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MEMORANDUM

To:	**Nunavut Water Board**	**Fax No.:**	**Via email**
Attention:	**Dionne Filiatrault, P. Eng., Executive Director**	**CC:**	**D. Hohnstein** **J. Grainger**
From:	**Holger Hartmaier, P. Eng.**	**Date:**	**February 7, 2008**
Subject:	**Cape Dorset Sewage Lagoon, Post- Hearing Notes for Draft Water Licence**		
No. of Pages (including this page): 18		**Project No:**	**0308-003-03-01**

As requested in your email of January 28, 2008, this memorandum provides a summary of the outstanding issues, questions for the applicant and recommended licence conditions pertaining to the Cape Dorset sewage lagoon license application by the Government of Nunavut Community Government Services (GNCGS).

1.0 INTRODUCTION

BGC's intervention statement was submitted to the Nunavut Water Board (NWB or Board) on January 8, 2008. BGC's intervention focussed on the geotechnical aspects of the sewage lagoon design and construction, including permafrost and geothermal issues. An Executive Summary of the intervention statement was prepared by BGC Engineering Inc. (BGC), at the request of the Board on January 17, 2008. An independent geothermal analysis of the sewage lagoon design was carried out by BGC and was summarized in a report dated January 17, 2008. Copies of the Executive Summary and Independent Geothermal Evaluation were distributed at the Public Hearing held in Cape Dorset January 23 -24, 2008 and were summarized as part of BGC's presentation as an intervener at the hearing. Refer to the official hearing transcripts for the information presented by BGC at the hearing.

2.0 ITEMS FOR FOLLOW UP BY APPLICANT

The following items were identified by BGC as part of the intervention review for follow-up by the applicant. During the public hearing, the applicant committed to providing the requested information.

2.1 As-Built Drawings

- The as-built (record) drawings must identify the areas where field changes were made from the original design drawings, preferably in the form of a revision bubble and a brief note in the revisions section of the title block.
- The updated record drawings must bear the stamp of AMEC as geotechnical engineer of record, in addition to Dillon's stamp on those drawings having geotechnical design content. As a minimum, these drawings are believed to include Record Drawings 101, 109, 110 and 112.
- In Record Drawing 100, the alignment of the access roads between the East and West Berms on the north and south sides of the lagoon was changed from the original design. The road berms were originally designed to deflect runoff from entering the lagoon. The applicant is requested to explain the rationale for changing the alignment of the road berms and how the as-built berm details in Record Drawing 110 prevents runoff from entering the lagoon.
- Record Drawing 109 shows up to 1 m of unfrozen fill used to level the ground surface under both the East and West berms. The applicant is requested to provide a grain size gradation curve and description of what this material is actually composed of. This levelling course of material has not been shown as a separate zone in the berm sections presented in Record Drawing 112.
- Record Drawing 109 shows that the berm contours at the north end of the West Berm have been modified from the original design drawings. The crest has been widened from 4 m to 25 m to accommodate what appears to be a vehicle turnaround on the downstream side of the berm. On the upstream side of the berm, two significant gullies or ditches are indicated by the contours. The applicant has agreed to provide additional as- built cross sections of this area and to confirm by geothermal analysis that there is sufficient fill thickness over the abutment to ensure that the GCL tie-in to the cut-off trench remains frozen.
- Record Drawing 110 should include the revised ditch detail for the road provided by GNCGS on July 30, 2007. The applicant was requested to provide further details as to how seepage through the active zone under the berm, which was observed after construction in the fall of 2007, will be prevented.
- Record Drawing 112 shows that the cut-off trench was backfilled with "Sand". The applicant was requested by BGC to provide a grain size gradation and description of this material. As noted on Drawing 112, this is the same material used to construct the berm. However, as noted above for Record Drawing 109, the grain size of the levelling fill must be checked by the applicant to confirm that it will act as a filter to the sand used in the construction of the berm in general and the cut off trench backfill in particular.

- The applicant was requested to provide the as-built liner embedment details for the abutment areas of the East and West berms on Record Drawing 112. The applicant was requested to provide further details to show that the as-built configuration will prevent "end-run" seepage around the liner through the active zone. This is expected to include additional geothermal modelling to show that the abutment areas will remain frozen.
- The applicant was requested to check the revised crest detail for the emergency overflow weir section shown in Record Drawing 112. BGC raised the concern that seepage from the lagoon could flow beneath the geo-web and GCL and lift the liner on the downstream side of the berm.
- The applicant was asked to provide the rationale for the as-built design changes with respect to the GCL configuration and the lack of impervious material in the cut-off trench as originally recommended by AMEC, the geotechnical design consultant.

It was noted during the hearing that as-built drawings are normally required within 90 days of completion of construction. This requirement would normally be included as a water licence condition. However, in the case of the Cape Dorset Sewage Lagoon, we are dealing with a newly constructed facility which has not yet received its water licence. In addition, the above deficiencies in the as-built drawings require some design follow-up on the part of the applicant to bring the facility up to a standard that can be licenced. Drafting of the final terms and conditions of the water licence therefore cannot be completed until these design deficiencies have been addressed by the applicant. BGC recommends that the Board instruct the applicant to re-submit the as-built drawings and supporting design information as soon as possible before a final water licence is drafted. See also Section 5, for BGC's post-meeting discussion on the overall facility design and construction acceptance process.

2.2 Operation and Maintenance Manual

- A licence condition is required instructing the licensee to notify the Board of any change in the lagoon waste water storage and decanting operations. This notification shall be accompanied by supporting documentation from the applicant's geotechnical consultant showing that the proposed modifications do not adversely impact the geothermal regime under the berm or lagoon floor that would degrade the water retention capability of the facility.
- Section 3.4.6 of the O&M Manual should provide the number, locations, and depths of thermistor beads used to monitor the berms. At the hearing, the applicant committed to providing this information, however they could only guarantee that the thermistors would be installed sometime in the next 9 months. BGC explained to the Board at the hearing the risks associated with allowing the lagoon to be commissioned before thermistors are installed that confirm freezeback of the cutoff trench. BGC recommended at least 3 thermistors 25 m deep from the crest of the berm into the foundation in the West Berm and at least 1 thermistor array 25 m deep into the deepest section of the East Berm.

BGC recommended that AMEC review the results of BGC's independent geothermal analysis before finalizing the details of the thermistor monitoring program. See further discussion of this requirement under Section 3, Geothermal Design and Monitoring Requirements.

- Section 3.4.7 of the O&M Manual should include the requirement for an annual geotechnical inspection. This requirement should be added to Table 6 under the "Yearly" frequency. Water licence conditions are required that stipulate the need for weekly (at minimum) inspections of the berms and lagoon by the operators, annual inspections by a qualified geotechnical engineer and a geotechnical review after the first year of operation. Subsequent geotechnical reviews can be done say every 3 years (in accordance with dam safety guidelines), if the lagoon was found to have no performance deficiencies.

3.0 GEOTHERMAL DESIGN AND MONITORING REQUIREMENTS

The water retention capability of the lagoon is dependent on the GCL as the primary liner within the berm and the development of a permanently frozen foundation around the cut-off trench so that the GCL is tied into the permafrost.

As noted in Section 2.1, there are several design deficiencies that need to be addressed immediately with respect to the construction of the lagoon that are related to geothermal aspects before drafting the final licence terms and conditions.

At the hearing, BGC presented the results of the independent geothermal analysis. The primary conclusion was the need to install thermistors to validate the design assumptions, confirm freezeback of the core trench and to monitor the long term performance of the facility. BGC recommended that AMEC, as geotechnical engineer of record, review BGC's geothermal analysis report before preparing the details of the thermistor installation so that these findings are considered in the context of the overall design of the monitoring program.

BGC recommended that as a minimum, three thermistors 25 m long be installed in the West Berm and at least one thermistor 25 m long be installed in the East Berm. The final location of these instruments is up to the applicant's design consultant. As a general guideline for the Board, BGC would consider the following to be appropriate locations for the thermistors:

- West Berm- one in each abutment to confirm freeze-back of the cut-off trench in bedrock and the third at the highest section of the berm adjacent to the discharge pipe through the berm.
- East Berm- one in the highest section of the berm.

In general, the thermistors would be installed from the crest of the berm to a final depth of 25 m below grade on the downstream side of the GCL. Recommended thermistor bead locations would be at the following depths; 0.0 (Ground surface), 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 10, 15, 20, 25 metres. Each thermistor installation should be connected to a data logger set to record twice daily readings at say noon and midnight. The dataloggers typically have enough data storage capacity to collect data for more than a year before being downloaded. This level of data collection will capture any extreme variation in the average diurnal temperature data and provide the information needed to validate the assumptions made in the geothermal analysis. If data loggers are not used, then weekly manual readings are a minimum requirement, however a greater level of uncertainty will be introduced with respect to validating the geothermal model assumptions.

Additional confirmation that the cut-off trench has frozen back, as predicted in the geothermal model can be obtained by monitoring for the presence of seepage along the downstream toe of both the East and West Berms. BGC recommends that at least 4 standpipes within the active zone across the valley floor within 5 m of the downstream toe of the West Berm be installed during the summer of 2008. On the East Berm, two standpipes are recommended within 5 m of the downstream toe of the berm in the valley floor. Water quality sampling of these standpipes should be conducted on an annual basis, during the late summer, when the lagoon water levels approach the maximum elevations prior to discharge and while there is seasonal groundwater flow in the active layer. The water samples should be analyzed for parameters related to sewage effluent to confirm that the lagoon contents are not leaking under the berm. A water license condition is required to include the standpipes in the SNP for the lagoon and to have the analytical results reported in the annual water licence report.

3.1 Freezing of Lagoon Contents

One of the conclusions from the geothermal modelling conducted by BGC was that the 0.45 m increments of filling over the winter resulted in relatively rapid freezing. The analyses indicated that the warm summer months may be too short to thaw the whole pond due to gravity driven natural convection. Even with high n-factors, the bottom of the pond stayed frozen. This raises the concern that the sewage may not be adequately treated before being discharged. The Board should be aware of the potential for non-compliant discharge under this scenario and the consequent implications for sewage management by the Hamlet. In addition, build-up of ice in lagoon on an annual basis reduces the long term storage capacity and potential operational life of the facility unless it can be removed. The question then becomes, where is the excavated ice going to be disposed of?

BGC recommends to the Board that a condition be included in the water license requiring the Licensee to undertake more work to confirm if this is a problem and to report back to the Board with their findings and recommendations.

During the hearing, there was still some discussion regarding the final compliance point. If the end-of-pipe discharge point at the downstream toe of the lagoon is used, then there may be problems meeting the regulatory discharge water quality criteria based on the model predictions. This issue needs to be resolved by all parties immediately.

4.0 ADDITIONAL ANALYSES REQUIRED

In addition to the overall validation of the geothermal model and lagoon design to be based on the thermistor monitoring program described above, BGC recommended additional stability analysis be carried out by the applicant of the upstream slope of the berm.

BGC requested that the applicant provide the results of a stability analysis based on a modelled case where the failure path follows along the inclined low shear strength GCL, as per the as-built configuration. The analysis should incorporate the 1 and 2 m head difference for the rapid drawdown case as well as all expected stability cases in agreement with Factors of Safety recommended by the Canadian Dam Association (CDA).

The applicant was also requested to provide further details regarding the event/trigger level when the contingency measures to mitigate potential instability in the berm slope would be implemented. These details should be included in the revised and updated O&M Manual to be provided by the applicant, as part of the water licence, as well as in the terms and conditions of the water licence.

5.0 COMMENTS REGARDING PROCESS FOR FACILITY ACCEPTANCE

The following comments were developed by BGC with input from John Grainger, P. Eng. of Associated Engineering subsequent to the public hearing and are provided for the information of the Board for the purposes deciding on the next steps towards a licenced facility.

At the technical pre-hearing held in Iqaluit on October 1, 2007, the Hamlet of Cape Dorset representatives expressed reluctance to accept responsibility as the licenced operator of the sewage lagoon facility from GNCGS due to perceived design deficiencies. At the Public Hearing in Cape Dorset on January 23-24, 2008, the Hamlet changed its position and confirmed that they will be the owner/operator and licensee of the facility.

Normal industry practice requires that the Proponent, GNCGS conduct inspections and identify any deficiencies with respect to the facility components during construction. The deficiency list must be addressed by the Contractor in order for the facility to be deemed completed. A Certificate of Substantial Completion must be completed between GNCGS and the Contractor indicating that there are no outstanding deficiencies and that the facility has been accepted by GNCGS. This certificate should exist now, as the facility was completed in August 2007. A copy of Sections GC43 "Engineer's Certificates", 01770 "Closeout Procedures" and 01810 "Commissioning" from the contract documents is attached for reference in Appendix A.

Normally, the construction contract would include provision for a one year warranty period. This provides the owner the opportunity to operate the facility and identify any further deficiencies. The Contractor would then be obliged to rectify these deficiencies, under the terms and conditions of the warranty. Once the warranty related deficiencies have been addressed, a Certificate of Final Completion is prepared between GNCGS and the Contractor. This certificate relieves the Contractor of any further obligations with respect to the constructed facility. A copy of Section 01820 "Demonstration and Training" from the Technical Specifications is also included in Appendix A for reference. Under this section, the Contractor is required to demonstrate and instruct the Owner's personnel on the equipment and systems. It is not clear how this obligation is being fulfilled for this contract, since the lagoon has yet to be commissioned.

With respect to this water licence, the Board requires certainty in terms of the Hamlet's acceptance of this facility as provided to them by GNCGS. Further, the Board must have assurance that the Hamlet of Cape Dorset as the licensed owner and operator of the sewage lagoon is satisfied that all deficiencies have been addressed and that they are prepared to become the operating authority of the system.

As such, the water licence should include the following provisions:

- The Hamlet shall provide the Board with a copy of GNCGS's Certificate of Substantial Completion for the Cape Dorset Sewage Lagoon. This document should have been provided to the Hamlet by GNCGS when they agreed to become the owner/operator of the facility.
- The Board also requires, at the conclusion of the 1 year warranty period, an acceptance letter from the Hamlet indicating that the Hamlet has accepted ownership of the Cape Dorset Sewage Lagoon and that the Hamlet is now the owning and operating authority to which the water license is granted.
- Upon completion of the one-year warranty period (August 2008 or one year after the date of the Certificate of Substantial Completion), the Board also requires a copy of the Certificate of Final Completion for this facility from the Hamlet.

At this time, BGC has not been privy to the actual contractual process that has taken place with respect to the above requirements between the Contractor, the Hamlet and GNCGS. The Board is therefore advised to review the applicable Nunavut procedures governing acceptance of municipal facilities by the Hamlet that were designed and constructed under the supervision of the Government of Nunavut. It is not the responsibility of the Board to address design deficiencies with water licence terms and conditions. These must be resolved between the Contractor, GNCGS and the Hamlet.

6.0 CLOSURE

BGC Engineering Inc. (BGC) prepared this report for the account of Nunavut Water Board. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of report preparation. Any use which a third party makes of this report, or any reliance on decisions to be based on it are the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Dillon and AMEC are the Engineers of Record for this project and are wholly responsible for the design and performance of the noted project and its components. None of the review comments provided herein by BGC absolves Dillon and AMEC of that responsibility and again, BGC accepts no responsibility for any damages suffered by third parties based on the review comments provided herein.

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We trust this information meets with your requirements. Please feel free to contact the undersigned at your convenience should you have any questions or require additional investigations.

Yours truly,
Per
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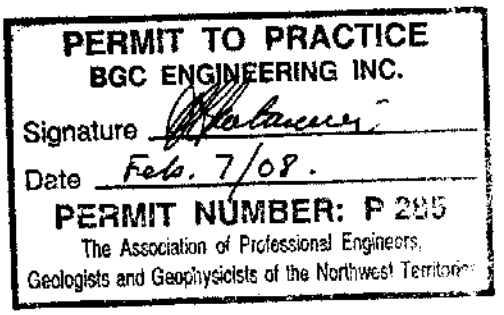

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HHH/sf

Attachments:
Appendix A- Excerpts of Contractual Documents for Cape Dorset Sewage Lagoon

APPENDIX A
EXCERPTS FROM CONTRACTUAL DOCUMENTS FOR CAPE DORSET SEWAGE LAGOON

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

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

40.4 If the Owner and the Contractor are unable to agree about an amount referred to in GC40.3 that amount shall be determined by the method referred to in GC49.

GC41 CLAIMS AGAINST AND OBLIGATIONS OF THE CONTRACTOR OR SUBCONTRACTOR

41.1 The Owner may, in order to discharge lawful obligations of and satisfy lawful claims against the Contractor or a subcontractor arising out of the performance of the contract, pay any amount that is due and payable to the Contractor pursuant to the contract directly to the obligees of and the claimants against the Contractor or subcontractor.

41.2 A payment made pursuant to GC41.1, is to the extent of the payment, a discharge of the Owner's liability to the Contractor under the contract and may be deducted from an amount payable to the Contractor under the contract.

41.3 To the extent that the circumstances of the work being performed for the Owner permit, the Contractor shall comply with all laws in force in Nunavut relating to payment periods, mandatory holdbacks, and creation and enforcement of mechanics' liens.

41.4 The Contractor shall discharge all his lawful obligations and shall satisfy all lawful claims against him arising out of the performance of the work at least as often as the contract requires the Owner to pay the Contractor.

41.5 The Contractor shall, whenever requested to do so by the Engineer, make a statutory declaration deposing to the existence and condition of any obligations and claims referred to in GC41.4.

41.6 GC41.1 shall only apply to claims and obligations that have been received by the Engineer in writing before payment to the Contractor pursuant to TP4.8 and within 120 days after a claimant

41.6.1 should have been paid in full under his contract with the Contractor or subcontractor where the claim is for money that was lawfully required to be held back from the claimant; or

41.6.2 performed the last of the service, work or labour, or furnished the last of the material pursuant to his contract with the Contractor or subcontractor, where the claim is not for money referred to in GC41.6.1.

41.7 No interest will be paid to the Contractor on any monies withheld pursuant to GC41 due to a Contractor or subcontractor's claim for non-payment.

GC42 SECURITY DEPOSIT - FORFEITURE OR RETURN

42.1 The Owner may convert the security deposit, if any, to its own use, if

42.1.1 the work is taken out of the Contractor's hands pursuant to GC37;

42.1.2 the contract is terminated pursuant to GC40; or

42.1.3 the Contractor is in breach of or in default under the contract.

42.2 If the Owner converts the contract security pursuant to GC42.1, the amount realized shall be deemed to be an amount due from the Owner to the Contractor under the contract.

42.3 Any balance of an amount referred to in GC42.2 that remains after payment of all losses, damage and claims of the Owner and other shall be paid by the Owner to the Contractor, if in the opinion of the Engineer, it is not required for the purposes of the contract.

GC43 ENGINEER'S CERTIFICATES

43.1 On the date that

43.1.1 the work has been completed, and

43.1.2 the Contractor has complied with the contract and all orders and directions made pursuant thereto,

both to the satisfaction of the Engineer, he shall issue a Certificate of Final Completion to the Contractor.

43.2 If the Engineer is satisfied that the work is sufficiently complete to be acceptable for use by the Owner, he may, at any time before he issues a certificate referred to in GC43.1, issue a Certificate of Substantial Completion to the Contractor.

43.3 A Certificate of Substantial Completion referred to in GC43.2 shall describe the parts of the work not completed to the satisfaction of the Engineer and all things that must be done by the Contractor before a certificate referred to in GC43.1 will be issued.

43.4 The Engineer may, in addition to the parts of the work described in a Certificate of Substantial Completion referred to in GC43.2, require the Contractor to rectify any other parts of the work not completed to his satisfaction and to do any other things that are necessary for the completion of the work.

43.5 If the contract or a part thereof is subject to a Unit Price Arrangement, the Engineer shall measure and record the quantities of labour, plant and material, performed, used and supplied by the Contractor in performing the work and shall, at the request of the Contractor, inform him of those measurements.

43.6 The Contractor shall assist and co-operate with the Engineer in the performance of his duties referred to in GC43.5 and shall be entitled to inspect any record made by the Engineer pursuant to GC43.5.

43.7 After the Engineer has issued a Certificate of Final Completion referred to in GC43.1, he shall, if GC43.5 applies, issue a Certificate of Final Measurement.

43.8 A Certificate of Final Measurement referred to in GC43.7 shall

43.8.1 contain the aggregate of all measurements of quantities referred to in GC43.5, and

43.8.2 be binding upon and conclusive between the Owner and the Contractor as to the quantities referred to therein.

GC44 RETURN OF SECURITY DEPOSIT

44.1 After a Certificate of Substantial Completion referred to in GC43.2 has been issued, the Owner shall, if the Contractor is not in breach of or in default under the contract, return to the Contractor all or any part of the security deposit that, in the opinion of the Engineer, is not required for the purposes of the contract.

44.2 After a Certificate of Final Completion referred to in GC43.1 has been issued, the Owner shall return to the Contractor the remainder of any security deposit unless the contract stipulates otherwise.

44.3 Interest shall not be paid on security deposits.

GC45 CLARIFICATION OF TERMS IN GC46 TO GC49

45.1 For the purposes of GC46 to GC49,

45.1.1 "Unit Price Table" means the table set out in the Tender, and

45.1.2 "plant" does not include tools customarily provided by a tradesman in practising his trade.

GC46 ADDITIONS OR AMENDMENTS TO UNIT PRICE TABLE