P Lake Sewage Lagoon
Water Licence Application
Design Report
Cape Dorset, NU

Report

December 21, 2006

P Lake Sewage Lagoon
Water Licence Application
Design Report
Cape Dorset, NU

Government of Nunavut, Community and Government Services

05-4319
Gary Strong, P. Eng. Project Manager

Submitted by

Dillon Consulting Limited

(In reply, please refer to)
Our File: 05-4319-2200

March 30, 2007

Community and Government Services
Government of Nunavut
Pond Inlet, NU

Attention: Bhabesh Roy, Municipal Planning Engineer

P Lake Sewage Lagoon Water Licence Application Design Report
Cape Dorset, NU

Dear Mr. Roy:

Enclosed please find the report for the ***P Lake Sewage Lagoon Water Licence Application Design Report Cape Dorset, NU***. This report has been developed to provide the required background on the submission to the Nunavut Water Board in the application for the water licence on the subject.

Yours sincerely,

DILLON CONSULTING LIMITED

Gary Strong, P. Eng

Project Manager

Encl.
cc:

(In reply, please refer to)
Our File: 05-4319-2200

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December 21, 2006

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POND INLET, NU

Community and Government Services
Government of Nunavut
Pond Inlet, NU

Attention: Bhabesh Roy, P.Eng
Municipal Planning Engineer

P Lake Sewage Lagoon Water Licence Application Design Report
Cape Dorset, NU

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Yours sincerely,

DILLON CONSULTING LIMITED

REGISTERED PROFESSIONAL ENGINEER
G. STRONG
N.W.T.

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
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1 INTRODUCTION

Dillon Consulting Limited (Dillon) has been retained by the Department of Community and Government Services (C&GS), Government of Nunavut, Dillon Consulting Limited (Dillon) to design a new sewage treatment system for the Hamlet of Cape Dorset. This document outlines the design for the P Lake Sewage Lagoon, and the measures taken to comply with the Nunavut Waters and Nunavut Surface Rights Tribunal Act 2002.

The Hamlet of Cape Dorset is located on Dorset Island, off the south shore of Baffin Island in Nunavut (**Drawing A**). Dorset Island, jutting southward into Hudson Strait, is part of a chain of islands connected to Baffin Island during low tide. By air, Cape Dorset is approximately 402 kilometers southwest of the city of Iqaluit.

The annual snowfall in Cape Dorset is approximately 118 cm and the annual rainfall is approximately 15 cm. The community experiences mild flooding during spring runoff. In January, temperatures range between a low of about -29^0C and a high of about -23^0C. In July the temperatures range between a low of 3^0C to a high of about 7^0C. Freeze up usually occurs during the month of November but may happen as early as September or October. In some years, early freeze up may thaw again before final freeze up. Spring thaw typically occurs during the month of July, but can vary as much as freeze up.

The community uses trucked services for both water delivery and sewage collection.

1.1 Background

Dillon was first retained by the Department of Community Government and Transportation (CG&T) in 2001 when the motion was made to produce a new sewage facility plan for the community of Cape Dorset. The motion was put forth due to a structural failure in the existing three-cell lagoon.

Over the course of four years, Dillon has been involved with this project, aiding CG&T and C&GS with planning studies, site selection studies, regulatory requirements and treatment alternatives. Several site options were identified for the new sewage lagoon, all of which were dismissed for various reasons:

Q Lake Lagoon Option– A small lake located to the north east of the community. The Mayor initially identified this site as a potential location for a lagoon. However, in the winter of 2001/2002, the community's water supply pipeline froze, and Q Lake was used as the emergency back-up water supply source. Subsequent to the pipeline freeze up the community stated that Q Lake should not be used as a sewage lagoon facility.

P Lake Lagoon Option– A small lake located south of the community. The community identified this site as a potential location for a lagoon. The road to P-Lake would have a constant grade of 8 to 10% over a length of approximately 1 km.

Site R Lagoon Option– Site R is a flat area north east of the community. This site is currently used as the granular stockpile for CG&T. The site is also located at the end of the runway. The Airports Division has expressed concerns over this location and the potential for the increased bird strike hazard. The site may not meet regulatory approval because of the increased risk of bird strikes.

Existing Site Mechanical Plant Option - Installation of a Mechanical Sewage Treatment Plant would be best at the existing lagoon site. The treated sewage effluent discharge is to the south of the tidal bridge. The proposed discharge location results in the effluent being directed away from the community. The effluent discharge location was an important issue to the community during the consultation period. This option carries with it the issue of higher operational costs and concern with hiring and training qualified operators in the community.

Based on the results of sewage treatment options and studies completed between 2001 and 2004, the Government of Nunavut has offered two possibilities, the use of the area up gradient of P Lake as a sewage lagoon and the use of a mechanical system for sewage treatment. The Hamlet through consultation selected a lagoon adjacent to "P Lake" as their preferred sewage treatment option.

2 WATER LICENCE REQUIREMENTS

The Nunavut Waters and Nunavut Surface Rights Tribunal Act 2002 have several articles that are directly applicable to the facilities at Cape Dorset. These are provided below.

Under Article 4 Definitions

"Licence" means, unless the context otherwise requires, a type A or type B licence, in accordance with the criteria prescribed by the regulations, issued for the use of waters or the deposit of waste, or both, in Nunavut under section 42

"Waste" means any substance that, by itself or in combination with other substances found in water, would have the effect of altering the quality of any water to which the substance is added to an extent that is detrimental to its use by people or by any animal, fish or plant, or any water that would have that effect because of the quantity or concentration of the substances contained in it or because it has been treated or changed, by heat or other means, and includes

(a) any substance or water that, for the purposes of the Canada Water Act, is deemed to be waste;
(b) any substance or class of substances specified by the regulations;

(c) water containing any substance or class of substances in a quantity or concentration that is equal to or greater than that prescribed by the regulations; and
(d) water that has been subjected to a treatment or change described by the regulations.

Article 13

13. (1) Except as otherwise provided by a compensation agreement referred to in this Part, a person, including the designated Inuit organization, who is adversely affected by a licensed use of waters or deposit of waste, or by an unlicensed use of waters or deposit of waste authorized by the regulations, is entitled to be compensated in respect of that adverse effect by the licensee or the person so authorized and to recover the compensation in any court of competent jurisdiction.

Article 38

38. (1) The Board may not issue, amend or renew a licence to use waters or deposit waste if there is an applicable land use plan approved in accordance with Part 5 of Article 11 of the Agreement unless the Nunavut Planning Commission, in accordance with section 11.5.10 of the Agreement,
(a) has determined that the use or deposit, or in the case of an amendment any change to the use or deposit, conforms to the land use plan; or
(b) has approved a variance in respect of the use, deposit or change.

Article 48

48. (1) An application in relation to a licence shall contain the information and be in the form required by the rules or by-laws of the Board, and be accompanied by the fees required by the regulations.
(2) An application, except in relation to a cancellation, shall be accompanied by the information and studies concerning the use of waters or the deposit of waste that are required for the Board to evaluate the qualitative and quantitative effects of the use or the deposit on waters.
(3) On the filing of an application, the Board may provide guidelines to the applicant respecting the information to be provided by the applicant in respect of any matter that the Board considers relevant, including the following:
(a) the description of the use of waters, deposit of waste or appurtenant undertaking, as the case may be;
(b) the qualitative and quantitative effects of the use of waters or the deposit of waste on the drainage basin where the use is to be undertaken or the deposit is to be made, and the anticipated impact of the use or deposit on other users;
(c) the measures the applicant proposes to take to avoid or mitigate any adverse impact of the use of waters or the deposit of waste;
(d) the measures the applicant proposes to take to compensate persons, including the designated Inuit organization, who are adversely affected by the use of waters or the deposit of waste;

(e) the program the applicant proposes to undertake to monitor the impact of the use of waters or the deposit of waste;
(f) the interests in and rights to lands and waters that the applicant has obtained or seeks to obtain; and
(g) the options available for the use of waters or the deposit of waste.

Article 57

57. The Board may not issue a licence unless the applicant satisfies the Board that
(a) any waste produced by the appurtenant undertaking will be treated and disposed of in a manner that is appropriate for the maintenance of the water quality standards and effluent standards that are prescribed by the regulations or, in the absence of such regulations, that the Board considers acceptable; and
(b) the financial responsibility of the applicant, taking into account the applicant's past performance, is adequate for
(i) the completion of the appurtenant undertaking,
(ii) such measures as may be required in mitigation of any adverse impact, and
(iii) the satisfactory maintenance and restoration of the site in the event of any future closing or abandonment of that undertaking.

Article 60

60. (1) The Board may not issue a licence unless
(a) the applicant satisfies the Board that compensation that the Board considers appropriate has been or will be paid by the applicant to any person who would be adversely affected by the proposed use of waters or deposit of waste and who, at the time the application was filed,
(i) used waters for a domestic purpose in the Northwest Territories or in Nunavut,
(ii) held a licence under this Act or the Northwest Territories Waters Act to deposit waste in the Northwest Territories or in Nunavut,
(iii) was an instream user in the Northwest Territories or in Nunavut,
(iv) was, as authorized by regulations made under this Act or the Northwest Territories Waters Act, using waters or depositing waste in the Northwest Territories or in Nunavut without a licence under either Act,
(v) was an owner or an occupier of land in the Northwest Territories or in Nunavut, or
(vi) was a holder of an outfitting concession, a registered trapline or other rights of a similar nature in the Northwest Territories or in Nunavut; or
(b) the applicant has entered into an agreement to compensate any person described in subparagraphs (a) (i) to (vi) who would be adversely affected.

2.1 Summary

This report provides the NWB an application that outlines the following;

(a) the description of the deposit of waste
(b) the qualitative and quantitative effects of the deposit of waste on the drainage basin where the deposit is to be made, and the anticipated impact of the deposit on other users;
(c) the measures the applicant proposes to take to avoid or mitigate any adverse impact of the deposit of waste;
(d) the measures the applicant proposes to take to compensate persons, including the designated Inuit organization, who are adversely affected by the deposit of waste;
(e) the program the applicant proposes to undertake to monitor the impact of the deposit of waste, and
(g) the options available for the deposit of waste.

The Board can not renew or issue a licence if the application indicates that;

(a) any waste produced by the appurtenant undertaking will be treated and disposed of in a manner that is appropriate for the maintenance of the water quality standards and effluent standards that are prescribed by the regulations or, in the absence of such regulations, that the Board considers acceptable; and
(b) the financial responsibility of the applicant, taking into account the applicant's past performance, is adequate for
    (i) the completion of the appurtenant undertaking,
    (ii) such measures as may be required in mitigation of any adverse impact, and
    (iii) the satisfactory maintenance and restoration of the site in the event of any future closing or abandonment of that undertaking

The following sections of this report provide the information required. This information has been previously submitted to the NWB in several documents, and in the technical hearing held in the community. This submission consolidates the information succinctly into one document.

3 ADDITINAL DOCUMENTATION

Appended to this document are the flowing reports and drawings;

- The Geotechnical Report completed by AMEC dated October 13, 2005
- AMEC's letter dated September 12, 2006.
- The Geotechnical Report by AMEC completed on November 1 2006, including the map of the test hole locations that describes the additional field drilling completed after the technical hearing.
- The detailed design drawings 100, 101, 109, 110, 111, and 112 (original drawings are on record with Engineer's Seal and signature). The other drawings in the drawing set (102 to 108 and 110) describe works not related to the construction of the waste site. The ancillary works are not regulated under the Nunavut Waters and Nunavut Surface Rights Tribunal Act 2002. The works relate to the access road. In previous correspondence with the NWB and INAC, the road has been determined to be not regulated by the NWB.

The above documents provide additional details.

4 THE DESCRIPTION OF THE DEPOSIT OF WASTE

4.1 Sewage Generation Rates

The new sewage treatment system will be designed for a 20 year life span (2006-2026). In order to do so, the sewage generation rates per capita and the population of Cape Dorset for the year 2026 were determined. Predicted population values until the year 2020 were provided by Nunavut Bureau of Statistics (**Appendix D)**. Population values beyond 2020 were predicted using both a linear growth rate similar to previous years (31 persons per year), and using a percentage growth rate (1.8%) as illustrated in **Chart 4.1**. The population for 2026 was predicted to be 2002 persons.

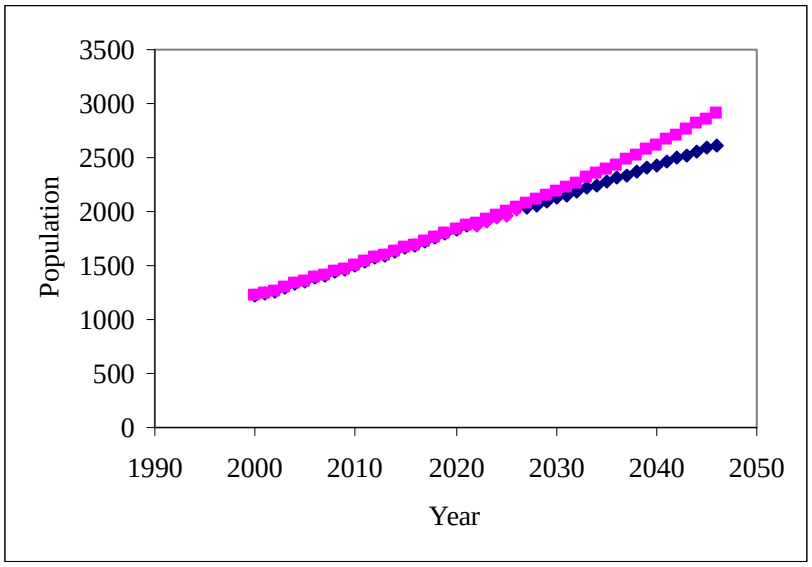


Chart 4.1: Population Growth in Cape Dorset

Data prior to 2021 was provided by Nunavut Bureau of Statistics and data proceeding 2021 was predicted. Blue data points indicate data calculated using a linear growth rate of 31 persons per year. Pink data points indicate data calculated using a percentage growth rate of 1.8%.

For communities with trucked sewage collection, the amount of sewage generated can be assumed equal to the amount of water consumed. The following formula (Department of Municipal and Community Affairs, Government of the Northwest Territories) is generally used to predict water consumption in Northern communities:

$$Water\ Usage\ (l/cd) = 90\ l/cd \times (1.0 + 0.00023 \times population) \quad [1]$$

Based on this information, the lagoon will be designed to treat 96 100 m^3, the annual sewage volume for a population of 2002 persons. **Error! Reference source not found.** It shows the calculated sewage generation for years 2006 – 2026.

Table 4.1: Predicted Sewage Generation 2006-2026

Year	Population	MACA Predicted Sewage Production (L)	MACA Predicted Sewage Production (m^3)
2000	1213	50963978	50964
2001	1240	52351337	52351
2002	1268	53801714	53802
2003	1298	55368837	55369
2004	1327	56896649	56897
2005	1354	58330519	58331
2006	1382	59829131	59829
2007	1412	61447933	61448
2008	1441	63025702	63026
2009	1471	64671251	64671
2010	1501	66330399	66330
2011	1536	68283261	68283
2012	1570	70198052	70198
2013	1600	71902080	71902
2014	1632	73734700	73735
2015	1662	75466835	75467
2016	1692	77212569	77213
2017	1726	79207509	79208
2018	1757	81041649	81042
2019	1793	83189842	83190
2020	1829	85357618	85358
2021	1848	86529675	86530
2022	1879	88404583	88405
2023	1910	90293760	90294
2024	1941	92197208	92197
2025	1971	94114925	94115
2026	2002	96046912	96047

The annual sewage generation volume used for design purposes is set at 96,000 m^3.

4.2 Sewage Quality

Due to the low water usage of communities using trucked water delivery and trucked sewage collection, sewage tends to be concentrated when compared to typical municipal wastewater. Cape Dorset trucked sewage is assumed to have the following characteristics:

- Average raw Biochemical Oxygen Demand (BOD_5) concentration of 625 mg/L
- Average raw suspended solids (SS) concentration of 900 mg/L

5 QUALITATIVE AND QUANTITATIVE EFFECTS OF THE DEPOSIT OF WASTE

The discharge of the lagoon will be directly up gradient of P Lake. Over the design life the sewage effluent will impact P Lake with increased BOD, TSS, and nutrient loading. Aquatic life within P Lake will be adversely affected during lagoon discharge. To understand the impact on the receiving environment, an assessment of P Lake and the P Lake basin was completed. The following sections describe the P Lake site area. (**Drawing B)**.

5.1 P Lake Fisheries

As part of the scope of work for this project Dillon conducted detailed fisheries investigations of P Lake, the results of which are included as **Section 6.0** of this report.

5.2 P Lake Area Wildlife

The topography surrounding P Lake is characterized by rock outcrops and steep cliffs. In addition to various mammals and birds common to this part of Baffin Island, the P Lake area is know to support a local population of Common Ravens (*Corvus corax)*. It can be assumed that the Ravens are using this area for nesting as they commonly nest on cliffs and within rock crevices. It is not expected that the development of a sewage treatment lagoon at P Lake would negatively impact the resident raven population or other wildlife of the area.

5.3 P Lake Bathymetry

A detailed bathymetric survey of P Lake was not completed. However, discrete soundings completed in 2003 found the lake to have a maximum depth of approximately 2.5 m. There is no connectivity between P Lake and other fresh water sources on the island. The single outlet from P Lake flows via a single-thread channel for approximately 370 m before entering Telik Inlet (marine environment). There is no direct conductivity to the marine environment.

P Lake and has a surface area of roughly 1.3 ha, and a maximum depth of 2.8 m. Leon Neson, Director, Cape Dorset Housing Department provided Dillon with eight (8) measured depths of P Lake. These depths were used to approximate a volume of P Lake: 11 667 m^3 (**Drawing C).**

5.4 P Lake Watershed

P Lake is a natural system and is subject to natural water recharge. Using climatic data for Cape Dorset, NU, and the water balance and recharge rates for P Lake have been determined and are illustrated in **Chart 5.1**

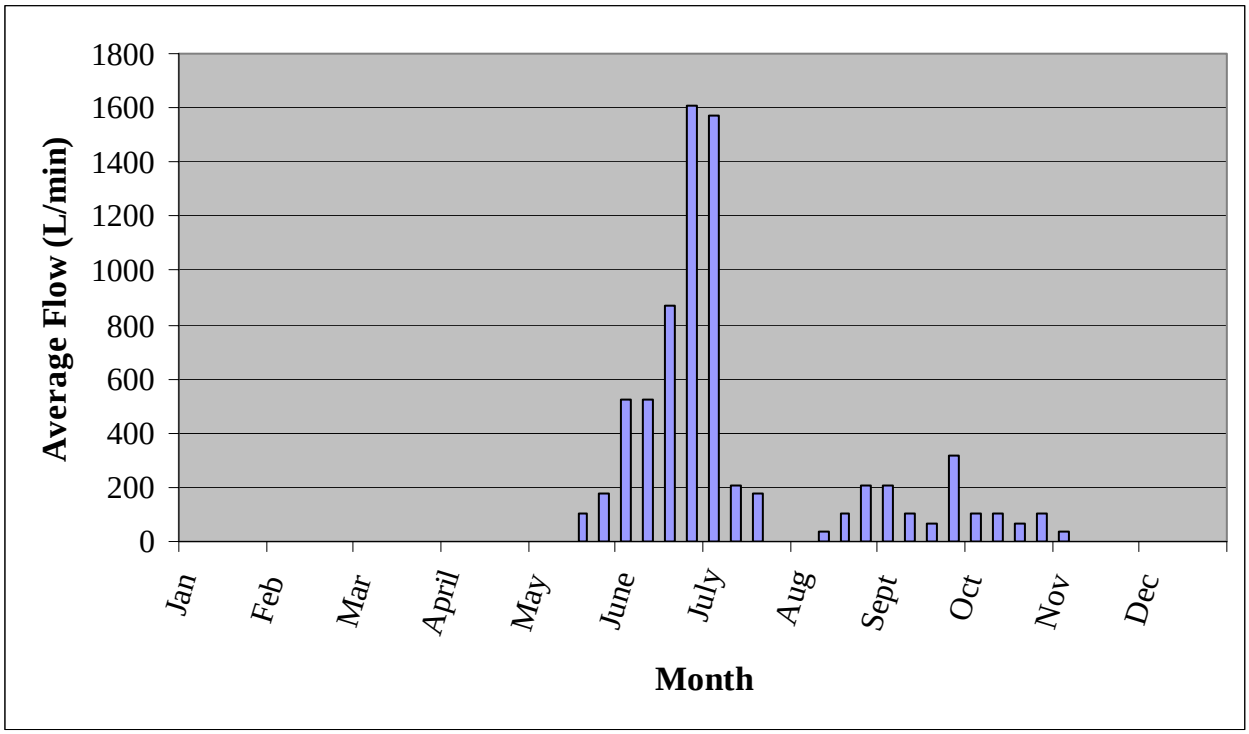


Chart 5.1 Water Recharge in P Lake

The method in which this data was determined is detailed in **Appendix B**.

Chart 5.1 illustrates that during the months of June and July, water recharges from the lake at a significant flow rate. In this respect, using P Lake as a primary sewage lagoon is not practical unless the recharge water is directed away from the proposed lagoon. The recharge would significantly reduce the retention of sewage in P Lake and decrease treatment, therefore the use of ditching to divert recharge water is carried forward in the conceptual design development.

5.5 Groundwater Movement from the Lagoon

There has been some concern raised with the ex-filtration from the lagoon through the base of the lagoon. AMEC (see annexed reports) completed a thermal analysis of the lagoon design and determined that the impact on the permafrost would not create a seepage or ex-filtration path from the lagoon, under the constructed berms. Therefore minimal, or no, impact to the environment is expected from ex-filtration of the sewage through the lagoon base.

5.5.1 Lagoon Discharge

The lagoon will be constructed in an irregular shape. This particular shape is used to maximize the use of the natural topography to minimize construction costs. The lagoon is designed such that sewage will be entrained in the lagoon for 12 months. During the summer months, the sewage will be treated through natural process (biological and physical). The effluent will discharge from the lagoon through P- Lake and then 500m to the from the shore of Telik inlet. The treatment process is described in the following section of this report.

5.5.2 Effluent Characteristics

The sewage treatment system needs to address two sets of criteria, namely;

- The requirements of the Fisheries Act as governed by the Department of Fisheries and Oceans and Ministry of Environment Canada at the point where the effluent impact fish barring water and or fish habitat. Section 6 of this report describers the work undertaken to identify the regulation point under this criteria. It has been determined that this regulatory point is Telik Inlet. Both departments have indicated that effluent meeting the criteria set out in the Guidelines for the discharge of treated Municipal Wastewater in the Northwest Territories, 1992, are applicable to this location. From this guideline, the criteria for discharge are BOD 100 mg/L and TSS 120 mg/L.
- The requirement of the Nunavut Waters and Nunavut Surface Rights Tribunal Act 2002, which indicates that *any waste produced by the appurtenant undertaking will be treated and disposed of in a manner that is appropriate for the maintenance of the water quality standards and effluent standards that are prescribed by the regulations or, in the absence of such regulations, that the Board considers acceptable.*

Should the Nunavut Water Board also apply the above noted guideline, then the required effluent criteria for a lake with Tr< 5 yr is; BOD 80 mg/L and TSS 100 mg/L, with F. Coli 10E. The following sections describe the expected effluent discharge values fort he design life of the lagoon.

5.6 Annual Lagoon Kinetics

The level of treatment achieved by a lagoon system can be predicted using the following kinetic formula[1]:

$$\frac{C_e}{C_i} = e^{-Kt} \quad \textbf{[2]}$$

Where,
C_e = Concentration of substrate (BOD_5) in lagoon effluent (mg/L)
C_i = Concentration of substrate (BOD_5) in lagoon influent (mg/L)
t = Residence time of sewage in lagoon (days)
K = kinetic rate constant for ($days^{-1}$)

The kinetic rate constant, K, varies according to temperature:

$$K = K_{20}\theta^{T-\theta} \quad \textbf{[3]}$$

Where,
K = BOD_5 kinetic rate constant ($days^{-1}$)
K_{20} = BOD_5 kinetic rate constant ($days^{-1}$) for 20^0C
θ = temperature coefficient
T = temperature of lagoon contents in the critical or coldest winter months in degrees Celsius (^{0}C)

A typical value for θ is 1.06[2]. Although typical values for K_{20} range from 0.25 – 0.50 $days^{-1}$, a significantly lower value for K (0.10 $days^{-1}$) was assumed in this case, to be conservative and to account for the cold climate conditions. Using these assumed values the effluent quality from the constructed primary lagoon was predicted for a variety of conservative temperatures and retention times (Error! Reference source not found.). Although the lagoon will hold sewage for a year's time, the effective treatment time used in Error! Reference source not found. Only accounts for the length of time sewage is completely thawed for treatment during the summer months. Since freeze-up can vary and occur anytime from September – November, a range of 70-90 days of treatment were analyzed. Winter treatment was assumed to be negligible in **Table 5.1**.

[1] Environment Canada Report EPS 3 NR 1. (1987) Cold Climate Sewage Lagoons. *Proceedings of the June 1985 Workshop, Winnipeg, Manitoba.* Appendix D-3.
[2] Metcalf and Eddy, Inc. (1991). Wastewater *Engineering: Treatment, Disposal and Reuse, 3rd Edition.* Toronto: McGraw-Hill Inc.

Table 5.1: Prediction of Effluent BOD using Lagoon Kinetics (Annual Retention Lagoon)

t (days)	K_{20} ($days^{-1}$)	θ	T (^oC)	K ($days^{-1}$)	C_e/C_i	C_i (mg/L)	C_e (mg/L)
90	0.1	1.06	3	0.037	0.0354	625	22
90	0.1	1.06	4	0.039	0.0289	625	18
90	0.1	1.06	5	0.042	0.0234	625	15
90	0.1	1.06	6	0.044	0.0187	625	12
90	0.1	1.06	7	0.047	0.0147	625	9
80	0.1	1.06	3	0.037	0.0513	625	32
80	0.1	1.06	4	0.039	0.0429	625	27
80	0.1	1.06	5	0.042	0.0355	625	22
80	0.1	1.06	6	0.044	0.0291	625	18
80	0.1	1.06	7	0.047	0.0235	625	15
70	0.1	1.06	3	0.037	0.0743	625	46
70	0.1	1.06	4	0.039	0.0636	625	40
70	0.1	1.06	5	0.042	0.0539	625	34
70	0.1	1.06	6	0.044	0.0452	625	28
70	0.1	1.06	7	0.047	0.0376	625	23

Based on the above data, the BOD_5 of the effluent discharged from the lagoon has an expected range of 9 mg/L (90 day treatment period, 7^0C) to 46 mg/L (70 day treatment period, 3^0C). Therefore using the very conservative value of 70 days of treatment, at a low temperature of 3 degrees for the sewage in the lagoon, the effluent will meet the Guidelines for the discharge of treated Municipal Wastewater in the Northwest Territories, 1992.

The document *Best Available Technology for Sewage Treatment in the North, Indian and Northern Affairs Canada, 2003*, indicates that removal rates of BOD for lagoons with detention times over 180 days is 85 to 95%. This gives a range of expected BOD effluent in the range of 31 to 93 mg/L. These values are below the discharge criteria set out in the reference document.

5.7 Fecal Coliform Reduction

The reduction of fecal coliforms (FC) can also be predicted. The average generation of FC in domestic sewage is $2x10^9$ FC per person per day[3]. Using this value and the predicted sewage volume generation, the average fecal coliform concentration in the P Lake Lagoon system was determined in **Table 5.2** the reduction rate is as described in the Guidelines for Planning Design, Operation and Maintenance of Wastewater Lagoon Systems, in the Northwest Territories, Heinke et al.

[3] Metcalf and Eddy, Inc. (1991). Wastewater *Engineering: Treatment, Disposal and Reuse, 3rd Edition.* Toronto: McGraw-Hill Inc.

Table 5.2 Reduction of Fecal Coliform from Lagoon Treatment System

Year	Population	Fecal Coliorm		Sewage Volume	Fecal Coliform	
					Raw Influent	Annual Lagoon Effluent (99.9% Reduction)
		(FC/p/d)	(FC/d)	(L/d)	(FC/L)	(FC/L)
2006	1382	2.0E+09	2.8E+12	1.6E+05	1.7E+07	1.7E+04
2007	1412	2.0E+09	2.8E+12	1.7E+05	1.7E+07	1.7E+04
2008	1441	2.0E+09	2.9E+12	1.7E+05	1.7E+07	1.7E+04
2009	1471	2.0E+09	2.9E+12	1.8E+05	1.7E+07	1.7E+04
2010	1501	2.0E+09	3.0E+12	1.8E+05	1.7E+07	1.7E+04
2011	1536	2.0E+09	3.1E+12	1.9E+05	1.6E+07	1.6E+04
2012	1570	2.0E+09	3.1E+12	1.9E+05	1.6E+07	1.6E+04
2013	1600	2.0E+09	3.2E+12	2.0E+05	1.6E+07	1.6E+04
2014	1632	2.0E+09	3.3E+12	2.0E+05	1.6E+07	1.6E+04
2015	1662	2.0E+09	3.3E+12	2.1E+05	1.6E+07	1.6E+04
2016	1692	2.0E+09	3.4E+12	2.1E+05	1.6E+07	1.6E+04
2017	1726	2.0E+09	3.5E+12	2.2E+05	1.6E+07	1.6E+04
2018	1757	2.0E+09	3.5E+12	2.2E+05	1.6E+07	1.6E+04
2019	1793	2.0E+09	3.6E+12	2.3E+05	1.6E+07	1.6E+04
2020	1829	2.0E+09	3.7E+12	2.3E+05	1.6E+07	1.6E+04
2021	1848	2.0E+09	3.7E+12	2.4E+05	1.6E+07	1.6E+04
2022	1879	2.0E+09	3.8E+12	2.4E+05	1.6E+07	1.6E+04
2023	1910	2.0E+09	3.8E+12	2.5E+05	1.5E+07	1.5E+04
2024	1941	2.0E+09	3.9E+12	2.5E+05	1.5E+07	1.5E+04
2025	1971	2.0E+09	3.9E+12	2.6E+05	1.5E+07	1.5E+04
2026	2002	2.0E+09	4.0E+12	2.6E+05	1.5E+07	1.5E+04

The predicted concentration of FC/100mL of the lagoon effluent is 1.5 E =04 FC/100mL.

5.8 TSS Reduction

The document *Best Available Technology for Sewage Treatment in the North, Indian and Northern Affairs Canada, 2003*, indicates that removal rates of TSS for lagoons with detention times over 180 days is 85 to 95%. This gives a range of expected BOD effluent in the range of 45 to 135 mg/L. These values are below the discharge criteria set out in the reference document.

Guidelines for Planning Design, Operation and Maintenance of Wastewater Lagoon Systems, in the Northwest Territories, Heinke et al indicates that lower values for TSS can be expected for fall discharges. Allowing the lagoon to experience die off of the algae, and other biological organisms, and allowing time in the fall for these to settle prior to discharge results in a effluent with lower TSS values. The planned operational sequence for the lagoon is to use a fall discharge. Therefore TSS values in the mid to lower range of those predicted using the *Best Available Technology for Sewage Treatment in the North, Indian and Northern Affairs Canada, 2003* is expected.

6 P LAKE FISHERIES

The community members have communicated to the Hamlet officials that P Lake is not used as a sport or sustenance fishery. It is, however, believed that the lake supports a forage fish base (i.e. Threespine Stickleback Gasterosteus Aculeatus, or the Ninespine Stickleback Pungitius*)*. The steep terrain between the P Lake outlet and the marine environment precludes the movement of fish between these aquatic environs. At this time we are unaware of any information/data on fish species composition or population estimates for the lake.

This section of the report describes the methods and results from the following environmental investigations:

- Fishery inventory and habitat descriptions of P Lake;
- Descriptions of general habitat conditions of the outlet stream between P Lake and the marine environment;
- Collection of baseline information from the marine environment (Telik Inlet) where the outlet of P Lake drains; and
- Photo documentation of all activities

In context of a proposed sewage lagoon for Cape Dorset, the purpose of the investigations was to confirm fish presence/absence in P Lake, and to characterize the receiving marine environment.

The lake is fed primarily through surface runoff and there is no connectivity between P Lake and other fresh water sources on the island. Existing information on inlet surface flow, and habitat in a possible inlet channel, was not found.

The single outlet from P Lake flows via a single-thread channel for approximately 370 m (over a steep cliff and then through a mossy area) and over a waterfall before draining into the marine environment (i.e., Telik Inlet). The steep terrain between the P Lake outlet and the marine environment prevents the movement of fish between these aquatic environments and there is no direct connectivity to the marine environment.

Current information on the fish inventory and habitat of P Lake is lacking. Community members have communicated to the Hamlet officials that P Lake is not used as a sport or sustenance fishery. DFO has confirmed that no "sport" fish are expected to be present in P Lake (Tania Gordanier, DFO, pers. comm.). It is thought, however, that the lake may support forage fish (i.e. Threespine Stickleback Gasterosteus Aculeatus, or the Ninespine Stickleback Pungitius).

6.1 Methods

6.1.1 Fishery Survey of P Lake

A multiple-method sampling protocol was selected to maximize the potential of observing and/or capturing fish that may reside in P Lake. The fishery surveys included: minnow trapping; seine hauls; snorkel surveys; and visual bank observations.

6.1.1.1 Minnow Traps

Minnow traps were set overnight on August 11, 2005. Minnow traps, baited with Power bait Trout Nuggets, were set between 14:00 and 15:15 hrs on August 11 and retrieved between 9:00 and 9:35 hrs on August 12, 2005. Eight traps were set around the shoreline of P Lake, at depths ranging from 0.2-1.0m (see **Figure F** for locations).

6.1.1.2 Seine Hauls

Seine hauls were carried out at various locations along the shoreline of P Lake (see **Figure F** for locations). A total of seven hauls were carried out on August 11, 2005. The seine net used was 10 m long and had a mesh size of 1 cm. The distance the seine hauls were pulled ranged from 10 to 20 m.

6.1.1.3 Snorkel survey

Snorkel surveys were carried out along six transects over a 1.5 hour period on August 11, 2005. Five transects (ranging in length from 50 to 85 m) were oriented east-west across the lake; while a sixth transect was oriented north-south across the lake (see **Figure F** for locations). Although visibility

extended beyond 2 m, the snorkel survey focused on observations within a 1.5 m distance on either side of the snorkeller.

6.1.1.4 Visual observations

During all field investigations visual observations were made any time a body of water was sampled or traversed. The field crew was instructed to carefully watch for fish and to record any observations of fish they made.

6.1.2 Habitat and Water Quality Survey of P Lake and Outlet

6.1.2.1 Habitat

Visual observations of underwater and shoreline substrates were recorded both within P Lake and in the outlet stream entering the small bay in Telik Inlet.

6.1.2.2 Water quality

Water quality measurements [dissolved oxygen (DO), pH, conductivity, salinity and water temperature] in P Lake were made with a hand-held pH, conductivity, salinity and temperature monitor (YSI Model 63), and a hand-held dissolved oxygen monitor (YSI Model 55)> Measurements were made once during the sampling period (August 11, 2005).

Water samples collected from the outflow stream from P Lake.

6.1.2.3 Aquatic invertebrates

Visual observations of aquatic invertebrates were made any time a body of water was sampled or traversed. No samples were collected.

6.1.3 Marine Environment

A boat was used to access Telik Inlet where the P Lake outflow stream drains into the marine environment. General habitat conditions of the Inlet were described and efforts to collect sediment sampled were attempted.

6.1.4 Photographic Record

During the site visit numerous photographs were collected so that a photographic record of the site could be developed. The locations of selected photographs are illustrated in **Figure G**.

6.2 Results

6.2.1 Fishery Survey of P Lake

6.2.1.1 Minnow Traps

Table 6.1 provides detailed information regarding the minnow trapping survey completed at P Lake. Despite over 152 hours of trapping effort, no fish were collected in any of the traps that were set.

Table 6.1 Effort and results from minnow trap sets in P Lake

Trap Number	Date Set	Time Set	Date Retrieved	Time Retrieved	Duration of set (hrs)	Number of fish captured
MT 1	Aug 11	14:00	Aug 12	09:00	19.00 hrs	0
MT 2	Aug 11	14:00	Aug 12	09:05	19.08 hrs	0
MT 3	Aug 11	14:00	Aug 12	09:10	19.17 hrs	0
MT 4	Aug 11	14:10	Aug 12	09:15	19.08 hrs	0
MT 5	Aug 11	14:15	Aug 12	09:20	19.08 hrs	0
MT 6	Aug 11	14:30	Aug 12	09:25	19.92 hrs	0
MT 7	Aug 11	15:00	Aug 12	09:30	18.50 hrs	0
MT 8	Aug 11	15:15	Aug 12	09:35	18.58 hrs	0
Totals					**152.41 hrs**	**0 fish**

6.2.1.2 Seine Hauls

Table 6.2 provides a summary of the fish catch results from seine netting activities in P Lake. No fish were captured, or observed, during any of the seine net hauls.

Table 6.2 Effort and results of seine netting efforts in P Lake on August 11, 2005

Haul #	Date	Length of haul (m)	Number of fish captured
SH 1	Aug 11	15	0
SH 2	Aug 11	15	0
SH 3	Aug 11	20	0
SH 4	Aug 11	10	0
SH 5	Aug 11	10	0
SH 6	Aug 11	10	0
SH 7	Aug 11	20	0
Total			**0 fish**

6.2.1.3 Snorkel survey

Table 6.3 presents the results of the snorkel surveys conducted in P Lake. An estimated area of 1380 m^2, and the complete diversity of habitat types, was examined during the snorkel surveys. This area represented approximately 10.6% of the total area of the lake. It should also be noted that although the snorkel survey concentrated on 1.5 m width on either side of the snorkeller, visibility often extended beyond this width (e.g., 3+ m). No fish were observed during the completion of transects.

Table 6.3 Effort and results of snorkel surveys in P Lake during August 11, 2005.

Transect #	Date	Length of transect (m)	Width of transect (m)	Area sampled by individual transects (m^2)	Number of fish observed
T1	Aug 11	50	3.0	150	0
T2	Aug 11	70	3.0	210	0
T3	Aug 11	75	3.0	225	0
T4	Aug 11	85	3.0	255	0
T5	Aug 11	60	3.0	180	0
T6	Aug 11	120	3.0	360	0
Total				**1380**	**0**

6.2.1.4 Visual observations

Although efforts were made to observe and record any fish that may have been made during visual bank observations, no fish were observed during the bank surveys. No attempt was made to document the level of effort expended during the bank surveys.

6.2.2 Habitat and Water Quality Survey of P Lake and Outlet

6.2.2.1 Habitat

P Lake

Substrates in P Lake were composed primarily of boulders and fractured rock (**Figure G**). Any cover which could be utilized by fish would have been provided primarily by depth, large boulders and fractured rock. Substrates at maximum depths were primarily composed of sands and fines. The north shoreline substrate was predominately fractured rock, some greater than 1-2 m diameter, (**Photo 1**), while the south shoreline substrate was a mixture of gravel with areas of sand and fines (**Photo 2**). All other shorelines consisted of rock.

No aquatic vegetation was observed in P Lake and only small amounts of algae were observed on the substrate. Caddisfly (trichopterids) and freshwater crustaceans (amphipods) were also observed in P Lake.

Outlet and Inlet of P Lake

The outlet of P Lake is characterized a small channel that drains into a small wetland area. From the wetland area, it drains through a small channel and over a large cliff forming a waterfall (**Photo 3**). Below the waterfall the outlet stream was intermittent as flow was subsurface and at times lacked a defined channel. Intermittent surface flow also continued downstream and is apparent where the channel passes through grassy/mossy area. Mean width and depth of the reaches where a defined channel occurred were approximately 0.1, and 0.05 m, respectively) (**Photo 4**). Below the grassy/mossy area, the stream again goes sub-surface and lacks a defined channel once the outlet reaches boulder cobble shoreline (**Photo 5**). **Figure G** provides a map of the shoreline and distribution of substrates in P Lake and the outlet into Telik Inlet.

The outlet stream does not provide fish access to P Lake from the ocean due to the large cliff and lack of a defined channel at several locations. Limited summer flows and conditions also suggest that the outlet stream would freeze to the bottom in winter.

The inlet stream into P Lake is best described as having a no or limited definition channel, and if fish were present in the lake, it is highly unlikely the inlet area would provide fish habitat. It would also be expected to freeze to the bottom in winter.

The mean depth and wetted widths for both the inlet and outlet streams where defined channels existed were both approximately 0.1 m, and 0.2 m, respectively.

Marine Environment

Substrates in the small bay in Telik Inlet where the P Lake outlet stream eventually drains were dominated by very clean cobble and boulders. Some algae was observed, but in limited quantities. Benthoses were not sampled due to high tide conditions, time limitations, and the coarseness of the substrate.

6.2.2.2 Water quality

Water quality measurements collected from P Lake with the hand-held YSI units are provided in **Table 6.4**. Some of the above readings, however, were unexpected (e.g., pH = 10.1 exceeds the CREM guidelines for aquatic life of 9.0), so the units were re-calibrated after being returned to Dillon's Yellowknife office. The results of the recalibrations suggested that the sensor units had been damaged in transport to Cape Dorset, and therefore, equipment malfunction is suspected and the above results collected during the present field trip should not be considered reliable.

Table 6.4 Water quality measurements collected from P Lake on August 11, 2005

Parameter measured	Measurement and units
Dissolved oxygen	3.0 mg/l
pH	10.1
Conductivity	42 microsiemens
Salinity	0.0 ppt
Temperature	10.2^{o}C

Other water samples were collected, but were not analyzed because unexpected delays in transit were encountered which exceeded the amount of time which would provide reliable analysis for some parameters (e.g., fecal coliforms).

6.3 Conclusions of Fisheries Investigations

Based on the results of the 2005 fisheries investigations, the absence of historical reports documenting fish presence in P Lake, and the presence of impassible barriers that prevent fish movement between P Lake and other fish-bearing waters, it can be concluded that P Lake is barren of fish. The intermittent flow conditions and waterfalls over the cliff indicate that fish passage into P Lake from the marine environment is impossible.

Given that the P Lake system is barren of fish, there is no reason to suggest that converting P Lake into an output lagoon is likely to cause a Harmful Alteration, Disruption or Destruction of fish habitat (HADD). If a HADD is unlikely, a Federal Fisheries Act Authorization for a HADD will not be required.

7 THE IMPACT OF THE DEPOSIT OF WASTE

The waste deposited will adversely impact the water quality of P Lake. The due to the organic, solids and nutrient loading that will result from the sewage effluent, it is likely that P Lake and the P Lake basin will under go a number of changes. In other Nunavut locations where sewage effluent his discharged to the land there is an increase in vegetation growth. In particular sedges and grasses become the dominant flora.

Water quality in P Lake will change as well. The water will carry a higher sediment (TSS) loading, particularly during lagoon discharge. The increase in organic loading, and increase in nutrient will likely result in an increase in algae growth during the open water season.

In other locations (Chesterfield Inlet as an example) the wetlands area down gradient of the sewage treatment cell is a primary staging area for water fowl and snow geese. This appears to occur for a number of reasons, two of which are; the prevalence of the sedges and grass attract the migratory birds that use the vegetation as forage; and there are areas of ponded water that open earlier in the spring and remain open longer in the fall that adjacent ponds. It is expected that there may be an increase in water fowl in the P Lake basin as the impacts from the sewage discharge impact and change the P Lake Basin.

8 COMPENSATE PERSONS, INCLUDING THE DESIGNATED INUIT ORGANIZATION, WHO ARE ADVERSELY AFFECTED BY THE DEPOSIT OF WASTE

During the community meetings and public presentations there were no identified Inuit persons or organizations impacted by the proposed works. The communities, through several council resolutions, support the proposed sewage treatment facility.

9 MONITOR THE IMPACT OF THE DEPOSIT OF WASTE

A key component to the operations and maintenance of the proposed sewage treatment system is a sampling program. Dillon has developed the following sampling program to:

- Monitor treatment and verify compliance to regulations; and
- Model and understand the treatment process to aid with future expansions of the system.

The proposed sampling program will address the water quality on a temporal basis, the cumulative impacts to the plants and soil, and allow for trending of the data to see if we reach a stasis point after several years of treatment. The sampling program should be undertaken by the community as part of the annual operations.

9.1 Sampling Protocol

It is estimated that 8 sample locations will be required to document conditions along the effluent path:

- Control;
- Lagoon inflow;
- Lagoon effluent;
- P Lake effluent;
- Wetlands effluent; and
- 3 taken along wetlands (between P-Lake discharge and outlet).

Water samples would be taken weekly, during periods of open water. With these sample locations, each stage of the treatment process would be noted, with emphasis on the wetlands area. This sampling protocol would need to be conducted over several years, to obtain data for trend analysis. It could be scaled down after the first year, to remove sample locations that are not considered essential (i.e. lagoon inflow, along wetlands flow path).

As recommended in Dillon's "Sewage Treatment Using Tundra Wetlands" report (1997), a site specific ecological study of the wetland system should be undertaken, to identify and characterize the plant species in the wetland system. If this is conducted before discharging sewage to the wetland and for a few subsequent years, it could be used to monitor changes in the plant species with time. A minimum of two plots is recommended, located along the wetlands channel, and one control plot. Data would be collected twice during the growing season, late June (early stages of growth) and early-August (peak growth). This should be conducted by trained biologists, made up of the same team each season, to ensure consistency. No sample analysis is required, as data collection and logging is done in the field, by trained personnel. Costs would include the time and disbursements to send biologist(s) to site to conduct survey, twice/year.

Cumulative impacts to the soil have not been addressed in the above program. Sediment sampling could occur, if desired, at various locations along the wetlands. Deposition rate could be measured, or sediment samples could be analyzed themselves, for various parameters. These options could be explored further, if desired.

Table 9.1: Analytical Parameters and Costs for Water Sampling

Parameter	Analytical Cost*
BOD_5	$21.60
Fecal coliforms	$11.20
Total suspended solids	$8.80
Ammonia nitrogen	$12.80
Total phosphorus	$14.40
Total (per sample)	$68.80

*Based on prices from Accutest Laboratories in Ottawa

For 8 samples, the total cost would be: $550.40 + GST

For weekly samples, over 10 weeks, the total cost would be: $5504.00 + GST

9.2 Sample Shipment

If samples are taken early Tuesday or Thursday mornings, they can be shipped on the 11 am First Air flight to Iqaluit. There is a 6 pm freighter from Iqaluit to Ottawa on Tues/Thurs. Coolers can be delivered/picked-up first thing Wednesday or Friday morning to/by Accutest.

According to Accutest, FC samples need to be analyzed within 48 hours, and BOD_5 samples need to be analyzed within 7 days of sampling. For both parameters, 24 hours is preferred between sampling and analysis, but not required.

Shipping costs are approximately $140 (general) and $180 (priority). Regular shipping should be sufficient to make the Iqaluit connection, but it could be sent priority as a precaution.

9.3 Sampling Equipment

Sample bottles and coolers will be sent to the community by Accutest. Latex gloves will be required for each sample. If a boat was available, samples could be taken from the middle of the wetlands.

Cost of latex gloves for the summer: $80.00

10 OPTIONS AVAILABLE FOR THE DEPOSIT OF WASTE

The site selection process completed over a number of years included the investigation into a number of sites and applicable technologies. Previously registered with the NWB are the selection process and the consultation undertaken by the GN to involve the community in the selection process. It is understood that the selection of the proposed site is consistent with the process and selection requirements of the NWB.

11 ASSESSMENT OF THE REQUIREMENTS OF THE NUNAVUT WATER BOARD

The description of the deposit of waste

This information is available and described in Section 5 of this report.

The qualitative and quantitative effects of the deposit of waste on the drainage basin.

This has been under taken. The effluent from the lagoon is described for quantity and quality. We have undertaken to describe the expected treatment rates of the sewage lagoon. Environmental impacts are described for the P Lake basin.

The measures the applicant proposes to take to avoid or mitigate any adverse impact of the deposit of waste

The application of best practices to the development to the lagoon treatment system is the means that the GN and the designers undertook to mitigate against adverse impacts. The use of an annual storage lagoon is described as one of the best practices by the INAC document.

The design elements have used standard engineering practices and reviewed by the geotechnical engineer.

The measures the applicant proposes to take to compensate persons, including the designated Inuit organization, who are adversely affected by the deposit of waste.

The background work completed by the GN undertook several community consultations. The community is supportive of the proposed systems and the location of the proposed system and discharge location. There has been no impacted Inuit or Inuit organization identified during the consultation, and as such no compensation requirements have been identified.

The program the applicant proposes to undertake to monitor the impact of the deposit of waste.

A monitoring program is required. In Section 7 we outline the propose monitoring program for the system.

The options available for the deposit of waste.

The background documents include the reporting on the selection process. We understand that this process has been accepted by the NWB.

Effluent standards that are prescribed by the regulations, or in the absence of such regulations, that the Board considers acceptable; and

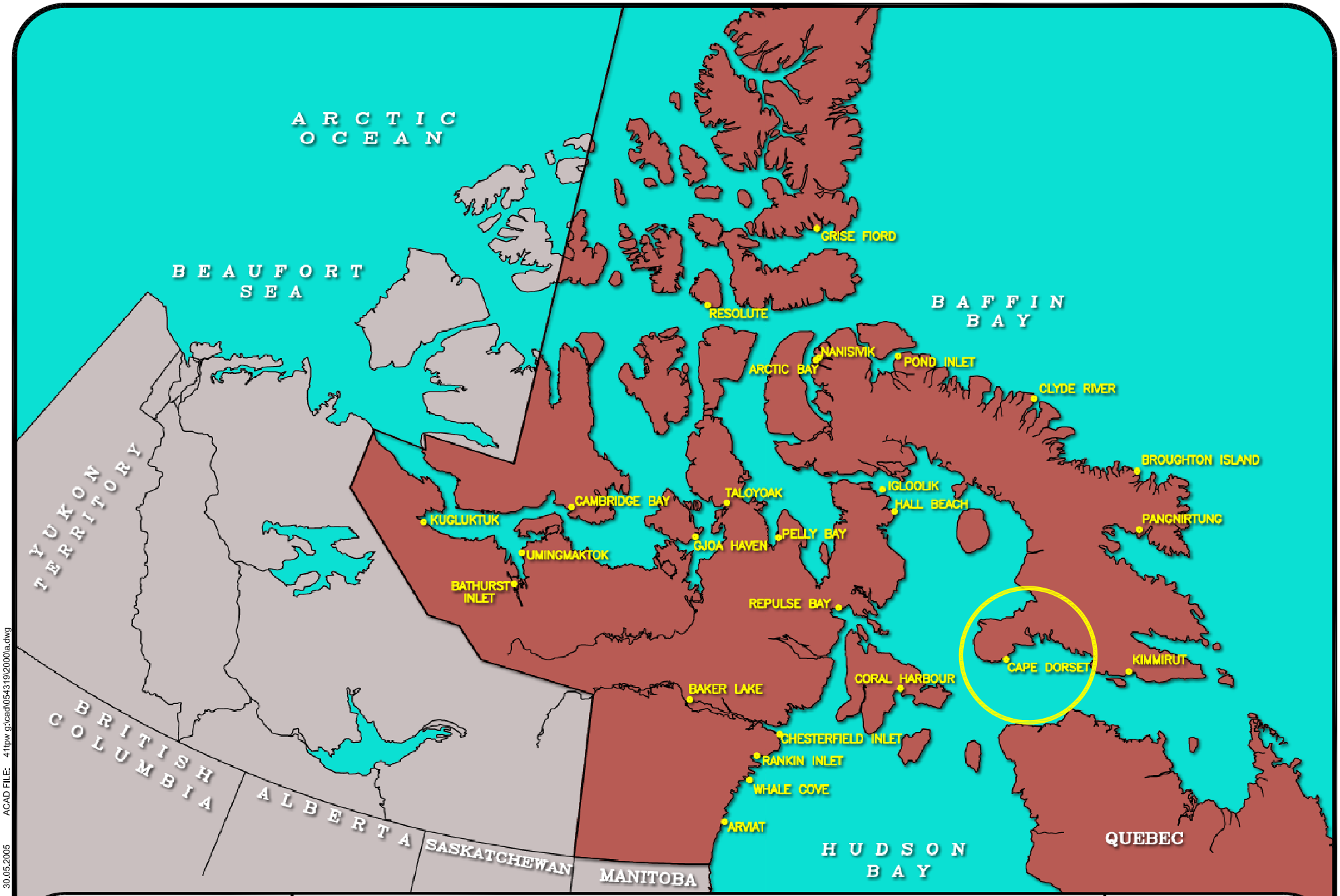
The proposed system will meet the current regulations at the point of discharge from the lagoon, and at the marine receiving environment.

Financial responsibility of the applicant

Hamlet of Cape Dorset will look after.

APPENDIX A

FIGURES



EDIT DATE: 30.05.2005 ACAD FILE: 41tpw g:\cad\05431912000la.dwg

DILLON CONSULTING

PROJECT	Cape Dorset Sewage Treatment System
TITLE	Cape Doset Location Plan
PROJECT NUMBER	05-4319-2000
DATE	May 05
FIGURE NUMBER	A

EDIT DATE: 30.05.2005 ACAD FILE: 41tpw g:\cad\054319\2000\b.dwg

DILLON CONSULTING

PROJECT
Cape Dorset
Sewage Treatment System

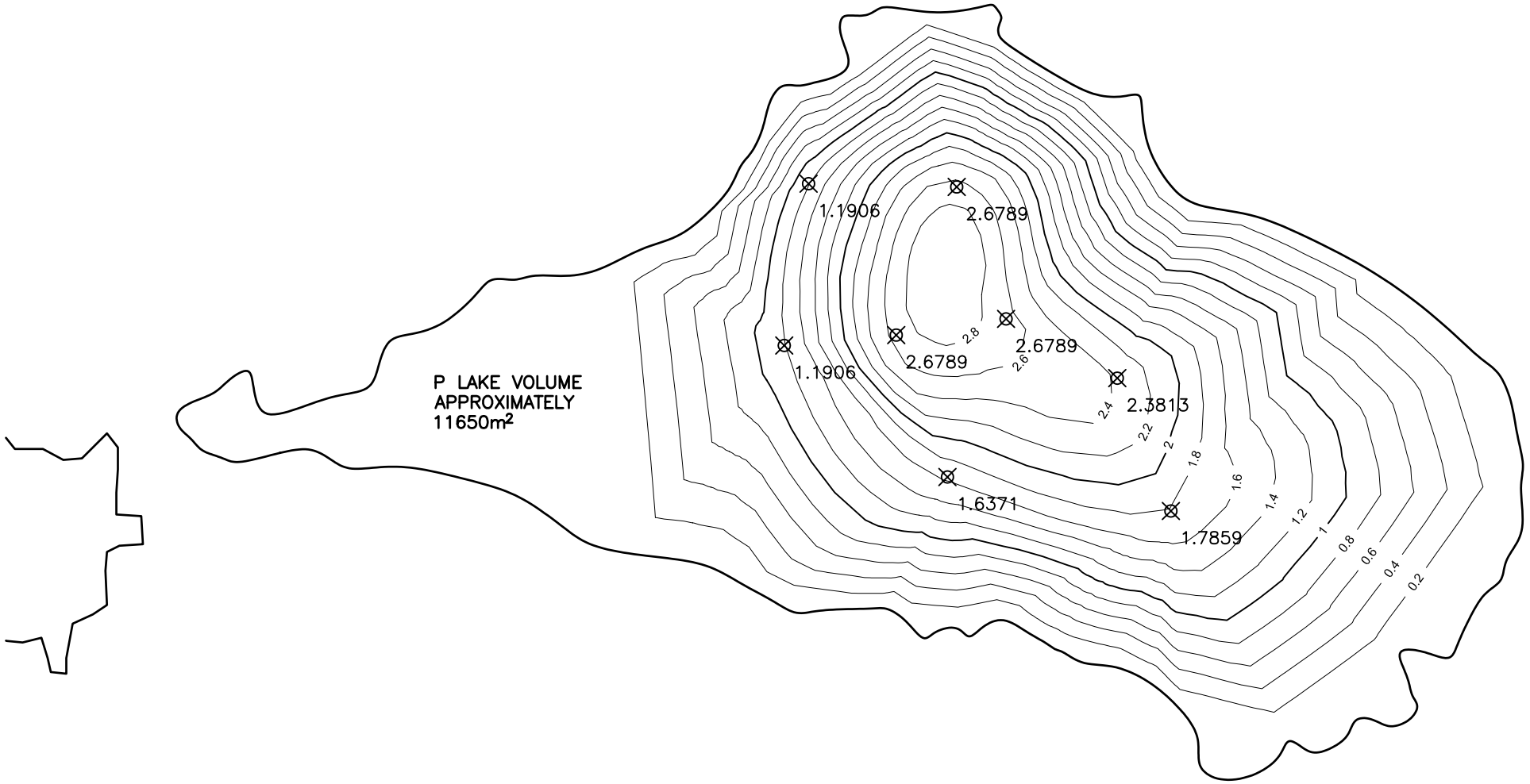
TITLE
Community Layout and Alternative Sites

PROJECT NUMBER
05-4319-2000

DATE
May 05

FIGURE NUMBER
B

SCALE 1:1000



NOTE: ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.

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DILLON CONSULTING

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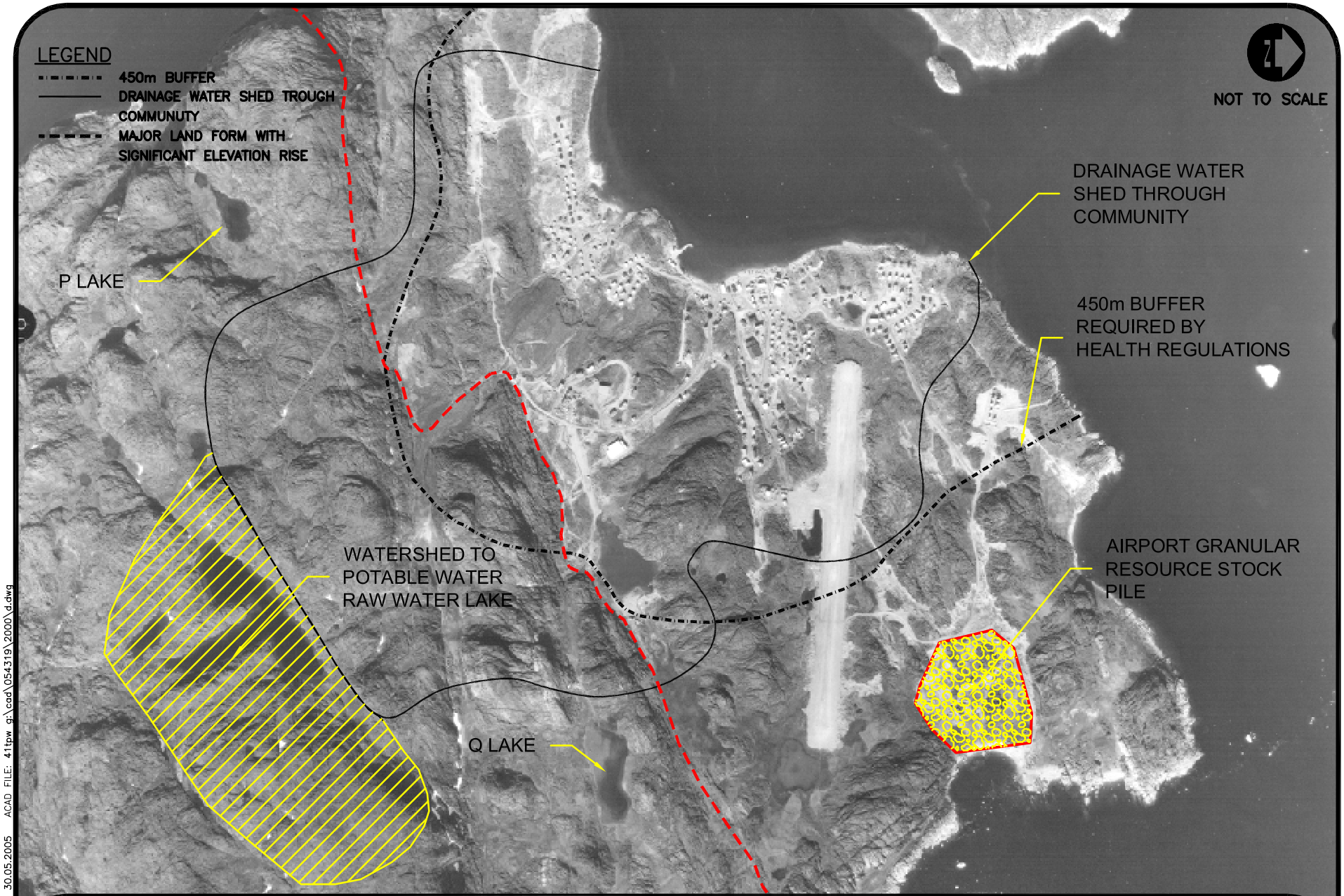
TITLE	Bathymetry of Lake – P
PROJECT NUMBER	05–4319–2000
DATE	June 05
FIGURE NUMBER	C



EDIT DATE: 30.05.2005 ACAD FILE: 41tpw g:\cad\054319\2000\d.dwg

DILLON CONSULTING

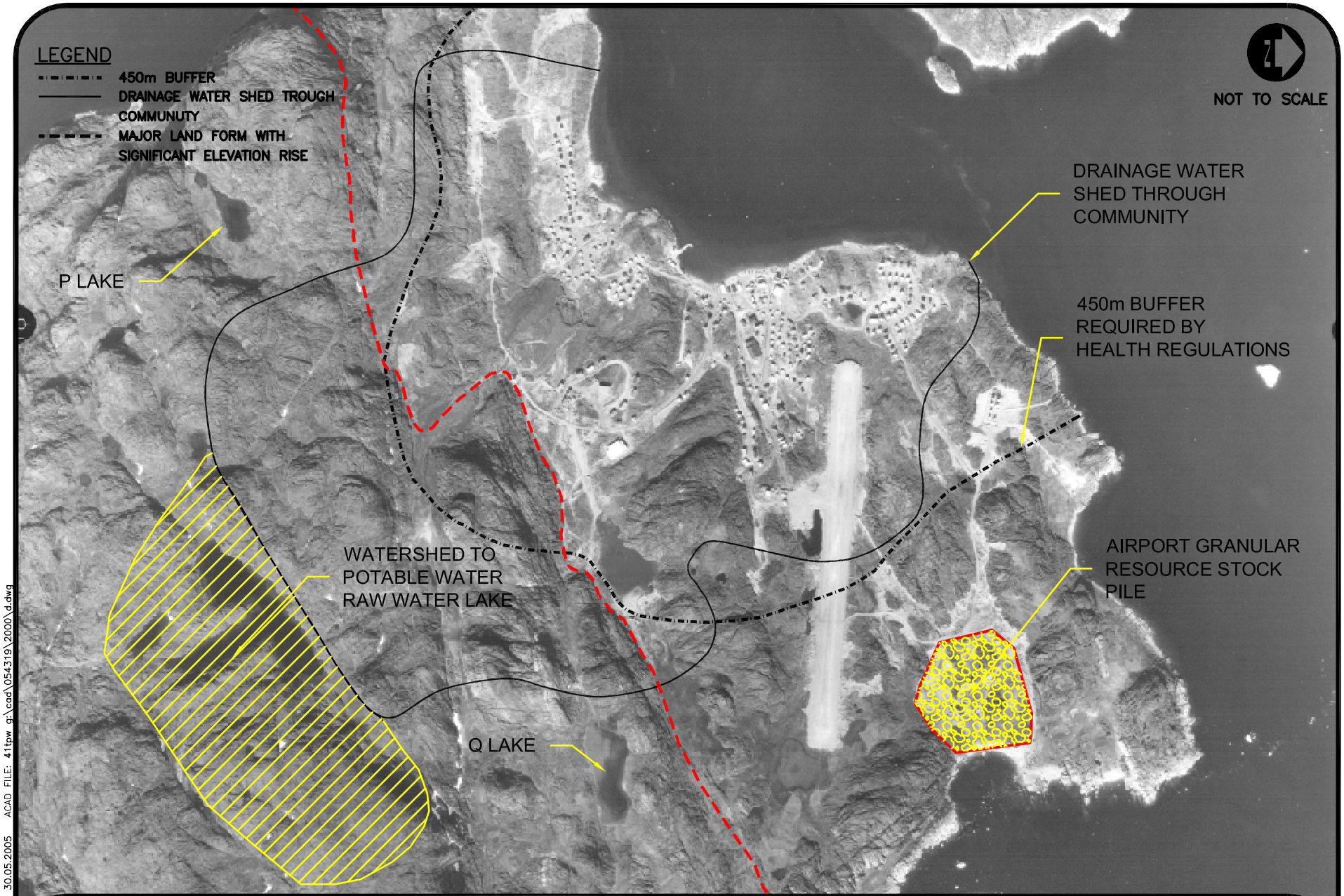
PROJECT
Cape Dorset
Sewage Treatment System

TITLE
Constraint Map – Community Water Shed and 450m Setback

PROJECT NUMBER
05-4319-2000

DATE
June 05

FIGURE NUMBER
D



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DILLON CONSULTING

PROJECT
Cape Dorset
Sewage Treatment System

TITLE
Constraint Map – Community Water Shed and 450m Setback

PROJECT NUMBER
05-4319-2000

DATE
June 05

FIGURE NUMBER
D

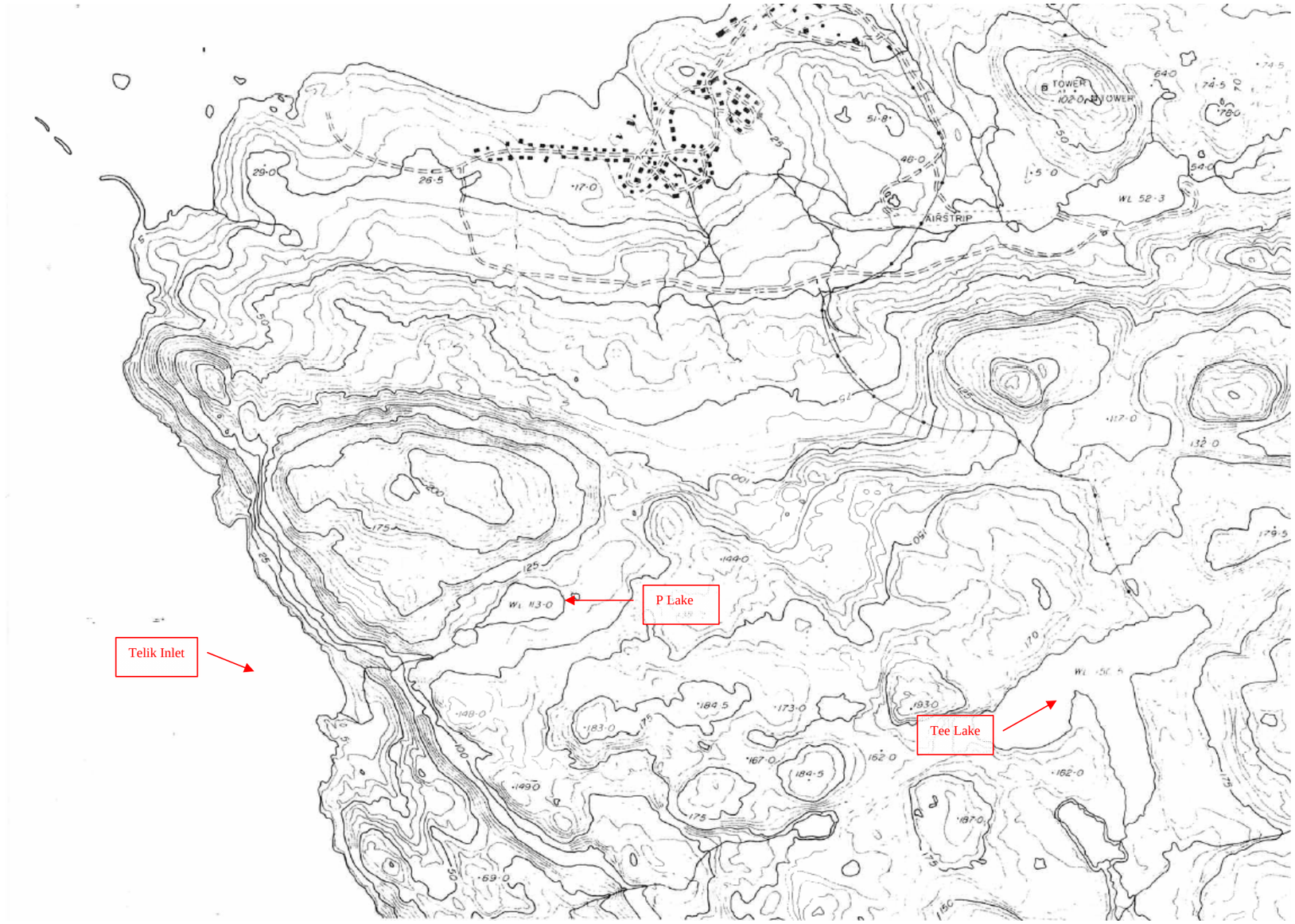


Figure E Topographic Map

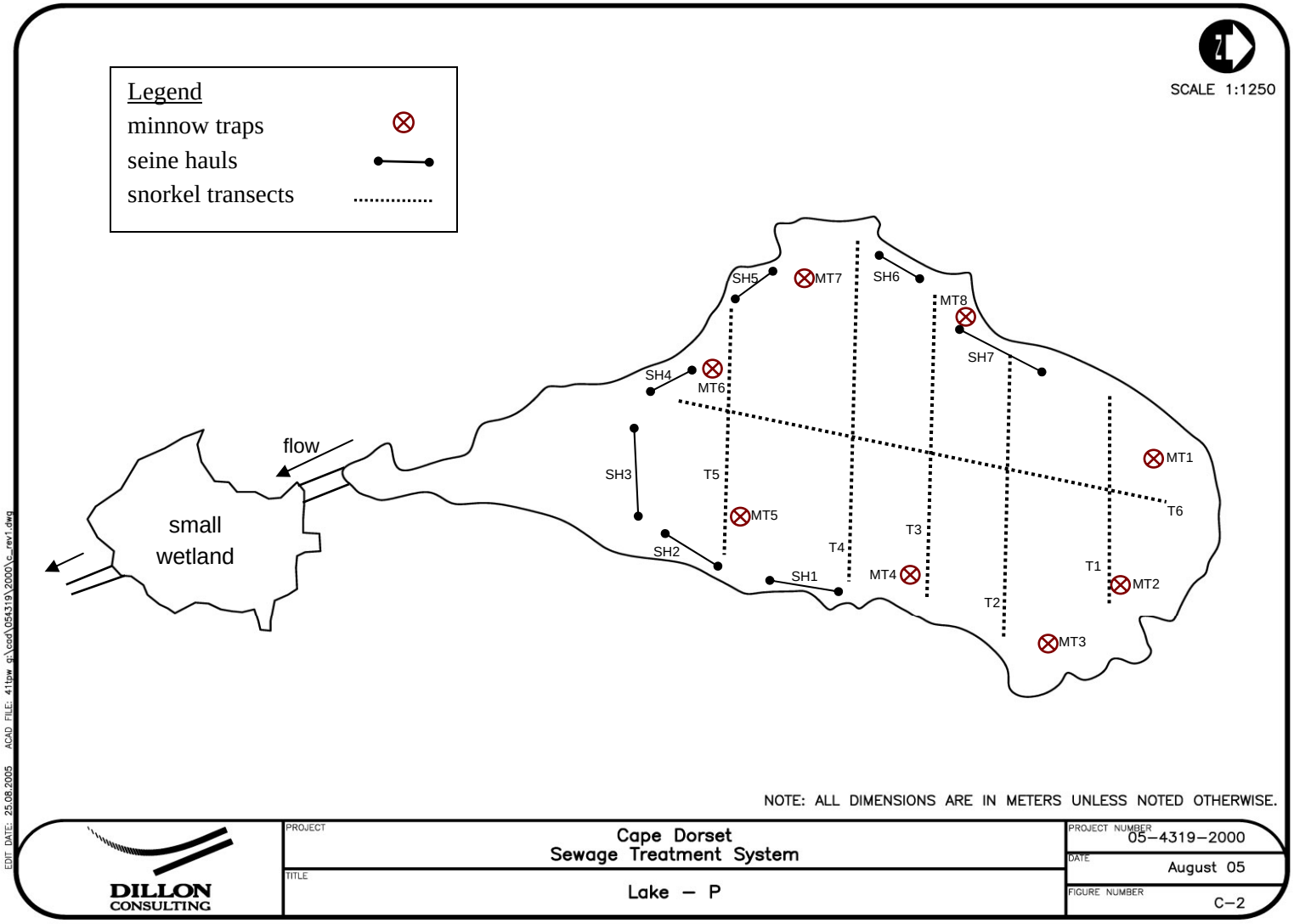


Figure F. Map showing locations of minnow trap sets, seine hauls and snorkel survey transects in P Lake.

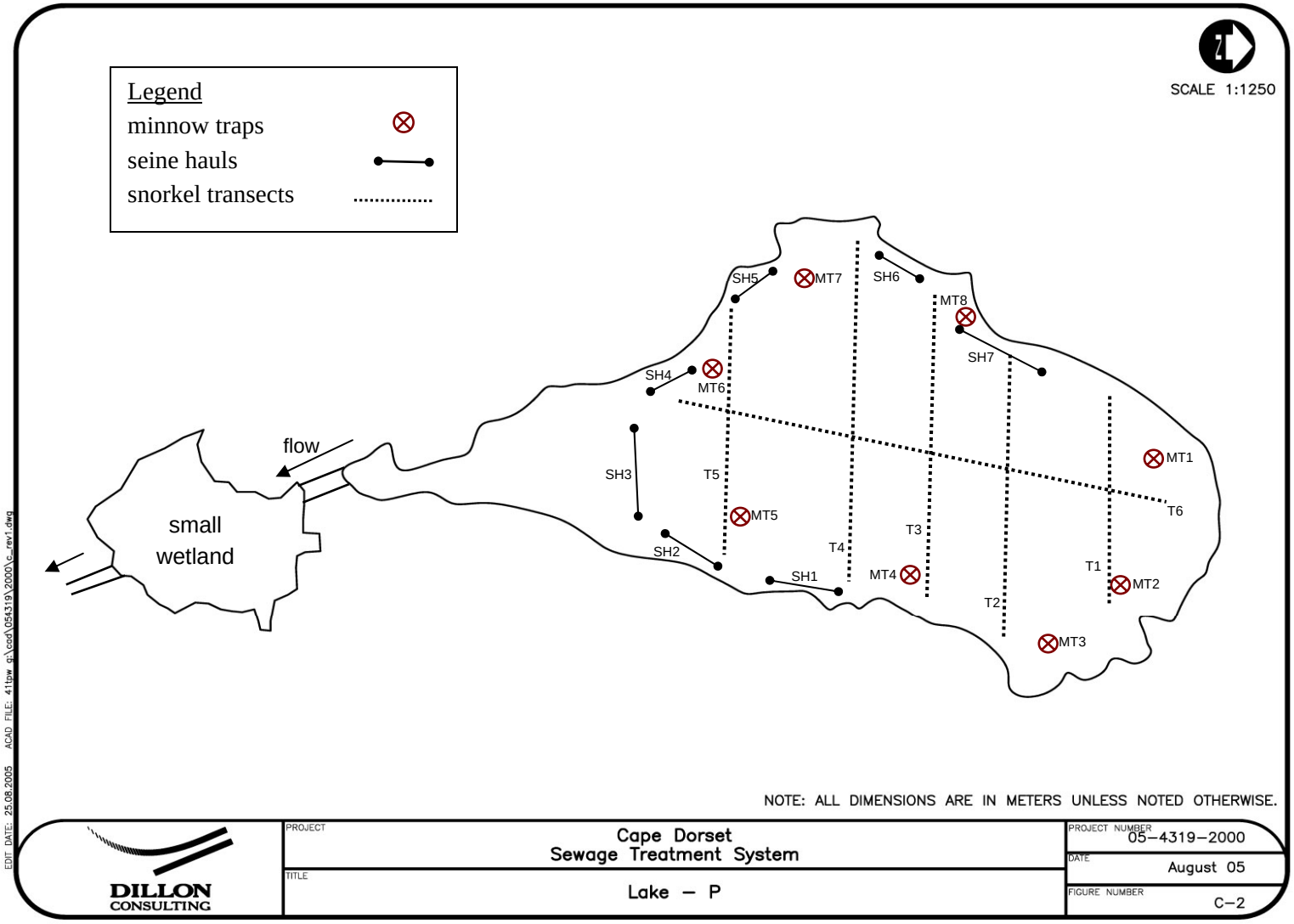


Figure F. Map showing locations of minnow trap sets, seine hauls and snorkel survey transects in P Lake.

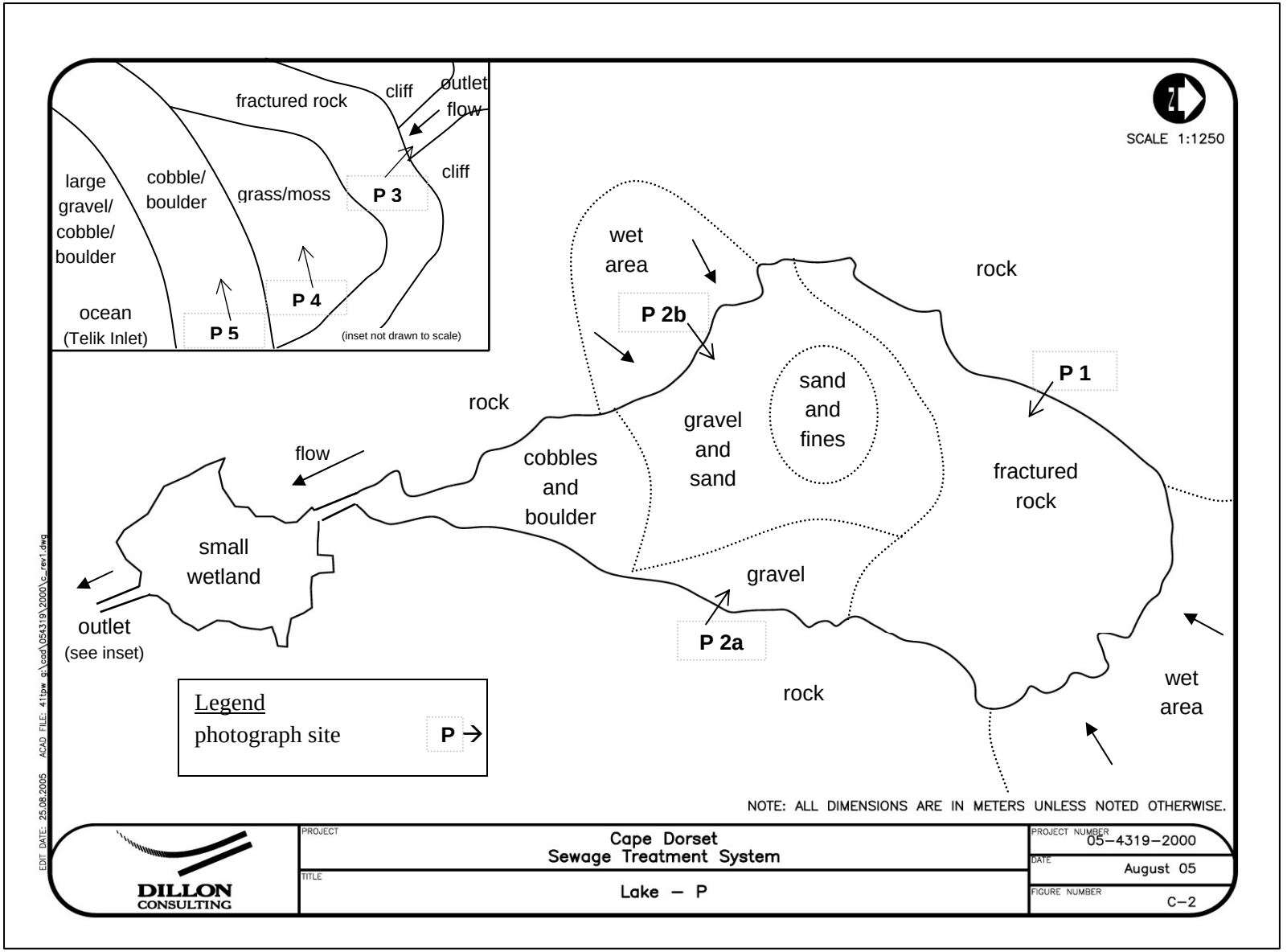


Figure G. Map showing shoreline and underwater substrate conditions in P Lake and the outlet into Telik Inlet (inset).

EDIT DATE: 30.05.2005 ACAD FILE: 41pw gt\cad\0543192000\e.dwg

DILLON CONSULTING

PROJECT	Cape Dorset Sewage Treatment System
TITLE	Proposed Lagoon and Road
PROJECT NUMBER	05-4319-2000
DATE	June 05
FIGURE NUMBER	H

APPENDIX B

PHOTOS

Photo 1. Substrate of north shoreline.

Photo 2a and 2b. Substrate of south shoreline.

Photo 3. Path of outlet stream over large cliff. Photo taken from base of cliff.

Photo 4. Path of outlet stream through mossy area at base of large cliff. Photo taken from bay.

Photo 5. Cobble/boulder substrate at shoreline of Telik Inlet.

APPENDIX C

P LAKE WATER SHED CALCULATIONS

Tributary Area & Runoff Calculations

Condition: 10 Year Return Period
Location: "P" Lake Catchment area (Cape Dorset)

Date: 14-Apr-05
P.O.C. P Lake

Area No.	Cover or Dev. State	Approx. Grade (%)	Area (m^2)	Area (ha)	R*	A X R	Comments:
1	Undeveloped	34	118507	11.85	0.85	10.0731	Steep, solid rock
2	Undeveloped	4	108010	10.80	0.50	5.4005	Flat. Silt-soil. Storage
3	Undeveloped	30	67303	6.73	0.80	5.3842	Steep. Channeled rock
4	Undeveloped	10	58242	5.82	0.70	4.0770	Moderate, small storage
		∑Areas=	352063	35.21	Total ∑AXR=	24.9348	

* R values were estimated using Table 2-26 "Watershed Characteristics for Determining Runoff Coefficinent..." (U.S. Soil Conservation Service)

Tc=Ts + Tr where,

Ts=Saturation Time (Inlet Time)
Tr=Running or system flow time

NOTE: For frozen or highly impervious surfaces, the value for Ts is near zero (0).

Method of Tr determination: Overland Flow Nomograph
Drop from Remote Point to Outlet: **25** m (From Topographic Map) Average Slope (%) = 5.2
Length of Overland Travel: **480** m (AutoCAD drawing - Figure 6)
Time Correction Factor: **1** (For Bare Earth)

Tr = **13** minutes (Overland Flow Nomograph)

Preliminary check: Velocity (average) = L/t **0.615 m/s**

CALCULATED FLOW (Qc):

Qc = (A · R · I) / 360 = (Total AR · I) / 360

Return Period: **10 years**
Drainage Area: **35.2** (AutoCAD drawing - Figure 6)
Total AR: **24.9** (See above)
Running Time (Tr): **7** (Overland Flow Nomograph - attached)
Saturation time (Ts): **3** (near 0 for frozen/impervious surfaces)
Concentration Time (Tc): **10** (minutes)
Intensity: **18** (mm/hr) - IDF curves for Cape Dorset

$$Q_{10} = \frac{24.9 \times 18}{360}$$

Q_{10} = **1.2467 m^3/s**

DESIGN FLOW:

$Q_d = Q_{10} \cdot (1+A\%)(1+R\%)(1+I\%)(FOS)$

Where: FOS 0.10
A%= 0.05
R%= 0.20
I%= 0.05

Q_d= 1.81 m^3/s

Cape Dorset A, NU WATER BUDGET MEANS FOR THE PERIOD 1980-1993

P' LAKE CATCHMENT AREA CALCULATIONS

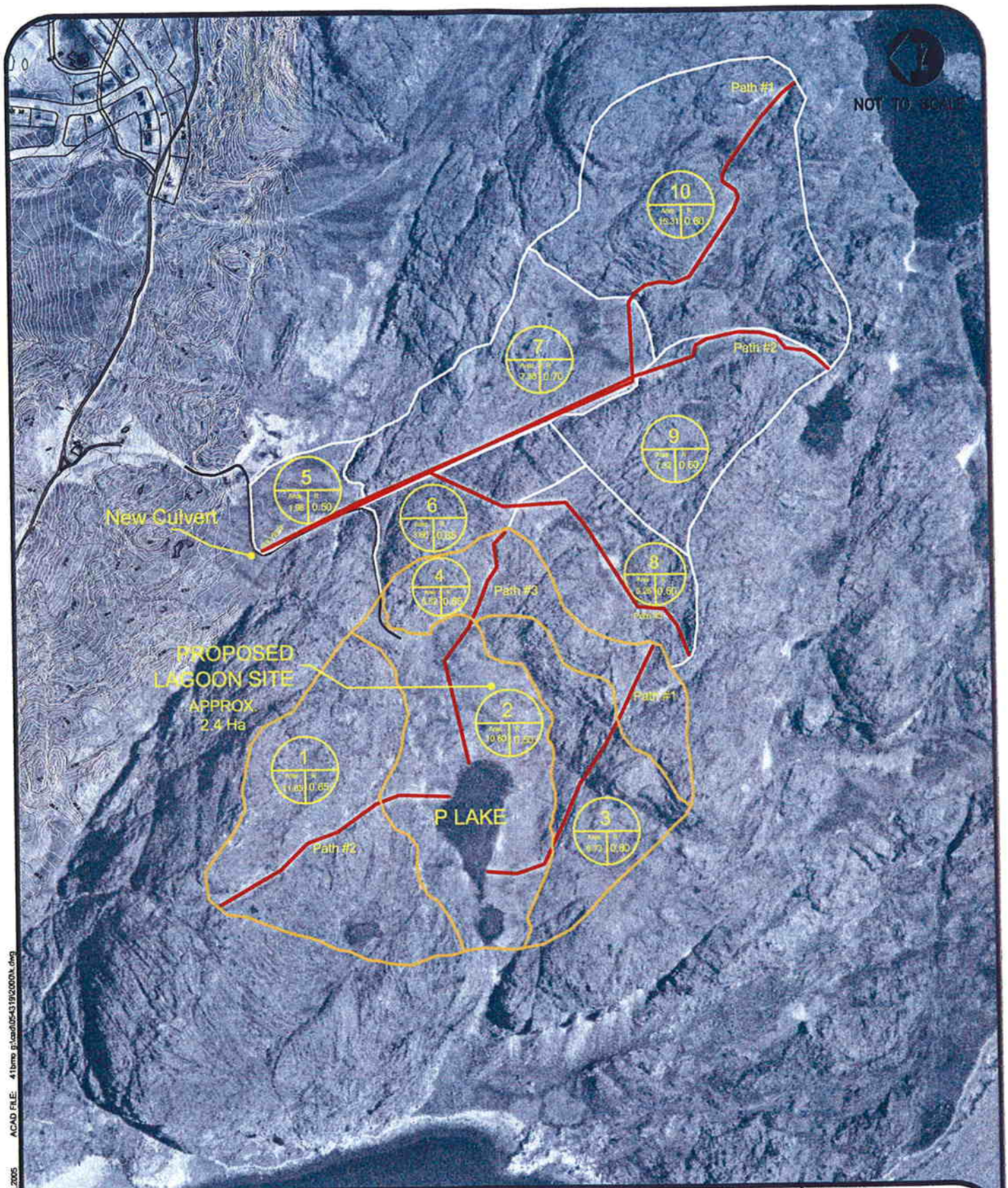
LAT.... 64.23 WATER HOLDING CAPACITY... 5 MM HEAT INDEX... 3.42
LONG... 76.53 LOWER ZONE..... 3 MM A..... .553

MONTH	TEMP °C	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P	AREA (m3)	AREA (ha)	AVRG Q (m^3/week)	AVRG Q (m^3/day)	AVRG Q (m^3/hr)	AVRG Q (m^3/sec)	AVRG Q (L/min)
01-Jan	-24	4	0	0	0	0	0	0	94	5	113	352063	35.21	0.00	0.00	0.00	0.0000	0.00
02-Jan	-24.9	5	0	0	0	0	0	0	99	5	117	352063	35.21	0.00	0.00	0.00	0.0000	0.00
03-Jan	-24.3	6	0	0	0	0	0	0	105	5	123	352063	35.21	0.00	0.00	0.00	0.0000	0.00
04-Jan	-25.4	3	0	0	0	0	0	0	109	5	127	352063	35.21	0.00	0.00	0.00	0.0000	0.00
01-Feb	-27.3	4	0	0	0	0	0	0	112	5	131	352063	35.21	0.00	0.00	0.00	0.0000	0.00
02-Feb	-26	2	0	0	0	0	0	0	114	5	133	352063	35.21	0.00	0.00	0.00	0.0000	0.00
03-Feb	-25.5	6	0	0	0	0	0	0	120	5	139	352063	35.21	0.00	0.00	0.00	0.0000	0.00
04-Feb	-24.5	5	0	0	0	0	0	0	125	5	144	352063	35.21	0.00	0.00	0.00	0.0000	0.00
01-Mar	-25.4	3	0	0	0	0	0	0	128	5	146	352063	35.21	0.00	0.00	0.00	0.0000	0.00
02-Mar	-23.6	6	0	0	0	0	0	0	134	5	153	352063	35.21	0.00	0.00	0.00	0.0000	0.00
03-Mar	-22.9	4	0	0	0	0	0	0	138	5	157	352063	35.21	0.00	0.00	0.00	0.0000	0.00
04-Mar	-20.4	5	0	0	0	0	0	0	143	5	161	352063	35.21	0.00	0.00	0.00	0.0000	0.00
01-Apr	-18.5	5	0	0	0	0	0	0	148	5	166	352063	35.21	0.00	0.00	0.00	0.0000	0.00
02-Apr	-18.4	5	0	0	0	0	0	0	153	5	171	352063	35.21	0.00	0.00	0.00	0.0000	0.00
03-Apr	-16.7	7	0	0	0	0	0	0	160	5	177	352063	35.21	0.00	0.00	0.00	0.0000	0.00
04-Apr	-13.9	8	0	0	0	0	0	0	168	5	184	352063	35.21	0.00	0.00	0.00	0.0000	0.00
05-Apr	-10.6	6	0	0	0	0	0	0	173	5	189	352063	35.21	0.00	0.00	0.00	0.0000	0.00
01-May	-8.9	8	0	0	0	0	0	0	182	5	197	352063	35.21	0.00	0.00	0.00	0.0000	0.00
02-May	-7.7	6	0	0	0	0	0	0	188	5	204	352063	35.21	0.00	0.00	0.00	0.0000	0.00
03-May	-5.6	4	0	4	1	1	0	3	188	5	209	352063	35.21	1056.19	150.88	6.29	0.0017	104.78
04-May	-3.7	8	1	6	2	2	0	5	189	5	217	352063	35.21	1760.31	251.47	10.48	0.0029	174.63
01-Jun	-1.3	8	2	18	4	4	0	15	177	5	224	352063	35.21	5280.94	754.42	31.43	0.0087	523.90
02-Jun	-0.1	7	5	14	5	5	0	15	164	5	231	352063	35.21	5280.94	754.42	31.43	0.0087	523.90
03-Jun	1.6	5	5	32	13	12	0	25	133	4	236	352063	35.21	8801.57	1257.37	52.39	0.0146	873.17
04-Jun	3.3	5	4	59	21	18	-4	46	75	4	242	352063	35.21	16194.89	2313.56	96.40	0.0268	1606.64
01-Jul	5.7	3	3	59	29	18	-11	45	16	3	245	352063	35.21	15842.82	2263.26	94.30	0.0262	1571.71
02-Jul	6.3	6	6	10	31	12	-19	6	6	1	251	352063	35.21	2112.38	301.77	12.57	0.0035	209.56
03-Jul	8.4	5	5	6	35	7	-28	5	0	0	257	352063	35.21	1760.31	251.47	10.48	0.0029	174.63
04-Jul	7.6	8	8	0	32	8	-25	0	0	0	265	352063	35.21	0.00	0.00	0.00	0.0000	0.00
05-Jul	7.8	11	11	0	32	11	-20	0	0	0	275	352063	35.21	0.00	0.00	0.00	0.0000	0.00
01-Aug	6.3	8	8	0	27	8	-19	0	0	0	283	352063	35.21	0.00	0.00	0.00	0.0000	0.00
02-Aug	6.3	14	14	0	26	13	-13	1	0	1	297	352063	35.21	352.06	50.29	2.10	0.0006	34.93
03-Aug	6	16	16	0	24	13	-11	3	0	1	314	352063	35.21	1056.19	150.88	6.29	0.0017	104.78
04-Aug	5.3	17	17	0	21	11	-10	6	0	2	331	352063	35.21	2112.38	301.77	12.57	0.0035	209.56
01-Sep	3.7	15	15	0	16	9	-7	6	0	2	347	352063	35.21	2112.38	301.77	12.57	0.0035	209.56
02-Sep	3.3	11	11	0	14	8	-7	3	0	2	358	352063	35.21	1056.19	150.88	6.29	0.0017	104.78
03-Sep	1.9	6	6	1	10	4	-5	2	0	2	365	352063	35.21	704.13	100.59	4.19	0.0012	69.85
04-Sep	0.7	17	16	0	6	5	-1	9	1	4	382	352063	35.21	3168.56	452.65	18.86	0.0052	314.34
05-Sep	-1.4	7	5	0	2	2	0	3	3	4	390	352063	35.21	1056.19	150.88	6.29	0.0017	104.78
01-Oct	-2.3	9	4	1	1	1	0	3	8	5	10	352063	35.21	1056.19	150.88	6.29	0.0017	104.78
02-Oct	-2.9	8	2	2	0	0	0	3	12	5	18	352063	35.21	1056.19	150.88	6.29	0.0017	104.78
03-Oct	-4.6	10	1	1	0	0	0	2	19	5	28	352063	35.21	704.13	100.59	4.19	0.0012	69.85
04-Oct	-5.8	10	2	2	0	0	0	3	26	5	39	352063	35.21	1056.19	150.88	6.29	0.0017	104.78
01-Nov	-8.4	7	0	0	0	0	0	1	33	5	46	352063	35.21	352.06	50.29	2.10	0.0006	34.93
02-Nov	-9.5	12	0	0	0	0	0	0	45	5	58	352063	35.21	0.00	0.00	0.00	0.0000	0.00
03-Nov	-13.7	10	0	0	0	0	0	0	54	5	68	352063	35.21	0.00	0.00	0.00	0.0000	0.00
04-Nov	-13.7	13	0	0	0	0	0	0	67	5	80	352063	35.21	0.00	0.00	0.00	0.0000	0.00
01-Dec	-14.8	7	0	0	0	0	0	0	74	5	87	352063	35.21	0.00	0.00	0.00	0.0000	0.00
02-Dec	-18.3	5	0	0	0	0	0	0	79	5	92	352063	35.21	0.00	0.00	0.00	0.0000	0.00
03-Dec	-20.2	6	0	0	0	0	0	0	86	5	99	352063	35.21	0.00	0.00	0.00	0.0000	0.00
04-Dec	-22.4	7	0	0	0	0	0	0	93	5	106	352063	35.21	0.00	0.00	0.00	0.0000	0.00
05-Dec	-24.2	6	0	0	0	0	0	0	99	5	112	352063	35.21	0.00	0.00	0.00	0.0000	0.00

Cape Dorset

STANDARD DEVIATIONS FOR THE PERIOD 1980 - 1993

MONTH	TEMP °C	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
01-Jan	4.3	2	0	0	0	0	0	0	38	1	26
02-Jan	3.8	3	0	0	0	0	0	0	37	1	27
03-Jan	4.3	4	0	0	0	0	0	0	38	1	28
04-Jan	5.9	3	0	0	0	0	0	0	38	1	28
01-Feb	3.5	3	0	0	0	0	0	0	40	1	29
02-Feb	5.5	1	0	0	0	0	0	0	40	1	29
03-Feb	4.3	3	0	0	0	0	0	0	40	1	30
04-Feb	4.7	4	0	0	0	0	0	0	40	1	30
01-Mar	6	3	0	0	0	0	0	0	40	1	31
02-Mar	5.2	6	0	0	0	0	0	0	43	1	33
03-Mar	4.3	3	0	0	0	0	0	0	44	1	34
04-Mar	5.5	4	0	0	0	0	0	0	43	1	34
01-Apr	4.6	4	0	0	0	0	0	0	44	1	35
02-Apr	2.4	4	0	0	0	0	0	0	44	1	36
03-Apr	3.7	6	0	0	0	0	0	0	45	1	37
04-Apr	3.9	7	0	0	0	0	0	0	45	1	40
05-Apr	3.8	5	0	0	0	0	0	0	44	1	40
01-May	2.2	7	0	0	0	0	0	0	50	1	46
02-May	2.9	6	0	1	0	0	0	0	53	1	49
03-May	3.4	3	1	11	3	3	0	9	58	1	51
04-May	2.8	8	2	11	3	3	0	9	60	1	48
01-Jun	2.1	6	3	28	7	7	0	23	82	0	51
02-Jun	1.1	7	7	17	5	5	0	15	87	0	48
03-Jun	2.2	8	8	23	9	8	1	17	94	2	52
04-Jun	1.6	6	5	39	7	8	8	31	86	2	51
01-Jul	1.9	4	4	67	6	13	14	55	50	3	51
02-Jul	1.4	9	9	26	4	10	11	23	24	2	51
03-Jul	2.9	5	5	24	7	8	13	19	0	1	51
04-Jul	2.4	8	8	0	6	6	11	1	0	1	50
05-Jul	2	9	9	0	5	8	11	0	0	0	53
01-Aug	1.5	7	7	0	4	7	9	0	0	0	52
02-Aug	2	10	10	0	4	8	11	2	0	2	55
03-Aug	1.8	14	14	0	4	8	11	7	0	2	53
04-Aug	1.9	19	19	0	4	8	10	14	0	2	61
01-Sep	1.7	15	15	0	4	6	9	10	0	2	63
02-Sep	1.4	11	11	0	4	6	8	6	0	2	65
03-Sep	1.8	7	7	2	5	3	6	4	0	2	63
04-Sep	1.5	12	10	0	4	4	2	8	4	2	66
05-Sep	1.9	6	6	1	3	3	1	5	4	2	64
01-Oct	1.6	7	5	2	2	2	0	4	7	1	7
02-Oct	1.5	5	2	2	1	1	0	4	11	1	7
03-Oct	2.1	7	3	4	1	1	0	4	11	1	10
04-Oct	3.1	6	4	5	1	1	0	9	16	1	11
01-Nov	4	4	1	1	0	0	0	1	18	1	12
02-Nov	3.1	6	0	0	0	0	0	0	17	1	11
03-Nov	3.8	8	0	0	0	0	0	0	23	1	17
04-Nov	3.2	7	0	0	0	0	0	0	27	1	21
01-Dec	4.5	4	0	0	0	0	0	0	27	1	22
02-Dec	5.1	3	0	0	0	0	0	0	26	1	21
03-Dec	5.4	4	0	0	0	0	0	0	27	1	22
04-Dec	4.4	5	0	0	0	0	0	0	28	1	24
05-Dec	4.4	6	0	0	0	0	0	0	28	1	26



DILLON CONSULTING

PROJECT	Cape Dorset Sewage Treatment System
TITLE	Lake - P and Lagoon Site Catchment Areas
PROJECT NUMBER	05-4319-2000
DATE	May 05
FIGURE NUMBER	K

EDIT DATE: 30.05.2005 ACAD FILE: 41bmp p:\ae\05431920001k.dwg

APPENDIX D

POPULATION SATISTICS

Nunavut: Community Population Projections

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Nunavut	27,688	28,410	29,154	29,885	30,601	31,317	32,036	32,774	33,530	34,311	35,114
Arctic Bay	730	747	763	782	801	819	837	855	876	894	916
Arviat	1,690	1,736	1,784	1,833	1,883	1,929	1,982	2,033	2,088	2,142	2,198
Baker Lake	1,470	1,501	1,534	1,563	1,594	1,624	1,655	1,683	1,712	1,745	1,777
Bathurst Inlet	X	X	X	X	X	X	X	X	X	X	X
Bay Chimo	X	X	X	X	X	X	X	X	X	X	X
Cambridge Bay	1,418	1,449	1,484	1,517	1,550	1,581	1,609	1,642	1,679	1,715	1,752
Cape Dorset	1,213	1,240	1,268	1,298	1,327	1,354	1,382	1,412	1,441	1,471	1,501
Chesterfield Inlet	372	382	391	401	409	420	431	443	452	465	476
Clyde River	771	789	812	830	848	867	890	913	937	959	982
Coral Harbour	845	865	888	911	933	955	978	1,003	1,024	1,049	1,078
Gjoa Haven	984	1,005	1,023	1,045	1,063	1,084	1,102	1,117	1,136	1,154	1,173
Grise Ford	145	146	147	146	146	147	149	151	151	153	155
Hall Beach	635	656	677	696	714	734	754	771	790	810	829
Igloolik	1,379	1,417	1,456	1,495	1,529	1,562	1,594	1,627	1,660	1,701	1,736
Iqaluit	4,762	4,930	5,108	5,278	5,438	5,606	5,768	5,936	6,108	6,289	6,477
Kimmirut	450	461	474	485	496	506	519	530	546	560	573
Kugaaruk	582	601	616	631	648	664	682	701	719	737	756
Kugluktuk	1,389	1,422	1,456	1,490	1,522	1,556	1,585	1,618	1,653	1,686	1,720
Nanisivik	230	225	224	226	225	223	222	220	221	221	220
Pangnirtung	1,506	1,539	1,575	1,613	1,651	1,687	1,722	1,756	1,792	1,831	1,870
Pond Inlet	1,314	1,361	1,405	1,443	1,489	1,532	1,574	1,624	1,668	1,714	1,761
Qikiqtarjuaq	522	537	551	566	582	599	614	629	641	654	668
Rankin Inlet	2,277	2,327	2,376	2,432	2,483	2,527	2,576	2,629	2,683	2,734	2,791
Repulse Bay	615	630	648	664	682	702	720	738	757	777	797
Resolute Bay	243	246	247	249	251	253	252	255	257	260	263
Sanikiluaq	702	722	740	758	776	796	816	834	853	873	896
Taloyoak	804	825	847	866	886	904	925	947	968	992	1,016
Whale Cove	312	321	328	336	344	351	358	367	378	388	397

Notes: Population projections produced by Statistics Canada and the Nunavut Bureau of Statistics include people in the population who are residents of Nunavut and do NOT have a home elsewhere in Canada from which they are temporarily absent. Therefore, temporary residents such as construction crews, residents in mining camps, etc. are not included in the population projections.

Data are suppressed for (a) communities with a population of 50 or less and (b) 'unorganized areas' -- but they are included in the Nunavut total.

Released by the Nunavut Bureau of Statistics *March 2000*

Nunavut: Community Population Projections

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Nunavut	35,114	35,937	36,773	37,619	38,471	39,335	40,217	41,106	42,001	42,904	43,824
Arctic Bay	916	939	960	980	1,003	1,019	1,033	1,049	1,065	1,078	1,094
Arviat	2,198	2,256	2,320	2,381	2,449	2,517	2,584	2,658	2,721	2,791	2,855
Baker Lake	1,777	1,808	1,843	1,882	1,918	1,957	1,996	2,036	2,072	2,108	2,148
Bathurst Inlet	X	X	X	X	X	X	X	X	X	X	X
Bay Chimo	X	X	X	X	X	X	X	X	X	X	X
Cambridge Bay	1,752	1,790	1,828	1,865	1,900	1,939	1,979	2,018	2,057	2,095	2,137
Cape Dorset	1,501	1,536	1,570	1,600	1,632	1,662	1,692	1,726	1,757	1,793	1,829
Chesterfield Inlet	476	486	498	509	519	528	539	549	563	572	583
Clyde River	982	1,007	1,028	1,050	1,072	1,095	1,121	1,144	1,167	1,190	1,214
Coral Harbour	1,078	1,101	1,128	1,158	1,187	1,219	1,250	1,281	1,312	1,345	1,376
Gjoa Haven	1,173	1,194	1,217	1,242	1,266	1,290	1,317	1,345	1,375	1,405	1,435
Grise Ford	155	157	160	160	163	165	166	168	169	172	173
Hall Beach	829	850	870	890	912	934	957	982	1,008	1,029	1,052
Igloolik	1,736	1,773	1,807	1,842	1,883	1,922	1,960	2,001	2,043	2,086	2,131
Iqaluit	6,477	6,669	6,866	7,064	7,276	7,456	7,637	7,814	7,997	8,178	8,391
Kimmirut	573	589	601	612	624	636	649	662	675	688	706
Kugaaruk	756	779	802	823	844	867	889	911	934	957	979
Kugluktuk	1,720	1,760	1,793	1,827	1,859	1,893	1,928	1,965	2,000	2,041	2,076
Nanisivik	220	218	215	215	209	205	202	200	196	195	191
Pangnirtung	1,870	1,905	1,955	1,995	2,032	2,074	2,117	2,160	2,202	2,243	2,280
Pond Inlet	1,761	1,808	1,851	1,904	1,951	1,999	2,047	2,093	2,137	2,184	2,233
Qikiqtarjuaq	668	683	697	711	724	737	752	765	780	795	811
Rankin Inlet	2,791	2,848	2,907	2,970	3,030	3,120	3,213	3,314	3,429	3,537	3,633
Repulse Bay	797	818	838	858	881	903	928	949	970	990	1,012
Resolute Bay	263	266	269	270	272	275	279	281	283	287	288
Sanikiluaq	896	918	939	963	987	1,008	1,029	1,050	1,069	1,090	1,108
Taloyoak	1,016	1,039	1,065	1,094	1,119	1,147	1,179	1,209	1,236	1,265	1,294
Whale Cove	397	405	412	422	432	442	450	458	469	481	491

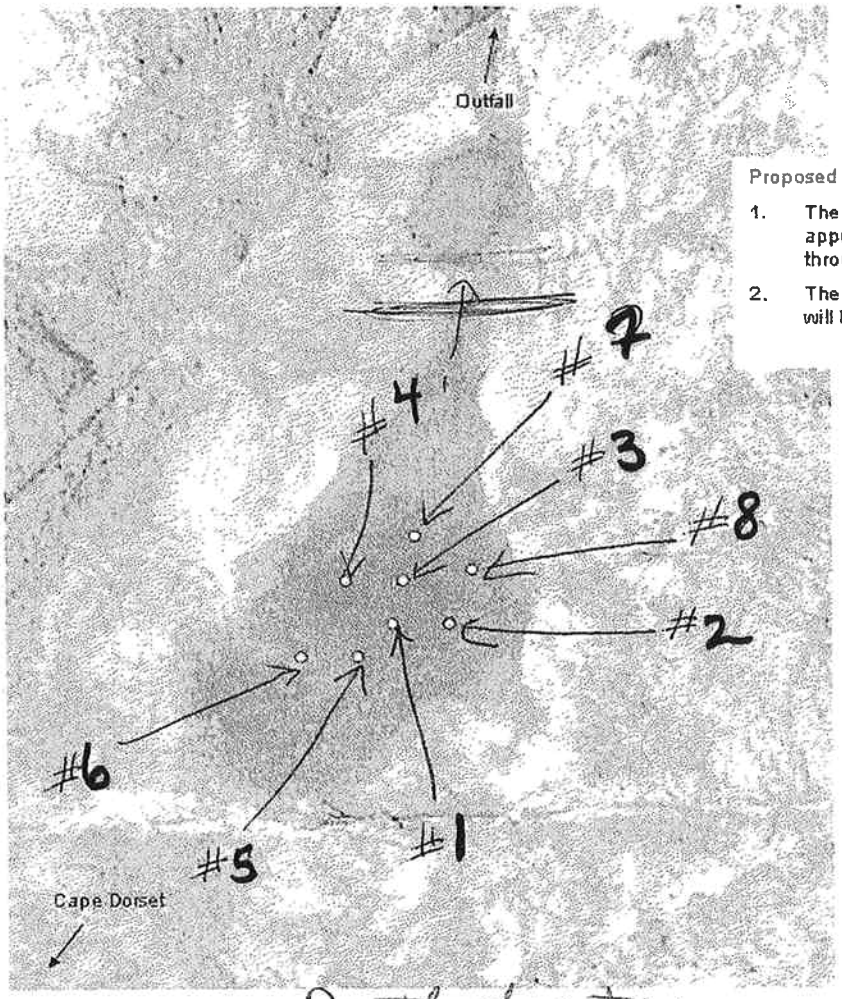
Notes: Population projections produced by Statistics Canada and the Nunavut Bureau of Statistics include people in the population who are residents of Nunavut and do NOT have a home elsewhere in Canada from which they are temporarily absent. Therefore, temporary residents such as construction crews, residents in mining camps, etc. are not included in the population projections.

Data are suppressed for (a) communities with a population of 50 or less and (b) 'unorganized areas' -- but they are included in the Nunavut total.

Released by the Nunavut Bureau of Statistics *March 2000*

APPENDIX E

P LAKE BATHYMETRY & VOLUME



Proposed Drill Points:

1. The yellow spots indicate the approximate locations for drilling through the ice
2. The depth of the ice and water will be required.

P Lake

	Depth of Ice	Depth of water	Total Depth from Top to Bottom
1	4'	5'	9'
2	4'	5'	9'
3	4'	5'	9'
4	4'	1.5'	5.5'
5	4'	4'	8'
6	4'	2'	6'
7	4'	Ø	4'
8	4'	Ø	4'

APPENDIX F

TECHNICAL SPECIFICATIONS

Special Provisions

The following section will form part of the contract.

The contractor shall be aware of the requirement of a quarry use permit for all blasting that is to be performed.

The contract will be based on stipulated price. Use Appendix C.

CONTENTS

SECTION 1 CONTENTS

PART 1 GENERAL

1.1 Section Includes

.1 Cape Dorset P-Lake Sewage Lagoon.

.2 Work Covered by Contract Documents.

.3 Contract Method.

.4 Work by Others.

.5 Contractor use of premises.

1.2 Work Covered by Contract Documents

.1 Work of this Contract comprises general construction, located at Cape Dorset, Nunavut Territory; and further identified as:

.1 Site Clearing;

.2 Road Works;

.3 Berm Construction;

.4 Culvert supply and Installation.

.5 Discharge flume supply and installation

.6 Discharge piping and control structure supply and installation

.7 Road guardrails and delineators, supply and installation

1.3 Contract Method

.1 Construct the Work under a single fixed price contract.

.2 Payment will only be made for actual work completed and on materials complete and delivered to site in Cape Dorset NU.

.3 Work to be completed prior to October 2006. Atmospheric temperatures in the winter months are expected to remain around minus forty degrees Celsius (-40ºC).

1.4 Contractor Use of Premises

.1 Contractor has unrestricted use of site.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used.

PART 3 EXECUTION

3.1 Not Used

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Product Installation Alternatives to Agreement.

1.2 Requirements

.1 Referenced specification Sections stipulate pertinent requirements for products and methods to achieve the Work stipulated under each Alternative.

.2 Coordinate affected related Work and modify surrounding Work to integrate the Work under each Alternative.

1.3 Award/Selection of Alternatives

.1 Indicate variation of Bid Price for Alternatives described below and listed in Bid Form. Note that this form requests a 'difference' in Bid Price by adding to or deducting from the base Bid price.

.2 Bids shall be evaluated on 'Base Bid' price. After determination of lowest Bidder, consideration will be given to Alternatives and Bid Price adjustments.

1.4 Alternatives

.1 Further to Clause 8 of the Instructions to Tenderers:

.1 No substitutions will be permitted without prior written approval of Engineer.

.2 Proposals for substitution may only be submitted after award of contract. Such request must include statements of respective costs of items originally specified and the proposed substitution.

.3 Proposals may be considered by Engineer if:

.1 materials selected by tenderer from those specified, are not available;

.2 delivery date of materials selected from those materials specified would unduly delay completion of contract, or

.3 alternative material to those specified, which are brought to the attention of and considered by Engineer as equivalent to the material specified and will result in a credit to the Contract amount.

.4 Should proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on project. Pay for design or drawing changes required as result of substitution.

.5 Amounts of all credits arising from approval of substitutions will be determined by Engineer and Contract Price will be reduced accordingly.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Coordination Work with other contractors.

.2 Scheduled preconstruction and progress meetings.

1.2 Related Sections

.1 Section 01110 - Summary of Work

.2 Section 01810 - Commissioning.

1.3 Description

.1 Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other contractors under instructions of Engineer.

.2 The following persons have been designated by the Department of Community and Government Services: Mr. Todd Parsons, Project Officer, Capital Projects, Iqaluit, Nunavut, Ph: (867) 975-5314.

1.4 Construction Organization and Start-up

.1 Within 15 days after award of Contract, attend a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Senior representatives of the Owner, Engineer, Contractor, Consultant, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Meeting will be held in a location deemed suitable to all parties.

.4 Agenda to include following:

.1 Appointment of official representative of participants in Work.

.2 Schedule of Work, progress scheduling.

.3 Schedule of submission of shop drawings, samples.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences.

.5 Delivery schedule of specified equipment.

.6 Site security in accordance with Section 01520 - Construction Facilities.

.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements (GC).

.8 Record drawings in accordance with Section 01770 - Closeout Procedures.

.9 Maintenance in accordance with Section 01770 - Closeout Procedures.

.10 Take-over procedures, acceptance, and warranties in accordance with Section 01770 - Closeout Procedures.

.11 Monthly progress claims, administrative procedures, photographs, and holdbacks (GC).

.12 Appointment of inspection and testing agencies or firms in accordance with Section 01450 - Quality Control.

.13 Insurances and transcript of policies (GC).

.5 Comply with Engineer's allocation of mobilization areas of site; for field offices and sheds, for access, and parking facilities.

.6 During construction coordinate use of site and facilities through Engineer's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.

.7 Comply with instructions of Engineer for use of temporary utilities and construction facilities.

.8 Coordinate field engineering and layout work with Engineer.

1.5 On-Site Documents

.1 Maintain at job site, one copy each of the following:

.1 Contract drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed shop drawings.

.5 Change orders.

.6 Other modifications to Contract.

.7 Field test reports.

.8 Copy of approved Work schedule.

.9 Manufacturers' installation and application instructions.

.10 Labour conditions and wage schedules.

.11 Approvals / Permits

1.6 Schedules

.1 Submit preliminary construction progress schedule to Engineer coordinated with Engineer's project schedule.

.2 After review, revise and resubmit schedule to comply with revised project schedule.

.3 During progress of Work revise and resubmit as directed by Engineer.

1.7 Construction Progress Meetings

.1 During course of Work, attend bi-weekly progress meetings.

.2 Owner, Engineer, Consultant, Contractor and major subcontractors involved in Work are to be in attendance.

.3 Notify parties a minimum of 5 days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 days after meeting.

.5 Agenda to include following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

1.8 Closeout Procedures

.1 Notify Engineer when Work is considered ready for Substantial Completion inspection.

.2 In the event the facility is not ready for inspection or cannot be successfully commissioned on the date set for commissioning and the Contractor has not notified the Engineer in sufficient time to prevent unnecessary travel, the Contractor shall pay for travel and accommodation costs for subsequent trips by the Engineer and Owner and all of their agents and representatives.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Schedule, form, content.

.2 Scheduled revisions.

.3 Critical path scheduling.

1.2 Related Sections

.1 Section 01770 - Closeout Procedures.

1.3 Schedules Required

.1 Submit schedules as follows:

.1 Construction Progress Schedule.

.2 Submittal Schedule for Shop Drawings and Product Data.

.3 Submittal Schedule for Samples.

.4 Submittal Schedule for timeliness of Owner furnished Products.

.5 Product Delivery Schedule.

.6 Cash Allowance Schedule for purchasing Products.

.7 Shutdown or closure activity.

.8 Within ten working days after each March 31 and September 30 occurring between commencement of Work and final completion, and within ten working days after final completion, provide to Engineer:

.1 Statement of total person days of labour used on site in performance of Contract, including labour provided under sub-contracts, as of dates identified in General Conditions 23.1.

.2 Estimate of total value in dollars of material delivered to site and installed, including material provided and installed under sub-contracts, as of dates identified in General Conditions 23.1.

1.4 Format

.1 Prepare schedule in form of a horizontal Gant bar chart.

.2 Provide a separate bar for each major item of work trade or operation.

.3 Split horizontally for projected and actual performance.

.4 Provide horizontal time scale identifying first work day of each week.

.5 Format for listings: chronological order of start of each item of work.

.6 Identification of listings: By Systems description.

1.5 Submission

.1 Submit initial format of schedules within 15 working days after award of Contract.

.2 Submit schedules in electronic format, forward through e-mail as pdf files.

.3 Submit 2 copies to be retained by Engineer.

.4 Engineer will review schedule and return review copy within 10 days after receipt.

.5 Resubmit finalized schedule within 7 days after return of review copy.

.6 Submit revised progress schedule with each application for payment.

.7 Distribute copies of revised schedule to:

.1 Job site office.

.2 Subcontractors.

.3 Other concerned parties.

.8 Instruct recipients to report to Contractor within 10 days, any problems anticipated by timetable shown in schedule.

1.6 Critical Path Scheduling

.1 Include complete sequence of construction activities.

.2 Include dates for commencement and completion of each major element of construction as follows.

.1 Site survey and layout

.2 Granular source permitting and development

.3 Site clearing.

.4 Road Works.

.5 Berm Construction.

.6 Culvert supply and Installation.

.7 Discharge flume supply and installation

.8 Discharge piping and control structure supply and installation

.9 Road guardrails and delineators, supply and installation

.10 Training and commissioning

.3 Show projected percentage of completion of each item as of first day of month.

.4 Indicate progress of each activity to date of submission schedule.

.5 Show changes occurring since previous submission of schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.6 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.

.2 Corrective action recommended and its effect.

.3 Effect of changes on schedules of other prime contractors.

1.7 Progress Photographs

.1 Sizes: Prints 100 x 150 mm.

.2 Type: semi-matt colour with binding margin at one end.

.3 Paper: single weight, mounted.

.4 Number of prints required: 2 sets.

.5 Identification: typewritten name and number of project and date of exposure on 25 x 50 mm white patch, reverse side.

.6 Viewpoints: interior and exterior locations: viewpoints determined by Engineer.

.7 Frequency: monthly with progress statement.

.8 Submit all negatives of before final acceptance.

.9 Insert negatives in envelopes and identify with name and number of project. Indicate exposure dates and view points of each frame of 35 mm film strips.

1.8 Submittals Schedule

.1 Include schedule for submitting shop drawings, product data, samples.

.2 Indicate dates for submitting, review time, resubmission time, last date for meeting fabrication schedule.

.3 Include dates when delivery will be required for Owner-furnished products.

.4 Include dates when reviewed submittals will be required from Consultant.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Shop drawings and product data.

.2 Samples.

.3 Certificates and transcripts.

1.2 Related Sections

.1 Section 01450 - Quality Control.

1.3 Administrative

.1 Submit to Engineer submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.

.6 Notify Engineer, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are coordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Engineer’s review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer review.

.10 Keep one reviewed copy of each submission on site.

1.4 Shop Drawings and Product Data

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.3 Allow 5 working days for Engineer's review of each submission.

.4 Adjustments made on shop drawings by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.

.5 Make changes in shop drawings as Engineer may require, consistent with Contract Documents. When resubmitting, notify Engineer in writing of any revisions other than those requested.

.6 Accompany submissions with transmittal letter, in duplicate, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.7 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.8 After Engineer's review, distribute copies.

.9 Submit 8 prints of shop drawings for each requirement requested in specification Sections and as consultant may reasonably request.

.10 Submit 8 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Engineer where shop drawings will not be prepared due to standardized manufacture of product.

.11 Delete information not applicable to project.

.12 Supplement standard information to provide details applicable to project.

.13 If upon review by Engineer, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.14 The review of shop drawings by the Engineer is for sole purpose of ascertaining conformance with general concept. This review shall not mean that the Engineer approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and Contract Documents. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Requirements and Procedures

.1 .....This section specifies general requirements and procedures for contractor’s submissions of shop drawings, product data, samples and mock-ups to Engineer for review. Additional specific requirements for submissions are specified in individual sections of Divisions 2 to 16.

.2 .....Do not proceed with work until relevant submissions are reviewed by Engineer.

.3 .....Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 .....Where items or information is not produced in SI Metric units converted values are acceptable.

.5 .....Contractor's responsibility for errors and omissions in submission is not relieved by Engineer's review of submissions.

.6 .....Notify Engineer, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 .....Make any changes in submissions, which Engineer may require, consistent with Contract Documents and resubmit as directed by Engineer.

1.2 Submission Requirements

.1 .....Coordinate each submission with requirements of work and Contract Documents. Individual submissions will not be reviewed until all related information is available.

.2 .....Allow 5 working days for Engineer's review of each submission.

.3 .....Accompany submissions with transmittal letter, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address, and subcontractor (if applicable)
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Name, address and telephone numbers of supplier and manufacturer.
- .6 Contractor's stamp, signed by Contractor’s authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

1.3 Shop Drawings

.1 .....The term "Shop Drawings" shall mean any of the following:

- .1 Original drawings or modified standard drawing prepared by the Contractor, or any of his subcontractors or equipment suppliers.

.2 Manufacturer's catalogue sheets, brochures, literature, performance charts and diagrams and similar documentation used to illustrate manufactured products.

.2 .....Shop drawings shall clearly indicate details of construction of the work, including:

.1 Layout, showing dimensions, including identified field dimensions and clearances

.2 Setting or erection details

.3 Capacities

.4 Performance characteristics

.3 .....Submit a minimum of eight (8) copies of all shop drawings. After review, Engineer will distribute:

.1 Two (2) copy to Engineer's files.

.2 Six (6) Copies to be returned to the Contractor for inclusion within O&M manuals.

.3 The submissions of Shop Drawings to the Contractor is intended to supplement the O&M Manual and are not the sole intent of the six (6) copies. O&M Manual data and information shall conform to the requirements of Section 1731 – Operations and Maintenance Manual.

PART 2 PRODUCTS

2.1 Not Used

.1 .....Not used.

PART 3 EXECUTION

3.1 Not Used

.1 .....Not used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 References and Codes.

1.2 References and Codes

.1 Perform Work in accordance with National Building Code of Canada (NBC) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 NU Public Health Act.

.3 Municipal Bylaws.

.4 Canadian Standards Association (CSA).

.5 Cold Regions Utilities Monograph.

.6 Water Supply for Public Fire Protection (Fire Underwriter's Survey).

.7 Nunavut Water Board

.8 Department of Fisheries and Oceans Canada (DFO)

.9 Indian and Northern Affairs Canada (INAC)

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Inspection and testing, administrative and enforcement requirements.

1.2 Related Sections

.1 Section 01330 - Submittal Procedures.

1.3 Inspection

.1 Allow Engineer access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Engineer instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Engineer may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents.

1.4 Access to Work

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.5 Procedures

.1 Notify appropriate agency and Engineer in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labor and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.6 Rejected Work

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Engineer as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 If in opinion of Engineer it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Engineer.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Temporary utilities.

1.2 Related Sections

.1 Section 01520 - Construction Facilities.

.2 Section 01560 - Temporary Barriers and Enclosures.

1.3 Installation and Removal

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.4 Dewatering

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.5 Temporary Power and Light

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools.

.2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.

1.6 Fire Protection

.1 Provide and maintain temporary fire protection equipment during performance of Work required by federal/municipal/territorial regulators and insurance companies having jurisdiction.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Construction aids.

.2 Parking.

.3 Project identification.

1.2 Related Sections

.1 Section 01510 - Temporary Utilities.

.2 Section 01560 - Temporary Barriers and Enclosures.

1.3 Installation and Removal

.1 Provide construction facilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.4 Site Storage/Loading

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.5 Construction Parking

.1 Provide and maintain adequate access to project site.

.2 Build and maintain temporary roads where required and provide snow removal during period of Work.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.6 Sanitary Facilities

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.7 Construction Signage

.1 If required, erect Owner supplied project sign in a location designated by Engineer.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Construction Safety Measures

.1 Observe construction safety measures of the National Building Code 1995 Part 8, Territorial Government, Nunavut Territory Workers' Compensation Board and Municipal authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.

.2 Comply with the requirements of the Safety Act of the Nunavut Territory.

1.2 Overloading

.1 Ensure no part of Work is subjected to loading that will endanger its safety or will cause permanent deformation.

1.3 WHMIS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, and storage, of hazardous materials; and regarding labeling of containers and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada and Health and Welfare Canada.

.2 Deliver copies of MSDS sheets to Engineer on delivery of materials.

1.4 Sheeting and Shoring

.1 Provide sheeting and shoring as required for installation of underground works to provide construction safety for workmen in accordance with National and Territorial regulations.

1.5 Propane Cylinders

.1 Propane cylinders shipped to site must be provided with a locked, tamper proof, closure cap for the operating valve.

.2 Propane to be stored in accordance with Territorial regulations.

.3 Propane cylinders and containers of other flammable materials to be stored in a locked and well ventilated area to prevent theft, vandalism etc.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used.

PART 3 EXECUTION

3.1 Not Used

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Barriers.

.2 Environmental Controls.

1.2 Related Sections

.1 Section 01510 - Temporary Utilities.

.2 Section 01520 - Construction Facilities.

1.3 Installation and Removal

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.4 Guard Rails and Barricades

.1 Provide secure, rigid guard rails and barricades around excavations and open ice areas.

1.5 Access to Site

.1 Provide and maintain access roads as may be required for access to Work.

1.6 Protection for Off-Site and Public Property

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Fires

.1 Fires and burning of rubbish on site in not permitted.

1.2 Disposal of Wastes

.1 Do not bury rubbish and waste materials on site unless approved by Engineer.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

.3 All waste material is to be disposed of at the community landfill site. The Contractor is responsible to obtain all permits.

1.3 Drainage

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with municipal and territorial requirements.

1.4 Work Adjacent to Waterways

.1 Do not operate construction equipment in waterways without proper silt containment measures in place.

.2 Use borrow material from watercourse beds when approved by Engineer.

.3 Do not dump excavated fill, waste material or debris in waterways, except as authorized.

1.5 Pollution Control

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Use of silt curtain is required when excavating in waterways.

.3 Control emissions from equipment and plant to municipal and Territorial emission requirements.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 General

.1 Use new material and equipment unless otherwise specified.

.2 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.

.3 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.

1.2 Manufacturers Instructions

.1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.2 Notify Engineer in writing of any conflict between these specifications and manufacturers instructions. Engineer will designate which document is to be followed.

1.3 Delivery and Storage

.1 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.

.2 Prevent damage, adulteration and soiling of material and equipment during delivery, handling and storage. Immediately remove rejected material and equipment from site.

.3 Store material and equipment in accordance with supplier’s instructions.

.4 Touch-up damaged factory finished surfaces to Engineer's satisfaction. Use primer or enamel to match original..

PART 2 PRODUCTS

2.1 Materials

.1 Quality:

.1 Refer to GC 22.

.2 Unless otherwise stipulated elsewhere in the Contract Documents, the Contractor shall provide and pay for labour, products, tools, construction machinery and equipment, water, heat, light, power, transportation and other facilities and services necessary for the performance of the work in accordance with the Contract.

.3 Products, materials, equipment and articles (referred to as Products throughout the specifications) incorporated in the work shall be new, not damaged or defective, and of the best quality (compatible with specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.4 Defective products, whenever identified prior to the completion of work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.5 Should any dispute arise as to the quality or fitness of products, the decision rests strictly with the Engineer based upon the requirements of the Contract Documents.

.6 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item.

.2 Availability:

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify the Engineer of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of work.

.2 In the event of failure to notify the Engineer at commencement of work and should it subsequently appear that work may be delayed for such reason, the Engineer reserves the right to substitute more readily available products of similar character, at no increase in Contract Price.

.3 Transportation:

.1 Pay costs of transportation and handling of products required in the performance of work.

PART 3 EXECUTION

3.1 Not Used

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Labour Standards Act of the Nunavut Territory, Canada Occupational Safety and Health Regulations.

.2 Canadian Standards Association (CSA)

.3 Nunavut Territory

.1 Safety Act, R.S.N.W.T. 2003.

1.2 Work Permit

.1 Obtain all permits related to project prior to commencement of Work.

1.3 Safety Assessment

.1 Perform site specific safety hazard assessment related to project.

1.4 Meetings

.1 Pre-construction meetings: attend health and safety pre-construction meeting.

1.5 Regulatory Requirements

.1 Comply with specified standards and regulations to ensure safe operations at site containing hazardous or toxic materials.

1.6 Responsibility

.1 Be responsible for safety of persons and property on site and for protection of persons off site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 Unforseen Hazards

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Engineer verbally and in writing.

1.8 Correction of Non-Compliance

.1 Immediately address health and safety non-compliance issues identified by Engineer.

.2 Provide Engineer with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Engineer may stop Work if non-compliance of health and safety regulations is not corrected.

1.9 Work Stoppage

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

.2 Assign responsibility and obligation to Contractor's Health and Safety Officer to stop or start Work when, at Health and Safety Officer's discretion, it is necessary or advisable for reasons of health or safety. Engineer may also stop Work for health and safety considerations.

PART 2 PRODUCTS

2.1 Not Used

.1 Not used.

PART 3 EXECUTION

3.1 Not Used

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Labour Standards Act of the Nunavut Territory, Canada Occupational Safety and Health Regulations.

.2 Canadian Standards Association (CSA)

.3 Nunavut Territory

.1 Safety Act, R.S.N.W.T. 2003.

1.2 Work Permit

.1 Obtain all permits related to project prior to commencement of Work.

1.3 Safety Assessment

.1 Perform site specific safety hazard assessment related to project.

1.4 Meetings

.1 Pre-construction meetings: attend health and safety pre-construction meeting.

1.5 Regulatory Requirements

.1 Comply with specified standards and regulations to ensure safe operations at site containing hazardous or toxic materials.

1.6 Responsibility

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PART 2 PRODUCTS

2.1 Not Used

.1 Not used.

PART 3 EXECUTION

3.1 Not Used

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 Record Drawings

.1 Engineer will provide two (2) sets of white prints for record drawing purposes.

.2 Maintain project record drawings and record accurately deviations from Contract documents.

.3 Record changes in red. Mark on one set of prints and at completion and prior to final inspection, neatly transfer notations to second set and submit both sets to Engineer.

.4 Record following information:

.1 Depths of various elements of culvert installation in relation to project benchmark.

.2 Horizontal and vertical location of utilities and appurtenances referenced to project benchmark.

.3 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.

.4 Field changes of dimension and detail.

.5 Changes made by Change Order or Field Instruction.

.5 Redlined drawings:

.1 Redlined drawings must be completed by the Contractor and submitted to Engineer. Engineer will update electronic copies of drawings.

.2 Provide reduced copies of as-built drawings received from Engineer for inclusion in Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used

PART 3 EXECUTION

3.1 Not Used

.1 Not Used

END OF SECTION

PART 1 GENERAL

1.1 Operations and Maintenance Manual

.1 Operations and Maintenance Manuals for the project will be produced by the Contractor, as outlined in Section 2.1.2.

.2 Manuals are to cover all installed items requiring or likely to require operating, maintenance, or repairs.

.3 The Contractor's work includes: the complete authoring, organization, and supply of O&M manual material as detailed in this section.

.4 All work described in this section is the Contractor's work except where specifically indicated otherwise.

.5 The number of copies required is six (6).

.6 The draft Operation and Maintenance manual is to be submitted for review by the Engineer a minimum of four (4) weeks prior to requesting Substantial Completion.

.7 The final approved and completed Operation and Maintenance Manuals are to be delivered to the Engineer at least 14 days before the Substantial Completion inspection. The data is to be separated into individual manual sets, organized into applicable categories of work parallel to the specification sections and each chapter in order and identified.

1.2 Reference Standards

.1 The Contractor's Operation and Maintenance manual submissions are to conform to the current edition of "Specifications for Operations and Maintenance Manuals", Department of Public Works and Services, Government of Northwest Territories.

PART 2 FORMAT

2.1 Organization

.1 The provision of Binders and Dividers are the responsibility of the Contractor.

.2 The completed manual will contain 10 chapters. The responsibility for production of each chapter is indicated below:

.1 Introduction (by Consultant)

.2 Index (by Contractor)

.3 Background, Design Data (by Consultant)

.4 Schematic, Functional Data (by Consultant)

.5 Components Details (by Contractor)

.6 Operating Procedures (by Consultant and Contractor)

.7 Maintenance Procedures (by Contractor)

.8 Testing and Certification Data (part by Contractor)

.9 Manufacturer Data and Service Information (by Contractor)

.10 Appendices (by Contractor)

.3 Group information logically by system within chapters to the greatest possible extent. Organize the information on each system in the most logical fashion, for example, from supply point through to point of use.

2.2 Language

.1 English for all information.

2.3 Testing and Certification Data (Chapter 8)

.1 List all items that require periodic inspection by independent inspectors. List the frequency of inspection, the inspection agency to contact, including address and current phone number.

.2 Include a photocopy of each certificate issued by the independent inspectors who make inspections pursuant to health, safety, and other regulations of a similar nature. Indicate where the original of each such certificate is filed and where it is to remain displayed.

.3 Include the originals of manufacturer's warranties and certificates issued by the independent inspectors in Copy 1 of the manual.

.4 Include clear, legible photocopies of manufacturers' warranties and certificates issued by the independent inspectors in copies 2 through 6.

.5 Group warranties together to form a section in Chapter 8.

2.4 Manufacturer's Information (Chapter 9)

.1 This chapter of the Operation and Maintenance manual provides a collection of all manufacturer's service manuals, parts lists, operating and maintenance instructions, and other applicable data that may be required in future years.

.2 Include information needed for operation, maintenance and repair of every system component , and any other system requiring or likely to require operation or routine maintenance.

.3 Preface this section with an index. List in order each item by the manufacturer's name and the pieces of equipment to which it refers. Include supplier's name, address, and phone number.

.4 Include:

.1 Maintenance instructions for finished surface and materials.

.5 Include all service manuals, data sheets, and other manufacturer's information for each component.

.6 Manufacturer's information is to be original in all copies of the manual. Photocopies are not acceptable.

.7 On the first page of each inclusion, identify the piece of equipment to which it refers.

.8 Remove pages from manufacturer's information that are irrelevant to the equipment provided to this project.

.9 Where tables and curves are given for the full range of sizes, underline in red in all copies the data that refers to the installed equipment. If more than one size or type in the same table was used, add the identification for each in the margin to assist positive identification. Draw a thick diagonal black line across all data not applicable to equipment provided.

.10 If any warning instructions are included which, if ignored, could significantly affect the equipment, mark these with red arrows in all copies, to draw to the operator's attention.

.11 Service manuals must be the operating and maintenance type, which gives parts lists, preferably including an exposed or sectioned drawing for guidance in assembling, installation details, lubrication, and operations details. Sales types of brochures, which give only a very general description and few details, are not acceptable.

.12 Mount any items that are smaller than 8½"x 11", on a full page, for inclusion in the manual.

.13 Include all wiring diagrams complete with wire coding.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 Related Sections

.1 Section 01810 - Commissioning.

1.3 Inspection and Declaration

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Engineer in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Engineer’s Inspection.

.2 Engineer’s Inspection: Engineer and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Operation of systems have been demonstrated to Owner's personnel.

.5 Work is complete and ready for Final Inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Owner, Engineer and Contractor. If Work is deemed incomplete by Owner and Engineer, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Completion: when Owner and Engineer consider deficiencies and defects have been corrected and final Operations and Maintenance Manuals are ready for submission, make application for certificate of Substantial Completion by way of GN form.

.6 Commencement of Warranty Periods: date of Owner’s acceptance of submitted declaration of Substantial Performance shall be dated for commencement for warranty period.

.7 Final Payment: When Owner and Engineer agree that final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, Contractor shall apply for Final Inspection. If Work is deemed incomplete, complete outstanding items and request re-inspection.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

Approved: 2002-12-04

Part 1 General

1.1 SECTION INCLUDES

.1 Includes general requirements for commissioning facilities and facility systems.

1.2 RELATED SECTIONS

.1 Section 01210 - Allowances.

.2 Section 01450 - Quality Control.

1.3 QUALITY ASSURANCE

.1 Provide testing organization services under provisions specified in Section 01450 - Quality Control.

.2 Comply with applicable procedures and standards of the certification sponsoring association.

.3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.4 SUBMITTALS

.1 Prior to start of Work, submit name of Contractor personnel proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.

.2 Submit documentation to confirm personnel compliance with quality assurance provision.

.3 Submit 3 preliminary specimen copies of each of report forms proposed for use.

.4 Fifteen days prior to Substantial Performance, submit 3 copies of final reports on applicable forms.

.5 Submit reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

1.5 PROCEDURES - GENERAL

.1 Comply with procedural standards of certifying association under whose standard services will be performed.

.2 Notify Engineer 7 days prior to beginning of operations.

.3 Accurately record data for each step.

.4 Report to Engineer any deficiencies or defects noted during performance of services.

1.6 FINAL REPORTS

.1 Organization having managerial responsibility shall make reports.

.2 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.

.3 Identify each instrument used, and latest date of calibration of each.

1.7 CONTRACTOR RESPONSIBILITIES

.1 Prepare each system for testing and balancing.

.2 Cooperate with testing organization and provide access to equipment and systems.

.3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.

.4 Notify testing organization 7 days prior to time project will be ready for testing, adjusting, and balancing.

1.8 PREPARATION

.1 Provide instruments required for testing, adjusting, and balancing operations.

.2 Make instruments available to Engineer to facilitate spot checks during testing.

.3 Retain possession of instruments and remove at completion of services.

.4 Verify systems installation is complete and in continuous operation.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Procedures for demonstration and instruction of equipment and systems to Owner's personnel.

1.2 Related Sections

.1 Section 01770 - Closeout Procedures

.2 Section 01810 - Commissioning.

1.3 Description

.1 Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.4 Quality Control

.1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.5 Submittals

.1 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Engineer’s approval.

.2 Give time and date of each demonstration, with list of persons present.

1.6 Preparation

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated personnel are present.

1.7 Demonstration and Instructions

.1 Review contents of manual in detail to explain all aspects of operation and maintenance.

.2 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

SECTION 2 CONTENTS

PART 1 GENERAL

1.1 Related Work

.1 Section [01330 - Submittal Procedures].

.2 Section [01355 - Waste Management Disposal].

.3 Section [02315 - Excavating, Trenching and Backfilling].

.4 Section [02317 - Roadway Excavation Embankment and Compaction].

.5 Section [02393 - Revetments].

.6 Section [02620 - Sub-Drainage].

.7 Section [02622 - Foundation and Underslab Drainage].

.8 Section [02071 - Geogrid Soil Reinforcement].

1.2 References

.1 Construction Quality Assurance (CQA) Plan.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM D 5084, Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

.2 ASTM D 5890, Standard Test Method for Water Absorption of Bentonite by the Porous Plate Method, Swell Index Test.

.3 ASTM D 4354, Standard Practice for Sampling of Geosynthetics for Testing.

.4 ASTM D 5993 Test Method for Measuring Mass per Unit Area of Geotextiles

.5 ASTM D 5891 Fluid Loss in Bentonite ClaysAmerican Society for Testing and Materials (ASTM)

1.3 Quality Control Certificates

.1 At least two (2) weeks prior to start of work, furnish CQA Consultant with copies of mill test data and certificate that GCL delivered to job site meets requirements of this Section.

The certificate shall include:

- Roll numbers and identification,
- Sampling procedures, and
- Results of quality control tests, including a description of test methods used.

.2 Remove and replace uncertified material and replace with new material at no cost to the Owner.

1.4 Material Warranty

.1 Provide the Owner with a written warranty against manufacturing defects for period of twenty (20) years from the date of installation.

1.5 Guarantee

.1 Provide the Owner with a written guarantee against defects in installation and workmanship for a period of five (5) years from the date of final acceptance, including the services of qualified technicians and materials necessary to make repairs, at no cost to the Owner.

1.6 Measurement for Payment

.1 Measurement for payment will be in square metres of area covered. The unit price quoted shall include the supply and installation of the GCL, all labour, materials, equipment necessary for the proper execution of the works.

.2 No allowance will be made for fabric overlap at joints or seams and wastage.

.3 All testing required for quality control certificates to be included in Contractor's cost at no cost to the Owner.

.4 Testing of field samples ordered by Engineer and conducted by testing company to be at Owner's cost, except that costs of "failed" tests shall be deducted from monies owing to the Contractor.

PART 2 PRODUCTS

2.1 Material

.1 The geotextile component to be non-woven, needle punched polypropylene or polyester material with Minimum Average Roll Values meeting or exceeding the criteria specified Table 1523-3-1.

.2 Provide test results from the Manufacturer for the product, as well as a certification that the material properties meet or exceed the specified values, at the frequency indicated in Table 1523-3-2.

.3 Synthetic material to be manufactured from inert polymeric materials which retain their structure during handling, placement and long-term service, have satisfactory resistance to acid and alkali action, are indestructible by micro-organisms and insects and are ultra violet light resistant.

.4 GCL to be manufactured by either adhesive /glue bonding or the mechanical bonding of the needlepunch process. Bentonite to consist of montmorillonite (sodium bentonite).

.5 If manufactured by needle punch process, verify that the geotextile component has been inspected continuously for the presence of broken needles using an in-line metal detector. Employ a method acceptable to the CQA Consultant for removal of broken needles.

.6 Verify that the proper mass per unit area of bentonite has been added to the product as specified in Table 1523-3-1.

.7 Test all material in accordance with the Manufacturer's quality control program. Samples not satisfying the Manufacturer's specifications shall result in the rejection of the applicable rolls. At the Manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify the non-complying rolls and/or qualify individual rolls.

.8 GCL to be supplied in rolls of minimum 3.6 metre continuous width.

.9 Minimum roll length to equal Manufacturer's standard minimum length.

.10 During shipping and on-site storage, protect the GCL at all times against exposure from sun; moisture, contamination by mud, dust, dirt; puncture; tearing and any other damaging or deleterious conditions. Contaminated GCL may require removal as directed by Engineer.

2.2 Labeling

.1 Each GCL roll to have a waterproof label which contains the following information:

- Manufacturer's name
- Production Identification
- Lot Number
- Roll Number
- Roll Weight; and
- Roll Dimensions

PART 3 EXECUTION

3.1 Installation

.1 PlaceHandle all GCL in such a manner as to ensure it is not damaged in any way.

.2 In the presence of wind, sufficiently weight all GCL's with sandbags or the equivalent. Install such sandbags during placement and maintain in place until replaced with cover material.

.3 Cut GCL using an utility blade in a manner recommended by the Manufacturer and exercise due care to prevent damage to any underlying or adjacent liner system components during cutting.

.4 Take care during placement not to entrap stones or moisture under the GCL and not to walk on or drag equipment across the exposed GCL.

.5 Replace or properly repair any GCL damaged by stones or other foreign objects, or installation activities at no additional cost to Owner.

.6 If white coloured geotextile is used to encapsulate the bentonite, take precautions against "snowblindness" of personnel.

.7 Do not install the GCL on standing water. Install the GCL in a way that reduces the potential for hydration of the mat prior to completion of construction of the overlying liner system.

.8 Do not install the GCL during precipitation, high winds or other conditions that may cause rapid hydration of or damage to the GCL.

.9 Install the GCL as indicated by the Manufacturer or Engineer.

.10 Place soil layers (clay liner, granular sub-liner sampler blanket) or geomembrane overlying the geosynthetic clay liner, immediately following the installation of the GCL. Remove the GCL and replace if it becomes hydrated before the overlying soil layer or geomembrane is placed, at Contractor's expense.

.11 Remove and replace all hydrated GCL with new material at no additional cost to Owner.

3.2 Overlaps

.1 Overlap all GCL panels. Along the length of the mat, the overlap shall be a minimum of 150 mm or as specified by the Manufacturer. Along the width of the mat, the overlap shall be a minimum of 0.3 m, as specified by the Manufacturer or Engineer. The edges of the GCL panels should be adjusted to smooth out any wrinkles, creases, or "fishmouths" in order to maximize contact with the underlying panel.

.2 Do not nail or staple the overlaps to the underlying materials.

.3 Place panels from the highest to the lowest elevation within the area to be lined. Up-slope panels to be shingled over down-slope panels in order that flow is over the seam and not into the seam.

.4 After panels are placed establish proper overlap orientation and pull back the edge of the panel to expose the overlap zone. Remove any soil or other deleterious material present in the overlap zone.

.5 Place or pour a fillet of granular bentonite, Volclay®, or other sealing material acceptable to the Engineer, in a continuous manner along the overlap zone at a rate of at least 1800 grams per lineal metre (0.25 pound per lineal foot) to seal the overlaps.

.6 No vehicles permitted directly on geotextile.

3.3 Repair

.1 Repair any holes or tears in the GCL by placing a GCL patch over the hole, overlapping the edges of the hole or tear by at least 0.3 m in all directions. The patch may be secured with a water-based adhesive approved by the Manufacturer.

.2 Take care to remove any soil or other material which may have penetrated the torn GCL.

.3 Make all repairs at no additional cost to Owner.

.4 Do not nail or staple patches.

3.4 Placement of Overlaying Materials

.1 Place materials above the GCL in such a manner as to ensure that the GCL is not damaged.

.2 Do not drive equipment used for placing other materials directly on the GCL. In areas of heavy vehicle traffic, such as access ramps, the soil thickness should be at least 1.0 m.

.3 Ensure that the GCL is not damaged while working around the appurtenances and ensure that connections of the GCL to appurtenances are properly sealed, including using bentonite if required.

3.5 Product Protection

.1 Protect all prior work and materials.

.2 In the event of damage, immediately make all repairs and replacements necessary, to the approval of Engineer and at no additional cost to the Owner.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 02701 - Aggregates: General.

1.2 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C 117- 03, Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C 136- 01, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D 422- 63(2002), Test Method for Particle-Size Analysis of Soils.

.4 ASTM D 698- 00, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).

.5 ASTM D 4318- 00, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1- 88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2- M88, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-A23.1- 94, Concrete Materials and Methods of Concrete Construction.

.4 Contractor is to complete his work in compliance with the Department of Fisheries Authorization. A letter of authorization has been applied for by the Owner. The Contractor shall be responsible to meet the terms and conditions of the letter of Authorization from DFO. The cost to provide a silt curtain around the excavation throughout the underwater section shall be included in the contract price.

1.3 Definitions

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock : any solid material in excess of 0.25 m^3 and which cannot be removed by means of duty mechanical excavating equipment having a 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Waste material: excavated material unsuitable for use in work or surplus to requirements.

.3 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.

.4 Unsuitable materials:

.1 Weak and compressible materials under excavated areas.

.2 Frost susceptible materials under excavated areas.

.3 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 : Sieve sizes to CAN/CGSB-8.1.

.2 Table

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

.3 Coarse-grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.5 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.4 Samples

.1 Submit samples in accordance with Section 01330 - Submittal Procedures.

.2 Inform Engineer at least four (4) weeks prior to commencing work, of proposed source of fill materials and provide access for sampling.

.3 Submit 70 kg samples of type of fill specified.

.4 Ship samples prepaid to Ottawa, in tightly closed containers to prevent contamination.

1.5 Protection of Existing Features

.1 Existing buried utilities and structures:

.1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing excavation work, notify applicable owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities by careful test excavations.

.4 .

.2 Existing buildings and surface features:

.1 Conduct, with Engineer, condition survey of existing buildings, service poles, wires, survey bench marks and monuments which may be affected by work.

.2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Engineer.

1.6 Shoring, Bracing and Underpinning

.1 Protect existing features in accordance with Section 01560 - Temporary Barriers and Enclosures and applicable local regulations.

.2 Engage services of qualified professional engineer who is registered or licensed in the Nunavut Territory, Canada in which work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for work.

.3 Submit design and supporting data at least two (2) weeks prior to commencing work.

.4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Nunavut Territory, Canada.

PART 2 PRODUCTS

2.1 Materials

.1 Type 1 and Type 2 fill: properties to section 02701 - Aggregates: General and the following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

.3 Table

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

.2 Type 3 fill: selected material from excavation or other sources, approved by Engineer for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum Portland cement content of 25 kg/m^3.

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CAN/CSA-A23.1.

.5 Portland cement: Type 10.

.6 Slump: 160 to 200 mm.

.4 Silt Curtian

.1 The silt curtain to be constructed of a woven geo-texile. Standard of Acceptance: Typar 3401.

.2 Curtain to be weighted using standard heavy gage chain, or similar stable material. Weights to be free of all grease or other soluble materials.

PART 3 EXECUTION

3.1 Site Preparation

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Install silt curtain prior to any excavation of riverbed materials below the water elevation. Silt curtain to extend from the top of the ice surface to the top of the riverbed. Gaps in the silt curtain are not permitted.

3.2 Stockpiling

.1 Stockpile fill materials in areas designated by Engineer. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.3 Excavation

.1 Advise Engineer at least seven (7) days in advance of excavation operations for initial cross sections to be taken.

.2 Excavate to lines, grades, elevations and dimensions as indicated Engineer.

.3 For trench excavation, unless otherwise authorized by Engineer in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.4 Dispose of surplus and unsuitable excavated material off site.

.5 Do not obstruct flow of surface drainage or natural watercourses.

.6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.7 Notify Engineer when bottom of excavation is reached.

.8 Obtain Engineer approval of completed excavation.

.9 Remove unsuitable material from trench bottom to extent and depth as directed by Engineer.

.10 Correct unauthorized over-excavation as follows:

.1 Fill under bearing surfaces and footings with fill concrete.

.2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected maximum dry density.

.11 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Engineer.

3.4 Fill Types and Compaction

.1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTMD698.

.1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95%.

.2 Place bedding and surround material in unfrozen condition.

3.5 Backfilling

.1 .....Do not proceed with backfilling operations until Engineer has inspected and approved installations.

.2 .....Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place unshrinkable fill in areas as indicated. Consolidate and level unshrinkable fill with internal vibrators.

.5 Vibratory compaction equipment: Use a hand compactor in trench.

.6 Shape bed true to grade to provide continuous uniform bearing surface for pipe using type I material.

.7 Shape transverse depressions in bedding as required to suit joints.

.8 Compact each layer full width of bed to at least 95% maximum density to ASTMD698.

.9 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

3.6 Restoration

.1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Engineer.

.2 Clean and reinstate areas affected by work as directed by Engineer.

END OF SECTION

Approved: 2001-12-04

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01330 - Submittal Procedure.

.2 Section 01560 - Temporary Barriers and Enclosures.

.3 Section 01705 - Health and Safety.

.4 Section 02315 - Excavating, Trenching and Backfilling.

1.2 MEASUREMENT PROCEDURES

.1 Quantities will be taken from cross section showing original rock surface and actual grade line set by Engineer, except that minimum depth of rock required to be excavated to be considered as 50 mm.

1.3 DEFINITION

.1 Rock: any solid material in excess of 0.25 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.

.2 PPV: peak particle velocity.

1.4 SUBMITTALS

.1 Blasting Operation

.1 Submit to Engineer and local authorities having jurisdiction for approval, written proposal of operations for removal of rock by blasting, in accordance with Section 01330 - Submittal Procedures.

.2 Indicate proposed method of carrying out work. Include details on protective measures, time of blasting and other pertinent details.

.3 Submit records to Engineer at end of each shift. Maintain complete and accurate record of drilling and blasting operations.

1.5 QUALIFICATIONS

.1 Retain licensed explosives expert to program and supervise blasting work, and to determine precautions, preparation and operations techniques.

1.6 BLASTING SURVEY AND MONITORING

.1 Engineer will visit property holders of adjacent buildings and structures to determine existing conditions and describe blasting and seismic recording operations.

1.7 BLASTING AND VIBRATION CONTROL

.1 Reduce ground vibrations to avoid damage to structures or remaining rock mass.

Part 2 Products

2.1 MATERIALS

.1 Not used.

Part 3 Execution

3.1 PROTECTION

.1 Prevent damage to surroundings and injury to persons in accordance with Section 01560 - Temporary Barriers and Enclosures. Erect fencing, post guards, sound warnings and display signs when blasting to take place.

3.2 ROCK REMOVAL

.1 Co-ordinate this Section with Section 01705 - Health and Safety.

.2 Remove rock to alignments, profiles, and cross sections as indicated.

.3 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.

.4 Excavate trenches to lines and grades to minimum of 50 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.

.5 Cut trenches to widths as indicated.

.6 Use pre-shearing, cushion blasting or other smooth wall drilling and blasting techniques or directed by Engineer.

.7 Remove boulders and fragments which may slide or roll into excavated areas.

.8 Correct unauthorized rock removal at no extra cost, in accordance with Section 02315 - Excavating, Trenching and Backfilling.

3.3 ROCK DISPOSAL

.1 Dispose of surplus removed rock off site.

.2 Do not dispose removed rock into landfill. Material must be sent to appropriate location as approved by the Engineer.

END OF SECTION

Part 1 GENERAL

1.1 References

.1 ASTM D698-98, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft3) (600 kN-m/m3).

1.2 Definitions

.1 Rock Excavation: excavation of:

.1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort from Caterpilar D9L or equivalent to be considered integral with parent mass.

.2 Boulder or rock fragments measuring in volume one (1) cubic meter or more.

.2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.

.3 Unclassified Excavation: excavation of whatever character other than stripping encountered in the work.

.4 Stripping: excavation of organic material covering original ground.

.5 Over Haul: authorized hauling in excess of free haul distance that excavated material is moved.

.6 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.

.7 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.

.8 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.

1.3 Requirements of Regulatory Agencies

.1 Adhere to regulations of authority having jurisdiction if blasting is required.

.2 Adhere to Territorial and National Environmental requirements if potentially toxic materials are involved.

Part 2 PRODUCTS

2.1 Materials

.1 Embankment materials require approval by Engineer.

.2 Borrow material:

.1 Obtain from borrow pit to be approved by Engineer.

Part 3 EXECUTION

3.1 Compaction Equiioment

.1 Compaction equipment must be capable of obtaining required densities in materials on project. Equipment that does not achieve specified densities must be replaced or supplemented.

.2 Operate minimum equivalent of one 12 tonne vibratory packer continuously in each embankment when placing material.

3.2 Excavating

.1 General:

.1 Notify Engineer whenever waste materials are encountered and remove to depth and extent directed.

.2 Subcut 500 mm below subgrade in cut sections unless otherwise directed. Compact top 150 mm below subcut to minimum 95% maximum dry density, ASTM D698 (AASHTO T99). Replace with approved embankment material and compact.

.3 Where subgrade is on transition from excavation to embankment treat ground slopes at grade points as directed by Engineer.

.2 Drainage:

.1 Maintain profiles, crowns and cross slopes to provide good surface drainage.

.2 Provide ditches as work progresses to provide drainage.

.3 Construct interceptor ditches as shown on plans or as directed before excavating or placing embankment in adjacent area.

.3 Rock excavation:

.1 If, during excavation, material appearing to conform to classification for rock is encountered, notify Engineer and provide sufficient time to enable measurements to be made to determine volume of rock.

.2 Shatter rock to 300 mm below subgrade elevation as indicated on plans.

.3 Reduce overbreak and increase stability of all rock faces by using smooth blasting techniques, such as pre-shearing, cushion blasting, buffer blasting, perimeter blasting and line drilling.

.4 Scale rock backslopes to achieve smooth, stable face, free of loose rock and overhangs to design backslope.

.5 Control blasting to minimize flying particles.

.4 Borrow Excavation:

.1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.

.2 Obtain embankment materials in excess of what is available from cut areas from designated borrow areas.

.1 Engineer to designate extent of borrow areas and allowable depth of excavation.

.2 Remove waste and stripping material from borrow pits to designated locations.

.3 Slope edges of borrow areas to minimum 3:1 and provide drainage as directed.

.4 Trim and leave borrow pits in condition to permit accurate measurement of material removed.

3.3 Embankments

.1 When directed, scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces. Method used to be subject to prior approval of Engineer.

.2 Break up or scarify existing road surface prior to placing embankment material.

.3 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized.

.4 Maintain crowned surface during construction to ensure ready run-off of surface water.

.5 Drain low areas before placing materials.

.1 Place and compact to full width in layers not exceeding 200 mm loose thickness. Engineer may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.

.6 Where material consists of rock:

.1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1 m.

.2 Carefully distribute rock material to fill voids with smaller fragments to form compact mass.

.3 Fill surface voids at subgrade level with rock spalls or selected material to form an earth-tight surface.

.4 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 300 mm of subgrade elevation.

.7 Deductions from excavation will be made for overbuild of embankments.

3.4 Subgrade Compaction

.1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.

.2 Compact each layer to minimum 95% maximum dry density, ASTM D698 (AASHTO T99) except top 150 mm of subgrade. Compact top 150 mm to 100% maximum dry density.

.3 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

3.5 Finishing

.1 Shape entire roadbed to within 50 mm of design elevations.

.2 Finish slopes, ditch bottoms and borrow pits to neat condition, true to lines, grades and drawings where applicable.

.3 Remove rocks over 150 mm in any dimension from slopes and ditch bottoms.

.4 Hand finish slopes that cannot be finished satisfactorily by machine.

.5 Round top of backslope 1.5 m both sides of top of slope.

.6 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

3.6 Protection

.1 Maintain finished surfaces in condition conforming to this section until acceptance by Engineer.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01561 - Environmental Protection.

1.2 Environmental Requirements

.1 Operation of construction equipment in water is prohibited.

.2 Use borrow material from watercourse beds when approved by Engineer.

.3 Design and construct temporary crossings to minimize environmental impact to watercourse.

.4 Constructing temporary crossings of watercourses when spawning beds are indicated is prohibited.

.5 Placing material in watercourse is to be completed in accordance with the Department of Fisheries and Oceans requirements.

PART 2 PRODUCTS

2.1 Preparation

.1 Obtain work permits from governing Federal, Territorial and/or Municipal authorities.

PART 3 EXECUTION

3.1 Existing Conditions

.1 Maintain existing flow pattern in natural watercourse systems.

3.2 Site Clearing

.1 Maintain temporary erosion and pollution control features installed under this contract.

3.3 Drainage

.1 Pumping water containing suspended materials into watercourse is prohibited.

END OF SECTION

.....1996-06-30

PART 1 GENERAL

1.1 Related Work

.1 Section 02701- Aggregates: General

.2 Section 02315 - Excavating, Trenching and Backfilling

1.2 References

.1 ASTM D1759 Standard Practice for Design of HDPE Manholes for Subsurface Applications.

.2 ASTM F894 Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.

.3 ASTM F714 Standard Practice or Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

.4 ISO 9001:2000 Quality management systems - Requirements

1.3 Material Certification

.1 Submit manufacturer's test data and certification at least four (4) weeks prior to commencing work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.4 Measurement for Payment

.1 Excavation and backfill will be measured in accordance with Section 02315- Excavating Trenching and Backfilling.

.2 Manholes will be measured in units within depth classifications as follows, measured from top of cover or grating to top of base slab:

.1 2 m or less.

.2 Greater than 2 m but not more than 2.5 m.

.3 Greater than 2.5 m but not more than 3 m.

.4 Greater than 3 m but not more than 3.5 m.

.5 Further stages in increments of 0.5 m.

.3 Outfall structures will be measured in units.

.4 Gratings will be measured in units supplied and installed.

PART 2 PRODUCTS

2.1 Materials

.1 The riser pipe shall only be manufactured from a closed profile high density polyethylene pipe that conforms to the requirements of section 5.1 'Base Materials' of ASTM F894, and that no materials other than the approved base materials shall be used to manufacture the pipe. When requested to do so, the manufacturer shall certify that the materials used to manufacture the riser pipe meets these requirements.

.2 All solid wall pipe used in the manhole fabrication shall meet the requirements of ASTM F714 and shall conform to the OD and DR requirements specified on the contract documents.

.3 The polyethylene raw material for riser pipe and solid wall pipe shall contain a minimum of 2%, well dispersed finely divided carbon black for UV stabilization. Additives that can be conclusively proven not to be detrimental to the pipe may also be used provided that the pipe produced meets or exceeds all of the requirements of this specification.

.4 The pipe shall contain no recycled compound except that generated in the manufacturers' own plant.

.5 The pipe manufacturers Quality System shall be certified as meeting the requirements of an ISO 9001:2000 Quality management system, by a qualified independent body.

.6 The riser pipe material and all solid wall pipe shall be resistant to corrosion resulting from the presence of Hydrogen Sulfide and to pH values between 2 and 13.

.7 The riser pipe shall be manufactured with dimensions and tolerances in accordance with the manufacturer's internal manufacturing standard. The pipe must meet the requirements of ASTM F894 when the pipe is marked as such. The nominal inside diameter of the pipe shall be true to the specified pipe size. The pipe shall be manufactured by the continuous winding of a closed profile onto suitably sized mandrels. It shall be produced to constant internal diameters.

.8 When more than 1 length of riser pipe is used to fabricate the riser, the termination of the helically wound profile that forms the pipe shall be manufactured with a 30° plated end cut.

.9 The pipe shall be manufactured in such a manner that the pipe is available in lengths from 3-60 feet. A variety of lengths are available to accommodate installation, storage or varying ground conditions. Unless otherwise stated, the standard laying length shall be 50 feet (15 meters). Each standard and random length of pipe in compliance with ASTM F894 shall be clearly marked as such as required by the standard.

.10 The pipe shall be homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.

.11 Manholes shall be designed in accordance with the requirements of ASTM D1759. The design shall be based on the site conditions identified on the project drawings and / or as identified by the owner.

PART 3 EXECUTION

3.1 Excavation and Backfill

.1 Excavate and backfill in accordance with Section 02315 - Excavating Trenching and Backfilling and as indicated.

.2 Obtain approval of Engineer before installing outfall structures and manhole.

3.2 Installation

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Dewater excavation to approval of Engineer and remove soft and foreign material before placing base.

.3 Set manhole base on 150 mm minimum of granular bedding compacted to 100% maximum density to ASTM D 698.

.4 Compact granular backfill to [95]% maximum density to ASTM D 698.

.5 Place unshrinkable backfill in accordance with Section 02315 - Excavating, Trenching and Backfill.

.6 Place frame and cover on top section to elevation as indicated. If adjustment required use mandhole riser ring.

.7 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

.8 Install safety platforms in manholes having depth of five (5) m or greater, as indicated.

.9 Manholes shall be factory fabricated to ensure consistency in product assembly.

.10 All joints in riser pipe sections shall be formed by extrusion welding along the helical ‘profile cut’ joints. Unless otherwise specifically noted on the contract documents, the profile winding shall be cut and sealed at a 30 ° angle, prior to extrusion welding of adjacent sections, to prevent flow along the pipe wall helix.

.11 All joints in solid wall pipe shall be by fusion welding unless specifically stated otherwise on the contract documents.

.12 All joints between the HDPE base plate, manhole base slope sections, manhole riser pipe, and mainline pipe extensions, shall be by extrusion welding. All extrusion welds shall conform to the requirements of the contract documents and WPS KWH01 (or equivalent).

.13 Connection of solid wall (ASTM F714) manhole stub extensions to HPDE mainline pipe meeting the same specification may be by mechanical connection, or by fusion welding.

.14 All fusion welds must be made following the fusion equipment manufacturers recommendations or the pipe manufacturers' butt fusion procedures.

3.3 Leakage Test

.1 Install watertight plugs or seals on inlets and outlets of each new manhole and fill manhole with water. Leakage not to exceed 0.3% per hour of volume of manhole.

.2 If permissible leakage is exceeded, correct defects. Repeat until acceptable to Engineer.

.3 Engineer will issue Test Certificate for each manhole passing test.

.4 Leak Testing: Installed sections of the fabricated HDPE manhole shall be examined for leaks by in-filtration where the ground water is 'high', or by ex-filtration where the ground water is 'low'.

.5 In-filtration Testing: The ground water table around the manhole must be at least 1 foot above the highest fabrication weld elevation of the section being examined. The joints may be examined visually for leaks. **No leaks should be observed**. If a leak is observed, it will be necessary to lower the water table below the area of the leak, and to completely dry and clean the area prior to undertaking a repair weld.

.6 Ex-filtration Testing: Establish a water level within the manhole that is at least 1 foot above the highest fabrication weld. Allow to stand for a minimum of 12 hours. *(The profile wall PE pipe will 'relax' due to the imposed internal pressure by minor deflection of the inside surface of the profile wall, increasing the volume inside the pipe.)* Add additional water as required to return the height of water to the original level. Let stand for 1 hour and measure the amount of water required to return the standing head to the initial level. Repeat three (3) times. The volume of 'make-up' water required in each subsequent step should be less than the preceding step. The values of 'make-up' water over time should trend to zero (0).

END OF SECTION

..... 1999-12-16

PART 1 GENERAL

1.1 Related Sections

.1 Section 02315 - Excavating, Trenching and Backfilling.

.2 Section 02317 - Roadway Excavation, Embankment and Compaction.

.3 Section 02701- Aggregates: General

.4 Section 01330 - Submittal Procedures

.5 Section 01355 - Waste Management and Disposal

.6 Section 01610 - Basic Product Requirements

1.2 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C 117-95, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C 136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D 698-91(1998), Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

.4 ASTM D 1248-98, Standard Specification for Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable.

.5 ASTM F 667-97, Standard Specification for 8, 10, 12, and 15 inch Corrugated Polyethylene Tubing and Fittings.

.2 Canadian Standards Association (CSA)

.1 CAN3-G401-93, Corrugated Steel Pipe Products.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire.

.2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.3 Samples

.1 Submit samples in accordance with Section 01330 - Submittal Procedures.

.2 Inform Engineer at least four (4) weeks prior to commencing work, of proposed source of bedding materials and provide access for sampling.

1.4 Material Certification

.1 Submit manufacturer's test data and certification at least four (4) weeks prior to commencing work.

.2 Certification to be marked on pipe.

1.5 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with Section 01610 - Basic Product Requirements.

PART 2 PRODUCTS

2.1 Corrugated Steel Pipe

.1 Corrugated steel pipe: to CAN3-G401.

.2 Water-tight cut-off collars: as indicated.

.3 Prefabricated end sections: as indicated.

.4 Corrugated fluming: to CAN3-G401.

2.2 Granular Bedding and Backfill

.1 Granular bedding and backfill material to Section 02701- Aggregates: General and following requirements:

.1 Crushed pit run or screened stone, gravel or sand.

PART 3 EXECUTION

3.1 Trenching

.1 Do trenching work in accordance with Section 02315- Excavating Trenching and Backfilling.

.2 Obtain Engineer's approval of trench line and depth prior to placing bedding material or pipe.

3.2 Bedding

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in the dry.

.2 Place minimum thickness of 200 mm of approved granular material on bottom of excavation and compact to minimum 95% maximum density to ASTM D 698.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Engineer, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.3 Laying Corrugated Steel Pipe Culverts

.1 Commence pipe placing at downstream end.

.2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.

.4 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.

.5 Do not allow water to flow through pipes during construction except as permitted by Engineer.

3.4 Joints: Corrugated Steel Culverts

.1 Corrugated steel pipe:

.1 Match corrugations or indentations of coupler with pipe sections before tightening.

.2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.

.3 Insert and tighten bolts.

.4 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint approved by Engineer or two coats of zinc rich epoxy paint.

.2 Structural plate:

.1 Erect in final position by connecting plates with bolts at longitudinal and circumferential seams.

.2 Drift pins may be used to facilitate matching of holes.

.3 Place plates in sequence recommended by manufacturer with joints staggered so that not more than three plates come together at any one point.

.4 Draw bolts up tight, without overstress, before beginning backfill.

.5 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint or two coats of zinc rich epoxy paint approved by Engineer.

3.5 Backfilling

.1 Backfill around and over culverts as indicated or as directed by Engineer.

.2 Place granular backfill material, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

.3 Compact each layer to 95% maximum density to ASTM D 698 taking special care to obtain required density under haunches.

.4 Protect installed culvert with minimum 500 mm cover of compacted fill before heavy equipment is permitted to cross. During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

.5 Place backfill in unfrozen condition.

3.6 Fluming

.1 Assemble and install fluming as indicated.

.2 Set top edges of fluming flush with side slope.

END OF SECTION

..... 1996-06-30

PART 1 GENERAL

1.1 Related Work

.1 Section 01330 - Submittal Procedures

.2 Section 02231- Clearing and Grubbing

.3 Section 02371- Rip-Rap

.4 Section 02631- Manholes and Catch Basins.

.5 Section 02701- Aggregates: General

1.2 References

.1 ASTMC117-90, Test Method for Material Finer Than 0.075mm Sieve in Mineral Aggregates by Washing.

.2 ASTMC136-84a, Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTMD698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m3).

.4 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire.

.5 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.3 Samples

.1 Submit samples in accordance with Section 01330 - Submittal Procedures.

.2 Submit to Engineer for testing, samples of following materials at least four (4) weeks prior to commencing work:

.1 Two samples 3600mm square of flexible lining including joint or intersecting joints if included in work.

.2 Two samples 600mm long of flexible lining including joint or intersecting joints if included in work.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01330 - Submittal Procedures.

.2 Indicate following items:

.1 Liner panels, details of anchoring panels, material, thickness and reinforcement.

.2 Projections through liner and method of sealing.

.3 Piping.

.4 Sluice or slide gates.

.5 Valves.

1.5 Classification of Excavation

.1 General: excavation of rock, common and unclassified materials shall include placing of suitable excavated materials in embankment fills or dikes, and disposal of unsuitable material.

.2 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of]m^3.

.3 Common excavation: excavation of all materials of whatever nature, which are not included under definition of rock excavation, including dense tills, hardpan and frozen materials.

.4 Unclassified excavation: excavation of deposits of whatever character encountered in work.

1.6 Measurement for Payment

.1 Construction of sewage lagoon: lump sum payment.

PART 2 PRODUCTS

2.1 Materials

.1 Rip-rap: to Section 02371- Rip-Rap.

.2 Granular material to Section 02701- Aggregates: General and following requirements:

.1 Stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTMC136 and ASTMC117. Sieve sizes to CAN/CGSB-8.1.

.3 Table

Sieve Designation	% Passing	
	Stone and Gravel	Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	-	-
19 mm	[100]	-
12.5 mm	-	-
9.5 mm	-	-
4.75 mm	[40-70]	[100]
2.00 mm	-	[50-100]
0.425 mm	[0-3]	[10-50]
0.180 mm	-	-

Sieve Designation	% Passing	
	Stone and Gravel	Sand
0.075 mm	-	[0-5]

PART 3 EXECUTION

3.1 Stripping of Topsoil

.1 Commence topsoil stripping of area as directed by Engineer after area has been cleared and grubbed.

.2 Strip topsoil to depths as directed by Engineer. Avoid mixing topsoil with subsoil.

.3 Stockpile in locations as directed by Engineer.

.4 Dispose of unused topsoil as directed by Engineer.

3.2 Excavation

.1 Excavate effluent ditches, by-pass ditches or re-routed surface drainage ditches as indicated.

.2 Remove unsuitable materials from dike foundation to depth as indicated.

.3 Excavate basin for lagoon to lines and elevations indicated.

3.3 Dike Construction

.1 Construct dikes as indicated.

.2 Place dike material in unfrozen condition.

.3 Place dike materials in layers of 150mm compacted thickness. Compact each layer to 95% maximum density to ASTM D 698.

.4 Hand finish or grade slopes and top of completed dike to remove stones over 25 mm in size and other debris.

.5 Finish slopes and top of dike as indicated.

.6 Rip-rap areas indicated in accordance with Section 02454- Rip-Rap.

3.4 Installation of Sewers

.1 Construct and install required manholes in accordance with Section 02631- Manholes and Catch Basins.

.2 Install valves, sluice gates, and slide gates in accordance with manufacturer's recommendations.

3.5 Flexible Lining

.1 Place compacted layer of granular material in unfrozen condition on bottom and sides of lagoon as indicated.

.2 Check surface on which flexible liner is to be placed and remove projections that may puncture lining.

.3 Place liner panels as directed by Engineer or as indicated. Anchor panels temporarily using sand bags or other weights that will not damage liner.

.4 Excavate anchor trenches at locations as indicated.

.5 Place and secure liner in anchor trenches.

.6 Backfill and compact anchor trenches.

.7 Clean edges of panels to be spliced and join as outlined in manufacturer's recommendations.

.8 Complete anchoring of panels at base of slope.

.9 Cut liner sheets to fit accurately around inlets, outlets, sleeves, concrete structures and other projections through lining.

.10 Complete flashing and sealing of penetrations as indicated.

.11 Place cover blanket as indicated.

3.6 Rip-Rap

.1 Place rip-rap in accordance with Section 02371- Rip-Rap and as indicated.

3.7 Leakage Testing

.1 Fill lagoon with water to depth of approximately 450mm.

.2 Mark level of water surface at minimum of 3 points approximately 50m apart.

.3 Check and record levels of water surface daily for two weeks to accuracy of 1mm.

.4 Fill watertight pan of at least $1m^2$ area to depth of 200mm in location near lagoon and exposed to weather.

.5 If, during two (2) week period, there is loss of water in lagoon in excess of water loss in test pan of more than 25mm, locate leaks and repair.

.6 Repeat above test if repairs were made.

.7 Perform test and repairs at no cost to Owner.

.8 When test results are acceptable to Engineer, proceed with clean up of site.

3.8 Clean Up

.1 Remove surplus material and debris from site.

END OF SECTION

Part 1 GENERAL

1.1 Related Sections

.1 Section 02315 – Excavating, Trenching and Backfilling

.2 Section 03302 – Cast-In-Place Concrete.

.3 Section 01330 - Submittal Procedures.

1.2 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.3 Samples

.1 Submit samples in accordance with Section 01330 - Submittal Procedures.

.2 Allow continual sampling by Engineer during production.

.3 Provide Engineer with access to source and processed material for sampling.

.4 Install sampling facilities at discharge end of production conveyor, to allow Engineer to obtain representative samples of items being produced.

.5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

Part 2 PRODUCTS

2.1 Materials

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed five times least dimension.

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

.3 Light weight aggregate, including slag and expanded shale.

2.2 Source Quality Control

.1 Inform Engineer of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.

.2 If, in opinion of Engineer, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.3 Advise Engineer 4 weeks in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 EXECUTION

3.1 Preparation

.1 Aggregate source preparation

.1 Prior to excavating materials for aggregate production, clear area to be worked, and strip unsuitable surface materials. Dispose of cleared and unsuitable materials as directed by Engineer.

.2 When excavation is completed dress sides of excavation to nominal [1.5:1] slope, and provide drains or ditches as required to prevent surface standing water.

.3 Trim off and dress slopes of waste material piles and leave site in neat condition.

.2 Processing

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Engineer.

.3 Wash aggregates, if required to meet specifications. Use only equipment approved by Engineer.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.

.3 Handling

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

.4 Stockpiling

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Engineer.

.2 Stockpile aggregates in sufficient quantities to meet Project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Engineer within 48 h of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Max 1.5 m for coarse aggregate and base course materials.

.2 Max 1.5 m for fine aggregate and sub-base materials.

.3 Max 1.5 m for other materials.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles.

.10 Do not use conveying stackers.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

.1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.2 Leave any unused aggregates in neat compact stockpiles as directed by Engineer.

.3 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

END OF SECTION

..... 1996-06-30

PART 1 GENERAL

1.1 Related Sections

.1 Section 02317 - Roadway Excavation, Embankment and Compaction.

.2 Section 02701- Aggregates General

.3 Section 02722- Granular Sub-base

1.2 References

.1 ASTMC117-90, Test Method for Material Finer Than 0.075mm Sieve in Mineral Aggregates by Washing.

.2 ASTMC131-89, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTMC136-92, Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTMD698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft3) (600kN-m/m3).

.5 ASTMD1557-91, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft3) (2,700kN-m/m3).

.6 ASTMD1883-92, Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.7 ASTMD4318-84, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.8 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.

.9 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.3 Delivery, Storage, and Handling

.1 Deliver and stockpile aggregates in accordance with Section 02701- Aggregates General. Stockpile minimum 50% of total aggregate required prior to commencing operation.

.2 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

PART 2 PRODUCTS

2.1 Materials

.1 Granular base: material to Section 02701- Aggregates: General and following requirements:

.1 Crushed stone or gravel.

.2 Gradations to be within limits specified when tested to ASTMC136. Sieve sizes to CAN/CGSB-8.1.

.1 Gradation to:

Sieve Designation	% Passing		
	(1)	(2)	(3)
100 mm	-	-	-
75 mm	-	-	-
50 mm	[100]	-	-
37.5 mm	[70-100]	-	-
25 mm	-	[100]	-
19 mm	[50-75]	-	[100]
12.5 mm	-	[65-100]	[70-100]
9.5 mm	[40-65]	-	-
4.75 mm	[30-50]	[35-60]	[40-70]
2.00 mm	-	[22-45]	[23-50]
0.425 mm	[10-30]	[10-25]	[7-25]
0.180 mm	-	-	-
0.075 mm	[3-8]	[3-8]	[3-8]

.2 Material to level surface depressions to meet gradation (2) limits in accordance with 2.1.1.2.1.

.3 Liquid limit: to ASTMD4318, maximum25

.4 Plasticity index: to ASTMD4318, maximum6

.5 Los Angeles degradation: to ASTMC131. Max. % loss by weight: 45

.6 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTMC136.

Passing		Retained on
[50] mm	to	[25] mm
[25] mm	to	[19.0] mm
[19.0] mm	to	[4.75] mm

.7 Soaked CBR: to ASTMD1883, min 80, when compacted to 100% of ASTMD1557.

PART 3 EXECUTION

3.1 Sequence of Operation

.1 Place granular base after sub-base surface is inspected and approved by Engineer.

.2 Placing

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Begin spreading base material on crown line or on high side of one-way slope.

.5 Place material using methods which do not lead to segregation or degradation of aggregate.

.6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.

.7 Place material to full width in uniform layers not exceeding 150mm compacted thickness. Engineer may authorize thicker lifts (layers) if specified compaction can be achieved.

.8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.9 Remove and replace that portion of layer in which material becomes segregated during spreading.

.3 Compaction Equipment

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Engineer before use.

.3 Equipped with device that records hours of actual work, not motor running hours.

.4 Compacting

.1 Compact to density not less than 100% maximum dry density in accordance with ASTMD1557.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Engineer.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.5 Proof rolling

.1 For proof rolling use standard roller of 45400kg gross mass with four pneumatic tires each carrying 11350kg and inflated to 620kPa. Four tires arranged abreast with centre to centre spacing of 730mm.

.2 Obtain approval from Engineer to use non standard proof rolling equipment.

.3 Proof roll at level in granular base as indicated. If use of non standard proof rolling equipment is approved, Engineer to determine level of proof rolling.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of defective subgrade:

.1 Remove base, sub-base and subgrade material to depth and extent as directed by Engineer.

.2 Backfill excavated subgrade with common material and compact in accordance with Section 02317 - Roadway Excavation, Embankment and Compaction.

.3 Replace sub-base material and compact in accordance with Section 02317 - Roadway Excavation, Embankment and Compaction.

.4 Replace base material and compact in accordance with this section.

.6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Engineer and replace with new materials in accordance with Section 02722- Granular Sub-base and this section at no extra cost.

3.2 Site Tolerances

.1 Finished base surface to be within plus or minus 10mm of established grade and cross section but not uniformly high or low.

3.3 Protection

.1 Maintain finished base in condition conforming to this section until succeeding material is applied or until acceptance by Engineer.

END OF SECTION

Approved: 2002-12-04

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01355 - Waste Management and Disposal.

.2 Section 02701 - Aggregates: General.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63(1998), Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.5 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3).

.6 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

Part 2 Products

2.1 MATERIALS

.1 Granular sub-base material: in accordance with Section 02701 - Aggregates: General and following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table

Sieve Designation	% Passing			
100 mm	-	-	-	-
75 mm	[100]	[100]	[100]	-
50 mm	-	-	-	[100]
37.5 mm	-	-	-	-
25 mm	[55-100]	-	-	[60-100]
19 mm	-	-	-	-

Sieve Designation	% Passing			
12.5 mm	-	-	-	[38-70]
9.5 mm	-	-	-	-
4.75 mm	[25-100]	[25-85]	-	[22-55]
2.00 mm	[15-80]	-	-	[13-42]
0.425 mm	[4-50]	[5-30]	[0-30]	[5-28]
0.180 mm	-	-	-	-
0.075 mm	[0-8]	[0-10]	[0-8]	[2-10]

.4 Other Properties as follows:

.1 Liquid Limit: to ASTM D4318, Maximum 25.

.2 Plasticity Index: to ASTM D4318, Maximum 6.

.3 Particles smaller than 0.02 mm: to ASTM D422, Maximum 3%.

.4 Soaked CBR: to ASTM D1883, Min 40 when compacted to 100% of ASTM D1557.

Part 3 Execution

3.1 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by Engineer.

.2 Construct granular sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Begin spreading sub-base material on crown line or high side of one-way slope.

.6 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.

.8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Engineer may authorize thicker lifts (layers) if specified compaction can be achieved.

.9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.10 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Compact to density of not less than 98% maximum dry density in accordance with ASTM D698.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Engineer.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

.1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.4 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Engineer.

END OF SECTION

..... 2000-12-05

PART 1 GENERAL

1.1 Related Sections

.1 Section 01330 - Submittal Procedures.

1.2 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM B209-96, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 62-GP-11M-78, Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing.

.3 Manual of Uniform Traffic Control Devices for Canada

1.3 Samples

.1 Submit samples in accordance with Section 01330 - Submittal Procedures.

.2 Submit to Engineer at least four (4) weeks prior to commencing work, following samples of materials proposed for use:

.1 Reflective markers.

.2 Galvanized steel posts.

PART 2 PRODUCTS

2.1 Reflective Markers

.1 200 x 100 mm with 20 mm radius corners aluminum base panel with permanently attached reflective sheeting:

.1 Aluminum base panel: to ASTM B209M, 1.6 mm thick, degreased and etched or treated with light amorphous chromate type coating.

.2 Reflective sheeting: to CGSB62-GP-11M, type I, class I, reflectivity level I. Colour: yellow.

2.2 Steel Posts

.1 Steel posts: galvanized steel sign standards 3.2 m long, flanged, "U" shaped in cross section, measuring 65 mm wide by 30 mm deep. Metal thickness: 4.5 mm. Pre-drill bolt holes in locations as indicated.

.2 Bolts: 65 mm long galvanized steel, 9 mm minimum diameter. Each bolt to be complete with two nylon washers, cast block spacer and galvanized steel nut.

PART 3 EXECUTION

3.1 Assembly

.1 Fasten reflective markers to steel posts using bolts, washers, spacers and nuts. Use two bolts for each delineator unit, centered and spaced at 150 mm.

.2 Fasten two reflective markers back to back to each steel post for delineator units installed on two-way roads. Attach single reflective marker to each post for delineator units installed on one-way roads.

3.2 Installation

.1 Do work in accordance with "Manual of Uniform Traffic Control Devices for Canada", (MUTCDC) except where specified otherwise.

.2 Install posts vertically and as indicated and in no case more than 4.0 m nor less than 1.2 m from edge of pavement.

.3 Locate centre of reflective marker 2.4 m above elevation of outside edge of adjacent lane in accordance with MUTCDC and at right angles to road centreline.

.4 On straight alignment, space delineator units at 60 m.

.5 On curves, space delineator units as follows:

Radius of Curve in Metres	Spacing in Metres on Curve	Spacing in Metres in Advance and Beyond		
		First Space	Second Space	Third Space
1500	42	60	60	60
1000	35	60	60	60
500	24	45	60	60
350	20	38	60	60
250	17	32	52	60
200	15	29	46	60
150	13	25	40	60
100	11	20	33	60
75	9	18	28	57
60	8	16	25	51
40	7	13	21	42

.6 Five markers to be always visible to the right of the road on approaches to and throughout horizontal curves.

END OF SECTION

..... 1996-06-30

PART 1 GENERAL

1.1 Related Work

.1 Section 01330 - Submittal Procedures

1.2 References

.1 ASTMA307-91, Specification for Carbon Steel Bolts and Studs, 60,000psi Tensile.

.2 CAN/CSA-O80 Series-M89, Wood Preservation.

.3 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

.4 CAN/CGSB-1.40-M89, Primer, Structural Steel, Oil Alkyd Type.

.5 CAN/CGSB-1.181-92, Ready Mixed Organic Zinc-RichCoating.

.6 CGSB31-GP-107Ma-90, Non-inhibited, PhosphoricAcid Base Metal Conditioner and Rust Remover.

.7 AASHTOM180-79, Corrugated Sheet Steel Beams forHighway Guardrails.

1.3 Samples

.1 Submit samples in accordance with Section 01330 - Submittal Procedures.

.2 Inform Engineer at least four (4) weeks prior to commencing work, of proposed sources of guide rail and components.

PART 2 PRODUCTS

2.1 Materials

.1 Steel W-beam guide rail as indicated and to following requirements:

.1 Steel rail and terminal sections: to AASHTOM180, classA Type1 zinc coated.

.2 Bolts, nuts and washers: to ASTMA307, hot dip galvanized to CSAG164.

.2 Organic zinc-rich coating: to CAN/CGSB-1.181.

.3 Metal conditioner, and paints:

.1 Metal conditioner: to CGSB31-GP-107Ma.

.2 Primer paint for galvanized steel: to CAN/CGSB-1.40.

.4 Sawn timber posts and offset blocks:

.1 Species: SPF

.2 Type: pressure treated in accordance withCAN/CSA-O80 Series.

.3 Grade: 1.

.4 Dimensions: as indicated.

PART 3 EXECUTION

3.1 Erection

.1 Set posts by instrument for alignment, and locations as indicated and as directed by Engineer.

.2 Excavate post holes to depths as indicated and to diameter of 360mm plus or minus 20mm. Compact bottom to provide firm foundation. Set post plumb and square in hole.

.3 Backfill around posts using excavated material and compact in uniform layers not exceeding 150mm compacted thickness.

.4 Leave or make depression approximately 150mm deep around posts until painting is completed, then fill and compact to ground elevation.

.5 Cut off tops of posts as indicated, with tops parallel to grade of pavement edge.

.6 Treat cut tops with two coats of wood preservative.

.7 Construct anchorages to details as indicated. Place and compact backfill for anchors as directed by Engineer.

.8 Erect steel W-beam components to details as indicated. Lap joints in direction of traffic. Tighten nuts to 100N.m torque. Maximum protrusion of bolt 12mm beyond nut.

3.2 Painting Touch up

.1 Galvanized steel-touch up:

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas. Pre-treat damaged surfaces according to manufacturer's instructions for zinc-rich paint.

END OF SECTION

SECTION 3 CONTENTS

1.0 General

.1 STANDARD

.1 Concrete materials and methods of construction: to CAN/CSA-A23.1 unless otherwise specified.

.2 INSPECTION

.1 Concrete testing: to CAN/CSA-A23.2 by testing laboratory designated and paid for by Engineer, including on site storage and shipping. Contractor to provide access to the site. Engineer will complete at least 1 set of 3 cylinders for each pour that they inspect. Cost associated with production of the concrete for testing will be the responsibility of the contractor.

.2 Give Engineer minimum 48 hours notice before each concrete pour.

.3 TESTING

.1 The contractor to complete 1 set of 3 cylinders for all concrete pours on the reservoir. This testing is in addition to the testing completed by the engineer.

.2 Concrete testing: to CAN/CSA-A23.2 by testing laboratory designated and paid for by contractor, including on site storage and shipping.

2.0 Products

.1 MATERIALS

.1 Portland cement: to CAN/CSA-A5, Type 50.

.2 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.

.3 Waterstops: extruded ribbed PVC strips, 12 MPa tensile strength, minimum 350% elongation, minus 45 C to plus 80 C working temperature, sizes as indicated. Contractor to provide shop drawings for waterstop.

.4 All other concrete materials: to CAN/CSA-A23.1.

.5 Crystallization concrete waterproofing: Xypex Concentrate C-Series Admixture.

.2 MIX PROPORTIONS

.1 Method: Alternative (1) of CAN/CSA-A23.1, Table 11.

.2 Cement type: as specified under 2.1.

.3 Minimum 28 day compressive strength shall be 32 MPa and exposure classification S-2.

.4 Nominal size of coarse aggregate: Clause 14 of CAN/CSA-A23.1.

.5 Slump: to Table 6 of CAN/CSA-A23.1. Slump to be 80 mm +/- 20 mm

.6 Air content: all concrete to contain purposely entrained air in accordance with category 2, Table 9 of CAN/CSA-A23.1. Air Content to be 5 to 8 %

.7 Admixtures: to Clause 6 of CAN/CSA-A23.1.

3.0 Execution

.1 INSERTS

.1 Cast in sleeves, anchors, reinforcement, frames, conduit, bolts and other inserts required to be built-in.

.2 FINISHES

.1 Formed surfaces shall receive a rough-form finish in accordance with CAN/CSA-A23.1.

.3 CURING

.1 Cure and protect concrete in accordance with CAN/CSA-A23.1, except that curing compounds shall not be used.

END OF SECTION

SECTION 5 CONTENTS

..... 2000-12-05

PART 1 GENERAL

1.1 Related Sections

.1 Section 01330 - Submittal Procedures

.2 Section 01610 - Basic Product Requirements

.3 Section 03300 - Cast-in-Place Concrete: Installation of anchors.

1.2 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A53/A53M-99b, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.

.2 ASTM A269-98, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-97, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.

.3 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.

.2 CSA W59-M1998, Welded Steel Construction (Metal Arc Welding).

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01330 - Submittal Procedures.

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 Protection

.1 Deliver, store, handle and protect materials in accordance with Section 01610 - Basic Product Requirements.

.2 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.

.3 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

PART 2 PRODUCTS

2.1 Materials

.1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade[300W] [350W].

.2 Steel pipe: to ASTM A53/A53M [standard weight] [extra strong] [double extra strong], black, galvanized finish.

.3 Bolts and anchorbolts: to ASTM A307.

.4 Stainless steel tubing: to ASTM A269, Type [302] [Commercial grade] [Seamless welded with AISI No[4] finish].

.5 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 Fabrication

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 Finishes

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m2to CAN/CSA-G164.

.2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.

.3 Shop coat primer: to CAN/CGSB-1.40.

.4 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

.5 Bituminous paint: to CAN/CGSB-1.108.

2.4 Isolation Coating

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 Shop Painting

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C.

.3 Clean surfaces to be field welded; do not paint.

2.6 Access Ladders

.1 Stringers: [___] x [___] x [___] mm thick, [steel] [angle].

.2 Steel Rungs: [___] x [___] x [___] mm thick, angle, welded to stringers at [___] mm oc.

.3 Brackets: sizes and shapes as indicated, weld to stringers at [___] mm o.c., complete with fixing anchors.

.4 Galvanize finish for exterior, prime paint for interior.

.5 Galvanize exterior ladders after fabrication.

2.7 Trench Covers and Frames

.1 Steel fabricate from 6 mm thick raised pattern plate set in L 55 x 55 x 6 frame. Include anchors at 1200 mm oc for embedding in concrete. Supply trench covers in 1200 mm removable lengths.

.2 Finish: [galvanized] [prime coat painted].

PART 3 EXECUTION

3.1 Erection

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Engineer such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.7 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.8 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 Access Ladders

.1 Install access ladders in locations as indicated.

.2 Erect ladders [___] mm clear of wall on bracket supports.

3.3 Trench Covers

.1 Install trench covers in locations as indicated.

END OF SECTION

SECTION 6 CONTENTS

..... 1997-11-07

PART 1 GENERAL

1.1 References

.1 Canadian Standards Association (CSA)

- .1 CSA B111-1974, Wire Nails, Spikes and Staples.
- .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O121-M1978, Douglas Fir Plywood.
- .4 CAN/CSA-O141-91, Softwood Lumber.
- .5 CSA O151-M1978, Canadian Softwood Plywood.

.2 National Lumber Grades Authority (NLGA)

- .1 Standard Grading Rules for Canadian Lumber 1991.

1.2 Quality Assurance

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

PART 2 PRODUCTS

2.1 Lumber Material

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

- .1 CAN/CSA-O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.

2.2 Accessories

.1 Nails, spikes and staples: to CSA B111.

.2 Bolts: [12.5] mm diameter unless indicated otherwise, complete with nuts and washers.

.3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, [explosive actuated fastening devices], recommended for purpose by manufacturer.

2.3 Wood Preservative

.1 Surface-applied wood preservative: coloured or copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

.2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.

.3 .

PART 3 EXECUTION

3.1 Preparation

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

END OF SECTION

SECTION 15 CONTENTS

PART 1 GENERAL

1.1 Related Work

Section 02315 Excavating, Trenching and Backfilling

1.2 References

.1 ASTMC518- 91, Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.2 ASTMD638M- 89, (D638-90), Test Method for Tensile Properties of Plastics.

.3 ASTMD1248- 84(1989), Specification for Polyethylene Plastics Molding and Extrusion Materials.

.4 ASTMD1505- 90, Test Method for Density of Plastics by the Density-Gradient Technique.

.5 ASTMD1621- 73(1979), Test Method for Compressive Properties of Rigid Cellular Plastics.

.6 ASTMD1622- 88, Test Method for Apparent Density of Rigid Cellular Plastics.

.7 ASTMD2657- 90, Practice for Heat Joining of Polyolefin Pipe and Fittings.

.8 ASTMD2837- 90, Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

.9 ASTMD2856- 87, Test Method for Open Cell Content of Rigid Cellular Plastics by the air Pycnometer.

.10 ASTMF714- 90, Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

.11 ASTMG14- 83, Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).

.12 CAN/CSA-B137.1- M89, Polyethylene Pipe, Tubing and Fittings for Cold Water Pressure Services.

1.3 Product Data

.1 Submit product data in accordance with Section 01330 - Submittal Procedures.

1.4 Material Certification

.1 At least 4 weeks prior to commencing work submit manufacturer’s test data and certification that materials meet requirements of this section.

.2 Record Drawings

.3 Provide data necessary to produce record drawings on project completion in accordance with the following requirements:

.1 Give details of pipe material, location of fittings, maintenance and operating instructions.

PART 2 PRODUCTS

2.1 Carrier Core Pipe

.1 Polyethylene pressure pipes to CSAB137.1 ASTMF714:

.1 Type PE3408 for ASTMF714, DR 17.

.2 Pressure rating:

.1 DR 17 for ASTMF714.

.2 Polyethylene to polyethylene joints: thermal butt fusion joined to ASTMD2657.

.3 Polyethylene fittings: to AWWA C906 for pipe sizes NPS4 to NPS63.

2.2 Factory Applied Insulation

.1 Pipes to be cleaned of surface dust or dirt and treated if necessary to ensure positive bond of foam to entire pipe surface.

.2 Material: rigid polyurethane foam factory applied.

.3 Insulation thickness: 50 mm.

.4 Density: to ASTMD1622, 0.032 to 0.048g/cm^3.

.5 Closed cell content: to ASTMD2856, 90 % minimum.

.6 Water absorption: to ASTMD2842, 4.0 g/1000 cm^3, maximum 4.25% by volume.

.7 Compressive strength: to ASTMD1621, up to 240 kPa.

.8 Thermal conductivity: to ASTMC518, 0.022 to 4 W/m C°.

.9 Service Temperature: minus 45°C to plus 120°C.

.10 Centering of pipe within insulation: no more than plus or minus 6mm off center.

.11 Protect insulation on both ends of pipe from moisture and sunlight by 3mm thick continuous concentration of black asphalt mastic compound.

2.3 Outer Jacket for Buried Applications

.1 Material: factory applied high-density polyethylene jacket, black in colour (UV inhibited).

.2 Density of HDPE jacket: to ASTMD1505, 0.940 g/cm^3 minimum.

.3 Sealant: synthetic polymers or modified rubber mastic.

.4 Jacket thickness: 1.14 mm minimum.

.5 Elongation: to ASTMD638, 400 % maximum 6 month test.

.6 Service temperature: minus 45 °C to plus 120 °C maximum.

.7 Water vapour transmission rate: 3 g/m^2/24 h average.

.8 Tensile strength: 25 kg/cm width minimum.

.9 Impact strength: to ASTMG14, 7.79 N/m at minus 40 °C minimum.

2.4 Pipe Bedding and Surround Materials

.1 granular material to following requirements:

.1 Crushed or screened stone or sand consisting of hard, durable, particles, free from clay lumps, cementation, organic material and other deleterious materials to Section 02315.

.2 ASTMC136 and ASTMC117. Sieve sizes to CAN/CGSB-8.1.

2.5 Backfill Materials

.1 Backfill material in accordance with Section 02315 Excavating, Trenching and Backfilling.

PART 3 EXECUTION

3.1 Unloading and Handling of Polyethylene Pipe

.1 Unload from trucks or containers by hand or by lifting apparatus with fabric slings. Do not use cables or chains.

.2 Once removed, store on smooth surface. Lay pipes flat. Where sleepers are desired use several lengths of wide planks to provide broad bearing surface.

.3 Lift, do not drag, insulated pipes from storage area to job site.

.4 Follow manufacturer’s recommendations.

3.2 Repairing Damaged Pipe

.1 Repair any damage to outer jacket by applying heat shrink sleeve to approval of Engineer or cover using heated HDPE UV resistant adhesive backed tape.

3.3 Trenching

.1 Do trenching work in accordance with Section 02315 - Excavating, Trenching and Backfilling.

.2 Trench depth to provide cover over pipe of not less than 1 m from finished grade.

.3 Trench alignment and depth require Engineer's approval prior to placing bedding material or pipe.

3.4 Granular Bedding and Surround

.1 Place bedding and surround material in unfrozen condition.

.2 Place materials in uniform layers not exceeding 150 mm compacted thickness up to 300 mm above top of pipe. Compact each layer before placing succeeding layer. Avoid compaction directly over pipe with less than 300 mm of cover.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.

.4 Shape transverse depressions in bedding as required to make joints.

.5 Compact each layer full width of bed to at least 90 % maximum density to ASTMD698.

.6 Fill authorized excavation or unauthorized over excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.5 Pipe Installation

.1 On dry ground, assemble shipping lengths of pipe into suitable installation lengths by heat butt-fusion.

.2 Provide trained personnel and jointing machine approved by pipe manufacturer for butt-fusion jointing of polyethylene pipe. Obtain services of trained technician from pipe manufacturer to certify and/or train Contractor's personnel on jointing procedures and inspect jointing machine. Obtain letter from manufacturer certifying that Contractor's representative(s) who will perform jointing, is/are qualified and that jointing equipment has been inspected and is suitable for pipe supplied.

.3 Follow manufacturer’s instructions in butt-fusion of joints.

.4 Join pipes at flanged ends in accordance with manufacturer’s recommendations.

.5 Recheck pipe joints assembled above ground after placing in trench to ensure no movement of joints has taken place.

.6 Complete installation of rigid polyurethane halves on joints after laying pipe in trench and after successful pressure testing of pipe.

.7 Install heat shrink sleeves using large broad flame propane torch to produce 600 mm flame.

.1 Peel back release liner 12 cm from end, centre sleeve over joint and press firmly down. Wrap sleeve around pipe, removing release liner as it is wrapped. If corner on underlap is not precut, then cut off about 25 mm from each corner.

.2 Before completing overlap wrapping, warm underlap area approximately 12 cm until adhesive starts to appear at edge. Smooth out any wrinkles with gloved hand.

.3 Remove remaining release liner and complete wrapping.

.4 Remove release paper from closure seal, prewarm adhesive slightly, centre seal over overlap and press down until well bonded. Heat closure seal, and press down with gloved hand to remove any bubbles and wrinkles.

.5 With torch, start at centre of sleeve and shrink it all around joint. Keep torch moving using broad circumferential strokes to avoid burning. continue shrinking sleeve toward one end until about 50mm is left. Then aim torch inward towards centre and shrink edges. Repeat this operation on other end of sleeve. Finish off by applying long horizontal strokes of torch all around sleeve.

.6 Pay special attention to sleeve overlap area, ensuring no void remains along underlap edge. Use roller, or gloved hand to firmly and thoroughly press down along underlap edge. Start in centre and work outwards.

.7 Allow joint and sleeve to cool for at least 30 min before lowering pipe into trench.

.8 Lay pipes on prepared bed, true to line and grade as indicated. No deviations to be made without written approval of Engineer. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take out and replace defective pipe. Correct pipe that is not in true alignment or grade, or pipe that shows undue settlement after installation. Change method or equipment for setting alignment or grade if requested by Engineer.

.9 Do not lay pipe on frozen bedding.

.10 Do not let rocks or other foreign material, which might damage insulation jacket, fall on pipe.

.11 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Install removable watertight bulkhead at open end of pipe to prevent entry of foreign materials.

3.6 Pipe Backfilling

.1 Do backfilling work in accordance with Section 02315 - Excavating Trenching and Backfilling.

.2 Lay continuous runs of warning tape on top of surround material 300 mm directly above water mains.

.3 Upon completion of pipe laying and after Engineer has inspected work in place, surround and cover pipes between joints.

.4 Protect pipe from freezing if temperatures lower than minus 5°C.

.5 When Engineer accepts testing results, surround and cover joints and fittings with surround material placed and compacted as specified.

.6 Place backfill material above pipe surround, in uniform layers not exceeding 150 mm compacted thickness.

.7 Mechanically compact each layer to at least 90 % maximum density to ASTMD698.

3.9 Testing

1. Give five (5) days written notice of date for tests.

2. Insulted or conceal work only after testing and approval by Engineer.

3. Engineer reserves the right to be present during testing.

4. Bear costs including retesting and making good.

5. Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

6. Hydrostatically test the high density polyethelene piping systems prior to installation in accordance with the following procedures, as recommended by the pipe manufacturer:

   .1 Over a period of three (3) hours, slowly raise the pressure in the pipe to 1.5 times the rated pressure of the pipe.

   .2 During the next 1 hour, maintain the required test pressure.

   .3 Start the test after the above described initial “pipe stretch” period.

   .4 Observe and record the hydrostatic pressure in the pipe over the next 3 hour period at ½ hour intervals.

   .5 At the end of the 3 hour test period, measure the amount of makeup water required to be added to the system to return the pipe to the test pressure.

   .6 An acceptable test is one for which the amount of makeup water does not exceed the following:

Nominal Pipe Size	**Maximum Allowable Makeup Water @ 23°C.**
100	5.0
250	7.8

300	12.6

Correction (Multiplication) factor to be applied to make up water.

Pipe Testing Temperature	**Allowance in Table Above**
23°C	1.0
22°C	0.875
20°C	0.75
18°C	0.66
16°C	0.60
14°C	0.53
12°C	0.47
10°C	0.42
8°C	0.36
6°C	0.325

For pipe testing temperatures between those listed above, interpolate correction factor.

For pipe testing temperatures above or below limits tabulated, contact Engineer.

.7 Allow a minimum of 8 hours between successive polyethelene pipe tests to allow pipe to "relax".

.8 Hydrostatically test steel piping system by pressurizing with water to 860kPa, and maintaining this pressure for a period of 4 hours without leakage.

.9 Flush out all new piping with fresh, clean water for a period of one (1) hour following final pressure test.

.10 Provide written documentation of all test results, for acknowledgement by Engineer.

3.10 Flushing and Disinfecting Water Lines

.1 Flushing and disinfection operations shall be carried out by the Contractor and must be witnessed by the Public Works Representative, or Engineer. Notify the Engineer at least five (5) days in advance of the proposed date when disinfecting operation will commence.

.2 Complete all leakage procedures, standards and tests before flushing and disinfection.

.3 Before being placed into service, all new process piping shall be flushed and disinfected.

.4 Flush all piping through available outlets with a sufficient flow to produce a velocity of 1.5 m/s, within the pipe for thirty (30) minutes, or until all foreign materials have been removed and the flushed water is clear. This includes the intake casings and is to be completed prior to final installation.

.5 Supply materials and test kits to carry out disinfection tests for total and fecal coliforms; and total and residual chlorine at no additional cost to the Owner.

.6 Disinfect immediately after flushing. Disinfect all potable water pipes. Use either Method A or B as indicated:

Method A

.1 Fill piping system with chlorine/water solution with a strength of at least 50mg/L. Ensure pipe is full and no air pockets remain.

.2 Leave solution in piping system for 24 hours, while maintaining a pressure of 175 kPa.

.3 After 24 hours sample and test the chlorine solution for total and fecal coliform (FC) levels. If the chlorine residual is at least 25 mg/L and the FC levels are within acceptable limits, the disinfection will be considered successful. Flush chlorine solution from the piping system. Protect against contamination of the disinfected system.

.4 If the chlorine residual is less than 25 mg/L or the total and FC levels are unacceptable, flush the piping system, clean any deleterious material, reflush and disinfect again. Repeat until satisfactory.

Method B

.1 Introduce chlorine solution into the intake casing to achieve a chlorine residual of 50 mg/L in the discharge pipe, which is to be recirculated back to the pump.

.2 Operate the pump and allow the chlorine solution in the intake casing. Operate continuously for 2 hours.

.3 After 2 hours sample and test the chlorine solution and the total and fecal coliform (FC) levels. If the chlorine residual is at least 25mg/L and the total and FC levels are within acceptable limits, the disinfection will be considered successful. Flush chlorine

solution from the piping system. Protect against contamination of the disinfected system.

.4 If the chlorine residual is less than 25mg/L or the total and FC levels are unacceptable, flush the piping system, clean any deleterious material, reflush and disinfect again. Repeat until satisfactory.

.7 The Contractor shall collect two (2) samples of disinfectant solution for bacteriological testing. The Contractor is responsible for submitting the samples to an accredited laboratory for total and fecal coliform testing for verification of field tests. The results are to be sent to the Engineer for confirmation.

.8 If, in the opinion of the Engineer, any component of the potable water system becomes contaminated after disinfection, it shall be flushed and disinfected again at no additional cost to the Owner.

.9 Do not discharge flush water or disinfection solution to the Mackenzie River. Flush water is to be disposed of at the community sewage lagoon.SPEC NOTE: Re 3.11. Delete where not applicable.

END OF SECTION

APPENDIX G

QA/QC PLAN

QA/QC Program

The technical specification describes the requirement for the contractor's QCD program. In addition to this program, the owner has retained Dillon Consulting Limited and AMEC Earth and environmental to provide a QA program. This separate Quality Control Plan has been developed for the construction phase of the project. It is summarized below.

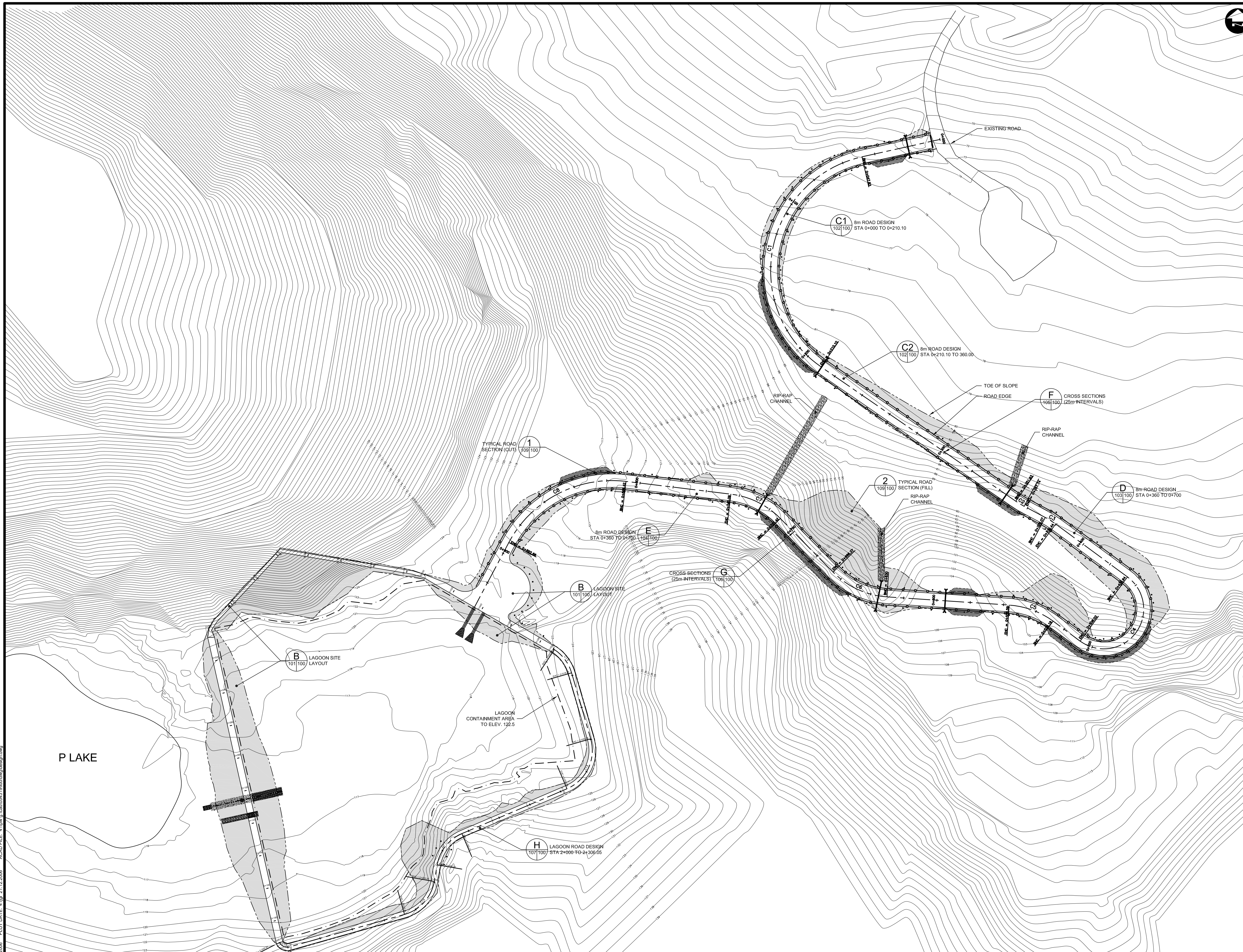
- Quality Assurance Team members – Dillon Consulting and AMEC Earth and Environmental.
- Quality Assurance to over see the contractor's QC program, and to provide direction during the construction of critical design elements. This included but is not limited to the berm construction, the granular clay liner installation, the excavation and backfilling of the embedment trench.
- The corrective action programs where deficiencies are found in the contractor's work are described in the technical specifications.
- Nuclear densometer testing is being completed for compaction of the granular material. The testing is being completed by a certified firm (Trow).
- The specifications provide the allowable deviations from the specified values.
- All testing is reviewed by the project engineer and the owner prior to acceptance by the owner of the works.
- The on site testing is recorded by a full time resident inspector. These reports are consolidated on a weekly basis and forwarded to the Project engineer and the owner for review.

Testing & Inspection

The Construction Quality Control Plan will contain the requirements for testing as outlined above. Test completion and inspection reporting mechanisms will vary depending on the type of test/inspection performed. Testing and inspection firms will be required to provide reports to the construction team in a timely fashion that allows the construction to proceed in an efficient and logical manner. Documentation and inspection form an integral part of the construction procedures and will occur on a regular basis and at critical points in the construction schedule.

APPENDIX H

CONSTRUCTION DRAWINGS



A 100 100 SEWAGE TREATMENT SYSTEM SITE PLAN
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LEGEND

PLAN:

EXISTING:
- MINOR CONTOUR (1m)
- MAJOR CONTOUR (5m)

DESIGN:
- ROAD CENTERLINE
- ROAD EDGE
- TOE OF SLOPE
- CUT LIMITS
- GUARDRAIL
- DELINEATOR
- LAGOON CONTAINMENT LIMIT
- BOLLARD
- FLOW DIRECTION
- FILL AREA
- CUT AREA

NOTES

DIMENSIONS ARE IN MILLIMETERS UNLESS SPECIFIED OTHERWISE

"DESCRIPTION OF DETAIL" 1 100 101 — DETAIL NUMBER; DRAWING SHEET WHERE DETAIL IS SHOWN; DETAIL REFERENCED (THIS DRAWING SHEET)

DRAWING REDUCED NOT TO SCALE

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4	03/07/06	ISSUED FOR TENDER	GS
3	01/20/06	95% SUBMISSION	GS
2	10/28/05	75% SUBMISSION	GS
1	08/11/05	ISSUED FOR CLIENT REVIEW	GS

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
GS	TPW	GS	SEPT 06

Nunavut

PROJECT
P LAKE AREA
SEWAGE LAGOON SYSTEM
CAPE DORSET

TITLE
SITE PLAN

DILLON CONSULTING

SCALE	AS SHOWN
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CLIENT PROJECT NUMBER	3439
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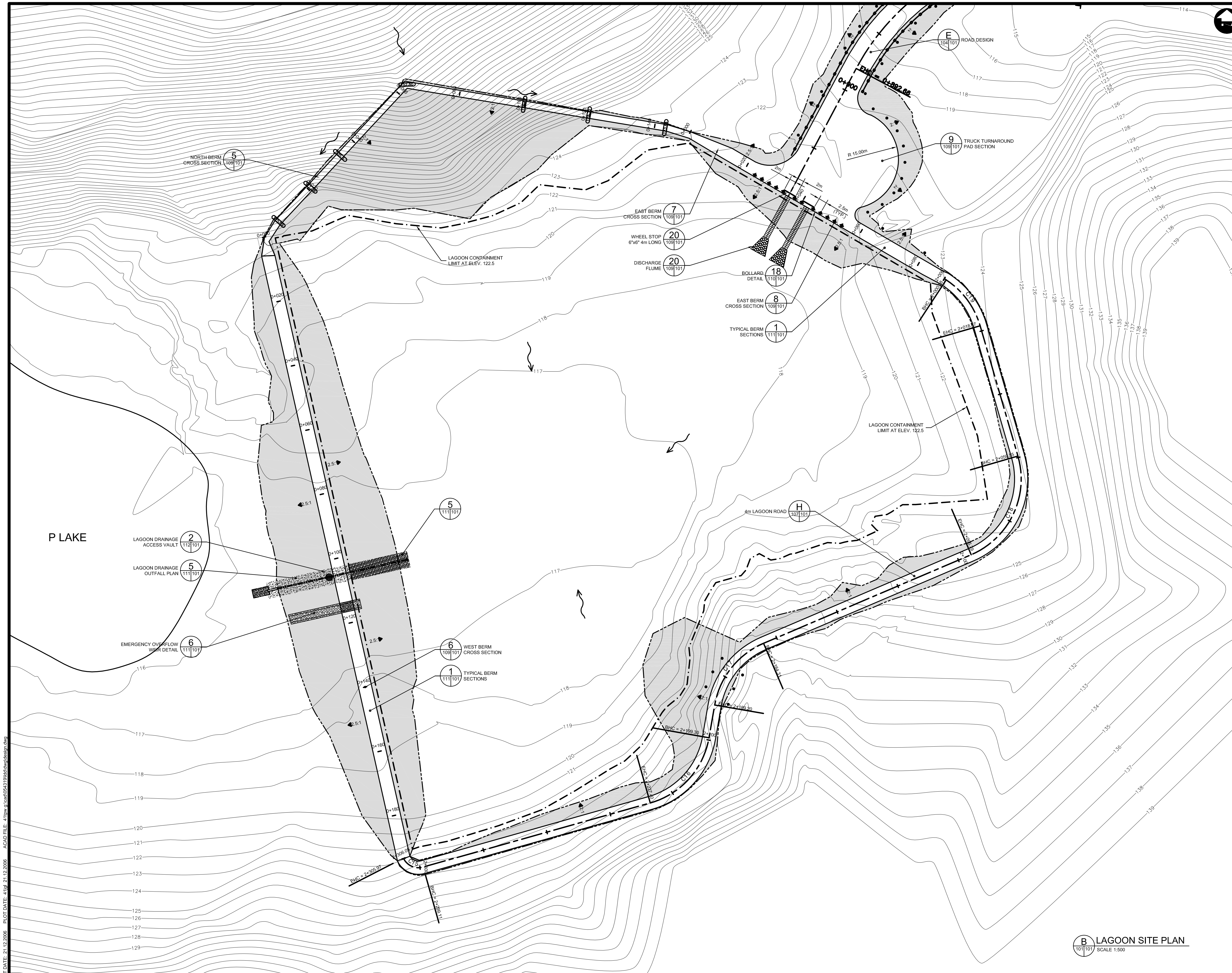

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LEGEND

PLAN:

EXISTING:
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DESIGN:
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DRAWING REDUCED NOT TO SCALE

CHANGE	DATE	DESCRIPTION	CHECK
5	09/07/06	ISSUED FOR CONSTRUCTION	GS
4	03/07/06	ISSUED FOR TENDER	GS
3	01/20/06	95% SUBMISSION	GS
2	10/28/05	75% SUBMISSION	GS
1	08/11/05	ISSUED FOR CLIENT REVIEW	GS

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
GS	TPW	GS	SEPT 06

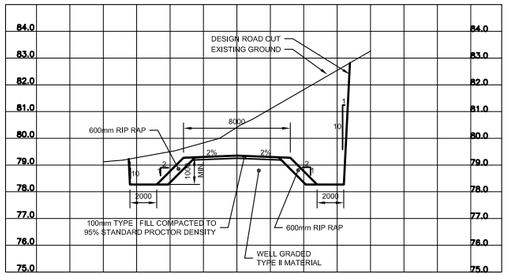
Nunavut

PROJECT
P LAKE AREA
SEWAGE LAGOON SYSTEM
CAPE DORSET

TITLE
LAGOON CONTAINMENT BERMS
AND TRUCK TURNAROUND PAD

DILLON CONSULTING

SCALE: AS SHOWN
DILLON PROJECT NUMBER: 05-4319-2000
CLIENT PROJECT NUMBER: 3439
DRAWING NUMBER: 101



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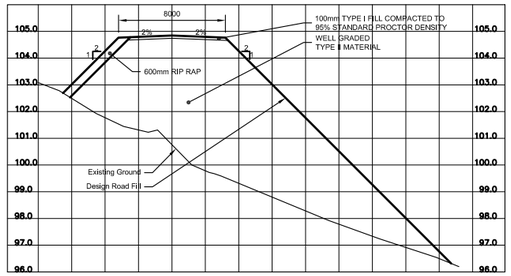

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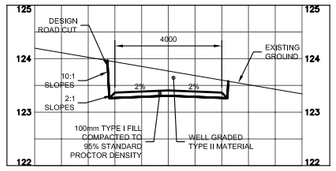

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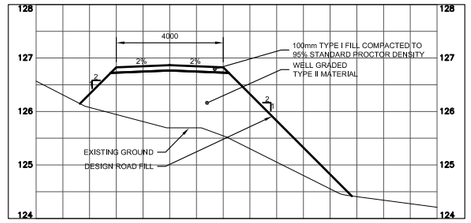

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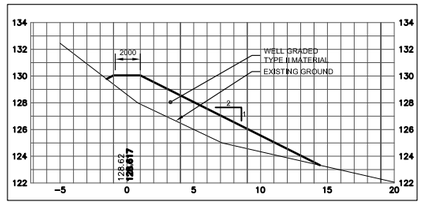

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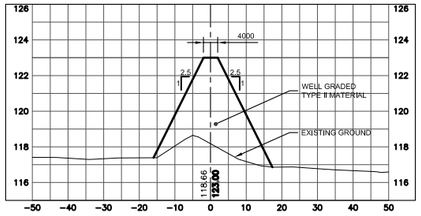

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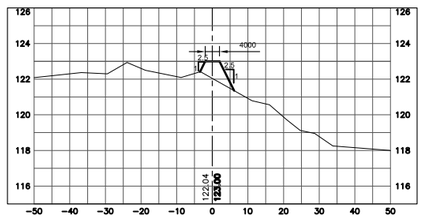

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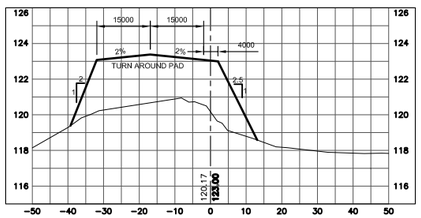

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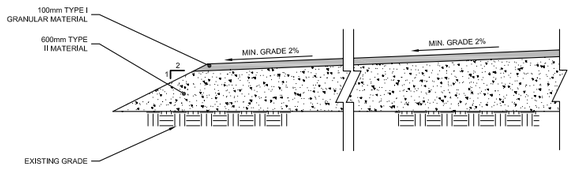

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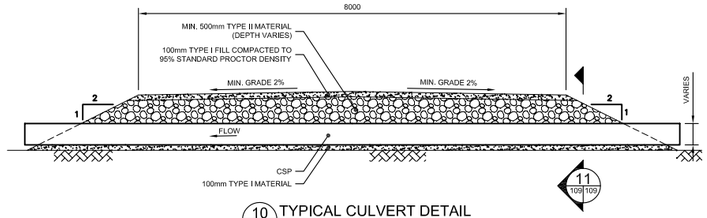

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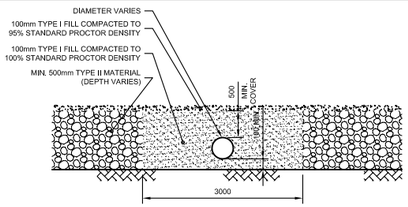

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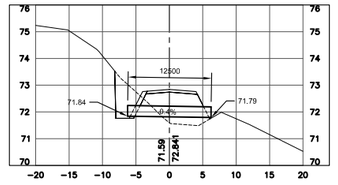

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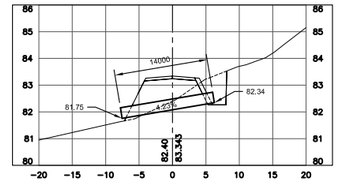

13 CULVERT SECTION AT 0+210.41
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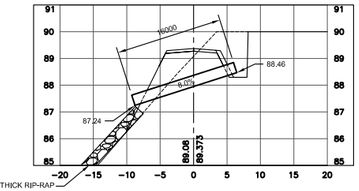
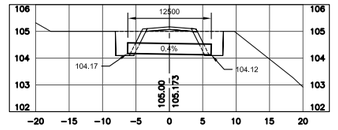
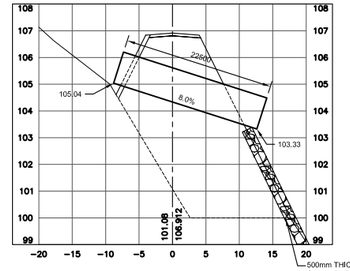


500mm THICK RIP-RAP CHANNEL TO TOE OF SLOPE CHANNEL TO BE 4.0m WIDE

14 CULVERT SECTION AT 0+345
109 109 SCALE 1:400h 1:100v

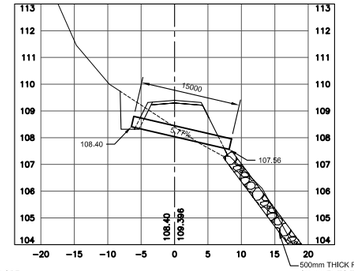


15 CULVERT SECTION AT 0+595
109 109 SCALE 1:400h 1:100v



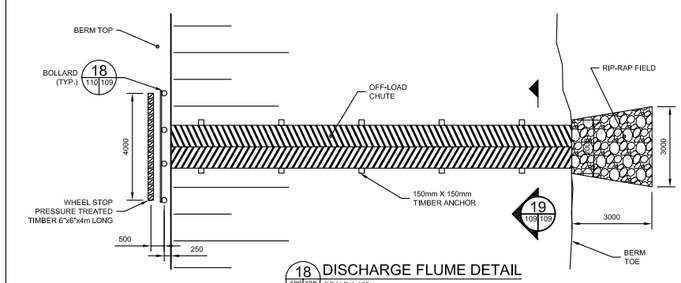
500mm THICK RIP-RAP CHANNEL TO TOE OF SLOPE CHANNEL TO BE 4.0m WIDE

16 CULVERT SECTION AT 0+635.10
109 109 SCALE 1:400h 1:100v

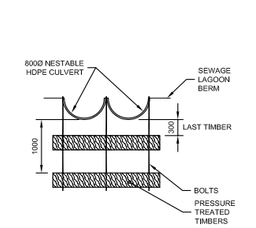


500mm THICK RIP-RAP CHANNEL TO TOE OF SLOPE CHANNEL TO BE 4.0m WIDE

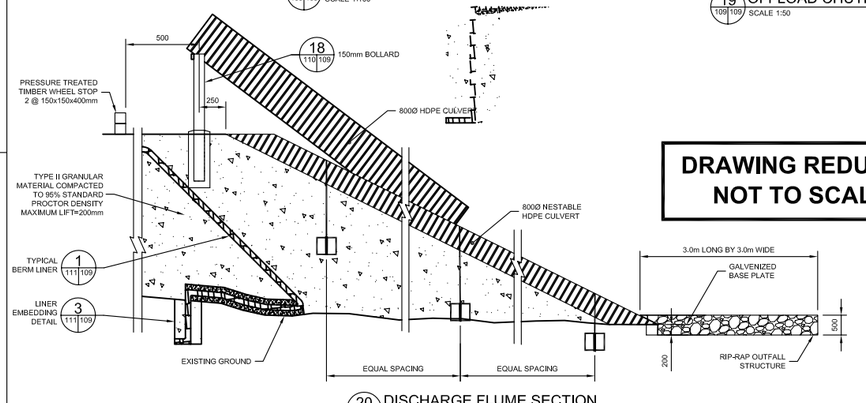
17 CULVERT SECTION AT 0+725.35
109 109 SCALE 1:400h 1:100v



18 DISCHARGE FLUME DETAIL
109 109 SCALE 1:100



19 OFFLOAD CHUTE SECTION
109 109 SCALE 1:50



20 DISCHARGE FLUME SECTION
109 109 SCALE NTS

DRAWING REDUCED NOT TO SCALE

5	09/07/06	ISSUED FOR CONSTRUCTION	GS
4	03/07/06	ISSUED FOR TENDER	GS
3	01/20/06	95% SUBMISSION	GS
2	10/28/05	75% SUBMISSION	GS
1	06/11/05	ISSUED FOR CLIENT REVIEW	GS
CHANGE	DATE	DESCRIPTION	CHECK

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
GS	TPW	GS	SEPT 06

Nunavut

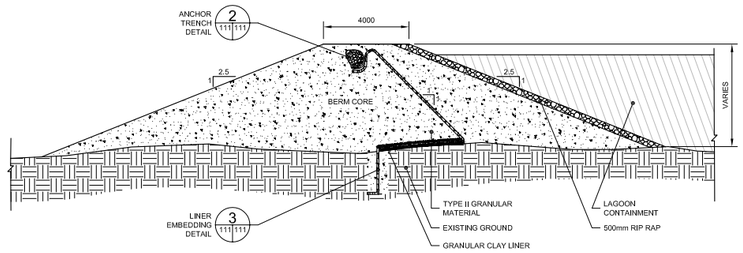
PROJECT
P LAKE AREA
SEWAGE LAGOON SYSTEM
CAPE DORSET

TITLE
EARTHWORKS & SEWAGE DISCHARGE DETAILS AND SECTIONS

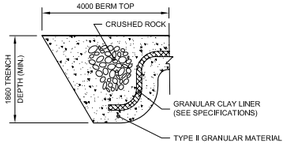
DILLON CONSULTING

SCALE AS SHOWN
DILLON PROJECT NUMBER 05-4319-2000
CLIENT PROJECT NUMBER 3439
DRAWING NUMBER 109

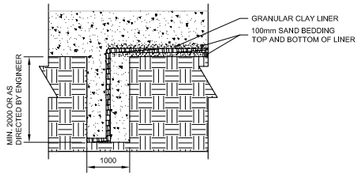
EDIT DATE: 21.12.2006 PLOT DATE: 41pt 21.12.2006 ACAD FILE: I:\files\cad\05431900\dgn\details2.dgn



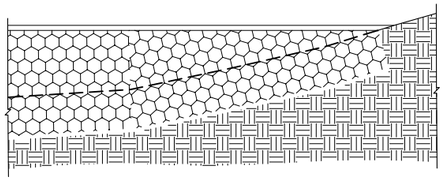
1 111 111 TYPICAL BERM SECTION
SCALE 1:125



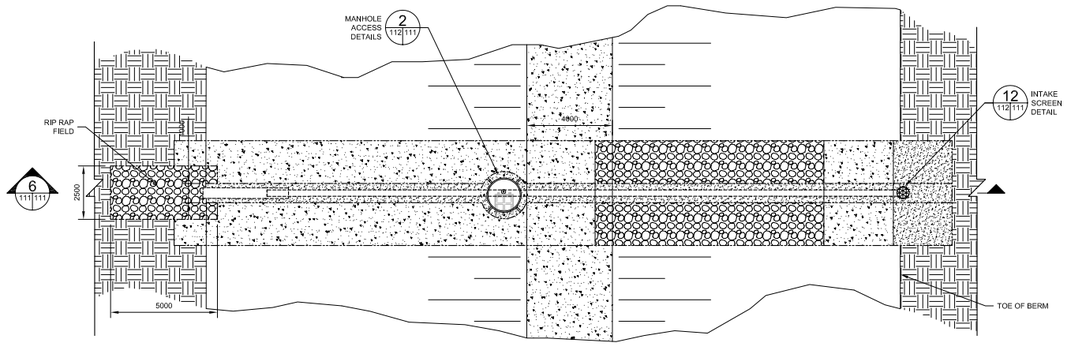
2 111 111 ANCHOR TRENCH DETAIL
SCALE N.T.S.



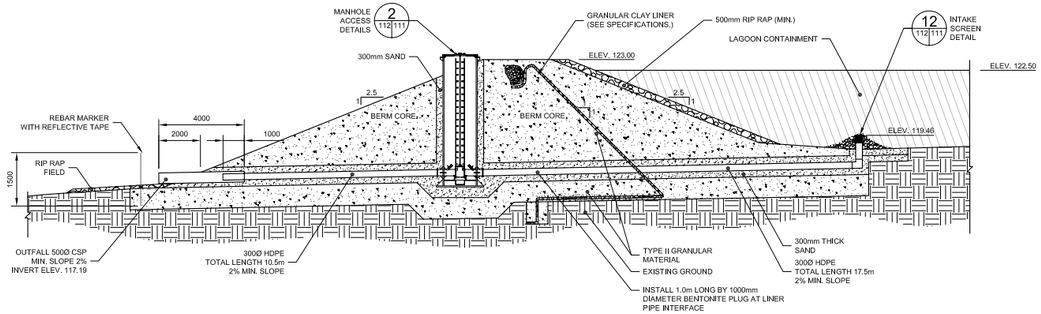
3 111 111 LINER EMBEDDING DETAIL
SCALE N.T.S.



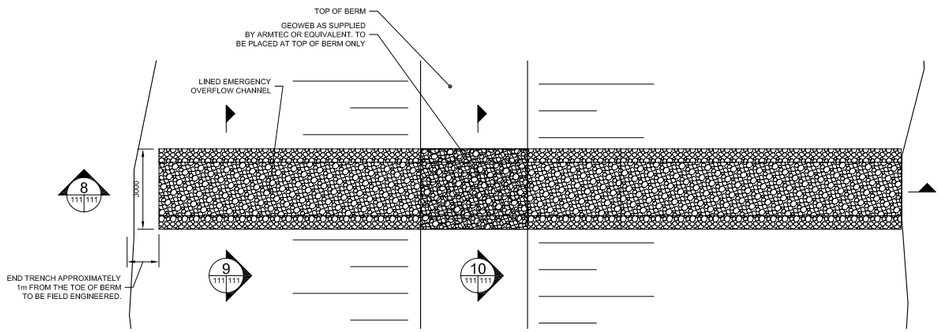
4 111 111 LINER EMBEDDING SECTION
SCALE 1:125



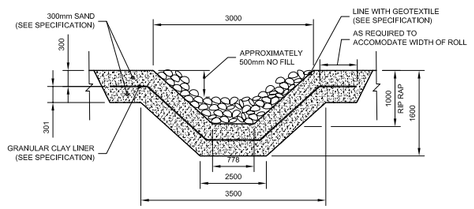
5 111 111 LAGOON DRAINAGE OUTFALL PLAN
SCALE 1:125



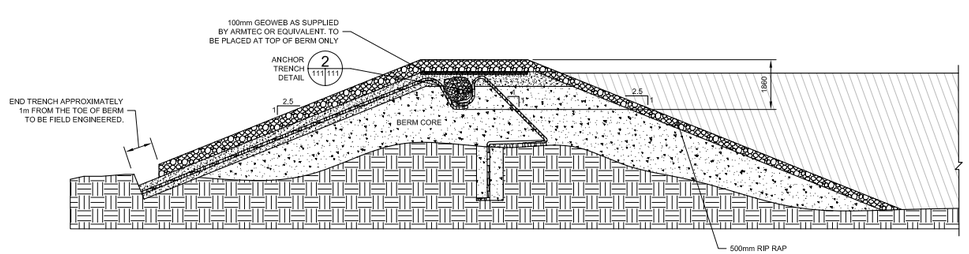
6 111 111 LAGOON DRAINAGE OUTFALL SECTION
SCALE 1:125h 1:125v



7 111 111 EMERGENCY OVERFLOW WEIR DETAIL
SCALE 1:100



9 111 111 EMERGENCY OVERFLOW WEIR SECTION
SCALE 1:50



8 111 111 EMERGENCY OVERFLOW WEIR SECTION
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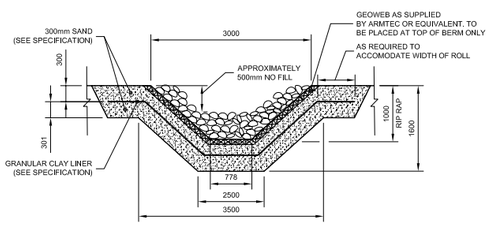


10 111 111 EMERGENCY OVERFLOW WEIR SECTION
SCALE 1:50

LEGEND

- BENTOMAT ST LINER, SEE SPECS
- TYPE II GRANULAR MATERIAL
- SAND, SEE SPECS
- RIP RAP, SEE SPECS
- EXISTING GROUND
- LAGOON CONTAINMENT AREA

NOTES:

ALL DIMENSIONS IN mm UNLESS NOTED OTHERWISE

1. FOR BACKFILL SPECIFICATIONS & SOIL CLASSIFICATION SEE SPECIFICATIONS.
2. FOR BENTOMAT ST LINER SEE SPECIFICATIONS.
3. FOR ANCHORING TRENCH SEE SPECIFICATIONS.
4. FOR CONCRETE AND WIRE MESH MATERIALS SEE SPECIFICATIONS.
5. BOLLARD TO BE PAINTED RED WITH REFLECTIVE BANDS. SEE SPECIFICATIONS.

REVIEWED BY
AMEC

DATE

DRAWING REDUCED NOT TO SCALE

CHANGE	DATE	DESCRIPTION	CHECK
5	09/07/06	ISSUED FOR CONSTRUCTION	GS
4	03/07/06	ISSUED FOR TENDER	GS
3	01/20/06	95% SUBMISSION	GS
2	10/28/05	75% SUBMISSION	GS
1	08/11/05	ISSUED FOR CLIENT REVIEW	GS

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
GS	TPW	GS	SEPT 06

Nunavut

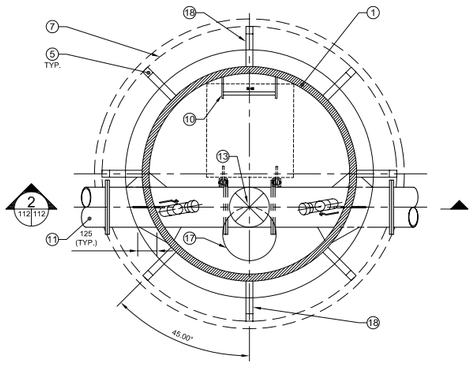
PROJECT
P LAKE AREA
SEWAGE LAGOON SYSTEM
CAPE DORSET

TITLE
LAGOON BERM SECTIONS AND DETAILS

DILLON CONSULTING

SCALE AS SHOWN
DILLON PROJECT NUMBER 05-4319-2000
CLIENT PROJECT NUMBER 3439
DRAWING NUMBER 111

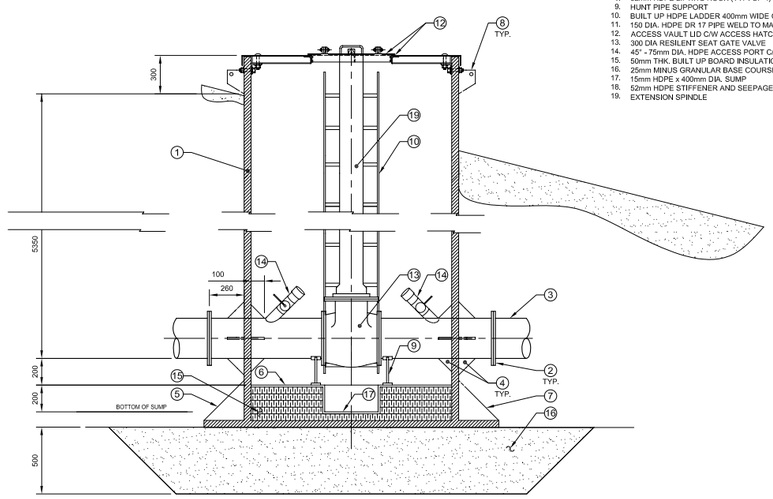
EDIT DATE: 30.03.2007 PLOT DATE: administrator 30.03.2007 LOAD FILE: 41tpw cj:\cad\05431916\05dwg\detail4.dwg



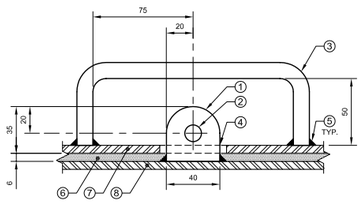
1 112|111 WATER SUPPLY LINE MANHOLE PLAN
SCALE 1:20

KEYNOTES:

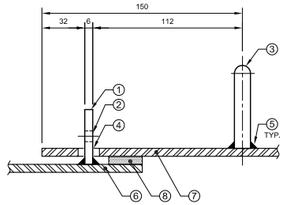
1. 1600mm DIA. HDPE PIPE DR 32.5
2. FLANGE TO FLANGE CONNECTION
3. 300 DIA. HDPE DR 17 PIPE FLANGED TO MANHOLE
4. 15mm HDPE STIFFENER (TYP. OF 4)
5. 52mm HDPE STIFFENER (TYP. OF 6)
6. 15mm HDPE FLOOR (SLOPE FLOOR TO SUMP), WELD TO MANHOLE
7. 52mm HDPE BASE. WELD TO MANHOLE
8. 52mm HDPE LIFTING HOOK (TYP. OF 4)
9. HUNT PIPE SUPPORT
10. BUILT UP HDPE LADDER 400mm WIDE C/W RUNGS @ 300 O.C. FIX TO HDPE MANHOLE
11. 150 DIA. HDPE DR 17 PIPE WELD TO MANHOLE
12. ACCESS VAULT LID C/W ACCESS HATCH
13. 300 DIA RESILENT SEAT GATE VALVE
14. 45° - 75mm DIA. HDPE ACCESS PORT C/W 75mm BALL VALVE AND CAP. INSTALL @ 10° SKEW FROM C
15. 50mm THK. BUILT UP BOARD INSULATION
16. 25mm MINUS GRANULAR BASE COURSE @ 97% S.P.D.
17. 15mm HDPE x 400mm DIA. SUMP
18. 52mm HDPE STIFFENER AND SEEPAGE CUT OFF 300mm X 1000mm HIGH (TYP. OF 6)
19. EXTENSION SPINDLE



2 112|112 WATER SUPPLY LINE MANHOLE SECTION
SCALE 1:20



6 112|112 HASP AND LIFTING HANDLE DETAIL
SCALE 1:2



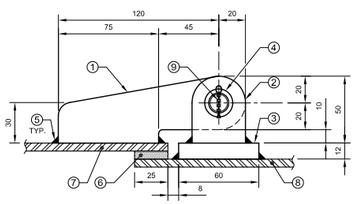
7 112|112 HASP AND LIFTING HANDLE SECTION
SCALE 1:2

NOTES:

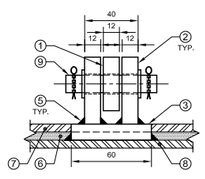
1. ACCESS MANHOLE LID & HATCH ANGLE FRAMING ARE NOT SHOWN FOR CLARITY. FOR DETAIL REFER TO FRAMING PLAN AS PER DETAIL
2. ALL WELDS AND ABRASIONS TO BE REPAIRED WITH TWO COATES OF GALVCON.

KEYNOTES:

1. 6mm THK. GALV. STEEL STAPLE
2. 12.5mm DIA. DRILLED HOLE FOR PADLOCK
3. 12.5mm DIA. GAVL. STEEL BAR LIFTING HANDLE
4. 50mmx15mm SLOT HOLE
5. 6mm FILLET WELD ALL AROUND (TYP.)
6. 25mm WIDE x 6mm THK. RUBBER GASKET MASTIC TO UNDERSIDE OF HATCH COVER (TYPICAL 4 SIDES)
7. 6mm THK. GALV. STEEL PLATE ACCESS HATCH COVER
8. 6mm THK. GALV. STEEL PLATE MANHOLE LID



8 112|112 MANHOLE ACCESS HATCH HINGE DETAIL
SCALE 1:2



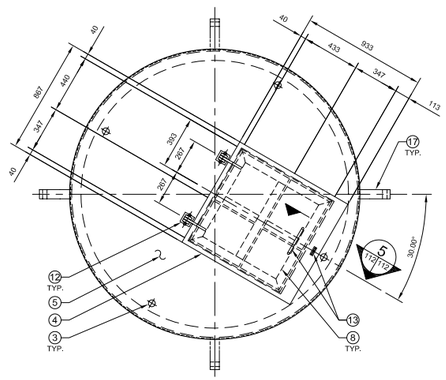
9 112|112 MANHOLE ACCESS HATCH HINGE SECTION
SCALE 1:2

NOTES:

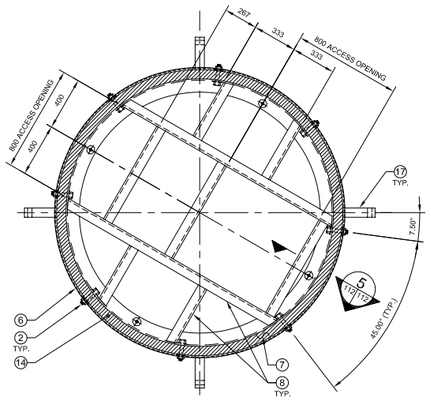
1. ACCESS MANHOLE LID & HATCH ANGLE FRAMING ARE NOT SHOWN FOR CLARITY. FOR DETAIL REFER TO FRAMING PLAN AS PER DETAIL.
2. ALL WELDS AND ABRASIONS TO BE REPAIRED WITH TWO COATES OF GALVCON.

KEYNOTES:

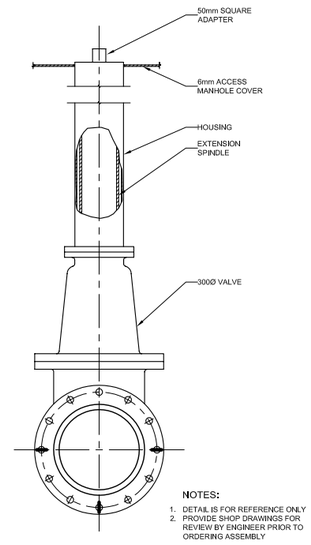
1. 12mm THK. GALV. STEEL HINGE ARM C/W HOLE FOR 13mm DIA. PIN
2. 12mm THK. GALV. STEEL HINGE ARM SUPPORT C/W HOLE FOR 13mm DIA. PIN (TYPICAL OF 2)
3. 60mm x 60mm x 12mm THK. GALV. STEEL BASE PLATE
4. GAVL. STEEL WASHER (TYP.)
5. 6mm FILLET WELD ALL AROUND
6. 25mm WIDE x 6mm THK. RUBBER GASKET MASTIC TO UNDERSIDE OF HATCH COVER (TYPICAL 4 SIDES)
7. 6mm THK. GALV. STEEL PLATE ACCESS HATCH COVER
8. 6mm THK. GALV. STEEL PLATE MANHOLE LID
9. 13mm DIA. GALV. STEEL PIN C/W 2 COTTER PIN



3 112|112 MANHOLE ACCESS HATCH FRAMING DETAIL
SCALE 1:20



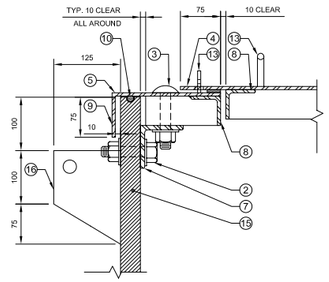
4 112|112 MANHOLE LID FRAMING DETAIL
SCALE 1:20



NOTES:

1. DETAIL IS FOR REFERENCE ONLY
2. PROVIDE SHOP DRAWINGS FOR REVIEW BY ENGINEER PRIOR TO ORDERING ASSEMBLY

10 112|112 EXTENSION SPINDLE DETAIL
SCALE 1:10



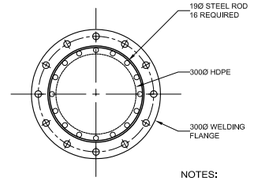
5 112|112 MANHOLE ACCESS SECTION
SCALE 1:5

NOTES:

1. FOR ACCESS MANHOLE LID FRAMING PLANS 6mm THK. GALV. STEEL PLATE LID NOT SHOWN FOR CLARITY.
2. ALL WELDS AND ABRASIONS TO BE REPAIRED WITH TWO COATES OF GALVCON.

KEYNOTES:

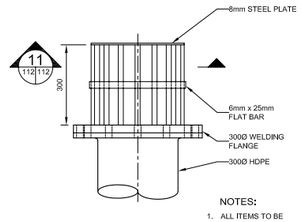
1. 1220mm DIA. HDPE DR 32.5 MANHOLE WALL
2. 19mm DIA. GALV. NUT, BOLT & WASHER (8 REQ'D) SEE ACCESS MANHOLE LID FRAMING PLAN FOR ARRANGEMENT
3. 19mm DIA. GALV. NUT, CARRIAGE BOLT & WASHER (4 REQ'D) SEE ACCESS HATCH FRAMING PLAN FOR ARRANGEMENT
4. 6mm THK. GALV. STEEL PLATE ACCESS HATCH COVER
5. 6mm THK. GALV. STEEL PLATE MANHOLE LID
6. 6mm THK. x 75mm DEEP GALV. STEEL BAND, WELD TO LID
7. 75x75x6 GALV. ROLLED ANGLE CONTINUOUS ALL AROUND AND BOLTED TO HDPE MANHOLE
8. 55x55x6 GALV. ANGLE SEE LID FRAMING **DETAIL 4**
9. 55x55x6 GALV. ANGLE SEE ACCESS HATCH FRAMING **DETAIL 3**
10. 12.5mm DIA. RUBBER GASKET IN ROUTERED SLOT CONTINUOUS ALL AROUND WEATHER TIGHT
11. 25mm WIDE x 6mm THK. RUBBER GASKET, MASTIC TO UNDERSIDE OF HATCH COVER (TYP. 4 SIDES)
12. ACCESS HATCH COVER HINGE (TYP. OF 2/PER) SEE **DETAIL 8** THIS DWG.
13. ACCESS HATCH COVER HASP & LIFTING HANDLE SEE **DETAIL 6** THIS DWG.
14. 1600mm DIA. HDPE DR 32.5 MANHOLE WALL
15. HDPE MANHOLE WALL
16. HDPE LIFTING HOOK SEE FRAMING DETAIL FOR ARRANGEMENT
17. 52mm HDPE LIFTING HOOK C/W 25mm DIA. HOLE (4 REQ'D)



NOTES:

1. ALL ITEMS TO BE GALVENIZED

11 112|112 INTAKE SCREEN SECTION
SCALE 1:10



NOTES:

1. ALL ITEMS TO BE GALVENIZED

12 112|111 INTAKE SCREEN DETAIL
SCALE 1:10

DRAWING REDUCED NOT TO SCALE

CHANGE	DATE	DESCRIPTION	CHECK
5	09/07/06	ISSUED FOR CONSTRUCTION	GS
4	03/07/06	ISSUED FOR TENDER	GS
3	01/20/06	95% SUBMISSION	GS
2	10/28/05	75% SUBMISSION	GS
1	08/11/05	ISSUED FOR CLIENT REVIEW	GS

REVISIONS

DESIGN	DRAWN	CHECKED	DATE
GS	TPW	GS	SEPT 06

Nunavut

PROJECT
P LAKE AREA
SEWAGE LAGOON SYSTEM
CAPE DORSET

TITLE
ACCESS MANHOLE DETAILS

DILLON CONSULTING

SCALE	AS SHOWN
DILLON PROJECT NUMBER	05-4319-2000
CLIENT PROJECT NUMBER	3439
DRAWING NUMBER	112

EDIT DATE: 08.09.2006 PLOT DATE: 4:19pl 21.12.2006 ACAD FILE: 4:\tpw g:\cad\05431\99\d5\dwg\detail4.dwg