B.Z	drawing no.	LP-5
checked by	S.L.B.	date	
scale	1:1000	30/05/14	



Alignment – (2)									
Number	Length	Radius	Direction	Start Station	End Station	Start Northing	Start Easting	End Northing	End Easting
L1	176.480		N18° 19'W	0+00.00	1+76.48	7073535.4169	521705.3709	7073702.9573	521649.9162
C1	21.889	200.00	N21° 27'W	0+176.48	0+198.37	7073702.957	521649.916	7073723.320	521641.916
L2	302.067		N24° 35'W	1+98.37	5+00.44	7073723.3197	521641.9159	7073998.0034	521516.2439
C2	8.785	200.00	N23° 20'W	0+500.44	0+509.22	7073998.003	521516.244	7074006.069	521512.766
L3	122.924		N22° 04'W	5+09.22	6+32.14	7074006.0694	521512.7658	7074119.9876	521466.5820
C3	15.449	200.00	N19° 51'W	0+632.14	0+647.59	7074119.988	521466.582	7074134.515	521461.336
L4	236.522		N17° 39'W	6+47.59	8+84.12	7074134.5150	521461.3360	7074359.9127	521389.6525
C4	57.413	200.00	N25° 52'W	0+884.12	0+941.53	7074359.913	521389.653	7074411.396	521364.691
L5	294.979		N34° 05'W	9+41.53	12+36.51	7074411.3963	521364.6912	7074655.6865	521199.3579
C5	114.360	200.00	N17° 43'W	1+236.51	1+350.87	7074655.687	521199.358	7074763.150	521165.044
L6	441.604		N1° 20'W	13+50.87	17+92.47	7074763.1499	521165.0437	7075204.6358	521154.8099
C6	81.763	100.00	N24° 45'W	1+792.47	1+874.24	7075204.636	521154.810	7075276.836	521121.523
L7	354.459		N48° 10'W	18+74.24	22+28.69	7075276.8364	521121.5230	7075513.2117	520857.3871
C7	94.480	200.00	N34° 38'W	2+228.69	2+323.17	7075513.212	520857.387	7075590.223	520804.179
L8	388.490		N21° 06'W	23+23.17	27+11.66	7075590.2225	520804.1789	7075952.6466	520664.2731
C8	74.540	200.00	N10° 26'W	2+711.66	2+786.20	7075952.647	520664.273	7076025.531	520650.856
L9	770.804		N0° 15'E	27+86.20	35+57.01	7076025.5308	520650.8556	7076796.3278	520654.1656
C9	60.585	200.00	N8° 26'W	3+557.01	3+617.59	7076796.328	520654.166	7076856.029	520645.315
L10	352.661		N17° 07'W	36+17.59	39+70.25	7076856.0293	520645.3154	7077193.0810	520541.5580

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PROJECT

PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

TITLE

LAYOUT PLAN

design by

A.B.Z

project no.

OTT-00219428-A0

drawn by

A.B.Z

drawing no.

checked by

S.L.B.

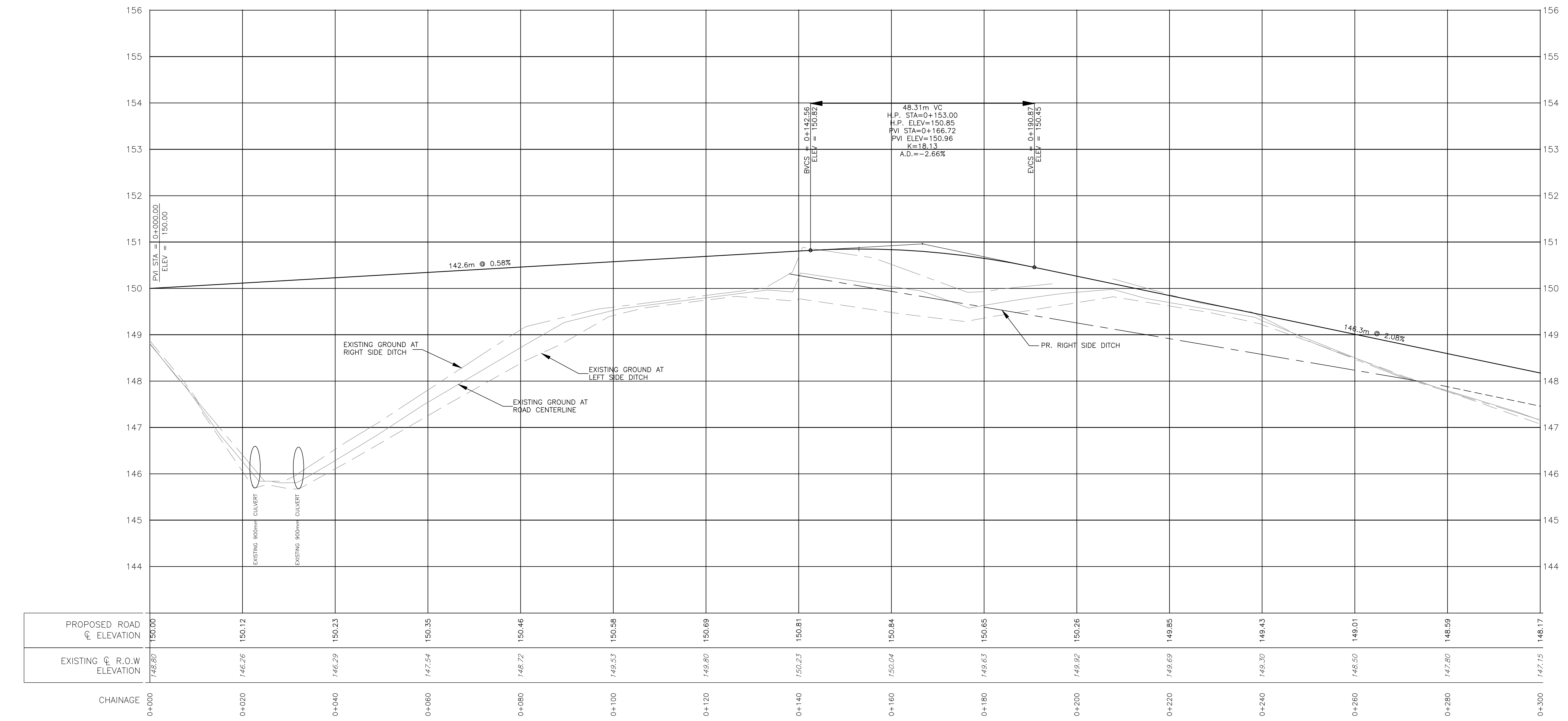
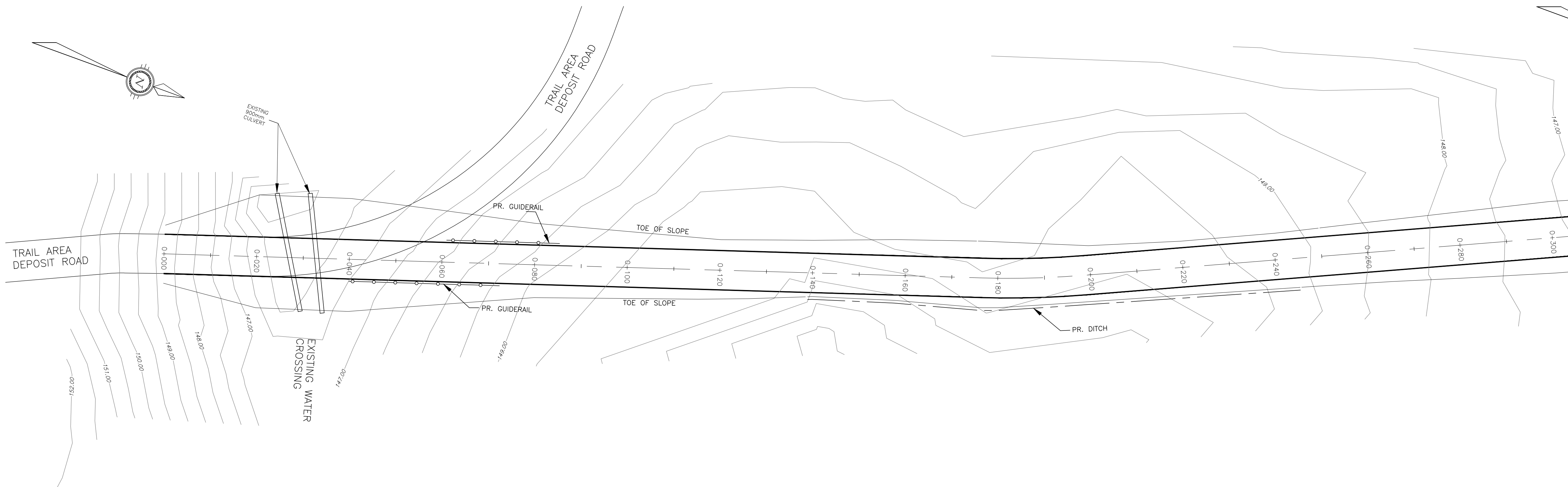
date

30/05/14

scale

1:1000

LP-6



LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

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DATE: AUGUST 13, 2014

No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
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01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB

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PROJECT
PROPOSED ROAD TO NORTHWEST AGGREGATE DEPOSIT

TITLE
PLAN & PROFILE

design by A.B.Z	project no. OTT-00219428-A0
drawn by A.B.Z	drawing no. PP-1
checked by S.L.B.	
date 30/05/14	
scale 1:500 HORIZ. 1:50 VERT.	



LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

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DATE: AUGUST 13, 2014

BENCH MARK

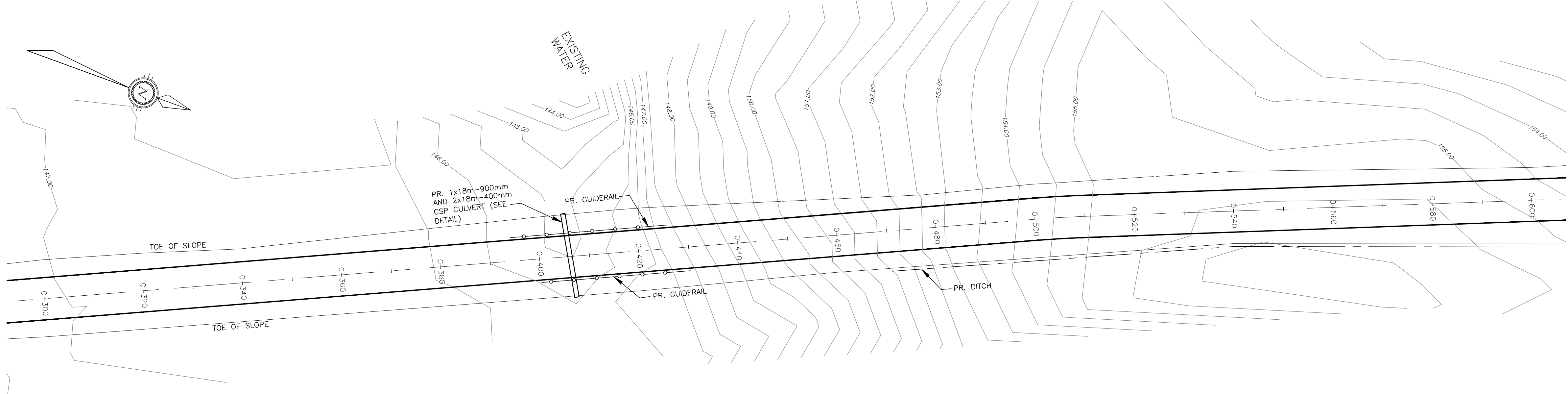
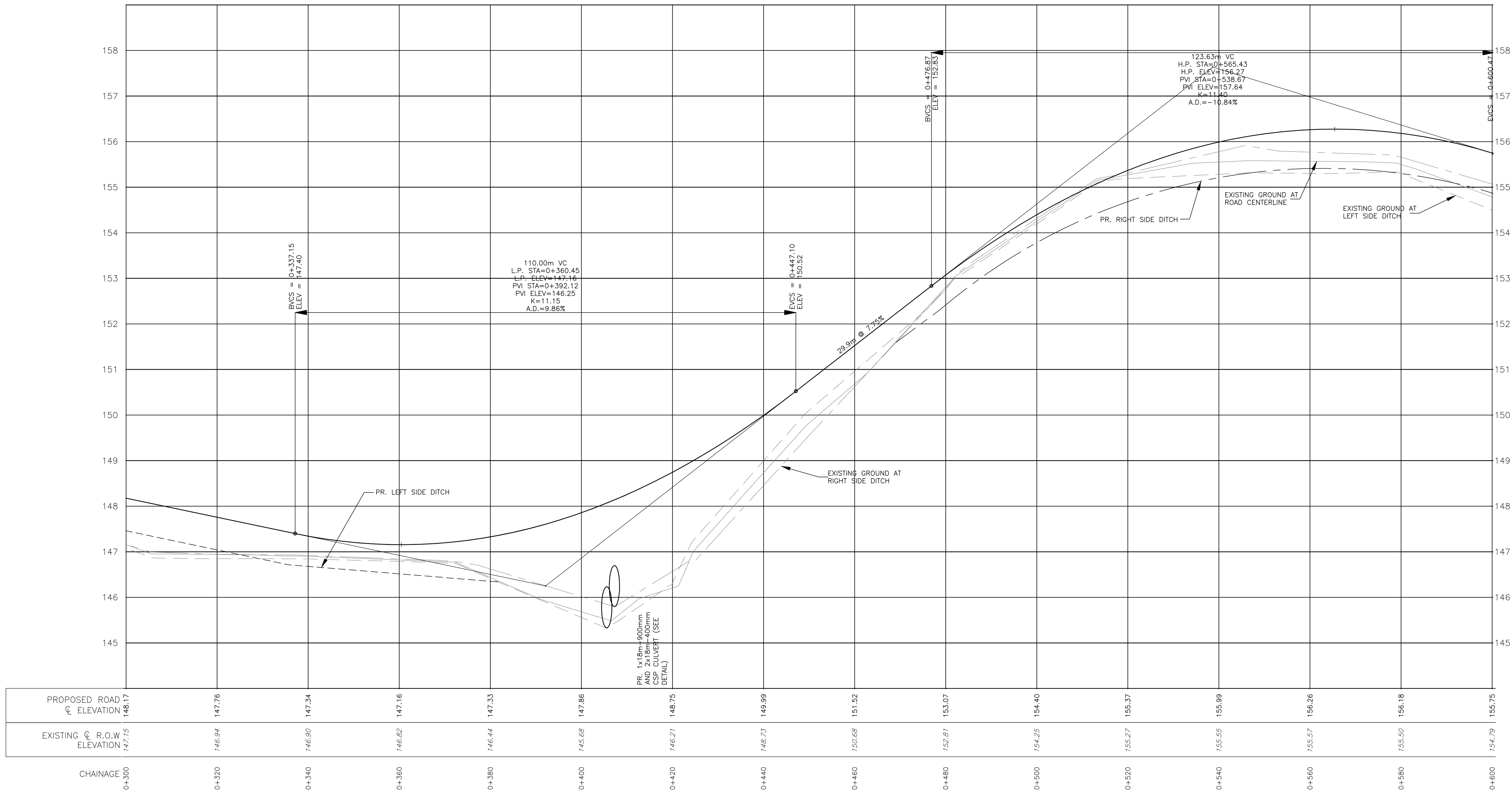
No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB
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PROJECT
PROPOSED ROAD TO NORTHWEST AGGREGATE DEPOSIT

TITLE	
PLAN & PROFILE	
design by	A.B.Z
drawn by	A.B.Z
checked by	S.L.B.
date	30/05/14
scale	1:500 HORIZ. 1:50 VERT.
project no.	OTT-00219428-A0
drawing no.	PP-2



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LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

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DATE: AUGUST 13, 2014

BENCH MARK

No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB
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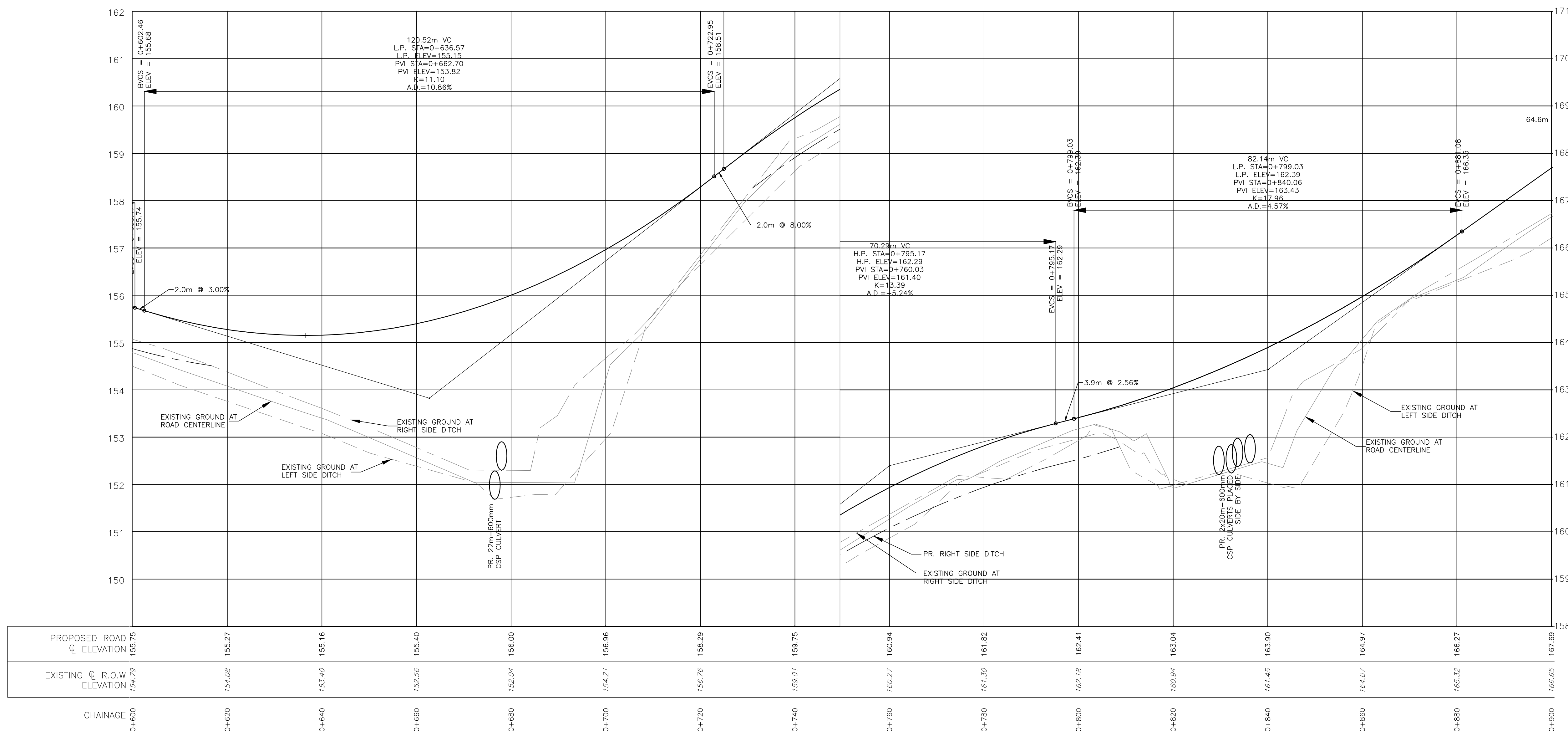
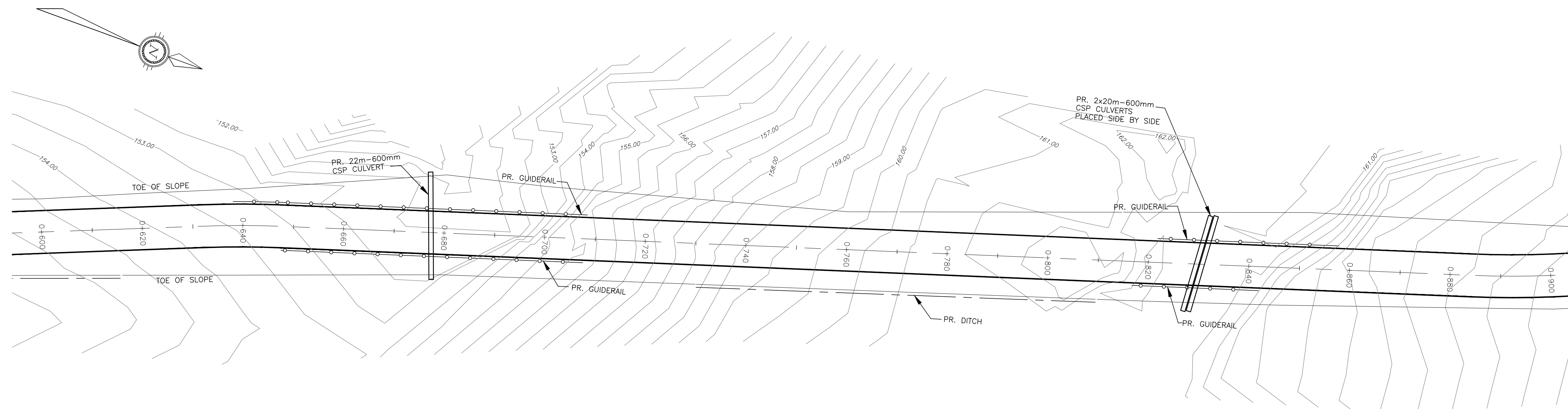
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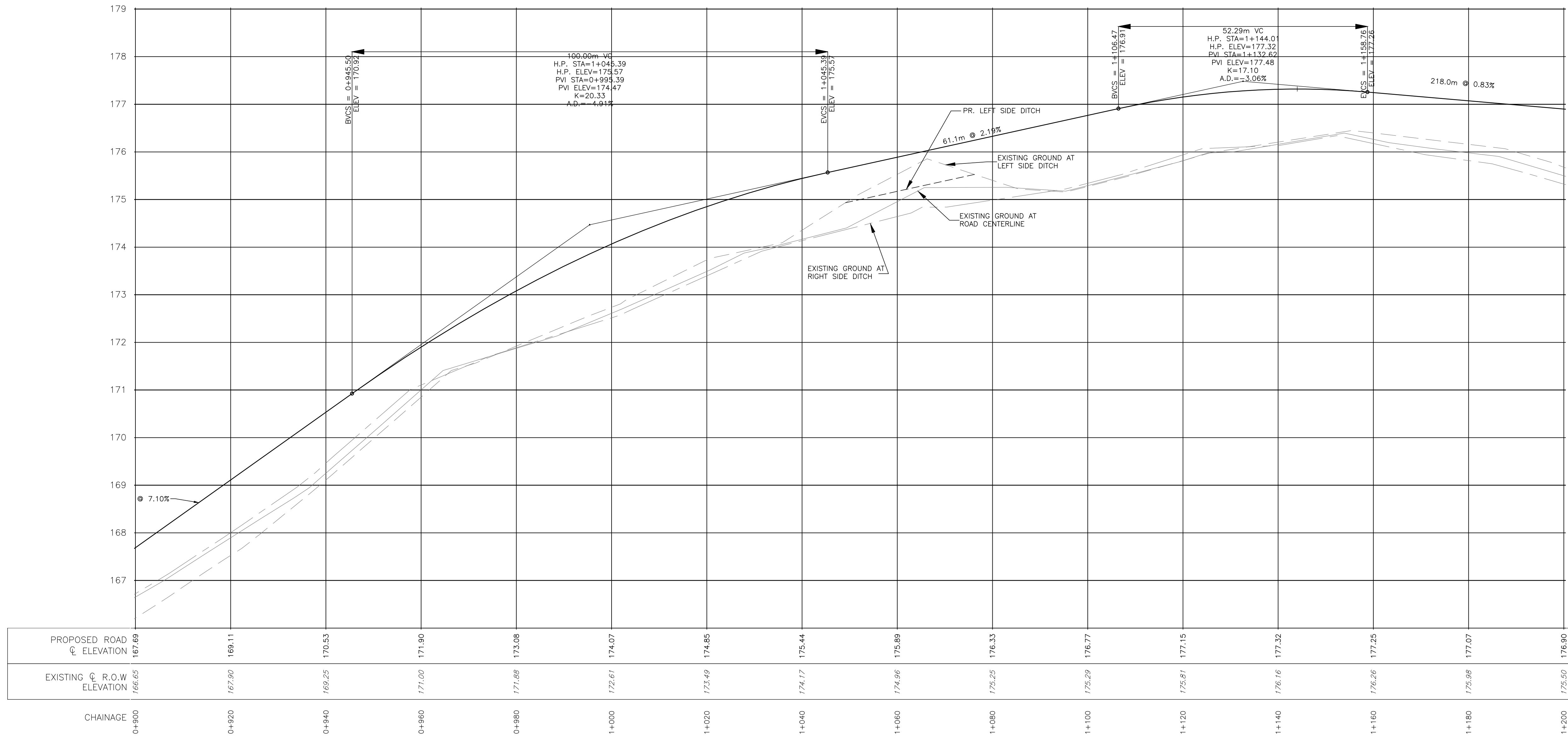
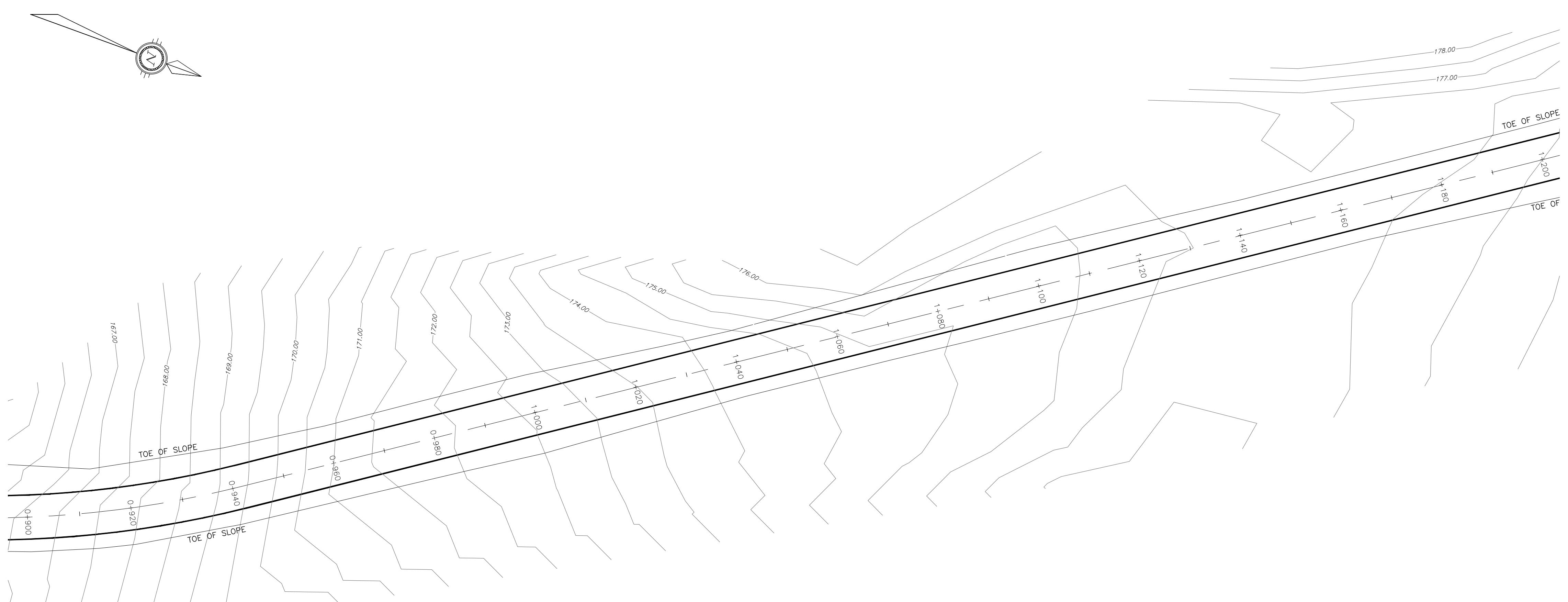
PROJECT
PROPOSED ROAD TO NORTHWEST AGGREGATE DEPOSIT

TITLE
PLAN & PROFILE

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drawn by	A.B.Z.	drawing no.	
checked by	S.L.B.		
date	30/05/14		
scale	1:500 HORIZ. 1:50 VERT.		

PP-3





LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

ISSUED FOR TENDER PURPOSES ONLY

DATE: AUGUST 13, 2014

BENCH MARK

No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB

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PROJECT
PROPOSED ROAD TO NORTHWEST AGGREGATE DEPOSIT

PLAN & PROFILE

design by	A.B.Z	project no.	OTT-00219428-A0
drawn by	A.B.Z	drawing no.	
checked by	S.L.B.		
date	30/05/14		
scale	1:500 HORIZ, 1:50 VERT.		

PP-4



LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

ISSUED FOR TENDER PURPOSES ONLY

DATE: AUGUST 13, 2014

BENCH MARK

No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB

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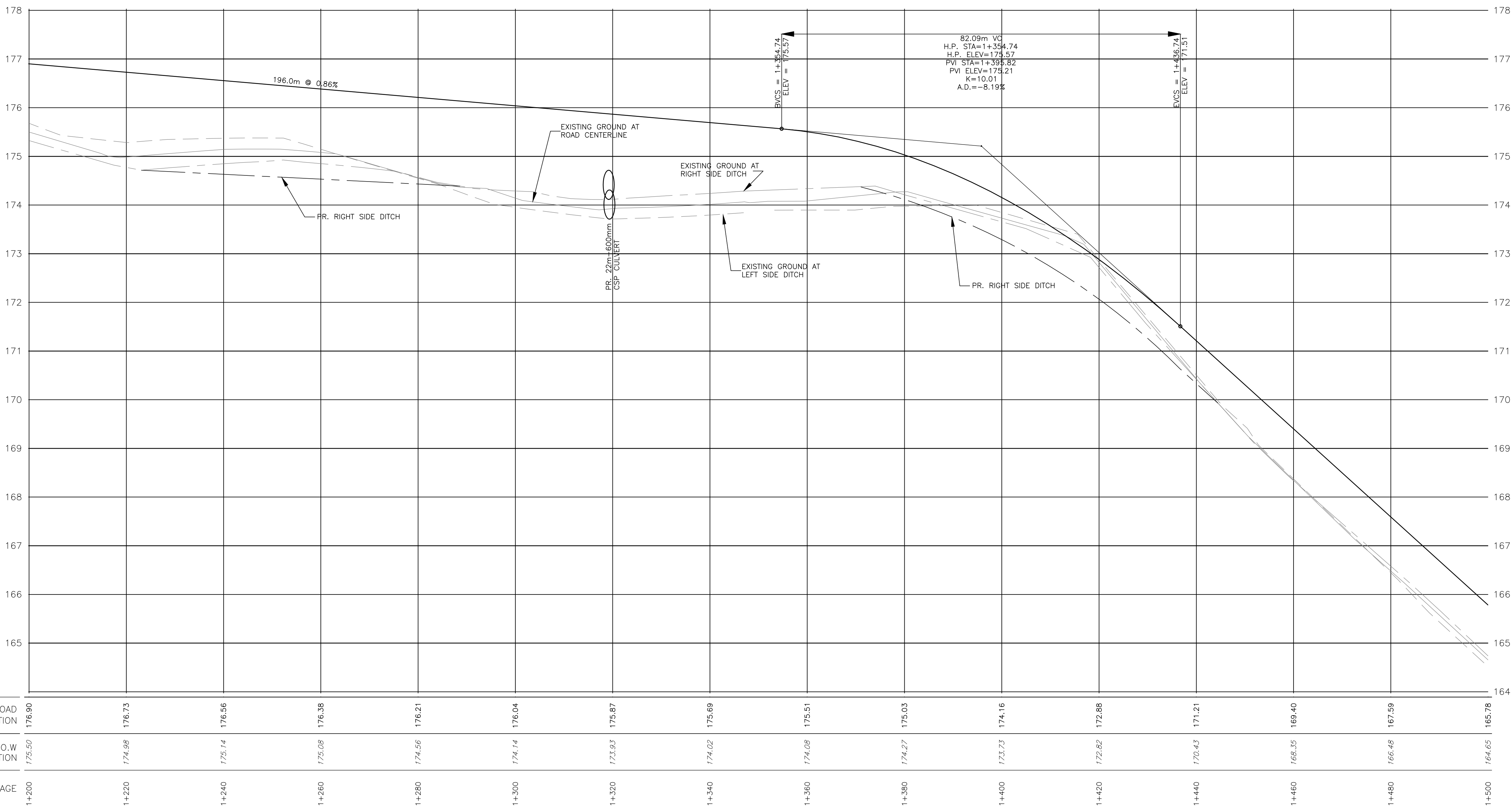
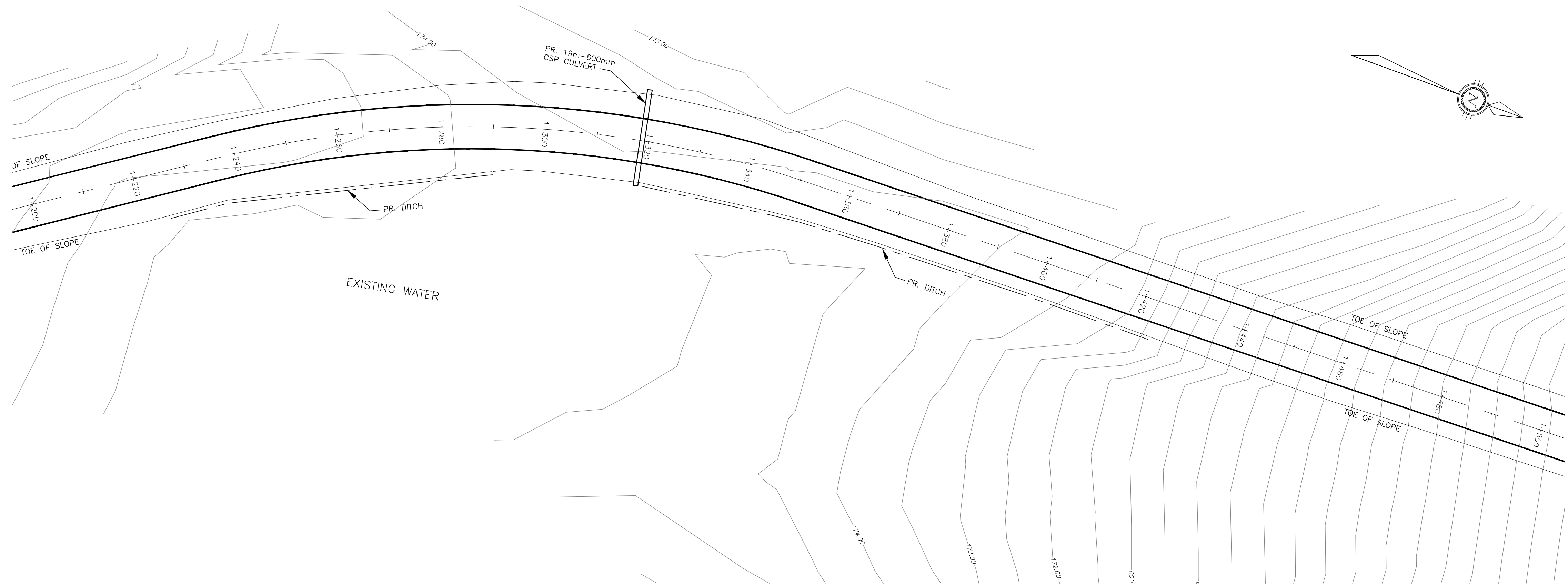
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CITY OF IQALUIT

PROJECT
PROPOSED ROAD TO NORTHWEST AGGREGATE DEPOSIT

TITLE
PLAN & PROFILE

design by A.B.Z	project no. OTT-00219428-A0
drawn by A.B.Z	drawing no.
checked by S.L.B.	
date 30/05/14	
scale 1:500 HORIZ. 1:50 VERT.	

PP-5



PROPOSED ROAD C/L ELEVATION	176.90	176.73	176.56	176.38	176.21	176.04	175.87	175.69	175.51	175.03	174.16	172.88	171.21	169.40	167.59	165.78
EXISTING C/L R.O.W ELEVATION	175.50	174.98	175.14	175.08	174.56	174.14	173.93	174.02	174.08	174.27	173.73	172.82	170.43	168.35	166.48	164.65
CHAINAGE	1+200	1+220	1+240	1+260	1+280	1+300	1+320	1+340	1+360	1+380	1+400	1+420	1+440	1+460	1+480	1+500



LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

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DATE: AUGUST 13, 2014

BENCH MARK

No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB
REVISIONS				

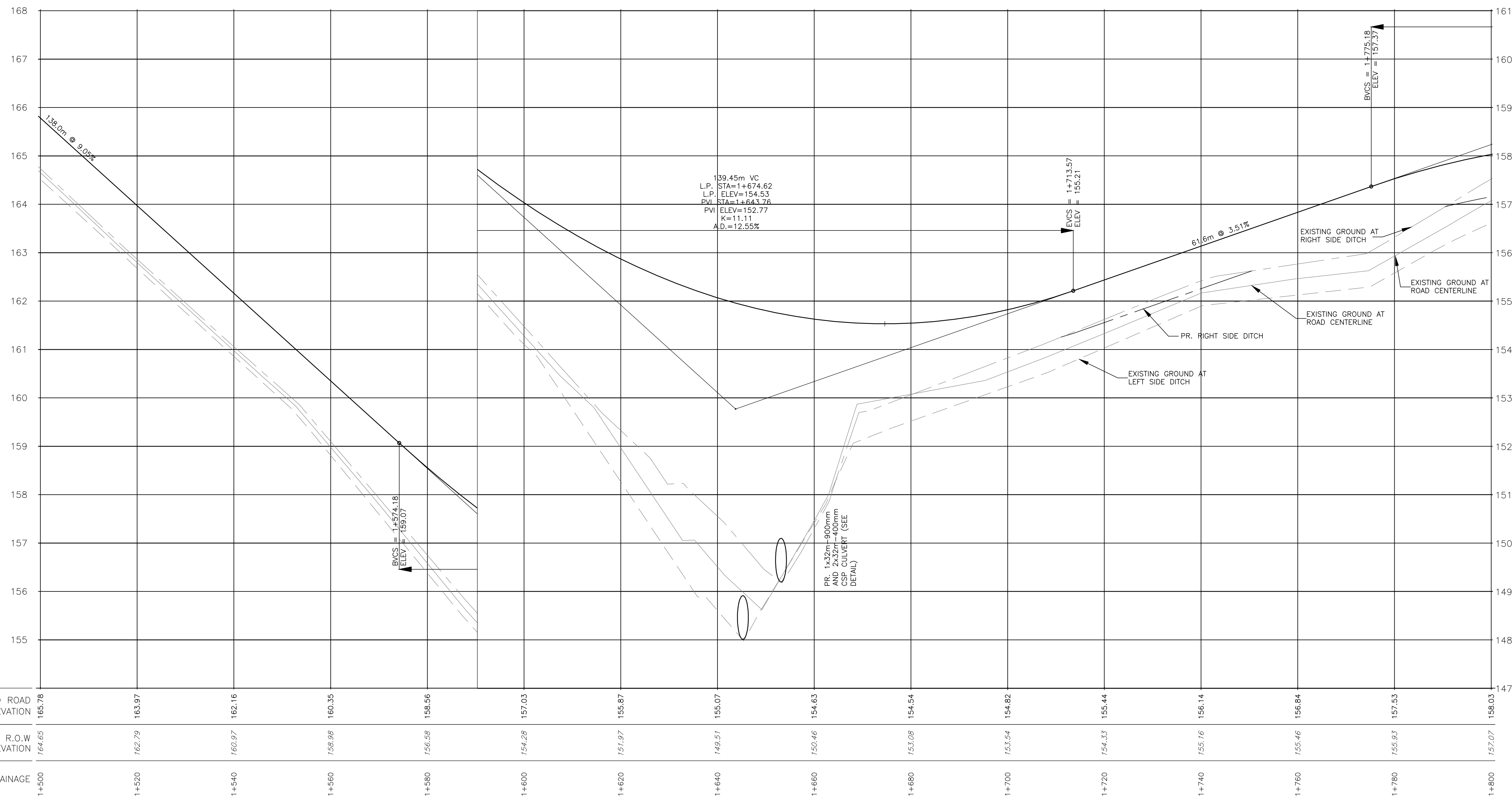
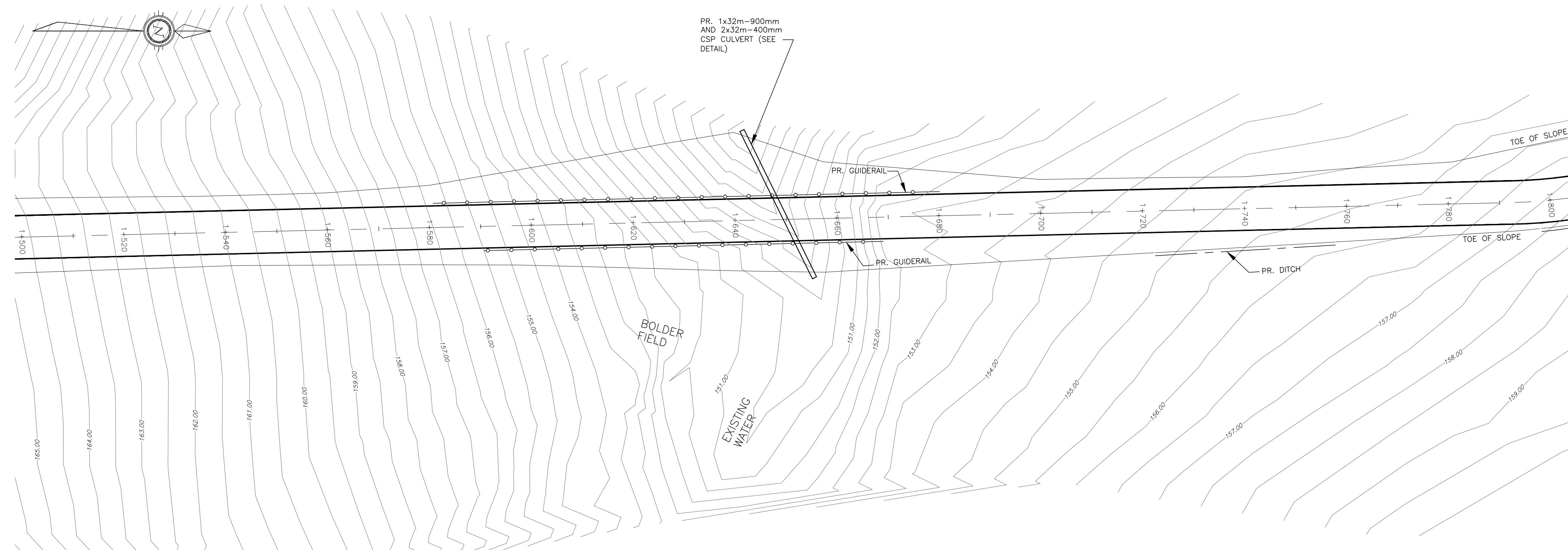
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CITY OF IQALUIT

PROJECT
PROPOSED ROAD TO NORTHWEST AGGREGATE DEPOSIT

TITLE
PLAN & PROFILE

design by A.B.Z	project no. OTT-00219428-AD
drawn by A.B.Z	drawing no. PP-6
checked by S.L.B.	
date 30/05/14	
scale 1:500 HORIZ. 1:50 VERT.	



PROPOSED ROAD C ELEVATION	165.78	163.97	162.16	160.35	158.56	157.03	155.87	155.07	154.63	154.54	154.82	155.44	156.14	156.84	157.53	158.03
EXISTING C R.O.W ELEVATION	164.65	162.79	160.97	159.08	157.56	156.29	155.07	149.51	150.46	151.08	152.54	154.33	155.16	155.46	155.93	157.07
CHAINAGE	1+500	1+520	1+540	1+560	1+580	1+600	1+620	1+640	1+660	1+680	1+700	1+720	1+740	1+760	1+780	1+800

Iqaluit



LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

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DATE: AUGUST 13, 2014

BENCH MARK

No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB
No.	DESCRIPTION	DATE	BY	APP'D
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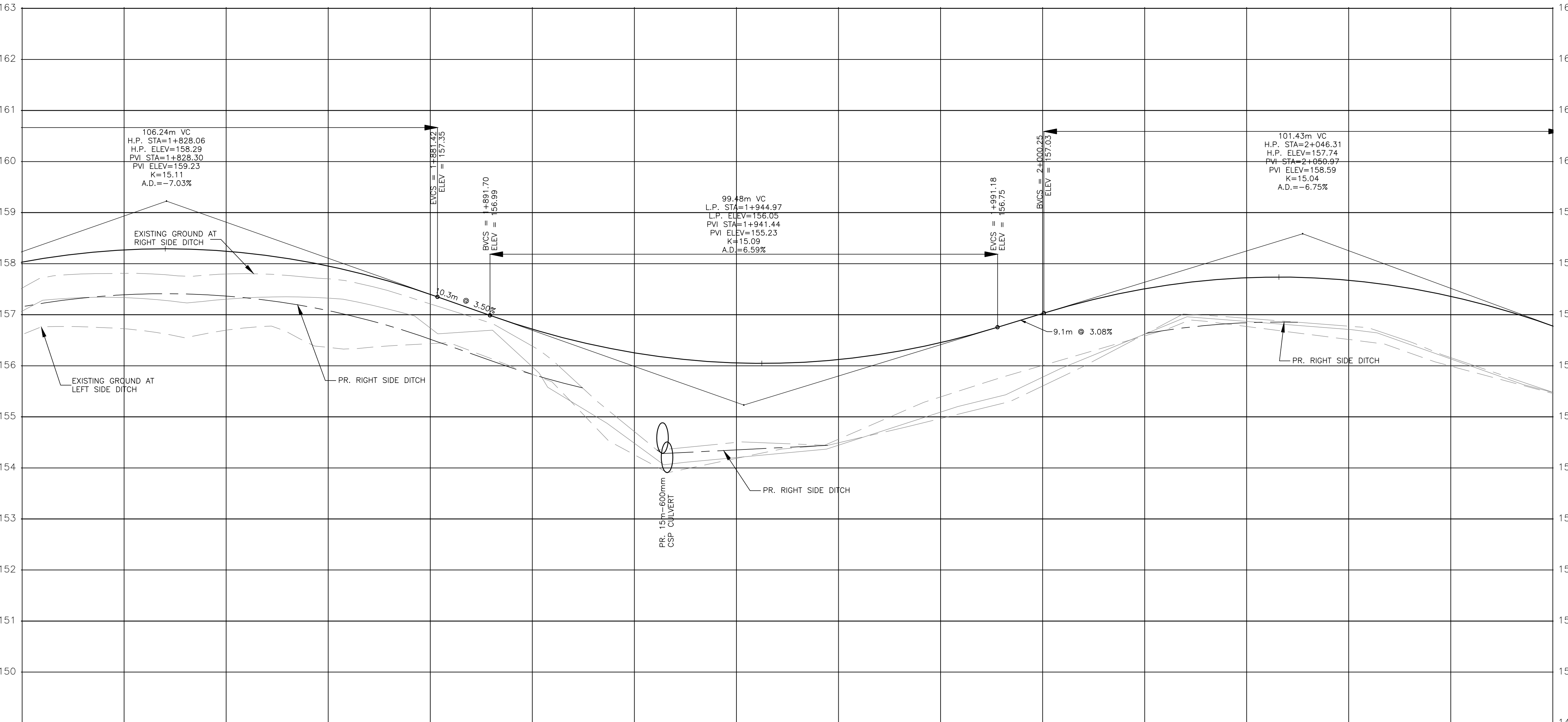
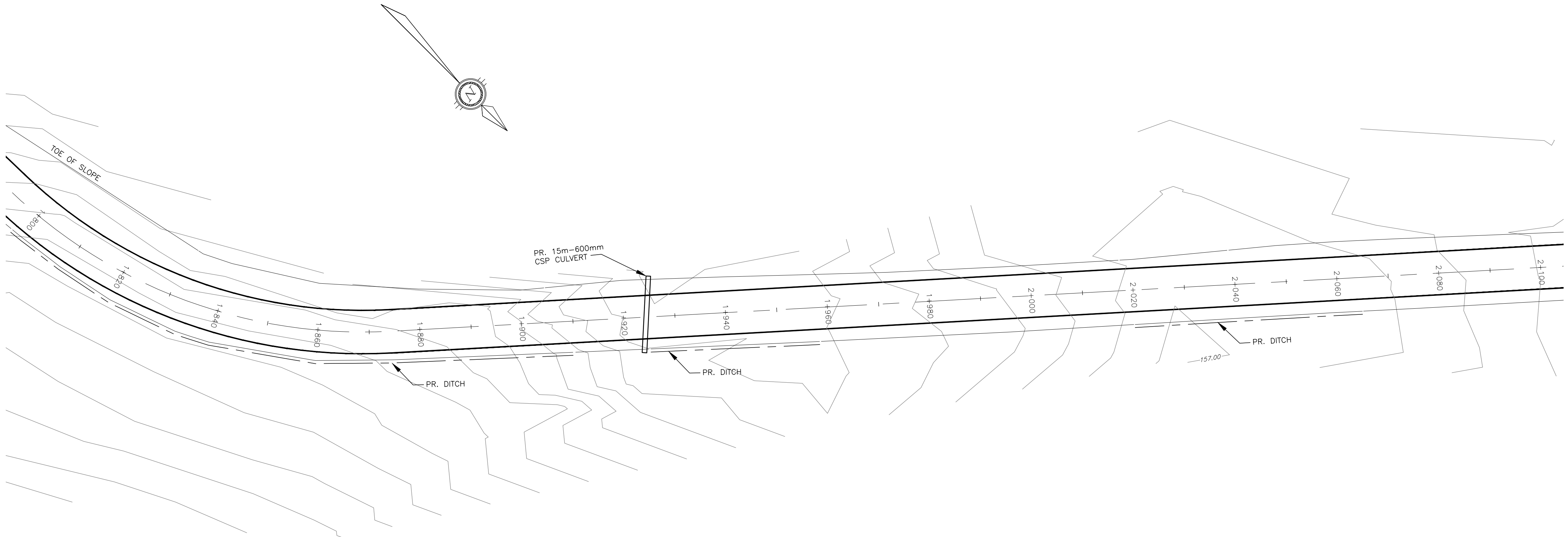
CITY OF IQALUIT

PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

PLAN & PROFILE

design by	A.B.Z	project no.	OTT-00219428-A0
drawn by	A.B.Z	drawing no.	
checked by	S.L.B.		
date	30/05/14		
scale	1:500 HORIZ, 1:50 VERT.		

PP-7



PROPOSED ROAD C ELEVATION	158.03	158.27	158.24	157.95	157.40	156.72	156.25	156.05	156.12	156.45	157.02	157.51	157.72	157.68	157.36	156.78
EXISTING C R.O.W ELEVATION	157.33	157.30	157.32	156.74	155.99	154.48	154.20	154.44	155.09	155.78	156.62	156.87	156.71	156.13	155.48	154.78
CHAINAGE	1+800	1+820	1+840	1+860	1+880	1+900	1+920	1+940	1+960	1+980	2+000	2+020	2+040	2+060	2+080	2+100

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LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

ISSUED FOR TENDER PURPOSES ONLY

DATE: AUGUST 13, 2014

BENCH MARK

No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB
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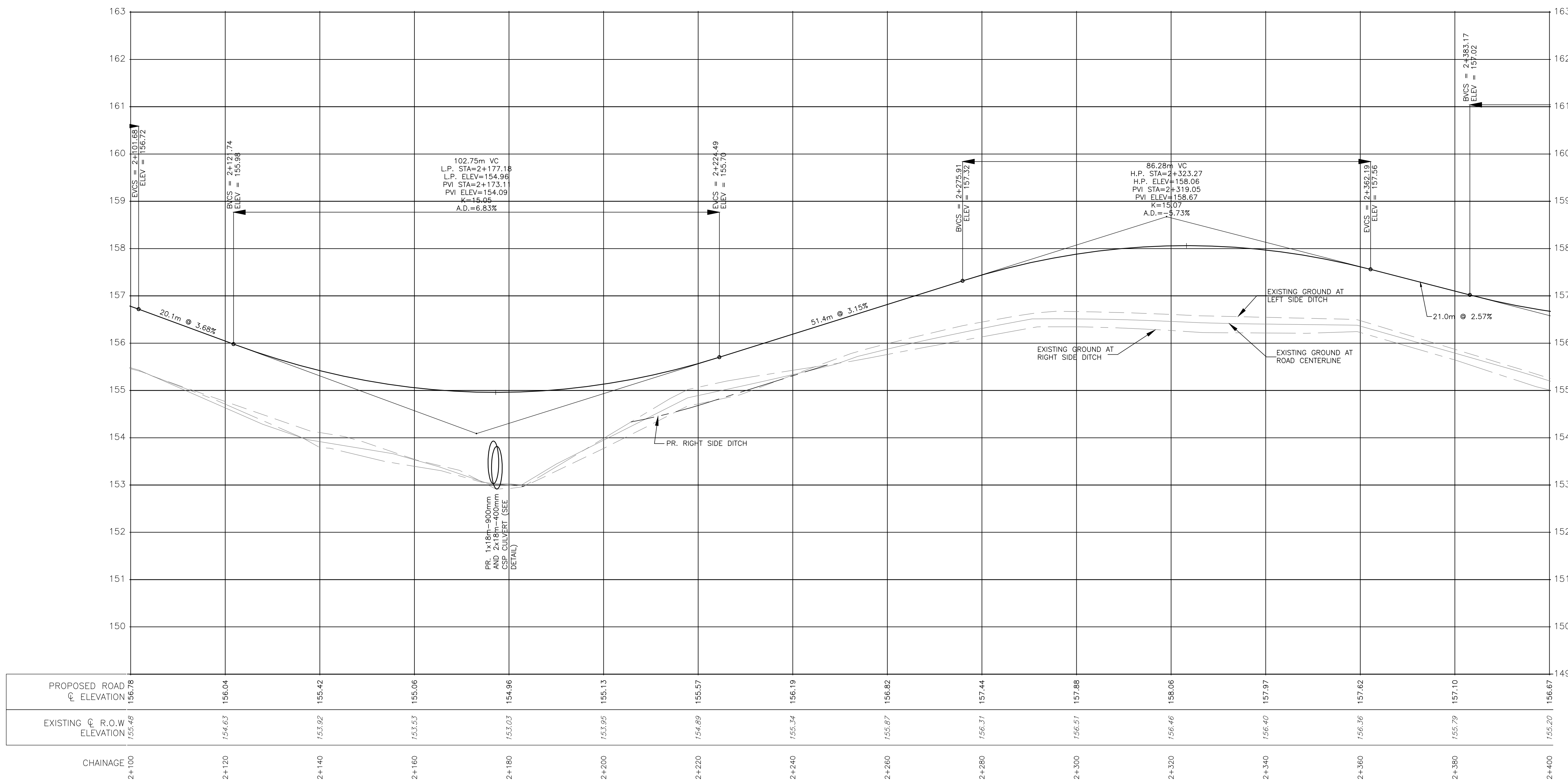
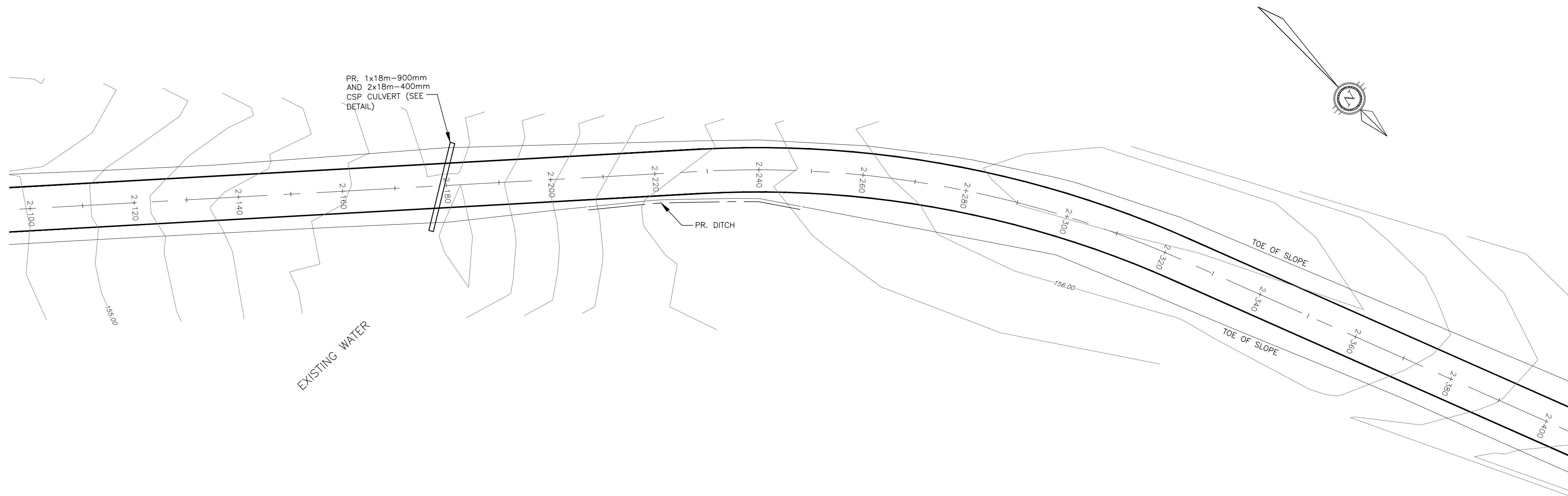
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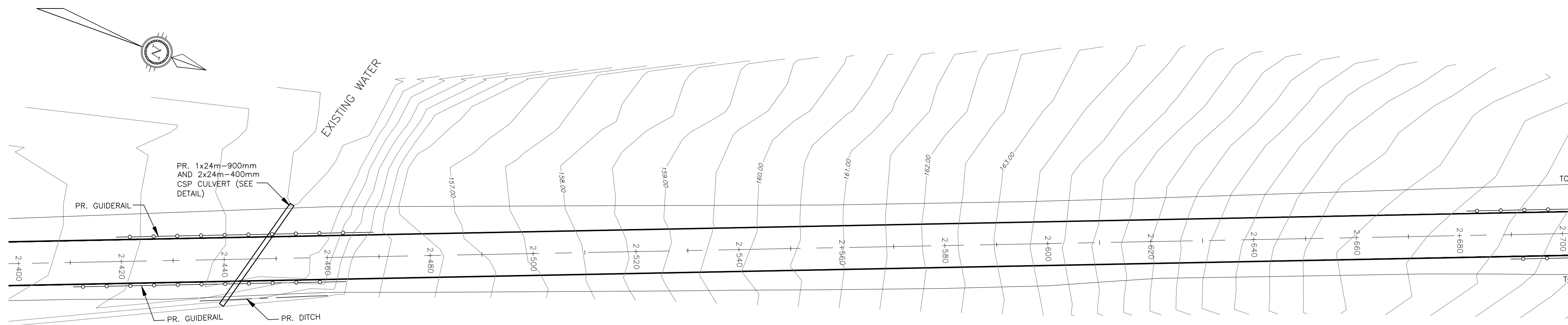
PROJECT
PROPOSED ROAD TO NORTHWEST AGGREGATE DEPOSIT

TITLE
PLAN & PROFILE

design by A.B.Z	project no. OTT-00219428-A0
drawn by A.B.Z	drawing no.
checked by S.L.B.	
date 30/05/14	
scale 1:500 HORIZ, 1:50 VERT.	

PP-8





————	EXISTING GROUND AT C/L NEW ROAD
- - - -	EXISTING GROUND AT C/L RIGHT SIDE DITCH
- - - -	EXISTING GROUND AT C/L LEFT SIDE DITCH
————	C/L OF NEW ROAD
- - - -	C/L OF NEW DITCH RIGHT
- - - -	C/L OF NEW DITCH LEFT
—●—●—●—	NEW GUIDE RAIL LOCATION
▬▬▬▬▬	NEW CULVERT LOCATION

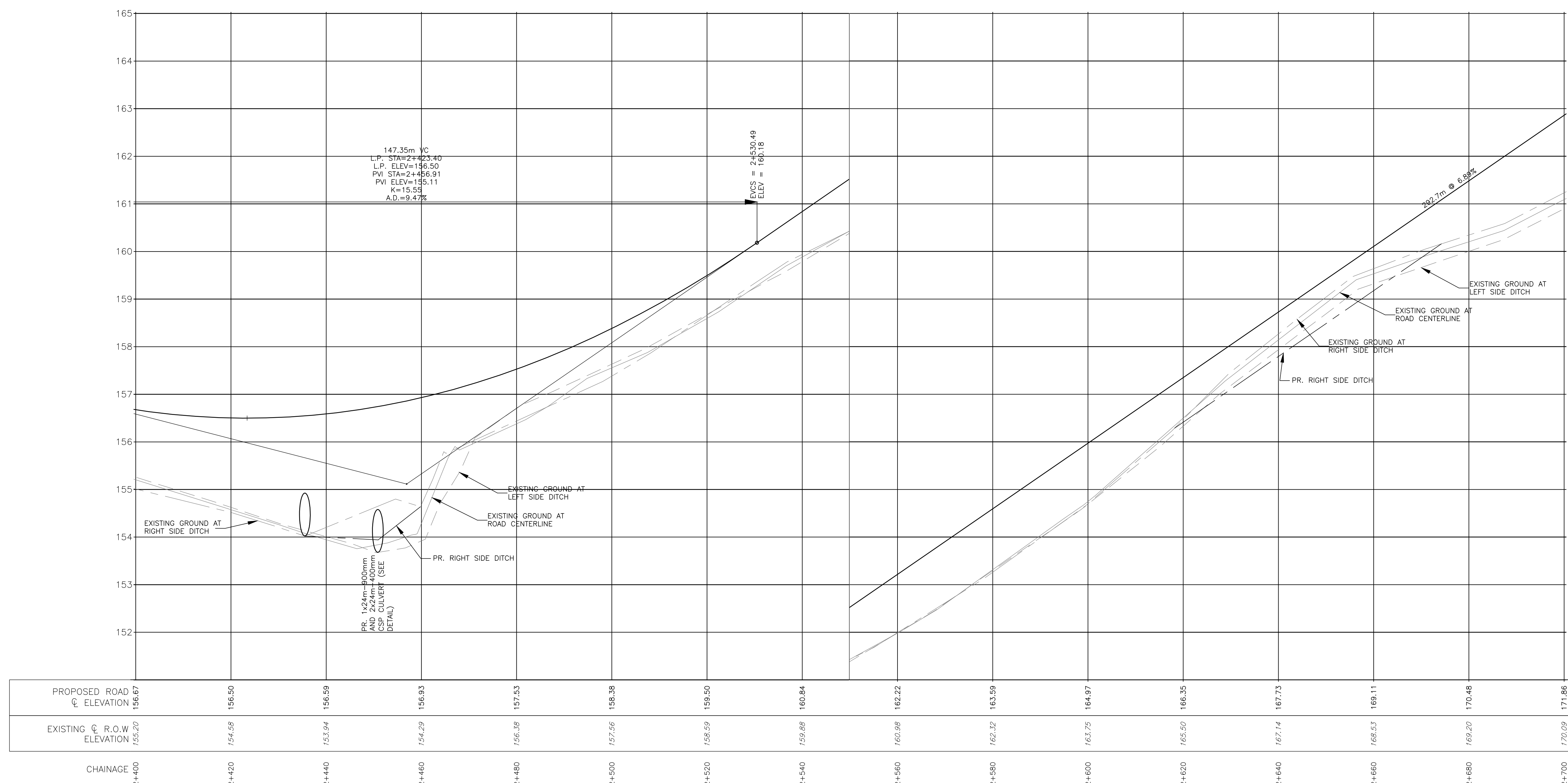
DATE: AUGUST 18, 2014

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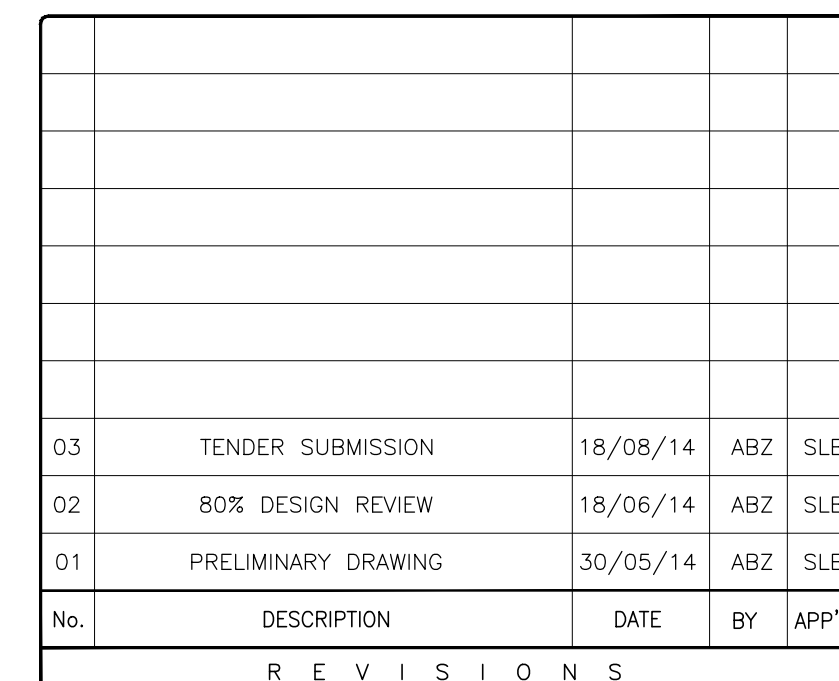
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PLAN & PROFILE		
design by	A.B.Z	
drawn by	A.B.Z	
checked by	S.L.B.	
date	30/05/14	
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BENCH MARK



03	TENDER SUBMISSION	18/08/14	ABZ	SLB
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PROJECT PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

TITLE

PLAN & PROFILE

design by	A.B.Z	project no. OTT-00219428-A0 drawing no. <div style="font-size: 2em; font-weight: bold; text-align: center;">PP-10</div>
drawn by	A.B.Z	
checked by	S.L.B.	
date	30/05/14	
scale	1:500 HORZ. 1:50 VERT.	

PP-10



LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

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BENCH MARK

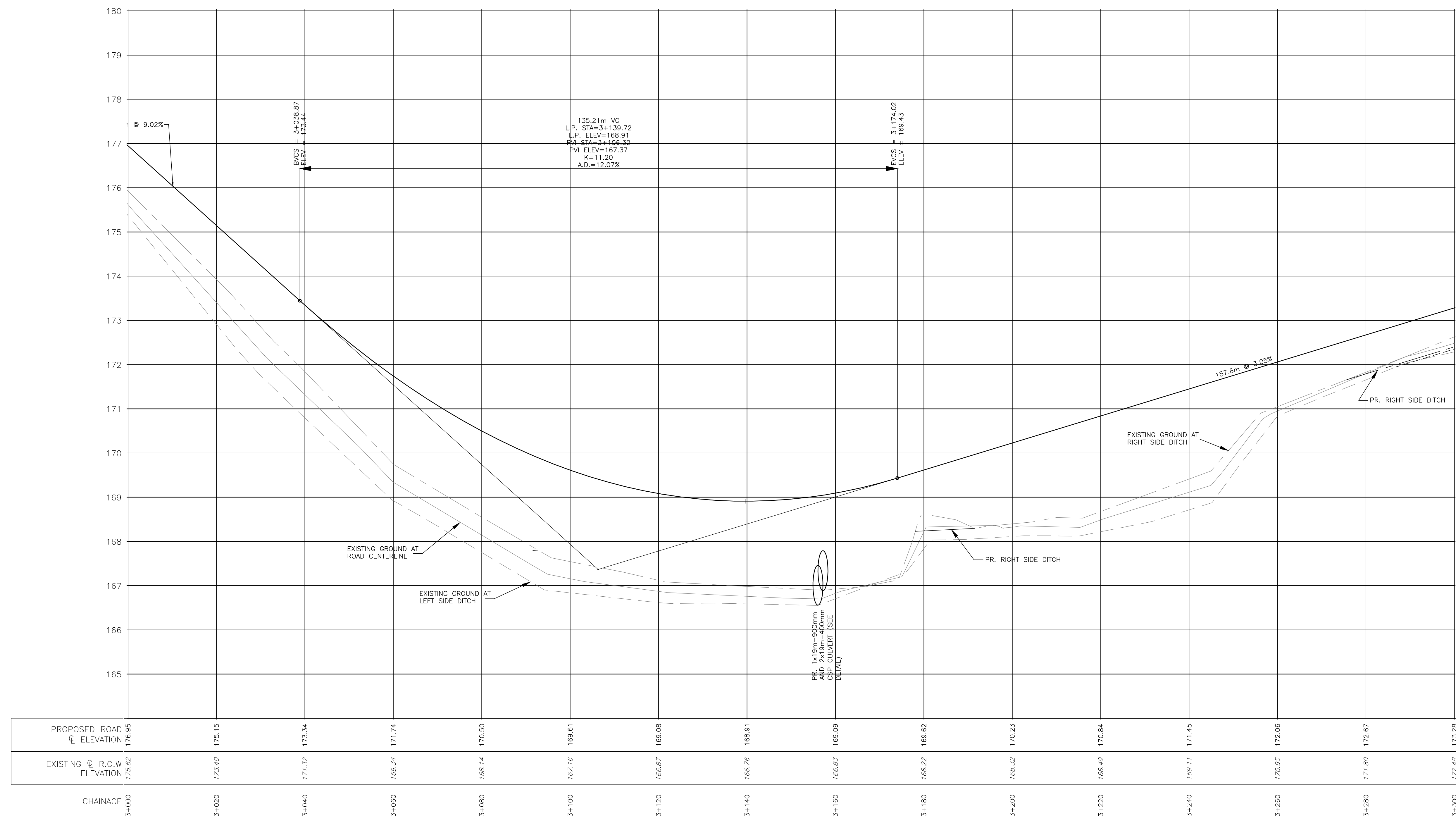
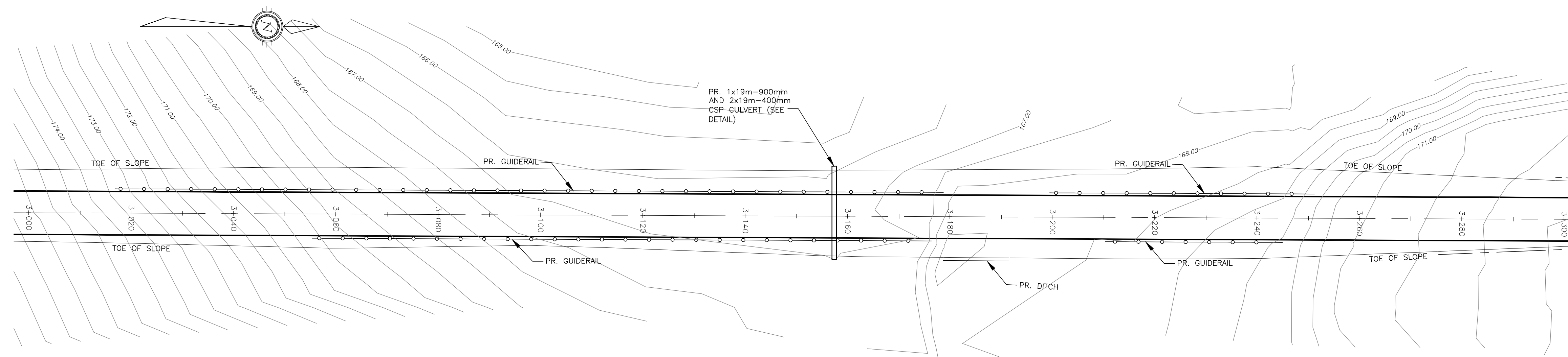
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02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB
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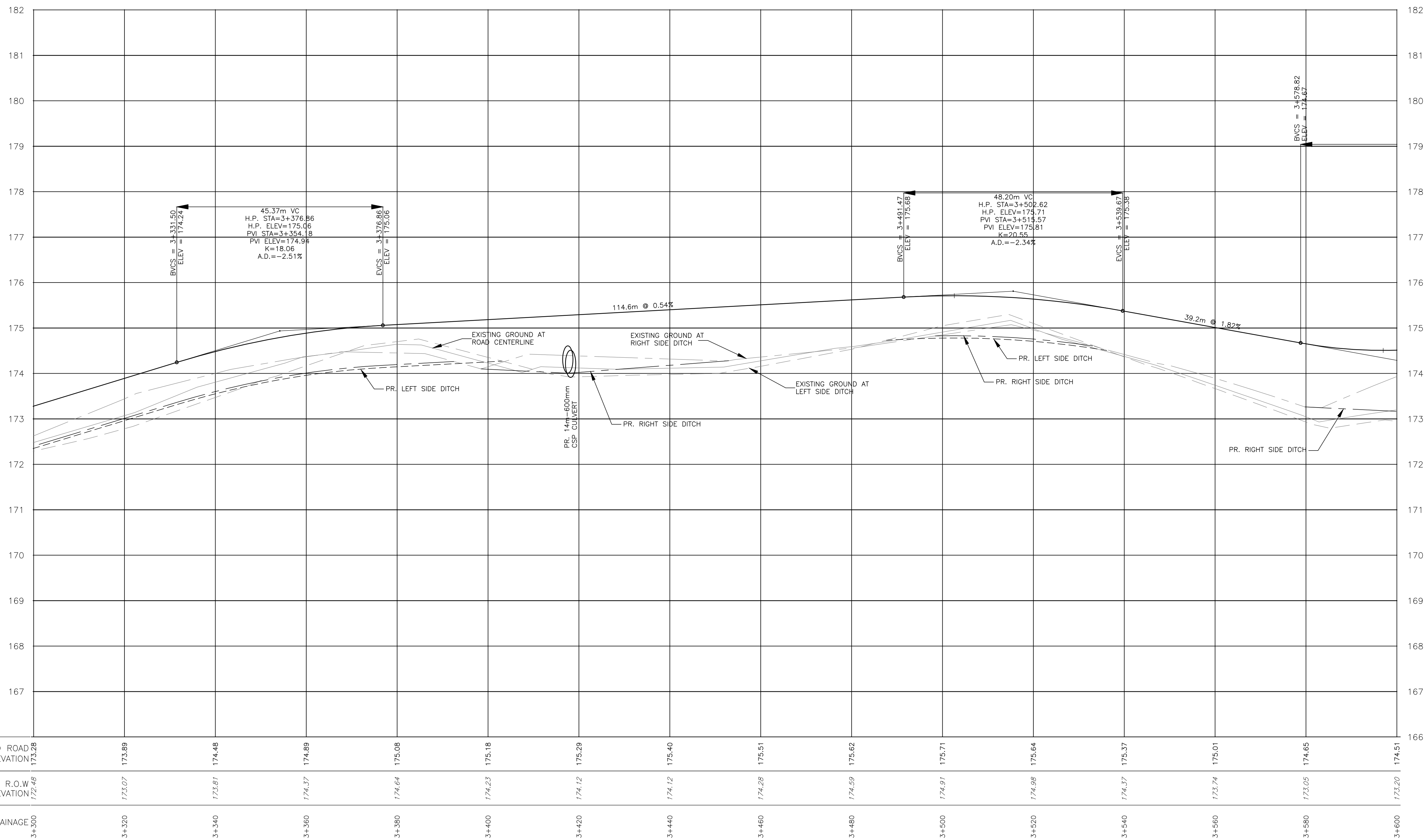
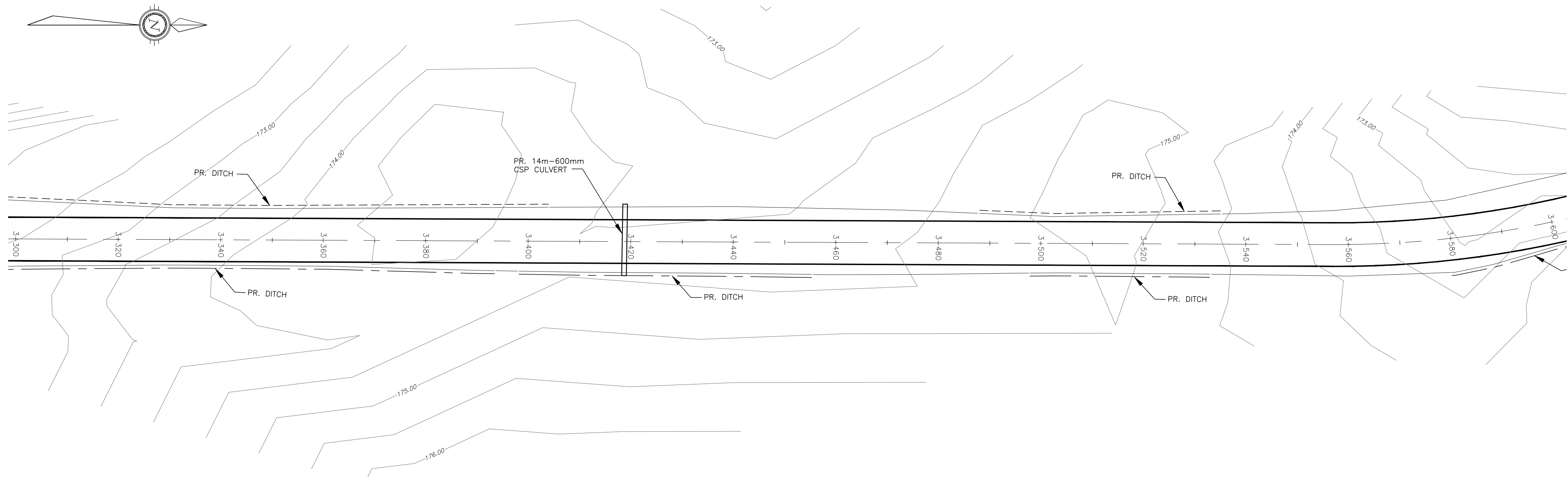
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TITLE	
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design by A.B.Z	project no. OTT-00219428-A0
drawn by A.B.Z	drawing no.
checked by S.L.B.	PP-11
date 30/05/14	
scale 1:500 HORIZ. 1:50 VERT.	





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LEGEND

- EXISTING GROUND AT C/L
- NEW ROAD
- EXISTING GROUND AT C/L
- RIGHT SIDE DITCH
- EXISTING GROUND AT C/L
- LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

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DATE: AUGUST 13, 2014

BENCH MARK

No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB
R E V I S I O N S				

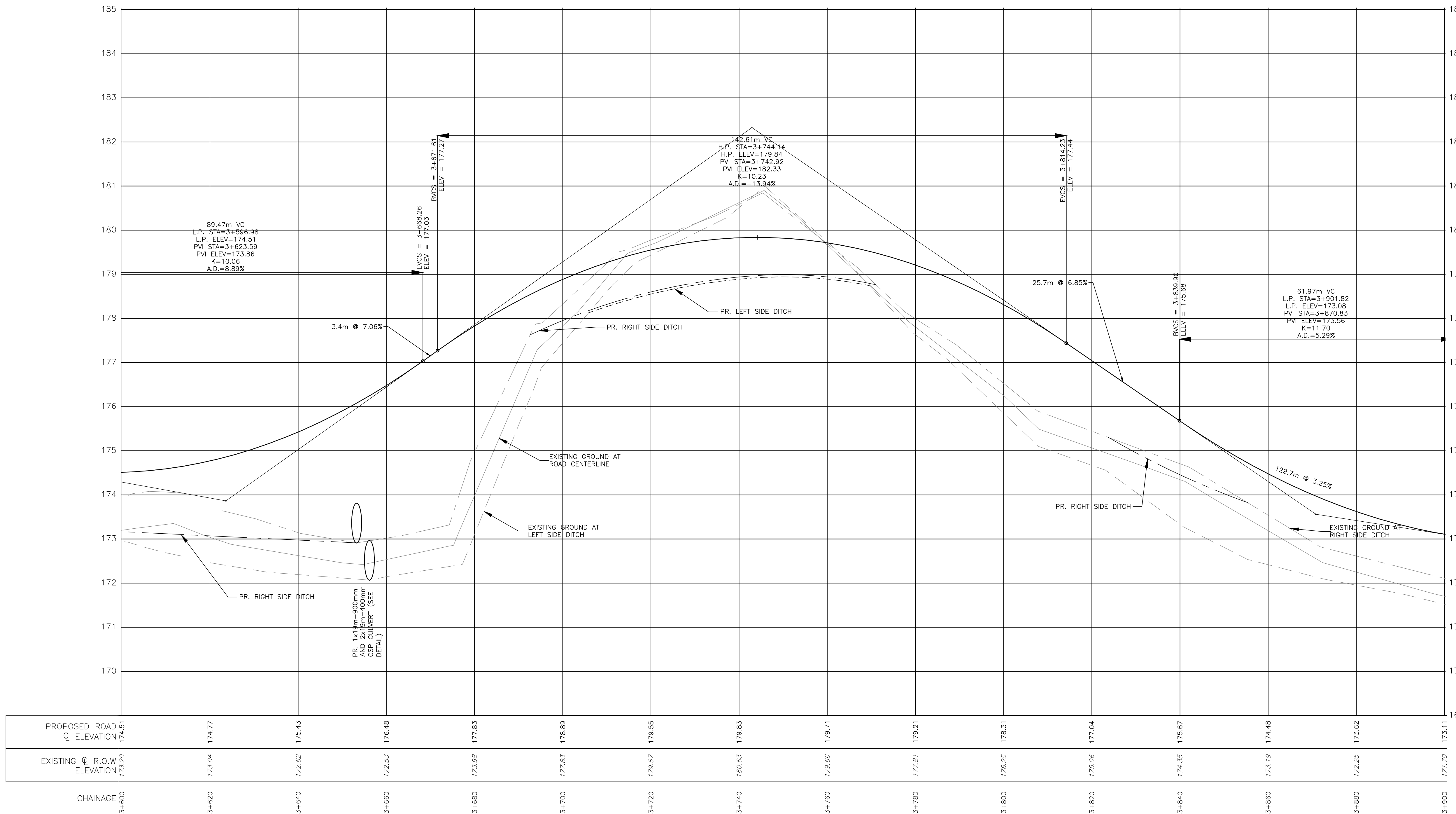
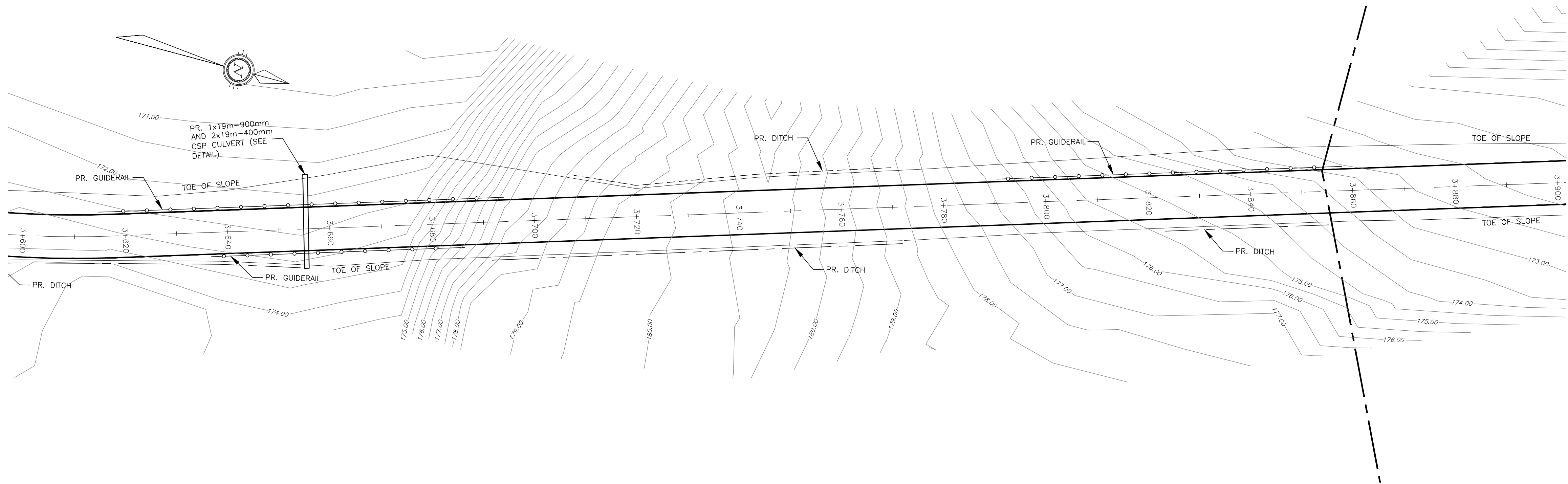


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PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

TITLE	
PLAN & PROFILE	
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drawn by A.B.Z.	drawing no.
checked by S.L.B.	
date 30/05/14	
scale 1:500 HORIZ. 1:50 VERT.	

PP-12



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LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

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DATE: AUGUST 13, 2014

BENCH MARK

No.	DESCRIPTION	DATE	BY	APP'D
03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB
REVISIONS				

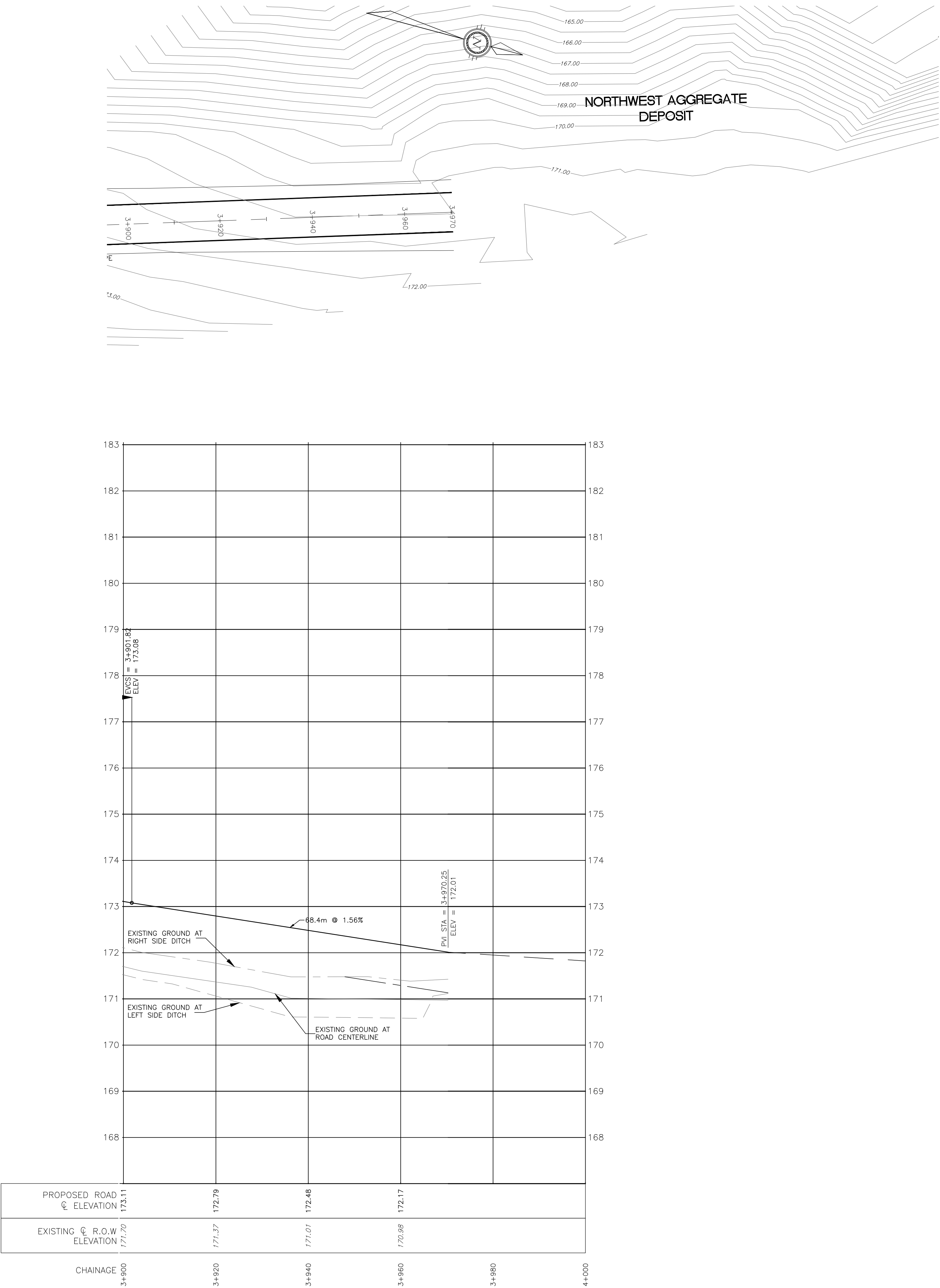


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PROPOSED ROAD TO NORTHWEST AGGREGATE DEPOSIT

PLAN & PROFILE			
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drawn by	A.B.Z	drawing no.	
checked by	S.L.B.		
date	30/05/14		
scale	1:500 HORIZ, 1:50 VERT.		

PP-13



LEGEND

- EXISTING GROUND AT C/L NEW ROAD
- EXISTING GROUND AT C/L RIGHT SIDE DITCH
- EXISTING GROUND AT C/L LEFT SIDE DITCH
- C/L OF NEW ROAD
- C/L OF NEW DITCH RIGHT
- C/L OF NEW DITCH LEFT
- NEW GUIDE RAIL LOCATION
- NEW CULVERT LOCATION

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DATE: AUGUST 13, 2014

BENCH MARK

03	TENDER SUBMISSION	18/08/14	ABZ	SLB
02	80% DESIGN REVIEW	18/06/14	ABZ	SLB
01	PRELIMINARY DRAWING	30/05/14	ABZ	SLB
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PROPOSED ROAD TO NORTHWEST AGGREGATE DEPOSIT

TITLE

PLAN & PROFILE

design by	A.B.Z	project no.	OTT-00219428-A0
drawn by	A.B.Z	drawing no.	
checked by	S.L.B.		
date	30/05/14		
scale	1:500 HORZ, 1:50 VERT.		

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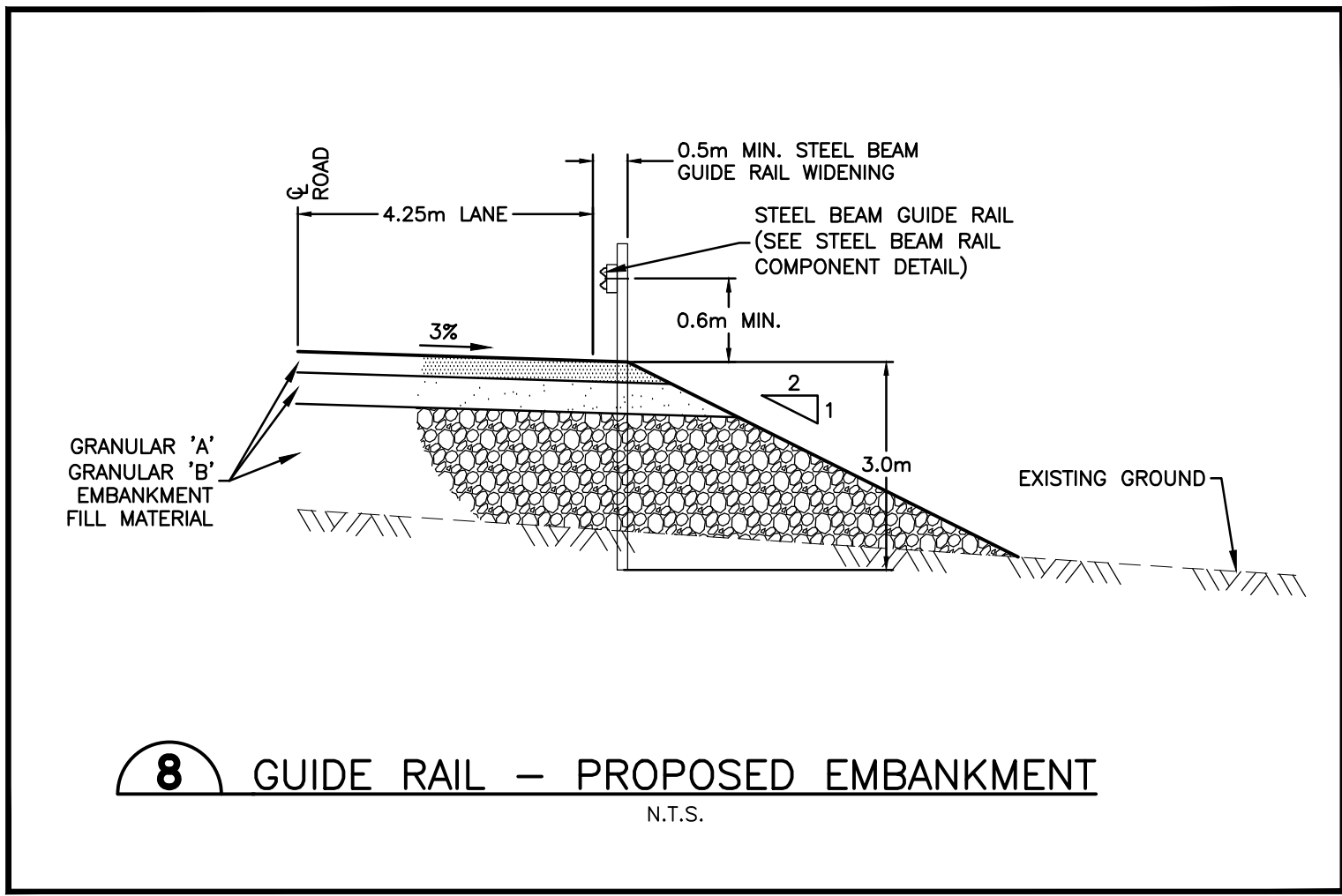
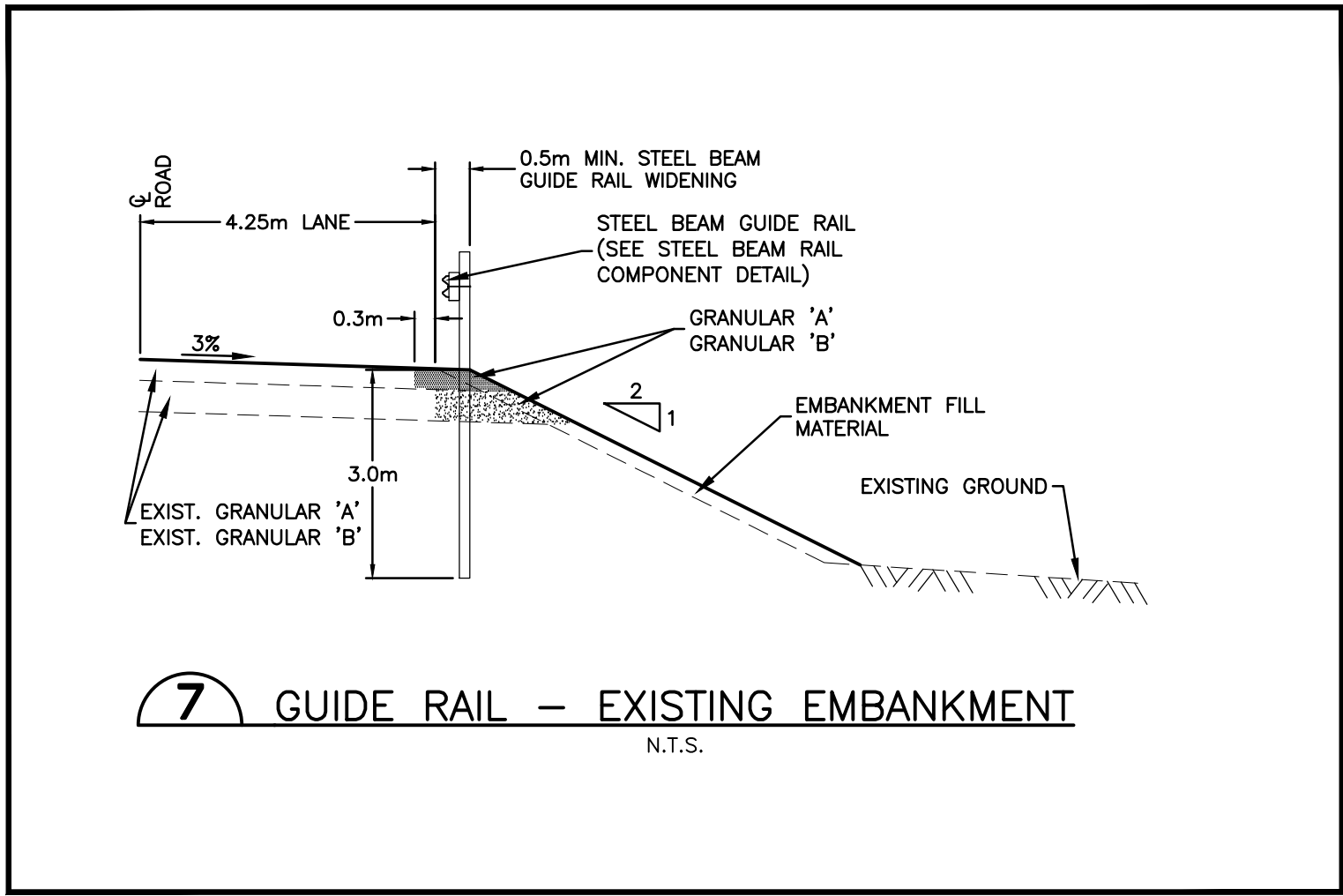
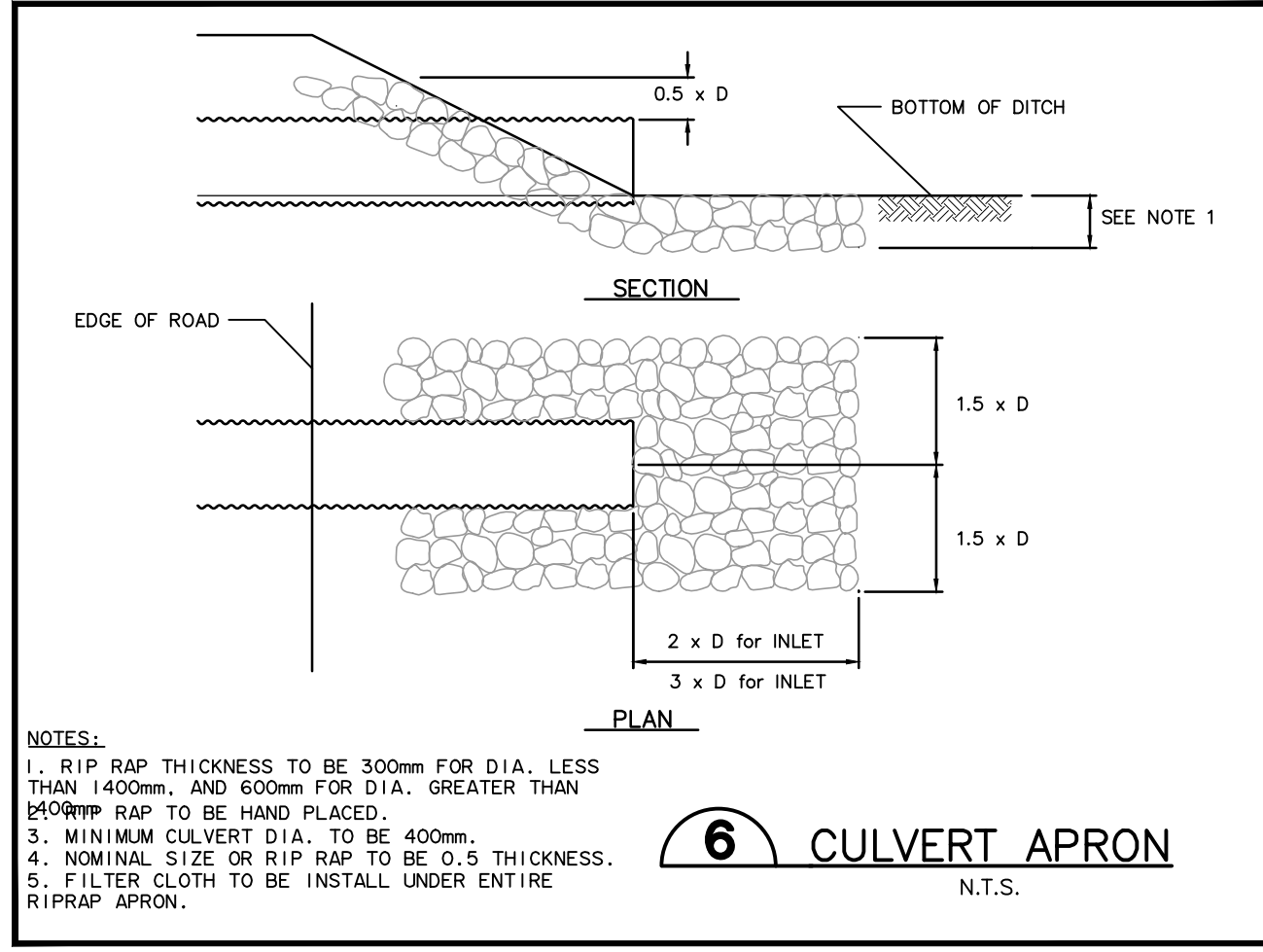
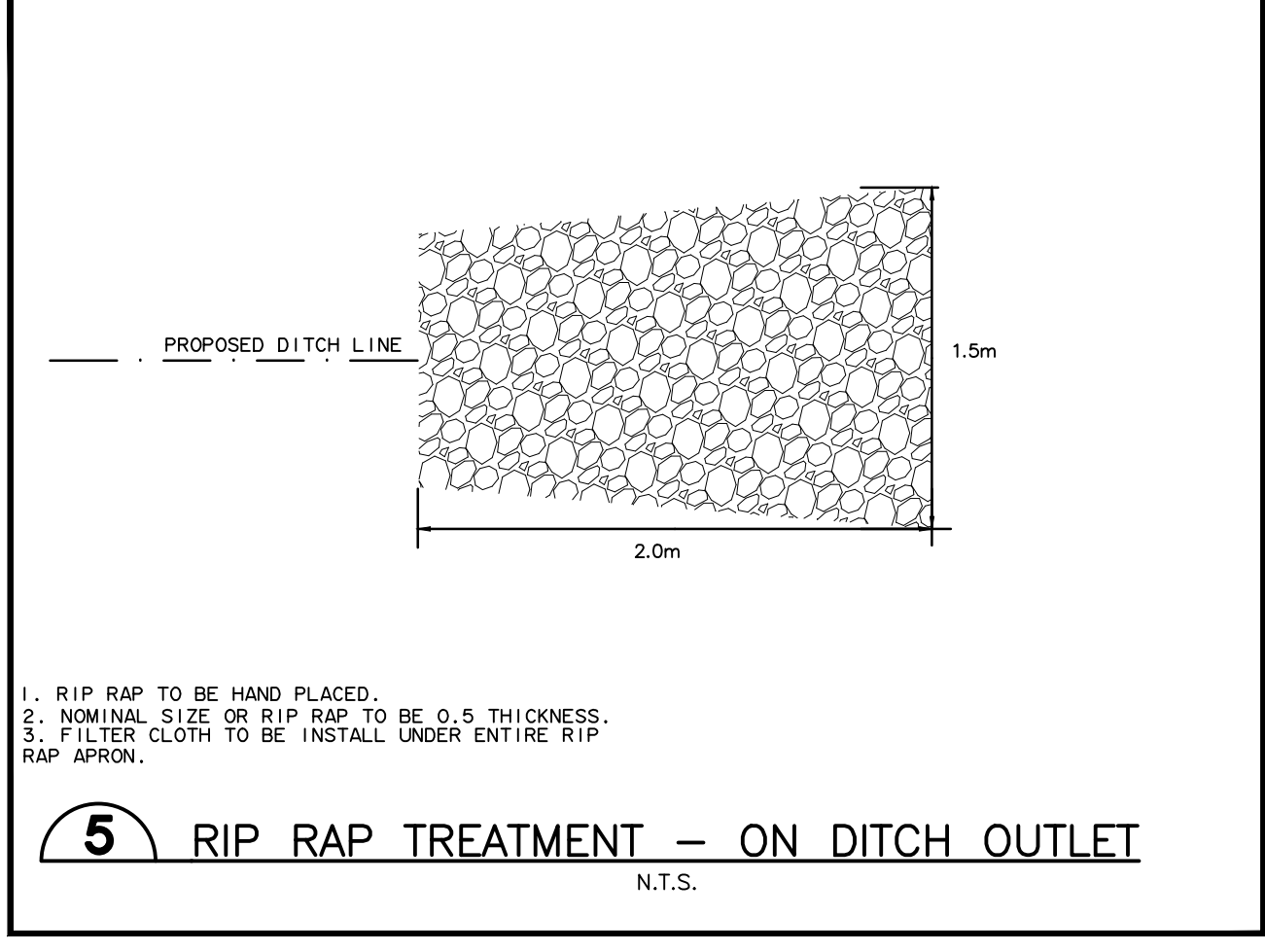
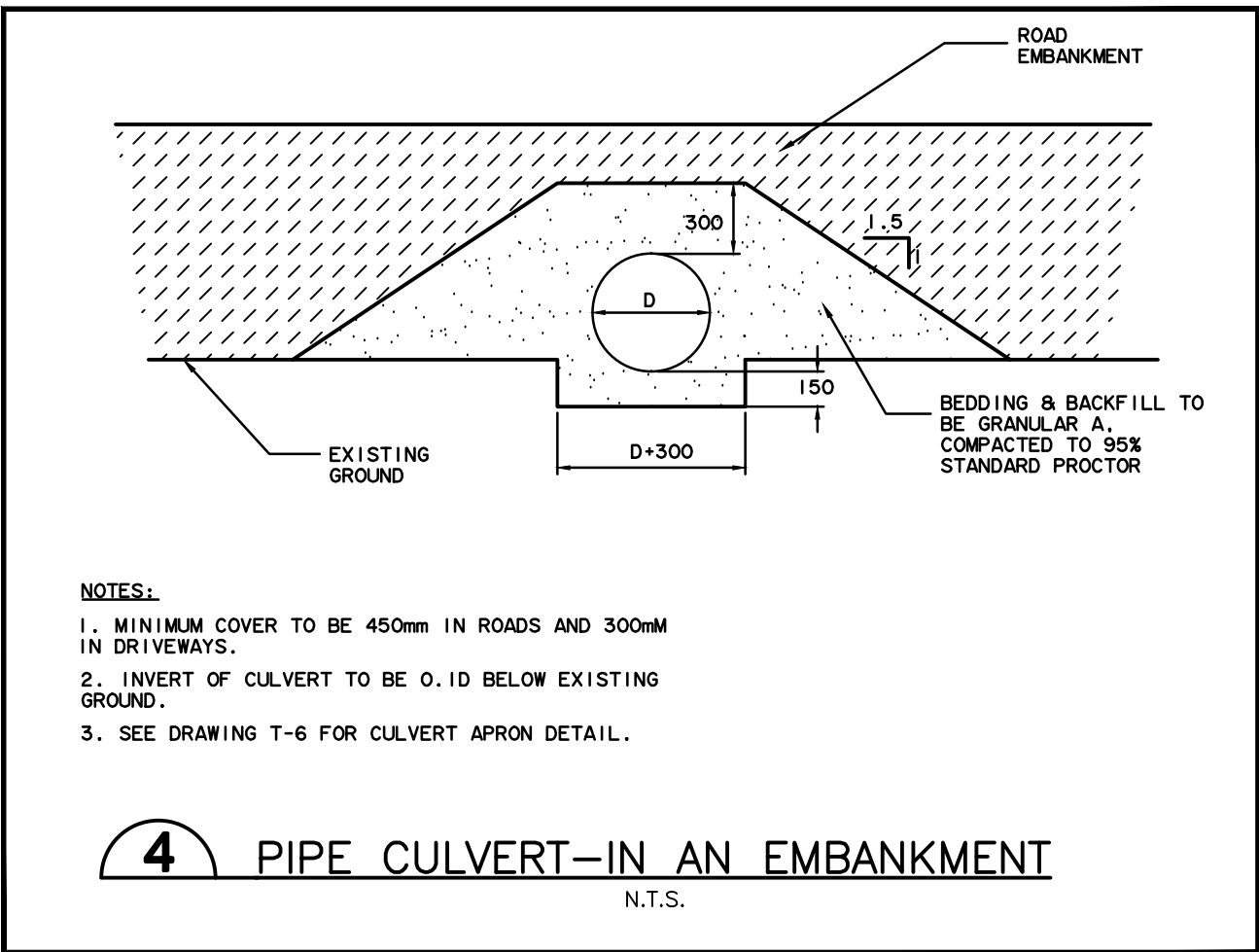
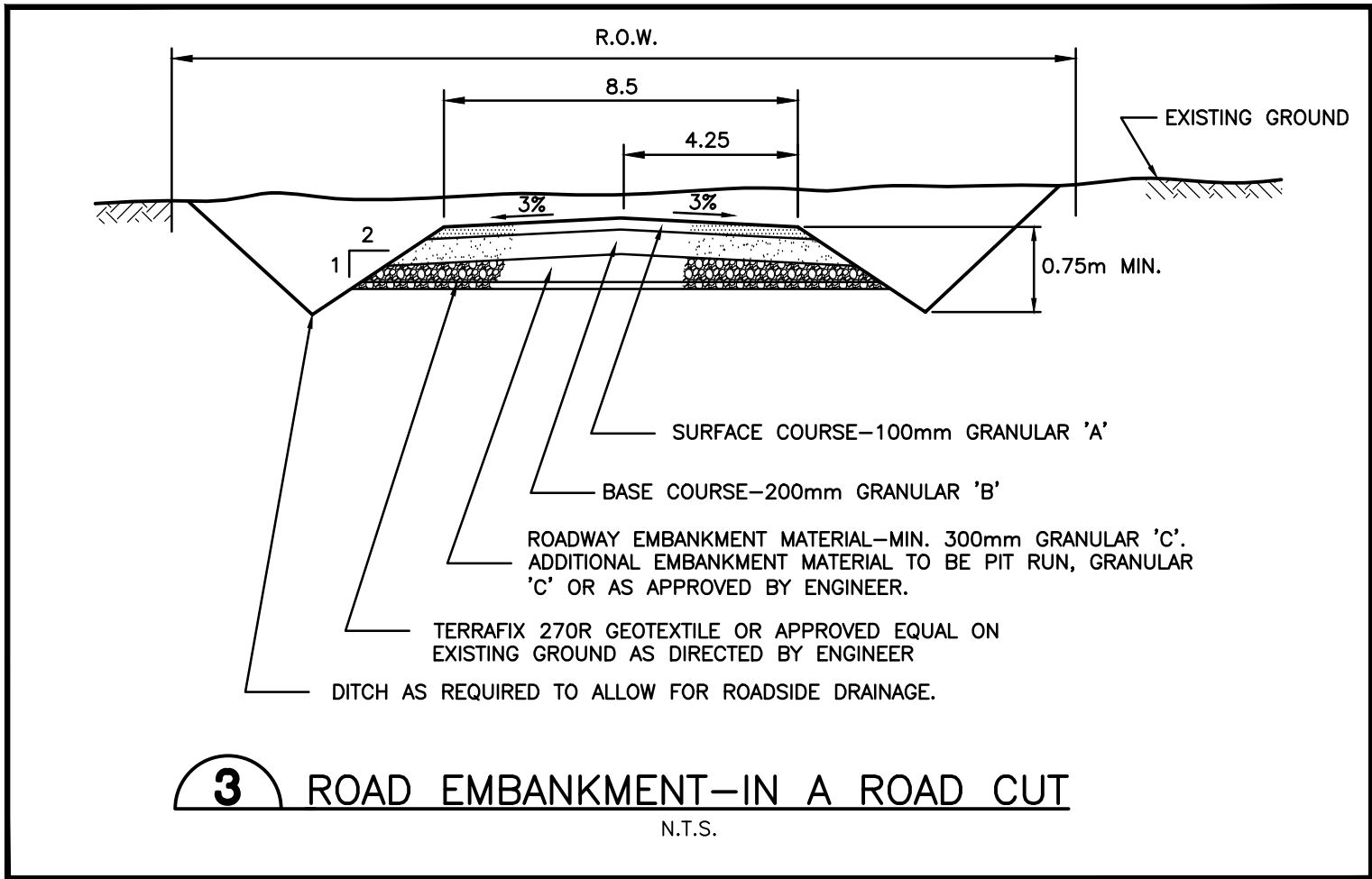
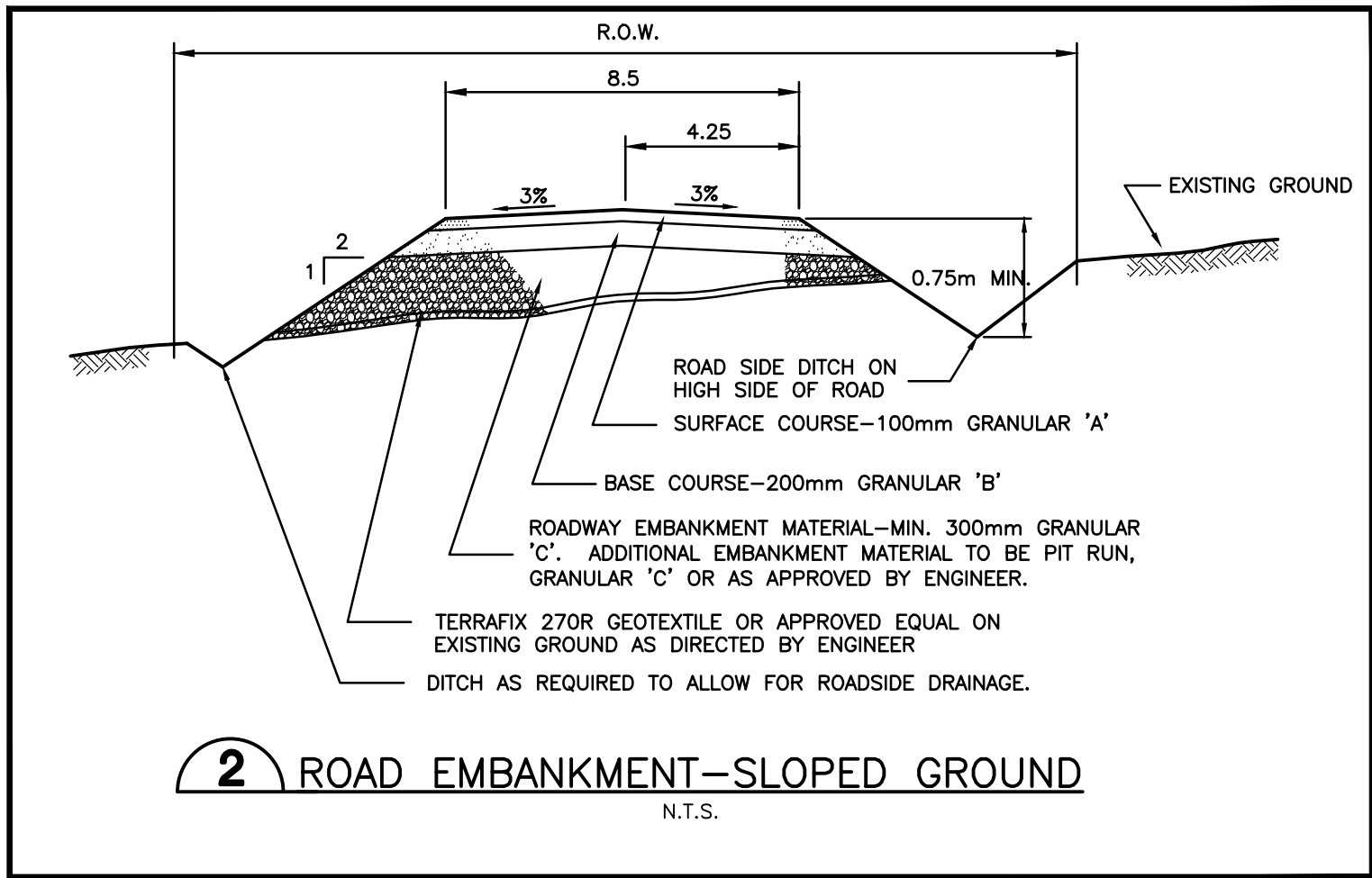
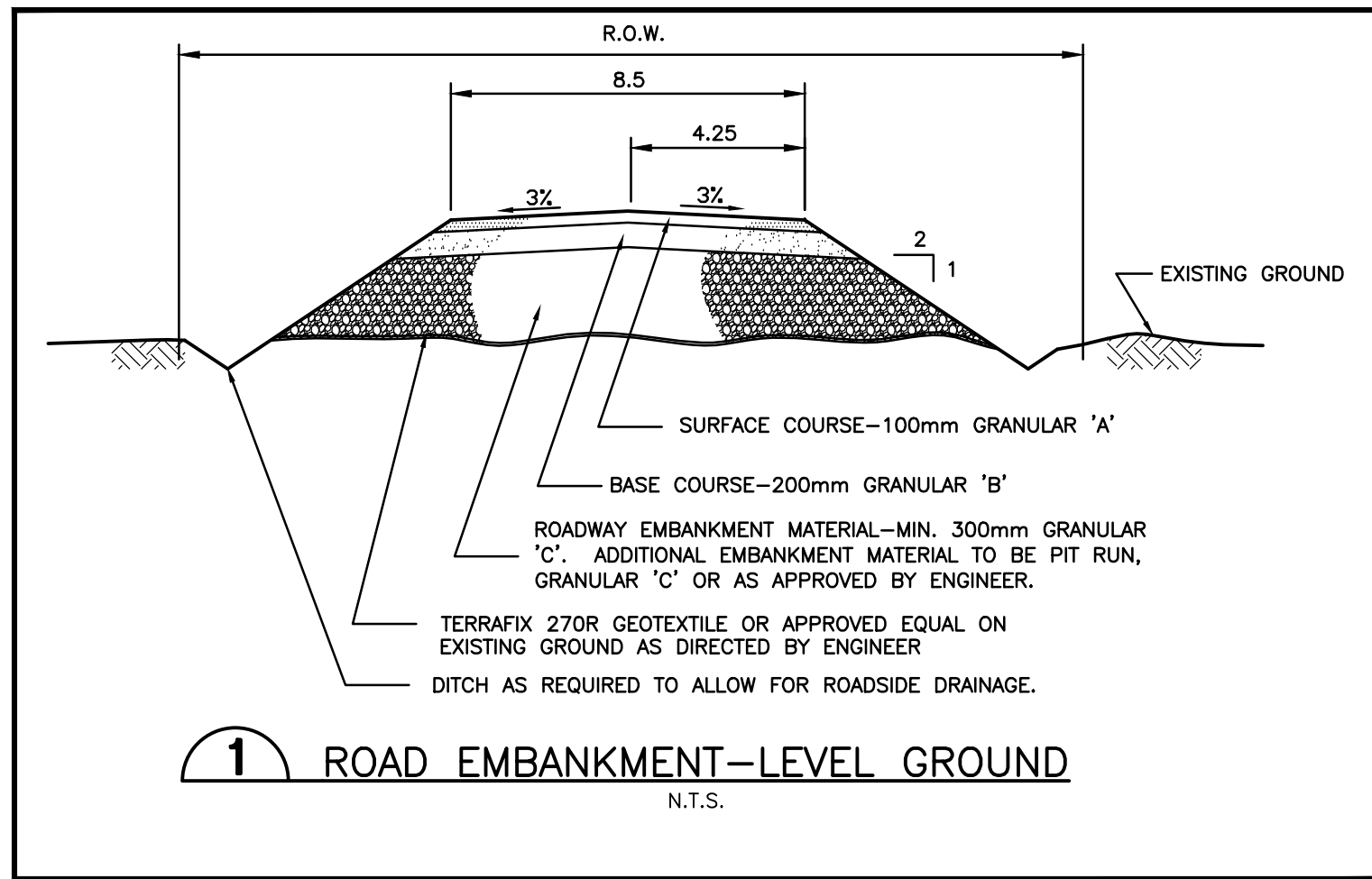
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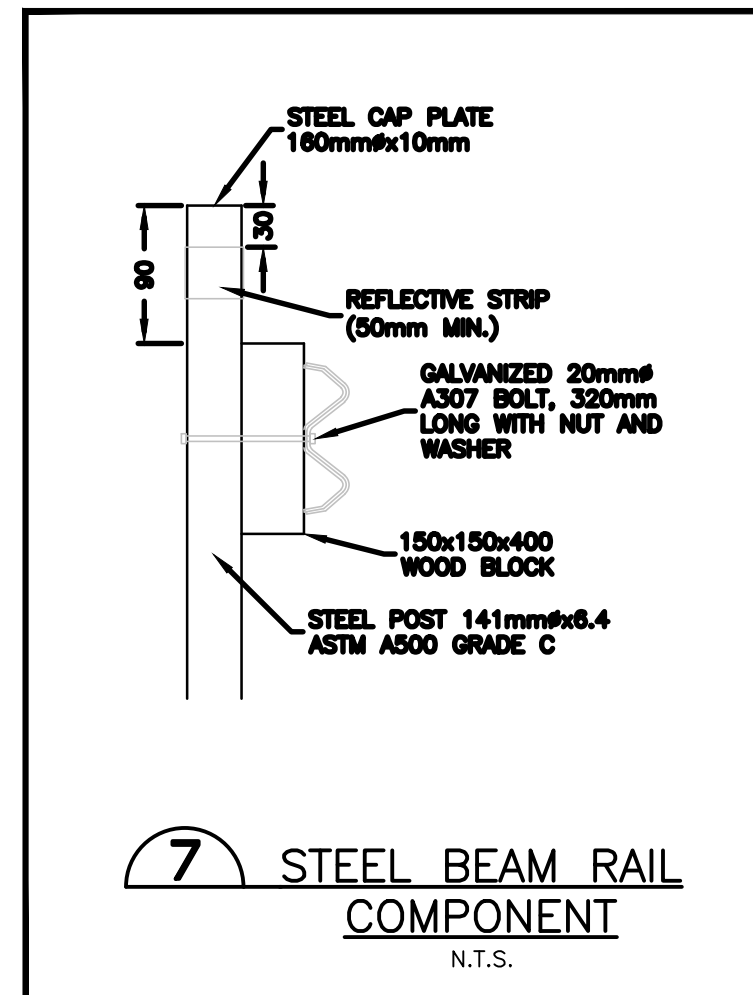
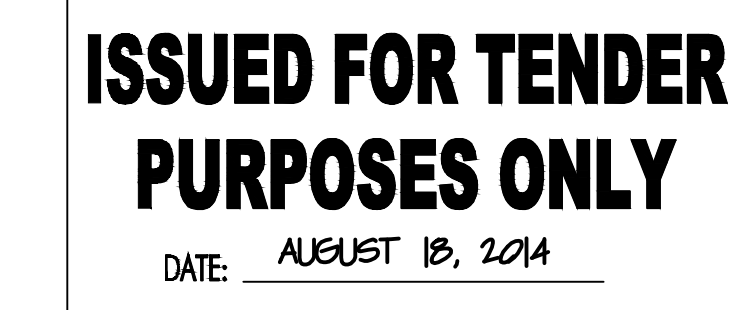
CITY OF IQALUIT

PROJECT

PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

TITLE		ROAD DETAILS	
design by	A.B.Z	project no.	OTT-00219428-A0
drawn by	A.B.Z	drawing no.	DE-1
checked by	S.L.B.		
date	30/05/14		
scale	N.T.S.		





02	ISSUED FOR TENDER	18/08/14	ABZ	SLB
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No.	DESCRIPTION	DATE	BY	APP'D
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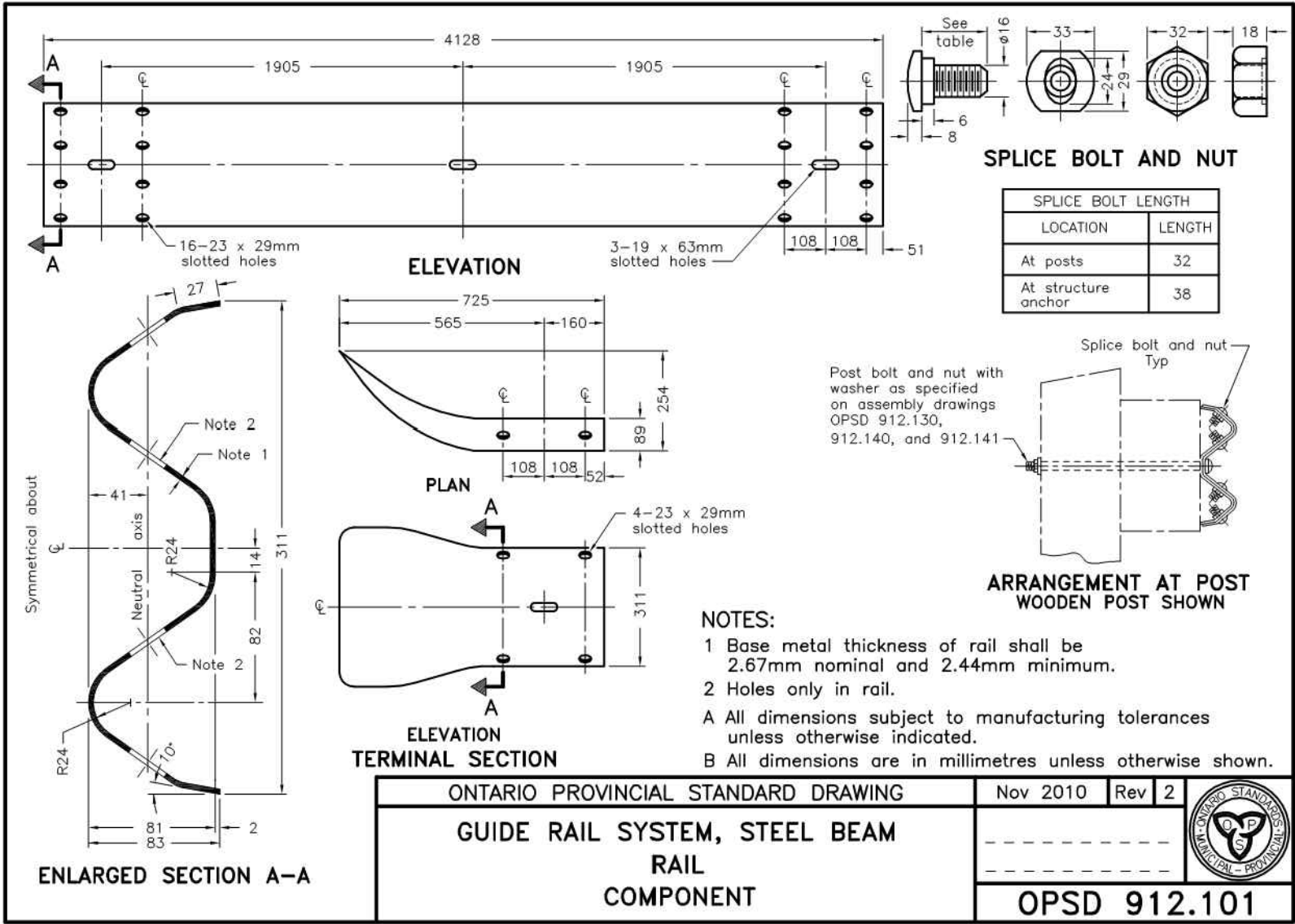
CITY OF IQALUIT

PROJECT

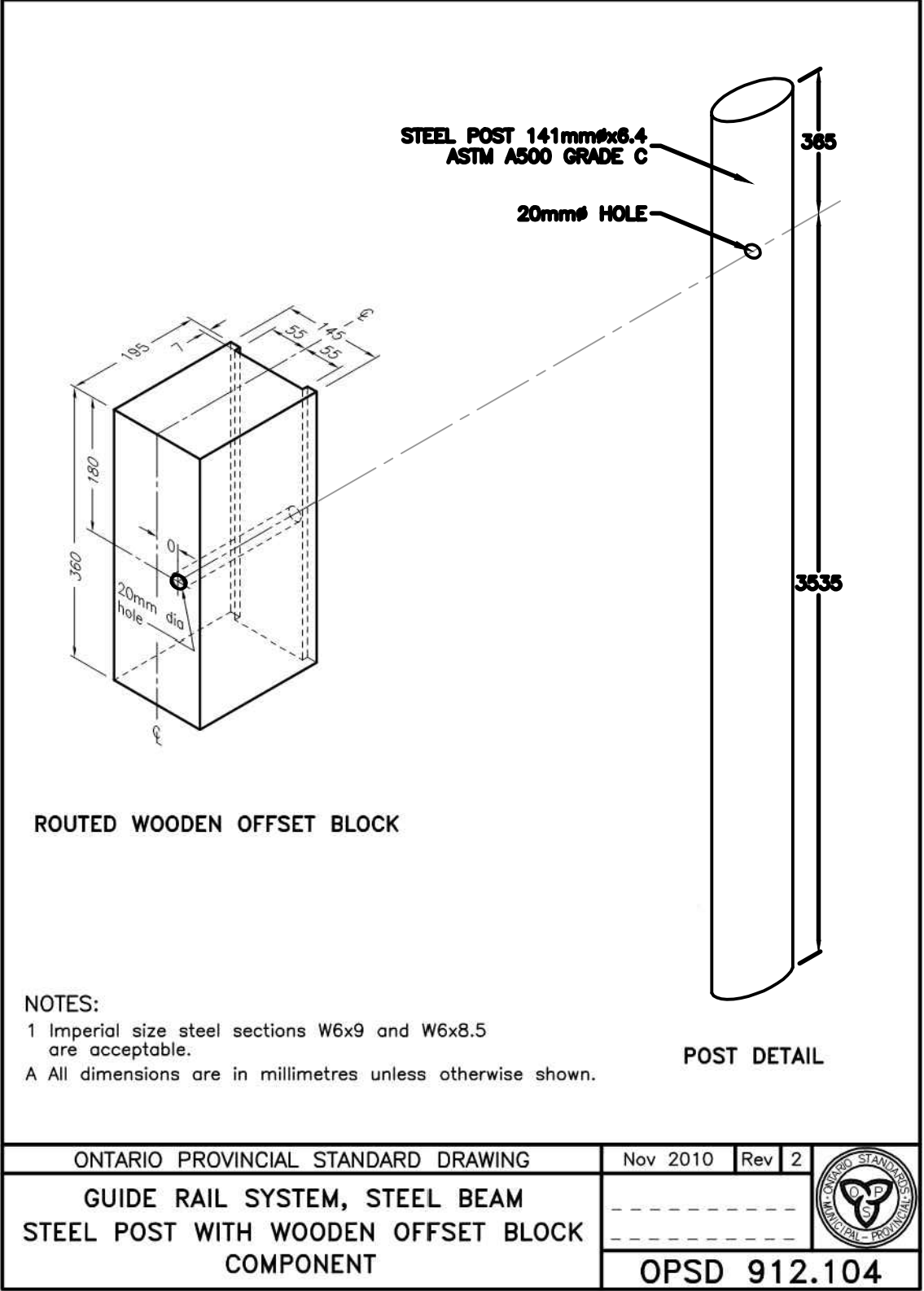
PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

GUIDERAIL DETAILS

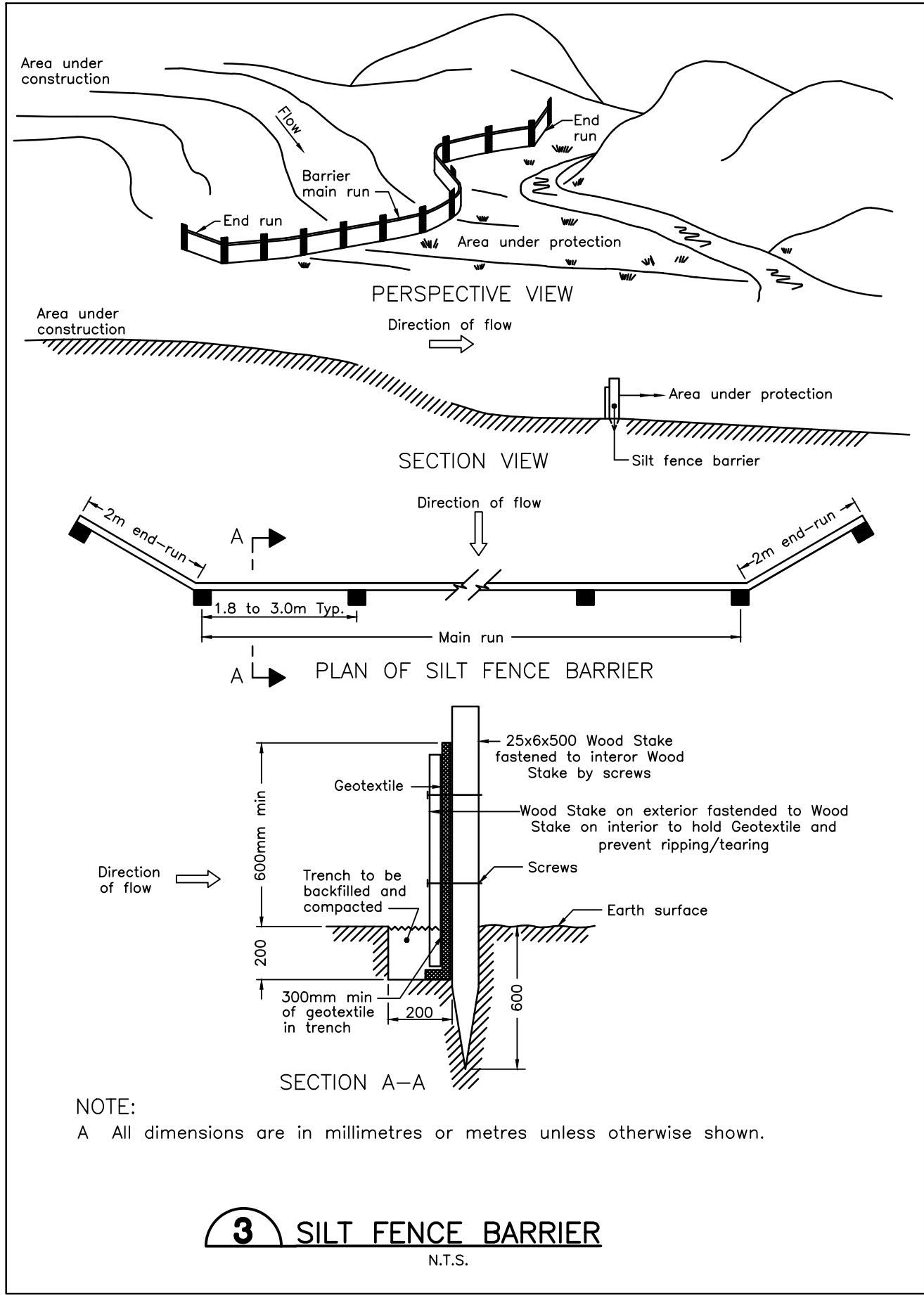
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drawn by	A.B.Z	
checked by	S.L.B.	
date	30/05/14	
scale	N.T.S.	



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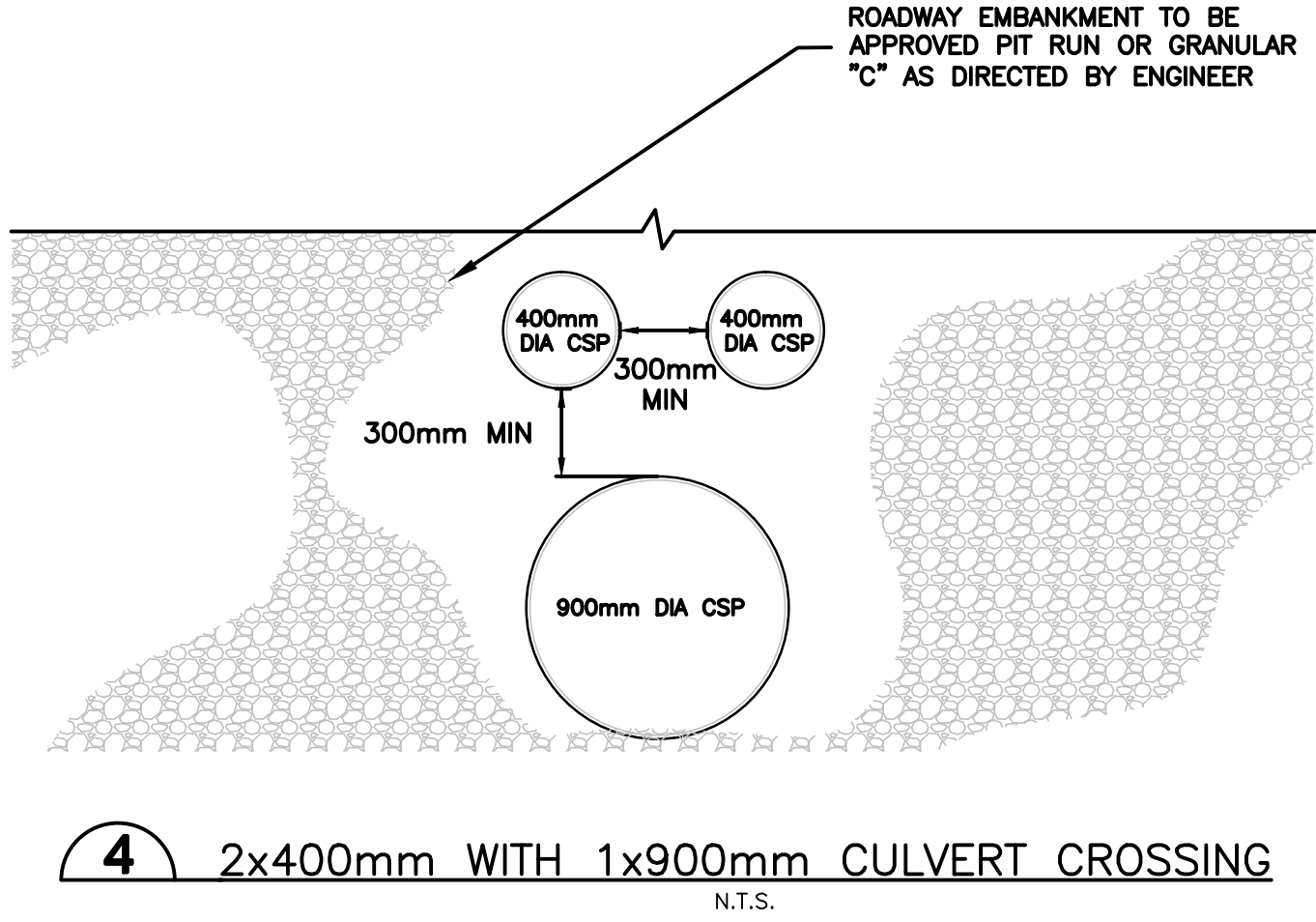


2



3 SILT FENCE BARRIER

N.T.S.



4 2x400mm WITH 1x900mm CULVERT CROSSING

N.T.S.

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01	80% PRELIMINARY SUBMISSION	18/06/14	ABZ	SLB
No.	DESCRIPTION	DATE	BY	APP'D
R E V I S I O N S				



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PROJECT
PROPOSED ROAD TO
NORTHWEST AGGREGATE DEPOSIT

TITLE
MISC. DETAILS

design by	A.B.Z	project no.	OTT-00219428-A0
drawn by	A.B.Z	drawing no.	DE-3
checked by	S.L.B.		
date	30/05/14		
scale	N.T.S.		