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BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS

MARC SPITZER, Chairman
WILLIAM A. MUNDELL
JEFF HATCH-MILLER
MIKE GLEASON
KRISTIN K. MAYES

IN THE MATTER OF THE APPLICATION OF PALO VERDE UTILITIES COMPANY FOR AN EXTENSION OF ITS EXISTING CERTIFICATE OF CONVENIENCE AND NECESSITY.	**DOCKET NO. SW-03575A-03-0586**
IN THE MATTER OF THE APPLICATION OF SANTA CRUZ WATER COMPANY FOR AN EXTENSION OF ITS EXISTING CERTIFICATE OF CONVENIENCE AND NECESSITY.	**DOCKET NO. W-03576A-03-0586** **NOTICE OF FILING DIRECT TESTIMONY OF TREVOR HILL AND SUPPLEMENTAL TESTIMONY OF CINDY LILES**

Notice is hereby given that Santa Cruz Water Company and Palo Verde Utilities Company have this day filed the Direct Pre-Filed Testimony of Trevor Hill, including appendices, and the Supplemental Pre-Filed Direct Testimony of Cindy Liles, including appendices, in the above-captioned dockets.

RESPECTFULLY submitted this 14th day of May, 2004.

Arizona Corporation Commission
DOCKETED
MAY 1 4 2004
DOCKETED BY

SNELL & WILMER

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Attorneys for Palo Verde Utilities Company
and Santa Cruz Water Company

ORIGINAL and thirteen (13) copies of the foregoing have been filed with Docket Control this 14th day of May, 2004.

A COPY of the foregoing was
been hand delivered this 14th day of
May, 2004, to:

Jim Fisher, Executive Consultant
Utilities Division
ARIZONA CORPORATION COMMISSION
1200 West Washington Street
Phoenix, Arizona 85007

A COPY of the foregoing was
mailed this 14th day of May,
2004, to:

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SUPPLEMENTAL PRE-FILED DIRECT TESTIMONY OF CINDY LILES

May 14, 2004

SUPPLEMENTAL PRE-FILED DIRECT TESTIONY OF CINDY LILES

Q. Have you previously submitted pre-filed testimony in this docket?

A. Yes. I submitted pre-filed testimony on April 16, 2004.

Q. What is the purpose of this supplemental pre-filed testimony?

A. While Utilities Division Staff was performing its analysis of this case, we learned that Staff desired additional information regarding the personnel involved in the operation of Palo Verde Utilities Company ("Palo Verde") and Santa Cruz Water Company ("Santa Cruz"). As a result, representatives of the companies met with Staff on April 30, 2004, to discuss certain questions of Staff. The purpose of this testimony is to provide additional information to be used by Staff in the preparation of a staff report or pre-filed testimony in this matter.

Q. Please identify each person or entity which has an ownership interest in Global Water Resources.

A. Bill Levine, Dan Cracchiolo, Trevor Hill, and Leo Commandeur.

Q. Please discuss the professional background and business experience of Mr. Levine.

A. Mr. Levine is a long time resident of Arizona and a very astute business man. He is a lawyer by professional training but is primarily involved in the ownership of a multitude of businesses now.

Q. Is Mr. Levine personally involved in the operation of Palo Verde and Santa Cruz, and if so, in what capacity?

A. No. Mr. Levine is the chairman of the board of Global Water, but is not involved in the day-to-day operations of the two utilities.

Q. Please discuss the professional background and business experience of Mr. Cracchiolo.

A. Mr. Cracchiolo is a prominent business man and lawyer in Phoenix. He is a lawyer by education and a co-founder of Burch and Cracchiolo, a well known law firm in Phoenix.

Q. Is Mr. Cracchiolo personally involved in the operation of Palo Verde and Santa Cruz, and if so, in what capacity?

A. No. Mr. Cracchiolo is a board member and minority shareholder of Global Water. He is not personally involved in the day-to-day operations of Santa Cruz or Palo Verde, however, he has had significant experience in the operations and administration of regulated utilities in Arizona. Mr. Cracchiolo was the President of Bella Vista Water company until it was sold to Algonquin Water in 2002.

Q. Please discuss the professional background and business experience of Mr. Hill.

A. Mr. Hill is an engineer and a retired naval officer. He co-founded a design-build engineering firm, Hill Murray and Associates, in the early 90's and built numerous water reclamation facilities in Canada. Mr. Hill's work at Hill Murray is discussed in his pre-filed direct testimony in this docket. Mr. Hill also co-founded Algonquin Water Resources of America (AWRA) in 2000 and successfully amassed 37,000 customers in Arizona and Texas. Mr. Hill is a co-founder of Global Water Resources and led the acquisition of Palo Verde and Santa Cruz.

Q. What are Mr. Hill's responsibilities with regard to Palo Verde and Santa Cruz?

A. Mr. Hill provides leadership and direction to the management team of Global Water but is not directly involved with the day-to-day operations of the utilities. I report to him.

Q. Please discuss the professional background and business experience of Mr. Commandeur.

A. Mr. Commandeur has an extensive professional and business background. He has a background in finance and accounting and has held numerous positions in a variety of

entrepreneurial endeavors. Most recently he was a partner in a high tech company which he took public and sold. Mr. Commandeur was a co-founder of Algonquin Water Resources and was responsible for finding the acquisitions this company conducted.

Q. What are Mr. Commandeur's responsibilities with regard to Palo Verde and Santa Cruz?

A. Mr. Commandeur is involved with business development at the Global Water level and as a result of this he has no responsibilities with the day-to-day operations of Santa Cruz or Palo Verde.

Q. Please discuss the professional background and business experience of Mr. Symmonds.

A. Mr. Symmonds is a professional engineer. He is a retired naval officer and spent 8 years in the Canadian navy as an engineering officer on a Canadian warship. He was a partner in Hill Murray and Associates, a design-build engineering firm specializing in water reclamation and re-use. He was instrumental in developing control systems for these facilities and later operating eight water reclamation facilities. Mr. Symmonds was a key executive in Algonquin Water Resources and held the role of General Manager of AWRA until he left in the fall of 2003. Mr. Symmonds is a senior executive in Global Water in the role of VP Regulatory and Compliance. He leads the technical diligence team during acquisitions and has a role in corporate compliance.

Q. What are Mr. Symmonds' responsibilities with regard to Palo Verde and Santa Cruz?

A. While he is leading the field operating group of Palo Verde and Santa Cruz currently, this position will ultimately be filled by a senior water operations executive. At that time, Mr. Symmonds will move solely to corporate compliance and providing strategic direction of utilities automations and control and compliance related activities for Palo Verde and Santa Cruz and future acquisitions.

Q. Please identify the other officers of Palo Verde and Santa Cruz.

A. Larry Braund is the VP Engineering for Global Water and is the chief engineer and architect of the infrastructure plan for Santa Cruz and Palo Verde. He is directly and personally responsible for the planning and engineering for these two utilities.

Q. Please discuss your professional background and business experience.

A. I am a Certified Public Accountant and have held a variety of posts as Chief Financial Officer. I have direct experience in the operations of very large public and private companies and have held very senior positions in both. I joined Phoenix Capital Partners as GM and CFO and have operated Santa Cruz and Palo Verde for two years.

Q. What are your specific responsibilities as General Manager of Palo Verde and Santa Cruz?

A. I am responsible for the day-to-day operations of these two utilities, and I am the CFO of Global Water. I oversee customer service, billing services, operations, development services and liaise directly with developers in the provision of infrastructure services. Further, I am responsible to the President of Global Water for the operations of these two utilities and the overall financial performance of the company.

Q. Please identify the other persons who are employed by Palo Verde and Santa Cruz, and describe their responsibilities with regard to the companies.

A. There are several other employees and key contractors involved in the operations of Palo Verde and Santa Cruz. The physical plants are currently operated by Severn Trent, a contract operator, and in addition we have just hired Jeff Lemley, a key field operator, Brian Manuel, a field operator and Susan Armijo for field compliance and sampling. We have 3 customer service personnel in the Global Water headquarters, one other CPA and a receptionist.

Q. Have any of the employees or owners of Palo Verde and Santa Cruz received any special training in the operation of water and wastewater companies?

A. All of Global Water's field personnel have specific levels of training to meet their job descriptions and technical requirements. Global Water promotes certification for all field personnel and incents employees to do so.

Q. Do Palo Verde and Santa Cruz use any outside contractors, consultants or other professionals in operating the companies?

A. Because Palo Verde and Santa Cruz are relatively new companies which are growing at a very fast rate, the companies have relied heavily on outside consultants for both operations and engineering. In addition to Severn Trent's role in operations, the company has employed from time to time, Kennedy Jenks (Fred Goldman, P.E.) for permitting activities, Southwest Groundwater (Steve Noel) for water supply determinations, JMI & Associates (Matt Olsen) for design services, and Weber Engineering (Gabe Tregaskes) for well repair work.

Q. Has Palo Verde or Santa Cruz received any notices of violation issued by the Arizona Department of Water Resources, the Arizona Department of Environmental Quality, or the Arizona Corporation Commission?

A. Yes. Palo Verde was issued a Notice Of Violation in 2003 and prior to the acquisition by Global Water for failure to report on its new aquifer protection permit, even though the plant was not yet completed. This was addressed with ADEQ, and no action of any kind resulted.

Q. Are Palo Verde and Santa Cruz current on all property taxes and other tax assessments?

A. Yes.

Q. How many customers do Palo Verde and Santa Cruz currently serve?

A. The companies serves approximately 2300 homes or 4600 service connections, combined.

Q. Approximately how many new customers do Palo Verde and Santa Cruz add each month?

A. The companies are adding approximately 200 customers each month at the moment for both water and wastewater.

Q. How many customer complaints, formal or informal, have been filed with the Arizona Corporation Commission involving Palo Verde or Santa Cruz?

A. In July of 2003, there were two Arizona Corporation Commission utility complaints filed with the Arizona Corporation Commission.

Q. What was the nature of the complaints?

A. In one case a customer had complained about having low pressure in their system. In that case, a generator had failed to start after a power outage in a storm. The problem was immediately addressed and resolved. In the other case, a customer complained about customer service.

Q. Were all of the issues resolved?

A., Yes, the complaints were resolved to the Arizona Corporation Commission's satisfaction and in a timely manner.

Q. Do Palo Verde and Santa Cruz have a customer complaint contact?

A. Yes, I am the senior customer complaint contact.

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BEFORE THE ARIZONA CORPORATION COMMISSION

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PRE-FILED DIRECT TESTIMONY OF TREVOR HILL

May 14, 2004

DIRECT TESTIMONY OF TREVOR HILL

Q. Please state your name and business address.

A. My name is Trevor Hill. My business address is 22601 North 19th Avenue, Suite 210, Phoenix, Arizona, 85027.

Q. By whom are you employed and in what capacity.

A. I am the President and CEO of Global Water Resources, L.L.C. ("Global Water"). In my capacity as President and CEO, I am primarily involved with acquisitions and the consolidation of new utility companies. In addition, I am the president of Palo Verde Utilities Company ("Palo Verde") and Santa Cruz Water Company ("Santa Cruz"), two utility companies regulated by the Arizona Corporation Commission ("Commission").

Q. Are you also a principal in Global Water?

A. Yes I am.

Q. Would you please describe the business operations and personnel involved in Global Water?

A. Yes. I have attached as Appendix A to my testimony Global Water's corporate profile. Also attached as Appendix C are various references.

Q. Were you involved in the recent acquisition of Santa Cruz and Palo Verde by Global Water?

A. Yes, I led the acquisition and negotiating team.

Q. What exactly did Global Water buy?

A. Global Water acquired one hundred percent of the membership interests in Santa Cruz and Palo Verde from Phoenix Capital Partners and Phoenix Utility Management.

Q. In essence, was this acquisition a stock acquisition?

A. Yes, buying the membership interests of a limited liability company is analogous to buying the stock of a subchapter "C" corporation. This is certainly how we treated the

acquisition, in that we acquired an operating company and retained all employees and key management personnel. All assets of the company including fitted infrastructure, the certificate of convenience and necessity, franchises, contracts, etc., stayed with the respective entities.

Q. Are you familiar with Mr. Michael Decker Reinbold?

A. Yes.

Q. What role did Mr. Reinbold play in the sale of the utilities to Global Water.

A. Mr. Reinbold was initially responsible for the negotiations with Global Water. However, as the deal progressed, Cindy Liles became the single point of contact for the acquisition. Mr. Reinbold had a *de minimus* role in the acquisitions.

Q. Were you aware at the time that Mr. Reinbold had a large judgment against him from the State of Oregon.

A. No, not initially. It came up in the due diligence process when I was reading Commission testimony.

Q. Was Mr. Reinbold's judgment of concern to you?

A. Yes. I was very concerned by this finding. I was not sure of the possible effect of the judgment on Mr. Reinbold's assets, and was worried that the judgment might attach in some way to Mr. Reinbold's holdings or potentially his direct or indirect interests in Santa Cruz and Palo Verde.

Q. Did you take any action to protect Global Water and the customers of the utility company against the Reinbold judgment?

A. Yes. We had to restructure the deal entirely. Phoenix Capital Partners and Phoenix Utility Management jointly owned 100% of the membership interests in Santa Cruz and Palo Verde. Initially we had proposed to buy Phoenix Capital Partners and Phoenix Utility Management, which would have been a relatively simple transaction. Ultimately, and solely due to the Reinbold judgment, and despite the fact that Mr. Reinbold held less that a 1% interest in the utilities, we required that Mr. Reinbold's interests in Phoenix Capital Partners and Phoenix Utility

Management first be acquired by his partners or other intermediate entities. Then Global Water bought the membership interests directly in Santa Cruz and Palo Verde from Phoenix Capital Partners and Phoenix Utility Management, leaving these two companies in place. We determined that this double layer of separation not only protected Global Water but also provided protection to the utilities' respective customers. Further, we had the partners and vendors in the deal indemnify Global Water completely and specifically from this liability and, in addition, held back a material sum of money from the sale proceeds as insurance. Further, Mr. Reinbold was required to resign in advance of the closing of the acquisition. Cindy Liles, an officer of Phoenix Capital Partners, signed on behalf of Phoenix Capital Partners.

Q. Does Mr. Reinbold have any role in Santa Cruz or Palo Verde today?

A. No, none.

Q. Are you familiar with the firm Hill, Murray & Associates, Inc?

A. Yes I am. Background information on Hill Murray is attached to my testimony as Appendix B. In addition, the Hill Murray appendix is supplemented by two additional appendices, Appendix 1 (Municipality of Iqaluit Wastewater Treatment Plant) and Appendix 2 (District of Powell River Wastewater Treatment Plant), which are also attached to my testimony.

Q. What was your role in the company?

A. I was a co-founder and President. I also had specific expertise in the regulatory field conducting all different types of permitting work particularly for water reclamation facilities.

Q. Did you have partners in Hill Murray?

A. Yes, I had two partners, Robert Murray, who was responsible for project management and engineering, and Graham Symmonds, who was responsible for plant operations.

Q. When was the company formed?

A. The company was incorporated in the Spring of 1992.

Q. What was the nature of the company's business?

A. Hill Murray was formed to provide turn-key wastewater reclamation facilities to clients with challenging sewage treatment and disposal problems. Hill Murray was a design-build firm. While other engineering firms could provide permitting advice, or could provide engineering services, none of those firms at the time could provide the full range of permitting, design, construction, project management, commissioning and operations expertise. Hill Murray provided a one-stop solution for water reclamation to many clients in British Columbia, Canada, and the Arctic for a fixed price and with guaranteed results. This was a novel approach in the industry.

Q. Was Hill Murray a successful business?

A. Yes. Hill Murray was successful. The company helped implement water reclamation regulations in the Province of British Columbia, and actually wrote the plumbing code for dual pipelines (potable and non-potable) in buildings which was first adopted by the Province and later Nationally into the Canadian Building Code. This innovative work allowed for the first fully recycling public school in Canada and the first tertiary fully recycling treatment plants in the Arctic.

Q. Was Hill Murray ever recognized for these achievements?

A. Yes. Hill Murray won numerous awards for innovation and was recognized by both Provincial and Federal Ministries in Canada as a leader in wastewater reclamation and re-use. Also, many of our facilities won awards for embracing environmental stewardship. One particularly notable project was the wastewater treatment plant at the Mt. Washington Ski Resort.

Q. Why is the Mt. Washington facility noteworthy?

A. Mt. Washington ski resort required a new very high quality treatment facility to allow for discharge of treated wastewater to an extremely sensitive environment. Hill Murray established the protocols for permitting of this first-ever discharge, and through significant work with environmental groups, Environment Canada, and the province ministry of Environment Land and Parks, Hill Murray obtained a permit which required the extremely high quality treated water to

be discharged to the stream to augment flows, necessary to promote the fishery. The facility was built in an area which would get twenty feet of snow each year; this coincided with the high flow season. Hill Murray pioneered automatic control of this 500,000 gallon-per-day treatment plant that allowed the plant to run in a virtually un-manned condition.

Q. Was the project successful?

A. The project was very successful.

Q. Did you replicate this facility anywhere else?

A. Yes. Hill Murray built a similar facility in Iqaluit in the Arctic. The Iqaluit facility was of the same flow rates and similar size footprint, and built upon the same technology.

Q. Did Hill Murray have competitors?

A. Yes, although no other firms in British Columbia provided the same ability to bundle technologies.

Q. What does bundling technologies mean?

A. Hill Murray provided turn-key wastewater treatment solutions, designed around Zenon membrane technology. Zenon Environmental, Inc., a publicly-traded Canadian corporation, developed a wastewater treatment process built around Membrane Bioreactor technology, or MBR. This effective new technology was in its infancy when Hill Murray was getting started. Together, Hill Murray and Zenon refined the process and were selected for some of the largest projects ever attempted at the time. Hill Murray was responsible for permitting, facilities design, buildings, post-treatment, commissioning and operations. Zenon would perform the process design and supply membranes and process equipment through Hill Murray to the clients. Much like a microchip is the heart of a computer, the Zenon membranes are the heart of the water treatment plant. Zenon provided the "chip" and Hill Murray built the "computer." In bidding projects, Hill Murray would provide fixed priced contracting and an effluent quality guarantee.

Q. Did Hill Murray operate treatment plants?

A. Yes. Hill Murray had a subsidiary corporation called Canadian Wastewater Corporation or CWC. CWC operated or held operations oversight contracts for all the facilities Hill Murray built.

Q. Did Hill Murray compete with any other firms to win the Mt. Washington project that you mentioned?

A. Yes. Hill Murray competed against several firms for all the projects won in Canada.

Q. Who did Hill Murray compete against for Mt. Washington?

A. Hill Murray competed against Reid Crowther and Hydroxyl Systems.

Q. Who is Reid Crowther?

A. Reid Crowther is a consulting engineering company in British Columbia that specializes in the traditional method of providing infrastructure – through design, bid, and build.

Q. Did Reid Crowther provide fixed price contracting or effluent quality guarantees?

A. No, neither.

Q. Are there differences in the way that Reid Crowther and Hill Murray ran their businesses?

A. Yes, while Reid Crowther was actively seeking contracts to design treatment plants (which design would then go out to bid and contractors would bid on the construction project), Hill Murray proposed the entire solution – at a fixed price with an effluent quality guarantee. Because of the one-stop approach, with fixed pricing and effluent quality guarantees, the Hill Murray methodology was often preferred by clients which ultimately led to many successes in the Province.

Q. Did Hill Murray compete with Reid Crowther on any other projects?

A. Yes, Hill Murray competed directly with Reid Crowther on Ganges, Mt. Washington, Powell River and Iqaluit.

Q. Did Reid Crowther win the design work for any of those projects.

A. No. The clients in every case preferred the Hill Murray methodology and/or technology. Reid Crowther was promoting traditional technologies in every case.

1 Q. How did Reid Crowther react to Hill Murray's presence in the wastewater sector.
2 A. Reid Crowther was extremely bitter. Reid Crowther had done considerable engineering
3 work for the towns of Powell River and Iqaluit for many years, and the loss of the wastewater
4 treatment projects to Hill Murray was not well received.
5 Q. What makes you say this?
6 A. It became apparent to Hill Murray that Reid Crowther was angered by the company's poor
7 performance in winning work when they wrote a report to Powell River which was very negative
8 with respect to Hill Murray's work on that project. The report was extremely misleading, and
9 ultimately damaging to Hill Murray's reputation.
10 Q. Are you saying that Powell River hired Reid Crowther--a competitor and the losing
11 bidder--to review Hill Murray's work on the project?
12 A. Yes, that is exactly what I am saying.
13 Q. Why did that happen?
14 A. The City's Chief Engineer, Jim Greenwood, left his position shortly after he had granted
15 the project substantial completion. While Hill Murray had a great relationship with the District
16 Councilors, District Staff felt they had been usurped by the Council. Consequently, the staff of
17 the Municipality did not support Hill Murray due to the long-standing relationship with Reid
18 Crowther, and the staff took the first opportunity to re-engage Reid Crowther. It is often
19 customary for a municipality to hire a third party to cover for a position until it is filled; however,
20 it is highly unusual for a competitor and losing bidder to be selected as the third party to prepare
21 and certify a completion report of their competitor.
22 Q. What was the purpose of Reid Crowther's report.
23 A. Since the project had met substantial completion, the report should have been to confirm
24 that contractual terms had been met. However, in Hill Murray's experience, a third-party
25 engineering report is often used as a sales tool by consulting engineering firms. They typically
26 take the opportunity to point out as many questions as possible with respect to design and

operations, and often try to create fear in the municipal leaders by referring not to Contract Documents, but to fictitious standards which are entirely subjective. Further, it is important to note that Reid Crowther was extremely nervous. The Municipality had relied upon the water flow characterization study which had been conducted by Reid Crowther when the Municipality entered into a performance contract with Hill Murray. It was later demonstrated that this study was fatally flawed and Reid Crowther's insurers were put on notice for negligence.

Q. In your opinion, did Reid Crowther have a conflict of interest?

A. There can be no question that Reid Crowther had a conflict of interest.

Q. Is Reid Crowther still in business?

A. No. In 2001 Reid Crowther was acquired by Earth Tech, a Tyco subsidiary.

Q. Have you seen a report entitled "Sewage Treatment Plant Investigation" written by Earth Tech in December 2002?

A. Yes I have.

Q. When did you first see it?

A. I received a copy of the report in May 2004.

Q. Have you read the report?

A. Yes. It was a scathing report as to Hill Murray's design of the water reclamation facility in Iqaluit.

Q. Is the report accurate?

A. No, far from it. However, the conclusions in the report are not surprising. Earth Tech, by its own admission, had virtually none of the design documentation, none of the correspondence with the Municipality of Iqaluit, very few of the drawings, and little other documentation regarding the project, so the report is largely based on speculation and conjecture. The report appears to me to be a sales tool, written specifically to point out alleged flaws in the Hill Murray design, with the objective of winning a contract to fix these alleged flaws.

Q. Can you give an example of a misleading or incorrect conclusion?

A. Yes. In the report Earth Tech concludes that the Iqaluit plant is undersized for the current flow generated from the town, that this was a mistake, and that the plant should be upgraded immediately, presumably by Earth Tech. However, the plant was designed and contracted for 1,800 m^3/day. Hill Murray installed sophisticated flow measurement devices to measure the actual average daily flow and determined it to be less than 1,600 m^3/day. In March 2002, Earth Tech wrote another report for the Municipality of Iqaluit – this time for a water proposal. In it they conclude that the average daily demand for water in 2002 is 1,200 m^3/day. The fact that Earth Tech concluded that the Iqaluit plant is undersized at 1,800 m^3/day in the first report and then in another report concludes the demand is as low as 1,200 m^3/day demonstrates that the intentions of Earth Tech is to purposefully mislead and damage.

Another example is Earth Tech's erroneous conclusion that the design flow rate issue would lead to bypass events and repeated violations. What the company failed to point out is that the plant is nearly identical to the Mt. Washington plant, also built in an Arctic type of setting, discharging to a fish bearing stream. Since start-up the Mt. Washington facility has not had a single violation and in fact passed an entire year of tests in which baby fish are introduced into effluent for a 96 hour period. During the first year of operations this test was conducted 12 times. In each test 100% of the fish survived in 100% effluent – a perfect result.

Q. Does a firm that is hired to perform an investigation of a facility ever get hired to implement a fix to a problem?

A. Absolutely. In fact, in March of this year, Reid Crowther/Earth Tech was hired and given a contract for $712,000 to begin to re-build Iqaluit's treatment plant.

Q. Could the Iqaluit plant have been started up for less?

A. Yes. The plant would have taken less than $200,000 to start at the time the project was shut down.

Q. Is Hill Murray still operating?

A. No. Hill Murray was wound down.

Q. Did Hill Murray ever file bankruptcy?

A. No. Hill Murray wound up its financial and business affairs in an orderly process, and all debts of the company were paid, settled, or in the case of Iqaluit, the balance of impressed trust funds held for retainage were irrevocably assigned to Iqaluit to be paid to a specific list of sub-contractors - also for retainage.

Q. Who operates the plants that Hill Murray built?

A. One of Hill Murray's old employees who was well respected by many of the company's customers took on the mission of keeping these customers happy. He has made a business out of operating Hill Murray facilities.

Q. Does this conclude your testimony?

A. Yes.

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APPENDIX A

GLOBAL WATER RESOURCES CORPORATE PROFILE

Global Water Resources
Corporate Profile

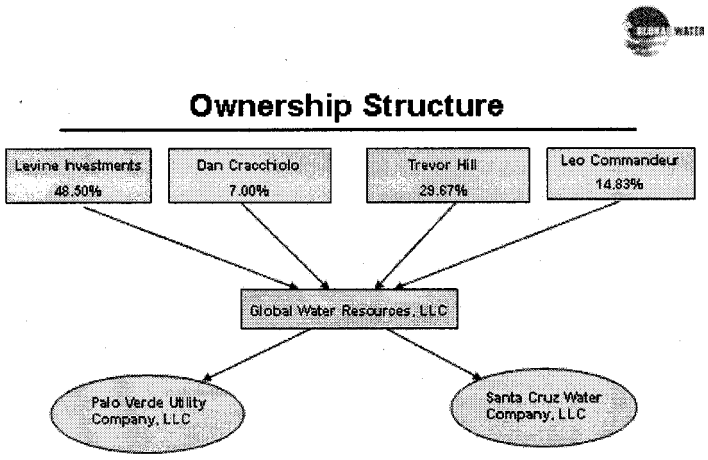
The Company

Global Water Resources, LLC was founded specifically to aggregate and consolidate small and medium size water and wastewater utilities in the Southwestern United States. The company, headquartered in Phoenix, Arizona, has assembled an extremely strong board of directors/investors with specific and relevant experience in the area of utility consolidation and operations management. The company has been initially capitalized with $50 MM of equity.

Global Water Resources (GWR) is focused on small to medium sized utilities. This size of utility typically struggles from a capital financing point of view, the result of which is a lack of modernization, or a lack of preparation for the future. GWR brings access to capital for these smaller utilities, and can therefore bring sub-standard facilities up to compliance, and provide the means by which some secondary, difficult-to-regulate elements (such as odor, and aesthetics) can be upgraded.

Ownership

Global Water Resources is 100% investor/manager owned and operated, and is tightly held by its founding board and management.



Mission

To build and acquire world class utilities and provide high quality water, wastewater and reclaimed water service to our customers, through knowledgeable people and sound infrastructure and strategic investment.

The Board of Directors

William S. Levine
Chairman of the Board

Mr. Levine was one of the founders of Outdoor Systems, now known as Viacom Outdoor, an outdoor advertising / billboard firm. The company grew through acquisitions to become the largest outdoor advertising company in the nation. In December of 1999, Outdoor Systems was acquired by Infinity Broadcasting Corporation, which was subsequently acquired by Viacom. Mr. Levine is a significant stockholder of Viacom, owning in excess of 14 million shares of Viacom stock.

Mr. Levine is the founder, director and officer of several successful operating companies.

Mr. Levine is also the co-founder and majority owner of Allstate U Lok Storage Co., a chain of self storage / mini-warehouses totaling over one million square feet.

Mr. Levine has been a significant real estate developer, owner, operator and lender for many years. He has been involved in land development, master planning, office, industrial and commercial projects. He is currently involved in developing ten grocery-anchored shopping centers in the Phoenix Metro area. Mr. Levine's portfolio of real estate exceeds $200 million of equity.

Mr. Levine has been a resident of Phoenix for over forty years.

Daniel Cracchiolo

Raised in Arizona, Mr. Cracchiolo served as a 1st Lieutenant in the United States Air Force from 1954 to 1956 after attending the University of Arizona where he received his Juris Doctorate in 1952. He was admitted to the Arizona State Bar in 1952 and was

admitted to practice before the U.S. Supreme Court in 1957. From 1952 through 1954 and from 1956 to 1957 Mr. Cracchiolo served as Deputy County Attorney of Maricopa County, thereafter entering private practice and co-founding the firm of Burch & Cracchiolo in 1970.

Mr. Cracchiolo is a member of the Maricopa County and American Bar Associations, the State Bar of Arizona, Phoenix Association of Defense Counsel, American Board of Trial Advocates, American Judicature Society, International Association of Defense Counsel and International Academy of Trial Lawyers. He is listed in two categories in "Best Lawyers In America". He is a Regent of Brophy College Preparatory, a member of the Board and past President of COMPAS and serves as President and Director of the Steele Foundation, an organization dedicated to the support of charitable, religious, educational and scientific purposes.

Mr. Cracchiolo has been a resident of Arizona and in the water business through his family owned Bella Vista Water Co., in Sierra Vista for over 50 years.

Trevor T. Hill, P.Eng
President & CEO

Raised in Vancouver, British Columbia, Mr. Hill graduated from Royal Roads Military College with a bachelor of Engineering in Mechanical Engineering in 1987. Mr. Hill attended the Royal Naval Engineering College in Plymouth, England where he completed his post-graduate studies in 1988. He served with the Canadian Navy as an Engineering officer retiring in 1994 after serving as Deputy Engineering officer in HMCS Huron in the 1991 Gulf War where he was decorated with the Gulf Kuwait Medal.

In 1994 Mr. Hill co-founded Hill, Murray & Associates, a design-build firm specializing in the construction and operation of water reclamation facilities in British Columbia and the Canadian Arctic. In 2000, Mr. Hill co-founded Algonquin Water Resources of America, a division of the Algonquin Power Income Fund. In his role of Director of Operations for AWRA, he led the acquisition team, acquiring 6 utilities in 3 years and amassing 37,000 customers in Arizona and Texas. In 2003, Mr. Hill co-founded Global Water Resources, a company established to acquire regulated utilities in the Southwestern United States. As President and CEO of Global Water, Mr. Hill is responsible for acquisition activities and the overall operations of Global Water Resources. Mr. Hill is a registered Professional Engineer and has been a resident of Arizona for 3 years.

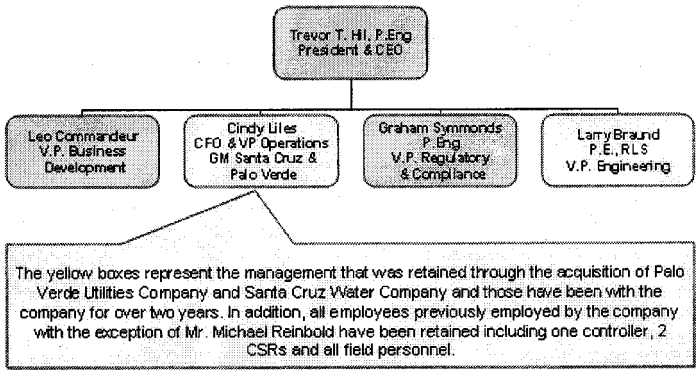
The Executive Management Team

Leo Commandeur
VP Business Development

Raised in Nelson, British Columbia, Mr. Commandeur attended Selkirk College where he studied accounting and business. Mr. Commandeur then further studied accounting through the society of management accountants or CMA Association. Mr. Commandeur spent several years in public accounting practice then branched out into the private sector.

In 1991, Mr. Commandeur co-founded Visionary Solution Corporation, an information technology company with offices in Seattle, Vancouver, Calgary, and Victoria. As the CFO and Director of the company. Mr. Commandeur led the growth and strategic direction of the company. During 1996, the company was taken public on a Canadian Stock Exchange and eventually sold in 1998 to a Norwegian Public Company. In 2000, Mr. Commandeur co-founded Algonquin Water Resources of America, a division of the Algonquin Power Income Fund. In his role of Director of Business Development for AWRA, he was a member of the acquisition team. In 2003, Mr. Commandeur co-founded Global Water Resources and as V.P. Business Development of Global Water, Mr. Commandeur is responsible for acquisitions. He has been a resident of Arizona for 3 years.

Executive Management Team



Graham Symmonds, P.Eng
VP Regulatory & Compliance

Mr. Symmonds was born in Uk and graduated from the University of Toronto in 1985 with a Bachelor of Applied Science degree in Mechanical Engineering. In 1986, Mr. Symmonds was commissioned as an officer in the Canadian Navy and spent nine years employed in a variety of operational and support units, and concluded his post-graduate education at the Royal Naval Engineering College in Plymouth, England.

In 1995, Mr. Symmonds joined Hill, Murray & Associates as Director of Operations and developed the formal design control practices for membrane bioreactor water reclamation facilities. Mr. Symmonds subsequently implemented the mechanisms required to measure the performance of the plants and implemented Design Validation trials agenda for each system.

In 2001, Mr. Symmonds joined Algonquin Water Resources of America, where, after a brief stint as the staff engineer, was promoted to Utility Manager for all of AWRA's utilities in Arizona and Texas, responsible for all business, technical and regulatory operations. In 2003, Mr. Symmonds joined the Global Water team as the VP Regulatory and Compliance.

Cindy Liles, CPA
CFO & VP Operations

Ms. Liles was raised in Mississippi and graduated from Delta State University with a bachelors degree in accounting. Ms. Liles is a certified public accountant (CPA) and was employed by Holiday Inns Worldwide, headquartered in Memphis, Tennessee. Ms. Liles was asked to join the team assigned to structure the sale of Holiday Inns balance sheet to Bass, PLC in 1990 while brands Embassy Suites, Homewood Suites, Hampton Inns and Harrahs Casinos were spun off to form Promus Corporation.

Ms. Liles, as Manager of Accounting, hired the staff for the Bass, PLC offices in Atlanta, Georgia and provided consulting to Promus Corporation until 1994. For the next six years, Ms. Liles was the Senior Vice President and Chief Accounting Officer for Mid-America Apartment Communities, an apartment real estate investment trust (REIT) headquartered in Memphis, TN trading on the New York Stock Exchange as MAA. Ms. Liles relocated to Phoenix, Arizona in 2001 to partner with the development company who formed Santa Cruz Water Company and Palo Verde Utilities Company.

Ms. Liles was CFO and General Manager of these companies which were formed to provide water and wastewater services to the fast growing area near Maricopa, AZ. Upon the acquisition by Global Water in 2004, Ms. Liles joined the team as CFO and VP Operations.

Larry Braund, PE, RLS
VP Engineering

Mr. Braund was raised in Michigan and served for 4 years in the United States Air Force. He graduated from the University of North Dakota with a Bachelor of Science in Civil Engineering.

In 1975, he co-founded Johnson Braund Design Group in Seattle, Washington and served as President of the firm for 10 years. The firm specialized in hotels, multi-family projects, and land development. The firm was sold to employees in 1985.

In 1985, he founded and became President of LSB International, Inc., an Arizona Corporation. LSB International (LSB) is a consulting engineering firm which specializes in providing it's clients with land development expertise in the areas of master land planning, entitlements and zoning, engineering design of streets and infrastructure, and construction management.

In 1996, Mr. Braund assisted in the formation Santa Cruz Water Company and Palo Verde Utilities Company to serve Rancho El Dorado and the surrounding, adjacent developments, in and near Maricopa, AZ. Mr. Braund served as Vice President of both companies. Mr. Braund now holds the position of VP Engineering for Global Water.

Mr. Braund holds registrations as a Professional Engineer in Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, Oregon, Texas, and Washington. In some of the States he also holds registrations as a Registered Land Surveyor.

EXECUTIVE RESUME

William S. Levine

CORPORATE ROLE

Mr. Levine is a Director of Global Water Resources, LLC and Chairman of the Board.

POSITION IN THE COMPANY

Mr. Levine is the major equity investor in Global Water and is a Director. His significant business experience, access to capital, and substantial commercial land development experience provide an ideal base from which to assist in directing the financial affairs of the Company. Mr. Levine provides guidance and steering to the strategic goals of Global Water to ensure Global Water meets its corporate objectives.

PERSONAL INFORMATION

Mr. Levine was born in 1932 and has lived with his family in the Phoenix area since 1960.

EDUCATION

- Attended University of Pennsylvania
- Attended New York University
- Graduated Brooklyn Law School LLB Degree
- Attended Graduate School of Law Taxation, New York University

PROFESSIONAL SUMMARY

Mr. Levine is the founder, director and officer of several successful local and national-level companies, and is involved in master planning, office, industrial, and commercial projects. He is currently involved in developing a number of grocery-anchored shopping centers in the Phoenix metropolitan area. In addition, Mr. Levine has experience in the following areas:

Restaurant Ownership and Management: Mr. Levine was involved in the restaurant business in phoenix from 1965 until the early 1990's, including locations like Brookshire's Coffee Shops, McDonald's North Bank Steakhouses, Pistol Pete's Pizza, Church's Fried Chicken.

Billboards and Advertising: Mr. Levine founded a billboard company in 1977 called Outdoor Systems, and outdoor advertising/billboard firm. The company grew through acquisitions to become the largest outdoor advertising company in the nation. The company sold public debt in early 1990's; sold public equity in 1996; and was sold in December of 1999. It is now know as Viacom Outdoor.

Real Estate Development: Mr. Levine has been involved in real estate since moving to Phoenix; presently owns real estate primarily in Arizona, California, and Nevada and to a lesser degree in several other states. The real estate consists primarily of shopping centers, including a 50% interest in Desert Ridge Shopping Center; self-storage facilities, office buildings and land.

CHARITIES

- President of the William S. Levine and Ina Levine Charitable Foundation.

EXECUTIVE RESUME

Dan Cracchiolo

CORPORATE ROLE

Mr. Cracchiolo is a Director of Global Water Resources, LLC.

POSITION IN THE COMPANY

Mr. Cracchiolo is a Member of the Board of Directors in Global Water, and is responsible for ensuring that corporate decisions are made that are consistent with the strategic goals of Global Water. Mr. Cracchiolo has direct Utility experience, having owned and operated a regulated water utility in the state of Arizona for over 50 years.

PERSONAL INFORMATION

Mr. Cracchilolo was born in 1929 and has lived in Arizona since 1940.

EDUCATION

- University of Arizona, graduating with a Juris Doctorate degree in 1952

PROFESSIONAL SUMMARY

In 1952, Mr. Cracchiolo was law clerk to the Honorable Evo DeConcini, a justice of the Arizona Supreme Court. Thereafter, he spent three years as Deputy County Attorney of Maricopa County. In January of 1954, he was called to serve in the United States Air Force with the rank of First Lieutenant and served honorably until discharged in late 1956.

Mr. Cracchiolo, together with his law partner Frank Haze Burch, founded the law firm that bears their name in January of 1970, and is located in the central Phoenix corridor. He serves as Chairman of his law firm, Burch & Cracchiolo, P.A.

He was President of Bella Vista Water Company in Sierra Vista, Arizona and supervised the affairs of that firm since 1988, until sold to Algonquin Water in 2002. He has been the General Manager of Bella Vista Ranches, a complex of real estate holdings in Sierra Vista, Arizona, comprising of approximately 4,200 acres, together with industrial and commercial buildings which are leased to small business enterprises and large business corporations throughout the State of Arizona and nationally. He has been involved in real estate development and financing for approximately 40 years and has extensive experience in that area.

PROFESSIONAL AFFILIATIONS

State Bar of Arizona
International Academy of Trial Lawyers
American Judicature Society
International Association of Defense Counsel

AWARDS AND HONORS

Mr. Cracchiolo appears under two separate categories in Best Lawyers in America. He is also the recipient of several awards such as the Center City Star Award (1999), the Italian-American Man of the Year (2002) and a "Special Award of Honor" by the State Bar of Arizona in recognition of more than 50 years of service in the legal profession.

CHARITIES

Cracchiolo has been heavily involved in the community and charitable affairs:

- Past President of COMPAS (Combined Metropolitan Phoenix Arts and Sciences), a fund-raising group established to support the region's five major cultural organizations: the Phoenix Art Museum, the Heard Museum, the Phoenix Zoo, the Desert Botanical Garden and the Phoenix Symphony.
- Manager, The Steele Foundation since 1985. The $80 Million Steele Foundation is a charitable foundation donating approximately $3.5 million per year to various community activities.

EXECUTIVE RESUME

Trevor Hill, P.Eng.

CORPORATE ROLE

Mr. Hill is the President and CEO of Global Water Resources, LLC.

POSITION IN THE COMPANY

Mr. Hill directs the overall operations of all Utilities in the Global Water portfolio. He is responsible for the corporate, regulatory, technical and financial operations of the Utilities, and reports directly to the Board of Directors. In addition, Mr. Hill is responsible for the acquisition of new utilities, including the financial, technical and regulatory due diligence associated with those acquisitions. It is under his direction that recommendations for acquisition are made to the Board. Mr. Hill has substantial regulated utility operations experience, having concurrently run seven water and wastewater utilities in the states of Arizona and Texas.

PERSONAL INFORMATION

Mr. Hill was born in 1965 in British Columbia, Canada, and has lived in Arizona since 2001.

EDUCATION

- 1987 Royal Military College of Canada, Bachelor of Science (Mechanical Engineering)
- 1988 Royal Naval engineering College, Plymouth, UK, post-graduate Marine Engineering diploma

PROFESSIONAL SUMMARY

Raised in Vancouver, British Columbia, Mr. Hill graduated from Royal Roads Military College with a bachelor of Engineering in Mechanical Engineering in 1987. Mr. Hill attended the Royal Naval Engineering College in Plymouth England where he completed his post-graduate studies in 1988. He served with Canadian Navy as an Engineering officer retiring in 1994 after serving as Deputy Engineering officer in HMCS Huron in the Gulf War 1991. Following this operational experience, Mr. Hill was the Naval Engineering Unit Pacific Marine Systems Engineering Officer, responsible for the technical readiness of Canada's west coast fleet.

In 1994 Mr. Hill co-founded Hill, Murray & Associates, a design-build firm specializing in the construction and operation of water reclamation facilities in British Columbia and the Canadian arctic. In 2000, Mr. Hill co-founded Algonquin Water Resources of America, a division of the Algonquin Power Income Fund. In his role of Director of Operations for AWRA, he led the acquisition team, acquiring 6 utilities in 3 years and amassing 37,000 customers in Arizona and Texas. In 2003, Mr. Hill co-founded Global Water Resources, a company established to acquire regulated utilities in the Southwestern states. As President & CEO of Global Water, Mr. Hill is responsible for acquisition activities and the overall corporate operations of Global Water Resources. Mr. Hill is a registered Professional Engineer.

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers and Geoscientists of British Columbia

AWARDS AND HONORS

- 1999 - Top 40 Under 40 Award, Business in Vancouver — January 1999
- 1998 - ZENON Merit Award for Design — October 1998
- 1998 - Finalist, Entrepreneur of the Year Award, Pacific Region, Canada — October 1998
- 1997 - BC Ministry of Environment, Lands and Parks, Minister's Environmental Award, Business/Industry Category
- 1997 - Nominated, Entrepreneur of the Year Award, Pacific Region, Canada
- 1996 - ZENON Merit Award for Design
- 1991 – Awarded Gulf Kuwait Medal (Gulf War 1991)

EXECUTIVE RESUME

Leo Commandeur

CORPORATE ROLE

Mr. Commandeur is the Secretary and Treasurer of Global Water Resources, LLC.

POSITION IN THE COMPANY

Mr. Commandeur acts as the Manager of Business Development for Global Water. Mr. Commandeur is responsible for the execution of the company's strategic business plan, including the aggregation of small to medium sized private water and wastewater utilities in the southwestern United States. In this capacity, Mr. Commandeur provides detailed analyses of financial performance of regulated utilities, assesses growth potential and ensures that utilities meet the internal metrics established by Global Water for acquisition. Mr. Commandeur also leads the deployment of Information Systems, providing vision and guidance in the development of business, reporting and back-office solutions.

PERSONAL INFORMATION

Mr. Commandeur was born in 1962 in British Columbia, Canada, and has lived in Arizona since 2003.

EDUCATION

- 1980-83 Pre-commerce program Selkirk College, Castlegar, British Columbia
- 1991-97 Certified Management Accountants Society of British Columbia
- 1993 IBM Canada – Joint Application Design

PROFESSIONAL SUMMARY

Starting in 1985, Mr. Commandeur worked through a variety of staff accounting positions, and in 1989 joined Buffalo Head Forest Products, Ltd. as a senior accountant. In this capacity, Mr. Commandeur assisted the controller in setting up a computerized accounting and A/P systems for the company. In 1990, Mr. Commandeur was a senior accountant in BHP Island Copper, in the heavily regulated mining industry, where he established the operational protocols for day-to-day accounting services, and outside agency financial reporting. In 1992, Mr. Commandeur joined Visionary Solutions Corporation as Chief Financial Officer. providing strategic and operational direction to the company's finance and accounting departments. Here, he established financial objectives and operating policies and procedures to ensure the attainment of corporate objectives and evaluated results within business units to determine if financial objectives were being met. Mr. Commandeur was instrumental in taking Visionary Solutions Corporation public in Canada.

In 1999, Mr. Commandeur worked with Trevor Hill to develop a business model to own and operate water and water reclamation facilities in areas where water had real, or potential value. Ultimately, this business model developed into Algonquin Water Resources of America (AWRA), within which Mr. Commandeur assisted with the acquisition of over $84,000,000 (CDN) of water and wastewater assets in Arizona and Texas. During this time Mr. Commandeur also assisted in establishment of an office in Carefree Arizona, and deployed new financial information systems to support the day to day operations of the utilities.

PROFESSIONAL AFFILIATIONS

Member, AWWA

EXECUTIVE RESUME

Graham Symmonds, P.Eng.

CORPORATE ROLE

Mr. Symmonds is the Vice President, Compliance of Global Water Resources, LLC.

POSITION IN THE COMPANY

Mr. Symmonds is responsible for the operational and regulatory compliance activities of the Global Water utilities, including regulatory reporting, process monitoring and operations. Mr. Symmonds is also responsible for developing Global Water's Codes of Practice for commercial and industrial customers, implementing an integrated command and control system for all the utilities. Mr. Symmonds performs technical due diligence for all utilities under consideration for acquisition, including process reviews and design reviews of existing infrastructure, and is ultimately responsible for the integration of new utilities with Global Water's systems.

PERSONAL INFORMATION

Mr. Symmonds was born in 1962 in Middlesbrough, UK, and has lived in Arizona since 2001.

EDUCATION

- 1985 University of Toronto, Bachelor of Applied Science (Mechanical Engineering)
- 1988 Royal Naval Engineering College, Plymouth, UK, post-graduate Marine Engineering diploma

PROFESSIONAL SUMMARY

Raised in Ontario, Canada, Mr. Symmonds graduated from University of Toronto with a Bachelors of Applied Science in Mechanical Engineering. In 1986, he joined the Canadian Navy and was posted to a variety of training and operational units, including post-graduate studies at the Royal Naval Engineering College in Plymouth, serving as Deputy Engineering Officer for HMCS ANNAPOLIS from 1989 to 1991, and finally being selected as the Equipment Health Monitoring Officer for the Naval Engineering Unit Pacific, where he was responsible for condition-based maintenance assessments for all equipment in west coast ships, as well as performing pre- and post-refit trials.

In 1995, Mr. Symmonds joined Hill, Murray & Associates as a partner and Director of Operations. During his time at Hill-Murray, Mr. Symmonds became a leading expert in the application, deployment and operation of membrane-bioreactor technologies. Mr. Symmonds developed the integrated control suite known as enviroSMART (Systems Monitoring and Remote Telemetry) which allowed for unmanned operations of water reclamation facilities, and second and third order condition assessments.

In 2001, Mr. Symmonds joined Algonquin Water Resources of America as Director of Operations, responsible for the day-to-day operation of AWRA's utilities, including regulatory filings, growth management, plant operations and capital project planning and execution.

Mr. Symmonds is a registered Professional Engineer.

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers and Geoscientists of British Columbia

EXECUTIVE RESUME

Cindy Liles, CPA

CORPORATE ROLE

Ms. Liles is the Chief Financial Officer and Vice President, Operations of Global Water Resources, LLC.

POSITION IN THE COMPANY

Ms. Liles is responsible for the financial performance and detailed financial reporting and auditing of Global Water utilities. In addition, she is responsible for maximizing the growth potential of the various utility service areas. She works hand in hand with the developers to develop infrastructure servicing solutions, as well as preparing and submitting the regulatory filings required for service area expansion (CC&N Extensions, Assured Water Supply Designations, 208 Plan Revisions etc). Ms. Liles actively seeks land developments that will complement the company's long range expansion plans.

PERSONAL INFORMATION

Ms. Liles is 41 years of age and moved from Memphis, Tennessee to Phoenix in August of 2001 to augment her career in operating real estate by learning the development arena coupled with an opportunity to invest in a private developer-owned water and wastewater utility.

EDUCATION

- BBA in Accounting, Delta State University, Cleveland, Mississippi
- Certified Public Accountant

PROFESSIONAL SUMMARY

Ms. Liles began her career with a wealth of experience in the general accounting and finance fields, including positions at Grenada Sunburst System Corporation in 1986-87, and Holiday Inn from 1987 through 1992. During this time, Ms. Liles directed the accounting and reporting of financial results for 70 hotels, 43 management contracts and 14 joint ventures. As a special project, Ms. Liles was selected for the team to create the balance sheet for the sale of Holiday Inn hotels to Bass, PLC in February 1990.

From 1992 to 1994, Ms. Liles acted as the Controller for Imaginative Operations, Inc until she was asked to join Mid-America Apartment Communities, Inc. Through the year 2000, Ms Liles was the Senior Vice President and Chief Accounting Officer for this firm. Ms. Liles was responsible for establishing the quarterly and annual financial reporting to the Security and Exchange Commission. During Ms. Liles tenure, the company's assets increased from $100 million to $1.4 billion and Ms. Liles was the point person to acquire funding from a variety of financing mechanisms, including common and preferred stock issuances, debt leverage, tax-exempt bonding vehicles etc.

In 2001, Ms. Liles joined Phoenix Capital Partners (PCP) and Phoenix Utility Management (PUM) as CFO and General Manager. PCP and PUM owned and managed private water and wastewater companies, Santa Cruz Water Company, LLC and Palo Verde Utilities Company, LLC. Both companies provide services to the

fast growing area of Maricopa, Arizona. As of the date of sale of the owners' interest in the utilities to Global Water Resources in February 2004, the two utilities had installed plant and infrastructure in excess of $21 million serving 4,500 customers in a service area established for 45,000.

As General Manager of the utility companies, Ms. Liles was instrumental in ensuring developers utility service expectations were met timely. Ms. Liles also was the key contact for various county and regulatory agencies including Pinal County, Arizona Corporation Commission, Pinal Active Management Association and Arizona Department of Water Resources.

As Chief Financial Officer, Ms. Liles implemented controls and procedures within the companies to process customer service requests for installation of meters and connection of service. Serving a successful development that sold 650 homes in the first 150 days, Ms. Liles had to secure that revenues and expenses were captured correctly while ensuring customer expectations were met.

PROFESSIONAL AFFILIATIONS

Certified Public Accountant

EXECUTIVE RESUME

Larry Braund, P.E.

CORPORATE ROLE

Mr. Braund is the Vice President, Engineering of Global Water Resources, LLC.

POSITION IN THE COMPANY

Mr. Braund is responsible for the deployment of infrastructure in order to supply service to all of Global Water's customers. He plans and directs all utility-owned work, and reviews and provides detailed guidance to all developers wishing to obtain service. He maintains the water and wastewater master plans, reviews service area expansions and provides detailed assessments of potential utility synergies and conflicts. Mr. Braund provides field services for installations, and ensures that all infrastructure installed meets Global Water's standards.

PERSONAL INFORMATION

Mr. Braund was raised in Michigan, and has lived in Arizona since 1985.

EDUCATION

- 1968 University of North Dakota, Bachelor of Civil Engineering

PROFESSIONAL SUMMARY

Mr. Braund was raised in Michigan, and served four years in the United States Air Force attached to the Air Installations Office. On being honorably discharged, he obtained his civil engineering degree, and earned his first of eleven professional engineering designations in Washington state. Mr. Braund is registered in Washington, Oregon, California, Arizona, Nevada, Colorado, Montana, Alaska, Idaho, Hawaii and Texas.

From 1968 to 1975, Mr. Braund was employed by a variety of engineering firms in the Seattle-Tacoma area. In 1975, Mr. Braund founded LSB International as a civil engineering firm specializing in water, wastewater, grading, drainage and land development services. In 1977, Mr. Braund formed Johnson Braund Design Group (JBDG). He sold his ownership in that firm in 1985 and moved to the Phoenix area. Here, Mr. Braund specialized in land development services, including work in the fort McDowell Indian Community, Laughlin airport and a 1000 acre master planned community in the Sierra Nevada mountains.

In 1995, Mr. Braund joined Coe & Van Loo in Phoenix as a Vice President. In 1997, Mr. Braund became the project engineer for Rancho El Dorado in 1997, and developed all the necessary infrastructure for that community from the ground up. He assisted in the establishment of Palo Verde Utilities Company and Santa Cruz Water Company, and was the principal engineer for the design and construction of the water and sewer systems in Rancho El Dorado. Mr. Braund joined Global Water in 2004.

PROFESSIONAL AFFILIATIONS

Numerous Professional Engineering affiliations
Registered Land Surveyor

APPENDIX B

HILL-MURRAY BACKGROUND

Hill-Murray Background

Background

Hill-Murray was a design-build company founded in 1992 on the premise that reclaimed water had both an intrinsic value and a future potential that was untapped, and largely ignored by the engineering community at large. The company specialized in deploying emerging technologies into water reclamation solutions, tailor suited to an array of complex wastewater treatment problems.

The partners of Hill-Murray, engineers with direct experiences with the value of water from combat experience in the first Gulf War, set to work on developing and bundling technologies while drafting enabling legislation to allow for water-quality-based uses, and the exploitation of various "grades" of water. Recognizing that reclaimed water is the only water source that is actually increasing in availability, Hill-Murray decided to set the standard for reclaimed water quality.

Hill-Murray systems have been employed in numerous areas: the arctic; closed-loop building systems; and in areas where high quality effluent was of paramount importance. Indeed, Hill-Murray systems alone have provided the impetus for development of areas that would have otherwise been impossible to develop.

Awards & Accomplishments

Hill-Murray received numerous awards for its environmental work and efforts in the water reclamation field, including the ***"BC Ministry of the Environment Minister's Award"*** **(SEE TAB A)**for work performed at Mt. Washington and the ***"Zenon Partnership Award"*** for excellence in design of facilities using Zenon technology. Along the way, principals in Hill-Murray were recognized by entrepreneurial and professional organizations. Trevor Hill was nominated for ***"Entrepreneur of the Year"*** in 1997 **(SEE TAB B)** and was a finalist for ***"Entrepreneur of the Year"*** in 1998 **(SEE TAB C)**. Additionally, Mr. Hill won the ***"Top 40 Under 40 Award"*** for accomplishments made by executives under the age of forty **(SEE TAB D)**.

Hill-Murray developed an international expertise in membrane bioreactor (MBR) technology, and the supporting regulatory environment. Hill-Murray was instrumental in the Province of British Columbia's water reclamation legislation, and drafted the BC Plumbing Code requirements for dual water mains in commercial and residential buildings. Hill-Murray was also active in developing nations through the Canadian International Development Agency (CIDA) where Hill-Murray was requested to provide regulatory assistance to the government of Barbados, and septage treatment expertise to Costa Rica.

Hill-Murray's corporate resume includes:

1. ***Mt. Washington Ski Resort*** 0.5 MGD Membrane Bioreactor **(SEE TAB E)**

The Mt. Washington Ski Resort is an area of rapid growth. The resort, located on Vancouver Island also had a strong mandate for environmental stewardship. As their existing treatment facility was overloaded, the Resort requested proposals to provide a new facility. The resort had a number of difficult criteria that needed to be solved: an extremely low residual phosphorus requirement (<0.5 mg/L); a requirement to be able to operate unmanned; a requirement to be located in an unserviceable location for the duration of the ski season; and the requirement to be able to treat the extremely variable flow patter (very high flows on the ski-season weekends, lower flows during the week, sustained high flows over Christmas, New Years, Easter and March break, and almost no flow during the summer).

Hill-Murray developed a fixed cost solution for the Resort, which included the installation of a membrane-bioreactor treatment system with an advanced, real-time P control via an on-line phosphorus monitor and sodium aluminate injection. In addition, the original discharge permit called for a limit on flows to Piggott Creek in order to maintain a 20:1 dilution rate. In order to accomplish this, the plant control system accessed daily data from the Environment Canada meter station via a TCP/IP link to Vancouver. The control algorithm averaged the previous seven days flow data and subtracted two standard deviations, in order to predict the next day's creek flow. This was used as an input to the control system, and flows to the creek were isolated when they approached to 20:1 dilution ratio. Treated water was then diverted to an aerated lined lagoon, and discharged over the next few days or weeks as the flows in Piggott Creek allowed.

Mt. Washington also was fitted with the ability to discharge treated water back to the resort for use as urinal and toilet flush water. This was implemented as the resort installed the reclaimed water system over the next few years. By designing the system with a "just-in-time" infrastructure approach, Mt. Washington was able to minimize the initial cost, and was allowed the flexibility to tailor flow capacity to the actual load.

After several years of operating data was accumulated showing the plant was consistently meeting the phosphorus limit, the discharge permit was amended to eliminate the 20:1 dilution ration requirement.

It should also be noted that this plant must, and does, operate totally independently throughout the ski season. All waste activated sludge is managed on site, stand-by emergency power is provided, and sufficient redundancy and control strategies are implemented to allow the plant to self-recover from a degraded condition. Mt. Washington treated water is of such a high, consistent quality, that it is required by the regulatory agencies discharge directly into a fish bearing stream to improve the viability of the juvenile salmon population in the summer.

This plant became the model for the Iqaluit facility, and continues to operate and win environmental awards for the Resort.

2. ***Ganges, Salt Spring Island*** 0.3 MGD Membrane Bioreactor **(SEE TAB F)**

The Ganges PCC is located on Salt Spring Island, in the Gulf Islands of British Columbia. Ganges PCC is operated by the Capital regional District. Prior to the municipal upgrade installed by Hill-Murray operated an RBC treatment process in the heart of the Ganges tourist-sensitive marina district. As such, there were grave concerns over odor and noise, as well as effluent quality. The RBC was not only was the plant at capacity, but there was little or no room for expansion of a standard 24-hour HRT treatment process.

In order to maximize the use of space, and to improve the effluent quality and eliminate any process odors, CRD chose the Hill-Murray designed municipal upgrade. This allowed for a significantly increased throughput, due to the higher MLSS inventory, and ensured complete nitrification, which was an issue at times with the RBC (Ganges was subjected to a widely varying flow based on the tourist loads).

Again, the ease of operation, and suitability for total automation made the plant a success. This plant has subsequently been upgraded a second time with Zenon membranes to increase the flow.

3. ***Burgoyne Bay Septage Treatment Facility*** **(SEE TAB G)**

Salt Spring Island has a legislated obligation to treat all wastes generated on the Island physically on the island. As many of the residences employ septic tanks for treatment, there is a large volume of septage generated. The normal practice of dumping septage into a wastewater treatment plant is not prudent, as 1 gallon of septage can represent as much as a 100 gallons of raw wastewater. In an area where the treatment plants are small, this impact is very significant. Accordingly, the CRD was looking for a means to treat this waste stream on-site, to a high quality suitable for ground disposal.

Hill-Murray offered a Design-Build-Operate solution, where HM supplied all the equipment necessary for dewatering, pressate treatment and disposal. By employing a Fournier rotary press, combined with a high rate MBR process, HM was able to deliver biosolids at 20% dryness and a treated water of < 10 mg/L BOD and TSS. This allowed the water to be disposed of in a tile field, even though the site had groundwater at less than 10 feet form the surface.

This was the first DBO project ever considered by the CRD, and in fact it is only in 2003 that the CRD chose to take over operations of the facility.

4. ***Huband School*** **(SEE TAB H)**

Huband School was the first closed loop school in Canada. Wastewater is collected from toilets and urinals, treated and returned for use as flush water. The site provided by the developers to the School board would have been unsuitable for building without this system: the groundwater table was too high and the site too small to support a standard septic tank/tile field system.

Hill-Murray obtained the necessary MoELP permits by going through the rigorous Innovative Technologies process with the Provincial government. This program required intensive testing and regulatory submittals.

This plant treats wastewater to beyond A+ standards and used the treated water for toilet and urinal flushing, resulting in a water savings of > 85%. The plant runs in a totally automated state, and only requires sludge hauling twice per year, allowing those activities to be scheduled when the school is shut down for the summer or winter breaks.

5. ***Sooke Harbour House/Kingfisher Resorts*** **(SEE TAB I)**

Sooke Harbour house and Kingfisher Oceanside Inn are two of the most exclusive resorts in BC, which required both a means of rectifying failed treatment systems, and a means to reduce water consumption. Hill-Murray's experience in permitting and compact treatment plant design, coupled with HM's ability to offer guaranteed effluent quality, operational support services, and standard design systems ensured the success of these projects.

Both resorts were undergoing expansion processes, and so were interested in the growth potential offered by the "just-in-time" infrastructure approach HM systems offered. In addition, recycled water cut water use, automated systems meant ease of use, and guaranteed effluent quality meant full-time regulatory compliance.

6. ***Lake O'Hara Resort***

Lake O'Hara Resort is a lodge facility located in Yoho National Park. This part of the Park is not accessible to normal traffic – all visitors must register prior to entering, and are required to be bused the

10 miles up the mountain to the resort. As a result, the resort was interested in the automated process, the ease of operations and the ability to guarantee effluent quality. In this case, treated water was discharge through shallow sub-surface disposal, and as such needed to be of very high quality. The MBR solutions provided by Hill-Murray met all the objectives.

7. ***LSS CAM Main/LSS FOX Main*** **(SEE TAB J)**

LSS CAM Main and LSS FOX Main are manned radar stations in the arctic. CAM Main is located outside Cambridge Bay, while FOX Main is located at Hall Beach. As a result of Hill-Murray's work in evaluating membrane treatment processes for BC Ferries, the North Warning System of the federal government contacted Hill-Murray to explore options for these facilities. Prior to the systems being installed, raw wastewater was discharged directly to the tundra.

Hill-Murray undertook to design, build, and install two containerized MBR treatment systems, as well as the associated reclaimed water system throughout the camps. HM had to marshall all equipment, tools, supplies, and dispatch them to the arctic via barge services. On arrival, HM oversaw the installation, and commissioned the plants.

These systems continue to operate today, and provide excellent treated water. Water consumption, an expensive and logistically difficult supply issue, has been reduced to less than 65% of it original rate.

8. ***Powell River*** **(SEE TAB K)**

Powell River contacted HM early in 1997 to review options associated with upgrading the infrastructure at the Westview wastewater treatment plant. The plant was built on the foundation of an existing facility, and based on the proven process designs of previous plants.

Hill-Murray was contracted in 1997 to provide a 931,000 GPD (Average Annual Flow) membrane bioreactor for the City of Powell River in British Columbia. At the time of commissioning, this was the largest membrane bioreactor in the world. As part of the project, an existing facility was decommissioned, converted and incorporated into the enclosed design. The resulting "boat-house" design has received numerous accolades from as far away as Georgia. A very rapid deployment schedule was required in order that the City could have access to government grant monies for wastewater infrastructure upgrades. In 1998, the plant was commissioned. During the commissioning, the plant was subjected to flows well in excess of the design, contracted flow. To its detriment, Hill-Murray and its sub-contractors spent several hundreds of thousands of dollars fixing what was an infiltration and inflow (I&I) problem in the City's collection system. Twenty months later the plant was finally accepted by the City (October 2000). During the twenty month period, Hill-Murray staff operated the plant at no cost to the City. The I&I problems remain at Powell River, and the plant sees an average daily flow of more than 1.3 MGD – 50% above the design flow, and continues to meet the permitted requirements. While the formal acceptance of the plant was delayed, and resulted in some unfortunate newspaper articles, Hill-Murray finally received a portion of the additional costs spent on the commissioning from the City and a full and complete settlement of the contract.

9. ***Iqaluit*** **(SEE TAB L)**

Hill-Murray was contracted to provide design services to the City of Iqaluit for a new water reclamation facility in Canada's high arctic. This design, functionally identical to the Mt Washington design, allowed for a small foot-print, expandable, high quality treatment plant to be constructed in a most inhospitable climate.

On completion of the design, Hill-Murray was requested to act in an Engineer-Procure-Manage capacity, whereby the equipment was ordered based on the design and the construction was contracted to a variety of local and national contractors. All contractors were required to bond directly to the City of Iqaluit. During the construction process, the tankage (which used a new forming technique known as Octaform) failed the hydrostatic test. The bonds established to protect the municipality from this contractor were subsequently called to execute repair work. As the construction season in the Arctic is only a few short months long, the window of opportunity to commission the plant during the year was lost, even though the necessary repairs were eventually performed. Zenon had been contracted to commission the facilities the following spring, but due to a change in leadership within the town council the plant was not commissioned and to this day remains uncommissioned. The plant is complete in all respects and simply awaits commissioning. Hill-Murray completed its scope of work and continued to provide assistance to the City in evaluating repair options, and providing the necessary support to ensure bonding agencies met their obligations to the City.

In 2000 Hill-Murray was wound down by the partners to transition from a design-build engineering firm to ownership and management of utilities. Hill-Murray had completed several innovative applications of membrane technologies, including fully recycling office buildings (**SEE TAB M**), and reclaimed water distribution for master planned communities (**SEE TAB N**) – both firsts in Canada. The goal of management was to leverage its experience in water reclamation and re-use in areas that were experiencing high growth rates and where reclaimed water would be a significant contributor in the future. The resulting organization was Algonquin Water Resources of America (AWRA).

Algonquin Water Resources of America (AWRA)

AWRA was formed to own and operate water and wastewater infrastructure in the Southwestern United States. From its formation in 2001, AWRA has actively acquired infrastructure in Arizona and Texas. Funded from a Canadian open-ended income trust fund with a desire to deploy capital for a stable return, AWRA provided a consolidation mechanism whereby utilities could be modernized, and updated to both expand their customer base and improve their efficiency with capital from Algonquin.

AWRA acquired and now owns Black Mountain Sewer Company, Gold Canyon Sewer Company, Litchfield Park Services Company, Bella Vista Water, Tall Timbers Utilities (Texas) and Woodmark Utilities (Texas). AWRA is presently the third largest supplier of water and wastewater services in the State of Arizona.

Algonquin Water Resources of America understood the difficulties faced by many small service providers. As most of the private utilities are strapped for capital dollars, much of the infrastructure that is available is lacking. AWRA brought a fresh vision, and access to capital for its utilities.

A case in point is Gold Canyon Sewer Company. When AWRA acquired GCSC, it was an eyesore, was having difficulty in water disposition, and produced offensive odors. To its credit, AWRA understood these issues, and developed solutions based on real technical criteria to deal with them. AWRA was ready to upgrade the facility when the process was usurped by CAAG. In the absence of the political interference, the plant would have completed its upgrade in December 2003.

Gold Canyon Sewer Company (GCSC)

Gold Canyon was purchased by Algonquin Water Resources of America in July 2001. At the time, the utility was experiencing tremendous growth combined with severe mismanagement by the contract managers, Faciligroup. The plant layout and design left much to be desired, and the planning to meet the anticipated flow was short sighted at best, non-existent at worst.

There were many issues with the plant, but two were paramount in the evaluation: odor control and treated water disposition. The plant is not ideally sited, and had no effective odor control. As a result, normal operations (sludge decanting) could result in significant unpleasant odors being released to the atmosphere. Recognizing this, what was termed "Phase III" was developed to allow for the expansion of the plant to 1.9 MGD, and included covered tankage, wet and dry odor scrubbers and increased effluent quality. It was felt that temporary odor measures would not be effective (as indeed they have proven to be) and rather than investing capital to mask the issue, capital could be far better employed in permanently fixing the problem in Phase III. AWRA made numerous attempts to improve the odor situation for the residents of Gold Canyon, while at the same time ensuring the integrity of the Phase III design. GCSC and AWRA worked very closely with all regulatory agencies to address this problem (ADEQ, ACC, Pinal County).

From a water disposition standpoint, GCSC had always been operated in a consumptive re-use mode – all water generated had to be delivered to the two surrounding golf courses. While this may have been appropriate for a 0.1 MGD facility, it is certainly not for a 1.0+ MGD facility. Compounding the problem was the phase difference between water production and water demand – GCSC produces large amounts of water in the winter months, just when the golf courses are cutting down dramatically on irrigation. In order to alleviate this problem, GCSC installed recharge basins and progressed work on an NPDES discharge permit, which would have allowed seasonal discharge to the wash. This "normal" mode of operations was denied the utility in a political move designed to isolate GCSC by Pinal County. By the

summer of 2003, AWRA was in the final stages of approval for the upgrade of the existing water reclamation facility for Gold Canyon. The $5 MM + budget for this project had been approved by the board, was in detailed design and was planned for completion in summer 2004.

Trevor Hill, Leo Commandeur and Graham Symmonds left Algonquin on amicable terms to start Global Water Resources in the fall of 2003. AWRA hired staff to maintain operations and remains committed to the utilities and their compliant operation.

Crockej\PHX\1515130.2

TAB A

Mississippi River Valley Alluvial Aquifer

TAB B

1 9 9 7

ENTREPRENEUR OF THE YEAR

Honouring those individuals whose ingenuity, hard work and innovation have created successful and growing business ventures

This Certificate Of Nomination is presented to

Trevor Hill

Hill, Murray & Associates Inc.

ERNST & YOUNG | Canadian Business | Bank of Montreal | NESBITT BURNS | Canada's National Law Firm McCarthy Tétrault | AIR CANADA

TAB C

ENTREPRENEUR OF THE YEAR

Honouring those individuals whose ingenuity, hard work and innovation have created successful and growing business ventures

This Certificate Of Nomination is presented to

Mr. Trevor Hill

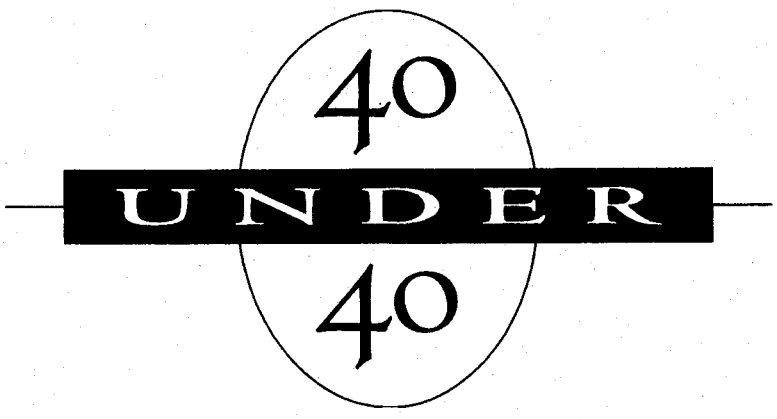
Hill, Murray & Associates Inc.

ENTREPRENEUR OF THE YEAR 1998

ERNST & YOUNG | Canadian Business | Bank of Montreal | NESBITT BURNS | CANADA'S NATIONAL LAW FIRM McCarthy Tétrault | AIR CANADA

TAB D

BIV New Year Achievement Award Winner



Trevor Hill

has been chosen as one of British Columbia's top business achievers under the age of forty

1998

TAB E

HILL
MURRAY
&
ASSOCIATES INC.

SUSTAINABLE SOLUTIONS

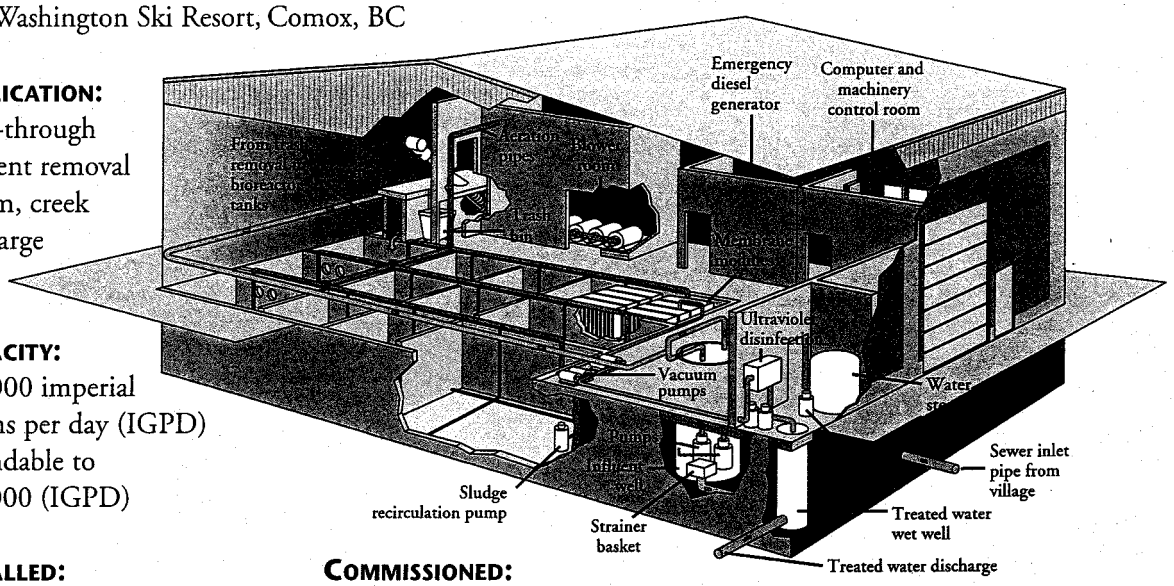
ENVIRONMENTAL
SYSTEMS ENGINEERS

MT. WASHINGTON SKI RESORT

PROJECT:
Mt. Washington Ski Resort, Comox, BC

APPLICATION:
Flow-through nutrient removal system, creek discharge

CAPACITY:
120,000 imperial gallons per day (IGPD) expandable to 500,000 (IGPD)



INSTALLED:
August - November 1996

COMMISSIONED:
November 1996

PROBLEM:
The existing sewage treatment plant for Mt. Washington's 445 chalets and condominiums and other facilities, was operating at capacity. The mountain's effluent discharge was directed into nearby Piggott Creek. The provincial Ministry of Environment required very low nutrient levels in the effluent to ensure that fish populations in the creek were not adversely affected.

The ski resort was planning a major expansion and required a sewage treatment facility that could handle larger volumes while still meeting environmental regulations.

SOLUTION:
Hill, Murray & Associates designed a new wastewater treatment facility housed in a small building a short distance away from the resort area. The building incorporates biological treatment and membrane filtration using Zenon's ZenoGem™ technology, as well as the mechanical and support systems required to operate and maintain a large facility.

The system treats wastewater to near drinking water quality. Nutrient levels are markedly reduced ensuring the treated wastewater easily meets strict Ministry of Environment regulations for fish-bearing streams.

TREATMENT:
Treatment is accomplished using hollow-fibre membranes deployed in a bioreactor that reduces nutrients, in particular phosphorus, to very low levels (less than 0.1 mg/L). The sewage treatment building contains a diesel generator for back-up power and an automatic trash removal and bagging system.

EFFLUENT QUALITY

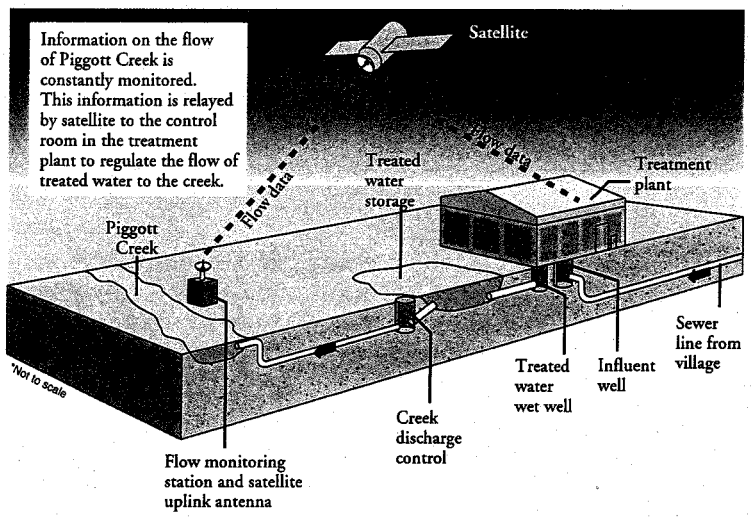
Parameter	New Permitted Limit	New Advanced Treatment Plant Level
BOD_5 (mg/L)	<10	<10
TSS (mg/L)	<10	<10
Phosphorus (mg/L)	<0.5	0.1
Toxicity	Non Toxic	Non-Toxic (BioAssay)
FC (MPN/100 mL)	<10	<10
Temp °C	Temperature Diffuser Required	Ambient
Turbidity	Not Specified	<0.2 NTU
pH	Not Specified	6.2 - 7.2

over ...

MONITORING:

The plant is actively controlled by a Programmable Logic Controller that activates systems as required by the plant's sensors. An autodialer notifies Hill, Murray if the plant is not operating at peak performance. The control system can also be accessed through a modem link, allowing the company's technicians to alter systems remotely. The plant is monitored 24 hours a day, seven days a week.

The flow of Piggott Creek is constantly monitored and the information is relayed by satellite to the instrument controls of the treatment plant in order to regulate the flow of treated wastewater to the creek.



MT. WASHINGTON SKI RESORT SYSTEM:

Trash Removal
Water passes through a channel containing an auger. The auger picks up non-organic debris, rinses it and deposits it in the trash bin. The strained wastewater continues along the channel to the bioreactor tanks.

Auger
Channel
Trash bin
Wastewater from influent well
Blower
PH monitor & probe
Control
Data
Data
Data
Main-system computer
Dissolved oxygen monitor & probe
Continuous phosphorous monitor

Filter membrane modules
Filter modules contain thousands of spaghetti-like strands. Vacuum pumps draw the surrounding water through the strand walls, filtering it and passing it on to the ultraviolet disinfection stage.

Biological Treatment
Air is supplied to the tanks by blowers to provide an aerobic environment for nitrification of ammonia, biochemical oxygen demand (BOD) reduction and solids digestion.

Control
Treated water discharge
Recycled washdown water
Ultraviolet disinfection
Vacuum pump
Sludge recirculation
Sodium Aluminate
Sodium hydroxide

NTU: Normal Turbidity Units
BOD: Biochemical Oxygen Demand - mg/L
TSS: Total Suspended Solids - mg/L
FC: Faecal Coliform measured as MPN - Most Probable Number of Pathogens in 100ml sample

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Email: hma@islandnet.com

HILL
MURRAY
&
ASSOCIATES INC.

WASTEWATER EXCHANGE

ENVIRONMENTAL
SYSTEMS ENGINEERS

Water is a precious resource...

it's time to start recycling wastewater because every drop counts.

SKI RESORT INVESTS $3 MILLION IN STATE-OF-THE-ART SEWAGE TREATMENT

For the owners of Mt. Washington Ski Resort, trying to meet strict environmental guidelines for wastewater was a difficult task. Further development of the Vancouver Island ski resort located near Comox, British Columbia, was a challenge because the existing wastewater treatment plant had limited expansion capabilities.

With the signing of a $3 million agreement for Hill, Murray & Associates to design and build a new advanced treatment facility, the future is bright. The proven technology allows the resort to expand while protecting sensitive aquatic environments.

The plant uses a highly effective system that treats wastewater to near drinking-water quality. The system combines biological treatment and membrane technology, developed by Zenon Environmental Systems. Nutrient levels will be markedly reduced and the treated wastewater will easily meet strict Ministry of Environment requirements for fish-spawning streams.

The new plant will greatly improve the quality of the discharge to Piggott Creek, a tributary in the headwaters of the Oyster River.

Installation began at the resort on July 8 and will be completed by the end of November.

ON THE LEADING EDGE

Hill, Murray & Associates is a Victoria-based, Canadian-owned company of registered professional engineers who specialize in advanced ecological wastewater treatment technologies.

Trevor Hill and Rob Murray had considerable experience with Zenon Environmental System's technology and its use in water desalination, shipboard wastewater treatment and other uses. They quickly realized the potential of this state-of-the-art technology to provide affordable, environment-friendly solutions to water conservation and wastewater problems.

In 1993, they formed Hill, Murray & Associates and since then the company has grown rapidly. It now has a core of nine highly trained staff and additional associates from a wide-range of disciplines.

Hill, Murray is a lot more than an environmental engineering firm. It sells a service — the company plans, designs, builds, installs, operates, maintains and monitors wastewater treatment and recycling equipment for the life of a system.

Victoria Times Colonist Photo

Trevor Hill, President of Hill, Murray & Associates: "We want to encourage people to think about water as a reusable resource."

Building uses less than 1/10 of the water of an average home

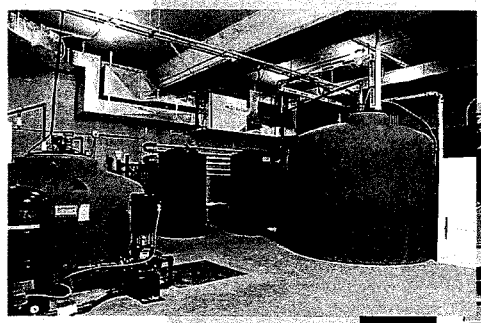
The lot for a new provincial government office building in Sooke, British Columbia was too small to accommodate a sewage disposal field for the 10,000 square foot offices.

With the assistance of Hill, Murray & Associates, the building now has BC's first wastewater reclamation system. Wastewater from sinks and toilets is passed through a bioreactor and membrane system, cleansed with a charcoal filter and ultraviolet sterilizer and then reused in the toilets.

The building was designed with two sets of water pipes — the first to deliver potable water to the sinks and the second to deliver treated water to the toilets.

Water consumption and sewage outflow are reduced by 95 per cent. The entire building uses only 17 gallons of potable water a day. The disposal field consists of one 17-foot length of perforated pipe.

The company is currently constructing other projects that will reuse treated wastewater for irrigating golf courses, watering lawns and gardens, and creating artificial ponds.



The wastewater recycling equipment in this Sooke, B.C. office building is housed in a 400 square foot maintenance room in the basement.

Monitoring is the key

When technician Denis Perreault wants to know how the wastewater recycling facility at a Sooke office building is doing, he picks up the phone. A digitized voice at the other end responds, and reports how all the different systems are performing. If Denis needs more information, he connects via computer modem and receives data on the immediate status of any component of the wastewater system.

Similarly, Denis regularly uses his computer in the Victoria offices of Hill, Murray & Associates, to check on two high-Arctic wastewater treatment plants that are more than 4,000 km away.

Hill, Murray staff check all of the company's installations by phone and regularly visit each of the sites in person but in fact all of the company's facilities are monitored constantly, 24 hours a day, seven days a week, through an automated system that sets off an alarm if strict criteria are not met.

The technicians at Hill, Murray monitor and maintain all of the company's installations. Maintenance is minor, but the company wants to ensure that environmental and health standards are met not once, but always.

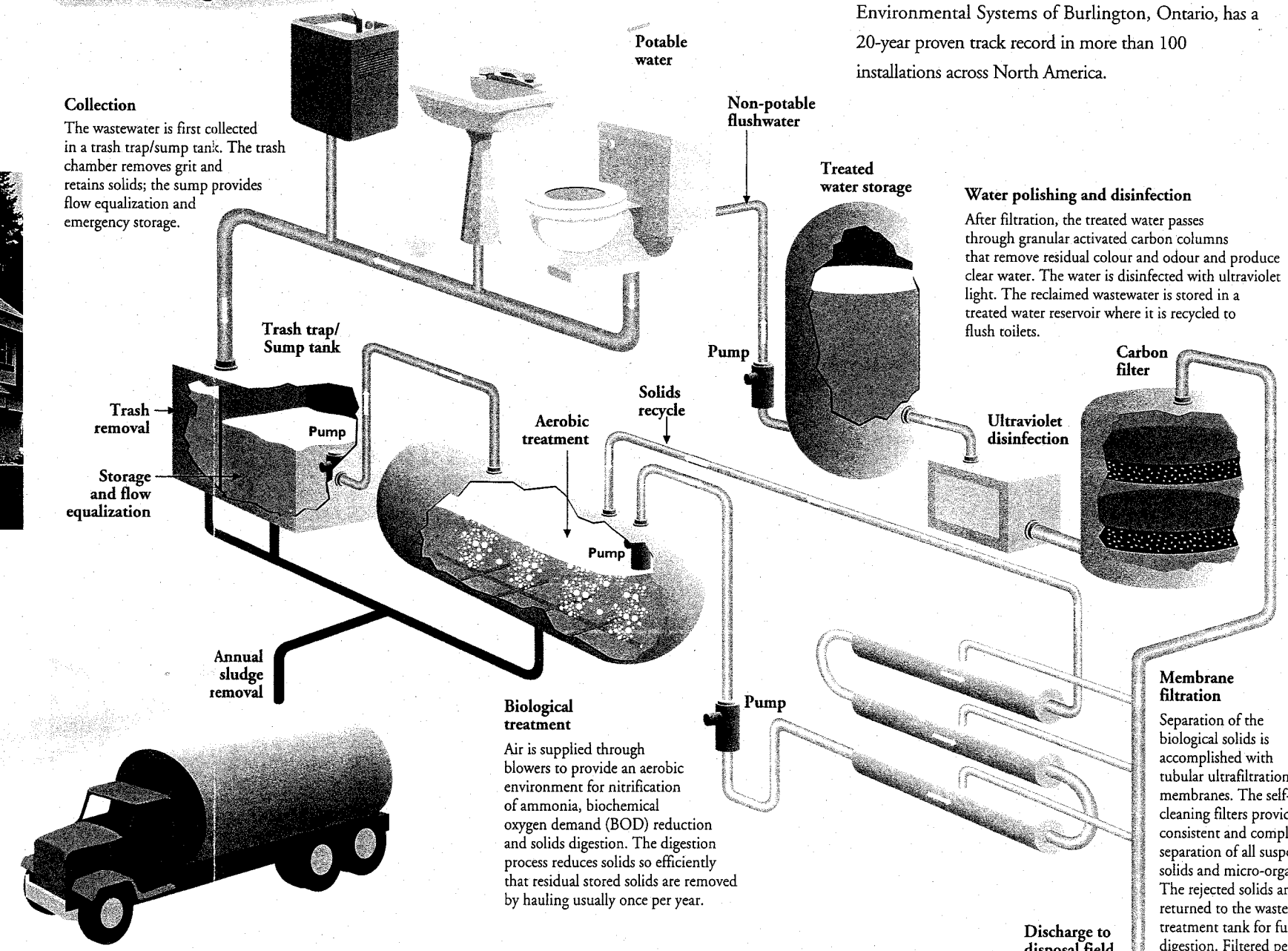
Why spend millions of dollars bringing drinking-standard water to a community for flushing toilets and watering lawns?

The heart of the technology - bioreactors and membranes

The bioreactor is a perfect home for micro-organisms. Sewage and wastewater in the reactor are provided with a constant supply of fresh air and the pH of the tank is continually adjusted to facilitate the rapid and effective breakdown of organic matter.

The slurry is forced through a special membrane that acts like a molecular filter retaining solids, bacteria and viruses. The resulting treated water is put through a carbon filter (to remove colour) and an ultraviolet light (to sterilize) and reused for irrigation, toilet flushing or other uses.

The technology, which is the brainchild of Zenon Environmental Systems of Burlington, Ontario, has a 20-year proven track record in more than 100 installations across North America.



Collection
The wastewater is first collected in a trash trap/sump tank. The trash chamber removes grit and retains solids; the sump provides flow equalization and emergency storage.

Biological treatment
Air is supplied through blowers to provide an aerobic environment for nitrification of ammonia, biochemical oxygen demand (BOD) reduction and solids digestion. The digestion process reduces solids so efficiently that residual stored solids are removed by hauling usually once per year.

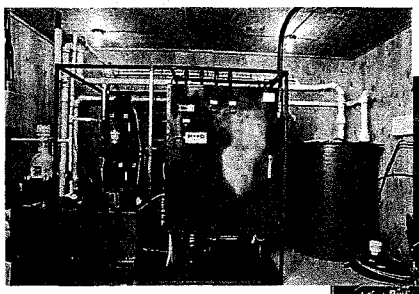
Water polishing and disinfection
After filtration, the treated water passes through granular activated carbon columns that remove residual colour and odour and produce clear water. The water is disinfected with ultraviolet light. The reclaimed wastewater is stored in a treated water reservoir where it is recycled to flush toilets.

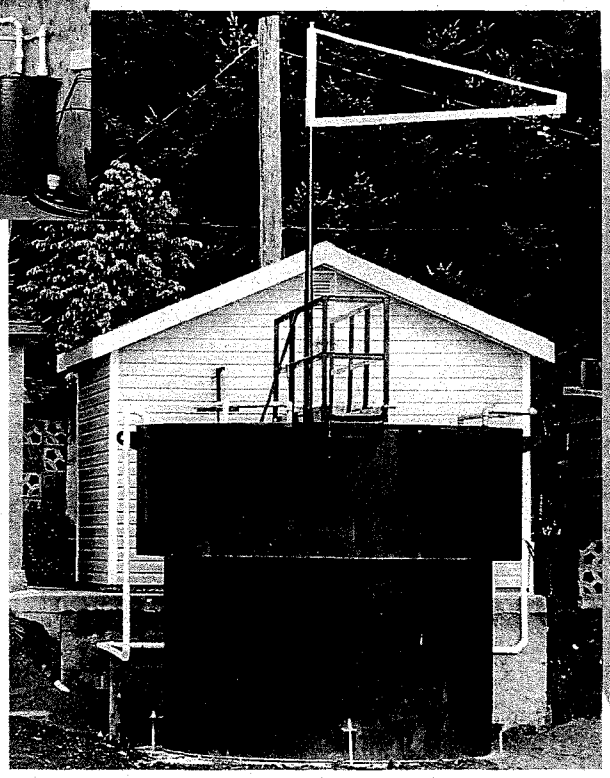
Membrane filtration
Separation of the biological solids is accomplished with tubular ultrafiltration membranes. The self-cleaning filters provide consistent and complete separation of all suspended solids and micro-organisms. The rejected solids are returned to the waste treatment tank for further digestion. Filtered permeate proceeds to the water polishing step. Any excess water is discharged.

A diagram of the wastewater recycling system in the Sooke office building. Similar systems are installed in Hill Murray's two high-Arctic facilities.

TRAILER PARK KEEPS THE HEALTH INSPECTOR HAPPY

The septic tank at Thetis Lake Trailer Park had failed. Health inspectors were requiring the owners to pump and haul 6,000 gallons of sewage per day, and they were searching for a solution.





The answer lay in the installation of new technology installed by Hill, Murray & Associates. The owners installed a two-chambered, aerated bioreactor system. Unlike the Sooke system (see diagram on previous page), spaghetti-like fibre membranes are immersed in the bioreactor (Zenon's ZenoGem™ system) and the wastewater is sucked into the hollow membranes.

The new system has been running for a year now with consistent, excellent results and the health inspectors are happy.

Small sewage treatment facilities like this one at Thetis Lake near Victoria, easily meet the challenges of health and environmental regulations.

REWRITING THE RULES - THE REAL CHALLENGE

When Trevor Hill, President of Hill, Murray & Associates, started out in business, he realized that the major roadblock to conserving and recycling water was not the technology, but the laws, bylaws, and regulations of environmental and health agencies.

Many of the old rules were made in a time when supplies of freshwater seemed limitless and the solution to pollution was dilution. But times have changed.

Hill, Murray has been instrumental in bringing about a revision to British Columbia's plumbing code, allowing for dual water mains in commercial and residential buildings.

The company researched and wrote an important guide for the B.C. Ministry of Health on the acceptance of wastewater treatment facilities for treated-water recycling.

Whenever Hill, Murray plans to install a facility in a community, the company works closely with environmental, health and local government regulators. Summing up the role that the firm plays with many of its clients, Trevor Hill refers to Hill, Murray & Associates as a "techno-facilitator".

HILL
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DEMONSTRATION SEPTAGE PLANT A SUCCESS

Most communities without sewers use septic tanks and disposal fields for treatment of their waste. The tanks fill up and the contents — known as septage — must be periodically pumped out and disposed.

One of the advantages of the Fournier press is the exceptional level of dryness of the sludge cake.

The Burgoyne Bay disposal facility on Saltspring Island, British Columbia, was using a lagoon system to remove water from septage. The plan was to allow the liquid to percolate through the soil and compost the dried sludge.

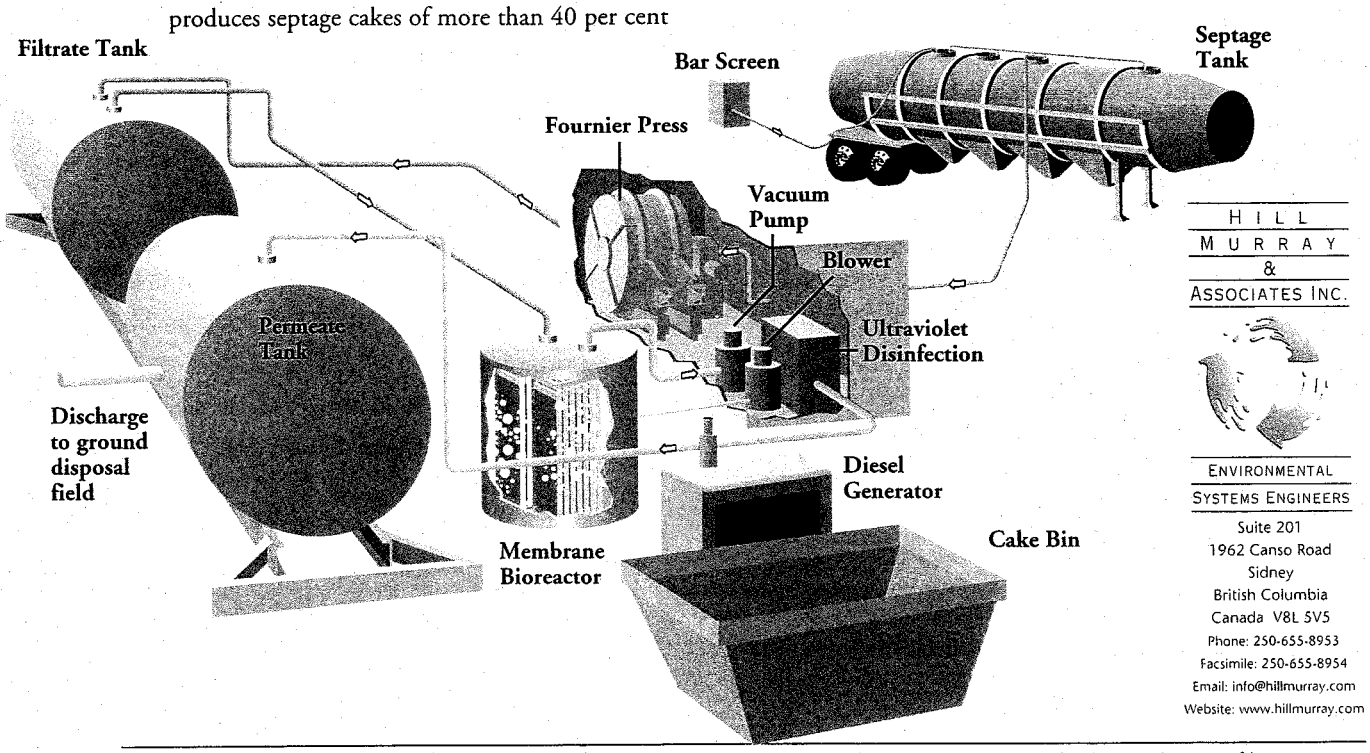
However, a high water table meant the lagoons failed to percolate and the septage was too wet to compost. The heavy, water-logged septage had to be hauled to another facility at considerable cost to the residents of Saltspring Island.

Hill, Murray & Associates established a de-watering facility at Burgoyne Bay. The highly efficient system produces septage cakes of more than 40 per cent dryness. The cakes can be composted on-site, but their lower weight means low trucking costs if hauling is required.

At the heart of the innovative facility is a 12"-diameter rotary press, manufactured by Les Industries Fournier of Quebec. The Fournier press has been used in a number of de-watering applications in Quebec and has a history of excellent performance on septage and sewage sludges.

The sealed unit operates quietly at very low speed, is nearly odourless and takes up very little floor space. Operating costs are low because the process runs automatically and the press has few moving parts.

The liquid removed from the sludge is treated with a membrane bioreactor. The treated water can either be reused or disposed of in a conventional disposal field.



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"Infra-stretching" — Extending the life of a sewage treatment plant

Expanding a sewage treatment plant can be a problem. Historically, communities grow around treatment plants leaving little room on site to increase the capacity of the facility.

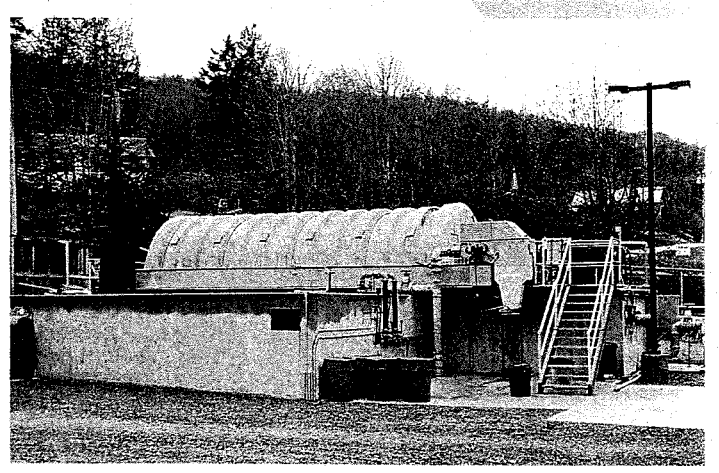
The Capital Regional District (CRD) operates a sewage treatment plant at Ganges on Saltspring Island near Victoria, British Columbia. CRD needed to upgrade the facility which was reaching its maximum capacity. The plant had to be designed to handle future increases in sewage volume and minimize the impact on the marine environment, where the outfall is located.

Simple expansion was difficult. The site is too small, very close to the town's stores, businesses and restaurants, and little additional land is available nearby.

Hill, Murray & Associates provided CRD with a unique solution. The plant was converted to a membrane-bioreactor system using existing tanks and buildings. This approach increased the capacity of the facility and improved the effectiveness of the treatment without altering the plant's overall "footprint".

The upgrade resulted in substantial cost savings to CRD. Many of the components for upgrading the facility were already in place and no costly sewer extensions were required. Operating costs were lowered through reduced maintenance and sludge disposal requirements.

The capacity of the plant can be further expanded in phases over time, to match actual demand as the community grows. Hence, taxpayers pay for what they need right now; they don't finance infrastructure which they may or may not need sometime in the future.



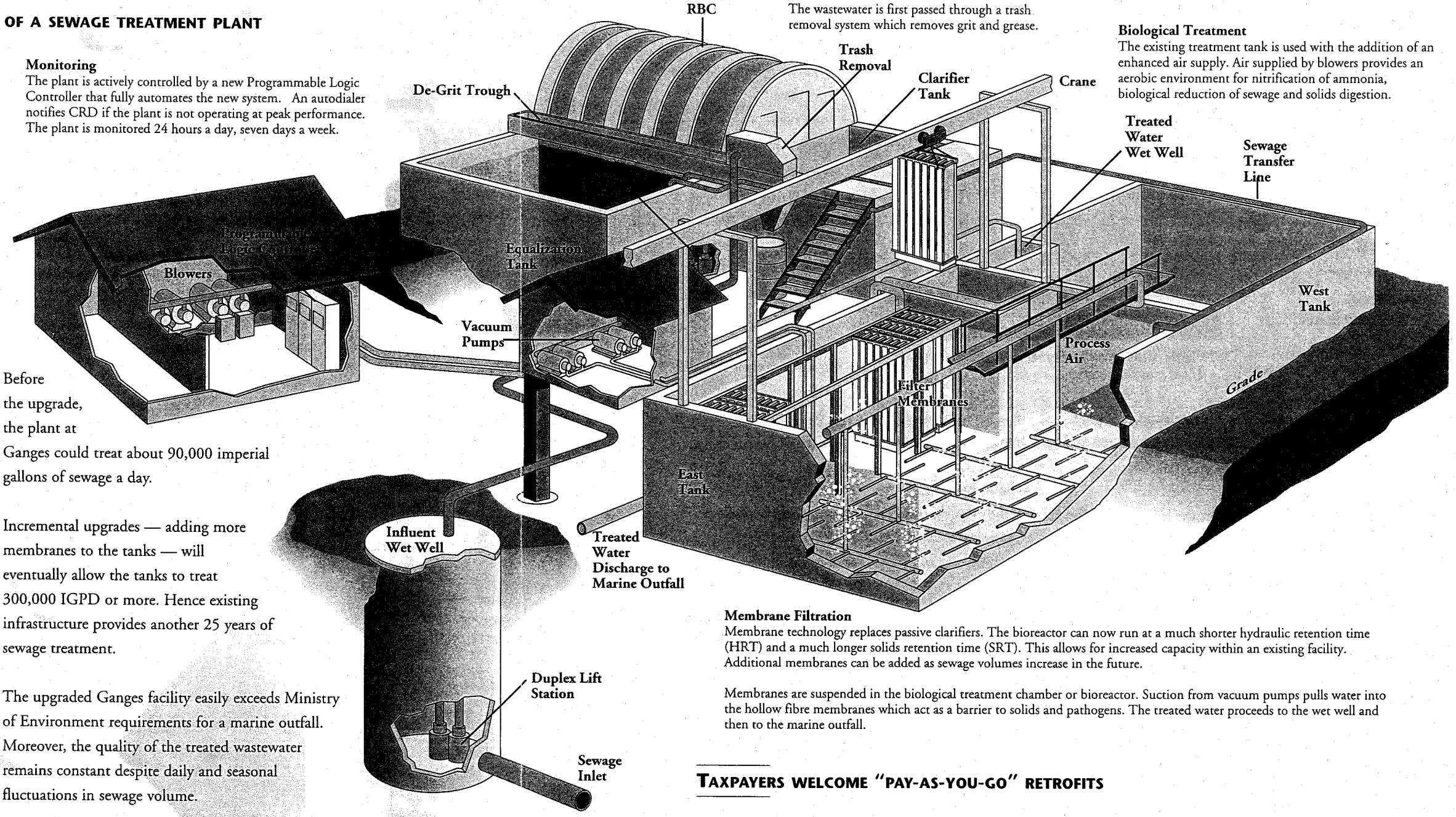
Capacity of the Ganges Pollution Control Centre can be more than tripled using existing tanks and buildings.

Monitoring
The plant is actively controlled by a new Programmable Logic Controller that fully automates the new system. An autodialer notifies CRD if the plant is not operating at peak performance. The plant is monitored 24 hours a day, seven days a week.

Before the upgrade, the plant at Ganges could treat about 90,000 imperial gallons of sewage a day.

Incremental upgrades — adding more membranes to the tanks — will eventually allow the tanks to treat 300,000 IGPD or more. Hence existing infrastructure provides another 25 years of sewage treatment.

The upgraded Ganges facility easily exceeds Ministry of Environment requirements for a marine outfall. Moreover, the quality of the treated wastewater remains constant despite daily and seasonal fluctuations in sewage volume.



Membrane Filtration
Membrane technology replaces passive clarifiers. The bioreactor can now run at a much shorter hydraulic retention time (HRT) and a much longer solids retention time (SRT). This allows for increased capacity within an existing facility. Additional membranes can be added as sewage volumes increase in the future.

Membranes are suspended in the biological treatment chamber or bioreactor. Suction from vacuum pumps pulls water into the hollow fibre membranes which act as a barrier to solids and pathogens. The treated water proceeds to the wet well and then to the marine outfall.

"The Ganges retrofit demonstrates how a community can extend the life of an existing plant and phase in more sewage treatment capability just as it is needed."

- Jim McFarland, Manager of Operations, CRD

Taxpayers welcome "pay-as-you-go" retrofits

If CRD had used the old-fashioned approach to sewage treatment problems, it would have borrowed large amounts of capital to finance the purchase of additional land, installation of more pipes, and the construction of a new plant. The size of the facility would have been matched to growth projections over the next 20 or 25 years. Inaccurate projections could have resulted in too much infrastructure or not enough. The costs of this investment would have been prohibitive to taxpayers because government grants to municipalities for new infrastructure have been drastically reduced.

Instead, Hill, Murray introduced the modern solution of modifying the existing tanks and installing membrane filters that increase the ability of the tanks to process greater volumes of sewage. Additional membranes are added as they are needed. The capacity of the plant matches actual population growth and the tax base.

The impact on taxpayers of what Trevor Hill calls "just-in-time infrastructure" is spread over a much longer period of time. Operating costs are also lower than in conventional plants.

DEMONSTRATION SEPTAGE PLANT A SUCCESS

Most communities without sewers use septic tanks and disposal fields for treatment of their waste. The tanks fill up and the contents — known as septage — must be periodically pumped out and disposed.

One of the advantages of the Fournier press is the exceptional level of dryness of the sludge cake.

The Burgoyne Bay disposal facility on Saltspring Island, British Columbia, was using a lagoon system to remove water from septage. The plan was to allow the liquid to percolate through the soil and compost the dried sludge.

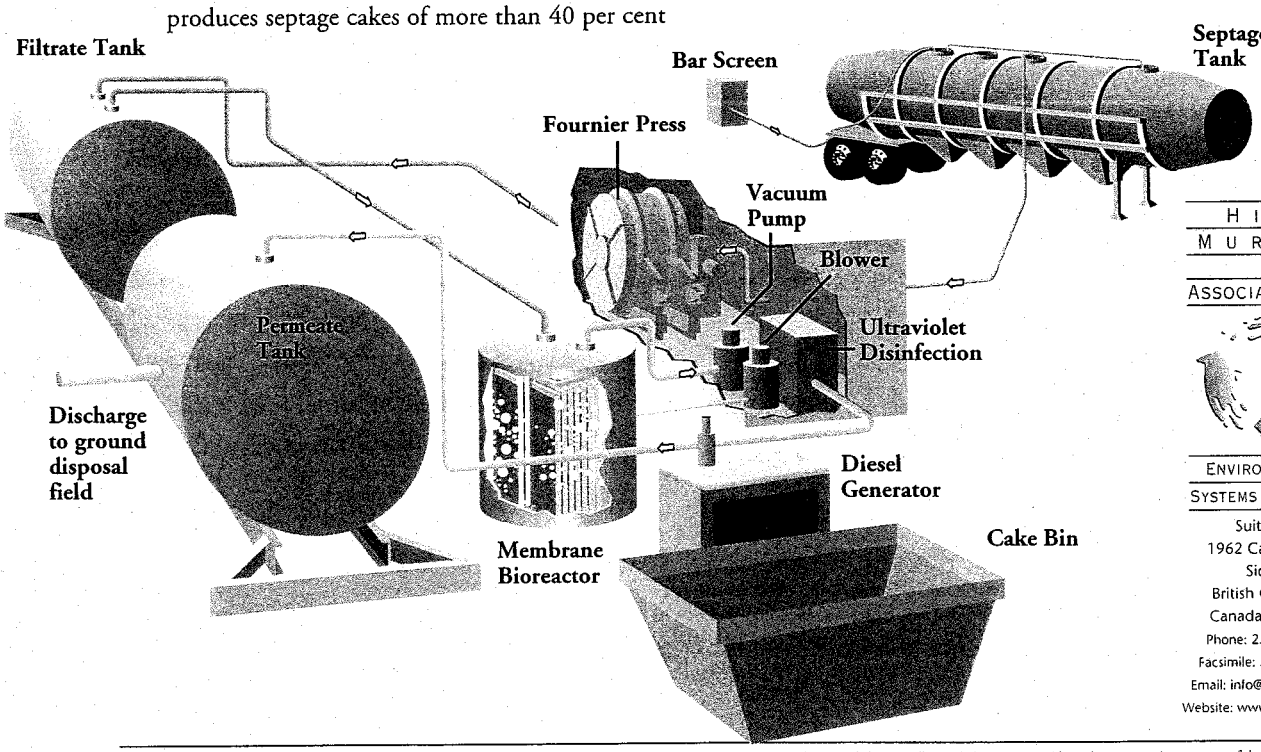
However, a high water table meant the lagoons failed to percolate and the septage was too wet to compost. The heavy, water-logged septage had to be hauled to another facility at considerable cost to the residents of Saltspring Island.

Hill, Murray & Associates established a de-watering facility at Burgoyne Bay. The highly efficient system produces septage cakes of more than 40 per cent dryness. The cakes can be composted on-site, but their lower weight means low trucking costs if hauling is required.

At the heart of the innovative facility is a 12"-diameter rotary press, manufactured by Les Industries Fournier of Quebec. The Fournier press has been used in a number of de-watering applications in Quebec and has a history of excellent performance on septage and sewage sludges.

The sealed unit operates quietly at very low speed, is nearly odourless and takes up very little floor space. Operating costs are low because the process runs automatically and the press has few moving parts.

The liquid removed from the sludge is treated with a membrane bioreactor. The treated water can either be reused or disposed of in a conventional disposal field.



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09-Mar-02

MT. WASHINGTON ALPINE RESORT WINS STARFISH AWARD

Oceans Blue Foundation Presents Environmentally Responsible Tourism Award

Mt. Washington Alpine Resort is the recipient of the 2001 Starfish Award for Environmentally Responsible Tourism. The award is sponsored by national environmental charitable organisation Oceans Blue Foundation in recognition of a tourism business in BC that makes an outstanding contribution to environmentally responsible business practices.

Mt. Washington impressed this year's judges with its integrated approach to conservation-based design and operations, as well as a clear commitment to the local community and adjacent wilderness areas. Environmental initiatives ranged from trail management and on-site wastewater treatment to efforts to save the endangered Vancouver Island Marmot from extinction (see the Backgrounder below for details).

Peter Gibson, President and General Manger of Mt. Washington Alpine Resort, was at the BC Tourism Awards ceremony to receive the award. "At Mt. Washington, we operate from a position of respect," said Mr. Sharpe. "Respect for our guests, our staff, our community and for the natural environment. Demonstrating this respect allows us to thrive as an alpine resort choice where guests have a quality experience they will remember for years to come."

The Starfish Award is determined according to five criteria. Nominees must demonstrate their:

Efforts to minimise the negative impact of their business practices on the natural environment; Economic benefits from their efforts; Commitment to Change in their ongoing and future operational practices to continue to improve their environmental record; Commitment to their community; and Overall commitment to conservation of their natural surroundings.

Mt. Washington scored highly in all five judging criteria.

Mike Harcourt, former BC Premier and a Patron of Oceans Blue Foundation, presented this year's Starfish Award. "I am delighted to present the Starfish Award to Mt. Washington Alpine Resort," said Mr. Harcourt. "They embody in their business practice exactly what Oceans Blue Foundation maintains as a core principle; that to thrive in the competitive tourism industry, businesses must take care of the spectacular surroundings that attract visitors."

The Starfish Award was presented as part of the third annual British Columbia Tourism Awards, which took place yesterday at the at the BC Tourism Industry Conference 2002 at the Park Plaza Vancouver Airport Conference Resort.

Created in 1996, Oceans Blue Foundation is an environmental charitable organisation with the mandate of conserving coastal environments through education and awareness. It is the first charity in North America to focus on developing environmentally responsible 'best practices' for all sectors of the tourism industry.

For Information: Coralie Breen, President & CEO Tracy London, General Manager Oceans Blue Foundation Oceans Blue Foundation T: 604.684.2583, ext. 1 (office) T: 604.684.2583, ext. 2 (office) T: 250.247.8813 (home)

BACKGROUNDER

Mt. Washington Alpine Resort is a four-season resort destination situated on Vancouver Island directly adjacent to Strathcona Provincial Park. Established in 1979, Mt. Washington Resort offers Alpine and Nordic skiing, as well as snowboarding, tubing, snowshoeing and luging activities to more than 400,000 winter visitors. An additional 50,000 people visit the Resort in summer to enjoy the alpine meadows.

Winner of the 2001 Starfish Award for Environmentally Responsible Tourism, Mt. Washington Alpine Resort initiated a complete repositioning strategy in 1999, a key component of which was to continue to monitor and be sensitive to its environment. Several environmental initiatives implemented subsequent to the repositioning helped Mt. Washington earn the prestigious environmental award, as follows:

Landscaping involved the replanting of plants and turf from construction sites, as well as the addition of indigenous plant species that require little watering; Interpretive trails include signage to inform visitors of surroundings and views; Catch basins were put in place to reduce silt runoff;

Recycled grey water is used in the toilets and urinals; Extensive glazing on the main lodge's southern face provides passive solar heating and lighting, minimising external energy requirements;

The new lodge's ceiling was built out of Hemlock, which was sourced from the construction site and new lift runs (green wood) and milled on site;

The property has a state of the art sewage treatment plant that treats sewage from both the resort and neighbouring condominiums. Bio-sludge from the sewage treatment plant is applied to the fields of a local farm;

Water conservation education for village condo owners is conducted at strata council meetings;

Water consumption has been reduced from 25 million gallons per year to 18 million gallons per year;

A pilot project is in place to dry wet food waste. To date the pilot has resulted in wet waste being reduced from 100 lbs to 2 lbs in a converted sewage treatment cell. Dried organic material is spread on the ground;

A recycling program is in place for the collection of cardboard, glass, metal, and plastic;

A staff coffee card program to reduce disposable cups;

A plan is being considered to introduce self composting toilets to replace port-a-potties;

A full section of high altitude land worth approximately $250,000 was donated to the Vancouver Island Marmot Recovery Foundation. The Foundation, which has built a remote Marmot Captive Breeding Facility on the donated land, captures endangered marmots and keeps them in the facility during hibernation and breeding;

In addition to the many conservation initiatives in place at the resort, Mt. Washington has demonstrated a strong commitment to the local community, as follows:

The resort has provided support in excess of $50,000 annually to various children's charities and events; and The resort has provided donations and support to the Strathcona Provincial Park for initiatives such as trail restoration.

The Starfish Award also requires that nominees demonstrate an indication of economic benefit related to environmental efforts. Mt. Washington Alpine Resort estimates that its environmental commitment contributed to a significant increase in visitation since the inception of the resort's repositioning strategy.

27-Apr-04

Ecotourism Award for Mount Washington Alpine Resort

Image: Skies Above Foundation Award for Mount Washington

Balancing the operations and growth of BC's 3rd most visited snow resort while at the same time protecting and nurturing the environment has again landed a major award for **Mount Washington Alpine Resort** on Vancouver Island. Recently, the ***Skies Above Foundation*** invited noted wildlife artist and visionary **Robert Bateman** to host a gala event in Vancouver that would be the showcase for the foundations' annual ***Environmental Leadership Awards***.

Located above the Comox Valley and adjacent to **Strathcona Provincial Park**, Mount Washington Alpine Resort is a four-season resort and it hosts visitors from around the world. Over 400,000 winter enthusiasts make the trip up to the 1588 metre (5215') mountain and almost 100,000 guests make the resort a stop in the summer. **President Peter Gibson** has been with Mount Washington Alpine Resort for its entire 25 years of operation. "This is our third major environmental award in as many years and it's gratifying to see that our values have helped steer us in this direction". Resort values, which are a strong part of each new employee's indoctrination, are: respect for the natural environment, healthy lifestyles, a commitment to the community, a safe and enjoyable experience for guests and staff and managed resort development. Gibson adds that there have been some milestones achieved in the last couple of years as the resort grows. "When we were designing Raven Lodge, our recent addition of a Nordic facility, part of the process dealt specifically with environmental initiatives. The building uses special glass to save heating energy and we recycle our grey water, through a filtration system, for our toilets and urinals."

The Skies Above Foundation noted that the resort won the award this year for its wholehearted practice of ecotourism, including many initiatives to minimize environmental impacts as well as its six-figure donation of land to the Marmot Recovery Foundation and the active involvement in funding for trail building, bridge work and camp sites at the adjacent Strathcona Provincial Park. Mount Washington Alpine Resort was one of three businesses that were honoured by The Skies Above Foundation. SED Technologies, of Sidney and Nelson, and Freybe's Gourmet Foods of Abbotsford both received awards for innovative methods of production and energy saving. The gala event was co-hosted by The Burns Bog Conservation Society.

Mount Washington Alpine Resort is celebrating its 25th anniversary this year and the resort is commemorating the year with a major terrain and lift expansion into The Outback this December. Other development progressing at the resort this summer includes the building of Bear Lodge, the twin to the much-touted Deer Lodge slope side luxury condo hotel. For more info, surf to **www.mountwashington.ca**

Live It Up!

TAB F

HILL
MURRAY
&
ASSOCIATES INC.

SUSTAINABLE SOLUTIONS

ENVIRONMENTAL
SYSTEMS ENGINEERS

GANGES POLLUTION CONTROL CENTRE UPGRADE

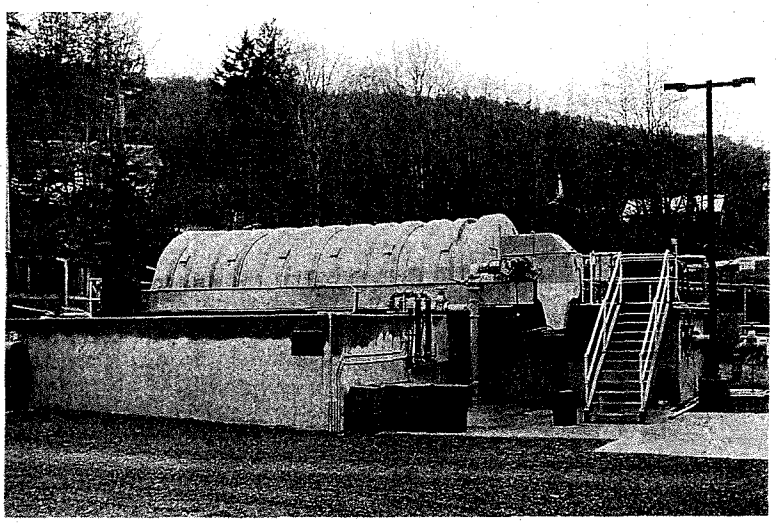
PROJECT:
Capital Regional District
Ganges Pollution Control Centre
Saltspring Island, BC

APPLICATION:
Sewage treatment plant upgrade

CAPACITY:
90,000 imperial gallons per day
expandable to 300,000 (IGPD)

INSTALLED:
November 1996 - January 1997

COMMISSIONED:
December 1996



PROBLEM:
The Capital Regional District (CRD) operates a sewage treatment plant to serve the growing community of Ganges on Saltspring Island. CRD needed to upgrade the facility which was reaching its maximum capacity. The plant had to be designed to handle future increases in sewage volume and minimize the impact on the marine environment where the ouftall is located.

Simple expansion was difficult, as the small site is very close to the town's stores, businesses and restaurants, and little additional land is available.

SOLUTION:
Hill, Murray & Associates' unique solution was to convert the plant to a membrane-bioreactor system which uses the existing tanks and buildings. This technology increased the facility's capacity and improved the effectiveness of the treatment.

This approach offered considerable cost savings, as many of the components for upgrading the facility were already in place and no costly sewer extensions were required. Reduced maintenance and sludge disposal requirements mean lower operating costs.

The capacity of the plant can be further expanded in phases over time, to match actual demand as the community grows — just-in-time infrastructure. Additional membranes are added to the tanks as they are needed. Taxpayers pay for what they need right now; they don't finance facilities which they may or may not need sometime in the future.

The upgraded Ganges facility easily exceeds Ministry of Environment requirements for a marine outfall. Moreover, the quality of the treated water remains constant despite daily and seasonal fluctuations in sewage volume.

over ...

TREATMENT:

Two existing tanks on the site were retrofitted with a ZenoGem™ membrane-bioreactor system. This technology, developed by Zenon Environmental, a leading Canadian environmental technology firm, has a proven 20-year track record at installations across North America.

Unlike conventional sewage treatment, where solids settle by gravity and then liquids flow off the surface, the Zenon process uses membranes to retain solids and the liquid is pulled through the membranes with vacuum pumps. The Zenon process treats significantly more sewage in the same size of tank.

EFFLUENT QUALITY

Parameter	New Permitted Limit	New Advanced Treatment Plant Level
BOD_5 (mg/L)	<25	<10
TSS (mg/L)	<25	<10
Toxicity	Non Toxic	Non-Toxic (BioAssay)
FC (MPN/100 mL)	<1000	<100 (no disinfection)
Turbidity	Not Specified	<0.2 NTU

Before the upgrade, the plant at Ganges could treat about 90,000 imperial gallons of sewage per day. Incremental upgrades — adding more membranes to the tanks — will allow the plant to treat at least 300,000 IGPD, giving the community more than 25 years of sewage treatment.

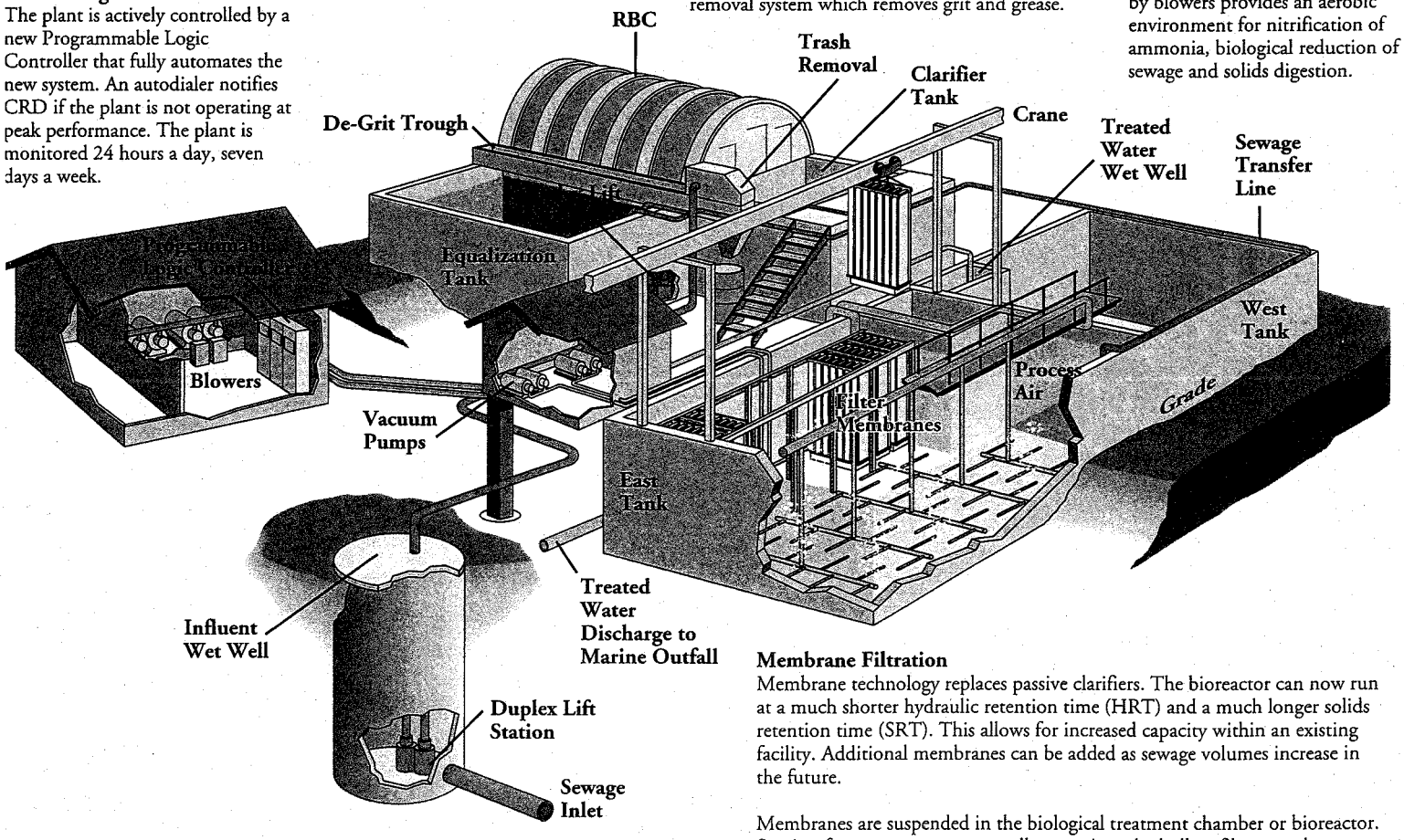
MONITORING:

The plant is actively controlled by a Programmable Logic Controller. The plant is monitored 24 hours a day, seven days a week to ensure peak performance.

Monitoring
The plant is actively controlled by a new Programmable Logic Controller that fully automates the new system. An autodialer notifies CRD if the plant is not operating at peak performance. The plant is monitored 24 hours a day, seven days a week.

Pre-Treatment
The wastewater is first passed through a trash removal system which removes grit and grease.

Biological Treatment
The existing treatment tank is used with the addition of an enhanced air supply. Air supplied by blowers provides an aerobic environment for nitrification of ammonia, biological reduction of sewage and solids digestion.



Membrane Filtration
Membrane technology replaces passive clarifiers. The bioreactor can now run at a much shorter hydraulic retention time (HRT) and a much longer solids retention time (SRT). This allows for increased capacity within an existing facility. Additional membranes can be added as sewage volumes increase in the future.

Membranes are suspended in the biological treatment chamber or bioreactor. Suction from vacuum pumps pulls water into the hollow fibre membranes which act as a barrier to solids and pathogens. The treated water proceeds to the wet well and then to the marine outfall.

BOD: Biochemical Oxygen Demand - mg/L
TSS: Total Suspended Solids - mg/L
FC: Faecal Coliform measured as MPN - Most Probable Number of Pathogens in 100ml sample

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Clippings Ganges

District pumps sewer upgrade

Work will begin soon on the next two phases of the Ganges sewer system upgrade.

The Capital Regional District (CRD) board approved a $415,000 contract last Wednesday with Zenon Municipal Systems Inc. to complete the upgrade started 18 months ago.

The Zenon system is an innovative one employing polymer membranes to filter wastewater. At present the sewer plant uses the Zenon system as well as the original rotating biological contactor. The latter will be shut down and removed as part of the latest work on the plant.

Larry Wolfe, assistant manager of the CRD's operations division, described the effluent quality from the Zenon system as "far superior."

Effluent testing has revealed readings that are well under levels required by the sewer system's operating permit. Biochemical oxygen demand (BOD) and suspended solids are both required to measure 25 milligrams per litre or better.

Sewer committee chairman Tom Toynbee said on Monday that suspended solids are being measured

SEWER 2

SEWER UPGRADE: *Cleaner effluent*

From Page 1

at less than one milligram, and BOD at less than five. The fecal coliform count, required to be under 1,000 fecal organisms per 100 millilitres, are occasionally showing up at 60 but are usually under five, Toynbee said.

They measure up to 15 million in wastewater entering the plant, he added.

Toynbee had some good news for sewer users. Annual operating costs are expected to decline by $21,000. Debt servicing costs are also coming down as the original debt used to build the system is retired. Those costs are $80,000 this year but will drop to $708 in 2002.

"We anticipate a fairly substantial reduction in user charges in about two years," Toynbee observed.

Cost of the three-phase upgrade which began in 1996 will total $1,214,970. Part of that cost was covered by a federal-provincial infrastructure grant of $421,866. The remainder will come from a capital reserve fund set up in the early 1980s when the system was built.

It took the form of a provincial grant to help subsidize the cost of operating the sewer, Toynbee said the principal amount actually grew because the subsidy was often less than the fund's interest income.

The average residential user on the system pays $350 for the sewer, an amount based on water consumption plus a flat $100 per year. Commercial users pay a charge based on building size and water consumption, while institutional users are billed on a water consumption basis.

The plant cost $284,600 to run in 1997, an amount that includes staff time, testing and consultant fees, but not debt service.

Once installed, the new system will have an increased capacity of 800 cubic metres (176,000 gallons) a day.

Toynbee said there are plans to hold a grand opening of the upgraded sewer plant next May.

TAB G

TREATMENT:

The septage is pumped from area septic tanks and hauled to Burgoyne Bay where it is screened to remove non-biodegradable materials such as plastic. The septage is put in a 10,000 gallon storage tank and is continuously mixed.

EFFLUENT QUALITY

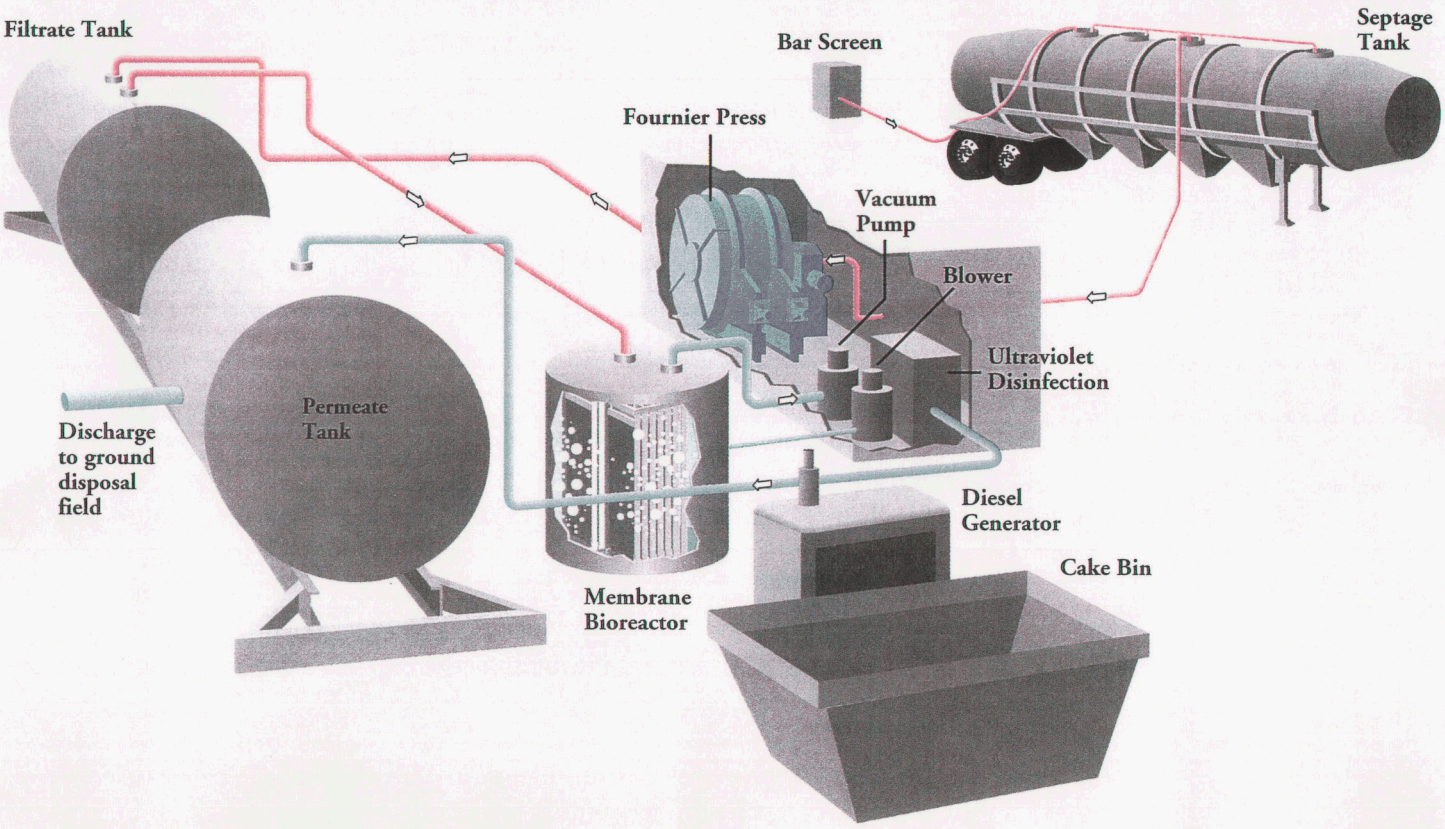
	Septage	Cake	Filtration	Treated Water
BOD_5 (mg/L)	10,000	–	<1,000	<10
TSS (mg/L)	20,000	–	<1,000	<10
FC (MPN/100 mL)	10,000,000	–	10,000,000	<1
Dryness	1 - 2.5%	>40%	–	–

The septage is fed into the Fournier rotary press where drag forces from a rotating channel push the liquid through filter elements and compress the solids. The 12"-diameter press can process 300 gallons an hour (larger models are available). As the sludge cake is formed, it is further compressed. A large percentage of the water is squeezed out of the sludge, resulting in a very dry cake.

The liquid is pumped into another storage tank where Zenon's ZenoGem™ membrane bioreactor treats the filtrate removing suspended solids and organics. The treated water can be reused or disposed of in a conventional field. The cakes are stored temporarily and can be composted or disposed of at a landfill site.

MONITORING:

The press only functions when an operator is present. More permanent septage facilities would use a variety of automatic features, including remote monitoring to ensure peak performance.



BOD: Biochemical Oxygen Demand - mg/L

TSS: Total Suspended Solids - mg/L

FC: Faecal Coliform measured as MPN - Most Probable Number of Pathogens in 100ml sample

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HILL
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SUSTAINABLE SOLUTIONS

ENVIRONMENTAL
SYSTEMS ENGINEERS

BURGOYNE BAY SEPTAGE FACILITY

PROJECT:
Capital Regional District
Burgoyne Bay Septage Facility
Saltspring Island, BC

APPLICATION:
Septage de-watering facility

CAPACITY:
400 gal/hour

INSTALLED:
September 1996

COMMISSIONED:
September 1996

PROBLEM:
The Burgoyne Bay Septage Facility had used a lagoon system to remove water from the septage. The plan was to allow the liquid to percolate through the lagoon bottom and compost the dried septage.

However, a high water table meant the lagoons failed to percolate and the septage was too wet to compost. The lagoons were closed and septage was hauled to another facility at considerable cost to the residents of Saltspring Island.

SOLUTION:
Hill, Murray & Associates established a de-watering facility. This highly efficient system produces septage cakes of greater than 40 per cent dryness, ready for composting.

While the cakes would ideally be composted on-site, their lower weight means low trucking costs if hauling is required.

At the heart of the innovative facility is a 12"-diameter rotary press, manufactured by Les Industries Fournier of Quebec. The Fournier press has been used in a number of de-watering applications in Quebec and has a history of excellent performance on septage and sewage sludges.

The sealed unit operates at a very low speed and is nearly odourless. Operating costs are low because the process runs automatically. The press takes up very little floor space, and is inexpensive to maintain.

over ...

TAB I

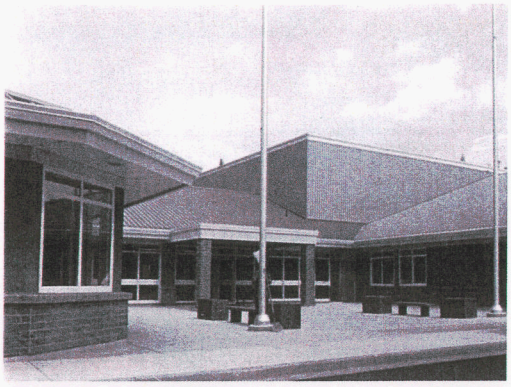
HILL MURRAY

SUSTAINABLE SOLUTIONS

ENGINEERING WATER SOLUTIONS

HUBAND PARK ELEMENTARY SCHOOL

PROJECT:
School District No. 71
Comox Valley Board of Education near Courtenay, BC



APPLICATION:
Fully recycling water reclamation plant in a public school; nitrification/denitrification

CAPACITY:
4,500 imperial gallons per day (IGPD)

INSTALLED:
Spring 1998

COMMISSIONED:
Summer 1998

PROBLEM:
The Comox Valley has been growing rapidly and new schools are needed in many communities. The land purchased for the construction of Huband Park Elementary School had a limited water supply, a high water table, and the percability of the soil was poor. A standard disposal field would not have been permitted at this location.

SOLUTION:
Hill Murray designed and built a fully recycling, tertiary-quality water reclamation facility in the school. The facility is housed in an equipment room in the school building.

Wastewater from the school is collected and passed through a membrane-bioreactor system and then reused to flush toilets and urinals. The building was designed with two sets of water pipes – the first to deliver potable water to the sinks, and the second to deliver reclaimed, treated water to the toilets and urinals.

With this system, water consumption and effluent outflow are reduced by more than 90 per cent to only 360 imperial gallons a day. The disposal field for the whole building requires only 26 feet of infiltrator pipe. Effluent quality is very high, thus protecting the high water table in the area. Low flush fixtures for the toilets and urinals were installed to reduce overall water usage.

The reduction in potable water consumption in the school results in a yearly saving of more than 800,000 gallons of water compared to a similar building with a conventional treatment system.

TREATMENT:
The wastewater from sinks, toilets, and urinals is collected in a trash trap and pumped to a bioreactor where the bioreduction of organics and ammonia takes place. In the bioreactor, aerobic microbial breakdown of the sewage is an odourless process.

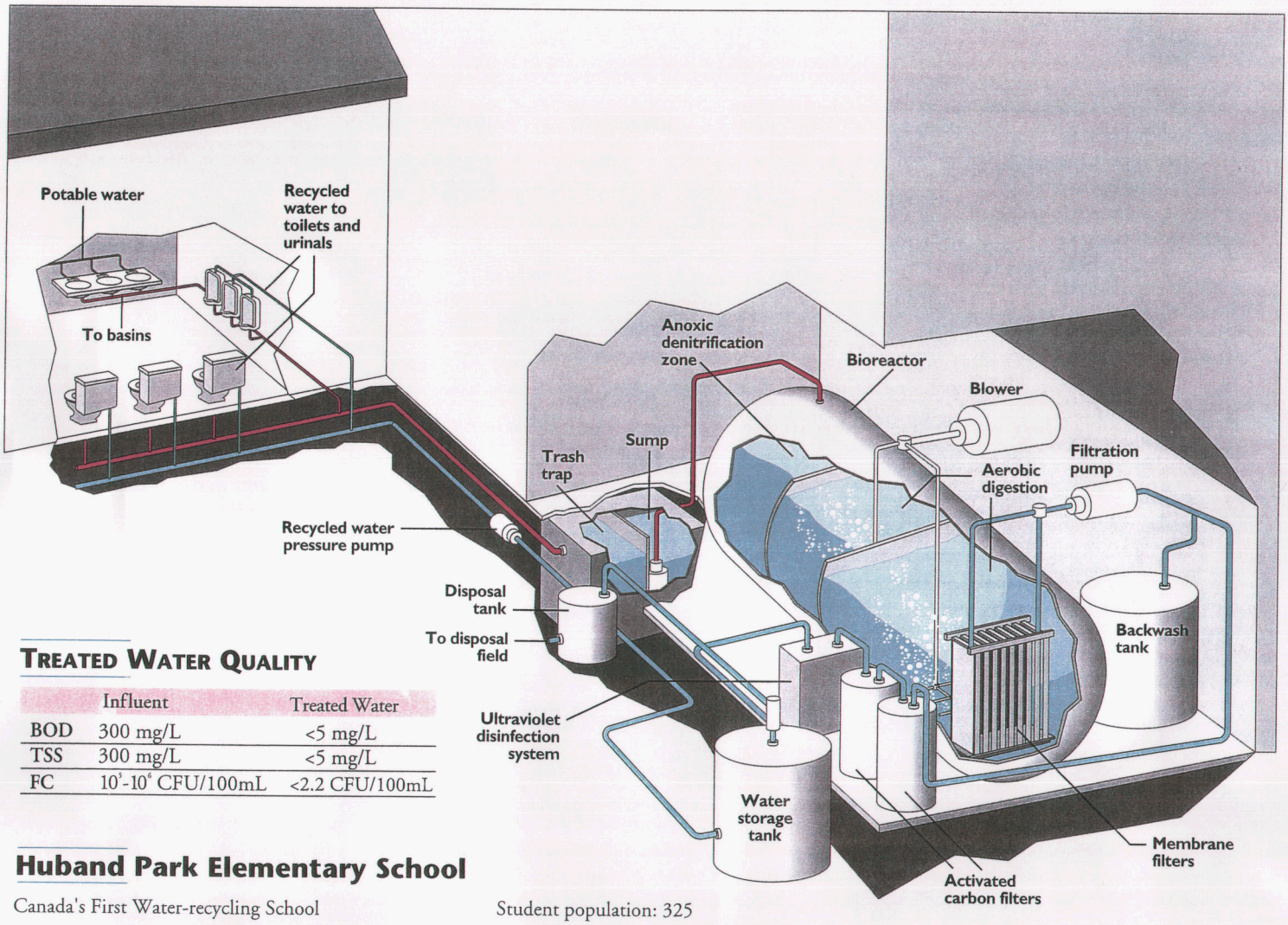
The biosolids including all bacteria and other water-borne pathogens are removed in a membrane ultrafiltration process using Zenon's ZenoGem™ technology. Water is prepared for reuse by passing it through a carbon filter and an ultraviolet sterilizer.

The treatment process reduces solids so efficiently that residual stored solids usually don't need to be removed more than once a year.

over ...

MONITORING:

The Huband Park facility is operated by Canadian Wastewater Corporation (CWC), a wholly-owned subsidiary of Hill Murray. The plant is monitored 24 hours a day, seven days a week. The plant is operated by a programmable logic controller. If the facility is not operating at peak performance, an alarm signal is sent to the CWC paging system. CWC technicians log on to the system remotely and in most cases can rectify the situation without visiting the site.



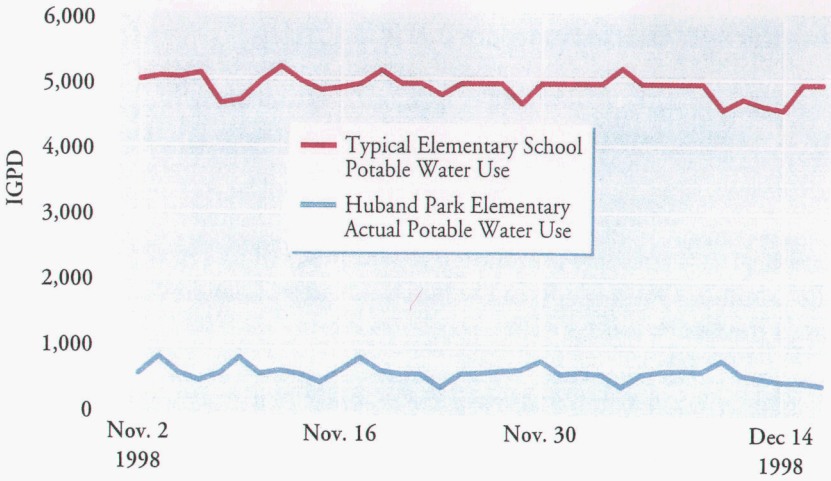
TREATED WATER QUALITY

	Influent	Treated Water
BOD	300 mg/L	<5 mg/L
TSS	300 mg/L	<5 mg/L
FC	10^5-10^6 CFU/100mL	<2.2 CFU/100mL

Huband Park Elementary School

Canada's First Water-recycling School

Student population: 325



BOD: Biochemical Oxygen Demand - mg/L

TSS: Total Suspended Solids - mg/L

FC: Faecal Coliform measured as CFU - Coliform Forming Units per 100mL sample

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TAB H

HILL
MURRAY
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ASSOCIATES INC.

SUSTAINABLE SOLUTIONS

ENVIRONMENTAL
SYSTEMS ENGINEERS

SMALL RESORTS

PROJECT:
Sooke Harbour House,
Sooke, BC

Kingfisher Oceanside Inn
Courtenay, BC

APPLICATION:
Fully recycling, wastewater treatment plant

CAPACITY:
6,000 imperial gallons per day (IGPD)/
10,000 IGPD

INSTALLED:
Sooke Harbour House: July-September 1997
Kingfisher Oceanside Inn: April-June 1997

COMMISSIONED:
Sooke Harbour House: September 1997
Kingfisher Oceanside Inn: June 1997

PROBLEM:
The owners of Sooke Harbour House, a world-renowned inn on the west coast of Vancouver Island, were told by the Ministry of Health that there was a problem with their septic system. The owners planned to expand the inn and they needed a wastewater system that would protect the fragile marine environment, which was such an integral part of the inn's popularity. The beautiful buildings and grounds at the inn are also part of its attraction, so it was important that a wastewater facility not be an eyesore.

Similarly, Kingfisher Oceanside Inn, a seaside resort on the east coast of Vancouver Island, was expanding and the owners were worried that an already failing septic system combined with a high water table might pollute the adjacent shoreline. Land was at a premium, so a wastewater facility would have to make efficient use of space. The owners were also concerned that the facility blend in with its surroundings.

SOLUTION:
Hill, Murray & Associates designed and built fully recycling, tertiary-quality wastewater treatment facilities for both Sooke Harbour House and Kingfisher Oceanside Inn. The heart of the treatment process is a Zenon ZenoGem™ membrane-bioreactor housed in an unobtrusive 15 foot by 24 foot building. Most of the wastewater handling equipment is located underground.

The new accomodations at both inns were built with the required additional plumbing so that treated water can be reused in toilets and urinals. Sooke Harbour House also uses the recycled water to irrigate large gardens and lawns.

Recycling water results in a marked reduction in water consumption and a decrease in the volume of wastewater discharged to the disposal fields. Hence, the fields are considerably smaller than conventional sewage treatment systems. Effluent quality is consistently very high at both locations.

The capacity of the water reclamation facilities can be increased in phases over time, to accommodate further expansion of the inns and increased volumes of wastewater.

over ...

Treatment:

In both installations, the wastewater from showers, sinks, and toilets is collected in a trash trap and pumped into the membrane-bioreactor. Blowers supply air for the efficient microbial breakdown of the waste. The Zenon process uses vacuum pumps that pull the liquid through the membranes, leaving solids and water-borne pathogens behind. The water is prepared for reuse by passing it through a carbon filter and ultraviolet sterilizer.

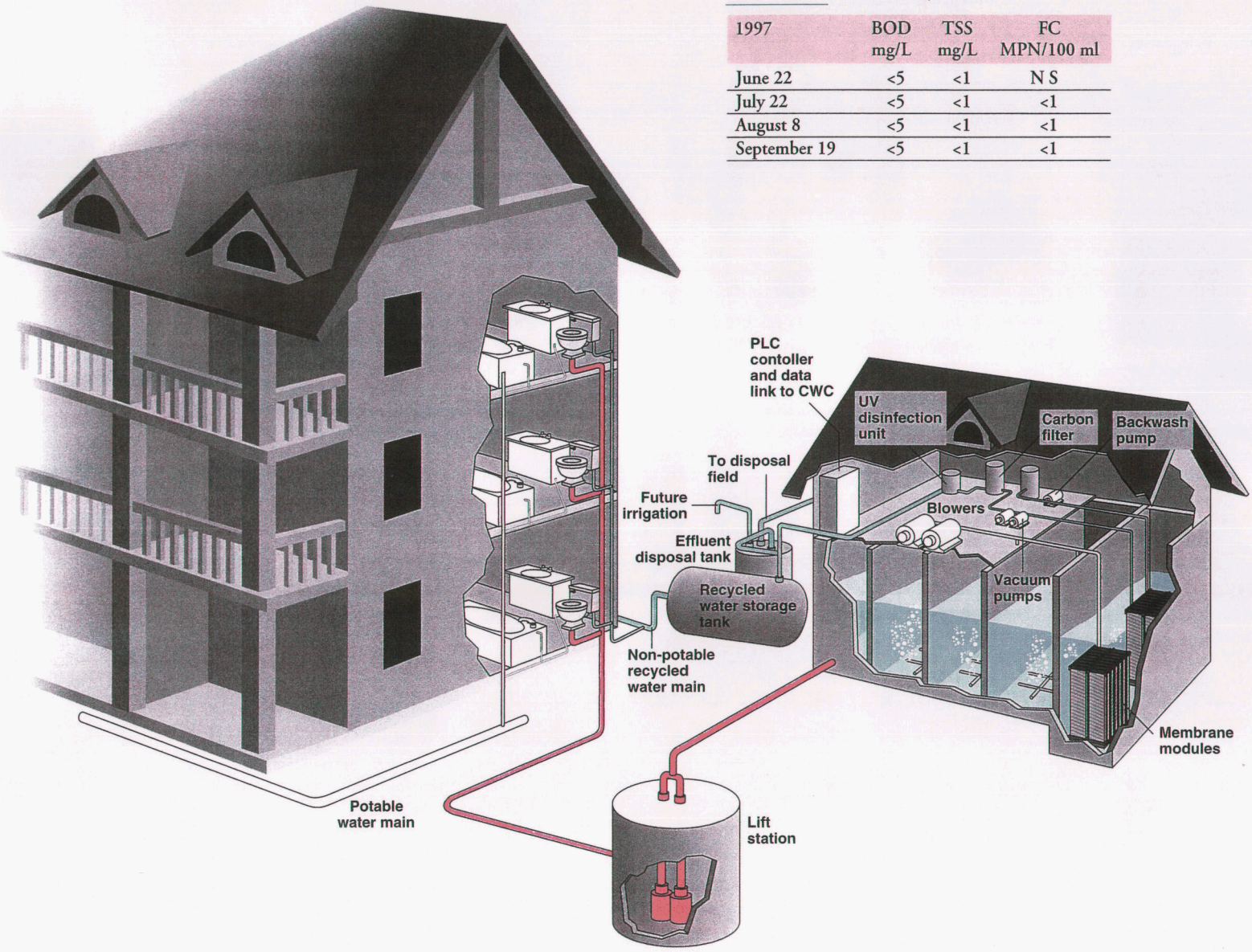
Monitoring:

Both facilities are actively controlled by a Programmable Logic Controller. The plants are operated, maintained and monitored by the Canadian Wastewater Corporation (CWC), a utility company and subsidiary of Hill, Murray & Associates.

Kingfisher Oceanside Inn:

Treated Water Quality

1997	BOD mg/L	TSS mg/L	FC MPN/100 ml
June 22	<5	<1	N S
July 22	<5	<1	<1
August 8	<5	<1	<1
September 19	<5	<1	<1



BOD: Biochemical Oxygen Demand - mg/L

TSS: Total Suspended Solids - mg/L

FC: Faecal Coliform measured as MPN - Most Probable Number of Pathogens in 100ml sample

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Email: hma@islandnet.com

TAB J

Up here
LIFE IN CANADA'S NORTH
MAY/JUNE 1996

THE Outer EDGE

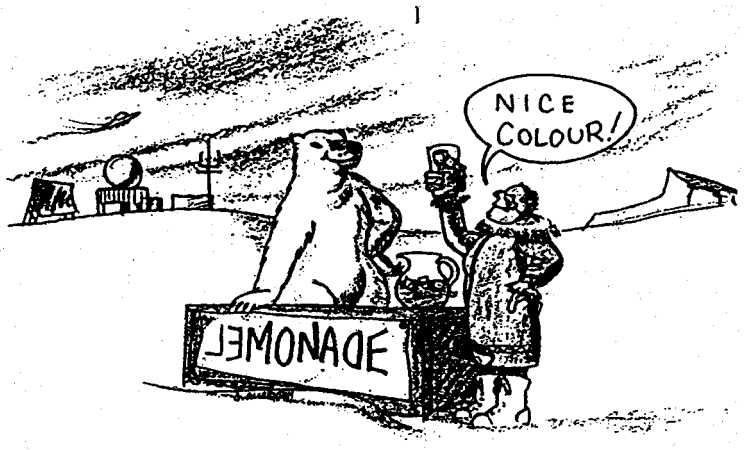
Recycling Arctic Water

Using water wisely makes sense in the Arctic, where the environment is ultra-sensitive to every human encroachment. Mindful of this, the Canadian military has installed impressive new water reclamation systems at its radar stations in Cambridge Bay and Hall Beach.

Since computer-monitored equipment was installed in November 1995, water consumption at the two High Arctic sites has been cut in half, estimates Trevor Hill, co-founder of Hill, Murray and Associates, the Pacific and NWT reps for Zenon Environmental Systems.

How's it done? Simple: water from toilets and showers on the base is cleaned and used again in toilets and urinals. (And the problem of dumping raw sewage onto the tundra has been, er, eliminated. Solid waste is separated from the water by super-fine filters and broken down by bacteria in special tanks.) A small amount of the cleaned water is sterilized by ultraviolet light and released back into the environment.

This kind of recycling isn't entirely new. In California, it's been the law for years. There, water used to flush toilets is cleaned and recirculated to irrigate lawns. ❑



TAB K

HILL MURRAY

SUSTAINABLE SOLUTIONS

ENGINEERING WATER SOLUTIONS

WESTVIEW WATER RECLAMATION FACILITY

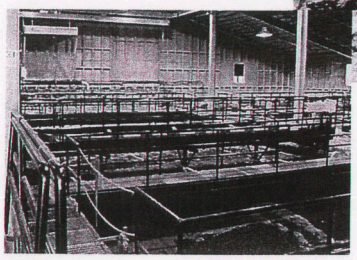
PROJECT:
Corporation of the District of Powell River
Powell River, BC

APPLICATION:
Municipal sewage treatment plant upgrade

CAPACITY:
Steady State Flow:
0.9 megagallons per day (USMGD)
Peaking Flow:
1.8 megagallons per day (USMGD)

INSTALLED:
Summer 1998

COMMISSIONED:
Fall 1998



PROBLEM:
The sewage treatment plant on the waterfront in Powell River was at capacity, produced strong odours, and was considered an eyesore. There was no room for expansion of the conventional plant and there was no land available adjacent to the site. The District of Powell River reviewed many options including relocation of the facility. Purchase of additional land would have been expensive and would have required new construction of a sewage transfer system.

The treatment plant at Powell River also receives inflow and infiltration. During periods of heavy rainfall, the plant was overloaded with high volumes and effluent discharge quality to the marine outfall was often compromised.

SOLUTION:
Hill Murray designed and built an innovative membrane-bioreactor system that was installed in the existing tanks of the old plant. Many of the components for upgrading the facility were already in place and no sewage transfer stations were required.

The new water reclamation facility is clean and odourless. The facility produces treated water that exceeds government regulations and protects the surrounding fragile marine environment. It is all housed in an attractive, 1920s-style boathouse building that blends in with its waterfront location. Following heavy rains, the plant is now capable of handling increases in flow volume of more than six times its normal capacity.

The plant can be expanded over time to match actual demand as the community grows, and may eventually handle four times its original capacity without the installation of more tanks. Additional membranes are placed in the tanks when they are needed. Taxpayers pay for what they need right now; they don't finance capacity they may not need in the future.

over ...

TREATMENT:

Half of the existing tanks were retrofitted with a ZenoGem™ membrane-bioreactor system. Unlike conventional sewage treatment, where solids slowly settle by gravity and the liquid is removed from the surface, the Zenon process pulls the liquid through the membranes with vacuum pumps, leaving the solids and pathogens behind. This process treats significantly more wastewater than conventional treatment in the same size tank.

The facility also incorporates an innovative combination of technologies that allows for complete treatment of all flows, including excess storm water (inflow and infiltration) during wet weather. The excess flow is diverted to a microscreening process that filters out suspended solids and reduces biochemical oxygen demand. When the screened flow is blended with the high-quality effluent from the membrane-bioreactor, the quality of the combined flow continues to meet the requirements of the plant's discharge permit.

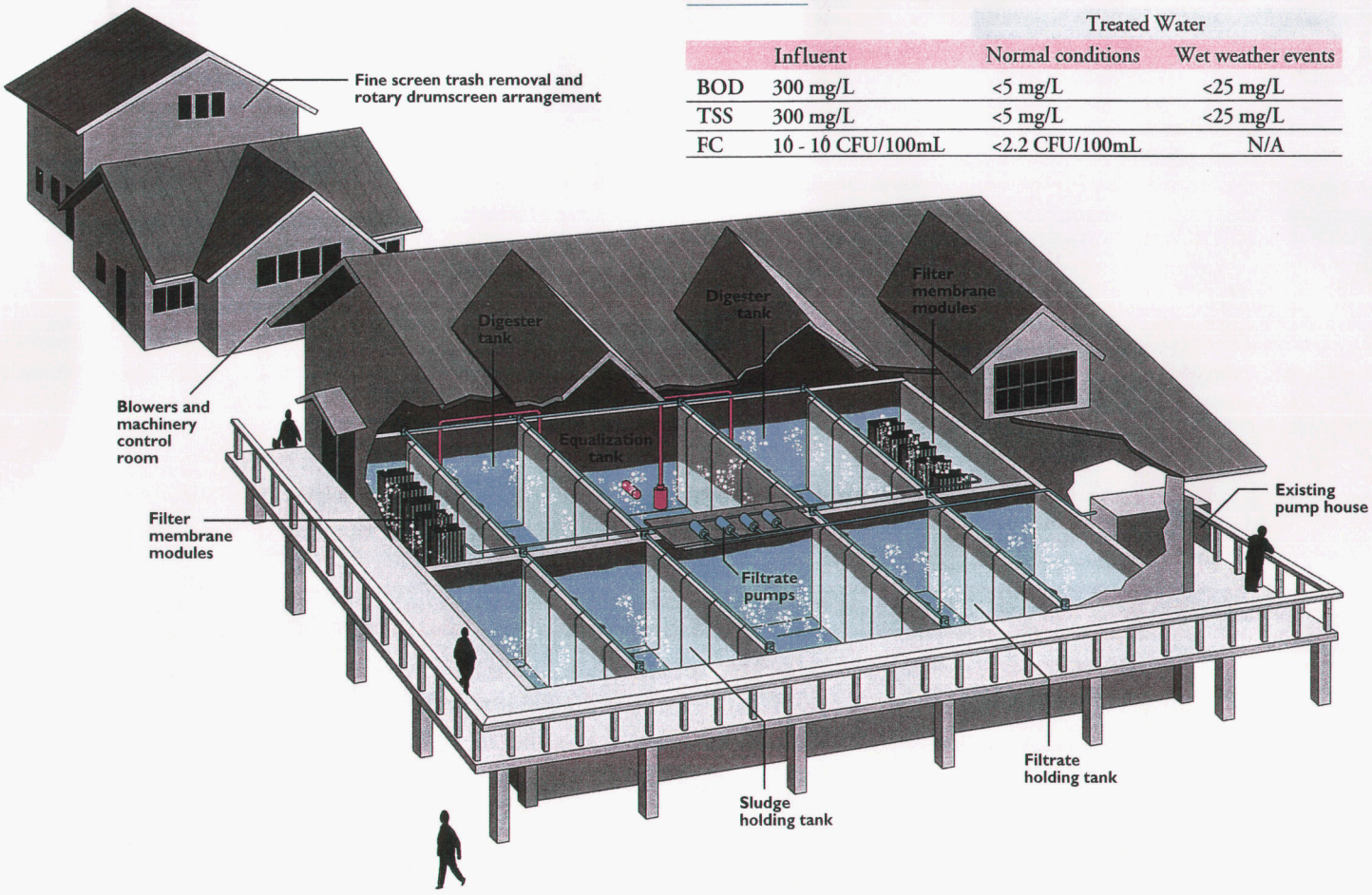
MONITORING:

The Westview Water Reclamation Facility is monitored by Canadian Wastewater Corporation, a wholly-owned subsidiary of Hill Murray. Management of the plant from a distance is accomplished with the use of a powerful suite of proprietary software and technology called Systems Monitoring And Remote Telemetry. The SMART™ system works in concert with the programmable logic controller that operates the plant. The system can verify any operating condition and respond immediately to control or alter operating parameters.

The plant is monitored 24 hours a day, seven days a week, to ensure peak performance.

TREATED WATER QUALITY

		Treated Water	
	Influent	Normal conditions	Wet weather events
BOD	300 mg/L	<5 mg/L	<25 mg/L
TSS	300 mg/L	<5 mg/L	<25 mg/L
FC	10^{6} - 10^{8} CFU/100mL	<2.2 CFU/100mL	N/A



BOD: Biochemical Oxygen Demand - mg/L

TSS: Total Suspended Solids - mg/L

FC: Faecal Coliform measured as CFU - Coliform Forming Units per 100mL sample

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Green Victoria Challenge Society Supplement

Trevor Hill with rendering of Powell River's new $5-million sewage treatment facility.

Sewage-treatment success nets city firm Green award

High-tech solutions at half the price

IT LOOKS LIKE an attractive 1920s-style boathouse, but it really contains a modern $5 million sewage-treatment plant engineered for the city of Powell River by Hill, Murray & Associates of Victoria.

The high-tech plant and its outer walls now under construction in Powell River's downtown Westview district have solved two problems for the coastal community of 10,000 people.

Powell River's old sewage plant had a continuing struggle to meet environmental regulations. Many critics regarded it as a smelly eyesore.

The first problem was finding a way to make it look, smell and work better. Some people wanted to move it out of the more densely developed area, where buildings had grown up around it. The second problem was keeping costs reasonable.

An expensive answer would have been to buy land farther away, build a new plant, and pump the sewage there for treatment. The capital cost would have been up $8–$10 million; there would have been a long public process of negotiating approvals for a new site, and the pumping cost would have been high.

Instead, Hill, Murray & Associates proposed an innovative solution that would deliver greater efficiency at half the price with less trouble. The firm won a contract to use existing tanks and buildings, install an odor-free state-of-the-art treatment facility inside, and erect the heritage-style boathouse walls and gables and public walkway on the outside.

The price is just over $5 million. For this lesser amount, Powell River gets a treatment plant that can be quickly doubled in capacity at modest cost with-

Please see RECYCLED/Page F6

CRD set f on pa

FROM THE OFFICES OF THE CRD ENGINEERING

IN FEBRUARY, the Capital District Board approved a p for Hartland landfill effectiv 1998. The ban is part of the waste management strategy the amount of material going to t landfill by 50 per cent.

The decision was based on the an extensive public consultation p which included stakeholder discu mailouts and newspaper and TV advertising. During this process s issues were identified by residents businesses.

Although many residents alrea all paper products in their Blue B have raised the question of what t confidential papers. Anke Bergner project co-ordinator, has several suggestions: "I tear apart any pap containing private information bef them into my Blue Box."

Residents can also take confidential documents to municipal depots from where they are hauled directly to the processing plant. Other options are to purchase a small shredder (share one with friends or neighbors) or to hire a private collection service for occasional large quantities.

An issue raised by many property managers is the lack of control over what some tenants might put into their garbage bins. The solution is education. The CRD has responded by producing a flyer which can be distributed to tenants and a poster which can be displayed in laundry or garbage rooms.

"We have a very active

Recycled water wave of future

Continued from Page F3

in the same walls, if the relatively stable population should take a sudden spurt in growth.

Key to the affordable answer is the patented ZenoGem™ system that combines biological treatment with membrane filtration, and uses aeration to keep the system odorless. The technology was developed by Zenon Environmental Inc. of Burlington, Ont., a leading environmental technology firm.

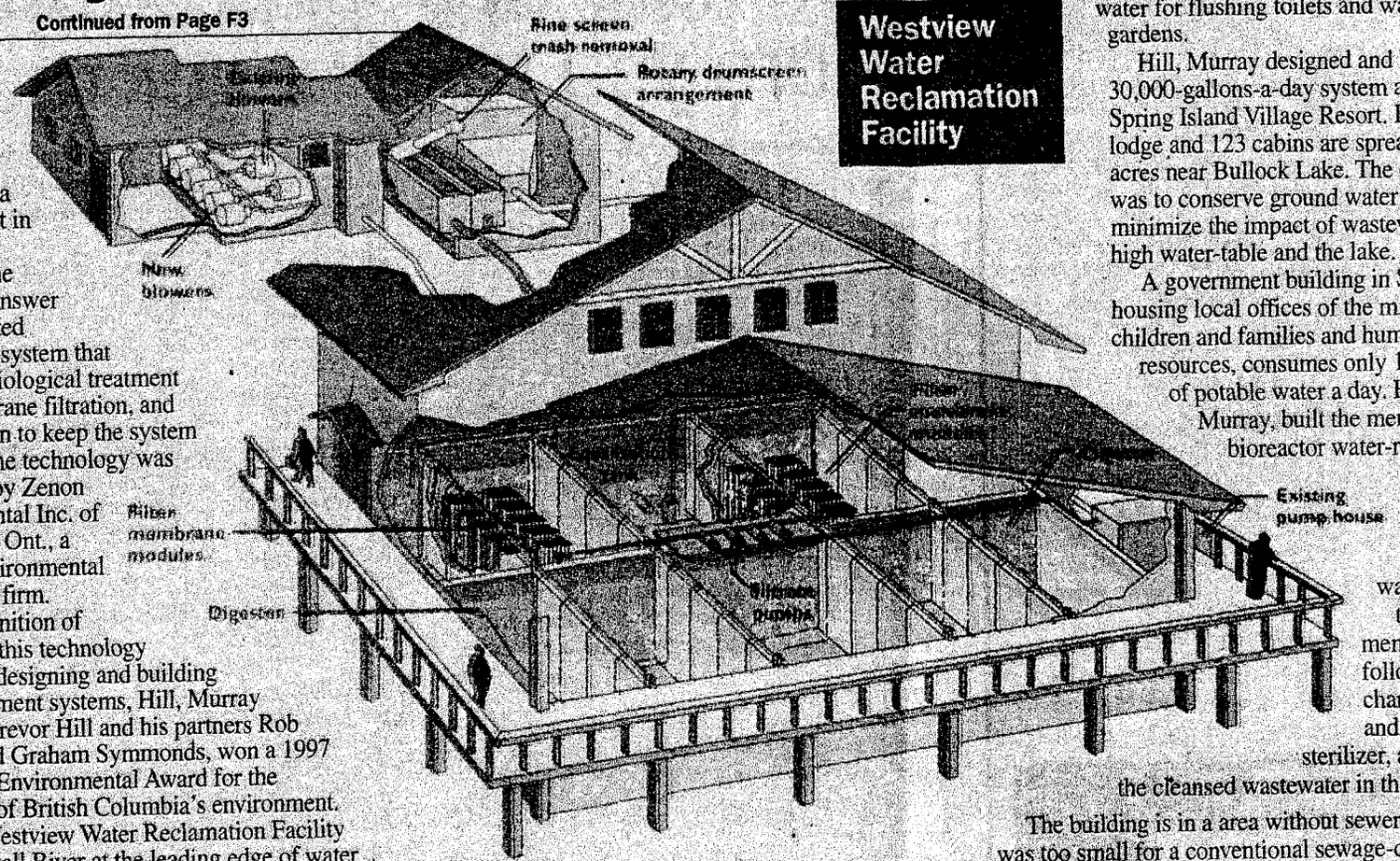
In recognition of having put this technology to work in designing and building water-treatment systems, Hill, Murray president Trevor Hill and his partners Rob Murray and Graham Symmonds, won a 1997 Minister's Environmental Award for the protection of British Columbia's environment.

Their Westview Water Reclamation Facility places Powell River at the leading edge of water reclamation. The plant becomes part of a managed biological system: Sludge is squeezed dry, composted, subjected to rigorous sanitary tests, and blended with sand and compost from yard and garden wastes to make an enriched-soil product resembling Ogogrow, the product of the Kelowna treatment plant.

"The Westview project breathes new life into an old plant, and it has no environmental impact," Trevor Hill said. "It's the largest of its kind in B.C."

Hill noted that, through processes he calls "infrastretching" and "just-in-time upgrading," the community makes thrifty use of its plant and spreads capital costs over a number of years. This keeps the load on the taxpayers to a minimum.

Operating costs are reduced as well. The plant — scheduled to open in June — will be computer-



Westview Water Reclamation Facility

Four kinds of public service earned their reputation: (1) cleansing wastewater to such a high degree that under careful safeguard it can be re-used for flushing toilets and urinals and for landscape watering; (2) working with Health, Environment and Municipal Affairs civil servants to help develop a set of regulations that govern the recycling of water; (3) saving money for the taxpayers (in projects at Powell River and Ganges, Saltspring Island, modular technology can be added step by step), and (4) protecting environment, as in the water-treatment systems they have built in ecologically sensitive places like Mount Washington Ski Resort, where purified water from their $3-million plant flows into water for flushing toilets and watering gardens.

Hill, Murray designed and built this 30,000-gallons-a-day system at Salt Spring Island Village Resort. Its main lodge and 123 cabins are spread over 36 acres near Bullock Lake. The challenge was to conserve ground water and minimize the impact of wastewater on a high water-table and the lake.

A government building in Sooke, housing local offices of the ministries of children and families and human resources, consumes only 17 gallons of potable water a day. Hill, Murray, built the membrane-bioreactor water-reclamation system which passes cleansed wastewater through membranes followed by a charcoal filter and ultraviolet sterilizer, and reuses the cleansed wastewater in the toilets.

The building is in a area without sewers; the lot was too small for a conventional sewage-disposal field. The system uses 95 per cent less water than a conventional system, and requires only a short length of disposal pipe. Hill, Murray has built similar water-reclamation systems for Sooke Harbor House (where recycled water irrigates gardens) and for Lake O'Hara Lodge near Lake Louise.

Many septic-tank sewage disposal fields in rural schools have failed owing to the heavy load routinely placed on them from 9 a.m. to 3 p.m. and at such times as parent-teacher nights — and because of the hard-packed impermeable nature of the soil under playing fields, where the disposal pipes often lie. Polluted water may even accumulate in playing areas.

This problem will not occur at the new $3.8-

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Operating costs are reduced as well. The plant — scheduled to open in June — will be computer-monitored from Hill, Murray's Victoria headquarters by Canadian Wastewater Corporation, a subsidiary company. Hill, Murray offers a written guarantee of ongoing compliance with environmental regulations.

Hill and Murray are two former marine systems engineers who started thinking about a civilian engineering enterprise when they were serving as Canadian naval officers. They drew inspiration from the on-board reverse-osmosis desalinators that turned salt water into drinking water in naval ships.

After leaving the navy, they made a connection with Zenon and built their water-treatment business in four years from a small home-based venture into a multimillion-dollar company.

places like Mount Washington Ski Resort, where purified water from their $3-million plant flows into Piggott Creek, and Kingfisher Oceanside Inn near Courtenay, where their water reclamation facility saves three million gallons a year and protects nearby Baynes Sound.

Until this year, recycled-water projects have been permitted in B.C. on a case-by-case basis only, while public health and environmental officials watched them closely. This year, B.C.'s first set of regulations for the use of piped recycle water are due to be proclaimed.

Water-short Saltspring Island is the scene of Canada's first resort/residential community with two sets of water mains in the streets. One set of pipes carries drinkable water. The other pipes carry recycled

Polluted water may even accumulate in playing areas.

This problem will not occur at the new $3.8-million, 300-student Huband Park Elementary School near Courtenay, due to open Sept. 1. A wastewater-recycling system built by Hill, Murray will cut the discharge of wastewater from 5,000 gallons a day to 500 (equivalent of the outflow from two households).

Without this technology, the school could not have been built at that site. The area and soil quality of the site did not allow a conventional septic field.

Other rural schools with limited well-water supply and stressed-out septic tank systems are candidates for a wastewater upgrade.

For more details, call Trevor Hill at Hill, Murray & Associates, (250) 388-3930 or 360-6688; fax (250) 388-3943.

'Cycle and soak' drives savings

devices can be shielded against abuse. A road-pricing trial could be organized on a Gulf Island.

People who leave the car in the garage and commute by bicycle, transit and vanpool would pay less than they pay now. People who habitually drive their cars on short errands, or drive long distances to work in single-occupant cars, would pay more. The majority of people on that test Gulf Island probably would pay less, so the social experiment would be off to a good start.

When the system were introduced on a larger scale, perhaps on Vancouver Island, the soaring increase in kilometres driven would be cut back. Road costs, road deaths, air pollution, police and health-care costs would be reduced.

Aren't drivers paying enough already? That is a matter of opinion, but one fact seems to be nailed down: Drivers pay far less in gas taxes, automo-

expense of non-drivers. Those who drive many kilometres a year are getting a cheap ride at the expense of those who drive only a little. Some public relations campaigns have argued the opposite, but the numbers can be sorted out. Transportation economist Todd Litman of Victoria Transport Policy Institute has done his homework on this question (*Environews*, June 18, 1996).

He cites studies that calculate the costs of road construction and maintenance, policing and emergency services. They show that, when all direct government costs are considered, private cars are subsidized more than five cents a kilometre by the general taxpayers.

Other costs — such as health-care costs from air pollution, and deaths and injuries and property damage from road crashes — create an additional subsidy to the private car of more than 10 cents a kilometre. Many drivers are in denial

opposite. It could make driving less nerve-wracking. By encouraging people to drive for use and enjoyment, rather than by habit, the system could open up the roads. By channelling more money into public transit, it could weave together roads, rail, buses and ferries into one user-friendly people-moving network.

The present mixture of traffic-clogged roads, sprawling urban growth, and stringent transit and ferry budgets, punishes the poor, the disabled and the elderly. It wastes millions in tax money. We still have a little time to change this ramshackle system before we are locked into it beyond reversal.

Automobile manufacturers such as Honda, which already is a front-runner in the race to make cars more fuel-efficient and less polluting, could diversify into the manufacture of small electric station cars which would plug in and recharge in parkades at rail stations. Tax

accessible taxis and jitney buses, could be widely extended.

Senator Kenny's earmarked-revenue principle could be applied here. Money for road-pricing would finance transport pilot projects. Provincial and federal governments would entrust arm's-length experts with the task of inventing solutions that would bring long-range benefits to all players. The experts could take the blame; the politicians could take the credit.

Some people will become angry about these proposals. Fear and anger are predictable responses to far-reaching changes. In our search for answers to social-economic puzzles, however, there is much to be said for social invention, experiment, fact-finding and cool, rational debate. We can learn a lot and gain great benefits if we are willing to risk innovation.

G.E. Mortimore PhD is an anthropologist and journalist. Tanis Doe PhD is a sociologist.

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VOL. 70 NO. 44 Sunday, October 11, 1998 36 Pages – 60¢ Copy

CRIERchronicle

Popcorn crew – Page 3

Little hiker – Page 13

Fall bazaar – Entertainer

Wastewater plant hailed as 'investment in future'

by Terry Kruger
Editor

Powell River's new "water reclamation facility" was officially opened Thursday and although it's still in the commissioning phase, the plant is already receiving rave reviews.

Dozens of contractors, municipal representatives, government officials and visitors from other communities gathered for the ceremony last week.

By all accounts the $5 million facility built to replace Westview's outdated sewage treatment plant is on the cutting edge.

"It's a major achievement," said Deputy Environment Minister Cassie Doyle. "It...sets a new community standard for wastewater treatment.

"The District of Powell River should be applauded for taking this opportunity to do this upgrade."

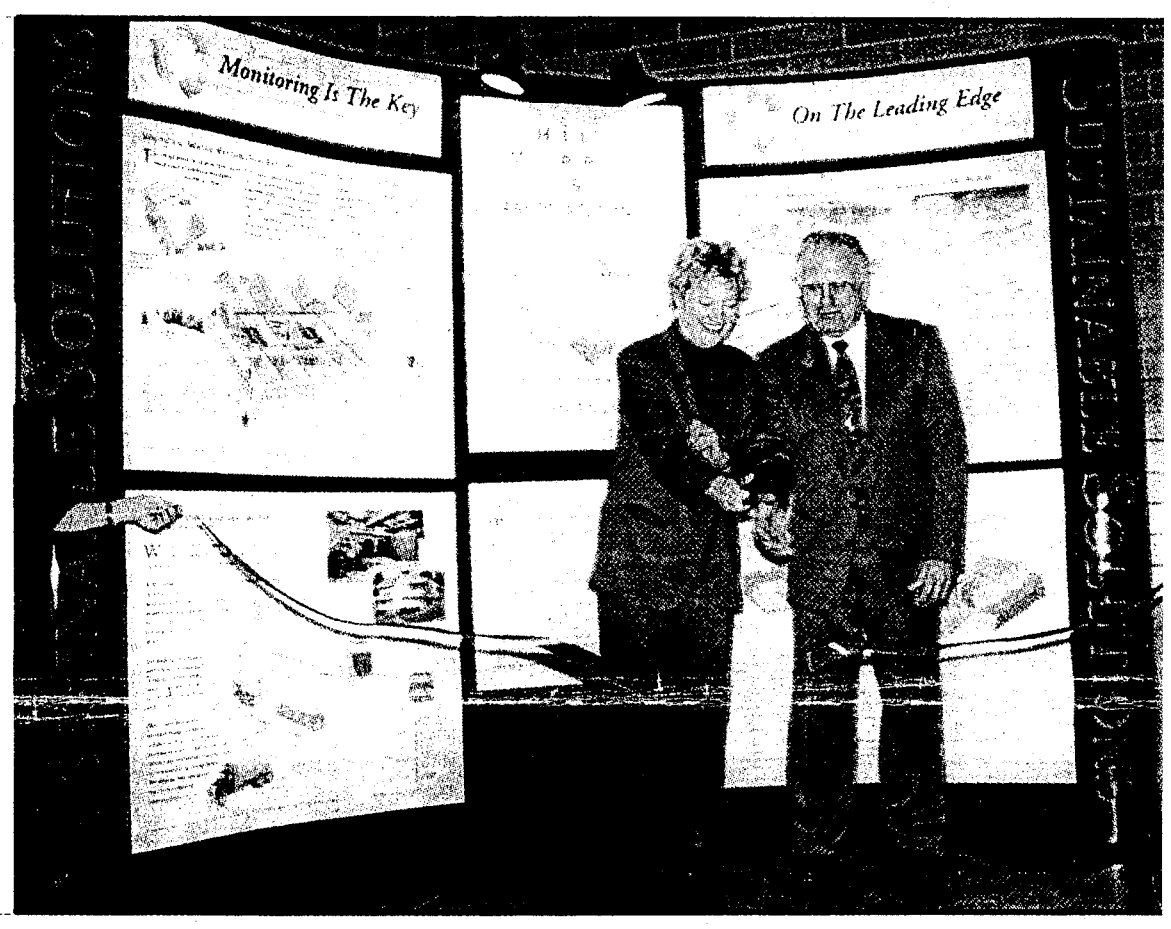
She said the issue of bringing old facilities into compliance with modern environmental standards is one of the "biggest challenges" facing municipalities.

"This project is exactly what sustainable development is all about," she said.

Trevor Hill, president of Hill, Murray and Associates – the company that designed and built the plant – said the Westview plant was a perfect opportunity to show what can be done.

"By retro-fitting the existing plant with advanced technology,

See WASTE, Page 2



A CUT ABOVE: Deputy Environment Minister Cassie Doyle and Mayor Arnold Carlson cut the ribbon to open the new Westview Water Reclamation Facility.

Official gets first-hand look at mill

A permit extension for Pacifica Paper's recovery boiler is a top priority for the provincial Ministry of Environment.

Cassie Doyle, the deputy minister was in town Thursday for the opening of Westview's new wastewater treatment plant. She also got a quick tour of the mill. "I wanted to see it on the ground," said Doyle, "and give the message to the mill that this is a top priority. We're looking to have a decision by mid-October."

The mill has applied for an extension until 2002 to meet Level A air quality guidelines for its recovery boiler. If it isn't granted, the mill expects to shut down the kraft mill and lay off 250 workers.

Pacifica strikes new tune with an old idea

by Terry Kruger
Editor

The old Powell River Company-sponsored pipe band helped establish this community's musical heritage.

Now, the new company that owns the pulp and paper mill wants to add a new dimension to the cultural scene.

Pacifica Papers Inc. has sponsored establishment of a male chorus of Powell River mill workers and former mill workers.

Chor Pacifica has already held two rehearsals and is developing quite a sound, said Dal Matterson. He volunteered to get the group going at the invitation of mill manager Harvey Reithaug.

Reithaug said it's a way for the company to be involved in the community and capitalize on Powell River's musical heritage as a "centre of musical culture in the province."

So far, 27 men are involved, including Reithaug. Don James is conductor, Steven Price is vocal coach and assistant director and Richard Olfert is accompanist and assistant conductor.

Matterson said there's a tremendous amount of energy in the group, even though it only got together for the first time Sept. 28.

"It is surprisingly good and incredibly rich," said Matterson. "The atmosphere is one of warmth, energy and enjoyment."

While some of the members have musical backgrounds, others do not.

Reithaug said his only exposure to this kind of music came 30 years ago when he was in the chorus of an amateur production of My Fair Lady.

"I guess I can carry a tune," he told the *Town Crier*.

The chorus will concentrate for now on folk songs and show tunes, said Matterson.

Their first public performance will come in December when they're scheduled to sing at the Pacifica Christmas party.

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Trail a harvest priority

by Sean Percy
Staff Reporter

The Toquenatch trail will be a serious consideration in making harvesting plans for nearby logging blocks.

That was the only firm commitment obtained by two dozen people who met with Forest Service officials on the Toquenatch trail Wednesday.

The trail is a historical logging road that goes through beautiful forest, including some old growth, near the the head of Okeover Inlet. It's also part of the Sunshine Coast trail, which runs from Saltery Bay to Sarah Point north of Lund.

The Forest Service's small business development plan shows logging to be done in the area by 2001.

Though most of the people at the meeting in the forest were opposed to logging in the area, Forest Service operations manager Mark Anderson said he's glad the concerns have been raised now, rather than just before logging was set to begin.

"We learned each other's needs," Anderson said.

"We're very pleased to have public input. We'll try to work within the process to see if there is some common ground."

Although he admitted the meeting brought no solutions, it was a valuable information gathering session.

In making decisions on where and how to log, all values, including recreational, environmental and business concerns, must be taken into account.

"We try to make a plan that incorporates all values."

"We talked about moving the trail, putting buffers along the trail, re-establishing the trail after logging, partial cutting, large clear cuts, small ones."

Field work to map out the area will be done later this year or next summer.

Anderson and the group also committed to establishing an inventory of the trail network in the backcountry so the Forest Service doesn't inadvertently impact recreational values.

"We'll be working toward funding, either from internal or external sources, to ensure the trails are surveyed and mapped properly," Anderson said.

Waste from Page 1

we eliminated the requirement for...Powell River to build a wholly new facility on a different site. This upgrade technique saved an estimated $3 million on infrastructure costs."

He also told the *Town Crier* that had the municipality chosen to go with a traditional plant that it would have been unlikely to be built in time to quality for $2.1 million in federal-provincial infrastructure funding.

The new facility uses membranes to reclaim water from the liquid waste stream.

The solids that result are dewatered and will be composted for use as a fertilizer.

Even during peak flows, the discharge into Malaspina Strait is said to be good enough to meet new provincial regulations.

As well, Hill said the project pumped more than $1 million into the Powell River community through contracting of some parts of the project to local firms.

Hill-Murray also dipped into its profit margin to put some of the finishing touches on the plant, said Hill.

He reiterated the company's pledge that once the facility is running at peak efficiency, any odor associated with the sewage treatment process should disappear.

Sludge options available

With the new Westview sewage plant operating, the municipality is to turn its attention to solving the question of what to do with the sludge created by the process.

Public Works Committee chairperson Councillor Gerry Gray said council will likely sit down to examine its options within the next couple of weeks.

Two companies that offered to run a municipally-funded compost operation later withdrew their bids when people living near the proposed sites opposed the plan.

That left council with nowhere to turn in early September, but Gray said there are a half-dozen options now available.

One would see the "biomass" left over from the treatment process composted in a facility at the present waste transfer site.

Another would see it shipped to a composting facility in Courtenay. It could also be sent to the Rabanco landfill. There is also the likely to be a new proposal from a local bidder, although no details were available. The possibility of spreading it on land near Sechelt is also in the preliminary stages of research.

Local RCMP feel impact of budget reductions

British Columbia RCMP have begun taking measures to balance the budget and make up a $8.5 million deficit from 1997-98.

The Vancouver E Division senior managers have taken steps such as grounding the force's air fleet and docking their boats.

Sgt. Jeff Lott of the Powell River detachment said the measures may affect the community force with regards to the aircraft and the boats.

"The budget will not affect us as far as service to the community," said Lott.

The Powell River detachment has use of the helicopter in Courtenay, however, it has been grounded as well, and is only to be used in emergency situations.

Lott said overtime is an issue at the local detachment and steps have been taken to reduce the amount of overtime worked.

L

We want a plant like yours

Editor's note: This letter to councillor Gordon Crawford at the Corporation of the District of Powell River was received for publication.

Dear Mr. Crawford:

I would like to take this opportunity to sincerely thank you for the hospitality you extended to my group and I when we recently toured your city's wastewater treatment plant. Powell River is a beautiful place that I will always remember fondly.

As impressed as I was with the local scenery, I have to say that as an engineer I was equally impressed with your wastewater treatment plant.

Your city's decision to construct a new wastewater treatment plant with this innovative Zenon system is one that I believe you can all be proud of. The effluent quality form this plant was particularly impressive.

I took an aerial photograph of your wastewater plant as we were leaving. If I didn't know better I would think it was a restaurant. Good job!

We were so impressed, in fact, that we will soon begin designing a similar facility for one of our clients here in California. I will keep you informed of our progress.

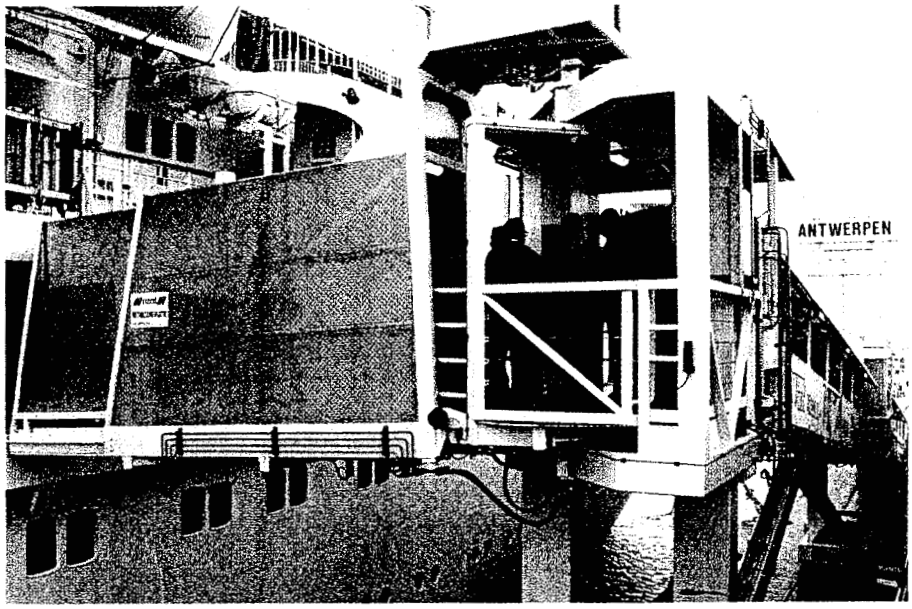
Thanks again,

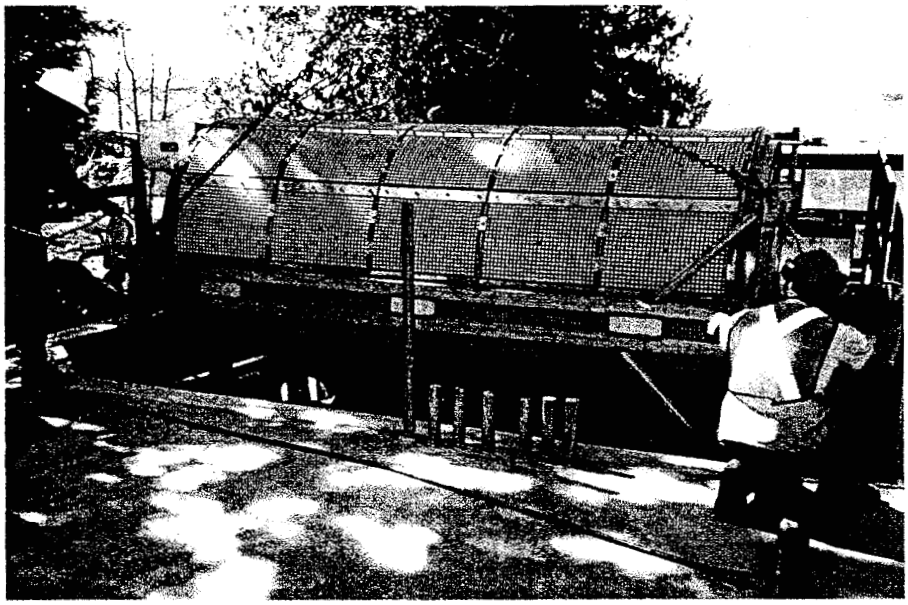
George Harris
HydroScience Engineers, Inc.
Sacramento, California

Mobile Cruise Ship Passenger Gangway

This gangway was designed for the Port of Antwerp, Belgium to service the new classes of cruise ships and solve passenger safety problems on an ancient pier with a cobblestone surface. The gangway was designed to move on existing rails along a narrow riverside pier in the "old city" section of Antwerp. The system is similar to gangways designed by CMC Engineering and Management Ltd of Vancouver for the Port of Vancouver's Ballantyne pier: all are fully automated to safely follow tide movement without operator intervention.

Owner: Havenbedrif Antwerpen (Port of Antwerp). Manufacturer: Real Corporation nv, Belgium. Design and Commission: CMC Engineering and Management Ltd. Partner in Charge: Michel Vander Noot PEng (electrical). Other CMC Professionals: Rene Wedding PEng (materials handling and mechanical), Kalyan Ghosh PEng (structural), Minoo Colah PEng (structural).



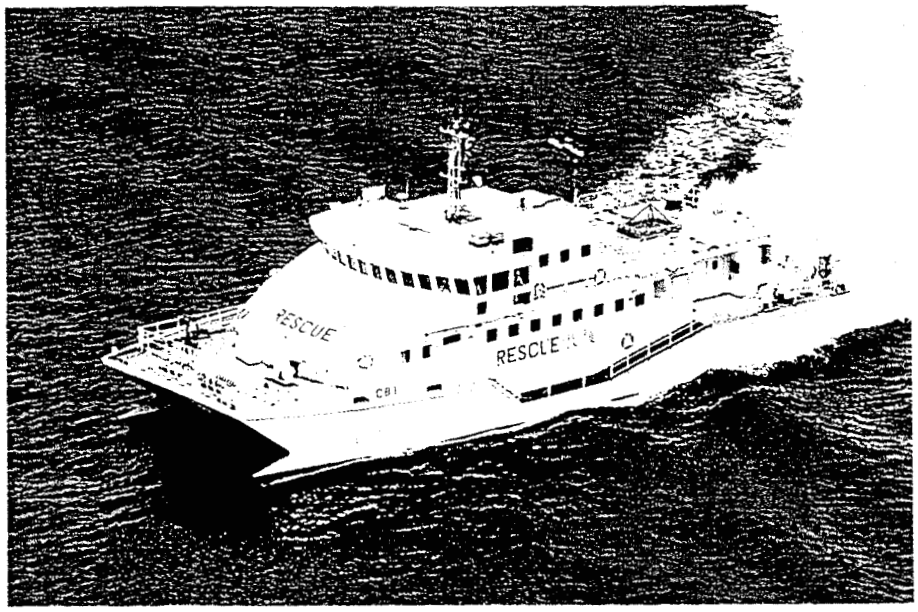


Water Reclamation Facility

Hill, Murray & Associates of Victoria designed and built a $5 million retrofit of the District of Powell River's sewage treatment plant. The old plant produced strong odours and frequently failed to meet environmental regulations. The installation of a state-of-the-art membrane bioreactor system resulted in significantly increased treatment capability in the existing infrastructure. By utilizing existing tankage and enclosing the facility in an aesthetically pleasing building, relocation of the facility was not required, resulting in an estimated savings to the District of $3 to $5 million. Designed to meet the new Municipal Sewage Regulations, the water reclamation plant, one of the largest in the province, produces tertiary quality treatment and has eliminated odour in the vicinity of the new facility. The plant also incorporates the concept of "just in time" infrastructure, which allows for simple phased upgrades in the future.

Rescue Command Vessels

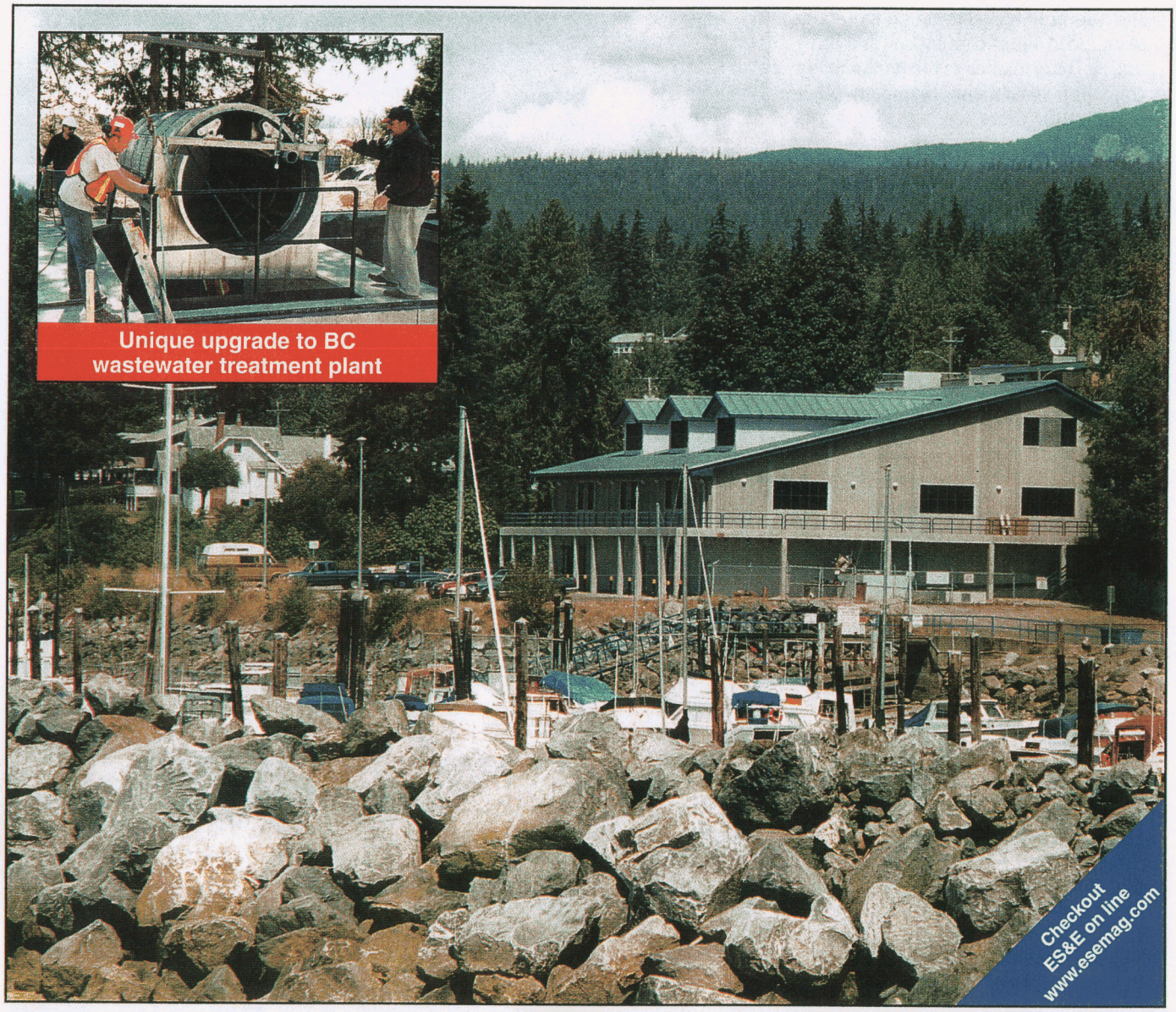
The air/sea rescue catamarans CB1 and CB2 were recently completed by Greenbay Marine (Pte) Ltd of Singapore for service at the new Chek Lap Kok airport in Hong Kong. These innovative vessels were jointly designed by Incat Designs of Sydney, Australia, and Robert Allan Ltd of Vancouver, BC, the same team responsible for the design of the new fast ferries for the British Columbia Ferries Corporation. These distinctive 35 m craft have a top speed of 28 knots powered by high-speed diesels driving KaMeWa 71 II waterjets. The vessels have the capacity to handle 300 survivors each and incorporate a large survivor holding lounge, inflatable rescue "beaches," fast rescue boats on rapid deployment launchers, emergency hospital facilities, helicopter rescue zone and firefighting capability. The project manager in Vancouver was Ken Harford PEng of Robert Allan Ltd.



ENVIRONMENTAL Science & Engineering

Focussing on industrial/municipal wastewaters – hazardous wastes – air pollution & drinking water treatment

Canada's top award-winning environmental magazine **November 1998**



Storage tank options – a special *ES&E* focus

Consulting engineers face new challenges

Management of combined sewer overflows

Some surprising insurance claim statistics

Large water treatment system opens in NS

Examining aquifer storage options

Unique upgrade to sewage plant in Powell River, British Columbia

The District of Powell River's facility for sewage treatment was considered an eyesore by local residents and businesses and was producing strong odours. The plant faced significant inflow and infiltration (I&I) challenges from the aging collection system and, like many other plants of the same age, was nearing its capacity.

The original facility had been built in the early 1970s near the waterfront in Powell River to take advantage of the hillside topography of the town and allow for a primarily gravity based collection system. This feature now created a significant hurdle for the replacement of the plant. One possible location for a new plant was approximately 3 km away and at an elevation of 70 metre rise above the current end of the collect system.

Installation of drum screen during construction of Headworks building.
Photos courtesy Hill-Murray and ZENON Environmental.

Hill, Murray and Associates, of Victoria, BC, has designed and built a unique and affordable upgrade of the original plant that avoided the costs of new land acquisition and forcemain construction associated with relocating the plant.

The renamed Westview Water Reclamation Facility has an upgraded design flow of 1 US mgd (3800 m^3) with a 2 x peaking factor. The facility provides tertiary quality wastewater treatment using a combination of technologies, including a ZENON Environmental Inc. patented ZenoGem™ Membrane Bioreactor (MBR) system, for the over 10,000 people of the community.

The plant receives influent wastewater into the new Headworks building, built within the borders of existing property. Trash is removed with two ML SCS 50 screw screens, supplied by Pro-Aqua Engineering. Within the existing British Columbia Ministry of the Environment regulations, there is an allowance for the provision of a primary bypass of flows in excess of 2 x Dry Weather Flow, (ie. Flows associated with I&I) if the community agrees to address the I&I issues over time. To meet this requirement the plant was fitted with two 1.5 US mgd (5700 m^3) capacity drum screens, built by PRA Manufacturing of Nanaimo, BC, in a parallel channel to the MBR feed system, to treat stormwater overflow during wet weather events. Panels with 37-micron screens filter out suspended solids and reduce overall biochemical oxygen demand from the filtrate. The concentrated reject water is directed back to the main flow for MBR treatment while filtrate is later blended with the main plant's outflow. This mechanism for dealing with I&I flows has proven very cost-effective.

The existing Process Control building was upgraded with a 600 volt, three phase electrical power supply system. The original facility's blowers were rewound and three new Lamson centrifugal blowers were installed to add extra capacity for the MBR process. The exterior of the building was renovated to match the new Headworks and Treatment buildings.

The original concrete treatment tanks were seismically upgraded and enclosed by a new two-story building. The exterior of the Treatment building has been designed to look like a 1920s style boathouse to blend in with the waterfront location. Both the Treatment building and the Headworks building were constructed using prefabricated concrete panels from Advanced Building Systems Inc. of Kelowna, BC.

In the tanks, two of the four treatment channels were fitted with ZenoGem™ MBR systems during a live change over performed through the drier summer months. Each channel has a capacity to treat over 750,000 US gpd (2850 m^3). Combined, this capacity equals two times dry weather flow. The ZenoGem™ Membrane Bioreactor system combines biological treatment with hollow fibre membrane ultrafiltration for municipal wastewater treatment. The MBR system also includes full nitrification and denitrification. In more conventional sewage treatment systems, solids retention time (SRT) and hydraulic retention time (HRT) are linked.

The ZenoGem™ system decouples the link by actively separating water with the membrane system, leaving the solids and pathogens behind. This process can treat significantly more volume of wastewater in the same size tank as a result of significantly reduced HRT. Typically, existing municipal treatment system's tankage may be upgraded to treat four times its original capacity. SRTs of over 50 days are normal as the MLSS concentration in the bioreactor operates between 13,000 and 16,000 mg/L. Total sludge volume produced is also reduced significantly because of the long SRT, and odour is significantly reduced as the plant acts both in an aerobic treatment capacity as well as in an

*President,
Hill, Murray & Associates Inc.

aerobic digester capacity. Treated water is disinfected with UV radiation from a Trojan Technologies Inc. unit before discharging to an ocean outfall.

A dual channel, rotary sludge dewatering press from Fournier Industries Inc. of Black Lake, Quebec, is installed in a portion of the Headworks building. The Fournier press has some unique ability to press activated sludges to 20-25% dryness. This equipment, combined with biofilters for odour control, completes the total on-site treatment system.

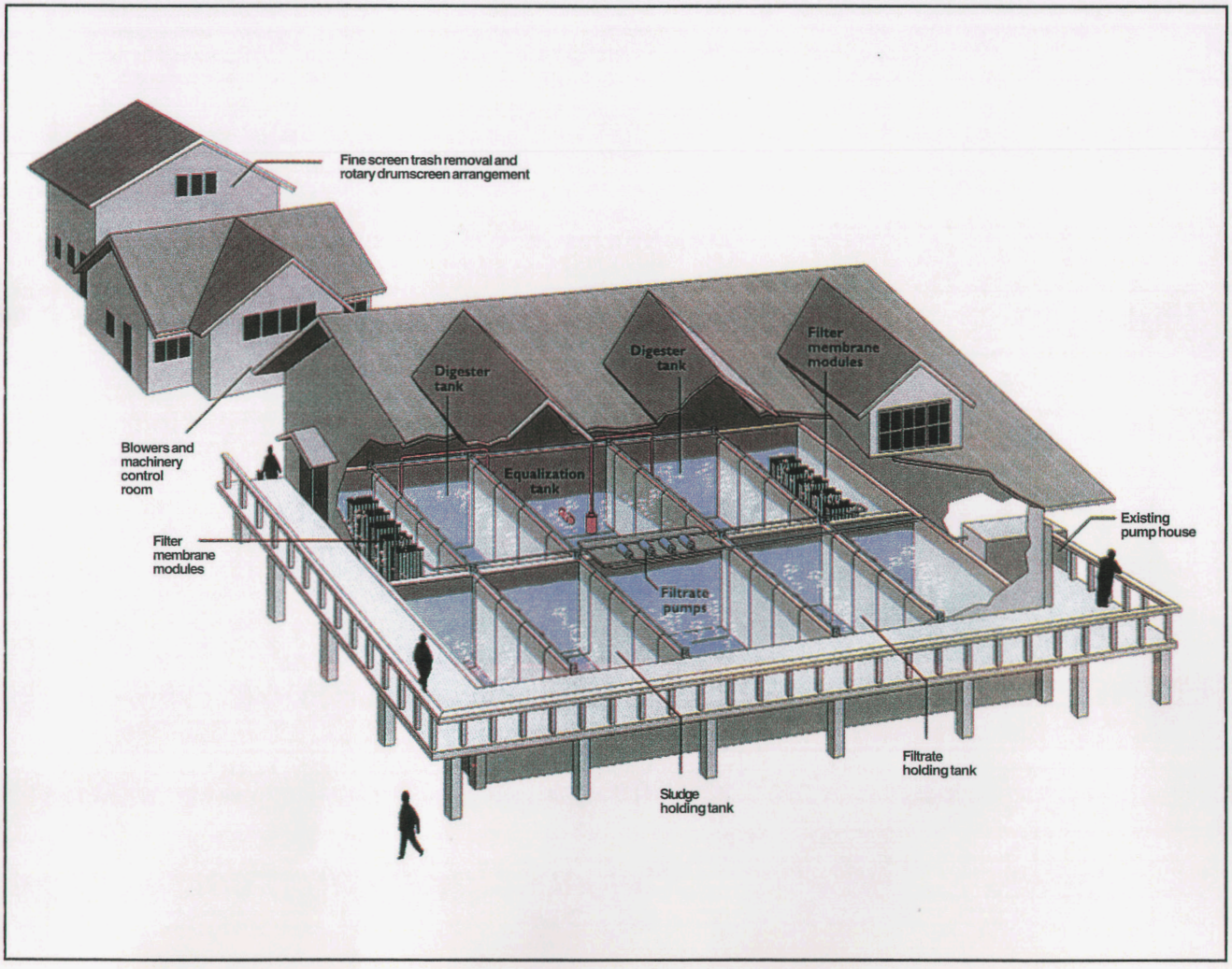
Treated water quality is produced at less than 5 mg/L BOD and TSS; turbidity is less than 0.1 NTU while fæcal coliform counts are less than 25 CFU per 100 mL. When stormwater overflow from the drum screens is blended with this high-quality effluent, the quality of the combined flow continues to meet the plant's secondary treatment requirement at all flows.

A suite of proprietary software and technology called *SMART™* works in concert with the programmable logic controller that operates the plant. The *SMART™* system, short for Systems Monitoring and Remote Telemetry, was developed by the Canadian Wastewater Corporation (CWC), a wholly-owned operations division of Hill-Murray. The system can monitor and control the operations of the plant locally and remotely, allowing CWC to respond immediately to control operating parameters, usually without a visit from a trained municipal operator.

From breaking ground in November 1997, the upgraded plant was commissioned in just eight months in July 1998. The project, representing the largest MBR plant of its kind in Canada, has breathed new life into the old plant. With the MBR upgrade, this facility has the capacity to handle all flows from the sewered areas of the District of Powell River which were served by the original facility. The MBR upgrade also begins to address challenges associated with inflow and infiltration in the aging collection system.

The plant can be expanded to accommodate increased wastewater volumes in the future when needed. Space for an additional trash auger and another drum screen has been included in the Headworks building. Two additional MBR treatment channels can be built in the reserve tanks in the Treatment building. The "just-in-time" concept of future upgrades means that capital costs for new equipment can be spread over a number of years and the impact on the taxpayer is minimized. In addition, this increased capacity can be accommodated within the existing footprint negating any requirements for additional land.

Hill-Murray's leadership in wastewater treatment and reclamation facilities resulted in a 1997 Minister's Environmental Award for its contribution to the protection of BC's environment.



Interior view of the Westview Treatment Facility. Photos courtesy Hill-Murray and ZENON Environmental.

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SOLUTIONS

Hill, Murray & Associates Inc. specializes in the Design-Build-Operation and Finance of water reclamation facilities for water recycling and reuse.

Hill Murray recognizes the contributions of ZENON Environmental Inc., Fournier Industries Inc., P.R.A. Manufacturing Ltd., and Advanced Building Systems Inc. in making the Westview project a great success.

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...because every drop counts.

TAB L

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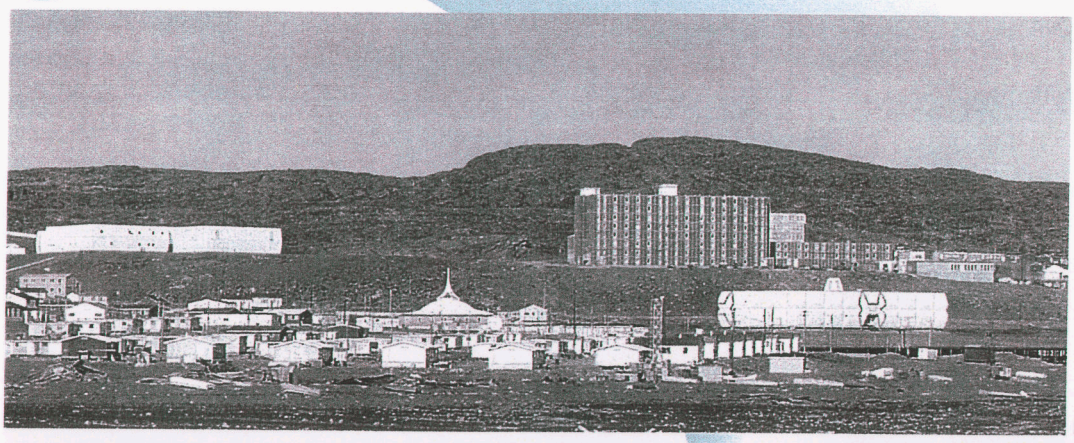
WASTEWATER EXCHANGE

ENGINEERING WATER SOLUTIONS

"Visit Hill Murray's Website at www.hillmurray.com"



Tessa MacIntosh/NWT Archives

The Iqaluit water reclamation facility will be Hill Murray's third Arctic installation.

CANADA'S NEWEST CAPITAL CHOOSES HILL MURRAY

A growing Arctic community has chosen an innovative proposal to design, build, and operate its new $6.7 million water reclamation facility. The Municipality of Iqaluit, which is rapidly becoming the hub of the eastern Arctic, selected Hill Murray over a large field of companies from across North America.

The facility's initial capacity will handle 500,000 imperial gallons a day. The high quality of effluent will have a significantly reduced impact on the marine environment. The fully aerobic system will provide treatment independent of seasonal temperature changes.

Construction of the new facility will start in the summer of 1999 and will be commissioned in January 2000. Iqaluit, formerly known as Frobisher Bay, is located on southern Baffin Island and has been designated as the capital of Canada's newest territory, Nunavut. The municipality is making many new investments in infrastructure, including a new legislative building, housing, and municipal services.

Hill Murray already has two water reclamation facilities in the Arctic, serving the Department of National Defence's remote radar stations. All plants, including Iqaluit, are monitored and operated remotely using software developed by Canadian Wastewater Corporation (CWC), the operations subsidiary of Hill Murray.

HILL MURRAY PRESIDENT FINALIST FOR ENTREPRENEUR AWARD

Trevor Hill, President of Hill, Murray & Associates, was one of three finalists in the Young Entrepreneur category for the Pacific Region Entrepreneur of the Year Awards.

Hill Murray President, Trevor Hill and Cassie Doyle, Deputy Minister of Environment, Lands and Parks at the recent opening of the Westview Water Reclamation Facility *(see page 4)*

In just four years, Hill, with partners Robert Murray and Graham Symmonds, has taken Hill Murray from three employees to over 20. The firm is now recognized as one of the leading design-build, water reclamation engineering companies in the Pacific Northwest.

Wastewater Exchange is published regularly by Hill Murray, a Victoria-based, Canadian-owned company that specializes in advanced water and wastewater treatment and water reclamation.

Canadian Wastewater Corporation: A new kind of utility

Canadian Wastewater Corporation (CWC) was established in 1995 as a unique utility company to operate and maintain the water reclamation facilities designed and built by Hill Murray.

CWC builds on Hill Murray's expertise to ensure accountability and knowledgeable service to clients – service that includes a commitment to permit, design, build, finance, operate, and maintain each facility for as long as it is needed.

In concert with Hill Murray, CWC transfers the risks involved in water reclamation projects by assuming responsibility for the facilities and the quality of the treated water.

One of CWC's key focuses is to form partnerships with local governments to own and operate facilities. These public-private partnerships (P3) represent a new, affordable way of providing services to communities. The costs of building water reclamation facilities are often prohibitive to taxpayers, especially since government grants to municipalities have been drastically reduced.

CWC
CANADIAN WASTEWATER CORPORATION

Public-private partnerships are the wave of the future for local governments

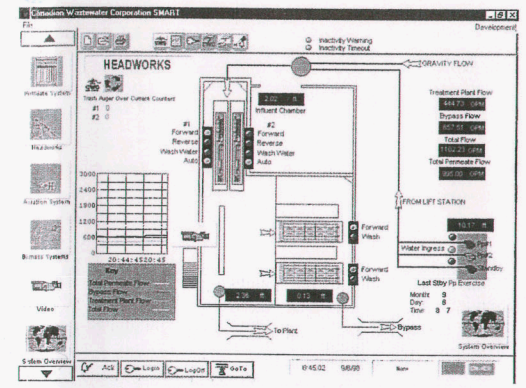
Most CWC installations run virtually without on-site staff. The plants are actively controlled by a programmable logic controller, a combination of hardware and software that activates systems as required by the plant's sensors.

Monitoring is a key element in all of these plants. Reclamation facilities are monitored continuously using sophisticated computer and telecommunications technologies. CWC staff are notified via pagers if the plants are not operating at peak performance.

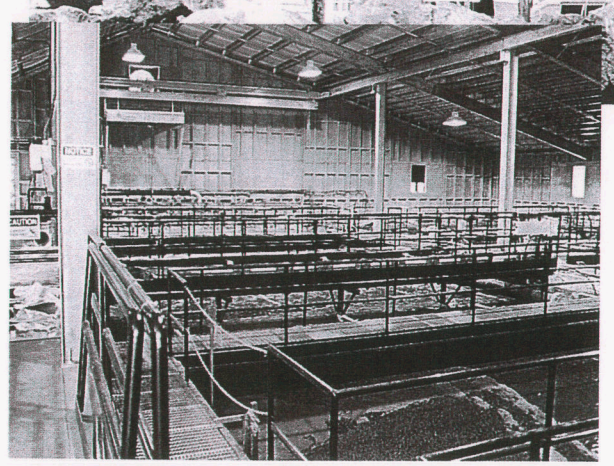
The control systems are accessed through a modem link, allowing the company's technicians to alter the operation of the plant remotely.

Management of a plant from a distance is accomplished with the use of a powerful suite of proprietary software and technology called SMART™ – Systems Monitoring And Remote Telemetry. The SMART system works in concert with the programmable logic controller that operates the plant. The system can verify any operating condition and respond immediately to control and alter operating parameters, usually without the need for an on-site operator or CWC technician to visit the plant.

CWC is currently developing a Web application that will allow owners, operators, and regulators access to their facilities via the Internet to obtain critical financial and operational information.



Hill Murray's SMART system (above) allows sophisticated remote monitoring and operation of all its facilities.



The Westview Water Reclamation Facility in Powell River, B.C. (above and left), is the largest of 14 plants monitored by Canadian Wastewater Corporation.

A government office building in the Vancouver Island community of Sooke, B.C. is saving more than 100,000 gallons of water a year by reusing treated wastewater to flush toilets.

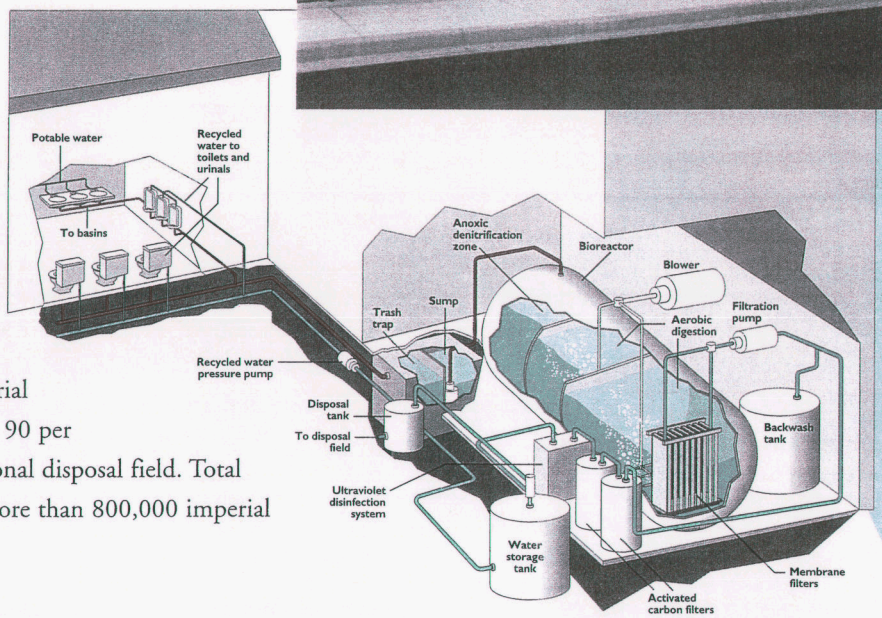
Chief Operating Officer, Rob Murray, with septage cakes from the Burgoyne Bay Septage Facility, the first public-private partnership, waste management facility in B.C.

Graham Symmonds, VP Technical Services, demonstrates the trash removal system at the Mt. Washington Water Reclamation Facility. Hosting plant tours for elected officials, government engineers and regulators, and community groups, are an important part of Hill Murray's public education program.

School first of its kind

The 325 children at Huband Park Elementary School, near Comox on Vancouver Island, probably don't know that every time they flush the toilet they are making history! This is the first school anywhere in Canada that utilizes water reclamation equipment.

Wastewater from sinks, toilets, and urinals is passed through a bioreactor and membrane system, polished with a charcoal filter and ultraviolet sterilizer, and then reused in the toilets and urinals. The building was designed with two sets of water pipes – the first to deliver potable water to the sinks, and the second to deliver treated water to the toilets and urinals.



The entire school uses about 350 imperial gallons of potable water a day, which is 90 per cent less than a school with a conventional disposal field. Total water savings for the year amount to more than 800,000 imperial gallons.

Grand opening for largest water reclamation facility of its kind in British Columbia

The Westview Water Reclamation Facility, an innovative upgrade to a municipal sewage treatment plant, formally opened this fall. The facility serves 10,000 people in the community of Powell River, B.C.

Hill Murray retrofitted the old plant and installed a state-of-the-art system that combines micro-screening with biological treatment and membrane filtration using existing tanks. By utilizing existing infrastructure, this approach saved taxpayers between $3 and $5 million.

The plant can be expanded over time to match actual demand as the community grows. These "just-in-time" expansions allow capital costs for new equipment to be spread over a number of years.

HILL MURRAY

ENGINEERING WATER SOLUTIONS

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TAB M

HILL
MURRAY
&
ASSOCIATES INC.

SUSTAINABLE SOLUTIONS

ENVIRONMENTAL
SYSTEMS ENGINEERS

SOOKE OFFICE BUILDING

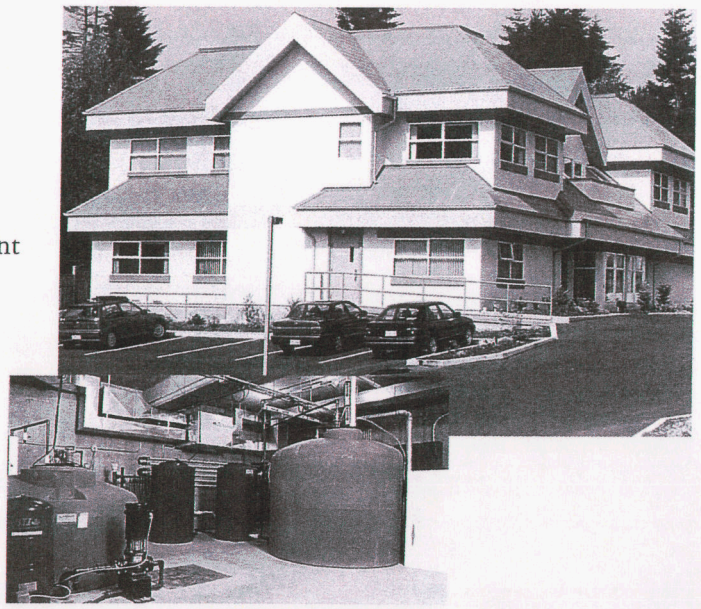
PROJECT:
British Columbia Buildings Corporation
Ministry of Social Services
Sooke, BC

APPLICATION:
Fully recycling, wastewater treatment plant

CAPACITY:
1000 imperial gallons per day (IGPD)

INSTALLED:
December 1995 - April 1996

COMMISSIONED:
April 1996

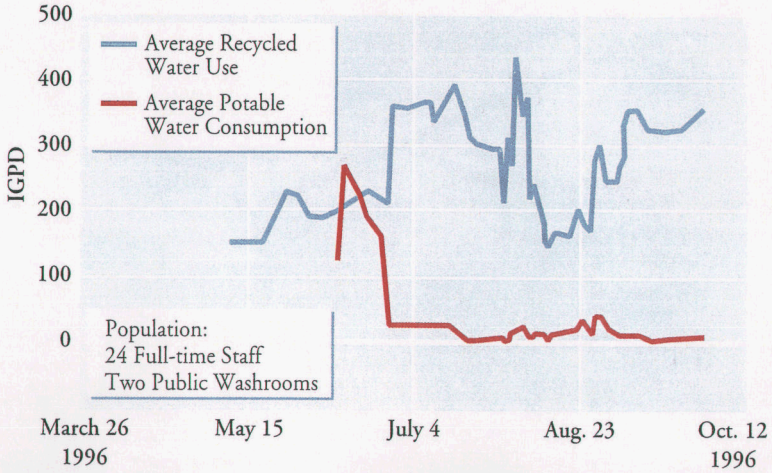


PROBLEM:
There are no sewers in the area so the building required a disposal field for the sewage generated by office workers and the public. The 10,000 ft^2 building needed a standard septic field of 400 feet of disposal pipe. A large parking lot and small overall lot size meant that there was insufficient space to install a standard field.

SOLUTION:
The developer and Hill, Murray & Associates provided a fully recycling, tertiary-quality, wastewater treatment facility. The discharge to the field was reduced to an average of 18 gallons per day and the disposal field consisted of only 17 feet of pipe. The treatment system is housed in a 400 ft^2 maintenance room in the basement of the building.

SOOKE SOCIAL SERVICES BUILDING

Canada's First Fully Recycling Building



Zenon's ZenoGem™ technology has reduced potable water consumption in the building to **only 18 gallons per day** from 400 gallons per day. This results in an annual **saving of 60,000 gallons** of potable water.

Effluent quality is consistently very high. The disposal field is not part of the treatment process, but merely acts as a hydraulic absorber for the treated water.

over ...

Treatment:

The wastewater is collected from sinks and toilets in a trash trap and pumped to a bioreactor. The bioreactor aerobically converts ammonia to nitrates and nitrites producing ideal conditions for microbial breakdown of the sewage. Fully aerobic conditions eliminate all odours.

Water in the sewage is drawn off in a process known as ultrafiltration. No bacteria, viruses, helminths or other water-borne pathogens can pass through these molecular filters. The water is prepared for reuse by a carbon filter and ultraviolet sterilization.

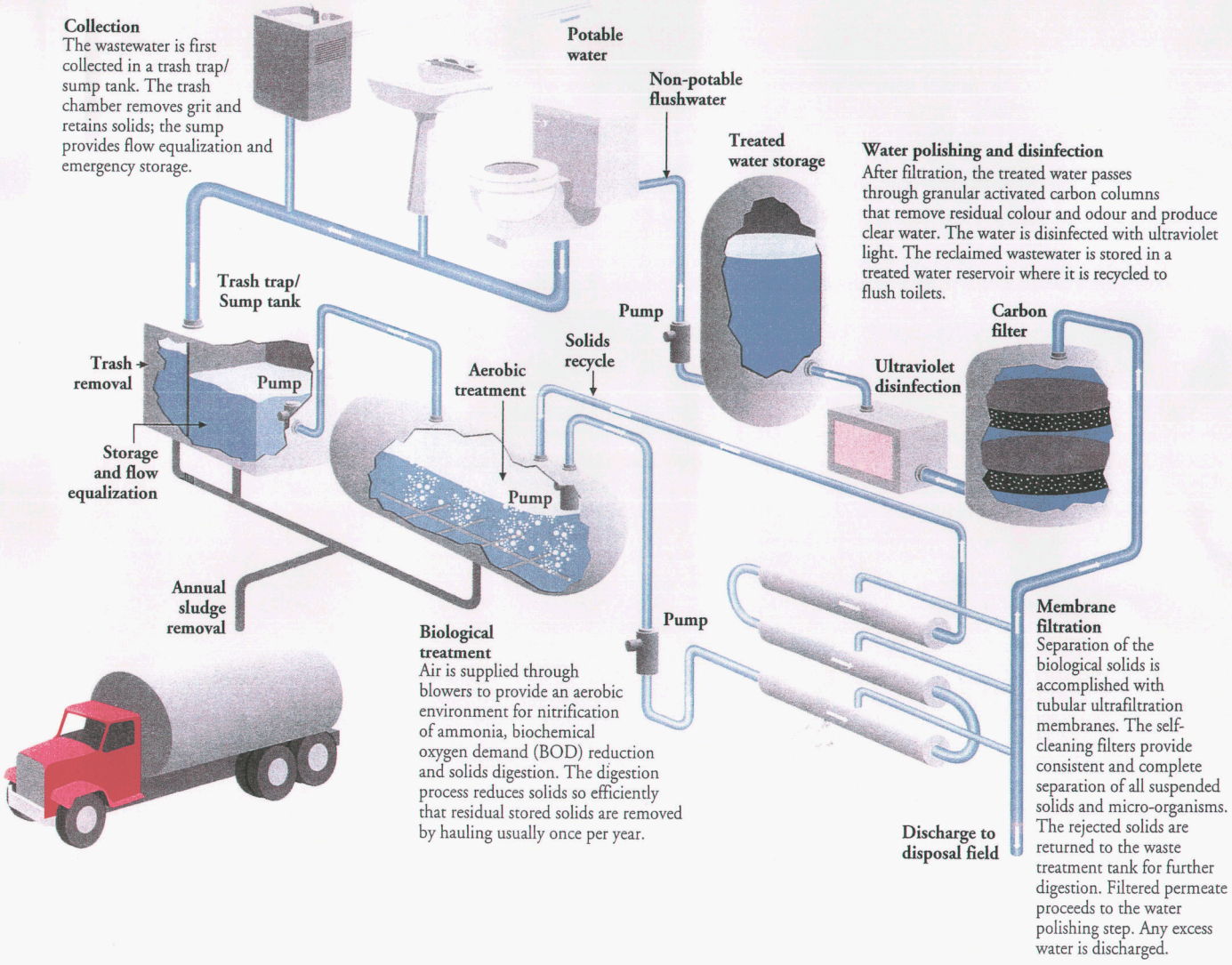
Monitoring:

The plant is actively controlled by a Programmable Logic Controller. The control system can also be accessed through a modem link, allowing technicians to alter systems remotely to ensure peak performance. The plant is monitored 24 hours a day and seven days a week.

Treated Water Quality

	BOD mg/L	TSS mg/L	FC MPN/100 ml
Influent Levels	600	600	1,000,000
Permitted Levels	5	5	2.2
Day 1	<5	1	<1
Day 2	<5	2	<1
Day 3	<5	1	<1
Week 2	<5	2	<1
Week 3	<5	1	<1
Week 4	<5	1	<1
Month 2	<5	1	<1
Month 3	<5	1	<1
Month 4	<5	1	<1
Month 5	<5	<1	<1
Month 6	<5	<1	<1

Sooke Social Services Building Wastewater System:



BOD: Biochemical Oxygen Demand - mg/L

TSS: Total Suspended Solids - mg/L

FC: Faecal Coliform measured as MPN - Most Probable Number of Pathogens in 100ml sample

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TAB N

HILL
MURRAY
&
ASSOCIATES INC.

SUSTAINABLE SOLUTIONS

SALT SPRING ISLAND VILLAGE RESORT

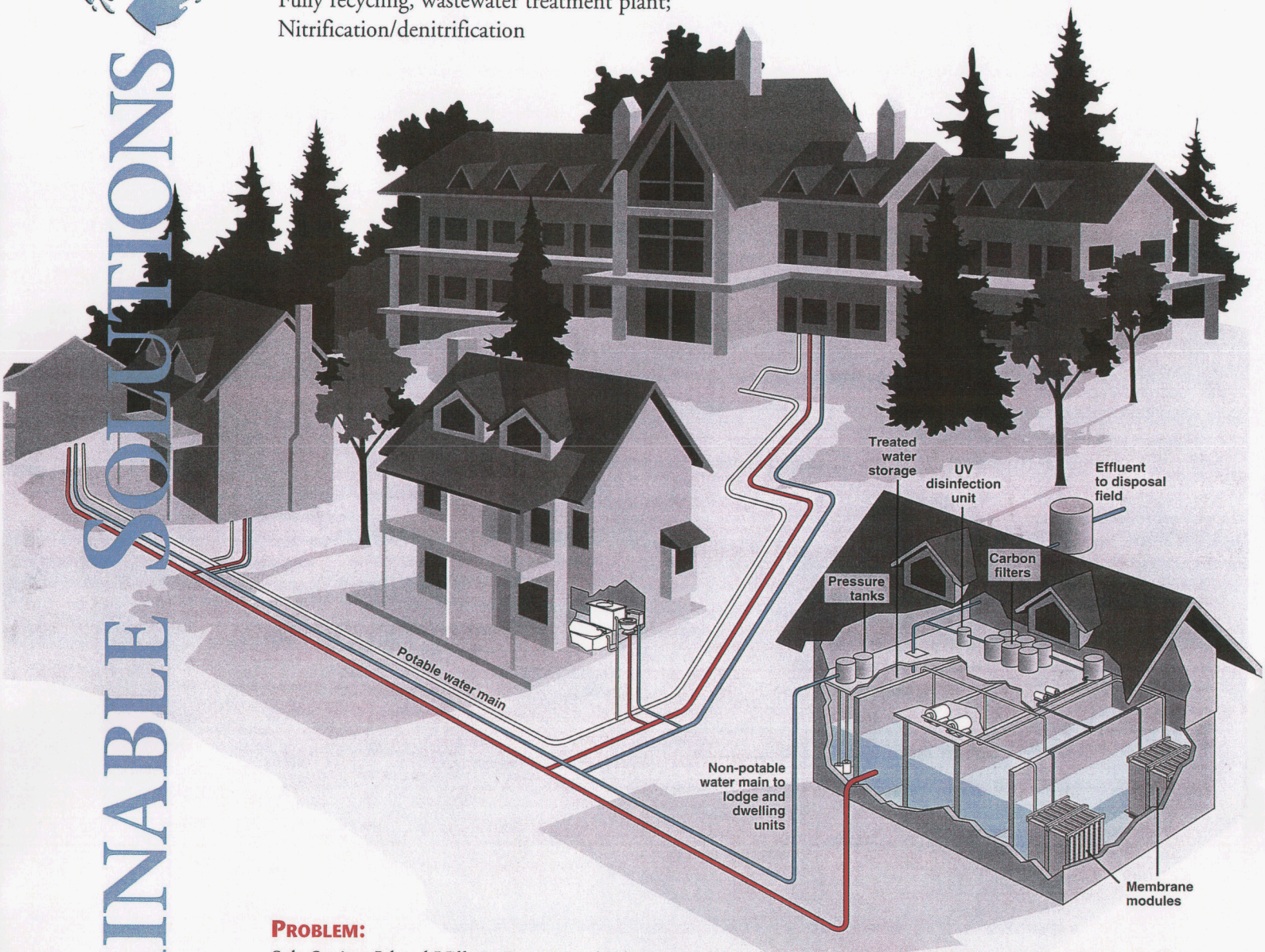
PROJECT:
Salt Spring Island Village Resort
Saltspring Island, BC

CAPACITY:
30,000 imperial gallons per day (IGPD)

INSTALLED:
Summer 1997

COMMISSIONED:
Summer 1997

APPLICATION:
Fully recycling, wastewater treatment plant;
Nitrification/denitrification



PROBLEM:
Salt Spring Island Village Resort is the largest resort of its kind in British Columbia's southern Gulf Islands. The resort features a main lodge and 123 cabins spread over 36 acres. The owners recognized that conserving ground water and minimizing the impact of wastewater on a high water table and nearby Bullock Lake would be a major challenge. Saltspring Island has also been plagued with severe water shortages.

SOLUTION:
A revolutionary new approach to wastewater treatment for residential and resort developments was designed and built by Hill, Murray & Associates. Sewage from each of the units and the lodge is pumped to a central facility where it is treated. The treated water is then pumped via a non-potable

ENVIRONMENTAL
SYSTEMS ENGINEERS

over ...

water main back to the lodge and 60 of the housekeeping units to be reused in the toilets and urinals. Treated water is also used to irrigate the grounds. Surplus treated water that is not recycled, is discharged to a disposal field. In total, 36 per cent of the water is recycled representing 4.2 million gallons of potable water conserved annually.

Hill, Murray & Associates played a key role in revising British Columbia's plumbing code to allow for dual water mains in commercial and residential buildings. The lodge and the 60 housekeeping units are plumbed with a dual water main in accordance with an amendment to the code.

Salt Spring Island Village Resort is the first resort/residential development in Canada with two sets of water mains in the streets. The resort sets a new precedent for water conservation in areas with limited water supplies.

Recycling water results in a marked reduction in water consumption and a decrease in the volume of wastewater discharged to the disposal field. Hence, the field is smaller and requires considerably less drainage pipe than with conventional sewage treatment systems.

Effluent quality is extremely consistent. Actual quality produced by the facility easily exceeds the stringent standards for beneficial reuse set by the Ministry of Environment, Lands and Parks.

The capacity of the water reclamation facility can be increased in phases over time, to accommodate further expansion of the resort and increased volumes of wastewater.

Treatment:

Wastewater from showers, sinks, and toilets in the housekeeping units and the main lodge is collected in trash traps and pumped to the treatment facility which uses Zenon's ZenoGem™ membrane-bioreactor technology. Blowers supply air for the efficient microbial breakdown of the waste. Vacuum pumps pull the liquid through membranes, leaving solids and water-borne pathogens behind. The water is prepared for reuse by passing it through a carbon filter and ultraviolet sterilizer.

Treated Water Quality

Parameter		Influent	Treated Water
BOD (mg/L)		250	<5
TSS (mg/L)		250	<5
FC (MPN/100ml)		10^4- 10^5	<2.2
Nitrogen:	Total	40	<4.5
	Ammonia	25	~0.01
	Nitrates	0	<4
	Nitrites	0	~0.02
	Organic	15	~0.4
TKN (ammonia + organic)		40	~0.4

Monitoring:

The facility is actively controlled by a Programmable Logic Controller. This plant is operated, maintained and monitored by the Canadian Wastewater Corporation, a utility company and subsidiary of Hill, Murray & Associates.

BOD: Biochemical Oxygen Demand - mg/L

TSS: Total Suspended Solids - mg/L

FC: Faecal Coliform measured as MPN - Most Probable Number of Pathogens in 100ml sample

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APPENDIX C

REFERENCES

Advanced
Energy
Strategies

May 14, 2004

Arizona Corporation Commission
Utilities Division
1200 West Washington
Phoenix, AZ, 85007

To whom it may concern:

My name is David W. Ellis and until December 31, 2003 I was the Manager of Litchfield Park Service Company (LPSCO). The purpose for this letter is to outline for you my business experience with Trevor Hill in that capacity.

I first became acquainted with Trevor Hill when Algonquin Water Resources of America was attempting to acquire LPSCO and Trevor was leading the effort on that acquisition. It was a very involved business deal and I found Trevor to be very straightforward in his approach and he acted in a very professional manner throughout the acquisition process. The transaction went off very smoothly in large part because of Trevor's skills and resourcefulness.

After the acquisition I stayed on as the General Manager of LPSCO and reported directly to Trevor. A big question always with acquisitions is will the new owners be sensitive to the real operating needs of the Company or are they just in the deal to wring as much profit out of the deal as possible. I found Trevor to be in tune with the operating realities and needs of both LPSCO's water and sewer systems.

All of the LPSCO employees were retained and almost immediately after the acquisition budgets were approved in both the capital and O & M areas that addressed the extremely rapid growth that was occurring on the LPSCO system.

My experience with Trevor has been excellent and extremely professional. If you would like additional information, please do not hesitate to call me at 623-935-2300.

David W. Ellis

David W. Ellis,
President

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ALGONQUIN
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Income Fund

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April 29, 2004

Arizona Corporation Commission
Utilities Division
1200 West Washington Street
Phoenix, AZ 85007

To Whom It May Concern:

It has come to my attention that during a discussion I recently had with Mr. Jim Fisher of the Arizona Corporation Commission, certain comments made by me, may possibly have been mis-communicated with respect to our employment and partnership with Trevor Hill and his capacity as Managing Director for Algonquin Water Resources of America ("AWRA").

AWRA was formed in partnership with Trevor Hill and Algonquin Power. Trevor and his team performed all of the acquisitions we have done in the water and wastewater sector and was entrusted in the operations and integration of these assets in Algonquin Water Resources.

In this capacity, Trevor Hill did an outstanding job. He is extremely knowledgeable in the water and wastewater sector and grew this division extremely quickly and in some cases through very challenging circumstances.

Some of the utilities we acquired were in need of much capital expansion and permitting work, and to this end, I believe Trevor performed very well, during what was a chaotic process.

During the summer of 2003, as I indicated to Mr. Fisher, we parted on good terms. Algonquin Water Resources remains a healthy, growing and profitable division of the Algonquin Power Income Fund. We are pleased to have invested in the water sector in Arizona and remain grateful for Trevor's role in its success.

We also look forwarding to continuing our excellent relationship with the Arizona Corporation Commission.

If you have any questions or comments, please feel to contact me directly at (905) 465-4511.

Yours truly,

David Kerr
Principal
Algonquin Power Management Inc.

May 13, 2004

Arizona Corporation Commission
Utilities Division
1200 West Washington Street
Phoenix, AZ, 85007

To Whom It May Concern:

I am the Vice President and Chief Financial Officer of SunCor Development Company. Until February 2003, I was also Vice President and Treasurer of Litchfield Park Service Company ("LPSCo"). LPSCo was a subsidiary of SunCor Development Company and I had ultimate responsibility for the operations of LPSCo. At that time, Mr. Dave Ellis was the General Manager of LPSCo and responsible for its day-to-day operations.

In 2001, Trevor Hill approached SunCor in his role as Director of Operations for Algonquin Water Resources of America ("AWRA"). At this time, AWRA was interested in acquiring LPSCo from SunCor. In February of 2003, the acquisition of LPSCo by AWRA was accomplished. SunCor chose AWRA because of its financial strength and the presence of Mr. Hill and his expertise and reputation in the area of water and sewer utility operations.

The negotiations for the disposition/acquisition of LPSCo were conducted primarily by Mr. Hill and me. During this process, Mr. Hill dealt openly and honestly. As a result of the work experience that I've had with Mr. Hill, I have remained in personal contact and we have reciprocally traded information and expertise that has benefited both of us.

Mr. Hill's presence made the transition in ownership of LPSCo as simple as possible. His efforts with the employees and the operations of the utility were impeccable. Mr. Hill's efforts, along with our manager, Mr. Ellis, whom Mr. Hill retained, made the transition seamless.

I would have no hesitation in working with Mr. Hill again in any capacity. If you have any questions, please feel free to call me at 480-317-6876.

Sincerely,

Geoffrey L. Appleyard

GLA/blp

DEPARTMENT OF NATIONAL DEFENCE

MINISTÈRE DE LA DÉFENSE NATIONALE

Engineering Certificate of Competency

Certificat de compétence-Ingénieur mécanicien

FOR DUTIES AS ENGINEER OFFICER IN HER MAJESTY'S CANADIAN SHIPS.

POUR LES FONCTIONS D'INGÉNIEUR MÉCANICIEN PRINCIPAL À BORD DES NAVIRES CANADIENS DE SA MAJESTÉ

This is to certify that
Je certifie par les présentes que

LIEUTENANT (NAVY) TREVOR HILL

is competent to perform the duties as head of the Engineering Department in accordance with current regulations and orders for the Canadian Forces.

à la compétence voulue pour exécuter les fonctions de chef du Service de génie conformément aux règlements et aux ordonnances applicables aux Forces canadiennes.

14 NOVEMBER 1991

Dated — Date

HMCS HURON

Name of Ship — Nom du Navire

COMMANDER E.R. PAQUETTE

Board Chairman — Président du Comité

COMMANDER F. SCHERBER

Commanding Officer — Commandant

APPENDIX 1

MUNICIPALITY OF IQALUIT WASTEWATER TREATMENT PLANT

Municipality of Iqaluit Wastewater Treatment Plant

The following is a description of the events and circumstances surrounding Hill-Murray's involvement in a wastewater treatment plant construction project for the Municipality of Iqaluit.

Background

Hill Murray & Associates, Inc. (HM) was a design build firm specializing in the design and construction of Water Reclamation Facilities, or facilities which required very high quality discharge for extremely sensitive receiving environments. In 1996 and 1997 HM had designed and built two water reclamation facilities in the arctic for two of the Distant Early Warning (DEW) Radar Sites (LSS FOX Main and LSS CAM Main). These systems employed membrane-bioreactor technology to produce a class A+ treated water for reuse within the site buildings. In this case, water was employed for urinal and toilet flushing, reducing the overall water consumption by over 35%. This is significant in the arctic where water transport and delivery is a complicated logistic process, and extremely expensive. These projects were very successful and resulted in HM becoming widely seen as an innovator in the field of arctic treatment systems.

Iqaluit, formerly Frobisher Bay, was once part of the Northwest Territories (NWT) of Canada. In 1997 approximately 50% of the NWT was converted to a self-governed territory known as Nunavut (NT). Iqaluit became the capital city of this newly formed territory. Like many new territories, particularly those involving first nations people, there were many levels of regulatory authorities assisting and overseeing the management of the transition to self-governance and independence. The territory is not and will never be financially independent. The Canadian government spends in excess of $500 MM CDN annually on supporting and servicing the 25,000 people who live in the arctic on a full time basis. This subsidy does not include military personnel posted to the various DEW line listening posts.

During the transition of territories, the newly formed Nunavut Water Board (NWB) was attempting to develop a new set of regulations for discharges to arctic waterways. They had strong convictions as to the requirements and were looking for standards of treated water that far exceeded the prior practices of simply discharging raw wastewater onto the tundra, or arctic lagoons which suffered from radical seasonal effluent quality variations.

HM was advised of the opportunity in Iqaluit by the NWB, who was aware of HM's work in the arctic and in the re-use and very high effluent quality fields. HM had a number of facilities discharging into pristine environments, including one facility at a ski resort which discharged continuously into a fish bearing steam. This particular resort often received in excess of 20 feet of snow during the ski season (November to April), totally isolating the plant from routine services (such as solids removal, screenings removal, etc.) and was rated at 0.5 USMGD. As such, this facility was seen by NWB as a perfect proxy for the condition in Iqaluit.

HM designed and constructed the ski resort facility to run with a minimum manning requirement, utilizing the latest in treatment technology and the latest in supervisory control and data acquisition technology. HM received several awards for this cold climate facility, in particular for achieving perfect results over a full year of operation in the lethal toxicity test – LT50. In this test, 50% survival of baby salmonates was required for fish in 100% effluent concentration. This test was performed monthly at the facility. These fish, only a few days old, are extremely sensitive to changes in water conditions, such as the presence of ammonia or nitrogen, the presence of fecal coliform, an imbalance in pH etc. During the test year, HM achieved 100% survival in 100% effluent in each of the 12 tests. This facility set the

standard for wilderness discharges in British Columbia. HM was ideally suited for a role in the design and construction of a treatment plant for the Municipality of Iqaluit.

In 1998, HM responded to the request for qualification advertised by the Municipality of Iqaluit (**SEE TAB A**). The request was generic, open to all technologies, and simply requested that the system employed be suitable for cold climate operations. Understanding that Canadian municipalities are typically under-capitalized, HM submitted a proposal that allowed for significant phasing opportunities, as well as a highly automated process with guaranteed effluent quality. Membrane-bioreactors (MBR) offer some of the finest treated water available in a very consistent and repeatable fashion. HM felt that MBR technologies allow operators to focus on maintenance and operations, rather than the biological process. This results in a system that is capable of being operated without a detailed kinetic process capability.

Of note is that the proposal was directed to Ian Mosher – the first in a line of Municipal employees given the mantle of project administrator.[1] HM was chosen as one of three firms to provide a detailed proposal for services (**SEE TAB B**). During this notification, it was evident that the Municipality lacked the financial backing required to complete a traditional project, and that a sense of flexibility on the contracting front would allow for a higher probability of success. That is, HM recognized that this was not going to be a routine project. HM's proposal (**SEE TAB C**), focused on the primary issues related to the project: flexibility of financing; just-in-time delivery of treatment infrastructure; and high quality effluent, to meet in letter and spirit NWB's objectives and to demonstrate that these objectives could be met in the arctic. A month later, HM was notified that it had won the RFP process (**SEE TAB D**), and moved to the contract development phase.

During the contract development process, it was clear that Iqaluit could not enter into a contract for the provision of the water reclamation facility as the funding was not yet finalized. Iqaluit, however, wanted to progress the development of the project, so that as much as possible equipment could be supplied in the short sea-lift season (mid-June to mid-September). Accordingly, a "service contract" arrangement was offered to HM, whereby HM could advance specific objectives (design, equipment selection, etc.) in order to meet the sea-lifts. The first of the "service contracts" was approved in August 1998 and issued in September (**SEE TABS E & F**). Throughout the fall of 1998, HM produced the design documentation necessary to specify the equipment, and performed flow monitoring services to identify the flow criteria for the project.

In January 1999, a second "service contract" was provided to begin the acquisition of equipment to meet the sea-lift dates for the 1999 season (**SEE TAB G**). In March 1999, HM was diligently trying to finalize the contract documents (**SEE TAB H**). HM had considerable exposure and was issuing purchase orders to meet the sea-lift deadlines, while still having no contract. In order to get the authority to ship equipment, HM required that Iqaluit review the design drawings in detail, and determine that they met local and territorial code requirements. This review was completed in May 1999 (signed drawings available on request).

The original RFP called for a system capable of treating 1668 m3/day (440,000 USGPD). Data collected by HM suggested that the diurnal flow pattern yielded an average daily flow of 1326 m3/day (350,000 USGPD) with a peak hour flow of 1931 m3/day (510,000 USMGD). HM determined that because there was very little flow data available and because the wastewater flows were delivered by pipeline and by truck, that the average flow for the design should be increased from 1668 m3/day to 1800 m3/day – this

[1] Throughout the design and construction process, functional control of the project changed hands no less than five times. HM maintained consistent communications with Ian Mosher, Rock Burton, Denis Bedard, Matthew Hough, Paul Fraser and Doug Sitland.

recommendation, although not initially accepted, ultimately became the contracted average flow requirement. In addition HM collected constituent lab data showing BOD_5 and TSS data both in the 350-500 mg/L range – materially higher than Iqaluit had suggested. These elements resulted in a change to the contract price (**SEE TAB I**), and ultimately led to another "service contract" (**SEE TAB J**).

In June 1999, as dates for sea-lift were slipping by, HM made one more push for a contract, and succeeded in obtaining Iqaluit concurrence on the way ahead (**SEE TAB K**). Following this, Iqaluit requested that HM determine the costs of halting work from a demobilization standpoint (**SEE TAB L**). In the end, two final service contracts were executed (**SEE TABS M & N**), which provided for the completion of shipping and site work in the 1999 construction year. Still, as late as July 1999, the Municipality was requesting the option of demobilizing after lock-up, and continue in 2000/2001 or potentially postponed indefinitely (**SEE TAB O**).

In August 1999, HM again tried to execute a contract for design-build services (**SEE TAB P**). Interestingly, the majority of the construction work had been completed, the final deliveries had been scheduled and at the time of actual execution of the contract document in September 1999 (**SEE TAB Q**) the plant was moving into the acceptance phase (hydrostatic test etc).

The hydrostatic test performed in October 1999 on the tankage at Iqaluit indicated that there were leaks in the concrete structure. The civil design-build contractor had employed a remain-in-place forming system known as Octaform. This system uses PVC sheeting, installed by Quigg Construction with the appropriate re-bar, to provide a full-finished surface without removing forms. Poor performance from the contractor in laying the concrete within the forms resulted in some voided areas in the walls, which leaked during the hydrostatic test.

As a result, HM immediately required Quigg Construction to remedy the situation. Engineering surveys and structural analyses were performed to determine the extent and effect of the problem, and a remedial action plan was developed (**SEE TAB R**). The plan was communicated to Iqaluit (**SEE TAB S**) and as HM expected full and complete remedy, the commissioning plan was progressed, where arrangements had been made for key commissioning personnel to be on site in late January/early February 2000 (**SEE TAB T**).

Quigg completed their recommended repair program in January 2000 (**SEE TAB U**), but were again unsuccessful in meeting the requirements of the hydrostatic test. This caused concern within HM, and with Iqaluit, and HM decided to provide a simple, but effective repair option – lining the tanks with a CIM membrane coating. Clean Seal Environmental had performed numerous repairs such as this in the past and as there were no structural issues with the tanks[2], this material could easily provide a water-tight seal. This was determined to be the best option (**SEE TAB V**). As all other activities were completed at the plant (minor construction activities remained, however, all were well within the capabilities of the commissioning team to complete), the plan was to execute the repair, and move through substantial completion to commissioning (**SEE TAB W**). Iqaluit accepted the plan, and approved a "no-cost" change order (Quigg Construction would pay for the actual repair) to supply and install the CIM membrane product, and agreed to provide substantial completion at this point.

All the repair equipment and materials were shipped to the site via air-lift, and Clean Seal staff proceeded to Iqaluit to complete the fix. The morning work was to commence, Paul Fraser (Acting Administrative Officer for Iqaluit) stopped all work and declared Dillon Consulting had been retained as the project manager for the remainder of the project (**SEE TAB X**). As a result, Dillon required several weeks to get up to speed on the project, which further delayed the project significantly.

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[2] As attested by Paul Salvian, the structural engineer.

In March 2000, HM exercised its contractual right to take over the work from Quigg Construction. The purpose was to allow Iqaluit the legal freedom to exercise its bond with Quigg, while allowing the CIM membrane fix to get back on track (**SEE TAB Y**). Iqaluit, in April 2000 decided that a Dillon structural review of the tankage was in order, which further delayed the fix (**SEE TAB Z**) and HM declared Quigg Construction in default (**SEE TAB AA**). The Dillon structural review (performed by CH2M Gore & Storrie) identified a potential structural issue with the voids in the tank walls, and Iqaluit ceased all work on the repair (**SEE TAB BB**). The CH2M report was refuted by Quigg's structural engineer. Iqaluit and Dillon decided that a different repair option involving shotcrete would be better, and they continued down that road. HM was not involved in the fix – Quigg's bond had been called by Iqaluit and Dillon was managing the fix. HM remained available at all times, but until the tanks were fixed, the commissioning could not continue.

The repair took substantially longer than expected, as it was not until a year later that Iqaluit contacted HM to develop a work plan for the commissioning (**SEE TAB CC**). Even today, the amount of work required to commission the plant is trivial – all necessary equipment is on site and the equipment manufacturers and process specialists have all been paid in full for commissioning services.

Conclusions & Facts

- HM won a competitive publicly tendered process for a new water reclamation facility in the Arctic;
- HM had a number of successes in this environment and was well known amongst regulators in the Arctic;
- Iqaluit was a city transitioning to self-governance and had been plagued by an inability to retain good people for key positions;
- During the course of the project the Municipality of Iqaluit's Director of Engineering changed 5 times. The key personnel are as follows:
    - Ian Mosher
    - Rock Burton
    - Denis Bedard
    - Paul Fraser
    - Matthew Hough
- Iqaluit was not in a position to contract for a new water reclamation facility in that the Municipality did not have the funds, nor financing capability to complete the proposed treatment works, irrespective of the fact that they tendered for the work.
- Representatives of Iqaluit greatly appreciated HM's work in the Arctic and took the time to visit numerous installations of HM's including Powell River;
- Iqaluit endorsed membrane technology, and the "just-in-time" approach presented by HM to save the Municipality money. This approach called for the expansion of the facilities if and when the Municipality grew, and not before;
- HM replicated an approved, award winning design used at another very successful facility at a ski-resort in British Columbia;
- Iqaluit issued 6 piece-meal service contracts to HM for various aspects of the project including, design, equipment specification, equipment selection, construction of tanks and buildings, etc.
- HM completed each phase of work and each phase of work was approved by the Municipality including each and every engineering drawing was signed by Denis Bedard, Director of Engineering and Planning at the time;

- All equipment was shipped to Iqaluit and installed in accordance with the approved specifications;
- HM brought the job to "substantial completion"
- Just before declaring "substantial completion" HM conducted hydrostatic tests of the cast in place concrete tanks. The tanks failed the hydrostatic tests.
- Quigg, the bonded sub-contractor agreed to fix at their sole cost. HM supported their proposed fix solution.
- Iqaluit agreed to the fix and signed both letter of support and a "no-cost" change order for the work;
- HM mobilized crews to complete the repair;
- Iqaluit stopped the work and called for a 3rd party study of the repair;
- HM protested vehemently, knowing that the work slow down could put the project in jeopardy;
- Iqaluit proceeded with their own version of the tank fix which took more than one year to complete;
- Iqaluit retained a local 3rd party engineering firm to manage the fix;
- HM was not included in the fix solution;
- HM was not implicated in the problems with the tanks;
- HM was not required to be bonded for the job;
- The project never got re-started;
- Iqaluit failed to pay HM its final progress draw of approximately $600k;
- HM paid all its sub-contractors but for retainage in the amount of approximately $600k;
- HM irrevocably assigned this final receivable to the sub-contractors who had worked on the job in an attempt to make them whole;
- HM never took legal action against the Municipality for the stoppage of work and the ensuing damages;
- HM believes that many of the sub-contractors were ultimately paid for the work directly by Iqaluit;
- HM was never sued by Iqaluit as, clearly Iqaluit had no grounds to do so;
- Zenon was prepaid in full to conduct the start-up of the plant – but was never called upon to do so;
- HM went out of its way to assist the district in obtaining money from the bonding company for Iqaluit's chosen version of the fix, despite HM's opposition of the methodology for the fix selected by Iqaluit;
- HM was contacted nearly 1 year after the fix was completed to detail what actions were required to complete the start-up of the project. HM provided this detailed information;

This project should be characterized as an extremely complicated and ambitious project taken on by the Municipality of Iqaluit. The project is hard to support logistically and a project of this type and size had never been undertaken in the Arctic. The Municipality had undergone numerous changes in personnel which led to a lack of consistency and "corporate knowledge". HM met the numerous challenges with flexibility and dedication and despite significant odds, delivered the facilities to substantial completion. A relatively small sub-contractor deficiency became a large problem for the Muncipality when 3rd party engineers attempted to earn themselves some work and make a project for themselves out of the tank fix. The Municipality lost all continuity and leverage with HM when they approved, then later cancelled the approved fix to the tank. This action and the one year repair path the Municipality embarked on ostensibly terminated the contract and extinguished any near term opportunity to complete the project. HM stood willing to do anything in its power to complete the project for nearly two years. During

this time the Municipality's council and staff changed another time. The new contract administrators never contacted HM again. The project could be started at any time. The costs of starting the project are in the $100k range. A variety of 3rd party engineers have attempted to garner work for themselves by drafting reports as to what to do with the plant and suggesting various criticisms with respect to capacity, design, standards, location, technology etc. The fact remains that HM won the competition and each and every step of the project was meticulously documented and approved by the Municipality. Every engineering drawing was stamped and sealed by a Professional Engineer, and the design and all its components had been proven in a similar circumstance once before in a facility that runs today.

The Earth Tech report published in 2002 (**SEE TAB DD**) is a report that HM had never seen until May 2004. It should be noted that Earth Tech – also know as Tyco, acquired Reid Crowther, HM's nemesis in British Columbia. Their report is nothing more than a proposal to garner work and point out "deficiencies" which they hope to be contracted to correct. There are numerous false and misleading statement in the documents that they produced. In particular, Earth Tech notes that the plant would require immediate upgrade to meet the flows in 1998, where in their own Water Master Plan of March 2002 (**SEE TAB EE**), Earth Tech shows the flows at 1200 m3/day – substantially less than the 1800 m3/day the water reclamation facility was design for. In addition, the Iqaluit design was based directly on the Mt Washington design – a highly successful, expandable and compliant MBR. As Earth Tech were not equipped with any of the design documentation and very few contractual documents, and as such have relied on conjecture, and speculation. It is interesting to note that Earth Tech was awarded an $86,000 contract (**SEE TAB FF**) to perform the review of the Iqaluit WRF, and was subsequently awarded a $712,000 contract in 2004 (**SEE TAB GG**) to design their unnecessary fixes. Of particular note is the fact that the proposed fix will actually degrade effluent quality from the Hill-Murray guaranteed values of BOD/TSS 10/10 mg/L to BOD/TSS of 45/45 mg/L. In addition, the "fix" will only partially nitrify (**SEE TAB HH**), which will have a direct impact on the viability of local marine life. Far from providing a fix, the Earth Tech proposal will result in a degradation of the environment.

Detailed Timeline

Description	Date
HM is advised of a public Request for Qualifications and Proposals ("RFQ") published by the Municipality of Iqaluit for Proposals for Sewage Treatment Options. The advertisement was generic in nature and very open to technologies delivery methodologies, financing and contract operations.	28 Jan 1998
HM responds to the RFQ, suggesting several options for potential treatment, financing, operations and deployment. It should be noted that at the time of the RFP, HM responded to Ian Mosher, P. Eng, Director Engineering & Planning.	19 Mar 1998
HM is short-listed with 3 other companies and asked to propose solutions for a secondary treatment facility for arctic operations capable of treating 1,668 m^3/day.	15 Apr 1998
Iqaluit sends short listed proponents a Request for Proposals ("RFP").	1 May 1998
Iqaluit send short-listed proponents a list of specific questions to answer. In this document Iqaluit reveals that the town has insufficient funds to conduct the project and requests help with financing. By 20 May 1998, Ian Mosher had left the Municipality of Iqaluit and Rock Burton, Director of Public works had taken his position.	20 May 1998
HM responds with details on proposal for a secondary treatment system utilizing membrane bioreactor technology ("MBR") including rough order costs and timeframes for completion. HM includes options for long term contract operations and financing.	12 June 1998
HM receives notification of being selected for the design and construction of the sewage treatment plant for the municipality of Iqaluit. This letter was signed by Denis Bedard, Director Engineering & Planning.	15 July 1998
Contract negotiations begin. HM hosts 3 Iqaluit representatives in HM headquarters for a pre-contracting meeting in Victoria to visit several HM facilities and discuss specifics of the project. They stay for 3 days and visit 3 HM wastewater plant locations including Mt. Washington, Ganges and Powell River. Iqaluit directs Denis Bedard, Director of Engineering and Planning to enter into price and contract negotiations.	27 July 1998
HM summarizes meeting in letter to Denis Bedard and concludes pre-contingency pricing of $6.88 MM CDN with $.83 MM CDN in options. Iqaluit also requests detailed operating costs proposals for Iqaluit to operate and for HM to operate. At this point, Iqaluit still does not have the financing in place to contract on the entire project.	14 Aug 1998
Robert Murray, partner in HM and Chief Operating Officer, attends Special Development & Public Safety Committee Meeting in Iqaluit to discuss launching the project. Council decides that it is important to launch engineering phase of project, but because Iqaluit does not have sufficient funds to contract for a design-construct contract as previously contemplated, the council recommends issuing a one page "Service Contract" for engineering in the amount of $634,540 CDN to begin engineering and to ship certain materials for forming and concrete to the site such that construction could begin immediately in the following spring. It should be noted that in Iqaluit there are typically less than 39 frost free days in the year, and the construction season runs from mid June to mid September (3 months).	26 Aug 1998
HM installs flow measurement devices in Iqaluit and begins measuring flows throughout the diurnal cycles of each day for 2 weeks. Flow results indicate peaking flows of .51 MGD (1,931 m^3/day) and average flows of .35 MGD (1,326 m^3/day). HM determined that because there was very little flow data available and because the wastewater flows were delivered by pipeline and by truck, that the average flow for the design should be increased from 1,668 m^3/day to 1,800 m^3/day – this recommendation, although not accepted initially, ultimately became the contracted average flow requirement. In addition HM collects constituent lab data showing BOD_5 and TSS data	28 Aug 1998

both in the 350-500 mg/L range – materially higher than Iqaluit had suggested.	
HM receives signed Service Contract for $634,549 CDN for design of treatment plant and materials acquisition and shipping.	9 Sept 1998
HM contracts with Civil, Mechanical and Electrical engineering sub-contractor and with ZENON for process and MBR design.	10 Sept though 31 Oct
Robert Murray visits Iqaluit to brief Denis Bedard on design progress and to attempt to get the contract signed. HM aids in Iqaluit's attempts to obtain financing from various government agencies. At this point the design is in process.	29 Oct 1998
Iqaluit issues HM second Service Contract in the amount of $228,105.10 for the balance of the design and to pay 3rd party design agents. HM is at this point paying all 3rd party sub-contractors by way of a trust account and through irrevocable directions to pay. In some cases, Iqaluit is paying sub-contractors directly.	18 Jan 1999
HM sends Iqaluit details of contract, now revised to reflect work ongoing and already completed.	9 Feb 1999
HM orders all process equipment	15 Feb 1999
HM submits detailed progress report and update on capital and operating costs for the facility.	15 Mar 1999
Iqaluit issues Service Contract #3 in the amount of $750,000 for increases in plant capacity and for the production of tender documentation for 3rd party sub-contractors.	19 Mar 1999
Robert Murray visits Iqaluit to review progress report and to attempt to get contract signed by Iqaluit.	2 Apr 1999
HM begins operator training and produces local operator Pass/Marginal reports to Municipality of Iqaluit.	28 Apr 1999
HM signs letter with Municipality to agree to move forward with the project in the absence of a signed contract and attempts to finance the required amounts to finish the project – some $2.8 MM CDN. Iqaluit agrees and signs the letter.	11 June 1999
HM signs design-build contract with Quigg Construction Ltd (and their Civil Engineering Firm, Western Engineering) ("Quigg") for $1.14 MM CDN for the design-construction of the tanks and buildings to house the water reclamation facility. Quigg bonds to HM but also to Iqaluit under a "dual oblige" rider as there is no contract in place with HM. Quigg contracts with Baffin Building Systems and other local contractors for various aspects of this contract.	15 June 1999
HM offers bridge financing to Iqaluit to help the Municipality finance the project.	22 June 1999
Iqaluit calls to inquire as to what costs would be incurred if project were stopped at this point. HM does this research.	24 June 1999
HM responds with cost/exposure estimate to terminating work – cost is estimated at $416,000 CDN. Many contractors are already mobilized on site in the arctic – many pieces of equipment have to be stored/returned - certain sub-contracts have cancellation fees, etc.	25 June 1999
All ordered equipment for the facility now awaits shipment from Montreal, Canada.	30 June 1999
Iqaluit issues Service Contract #4 in the amount of $1,875,743 for building construction. HM remains concerned for the sake of many sub-contractors – the project has yet to be fully financed.	12 July 1999
Iqaluit issues Service Contract #5 in the amount of $878,200 for building construction.	12 July 1999
To ensure 3rd party contractors get paid, HM begins providing "Irrevocable Directions to Pay" to Iqaluit such that they may pay certain contractors directly.	14 July 1999
HM prepares and submits a report to Chairmen and Members of Development Works and Public Safety Committee. The report outlines the progress to date, the costs associated with stopping and starting the contract – the value which requires financing, and detailed operations and maintenance costs.	22 July 1999

Iqaluit signs off on and approves all plans and designs for the water reclamation facility including all sub-contractor plans including ZENON, Fournier (sludge press), Western Engineering (Quigg's engineer for tanks and building) etc.	4 Aug 1999
HM again sends copies of Design-Build contract to Iqaluit for signature and urges Iqaluit to sign the contract now reflecting the approved designs. Because Iqaluit has not yet organized their financing for the project, Iqaluit will still not sign the contract.	10 Aug 1999
By this point, all equipment has been shipped and has either arrived on site or is in transit. The construction season is half-over.	
HM writes letter to Iqaluit informing of HM's use of trust accounts to ensure all sub-contractors were getting paid out of HM progress draws. HM further had always signed statutory declarations as to the payments of sub-contractors prior to taking any draws into HM.	1 Sep 1999
Design-Build Contract signed by Iqaluit and HM. Of note are the following: The contract is for 1800 m^3/day (475,200). HM had the previous September demonstrated that this flow represented the average annual flow plus two standard deviations. The plant is also configured to allow for expansion in the future, if in fact some growth occurs. Although the contract is signed, Iqaluit still has not secured the necessary financing to complete the project – by this point the tanks and building are complete and work is progressing rapidly to install all fitted equipment in the facility. Due to weather, the facility needs to be at lock-up by 01 Oct 1999.	9 Sept 1999
Per the contract, Iqaluit hires Dillon Engineering as a 3rd party engineering assigned to review draws and completion for HM.	17 Sept 1999
Lock-up is achieved. Robert Murray leaves HM for personal reasons and takes a job with ZENON. Lorne Cowley of HM assumes the responsibility for project management.	1 Oct 1999
Iqaluit finally gets financing issues resolved and issues Service Contract #6 in the amount of $2,683,331 to HM for completion of the water reclamation facility.	13 Oct 1999
Trevor Hill visits Iqaluit for an inspection of progress. By this date the building's interior is nearing completion and most of the mechanical and electrical equipment has been installed. During this site visit Quigg and Western Engineering notify HM that they have discovered certain honey-coming in the tank walls. Normally, this honey-coming would be parged with cement to fill the voids, but in this case because the contractor is using a material known as Octaform which is a forming material which is not stripped from the concrete walls, concrete parging will not work. The contractor and his engineer agree to fix the deficiency and render a stamped and sealed remediation letter as to their intentions.	5 Nov 1999
Western Engineering issues detailed compliance report of honey-coming and other observations made by Dillon Engineering, Iqaluit's 3rd party consulting engineer.	10 Nov 1999
HM sends letter to Iqaluit of honey-coming issue and remediation plan. HM also cautions Iqaluit as to comments made by Dillon as to design. Dillon refuses to sign off on the entire October progress draw until honey-coming issue is resolved. This action is not allowed under the contract, but HM agrees to not make any further progress draws as they relate to the building until a plan has been delivered to HM and sealed.	11 Nov 1999
HM is requested to provide the bonds from the key contractors on the project, namely, Quigg for $574k (Labor & Materials Payment Bond) and $574k (Labor & Materials Payment Bond) and ZENON for $782k (Maintenance Bond). As there existed substantial evidence of contractors having been paid through HM trust accounts with statutory declarations and waivers and because ZENON and many other contractors had been paid directly from the municipality, there existed no further requirement for bonds Additionally, both Iqaluit and HM were named as the insured parties under the bonds in	15 Nov 1999

what is referred to as a "dual obligee" format.	
HM makes progress claim for $1,376,500 for the completion of the mechanical and electrical fit-out of the facility. HM backs out the draws as they relate to the building and the alleged issues with honey-coming.	18 Nov 1999
Western Engineering delivers compliance reports as they relate to the fixes and remediation plans for the tankage. HM sends the remediation report to another 3rd party civil engineer Larry Dreger, P. Eng to perform an external review of the proposed tank fixes.	1 Dec 1999
The bonds and dual obligee riders are sent to Iqaluit on 22 Dec 1999. Iqaluit was satisfied with the bonds provided and signed them on 31 Jan 1999.	22 Dec 1999
Quigg performs hydrostatic test of the tanks. They leak, suggesting not all the honey-coming in the tank walls has been fixed or the fixes to date are inadequate. The tanks, however, showed no signs of deflection or of any structural inadequacy.	10 Jan 2000
HM puts Quigg on Notice of Default and gives Quigg 5 working days to commence remedy	21 Jan 2000
Quigg sends letter to HM to notify of their agreement. Quigg takes responsibility for the failures and agrees to fix.	21 Jan 2000
Western Engineering delivers to HM its remediation plan for the tank leakage and many other points Dillon Engineering had requested Western to address. The report concludes that there are not structural implications of the honey-coming in the tank walls and calls for the application of an elastomeric coating for the interior of the tankage – a material called CIM 1000	22 Jan 2000
HM accepts the application of CIM 1000 as the elastomeric seal coating for the interior faces of the tank walls.	4 Feb 2000
Quigg's lawyers Phillips and Wright lean the project in Iqaluit.	9 Feb 2000
Quadra Coatings/Clean Seal bids on the application of the CIM 1000 product. The technical specification package is sent to Iqaluit for their review.	11 Feb 2000
HM writes letter to Iqaluit which outlines the plan to provide the CIM 1000 product to the tank walls and Western Engineering's approval of the remediation plan. This document outlines the repair, the timeline, an augmentation to the Quigg bond, and the project completion timeline. This letter also calls for Iqaluit to sign a no-cost change order for the tank repair, and conditions the repair on approving substantial completion for Quigg upon a successful hydro-static test of the tanks, and thereafter HM for substantial completion on the project. All the equipment internal to the tanks and building has now been fitted – but for the tank repairs, the facility is ready to start-up.	18 Feb 2000
Iqaluit signs the "Acceptance of Tank Repair/Substantial Completion" letter 28 Feb 2000 and sign a zero cost Change Order for the work to proceed	28 Feb 2000
Quigg is in financial trouble. Quigg's bonding company is now on notice. Quigg asks HM to manage the fix on Quigg's behalf and pay for fixes out of balance of funds owed to Quigg. HM agrees to pay through a direction to pay out of Quigg's allocation of contract funds Quadra Coatings/Clean Seal $118k for the fix.	22 Mar 2000
HM notifies Quigg of its intention to issue a PO to Quadra Coatings/Clean Seal as Quigg has been unresponsive. HM issues PO to Clean Seal and Clean Seal is mobilized to the site.	27 Mar 2000
HM is notified that Denis Bedard, Director of Engineering & Planning is no longer with the District – as Denis Bedard had been working with HM for nearly 2 years, this came as a significant shock to HM and as the contract was taken over by the Acting Senior Administrative Officer, Paul Fraser, HM was deeply troubled by this arising. The letter goes on to say that "Dillon Consulting has been retained by the Municipality of Iqaluit to provide project management for the remainder of *this* job." Effectively, this letter	28 Mar 2000

terminates the contract between Iqaluit and HM.	
Irrespective of the de facto termination, HM notifies by letter to Iqaluit of the plan in place to repair the tanks, the costs, the contractors and the timeline complete with Western Engineering's stamped and sealed approval of the tank repairs. HM further notifies Iqaluit that it has been unable to get Quigg to effect the repairs of their own accord and therefore is exercising its contractual right to effect the repairs on Quigg's behalf and informs Iqaluit and Quigg that the costs of the repairs would be set off against the Quigg contract from money's still held by Iqaluit.	29 Mar 2000
HM puts Quigg's bonding company on notice by letter and notifies Iqaluit of this action. Clean Seal and all equipment for the fix is now on site – work is scheduled to begin 6 Apr 2000.	5 Apr 2000
Iqaluit (Paul Fraser) sends HM a letter saying that he has unilaterally decided to have yet another 3rd party engineering firm review the tanks for structural defects. While Paul Fraser indicates he does not intend to slow down the work already in motion by Clean Seal and Quadra Coatings. This work is now stopped and the crews sent back to Victoria.	6 April 2000
HM writes letter to Iqaluit (Paul Fraser) notifying Iqaluit of HM's requirement to demobilize. The letter puts Iqaluit on notice of a material change in the contract. Iqaluit had approved the fix and then postponed it after Clean-Seal's crews were mobilized to Iqaluit.	11 April 2000
Western Engineering is put on notice to notify their insurers	14 Apr 2000
HM calls Quigg's bond	14 Apr 2000
Iqaluit informs HM that the structural report would be ready 1 May 2000 – the month of April has been lost. Iqaluit still will not permit Clean Seal to commence the fix on the tanks.	19 Apr 2000
Iqaluit sends HM the structural report prepared by CH_2M Gore & Storrie. The report condemns the Western Engineering stamped structural report in favor of a more comprehensive fix using shotcrete. The fix is estimated at $400k Iqaluit gives HM 10 days to respond to the CH_2M Gore & Storrie report. HM responds within the 10 days with a report from Western Engineering that refutes CH_2M's findings and reinforces the approved plan of action. This report is later published in its final form with all calculations and annexes on 25 May 2000.	1 May 2000
HM sends the report to Quigg's bonding company, Clean Seal and Quigg. Clean Seal and Western Engineering and asked to formally respond to the CH_2M Report to HM as soon as possible	1 May 2000
Quadro Coatings responds to HM refuting the claims that CIM 1000 will not function in the long term in the tanks and provides manufacturers back-up of this argument.	3 May 2000
Western Engineering responds, refuting the findings of the CH_2M Gore & Storrie and reiterate the fix as proposed was appropriate, that they'd stamp it, that there were no structural implications to the honey-coming and that Iqaluit should proceed as had been planned.	25 May 2000
Iqaluit decides to move ahead with the fix as outlined in the CH_2M Gore & Storrie report without formal notification to HM. HM notifies Iqaluit of the contractual implications of such action and that the delay allows for the termination of the contract by HM. Iqaluit is unresponsive. The plant is now at "Substantial Completion", and has been since the end of January 2000. All punch-list items have been addressed by HM. HM also outlines for Iqaluit the required steps to take to get the plant commissioned, particularly those steps that should be completed in the summer months. ZENON has been paid in full for the facility commissioning. At this point, HM is owed $600k from Iqaluit, largely for retainage, and HM/Iqaluit owes contractors $600k also for retainage.	1 Jun to 15 Aug

Iqaluit decides to strip all the Octaform material from the inside of the tank walls. The process is extremely laborious and takes 2 months to begin. Iqaluit does not communicate with HM. HM attempts on numerous occasions to stop Iqaluit from taking the approach of stripping the Octaform but to no avail.	
In August, HM is contacted by the bonding company to ask if HM would consent to the bonding company's decision to remove sufficient material to complete the investigation. HM consents on the condition that the consent in no way compromises' HM's claims in the project.	15 Aug 2000
HM retains Bill Hopkins (attorney) to aid in bringing the Quigg matter and their bond with the Guarantee company to a close.	17 Aug 2000
Hill Murray informs Baffin Building of Iqaluit's decision to repair the tanks in accordance with the CH_2M Gore & Storrie report and against HM's direction. HM advises Baffin Buildings who is owed retainage by HM which was not paid by Iqaluit and who is owed monies from Quigg who has not paid them, that they should vigorously pursue their lien rights and L&M bonds put in place against Iqaluit.	10 Oct 2000
HM is contacted by Matthew Hough, the new Director of Engineering and Public Works for the Municipality of Iqaluit. Mr. Hough call was to see if HM was interested in helping start-up the facility and requests from HM a list of those things required to start the facility up.	29 Mar 2001
HM responds stating that the actions of Iqaluit and the more than 1 year delay in the project without communication against the specific approved, sealed and bonded direction of HM has cost HM a material sum of money. In addition many sub-contractors remain unpaid. Notwithstanding this HM provides a detailed scope of work required to start the plant and a budget to do so. Further, HM provides Iqaluit of list of the contractor owed money and directs Iqaluit to pay these sub-contractors from monies owed to HM.	4 Apr 2001
HM decides not to pursue Iqaluit under its contractual rights and releases Bill Hopkins from his representation of HM.	29 Jun 2001
HM sends letter to Matthew Hough of Iqaluit authorizing irrevocable direction to forward any impressed trust monies held for HM to be paid to sub-contractors in accordance with a list provided. There was enough money left in the contract to make all the sub-contractors whole. It is not known whether this action was taken or not.	3 Aug 2001

Crockej\PHX\1515099.2

TAB A

ara Tartak,
Barr,
440

ical shape.

Previous airside experience would be preferable but we would be willing to train the right candidate. You must be able to pass a security check and clearance and you must hold a valid Class 5 driver's licence.

Please fax resumes attention "Graham" at 867-669-7371.

Rankin Inlet, NT, X0C 0G0

Deadline for submissions:
February 13, 1998

Request for Proposals are available from the above address. All or any proposals are not necessarily accepted. For more information contact Alison Barr at (867) 645-5440.

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ᐊᖃᕈᒪᔪᑎᑦ ᐃᓴᑕᐅᖃᑦᑕᕐᓂᐊᖅᑐᑦ ᑎᑭᓪᓗᒍ 998. ᐱᔪᑎᑭᓪᓗᒍ ᖃᓄᐃᓐᓂᓇᔾᔪᖕᒐ ᑖᑦᓯᒪ ᑦ ᑕᐃᒪᐅᑎᓪᓗᒋᑦ ᒪᑐᐃᖅᓯᓂᖅᑕᖃᕐᓂ-

ᑐᓴᒐᒃᓴᓂᒃ ᐱᔪᒪᒍᐃᑦ, ᑐᓴᖅᑎᓪᓗᒍ ᐃᐊᓐ ᐃᐊᓐᓯᒋᓐᓂᓕᓇᓂᖅ ᐃᓯᒪᓕᐅᕐᓂᕐᒍ, ᓄᓇᓕᖕᒥ 7) 979-5636 ᐅᑭᓐᓂᓐᓂᑦ ᓱᒃᓴᔪᒃᑯᑦ

Request For Proposals

Sewage Treatment Options
Iqaluit, NT

The Municipality of Iqaluit is soliciting qualifications and proposals from interested parties for design and construction of sewage treatment options for the Municipality's system that will meet Nunavut Water Board Waste Disposal Requirements.

Proposals must include complete information of the proposed system, which has previously been demonstrated to be effective in a "northern climate," as well as the qualifications of the system supplier. The Municipality is open to all technologies and forms of delivery including those that may or may not include financing by parties other than the Municipality of Iqaluit. Following the submission period, an evaluation will be completed of all proposals. After a determination of the most acceptable proposal, it is the Municipality's intention to enter into contract negotiations with the preferred proposer.

Sealed qualifications and proposals will be received by 4:00 p.m., local time March 06, 1998. Due to the nature of this proposal, there will not be a public opening.

For detailed proposal information; contact Ian Mosher, P. Eng., Director, Engineering and Planning, Municipality of Iqaluit, at (867) 979-5600 or fax (867) 979-5910. (867) 979-5600

INFORMATION

TAB B

MUNICIPALITY OF IQALUIT

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May 20, 1998

Hill Murray & Assoc.
Suite 202, 780 Tolmie Ave.
Victoria, B.C.
V8X 3W4

Terry -

Secondary Treatment System - Request for Proposals
Iqaluit, NT.

Dear Sirs;

Further to our letter dated May 15, 1998, the following is a list of questions that arose during the evaluation of the submissions. These questions are to be considered as additional information to the information that was submitted in your original proposal. All short listed proponents are receiving the same questions. Should you wish to resubmit your original proposal with revisions that address the questions, this would be acceptable, however is not a requirement.

1. Attached is a letter from the Nunavut Water Board. Confirm that your proposed system can meet the effluent requirements indicated on this letter. ✓ in current proposal

2. Based on the location shown on the mapping attached and the requirements of the Nunavut Water Board, update the design and construction estimates. Include itemized costs for;

   Lift Station c/w stand by power or diesel driven pump.

   Force main from lift station to treatment facility. Assume 200mm HDPE with 50 mm of insulation and heat trace.

P.O. BOX 460 · IQALUIT, N.W.T. X0A 0H0 · TEL: (867) 979-5600 · FAX: (867) 979-5922
ᑎᑎᕋᓛᐃᓐ 460 · ᐃᖃᓗᐃᑦ, ᓄᓇᕗᑦᑐᒥ X0A 0H0 · ᐅᖃᓕᐅᑦ : (867) 979-5600 · ᓱᒃᑕᑐᒃᑯᑦ: (867) 979-5922

Treatment plant building. Include site works, foundation, road access, building envelope, lighting, heating, stand by power. Building to have a minium of RSI 3.5 on all walls. The roof is to have an RSI value of 5.0.

Treatment process.

Sludge handling and disposal system. Provide a description of this process.

Outfall piping and outfall structure. Assume outfall is located at high water mark.

GS 3. Update Operation and Maintenance costs based on the above facility.

GS 4. List the expected kilowatt-hour consumption of the treatment facility, lift station and pipeline on a annual basis. Assuming heat fuel will be used for heating the lift station and treatment facility, estimate the consumption of fuel in litres on an annual basis. J

5. Indicate if you would be willing to provide a performance bond guarantee to cover the estimated consumption of power and heating fuel based on the above estimates. yes

6. Indicate your firms willingness to provide non pro rated 5 year warranties on the major facility components. yes

7. List the three (3) most recent installations of the proposed treatment systems of an equivalent size (1000 to 50,000 person town). Provide reference names for these installations. J P.R. MTN Corp.

8. Describe the proposed commissioning and training that you will provide to the Town at the completion of the construction. Include a brief list of the required daily and weekly activities that the operator will be required to perform to operate the plant. J

GS

9. The Town may require financing to complete the capital works an this project. Provide details of the options that your firm will be willing to undertake to aid the Town in this respect. J

Graham : Nunavut Water Board Letter

Rebecka : Gord Selman

Rock Burton – Public Works

Terry Slaney – Administration

Gary Strong ~ Consultant, Dillon.

The date for submissions for the above responses is June ~~5~~ 12, 1998 at 3 p.m. local time in Iqaluit. Submissions will only be received at the Town of Iqaluit. Inquires for the proponents can be directed to either Mr. Rock Burton, Director Public Works, Town of Iqaluit 867-979-5633, or Mr. Gary Strong, P. Eng. Dillon Consulting Limited 867-920-4555.

fax copy approved originals by mail

Thank you for your interest in our project.

M29.98

Yours Sincerely

Rock Burton
Director Public Works

TAB C

NOTICE

Confidentiality

This document is intended only for the person, persons or organization listed on the front cover. This document contains proprietary information that if released could damage the potential sales or reputations of Hill, Murray & Associates Inc., the Canadian Wastewater Corporation, its clients and its equipment suppliers. Any unauthorized reproduction, transmission or release, in whole or in part, constitutes a copyright infringement and is subject to the appropriate remedies under the law.

Prepared for

Rock Burton
Director, Public Works

Revised Proposal for Fully Integrated Sewage Treatment Facility for

The Municipality of Iqaluit

June 12, 1998

Suite #202 - 780 Tolmie Ave, Victoria, British Columbia CANADA V8X 3W4
(250) 388-3930 FAX: (250) 388-3943

I:\PROJECTS\CURRENT\Iqaluit\revised proposal for 12 June a.wpd

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TAB D

MUNICIPALITY OF IQALUIT

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July 15, 1998

Hill Murray and Associates
Suite 202, 780 Tolmie Ave.
Victoria, BC
V8X 3W4

Dear Sir;

Re: Sewage Treatment Proposals

This letter is to inform you that the Municipal Review Committee and the Municipal Council has completed it's review and final selection of the proponents for the design and construction of the sewage treatment plant for the Municipality of Iqaluit.

Please consider this your official notification that your submission has been accepted by the Municipality of Iqaluit. The Municipal Review Committee and the Municipal Council thank you for your submission, you will be contacted shortly to begin contract negotiations.

Again congratulations and we look forward to working with you and your staff on this project.

Sincerely;

Denis Bedard, P. Eng.
Director, Engineering and Planning

P.O. BOX 460 • IQALUIT, N.W.T. X0A 0H0 • TEL: (867) 979-5600 • FAX: (867) 979-5922
ᑎᑎᖅᑲᐃᑦ 460 • ᐃᖃᓗᐃᑦ, ᓄᓇᕗᑦ X0A 0H0 • ᑲᖏᓐᓂᑦ (867) 979-5600 • ᓱᒪᒋᔭᖅᑕ (867) 979-5922

TAB E

MUNICIPALITY OF IQALUIT
SPECIAL DEVELOPMENT, WORKS & PUBLIC SAFETY COMMITTEE MEETING

AUGUST 26, 1998 MINUTES

Committee

Councillor Matt Spence
Councillor John Mathews

Staff

John Raycroft, SAO
Denis Bedard, Director, Eng. & Plng
Teri Slaney, Coord., Eng. & Plng

Meeting Called to Order

Meeting called to order at 1:20 p.m.

Adoption of Agenda

- Recommended by: Councillor Mathews
  Seconded by: Councillor Spence
  That:

  "The agenda be adopted as presented".

Carried

1. **Declaration of Interest**

   Chair noted that no interest was declared.

2. **Special Business:**

a) Sewage Treatment Facility Update

Denis Bedard referred to a report summarizing the trip to BC to inspect and review several existing Hill Murray sewage treatment facilities.

- Recommended by: Councillor Mathews
  Seconded by: Councillor Spence
  That:

"The DWPS Committee accept this report as information".

Carried

b) Sewage Treatment Facility Design Proposal

Rob Murray, Director of Engineering, Hill Murray & Assoc., gave the Committee a short presentation on the sewage facility being proposed for Iqaluit. Councillors were given the opportunity to ask questions and receive clarification on the information provided. Denis informed the Committee of what the design contract for the Sewage Treatment Facility will entail:

Treatment Building
Force Main
Lift Station
Electronic Controls
Mechanical Controls
Purchase of Cement
Shipping of Form Work

- Recommended by: Councillor Mathews
  Seconded by: Councillor Spence
  That:

"The DWPS Committee recommend to Council that the Municipality enter into a contract for the design of the above noted components/work for an amount of $634,540.00".

Carried

3. **Adjournment**

- Recommended by: Councillor Mathews
  Seconded by: Councillor Spence
  That:

  "The meeting be adjourned at 2:10 p.m."

Carried

TAB F

MUNICIPALITY OF IQALUIT
SERVICE CONTRACT

CONTRACT NO.
SC-1512

CONTRACTOR:

Hill Murray & Assoc.
780 Tolmie Ave.
Victoria, B.C.

GENERAL DESCRIPTION:

Design of sewage treatment Bldg.

LOCATION:

DETAILS OF TERMS OF CONTRACT

	UNIT PRICE	TOTAL
Design of sewage treatment Bldg Force Main lift station electronic controls mechanical controls Purchase of cement Shipping of form work		$634,540.0
G.S.T.		$44,417.80
	TOTAL:	$678,957.8

THIS CONTRACT SHALL:

COMMENCE ON THE _____ OF _____ ,19____

TERMINATE ON THE _____ OF _____ ,19____

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED $_____

I/WE AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE WORK OR SERVICES AS STIPULATED ON THE COVENANTS AND AGREEMENT CONTAINED ABOVE AND ON THE REVERSE SIDE HEREOF.

CODING	AMOUNT
02-00-00-4130	$634,549.00
	$44,417.80
FUNDS COMMITTED TOTAL	$678,957.80

DATE _____ INITIALS _____

Sept 09 98 — DATE — SIGNATURE OF CONTRACTOR

SEPT. 9/98 — DATE — SIGNATURE OF WITNESS

Sept 9/98 — DATE — SIGNATURE OF DIRECTOR

ACCEPTED ON BEHALF OF THE MUNICIPALITY OF IQALUIT

THIS 10 DAY OF SEPT ,19 98

SIGNATURE OF TOWN MANAGER

INVOICING: CONTRACTOR TO SUBMIT INVOICES TO:

MUNICIPALITY OF IQALUIT
P.O. BOX 460
IQALUIT, N.W.T. X0A 0H0
TEL (819) 979-5381
FAX (819) 979-5910

SEP 10 1998

TAB G

-02-99 TUE 11:06

P. 03

ANNEX I

ANNEX J

MUNICIPALITY OF IQALUIT
SERVICE CONTRACT

P.O. BOX 460, IQALUIT, N.W.T. X0A 0H0
TEL: (867) 979-5600 FAX: (867) 979-5922

SERVICE CONTRACT

991527

THIS NUMBER MUST APPEAR ON ALL INVOICES AND CORRESPONDENCE

:TOR

11 Murray & Associates
0 Tolmie Avenue
ctoria, B.C.
X 3W4

MUNICIPALITY OF IQALUIT

1999	COMMENCE ON ASAP		
ATE ON -4130	ACCOUNT NUMBER/CODING CHEAPEST WAY		TERMS 0/10

DETAILS OF TERMS OF CONTRACT	UNIT PRICE	TOTAL
1. Sewage Treatment Plant / Progress Claim # 3 As Per Attaached	228,105.10 EACH	228,105.10
SUBTOTAL		228,105.10
GST		15,967.36
TOTAL		244,072.46

AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE C OR SERVICES STIPULATED ON THE CONVENANTS AND EMENTS CONTAINED ABOVE AND ON THE REVERSE SIDE OF.
TRACTOR TO SUBMIT INVOICES TO ADDRESS SHOWN AT TOP

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED
BLANKET ORDER EXPIRES ON MAR 31, 1999
ORDER NOT TO EXCEED $244,072.56

DATE 18/99 SIGNATURE OF CONTRACTOR

ACCEPTED ON BEHALF OF THE MUNICIPALITY OF IQALUIT

THIS 18 DAY OF Jan 99.

SIGNATURE OF WITNESS

DATE 18/99 SIGNATURE OF DIRECTOR

SIGNATURE OF TOWN MANAGER

WHITE-CONTRACTOR YELLOW-PURCHASING PINK-ACCOUNTS PAYABLE GREEN-DEPARTMENT

JAN 19 1999

ANNEX H

TAB H

HILL
MURRAY

ENGINEERING
WATER
SOLUTIONS

March 17, 1999

file.

Our File: 38-70 Iqaluit

Municipality of Iqaluit
Denis Bedard
Director Engineering and planning
P.O. Box 460
Iqaluit, NWT
X0A 0H0

Dear Denis:

Re: Iqaluit Wastewater Treatment Facility
Execution Version - Design Build Contract

We have reviewed your comments on our February 9th, 1999, draft of the Design-Build contract for the Municipality's new Wastewater Treatment Plant. We have also considered your comments regarding the contract price in your fax letters of February 19th and February 23rd, 1999.

Both the Municipality and Hill-Murray have shown creativity and flexibility by working to this point without the main contract in place. Many changes and arisings have been introduced over the last few months which must now be captured in the main contract document. For clarity we submit our project summary in the attached report. The followings items are arisings which have resulted in adjustments to the contract price:

- inclusion of all "spare" equipment within the main contract
- supply of "fifth"and "sixth"aeration blower so that both *process* air supply and *membrane* air supply have independent fitted redundant machines
- the addition of 16 membrane modules to allow for low influent temperature (to 10°C)
- all stainless steel components in wetted areas of the treatment tanks
- the addition of primary power "switchgear" and wiring to the NTPC primary electrical service
- the provision of all training services **in Iqaluit** instead of Victoria. This will result in **no** out of pocket costs to the Municipality for operator training
- the inclusion of all blasting and rock removal for the treatment facility and all pipelines
- inclusion of a dump-box truck for cake removal

These items have resulted in a net capital cost increase on the project and a reduction in the operations and maintenance costs. In the attached breakdown, all items and corresponding cost adjustments are listed. Please note that we propose a direct-cost plus mark-up of 8% only, without profit. The additions indicated will provide the following savings:

.../2

Suite 201
1962 Canso Road
Sidney
British Columbia
Canada
V8L 5V5
Telephone:
250-655-8953
Facsimile:
250-655-8954
Email:
info@hillmurray.com
Website:
www.hillmurray.com

Description	Capital Cost Savings
1. Provision of Spare Equipment	$74,000.00
2. Travel and Accommodation for training (this is for four Iqaluit Municipal staff). Hill-Murray will conduct **all** training in Iqaluit	$12,000.00
3. Cake Bin Vehicle (Dump Truck)	$27, 000.00

Operations & Maintenance Cost Savings

Description	Operations & Maintenance Cost Savings
1. Electrical Costs reduced by 2.92¢ /kwh	$1,022.00/month
2. Equipment Sinking Fund reduced based on stainless components	$250.00/month
3. Regular Inspection of 4160V Switchgear	Included in CWC services

Finally, we direct your attention to the following urgent issues.

- Finalize and Execute Main Contract
- Pay Outstanding Invoices
- Prepare for Operator Training April 5 - 9, 1999 in Iqaluit
- Order Consumables for 1999/2000
- Finalize Airport Lease

I will be in Iqaluit April 3-15, I request that arrangements be made for a Project Review meeting with MACA and the SAO. We should be able to address all of the above items by March 15th, 1999.

Regards,

HILL, MURRAY & ASSOCIATES INC.

Robert A. Murray, P.Eng.
Chief Operations Officer

RAM/emb
I:\PROJECTS\CURRENT\Iqaluit\denisbedardletterexecutionversion.wpd

MUNICIPALITY OF IQALUIT
WASTEWATER TREATMENT FACILITY
PROJECT SUMMARY

Prepared by
Robert A. Murray

March. 15th, 1999

Background

In the first stage of the RFP process conducted by the municipality of Iqaluit, Hill-Murray proposed two options. The first option was a minimum cost "BLENDED FLOW OPTION" which treated half of the flow through the membrane process and half through a mechanical drum screen. This option was initially priced at $6.95 million . The second option was , a "FULL TERTIARY OPTION" where the membrane process was sized for the total flow. The second option was priced at $13.8 million.

In the second phase of the RFP process, Hill-Murray modified the "Blended" option and priced this option **without** contingency at $5.53 million. Hill-Murray and Zenon were ultimately selected to provide an advanced Wastewater Treatment Plant for Iqaluit. As a creative approach, in order to meet the lead time and sea-lift requirements for a 1999 project, Hill-Murray was retained by the Municipality to undertake the design process to 75% completion and to ship concrete and forming material under a service contract.

Through the process of preliminary design and owner design reviews, the "blended" option was modified to a full flow tertiary configuration. The plant was relocated to more a more desirable site. Several additional items were added including capacity for extra flow and high strength influent. Deleted items were credited to the Municipality and the net result was a contract price of $6.7 million.

Through the process of detailed design from October 1998 - February 1999, final layouts, geotechnical assessments, flow monitoring, influent strength monitoring and influent temperature monitoring programs were completed.

Plan reviews were conducted with the Municipality on October 21, 1998, January 20, 1999, and March 5, 1999.

Recent adjustments to the contract price resulted in a final contract price of $7,050,000.00

Project Schedule

Administrative delays and complications with funding were encountered in November , December, 1998, and January, 1999. Work on the "75% design" service contract continued but critical path purchasing milestones were missed in early February, 1999. After discussions with the municipality and MACA, Hill-Murray issued critical path purchase orders and deposits with equipment suppliers including Zenon, Fournier, Caterpillar and Cutler Hammer. Hill-Murray has kept the project on schedule by meeting all critical path milestones. Hill-Murray has incurred significant financing charges to do so. Completion of contract negotiations and execution of the Design-Build contract are critical to the continued success of the project.

Contract Price

As of February 5, 1999, the contract price is $7,050,000 plus GST. This cost increase is a result of several factors including lower than anticipated influent temperature, carrying charges due to delays in contract signing and additions to the scope of work. Minimizing operations and maintenance costs has resulted in additional capital cost for primary electrical service which now includes primary switchgear.

The progression of all cost adjustments is explained in the following pages.

Option 2 - Minimum Budget Compliance
Phased Tertiary

MBR Flow 1000 m^3/day
Microscreen Flow 1000 m^3/day

Blended Flow 2000 m^3/day

Item	Cost ($M)
Engineering/Design	0.8
Permitting	0.3
ZenoGEM Equipment	1.8
Drum Screen Equipment	.015
Sludge Pressing Equipment	0.3
Headworks Equipment	0.1
Headworks Tanks	0.15
Headworks Building	0.15
Treatment Tanks	0.4
Treatment Building	0.4
Civil Improvements	0.5
Mobilization & Shipping	0.3
Installation & Management	0.45
Commissioning	0.15
Sub-Total - Option 2	5.95
Recommended Contingency - may be reduced subject to site visit	1.0

Subject to: Summer Site Visit
Errors & Omissions Excepted

Capital Costs for BLENDED OPTION
From initial proposal dated: March 18, 1998

Municipality of Iqaluit
Water Reclamation Facility

Option 1 - Full Tertiary Immediately

MBR Flow 2000 m^3/day

Item	Cost ($M)
Engineering/Design	1.5
Permitting	0.5
ZenoGEM Equipment	3.5
Fournier Press Equipment	0.5
Headworks Equipment	0.35
Headworks Tanks	0.25
Headworks Building (2000 ft^2)	0.25
Treatment Tanks	1.0
Treatment Building (10000 ft^2)	1.0
Civil Improvements	1.0
Mobilization & Shipping	0.5
Installation & Management	0.75
Commissioning	0.2
Sub-Total - Option 1	11.3
Recommended Contingency - may be reduced subject to site visit.	2.5

Subject to: Summer Site Visit
Errors & Omissions Excepted

Capital cost for TERTIARY OPTION
From initial proposal dated: March 18, 1998

TRAINING, OPERATIONS AND MAINTENANCE

Training

Instead of having Municipality of Iqaluit personnel travel to Victoria for training. Operator training will be conducted in Iqaluit. This will minimize disruption of municipal personnel and municipal services and will result in no out of pocket costs to the municipality.

Liaison With Arctic College

Hill-Murray and CWC have made commitments to have a long term presence in Iqaluit and the Eastern Arctic. We have planned quarterly visits to Iqaluit to provide monitoring and operational support services, however, it is intended that Hill-Murray will hire a full-time Iqaluit employee as soon as possible to support all arctic support service from a Nunavut Operations base. This is re-enforced by our commitment to take part in the environmental studies program at Arctic college by providing ongoing lectures and training on Arctic water and wastewater utilities.

Ongoing Operations & Maintenance Costs

Agreement in principle was reached on a total operations and maintenance cost in the order of $300,000/ year this did not include 1.4 person years provided by municipal utilidor and road maintenance crews. It did include a $5,621/month monitoring contract with CWC. Significant cost savings were realized on electrical power by converting building heat to furnace oil and converting the electrical service to a primary service. There are significant capital cost increases associated with a primary electrical service

Local Economic Development

As a mutual commitment to local economic development, a six month commitment to operations and maintenance services with an option to renew for another six months is required from the municipality.

Primary Electrical Service

Original Electrical Service Allowance	$ 50,000
August 26th, 1998, Design Review	$ 59,000
Previous Capital Budget Line Item	$109,000
February 10th, 1999, Design Review	$ 79,200
Revised Capital Budget Line Item	$188,000

This will result in further reduction of monthly operations and maintenance costs by $1,022/month.

- Monthly power demand 35000kwh
- Current commercial (600V service) rate 29.27¢.
- Revised commercial rate 600V service effective March 29, 1999, 26.34¢.
- Primary service rate (unchanged) 23.32¢

35000kwh/month *(26.34¢/kwh - 23.32¢/kwh) = $1,022/month

OPERATIONS AND MAINTENANCE COSTS

CWC and HM&A have a detailed understanding of the operations and maintenance requirements for MBR water reclamation facilities. The numbers presented have been developed from first principals, based on kinetic requirements of the treatment process, and backed up by operational experience.

The majority of the operating costs associated with the treatment process are driven by the electrical power consumption. As a result, a comprehensive economies and efficiencies plan is a required element to ensure that the operating costs are minimized. CWC's economies and efficiencies plan includes the following:

- Variable Frequency Drives:

  Large motors are controlled with VFDs to allow for close control of product delivery by varying speed. This allows the treatment process to be controlled to the kinetic design and reducing power consumption. Power consumption is a function the cube of the speed. As a result, reducing the speed of an electrical prime mover by ½ reduces power consumption to ⅛ that of full load.

- Active DO control:

  The plant is operated at the minimum required dissolved oxygen level required to ensure effective treatment. During times of low flow, or when the membrane process is isolated, air blowers are throttled or shut down to reduce power consumption.

- Phased Equipment Starts:

  In order to reduce demand charges, all equipment is phased in starting and operation to reduce demand charges on the electrical service.

- Isolation of Systems:

  Other systems that are not actively in use will be isolated.

- Close-controlled Power Monitoring:

  Power consumption at the plant is continuously monitored by the on-board power monitor.

- Minimization of Chemical Use

ANNEX D

CAPITAL COSTS, SITE 3

DESCRIPTION	COST (millions)	
Engineering and Design	0.5	
ZenoGEM Equipment	1.5	
PRA Drumscreen Equipment	0.05	
Fournier Sludge Press	0.3	
Headworks Equipment	0.08	
Integrated Tanks and Channels	0.5	
Building	0.5	
Lift Station/Genset/Building (for 1000' forcemain)	0.1	Site dependent
Forcemain, (nominal 1000m)	0.5	Site dependent
Outfall (nominal 200m)	0.1	Site dependent
NTPC Power lines (2)	0.05	Site dependent
Diesel Generator	0.05	
Shipping and Mobilization	0.5	
Local Installation Sub Contracts	0.25	
Project Management	0.4	
Training and Commissioning	0.15	
TOTAL	5.53	
OPTIONS		
Composter	0.35	
Spares	0.05	
UV System	0.10	

Revised Capital Cost for "BLENDED OPTION"
From revised proposal dated: June 12, 1998

MUNICIPALITY OF IQALUIT

CAPITAL COSTS ADJUSTMENTS	
Initial Capital Cost Estimate (May 1998)	**$6.95 M**
Description	**Cost**
Combined Flow 1000/1000 (June 1999) no contingency	$5,530,000.00
Victoria Design Review (July 27, 1998 - July 30, 1998) Changes:	
• Raise Equipment Platform	220,000.00
• Slab and Insulate Storage Area	127,500.00
• Airlock Type Entrance	17,000.00
• Metal Halide Lighting	13,500.00
• Boiler/Hot Water Heat	42,500.00
• Extra Marshalling/Shipping	7,200.00
• Final 25% Design	48,135.00
• Cat Genset Upgrade	12,200.00
• Design Contingency	69,965.00
Victoria Design Changes Sub-total	558,000.00
Sub-total	**6,088,000.00**
Total	**$6,088,00.00**

CAPITAL COSTS ADJUSTMENTS	
Victoria Design Review (July 27, 1998 - July 30, 1998)	$6,088,000.00
Iqaluit Design Review (August 22, 1998 - August 26, 1998) Changes:	
Site 3 Development:	
• Geotechnical Upgrade, grade beams and pilings	131,500.00
• Deep Gravity Sewer, counter ice lance	117,500.00
Feed Strength Upgrade:	
• BOD, increase tank size	459,500.00
• TSS, increase recirc rate	92,000.00
Project Contingency	
Electrical Power, primary service	59,000.00
Iqaluit Design Changes Sub-total	859,500.00
Iqaluit Design Review Credits:	
• No Lift-station building	(37,500.00)
• Forcemain Shortened	(210,000.00)
Iqaluit Design Review Credits Sub-total	$247,500.00
Total	**$6,700,000.00**

Total Credits	$ 247,500.00
	$ 247,500.00
Total Extra Charges	$ 558,000.00
	$ 859,500.00
	$1,417,500.00

Lift Station Building is Back-in now.

ANNEX C

CAPITAL COSTS

Line Item	DESCRIPTION	MBR/Drum Screen 1668m³/d ($CDN) (millions)
1	Engineering and Design	0.79
2	ZenoGEM Equipment	1.55
3	PRA Drumscreen Equipment	0
4	Fournier Sludge Press	0.3
5	Headworks Equipment	0.08
6	Integrated Tanks and Channels	0.83
7	Building (Revised)	0.95
8	Lift Station/Genset/Building (for 1000 m forcemain)	0.0625
9	Gravity Sewer Extension	0.377
10	Outfall (nominal 200 m)	0.07
11	NTPC Powerlines Primary Power 4160	0.109
12	Diesel Generator	0.0793
13	Shipping and Mobilization	0.542
14	Local Installation Sub Contracts (Revised)	0.423
15	Project Management	0.4072
16	Training and Commissioning	0.13
	TOTAL	6.70

NOTE: All value added taxes are extra.

IQALUIT WWTP
Contract Price Adjustments
March 2 ,1999
Prepared By: Robert A. Murray

Initial Proposal for Blended Effluent (48 Modules)	$5,530,000
Credits (duel to relocation)	($247,500)
Changes (Addition of 16 Modules) total flow through ZENON system	$1,417,500
TOTAL	**$6,700,000**

FEBRUARY ADDITIONS		
Financing Charges (due to delays in contract signing)		$4,900
SS Frames & Components (in wetted areas)		$45,500
Plant Spares:		
Filters	1,000	
Mechanical Parts	1,000	
Spare Sensors	10,000	
Permeatic Pump	17,100	
Blower	22,500	
Recirc Pump	13,000	
Air Compressor	10,300	$74,900
Temp Transmitter (in biomass)		$3,500
Flow Meter/Transmitter (on influent line)		$4,800
4160 Volt Switchgear & Transformer		$79,200
Membranes Modules 1800 m^3 @ 10° (16 modules)		$109,550
TOTAL ADDITIONS		$322,350
8% Mark-Up for Overhead & Contingency		$25,788
Additions With Mark-Up		$348,148
Previous Total		$6,700,000
Truck for Cake Removal		no extra charge
Training in Iqaluit		no extra charge
Rock Removal		no extra charge
REVISED TOTAL		**$7,048,138**

Lift Station Building $37,500

ANNEX C

CAPITAL COSTS

Line Item	DESCRIPTION	MBR/Drum Screen 1800m³/d ($CDN) (millions)
1	Engineering and Design	0.79
2	ZenoGEM Equipment	1.67
3	PRA Drumscreen Equipment	0
4	Fournier Sludge Press	0.30
5	Headworks Equipment	0.08
6	Integrated Tanks and Channels	0.83
7	Building (Revised)	1.10
8	Lift Station/Genset/Building (for 1000 m forcemain)	0.0625
9	Gravity Sewer Extension	0.377
10	Outfall (nominal 200 m)	0.070
11	NTPC Powerlines Primary Power 4160	0.189
12	Diesel Generator	0.0793
13	Shipping and Mobilization	0.542
14	Local Installation Sub Contracts (Revised)	0.423
15	Project Management	0.4072
16	Training and Commissioning	0.130
	TOTAL	**7.050**

NOTE: All value added taxes are extra.

Operations and Maintenance Costing - Summary			
Item	Details		Annual Cost
Man-hours			
• Water Reclamation Facility		By Owner (based on an internal charge out rate of $35/hour)	
• Operations Man-hours	400 Man-hours/year		$14,000.00
• Maintenance Man-hours	330 Man-hours/year		$11,550.00
• Sludge Management			
• Operations Man-hours	1460 Man-hours/year		$51,100.00
• Maintenance Man-hours	100 Man-hours/year		$3,500.00
• Bin Transfer	208 Man-hours/year		$7,280.00
• Trucking	104 Man-hours/year		$3,640.00
• Collection System	1095 Man-hours/year		$38,325.00
• Lift Station			
• Maintenance Man-hours	182.5 Man-hours/year		$6,387.50
		TOTAL LABOUR	$135,782.50
Operations & Maintenance			
Power	$18,059/month		$216,708.00
• Process	34,562 kWhrs/month		
• Lift Station	1,614 kWhrs/month		
• Outfall	1,235 kWhrs/month		
• Building	13,301 kWhrs/month		
• Heat Trace Piping	8,660 kWhrs/month		
Consumables			
• WRF	$2813/year		$2,813.00
• Sludge Management	$7077/year		$7,077.00

From revised proposal dated: June 12, 1998

Operations and Maintenance Costing - Summary			
• Cake Disposal			
Warranties			
• Process Warranty			$10,000.00
• Membrane Warranty			$14,000.00
Operations & Maintenance Management Technical Support			$41,422.00
Administration, Lab Analysis, Overhead			$26,038.00
		TOTAL O&M	$318,058.00
Other Requirements			
Capital Equipment Replacement			
• Membranes	$41,000/year		
• Other Equipment	$8,400/year		
Telephone Line	2 @ $36.00/month + Long Distance Charges		

Command, Control, Communication and Information (C_3I) Technologies

In order to effectively manage the operation of the plant remotely, CWC employs a powerful suite of man-machine interface software, remote imaging, active process and plant control and advanced communications technologies. This control suite, supplementary to the control logic for the operation of the plant allows for immediate notification of any alarm conditions, ensures that CWC staff can verify any operating condition at the plant and allows for alteration of control logic as well as recovery from any abnormal condition.

This suite has been developed by CWC to ensure that the operating state of any portion of the plant can be confirmed, altered or queried 24 hours per day, seven days a week. This system allows for immediate response to any problem and in most cases negates any requirement for the on-site operator or CWC staff to visit the plant.

Local Administration & Overhead

Provision of Membrane Warranties from Zenon
- ZMS administration costs (flow through from Zenon)

Lab Analysis
- Dependent on permit requirements

Zenon Reporting
- Weekly for the first six months
- Monthly thereafter

Billing

Site Support for Routine Activities
- Preparing for Sludge Wasting
- Preparing for Membrane Cleaning

Permit Administration and MOE Reporting

Customer Service Activities

OPERATIONS AND MAINTENANCE COST SUMMARY FROM NOVEMBER, 1998		
• System Manhours	60.8 hours/month, Utilidor Crew	1.4 persons per year
• Biosolids Management	130 hours/month, Utilidor Crew	from current
• Trucking Manhours	31.2 hours/month, Road Crew	municipal crew
• Electrical Power	35,000 kw hours/month	9,562.00
• Chemicals		235.00
• Pellets		590.00
• Fuel		1,820.00
• Contingency		0.00
• CWC Fee, 4 trips		5,621.00
• ZENON Fee, Warranties		2,500.00
• Sinking Fund		4,117.00
Operations and Maintenance Expenditures Per Month		**24,445.00**

OPERATIONS AND MAINTENANCE COST SUMMARY FOR MARCH, 1999	
Labour (provided by Municipality)	
Electrical Power @23.32¢/kwh	$ 8,162.00
Chemicals	235.00
Pellets	590.00
Fuel	1,820.00
CWC Fee for Operations & Maintenance Services	5,621.00
Extended Warranty ZENON	2,500.00
Recommended Sinking Fund	3,867.00
Recommended Operations & Maintenance & Replacement Monthly Budget	**$22,795.00**

Operations & Maintenance Costs Savings $1,650/month

44

NORTHWEST TERRITORIES POWER CORPORATION

Effective Date: April 1, 1998
Supersedes: July 1, 1997

Rate Schedule: FB - 07

Community: **IQALUIT**

Domestic Service	Customer	Government Customer
Monthly Service Charge:	$15.00	$15.00
Monthly Energy Charge:	32.13 c/kWh	32.13 c/kWh
Minimum Monthly Bill:	$15.00	$15.00
Rate Rider:	0.251 c/kWh	0.000 c/kWh

based on one time annual peak demand

Commercial Service *	Customer	Government Customer
Monthly Demand Charge:	$7.00 /kW	$7.00 /kW
Monthly Energy Charge:	25.82 c/kWh	29.27 c/kWh
Minimum Monthly Bill:	$35.00	$35.00
Rate Rider:	0.000 c/kWh	~~0.000 c/kWh~~

Commercial Primary Service	Customer		
Monthly Demand Charge:	$7.00 /kW	Minimum Monthly Bill:	$35.00
Monthly Energy Charge:	23.32 c/kWh		
Rate Rider:	~~0.000 c/kWh~~		

* Commercial Service - Billing Demand shall be the greater of the current month's maximum Demand or the maximum Demand experienced during the 12-month period ending with the current billing month.

Note: The riders will be collected until June 30, 1998 or until the combined 1995/96 and 1996/97 deficiencies are collected.

Rob Murray
250 655 8954

NORTHWEST TERRITORIES POWER CORPORATION

Effective Date: March 29, 1999
Supersedes: April 1, 1998

Rate Schedule: FB - 07

Community: IQALUIT

Domestic Service	Customer	Government Customer
Monthly Service Charge:	$18.00	$18.00
Monthly Energy Charge:	31.58 c/kWh	31.58 c/kWh
Minimum Monthly Bill:	$18.00	$18.00
Rate Rider:	$0.0000 c/kWh	$0.0000 c/kWh

Commercial Service *	Customer	Government Customer
Monthly Demand Charge:	$8.00 /kW	$8.00 /kW
Monthly Energy Charge:	25.47 c/kWh	26.34 c/kWh
Minimum Monthly Bill:	$40.00	$40.00
Rate Rider:	$0.0000 c/kWh	$0.0000 c/kWh

- Commercial Service - Billing Demand shall be the greater of the current month's maximum Demand or the maximum Demand experienced during the 12-month period ending with the current billing month.

Commercial Primary Service	Customer		
Monthly Demand Charge:	$8.00 /kW	Minimum Monthly Bill:	$40.00
Monthly Energy Charge:	23.32 c/kWh		

1.0 COMMERCIAL

1.1 Pricing Summary

The pricing to supply equipment and services as described in this proposal is as follows:

One (1) ZenoGem® Membrane Bioreactor Waste Treatment System including aeration system, pumps, blowers, instruments, control system and motor control equipment.

Process equipment will be supplied loose, i.e. not on skids c/w pipe spools

Average Day Flow	**1,800**	**m^3/day**
Maximum Day Flow	**2,500**	**m^3/day**
Peak Hourly Flow	**150**	**m^3/hour**

Engineering Design Only	**CDN$ 95,000.00**
System Price: Balance	**CDN$ 1,462,500.00**
Total	**CDN$ 1,557,500.00**

Validity

Pricing is valid for a period of 60 days from December 23, 1998. If a formal purchase order is not received within the 60 day period, both the pricing and delivery schedule are subject to review and adjustment.

Taxes and Duties

No taxes or duties or brokerage are included in the above pricing. Any taxes, duties, tariffs of any type are for the account of the Purchaser.

Equipment: Country of Origin and Manufacture

The country of origin of the membranes and major process equipment included in this proposal is Burlington, Ontario, Canada.

Freight

Freight and insurance is included F.O.B. Port of Montreal, Barge Shipment Ready. Delivery to the project site is conditional upon provision of access roads of a nature that will permit access by tractor-trailers to the project site. Off-loading, appropriate storage, positioning and installation of equipment at the job-site is not included.

Z

1.0 COMMERCIAL

1.1 Pricing Summary

The pricing to supply equipment and services as described in this proposal is as follows:

One (1) ZenoGem® Membrane Bioreactor Waste Treatment System including aeration system, pumps, blowers, instruments, control system and motor control equipment.

Process equipment will be supplied loose, i.e. not on skids c/w pipe spools

Average Day Flow	**1,800**	**m^3/day**
Maximum Day Flow	**2,500**	**m^3/day**
Peak Hourly Flow	**150**	**m^3/hour**

System Price **CDN$ 1,825,000.00**

Validity

Pricing is valid for a period of 60 days from December 4, 1998. If a formal purchase order is not received within the 60 day period, both the pricing and delivery schedule are subject to review and adjustment.

Taxes and Duties

No taxes or duties or brokerage are included in the above pricing. Any taxes, duties, tariffs of any type are for the account of the Purchaser.

Equipment: Country of Origin and Manufacture

The country of origin of the membranes and major process equipment included in this proposal is Burlington, Ontario, Canada.

Freight

Freight and insurance is included F.O.B. Port of Montreal. Delivery to the project site is conditional upon provision of access roads of a nature that will permit access by tractor-trailers to the project site. Off-loading, appropriate storage, positioning and installation of equipment at the job-site is not included.

TAB I

HILL MURRAY & ASSOCIATES INC.

ENVIRONMENTAL SYSTEMS ENGINEERS

Facsimile Transmittal

Suite 202 • 780 Tolmie Avenue • Victoria • B.C. • Canada • V8X 3W4
☎ (250) 388-3930 • Fax (250) 388-3943 • Email: rob@hillmurray.com

Our File:

To: Doug Sitland
Fax: 4779
From: Robert A. Murray, Partner
Date: January 20, 1999
Subject: Iqaluit WWTP
Total pages this fax (including cover sheet): 6

MESSAGE

Per Our Discussion

Doug.

The original proposed cost was $5.53 million. This was based on 1668 $\frac{m^3}{d}$ and influent characteristics of

BOD ≤ 190 mg/l
TSS ≤ 190 mg/l

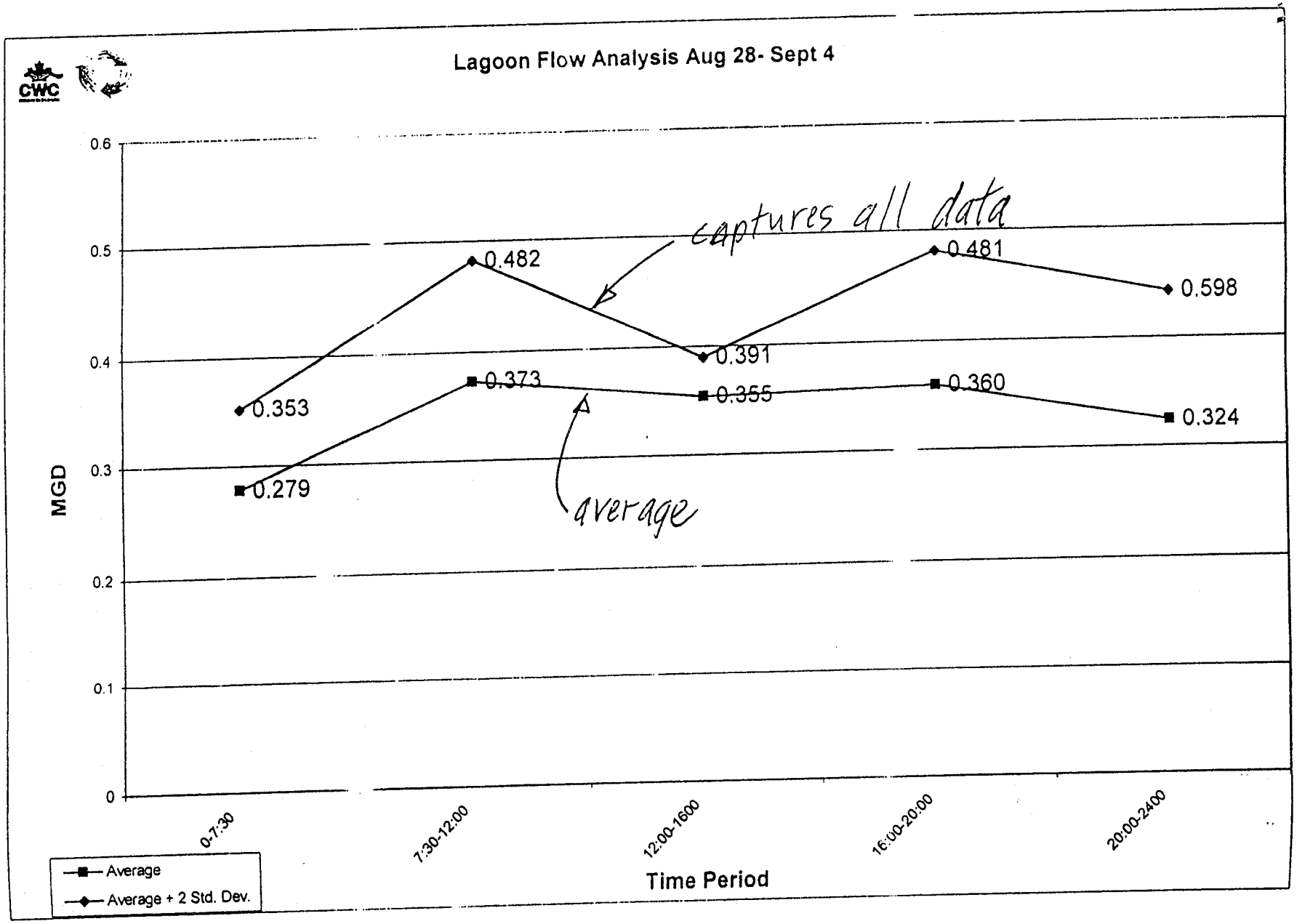
The revised design is for 1800 $\frac{m^3}{d}$ and

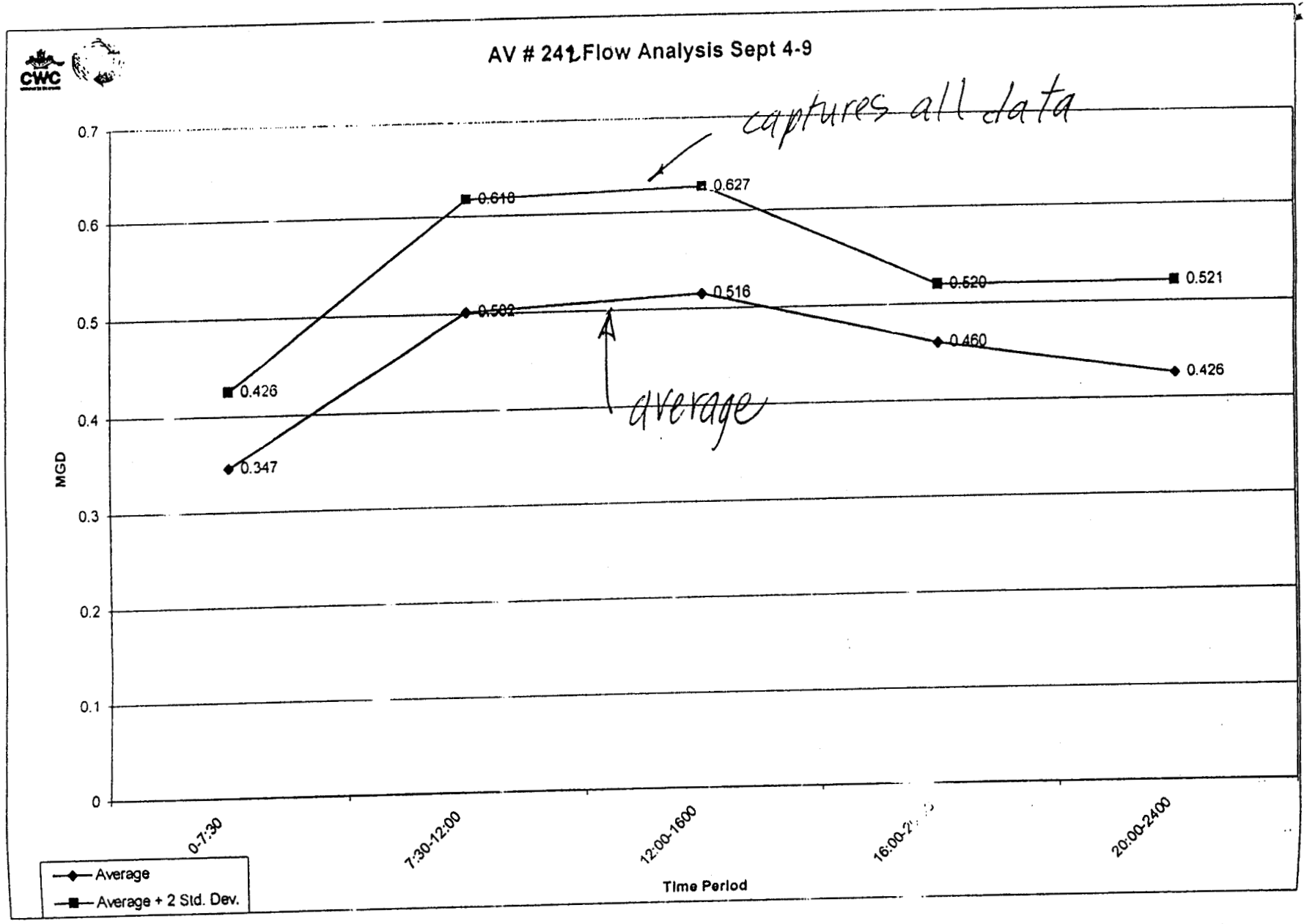
BOD ≤ 400 mg/l
TSS ≤ 500 mg/l

The revised project cost is $6.7 million plus GST

ANNEX J

FLOW DATA FROM ON SITE FLOW
MEASUREMENTS DONE BY CWC


Lagoon Flow Analysis Aug 28- Sept 4
CWC
MGD
0.6
0.5
0.4
0.3
0.2
0.1
0
0.353
0.482
0.391
0.481
0.598
0.279
0.373
0.355
0.360
0.324
captures all data
average
0-7:30
7:30-12:00
12:00-1600
16:00-20:00
20:00-2400
Time Period
Average
Average + 2 Std. Dev.


AV # 241 Flow Analysis Sept 4-9
captures all data
average
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
MGD
0.426
0.618
0.627
0.520
0.521
0.347
0.502
0.516
0.460
0.426
0-7:30
7:30-12:00
12:00-1600
16:00-2
20:00-2400
Time Period
Average
Average + 2 Std. Dev.

ANNEX K

LAB DATA
INFLUENT FEED STRENGTH

JB LABS

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364
jblabs@islandnet.com

DATE: September 2, 1998

JOB NO: JB 1750A
LR NO: 26683

SAMPLING DATE: See Below
SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

CLIENT: HILL MURRAY & ASSOCIATES
CONSTRUCTION DIVISION
780 TOLMIE AVE UNIT 202
VICTORIA BC V8X 3W4

Attn: Robert A. Murray

SAMPLE:
Sample # 1: Iqualuit - Raw Aug 26/98
Sample # 2: Iqualuit - Lagoon discharge

		Sample 1	Sample 2
Tot Suspended Solids	mg/L	432	84
BOD_5	mg/L	340	70
Alkalinity, Total	mg/L $CaCO_3$	220	

(average) (influent tests August 1996

TAB J

MUNICIPALITY OF IQALUIT
SERVICE CONTRACT

P.O. BOX 460, IQALUIT, N.W.T. X0A 0H0
TEL: (867) 979-5600 FAX: (867) 979-5922

SERVICE CONTRACT

991547
THIS NUMBER MUST APPEAR ON ALL INVOICES AND CORRESPONDENCE

Hill Murray & Associates
780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

MUNICIPALITY OF IQALUIT

E	COMMENCE ON		
R 19, 1999	ASAP		

MINATE ON	ACCOUNT NUMBER/CODING	TERMS
-00-00-4130	CHEAPEST WAY	0/10

DETAILS OF TERMS OF CONTRACT	UNIT PRICE	TOTAL
1. Increase sewage treatment capacity / Produce detailed design	750,000.00 EACH	750,000.
1. Produce tender documents / Purchase construction materials	EACH	
SEE ATTACHED Summary		
SUBTOTAL		750,000.
GST		52,500.
TOTAL		802,500.

WE AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE ORK OR SERVICES STIPULATED ON THE CONVENANTS AND GREEMENTS CONTAINED ABOVE AND ON THE REVERSE SIDE EREOF.
ONTRACTOR TO SUBMIT INVOICES TO ADDRESS SHOWN AT TOP.

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED

BLANKET ORDER EXPIRES ON MAR 31, 1999
ORDER NOT TO EXCEED $802,500.00

Mar 19,99
DATE

SIGNATURE OF CONTRACTOR

Mar 19/99
DATE

SIGNATURE OF WITNESS

MAR 19/99
DATE

SIGNATURE OF DIRECTOR

ACCEPTED ON BEHALF OF THE MUNICIPALITY OF IQALUIT

THIS _____ DAY OF _____

MAYOR

SIGNATURE OF TOWN MANAGER

WHITE-CONTRACTOR YELLOW-PURCHASING PINK-ACCOUNTS PAYABLE GREEN-DEPARTMENT

TAB K

HILL
MURRAY

ENGINEERING
WATER
SOLUTIONS

June 11, 1999

Our File: 38000-27/Iqaluit

VIA FACSIMILE: 867-979-5910

Denis Bedard
Director Engineering and planning
Municipality of Iqaluit, P.O. Box 460
Iqaluit, Nunavut, X0A 0H0

Dear Denis:

Re: Municipality of Iqaluit Water Reclamation Facility

Further to our discussion this afternoon with respect to capital costs associated with the new municipal water reclamation facility, we have reviewed and reconciled our accounts. The following represents our view of the status of this account.

Iqaluit Water Reclamation Facility
Financial Synopsis as at 14:30 PST 11 June 1999

	Description	Value	Amount Billed	Amount Unbilled
Complete Facility	Contract	$ 7,050,000.00		
Service Contract	CC 1512	$ 604,540.00	$ 500,500.90	$ 75,976.04
Service Contract	SC-991527	$ 228,105.10	$ 228,105.10	$ -
Service Contract	SC-991547	$ 750,000.00	$ 750,000.00	$ -
Paid in 1998 Budget			$ 1,536,688.46	$ 75,976.64
Balance Outstanding for payment in FY 1999			$ 5,513,331.54	
Capital Funds Available in FY 1999				
1999/00 CCHT Funding			$ 1,800,000.00	
1999/00 Infrastructure			$ 875,000.00	
1999/00CCHT Funding			$ 44,000.00	
Balance to be Financed			$ 2,794,331.54	

We are prepared on the basis of a series of very positive discussions this week to move forward on this basis to ensure we meet the pending sea-lift and associated project time-line.

Our signatures below indicated our intention to move forward with this project and our consensus as to the financial status of the project.

Trevor T. Hill
President & CEO
Hill, Murray & Asss. Inc.

Denis Bedard
Director of Engineering
Municipality of Iqaluit

John Raycroft
City Administrator
Municipality of Iqaluit

G:\PROJECTS\CURRENT\Iqaluit\bedardlet06.wpd

Suite 201
1962 Canso Road
Sidney
British Columbia
Canada
V8L 5V5
Telephone:
250-655-8953
Facsimile:
250-655-8954
Email:
info@hillmurray.com
Website:
www.hillmurray.com

TAB L

HILL MURRAY

ENGINEERING WATER SOLUTIONS

June 25th, 1999

Our File: 38000-70 Iqaluit

VIA FACSIMILE (867) 979-5305

Lorna
Leo
Trevor
File

Rosemary Keenainak
Through Doug Sitland, Project Engineer
Government of Nunavut
Box 800
Iqaluit, Nunavut X0A 0H0

Dear Rosemary:

Re: Iqaluit Water Reclamation Facility
Project Demobilization/Mobilization

With regards to the costs for stopping and starting the project the following table explains each line item and shows a representative cost effect of demobilization and then mobilization. The amounts are current as of June 24th, 1999, but all suppliers would not commit to an exact cost for shipments June, 2000, therefore we do show a contingency line item. We do not have warrantee commitments for items shipped 1999 and installed 2000.

Should you require any further information, please feel free to contact me.

Regards,

Robert A. Murray, P. Eng.
Chief Operations Officer

Attachments

/emb

\\DATASERVER\d-drive\PROJECTS\CURRENT\iqaluitrosemary demo costs.doc

Suite 201
1962 Canso Road
Sidney
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V8L 5V5
Telephone:
250-655-8953
Facsimile:
250-655-8954
Email:
info@hillmurray.com
Website:
www.hillmurray.com

IQALUIT WATER RECLAMTION FACILITY Project Demobilization/Mobilization		
Design	• Extend building permit • Drawing certification & extension • Extra plan review • Extra Engineering inspections (3)	 8,000 2,400 15,360
Sub total	•	**$25,760**
Zenon	All equipment shipped but not installed membranes re-stocked • Winterize and re-crate • Re-inventory upon start up • Re-stock membrane with supplier	 4,800 3,600 58,550
Sub total		**$66,950**
Fournier	• Cancel the Fournier purchase agreement 50% • Engineering and administration fee	52,000 3,000
Sub total	•	**$55,000**
Headworks Equipment	• Cancel the head works equipment purchase agreement 25%	22,000
Sub total		**$22,000**
Tanks	• Cancel soaking tanks • Cancel trash channels Construct, cast in place treatment tanks	18,640 3,280
Subtotal	•	**$21,920**
Building	• Construct, cast in place walls and install steel structure and doors to lock up	
Receiving Station	Construct, cast in place concrete only • Pumps relocking 25%	 4,200
Sub total		**$4,200**
Sewer Line	• Construction complete	
Outfall	• Construct complete	
Power Service	• Complete primary power	
Diesel Gen Set	• Ship complete • Cancel fuel tank 50% restocking	 4,000
Sub total		**$4,000**
Shipping	• Year 2000 rate increase 10% x 260,000	26,000
Sub total		**$26,000**
Installation of Equipment	• Increase cost year 2000 800,000 x 10%	80,000
Sub total		**$80,000**
Project Management	• Demobilization of sub contractor • Demobilization of site supervisors • Insurance $1,260 x 9 months • Living Unit Maintenance 9 x $470 month • Site Security 9 x $600	40,200 11,400 11,340 4,230 5,400
Sub total		**$72,570**
Training & Startup	• Delayed	
Operations	• Warranties may not be extended by manufacturers	
Subtotal		**$378,400**
Contingency on mobilization & demobilization	• $378,400 x 10%	37,840
TOTAL		**$416,240**

TAB M

MUNICIPALITY OF IQALUIT
SERVICE CONTRACT

P.O. BOX 460, IQALUIT, NW.T. X0A 0H0
TEL: (867) 979 5600 FAX: (867) 979-5922

SERVICE CONTRACT

991559

THIS NUMBER MUST APPEAR ON ALL INVOICES AND CORRESPONDENCE

CONTRACTOR

Hill Murray & Associates
700 Telmia Avenue
Victoria, B.C.
V8X 3W4

MUNICIPALITY OF IQALUIT

DATE	COMMENCE ON		
JUN 12, 1999	ASAP		
TERMINATE ON	ACCOUNT NUMBER/CODING		TERMS
02-00-00-4130	CHURCHEST WAY		0/10

DETAILS OF TERMS OF CONTRACT	UNIT PRICE	TOTAL
1. Building & Apron as per attached /	878,200.00 EACH	878,200.00
SUBTOTAL		878,200.00
GST		61,479.60
TOTAL		939,759.60

I/WE AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE WORK OR SERVICES STIPULATED ON THE CONVENANTS AND AGREEMENTS CONTAINED ABOVE AND ON THE REVERSE SIDE HEREOF.
CONTRACTOR TO SUBMIT INVOICES TO ADDRESS SHOWN AT TOP.

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED
BLANKET ORDER EXPIRES ON SEP 30, 1999
ORDER NOT TO EXCEED $939,759.60

DATE — SIGNATURE OF CONTRACTOR

THIS 12 DAY OF July

DATE July 12/99 — SIGNATURE OF WITNESS

DATE — SIGNATURE OF DIRECTOR

SIGNATURE OF TOWN MANAGER

WHITE-CONTRACTOR YELLOW-PURCHASING PINK-ACCOUNTS PAYABLE GREEN-DEPARTMENT

TAB N

P.O BOX 460, IQALUIT, N.W.T. X0A 0H0
TEL: (867) 979-5600 FAX: (867) 979-5972

THIS NUMBER MUST APPEAR ON ALL INVOICES AND CORRESPONDENCE

:TOR

Hill Murray & Associates
Tolmie Avenue
ria, B.C.
V8X 3W4

MUNICIPALITY OF IQALUIT

2, 1999	ASAP		
ATE ON 1-00-4130	ACCOUNT NUMBER/CODING CHEAPEST WAY		TERMS 0/10

DETAILS OF TERMS OF CONTRACT	UNIT PRICE	TOTAL
1. Site Improvements as per attached /	1,875,743.64 EACH	1,875,743.64
SUBTOTAL		1,875,743.64
GST		131,302.05
TOTAL		2,007,045.69

AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE K OR SERVICES STIPULATED ON THE CONVENANTS AND EMENTS CONTAINED ABOVE AND ON THE REVERSE SIDE OF
KACTOR TO SUBMIT INVOICES TO ADDRESS SHOWN AT TOP.

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED
BLANKET ORDER EXPIRES ON SEP 30, 1999
ORDER NOT TO EXCEED $2,007,045.69

DATE
SIGNATURE OF CONTRACTOR

DATE
SIGNATURE OF WITNESS

DATE July 12/99
SIGNATURE OF DIRECTOR

ACCEPTED ON BEHALF OF THE MUNICIPALITY OF IQALUIT
THIS 12 DAY OF July
SIGNATURE OF TOWN MANAGER

WHITE-CONTRACTOR YELLOW-PURCHASING PINK-ACCOUNTS PAYABLE GREEN-DEPARTMENT

ANNEX I
ANNEX J
ANNEX K
ANNEX L
ANNEX H

TAB O

HILL
MURRAY

ENGINEERING
WATER
SOLUTIONS

July 22, 1999

Denis Bedard
Director of Engineering and Planning
Municipality of Iqaluit
P.O. Box 460
Iqaluit, NT
X0A 0H0

Dear Denis:

Re: Iqaluit Water Reclamation Facility -- Report to Chairmen and Members, Development Works and Public Safety

Enclosed is a copy of the Report to Development Works and Public Safety dated July 22, 1999 for your perusal. This report is submitted as per the request of Councillor Spence.

Please do not hesitate to contact should you have any questions.

Kindest regards,

HILL, MURRAY & ASSOCIATES INC.

Robert A. Murray, P.Eng.
COO

Enclosure

/ram
A:\D. Bedard Report Cover Letter.doc

Suite 201
1962 Canso Road
Sidney
British Columbia
Canada
V8L 5V5
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250-655-8953
Facsimile:
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Email:
info@hillmurray.com
Website:
www.hillmurray.com

HILL, MURRAY & ASSOCIATES INC.
EXECUTIVE SUMMARY
FOR THE REPORT TO CHAIRMEN & MEMBERS

Development Works and Public Safety
The Municipality of Iqaluit

Following the Request For Proposal process in 1997, Hill, Murray & Associates was selected to provide Design-Build-Operate services to the Municipality of Iqaluit. At the time of the RFP, Hill Murray proposed two options: One (at $6.0 M) providing the bare minimum with no disinfection to meet the new water board permit, and the second (at $11.0 M) providing a higher level of treatment or tertiary treatment.

The municipality ultimately selected the option with the highest level of treatment and requested that the design incorporate expandability for the future growth of Iqaluit. The municipality instructed Hill Murray to reduce costs as much as possible both on the capital costs and on the operations and maintenance and replacement costs.

Significant capital costs were saved by relocating the plant from the proposed site near the tank farm to a site adjacent to the existing lagoon. Capital expenditures that added to the project costs were reviewed and approved by the municipality throughout the design process. These additional costs were due to:

- Higher than stated flows,
- higher than stated wastewater strength, and
- extra membranes and equipment to reduce operations and maintenance costs.

The final cost which does not include financing costs is $7.088 M.

Many delays were encountered awaiting confirmation of capital and operations and maintenance funding from the Nunavut government. The municipality used small service contracts with Hill Murray starting in September 1998 to allow Hill Murray to proceed with design and procurement to ensure that the project be completed by December 1999. The new water license was to take effect in December 1998. The municipality requested and was granted an extension until July 1999.

The public consultation meeting originally scheduled for July 20, 1999 has been rescheduled to September 1999 by the Nunavut Water Board.

HILL, MURRAY & ASSOCIATES INC.

NOTICE

Confidentiality

This document is intended only for the person, persons or organization listed on the front cover. This document contains proprietary information that if released could damage the potential sales or reputations of Hill, Murray & Associates Inc., the Canadian Wastewater Corporation, its clients and its equipment suppliers. Any unauthorized reproduction, transmission or release, in whole or in part, constitutes a copyright infringement and is subject to the appropriate remedies under the law.

Report to

Chairmen & Members

Development Works and Public Safety

The Municipality of Iqaluit

(Information Only)

Prepared for

Matthew Spence

July 5, 1999

Hill, Murray & Associates Inc., Suite 201, 1962 Canso Road, Sidney, B.C. V8L 5V5
Phone: (250) 655-8953; Fax: (250) 655-8954

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- *Plan A*
- *Plan B*
- *Plan C*

Review of Design Changes and Project Cost Adjustments
- Flow
- Strength

Review of Project Scope

Biosolids Management

Operations & Maintenance

The Way Ahead

Executive Summary

Following the Request For Proposal process in 1997, Hill, Murray & Associates was selected to provide Design-Build-Operate services to the Municipality of Iqaluit. At the time of the RFP, Hill Murray proposed two options: One (at $7.0 M) providing the bare minimum with no disinfection to meet the new water board permit, and the second (at $12.0 M) providing a higher level of treatment or tertiary treatment.

The municipality ultimately selected the option with the highest level of treatment and requested that the design incorporate expandability for the future growth of Iqaluit. The municipality instructed Hill Murray to reduce costs as much as possible both on the capital costs and on the operations and maintenance and replacement costs.

Significant capital costs were saved by relocating the plant from the proposed site near the tank farm to a site adjacent to the existing lagoon. Capital expenditures that added to the project costs were reviewed and approved by the municipality throughout the design process. These additional costs were due to:

- Higher than stated flows,
- higher than stated wastewater strength, and
- extra membranes and equipment to reduce operations and maintenance costs.

The final cost which does not include financing costs is $7.088 M. This will allow minimum operating costs and full, tertiary treatment at nearly $5.0 M less than the original estimate for the tertiary option.

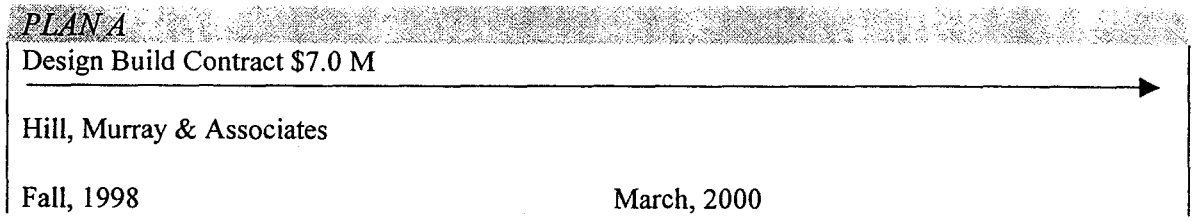
Many delays were encountered awaiting confirmation of capital and operations and maintenance funding from the Nunavut government. The municipality used small service contracts with Hill Murray starting in September 1998 to allow Hill Murray to proceed with design and procurement to ensure that the project be completed by December 1999. The new water license was to take effect in December 1998. The municipality requested and was granted an extension until July 1999. The public consultation meeting originally scheduled for July 20, 1999 has been rescheduled to September 1999 by the Nunavut Water Board.

The project is underway, construction on site has commenced and treatment equipment is in Montreal for the August 2nd sea-lift. The municipality needs to focus on continued management of the project and the ongoing management of biosolids generated by the facility.

Review of Project Progress

Plan A

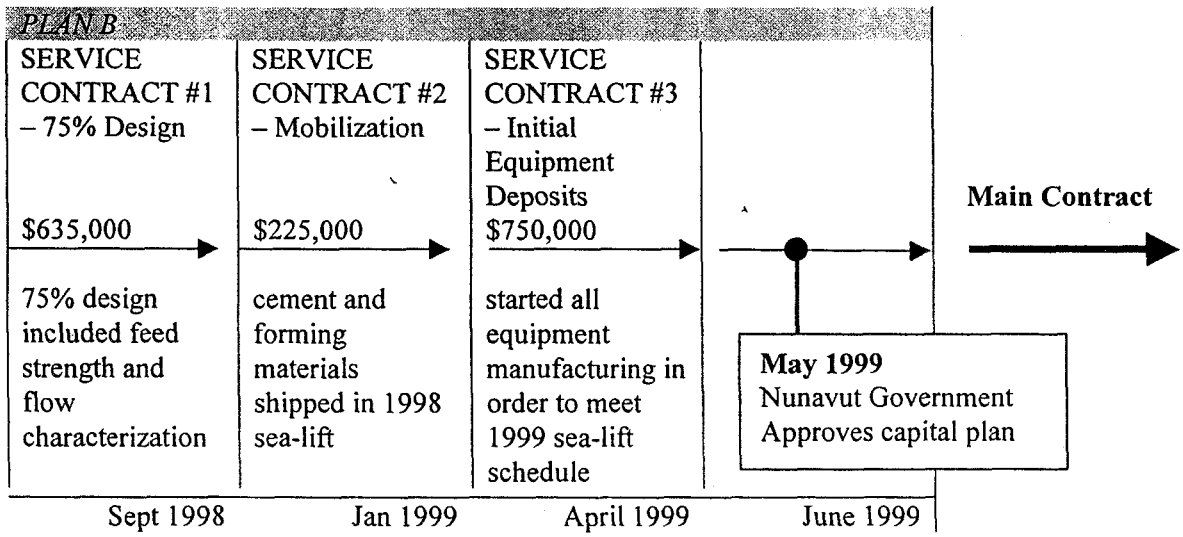
Initially, a single "design-build" contract was contemplated by the municipality.



Plan A required capital funding from the GNWT (MACA) for the entire project amount of nearly seven million dollars. This approach was abandoned due to the fact that responsibility for capital funding would switch to the Government of Nunavut in April 1999. In order to ensure that the project got started in summer 1999, the municipality used existing infrastructure improvement funding and signed three service contracts with Hill Murray. This was called Plan B.

Plan B

Under Plan B, the contractor (Hill Murray) would continue with essential project commitments to stay on the original project timeline. It was anticipated that the $1.6 M spent under services contracts 1, 2, and 3 would be applied to the total contract value of roughly $7.0 M and that the main contract would be signed by the municipality in June 1999 after the Nunavut government released the approved capital plan from the first meeting of the legislature (May 1999). Plan B fell through when the fiscal year 1999/2000 capital budget was released.



The 1999/2000 capital budget did not contain enough money to complete the project; it fell some $2.7 M short. This gave rise to Plan C.

Plan C

Under Plan C, the Municipality uses the territorial capital funds in the fiscal year 1999/2000 ($1.875 M), and the Federal Incremental Infrastructure funds ($0.85 M) to advance the project to a "lock-up" stage in the 1999 construction season. The territorial government has been reviewing a proposal to "finance" the capital funding shortfall until fiscal year 2000/2001 capital funding dollars are available. It is anticipated that the territorial government will approve this plan and approve fiscal year 2000/2001 capital funding for release in June 2000. The cost of financing the gap between fiscal year 1999/2000 dollars and fiscal year 2000/2001 dollars is between $100,000.00 and $150,000.00.

PLAN C

SERVICE CONTRACT #1 – 75% Design	SERVICE CONTRACT #2 – Mobilization	SERVICE CONTRACT #3 – Initial Equipment Deposits	SERVICE CONTRACT #4 Equipment Release Payments	SERVICE CONTRACT #5 Complete Tanks and building to 70%	
$635,000	$225,000	$750,000	$1.88 M	$850,000	Main Contract
75% design included feed strength, flow characterization	cement and forming materials shipped in 1998 sea-lift	started all equipment manufacturing to 1999 sea-lift	Nunavut Government Approves capital plan		
Sept 1998	Jan 1999	April 1999	June 1999		July 1999

There is a contingency option under Plan C to stop the project after service contract # 4 and service contract # 5 are completed, and demobilize the installation crews. Under this option the equipment would sit, not installed until capital dollars became available in fiscal year 2000/2001, at which time crews would be re-mobilized to complete the project. The costs under the demobilize/remobilize option, which include one season of heating the building to ensure that no damage comes to the uninstalled equipment, are in the order of $450,000.00. The likelihood of the demobilize/remobilize option is low.

Review of Design Changes and Project Cost Adjustments

Through the processes of a RFP, a preliminary design phase, a detailed design phase and several reviews by the municipality and CGHT (formerly MACA), the project cost has been adjusted from $6.95 M in the initial proposal to $5.53 M in the revised proposal, to $6.7 M through preliminary design, $7.05 M through final design, and finally $7.082 M due to additional carrying costs due to funding delays. Cost adjustments, both credits (such as the reduced length of the pipe line), and extra costs (due to higher flow) have been included in detailed reports reviewed by municipal staff and CGHT staff over the last six months. Major credits came in the area of the lift station, the pipeline and the operations and maintenance costs. Extra capital costs were a result of three major factors.

1. Actual flows 2000m^3/d, (measured) were higher than the flows specified in the RFP 1668m^3/d (estimated).

Flow

RFP value (estimated)	1668m^3/d
Actual value (measured)	2000 m^3/d.

2. Wastewater strength measured in parts per million was significantly higher than the estimated wastewater strength specified in the RFP.

Strength

RFP value (estimated)	250ppm
Actual value (measured).	450ppm

3. Change from "minimum compliance" to full tertiary, fully automated option.

In the detailed analysis of the minimum compliance option which combined membranes and finescreens in a split and re-blended flow.
Problems with reliability and operating costs were identified. A decision was made to change to the full

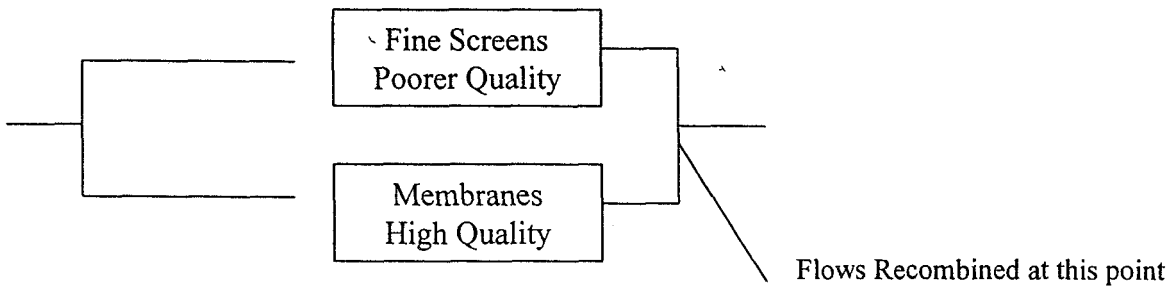


Diagram #1 – Mixed Flow Minimum Compliance Option

tertiary option with a requirement for minimum possible cost.

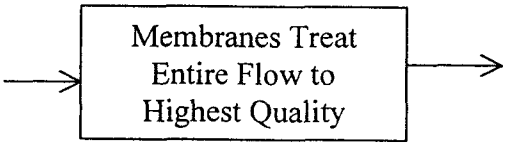


Diagram #2 – Full Tertiary Option

Over five million dollars was saved from the cost for the full tertiary option identified in the RFP submission.

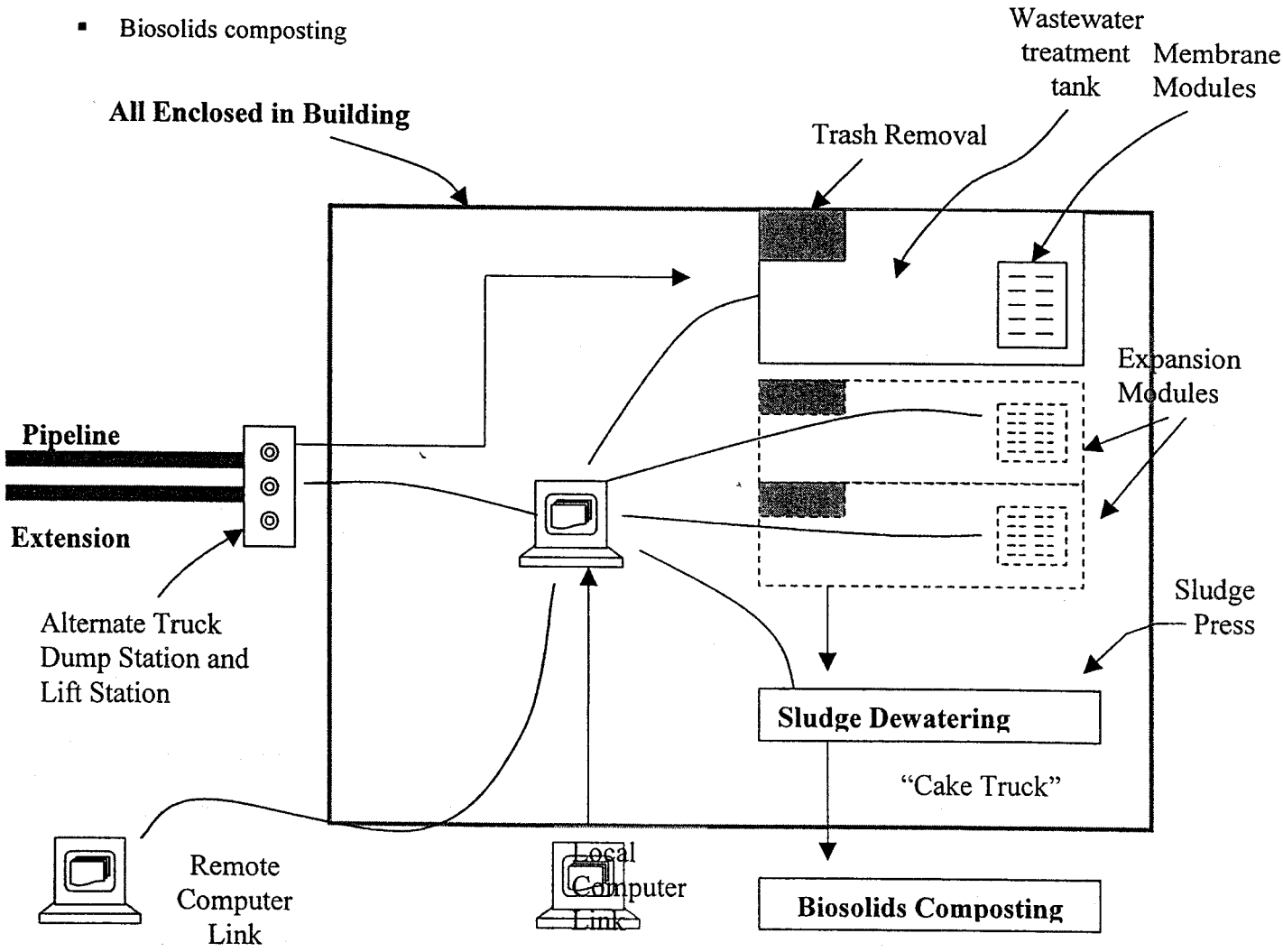
Review of Project Scope

It is important to remember that the project scope includes much more than simple wastewater treatment to meet the water board's permit. Other requirements from the municipality deal with:

- Full computer automation and remote monitoring
- Minimum operations and maintenance costs
- Expandability from 2000 to 3500 m^3/d
- All inclusive, turnkey project.

The water board, in addition to discharge quality, has requirements for:

- Trash management
- Sludge management
- Biosolids composting



Items Included in Project Scope

- New pipelines
- Truck dump station
- Trash removal
- Local MMI computer
- MMI software for "remote monitoring"
- Allowance for expansion modules to 3500m^3/d
- Sludge dewatering press
- Sludge cake dump truck with snow-blade
- Fully enclosed building

Biosolids Management

The contract includes all equipment to take liquid sludge out of the wastewater process daily. This keeps the wastewater process working properly. Fitted equipment will squeeze the water out of the liquid sludge and eject a sludge "cake." Sludge cakes are stored in a mini dump truck (supplied by the contractor) that will be used to haul "cakes" to the landfill site. Cakes may contain microbiology that is unsafe so they must be handled carefully. Cakes must be composted before they are suitable for land application or human contact. Hill Murray is not providing any composting equipment or infrastructure or site improvements for composting, however, we will be helping with the composting plan.

The municipality will need to provide a windrow composting area at the landfill site. It should be fenced and it should have some kind of cover (even a tarpaulin) to keep rain off of the composting material. The windrows will be to be "turned" periodically with a loader to aerate the windrow. A bulking agent—waste wood or waste paper—must be added in the composting process.

Biosolids Management	
Sludge Volume Daily (Estimated)	17.5 m^3
Cake Volume Daily (Estimated)	1.75 m^3
Annual Cake Volume	640 m^3
Windrow Pile Volume With bulking agent	1500 m^3

* minimum compost time: 60 days
* minimum ambient air temperature for composting: 5 °c

Operations & Maintenance

The following excerpt from the contract document explains the O&M arrangement for the facility. Costs include manpower, consumables, power, monitoring/management, and capital sinking funds

ESTIMATED OPERATIONS AND MAINTENANCE COST SUMMARY		
• System Man-hours	60.8 hours/month, Utilidor Crew	1.4 persons per year from current municipal crew
• Biosolids Man-hours	130 hours/ month, Utilidor Crew	
• Trucking Man-hours	31.2 hours/month, Road Crew	
• Electrical Power	35,000 kW hours/month	9,562.00
• Chlorine (Bromine)		7,901.00
• Pellets		2,345.00
• Polymer		2,134.00
• Caustic		1,995.00
• Acid		1,312.00
• Fuel		1,820.00
• Contingency		0.00
• CWC Fee, 4 trips/year		5,621.00
• ZENON Fee, Warranties		2,500.00
• Sinking Fund		4,117.00
Estimated Operations & Maintenance Expenditures Per Month		**$39,307.00**

The Way Ahead

Service contracts #4 and #5 are currently being processed by the municipality. As soon as these service contracts are executed, they will allow the project to recover from recent delays and setbacks. Immediate action is required to allow the construction of the tanks and building, and timely shipment of equipment in this construction season.

The financial management board has favorably reviewed the proposal to finance the capital-funding shortfall. Several mechanisms for authority to proceed are being considered: one possibility is that CGHT could now prepare contribution agreements for the 2000/2001 capital funds. Upon receipt of these contribution agreements, the municipality could execute the main contract.

TAB P

Fax

Date: 8/5/99

To: Municipality of Iqaluit
Denis G. Bedard, P. Eng
Phone: [1] 867-979-5633
Fax: [1] 867-979-5910

FAXED
AUG 05 1999
Pages X3 1316

From: Hill, Murray & Associates Inc.
Robert A. Murray
Phone: (250) 655-8953
Fax: (250) 655-8954

Pages:

Subject: Action Plan – Project Administration

Denis,

This fax is a reminder that we have important contract documents that we must get signed immediately. This is a repeat of my letter of July 30th, 1999.

The following items need your immediate attention:

1) If the contract document date July 22, 1999 is acceptable to the municipality, it must be signed. If there are areas of concern with the document they must be brought forward so they can be addressed. This is an urgent issue – The contract document contains many clauses that define deliverables and protect the Municipality.

2) Please sign-off the project drawings that were left with you on June 26, 1999. Gary Jerzak reviewed these in detail with Matthew Hough on June 26,1999. These drawings, once signed become an integral part of the contract documents. If there are any areas of concern then they should be noted on the drawings.

Thank you for looking after these items for our mutual benefit. I have been leaving many voice mail messages for you but cannot seem to get my calls returned. Is there some way that we can improve communications? I can be reached in the office at (250) 655-8953 ext. 207 or on my pager at (250) 388-2823.

Please contact me at your earliest convenience.

Kindest Regards,

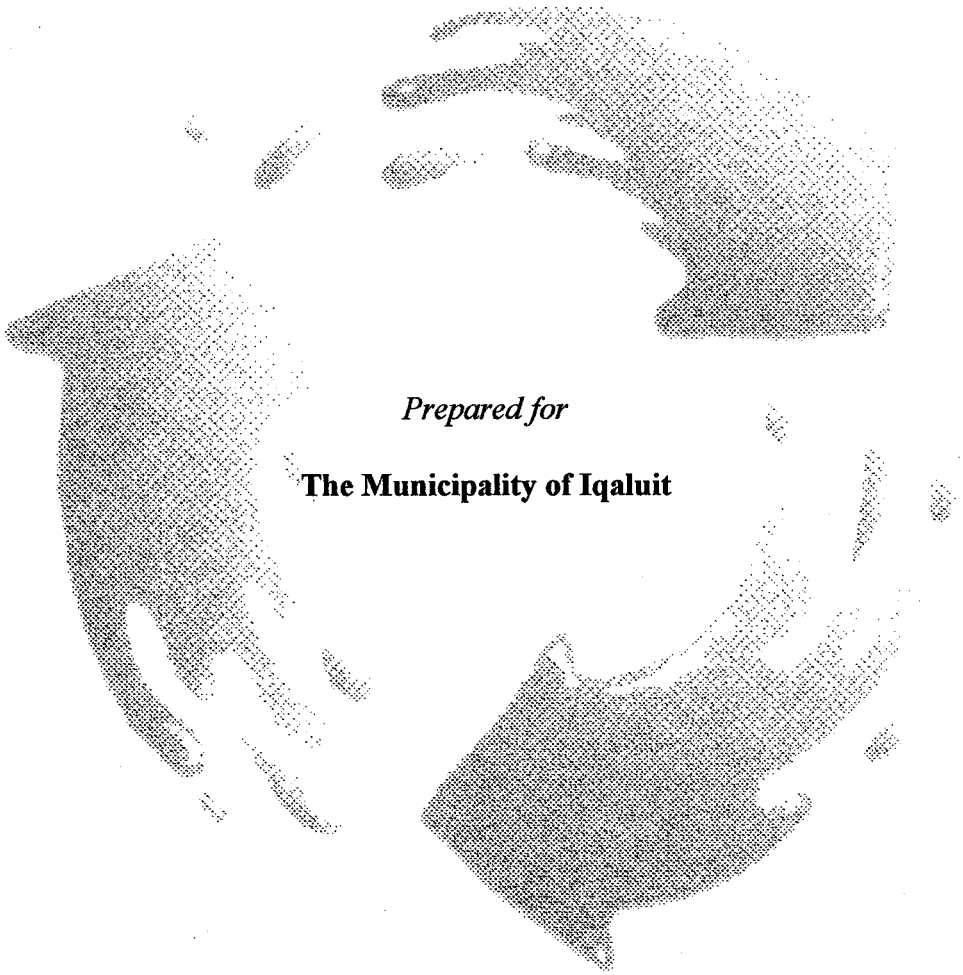
Robert A. Murray, P.Eng.
Chief Operations Officer

PS We appreciate the e-mail from Matthew Hough this morning updating us on the Municipality's progress with the project plans. This letter addresses the urgency of this matter.

\\DATASERVER\DATA\PROJECTS\CURRENT\Iqaluit\denisbedardletcontractsign aug5-99.doc

1 x E.
6 x 316.

TAB Q



Prepared for

The Municipality of Iqaluit

Design-Build Stipulated Price Contract
For
The Municipality of Iqaluit
Water Reclamation Facility

July 22, 1999

Suite #201 – 1962 Canso Road, Sidney, British Columbia CANADA V8L 5V5
(250) 655-8953 FAX: (250) 655-8954

000008

A:\Iqaluit contact - june 14, 1999 (b).doc

Design-Build Stipulated Price Contract
For
The Municipality of Iqaluit

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INTRODUCTION

The template for this Design-Build Stipulated Price Contract was developed by the Joint Design-Build Working Group comprised of representatives from:

The Canadian Construction Association
Construction Specifications Canada
The Royal Architectural Institute of Canada

This document is based on CCDC 2 - 1994 'Stipulated Price Contract' and CCAC 6 - 1994 'Canadian Standard Form of Agreement Between Client and Architect'. A number of terms in Document 14 are defined differently from other standard contract documents and, accordingly, all definitions should be read to properly understand the terms and conditions of this document.

The following are the basic principles:

1. The *Owner* deals with one single administrative entity, the *Design-Builder*, who performs *Design Services* and *Construction* of the project under one contract package.

2. The *Contract Documents* are comprised of:
   - Agreement
   - Definitions
   - General Conditions
   - *Owner's Statement of Requirements*, and
   - *Construction Documents*, after they have been accepted by the *Owner*.

3. After execution of the *Contract*, *Construction Documents* are prepared to illustrate the details of the design that meets the *Owner's Statement of Requirements*. When accepted and signed by both the *Owner* and *Design-Builder*, these also become part of the *Contract Documents*.

4. *Change Orders* are issued to change:
   - the *Work;*
   - the *Owner's Statement of Requirements* (Scope);
   - The *Contract Price*; and
   - the *Contract Time*.

5. The only consultants recognized in the *Contract* are the *Design-Builder's* consultants. The *Owner* may also appoint representatives or consultants, but they are recognized in the *Contract* as the *Owner's* authorized agents or representatives.

6. The roles of the *Design-Builder's* consultants:
   - to design to the *Owner's Statement of Requirements* and prepare *Construction Documents*;
   - to be the interpreter of the *Contract* and *Construction Documents* in the first instance;
   - to certify
     - compliance with *Construction Documents*
     - progress payments based on the agreed schedule of values
     - substantial performance of the *Work*.

7. The *Design-Builder's* consultants are bound to fulfill their duties and responsibilities in accordance with the professional standards required by the various professions. The *Design-Builder's* consultants are consultants to the *Design-Builder* to provide the *Design Services*. This does not preclude them from performing normal professional duties, i.e. certifying payments, issuing certificates for payment and interpretation of the *Contract* and *Construction Documents*.

AGREEMENT BETWEEN OWNER AND DESIGN-BUILDER

This Agreement made on the 15h day of June in the year 1999.

by and between

MUNICIPALITY OF IQALUIT
P.O. Box 460
Iqaluit, NT X0A 0H0

(hereinafter called the "*Owner*")

and

CANADIAN WASTEWATER CORPORATION (CWC)
As a wholly owned subsidiary of
HILL, MURRAY & ASSOCIATES INC. (HMA)
201 – 1962 Canso Road
Sidney, BC V8L 5V5

(hereinafter called the "*Design-Builder*")

The *Owner* and the *Design-Builder* agree as follows:

ARTICLE A-1 THE WORK

The *Design-Builder* shall:

1.1 Perform the *Work* required by the *Contract Documents* for the design and construction of the sewage treatment plant located at Lot #664, Plan 1671, Iqaluit Lands Map (GNWT) adjacent to existing lagoon access road, see attached plan (Annex P), for which the Agreement has been signed by the parties.

1.2 Do and fulfill everything indicated by the *Contract Documents*.

1.3 commence the *Work* by the 22nd day of July in the year, 1999 and, subject to adjustment in *Contract Documents*, attain *Substantial Performance of the Work* by the end of February 2000.

ARTICLE A-2 AGREEMENTS AND AMENDMENTS

2.1 The *Contract* as described in Article A-3 of the Agreement (Contract Documents) supersedes all prior negotiations, representations, or agreements, either written or oral, relating in any manner to the *Work*.

2.2 The *Contract* may be amended only as provided in the *Contract Documents*.

ARTICLE A-3 CONTRACT DOCUMENTS

3.1 The following are the *Contract Documents* referred to in Article A-1 of the Agreement (The Work):

- Agreement Between *Owner* and *Design-Builder*
- Definitions of the Design-Build Stipulated Price Contract
- General Conditions of the Design-Build Stipulated Price Contract
- *Owner's Statement of Requirements* (Annex F)
- *Construction Documents*, after they have been accepted by the *Owner*

ARTICLE A-4 CONTRACT PRICE

4.1 The *Contract Price*, which excludes *Value Added Taxes*, is:
Seven Million Eighty Eight Thousand Dollars and Zero Cents $7,088,000.00

4.2 *Value GST* (of 7 %) payable by the *Owner* to the *Design-Builder* are:
Four Hundred and Ninety-six Thousand One Hundred and Sixty Dollars and Zero Cents $ 496,160.00

4.3 Total amount payable by the *Owner* to the *Design-Builder* is:
Seven Million Five Hundred and Eighty-Four Thousand One Hundred and Sixty Dollars and Zero Cents $7,584,160.00

4.4 In addition to the *Contract Price*, the *Owner* will pay for six months following substantial completion of operations, monitoring, and software support services from CWC at the rate of $5,621.00 per month (see Annex E). After six months and at the request of the *Owner*, CWC will continue to provide these services for the quoted fee. Fees and services quoted will be subject to re-negotiation with 30 days written notice from either party. All fees are subject to yearly Consumer Price Indexing.

4.5 All amounts are in Canadian funds.

4.6 These amounts shall be subject to adjustments as provided in the *Contract Documents*.

4.7 The owner has issued Service Contracts (#1512, #991527, #991547, #991559, and #991550) to HMA for design, mobilization, building materials, equipment deposits, tanks and building and site improvements for a total of $4,366,668.74 (GST not included). These service contracts, when billed to 100%, will be deducted from the contract price of 7,088,000.00 (see Annex G).

ARTICLE A-5 PAYMENT

5.1 Subject to the provisions of the NWT Lien Act supplemented by the definition of substantial performance from the BC Lien Act, which are both included as

Contract Documents, and in accordance with legislation and statutory regulations respecting holdback percentages and, where such legislation or regulations do not exist or apply, subject to a holdback of ten percent (10%), the *Owner* shall:

1. Make progress payments to the *Design-Builder* on account of the *Contract Price* when due in the amount certified by the *Consultant* together with such *Value Added Taxes* as may be applicable to such payment;

2. upon 45 days after *Substantial Performance of the Work*, pay to the *Design Builder* the unpaid balance of the holdback amount when due together with such *Value Added Taxes* as may be applicable to such payment;

3. upon the issuance of the final certificate for payment, pay to the *Design Builder* the unpaid balance of the *Contract Price* when due, together with such *Value Added Taxes* as may be applicable to such payment.

5.2 In the event of loss or damage occurring where payment due under the property and boiler and machinery insurance policies, payments shall be made to the *Design-Builder* in accordance with the provisions of GC 11.1 (Insurance).

5.3 Interest

1. Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by arbitration or court, interest at five percent (5%) per annum above the prime rate on such unpaid amounts shall also become due and payable until payment. Such interest shall be compounded on a monthly basis. The prime rate shall be the lowest rate of interest quoted by the Royal Bank of Canada for prime business loans.

2. Interest shall apply at a rate and in the manner prescribed by paragraph 5.3.1 of this Article on the amount of any claim advanced and for which the *Design-Builder* is thereafter entitled to payment, either pursuant to Part 8 of the General Condition (Dispute Resolution), or otherwise, from the date the amount would have been due and payable under the *Contract*, had it not been in dispute, until the date it is paid.

ARTICLE A-6 TITLE SEARCH

6.1 The *Owner,* once the site for Sewage Treatment Plant is identified, will provide title documentation confirming that title has been raised to the property in the name of the Owner.

ARTICLE A-7 RECEIPT OF AND ADDRESSES FOR NOTICES

7.1 Notices in writing between the parties or between them and the *Consultant* shall be considered to have been received by the addressee on the date of delivery if delivered to the individual, or to a member of the firm, or to an officer of the corporation for whom they

are intended by hand or by registered post; or if sent by regular post, to have been delivered within five *(5) Working Days* of the date of mailing when addressed as follows:

The *Owner* at P.O. Box 460
street and number and postal box number if applicable
Iqaluit, Nunavut X0A 0H0
post office or district, province, postal code

The *Design-Builder* at Canadian Wastewater Corporation (CWC), 201 - 1962 Canso Road
street and number and postal box number if applicable
Sidney, BC V8L 5V5
post office or district, province, postal code

The *Consultant* at Hill, Murray & Associates Inc.(HMA) 201-1962 Canso Rd
street and number and postal box number if applicable
Sidney, BC V8L 5V5
post office or district, province, postal code

ARTICLE A-8 LANGUAGE OF THE CONTRACT

8.1 When the *Contract Documents* are prepared in both the English and French languages, it is agreed that in the event of any apparent discrepancy between the English and French versions, the English language shall prevail.

8.2 This Agreement is drawn in English at the request of the parties hereto. La présente convention est rédigée en anglais à la demande des parties.

ARTICLE A-9 SUCCESSION

9.1 The *Contract* shall ensure to the benefit of and be binding upon the parties hereto, their respective heirs, legal representatives, successors, and permitted assigns;

In witness where the parties hereto have executed this Agreement and by the hands of their duly authorized representatives.

SIGNED AND DELIVERED
in the presence of:

Owner

Municipality of Iqaluit
name of Owner

J. ITILABUK
signature

Jimmy Kilabuk - Mayor
name and title of person signing

signature

name and title of person signing

WITNESS

signature

Director Eng & Planning
name and title of person signing

Design-Builder

HILL-MURRAY
name of Design-Builder

signature

PRESIDENT & CEO.
name and title of person signing

signature

name and title of person signing

WITNESS

signature

LEO COMMANDEUR - CFO.
name and title of person signing

N.B. Where legal jurisdiction, local practice, or Owner or Design-Builder requirement calls for:

(a) *proof of authority to execute this document, attach such proof of authority in the form of a certified copy of a resolution naming the representative(s)* authorized to sign the Agreement for and on behalf of the corporation or partnership; or

(b) *the affixing of a corporate seal, this Agreement should be properly sealed.*

DEFINITIONS OF THE DESIGN-BUILD STIPULATED PRICE CONTRACT

The following Definitions shall apply to all *Contract Documents*.

1. Change Directive

A *Change Directive* is a written instruction signed by the *Owner* directing a change in the *Work* within the general scope of the *Contract Documents*.

2. Change Order

A *Change Order* is a written amendment to the *Contract* signed by the *Owner* and the *Design-Builder* stating their agreement upon:

- a change in the *Work*;
- an amendment to the *Owner's Statement of Requirements*, if any;
- the method of adjustment or the amount of the adjustments in the *Contract Price*, if any; and
- the extent of the adjustment in the *Contract Time*, if any.

3. Construction

Construction means the total construction and related services required by the *Contract Documents*.

4. Construction Documents

The *Construction Documents* consist of the drawings and specifications that are prepared based on the *Contract Documents* by or on behalf of the *Design-Builder* and that are accepted and signed by the *Owner* and the *Design-Builder* after execution of the Agreement.

5. Consultant

The term *Consultant* means Professional Engineer(s) employed by Hill Murray and Associates Inc. and/or their agents licensed to practice in the province or territory of the *Place of the Work* and/or engaged to provide the *Consultant's Design Services* and to coordinate the provision of the *Design Services* of all other consultants employed by the *Design-Builder*. The term *Consultant* means the *Consultant* or the *Consultant's* authorized representative. The *Consultant's "agent"*, licensed to practice in the Province or Territory of the place of work, is to be identified in writing within 15 days of signing this contract.

6. Contract

The *Contract* is the undertaking by the parties to perform their respective duties, responsibilities, and obligations as prescribed in the *Contract Documents* and represents the entire agreement between the parties.

7. Contract Documents

The *Contract Documents* consist of those documents listed in Article A-3 of the Agreement (Contract Documents) and amendments thereto agreed upon between the parties.

8. Contract Price
The *Contract Price* is the amount stipulated in Article A-4 of the Agreement (Contract Price).

9. Contract Time
The *Contract Time* is the time stipulated in paragraph 1.3 of Article A-1 of the Agreement (The Work) from commencement of the *Work* to *Substantial Performance of the Work.*

10. Design-Builder
The *Design-Builder* is the person or entity identified as such in the Agreement. The term *Design-Builder* includes the *Design Builder's* authorized representative as designated to the *Owner* in writing.

11. Design Services
Design Services means the professional services for the design and construction administration performed by the *Consultant* or other consultants under the *Contract.*

12. Owner
The *Owner* is the person or entity identified as such in the Agreement. The term *Owner includes the owner's* authorized agent or representative as designated to the *Design-Builder* in writing.

13. Owner's Statement of Requirements
The *Owner's Statement of Requirements* consists of the site information and program requirements provided by the *Owner* and as listed in Article A-3 of the Agreement (Contract Documents) and amendments thereto agreed upon between the parties.

14. Place of the Work
The *Place of the Work* is the designated site or location of the *Construction* identified in Article A-1 of the Agreement (The Work).

15. Product
Product or Products means material, machinery, equipment and fixtures forming part of the *Work*, but does not include machinery and equipment used to prepare, fabricate, convey, or erect the *Work*, which are referred to as construction machinery and equipment.

16. Project
The *Project* means the *Owner's* enterprise of which the *Work* may be the whole or a part.

17. Provide
Provide means to supply and install.

18. Subcontractor

A *Subcontractor* is a person or entity, other than the *Consultant* or other consultants, having a direct contract with the *Design-Builder* to perform a part or parts of the *Work*, or to supply *Products* worked to a special design for the *Work*.

19. Substantial Performance of the Work

Substantial Performance of the Work is as defined in the lien legislation applicable to the *Place of the Work*. When such legislation does not contain such definition, or if the *Work* is governed by the Civil Code of British Columbia; *Substantial Performance of the Work* shall have been reached when the *Work* is ready for use or is being used for the purpose intended and is so certified by the *Consultant*. The *Builders Lien Act* of the Northwest Territories (Nunavut) does not define Substantial Performance. For purposes of progressive lien holdback releases; Substantial Performance of the *Work* is reached on the date on which the Contractor's Representative issues a certificate of Substantial Performance to the *Owner*, which the Contractor's Representative shall do as of the date on which the Contractor's Representative has determined the *Work* has reached Substantial Performance determined in accordance with the *Builders Lien Act* of British Columbia. See Annex Q for a copy of the clause containing Substantial Performance in the *Builders Lien Act* of British Columbia.

20. Supplier

A *Supplier* is a person or entity having a direct contract with the *Design-Builder* to supply P*roducts* not worked to a special design for the *Work*.

21. Value Added Taxes

Value Added Taxes means such sum as shall be levied upon the *Contract Price* by the Federal or any Provincial or Territorial Government and is computed as a percentage of the *Contract Price* and includes the Goods and Services Tax, the Quebec Sales Tax and any similar tax, the payment or collection of which, by the legislation imposing such tax, is an obligation of the *Design-Builder*.

22. Work

The *Work* means the *Design Services* and *Construction* required by the *Contract*.

23. Working Day

Working Day means a day other than a Saturday, Sunday, or a holiday which is observed by the construction industry in the area of the *Place of Work*.

GENERAL CONDITIONS OF THE DESIGN-BUILD STIPULATED PRICE CONTRACT

PART 1 GENERAL PROVISIONS

GC 1.1 CONTRACT DOCUMENTS

1.1.1 The intent of the *Contract Documents* is to include the *Design Services, Construction,* and other services necessary for the performance of the *Work* in accordance with these documents. It is not intended, however, that the *Design-Builder* shall supply products or perform work not consistent with, not covered by, or not properly inferable from the *Contract Documents*.

1.1.2 Nothing contained in the *Contract Documents* shall create any contractual relationship between the *Owner* and the *Consultant*'s agent, a *Subcontractor*, a *Supplier*, or their agent, employee, or any other person performing any of the *Work*.

1.1.3 The *Contract Documents* are complementary, and what is required by any one shall be as binding as if required by all.

1.1.4 Words and abbreviations which have well known technical or trade meanings are used in the *Contract Documents* in accordance with such recognized meanings.

1.1.5 References in the *Contract Documents* to the singular shall be considered to include the plural as the context requires.

1.1.6 The specifications are that portion of the *Contract Documents*, wherever located and whenever issued, consisting of the written requirements and standards for *Products*, systems, workmanship, and the services necessary for the performance of the *Construction*.

1.1.7 The drawings are the graphic and pictorial portions of the *Contract Documents*, wherever located and whenever issued, showing the design, location, and dimensions of the *Construction*, generally including plans, elevations, sections, details, schedules, and diagrams.

1.1.8 Neither the organization of the specifications into divisions, sections, and parts, nor the arrangement of drawings shall control the *Design-Builder* in dividing the work among *Subcontractors* and *Suppliers* or in establishing the extent of the work to be performed by a trade.

1.1.9 If there is a conflict within the *Contract Documents*:

1. The order of priority of documents, from highest to lowest, shall be:
   - The Contribution Agreements between *CGHT* and the *Owner;*
   - the Agreement between the *Owner* and the *Design-Builder;*
   - the Definitions;

- supplementary Conditions;
- the General Conditions;
- the *Owner's Statement of Requirements*;
- the *Construction Documents*:
  - Division 1 of the specifications,
  - Divisions 2 through 16 of the specifications,
  - material and finishing schedules,
  - drawings.

2. drawings of larger scale shall govern over those of smaller scale of the same date;
3. dimensions shown on drawings shall govern over dimensions scaled from drawings; and
4. later dated documents shall govern over earlier documents of the same type.

1.1.10 Copyright for the design and drawings prepared by or on behalf of the *Design-Builder* belongs to the *Consultant* or other consultants who prepared them.

1.1.11 Plans, sketches, drawings, graphic representations, and specifications, including computer generated designs, when prepared by the *Consultant*, or other consultants, are instruments of their service and shall remain their property whether the *Construction* for which they are made is executed or not.

1.1.12 Submissions or distribution of the *Consultant* or other consultants' plans, sketches, drawings, graphic representations, and specifications to meet official regulatory requirements, or for other purposes in connection with the *Work*, is not to be construed as publication in derogation of their reserved rights.

1.1.13 The *Owner* may retain copies, including reproducible copies, of plans, sketches, drawings, graphic representations, and specifications for information and reference in connection with the *Owner's* design and construction, and the *Owner's* use and occupancy of the *Work*. As a condition precedent to the use of such documents, the *Owner* shall have paid in full for any *Design Services* rendered.

1.1.14 Except for reference purposes, the plans, sketches, drawings, graphic representations, and specifications shall not be used for additions or alterations to the *Work* or on any other project.

1.1.15 Models and architectural renderings furnished by the *Design-Builder* at the *Owner's* expense are the property of the *Owner*.

GC 1.2 OWNER SUPPLIED INFORMATION

1.2.1 Unless the *Contract Documents* specifically state otherwise, the *Design-Builder's Consultant* and other consultants may rely on the accuracy and completeness of all information provided by the *Owner* without regard for the source of such information.

1.2.2 Notwithstanding any other provision of the *Contract*, the *Design-Builder* is not responsible for any design errors or omission in any designs or specifications provided by or on behalf of the *Owner* unless the *Design-Builder* has been specifically requested to review and has accepted those designs and specifications under the *Contract*.

1.2.3 The *Owner* shall furnish the information and services required under the *Contract* promptly to avoid delay in the performance of the *Contract*.

1.2.4 The *Owner's Statement of Requirements* may include:

1. site information, e.g. site description, topographical and boundary surveys, environmental, geotechnical and designated substance investigation reports, utility information, and covenants and restrictions on the property; and
2. the *Owner*'s program requirements, e.g. design objectives and parameters, performance requirements, constraints and criteria, spatial and functional requirements, and relationships.

1.2.5 The *Design-Builder* shall review the *Owner's Statement of Requirements* and shall report promptly to the *Owner* any significant error, inconsistency, or omission the *Design-Builder* may discover.

1.2.6 The review by the *Design-Builder* under paragraph 1.2.5 shall be to the best of the *Design-Builder's* knowledge, information, and belief, and in making such review, the *Design-Builder* does not assume any responsibility to the *Owner* for the accuracy of the review with respect to the *Owner's Statement of Requirements* prepared by or on behalf of the *Owner*.

1.2.7 The *Design-Builder* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Owner's Statement of Requirements* prepared by or on behalf of the *Owner* which the *Design-Builder* did not discover.

1.2.8 If the *Design-Builder* does discover any significant error, inconsistency, or omission in the *Owner's Statement of Requirements* prepared by or on behalf of the *Owner*, the *Design-Builder* shall not proceed with the work affected until the *Design-Builder* and the *Owner* have discussed how the information should be corrected or supplied.

GC 1.3 LAW OF THE CONTRACT

1.3.1 The law of the *Place of the Work* shall govern the interpretation of the *Contract*.

GC 1.4 RIGHTS AND REMEDIES

1.4.1 Except as expressly provided in the *Contract Documents*, the duties and obligations imposed by the *Contract Documents*, and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights, and remedies otherwise imposed or available by law.

1.4.2 Except as expressly provided in the *Contract Documents*, no action or failure to act by the *Owner*, *Design-Builder*, or the *Consultant* shall constitute a waiver of any right or duty afforded any of them under the *Contract*, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed to in writing.

GG 1.5 ASSIGNMENT

1.5.1 Neither party to the *Contract* shall assign all or any part of the *Contract* without the written consent of the other. Consent shall not be unreasonably withheld.

GC 1.6 CONFIDENTIALITY

1.6.1 The *Owner* and the *Design-Builder* shall keep confidential all matters respecting technical, commercial, and legal issues relating to or arising out of the *Work* or the performance of the *Contract* and shall not, without the prior written consent of the other party, disclose any such matters, except in strict confidence, to its professional advisors. The GN is to have unrestricted access to all documentation as required by the GN.

PART 2 DESIGN SERVICES AND ADMINISTRATION OF THE CONTRACT

GC 2.1 CONSULTANT

2.1.1 The *Consultant's* duties and responsibilities will include:

1. The review of the *Owner's Statement of Requirements*;
2. the review with the *Owner* of reasonable alternative approaches to the design;
3. the preparation of a design that meets the criteria set forth in the *Contract Documents*;
4. the coordination required to integrate all parts of the *Design Services*;
5. the preparation of schematic design documents to illustrate the scale and character of the *Work* and how the parts of the *Work* functionally relate to each other;
6. the preparation of design development documents, based on the schematic design documents accepted by the *Owner*, consisting of drawings and other documents

appropriate to the size of the *Work* to describe the size and character of the entire *Work* including architectural, mechanical and electrical systems, materials, and such other elements as may be appropriate;

7. the preparation of *Construction Documents* setting forth in detail the requirements for *Construction* based on the design development documents accepted by the *Owner*;
8. the provisions of assistance to the *Owner* and *Design-Builder* to obtain approvals, permits, and licenses for the *Construction*;
9 the conducting of the general review of the progress of the *Construction*, to the extent necessary, in order to determine to the *Consultant's* satisfaction that the *Construction* is performed in general compliance with the requirements of: (1) The *Contract Documents*; and (2) The applicable statutes, regulations, codes, and bylaws of all authorities having jurisdiction over the *Work*;
10. the assurances required to regulatory authorities respecting substantial conformance of the design with the applicable building regulations, excluding construction safety issues;
11. the preparation of *Change Orders* and *Change Directives* as set out in GC 6.2 (Change Order) and GC 6.3 (Change Directive);
12. the determining of amounts owing to the *Design-Builder* based on the *Consultant's* observations and evaluation of the *Design-Builder's* applications for payment;*
13. the issuance of certificates for payment in the value proportionate to the amount of the *Contract*, for *Work* performed and *Products* delivered to the *Place of the Work*; *
14. the interpretation, in the first instance, of the requirements of the *Construction Documents* and the making of findings as to the performance thereunder by both the *Owner* and the *Design-Builder* and in no event incurring liability for the result of such interpretations or findings rendered in good faith in such capacity;
15. the interpretation and finding, in the first instance, for claims, disputes, and other matters in question relating to the performance of the *Work* or the interpretation of the *Contract Documents* , except for GC 5.1 (Financing Information Required of the Owner);
16. the rejecting of work which does not conform to the requirements of the *Contract Documents*;
17. the requiring of special testing and inspection of the *Construction* at the sole discretion of the *Consultant*, whether or not such *Construction* has been fabricated, installed, or completed;
18. the determining of the date of *Substantial Performance of the Work* and the issuing of a hcertificate attesting to same; *
19. the verification of the *Design-Builder's* application for final payment and the issuing of a certificate for payment; *
20. the reviewing of any defects or deficiencies in the *Work* during the period described in CG 12.3 (Warranty) and the issuance of appropriate instructions for the correction of same; and

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* The *Owner* may hire, at the *Owner's* sole cost, a third party engineer(s) registered in the appropriate discipline(s) to review the findings of the *Consultant* for Items 12, 13, 18, and 19.

21. such other work that may be required from time to time that is agreed to by the *Design-Builder*, the *Consultant*, and the *Owner* in writing.

2.1.2 In performing the above duties, the *Consultant* will provide the necessary services as expeditiously as is required for the orderly progress of the *Work*.

2.1.3 All certificates issued by the *Consultant* shall be to the best of the *Consultant's* knowledge, information, and belief. By issuing any certificate, the *Consultant* does not guarantee the *Work* is correct or complete.

2.1.4 The *Consultant* shall perform the *Design Services* and fulfill the *Consultant's* duties and responsibilities to the standard of diligence, skill, and care that consultants would customarily provide in similar circumstances and in the same relative geographic location, subject to the *Consultant's* professional and legal obligations.

2.1.5 ~~The *Owner* waives any right of action in negligence or otherwise against the *Consultant* or any other consultant employed by the *Design-Builder* in respect of performance of the *Design Services* except to the extent the *Owner* may be entitled to make a claim against the *Design-Builder* under the *Contract*.~~ delete & initial

2.1.6 If the *Consultant's* engagement is terminated, the *Design-Builder* shall notify the *Owner* in writing before appointing or re-appointing a *Consultant* to provide *Design Services*.

GC 2.2 OWNER'S REPRESENTATIVE

2.2.1 The *Owner* shall designate a representative or third party engineer authorized to act on the *Owner's* behalf and shall specify in written notice to the *Design-Builder* any limits on the representative's authority.

2.2.2 Subject to any notified limitations in authority, the *Design-Builder* may rely upon any written instructions or directions provided by the *Owner's* representative.

2.2.3 The *Owner's* representative shall take all reasonable steps to be accessible to the *Design-Builder* during performance of the *Contract* and shall render any necessary decisions or instructions promptly to avoid delay in the performance of the *Contract*.

2.2.4 The *Owner* and *Owner's* representative shall not communicate with any *Subcontractors*, and vice versa, performing the *Work* except through the *Design-Builder* or a person designated by the *Design-Builder*.

GC 2.3 REVIEW AND INSPECTION OF THE WORK

2.3.1 The *Design-Builder* shall:

1. Permit the *Owner* to review all material aspects of the design of the *Work* as the design proceeds; and
2. provide a copy of all drawings, specifications, and diagrams to the *Owner* and/or GN when required for review and acceptance.

2.3.2 From time to time, the *Design-Builder* may request and, on request, the *Owner* shall examine certain aspects of the design as set out on design development documents of *Construction Documents* to confirm that the design aspects are in general compliance with:

1. The qualitative, functional layout, operational, and other *Owner* requirements for the *Work*; and
2. the standards of finish, comfort, or aesthetics as required by the *Contract Documents*.

2.3.3 The *Owner* shall have access to the *Construction* at all times. The *Design-Builder* shall provide sufficient, safe, and proper facilities at all times for the review of the *Construction* by the *Owner* and the *Consultant* and the inspection of the *Construction* by authorized agencies. If parts of the *Construction* are in preparation at locations other than the *Place of the Work*, the *Owner* and the *Consultant* shall be given access to such work whenever it is in progress.

2.3.4 If work is designated for tests, inspections, or approvals in the *Contract Documents*, or by the instructions of the *Owner* or the *Consultant*, or the laws or ordinances of the *Place of the Work*, the *Design-Builder* shall give the *Owner* reasonable notice of when the work will be ready for review and inspection. The *Design-Builder* shall arrange for and shall give the *Owner* reasonable notice of the date and time of inspections by other authorities.

2.3.5 The *Design-Builder* shall furnish promptly to the *Consultant* and to the *Owner*, on request, a copy of certificates and inspection reports relating to the *Work*.

2.3.6 If the *Design-Builder* covers, or permits to be covered, work that has been designated for special tests, inspections, or approvals before such special tests, inspections, or approvals are made, given or, completed, the *Design-Builder* shall, if so directed, uncover such work, have the inspections or tests satisfactorily completed, and make good the covering work at the *Design-Builder's* expense.

2.3.7 The *Owner* may order any portion or portions of the *Construction* to be examined to confirm that such work is in accordance with the requirements of the *Contract Documents*. If the work is not in accordance with the requirements of the *Contract Documents*, the *Design-Builder* shall correct the work and pay the cost of examination and correction.

2.3.8 Notwithstanding any other provision of the Agreement, no fee payment will be made by the *Owner* based on the cost of Services, and/or the cost of the Work incurred by the *Design-Builder* to remedy errors or omissions for which the *Design-Builder* is responsible.

2.3.9 The *Consultant* shall provide any required assurances to regulatory authorities respecting substantial conformance of the *Construction* with the design approved by that authority for issuance of the building permit.

GC 2.4 DEFECTIVE WORK

2.4.1 The *Design-Builder* shall make good promptly other contractors' work destroyed or damaged by such removals or replacements at the *Design-Builder's* expense.

2.4.2 The *Design-Builder* shall make good promptly other contractors' work destroyed or damaged by such removals or replacements at the *Design-Builder's* expense.

2.4.3 If, in the opinion of the *Owner* and *Consultant*, it is not expedient to correct defective work or work not performed as provided in the *Contract Documents*, the *Owner* may deduct from the amount otherwise due to the *Design-Builder* the difference in value between the work as performed and that called for by the *Contract Documents*. If the *Design-Builder* does not agree on the difference in value, the *Design-Builder* shall refer the dispute to Part 8 of the General Conditions (Dispute Resolution).

PART 3 EXECUTION OF THE WORK

GC 3.1 CONTROL OF THE WORK

3.1.1 The *Design-Builder* shall have total control of the *Work* and shall effectively direct and supervise the *Work* so as to ensure conformity with the *Contract Documents*.

3.1.2 The *Design-Builder* shall be solely responsible for construction means, methods, techniques, sequences, and procedures with respect to the *Construction* and coordinating the various parts of the *Construction* under the *Contract*.

3.1.3 The *Design-Builder* shall keep the *Owner* informed of the progress of the *Work*.

3.1.4 The *Design-Builder* is solely responsible for the quality of the *Work* and shall undertake any quality control activities specified in the *Contract Documents* or, if none are specified, as may be reasonably required to ensure such quality.

GC 3.2 CONSTRUCTION DOCUMENTS

3.2.1 During the progress of the *Work*, the *Design-Builder* shall furnish to the *Owner* the *Construction Documents* that describe details of the design required by the *Contract Documents*. At the time of submission the *Design-Builder* shall notify the *Owner* in writing of any significant deviations in the *Construction Documents* from the requirements of the *Contract Documents*.

3.2.2 The *Design-Builder* shall submit the *Construction Documents* to the *Owner* to review in orderly sequence and sufficiently in advance so as to cause no delay in the *Work*. Upon request of the *Owner* or the *Design-Builder*, they jointly shall prepare a schedule of the dates for submission and return of *Construction Documents*.

3.2.3 The *Owner* shall review the *Construction Documents* in accordance with the schedule agreed upon, or in the absence of an agreed schedule with reasonable promptness so as to cause no delay. The *Owner's* review is for conformity to the intent of the *Construction Documents*. The *Owner's* review shall not relieve the *Design-Builder* of responsibility for errors or omissions in the *Construction Documents* or for meeting all requirements of the *Contract Documents* unless the *Owner* expressly accepts a deviation from the *Contract Documents*.

3.2.4 No later than seven (7) days after completing the review, the *Owner* shall notify the *Design-Builder* in writing that the *Owner* has accepted and has signed the *Construction Documents* or shall notify the *Design-Builder*, giving reasons in writing, why the *Owner* rejects the *Construction Documents*. Upon request by the *Owner*, the *Design-Builder* shall revise and resubmit the *Construction Documents* which the *Owner* has rejected. The *Design-Builder* shall notify the *Owner* in writing of any revisions to any resubmission other than those requested by the *Owner*.

3.2.5 When the *Construction Documents* are accepted and signed by the *Owner* and the *Design-Builder*, such *Construction Documents* shall become part of the *Contract Documents*.

3.2.6 When a change is required to the *Construction Documents* that have been accepted and signed by the *Owner*, it shall be made in accordance with GC 6.1 (Changes), GC 6.2 (Change Order) or GC 6.3 (Change Directive).

GC 3.3 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

3.3.1 The *Owner* reserves the right to award separate contract in connection with other parts of the *Project* to other contractors and to perform work with own forces.

3.3.2 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner's* own forces, the *Owner* shall:

1. Provide for the co-ordination of the activities and work of other contractors and *Owner's* own forces with the *Work* of the *Contract*;
2. assume overall responsibility for compliance with the applicable health and construction safety legislation at the *Place of the Work*;
3. enter into separate contracts with other contractors under conditions of contract which are compatible with the conditions of the *Contract*;
4. ensure that insurance coverage is provided to the same requirements as are called for in GC 11.1 (Insurance) and co-ordinate such insurance with the insurance coverage of the *Design-Builder* as it affects the *Work*; and

5. take all reasonable precautions to avoid labour disputes or other disputes on the *Project* arising from the work of other contractors of the *Owner's* own forces.

3.3.3 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner's* own forces, the *Design-Builder* shall:

1. Afford the *Owner* and other contractors reasonable opportunity to introduce and store their products and use their construction machinery and equipment to execute their work;
2. co-ordinate and schedule the *Work* with the work of other contractors and the *Owner's* own forces and connect as specified or shown in the *Contract Documents*;
3. participate with other contractors and the *Owner* in reviewing their schedules when directed by the *Owner*; and
4. where part of the *Work* is affected by or depends upon, for its proper execution, the work of other contractors or *Owner's* own forces, promptly report to the *Owner* in writing and prior to proceeding with that part of the *Work*, any apparent deficiencies in such work. Failure by the *Design-Builder* to so report shall invalidate any claims against the *Owner* by reason of the deficiencies in the work of other contractors or *Owner's* own forces except those deficiencies not then reasonably discoverable.

3.3.4 Where a change in the *Work* is required as a result of the coordination and connection of the work of other contractors of *Owner's* own forces with the *Work*, the changes shall be authorized and valued as provided in GC 6.1 (Changes), GC 6.2 (Change Order) and GC 6.3 (Change Directive).

3.3.5 Claims, disputes, and other matters in question between the *Design-Builder* and other contractors shall be dealt with as provided in Part 8 of the General Conditions (Dispute Resolution) provided the other contractors have reciprocal obligations. The *Design-Builder* shall be deemed to have consented to arbitration of any dispute with any other contractor whose contract with the *Owner* contains a similar requirement to arbitrate such dispute.

GC 3.4 SCHEDULE OF THE WORK

3.4.1 The *Design-Builder* shall:

1. Prepare and submit to the *Owner* prior to the first application for payment, a schedule of the *Work* that indicates the timing of the major activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time*;
2. monitor the progress of the *Design Services* and *Construction* relative to the schedule of the *Work* and update the schedule on a monthly basis, or as stipulated by the *Contract Documents*; and

3. advise the *Owner* in writing of any revisions required to the schedule as the result of extension of the *Contract Time* as provided in Part 6 of the General Conditions (Changes in the Work).

GC 3.5 CONSTRUCTION SAFETY

3.5.1 Subject to paragraph 3.3.2.2. of GC 3.3 (Construction by Owner or Other Contractors), the *Design Builder* shall be solely responsible for construction safety at the *Place of the Work* and for compliance with the rules, regulations, and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the *Construction*.

GC 3.6 SUPERVISOR

3.6.1 The *Design-Builder* shall employ a competent supervisor and necessary assistance while the *Construction* is being performed. The supervisor shall not be changed except for valid reason.

3.6.2 The supervisor shall represent the *Design-Builder* at the *Place of the Work* and notices and instructions given to the supervisor by the *Owner* shall be held to have been received by the *Design-Builder*.

GC 3.7 OTHER CONSULTANTS, SUBCONTRACTORS AND SUPPLIERS

3.7.1 The *Design-Builder* shall preserve and protect the rights of the parties under the *Contract* with respect to work to be performed under subcontract, and shall:

1. Enter into contracts or written agreements with the *Consultant*, and other consultants to require them to perform their design and other services as provided in the *Contract Documents*;
2. enter into contracts or written agreements with *Subcontractors* and *Suppliers* to require to perform their work and related services as required by the *Contract Documents;*
3. incorporate the terms and conditions of the *Contract Documents* into all contracts or written agreements with the *Consultant*, other consultants, *Subcontractors*, and *Suppliers* insofar as they are applicable; and
4. be as fully responsible to the *Owner* for acts and omissions of the *Consultant*, other consultants, *Subcontractors, Suppliers*, and of persons directly or indirectly employed by them as for acts and omissions of persons directly employed by the *Design-Builder*.

3.7.2 The *Design-Builder* shall indicate in writing, at the request of the *Owner*, other consultants, *Subcontractors,* or *Suppliers* whose proposals or bids have been received by the *Design-Builder* which the *Design-Builder* would be prepared to accept for the performance of a portion of the *Work*. Should the *Owner* not object before signing the *Contract*, the *Design-*

Builder shall employ other consultants, *Subcontractors*, or *Suppliers* so identified by the *Design-Builder* in writing for the performance of that portion of the *Work* to which their proposal or bid applies.

3.7.3 The *Owner* may, for reasonable cause, at any time before the *Design-Builder* has signed the subcontract, object to the use of a proposed other consultant, *Subcontractor*, or *Supplier* and require the *Design-Builder* to employ another proposed other consultant or subcontract bidder.

3.7.4 If the *Owner* requires the *Design-Builder* to change a proposed other consultant, *Subcontractor*, or *Supplier*, the *Contract Price* and *Contract Time* shall be adjusted by the differences occasioned by such required change.

3.7.5 The *Design-Builder* shall not be required to employ as an other consultant, *Subcontractor*, or *Supplier*, a person or firm to whom the *Design-Builder* may reasonably object.

3.7.6 The *Owner* may provide to other consultants, *Subcontractors*, or *Suppliers* information as to the percentage of their work which has been certified for payment.

GC 3.8 LABOUR AND PRODUCTS

3.8.1 The *Design-Builder* shall provide and pay for labour, Products, tools, construction machinery and equipment, water, heat, light, power, transportation, and other facilities and services, including *Design Services*, necessary for the performance of the *Work* in accordance with the *Contract*.

3.8.2 Unless otherwise specified, all *Products* provided shall be new. *Products* which are not specified shall be of a quality consistent with those similar products specified.

3.8.3 The *Design-Builder* shall maintain good order and discipline among the *Design-Builder's* employees engaged on the *Work* and shall not employ on the *Work* anyone not skilled in the tasks assigned.

GC 3.9 DOCUMENTS AT THE SITE

3.9.1 The *Design-Builder* shall keep one copy of current *Contract Documents*, submittals, reports, and records of meetings at the *Place of the Work*, in good order and available to the *Owner*.

GC 3.10 SHOP DRAWINGS

3.10.1 Shop drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures, product, and other data which the *Design Builder* provides to illustrate details of a portion of the *Work*. The shop drawings shall be in the form specified by the *Consultant*.

3.10.2 The *Design-Builder* shall provide shop drawings as required by the *Consultants.*

3.10.3 The *Design-Builder*, the *Consultant*, and where appropriate, other consultants, shall review all shop drawings. The *Design-Builder* represent by this review that: The *Design-Builder* has determined and verified all field measurements and field construction conditions, or will do so; *Product* requirements; catalogue numbers; and similar data, and that the *Design-Builder* has checked and coordinated each shop drawing with the requirements of the *Work* and of the *Contract Documents*.

3.10.4 Shop drawings which require approval of any authority having jurisdiction shall be submitted to such authority by the *Design-Builder*.

3.10.5 If the *Owner* requests to review shop drawings, the *Design-Builder* shall submit them in orderly sequence and sufficiently in advance so as to cause no delay in the *Work* or in the work of other contractors. The *Owner* and the *Design-Builder* shall jointly prepare a schedule of the dates for submission and return of shop drawings.

3.10.6 The *Owner's* review under paragraph 3.10.5 is for conformity to the intent of the *Contract Documents* and for general arrangement only. The *Owner*'s review shall not relieve the *Design-Builder* of the responsibility for errors or omissions in the shop drawings or for meeting all requirements of the *Contract Documents* unless the *Owner* expressly accepts a deviation from the *Contract Documents*.

GC 3.11 USE OF THE WORK

3.11.1 The *Design-Builder* shall confine construction machinery and equipment, storage or *Products*, and operations of employees to limits indicated by laws, ordinances, permits, or the *Contract Documents,* and shall not unreasonably encumber the *Construction*.

3.11.2 The *Design-Builder* shall not load or permit to be loaded any part of the *Construction* with a weight or force that will endanger the safety of the *Project*.

GC 3.12 CUTTING AND REMEDIAL WORK

3.12.1 The *Design-Builder* shall co-ordinate the *Work* to ensure that this requirement is kept to a minimum.

3.12.2 Cutting and remedial work shall be performed by specialists familiar with the *Products* affected and shall be performed in a manner to neither damage nor endanger the *Construction* and IAW applicable WCB/OSHA rules.

GC 3.13 CLEANUP

3.13.1 The *Design-Builder* shall maintain the *Construction* in a tidy condition and free from the accumulation of waste products and debris, other than that caused by the *Owner*, other contractors, or their employees.

3.13.2 The *Design-Builder* shall remove waste products and debris, other than that resulting from the work of the *Owner*, other contractors, or their employees, and shall leave the *Construction* clean and suitable for occupancy by the *Owner* before attainment of *Substantial Performance of the Work.* The *Design-Builder* shall remove products, tools, construction machinery, and equipment not required for the performance of the remaining work.

3.13.3 Prior to application for the final certificate for payment, the *Design-Builder* shall remove products, tools, construction machinery and equipment, and waste products and debris, other than that resulting from the work of the *Owner*, other contractors, or their employees.

GC 3.14 SIGNAGE

3.14.1 ~~Unless reasonably objected by the *Owner*, the *Design-Builder* and the *Consultant* shall be entitled to sign the building by inscription or otherwise on a suitable and reasonably visible part of the permanent fabric of the building.~~ delete & initial

3.14.2 The *Design-Builder* may erect a sign identifying the *Design-Builder*, the *Consultant*, other consultants, and *Subcontractors* at the *Place of the Work* during the construction.

PART 4 ALLOWANCES

GC 4.1 CASH ALLOWANCES

4.1.1 If the *Contract Price* includes cash allowances stated in the *Contract Documents*, these allowance shall be expended as the *Owner* directs.

4.1.2 Cash allowances cover the net cost to the *Design-Builder* of services, *Products*, construction machinery and equipment, freight, unloading, handling, storage, installation, and other authorized expenses incurred in performing the *Work* stipulated under the cash allowances but do not include any *Value Added Taxes* payable by the *Owner* to the *Design-Builder.*

4.1.3 The *Contract Price*, and not the cash allowance, includes the *Design-Builder's* overhead and profit in connection with such cash allowances.

4.1.4 Where costs under a cash allowance exceed the amount of the allowance, the *Design-Builder* shall be compensated for any excess and substantiated plus amount for overhead and profit as provided in GC 6.1 (Changes).

4.1.5 The *Contract Price* shall be adjusted by *Change Order* to provide for any difference between the actual cost and each cash allowance.

4.1.6 The value of the *Work* performed under a cash allowance is eligible to be included in progress payments.

4.1.7 The *Design-Builder* and the *Owner* shall jointly prepare a schedule that shows when the *Owner* must authorize ordering of items called for under cash allowance to avoid delaying the progress of the *Work*.

GC 4.2 CONTINGENCY ALLOWANCE

4.2.1 If the *Contract Price* includes the *Design-Builder*'s contingency allowance, it is to be shown within the last breakdown included in the *Contract Documents*.

4.2.2 Expenditures not covered under contingency allowances shall be authorized and valued as provided in GC 6.1 (Changes), GC 6.2 (Change Order) and GC 6.3 (Change Directive).

4.2.3 The *Contract Price* shall be adjusted by *Change Order* to provide for any difference between expenditures authorized under paragraph 4.2.2 and the original contract price.

PART 5 PAYMENT

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

5.1.1 The *Owner* shall, at the request of the *Design-Builder*, prior to execution of the Agreement, and promptly from time to time as requested thereafter, furnish to the *Design-Builder* reasonable evidence that financial arrangements have been made to fulfill the *Owner's* obligations under the *Contract*.

5.1.2 The *Owner* shall notify the *Design-Builder* in writing of any material change in the *Owner's* financial arrangements during the performance of the *Contract*.

GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT

5.2.1 Applications for payment by the *Design-Builder* as provided in Article A-5 of the Agreement (Payment) will be made monthly as the *Work* progresses. Due to the difficulty of logistics and shipping, a schedule of draws based on the project schedule has been prepared which progress draws will be based upon. Progress draws will be based upon the schedule of draws subject to review and approval of all progress draws by the consultant.

5.2.2 Applications for payment shall be dated the last day of the agreed monthly payment period and the amount claimed shall be for the value, proportionate to the amount of the *Contract*, of *Work* performed and *Products* delivered to the *Place of the Work* at that date.

5.2.3 The *Design-Builder* shall submit to the *Owner*, a schedule of values for the parts of the *Work*, aggregating the total amount of the *Contract Price*, so as to facilitate evaluation of applications for payment.

5.2.4 The schedule of values shall be made out in such form and supported by such evidence as the *Consultant* may reasonably direct, and when accepted by the *Owner*, shall be used as the basis for applications for payment, unless it is found to be in error.

5.2.5 The *Design-Builder* shall include a statement based on the schedule of values with each application for payment.

5.2.6 Claims for *Products* delivered to the *Place of the Work* but not yet incorporated into the *Work* shall be supported by such evidence as the *Owner* may reasonably require to establish the value and delivery of the *Products*.

GC 5.3 PROGRESS PAYMENT

5.3.1 The *Consultant* will issue to the *Owner* and the *Design –Builder* a "certificate for payment" in the amount as the *Consultant* determines to be properly due.

5.3.2 The *Design-Build* shall invoice the *Owner* using those amounts as documented in the *Consultants* "Certificate for Payment." The *Owner* shall make payment to the *Design-Builder* on account as provided in Article A-5 of the Agreement (Payment) no later than thirty (30) days after the receipt of a certificate for payment issued by the *Consultant*.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

5.4.1 When the *Design-Builder* considers that the *Work* is substantially performed, or if permitted by the lien legislation applicable to the *Place of the Work,* a designated portion thereof which the *Owner* agrees to accept separately is substantially performed, the *Design-Builder* shall prepare and submit to the *Owner* and the *Consultant* a comprehensive list of items to be completed or corrected and apply for a review by the *Owner* and the *Consultant*. Failure to include an item on the list does not alter the responsibility of the *Design-Builder* to complete the *Contract*.

5.4.2 No later than ten (10) days after the receipt of the *Design-Builder's* list and application, the *Consultant* will review the *Work* to verify the validity of the application and will notify in writing the *Owner* and the *Design-Builder* whether the *Work* or the designated portion of the *Work* is substantially performed.

5.4.3 The *Consultant* shall state the date of *Substantial Performance of the Work* or designated portion of the *Work* in a certificate.

5.4.4 Immediately following the issuance of the certificate of *Substantial Performance of the Work*, the *Design-Builder*, in consultation with the *Owner*, will establish a reasonable date for finishing the *Work*.

GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

5.5.1 After the issuance of the certificate of *Substantial Performance of the Work*, and the expiration of the statutory lien period the *Design-Builder* shall:

1. Submit an application for payment of the holdback amount;
2. submit a sworn statement that all accounts for the *Design Services*, labour, subcontracts, *Products, Design-Builder* in the *Substantial Performance of the Work* and for which the *Owner* might in any way be held responsible have been paid in full, except for amounts properly retained as a holdback or as an identified amount in dispute.

5.5.2 After the receipt of an application for payment from the *Design-Builder* and the sworn statement as provided in paragraph 5.5.1, the *Consultant* will issue a certificate for payment of the holdback amount.

5.5.3 Where the holdback amount has not been placed in a separate holdback account as may be required by the lien legislation applicable to the *Place of the Work*, the *Owner* shall, ten (10) days prior to the expiry of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*, place the holdback amount in a bank account in the joint names of the *Owner* and the *Design-Builder*.

5.5.4 The holdback amount authorized by the certificate for payment of the holdback amount is due and payable on the day following the expiration of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*. Where lien legislation does not exist or apply, the holdback amount shall be due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between the parties. The *Owner* may retain out of the holdback amount any sums required by law to satisfy any liens against the *Work*, or, if permitted by the lien legislation applicable to the *Place of the Work*, other third party monetary claims against the *Design-Builder* which are enforceable against the *Owner*.

GC 5.6 PROGRESSIVE RELEASE OF HOLDBACK

5.6.1 Where legislation permits and where upon application by the *Design-Builder*, the *Consultant* has certified that the work of a *Subcontractor* or *Supplier* has been performed prior to *Substantial Performance of the Work*, the *Owner* shall pay the *Design-Builder* the holdback amount retained for such subcontract work, or the *Products* supplied by such *Supplier*, on the day following the expiration of the holdback period for such work stipulated in the lien legislation applicable to the *Place of the Work*.

5.6.2 Notwithstanding the provisions of the preceding paragraph, and notwithstanding the wording of such certificates, the *Design-Builder* shall ensure that such sub-contract work or *Products* is protected pending the issuance of a final certificate for payment and be

responsible for the correction of defects or work not performed regardless of whether or not such was apparent when such certificates were issued.

GC 5.7 FINAL PAYMENT

5.7.1 When the *Design-Builder* considers that the *Work* is completed, the *Design-Builder* shall submit an application for final payment.

5.7.2 Upon receipt of the *Design-Builder's* application for final payment, the *Consultant* will review the *Work* to verify the validity of the application. The *Consultant* will, no later than seven (7) days after reviewing the *Work*, provide the *Owner* and the *Design-Builder* with a certificate for payment or give reasons for not doing so.

5.7.3 Subject to the provision of paragraph 10.4.1 of GC 10.4 (Workers' Compensation), and any lien legislation applicable to the *Place of the Work*, the *Owner* shall, no later than five (5) days after the receipt of a final certificate for payment, pay the *Design-Builder* as provided in Article A-5 of the Agreement (Payment).

GC 5.8 WITHHOLDING OF PAYMENT

5.8.1 If because of climatic or other conditions reasonably beyond the control of the *Design-Builder*, there are items of the *Work* that cannot be performed, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the costs of performing such remaining work.

5.9 NON-CONFORMING WORK

5.9.1 No payment by the *Owner* under the *Contract* nor partial or entire use or occupancy of the *Work* by the *Owner* shall constitute an acceptance of any portion of the *Work* or *Products* which are not in accordance with the requirements of the *Contract Documents*.

PART 6 CHANGES IN THE WORK

GC 6.1 CHANGES

6.1.1 The *Owner* without invalidating the *Contract*, may make changes in the *Work* consisting of additions, deletions, or other revision to the *Work* by *Change Order* or *Change Directive*.

6.1.2 The *Design-Builder* shall not perform a change in the *Work* without a *Change Order* or a *Change Directive* except as provided in paragraph 6.1.6.

6.1.3 If a change in the *Work* results in a net increase in the *Contract Price*, an allowance of 15% overhead and 15% profit shall be added to the total cost of the change.

6.1.4 If a change in the *Work* results in a net decrease in the *Contract Price*, an amount of the credit shall be the net costs, with appropriate deduction for overhead or profit.

6.1.5 When both additions and deletions covering related work or substitutions are involved in a change in the *Work*, the allowance for overhead and profit shall be calculated on the basis of the net increase, if any, with respect to that change in the *Work*.

6.1.6 The *Design-Builder*, without invalidating the *Contract*, may make minor adjustments in the *Work* consistent with the intent of the *Contract Documents* without a *Change Order* and shall advise the *Owner* in writing of such adjustments. Such adjustments in the *Work* shall not involve adjustment in the *Contract Price* or *Contract Time*.

GC 6.2 CHANGE ORDER

6.2.1 When a change in the *Work* is proposed or required, the *Owner* or the *Design-Builder* shall provide a notice in writing describing the proposed change in the *Work* to the other party. The responding party shall present, in the form acceptable to the other party, an amendment to the *Owner's Statement of Requirements*, if any, and a method of adjustment or an amount of adjustment for the *Contract Price*, if any, and the adjustment in the *Contract Time*, if any, for the proposed change in the *Work*.

6.2.2 When the *Owner* and *Design-Builder* agree to the amendment to the *Owner's Statement of Requirements*, the adjustments in the *Contract Price* and *Contract Time,* or to the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a *Change Order* and signed by the *Owner* and *Design-Builder*. The value of the *Work* performed as the result of a *Change Order* shall be included in applications for progress payment.

GC 6.3 CHANGE DIRECTIVE

6.3.1 If the *Owner* requires the *Design-Builder* to proceed with a change in the *Work*, within the general scope of the *Work* prior to the *Owner* and the *Design-Builder* agreeing upon the adjustment in *Contract Price* and *Contract Time*, the *Owner* shall direct the preparation of a *Change Directive*.

6.3.2 Upon receipt of a *Change Directive*, the *Design-Builder* shall proceed promptly with the change in the *Work*.

6.3.3 The adjustment in the *Contract Price* for a change carried out by way of a *Change Directive* shall be determined on the basis of the costs of expenditures and saving to perform the work attributable to the change (see 6.1).

6.3.4 The *Design-Builder* shall keep an account of the costs of expenditures and savings referred to in paragraph 6.3.3 together with supporting data. The cost of performing the work

attributable to the *Change Directive* shall be limited to the actual costs incurred, plus profits and overhead as follows:

1. Wages and benefits paid for labour in the direct employ of the *Design-Builder* under applicable collective bargaining agreements, or under a salary or wage schedule agreed upon by the *Owner* and *Design-Builder*;
2. salaries, wages, and benefits of the *Design-Builder's* personnel, when stationed at the field office, in whatever capacity employed; and personnel engaged at shops or on the road, in expediting the production or transportation of materials or equipment;
3. salaries, wages, and benefits of the *Design-Builder's* personnel, when stationed at the field office, in whatever capacity employed; and personnel engaged at shops or on the road, in expediting the production or transportation of materials or equipment;
4. contributions, assessments, or taxes incurred for such items as employment insurance, provincial health insurance, workers' compensation, and Canada or Quebec Pension Plan, insofar as such cost is based on wages, salaries, or other remuneration paid to employees of the *Design-Builder* and included in the cost of the work as provided in paragraphs 6.3.4.1, 6.3.4.2, and 6.3.4.3;
5. travel and subsistence expenses of the *Design-Builder's* personnel described in paragraphs 6.3.4.1, 6.3.4.2, 6.4.3.3;
6. the cost of *Design Services* including all fees and disbursements of the *Consultant* or other consultants engaged or employed to provide such services;
7. the cost of all *Products* including cost of transportation thereof;
8. the cost of materials, supplies, equipment, temporary services and facilities, and hand tools not owned by the workers, including transportation and maintenance thereof, which are consumed; and cost less salvage value on such items used but not consumed, which remain the property of the *Design-Builder*;
9. rental cost of all tools, machinery. and equipment, exclusive of hand tools, whether rented from or provided by the *Design-Builder* or others, including installation, minor repairs and replacements, dismantling, removal, transportation and delivery cost thereof;
10. deposits lost;
11. the amounts of all subcontracts;
12. the cost of quality assurance such as independent inspection and testing services;
13. charges levied by authorities having jurisdiction at the *Place of the Work*;
14. royalties, patent license fees, and damages for infringement of patents and cost of defending suits therefor subject always to the *Design-Builder's* obligations to indemnify the *Owner* as provided in paragraph 10.3.1 of GC 10.3 (Patent Fees);
15. any adjustment in premium for all bonds add insurance which the *Design-Builder* is required, by the *Contract Documents*, to purchase and maintain in relation to the performance of the *Work*;
16. any adjustment in taxes and duties for which the *Design-Builder* is liable in relation to the performance of the *Work*;

17. charges for long distance telephone and facsimile communications, courier services, expressage, photocopying, reproduction of *Contract Documents*, and petty cash items incurred in relation to the performance of the *Work*;
18. the cost of removal and disposal of waste products and debris;
19. costs incurred due to emergencies affecting the safety of persons or property.

6.3.5 Pending determination of the final amount of a *Change Directive*, the undisputed value of the work performed as the result of a *Change Directive* is eligible to be included in progress payments.

6.3.6 If the *Owner* and *Design-Builder* do not agree on the proposed adjustment in the *Contract Time* or the method of determining it, the adjustment shall be referred to the *Consultant* for determination.

6.3.7 If at any time after the start of the *Work* directed by a *Change Directive*, the *Owner* and the *Design-Builder* reach agreement on the amendment to the *Owner's Statement of Requirement* or the adjustment to the *Contract Price* and to the *Contract Time*, this agreement shall be recorded in a *Change Order* signed by the *Owner* and the *Design-Builder*.

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

6.4.1 If the *Owner* or the *Design-Builder* discover conditions at the *Place of the Work* which are:

1. subsurface or otherwise concealed physical conditions which existed before the commencement of the *Work* which differ materially from those indicated in the *Contract Documents*; or
2. physical conditions of a nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the *Contract Documents*.

6.4.2 The *Consultant* or other consultants will promptly investigate such conditions. The *Consultant* will notify the *Owner* and the *Design-Builder* of the finding in writing. If the finding is that the conditions differ materially and this would cause an increase or decrease in the *Design-Builder's* cost or time to perform the *Work*, the *Owner* shall issue appropriate instructions for a change in the *Work* as provided in GC 6.1 (Changes), GC 6.2 (Change Order) and GC 6.3 (Change Directive).

6.4.3 If the *Consultant* finds that the conditions at the *Place of the Work* are not materially different or that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* shall notify the *Owner* and *Design-Builder* in writing.

GC 6.5 DELAYS

6.5.1 If the *Design-Builder* is delayed in the performance of the *Work* by an action or omission of the *Owner* or anyone employed or engaged by them directly indirectly, contrary to the

provisions of the *Contract Documents*, then the *Contract Time* shall be extended for such reasonable time as agreed between the *Owner* and the *Design-Builder* as the *Design-Builder* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Design-Builder* as the result of such delay.

6.5.2 If the *Design-Builder* is delayed in the performance of the *Work* by a stop work order issued by a court or other public authority and providing that such order was not issued as the result of an act or fault of the *Design-Builder* directly or indirectly, then the *Contract Time* shall be extended for such reasonable time as agreed between the *Owner* and the *Design-Builder*. The *Design-Builder* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Design-Builder* as the result of such delay. Any dispute in monies owing will be subject to "negotiation, mediation or arbitration" as set out in Part 8 of this contract.

6.5.3 If the *Design-Builder* is delayed in the performance of the *Work* by inclement weather (by mutual agreement between the *Design-Builder* and the *Owner*), labour disputes, strikes, lock-outs (including lock-outs decreed or recommended for its members by a recognized contractors' association, of which the *Design-Builder* is a member or to which the *Design-Builder* is otherwise bound), fire, unusual delay by common carriers or unavoidable casualties, or without limit to any of the foregoing, by a cause beyond the *Design-Builder's* control, then the *Contract Time* shall be extended for such reasonable time as agreed between the *Owner* and the *Design-Builder*. The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the *Design-Builder* agrees to a shorter extension. The *Design-Builder* shall be entitled to payment for costs incurred by inclement weather delays on a cost recovery basis only.

6.5.4 No extension shall be made for delay unless notice in writing of claim is given promptly to the *Owner* and in no event later than ten (10) *Working Days* after the commencement of delay, providing however, that in the case of a continuing cause of delay only one notice of claim shall be necessary.

6.5.5 Any adjustment to *Contract Price* and *Contract Time* required as a result of GC 6.5 (Delays) shall be made as provided in GC 6.1 (Changes), GC 6.2 (Change Order) and GC 6.3 (Change Directive).

PART 7 DEFAULT NOTICE

GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, SUSPEND THE WORK, OR TERMINATE THE CONTRACT

7.1.1 If the *Design-Builder* should be adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Design-Builder's* insolvency, or if a receiver is appointed because of the *Design-Builder's* insolvency, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, by giving the *Design-Builder* or receiver or trustee in bankruptcy notice in writing, terminate the *Design Builder's* right to continue with the *Work*.

7.1.2 If the *Design-Builder* should neglect to prosecute the *Work* properly or otherwise fails to comply with the requirements of the *Contract* to a substantial degree, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, notify the *Design-Builder* in writing that the *Design-Builder* is in default of the *Design-Builder's* contractual obligations and instruct the *Design-Builder* to correct the default in the thirty (30) *Working Days* immediately following the receipt of such notice.

7.1.3 If the default cannot be corrected in the thirty (30) *Working Days* specified, the *Design-Builder* shall be in compliance with the *Owner's* instructions if the *Design-Builder*:

1. Commences the correction of the default within the specified time;
2. provides the *Owner* with an acceptable schedule for such correction; and
3. corrects the default in accordance with such schedule.

7.1.4 If the *Design-Builder* fails to correct the default in the time specified or subsequently agreed upon, without prejudice to any other right or remedy the *Owner* may have, the *Owner* may:

1. Correct such default and deduct the cost thereof from any payment then or thereafter due to the *Design-Builder*; or
2. terminate the *Design-Builder's* right to continue with the *Work* in whole or in part or terminate the *Contract*.

7.1.5 If the *Owner* terminates the *Design-Builder's* right to continue with the *Work* as provided in paragraphs 7.1.1 and 7.1.4, the *Owner* shall be entitled to:

1. Take possession of the *Construction*, and *Products*; utilize the *Construction Documents*, construction machinery, and equipment; subject to the rights of third parties, finish the *Work* by whatever reasonable method the *Owner* may consider expedient, but without undue delay or expense;
2. withhold further payment to the *Design-Builder* until a final certificate for payment is issued;
3. charge the *Design-Builder* the amount by which the full cost of finishing the *Work* and a reasonable allowance to cover the cost of corrections to *Work* performed by the *Design-Builder* that may be required under GC 12.3 (Warranty), exceeds the unpaid balance of the *Contract Price*; however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Design-Builder* the difference; and
4. on expiry of the warranty period, charge the *Design-Builder* the amount by which the cost of corrections to the *Design-Builder's* work under GC 12.3 (Warranty) exceeds the allowance provided for such corrections, or if the cost of such corrections is less than the allowance, pay the *Design-Builder* the difference.

7.1.6 The *Design-Builder's* obligation under the *Contract* as to quality, correction, and warranty of the work performed by the *Design-Builder* up to the time of termination shall continue in force after such termination.

7.1.7 The *Owner* may, if conditions arise which make it necessary for reasons other than as provided in paragraphs 7.1.1 and 7.1.4, suspend performance of the *Work* or terminate the *Contract* by giving written notice to that effect to the *Design-Builder* identifying the reason for the suspension and the expected length of the suspension. Such suspension or termination shall be effective in the manner specified in said notice and shall be without prejudice to any claims which either party may have against the other.

7.1.8 The *Design-Builder* upon receiving notice of suspension or termination from the *Owner* shall suspend all operations as soon as reasonably possible except *Work* which, in the *Design-Builder's* opinion, is necessary for the safety of personnel and for the care and preservation of the *Work*, the materials and plant. Subject to any directions in the notice of suspension or termination, the *Design-Builder* shall discontinue ordering materials, facilities, and supplies and make every reasonable effort to delay delivery of existing orders and, in the event of termination, to cancel existing orders on the best terms available.

7.1.9 During the period of suspension, the *Design-Builder* shall not remove from the site any part of the *Work*, or any *Product* or materials without the consent of the *Owner*.

7.1.10 If the *Work* should be suspended for a period of thirty (30) days or less, the *Design-Builder*, upon the expiration of the period of suspension, shall resume the performance of the *Work* in accordance with the *Contract Documents*. If the suspension was not due to an act or omission of the *Design-Builder*, the *Contract Price* and *Contract Time* shall be adjusted as provided in paragraph 6.5.1 of GC 6.5 (Delays).

7.1.11 If, after thirty (30) days from the date of notice of suspension of the *Work* the *Owner* and the *Design-Builder* agree to continue with and complete the *Work*, the *Design-Builder* shall resume operations and complete the *Work* in accordance with any terms and conditions agreed upon by the *Owner* and the *Design-Builder*.

GC 7.2 DESIGN-BUILDER'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

7.2.1 If the *Owner* should be adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Owner's* insolvency, or if a receiver is appointed because of the *Owner's* insolvency, the *Design-Builder* may, without prejudice to any other right or remedy the *Design-Builder* may have, by giving the *Owner* or receiver or trustee in bankruptcy notice in writing, terminate the *Contract*.

7.2.2 If the *Work* should be suspended or otherwise delayed for a period of thirty (30) days or more under the *Owner's* direction as provided in paragraph 7.1.7 of GC 7.1 (Owner's Right to Perform the Work, Suspend the Work, or Terminate the Contract) or under an

order of a court or other public authority and providing that such order was not issued as a result of an act or fault of the *Design-Builder* or if anyone directly or indirectly employed or engaged by the *Design-Builder*, the *Design-Builder* may, without prejudice to any other right or remedy the *Design-Builder* may have, by giving the *Owner* notice in writing, terminate the *Contract*.

7.2.3 The *Design-Builder* may notify the *Owner* in writing that the *Owner* is in default of the *Owner's* contractual obligations if:

1. The *Owner* fails to furnish, when so requested by the *Design-Builder*, reasonable evidence that financial arrangements have been made to fulfill the *Owner's* obligations under the *Contract*;
2. the *Owner* fails to pay the *Design-Builder* the amounts due under the *Contract* or awarded by arbitration or court;
3. the *Owner* has made an assignment of the *Contract* without the required consent of the *Design-Builder;* or
4. the *Owner* persistently disregards communications or reasonable requests from the *Design-Builder* for information or instructions, or otherwise violates the requirements of the *Contract* to a substantial degree.

7.2.4 The *Design-Builder's* notice in writing to the *Owner* provided under paragraph 7.2.3 shall advise that if the default is not corrected within five (5) *Working Days* following the receipt of the notice, the *Design-Builder* may, without prejudice to any other right or remedy the *Design-Builder* may have, suspend the *Work* or terminate the *Contract*.

7.2.5 If the *Design-Builder* terminates the *Contract* under the conditions set out above, the *Design-Builder* shall be entitled to be paid for all *Work* performed including reasonable profit, for loss sustained upon *Products* and construction machinery and equipment, and such other damages as the *Design-Builder* may have sustained as a result of the termination of the *Contract*.

PART 8 DISPUTE RESOLUTION

GC 8.1 AUTHORITY OF THE CONSULTANT

8.1.1 Differences between the parties to the *Contract* as to the interpretation, application, or administration of the *Contract* or any failure to agree where agreement between the parties is called for, collectively referred to as disputes, which are not resolved in the first instance by findings of the *Consultant* as provided in GC 2.1 (Consultant), shall be settled in accordance with the requirements of Part 8 of the General Conditions (Dispute Resolution).

8.1.2 If a dispute is not resolved promptly, the *Consultant* shall give such written instructions as in the *Consultant's* opinion are necessary for the proper performance of the *Work* and to prevent delays pending settlement of the dispute. The *Design-Builder* shall act immediately according to such instructions, if being understood that by so doing the *Design-Builder* will not jeopardize any claim the *Design-Builder* may have. If it is

subsequently determined that such instructions were in error or at variance with the *Contract Documents*, the *Owner* shall pay the *Design-Builder* costs incurred by the *Design-Builder* in carrying out such instructions which the *Design-Builder* was required to do beyond what the *Contract Documents* correctly understood and interpreted would have required, including costs resulting from the interruption of the *Work*.

GC 8.2 NEGOTIATION, MEDIATION AND ARBITRATION

8.2.1 In accordance with the latest edition of the Rules for Mediation of Constructions Disputes as provided in CCDC 40, the parties shall appoint a Project Mediator:

1. Within thirty (30) days after the *Contract* was awarded; or
2. if the parties neglected to make an appointment within the thirty (30) day period, within fifteen (15) days after either party by notice in writing requests that the Project Mediator be appointed.

8.2.2 A party shall be conclusively deemed to have accepted a finding of the *Consultant* under GC 2.1 (Consultant) and to have expressly waived and released the other party from any claim in respect of the particular matter dealt with in that finding unless, within fifteen (15) *Working Days* after receipt of that finding, the party sends a notice in writing of dispute to the other party and to the *Consultant*, which contains the particulars of the matter in dispute and the relevant provisions of the *Contract Documents*. The responding party shall send a notice in writing of reply to the dispute within ten (10) *Working Days* after receipt of the notice of dispute setting out particulars of this response and any relevant provisions of the *Contract Documents*.

8.2.3 The parties shall make all reasonable efforts to resolve their disputes by amicable negotiations and agree to provide, without prejudice, frank, candid, and timely disclosure of relevant facts, information, and documents to facilitate these negotiations.

8.2.4 After a period of ten (10) *Working Days* following receipt of a responding party's notice in writing of reply under paragraph 8.2.2, the parties shall request the Project Mediator to assist the parties to reach agreement on any unresolved dispute. The mediated negotiations shall be conducted in accordance with the latest edition of the Rules for Mediation of Construction Disputes as provided in CCDC 40.

8.2.5 If the dispute has not been resolved within ten (10) *Working Days* after the Project Mediator was requested under paragraph 8.2.4 or within such further period agreed by the parties, the Project Mediator shall terminate the mediated negotiations by giving notice in writing to both parties.

8.2.6 By giving a notice in writing to the other party, not later than ten (10) *Working Days* after the date of termination of the mediated negotiations under paragraph 8.2.5, either party may refer the dispute to be finally resolved by arbitration under the latest edition of the

Rules for Arbitration of Construction Disputes as provided in CCDC 40. The arbitration shall be conducted in the jurisdiction of the *Place of the Work.*

8.2.7 On expiration of the ten (10) *Working Days*, the arbitration agreement under paragraph 8.2.6 is not binding on the parties and, if a notice is not given under paragraph 8.2.6 within the required time, the parties may refer the unresolved dispute to the courts or to any other form of dispute resolution, including arbitration, which they have agreed to use.

8.2.8 If neither party requires by notice in writing given within ten (10) *Working Days* of the date of notice requesting arbitration in paragraph 8.2.6 that a dispute be arbitrated immediately, all disputes referred to arbitration as provided in paragraph 8.2.6 shall be

1. Held in abeyance until:
   (1) *Substantial Performance of the Work,*
   (2) the *Contract* has been terminated, or
   (3) the *Design-Builder* has abandoned the *Work,*
   whichever is earlier; and
2. consolidated into a single arbitration under the rules governing the arbitration under paragraph 8.2.6.

GC 8.3 RETENTION OF RIGHTS

8.3.1 It is agreed that no act by either party shall be construed as a renunciation or waiver of any rights or recourses, provided the party has given the notices required under Part 8 of the General Conditions (Dispute Resolution) and has carried out the instructions as provided in paragraph 8.1.2.

8.3.2 Nothing in Part 8 of the General Conditions (Dispute Resolution) shall be construed in any way to limit a party from asserting any statutory right to a lien under applicable lien legislation of the jurisdiction of the *Place of the Work* and the assertion of such right by initiating judicial proceedings is not to be construed as a waiver of any right that party may have under paragraph 8.2.6 to proceed by way of arbitration to adjudicate the merits of the claim upon which such a lien is based.

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.1 PROTECTION OF WORK AND PROPERTY

9.1.1 The *Design-Builder* shall protect the *Work* and the *Owner's* as property and property adjacent to the *Place of the Work* from damage which may arise~~s~~ the result of the *Design-Builder's* operations under the *Contract*, and shall be responsible for such damage, except damage which occurs as the result of:

1. Errors in the *Contract Documents* issued by the *Owner*;
2. acts or omissions by the *Owner*, other contractors, their agents, and employees.

9.1.2 Should the *Design-Builder* in the performance of the *Contract* damage the *Work*, the *Owner's* property, or property adjacent to the *Place of the Work*, the *Design-Builder* shall be responsible for making good such damage at the *Design-Builder's* expense.

9.1.3 ~~Should damage occur to the *Work* or *Owner's* property for which the *Design-Builder* is not responsible, as provided in paragraph 9.1.1, the *Design-Builder* shall at the *Owner's* expense make good such damage to the *Work* and, if the *Owner* so directs, to the *Owner's* property. The *Contract Price* and *Contract Time* shall be adjusted as provided in GC 6.1 (Changes), GC 6.2 (Change Order) and GC 6.3 (Change Directive).~~ delete & initial

GC 9.2 DAMAGES AND MUTUAL RESPONSIBILITY

9.2.1 If either party to the *Contract* should suffer damage in any manner because of any wrongful act or neglect of the other party or of anyone for whom the other party is responsible in law, then that party shall be reimbursed by the other party for such damage. The reimbursing party shall be subrogated to the rights of the other party in respect of such wrongful act or neglect if it be that of a third party.

9.2.2 Claims for damage under paragraph 9.2.1 shall be made in writing to the party liable within reasonable time after the first observance of such damage and if undisputed shall be confirmed by *Change Order*. Disputed claims shall be resolved as set out in Part 8 of the General Conditions (Dispute Resolution).

9.2.3 If the *Design-Builder* has caused damage to the work of another contractor on the *Project*, the *Design-Builder* agrees upon due notice to settle with the other contractor by negotiation or arbitration. If the other contractor makes a claim against the *Owner* on account of damage alleged to have been so sustained, the *Owner* shall notify the *Design-Builder* and may require the *Design-Builder* to defend the action at the *Design-Builder's* expense. The *Design-Builder* shall satisfy a final order or judgment against the *Owner* and pay the costs incurred by the *Owner* arising from such action.

9.2.4 If the *Design-Builder* becomes liable to pay or satisfy a final order, judgment, or award against the *Owner*, then the *Design-Builder*, upon undertaking to indemnify the *Owner* against any and all liability for costs, shall have the right to appeal in the name of the *Owner* and such final order or judgment to any and all courts of competent jurisdiction.

GC 9.3 TOXIC AND HAZARDOUS SUBSTANCES AND MATERIALS

9.3.1 For the purpose of applicable environmental legislation, the *Owner* shall be deemed to have control and management of the *Place of Work* with respect to existing conditions prior to the *Design-Builder* commencing the work.

9.3.2 Prior to the *Design-Builder* commencing the *Work*, the *Owner* shall:

1. Take all reasonable steps to determine whether any toxic or hazardous substances or materials are present at the *Place of Work*; and
2. provide the *Design-Builder* with a written list of any such substances and materials.

9.3.3 The *Owner* shall take all reasonable steps to ensure that no person suffers injury, sickness, or death and that no property is injured, damaged, or destroyed as a result of exposure to, or the presence of, toxic or hazardous substances or materials which were at the *Place of Work* prior to the *Design-Builder* commencing the *Work*. The *Owner* is responsible for proper operation of and safety considerations associated with the wastewater lagoon.

9.3.4 Unless the *Contract Documents* expressly provides otherwise, the *Owner* shall be responsible for taking all necessary steps, in accordance with legal requirements, to dispose of, store or otherwise render harmless, toxic or hazardous substances or materials which were present at the *Place of the Work* prior to the *Design-Builder* commencing the *Work*.

9.3.5 If the *Design-Builder*

1. Encounters toxic or hazardous substances or materials at the *Place or Work*, or
2. has reasonable grounds to believe that toxic or hazardous substances or materials are present at the *Place of Work*, which were not disclosed by the *Owner*, as required under paragraph 9.3.2 or which were disclosed but have not been dealt with as required under paragraph 9.3.4, the *Design-Builder* shall:
3. Take all reasonable steps, including stopping the *Work*, to ensure that no person suffers injury, sickness, or death and that no property is injured or destroyed as a result of exposure to or the presence of the substances or materials; and
4. immediately report the circumstances to the *Owner* in writing.

9.3.6 If the *Design-Builder* is delayed in performing the *Work* or incurs additional costs as a result of taking steps required under paragraph 9.3.5.3, the *Contract Time* shall be extended and the *Design-Builder* shall be reimbursed for all reasonable costs incurred as a result of the delay and as a result of taking those steps.

9.3.7 The *Owner* and the *Design-Builder* may jointly rely upon the advice of an independent expert in a dispute under paragraph 9.3.6 and, in that case, the expert shall be jointly selected, retained, and paid by the *Owner* and the *Design-Builder*.

9.3.8 The *Owner* shall indemnify and hold harmless the *Design-Builder*, *Consultant*, other consultants, *Subcontractors*, *Suppliers*, and their agents and employees, from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of or resulting from exposure to, or the presence of, toxic or hazardous substances or materials which were at the *Place of Work* prior to the *Design-Builder* commencing the *Work*. The obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity set out in GC 12.1 (Indemnification) or which otherwise exist respecting a person or party described in this paragraph.

9.3.9 GC 9.3 (Toxic and Hazardous Substances and Materials) shall govern over the provisions of paragraph 1.4.1 of GC 1.4 (Rights and Remedies) or GC 9.2 (Damages and Mutual Responsibility).

PART 10 GOVERNING REGULATIONS

GC 10.1 TAXES AND DUTIES

10.1.1 The *Contract Price* shall include all taxes and customs duties in effect at the time of the proposal or bid closing except for *Value Added Taxes* payable by the *Owner* to the *Design-Builder* as stipulated in Article A-4 of the Agreement (Contract Price).

10.1.2 Any increase or decrease in costs to the *Design-Builder* due to changes in such included taxes and duties after the time of the proposal or bid closing, as the case may be, shall increase or decrease the *Contact Price* accordingly.

10.1.3 Refunds that are properly due to the *Owner* and have been recovered by the *Design-Builder* will be promptly refunded to the *Owner*.

GC 10.2 LAWS, NOTICES, PERMITS AND FEES

10.2.1 The *Owner* shall obtain and pay for the permanent easements and rights of servitude.

10.2.2 Unless otherwise stated, the *Design-Builder* shall obtain and pay for the building permit and other permits, licenses, or certificates necessary for the performance of the *Work* which were in force at the time of the proposal or bid closing.

10.2.3 The *Design-Builder* shall give the required notices and comply with the laws, ordinances, rules, regulations, or codes which are or become in force during the performance of the *Work* and which relates to the *Work*, to the preservation of the public health, and to construction safety.

10.2.4 The *Design-Builder* shall not be responsible for verifying that the *Owner's Statement of Requirements* is in substantial compliance with the applicable laws, ordinances, rules, regulations, or codes relating to the *Work*. If, after the time of the proposal or bid closing, changes are made to the applicable laws, ordinances, rules, regulations, or codes which require modification to the *Contract Documents*, the *Design Builder* shall notify the *Owner* in writing requesting direction immediately upon such variance or change becoming known. Changes shall be made as provided in GC 6.1 (Changes), GC 6.2 (Change Order) and GC 6.3 (Change Directive).

10.2.5 If the *Design-Builder* fails to notify the *Owner* in writing, fails to obtain direction as required in paragraph 10.2.4, and performs work knowing it to be necessary to any laws, ordinances, rules, regulations, or codes; the *Design-Builder* shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages

attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations, or codes.

GC 10.3 PATENT FEES

10.3.1 The *Design-Builder* shall pay the royalties and patent license fees required for the performance of the *Contract*. The *Design-Builder* shall hold the *Owner* harmless from and against claims, demands, losses, costs, damages, actions, suits or proceedings arising out of the *Design-Builder's* performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention by the *Design-Builder* or anyone for whose acts the *Design-Builder* may be liable.

10.3.2 The *Owner* shall hold the *Design-Builder* harmless against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Design Builder's* performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention in executing anything for the purpose of the *Contract*, the model, plan, or design of which was supplied to the *Design-Builder* as part of the *Contract Documents*.

GC 10.4 WORKER'S COMPENSATION

10.4.1 Prior to commencement the *Work, Substantial Performance of the Work*, and the application for final payment, the *Design-Builder* shall provide evidence of compliance with workers' compensation legislation at the *Place of Work*, including payments due under it.

10.4.2 At any time during the term of the *Contract*, when requested by the *Owner*, the *Design-Builder* shall provide such evidence of compliance by the *Design-Builder* and *Subcontractors* and any other person performing the *Work* who is required to comply with such legislation.

PART 11 INSURANCE - BONDS

GC 11.1 INSURANCE

11.1.1 Without restricting the generality of GC 12.1 (Indemnification) and unless the *Owner* and the *Design-Builder* agree to obtain project-specific insurance, or higher insurance limits, the *Design-Builder* shall provide, maintain, and pay for the minimum insurance coverages specified in GC 11.1 (Insurance).

1. **General Liability Insurance:**

The policy shall be in the joint names of the *Design-Builder*, the *Owner*, the *Consultant* and other consultants, with limits of not less than $2,000,000.00 per occurrence and with a property damage deductible of not more than $5,000.00. The insurance coverage shall not be less than the insurance required by IBC Form 2100, or its equivalent replacement, provided that IBC Form 2100 shall contain the latest

edition of the relevant CCDC endorsement. Umbrella or excess liability insurance may be used to achieve the desired limit. Where the *Design-Builder* maintains a single, blanket policy, the addition of the *Owner* is limited to liability arising out of the *Work* and all operations necessary or incidental thereto.

Completed Operations Liability coverage shall be maintained continuously from the commencement of the *Construction* until two years after the *Substantial Performance of the Work.*

2. **Errors and Omissions Insurance:**

The *Design-Builder* shall ensure that the *Consultant* and other consultants engaged in the performance of the *Design Services* each carry Errors and Omissions Insurance that have limits have not less than $250,000.00 per claim and with an aggregate limit of not less than $500,000.00. The *Consultant* or other consultants found to be at fault will be responsible for the deductible amount.

The policy shall be maintained continuously from the commencement of the *Work*, until two (2) years after *Substantial Performance of the Work.*

3. **Automobile Liability Insurance:**

The policy covers for bodily injury, death, and damage to property with respect to all licensed vehicles owned or leased by the *Design-Builder*. The policy shall have limits of not less than $2,000,000.00 inclusive per occurrence. If the policy is issued pursuant to a government-operated automobile insurance system, the *Design-Builder* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Design-Builder*.

4. **Aircraft and Watercraft Liability Insurance:**

The policy shall be for owned or non-owned aircraft and watercraft used directly or indirectly by the *Design-Builder* in the performance of the *Work*, including use of additional premises. The policy shall have limits of not less than $2,000,000.00 inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof and limits of not less than $2,000,000.00 for aircraft passenger hazard.

5. **Property and Boiler and Machinery Insurance:**

(1) "All risks" property insurance shall be in the joint names of the *Design-Builder*, the *Owner*, the *Consultant*, all other consultants, and all *Subcontractors*. The insurance coverage shall not be less than the insurance required by IBC Form 4042 or its equivalent replacement, provided that IBC Form 4042 shall contain the latest edition of the relevant CCDC endorsement form. The insurance provided shall have limits of not less than

the sum of the amount of the *Contract Price*, the applicable *Value Added Taxes*, and the full value of products provided by the *Owner* for incorporation into the *Work* as specified in the Supplementary Conditions. The policy shall have a deductible of not more than $10,000.00.

(2) Boiler and machinery insurance shall be in the joint names of the *Design-Builder*, the *Owner*, the *Consultant*, all consultants, and all *Subcontractors*. The insurance coverage shall not be less than the insurance provided by the "Comprehensive Boiler and Machinery Form". The insurance provided shall have limits of not less than the replacement value of the boilers, pressure vessels, and other insurable objects forming part of the *Work*.

(3) The policies shall allow for partial or total use or occupancy of the *Work*. If because of such use or occupancy the *Design-Builder* is unable to provide coverage, the *Design-Builder* shall notify the *Owner* in writing. Prior to such use or occupancy, the *Owner* shall provide, maintain, and pay for all risk property and boiler insurance in the amounts described in subparagraphs (1) and (2), including coverage for such use or occupancy and provide the *Design-Builder* with proof of such insurance. The policies shall be amended to include permission for completion of *Construction* and shall include all insureds as specified in subparagraph (1). The *Design-Builder* shall refund to the *Owner* the unearned premiums applicable to the *Design-Builder's* policies upon termination of coverage.

(4) The policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Design-Builder* as their respective interests may appear. The *Design-Builder* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the *Design-Builder* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Design-Builder* shall be entitled to a reasonable extension of *Contract Time*.

(5) The *Design-Builder* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount at which the *Owner's* interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds and as provided in GC 5.2 (Applications for Progress Payment) and GC 5.3 (Progress Payment). In addition the *Design-Builder* shall be entitled to receive from the payments made by the insurer the amount of the *Design Builder's* interest in the restoration of the *Work*.

(6) In the case of loss or damage to the *Work* arising from the work of another contractor, or *Owner's* own forces, the *Owner*, in accordance with the *Owner's* obligations under paragraph 3.3.2.4 or GC 3.3 (Construction by Owner or Other Contractors), shall pay the *Design-Builder* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as provided in GC 5.2 (Applications for Progress Payment) and GC 5.3 (Progress Payment).

6. **Equipment Insurance:**

The policy covers construction machinery and equipment used by the *Design-Builder* for the performance of the *Work*, including boiler insurance on temporary boilers and pressure vessels. The policy shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner*. Subject to satisfactory proof of financial capability by the *Design-Builder* for self-insurance, the *Owner* agrees to waive the equipment insurance requirement.

11.1.2 Unless otherwise stipulated, the duration of the each insurance policy shall be from the date of commencement of the *Work* until the date of the final certificate for payment.

11.1.3 The *Design-Builder* shall be responsible for deductible amounts under the policies except where otherwise provided in GC 11.1 (Insurance) or where such amounts may be excluded from the *Design-Builder's* responsibility by the terms of GC 9.1 (Protection of Work and Property) and GC 9.2 (Damages and Mutual Responsibility).

11.1.4 Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Design-Builder* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements.

11.1.5 Where the full insurable value of the *Work* is substantially less than the *Contract Price*, the *Owner* may reduce the amount of insurance required or waive the Property and Boiler and Machinery Insurance requirement.

11.1.6 If the *Design-Builder* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and give evidence to the *Design-Builder* and the *Consultant*. The *Design-Builder* shall pay the cost thereof to the *Owner* on demand or the *Owner* may deduct the amount which is due or may become due to the *Design Builder*.

11.1.7 All required insurance policies shall be placed with insurers licensed to underwrite insurance in the jurisdiction of the *Place of Work*.

11.1.8 All required insurance policies shall be endorsed to provide the *Owner* with not less than thirty (30) days notice in writing in advance of any cancellation and material amendment or change restricting coverage.

11.1.9 All insureds shall cooperate with the *Design-Builder* to comply with any reporting requirements of the insurance policies in order to maintain the policies in good standing, to give notice in writing of any incidents which may result in a claim or loss covered by the policies and to provide documentation necessary in the defense or settlement of claims.

GC 11.2 BONDS

11.2.1 The *Design-Builder* shall, prior to commencement of material improvements on site, provide to the *Owner* such surety bonds as are required by the *Contract Documents*. Bonding is not required for test holes, investigation, design, or the removal or addition of fill.

11.2.2 Such bonds shall be issued by a duly licensed surety company authorized to transact a business of suretyship in the province or territory of the *Place of Work* and shall be maintained in good standing until the fulfillment of the *Contract*. The surety bonds shall be in accordance with the latest edition of the CCDC approved bond forms.

PART 12 INDEMNIFICATION - WAIVER – WARRANTY

GC 12.1 INDEMNIFICATION

12.1.1 The *Design-Builder* shall indemnify and hold harmless the *Owner*, the *Owner's* agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings (hereinafter called "claims"), by third parties that arise out of, or are attributable to, the *Design-Builder's* performance of the *Work*, provided such claims are:

1. Attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property; and
2. caused by negligent acts or omissions of the *Design-Builder*, the *Consultant*, all other consultants, all *Subcontractors* or anyone for whose acts the *Design-Builder* may be liable, and
3. made in writing within a period of 2 years the from the date of *Substantial Performance of the Work* or within ~~such shorter~~ period as may be prescribed by any limitation statute of the province or territory of the *Place of the Work*. whichever is greate

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The *Owner* expressly waives the right to indemnify for claims other than those stated above.

12.1.2 The obligation of the *Design-Builder* to indemnify under this *Contract* shall be limited to the insurance coverages and limits as agreed to be provided in GC 11.1 (Insurance).

12.1.3 The *Owner* shall indemnify and hold harmless the *Design-Builder*, the *Consultant*, all other consultants, all *Subcontractors*, all *Suppliers*, their agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Design-Builder's* performance of the *Design Services* and *Construction*, which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the *Place of Work* or a negligent act or omission or willful default of the *Owner*, its agents and employees or any other person in respect of those acts the *Owner* may be liable.

12.1.4 GC 12.1 (Indemnification) shall govern over the provisions of paragraph 1.4.1 of GC 1.4 (Rights and Remedies) or GC 9.2 (Damages and Mutual Responsibility).

GC 12.2 WAIVER OF CLAIMS

12.2.1 Waiver of Claims by *Owner*

As of the date of the final certificate for payment, the *Owner* expressly waives and releases the *Design-Builder*, the *Consultant*, all other consultants, all *Subcontractors*, all *Suppliers*, and their agents and employees from all claims against them including without limitation those that might arise from the negligence or breach of contract by the *Design Builder*, the *Consultant*, all other consultants, all *Subcontractors*, and their agents and employees except one or more of the following:

1. Those made in writing prior to the date of the final certificate for payment and still unsettled;
2. those arising from the provisions of GC 12.1 (Indemnification) or GC 12.3 (Warranty);
3. those arising from the provisions of paragraph 9.3.5 of GC 9.3 (Toxic and Hazardous Substances and Materials) and those arising from the *Design-Builder* bringing or introducing any toxic or hazardous substances and materials to the *Place of Work* after the *Design-Builder* commences the *Work*;
4. those made in writing within a period of two (2) years form the date of *Substantial Performance of the Work* or within ~~such shorter~~ the period as may be prescribed by any limitation statute of the province or territory of the *Place of Work* and arising from any liability of the *Design-Builder* for damages resulting from the *Design-Builder's* performance of the *Contract* with respect to substantial defects or deficiencies in the *Work* for which the *Design-Builder* is proven responsible. As used herein "substantial defects or deficiencies" means those defects or deficiencies in the *Construction* which affect the *Work* to such an extent or in such manner that a significant part or the whole of the *Construction* is unfit for the purpose specified in the *Contract Documents*.

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whichever is greater

12.2.2 Waiver of Claims by *Design-Builder*

As of the date of the final certificate for payment, the *Design-Builder* expressly waives and releases the *Owner* from all claims against the *Owner* including with out limitation those that might arise from the negligence or breach of contract by the *Owner* except:

1. those made in writing prior to the *Design-Builder's* application for final payment and still unsettled; and
2. those arising from the provisions of GC 9.3 (Toxic and Hazardous Substance and Materials) or GC 10.3 (Patent Fees).

12.2.3 GC 12.2 (Waiver of Claims) shall govern over the provisions of paragraph 1.4.1 of GC 1.4 (Rights and Remedies) or GC 9.2 (Damages and Mutual Responsibility).

GC 12.3 WARRANTY

12.3.1 The warranty period with regard to the *Contract* is one year from the date of *Substantial Performance of the Work* or such other periods specified in the *Contract Documents* for certain portions of the *Work* or *Products*.

12.3.2 The *Design-Builder* warrants that the *Design Services* meet the standard described in GC 2.1.4 and that the *Work* shall be suitable of the purpose required by the *Contract*, to the extent that the *Design Services* and *Contract Documents* permit such purpose.

12.3.3 Except for the provisions of paragraph 12.3.6, the *Design-Builder* shall correct promptly, at the *Design-Builder's* expense, any work which is not in accordance with the *Contract Documents* or defects or deficiencies in the *Work* which appear prior to and during the warranty periods specified in the *Contract Documents*.

12.3.4 The *Owner* shall promptly give the *Design-Builder* notice in writing of observed defects and deficiencies that occur during the warranty period.

12.3.5 The *Design-Builder* shall correct or pay for damage resulting from the defects or deficiencies and the corrections made under the requirements of paragraph 12.3.3.

12.3.6 The *Design-Builder* shall be responsible for obtaining *Product* warranties in excess of one year on behalf of the *Owner* form the manufacturer. These *Product* warranties shall be issued by the manufacturer to the benefit of the *Owner*.

12.3.7 The *Design-Builder* does not warrant against the effects of corrosion, erosion or wear and tear of any *Product* or failure of any *Product* due to faulty operations or maintenance by the *Owner* or conditions of operation more severe than those specified for the *Product* by the manufacturer in the manufacturer's Operations and Maintenance Manuals and Product Specifications.

12.3.8 The warranties and guarantees specified in GC 12.3 (Warranty) or elsewhere in the *Contract Documents* are only warranties and guarantees of the *Design-Builder* applicable to the *Work* and no other warranties or guarantees, statutory or otherwise, are or will be implied.

ANNEX A

IQALUIT WATER RECLAMATION FACILITY
SCOPE OF WORK

Owner Scope of Work:

- The cost of electrical power after substantial completion plus 45 days
- Specify Location of Plant
- All ownership or lease arrangements for land.
- Discharge Permit Application Processing and Negotiation
- Interim Financing if Required
- Operator for all Live Changeover Evolutions
- Operator for all work involving existing Iqaluit Infrastructure
- Upgrades, additions, and changes to the work
- Supply of sufficient wastewater and/or potable water for full start-up, wet testing, and flow trials
- All consumables, sample courier costs and analytical testing, and all operations and maintenance costs, after the expiration of the lien holdback period (substantial completion plus 45 days)
- Provide Design-Builder with copies of all executed contribution agreements from CGHT
- The cost of third party review
- Spare Cake Storage Container

Design-Builder Scope of Work (The Work):

Treatment Plant:

- The cost of electrical power up to the point of substantial completion plus 45 days
- Flow Monitoring Program
- Council Presentation
- Geotechnical Investigation
- Representation at any Public Hearings for Site Selection and or Discharge Permit
- Bonding
- Site Preparation
- Excavation
- Engineered Fill and Insulation
- Cast-In Place Treatment Tanks
- Treatment Plant Building
- All Lighting, Heating and Ventilation
- All interior walls & doors as shown in the contract documents
- All exterior doors and windows as shown in the contract documents
- All patching finishing and painting
- ZENON MBR Equipment for 1800 m^3/d flow (no disinfection)

  Fitted Redundant Equipment Provided:

  - Filters — Augmented from 72 modules to 80 modules + 1 x 10 module soaking cassette
  - Mechanical Upgrade — Piping sized and provided to 2500 m^3/day
  - Spare Sensors — Dissolved O_2 x 4
    Biomass Temperature x4
    Turbidity x 2
    Biomass pH
  - Permeate Pump — 2 primary duty pumps + 1 standby
  - Blower — Membranes 2 primary units +1 standby

ANNEX A (CONT'D)

- Process — 2 primary units + 1 standby
- Recirc Pump — 2 installed units
- Air Compressor — 1 primary + 1 standby unit

- Duplex Trash Removal Machines by ML Screw Screen.
- Single Channel Fournier Press
- Diesel Generator
- All Shipping and Handling
- All Equipment Installation & Testing
- All Electrical Wiring and Testing
- All Instrument Wiring and Testing
- All PLC Software & Testing
- Electrical Service for Treatment Plant
- Gravity Sewer Extension
- Outfall Piping
- Supply of consumables up to and including substantial completion plus the statutory lien holdback period of 45 days
- Initial provision of "spares" and "stand-by" equipment
- Used cake bin truck with 2 m^3 "dump box"
- Transformers, switchgear for primary power service
- Travel and accommodation for classroom training in Iqaluit
- Lift Station
  Includes:
  - triplex pumps
  - control panel
  - back-up power from plant system
  - lifting appliance
- Electrical Service for Lift Station

Services Provided:

- Design & Engineering
- Project Management
- Working Drawings
- As-Built Drawings (3 sets of prints plus electronic version, Autocad 14 format)
- O & M Manuals (4)
- Commissioning
- Start-up
- Operator Training (4 personnel)
  - Part I - Classroom (Iqaluit)
  - Part II - Hands-on (Iqaluit)
- Full repairs to as-new state, up to and including test and trials period and substantial completion

Spares /Stand-by Equipment Provided:

•	Filters	12 x Blower Air Filters
		20 x Sanitaire Fine Bubble Diffusers
		6 x 10μ Air Filters (F88 – back pulse tank)
•	Mechanical Parts	1 x Spare Air Diaphragm Pump
		2 x 6" Bray Actuators (pneumatic)
		2 x Pressure Gauges (0 – 30psi)
		2 x Vacuum Gauges (0-30ltg)

ANNEX A (CONT'D)

• Spare Sensors	1 x Formazin Turbidimeter Calibration Kit 1 x DO probe calibration kit 1 x pH probe (spare) 1 x DO probe (spare) 2 x N.O. Contact Floats
• Permeate Pump	1 x spare pump assembly 2 x mechanical seals 2 x permeate system pressure switch (30" Hg-20 psi)
• Blower	1 x 50 gallons – lubricating oil 12 x V-belts 5 x cases lubricating grease (120 tubes) 1 x blower body
• Recirclation Pump	1 x Seal Assembly 1 x Recirc Pump Assembly 1 x Anoxic Mixer Seal Assembly
• Air Compressor	10 x gallons lubricating oil 5 x pressure regulator filters 1 x air compressor motor 7.5 HP/575V

ANNEX B

REVISED SCHEDULE

JULY 22, 1999

10 June 98:	Dillon Consulting Sets up Iqaluit Office
12 June 98:	Submission of Revised Proposals by Proponents
12 June 98 - 08 July 98:	Review of Revised Submissions by : ➢ The Committee ➢ Municipal and Community Affairs (Iqaluit) ➢ Municipal and Community Affairs (Yellowknife) ➢ Dillon Consulting
08 July 98:	Council Selection of Preferred Proponent
08 July 98:	Council Executes Letter of Intent to contract with Successful Proponent
08 July 98 - 15 August 98:	Negotiation of Stipulated Price Contract between the Municipality of Iqaluit and Successful Proponent
01 August - 15 August 98:	Preparation of Conceptual Design
05 September - 09 September 98:	Presentation to Council ➢ Design and Management Team ➢ Conceptual Design ➢ Stipulated Capital Budget ➢ Stipulated Operating Budget ➢ Bonding and Security ➢ Local Economic Development
01 September - 15 October 98:	Prepare Preliminary Design
01 October 98:	Owner Review
21 September - 24 September 98:	Nunavut Water Board Review and Public Hearing
25 September 98:	Ship cement and forming materials to Iqaluit
15 October - 30 January 99:	Prepare Working Drawings
15 February 99:	Place Equipment Orders
June 99:	Execute Design-Build-Operate Stipulated Price Contract
June 99:	Factory Acceptance Trials of ZENON Equipment
June 99:	Ship to Shipping Point (Port of Montreal)

ANNEX B (Continued)

June 99:	Mobilization
June - October 99:	Construction of Infrastructure
June 99:	Municipality to Submit Application for renewal of discharge license
June - September 99:	Sea Lift Transportation of Equipment
September - December 99:	Installation of Equipment
January 2000:	Commissioning
February 2000:	Biomass Monitoring
March 2000:	Substantial Completion

ANNEX C

CAPITAL COST BREAKDOWN
SHOWING ALL COST ADJUSTMENTS

IQALUIT WWTP
Contract Price Adjustments
March 2 ,1999
Prepared By: Robert A. Murray

Initial Proposal for Blended Effluent (48 Modules)	$5,530,000
Credits (duel to relocation)	($247,500)
Changes (Addition of 16 Modules) total flow through ZENON system	$1,417,500
TOTAL	**$6,700,000**

FEBRUARY ADDITIONS		
Financing Charges (due to delays in contract signing)		$4,900
SS Frames & Components (in wetted areas)		$45,500
Plant Spares:		
Filters	1,000	
Mechanical Parts	1,000	
Spare Sensors	10,000	
Permeate Pump	17,100	
Blower	22,500	
Recirc Pump	13,000	
Air Compressor	10,300	$74,900
Temp Transmitter (in biomass)		$3,500
Flow Meter/Transmitter (on influent line)		$4,800
4160 Volt Switchgear & Transformer		$79,200
Membranes Modules 1800 m^3 @ 10° (16 modules)		$109,550
TOTAL ADDITIONS		$322,350
8% Mark-Up for Overhead & Contingency		$25,788
Additions With Mark-Up		$348,148
Previous Total		$6,700,000
Truck for Cake Removal		no extra charge
Training in Iqaluit		no extra charge
JULY 1999		
Additional Financing Charges for Delay in Shipment June-July		$32,000
Additional Trip Due to Administrative Delays		$7,862
Rock Removal		no extra charge
REVISED TOTAL		**$7,088,000**

ANNEX D

SCHEDULE OF DRAWS

HILL MURRAY

ENGINEERING WATER SOLUTIONS

Municipality of Iqaluit

Water Reclamation Facility

Schedule of Draws to September 1999

	Project Allocation	Progress Claim #1 DESIGN Service Contract #1512 ($634,540.00)	% to date	Progress Claim #2 DESIGN Service Contract #1512 ($634,540.00)	% to date	Progress Claim #3 MOBILIZATION Service Contract #1527 ($228,105.20)	% to date	Progress Claim # 4 DEPOSITS on Equipment Service Contract #991547 ($750,000.00)	% to date	Progress Claim # 5 DESIGN Service Contract #1512 ($634,540.00)	% to date
Design	$ 790,000.00	$ 465,405.00	58.912%	$ 93,158.36	70.704%		70.704%		70.704%	$ 75,976.64	80.322%
Infrastructure & Equipment	$ 5,377,200.00		0.000%		0.000%		0.000%	$ 750,000.00	13.948%		13.948%
Shipping & Mobilization	$ 352,000.00		0.000%		0.000%	$ 228,105.20	64.803%		64.803%		64.803%
Project Management	$ 498,800.00		0.000%		0.000%		0.000%		0.000%		0.000%
Training & Commissioning	$ 70,000.00		0.000%		0.000%		0.000%		0.000%		0.000%
Progress Claim Amount	$ 7,088,000.00	$ 465,405.00		$ 93,158.36		$ 228,105.20		$ 750,000.00		$ 75,976.64	
Claimed to Date		$ 465,405.00	6.566%	$ 558,563.36	7.880%	$ 786,668.56	11.099%	$ 1,536,668.56	21.680%	$ 1,612,645.20	22.752%

	June 1999 Progress Claim # 6 SITE IMPROVEMENTS Service Contract #991560 ($1,875,743.64)	% to date	July 1999 Progress Claim # 7 SITE IMPROVEMENTS Service Contract #991560 ($1,875,743.64)	% to date	August 1999 Progress Claim # 8 SITE IMPROVEMENTS Service Contract #991560 ($1,875,743.64)	% to date	September 1999 Progress Claim # 9 BUILDING & APRON Service Contract #991560 ($878,280.00)	% to date
Design	$ 80,230.00	90.477%	$ 75,230.00	100.000%	$ -	100.000%	$ -	100.000%
Infrastructure & Equipment	$ 233,241.60	18.285%	$ 663,567.04	30.626%	$ 578,935.00	41.392%	$ 788,280.00	56.052%
Shipping & Mobilization		64.803%		64.803%		64.803%		64.803%
Project Management	$ 74,770.00	14.990%	$ 79,770.00	30.982%	$ 90,000.00	49.026%	$ 90,000.00	67.069%
Training & Commissioning		0.000%		0.000%		0.000%		0.000%
Progress Claim Amount	$ 388,241.60		$ 818,567.04		$ 668,935.00		$ 878,280.00	
Claimed to Date	$ 2,000,886.80	28.229%	$ 2,819,453.84	39.778%	$ 3,488,388.84	49.215%	$ 4,366,668.84	61.607%

Hill Murray & Associates Inc and
Canadian Wastewater Corporation

Sidney, British Columbia, Canada

CURRENT SITUATION AFTER SERVICE CONTRACTS #1,#2,#3
MUNICIPAL SERVICE CONTRACT #'S 1520,1527 AND 1547
ALL DOLLAR VALUES DO NOT INCLUDE GST

		PERCENT COMPLETE TO JUNE 24	PAID TO DATE BY MUNICIPALITY
DESIGN	$790,000.00	64.67%	$510,893.00
ZENON	$1,550,000.00	39.71%	$615,505.00
FOURNIER	$300,000.00	35.00%	$105,000.00
HEADWORKS	$80,000.00	20.00%	$16,000.00
TANKS	$850,000.00	0.00%	$0.00
BUILDING	$1,300,000.00	22.39%	$291,070.00
RECEIVE STN	$62,500.00	18.00%	$11,250.00
SEWER LINE L/S	$377,000.00	0.00%	$0.00
OUTFALL	$70,000.00	0.00%	$0.00
ELEC SERVICE	$109,000.00	0.00%	$0.00
GENSET	$79,300.00	19.72%	$15,637.96
SHIPPING	$502,000.00	6.97%	$34,989.40
INSTALLATION	$423,000.00	0.00%	$0.00
P MGMT	$407,200.00	3.00%	$12,216.00
TRAIN/COMN	$150,000.00	0.00%	$0.00
CARRYING COSTS	$38,000.00		$0.00
TOTAL CONTRACT	$7,088,000.00	PAID TO DATE	$1,612,561.36

SERVICE CONTRACT #4 -- SITE IMPROVEMENTS
ALL DOLLAR VALUES DO NOT INCLUDE GST

	PROGRESS CLAIM #1			PROGRESS CLAIM #2		
	PROGRESS THIS CLAIM	TOTAL TO DATE	AMOUNT THIS CLAIM	PERCENT THIS CLAIM	TOTAL TO DATE	AMOUNT THIS CLAIM
	JUNE 99	JUNE 99	JUNE 99	JULY 99	JULY 99	JULY 99
DESIGN	20.33%	85.00%	$160,607.00	0.00%	85.00%	$0.00
ZENON	0.00%	39.71%	$0.00	25.29%	65.00%	$391,995.00
FOURNIER	0.00%	35.00%	$0.00	0.00%	35.00%	$0.00
HEADWORKS	10.00%	30.00%	$8,000.00	0.00%	30.00%	$0.00
TANKS	10.00%	10.00%	$85,000.00	10.00%	20.00%	$85,000.00
BUILDING	0.00%	22.39%	$0.00	2.61%	25.00%	$33,930.00
RECEIVE STN	0.00%	18.00%	$0.00	7.00%	25.00%	$4,375.00
SEWER LINE L/S	0.00%	0.00%	$0.00	20.00%	20.00%	$75,400.00
OUTFALL	0.00%	0.00%	$0.00	25.00%	25.00%	$17,500.00
ELEC SERVICE	0.00%	0.00%	$0.00	100.00%	100.00%	$109,000.00
GENSET	0.00%	19.72%	$0.00	5.28%	25.00%	$4,187.04
SHIPPING	13.03%	20.00%	$65,410.60	5.00%	25.00%	$25,100.00
INSTALLATION	0.00%	0.00%	$0.00	0.00%	0.00%	$0.00
P MGMT	17.00%	20.00%	$69,224.00	15.00%	35.00%	$61,080.00
TRAIN/COMN	0.00%	0.00%	$0.00	5.00%	5.00%	$7,500.00
PROJECT MANAGEMENT ADDER (EXPENSES ONLY)			$0.00			$3,500.00
		CLAIM #1	$388,241.60		CLAIM #2	$818,567.04
					PAGE TOTAL	$1,206,808.64

SERVICE CONTRACT #4 -- SITE IMPROVEMENTS
ALL DOLLAR VALUES DO NOT INCLUDE GST

PROGRESS CLAIM #3

	PERCENT THIS CLAIM	TOTAL TO DATE	AMOUNT THIS CLAIM
	AUG 99	AUG 99	AUG 99
DESIGN	15.00%	100.00%	$118,500.00
ZENON	0.00%	65.00%	$0.00
FOURNIER	0.00%	35.00%	$0.00
HEADWORKS	0.00%	30.00%	$0.00
TANKS	20.00%	40.00%	$170,000.00
BUILDING	15.00%	40.00%	$195,000.00
RECEIVE STN	5.00%	30.00%	$3,125.00
SEWER LINE L/S	25.00%	45.00%	$94,250.00
OUTFALL	20.00%	45.00%	$14,000.00
ELEC SERVICE	0.00%	100.00%	$0.00
GENSET	0.00%	25.00%	$0.00
SHIPPING	10.00%	35.00%	$50,200.00
INSTALLATION	0.00%	0.00%	$0.00
P MGMT	5.00%	40.00%	$20,360.00
TRAIN/COMN	0.00%	5.00%	$0.00
PROJECT MANAGEMENT ADDER (EXPENSES ONLY)			$3,500.00
		CLAIM #3	$668,935.00
		S.C #4	$1,875,743.64

SERVICE CONTRACT #5 -- BUILDING AND APRON
ALL DOLLAR VALUES DO NOT INCLUDE GST

PROGRESS CLAIM

	PERCENT THIS CLAIM	TOTAL TO DATE	AMOUNT THIS CLAIM
	SEPT 99	SEPT 99	SEPT 99
DESIGN	0.00%	100.00%	$0.00
ZENON	0.00%	65.00%	$0.00
FOURNIER	0.00%	35.00%	$0.00
HEADWORKS	0.00%	30.00%	$0.00
TANKS	30.00%	70.00%	$255,000.00
BUILDING	30.00%	70.00%	$390,000.00
RECEIVE STN	0.00%	30.00%	$0.00
SEWER LINE L/S	20.00%	65.00%	$75,400.00
OUTFALL	20.00%	65.00%	$14,000.00
ELEC SERVICE	0.00%	100.00%	$0.00
GENSET	0.00%	25.00%	$0.00
SHIPPING	15.00%	50.00%	$75,300.00
INSTALLATION	0.00%	0.00%	$0.00
P MGMT	15.00%	55.00%	$61,080.00
TRAIN/COMN	0.00%	5.00%	$0.00
PROJECT MANAGEMENT ADDER (EXPENSES ONLY)			$7,500.00
		S.C.#5	$878,280.00
		S.C. #4+#5	$2,754,023.64

AFTER SERVICE CONTRACT #5 -- PROJECT COMPLETION
ALL DOLLAR VALUES DO NOT INCLUDE GST

PROGRESS CLAIM

OCTOBER 1999

	PERCENT THIS CLAI ~~Jun 00~~	TOTAL TO DATE ~~Jun 00~~	AMOUNT THIS CLAIM ~~Jun 00~~
DESIGN	0.00%	100.00%	$0.00
ZENON	30.00%	95.00%	$465,000.00
FOURNIER	20.00%	55.00%	$60,000.00
HEADWORKS	25.00%	55.00%	$20,000.00
TANKS	15.00%	85.00%	$127,500.00
BUILDING	15.00%	85.00%	$195,000.00
RECEIVE STN	25.00%	55.00%	$15,625.00
SEWER LINE L/S	20.00%	85.00%	$75,400.00
OUTFALL	20.00%	85.00%	$14,000.00
ELEC SERVICE	0.00%	100.00%	$0.00
GENSET	30.00%	55.00%	$23,790.00
SHIPPING	15.00%	65.00%	$75,300.00
INSTALLATION	50.00%	50.00%	$211,500.00
P MGMT	30.00%	85.00%	$122,160.00
TRAIN/COMN	50.00%	55.00%	$75,000.00
PROJECT MANAGEMENT ADDER (EXPENSES ONLY)			$17,500.00
			$1,497,775.00
PROJECT PROGRESS			$5,864,360.00

AFTER SERVICE CONTRACT #5 -- PROJECT COMPLETION
ALL DOLLAR VALUES DO NOT INCLUDE GST

PROGRESS CLAIM

	PERCENT THIS CLAI ~~Jul 00~~ November	TOTAL TO DATE ~~Jul 00~~	AMOUNT THIS CLAIM ~~Jul 00~~ 1999
DESIGN	0.00%	100.00%	$0.00
ZENON	0.00%	95.00%	$0.00
FOURNIER	45.00%	100.00%	$135,000.00
HEADWORKS	45.00%	100.00%	$36,000.00
TANKS	15.00%	100.00%	$127,500.00
BUILDING	15.00%	100.00%	$195,000.00
RECEIVE STN	45.00%	100.00%	$28,125.00
SEWER LINE L/S	15.00%	100.00%	$56,550.00
OUTFALL	15.00%	100.00%	$10,500.00
ELEC SERVICE	0.00%	100.00%	$0.00
GENSET	45.00%	100.00%	$35,685.00
SHIPPING	25.00%	90.00%	$125,500.00
INSTALLATION	35.00%	85.00%	$148,050.00
P MGMT	0.00%	85.00%	$0.00
TRAIN/COMN	30.00%	85.00%	$45,000.00
PROJECT MANAGEMENT ADDER (EXPENSES ONLY)			$6,000.00
			$948,910.00
PROJECT PROGRESS			$6,813,270.00

AFTER SERVICE CONTRACT #5 -- PROJECT COMPLETION
ALL DOLLAR VALUES DO NOT INCLUDE GST

PROGRESS CLAIM

December 1999

	PERCENT THIS CLAI ~~Aug 00~~	TOTAL TO DATE ~~Aug 00~~	AMOUNT THIS CLAIM ~~Aug 00~~
DESIGN	0.00%	100.00%	$0.00
ZENON	5.00%	100.00%	$77,500.00
FOURNIER	0.00%	100.00%	$0.00
HEADWORKS	0.00%	100.00%	$0.00
TANKS	0.00%	100.00%	$0.00
BUILDING	0.00%	100.00%	$0.00
RECEIVE STN	0.00%	100.00%	$0.00
SEWER LINE L/S	0.00%	100.00%	$0.00
OUTFALL	0.00%	100.00%	$0.00
ELEC SERVICE	0.00%	100.00%	$0.00
GENSET	0.00%	100.00%	$0.00
SHIPPING	10.00%	100.00%	$50,200.00
INSTALLATION	15.00%	100.00%	$63,450.00
P MGMT	15.00%	100.00%	$61,080.00
TRAIN/COMN	15.00%	100.00%	$22,500.00
PROJECT MANAGEMENT ADDER (EXPENSES ONLY)			$0.00
			$274,730.00
PROJECT PROGRESS			$7,088,000.00

ANNEX E

ESTIMATED OPERATIONS & MAINTENANCE COST SUMMARY

ESTIMATED OPERATIONS AND MAINTENANCE COST SUMMARY The following costs will be borne by Owner following Substantial Completion + 45 days		
• System Man-hours	60.8 hours/month, Utilidor Crew	1.4 persons per
• Biosolids Man-hours	130 hours/ month, Utilidor Crew	year from current
• Trucking Man-hours	31.2 hours/month, Road Crew	municipal crew
• Electrical Power	35,000 kW hours/month	9,562.00
• Chlorine (Bromine)		7,901.00
• Pellets		2,345.00
• Polymer		2,134.00
• Caustic		1,995.00
• Acid		1,312.00
• Fuel		1,820.00
• Contingency		0.00
• CWC Fee, Site Inspections and Operator Interviews by CWC Staff		5,621.00
• ZENON Fee, Extended 60 Month Membrane Warranty		2,500.00
• Sinking Fund for Equipment and Membranes		4,117.00
Estimated Operations & Maintenance Expenditures Per Month		**$39,307.00**

CWC
CANADIAN WASTEWATER CORPORATION

January 29, 1999

File: 61000-45 Iqaluit

Rock Burton
Director of Public Works
Municipality of Iqaluit
P.O. Box 460
Iqaluit, NT
X0A 0H0

Dear Sir,

Canadian Wastewater Corporation (CWC) is a wastewater treatment utility company that provides operations, maintenance, technical support and management services for owners of "Water Reclamation Facilities" that Hill Murray has designed and built.

Canadian Wastewater Corporation is pleased to offer our services in the area of Operations and Maintenance Management for The Iqaluit Water Reclamation Facility.

CWC has designed and built a computer-based data collection, reduction and analysis tool that combines remote control and data transfer protocols. This system, known as SMART (System Management and Remote Telemetry), complements the PLC ladder logic allowing on-site staff to focus on priority maintenance issues, rather than rudimentary data collection.

The SMART system is designed to offer the plant operators easier access to the information required to efficiently operate your facility. This interface will let the operators operate the plant through a sophisticated control console that runs in real time and has the ability to operate all systems and log all pertinent data for tracking and reporting plant operation.

The SMART system provides the basis for an efficient operations management plan, combining process control, process monitoring, maintenance management and remote control. This system allows on-site staff to be an order of magnitude more efficient in their day to day operations.

The staff at the Municipality of Iqaluit will be able to take comfort that CWC engineers and technicians will constantly upgrade and improve the SMART system programs and services, and tailor the SMART system to their needs.

As well as providing the SMART services as described, CWC technicians will be on site every third month to assist in the operation of your facility. This includes maintaining and managing the PLC

.../2

Suite 202 • 780 Tolmie Avenue • Victoria • British Columbia • Canada • V8X 3W4
Business: 250-388-3930 • Facsimile: 250-388-3943 • Email: hma@islandnet.com

JAN 29 1999

logic as required and requested by the operators, giving technical training and advice on your state-of-the-art wastewater treatment process, as well as providing 24 hour a day monitoring of the plant.

Specifically, CWC offers the following services:

The SMART system will continuously monitor the plant operation. Through a remote interface, CWC technicians will review the previous 24 hours of operational data to confirm proper operation of the lift station, the headworks equipment and membrane systems. All pertinent data and alarms from the previous 24 hours will be analyzed and diagnosed. Any concern or immediate action that is required will be discussed with the municipality's operators. Process monitoring by experienced CWC personnel will provide detailed derivative information necessary to properly assess performance of the membrane-bioreactor. CWC's operators and engineers will determine trends in performance, offer immediate guidance and prevent small issues from becoming larger problems.

Monday to Friday, during regular CWC business hours, engineers and process technicians staff a trouble desk and are available to answer inquiries from Operators on the operation of the biological process, control system interpretation and plant sequencing, as well as maintenance and operational issues. This service allows access to technical support and detailed process and operations expertise.

As an extension of the Trouble Desk, an emergency response service is operated seven days a week, 24 hours a day. A CWC technician will be available by pager. This pager number will be activated by the "Emergency Response" automatic call-out feature in our on-site SMART system computer. A CWC technician will respond immediately to any call-out and will connect "on-line" to diagnose the alarm condition. This technician will coordinate, by telephone, any immediate action required by the Municipality of Iqaluit operators. If necessary, a CWC technician will be dispatched to the site. This service is intended to provide emergency response to major equipment failures or system malfunction. This extension of the Trouble Desk hours, covers after hours and weekends and will allow CWC to receive all alarm calls and to evaluate the need for operator response. Since on-line evaluation is immediate, any failed equipment can be isolated remotely, avoiding machinery damage and /or discharge violations. This on-line evaluation may avoid costly call-outs or machinery damage.

Please note that emergency call-outs, by CWC technicians, are not covered by this offer and would be billable as an extra charge to the municipality. Please refer to the "CWC Schedule of Rates" for these charges.

CWC technicians will perform scheduled downloading of specific data (including rounds-sheet data) into a predictive filter management program. Performance of all membrane system components will be analyzed along with the system's biological parameters and corresponding analytical laboratory data. These include, but are not limited to the following:

- Influent characteristic analysis,
- influent flow analysis,
- inflow/infiltration analysis,

JAN 29 1999

- drum screen performance analysis,
- dissolved Oxygen, pH, temperature analysis,
- MLSS, BOD, TSS, FC results compilation and analysis,
- toxicity nitrification & de-nitrification analysis,
- membrane aeration/backwash analysis,
- membrane flux analysis,
- membrane flux normalized against TMP analysis, and
- membrane flux trend analysis - soaking regime management,

To increase efficiency and extended membrane life, data will be recorded by sensing equipment throughout the plant and by operators doing daily rounds. Operational data is to include influent, effluent and mixed liquor samples. This data will be reduced for assessment for appropriate operational action.

Through the SMART system, Operations Management will be able to provide summarized reports that will provide guidance for operators as well as the basis for reports to DIAND and the Nunavut Water Board. Data reduced and analyzed by CWC staff will be forwarded to the operators. Operators will be afforded more time to perform necessary plant operations and maintenance.

The SMART system database records running hours for specific pumps and machinery. This data can be used for operational analysis, for the determination of production rates, and the general health of the process for Maintenance Management. This data, moreover, can be used to help plan maintenance activities for rotating machinery, sensors and actuators. Inspection routines for valves, motors, piping and membranes can be generated based on manufacturers recommended routines and SMART system historical data. Manufacturers specifications for planned maintenance routines including greasing, oil changes, alignment checks, run-down timing, inspections, calibration, and testing are fed into the expert system. SMART system historical data is downloaded to the Maintenance Management module, generating the necessary work orders and requirements for replacement of required on-site spares. Proper preventative maintenance and record keeping will greatly reduce the risk of machinery failure and will reduce the likelihood of a manufacturer rejecting a warranty claim. CWC will help to provide the data for Municipality of Iqaluit staff to manage all planned maintenance.

To ensure maximum membrane life, CWC will assess membrane condition, sludge blinding, aerator efficiency and overall performance. Operational parameters, external to the membranes themselves, will be assessed as to effect on membrane performance. Factory authorized CWC personnel will determine the cause of unexpected performance degradation and provide recommendations to help reduce their effects. The proper handling, cleaning, and storage of the membranes will have a direct impact on their performance and subsequent life. In order to achieve optimum performance, membranes will be subjected to comprehensive inspection services. CWC will compare performance of the Iqaluit plant against similar facilities, allowing the determination of global trends in membrane performance. Experience in dealing with membrane-bioreactor technology and trouble shooting are essential in performing this function.

CWC will provide and maintain software for the detailed reviews of all maintenance routines, costed in man-hours, to the Municipality. The Municipality of Iqaluit staff will be responsible for

JAN 29 1999

inputting data and generating work orders for the continued maintenance of the Municipality of Iqaluit O&M budget This data may be used to help reduce the costs associated with the operations and maintenance of the Iqaluit Water Reclamation Facility.

The Nunavut Water Board discharge permit requires that an operations plan and an emergency plan be developed. Data collected and logged in CWC software will help the Municipality of Iqaluit make this procedure more accurate, less time consuming, and easier to maintain.

CWC will dedicate operator and engineer time to help Municipality of Iqaluit operators to keep current in their operators certification, if applicable. This will include on-going instruction in advanced membrane technology designed to provide technical knowledge, and hands-on guidance and tutorial workshops.

CWC is pleased to offer our technical services, as described above, including hardware, software and software upgrades in the CWC SMART System Suite, for the fee of $5,621.00 per month (GST out)

At the substantial completion following the commissioning of your facility, the plant will be ready to go into steady state operation. We recommend that you review the training and commissioning services provided by Hill-Murray within the design-build project along with this offer for on-going services from CWC. We recommend that you engage our services immediately so that hardware and software development can begin. The monthly fee will not start until the certificate of substantial completion is issued by Hill-Murray.

Thank you.

Sincerely,

CANADIAN WASTEWATER CORPORATION

Lorne Cowley
General Manager

Terms: Net 30 days from invoice date . Interest of 2% per month (26.8% per annum) on overdue accounts. E & OE

ldc/Attachment

JAN 29 1999

CANADIAN WASTEWATER CORPORATION

CWC Schedule of Rates

Canadian Wastewater Corporation is pleased to offer The Municipality of Iqaluit, our services at the following rates:

PERSONNEL CHARGES (beyond quoted services):

Engineering / Management $ 125.00/hr
Operations Superintendent $ 95.00/hr.
Technician $ 85.00/hr.

Emergency Trips will be billed at $9,850.00 per trip plus $979.00 per day for time on site beyond the trip allowance of three days

REIMBURSABLE EXPENSES:

All Materials, shipping, laboratory testing and sub-contracted work will be invoiced at our cost plus 20% (gross profit margin).

Quoted prices do not include applicable taxes. All invoices are due upon receipt. 2% per month, 26.8%/year will be charged on overdue invoice.

I:\CWC\Operating Plants\Iqaluit\61000-45\Iqaluit schedule of Rates Aug98.wpd

JAN 29 1999

ANNEX F

OWNER'S STATEMENT OF REQUIREMENTS

- Third Party Review at the Owner's Expense of:
  - Progress Payments
  - Substantial Completion
  - Final Completion

- No Extra Membrane Cleaning Due To Fouling, Maximum of 20 Man Hours/Month

- Proper Performance of Headworks "Trash Removal" Equipment in Accordance with The WEF Manual of Practice No. 8

Governing Guidelines and Specifications:

- Nunavut Water Board Letter (see Annex I)

- All Work in Compliance With the GN Contribution Agreements

- Municipal Capital Standards and Criteria referring to:
  - Fire Protection
  - Granular & Borrow Materials
  - Legal Surveys/Control Surveys
  - Site Development
  - Solid Waste Management Facilities
  - Water and Sewage Facilities

- Airport Manager ASPR Chapter 4 (see Annex H)

- National Building Code

- Design Flow: 1,800 m^3/d

- Influent Strength: BOD $\leq$ 500 mg./L
  TSS $\leq$ 500 mg/L
  Alkalinity $\geq$ 100 mg/L
  Temperature $\geq$ 10° C

- Effluent Parameters: BOD $\leq$ 10 mg/L
  TSS $\leq$ 10 mg/L
  FC $\leq$ 1,000 mg/L

- Treatment Plant Expandable to 3,500 m^3/d With Addition of Tankage, Equipment, and Extension of Building

- Building: Roof RSI $\geq$ 5.0 (R28)
  Walls RSI $\geq$ 3.5 (R20)

- Operator Training, four People

ANNEX F (Continued)

- Commissioning and Start-up Services Until Plant is at "Substantial Completion"
- Operations and Maintenance Management Services (on a fee for service basis for six months after substantial completion)
- Performance Monitoring Services (on a fee for service basis for six months after substantial completion)
- EnviroSMART Software Support Services (on a fee for service basis for six months after substantial completion)

ANNEX G

LETTER OF INTENT
SERVICE CONTRACT #1512
SERVICE CONTRACT #991527
SERVICE CONTRACT #991547
SERVICE CONTRACT #991559
SERVICE CONTRACT #991550

MUNICIPALITY OF IQALUIT

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July 15, 1998

Hill Murray and Associates
Suite 202, 780 Tolmie Ave.
Victoria, BC
V8X 3W4

Dear Sir;

Re: Sewage Treatment Proposals

This letter is to inform you that the Municipal Review Committee and the Municipal Council has completed it's review and final selection of the proponents for the design and construction of the sewage treatment plant for the Municipality of Iqaluit.

Please consider this your official notification that your submission has been accepted by the Municipality of Iqaluit. The Municipal Review Committee and the Municipal Council thank you for your submission, you will be contacted shortly to begin contract negotiations.

Again congratulations and we look forward to working with you and your staff on this project.

Sincerely;

Denis Bedard, P. Eng.
Director, Engineering and Planning

JUL 19 1998

P.O. BOX 460 • IQALUIT, N.W.T. X0A 0H0 • TEL: (867) 979-5600 • FAX: (867) 979-5922
ᑎᑎᖅᑲᐃᑦ 460 • ᐃᖃᓗᐃᑦ, ᓄᓇᕗᑦ X0A 0H0 • ᑲᖏᒃᑲᑦ (867) 979-5600 • ᓯᒪᔪᖅᑐᓕ (867) 979-5922

MUNICIPALITY OF IQALUIT
SERVICE CONTRACT

CONTRACT NO.
SC-1512

CONTRACTOR:

Hill Murray & Assoc.
780 Tolmie Ave.
Victoria, B.C.

GENERAL DESCRIPTION:

Design of sewage treatment Bldg.

LOCATION:

DETAILS OF TERMS OF CONTRACT	UNIT PRICE	TOTAL
Design of sewage treatment Bldg Force Main lift station electronic controls mechanical controls Purchase of cement Shipping of form work		$634,540.0
G.S.T.		$44,417.80
	TOTAL:	$678,957.8

THIS CONTRACT SHALL:

COMMENCE ON THE _____ OF _____ ,19____

TERMINATE ON THE _____ OF _____ ,19____

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED $ _____

I/WE AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE WORK OR SERVICES AS STIPULATED ON THE COVENANTS AND AGREEMENT CONTAINED ABOVE AND ON THE REVERSE SIDE HEREOF.

CODING	AMOUNT
02-00-00-4130	$634,549.00
	$44,417.80
FUNDS COMMITTED TOTAL	$678,957.80

DATE _____ INITIALS _____

Sept 09, 98 — DATE — SIGNATURE OF CONTRACTOR

SEPT. 9/98 — DATE — SIGNATURE OF WITNESS

Sept 9/98 — DATE — SIGNATURE OF DIRECTOR

ACCEPTED ON BEHALF OF THE MUNICIPALITY OF IQALUIT

THIS 10 DAY OF SEPT ,19 98

SIGNATURE OF TOWN MANAGER

SEP 10 1999

INVOICING: CONTRACTOR TO SUBMIT INVOICES TO:

MUNICIPALITY OF IQALUIT
P.O. BOX 460
IQALUIT, N.W.T. X0A 0H0
TEL (819) 979-5381
FAX (819) 979-5910

MUNICIPALITY OF IQALUIT
SERVICE CONTRACT

P.O. BOX 460, IQALUIT, N.W.T. X0A 0H0
TEL: (867) 979-5600 FAX: (867) 979-5922

SERVICE CONTRACT

991527

THIS NUMBER MUST APPEAR ON ALL INVOICES AND CORRESPONDENCE

RACTOR

Hill Murray & Associates
780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

MUNICIPALITY OF IQALUIT

DATE	COMMENCE ON		
18, 1999	ASAP		
TERMINATE ON	ACCOUNT NUMBER/CODING		TERMS
00-00-4130	CHEAPEST WAY		0/10

DETAILS OF TERMS OF CONTRACT	UNIT PRICE	TOTAL
1. Sewage Treatment Plant / Progress Claim # 3 As Per Attaached	228,105.10 EACH	228,105.10
SUBTOTAL		228,105.10
GST		15,967.36
TOTAL		244,072.46

I/WE AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE WORK OR SERVICES STIPULATED ON THE CONVENANTS AND AGREEMENTS CONTAINED ABOVE AND ON THE REVERSE SIDE HEREOF.
CONTRACTOR TO SUBMIT INVOICES TO ADDRESS SHOWN AT TOP

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED
BLANKET ORDER EXPIRES ON MAR 31, 1999
ORDER NOT TO EXCEED $244,072.56

Jan 19/99
DATE — SIGNATURE OF CONTRACTOR

ACCEPTED ON BEHALF OF THE MUNICIPALITY OF IQALUIT

THIS 18 DAY OF Jan 99.

DATE — SIGNATURE OF WITNESS

Jan 18/99
DATE — SIGNATURE OF DIRECTOR

SIGNATURE OF TOWN MANAGER

WHITE-CONTRACTOR YELLOW-PURCHASING PINK-ACCOUNTS PAYABLE GREEN-DEPARTMENT

JAN 19 1999

MUNICIPALITY OF IQALUIT
SERVICE CONTRACT

P.O. BOX 460, IQALUIT, N.W.T. X0A 0H0
TEL: (867) 979-5600 FAX: (867) 979-5922

SERVICE CONTRACT

991547
THIS NUMBER MUST APPEAR ON ALL INVOICES AND CORRESPONDENCE

RACTOR

Hill Murray & Associates
780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

MUNICIPALITY OF IQALUIT

DATE	COMMENCE ON		
MAR 19, 1999	ASAP		

TERMINATE ON	ACCOUNT NUMBER/CODING	TERMS
02-00-00-4130	CHEAPEST WAY	0/10

DETAILS OF TERMS OF CONTRACT	UNIT PRICE	TOTAL
1. Increase sewage treatment capacity / Produce detailed design	750,000.00 EACH	750,000.
1. Produce tender documents / Purchase construction materials	EACH	
SEE ATTACHED SUMMARY		
SUBTOTAL		750,000.
GST		52,500.
TOTAL		802,500.

I/WE AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE WORK OR SERVICES STIPULATED ON THE CONVENANTS AND AGREEMENTS CONTAINED ABOVE AND ON THE REVERSE SIDE HEREOF.
CONTRACTOR TO SUBMIT INVOICES TO ADDRESS SHOWN AT TOP.

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED

BLANKET ORDER EXPIRES ON MAR 31, 1999
ORDER NOT TO EXCEED $802,500.00

Mar 19, 99 — DATE — SIGNATURE OF CONTRACTOR

MAR. 19/99 — DATE — SIGNATURE OF WITNESS

MAR 19/99 — DATE — SIGNATURE OF DIRECTOR

ACCEPTED ON BEHALF OF THE MUNICIPALITY OF IQALUIT

THIS _____ DAY OF _____

MAYOR — SIGNATURE OF TOWN MANAGER

WHITE-CONTRACTOR YELLOW-PURCHASING PINK-ACCOUNTS PAYABLE GREEN-DEPARTMENT

MUNICIPALITY OF IQALUIT
SERVICE CONTRACT

P.O. BOX 460, IQALUIT, NW.T. X0A 0H0
TEL: (867) 979 5600 FAX: (867) 979-5922

SERVICE CONTRACT
991559
THIS NUMBER MUST APPEAR ON ALL INVOICES AND CORRESPONDENCE

CONTRACTOR

Hill Murray & Associates
780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

MUNICIPALITY OF IQALUIT

DATE	COMMENCE ON		
JUN 12, 1999	ASAP		
TERMINATE ON	ACCOUNT NUMBER/CODING		TERMS
02-00-00-4130	CHURCHEST WAY		0/10

	DETAILS OF TERMS OF CONTRACT	UNIT PRICE	TOTAL
01	1. Building & Apron as per attached /	878,200.00 EACH	878,200.00
	SUBTOTAL		878,200.00
	GST		61,479.60
	TOTAL		939,759.60

I/WE AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE WORK OR SERVICES STIPULATED ON THE CONVENANTS AND AGREEMENTS CONTAINED ABOVE AND ON THE REVERSE SIDE HEREOF.
CONTRACTOR TO SUBMIT INVOICES TO ADDRESS SHOWN AT TOP.

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED
BLANKET ORDER EXPIRES ON SEP 30, 1999
ORDER NOT TO EXCEED $939,759.60

DATE _____ SIGNATURE OF WITNESS _____ THIS 12 DAY OF July

DATE July 12/99 SIGNATURE OF DIRECTOR _____ SIGNATURE OF TOWN MANAGER _____

WHITE-CONTRACTOR YELLOW-PURCHASING PINK-ACCOUNTS PAYABLE GREEN-DEPARTMENT

JUL 13 99 TUE 13:05

MUNICIPALITY OF IQALUIT
SERVICE CONTRACT

P.O. BOX 460, IQALUIT, N.W.T. X0A 0H0
TEL: (867) 979-5600 FAX: (867) 979-5972

SERVICE CONTRACT

991550

THIS NUMBER MUST APPEAR ON ALL INVOICES AND CORRESPONDENCE

CONTRACTOR

Hill Murray & Associates
780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

MUNICIPALITY OF IQALUIT

DATE	DESCRIPTION
JUL. 12, 1999	ASAP

TERMINATE ON	ACCOUNT NUMBER/CODING	TERMS
02-00-00-4130	CHEAPEST WAY	0/10

	DETAILS OF TERMS OF CONTRACT	UNIT PRICE	TOTAL
01	1. Site Improvements as per attached /	1,875,743.64 EACH	1,875,743.64
	SUBTOTAL		1,875,743.64
	GST		131,302.05
	TOTAL		2,007,045.69

I/WE AGREE TO SUPPLY THE EQUIPMENT AND/OR PERFORM THE WORK OR SERVICES STIPULATED ON THE CONVENANTS AND AGREEMENTS CONTAINED ABOVE AND ON THE REVERSE SIDE HEREOF
CONTRACTOR TO SUBMIT INVOICES TO ADDRESS SHOWN AT TOP.

THE MAXIMUM AMOUNT PAYABLE UNDER THIS CONTRACT SHALL NOT EXCEED
BLANKET ORDER EXPIRES ON SEP 30, 1999
ORDER NOT TO EXCEED $2,007,045.69

DATE | SIGNATURE OF CONTRACTOR

DATE | SIGNATURE OF WITNESS

DATE July 12/99 | SIGNATURE OF DIRECTOR

ACCEPTED ON BEHALF OF THE MUNICIPALITY OF IQALUIT
THIS 12 DAY OF July

SIGNATURE OF TOWN MANAGER

WHITE-CONTRACTOR YELLOW-PURCHASING PINK-ACCOUNTS PAYABLE GREEN-DEPARTMENT

ANNEX H

AERODROME STANDARDS AND RECOMMENDED PRACTICES
CHAPTER 4 – OBSTACLE RESTRICTION AND REMOVAL

July 22, 1999

CHAPTER 4.
OBSTACLE RESTRICTION AND REMOVAL

Introductory Note.— The objectives of the specifications in this chapter are;

a) to define the airspace around aerodromes to be maintained free from obstacles in order to minimize the dangers presented by obstacles to an aircraft, either during an entirely visual approach or during the visual segment of an instrument approach; and

b) to prevent the aerodrome from becoming unusable by the growth of obstacles around the aerodrome.

These objectives are achieved by establishing a series of obstacle limitation surfaces that define the limits to which objects may project into the airspace.

4.1 OBSTACLE LIMITATION SURFACES

Note 1.— Obstacle limitation surfaces normally extend beyond the boundary of the aerodrome Such surfaces can be protected by the enactment of Registered Zoning Regulations in accordance with the Aeronautics Act. Enactment of such a regulation will prohibit the erection of any new structure which would violate any of the defined surfaces.

Note 2.— Objects which project into the obstacle limitation surfaces may in certain circumstances cause an increase in the obstacle clearance altitude/height for an instrument approach procedure or any associated visual circling procedure. Criteria for evaluating obstacles are contained in, Criteria for the Development of Instrument Procedures, TP 308. TP 308 also provides further information on the distinction between obstacle limitation surfaces and obstacle clearance surfaces.

Note 3.— The establishment of, and requirements for, an obstacle protection surface for visual approach slope indicator systems are specified in 5.3.6.23 to 5.3.6.27.

4.1.1 OUTER SURFACE

Characteristics

4.1.1.1 Standard.— The limits of an Outer Surface shall comprise a common plane established at a constant elevation above the assigned elevation of the aerodrome reference point and extending over a horizontal distance:

- of at least 4000 m where the code number is 1, 2 or 3;
- to be determined by an aeronautical study where the code number is 4, but never less than 4000 m;

measured from the designated aerodrome reference point or points and extending over an area not less than 180° sector along the runway centre line

4.1.1.2 Recommendation.— An outer surface should extend horizontally 360° about the aerodrome.

4.1.1.3 Standard.— An outer surface shall be established at 45 m above the assigned elevation of the aerodrome reference point except, when the common plane is less than 9 m above the ground, an imaginary surface shall be established 9 m above the surface of the ground. (see Figure 4-1)

Note.— The imaginary surface at 9 m is intended to allow for an isolated topographical obstruction.

4.1.2 TAKE-OFF/ APPROACH SURFACE

Characteristics

4.1.2.1 Standard.— The limits of the take-off/approach surface shall comprise:

a) an inner edge of specified length perpendicular to and evenly divided on each

side of the extended centre line of the runway, beginning at the end of the runway strip;

b) two sides originating at the ends of the inner edge, diverging uniformly at a specified rate in the direction of take–off, terminating at the outer edge; and

c) an outer edge parallel to the inner edge at a specified length from the inner edge.

Note.— The width of the take–off/approach surface at any point can be found by summing the products of the length (ie. distance from inner edge) and the divergence (either side) with the length of the inner edge.

4.1.2.2 Standard.— Where a threshold has been displaced, the inner edge shall be located at the point of displacement. In this event the landing distance available will be reduced by an amount equal to the displacement and it will be necessary to recalculate the declared distance information for the aerodrome.

Note.— See 2.3.2 on calculation of declared distances.

4.1.2.3 Standard.— The elevation of the inner edge shall be equal to the elevation of the threshold.

Note.— Because of transverse slopes on a strip, in certain cases portions of the inner edge of the take–off/approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform to the inner edge.

4.1.2.4 Recommendation.— Where practicable, the inner edge should be located at a position that will allow the take–off/approach surface to clear the airport boundary by at least 9 m vertically.

4.1.2.5 Standard.— The slope(s) of the take–off/approach surface shall be measured in the vertical plane containing the centre line of the runway, and shall be of a constant gradient.

4.1.2.6 Standard.— The widths and lengths of the take–off/approach surfaces shall be measured in the horizontal plane.

4.1.3 TRANSITIONAL SURFACE

Characteristics

4.1.3.1 Standard.— The limits of the transitional surface shall comprise:

(a) a lower edge beginning at the intersection of the side of the approach surface with the outer surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the edge of the strip; and

(b) an upper edge located in the plane of the outer surface or 45 m above airport assigned elevation if no outer surface has been established.

Note.— A transitional surface is a combination of three planar surfaces. The first is a trapezoidal surface that rises from the edge of the runway strip at the specified slope till reaches the upper edge. Joining this surface on either end are triangular surfaces that are completed by the lower edge along the take–off/approach surface and the upper edge (see Figure 4–1).

4.1.3.2 Standard.— The elevation of a point on the lower edge shall be:

(a) along the side of the take–off/approach surface prescribed in this chapter; equal to the elevation of the take–off/approach surface at that point; and,

(b) along the runway strip; equal to the elevation of the nearest point on the centre line of the runway or its extension, to the edge of the graded area.

4.1.3.3 Recommendation.— The slopes of any portion of the strip beyond the graded area should not exceed an upward slope of 5% as measured from the edge of the graded area perpendicular to the runway. This upward slope will extend to intersect with the transitional surface.

4.1.3.4 Standard.— The slope of a transitional surface shall be measured in a vertical plane perpendicular to the extended centre line of each runway.

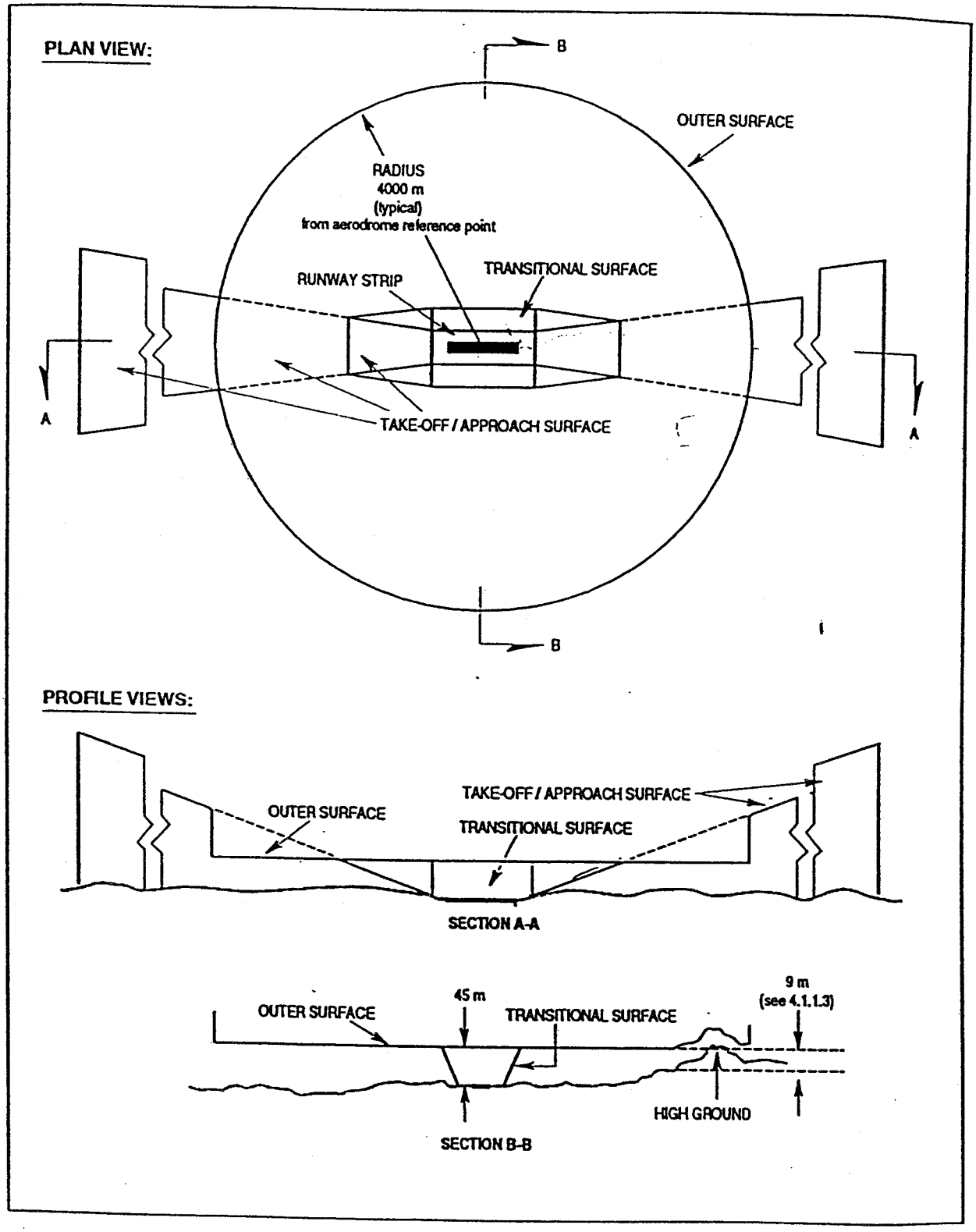

Figure 4-1. Obstacle Limitation Surfaces

4.2 OBSTACLE LIMITATION REQUIREMENTS

Note. 1.— The requirements for obstacle limitation surfaces are specified on the basis of the intended use of a runway, i.e. type of approach and take–off or landing, and are intended to be applied when such use is made of the runway.

Note 2.— A runway is categorized by the following types of approach:

- *non–instrument,*
- *non–precision,*
- *precision.*

4.2.1 GENERAL

4.2.1.1 Standard.— An outer surface shall be established where required for the protection of airspace for aircraft conducting a circling procedure or manoeuvring in the vicinity of an aerodrome.

4.2.2 NON–INSTRUMENT RUNWAYS

4.2.2.1 Standard.— The following obstacle limitation surfaces shall be established for all non–instrument runways:

- take–off/approach surfaces; and
- transitional surfaces, except as specified in 4.2.2.4 (c).

4.2.2.2 Standard.— An outer surface shall be established for a runway which does not have an straight–in instrument approach but where there is a published circling approach procedure to that runway or where it is necessary, in the view of the certifying authority, to protect airspace for aircraft manoeuvring in the vicinity of the airport.

4.2.2.3 Standard.— The heights of these surfaces shall not be greater than, and their other dimensions not less than, those specified in Table 4–1, except in the case of the outer surface.

Note.— It may not be necessary to protect the airspace from obstacles in all sectors of the outer surface at certain airports. In these cases, it is possible to establish an outer surface with non–uniform dimensions, provided procedures are established to ensure that aircraft do not fly in these sectors.

4.2.2.4 Standard.— The slope of the transitional surface where the code number is 1 or 2 shall not exceed the appropriate value shown in Table 4-1 except where:

a) the slope cannot be established due to topographic or unavoidable natural obstructions;

b) the aerodrome is used only in VMC; and

c) one of the following measures is undertaken and approved by the certifying authority:

   i) the width of the runway strip is increased to at least 45 m from the centre line of the runway and a transitional surface is established with a slope not exceeding 33% (1:3); or

   ii) the width of the runway strip is increased to at least 60 m from the centre line of the runway where the code number is 2 and a transitional surface is established with a slope not exceeding 50% (1:2); or

   iii) the width of the runway strip is increased to at least:

      - 60 m from the centre line of the runway where the code number is 1;
      - 75 m from the centre line of the runway where the code number is 2.

4.2.2.5 Standard.— The slope of the transitional surface where the code number is 3 or 4 shall not exceed the appropriate value shown in Table 4-1.

4.2.2.6 Standard.— New objects or extensions of existing objects shall not be permitted above a take–off/approach or transitional surface except when, in the opinion of the certifying authority, the new object or extension would be shielded by an existing immovable object.

MAR 31 1999

Note.— Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual, Part 6.

4.2.2.7 Recommendation.— New objects or extensions of existing objects should not be permitted above the outer surface except when, in the opinion of the certifying authority, the object would be shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aircraft.

4.2.2.8 Recommendation.— In considering proposed construction, account should be taken of the possible future development of an instrument runway and consequent requirement for more stringent obstacle limitation surfaces.

4.2.3 NON-PRECISION APPROACH RUNWAYS

Note.— See 8.6 for information regarding siting and construction of equipment and installations on operational areas.

4.2.3.1 Standard.— The following obstacle limitation surfaces shall be established for a non-precision approach runway:

- outer surface;
- take-off/approach surface; and
- transitional surfaces.

4.2.3.2 Standard.— The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table 4-1.

Table 4-1. Dimensions and Slopes of Obstacle Limitation Surfaces

SURFACE and DIMENSIONS	RUNWAY TYPE / CODE NUMBER								
	Non-instrument				Non-precision approach			Precision approach Cat I	
	(1)				(2)			(3)	
	Code number				Code number			Code number	
	1	2	3	4	1&2	3	4	1&2	3&4
OUTER SURFACE									
- Height	45m	45m	45m	45m	45m	45m	45m	45m	45m
- Radius	4000 m	4000 m	4000 m	4000 m	4000 m	4000 m	4000 m	4000 m	4000 m
TAKE-OFF/APPROACH SURFACE									
- Length of Inner Edge	30 m	30 m	45 m	75 m	45 m	75 m	150 m	75 m	150 m
- Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
- Divergence (minimum each side)	10%	10%	10%	10%	10%	15%	15%	15%	15%
- Length (minimum)	2500 m	2500m	2500m	2500m	2500 m	3000 m	3000 m	15000m	15000m
- Slope (maximum)	5% (1:20)	4% (1:25)	2.5% (1:40)	2.5% (1:40)	3.33% (1:30)	2.5% (1:40)	2.5% (1:40)	2.5% (1:40)	2.0% (1:50)
TRANSITION SURFACE									
- Slope (maximum)	20.0% (1:5)	20.0% (1:5)	14.3% (1:7)	14.3% (1:7)	14.3% (1:7)	14.3% (1:7)	14.3% (1:7)	14.3% (1:7)	14.3% (1:7)

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4.2.3.3 Recommendation.— Where practicable, the slope of the take–off/approach surface should be 2.0%.

4.2.3.4 **Standard.**— New objects or extensions of existing objects shall not be permitted above a take–off/approach surface within 3000 m of the inner edge or above a transitional surface except when, in the opinion of the certifying authority, the new object or extension would be shielded by an existing immovable object.

Note.— Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Airport Services Manual, Part 6.

4.2.3.5 Recommendation.— New objects or extensions of existing objects should not be permitted above the take–off/approach surface beyond 3000 m from the inner edge or above the outer surface except when, in the opinion of the certifying authority, the object would be shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aircraft.

4.2.3.6 Recommendation.— Existing objects above any of the surfaces required by 4.2.3.1 should as far as practicable be removed except when, in the opinion of the certifying authority, the object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aircraft.

Note.— Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the take–off/approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the take–off/approach surface, nor is it intended that terrain or objects which are above the take–off/approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered they may endanger aeroplanes.

4.2.4 PRECISION APPROACH RUNWAYS

Note 1.— See 8.6 for information regarding siting and construction of equipment and installations on operational areas.

Note 2.— Guidance on obstacle limitation surfaces for precision approach runways is given in the ICAO Airport Services Manual, Part 6.

4.2.4.1 **Standard.**— The following obstacle limitation surfaces shall be established for a precision approach runway category I:

- outer surface;
- take–off/approach surface; and
- transitional surfaces.

Note.— Obstacle limitation surfaces for precision approach runways categories II & III are established in accordance with specifications contained in TP 1490, Manual of All Weather Operations.

4.2.4.2 **Standard.**— The heights and slopes of the surfaces shall not be greater than, and their other dimensions not less than, those specified in Table 4–1.

4.2.4.3 Recommendation.— Where practicable, for new runways where the code number is 3 or 4, the slope of the take–off/approach surface should be 1.66% for the first 3000 m and 2.0% thereafter for a total length of 15000 m.

4.2.4.4 **Standard.**— Fixed objects shall not be permitted above the take–off/approach surface, or the transitional surface, except for frangibly mounted objects which because of their function must be located on the strip. Mobile objects shall not be permitted above these surfaces during the use of the runway for landing.

MAR 31 1999

ANNEX I

EFFLUENT CRITERIA FROM THE NUNAVUT WATER BOARD

P.O. Box 119
Gjoa Haven, NT X0E 1J0
Tel: (867) 360-6338
Fax: (867) 360-6369

ᓄᓇᕗᑦ ᐃᒪᓕᕆᔨᑦ ᑲᑎᒪᔨᖏᑦ
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI

March 18, 1998

File No. N5L3-0087

Ms. Sara Brown
Senior Administrative Officer
Municipality of Iqaluit
Iqaluit, NT X0A

Re: Sewage Effluent Parameters

Dear Ms. Brown:

Following a review of background information on file in the Public Registry of the Nunavut Water Board, I wish to clarify our expectations with regards to modifications to the Sewage Treatment Facilities of the Town of Iqaluit.

To ensure preservation of the fisheries in Koojessee Inlet and the protection of public health, the NWB expects the following effluent quality levels to be met:

Wastewater Flow (Lpd)	Parameter	Level
150-600 Lcd	BOD SS F. Coli	30 mg/L 35 mg/L 10 000 CFU/dL
>600 Lcd	BOD SS F. Coli	25 mg/L 30 mg/L 1000 CFU/dL

The above parameters were established based on consultations with other regulatory agencies and would be acceptable should the Town decide to discharge in a location somewhere between the existing discharge and the causeway. We have reviewed the Public Registry files and the NWT Water Board Technical Advisory Committee minutes, and we understand that Town representatives and Technical Advisory Committee members agreed at that time of issuance of the current licence that the facilities would be upgraded progressively. Moreover, should the treatment system be unable to reach the above mentioned parameters, a deep water discharge may still need to be considered.

Before making any modifications to the current sewage treatment system or installing a new

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treatment system, the Town will have to file a request for modification or amendment to the current licence with the Board. The current licence is due to expire December 31, 1998 and therefore, an application for the renewal of this licence should be filed at least six months before the expiry date.

Do not hesitate to contact me should you need clarification regarding this matter.

Sincerely,

Dionne Filiatrault
Technical Advisor

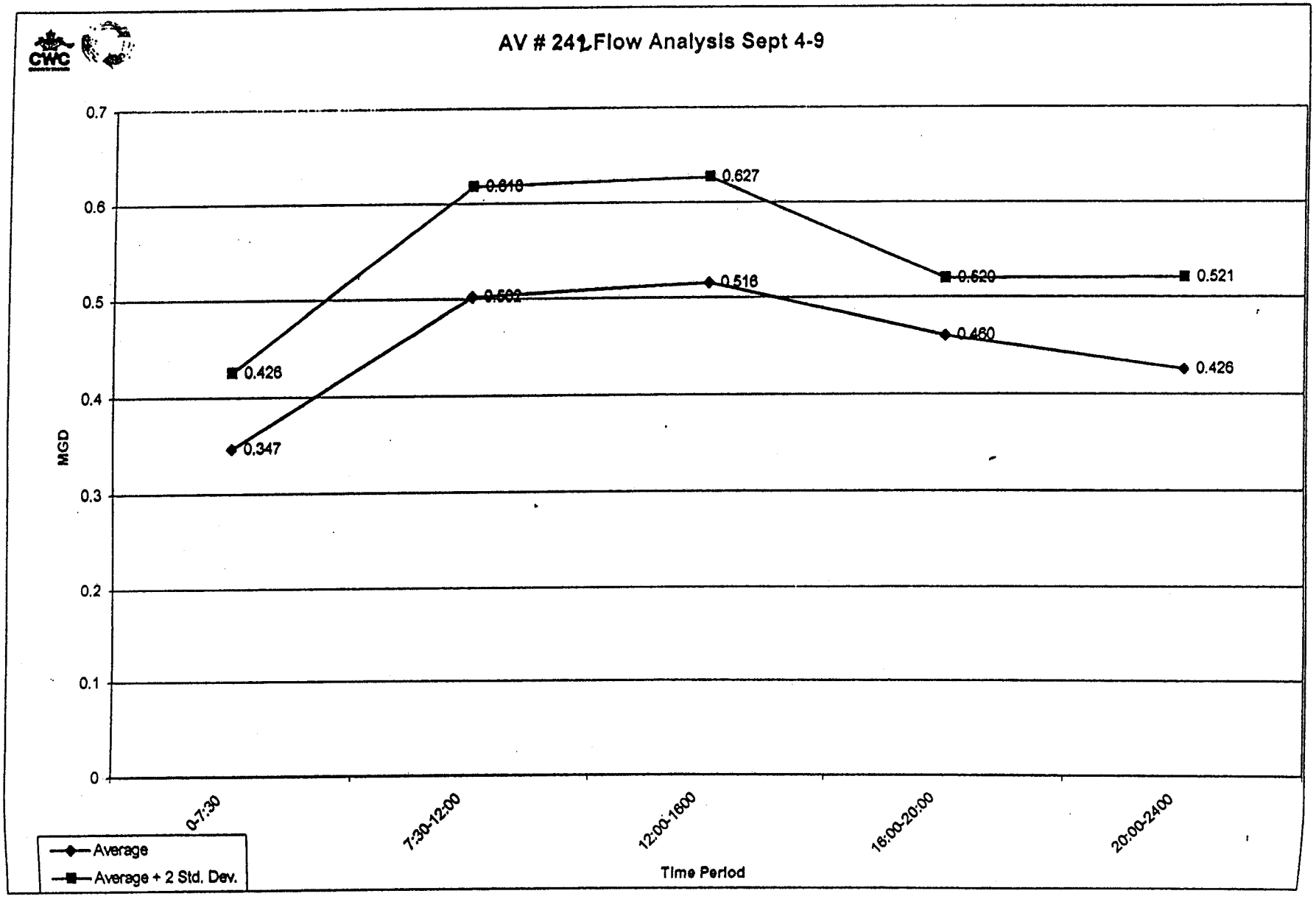
cc. RWED-Lisa Dyer, Robert Eno
EC-Steve Harbicht, Ed Collins
DIAND-Shannon Pagotto, Paul Smith
Public Health-Nicole Richie
DFO-Ken Chang-Kue
MACA-Tanja Smith, Terry Brookes

NWB3.IQ.TR.960319

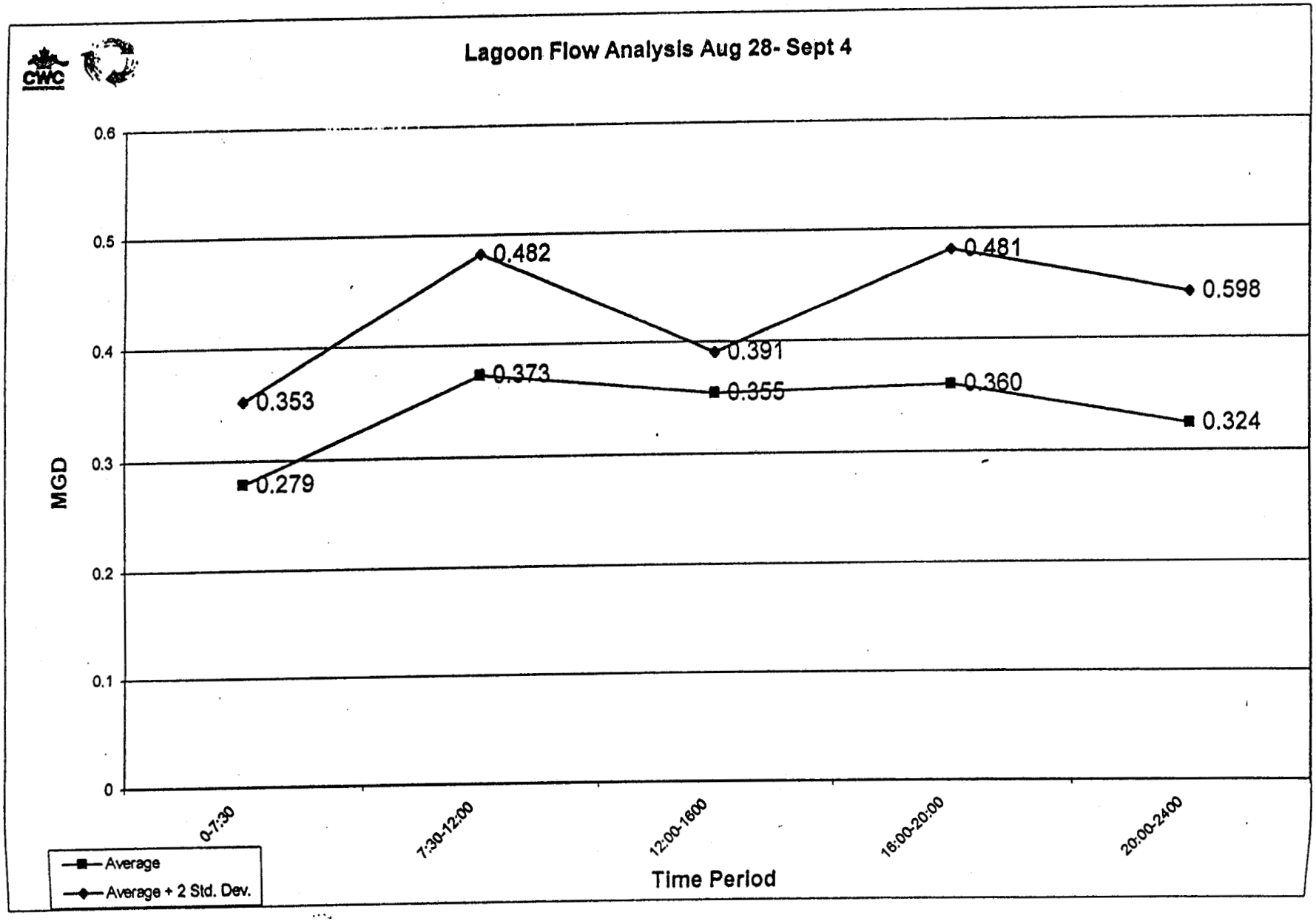
MAR 18 1998

ANNEX J

FLOW DATA FROM ON SITE FLOW
MEASUREMENTS DONE BY CWC


AV # 241 Flow Analysis Sept 4-9
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
MGD
0.426
0.618
0.627
0.620
0.521
0.347
0.502
0.516
0.460
0.426
0-7:30
7:30-12:00
12:00-16:00
16:00-20:00
20:00-24:00
Time Period
Average
Average + 2 Std. Dev.

MAR 3 1 1999


Lagoon Flow Analysis Aug 28- Sept 4
CWC
MGD
0.6
0.5
0.4
0.3
0.2
0.1
0
0.482
0.481
0.598
0.391
0.373
0.355
0.360
0.353
0.324
0.279
0-7:30
7:30-12:00
12:00-16:00
16:00-20:00
20:00-24:00
Time Period
Average
Average + 2 Std. Dev.

MAR 3 1 1999

ANNEX K

LAB DATA
INFLUENT FEED STRENGTH

July 22, 1999

JB LABS

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364
jblabs@islandnet.com

DATE: September 2, 1998

JOB NO: JB 1750A
LR NO: 26683

SAMPLING DATE: See Below
SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

CLIENT: HILL MURRAY & ASSOCIATES
CONSTRUCTION DIVISION
780 TOLMIE AVE UNIT 202
VICTORIA BC V8X 3W4

Attn: Robert A. Murray

SAMPLE:

Sample # 1: Iqualuit - Raw Aug 26/98
Sample # 2: Iqualuit - Lagoon discharge

		Sample 1	Sample 2
Tot Suspended Solids	mg/L	432	84
BOD_5	mg/L	340	70
Alkalinity, Total	mg/L $CaCO_3$	220	

MAR 31 1999

JB Laboratories Ltd.
water/wastewaters

John E. Evanoff, M.Sc.
Barbara M. Klassen, B.Sc.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of Water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods/Water and Wastewater", American Public Health Association.

TAB R

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COMPLIANCE REPORT

PROJECT:	**IQALUIT WASTEWATER TREATMENT PLAN**
FOR:	QUIGG CONSTRUCTION – Structural Contractor
CONSULTANTS:	HILL MURRAY & ASSOCIATES – General Contractor TED THOMAS & ASSOCIATES – Architectural Consultant F&Y ENGINEERING – Mechanical Consultant
BY:	WESTERN ENGINEERING – Structural Consultant
DATE:	INSPECTED July 12, 1999 TO September 22, 1999 And November 5 to November 8, 1999 ORIGINAL REPORT ISSUED October 22, 1999 COMPLIANCE REPORT ISSUED November 10, 1999

WESTERN ENGINEERING
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   a) Location of voids
   b) Types of Voids and their causes
      - Type 1: Empty 45° pieces
      - Type 2: Honeycombing
      - Type 3: Delamination
2. Installation
   a) Method of installation of walls, reinforcing and concrete
   b) Problems encountered
   c) Causes for voids in the walls
3. Possible Effects of Wall Voids and Displaced Reinforcing
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   b) Weakened structural capacity
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      - Results of calculation of effects of having empty Octaform
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APPENDICES

A1. Calculations
A2. Copy of insurance for Western Engineering

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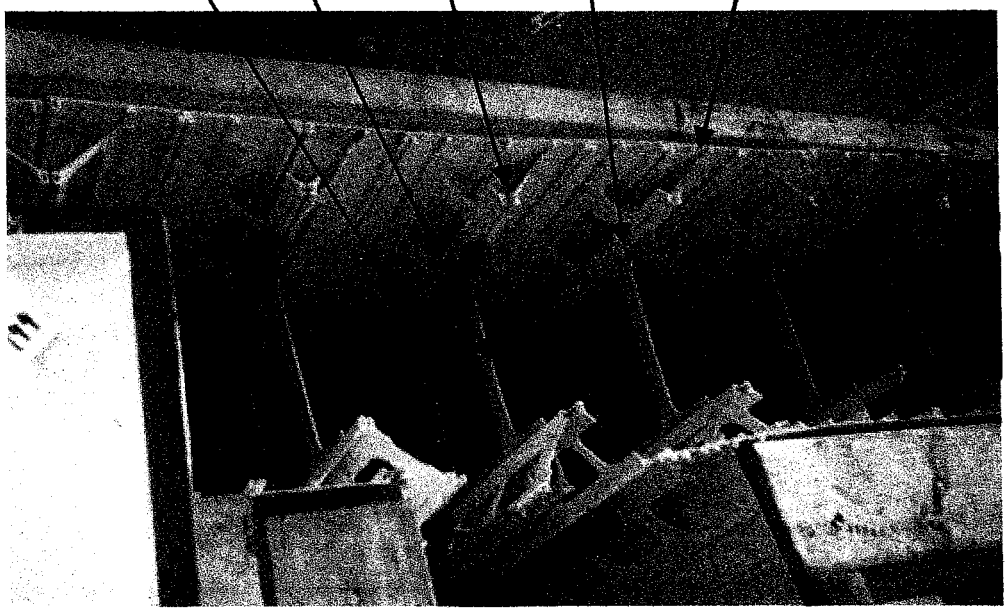
10 November, 1999

The Treatment Plant concrete walls, including exterior and interior tank walls, were inspected on the 5th to 8th of November, 1999 by Paul Salvian as a result of Gary Strong of Dillon Consulting advising at the inspection meeting on the 5th of November that there was some porosity in the walls of the building and tank.

Our findings, as shown on the attached drawings of the first and second floor layout, confirmed that there were voids in some areas. These voids were broken down into three types, as shown on the attached drawing of the wall cross sections:

1. Type 1 – Characterized as an area bounded by a 45° reinforcing web, the exterior panel and the through web. This void was caused by:
   a. Concrete with a greater cement powder content than would normally be used. Glen Earl of BBS confirmed this problem. The powder was required to compensate for silty sand that was used. The greater powder content combined with the silt to create a sticky concrete. The sticky concrete tended to encase rebar completely if pouring of the concrete did not completely fill a panel.
   b. Inadequate vibrating of the concrete. Each 6" panel had to be vibrated for the full 16' or 19' walls. Careful monitoring of vibrating of the concrete was required but may not have been achieved for the various reasons that are typical to pouring of concrete.
   c. Large stones. The quality control of the sand used for the concrete was inadequate. Large stones were observed and removed while the concrete was being poured.
   d. The size of the holes in the reinforcing strip inside the wall may have been inadequate to permit a complete migration of concrete into the 45° shaped area. The size of the holes would also prevent inadequate vibrating of the area if the concrete was very sticky.



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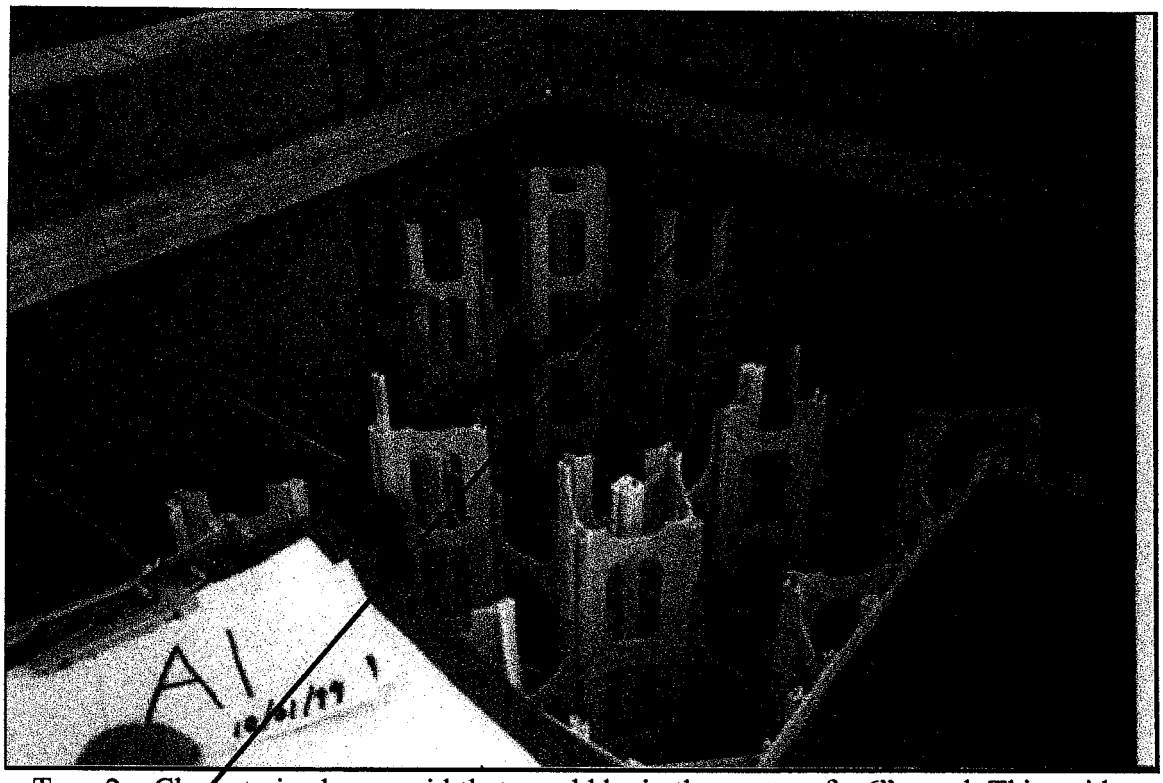

2. Type 2 – Characterized as a void that would be in the center of a 6" panel. This void could be small penetrating a few inches into the concrete or it could be large penetrating to the outside insulation. This type of void was not noted in any of the interior, uninsulated, walls.

3. Type 3 – Characterized as a separation of the exterior panels from the concrete leaving a ½ mm space between the concrete and the plastic. This type of void may have been caused by the panel warming and expanding once the roof was installed and the building heated.

Determination of the Severity of the Problem

1. Type 1 Voids - Calculations attached with this report confirm that the Type 1 holes will present no structural problems to the PVC wall panel, concrete wall or the rebar. If a leak were to occur there may be some seepage of water into the void. We have been advised that seepage should stop. The cellulose in the sewage will seal any voids preventing any further migration of water into the concrete.
2. Type 2 Voids – Calculations confirm that Type 2 Voids will present no structural problems if the void were not filled. The voids in the second floor walls would be comparable to a window or a door being installed in the wall. Please note that replacement of the concrete will return the wall to full strength capacity.
3. Type 3 Voids – These voids represent no problems structurally or to the strength characteristics of the PVC panels.

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INSTALLATION

Method of Installation of walls, reinforcing and concrete

The Octaform panels were pre-fabricated on site in 2'-6" sections and lifted into place by three people.

Where pipes were located, a hole was cut in the Octaform using a hole saw on a drill. If the pipe was too large, the Octaform panels were cut using tin snips. The webs and the 45° pieces of the Octaform were removed, cut to length and replaced. The openings for beam pockets were made by inserting styrofoam to create a void, which was removed after pouring.

The reinforcing was installed by sliding the horizontal bars in from the open sides of the walls. The vertical bars were installed by sliding them down from the top of the wall after the horizontals had been installed. For the walls in the main floor, the bars were tied at the top and about 5' from the bottom.

The concrete was generally poured in lifts ranging from 3' to 6' and was well-vibrated for the full height.

Problems Encountered

There was some difficulty in getting concrete to flow under obstructions such as pipes, beam pockets, and other openings. Considerable effort was put into making sure that the areas under these obstructions were filled as well as possible.

Causes for voids in walls

The three types of voids described above were each caused by different phenomena.

The Type 1 voids are caused by the concrete not being able to get into the 45° pieces. There are openings the full length of these pieces that the concrete must pass through, but they are small (approximately 2" x 1-1/2" and it is not inconceivable that two or three pieces of aggregate might create a blockage. These voids were found often under pipes, which is understandable since the concrete would essentially have to move horizontally to fill under the pipe. As noted above, every attempt was made to ensure concrete filled under the pipes, with varying results.

The Type 2 voids are the largest voids that were found in the building. They seem to be caused by blockages. On the second floor, the east and west walls were poured to a level of approximately 3'-4' in order to secure them against the high winds that were prevalent at the time. The upper portion of the walls was poured some days later. It is probable, based on visual

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observation of the reinforcing in one of the larger voids on the second floor, that during the first pour, the concrete accumulated around the reinforcing to such an extent that when it hardened a blockage was caused. Adding to this is the fact that the largest Type 2 voids were found almost exclusively on the east and west walls of the second floor.

The Type 3 voids are small voids that seem to be caused by a delamination of the plastic panels. The cause of this is most likely that the plastic has elongated due to an increase in the temperature. The concrete was poured in cool weather, and as the construction progressed, the building was enclosed and later heated. The estimated elongation could be as high as ¼" in the length. If the ends are restrained against the plastic growing, there could be some local buckling, resulting in this type of void.

POSSIBLE EFFECTS OF WALL VOIDS AND DISPLACED REINFORCING

The main concerns associated with the voids are that they may create a reduced capacity to retain liquid , and that the load carrying strength may be reduced. The three types of voids would each create different problematic conditions. The Type 1 void could induce leakage if the void were to initiate a crack through the wall. These could also reduce the strength, but not likely to any significant amount. Type 2 voids would create the most concern from both a leakage and strength point of view, since they are of the largest magnitude of any of the voids. The Type 3 voids are of little concern since the wall is filled with concrete.

RESOLUTION

Determination of the Severity of Problems

A calculation was done to determine if a large hole in the center of the tank walls would be of major concern. A calculation was also done to determine if there were any danger of the Octaform failing at a height of approximately 5'-0"

The first calculation estimated the bending forces and endeavored to determine whether the existing tank walls with decreased strength would accept the applied pressure loads. The design loads were taken to be the hydrostatic pressure assuming that the tank was full (16'-0"). The bottom of the walls and the wall connection to the columns were assumed to allow no rotation of the wall. The walls were designed for the highest bending loads, which occur at the bottom of the wall and at the edges of the columns. The bending in the center of the wall are also high, but are on the order of about half of the maximum bending.

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The simulated hole was taken to be one third of the length of the wall and one third of the height of the wall. The load from the water pressure acting on the hole location was re-distributed to the surrounding wall and the new maximum loads was compared to the design loads. The result of the calculation indicates that the new loads are only slightly higher than the design values. The higher load will be re-distributed to the surrounding structure.

The second floor walls do not have any considerable pressure loads, but are subject to axial loads. Large holes in these walls can be predicted to act much like windows, which are generally of no great concern. Axial loads on concrete walls transfers to a very wide length of wall rather than remaining very localized directly under the applied load. At doors and windows, an "arch" action is generally observed, wherein the top of the opening receives very little load, depending on the depth of the concrete above.

This calculation confirms that Type 2 Voids will present no structural problems if the void were not filled. The voids in the tank will be filled, and thus some strength will be regained. The voids in the second floor walls would be comparable to a window or a door being installed in the wall.

The second calculation estimated the effect of a high hydrostatic pressure on an unsupported strip of Octaform, simulating an empty 45° piece, which was the most common void type in the tanks. The calculation showed that the plastic strength would be more than adequate to withstand this pressure, and that the bending would be small. Holes larger than the width of the 45° pieces were assumed to have been filled.

This calculation (see AppendixA2) confirms that the Type 1 holes will present no structural problems to the PVC wall panel, concrete wall or the rebar. If a leak were to occur there may be some seepage of water into the void. We have been advised that seepage would eventually stop since the cellulose in the sewage will seal any voids preventing any further migration of water into the concrete.

Correction of Voids in the Walls

Type 1 Voids

Although the Type 1 voids are prevalent throughout all the walls, they do not represent a structural or leakage problem of any type. Consequently we do not recommend the filling of these voids other than where holes have been drilled to confirm the depth of the void.

In the locations where holes have been drilled grout mixed with Lepage's glue will be pumped into the void from a hole drilled at the top of the void. A second hole will be drilled

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adjacent to the pumped hole. When grout exists from this hole the void may be considered to be filled since the grout will flow by gravity to fill the void up to the exit hole.

Note the strength of the Lepage's glue exceeds the shear strength of the concrete.

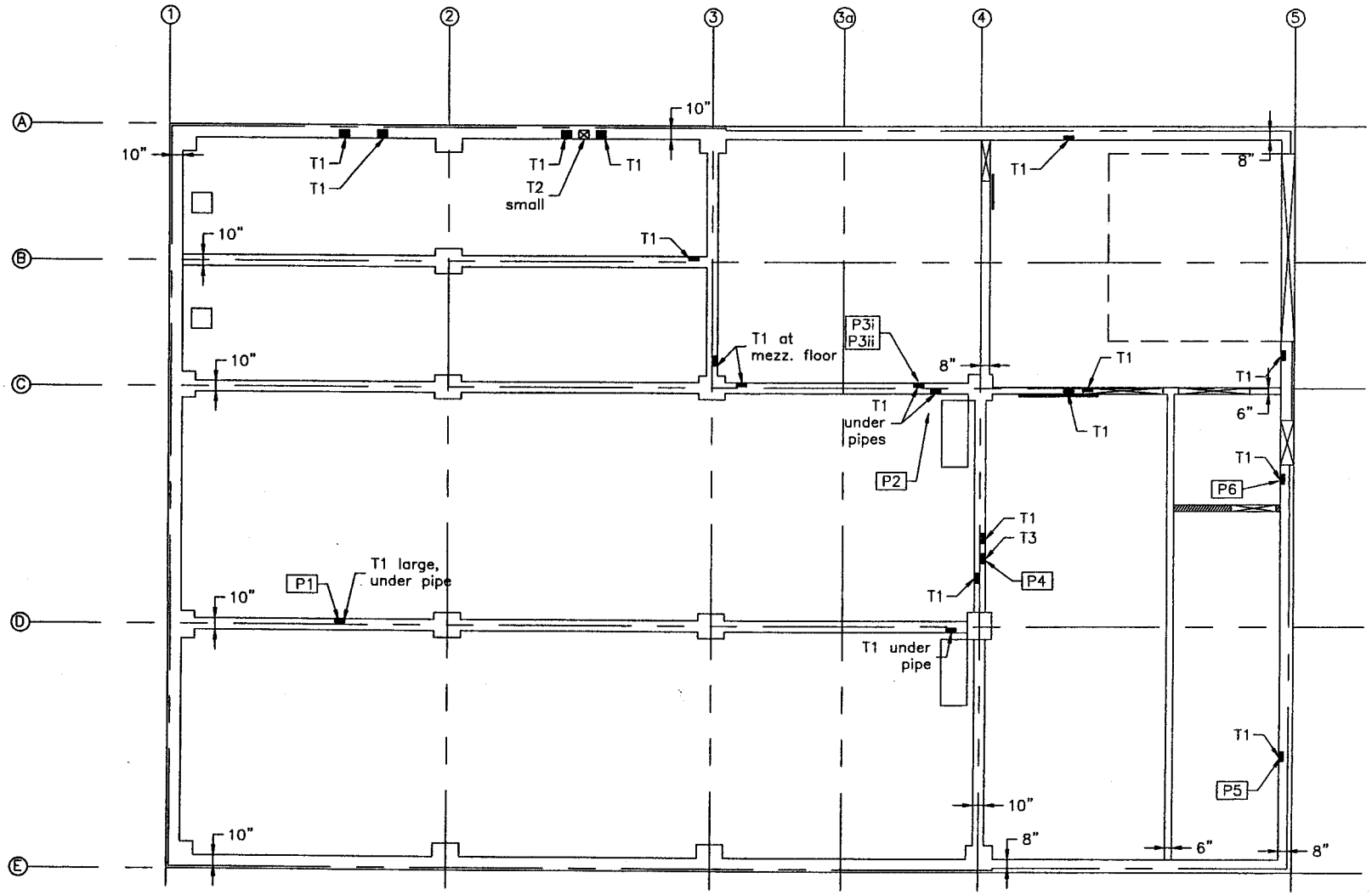
Type 2 Voids

All Type 2 voids will be filled similar to Type 1 voids.

Filling the voids will return the wall to its non-void strength capacity.

Type 3 Voids

These voids will require no reparation.



Stamp Seal

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Architectural Consultant
TED THOMAS & Ass.

Mechanical Consultant
F&Y ENGINEERING

Electrical Consultant
F&Y ENGINEERING

Revisions

Rev	Date	Description
1	Nov 5, 99	Issued with report
2		
3		
4		
5		

MUNICIPALITY OF IQALUIT WASTEWATER TREATMENT PLANT

Iqaluit, NT

Project No.

Drawing
Main Floor Wall Void Locations

Drawing Series
Compliance Report

Designed By
PS

Drawn By
JG

Scale
1/8" = 1'-0"

Date Plotted
Nov 9, 1999

Sheet
CR-1

Page
1 of 1

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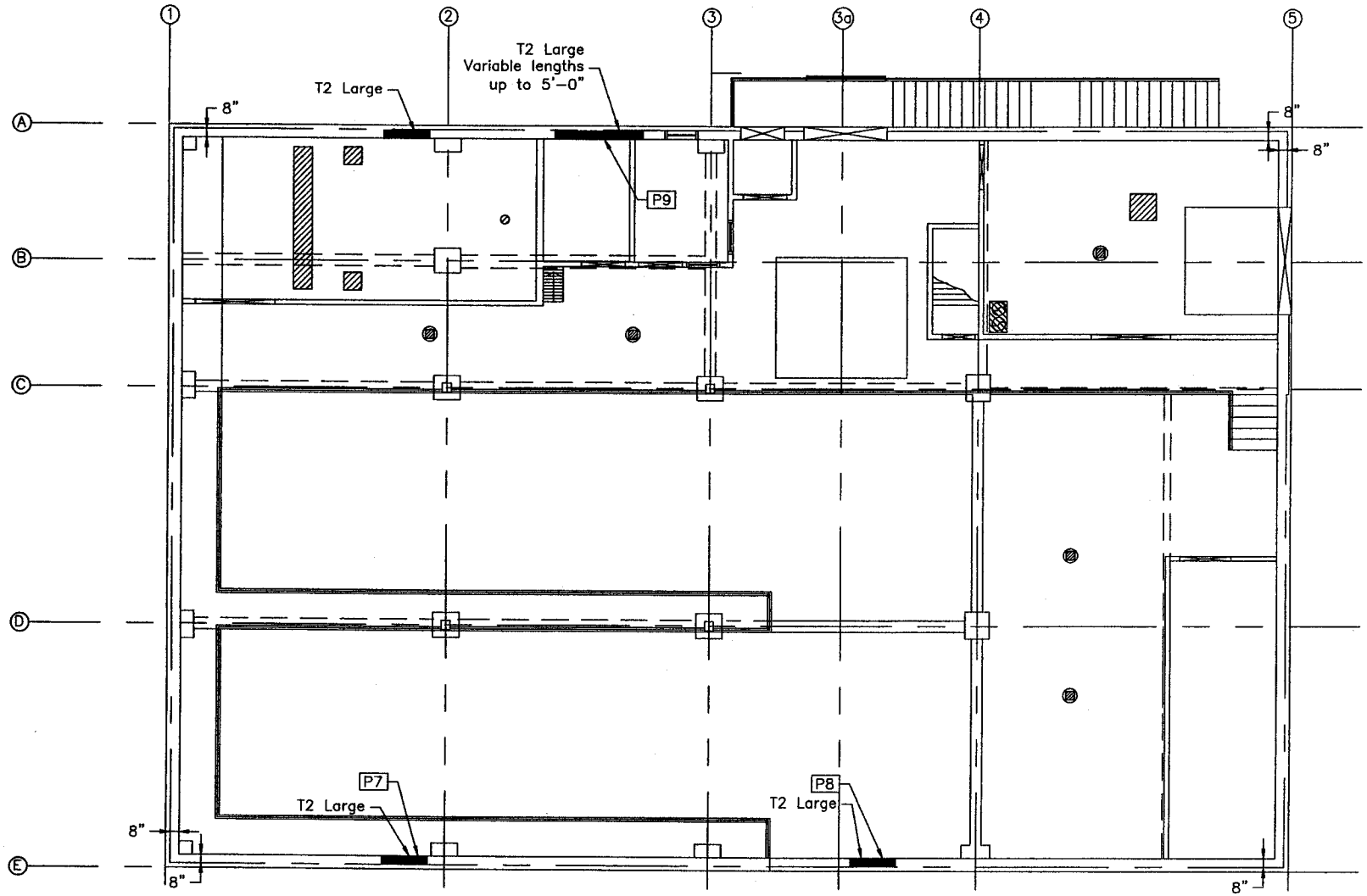

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TED THOMAS & Ass.

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Electrical Consultant
F&Y ENGINEERING

Revisions

Rev	Date	Description
1	Nov 9,99	Issued with report
2		
3		
4		
5		

MUNICIPALITY OF IQALUIT WASTEWATER TREATMENT PLANT

Iqaluit, NT

Project No.

Drawing
Second Floor Wall Void Locations

Drawing Series
Compliance Report

Designed By
PS

Drawn By
JG

Scale
1/8" = 1'-0"

Date Plotted
Nov 9,99

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CR-2

Page
1 of 1

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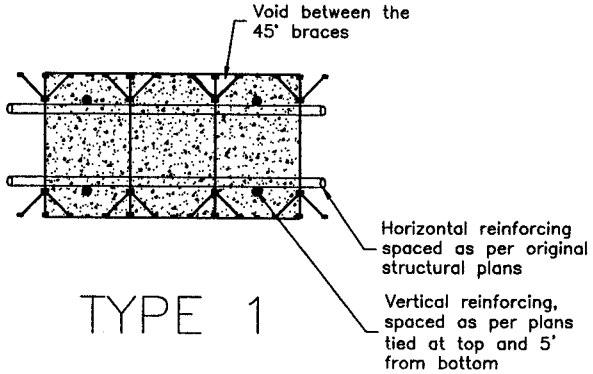

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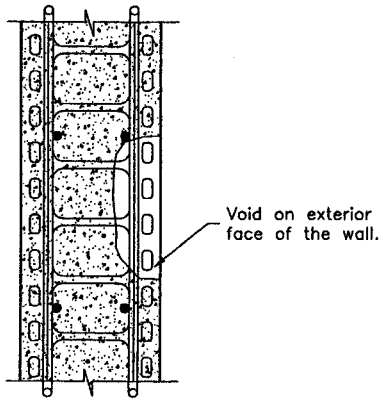

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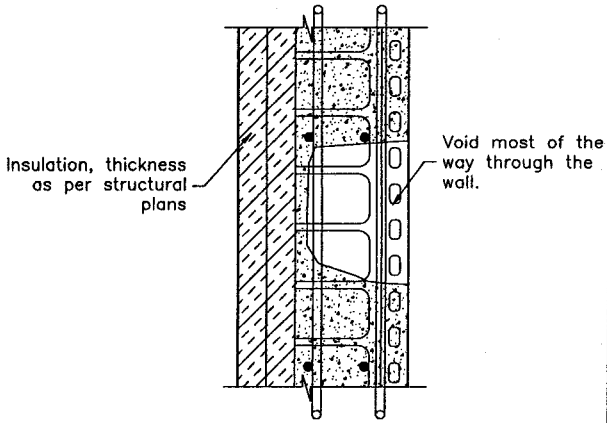

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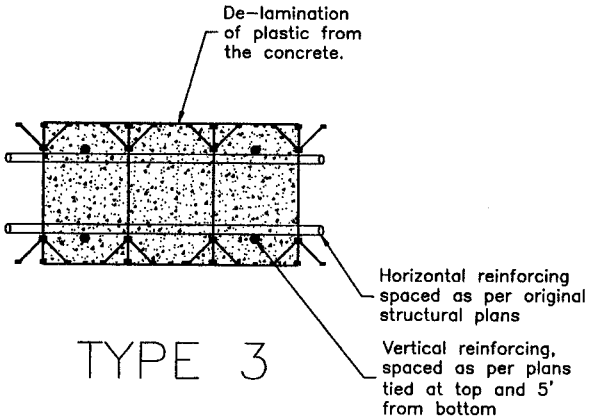

TYPE 3

Stamp | Seal

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Architectural Consultant
TED THOMAS & Ass.

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F&Y ENGINEERING

Electrical Consultant
F&Y ENGINEERING

Revisions

Rev	Date	Description
1	Nov 8,99	Issued with report
2		
3		
4		
5		

MUNICIPALITY OF IQALUIT
WASTEWATER TREATMENT PLANT
Iqaluit, NT

Project No.

Drawing
Wall Void Descriptions

Drawing Series
Compliance Report

Designed By
PB

Drawn By
JG

Scale
1" = 1'-0"

Date Plotted

Sheet
CR-3

Page
1 of 1

Issue
1

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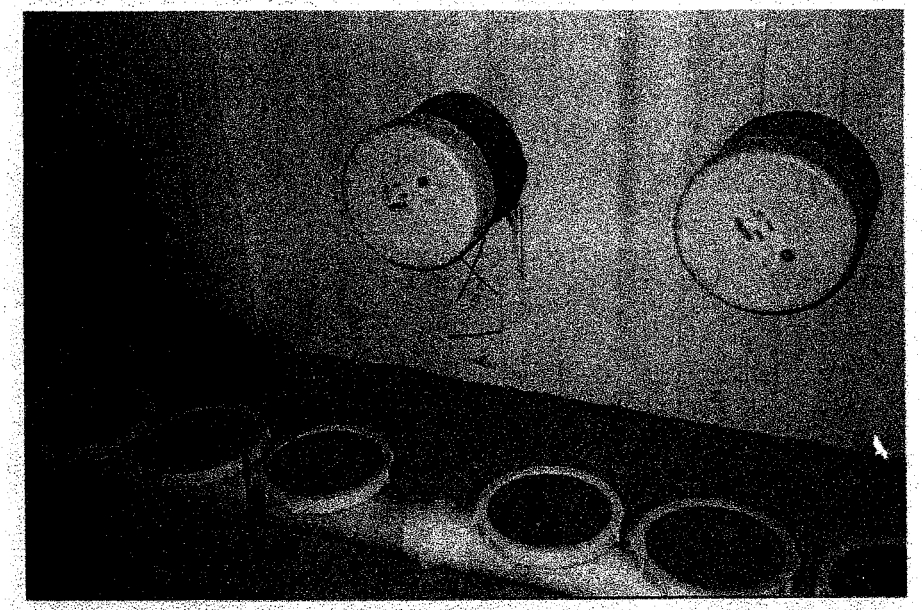

Figure 4 - P1 – Location of voids under pipe on Gridline D between Gridlines 1 & 2

Figure 5 – P2 – Location of voids under pipe on Gridline C between Gridlines 3 & 4

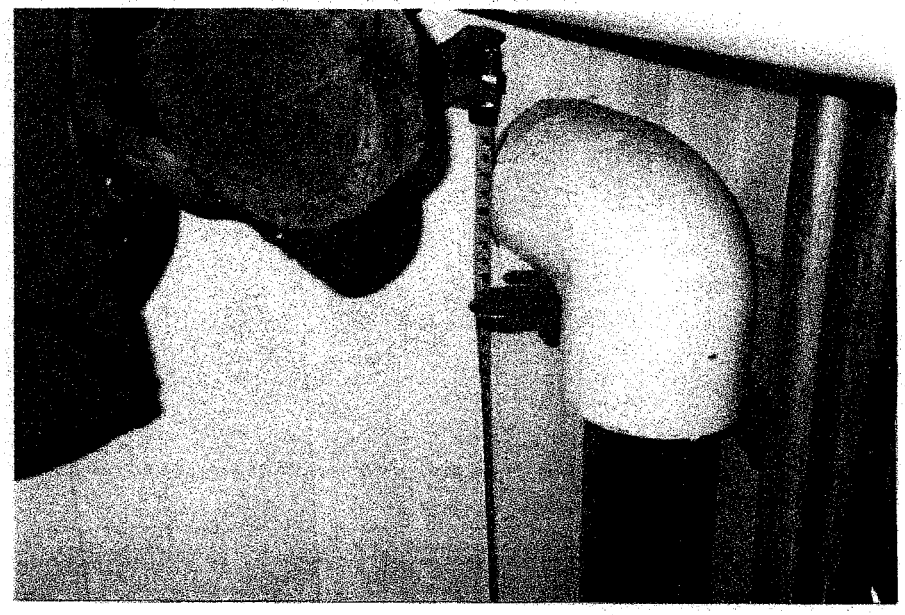

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Figure 6 - P3i – Location of voids under pipe on Gridline C between Gridlines 3 & 4

Figure 7 – P3ii – Location of voids under pipe on Gridline C between Gridlines 3 & 4

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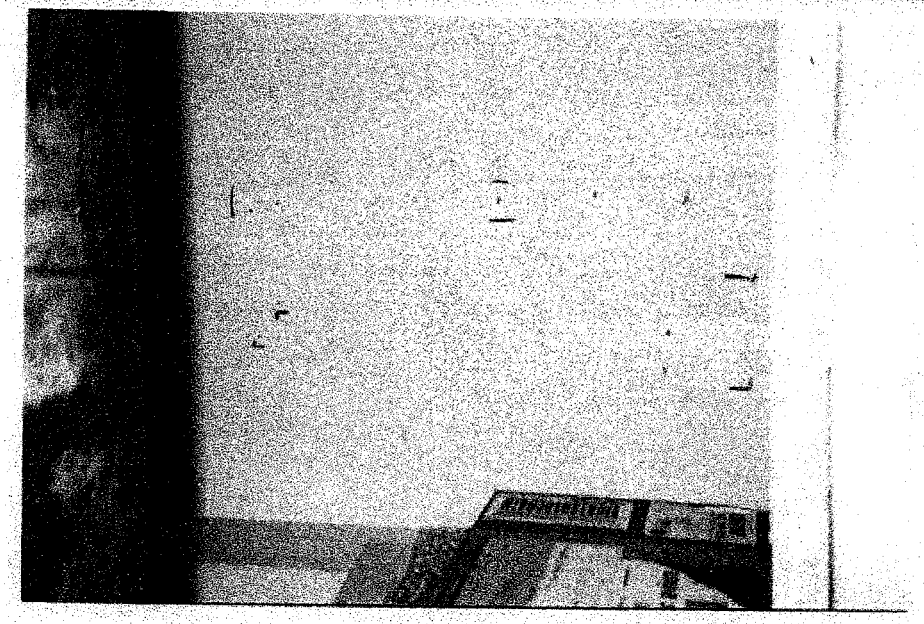
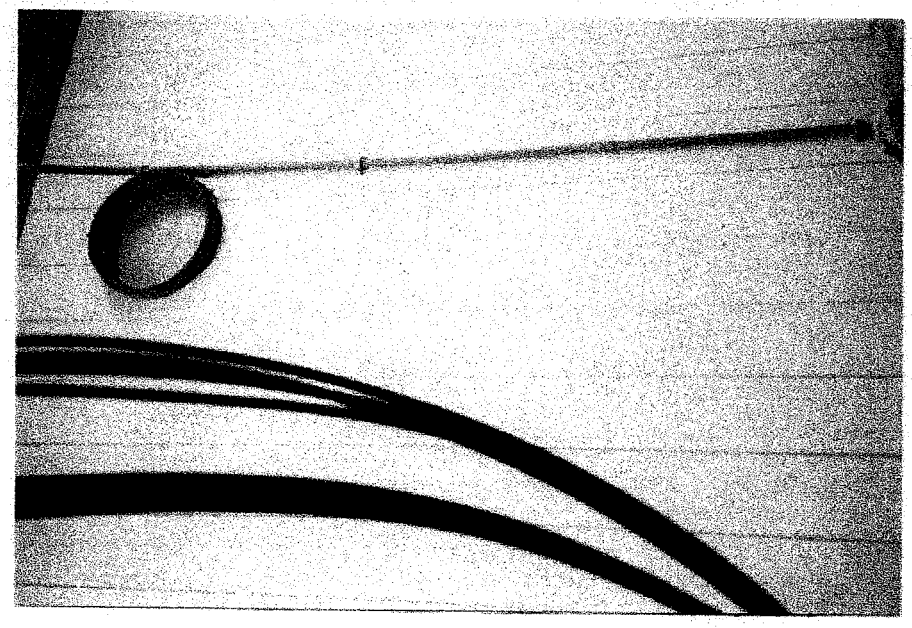


Figure 6 - P4 – Location of voids on Gridline 4 between Gridlines C & D

Figure 7 – P5 – Location of voids under pipe on Gridline 5 between Gridlines D & E



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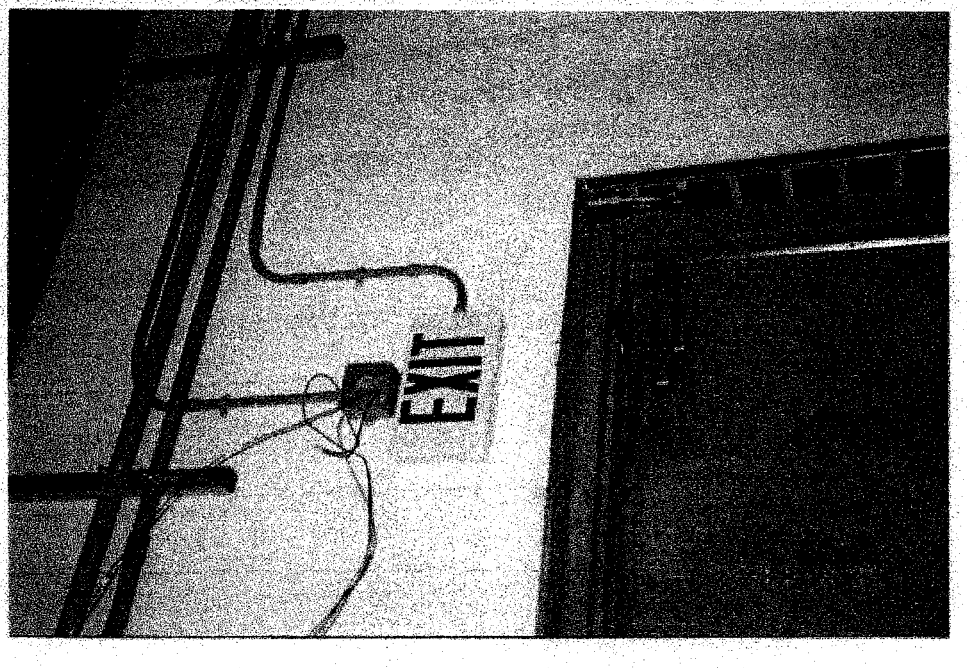
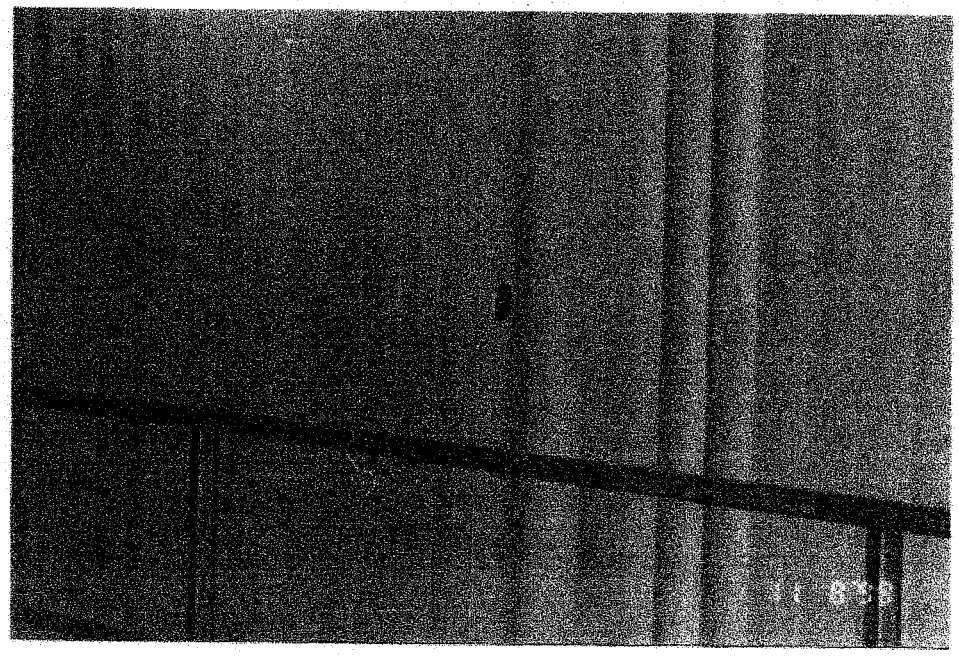


Figure 8 - P6 – Location of voids on 5 over mandoor

Figure 9 – P7 – Location of voids on second floor on Gridline E between Gridlines 1 & 2



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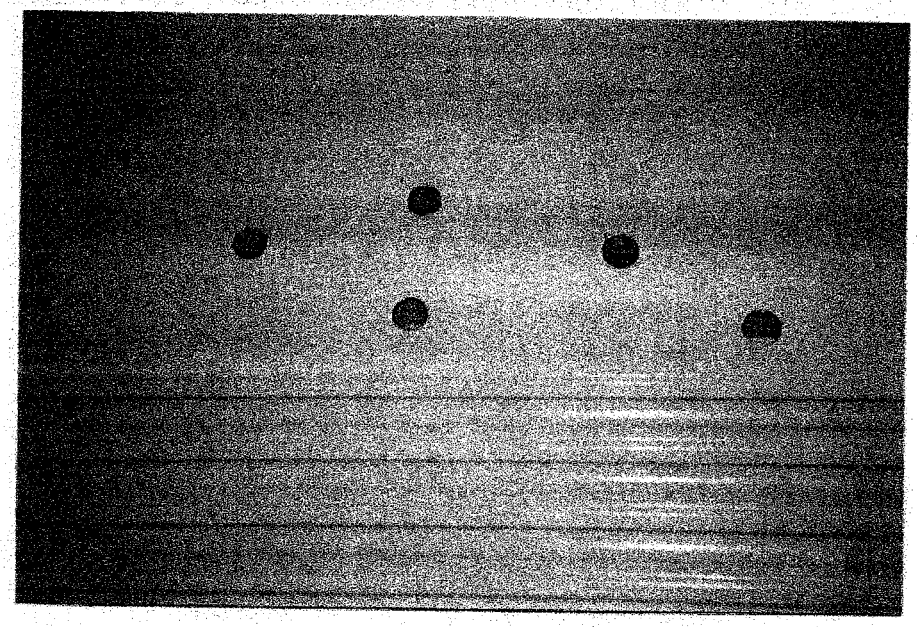
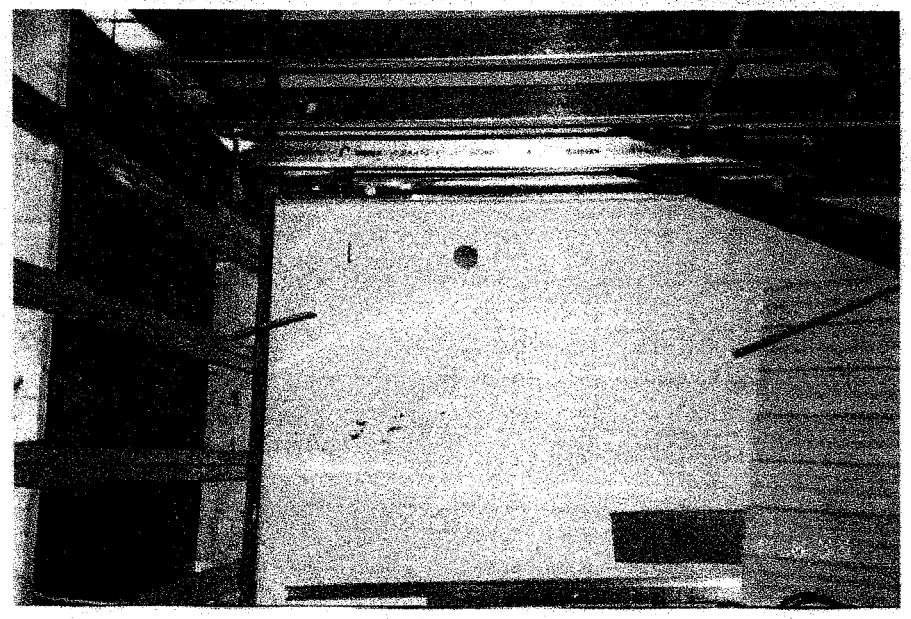


Figure 10 - P8 – Location of voids on second floor on Gridline E between 3 & 4

Figure 11 – P9 – Location of voids on second floor on Gridline A between Gridlines 2 & 3



TAB S

HILL
MURRAY

ENGINEERING
WATER
SOLUTIONS

IQ/10

November 11, 1999

VIA FACSIMILE: 867-979-5910

Denis Bedard P. Eng
Municipality of Iqaluit
P. O. Box 460
Iqaluit, Nunavut
X0A 0H0

Dear Denis:

Re: Iqaluit Water Reclamation Facility

Thank you for your time to meet with us last week. Generally we are happy with the progress being made on site. Despite the many project delays we had getting started, we foresee completion of this project on time.

At the site meeting of November 5, 1999, our building sub-contractor identified some honey combing within the building walls and tankage that only recently came to their attention. Their intention was, and is, to deal with this as an internal deficiency, to be corrected immediately.

During our meeting with Gary Strong and Tanya Smith of Dillon Consulting on Friday afternoon November 5, 1999, we agreed that it would be prudent to back out the building portion of our October draw until we had an opportunity to investigate potential structural problems that this honey combing could cause and assure ourselves that all issues would be resolved to the complete satisfaction of Hill Murray consultants, thereby assuring the interests of the Municipality would be satisfied.

We are enjoying our relationship with Dillon Consulting and have found them to be fair and reasonable. We feel, however, it is an important requirement of our contract to rely on the opinions and designations of the Professionals working within the CWC - Hill Murray Design-Build team and to ensure that we do not place Dillon Consulting in a role which liability could inadvertently be transferred to them.

We are in receipt of Dillon's letter of November 8, 1999. This letter addresses four issues:

- Method to isolate and de-water the pipeline from the dump station to the lift station: this is an arising and we will be forwarding our recommended solution to this in the near future.
- Method to divert sewage flow to the lagoon during an emergency situation: this is an arising and we will be forwarding our recommended solution to this in the near future
- Voids and displaced rebar in the concrete structure: this issue is addressed within the body of this letter.
- Nov. 1, 1999 progress claim: we feel that concerns have been identified the method of dealing with remedial action has been dealt with within the body of this letter. This information will allow Dillon Consulting the comfort to approve our Progress Schedule as submitted for progress to October 30, 1999.

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1962 Canso Road
Sidney
British Columbia
Canada
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250-655-8953
Facsimile:
250-655-8954
Email:
info@hillmurray.com
Website:
www.hillmurray.com

We feel that Dillon has echoed many of our concerns in their letter to you and that their assessment is generally fair. We will not be billing for any further draws against the building until such time as we are completely satisfied that the build is sound and meets in all respects our specifications. In our capacity as consultant on this project, we have directed our sub-contractors engineer to complete a thorough review of building structures and the water tight integrity of the process tanks and to prepare a certifiable resolution plan with respect to any findings. We have further required some additional bonding and insurance documents from our building sub-contractor and his engineer.

We have received this resolution plan from our sub-contractor and their engineer which appears reasonable and which their engineer is prepared to stamp and seal. We have engaged a third party engineer to provide us a professional opinion on the magnitude of the identified structural deficiencies and the validity of the resolution plan. We expect to have a response in the next few days and hope to approve the resolution plan shortly. We have confidence in our sub-trades ability to perform to our high standards. Our goal is to have all remedial work completed to ~~the~~ our complete satisfaction by the end of November.

Before calling for completion on this project, you can be assured that Hill Murray and CWC will be delighted with every aspect of this project.

Please find attached, documents that speak to the concerns voiced in Dillon's correspondence on November 8, 1999. We feel that this documentation and remedial work plan will allow Dillon the comfort to approve the October Progress Schedule as submitted to Tanya Smith of Dillon Consulting on November 8, 1999. When approved, the remedial work plan will be forwarded to the Municipality for comment before work commences.

Thank you for your time and patience on these issues and please call me if you have any questions or I may be of any further assistance to you.

Sincerely,

Lorne Cowley
COO - Hill Murray Group

Attachments

CC: Dillon Consulting - Gary Strong
Dillon Consulting - Tanya Smith
Quigg Construction - Bert Quigg

I:\PROJECTS\CURRENT\Iqaluit\Bedard let nov 11 99.wpd

TAB T

CWC

Canadian Wastewater Corporation

70

January 12, 2000

FAXED
JAN 13 2000
#Pages 3426

VIA FACSIMILE: 867-979-5922

Denis Bedard P. Eng
Director of Engineering & Planning
Municipality of Iqaluit
P. O. Box 460 (911 Ring Road)
Iqaluit, Nunavut
X0A 0H0

Dear Denis:

Re: Iqaluit Water Reclamation Facility - Project Update

Just a short update on progress at the new Iqaluit Water Reclamation facility.

After the Christmas break our crew returned to the site with renewed vigor and great progress is being made. Ron, Chris Baker, Scott are on site till January 21. Fred Black is on site, leaving on January 24th. Chris Phyall arrives today (leaving Jan 31) and Garth Nye will be on site from January 18 to 28th. BBS will be working with us during January to complete the boiler installation and provide assistance in the installation of electrical equipment. We expect to have the project to Substantial Completion by January 28, 2000.

Quigg Construction is on site and with the guidance of their professional structural consultants, are performing the repairs to the concrete work as documented in their stamped and sealed Compliance Report. All comments from Dillon Consulting have been forwarded to Quigg Construction and Western Engineering and we have been assured that due consideration has been given to all of their comments. Western Engineering will ensure that all due diligence has been conducted before hydrostatic testing commences. Tentatively, testing is slated to begin in the week of January 17, 2000. A complete stamped report will be forwarded to the Municipality upon successful completion of the compliance work.

In the Commissioning and Operations division, Denis Perreault has started the commissioning process and is working closely with ZENON to ensure a smooth start up. Denis will be working in Iqaluit from January 27th till February 11th. ZENON field technicians arrive on February 1, 2000, as will our Electrical Superintendent, Ron Megenbir and our enviroSMART implementation team. Iqaluit technical training will commence during the first two weeks of February. CWC Operators will be on site continuously starting on February 8th. (Don Dingwell Feb 8 - 18th, Mike O'Hanley Feb 15th - Mar 3rd, Daryl Koshey Feb 29th - Mar 17th)

.../2

A SUBSIDIARY OF HILL MURRAY

Suite 201 • 1962 Canso Road • Sidney • British Columbia • Canada • V8L 5V5
Telephone: 250-655-8953 • Facsimile: 250-655-8954 • Email: info@hillmurray.com • Website: www.hillmurray.com

Graham Symmonds, Gary Jerzak and I will arrive at noon on Thursday, February 3, 2000 to deal with final building issues and to ensure a smooth start to the commissioning process. If you, your technical support staff and associated spouses are available on Thursday or Friday evening, we would like to extend an invitation to join us for dinner.

At this time, I would like to ask for a couple of hours of your time on Friday, February 4, 2000 for a site meeting for the purpose of a Substantial Completion review. On this day, we will have all systems in place and commissioning will be well under way, with the seeding process being stage one of steady state operation. I will call you to confirm this.

Thank you for your continued support in this very exciting project and look forward to meeting with you again in Iqaluit.

Sincerely,

Lorne Cowley
COO - Hill Murray Group

I:\PROJECTS\CURRENT\Iqaluit\bedardl- Progress Report Jan 12 00.wpd

TAB U

WESTERN ENGINEERING
B102, 12225-105 Ave., Edmonton, AB T5N 0Y3
Phone: (780) 488-7403 Fax: (780) 488-0475
Email: west_eng@telusplanet.net

INSPECTION REPORT

Project No.:	*PROJ No. 99001*
Client:	*Quigg Construction*
Project Description:	*Iqaluit Sewage Treatment Plant*
Inspection Date:	*17, 18 January, 2000*
Report Date:	*22 January, 2000*
Area Inspected:	*Areas where cavities have been filled in the plant walls.*
Inspected By:	*Paul Salvian, Western Engineering*

Met with Henry (Quigg staff) to inspect the various areas of the walls was taking place.

All areas were filled except for the following areas that were subsequently filled on the 18 January.

1. In the downstairs south wall at the right hand side of the overhead door.
2. In the south wall of the generator room beneath the pipe closest to the west wall.
3. On the east wall behind the augers.
4. On the east wall on the mezzanine floor near the floor.
5. Around the bottom corners of all tanks.

I was satisfied with the work that had been done.

Hydrostatic testing is to be done this coming week.

Sincerely,

REGISTERED PROFESSIONAL ENGINEER
P.D. SALVIAN
LICENSEE
N.W.T.

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS AND GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER
P 346
WESTERN ENGINEERING

WESTERN ENGINEERING

B102, 12225-105 Ave., Edmonton, AB T5N 0Y3
Phone: (780) 488-7403 Fax: (780) 488-0475
Email: psalvian@telusplanet.net

IQALUIT WASTEWATER TREATMENT PLANT

COMPLIANCE REPORT (REVISED)

REGISTERED PROFESSIONAL ENGINEER
P.D. SALVIAN
LICENSEE
N.W.T.

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER
P 346
WESTERN ENGINEERING

Prepared for: Hill Murray & Associates – General Contractor
Quigg Construction – Structural Contractor

Prepared by: Western Engineering – Structural Design Consultant

Original Issue Date: November 10, 1999
Revision Issue Date: November 24, 1999

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5) CONCLUSION

Some problems have been discovered in the tank and building walls. Honeycombs and displaced reinforcing were found in the walls. In addition, questions were raised concerning the ability of the tanks to retain liquid since the Octaform forming system has not been used in tanks of this size. The items listed in the introduction have all been answered.

I. Possible problems with the tank strength and water retention integrity (namely honeycombing, and displaced reinforcing) have been identified and repair plans have been included. Calculations have also shown that the strength of the building and tank walls will be adequate after being repaired. The voids will not cause any leakage problems because they will be sealed with grout, and the PVC formwork will not allow leaks to start.

II. Displaced reinforcing in the walls has not been quantified due to the impossibility of visual inspection. Possible causes for and effects of displaced reinforcing have been described. It is concluded that the strength will not be adversely affected and that the PVC sheathing will help reduce exposure to the corrosive environment.

III. Although no Octaform tanks of this size have been constructed, the formwork has been shown to be effective in smaller, similar applications. Octaform will be an effective barrier against leakage.

IV. A tank testing procedure has been developed which makes good use of time and resources and will identify and locate problems. A remediation plan, if required after testing, has been outlined and will be implemented.

V. A warrantee bond has been supplied by Quigg Construction.

VI. This report includes a copy of Western Engineering's liability insurance.

VII. An explanation for the letter of compliance not including ACI 350 in a list of design codes has been included.

Many features were implemented to assure that the tanks perform their function. High strength concrete with water repellant admixture was used, a volclay seal was installed at the bottom of the walls, and an impermeable stay-in-place PVC formwork was used. As a precaution, a urethane seal will be installed at the tank wall-to-floor joint before testing or use.

In light of these several points, we are confident that the tanks will perform their purpose. Testing will be performed to confirm this, and in the event that problems should appear, they will be dealt with.

TAB V

CWC
Canadian Wastewater Corporation

FAXED
FEB 04 2000
#Pages 3+4

BY FAX: 867-979-5922

February 4, 2000

Denis Bedard P. Eng
Director
Municipality of Iqaluit
P. O. Box 460 (911 Ring Road)
Iqaluit, Nunavut X0A 0H0

Dear Denis:

Re: Iqaluit Water Reclamation Facility : Tank Remediation

I have in been in constant contact with Quigg Construction in order to expedite the remediation of the tanks, and wish to brief you on their progress to date.

Three methods of lining the tanks were considered,

1- installation of a full HDPE liner covering the walls and floor
2- installation of a HDPE partial liner with pinch bars to suspend liner above water line as well as at the floor intersection.
3- spray application of an elastomeric barrier.

The CIM 1000 elastomeric barrier appears to be the preferred method, its benefits include a seamless finish, can be applied to irregular surfaces and simplified repair procedure.

Quadro Coatings Inc. the supplier of CIM membrane coating products are testing for adhesion to the Octaform product. Preliminary in house tests were positive, quantitative testing is underway, their results are expected within a few days.

Upon our acceptance a detailed technical package will be sent to you for your review. The installation time for this product is estimated at 3-4 days utilizing a 3 man crew, product shipping and mobilization to the site approximately one week.

I will keep you well informed of our progress throughout the week.

Yours truly,
CANADIAN WASTEWATER CORPORATION

Garth Nye
Project Manager
I:\PROJECTS\CURRENT\Iqaluit\Bedard let feb 4.wpd

A SUBSIDIARY OF HILL MURRAY

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TAB W

HILL MURRAY

ENGINEERING WATER SOLUTIONS

Annex A

VIA FACSIMILIE:: 867-979-5910

Our File: 38000-70/Iqaluit

February 18, 2000

Denis Bedard
Director, Engineering and Planning
Municipality of Iqaluit
P.O. Box 460
Iqaluit, NWT X0A 0H0

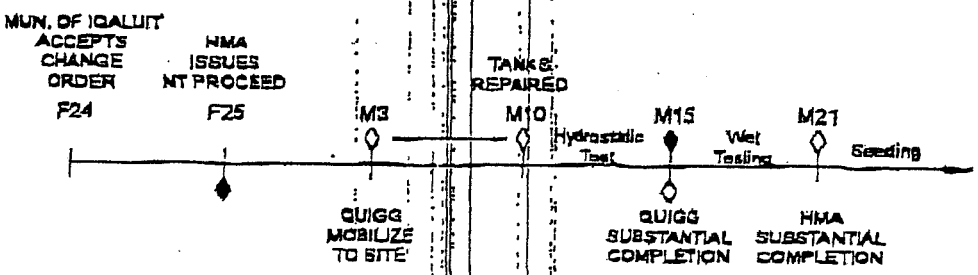
Dear Denis:

Re: Water Reclamation Facility – Acceptance of Tank Repair, Substantial Completion

Attached please find a copy of sealed report prepared by Western Engineering for use of CIM membrane coating of the treatment tanks. We have reviewed this report and concur that providing the recommendations outlined on page 8 be adopted by the appropriate parties, this product will provide a durable coating as intended for use within the MBR. The membrane application will be covered within the extended maintenance bond already in place. In order for Quigg Construction to proceed, we will require your approval and returned signed copy of the attached no-charge change order # 002rev.

To remove the lien placed on the structure we are preparing an irrevocable direction to pay Quigg Construction at substantial completion, which will be issued upon application of the CIM membrane and a successful hydrostatic test. This amount is being tabulated and will be sent to our lawyer to execute.

CWC will request substantial completion upon a successful wet test and start up of the seeding procedure, the enclosed graph illustrates the anticipated timeline for repairs, testing, commissioning and substantial completion.



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Annex A

Please indicate your acceptance below and return via fax to our office.(204-655-8953)

Trevor T. Hill P.Eng
Hill, Murray & Associates

Bert Quigg
Quigg Construction Ltd.

Denis Bedard P.Eng
Municipality of Iqaluit

HILL, MURRAY & ASSOCIATES

Trevor T. Hill, P.Eng.
President & CEO

cc: Garth Nye

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CHANGE ORDER NO.	002(a)
JOB NO.	00199

CWC

CANADIAN WASTEWATER CORPORATION

CHANGE ORDER

To the scope and cost in the Contract between the Municipality of Iqaluit and CWC dated the 22nd day of July, 1999, for the design and construction of the Iqaluit Water Reclamation Facility.

Description	Value	GST	PST	Value This Change Order
To supply and install CIM elastomeric membrane coating in Water Reclamation Facility	N/V	N/V	N/V	$ 0
application as per CIM technical directions and Western Engineering Sealed Report				
Dated February 14, 2000				

Iqaluit Authorized Representative

Date Feb 28/00

CWC Authorized Representative

Date Feb 21/2000

TOTAL VALUE THIS CHANGE ORDER	$0.00
ORIGINAL CONTRACT AMOUNT	$7,543,500.00
TOTAL AMOUNT OF PREVIOUS CHANGE ORDERS TO DATE	$10,660.00
TOTAL REVISED CONTRACT AMOUNT	$7,534,160.00

This change order, when signed by both parties, constitutes an amendment to the contract documents
Terms and conditions of the above noted contract apply to this change order.

Annex

CHANGE ORDER NO.	003
JOB NO.	00199

CANADIAN WASTEWATER CORPORATION

CHANGE ORDER

To the scope and cost in the Contract between the Municipality of Iqaluit and CWC dated the 22nd day of July, 1999, for the design and construction of the Iqaluit Water Reclamation Facility.

Description	Value	GST	PST	Value This Change Order
Cancellation of change order 2(a) as approved by Municipality Feb. 28/ 00				
Cost recovery Clean Seal Environment Canada invoice #117	48,000.00	3,600.00		51,360.00
Cost recovery CWC see attached annex G	19,554.60	1,368.82		20,923.42

TOTAL VALUE THIS CHANGE ORDER	$72,283.42
ORIGINAL CONTRACT AMOUNT	$7,543,500.00
TOTAL AMOUNT OF PREVIOUS CHANGE ORDERS TO DATE	$40,660.00
TOTAL REVISED CONTRACT AMOUNT	$7,656,443.42

Iqaluit-Authorized Representative

CWC Authorized Representative

Date _____

Date _____

This change order, when signed by both parties, constitutes an amendment to the contract documents
Terms and conditions of the above noted contract apply to this change order.

I:\PROJECTS\CURRENT\Iqaluit\Project POs & Financial letters\IQ Change Order #3 .doc

Annex D

Clean-Seal
ENVIRONMENT CANADA

April 13, 2000

CANADIAN WASTE WATER CORP.
201 - 1962 Canso Road
Sidney, BC V8L 5V5
pH: (250) 655-8953 ext. 229
Fax: (250) 655-8954

Attention: Trevor Hill

Re: **Invoice breakdown for mobilization and demolilization of crew, equipment and CIM inspector to the Waste Water reclamation facility in Iqualuit, Nunavut**

Rooms in Iqualuit	$ 1,169.45
Equipment freight	$ 2,475.00
Meals & travel expenses for four men	$ 1,320.00
Men's salary	$ 6,210.00
CIM Inspector fee	$ 5,320.65 can. Funds
Equipment for one week	$ 2,000.00
Plane fairs for four men	$11,000.00
Rooms in Ottawa	$ 506.00
Long distance calls	$ 500.00
Room in Vancouver for Inspector	$ 677.00
Compressor and move product	$ 2,500.00
Management and support staff	$ 4,500.00
Loss of profit	$10,000.00
Total	**$48,000.00**
	Plus GST

Should you require any further information, please do not hesitate to call.

Yours truly,
CLEAN-SEAL Environment Canada

Richard Giroux
President

8773 - 116A STREET, DELTA, B.C. V4C 5Z7 • TEL: (604) 594-0035 • FAX: (604) 502-0370

Annex D

Invoice

Clean-Seal
ENVIRONMENT CANADA

DATE	INVOICE #
4/13/00	117

BILL TO	JOB SITE
CANADIAN WASTWATER CORP. 201-1962 Canso Road Sidney, BC V8L 5V5	Municipality of Iqualuit Waste Water Reclamation Facility

DUE DATE	P.O. NUMBER
4/19/00	

DESCRIPTION	AMOUNT
Mobilization and Demobilization of application crew, equipment and CIM quality inspector to the Waste Water reclamation Facility in Iqualuit.	48,000.00T

Subtotal	48,000.00
7% GST	3,360.00
Total	**51,360.00**

8773 - 116A STREET, DELTA, B.C. V4C 5Z7 • TEL: (604) 594-0035 • FAX: (604) 502-0370

HILL
MURRAY

ENGINEERING
WATER
SOLUTIONS

IQALUIT COST RECOVERY - HILL, MURRAY & ASSOCIATES

Annex E

Cost recovery - Airfare

	Ticket Cost	GST		
Gary Jerzak - Ticket/Change Fee	$1,385.56	$96.99		
Todd Rogers - Ticket/Change Fee	$1,534.01	$107.38		
Graham Symmonds Ticket/Change Fee	$1,496.02	$104.72		
Fred Black - Ticket/Change Fee	$1,885.01	$131.95		
Total	$6,300.60	$441.04	Total Airfare	$6,741.64

Cost recovery - Labour

Week of:	7-Apr	to April 14	to April 21	to Arpil 28	Total Hrs	Rate	Total
Trevor Hill	3	7	7	8	25	$125.00	$3,125.00
Graham S. Symmonds	3	4	1.75	0.5	9.25	$125.00	$1,156.25
Gary Jerzak	3.5	3.25	5	0	11.75	$95.00	$1,116.25
Garth Nye	5	20	6	3	34	$95.00	$3,230.00
Fred Black	0	0	20	0	20	$85.00	$1,700.00
Wendy Hamilton	1	1	1.75	0.5	4.25	$50.00	$212.50
					TOTAL		$10,540.00
					GST		$737.80
					Total Labour		$11,277.80

Additonal Costs

	Units/Days	Price		
Site Security	23	$50.00		$1,150.00
Utilities and heating costs	23	$25.00		$575.00
Site insurance	23	$43.00		$989.00
			Subtotal	$2,714.00
			GST	$189.98
			Total Additional cost	$2,903.98
			Total costs	$19,554.60
			GST	$1,368.82
				$20,923.42

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TAB X

MUNICIPALITY OF IQALUIT

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March 28, 2000

Trevor Hill
President & CEO
Hill Murray and Associates
Suite 201-1962 Canso Rd
Sidney, BC
V8L 5V5

Dear Trevor;

As per your conversation with Teri earlier today Denis is no longer with the Municipality, in the future, all inquiries pertaining to the Sewage Treatment Plant should be forwarded to me. I would also like to inform you that Dillon Consulting has been retained by the Municipality of Iqaluit to provide project management for the remainder of this job. We look forward to working with both you and Garth Nye in completing this project.

Sincerely;

Paul Fraser
Acting Senior Administrative Officer

P.O. BOX 460 • IQALUIT, N.W.T. X0A 0H0 • TEL: (867) 979-5600 • FAX: (867) 979-5922
ᑎᑎᖅᑳᓇᐃᒃ 460 • ᐃᖃᓗᐃᑦ, ᓄᓇᕗᑦᑐᐊᒥ X0A 0H0 • ᐅᖃᓕᐅᑦ : (867) 979-5600 • ᓱᒃᑕᑦᑐᒃᑯᑦ: (867) 979-5922

TAB Y

HILL
MURRAY

ENGINEERING
WATER
SOLUTIONS

BY FAX: 867-979-5910

Our File: 38000-70/Iqaluit

March 29, 2000

Paul Fraser
Municipality of Iqaluit
P.O. Box 460
Iqaluit, NWT X0A 0H0

Dear Mr. Fraser:

Re: Iqaluit Water Reclamation Facility – Tankage Repair

As you are aware, the tank walls at the Iqaluit Water Reclamation Facility failed the hydrostatic test performed in January 2000. As a result, the building contractor (Quigg Construction Ltd) identified a two-part elastomeric membrane material for coating the interior of the tanks to provide a water-tight seal. During the time of the investigation of alternatives, Quigg Construction placed a lien on the project.

We are currently incapable of resolving this issue with Quigg Construction. As a result, we are executing our right to take over completion of the Quigg contract. The technical plan involves the application of a membrane liner material to the interior of the tank walls. An experienced sub-contractor (Clean-Seal Environment Canada) for this CIM membrane installation will be mobilized to the site as early as 7 April to commence installation. Installation is to take approximately three days, followed by a 24-hour curing period.

The financial plan is to issue the membrane supplier Quadro Coating Inc. a "Direction to Pay". I have enclosed the documents for your review. On completion of the repairs and a successful hydrostatic test, we will submit our Progress Claim #4 in the amount of $160,900.00 (see draft enclosed). The full amount of the fix is included in these monies paid into the Jones Emery Hargreaves Swan Trust Account. Quadro Coatings Inc.will be paid directly their invoiceable amount ($126,260.00 includes all taxes).

The responsibility for the repairs of the tanks remains with Quigg Construction. The municipality retains all rights and obligations of the bonding and insurance.

Should you have any questions, I may be reached at 250-655-8953 ext. 212.

HILL, MURRAY & ASSOCIATES INC.

Trevor T. Hill, P.Eng.
President & CEO

cc: Garth Nye
Michael Holmes,
Jones Emery Hargreaves Swan

I:\PROJECTS\CURRENT\Iqaluit\bedard let Mar 24-2000.doc

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info@hillmurray.com
Website:
www.hillmurray.com

TAB Z

10/70

MUNICIPALITY OF IQALUIT

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FILE COPY

April 6, 2000

Trevor Hill, P.Eng.
President & CEO
Hill Murray & Associates Ltd.
Suite 201, 1962 Canso Road
Sidney, BC
V8L 5V5

Fax #: (250) 655-8954

Dear Mr. Hill:

Re: Structural investigation of tanks at the Iqaluit Reclamation Facility

On behalf of the Municipality of Iqaluit, upon request of a representative of the Government of Nunavut, and on the recommendation of Dillon Consulting, I have decided to have the structural integrity of the tank walls studied by an independent consultant. The objective of this study is to assess the number of displaced rebar in the walls of the tanks and to determine if this displaced rebar detrimentally impacts upon the strength of the tanks. This decision was addressed at a meeting this morning. This meeting was attended by Garth Nye, Doug Sitland, Paul Wieczorek, Tania Smith, Gary Strong and Matthew Hough. I am writing to you to formalize this course of action.

There will be a consulting engineer from CH2M – G&S on site next week to do a cover meter test to gather data on the position of rebar in the walls of the tanks. It is expected that testing will take a day and the analysis of data will be in hand by Easter. The scope of work for the consultant includes:

- A review of drawings;
- An inspection of the facility;
- The completion of a cover meter test to determine the rebar location in the tanks; and
- The provision of statements with respect to the suitability of the tanks for intended purpose.

This course of action will not delay the installation of the liner by Clean-Seal Environment Canada. Testing of the tanks, however, will need to be postponed until the results of the structural investigation are received. If no further problems are discovered by our consultant then testing of the tanks will be able to proceed.

Sincerely,

Paul Fraser
Senior Administrative Officer

cc. Doug Sitland, Manager, Capital Programs, GN CG&T
Tania Smith, Dillon Consulting Limited

P.O. BOX 460 • IQALUIT, N.W.T. X0A 0H0 • TEL: (867) 979-5600 • FAX: (867) 979-5922
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TAB AA

CWC

Canadian Wastewater Corporation

April 14, 2000

Our File: Iqaluit 70/23

Mr. Bert Quigg – via facsimile (604-207-8150)
Quigg Construction Ltd.
2143 – 13353 Commerce Parkway
Richmond, BC
V6V 2X7

Mr. Gary Seedhouse – via facsimile (604-687-8861)
The Guarantee Company of North America
400 Burrard Street
Box 57, Suite 810
Vancouver, BC
V6C 3A6

Gentlemen:

Re: Declaration of Default – Quigg Construction Ltd.
Performance Bond No VS6006403

On January 20, 2000, the tanks integral to the building, and critical to the operation of the Iqaluit Water Reclamation Facility, failed the hydrostatic test. On January 21, 2000, we directed Quigg Construction Ltd. to comply with clause 21 of the BCCA Document 200 contract requiring action to remedy deficient work within five days (reference A). Quigg Construction Ltd. acknowledged the leaks and the requirement for repair on January 21, 2000 (reference B).

Since January 21, 2000, our efforts to persuade Quigg Construction Ltd. to complete the work under the contract have failed. Accordingly, we hereby declare that Quigg Construction Ltd. is in DEFAULT under the terms of the contract between Canadian Wastewater Corporation and Quigg Construction Ltd. for Iqaluit Water Reclamation Facility contract # 0199-0100, by reason of:

1. Failure to respond to Canadian Wastewater Corporation's January 21, 2000 notice to remedy deficiencies and complete the work under the contract; and
2. Failure to provide prior written notice of Quigg's intention to file a wholly unsupported claim of lien.

Please advise as to which of the alternative course of action available under the performance bond which the Guarantee Company of North America intends to pursue.

Sincerely,

CANADIAN WASTEWATER CORPORATION

for Trevor T. Hill, P.Eng.
President

Attachments:
A. Notice to Remedy Deficient Work – January 21, 2000
B. Acknowledgement of Remedial Work Required – January 21, 2000

TTH/wh

A SUBSIDIARY OF HILL MURRAY

Suite 201 • 1962 Canso Road • Sidney • British Columbia • Canada • V8L 5V5
Telephone: 250-655-8953 • Facsimile: 250-655-8954 • Email: info@[illegible]

TAB BB

MUNICIPALITY OF IQALUIT

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April 19, 2000

Trevor Hill, P.Eng.
President & CEO
Hill Murray & Associates Ltd.
Suite 201, 1962 Canso Road
Sidney, BC
V8L 5V5

Fax #: (250) 655-8954 Pages: 1

Dear Mr. Hill:

Re: Structural investigation of tanks at the Iqaluit Reclamation Facility

Further to your phone message of yesterday I wish to bring to your attention that the structural report being prepared by CH2M Gore & Storrie of Toronto will be available on Monday May 1, 2000. Until that time it is imperative that no further work be done on the treatment tanks at the Iqaluit Reclamation Facility.

Sincerely,

Paul Fraser
Senior Administrative Officer

cc. Doug Sitland, Manager, Capital Programs, GN CG&T
Tania Smith, Dillon Consulting Limited

Iqalu/Hill Murray – Letter April 19, 2000

P.O. BOX 460 • IQALUIT, N.W.T. X0A 0H0 • TEL: (867) 979-5600 • FAX: (867) 979-5922
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TAB CC

04 April 2001 Our File: Iqaluit

Via Facsimile (867-979-5910)

Matthew Hough
Director of Engineering and Public Works
Municipality of Iqaluit
P.O. Box 460
Iqaluit, NU
X0A 0H0

Re: Iqaluit Work Plan

Dear Matthew:

Thank you for the copies of the tender documents for review. In response to your specific queries, I have provided the following information in as much detail as possible.

The Iqaluit WRF project has been significantly delayed for a number of reasons, including: the failure of the tanks to meet the hydrostatic specifications; the acceptance and subsequent rejection of Change Order #2; and the time taken by the Municipality and its consultants to evaluate various repair options. While Quigg Construction and its consultants and suppliers would appear to be responsible for the initial failure of the tanks, the impact on the schedule has been exacerbated by the time taken by the Municipality to evaluate various repair options. Moreover, the repair specifications that were ultimately developed far exceed what in our view is reasonably required. In any event, the costs associated with the delays to this project caused by both Quigg and the Municipality have made it impossible for us to complete the commissioning phase without additional compensation.

Finances

As you are aware, the hydrostatic failure of the tanks has resulted in significant delays in payment and significant costs for Hill-Murray. As a result, we have not been able to pay many of the sub-contractors for the work performed at the site. All of these subcontractors should be paid directly from monies remaining in the project funds, and we understand that in fact some contractors may have already been paid.

The outstanding contract amount, net of GST, is $579,600. This is exclusive of any delay claims or soft costs which I estimate in the order of $125,000 to $175,000. A detailed list of outstanding third-party HM/CWC payables is provided as attached. The outstanding payables from our end is $600,778.94, the delta ($21,778.94) representing some of the costs associated with mobilization/demobilization charges for the stalled commissioning process, legal costs, and the aborted Change Order #2, originally approved by Denis Bedard.

From the amounts listed, Quigg Construction has outstanding payables, as we understand, in the order of $204,000, which includes:

Clean Seal	$51,360.00 (Approved Change Order #2)
Hill Murray Mob/Demob	$20,932.42
BBS – Quigg Deficiencies	$50,000.00
BBS	$79,657.53
Nunavut Constructors	$ 2,573.00

Outstanding Items Construction Items

On completion of the repair to the tanks, the plant can be moved to the set-to-work/wet-testing phase, and then to the commissioning phase. The Zenon system commissioning has been fully paid, and indeed their commissioning staffs are currently attempting to schedule the start-up for the summer period (subject to the successful completion of the tank repairs). All the ancillary systems (HVAC etc) have already been commissioned by HM/CWC. There are some issues that need to be addressed, and I provide the following information in as much detail as possible.

System	Requirements
Influent Dump Station	The proposed diversion to the lagoons has never been approved, and as such no materials have been ordered. There is presently a cement plug installed in the gravity line to the dump station, and an inflatable pig installed on the downstream side of the new valve. Removal of this plug assembly is required prior to allowing raw sewage into the plant. The new lift station has been supplied with a 4" steel and victaulic line to facilitate dumping of raw sewage. A 4" victaulic nipple (4" MIPT x groove), one 400D Kamlock (4" FIPT x female kamlock) and a 4" #31 victaulic coupling are required to complete the dumping assembly. The 3" pipe nipple welded to the inlet of the strainer box needs to be changed to 4".
Lift Station	The diverter valve has been installed, but as yet no actuator has been supplied (part of unapproved change order) 2 runs of 150ft ¼" OD air tubing is required to actuate this proposed valve. A ¾" kitec conduit has been installed from the mechanical room for this purpose. The required compression fittings for this tubing are on site. The tubing is not. The solenoid valve located on the wall behind then staircase requires a change to the actuator coil. The original supply was 230V (Numatics Model L238A4520 coil 237-507B), and this needs to be changed to a 115V coil.
Trash Room	The trash augers have been bumped and verified. The recycled water supply to the augers requires a ¾" Boshart Industries Valve with FIPT ends.
Anoxic Mixers, Sludge Recirculation Pumps	These units require lifting cables to be fitted (combined requirement of 150ft 3/16" stainless steel wire rope. Clamps and thimbles are also required. The mixers are required to be placed at the height specified in the drawings with the appropriate angle offset.
Aerobic Tanks	The aerator assemblies have been removed for the tank repair. Depending on any elevation changes to the floor of the tank, it may be necessary to change the downcomer height to accommodate. Similarly, if there is substantial changes to the width or length of the tank, this may affect the lateral assemblies. This material is 4" PVC sewer/drain pipe, and it would be appropriate to have on hand several 4" PVC caps and couplings as a contingency plan. Sludge Recirculation Pumps have been removed for the tank repair. The lifting davit in the trash room is used to remove/replace these units. The pedestal bases are installed for both pumps and one lifting cable needs to be installed on one pump (the other exists).
Zenon	Alignment of the permeate pumps has not been completed. This is required prior to wet testing.
Soaking Tank Recirc System	Both pump systems with NaOCl, Citric Acid and heating system are complete. The new suction header and discharge terminations are also complete. A priming assembly has been installed (3-way valve). During normal operation, the

System	Requirements
	pumps will draw through the soaking cassette and return to the soak tank. To prime, move the ball tot he alternate position. This pi[ping is connected to vacuum pumps P-36 A & B and will evacuate the air within the suction piping, pump and hoses. Once the air is removed, move the 3-way valve to the original position prior to energizing pump.
Cassette modifications	In order to accommodate the depth of the soaking tank, PVC tees are to be installed on the Zenon cassette header at the top of the membranes. These PVC fittings, hoses and cam-lock fittings are on site.
Sludge Pressing Module	The Fournier press requires one ¾" plastic line connection to the flocculator. This will require the supply of one ¾" FIPT/FIPT PVC coupling. The flexible chute for cake to the lower floor has not been supplied, but will be required. 1 x 6" ABS cap and 1 x 4" ABS cap are required to close off floor can in the press room. A 1.5 yd3 self-tilting trash bin is on site. The intent is to have this placed under the Fournier chute. Once full, the bin gets moved under the hoist and lifted (lifting straps and eye-bolts are on-site but need to be installed). The truck is backed under the bin, and the bin lowered for transport to the disposal site.
Emergency Diesel Generator	A 24V-trickle battery charger is required. The generator has been fired, and has completed an ABT test. The full load trials of the generator have not been completed.
HVAC	Circulation to all unit heaters through the boilers has been completed. Both boilers have been fired. Not that the thermostats on the boilers have not been staggered, rather, it is a manual function to switch between the boilers (say, every 2 weeks) 2 x 1/8" MIPT Maid o' Mist air release valves are required to replace leaking units on the boilers. Ventilation ducting was near complete for the air-handling unit. This unit has not been run. Two actuators from silent air are still owing. There is some shipping damage (noted via fluorescent orange paint). The damage should be repaired prior to commissioning of these units. Exhaust fan and ducting for the trash room has not been completed. An exhaust fan has yet to be ordered. Insulation for the 2" line to the air-handling unit is partially complete. 160 ft of insulation is required. There is one in-line circulating heating pump (Grundfos UPS 40-160 115V 60 Hz) that causes the circuit breaker to trip after approximately 30 seconds of operation. This pump needs to be replaced. This is a warranty item with Westburne Victoria. Currently the main circulating pump is sufficient to maintain the appropriate circulation in the heating system.
Office/Washroom/Lab	Office counter top and painting complete. Phone jack is energized. Baseboards are required (extruded plastic) – 65 ft plus two molded corners. Washroom shower and sink are operational. Presently, the P-trap in the sink has been disconnected until the anoxic tanks are in operation (system drains to these tanks). The shower drain is temporarily connected to the outside. This will need to be disconnected PRIOR TO THE COMMISSIONING OF ANOXIC TANK #1. Once this tank is full, there will be no access to this temporary line. The potable water system is operational. In order to empty the tank, the low-level float was raised and tied. This float must be released for normal operation of the system. The interior lift station has been tested but is currently shut down. The 3" ABS transport line (located at eye level on the mezzanine deck above the boilers) has been disconnected. A temporary shower drain runs through this line to the outside. A FEMCO rubber coupling is there to allow for reconnection.

System	Requirements
Control	For commissioning, temporary wiring has been installed as follows, to bypass the PLC: A single float switch in the lift station will activate one pump only and start the trash augers (and the associated washwater solenoids – note that the backpulse tanks supply this water). Water from the hydrostatic test should be used to fill the recycle water system (this system is currently bypassed to allow one pump to run from a pressure switch indication) On completion of the set-to-work and wet testing, and commissioning this temporary wiring is to be reconnected to the PLC (this wiring has been labeled at the panel for reconnection to the terminal block)
General	Final grading needs to be completed.

Set-to-Work/Wet testing

For hydrostatic testing, the lay-flat hose needs to be connected from the hydrant adjacent the Mariner Lodge to the newly installed AV. The downstream side of the piping will need to have the pig removed, which will allow water into the lift station. The temporary float switch will allow the pump and trash auger to energize.

For wet testing, the effluent discharge upstream of the flow meter has been disconnected and turned 180 degrees. A flange and an elbow allow for proper orientation of the flow back to the MBR. On completion of wet testing, this assembly needs to be returned to its original position.

Seeding and Commissioning

For seeding, the plan is to provide trucked sewage to the new lift station, feed the reactor in batches, aerate and operate in a similar fashion to an SBR until a viable biomass is obtained. Nitrifying and BOD reduction organisms in a dried state are on-site to assist this process. Zenon has the responsibility for commissioning of the membrane and biological systems.

Conclusion

I trust the foregoing answers your specific questions in sufficient detail. Should you have any further questions, please feel free to contact me at your convenience.

Sincerely,

HILL, MURRAY & ASSOCIATES, INC.

Trevor T. Hill, P.Eng.
President

HM/CWC Third Party Payables

Item	HM Amount	CWC Amount	Total	Net of GST
Aco Containers	3,072.29	-	3,072.29	2,871.30
Agra	3,260.97	-	3,260.97	3,047.64
Air Canada Cargo	1,798.27	-	1,798.27	1,680.63
Baffin Building Systems	152,234.76	-	152,234.76	142,275.48
Baffin Energy Systems	7,442.91	-	7,442.91	6,955.99
Bartle & Gibsons	5,487.53	-	5,487.53	5,128.53
Canadian Airlines	27,578.50	-	27,578.50	25,774.30
Canadian Freightways	1,409.05	-	1,409.05	1,316.87
Candrill Limited	27,714.82	-	27,714.82	25,901.70
Columbia Fire & Safety	1,864.05	-	1,864.05	1,742.10
Columbia Valve & Fitting	-	186.98	186.98	174.75
Bradley Air Services	41,565.13	815.50	42,380.63	39,608.07
Eastern Arctic TV	35.90	-	35.90	33.55
Emco Ltd	583.34	-	583.34	545.18
F&Y Engineering Concepts	1,605.00	-	1,605.00	1,500.00
F3 Consultants	-	299.60	299.60	280.00
Factotum Steel	865.27	-	865.27	808.66
Hansen Trucking	3,031.51	-	3,031.51	2,833.19
Inmate welfare fund	770.40	-	770.40	720.00
Millenium	7,215.51	-	7,215.51	6,743.47
Municipality of Iqaluit	2,865.23	-	2,865.23	2,677.79
Northwest Power	11,516.33	-	11,516.33	10,762.93
Norwest Tel	2,706.23	-	2,706.23	2,529.19
Norwheels Enterprises	2,961.23	-	2,961.23	2,767.50
OMM	6,857.13	-	6,857.13	6,408.53
Quigg Construction	290,813.90	-	290,813.90	271,788.69

Item	HM Amount	CWC Amount	Total	Net of GST
Receiver General	10,272.05	-	10,272.05	9,600.05
Silent Aire Mfg Inc	18,832.00	-	18,832.00	17,600.00
Uqsuq Corporation	4,202.73	-	4,202.73	3,927.79
Western Engineering	2,969.35	-	2,969.35	2,775.09
Totals	648,572.00	1,302.08	649,874.08	600,778.97

HILL
MURRAY

ENGINEERING
WATER
SOLUTIONS

VIA FACSIMILE: 867-979-4874

10 Oct 2000

Glenn Earle
Baffin Building Systems
P.O. Box 699,
Iqaluit, NU, X0A 080

RE: Iqaluit Water Reclamation Facility

Dear Sir:

Further to a letter received from the Brown Beattle O'Donovan the legal council for the Municipality of Iqaluit, the following will outline the situation with respect to outstanding payables of Hill Murray & Associates Inc. (HM) or Canadian Wastewater Corporation (CWC).

As you are aware, the tank walls as constructed in Iqaluit in respect of the wastewater treatment facility leaked as a direct result of the materials and workmanship as supplied through our sub-contractor Quigg Construction Ltd, and their engineer Western Engineering Ltd. This sub-contract was bonded with the Guarantee Company to CWC and the Municipality of Iqaluit directly under a dual obligee rider. It is the intention of the Municipality to begin the fix of these tanks on their own with their own engineers if necessary to bring the project to closure.

There is currently $570,000 left owing in the CWC contract with the Municipality of Iqaluit, and in January there was enough money to finish the project and make all of our sub-contractors whole. Through the passage of the last 10 months, Hill Murray has kept this project alive and funded the legal and direct costs to keep this project from collapsing. This has cost in excess of $250,000 and it is expected that the various pieces of litigation which are now likely required to ensure that all parties uphold their commitment, will cost a further $50,000 to $100,000. Hill Murray is no longer prepared to front all of these costs.

It is further likely, judging from the actions and correspondence received from the Guarantee Company that they in fact will need to be sued to ensure all parties are paid.

If the Municipality chooses to pay for the fixes which are now underway from monies held back in CWC's contract, then it is clear that none of the sub-contractors will be paid anything more on this contract.

Each sub-contractor should note that there is an L&M bond attached to the Quigg bond to CWC and the Municipality. It is strongly recommended that each sub-contractor of Quigg's make an immediate claim on that bond in the form of a statement of claim to preserve any rights which they may have.

Hill Murray will continue to fund this situation if the sub-contractors can agree to the following:

> Provided that the fix that the Municipality has now embarked upon proves to be satisfactory, in that the tanks hold water, Hill Murray will complete the contract and commission the facility. We will require approximately $100,000 to do this and continue to continue paying legal bills in pursuit of the bond and other remedies in law. We will seek an agreement from the Municipality to pay from the monies left in the project funds, all sub-contractors to a level of 25% immediately and to pay the $100,000 from above and all legal bills to date. We intend on allocating monies earmarked for Quigg toward sub-contractor resolution and our delay claim.

When CWC is successful in realizing on the bond call (which is in process), and on any other suits, then unsecured sub-contractors will be paid on a pro-rata basis.

Without the cooperation of the sub-contractors and the bonding company in the completion of this contract, this plant will not be completed, or if it is completed, the sub-contractors are likely to receive nothing. We are seeking a cooperative front such that we may complete the project and make as many sub-contractors whole as possible.

Please call me as soon as possible to discuss the next steps (250) 655-8953 – ext 212

I have attached an accounting of the project to completion for review.

Sincerely,

HILL MURRAY & ASSOCIATES INC.

Trevor T. Hill P.Eng
President

cc: Bill Hopkins via facsimile (604) 687-0043

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1962 Canso Road
Sidney
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Website:
www.hillmurray.com

HILL
MURRAY

ENGINEERING
WATER
SOLUTIONS

3 August 2001

Matthew Hough
Municipality of Iqaluit
P.O. Box 460
Iqaluit, Nunavut X0A 0H0

RE: Your Letter 27 July 2001

Dear Matthew:

Thank you for the reference letter. We recommend that you accept the bonding company's offer of a lump sum cash payment of $550,000 and hereby give you our agreement to this settlement, though we have no knowledge as to what the fixed which presumably have been performed actually cost and what they ultimately entailed.

We trust that none of the impressed trust monies which remain outstanding to Hill Murray have been put toward this work and irrevocably direct the Town to pay the many sub-contractors who are still owed money on this project either at full value or pro-rata based on the following outstanding payables.

Further, we understand that ZENON remains willing to perform the commissioning work on this facility under their pre-paid contract, and recommend that the Town pursue this if they have not done so already.

Sincerely,

HILL MURRAY & ASSOCIATES INC

Trevor T. Hill, P.Eng
President

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TAB DD

Iqaluit

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Sewage Treatment Plant Investigation

Prepared for:
City of Iqaluit
P.O. Box 460
Iqaluit, N.W.T.
X0A 0H0

Prepared by:
Earth Tech (Canada) Inc.

December 2002

Project No. 52333

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SECTION 1.0
EXECUTIVE SUMMARY

1.1 INTRODUCTION

This report has been prepared to provide a comprehensive assessment of the existing operational status and physical condition the City of Iqaluit's newly constructed Sewer Treatment Plant. This report also includes appropriate recommendations to bring the idle plant online taking into consideration a number of critical economic, environmental, engineering design and construction issues that can be associated with the overall plant development and operation.

Specific elements of the report include:

A written evaluation of the overall physical condition of the existing STP with a focus on building code deficiencies, the layout and performance of electrical and mechanical equipment according to established design/performance requirements, and various deficiencies that can be associated with the overall integrity of the plant's architectural and structural design.

An accounting of all electrical, instrumentation, mechanical, structural, and architectural equipment or features found within the existing plant versus equipment and features shown on the facility design documents.

Presentation of recommendations to replace, or modify, electrical, instrumentation, mechanical, and structural elements of the existing facility expected to create severe operational problems during the plant's commissioning and operation over an extended period of time. These problems are generally associated with plant hydraulic capacity; limited process efficiency; overall durability against extreme cold weather conditions and a corrosive plant environment; ability of plant personnel to operate and maintain a complex and highly automated facility in a safe, efficient, and practical manner; and various considerations applied to plant operational costs.

An evaluation of the general quality of all design and vender installation documents against accepted standards for good engineering practice as applied to the overall wastewater treatment industry.

An evaluation of the plant's overall capability to meet minimal treatment expectations including recommendations to implement optional schemes to increase the existing plant's hydraulic and process capacity.

The presentation of costs to complete the existing plant's construction in accordance with existing building codes, operational expectations, and fulfillment of contractual treatment requirements.

The presentation of costs to modify, or expand, existing plant facilities and equipment necessary to implement less complex (and more stable) process options. These options are developed with the goal of providing for an immediate increase in plant hydraulic and treatment capacity, while

at the same time, reducing additional plant construction and extended operation and maintenance costs to the lowest amount possible.

1.2 BACKGOUND

The consulting firm of Hill, Murray & Associates (HMA) was selected by the City of Iqaluit in mid 1998 to complete all design documents and manage the construction of the City's existing STP. HMA completed the plant's design and began the construction phase of the project by mid 1999. Within a few months of initiating the plant's construction, significant problems began to arise concerning the placement of concrete within major structural and process basin walls. As discovered during an inspection of ongoing plant construction, it was noted that the contractor's use of a concrete-wall forming technique, or methodology, (described as Octaform) resulted in significant honeycombing of placed concrete and the misalignment of structural steel. To effectively deal with the problem, the City suspended all construction activities and solicited the services of CH2M Gore & Storrie Limited (CGSL) to complete the necessary structural investigations and make recommendations as appropriate. In accordance with the stated directive, CGSL recommended that shotcrete be applied to all honey-combed wall sections.

Although the shotcrete recommendation was completed per CGSL's specifications, all construction on the treatment plant has stopped with the initial contractor and design engineer effectively abandoned the project. During the inspection of the concrete walls, the City became aware of other, and more significant, problems with the plant's overall design and construction. These issues are addressed in this report including various discussions aimed at providing recommendations and related costs to bring the existing plant into service within a reasonable period of time.

1.3 SCOPE OF STUDY

The recommendations and costs presented herein reflect improvements and modifications to the existing plant in full conformance with appropriate construction and building codes. The indicated improvements and modifications are also recommended to provide for the most feasible treatment of the City's domestic sanitary sewage in full conformance with established, and mutually acknowledged, effluent discharge standards.

During January of 2002 the existing treatment plant was inspected by a team of process, mechanical, electrical, and structural engineers employed by Earth Tech (Canada) Inc. The inspection included a complete audit of all existing mechanical equipment, electrical distribution equipment and control systems, process and facility support piping, overall building superstructure, miscellaneous process systems and equipment, and the overall plant layout to assess issues relating to the long term operation and maintenance of the entire facility.

Earth Tech's on-site inspection generally confirms that the existing plant is inoperable with a number of safety issues that need to be resolved before any attempt is made to finish the plant's construction in accordance with HMA's initial design. The existing plant is roughly 60 to 70 percent complete in terms of remaining effort and costs to make design and construction changes necessary to meet minimal building code standards and acceptable levels of engineering practice.

The original design and actual facility construction was evaluated against various building codes and design standards normally applied to the design, construction, and operation of wastewater treatment facilities. These codes and standards include the Canadian Electrical Code (CEC), National Building Code-1995 (NBC), National Fire Protection Association Standard for Fire Protection within Wastewater Treatment and Collection Facilities-1995 Edition (NFPA 820), American Concrete Institute Standard for Hydraulic Structures (ACI 350), WBC Industrial Health and Safety Standards, and Canadian Plumbing Code (NPC).

1.4 FINDINGS

Although the plant is inoperable and in need of significant modifications and improvements, the structural and architectural elements of the facility are nearly 100 percent complete and in general conformance with the various building codes cited above. Remaining structural and architectural issues include:

The floor of the electrical room was constructed with shallow (38 mm as opposed to the specified 75 mm) rib decking resulting in excessive sagging of the finished deck. The obvious aesthetic problem notwithstanding, the sagging deck is structurally sound but will create localized drainage problems during extended plant operations.

Questionable fire rating of the building's roof, exterior walls, and various doors separating more fire and explosion prone areas of the plant.

Consideration should be given to constructing more substantial walls to better confine or manage potential fires and explosions within the influent screening and anoxic mixing areas of the overall plant.

Miscellaneous improvements include better plant ventilation effectively reducing corrosion potential for all galvanized structural steel found inside the existing building, replace damaged insulation and backfill around concrete footings were necessary, and provide for the installation of all bracing shown for attachment to existing roof purlin flanges according to the original building design.

The floor of all reinforced concrete process tanks should be refinished and sloped to provide for better drainage during inspection and maintenance.

The existing plant's substantial, and most critical, code violations and engineering problems are primarily associated with the specifying, construction, installation, and projected operation of mechanical and electrical systems. Most of the code and engineering issues involve the installation and operation of electrical equipment in high hazard (fire and explosion) rated areas of the plant and the general lack of capacity and effectiveness for the HVAC system. Specific issues include:

Limited capacity with the existing electrical power distribution system (estimated full load demand at 386 amps with the existing system rated at 400 amps).

Standby generator rated at slightly more than half of the stated plant full load capacity and will require the implementation of a power load control scheme to effectively come online during a plant-wide power outage. Additional issues include: the generator is expected to operate without a battery charger, the generator room has poor ventilation allowing for the outside migration of combustion air, the actual generator performance is unknown because the overall unit has never been tested to full load.

Numerous inconsistencies between electrical design schematics (HMA's design and major vendor wiring diagrams) and the actual installation and wiring of motor control centres (MCCs), related switch gear, miscellaneous control panels, plant lighting, HVAC controls, etc.

Most of the electrical motors and related switchgear are not rated for duty within high hazard areas of the plant and have been installed in violation of the CEC.

Fire alarms not found in critical plant locations subject to the ignition of combustible air from volatilized of combustible influent contaminants.

No electrical utility meter found within the existing plant.

The existing PLC system is incomplete due to a missing second processor module and access to documentation stating the function and purpose of the overall system.

Switch gear and attaching power cables are place on a recessed pad within the lower plant electrical and blower room creating an operational hazard in the event adjacent floor drains fail to adequately remove drainage from surrounding and upper floors of the plant.

Electrical power and control cables should be separated from instrumentation, control and monitoring cables/wires.

It appears that the plant was designed to be highly automated which may result in a number of operational problems given the plant's remote location and accessibility to personnel with the training and technical skills to deal with periodic malfunctions and/or adjustments to the overriding control system software, processor modules, logic and control panels, process monitoring sensors, etc.

The overall arrangement, or layout, of plant piping and equipment has resulted in a number of situations where it would be extremely difficult, if not impossible, for City personnel to operate and maintain the plant's electrical and mechanical equipment.
The project plans and specification provide little, or in some cases, no information regarding the performance, operation, and control of the process mechanical equipment and HVAC system. As a result, the performance and operational characteristics of the overall treatment process and support equipment cannot be assessed with any level of confidence. It is uncertain if the plant can be adequately heated during extended winter operations or provide for proper air circulation in areas of the plant subject to contaminated and combustible air flow. Additionally, the existing system has no redundant heating pumps creating the possibility of periodic plant shutdowns due

to the lack of heated air circulation within the plant during freezing conditions winter weather conditions.

Mechanical equipment shown on HMA's design but not found in the existing plant includes an exhaust fan and hood at the auger screening room, miscellaneous outside air intake louver and hoods, blower and ventilation room controls, heating pipe insulation, a domestic water storage tank, and an operational boiler heating circulator.

An adequate fire and air seal needs to be constructed to enclose the existing coarse screening room from the remainder of the plant. The recommended enclosure would mitigate the potential for the spread of a major fire or explosion in adjacent plant areas.

The cost to implement the structural, architectural, mechanical, and electrical modifications cited above and as further documented in the remaining sections of this report is estimated at slightly over $820,000. An itemized breakdown of the stated construction cost is given in Section 3.7 of the report.

In the event the City of Iqaluit elects to finish the construction of the existing STP according to HMA's existing design, the completed plant will be faced with immediate capacity and process issues regarding future growth and related increase in domestic sewage flows. The most recent population count in 1996 put the City's population base at 4,220. Considering an estimated growth rate of 3.4 percent and an average per capita indoor water demand at 400 lpcd, the current average day domestic wastewater flow rate can be determined at 2,100 M^3/day for an estimated 2002 population base of 5,200. By comparing the current estimated wastewater flow rate with the stated plant capacity of 1,800 M^3/day, it becomes apparent that the newly constructed plant will be unable to accommodate immediate average day flow rates or future increases in wastewater flow without significant bypass events to the existing sea outfall. This type of plant operation will result in repeated violations to the established water quality agreement with the Nunavut Water Board.

1.5 RECOMMENDATIONS

To address the expected plant capacity problem, the City can pursue a number of options to increase the current plant's hydraulic capacity while, at the same time, making the plant less complex to operate by modifying the current process scheme. Viable options to increase plant capacity and improve on the design process scheme may include a conversion to primary treatment only, conventional activated sludge process with secondary clarification, non-conventional activated sludge process with limited filtration, or a conversion to a sequence batch reactor scheme.

After an evaluation of effluent quality standards, long range economic impacts, and general issues concerning process reliability and complexity of plant operations, the conventional activated sludge process appears to be the best option to implement at the Iqaluit STP.

Primary treatment is the least expensive option to pursue in terms of initial construction costs and long range operation and maintenance costs. However, the resulting effluent quality would

only be marginally improved over the existing lagoon system. As a result, the Nunavut Water Quality Board would have to relax their established effluent standards for the plant's sea outfall.

A non-conventional activated sludge plant would require the use of filtration media in lieu of conventional secondary clarifiers for sludge removal. Although the non-conventional activated sludge option would be easier (in terms of time to make necessary plant modifications) to implement, the overall process requires slightly more labour and related operational costs as compared with a conventional activated sludge plant. The additional costs can be associated with the ongoing, or day-to-day, operation and maintenance of the filtration media equipment and/or system.

A sequencing batch reactor process is a viable option to expand the hydraulic capacity of the existing plant to whatever level is dictated by appropriate population growth projections. However, operation of a batch reactor plant requires continuous monitoring of a number of parameters effecting effluent quality. The monitored data and information is further used to make repeated changes, or modifications, to the ongoing process or operation of the plant's bioreactors. The operation of the plant would require more labour and staff with considerable technical training to monitor and interpret critical biochemical data and make appropriate changes in the overall plant operation. A facility operator with the level of training to manage the daily operations of a sequencing batch reactor plant may be difficult for the City to employ over an extended period of time. In the event the City cannot employ a skilled plant operator, it would be very difficult, if not impossible, for untrained staff to operate the plant with any level of efficiency in terms of consistently producing acceptable effluent water quality.

The conversion to a conventional activated sludge plant is recommended at Iqaluit primarily because of its relative simplicity of operation and proven process reliability. The conversion will require the installation of aerators within the existing anoxic basins and the construction of new secondary clarifiers outside the existing plant building. As stated, the conversion is simple and straightforward as compared with other options providing an acceptable level of treatment. The overall process is primarily based on steady-state flow and does not require continuous effluent monitoring or process adjustments. Plant maintenance is less demanding given that filters and/or media are not required for sludge removal.

Implementation of the full secondary treatment options presented above are expected to have a range in construction costs from $4.01 to $ 8.61 million depending on the final plant hydraulic capacity and level of treatment. In consideration that the City has expressed an interest in bringing the existing plant online over an extended period of time, a recommendation will be made to pursue a phased completion of the existing treatment facility base on a number of assumptions regarding projected population growth and per capita indoor water use.
When completed according to the original design, the existing plant process scheme is said to allow for an average day hydraulic capacity of 1.8 Ml/d and produce effluent meeting water quality standards established by the Nunavut Water Board of 10.0 mg/l BOD_5 and 10.0 mg/l TSS. ETC's assessment of the existing facility indicates that the existing bioreactors can be converted to aeration basins with air distribution piping and aeration equipment typically used in a conventional secondary activated sludge plant. However, the average day hydraulic capacity would be 1.6 Ml/d which is slightly less than the stated capacity for the existing plant design.

The slight reduction in capacity is due to a limited Sludge Retention Time (SRT) in the converted aeration basins. Once the existing bioreactors are converted to aeration basins, secondary clarifiers can be constructed outside the existing plant to complete the overall plant conversion to conventional full secondary treatment. Although the conversion will provide the City with a stable secondary treatment facility, the hydraulic capacity will only accommodate an estimated population base of 4,000 full time residences; which is substantially less than the current estimated population base of 5,100 full time residences.

The estimate of serviceable population is based on the assumption of 400 litres per capita per day of indoor culinary water use. This level of domestic water demand was evaluated as a reasonable planning number from the City's recent master plan of the water treatment. The master plan was completed by ETC during March of 2002.

To provide wastewater treatment capability for the City's current population base and allow for some level of future growth, it is recommended that the City pursue a phased expansion of the existing treatment plant. Phase 1 would include the conversion of the existing bioreactors to aeration basins as described above. The conversion would be done in conjunction with all other modifications to bring the entire plant up to code in terms of the structural, mechanical, electrical, and instrumentation deficiencies stated in this report. The estimated cost to complete Phase 1 is $1.01 million including the installation of a small centrifuge to facilitate the land disposal of secondary sludge per recommendations made in the attached report (reference Section 3.7).

Phase 2 would include the design and construction of a 12.0 metre secondary clarifier to match the hydraulic capacity of the aeration basins completed in Phase 1. The completion of the secondary clarifiers will provide for a fully functional (all basic treatment elements in place) secondary treatment plant capable of treating 1.6 Ml/d of average daily influent flow with a peak day flow factor of between 2.0 and 3.0. The cost of the clarifier is estimated at $3.0 million including removable covers to eliminate freezing during the winter months of operation.

Phase 3 would include the design and construction of additional aeration basins with the hydraulic capacity of the converted bioreactors completed in Phase 1. The cost of the additional aeration basins is estimated at $1.60 million.

Phase 4 would include the design and construction of the final 12.0 metre secondary clarifier resulting in a final plant average day flow capacity of 3.2 Ml/d. The stated capacity would service an estimated 8,000 residences before more expansion is warranted. By making a number of simplifying assumptions it can be shown that the Phase 4 plant would provide adequate wastewater treatment at Iqaluit until the planning year of 2013. These assumptions include a current (2002) population base of 5,100 residences, a projected population growth rate of 3.7 percent per year, an average per capita indoor water demand of 400 lpcd, all construction for Phase 1 completed by the end of 2003 with each subsequent Phase completed in a 12.0 month period of time ending in 2006.

The recommended phased construction approach would cost a total of $8.61 million (sum total of all costs as presented above with no present worth adjustment utilizing an acceptable discount

rate). The plant could be completed within a reasonable period of time and provide a level of wastewater treatment in full conformity with established effluent water quality standards. The completion of the plant by the planning year of 2006 would allow for an additional 6 to 7 years of additional time to better assess per capita indoor water demand, raw sewage contaminant levels, population growth projections, and all other lesser parameters to accurately determine the need for additional expansion to the treatment facility.

SECTION 2.0
DOCUMENT REVIEW

2.1 DESIGN/PERFORMANCE

2.1.1 Civil

The civil engineering aspects of a treatment plant's construction typically includes the drainage, grading, and possible surfacing of parking lots and access roads to various, and surrounding, treatment facilities and related operation and maintenance buildings. The civil engineering design also includes potable water service to the overall plant site for both indoor and outdoor uses.

The Hill Murray & Associates design of the Iqaluit sewage treatment plant does not provide detailed drawings or specifications for the stated civil-site improvements. Additionally, an on-site audit and inspection indicates that the area immediately surrounding the plant has not been paved. The area has been improved to some extent by the placement of gravel typical of most sites in Iqaluit, to accommodate periodic parking for City maintenance personnel and/or miscellaneous visitors to the plant.

Potable water for the plant is provided by truck service. The gravity sanitary sewer enters the lift station adjacent to the treatment plant building. Drawing D-0199-G002 is a site plan that indicates a general alignment (in plan) for both an existing 300 mm sewer and a proposed 300 mm sewer outfall. The drawing shows a general sewer alignment that is not tied to any existing horizontal survey control. As a result, it would be difficult, perhaps impossible, to locate existing sewer lines without probing (temporary trench excavations across an assumed pipe alignment).

2.1.2 Structural/Architectural

The design drawings for the building (excluding electrical and mechanical) are by and large complete and professionally prepared in CAD format. There are thirty-three (33) structural drawings and nine (9) architectural drawings, plus two (2) formwork drawings that show typical details for the somewhat contentious concrete wall forming (Octaform) system.

Comments with respect to tank design and construction are included below only for completeness. A report prepared by CH2M Gore and Storrie in April 2000 discusses this aspect of the project in detail.

Structural Design

In some cases, the level of structural detail is beyond what would normally be included in a tender package, probably because many of the details are for apparent shop use. For example, steel details include connection and weld details that are often left to the fabricator. It is

recommended that the design files be obtained from the original designers for use in any future renovation work.

In general, structural design performance has been met, based on the fact that the drawings are well detailed and the structures are substantially complete (indicating that the contractor was able to build what was detailed). The specified 75 mm Q deck was substituted with a 38 mm deck, which created concrete floor deflections during the pour. However, this is not a design issue (discussed in Section 3.3 as a variance from contract documents).

A detailed design check was not performed during this review; however, the structural member sizes seem to be appropriate for the expected vertical loads, and there appears to be significant redundancy in the lateral load carrying elements.

Architectural Design

Architectural design and details are also adequately treated, to a lesser extent than structural. However, this is normal for an industrial facility. In some cases, it is apparent that the architectural layout followed the process layout, because some of the usable space is compromised by problematic access routes. For example, the mezzanine above the office/washroom is accessible only via cat ladder, due to the fact that any other type of stair would interfere with internal access on the upper floor. There may be a way to incorporate a spiral stair, which would at least allow a user to carry objects to the mezzanine level.

Architectural design performance has been met with the drawings and details provided, and the code analysis discussed below.

2.1.3 Process

A number of documents have been both referenced and generated to design and construct the sewage treatment plant. The documents relating to the development of the treatment process are reviewed and assessed in this section of the report.

Documents Reviewed

The following documents have been reviewed for content and level of detail related to the process systems within the Iqaluit Sewage Treatment Plant. The abbreviated form of the document name is shown in (brackets). This document abbreviation is used throughout the subsequent text.

Document	Abbreviated Name	Prepared by
RFQ – Requirements – January 21, 1998	IRFQ-1/21/98	City of Iqaluit
Response to Request for Qualifications and Proposals for Sewage Treatment Option for the City of Iqaluit-March 18, 1998	HMAP-3/18/98	Hill Murray and Associates March 19, 1998
Revised Proposal for a Fully Integrated Sewage Treatment Facility for the City of Iqaluit-June 12, 1998	HMAP-6/12/98	Hill Murray and Associates June 12, 1998
Design-Build Stipulated Price Contract for the City of Iqaluit Water Reclamation Facility-July 22, 1999	DBSPC-7/22/99	Hill Murray and Associates July 22, 2999
Project Process Drawings included in the Contract: Process Drawings M001 - M004 M001: Influent Tank Fabrication dwg. M002 and M003: Auger Tank Fabrication dwg. M004: Fournier Press Layout dwg.		Hill Murray and Associates Fournier Industries Inc.

Documents Not Included In The Contract But Reviewed During The Site Visit

Construction Drawings: D-0199- M001 to D-0199- M003 and D-0199- M010 to D-0199-M013		Hill Murray and Associates
Process and Instrumentation Drawings (P&IDs) and Installation Drawings:		Zenon Environmental Systems Inc. Fournier Industries Inc. Sanitaire
Operation and Maintenance Literature		Zenon Environmental Systems Inc. Fournier Industries Inc.

Iqaluit Request for Qualifications Requirements

The original IRFQ-1/21/98 provides the outline of the basis for design for the sewage treatment plant. Key elements are the design flows and loads, as described in the following paragraph.

The population in 1996 was 4,220 people. The twenty year projected population to the year 2017 was 8,500 people. The IRFQ-1/21/98 stipulates that an average daily flow of 400 liter per capita per day (Lcd) should be used for the design. The 1996 average daily flow and the projected 20-year average daily flow are 1,688 m3/day and 3,400 m3/day, respectively.

The design parameters for the raw wastewater characteristics and design maximum average effluent concentration based on the future treatment requirements are presented in the following table:

Parameter	Raw Wastewater Characteristics	Max. Average Effluent Concentration
Ave. Daily Flow, Design Year 2017	**3,400 m^3/day**	N/A
BOD_5	220 mg/L	80 mg/L
TSS	220 mg/L	70 mg/L
Feacal Coliform	9,000,000 FCU/100 mL	100,000 CFU/ 100 mL
pH		6 to 9
Oil and Grease		No visible sheen

Hill Murray Proposal Submissions and Contract Documents

Hill Murray submitted a Response to the Request for Qualifications and Proposals for the Sewage Treatment Options on March 19, 1998 and a revised proposal on June 12, 1998. A Design –Build Stipulated Price Contract for the City of Iqaluit Water Reclamation Facility was signed July 22, 1999 between the City of Iqaluit (the Owner) and Hill Murray. Design parameters identified by the Owner in Annex F of the Contract are presented in the following table along with effluent criteria stipulated by the Nunavut Water Board, as presented in Appendix I of the Contract.

Parameter	Raw Wastewater Characteristics *Appendix F*	Hill Murray & Assoc. Guaranteed Effluent Concentration	Max. Average Effluent Conc. Stipulated by City of Iqaluit in Appendix F of the Contract	Max. Average Effluent Conc. Stipulated by Nunavut Water Board in Appendix I of the Contract
Design Flow (1) (2)	**1,800 m^3/day**			
BOD_5	≤ 500 mg/L	≤ 10 mg/L	≤ 10 mg/L	≤ 30 mg/L(3)
TSS	≤ 500 mg/L	≤ 10 mg/L	≤ 10 mg/L	≤ 35 mg/L(3)
Alkalinity	≥ 100 mg/L			
Temperature	≥ 10°C			
Feacal Coliform		≤ 1,000 MPN/ 100 mL Complete nitrification of ammonia	≤ 1,000CFU/ 100 mL	≤ 10,000 CFU /100 mL(3)

Notes:
(1) The Contract documents indicate that the piping is sized for 2,500 m^3/day
(2) Appendix F requires that the treatment plant be expandable to 3,500 m^3/day with the addition of tankage, equipment, and extension of the building.
(3) Effluent criteria based on 150 – 600 lcd.

The design parameters have changed significantly compared to the original IRFQ-1/21/98. The raw wastewater characteristics are generally much higher than in the original IRFQ-1/21/98 whereas the effluent criteria are much more stringent. In addition, the effluent design criteria stipulated by the Owner (Appendix F of the Contract Documents) are also more stringent than those stipulated by the Nunavut Water Board (Appendix I of the Contract Documents). Of significant note is the change in average daily design flow and design year, which has changed from 3,400 m^3/day in 2017 to 1,800 m^3/day in the construction year. Sizing and building the system to meet current average day flows means that consideration must be given to expanding the plant the day construction is finished as there is no room for growth. In addition, good engineering practice would dictate that wastewater treatment plants are designed to treat at least the current peak hour flows. Good engineering practice is further discussed in Section 3.5 of this report.

Hill Murray's proposed process train to meet effluent criteria included the following equipment and tanks:

- Two channels with screens and inclined augers and an influent by-pass channel.
- Two anoxic tanks, including one mixer per tank, in which influent screened wastewater is mixed with return activated sludge.
- Two aeration tanks in which a suspended growth activated sludge system are followed by the ZENON ultra filtration membrane system, to be located at the downstream end of the aeration tanks. The membrane is a vacuum driven system whereby the wastewater is drawn through the surface of the membrane that rejects the insoluble material.
- Filtered wastewater is then discharged to the bay.
- The insoluble material, or sludge which includes bacteria, is collected at the end of the aeration tank in a sump and returned to the start of the process (return activated sludge) to mix with the incoming screened sewage in the anoxic tanks.
- A portion of the return activated sludge is wasted on a daily basis to maintain the biomass concentration in the aeration tanks at the desired level. The waste activated sludge (WAS) is dewatered in a rotary press to reduce the volume of sludge to be sent to disposal. Dewatering requires the addition of polymer for flocculation and wood pellets that provide structure to the dewatered sludge.
- Filter cake is disposed at the landfill which the filtrate is pumped to the start of the process train.

Process Description

The proposed process is described in the following paragraphs.

Wastewater flows enter the plant by immediately discharging to the influent tank located in the screening room. Wastewater then flows through one of two channels through coarse screens with more openings. Inclined screw augers remove debris from the face of the screens and convey it through a compaction zone to discharge into an underdrain. A by-pass channel is also provided. Screened influent discharges into one of two anoxic tanks located below the influent tank. Two mixers in each anoxic tank provide mixing to ensure that solids do not settle. Return activated sludge from the aeration tank is pumped to this tank and is mixed with screened wastewater. Hatches are provided for access into these tanks. The hatches extend along the length of the anoxic tanks, thus cradling both the screening room and the aeration room. A sump is provided below the hatches in the event that a submersible pump must be dropped into the tank to empty the tank.

Mixed liquor flows from the anoxic tanks to the aerations tanks. Aeration grids are provided in each aeration tank. At the end of each tank, ZENON membranes cassettes are provided.
Two membrane cassette cleaning tanks are provided.
The pumping and piping system, including two backwashing tanks, are provided on the main floor of the building. The main floor also includes the electrical room, the sludge dewatering room, the office and the washroom.

The main floor sludge dewatering room includes the Fournier rotary press, the polymer addition system, and the wood chip bin used to introduce wood chips into the sludge dewatering process.

The membrane cassette cleaning tanks extend to an intermediate floor.

The blower room, the generator room, and the dewatered sludge collection room are situated at ground level.

Hill Murray proposed to provided process equipment for 2000 m^3/day, expandable on an as required basis in the March 19, 1998 Proposal. The design flow was decreased to 1668 m^3/day in the revised proposal dated June 12,1998 and increased to 1800 m^3/day in the contract documents. Hill Murray estimated that at a design flow rate of 1800 m^3/day, 40 m^3/day of sludge would be wasted daily from the secondary treatment system. This volume would be reduced using the filter press. According to Hill Murray, two to three man-hours would be required for sludge dewatering. It was also estimated that 16 tons of wood pellets would be required on an annual basis for the sludge dewatering process.

Contract documents indicate that the piping is sized to handle a flow rate of 2500 m^3/day whereas the tankage has been designed for a build out capacity of 3400 m^3/day.

Plant Equipment Capacity

A summary of major equipment size and rated capacity is presented in the following table.

Description	Size	No of Units	Rated Capacity	Total Capacity
Plant			20.8 l/s	1,800 m^3/day
Influent Pipe	200 mm	1		2,500 m^3/day
Influent Tank				1,800 m^3/day
Bar Screen	2.5 mm openings	2		1.800 m^3/day
Screw Auger		2	77 l/s each	m 1,800 M^3/day
Anoxic Tank – Original size	198 m3 to 277 m3	2		HRT: 2.4 to 3.2 hrs
Aeration Tank – Original dedicated aeration area and assuming RAS rate equals influent rate		2		HRT: 3 to 4.2 hrs
Aeration Blowers	20 kW	3	200 l/s @48 kPa	600 l/s @ 48 kPa
Membrane System Cassettes	510 m^2/cas	10	<1.8 ml/d avg. 3.6 ml/d peak	
Membrane System Blowers	40 kW	3	536 l/s @ 48 kPa	1,608 l/s
Process Vacuum Pumps		3	14.4 l/s @ 15.24 m Hg Vacuum	430.2 l/s
Vacuum Pumps for Priming	*1	2	0.25 ml/d @ 0.45 m Hg Vacuum	5.8 l/s
Mixed Liquor Recycle Pumps	10 kW	2	7.5 ml/d each	170 l/s
Citric Acid Metering Pumps	*1	1	0.02 l/s @ 103 kPa	0.02 l/s
Citric Acid Dip Tank Pump	*1	1	3.4 l/s @ 7.62 m	3.4 l/s
Backpulse Sodium Hypochlorite Metering Pumps	*1	2	5.4 l/hr @ 103 kPa	10.8 l/hr
CIP Sodium Hypochlorite Metering Pumps	*1	1	0.027 l/s @ 103 kPa	0.027 l/s
Sodium Dip Tank Pump	*1	1	3.4 l/s @ 7.62 m	3.4 l/s
Air Compressor	562 kW	2	1.7 mm3/min @ 610 k Pa	11.24 cfm
Fournier Press	1.5 m^2 filtration surface			Expandable to 3 m^2
Flocculator	100 l			
Progressive Cavity Pump	*1	1	10 m^3/hr	1.0 m^3/hr

*1 Table Note: Data not readily attainable from construction drawings/specifications.

The process drawings that were provided in the Contract documents are limited to the fabrication drawings for the influent tank and auger tanks and layout drawings for the Fournier Press. The general plant layout is presented in the structural drawings.

There is no information in the contract documents with respect to acceptable manufacturers for products, design standards, acceptable valve suppliers, piping material or the requirement to provide an operator friendly system. This information should have been included to provide quality control.

2.1.4 Mechanical

The following documents have been reviewed for content and level of detail related to the mechanical systems within the Iqaluit Sewage Treatment Plant. This document abbreviation is used throughout the subsequent text.

Document	Prepared by
3/18/98 Project Proposal	Hill, Murray & Assoc.
Plant Mechanical Drawings M-1 through M-8	F&Y Engineering Concepts Ltd.

The design/performance of the facility's mechanical HVAC and control systems are not specifically referenced in the HMAD-3/18/98 document. The document does however reference the level of plant automation and redundancy.

The Proposal document does not present any further information on the design performance of the mechanical HVAC or control systems to be provided within the facility.

Project "Issued for Construction" drawings have been provided as described in the Documents Reviewed section. The specification included on the drawings is incomplete in the controls section as no sequence of operation, setpoints or control components other than thermostats are indicated. Redundant secondary heating supply pumps have not been provided in the design, requiring a pump replacement in the event of failure.

2.1.5 Electrical and ICA

The following documents have been reviewed for content and level of detail related to the electrical systems within the Iqaluit Sewage Treatment Plant. The abbreviated form of the document name is shown in (brackets). This method of document abbreviation is used throughout the remainder of this report.

Document	Abbreviated Name	Prepared by
Response to Request for Qualifications and Proposals for Sewage Treatment Option for the City of Iqaluit	HMAD-3/18/98	Hill Murray and Associates March 18, 1998
Revised Proposal for a Fully Integrated Sewage Treatment Facility for the City of Iqaluit	HMAD-6/12/98	Hill Murray and Associates June 12, 1998
Design-Build Stipulated Price Contract for the City of Iqaluit Water Reclamation Facility	DBSPC-7/22/99	Hill Murray and Associates July 22, 1999
Project Electrical Drawings in 3 Portions:		Hill Murray and Associates
1. Plant Electrical Drawings E001 through E008		Zenon Environmental Systems Inc.
2. Plant Control Systems Drawings D-0199-E030 through D-0199-E060		Fournier Industries Inc.
3. Dewatering System Power and Controls Drawings D-0199-E070 through D0199-E082		
Operation and Maintenance Literature		Zenon Environmental Systems Inc. Fournier Industries Inc. ProAqua Engineering Canadian Wastewater Corp.

Electrical and ICA Design/Performance

The design/performance of the facility's electrical and control systems are not specifically referenced in any of the documents referenced in the Table. However the DBSPC-7/22/99 does however reference two key points for further review in this report: First, the level of plant automation and the method of providing this automation.

The Proposal document does not present any further information on the design performance of the electrical or control systems to be provided within the facility. Electrical and controls design/performance criteria are referenced in Annex A and Annex E of the Contract.

Annex A outlines the project scope of work. Items listed that would be considered electrical or controls work are as follows:

- Lighting
- Diesel generator
- All electrical wiring and testing
- All instrument wiring and testing
- All PLC software and testing
- Electrical service for the treatment plant
- Transformers, switchgear for primary power service
- Lift station
- Control panel
- Back-up power from plant system
- Electrical service for lift station

A key item not listed in Annex A is the provision of a motor control centre (MCC) and the related connections and testing of all process and mechanical equipment.
Annex E contains an operation and maintenance cost summary and a letter from the Canadian Wastewater Corporation outlining the operation and maintenance services that they could provide. A large portion of the letter is dedicated to the capabilities and functions of the SMART computerized process monitoring and O & M data logging system.

Site investigation revealed that the project was being constructed to include the field infrastructure to support the SMART system.
Project drawings have been provided in three packages as described in the Documents Reviewed section. Packages provided by Zenon and Fournier detail only the configuration of equipment provided by these vendors. The package provided by Hill Murray shows the overall electrical scheme for the facility. There are no drawings indicating the necessary controls scheme for the facility such as overall instrument wiring diagrams, block schematics, instrument loop drawings, or an instrument index.

Drawings for the Fournier package are complete and comprehensive. The package includes:

- Block system layout drawing.
- Control panel layouts for each panel complete with components lists.
- Analog wiring diagrams.
- Discrete wiring diagrams complete with terminal block wiring numbers.

- Motor drive wiring diagrams complete with terminal block wiring numbers.
- Current to pressure (I/P) transducer layout diagram.

Drawings for the Zenon package detail include:

- Layout of the Zenon PLC cabinet.
- All PLC input and output wiring within the PLC cabinet (with connection to field devices to be "by others").
- Two pages of single line diagrams.

PLC input/output wiring diagrams are set up to show the wiring for each PLC module mounted within the PLC rack. Each drawing details I/O addresses and wiring numbers within the PLC cabinet and provides blank spaces for the contractor who provides the field wiring to record the field wiring identification numbers. Field wiring is also shown to be terminated in field junction boxes, but there are no drawings that indicate the locations of these field junction boxes. Review of the PLC drawings and the plant Piping and Instrument Diagrams (P&ID's) reveal a number of discrepancies, such as differences in instrument identification tag numbers and a number of instruments appearing on the P&ID but not in the I/O scheme.

Single line diagrams included in the overall electrical design show the MCC line-up for the process motors that are part of the Zenon process equipment. MCC single line information is also included in the Hill Murray single line drawing, with a number of additional motors shown on the Hill Murray drawing. The Zenon single line drawings are incomplete as they do not include sizing of the overcurrent protective devices or sizing of the motor feed conductors. The Zenon single line drawings also include notes indicating the configuration of the MCC to be "Zenon's standard" and a number of features to be included in the MCC. The project documentation includes no definitions of "Zenon's standard" MCC configuration and no other MCC specification information.

The Hill Murray drawings package includes drawings E001 through E008.

- Drawing E001 ELECTRICAL NOTES & CODE LOAD. This drawing shows 16 points of project specification information. In our review of the project documentation as defined in section 2.1.5 of the report, this is the only electrical specification information that appears in the project documents. A number of items in this specification information are of concern to the project design/performance. Use of non metallic sheathed cable is allowed under specification point 7 c) but can not be used for applications greater than 300 volts, or in hazardous locations unless it is installed in threaded metal conduit. The aforementioned CEC requirements render the product useless for this facility. Item 9 indicates bonding and grounding to be as required by code. The project documentation does not indicate how to achieve the required bonding and grounding for the facility. Item 10, a) indicates the mains service interrupting capacity (fault current) is to be coordinated with the utility. There is no

documentation that the required coordination with the utility has been completed or provided the contractor. Specification notes 13 and 14 describe the installation of underground ducts for the NWT Power Corp. service, and the Northwest Tel. Service. Project documentation provides no further information regarding routing of the location of service connection points. This drawing also includes a load calculation, which is used to determine the size of the electrical service to the facility. This calculation indicates a full load operating current for the facility of 386 Amps, and subsequently specifies a 400 Amp service to the facility. This leaves an excess design capacity for this service of 3.5% or 12 Amps. With the service entry equipment installed as specified, the facility will not have any available capacity in the electrical distribution system to allow for expansion. Should the Just – In –Time infrastructure approach, as outlined in Hill Murray's documentation, result in any expansion that requires electrical power, the facility's electrical service will immediately require upgrade.

- Drawing E002 ELECTRICAL POWER. This drawing shows the facility's single line power distribution diagram. The intended design of the facility is shown with the incoming electrical service routed through a 400A 100% rated breaker, a 400A transfer switch, to a main distribution panel with three major branches of power distribution. The three major branches are: to the MCC, to the Fournier Press and building ventilation, and the 120/208 Volt distribution panel. The configuration of the Single Line Diagram presents several performance issues. These items will be discussed in sequence, from the incoming service connection to the point of use.

    - The incoming service equipment is not fitted with any provision for metering.

    - The transfer switch is shown with a power loss sensor to the PLC. PLC drawings do not indicate an input from the power loss detection device.

    - The incoming service is shown with a "HM&A" power meter with an output to the PLC. PLC drawings do not indicate an input from the power meter.

    - Interrupting capacities and buss fault current ratings for the main breaker, transfer switch, the main distribution panel, or any of the other distribution equipment is not indicated.

    - The MCC overcurrent protective devices for 3 membrane blowers, 3 lift station pumps, 2 anoxic mixers, and 2 air extraction pumps are undersized.

    - Motor feed conductors for the 3 lift station pumps are undersized.

    - Motor disconnects for 3 membrane blowers and 3 process blowers are undersized and the sizing shown is inconsistent with the drawing note to provide hp rated equipment isolation disconnect switches.

- The single line diagram indicates a 100 Amp breaker to feed the Fournier press equipment and the building ventilation system via a splitter. Conductor sizing is not indicated for the feed to the building ventilation system.

- The drawing indicates the feed to the Fournier press equipment to be controlled by a Hand, Off, Auto selectable contactor. The contactor location, wiring, and the required control scheme are not indicated on any other project drawing or document.

- The 120/208 panel 'A' is fed from a 45 kVA transformer. From this panel a sub-panel 'B' is fed with a 100 Amp breaker. The drawing indicates the feed to panel 'B' to be controlled by a Hand-Off-Auto selectable contactor. The contactor wiring, and the required control scheme are not indicated on any other project drawing or document.

- A number of the circuit breakers in panels 'A' and 'B' are not sized on the drawing.

- An issue of general concern with the entire drawing is that the load management scheme for the emergency generator is not clearly defined. The generator is capable of providing approximately 250 Amps, and the load control scheme to limit the equipment operated under emergency power conditions is not indicated on the drawing or elsewhere in the project documentation. A load management scheme that shuts down one half of the building load would be required to prevent the generator from shutting down due to an overload condition.

- Drawings E003 and E004 FIRST FLOOR LIGHTING PLAN, and SECOND FLOOR LIGHTING PLAN. Both plans indicate lighting layout, conduit routing and luminaire switching provisions.

  - The circuiting (panel & circuit number) of the luminaries is not indicated on the lighting plans.

  - The Symbols legend indicates five different luminaire types, only three of which are specified in the fixture schedule shown on drawing E001.

  - The incandescent light and the Class I Zone II fixtures have no specification in the project documentation.

  - The Class I Zone II Luminaire symbol is shown on the drawings in spaces that also contain non-rated luminaries. Class I Zone II areas should only be fitted with equipment suitable for use in such atmospheres. This reference to lighting fixtures is the only reference in the reviewed documents to indicate a requirement for any portion of the space to be constructed as a hazardous location. Further discussion of this issue can be found in the Code Review portion(s) of this report.

  - The lighting drawings also are used to show the receptacle and telephone locations, as well as the provision of power for the generator battery charger and block-heater. The

circuiting (panel & circuit number) of the receptacles and support equipment is not indicated on the lighting plans.

- Drawings E005 and E006 FIRST FLOOR EQUIPMENT - ELECTRICAL, and SECOND FLOOR EQUIPMENT - ELECTRICAL. Both of these drawings show the locations of process equipment and control devices. While the two plans show the locations of devices, the corresponding wiring, conduit, and power feed (from a 120/208V circuit or the MCC) requirements are not indicated on the drawings. Some devices such as valve actuators may be pneumatically operated and require only low voltage control signals, however this is not clearly indicated on the drawings.

  - The number, type and location of control devices shown are inconsistent with those shown on the process drawings provided by Zenon.

  - The first floor drawing does not indicate power to mechanical louvers, required to regulate the heat generated within the room. When the generator is running. This control is essential for the unit to operate.

  - The first floor drawing shows the electrical disconnects for the anoxic mixers to be located on this level of the building. These disconnects should be shown on the level 2 drawing, in an accessible, dry location.

  - The Second floor drawing shows the layout of the electrical room. This layout shows two items that are inconsistent with what is shown on the single line drawing. First, this drawing shows provision of utility CT's (Current Transformers). This would indicate that provisions were to be included for utility metering. Second, the transformer to feed the 120/208 volt panels is shown to be sized as 75kVA (45kVA sizing is shown on the single line).

  - The Electrical room layout does not show the location of the splitter indicated on the single line diagram.

  - The two contactors, indicated on the single line diagram, are shown located in the electrical room. Notes describe their function that are inconsistent with the functions shown on the single line diagram. One of these contactors is indicated as remote lighting relay. The relay wiring, control scheme, or the lights to be controlled are not indicated on any other project drawing or document.

  - The function of the relays is further confused by the symbol shown in the legend as a Lighting Relay (PLC Controlled). The PLC control schemes for these relays is not outlined on any other project drawing or document.
  - The second floor drawing shows gas detection, as well as audible and visual alarm indicators. The type of detected gas is not indicated nor is the configuration of the alarm circuit. (How is the alarm acknowledged, silenced or reset?)

- The second floor drawings also indicate the installation of motor disconnects for the 3 process pumps in the pumping area to be located on the tank wall behind the process piping and related equipment. This location places the disconnects out of practical reach for either service or operational use.

- Drawings E007 and E008 FIRST FLOOR ELECTRICAL SLAB AND WALL PENETRATION, and SECOND FLOOR ELECTRICAL PENETRATIONS. These two drawings indicate locations and sizes of conduits to penetrate the first and second floor slabs and the wall penetrations for both interior and exterior wall mounted electrical equipment.

  - The first floor drawing indicates three conduits to penetrate the floor and be routed to the lift station. The drawing does not indicate the number or type of conductors to be installed or the intended purpose of the 3 conduits.

  - The drawing shows two first floor penetrations for grounding conductors, a conductor size and a length. The project documents provide no further information on the installation of the main electrical service ground or the grounding of the Emergency Generator.

The operations and maintenance literature has been provided by Fournier, Pro Aqua Engineering, and Zenon. Documents provided by Fournier (Dewatering Equipment), and Pro Aqua Engineering (Trash Augers) are complete and relevant to the equipment provided for the facility. These manuals are consistent with those we routinely approve at the close of a project of this type. The manual information provided by Zenon is incomplete and in some cases, provides incorrect information. Some examples are:

- the PLC control system documentation includes a user manual for two of the module types, but only a data sheet or information sheet for the balance of the modules.

- The MCC documentation includes information on only one half of the entire MCC line up. The sizing information for the MCC components related to the Lift Station pumps is incorrect as the motors are of a larger size than noted. The O&M documentation does not include any information on the main distribution panel board, the transfer switch, or the emergency generator.

2.2 REGULATORY/CODE

2.2.1 Structural/Architectural

The design drawings were prepared in 1999 and therefore the applicable code is NBC 1995 with respect to general building requirements. Design parameters for anoxic and aerobic tanks for the wastewater process, as well as some of the ancillary building requirements are also covered in part by NFPA 820.

It is usual for a design/build project to include specifications with the drawing package, and this method was used here. In this case, the design codes in effect are noted on the first structural

sheet (Specifications - S001) for structural requirements and again on the first architectural sheet (Code Check / Notes – A001).

As discussed in process below, Table 3 of NFPA 820 identifies the Trash Augers room as potentially requiring Class I Zone II classification (Class I Zone II if 12 air changes are provided). As this area may be considered to be a 'Critical Unit Processes' (6-3.3.2), it would require a 3-hr fire rating. This rating would apply to not only the partition walls separating this area from the rest of the plant, but also the roof structure. At present, the roof structure is not rated, being exposed steel, and the walls are constructed using prefabricated panels on galvanized. steel studs. Although good from the point of view of cleaning, to our knowledge, these panels have no tested fire rating. In addition, the door is of the sliding barn-type, also without rating or air seal.

In the worst case, flammable gases would collect, ignite and blow out the partition walls and possibly the roof if the explosion were substantially powerful. Because the roof structure is reinforced for some uplift, the walls would go first in a minor explosion, exposing staff to some danger. Given that only a reinforced block wall might prevent explosion into the remainder of the building, it would be prudent to provide ventilation as well as gas detection. These requirements are discussed further in Mechanical Section. The combustible construction materials in this room are minor and fire protection to 3 hours is attainable only with a 190 mm block wall either filled with concrete/perlite or covered with fire rated drywall. In addition, improving the roof structure rating to 3 hours will entail considerable cost. The definition of what constitutes a Critical, Essential or Other Unit Processes is debatable and when it is considered that an explosion will not be prevented by a 3-hr fire rating, some compromise would be appropriate here. If the danger of an explosion occurring in the area above the anoxic tanks is eliminated, the concrete floor slab could be argued as a form of protection from an explosion in the head space above the tank. For this reason, we recommend that the areas of checker plate covering the anoxic tank outside of the Trash Auger room be removed and replaced with concrete so as to confine a head space explosion to this room. An argument can be made to leave the sliding door in place as a type of explosion relief that might keep the partition walls from blowing out in the event of gas ignition.

In Process Section it is proposed that an opening through the north wall (concrete) of the Trash Auger room be provided, allowing collected trash to be dumped directly into a bin rather than wheeling it through the plant. Use of an awning swinging door may provide dual function as an insulated trapdoor and blow out panel (from minor explosions; the partition walls would likely not resist a large explosion even with a blow-out panel).

Structural Codes

In addition to NBC 1995 and NFPA 820, ACI 350 is normally used in the design of concrete wastewater tanks. The Cold Regions Utilities Monograph, although not mandatory, is often used a design guideline for Northern regions. As indicated in the CH2M Gore and Storrie report, it appears that ACI 350 was not used as a reference document. The designers may have considered the PVC octaform liner as sufficient reason to discard leakage concern, although any one of the many PVC webs may have provided a potential leak path through the wall, and particularly if the

surface of the PVC was contaminated. Normal PVC waterstop forces the water to follow a tortuous path to be effective.

NBC 1995 specifies loads for use and occupancy, wind, snow, rain and seismic loading to employ in the design. The second section in the first column on Drawing S001 (CODE Loads) suggests that designs were prepared with the correct input data except for the seismic loading. Iqaluit is in a zone where $Z_a = 1$ (acceleration - related) and $Z_v = 0$ (velocity - related). There is no reference to these parameters on the drawings, however if the facility was designed under Part 9 (small buildings), this is not unusual. It is however a slight omission because Part 9 specifically refers to Part 4 when wood framing is not being used.

Architectural Codes

Requirements for exiting, numbers of doors, fire separations, etc. normally fall under this category. In addition, the exterior building envelope would normally be considered an architectural design requirement. The mandatory requirements of the Model Energy Code require an R value of 15.3 (2.7) or 21.6 (3.8) for oil and electric heat respectively, for walls and roofs. The assembly is specified to be R20 and R28 for these two components, and with the few number of windows and doors, this would be close to the required effective R values since the insulation is a wrap system (rigid).

Given that large volumes of water enter this plant continuously basis, building envelope insulation becomes less of a concern, except for the aspect of durability. The exterior walls are very durable (rigid insulation on PVC on concrete, with the odd void). The use of 30R rigid insulation on the roof is appropriate, particularly with the use of a potentially less than perfect vapour barrier (6 mil polyethylene).

The building area is under 600 m^2. even if the tanks are included. Application of Section 2.1 of NBC indicates that the building would fall under Part 9 if designated F2 or F3 (intermediate or low hazard industrial respectively). This is a debatable point, because the presence of combustible gases might suggest that the building be rated as F1 (high hazard industrial). We however concur with either the F2 or F3 designation, which does not require sprinklers.

2.2.2 Process

The proposal indicates that design and construction will be in accordance with, or governed by, the Canada Building, Plumbing and Electrical codes, and the WCB Industrial Health and Safety Standards, in addition to the:

- Nunavut Water Board Letter – Appendix I in the Contract Documents
- GN Contribution Agreement
- Municipal and Capital Standards and Criteria referring to:
  - Fire Protection
  - Solid Waste Management Facilities
  - Water and Sewerage Facilities

Based on the effluent concentrations guaranteed by Hill Murray in the Contract Documents, the Nunavut Water Board and Town of Iqaluit effluent concentrations for BOD_5, TSS and Fecal coliform could be met.

The National Fire Protection Association (NFPA) 820 standard, "Fire Protection in Wastewater Treatment and Collection Facilities" was developed by NFPA's Technical Committee on Wastewater Treatment Plants. This standard includes the hazard classification of specific areas and processes common to most wastewater collection and treatment facilities and is widely used within Canada to assist in the design of wastewater treatment plants. NFPA 820 outlines the potential fire and explosion hazards in each process area, and based on the ventilation and physical separation provided between each process area, NFPA 820 dictates the extent of the classified area, the electrical classification, the required material of construction and the required fire protection measures.

The designer must ensure that the appropriate level of protection and suitable equipment is provided in each classified area. It should also be noted that it is often more cost effective to alter the atmosphere, thereby changing the area classification, than providing equipment to meet a more stringent area classification.

Following the NFPA 820 guidelines, if sufficient physical separation and ventilation were provided in the facility, the process areas Iqaluit water reclamation facility could be divided into three functional areas as follows:

- The coarse screening facilities
- The aeration basin
- The sludge dewatering room

Coarse Screening Facilities

All coarse screening facilities are considered Class 1, Group D due to the possible ignition of flammable gas produced when volatile flammable liquids enter the sewer system and the flammable gas evolves into the air. Because flammable gas concentrations can only be controlled by exhausting them from the building envelope, only the ventilation rate can influence the Division classification.

At the Iqaluit plant, the screenings equipment is enclosed in the main building and would include the influent chamber, screening and trash auger system and the anoxic tanks that are directly below. Providing less than 12 air changes per hour would result in an area classification of Class 1, Zone I; providing at least 12 air changes per hour would result in an area classification of Class 1, Zone II. In either scenario, the entire enclosed space is considered classified and electrical equipment must be suitable for use in these classification requirements.

As discussed in more detail in the mechanical section, the screening area has been provided with less than 12 air changes per hour and therefore the area Classification would be Class 1, Division I. In addition, the room is poorly sealed, thereby influencing the classification of the

aeration basin area. Neither the structural, mechanical or electrical design meets the requirements of a Class I, Zone I area.

Aeration Basin
Aeration basins that are not preceded by primary treatment are considered Class 1 due to the possibility of ignition of flammable gas released in the air and floating flammable liquids that may be transferred from the screening facility directly to the aeration basin. If primary treatment is provided, aeration basins are deemed to be in an "unclassified" area, since floating material will be removed during the primary treatment process.

At the Iqaluit plant, although primary treatment is not provided, the possibility of transferring flammable gas and/or floating flammable liquids from the anoxic tank to the aerobic tank is minimal due to the submerged connection between the two tanks. Flammable gas would likely volatilize either in the influent and screening tank or in the anoxic tanks. Thus, to ensure that flammable gas does not escape to the aeration tank zone, the physical barrier between the two areas must be maintained, including sealing of anoxic tank hatches that straddle the screening and aeration basin areas. Inherent in this recommendation is the understanding that floating debris, scum, and oil regularly will have to be removed from the anoxic tank using a manual technique.

Liquid transfers between the anoxic tanks and aeration tanks through pipes located close to the tank floor. Thus, floating flammable liquids likely would be released in the anoxic tank.

If the coarse screen area were completely sealed from the aeration area and adequate positive pressure were provided in the aeration basin area, the aeration basin area, including the toilets, the office, and the pump area, would be considered "unclassified." However, the existing facility does not provide adequate physical separation between the two areas and the trash room classification envelope would extend beyond the door into the aeration basin area. The area extending 3 m beyond the door into the aeration basin area would be classified Class I, Zone II and the rest of the area would be unclassified.

Sludge Dewatering Room
Stand alone sludge dewatering buildings containing filter presses are "unclassified". However, when the sludge dewatering process room is contained within the plant, as is the case in Iqaluit, the surrounding atmosphere influences the room classification. At Iqaluit, the adjacent areas are rated unclassified; therefore, so is the sludge dewatering room.

2.2.3 Mechanical

Mechanical documentation listed in section 2.1.4 has been reviewed for its conformance with the National Building Code, National Plumbing Code and NFPA 820 (1995) "Standard for Fire Protection in Wastewater Treatment and Collection Facilities". There are a number of concerns pertaining to ventilation system design and the use of ordinary classification electric motors and mechanical equipment controls, as discussed in the process portion of this report. Use of equipment that is not protected could present potential fire and explosion hazards. Due to the lack of physical separations between areas, it is our interpretation that the entire facility should

be ventilated to the required 12 air change level and all mechanical equipment be equipped with classified electric motors and control components.

Course Screening Facilities-Trash Auger Room

The potential hazard in the coarse screening facilities is due to the possibility of ignition of flammable gas produced in the sewer system and released into the air at the wastewater treatment facility and floating flammable liquids. NFPA 820 indicates these areas are to be electrically classified as Class 1, Zone I provided with a minimum of 12 air changes of ventilation. Electric motors have to be rated for use in this classification.
The current installation incorporates a 850 M^3/hr inline cabinet exhaust fan which will only provide approximately 8.5 air changes. The hydronic unit heater located in the space is equipped with an ordinary motor which is not suitable for this area. The room is not equipped with dedicated makeup air as the design utilizes transferred air from the rest of the facility thereby creating a migration path of hazardous contaminants to adjacent areas in the event of exhaust fan failure.

2.2.4 Electrical

Electrical documentation listed in section 2.1.5 has been reviewed for its conformance with the Canadian Electrical Code (CEC) 1998, the National Building Code, and NFPA 820 (1995) Standard for Fire Protection in Wastewater Treatment and Collection Facilities. A number of the concerns raised in Section 2.1.5 related to design performance concerns with HMA Drawing E002 also are CEC variances. The correct sizing of motor feed breakers, motor feed conductors, and motor disconnect switches are all clearly defined within the code. The project documentation does not indicate any specific electrical design considerations to address the potential fire and explosion hazards within individual process areas, or within the facility as a whole. However the designer has indicated a least an awareness of these concerns in that there are Class I Zone II Luminaire, and gas detector symbols placed on the drawings. As discussed in the process portion of this report the following areas could present a potential for fire and explosion hazards.

- The coarse screening facilities
- The aeration basin
- The sludge dewatering room

The potential hazard in the coarse screening facilities are due to the possibility of ignition of flammable gas produced in the sewer system and released into the air at the wastewater treatment facility and floating flammable liquids. NFPA 820 indicates these areas are to be electrically classified as Class 1 Zone I. Section 18 of the CEC describes locations where explosive gas atmospheres are present as Class 1, and further defines the spaces where these atmospheres occur as three basic types. (The NFPA document uses the same definitions and indicates the spaces as Division 0, Division 1, and Division 2).

- Zone 0, explosive atmospheres are present continuously or for long periods.
- Zone 1, explosive atmospheres are likely to occur during normal operation
- Zone 2, explosive atmospheres are not likely to occur during normal operations, and if they

do occur the duration of exposure will be for a short period of time

The installation requirements for electrical equipment installed in a Zone 1, or Zone 2 space is clearly defined in Section 18 of the CEC and includes requirements for both the construction of energized equipment and the wiring techniques required to connect that equipment. NFPA further requires that course screening facilities be fitted with a combustible gas detection system. The gas detector shown on the drawings is not shown at or near this portion of the process. As discussed in the process and mechanical portions of this report the potential for explosive atmospheres in the balance of the facility would most sensibly be addressed by providing the required ventilation to these spaces. There is a further reference in the NFPA document that is of interest to the electrical design and construction of the facility. NFPA 820 indicates the requirement for a fire alarm system to be provided in spaces where combustible materials are generated or stored. This facility has two such areas; course or fine screenings storage areas, and dewatering facilities. The dewatering process used in the facility also requires wood chips, therefore, all wood chip storage and handling areas should be fitted with fire detection devices.

The project documentation does not indicate any fire alarm system.

The National Building Code requirements for illuminated exit signage are met within the documents. The requirement for lighting to illuminate the route to exit doors is indicated by "essential lighting" on the single line diagram; however the luminaries to be powered in this manner are not indicated on the floor plans.

The last regulatory item of note is that the IRFQ-2/21/98, HMAD-3/18/98, HMAD-6/12/98, DBSPC-7/22/99, and Drawings do not include any reference to a registered professional whose discipline of practice is Electrical Engineering. Annex N indicates certification is to be provided by the firm of Saldon Engineering, and Mr. Paul Salvian P. Eng. (APEGNWT). A check with the Association of Professional Engineers, Geologists, and Geophysicists of Alberta indicates that Mr Salvian's discipline of practice is Mechanical Engineering. Mr Salvian's stamp and signature are affixed to the electrical, structural, and mechanical drawings for this project. The process and mechanical drawings for the project are unsigned.

2.3 CONTRACTUAL OBLIGATIONS

2.3.1 Civil

The site audit, or inspection, conducted by the Earth Tech (Canada) Inc. indicated that adequate culinary water service has been provided to the plant. The site audit also indicated that little or no effort has been made to grade the site immediately surrounding the plant to accommodate parking or to remove surface drainage from the overall plant site. Although there is no specific contractual obligation to provide for site drainage, it is incumbent on the designer to allow for the removal of surface runoff and adequate parking accommodations within the area immediately surrounding the physical plant. The final effort to finish all plant construction should include grading to discharge surface runoff to a point of discharge that is compatible with the overall City drainage system or to a natural drainage channel. All points of discharge should have adequate capacity to drain the overall plant site without severely flooding other areas of the City.

As a minimum, consideration should also be given to place a compacted gravel surface within designated parking areas to allow for limited light vehicle traffic in-and-out of the site during periods of wet weather.

2.3.2 Structural/Architectural

The facility is substantially complete with respect to structural and architectural disciplines. A few minor deficiencies were noted, which are
addressed below and in the cost summary.

Prior to this detailed review of the facility, a number of investigations and several reports were produced with respect to the viability of the four tank walls, both structurally and from a containment perspective. This aspect of the project will not be addressed here in detail other than to confirm that the walls have been repaired and the tanks tested for leakage. Ignoring monetary impacts of the inappropriate method of wall construction, the only real impact of these earlier contractual problems is that the volume of all of the tanks has been reduced by approximately 5% due to the added thickness of shotcrete on the wall surface.

While this report was being prepared, plans were underway by the City to conduct a simultaneous complete fill of all tanks, which is recommended as a final check on not only wall strength and containment, but also as a necessary check on foundation veracity.

The drawings provided satisfy the intent of the contract insofar as the structural design of the facility appears to be virtually complete. Structural contractual obligations also include constructing the building to the plans and specifications, and in some cases this was not done. For example, the metal deck was specified to be 75 mm deep however the contractor / builder chose to use the more readily available 38 mm deep deck, with the result that the floor for the electrical room deflected considerably during the pour. This has resulted in a cosmetic and possibly operational problem in that water will not drain from the depressions directly below several of the MCCs. The metal deck was primarily used as a form for the 5 inch concrete topping but it also has structural function because the floor slab reinforcing was called up as crack control reinforcing only. When comparing the capacity of 75 mm and 38 mm deep composite metal decks of the same gauge, we typically find little difference in their load carrying capacity after concrete set. In fact the 38 mm deck has a greater shear capacity due to the increased average depth of concrete.

The beams supporting the second floor were specified to have nelson studs at every flute or at 300 o.c. Given the deck substitution observed, it is possible that these studs were not installed. A review of the beam layout on drawing S005 (and S004) indicates that most of these beams are somewhat self or mutually bracing and therefore this is not a concern.

Notwithstanding the omitted reference to seismic design parameters, the facility appears to satisfy most contractual obligations. Exceptions to this include the following:

- Missing bracing to bottom flange of roof purlins. Note 5 on Drawing S007 indicates a need for stabilizer rods, which are used to brace the long spanning purlin bottom flanges, under negative wind pressure (uplift).
- Exterior backfill (details 1, 2, 5 and 12 on S021)
- Floor drain in Blower room (buried under housekeeping pads). The facility can function without this drain due to the proximity of the floor drain in Cake Bin Room.
- Floor deflections in the electrical room (due to use of wrong deck material)
- No floor slope in the tanks. This was shown on the drawings and allows for easier cleaning, when necessary; however the lack of slope should not affect the process.

2.3.3 Process

The Contract Documents do not reference the Request for Proposal prepared by the Owner or the proposal and revised proposal submitted to the Owner by Hill Murray in March and June 1998.

The Contract Documents provide limited information on the specific requirements of the project, such as standards for equipment. As noted in Section 2.1, there are only four process mechanical drawings included in the Contract Document. Three drawings are the fabrication drawings for the influent tank and screenings and auger tank. The fourth drawing is a layout drawing for the Fournier filter press equipment. The structural drawings included in the Contract Documents provide the proposed layout for the rest of the facility and equipment.
A list of equipment and services to be provided is included in Annex A of the design/build contract. Base design criteria are provided in Annex F and the Nunavut Board effluent criteria are provided in Annex I for reference, as the effluent criteria required by the City of Iqaluit are more stringent.

The operations and maintenance proposal for the plant, including operations and maintenance services to be provided by the Canadian Wastewater Corporation and the estimated operations and maintenance costs for the facility, are briefly outlined in a letter in Annex E.

2.3.4 Mechanical

The design does not specifically indicate how the building mechanical systems are to be controlled and monitored therefore it does not comply with the full automation requirement of plant control and monitoring. Furthermore, the heating system is provided with single heating pumps for each circuit which does not comply with the redundancy requirement of the project.

2.3.5 Electrical

The contract document makes a limited number of references to the electrical requirements for the facility. Electrical requirements are described in Annex A, Scope of Work; Annex N, Quality Control Plans; and Annex P, Preliminary drawings. Of the 11 line items listed as the electrical scope of work in Annex A, there are a number that have no further documentation. These

include; The PLC software and testing, the transformers, switchgear for the primary power service, and the lift station control panel. Relevant Codes and standards related to the electrical installation for the facility are not referenced in the contract. The IRFQ-2/21/98, HMAD-3/18/98, and HMAD-6/12/98 documents are not referenced in the DBSPC-7/22/99 and therefore this report does not discuss issues such as the lack of excess capacity in the buildings electrical service as a contractual issue.

SECTION 3.0
SITE INVESTIGATION

3.1 EQUIPMENT INVENTORIES

Code and regulatory issues relating to site work are discussed in Section 2.1.1.

3.1.1 Structural/Architectural

Foundations

- Insulated shallow foundations founded on grade. The perimeter insulation was left exposed (not backfilled) and some of it will require replacement.

- Partially tested during tank leak tests. This would represent conditions where most of the differential loads that these foundations would see may occur, however the filling of all tanks at once is still to occur.

Tanks

- Design volumes reduced by approximately 5%. Following simultaneous filling of all tanks, they should be ready for use.

Walls

- Concrete walls predominate and work as both structure and fire separation. The plastic liner (the Octaform system) will produce noxious gases if allowed to burn however this is not considered a significant risk.

- Remaining walls are typically 90 mm steel stud and drywall, in some cases load bearing for small mezzanine or storage areas. Washroom partition walls are 152 mm steel stud and drywall.

Superstructure

- Roof support is provided by load bearing walls, interior columns and beams, the latter being galvanized structural steel.

Roof Structure
Beams

- Galvanized – suitable for enclosed wastewater treatment plant use only if adequate air changes provided (galvanized steel does not stand up well to H_2S).

- Bolted connections installed.

Purlins
- Cold formed sections – cold rolled from galvanized steel sheet, generally 12 to 14 gauge. Similar comments to beams and columns apply.

- Bottom flange bracing was not installed.

Wind and Seismic Bracing
- Generally provided by concrete walls, which in some cases are full height, to bring lateral loads to grade.

- Roof bracing is provided by cables and turn-buckles. Although the turnbuckles are galvanized, the cables themselves are not, which will create maintenance problems.

Miscellaneous Structures
- Dip tanks and supports. It is not known if they have been leak tested.

Mezzanines
- Various types of structures including light gauge steel framing or galvanized grating.

Gratings and Access Covers
- Galvanized – generally located over aerobic tanks where removal required.

- Checkered plate – generally located over anoxic tanks where removal required.

Hoists
- Monorail beam provided down the spine of the building for removal of cassettes. The trolley and chain hoist are manual with an apparent capacity of 1.4 Metric Tons.

- The two small derrick swing-type hoists (for pump removal) are 230 kg capacity. The adjacent pumps weight approximately 154 kg. They are installed in a questionable location however.

Guard Rails
- Various combinations of aluminum and galv. pipe rails. They generally appear to have adequate stiffness, except for a short length between the two aerobic tanks.

Stairs
- Exterior stairs – galvanized structural steel.
- Stairs to lower floor – Steep ship type, not suitable as a fire exit (and not required as such).
- Stairs to pump area – galvanized structural steel.

3.1.2 Process

The Contract Drawings, along with Hill Murray's process mechanical drawings and the Supplier installation drawings listed in the Table in Section 2.1.3 were used to determine the extent of equipment provided on site and installed.

Almost all of the equipment shown on the drawings and P&IDs was found in the Water Reclamation Facility. There were several large storage containers outside and inside the main floor garage, which presumably contained the ZENON membrane cassettes as many of the crates were of identical weight and dimension.

Installation of equipment on-site was compared to the process drawings and P&IDs. Again, most of the piping has been installed. Equipment shown on the drawings had been installed with some minor deviations from the contract, as described in the following list:

Screening System:

- Slide gates on auger influent.
- 250 mm auger discharge lines into anoxic tank.

Anoxic Tanks

- Two mixers.
- Two Miltronics probes.
- 250 mm piping from the screening effluent chamber into the anoxic chambers
- 300 mm piping between Anoxic 1 and Aerobic 1.
- Two D.O. probes.

Aerobic Tanks

- Four sluice gate stems/operators on the pipes between the anoxic tanks and the aerobic tanks.
- Aeration grids in both aeration tanks.
- Complete installation of the aeration supply line to aeration grid.
- ZENON cartridges (including vacuum, backwash and aeration piping) x 10 cartridges.
- Instruments: four float switches, two level sensors, two D.O. probes, and two temperature sensors

Mixed Liquor Recycle System

- Mixed Liquor Recycle pumps.
- 200 mm Mixed Liquor Recycle line between aerobic 1 tank and boiler room.

Blower System

- Blowers
- One flow transmitter on the air supply line into each tank (two flow transmitters in total).
- 75 mm air supply line to sodium hypochlorite tank.
- 50 mm PVC air supply line to the acid dip tank was installed instead of a 75 mm schedule 40.

General Comments on the Piping

- Complete installation of discharge piping to effluent magnetic meter.
- Sample valves.
- Aeration piping to Zenon equipment slightly different than P&ID, but still acceptable.
- Additional valves and interconnecting piping was provided on RAS lines to allow recycling from either aerobic tank into either anoxic tank.
- Missing site glass on both air separation tanks.
- Vent piping on back pulse line does not extend above air separator.

Chemical Systems

- Drains on tanks.
- Isolation valves on hypochlorite pump discharge line.
- Some isolation valves may be missing on back pulse tank influent lines.
- Seal water piping back pulse tanks to vacuum pumps not found. Seal water taken directly from pump casing.
- Additional 50 mm line comes with isolation valves provided between backwash tanks.

Cassette Cleaning (Dip Tanks)

- The common drain line from hypochlorite and citric acid pumps should be separated.
- Complete piping into dip tanks from floor.
- Install pressure indicators on pump suction lines.
- Of significance, rusting of the dip tanks is already noticeable at the weld locations. Dip tanks would either have to be re-welded or replaced. The latter option is the more likely of the two.

Compressors
- Drain lines on air dryer and air compressor.

Sludge Dewatering System
- Ball valve on the diaphragm/pressure indicator line on the flocculator.
- A 25 mm ball valve installed instead of a 38 mm check valve from the polymer supply line into the flocculator (not sure if ball check valve installed).
- Connection of air hose lines required.

In addition, it should be noted that the actual anoxic and aeration tank dimensions are less than those indicated in the original contract documents due to structural problems and subsequent remediation encountered during construction. As such, the original design capacity has been reduced somewhat. Original design and existing dimensions for the tanks are provided in the following table. Note that the height indicated is to top of concrete.

Tank	Original Contract Dimensions	Existing Dimensions
Anoxic	2.692 m wide x 12.065 m long x4.877m high [158.4 M^3 Volume]	2.442 m wide x 11.815 m long x 4.877 m high [140 M^3 Volume]
Aerobic	5.182 m wide x 18.288 m long x 4.877 m high [462.2 M^3 Volume]	4.931 m wide x 18.038 m long x 4.877 m high [433.8 M^3 Volume]

3.1.3 Mechanical

The "Issued for Construction" mechanical HVAC drawings listed in Section 2.1.4 were used to determine the extent of equipment provided on site and status of installation. The following equipment was not installed or visible during our site review:

- Trash Auger Room Exhaust Fan EF-1
- All intake/exhaust exterior weather hoods
- Boiler system controls
- Ventilation system controls
- Heating system piping insulation
- Domestic water storage tank

3.1.4 Electrical

Equipment installed and items indicated within the project documentation that remain outstanding are listed below on a system by system basis.

Power Distribution

- Building service equipment is installed and energized.
- No provisions for utility metering within the distribution equipment.
- Owner's metering is installed and operational.
- Automatic Transfer switch is installed (No evidence that it has been tested or operated).
- Main distribution breakers installed and energized.
- 45kVA 120/208 volt transformer installed and energized.
- 120/208 distribution panel A installed and energized.
- Branch circuit wiring installed 120/208 volt devices complete (Power provided from this panel to numerous loads not indicated on the drawings).
- No H.O.A. contactors installed.
- No 120/208 volt distribution panel B installed.
- Motor control center installed as indicated on drawings and energized.
- Motor wiring, motor disconnects and terminations complete as indicated on drawings (No evidence that motors have been tested or operated).

Emergency Generator

- Generator in place.
- Room ventilation and controls incomplete.
- Battery charger not installed.
- Unit has not been run or tested.

Lighting

- Exterior lighting installed.
- Illuminated exit signage installed.
- Interior fluorescent lighting installed and energized.
- Interior High Intensity Discharge (HID) lighting installed and energized.
- Switching provisions for the above lighting complete and operational.
- Incandescent and Class I Zone II Luminaires not installed.

Communications Systems

- Building telephone system is installed and operational.

- Zenon PLC cabinet installed.
- Field wiring to Zenon PLC cabinet installed.
- Wiring identification not yet complete.
- PLC power supply DIN rail, input modules, Output modules, and communications module installed.
- Processor module not installed and not found on site.
- Panelview operator terminal remotely mounted outside of the office/lab area.
- A second PLC cabinet found located below the incoming telephone service.
- Cabinet contains a second Allen Bradley SLC 500 series PLC, associated Input modules, Output modules and communications module.
- The second PLC does not have a processor module.
- The second PLC does not have any documentation to indicate its function or purpose.

3.2 REAL PROGRESS VS CLAIMED PERCENT COMPLETE

3.2.1 Civil

As noted in Subsection 2.3.1, the site-civil aspects of the project design are significantly complete. The plant has adequate culinary water service and enough site grading has been completed to provide for surface drainage away from the constructed plant building. Site-civil work remaining would include the identification of points of discharge for all surface drainage and a more refined grading scheme to provide for direct runoff to effectively discharge to an existing storm sewer system or drainage channel adjacent to the overall plant site. Consideration may also be given to placing a gravel surface adjacent to the plant building allowing for a more durable parking surface during wet weather conditions. The site-civil work is considered 70 percent complete given the stated site deficiencies.
Code and regulatory issues relating to site work are discussed in Section 2.1.1.

3.2.2 Structural/Architectural

The structural and architectural components are substantially complete, and for the sake of quantifying the progress, it can be stated that completion is at the 99% stage.

3.2.3 Process

As discussed in the previous section, almost all of the equipment has been accounted for. Installation of equipment on-site was compared to the process drawings and P&IDs and most of

the piping has been installed. However, since commissioning of the equipment has not yet been started, the quality of the installation has not yet been verified. For example, pressure testing the piping system would provide proof that the piping has been properly installed. In general, process systems, without completing some of the minor installations and trouble shooting and commissioning stage, can be estimated at a maximum of 90 percent complete.

A list of work and estimated cost to complete, excluding remediation of any deficiencies, is presented in Section 6.0.

3.2.4 Mechanical

Based upon our site review of the status of the mechanical installation, lack of O&M material, training, test reports, asbuilts and commissioning we would estimate the progress of the mechanical trade to be no more than 75%. Boiler heating circuit circulator is not operational due to an electrical problem.

3.2.5 Electrical

Based upon our site review of the status of the electrical installation, lack of O&M material, training, test reports, as-built drawings and commissioning we would estimate the progress of the electrical trade to be no more than 80%. This level of completion is related to the execution of work indicated in the project drawings. Should the rectification of Canadian Electrical Code issues (to comply with Note 3a on drawing D-01999-E001) be considered, we would estimate the progress of the electrical trade to be no more than 60%.
Based upon our site review of the status of the controls installation, incomplete installation status of a number of measurement and control devices, the incomplete status of both of the Plant PLC systems, lack of O&M material, training, test reports, as-built drawings and commissioning we would estimate the progress of the controls to be no more than 50%.

3.3 VARIANCES FROM THE CONTRACT DOCUMENTS

3.3.1 Structural/Architectural

The following items are in variance from contract documents:

Structural Items
- Missing sag rods (purlin braces)
- Truck fill attachment onto lift station has not been installed.

Architectural Items
- Missing floor bases on upper level walls (office, washroom)
- Paint touch-up required throughout plant
- Minor damage to cabinetry should be repaired.

3.3.2 Process

Due to the problems encountered with the Octoform, the size of the anoxic and aeration tanks is less than that originally proposed. Otherwise, variances of the equipment installation compared to contract drawings are limited and are listed below:

- Aeration piping to Zenon equipment slightly different than P&ID, but still acceptable.
- Additional valves and interconnecting piping provided on RAS lines to allow recycling from either aerobic tank into either anoxic tank.
- Seal water piping flow back pulse tanks to vacuum pumps not found. Seal water taken directly from pump casing.
- Additional 50 mm line with isolation valves provided between backwash tanks.
- A 25 mm ball valve installed instead of a 38 mm check valve from the polymer supply line into the flocculator (not sure if ball check valve installed).

3.3.3 Mechanical

Primarily, the building mechanical contractor has followed the Issued for Construction drawings with the exception of the ventilation system. The air handling unit is installed in a different orientation than was depicted on the drawings and its installed location has created access problems. Filter removal, which will be required frequently, is almost impossible without damage to the filters. Coil removal will not be possible without dismantling the return/exhaust section of the unit air handling or installing an additional coil access door on the opposite side of the unit. Fresh air ductwork to the unit has been modified to suit available space and will create large static pressure losses for which the unit was not designed. Ventilation ductwork distribution has been modified, which has left some areas without ventilation or heat; the main lower vestibule is one of these spaces.

3.3.4 Electrical

There are a number of variances where the electrical installation does not conform with the contract documents. One variance is that the main service distribution equipment is rated at an interrupting capacity if 18 kAIC, making the distribution equipment more robust than what has been specified on the drawings. There are a number of items indicated on the drawings which have not been installed. These include the two contactors and 120/208 volt Panel B. The lift station piping within the structure is fitted with electric heat tracing. Heat tracing (while essential) has not been included in the electrical load calculation for the facility and may cause difficulties related to the facility's electrical service size.

3.4 CODE VARIANCES

3.4.1 Civil

Typically, national building and structural codes do not apply to civil-site construction. The construction of water lines, sanitary sewers, storm drains, and site drainage improvements are generally governed by standards established by the municipality in which the construction takes

place. Accordingly, a review of all record project design documentation has not produced reference standards for general civil-site construction. The completed civil-site work can only be assessed for standards considered to be good engineering practice. In this regard, there is no information or details shown on the project construction drawings that indicate the size of line, piping materials, or location of appurtenant fittings/valves for the existing water line. Until this information is determined, an assessment of whether the existing culinary water line was done according to good engineering practice is impossible. It is recommended that the existing water line be exposed in enough locations to determine the indicated information.
Code and regulatory issues relating to site work are discussed in Section 2.1.1.

3.4.2 Structural/Architectural

Structural-Seismic design – not indicated in structural notes. Although this is an omission, it is not considered serious for a structure of this type.

Architectural-Separation between Trash Auger room and remaining plant areas; This may not be an NBC variance however reference to NFPA requirements would suggest it is a Fire Code variance. Refer to discussions in previous subsections.

3.4.3 Process

As discussed in Section 2.2.3, the Iqaluit Sewage Treatment Plant can be divided into several functional areas according to NFPA 820 as follows:

- The coarse screening facilities
- The aeration basin.
- The sludge dewatering room

Presently, the coarse screening area does not meet structural, mechanical or electrical requirements identified in NFPA 820. Refer to the appropriate section for further comments.

Ventilation requirements in the aeration basin area are also inadequate and as such electrical requirements identified in NFPA 820 are likely deficient.

3.4.4 Mechanical

The following code variances were noted during our site investigation and are categorized by system:

Fuel Oil System
The outdoor self contained fuel oil storage tank is supported by a steel frame which is not 2 hour fire rated as per the NFC Part 4.

The fuel oil daytank has not been provided with secondary containment as per code.

Plumbing System

Floor drains serving the washroom and Main plant floor discharge directly into the Anoxic Tanks with a short tailpiece and no trap. The tailpieces should be extended below the normal water level within the Anoxic tanks to prevent vapours from migrating to the areas above.

Domestic water tank located on the mezzanine above the office and washroom must have the temperature and pressure relief valve piped to a safe discharge drain.

Heating System

Combustion air ductwork has been provided with a volume control damper and is physically too small to serve the mechanical room appliances.

Unit heater fan motors and thermostats are not suitable for area classifications.

Boiler flues are not insulated and the boiler chimney condensate drain is not piped to suitable drain.

Ventilation System

Ventilation system must be revised to suit NFPA 820 requirements. Fire dampers are required at all fire separations as per the National Fire Code (NFC).

3.4.5 Electrical

Code variances have completely been incorporated into the construction of the facility as described in the previous Documents Review Portion of this report. From a Canadian Electrical Code variance perspective the facility has been built to what is shown on the drawings and not to the HMA drawing E001, Note 3. Standard of Work, item a) which states "All the electrical work shall be installed in accordance with the Canadian Electrical Code as revised and adopted in the Northwest Territories and shall be the satisfaction of the inspector of Electrical Energy and the Electrical Engineer." There are additional Canadian Electrical Code considerations arising from the manner in which the existing construction has been completed. The most significant item is conduit supports. The facility contains vast amounts of seal tight flexible conduit that is not supported and where it is supported, the manner in which the support is provided is unacceptable. Other tech cables and PVC conduit installations do not comply with the conduit support requirements. The manner in which the facility ground is provided is not indicated in the project documentation and is now encased below the building slab. The verification process required to ensure the existing ground is acceptable may be more expensive than the installation of a new grounding system that has been reviewed and accepted by the local code authority. Code considerations related to NFPA 820 have not been addressed during construction and the Class I Zone II Luminaires, and gas detector shown on the drawings have not been installed. The requirement for a fire alarm system will need to be addressed, and by doing so the owner will gain a measure of asset protection (as well as code compliance) as the building does not require sprinklers.

3.5 DEVIATION FROM GOOD ENGINEERING PRACTICE

3.5.1 Civil

As stated in Subsection 3.4.1, there is no information or details shown on the existing project construction drawings to determine pipe sizing, piping materials, appurtenant fittings/valves, and overall trench installation to assess whether or not the existing culinary water line has been installed in accordance to any standard or code. The existing line would have to be exposed and inspected to assess the condition of the existing line and to make a determination of the overall adherence to accepted engineering standards and/or practice.

3.5.2 Structural/Architectural

- Purlin bottom flange bracing – structure is incomplete without these braces.
- Stair access, jib hoists – jib hoists poorly located for their functional use.
- Ladder access to mezzanine –poor access due to ship ladder access venders.
- Lack of galvanizing to roof bracing cables, AHU bracing – maintenance issue.
- Curbs around chemical tanks – tank leakage is uncontained, and could find its way into electrical room and/or blower room below.
- Fuel containment (refer also to mechanical) – containment lacking.
- Gratings over the cassettes probable does not extend far enough south (there is enough room for a foot to enter gap) – potential user hazard.
- Guards handrails/guards between the two aerobic tanks is too flexible (spans too far) and should be reinforced.
- Access – from Trash Auger to Fournier Press (see Process comments).
- Arch rating 3hr to screening – discussed in detail previously.

3.5.3 Process

Plant Capacity

Since flows fluctuate over the course of the day (diurnal fluctuations) and over the course of the year (seasonal fluctuations), design of any wastewater treatment plant should not be based on average day flows but rather consideration must be given to the minimum and maximum day and peak hour flows seen in the system. Maximum day and peak hour water demands are two and three times higher than the average day flows, based on information derived for the Water Treatment Plant Design Brief (Earth Tech, October 2001). For a system such as Iqaluit, water demand will closely match wastewater production. Thus, the 1998 construction year average day

flow of 1,800 m^3/day would required that the wastewater plant be designed for a peak treatment capacity of at least 3,600 m^3/day.
The City of Iqaluit provided the average day flows in the IRFQ-2/21/98. Good engineering practice would dictate that the designer, Hill Murray, take into account the maximum day flows in designing the wastewater treatment plant. Having based the design of the wastewater treatment plant on current average day flow, the existing system is already under designed to accept even current peak flows, and no buffer or peak shaving storage is provided. Therefore, during peak flow periods, insufficient treatment and/or direct release of untreated sewage may be the result.

In addition to deviating from general plant capacity design philosophy and sizing of equipment, comments on specific equipment items and general operability of the plant are provided in the following paragraphs.

Trash Room

Grout was not provided under the screening/auger tank. Consequently, as liquid levels in the tank are likely to fluctuate, the floor of the tank will likely be subjected to metal fatigue due to flexing. The intent for disposal of the collected screenings unclear. Based on the layout of the plant, two scenarios are envisaged, as follows:

- The screenings will be collected in a bin in the screening room. To dispose of the screenings, the bin will have to be rolled through the aeration tanks area, over grating and either through the double doors near the front entrance and onto the grating outside. A removable chain would allow the bin's contents to be dumped two stories down into an awaiting container.

- Alternatively, the bin could be rolled into the sludge dewatering room and the bin's contents disposed through the roll-up garage door into a bin or truck below.

Neither option is operator friendly. In addition, both options would require that the Trash Room door be opened on a regular basis, thus allowing potentially hazardous gas to escape into the main area of the plant.

To make the collection and disposal of screening more operator friendly, it is proposed that a door be added to the outside wall so that the screenings could be dumped directly from the trash room into an outside container. Not only would this minimize the time and facilitate the operation of removing screenings from the trash room, but this would also minimize the number of times per day that the door between the trash room and main plant area must be opened.

Aeration System

The fine bubble diffusers have been sitting uncovered in the plant and the diffusers are completely covered with dust. The equipment supplier was contacted to provide comment on storage requirements. The supplier indicated that although the present diffuser storage is less than ideal, as long as the diffusers have been stored in a heated environment, protected from the elements, the diffusers should still be usable.

Zenon Membrane System

Zenon estimates that the cleaning frequency of the cartridges in each tank would be required every three to six months. However, the cleaning frequency is likely more frequent. At another membrane plant in Powell River, membrane cassettes have to be cleaned every two to three weeks. Consequently, we expect that two operators will be required two hours per day, five days a week just to clean the modules. This would significantly increase the estimated annual operating costs for the facility.

Removal of a module for cleaning consists of the following steps:

- The floor grating must be opened. Normally, temporary guardrails should be provided to ensure operator safety so that there is no risk of falling into the aeration tank during this process. None has been provided.

- The module must then be removed from the aeration tank using a manual hoist. The approximate weight of the module is 2 tons. Considering the weight of the module, an electric hoist would be easier to operate.

- No walkway space allowances have been provided to permit the operator to walk around the module, once the module has been removed from the aeration tank.

- Two operators are required to pull the module toward the dip tanks. The module will have to be carefully steered to ensure that the piping leading to the modules is not damaged.

RAS System

A hoist has been provided in the event that the RAS pumps must be removed from the aeration tank for maintenance or repair. However, actual removal of the pump and access to the pump is nearly impossible. Once the RAS pumps are hoisted out of the tank, the hoist reach only allows for the pumps to be set on the tank wall. The piping systems on either side of the tank wall prevent access to the pumps.

Piping System

Many of the actuated valves are difficult to access and an insufficient amount of isolation valves has been provided. In addition, normally consideration is given to future disassembly requirements of a piping and pumping system and flexible couplings or victaulic joints are provided to facilitate disassembly. However, no such provisions have been included in a systematic manner for this piping system. The piping material is also inconsistent and is likely defined by the limits of the various supply contracts. In general, there is very little, if any, piping or equipment support.

Pumping Systems

Removal of the pumps is made difficult for several reasons: flexible couplings to remove the pumps have not been provided; there is insufficient space to remove the pump motors, due to the mixing tank or the backwash tank; and it is difficult to provide an A-frame crane for some of the pumps due to the lack of headspace and room taken up by the HVAC system.

It is not clear how the small vacuum pumps provided for priming the system will be controlled for shut off.

Fournier Filter Press

The progressive cavity pump supplied with the Fournier equipment has been installed on the wall. Aside from the fact that such an installation is unconventional, maintenance of the pump is made difficult as there is no room to remove the pump shaft.

The sludge dewatering system includes a requirement of 16 tons of woodchips per year. Considering Iqaluit's climate, availability of woodchips is minimal. Thus woodchips would have to be shipped to Iqaluit on a yearly basis, and dry storage provided. In addition, the wood chips are to be dumped into a hopper located on the main operating level. The top of the hopper is approximately 1.5 m. No provisions to facilitate dumping the woodchips into the hopper, such as a ladder and platform for the operator, have been included.

Fournier Polymer System

The use of recycle flush water for the polymer system, current design, is not recommended since the polymer will react with constituents in the recycle water thereby increasing polymer dosing requirements.

Blowers

According to the nameplate, the Aerzen blowers are 25 hp blowers rated for 16.9 m^3/min, with a backpressure of 0.7 bar and operating at a speed of 4800 rpm. However, the drawings indicate that the blower should run at 1800 rmp. It was not obvious on site or clear from the O&M equipment whether speed reducers have been provided. The noise produced from the blowers running at 4800 rpm will require protective hearing. The blowers should be sized to run at 1800 rpm to minimize noise levels. In addition, acoustic enclosures around the blower are recommended to minimize noise levels.

Chemical Feed Systems

The citric acid and hypochlorite chemical feed systems are being stored adjacent to each other without any containment.

Laboratory

The laboratory is located above the office and washroom and is approximately 2.43 m above the operating floor level. Access is by ship's ladder. Carrying samples up the ladder will prove precarious. As a minimum, a spiral type staircase should be provided.

3.5.4 Mechanical

Fuel oil supply line from outdoor fuel oil storage tank is a gravity feed line and, based on our experience, should be increased to 50mm to provide adequate fuel supply during cold weather

conditions. The installed location of the daytank is inappropriate due to its height. It appears that when the level of the outdoor storage tank drops below 50% the achievable level of the also daytank decreases. The supply line enters the bottom of the daytank which will create problems with sludge accumulation. The main supply line is currently sloped towards the main storage tank.

3.5.5 Electrical

The project drawings are incomplete in that, good engineering practice dictates that a number of other items should be detailed and specified in the project documents. Examples of this are:

- Grounding details, including the layout of the ground, type size and location of ground rods, type and size of ground conductors.
- Circuiting of all equipment, lighting and receptacles.
- Motor control schematics and MCC elevations.
- Emergency generator load control schematics.
- Equipment installation and connection details.
- Contactor control schematics.

The project drawings do not show a sufficient level of coordination between the Hill Murray, Fournier, and Zenon packages. This is particularly evident with respect to the facilities control systems, where there is an entire PLC system installed that does not appear on any drawing or in any document.

This project was also of the magnitude that would warrant a three part specification. The specification should outline General Requirements, Product Details, Installation Execution instructions, for all major electrical and controls assemblies or systems.

Good engineering practice would dictate a different approach to the "Code Load Calculation" shown on the drawings. The recommended calculation would be performed as follows:

A = the sum of all required motor loads at 100%, except the largest motor.
B = the starting load of the largest motor.
C = the sum of all electric heating loads at 100%
D = the base building load at 25 W/m sq. (as per Table 14 C.E.C.)
Additional 25% capacity for future expansion.

Minimum service size = (A+B+C+D)+ (A+B+C+D)*.25

Inspection of the facility has revealed further deviations from good engineering practice. The Electrical room location and the installation of equipment within the room will be problematic. The electrical room location is such that it sits within a recessed containment area with all the

membrane process pumps, piping, two large back pulse tanks, and two large chemical storage tanks (show as PUMPS AREA on the drawings). Any piping or equipment failure, or maintenance activities will result in fluids on the floor in the recessed area. Should the volume of fluid exceed the capacity of the 2, 4" floor drains there will be fluid in the electrical room. This problem is made worse by the fact that the electrical equipment is mounted directly on the floor, and not on a 2" housekeeping pad. The MCC configuration is such that all MCC control wiring is routed in a chase along the bottom of the unit. It will take very little fluid in the electrical room to get this control wiring wet.

Good engineering practice would also dictate that the facility would be fitted with a conduit and wiring system that will enable access to both the equipment and all local motor disconnect switches. The sealtight flexible conduit has been run randomly from the field terminations to a local controls junction box or disconnect switch mounted on the wall behind all of the process equipment. In this installation the disconnects are inoperable, the junction boxes are inaccessible for service work and any process work that requires removal of piping will have to contend with moving the conduit. The design should have included a separate tray network for power and controls systems. The disconnect switches should be located at each pump motor for case of operation.

The lighting levels on the second floor of the facility are acceptable at the present time, however as the facility ages and the reflectance levels of the interior surfaces diminishes the lighting levels may be poor.

The installation of the generator has not been completed in that the support equipment for the generator set is either incomplete or requires revision. The numerous problems with the fuel handling and room ventilation systems are documented in the mechanical portion of the report. The battery charging system is yet to be installed. The emergency power system will require a load management scheme be devised, approved by an engineer, and implemented in order to have the unit function.

The last item we have reviewed with respect to deviations from good engineering practice is the level of automation to be implemented in this facility. Although not well documented, a review of the installed equipment and the nature of the membrane process indicates that this was to be a highly automated facility. Implementation of any automation scheme in Iqaluit should be undertaken with care, as the skills required to troubleshoot, or repair failures of the automation system itself may not always be available on site. This may place the facility in a compromised state while knowledgeable personal or required repair parts are brought in from the south. The facility design has not included any redundancy in systems or provisions to operate the process manually.

3.6 PROPOSED/RECOMMENDED MODIFICATIONS

3.6.1 Civil

Recommended modifications for the civil-site design would include possible improvements to the existing grading and surfacing of parking or service areas immediately surrounding the existing

plant building. Depending on the extent, or quantity, of potential storm runoff from the overall plant site and capacity of the surrounding drainage system, an attempt should be made to grade the parking area surrounding the existing plant to allow for the proper collection and discharge of storm water runoff from the overall plant area. Gravel surfacing should also be placed to facilitate the general accessibility to the plant from parked vehicles and to lessen the extent of deep rutting by light vehicle traffic during wet weather conditions.

3.6.2 Structural/Architectural

These will be largely process driven. All items in 3.3.2 and 5.2 above should be addressed. In addition, exterior work is required such as backfilling and general cleanup.

3.6.3 Process

More recent population projections were presented by Earth Tech in the Water Treatment Plant Design Brief (October 2001). The year 2021 design population is estimated at 9,788 with a drinking water demand of 4,520 m^3/day and a net capacity of 9,040 m^3/day to meet maximum day demands. The peak hour demand was estimated at 13, 560 m^3/day in the report.

Trash Room

To make the collection and disposal of screening more operator friendly, it is proposed that a door be added to the outside wall so that the screenings could be dumped directly from the trash room into an outside container. Not only would this minimize the time and facilitate the operation of removing screenings from the trash room, but this would also minimize the number of times per day that the door between the trash room and main plant area is opened.

3.6.4 Mechanical

Fuel Oil System

Provide the outdoor self contained fuel oil storage tank with a certified 2 hour fire rated support as per the NFC Part 4.

Relocate the fuel oil daytank and provide secondary containment.

Increase fuel oil supply line to 50mm and slope towards daytank.

Heating System

Increase combustion air ductwork size, remove volume control damper and provide cold air trap at discharge to prevent freezing conditions in mechanical room.

Replace Unit heater fan motors and thermostats that are not suitable for area classifications.

Insulate boiler flues and pipe the boiler chimney condensate drain to suitable drain.

Insulate heating piping.
Pipe boiler PRV's to glycol storage tank.

Provide source of heat in lower floor vestibule.

Plumbing System
Extend tailpieces of floor drains serving the washroom and Main plant floor below the normal water level within the Anoxic tanks to prevent vapours from migrating to the areas above.

Pipe domestic water tank T&P relief valve to a safe discharge drain to alleviate safety hazard.

Install potable water storage tank level controls.

Ventilation System

Ventilation system must be redesigned to suit NFPA 820 requirements. Fire dampers are required at all fire separations as per the NFC of Canada. Additional ventilation equipment is required to meet requirements of NFPA 820.

Install new exhaust fan in Trash Auger room to meet the 12 air change requirement.

3.6.5 Electrical

Modifications to the buildings electrical and controls systems should be undertaken to achieve the following three goals:

- Provide an electrical distribution system that is of a correct size and configuration to ensure the operability of the facility in both normal and emergency power modes.
- Ensure the facility's electrical systems meet or exceed the code requirements discussed in this report.
- Provide electrical and controls systems that are revised to match the requirements of any modifications to the wastewater treatment process.

Should the Zenon membrane treatment system be implemented, the facility will require an additional electrical service in order to accommodate the new air handling equipment required to meet the code dictated ventilation requirements. Should the wastewater treatment process be revised to a less pumping/ blower intensive scheme, the reduced requirement for process motors will free up capacity in the existing service.

3.7 COST ESTIMATE TO COMPLETE PER EXISTING CONTRACT DOCUMENTS

The cost to bring the existing plant into operation in accordance with the initial design and specifications has been estimated at slightly over $820,000. The stated cost is completely assigned to making modifications and upgrades to structural, mechanical, electrical, and instrumentation components of the existing plant to satisfy code violations and to generally make the existing plant operable.

Four optional process schemes were also evaluated to complete the existing within a reasonable period of time. The goal of the evaluation was to apply alternative treatment processes to the existing plant design that would minimize additional construction costs, while at the same time, adhere to effluent quality standards established by the City of Iqaluit and the Nunavut Environmental Authority.

The initial option is to finish all plant construction in general accordance with the existing design. However, the existing facility including all structural features, in addition to all electrical and mechanical equipment, will have to be replaced or brought up to code according to the findings and recommendations presented in the previous sections of this report. This option will most-likely result in the quickest and most direct solution to the problem of providing acceptable treatment to the community's domestic wastewater. The completion of the plant in general conformance with the existing design will also result in a number of operational problems that need to be addressed before this option is selected.

A membrane treatment process typically results in considerable operation and maintenance costs. Based on actual data collected at other plants, annual maintenance and operational costs at the Iqaluit plant are expected to reach $900,000 per year for the first few years of operation. In addition to general plant operations, the stated cost also includes all labour, materials, and equipment to clean and replace membrane cassettes according to the manufacturer's recommendations.

Membrane processes are complex and require a significant level of training to properly operate and maintain. Given the plant's remote location, size of community, and limited access to training opportunities, there is a concern as to whether the City's public works staff can acquire and maintain the expertise needed to operate the system.

The Fournier rotary press is generally a viable equipment option to effectively dewater activated domestic sludge. However, the process requires a considerable volume of wood chips, or pellets, to operate. These chips or pellets are not available locally and will have to be shipped by sea from the lower Province. Accordingly, the cost of shipping and storing the indicated amendment material is expected to be expensive and further add to excessive operation and maintenance cost of the plant.

Based on stated design and membrane manufacturer criteria, it is apparent that the existing plant is undersized in terms of both process and hydraulic capacity. As noted in Section 2.1.3, the estimated current population base is 5,200. By applying the established per capita water use rate of 400 lpcd to the indicated population base, the immediate average day influent flow is estimated at 2.1 ML/d; which exceeds the stated plant hydraulic capacity of 1.8 ML/d. The membrane manufacturer's process design criteria guarantees the established effluent water quality of 10 mg/L for both TSS and BOD given an influent contaminate level of around 220 mg/L. The average measured influent contaminate level is 350 mg/L.

3.8 COST ESTIMATE TO COMPLETE ALTERNATE PROCESS OPTIONS

In addition to completing the existing plant's construction with the current process equipment and facilities in-place, four other options were considered that would allow for various levels of treatment and process schemes that would significantly reduce annual plant operation and maintenance costs. These options include the plant's conversion to primary treatment, an activated sludge process, a non conventional activated sludge process, and a sequence batch reactor process.

Conversion to Primary Treatment Only. The conversion to primary treatment would effectively remove the existing bioreactors, blowers, and attached aeration system from service. The aeration system would be removed from the existing bioreactors which would be converted to primary clarifiers. Primary sludge would be removed from the newly converted bioreactors by mechanical means, thickened, then pumped to a holding tank for final disposal at the City's existing landfill. This option would provide the City with a simplified and relatively inexpensive solution to the problem bringing the existing plant online within the shortest possible period of time. However, the level of treatment would not be much improved over the existing lagoon system now in service. For this option to be implemented, the Nunavut Environmental Authority would have to relax the established water quality standard established for the new plant and sea outfall.

The conversion to primary treatment would require the installation of new sludge pumps, related piping, and mechanical equipment to remove settled sludge in addition to making modifications to the existing plant to correct code violations and to improve on overall plant operations. The costs to install the indicated new equipment and related plant modifications are presented as liquid stream capital costs in the following table with similar costs associated with other process options.

Conversion to Conventional Secondary Treatment. Converting to a conventional activated sludge process would require considerable mechanical and structural modifications to the existing plant. The primary change would include a conversion from a membrane to an activated sludge removal process utilizing newly constructed secondary clarifiers. The new clarifiers would have to be constructed outside the existing plant building; which, due to extreme cold winter temperatures, would need to be covered or place inside a new building. It is anticipated that the entire tankage (anoxic basins plus the existing bioreactors) of the existing plant would have to utilized as aeration basins in the activated sludge conversion. The effluent quality with this option is expected to meet and exceed the newly established water quality standard for a localized sea outfall. The stated treatment performance is based on the need for a minimum 15 day sludge retention time (SRT) in the newly constructed clarifiers. The costs associated with the design and construction of the new secondary clarifiers has been estimated at $3.3 million as shown on the following cost summary table.

Conversion to Limited Conventional Treatment with Filtration. A less conventional process can be incorporated into the existing plant effectively eliminating the need for secondary clarification as described for the previous conventional activated sludge option. The existing anoxic basins and bioreactors could be operated in series as opposed to the current, or as designed, parallel flow scheme. The series operation of the existing process tanks, or basins, would allow for an increase in SRT and a marked improvement with sludge removal efficiency

and the overall treatment process. Sludge removal would be accomplished by utilizing Kaldnes or Evirosim filtration media at the terminal point of flow within the last bioreactor. This is a simplified option requiring significant mechanical and structural modifications to the existing plant. The option proposes the use of filtration media which typically requires more labour and related expenses to operate and maintain. The effluent quality is expected to meet and exceed established standards, closely approximating the previous activated sludge process option. The costs associated with the design and construction of the described conversion to limited secondary filtration has been estimated at $3.5 million as shown on the following cost summary table.

Conversion to Sequencing Batch Reactor. Incorporating a sequencing batch reactor process-approach to the existing layout of anoxic and aerated bioreactor tanks is a viable option to improve the plant's level of treatment. However, this option would require the construction of a second set of bioreactors with the same volume and general configuration as found in the existing plant. The operation of a time sequencing versus a continuous flow plant is significantly more complex requiring additional training of operational personnel. This option, like the conventional activated sludge option, will require that the proposed additional bioractor(s) to be covered or enclosed within a new building. Effluent quality is expected to meet and exceed established standards for a sea outfall. The costs associated with the design and construction of the new bioreactors has been estimated at $4.0 million as shown on the following cost summary table.

The projected costs to operate, maintain, and complete the various construction requirements that can be associated with the process alternatives discussed above are summarized in the following table:

Option	EPCC[1]	LSCC[2]	SMCC[3]	AO&M[4]	15 YPW[5]
Operate Existing Plant	$820,000	NA	$300,000	$900,000	$10,000,000
Primary Treatment	$500,000	$250,000	$300,000	$200,000	$3,000,000
Conventional AS	$710,000	$3,300,000	$300,000	$300,000	$7,200,000
Non-Conventional AS	$634,000	$3,500,000	$300,000	$350,000	$7,800,000
Sequential Batch Reactor	$750,000	$4,000,000	$300,000	$300,000	$8,000,000

Table Notes:

1. EPCC: Capital costs to bring the existing plant to code and operational as recommended for the stated plant option.

2. LSCC: Liquid stream capital costs including all concrete structures, pumping and piping systems, aeration equipment, mechanical equipment, electrical and instrumentation systems, etc. needed to modify the existing plant and implement the process scheme associated with the stated option.

3. SMCC: Solids management capital costs including sludge thickening and/or dewatering equipment and all related piping and electrical control systems for all options.

4. AO&M: Annual operations and maintenance costs for all options.

5. 15 YPW: Present worth of all costs for a 15 year project life at a 7.0 percent discount rate.

6. The costs shown for solids management improvements include the replacement of the Fournier Rotary Press with a thickening centrifuge. The justification for the recommended replacement is due to the anticipated excessive costs and general unavailability of wood chips or pellets to operate the Fourier press per the manufacturer's recommendations.

3.9 RECOMMENDATIONS AND SUMMARY OF FINDINGS

The City of Iqaluit has to date invested an estimated $7.0 million to design and construct a viable and cost effective sewer treatment plant to conform with more stringent effluent discharge requirements as established by the Nunavut Environmental Authority. Unfortunately, construction of the plant was ordered to a stop due to numerous construction code violations, questionable engineering, poor selection of process equipment, impractical layout of plant piping and mechanical equipment, and various concerns regarding the expected costs to operate the facility over an extended period of time.

The objective, or goal, of work presented in this report was to assess the condition of the existing facility and carefully evaluate feasible options to put the plant in service at the earliest possible date. With the exception of converting the existing plant to primary treatment, the various process and construction options presented above will allow for effluent quality in full conformity with established water quality standards.

The general scope of this report requires the completion of a comprehensive plant audit to establish all deficiencies in terms of applicable building/construction code violations to further assess the scope of all additional work to bring the plant operational according to original performance criteria. This is interpreted as allowing for a completed treatment facility with an average day hydraulic capacity of 1.8 Ml/d with the capability to reduce regulated contaminants contained in raw domestic sanitary sewage to meet effluent water quality standards established by the Nunavut Water Board.

The problem with the stated interpretation of the report scope of work is that 1.8 Ml/d will, in all likelihood, be less than adequate to service the City's population base by the time the existing plant is brought up to code in accordance with the recommendations made in this report. Therefore, additional consideration must be given to address the issue of plant requirements to meet projected growth over a reasonable planning period. To address this issue, and from various discussions with City officials, it has been tentatively agreed to that the City needs to pursue a phased construction approach to bringing the existing plant on-line over an extended period of time. The phased approach would allow the City to fund the additional plant construction over several years as opposed to spending a considerable amount of money to finance a much larger project within the immediate future.

The remaining discussions will attempt to outline a feasible program to phase the reconstruction of the existing wastewater treatment plant. However, a number of basic and critical, design parameters will have to be assessed based on very limited data and information. The contaminant levels of existing sanitary sewage has been estimated at 200 mg/l to 300 mg/l for both BOD_5 and TSS. The accuracy of this data is questionable due to the limited number of samples taken to arrive at the stated range of concentrations. Per capita indoor water demand has been estimated at between 200 lpcd to nearly 600 lpcd according to historical records taken at the Iqaluit Water

Treatment Plant from 1978 to 2000. The range of the stated basic design parameters is considerable and will have a significant impact on the scope of work, and related cost, to reconstruct the existing wastewater treatment facility. For the purpose of making a reconnaissance level effort to outline a possible phased approach to reconstructing the existing plant, it is assumed that BOD_5 and TSS contaminant levels will not exceed the 300 mg/l level and average day indoor water demand will not exceed 400 lpcd. It is further assumed that a conventional secondary activated sludge process will be incorporated into the design and operation of the final treatment facility.

Phase 1 of an extended reconstruction project would include all work to bring the existing plant up to code for all structural, mechanical, electrical, and instrumentation deficiencies as identified in this report. The scope of work would also a conversion of the existing two bioreactors to aeration basins compatible with a conventional activated sludge treatment process. The completed Phase 1 work, as described, would allow for a hydraulic capacity of 1.60 Ml/d through the entire plant including the converted conventional activated sludge aeration basins. It must be noted that the completion of this reconstruction Phase would not allow for the treatment of wastewater influent. The plant will not be capable of treating raw sanitary sewage until secondary clarifiers have been constructed and included in the overall liquid treatment train in addition to the newly converted aeration basins. The plant would remain out-of-service until the completion of Phase 2. Engineering and construction costs to complete Phase 1 is estimated at $1.01 million.

Phase 2 would include the design and construction of one 12.0 metre secondary clarifier with a hydraulic capacity of 1.60 Ml/d. The new clarifier would match the hydraulic capacity of the aeration basins completed in Phase 1 of the overall reconstruction project and would allow the plant to go on-line for the first time. The Phase 2 plant would have the capability to treat raw sanitary sewage to the standards established by the Nunavut Water Board for a population base of 4,000 full time residences. Engineering and construction costs to complete Phase 2 is estimated at $3.0 million. The stated cost does not include an insulted building to totally enclose the new clarifiers. Freeze protection will be provided by removable-insulted covers to be placed over the newly constructed clarifier during cold weather operations.

Phase 3 would include the design and construction of two additional aeration basins (same geometry and hydraulic characteristics as the basins converted in Phase 1). The construction of the new aeration basins would add an additional 1.60 Ml/d for a total of 3.20 Ml/d of liquid stream hydraulic capacity through the aeration phase of the overall process scheme. However, the plant would only have a treatment capacity of 1.60 Ml/d due to the existence of only one 12.0 metre secondary clarifier. Engineering and construction costs to complete Phase 3 is estimated at $1.6 million including insulted basin covers for cold weather operations.

Phase 4 would include the design and construction of a final 12.0 metre secondary clarifier. The plant would have a total hydraulic capacity of 3.2 Ml/d allowing for the treatment of raw domestic sewage from a population base of 8,000 residences. Engineering and construction costs to complete Phase 4 is estimated at an additional $3.0 million including insulated covers for cold weather operations.

Making a few basic assumptions, the completion of all four phases of the reconstruction project would allow for adequate raw sewage treatment to the planning year of 2012. The basic assumptions would include 1) the population growth rate for Iqaluit averages 3.7 percent over the

foreseeable future, 2) raw sewage contaminant levels remain at or below current levels over the stated planning period, and 3) the average per capita indoor water demand stabilizes at or below 400 lpcd. Assuming that each of the described project phases can be completed within a 12 month time frame starting in 2003, the final plant can be on-line by late 2006 allowing for an additional 6 years of operation without further expansions or modifications to the existing facility. This time frame would also allow for the City to acquire better operational data/information to more accurately assess the need and timing of future plant expansions.

GLOSSARY OF TERMS/ACRONYMS

ACI 350:	American Concrete Institute Standard for Hydraulic Structures.
BOD_5:	Five day Biological Oxygen Demand for influent/effluent contaminants.
CAD:	Computer Aided Design.
CEC:	Canadian Electrical Code.
CGSL:	The consulting firm of CH2M Gore & Storrie Limited.
DBSPC-7/22/99:	Design-Build Stipulated Price Contract for the Municipality of Iqaluit Water Reclamation Facility as prepared by Hill, Murray & Associates dated July 22, 1999.
DO:	Dissolved Oxygen concentrations.
ETC:	Earth Tech Canada, Inc.
HDD:	High Density Discharge.
HMA:	The consulting firm of Hill, Murray & Associates.
HMAP-3/18/98:	Response to Request for Qualifications and Proposals for Sewage Treatment Options for the Municipality of Iqaluit as prepared by Hill, Murray & Associates dated March 19, 1998.
HMAP-6/12/98:	Revised Proposal for Fully Integrated Sewage Treatment Facility for the Municipality of Iqaluit as prepared by Hill, Murray & Associates dated June 12, 1998.
HVAC:	Heating, Ventilation, and Air Conditioning.
IP:	Input Program.
IRFQ-1/21/98:	Request for Qualifications and Proposals for Sewage Treatment Options as prepared by the Municipality of Iqaluit dated January 21, 1998.
MCC:	Motor Control Center.
NBC:	National Building Code-1995.
NFPA:	National Fire Protection Association.
NPC:	Industrial Health and Safety Standards and Canadian Plumbing Code.
NWT:	Northwest Territories.
P&ID:	Process and Instrumentation Diagram.
PLC:	Process Logic Control.
RAS:	Return Activated Sludge.

SMART: Unspecified proprietary term used for system control software as proposed by Hill, Murray & Associates. Actual definition of the acronym not given in the design or contract documentation.

SRT: Sludge Retention Time.

TSS: Total Suspended Solids.

WAS: Waste Activated Sludge.

TAB EE

MUNICIPALITY OF IQALUIT

WATER TREATMENT PLANT

PRE-DESIGN BRIEF

Prepared for:

City of Iqaluit
P.O. Box 460
Iqaluit, NT X0A 0H0

Prepared by:

Earth Tech (Canada) Inc.
(Formerly Reid Crowther & Partners Ltd.)
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Yellowknife, NT. X1A 2N9

March 2002

Earth Tech Project No. 49,745

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EXECUTIVE SUMMARY

The existing water treatment plant has a useful output of 1,050 m^3/day, which is currently less than the average day demand of 1,200 m^3/day, and the throughput of the existing plant is limited by the capacity of the filters.

The water treatment plant has been in need of an upgrade for several years and this continues to be the case. The excellent of the raw water quality of the Lake Geraldine source has permitted the City of Iqaluit to overcome the operational shortfall of the water treatment plant in its current configuration, but not without risk.

Based on a current design year of 2022, available population demands and projections, the upgraded water treatment plant will need to have a production capability of approximately 9,500 m^3/day in the design year. For the most part, this can be achieved utilizing the existing infrastructure, along with new, increased capacity filters, contained in a new building addition above an existing clearwell. However, shortfalls exist in both the existing intake and the recharge capability of Lake Geraldine, as described below.

The best information available at the time of this report, from OMM/Trow indicates, that the Lake Geraldine reservoir has an annual recharge volume of approximately 586,000 m^3. Based on this information, there may be a potential raw water shortfall situation in the year 2005. Consequently, additional raw water may need to be transferred into the Lake Geraldine reservoir from an alternate raw water source. This transfer has potential treatment process implications, however , we feel these are limited, given that the alternate raw water being transferred to Lake Geraldine should be of similar quality. This needs to be investigated and confirmed.

The existing raw water intake from the Lake Geraldine dam structure to the water treatment plant is approaching the end of its useful life. Based on current population and demand projections, the intake may be unable to meet the maximum day requirements of 4,000 m^3/day in approximately the year 2001/02. It is recommended that the intake be replaced

TAB FF

MUNICIPALITY OF IQALUIT
CITY COUNCIL MEETING # 29
NOVEMBER 27, 2001 AT 3:30 P.M.
CITY COUNCIL CHAMBERS

Action

PRESENT FROM COUNCIL

A/Mayor Matthew Spence
Councillor Kirt Ejesiak
Councillor Lynda Gunn – arrived at 3:55 P.M.
Councillor Keith Irving
Councillor Chris Wilson

Mayor John Matthews – Out of town
Councillor Simon Nattaq – medical leave
Councillor Stu Kennedy– Out of town
Councillor Glenn Williams– Out of town

PRESENT FROM ADMINISTRATION

Chief Administrative Officer, Rick Butler
Deputy Senior Administrative Officer, Ookalik Curley
Municipal Liaison Officer, Jose Arreak
Finance Controller, John Hussey
A/Director of Emergency Services, Terry Augustus
A/Deputy Fire Chief, Cory Chegwyn
Director of Public Works, Paul Fraser
Director of Engineering, Matthew Hough
Community Economic Developer, Cheri Kemp-Kinnear
City Planner/Development Officer, Bruce Parker

Others Present

R.C.M.P. Staff Sargeant M. Jefferies
Nunatsiaq News, Denise Rideout
CBC, Trish Estabrooks
NewsNorth, Nathan Vanderklippe

PRAYER

A/Mayor Matthew Spence opened the meeting at 3:30 P.M. and before they had a quorum, allowed the delegate, Captain Elisah Sloan of the Recruiting Centre for Canadian Armed Forces to make her presentation.

Councillor Lynda Gunn arrived at 3:55 p.m.

ADOPTION OF AGENDA

- **Motion: 01-412**

Moved by: Councillor Chris Wilson
Seconded by: Councillor Keith Irving
That:

"Council approve the amended agenda as noted."

Unanimously Carried

Delete 3 a) Cpl. Lew Philip to January City Council meeting; Add, in its place, 3 a) Captain Elisha Sloan , Recruiting Centre for Canadian Armed Forces; Add 8 a) (i) Lands Administration By-law 550 for first reading,; Delete 8 c) (i) By-law 540 Zoning Amendment for third reading.

MINUTES

a) **Regular City Council Meeting Minutes # 28 November 13, 2001**

Action

- **Motion: 01-413**

Moved by: Councillor Chris Wilson
Seconded by: Councillor Lynda Gunn
That:

"Council adopt the Regular City Council Meeting Minutes # 28 November 13, 2001 with a spelling correction."

Unanimously Carried

2. DECLARATION OF INTEREST:

A/Mayor Matthew Spence declared interest when Council start discussion under 6(f) on the Hospital Land Application. A/Mayor noted no other declarations.

3. DELEGATIONS:

Captain Elisah Sloan from Recruiting Centre of Canadian Armed Forces, based in Yellowknife, came to Iqaluit, as part of their recruiting in Nunavut and wanted to inform Council on it and that she has been speaking with groups locally promoting Canadian Armed Forces under Aboriginal Entry Program which she handed out to Council as information. She continued that in order to be eligible, one has to be at least 17, at least completed grade 10 and be physically fit. They have to have a medical while taking the first course and have no legal obligations while taking the course. The first course is held in Ft. Smith, NWT. Should they want to continue, they can take a three week course held in Montreal P.Q., with Aboriginals across Canada. After completion of these two courses, the Aboriginals would then be free to join the Canadian Armed Forces if they want to. She added that there are no set quotas to join the program. Captain Elisah Sloan concluded by stating that a public meeting at Parrish hall will be held on Thursday at 7:00 P.M., and welcomed anyone to attend that meeting. After some questions and responses from Council, A/Mayor Matthew Spence thanked Captain Elisah Sloan for her time and presentation.

RCMP Staff Sergeant Michael Jefferies provided an overview of his monthly and statistical report to Council. After questions and responses to the report, ranging from provincial tickets to dispatch services clarification, A/Mayor Spence thanked Staff Sergeant Michael Jefferies for his report.

4. STATEMENTS

None

5. CORRESPONDENCE

Chief Administrative Officer, Rick Butler provided an overview of Council Correspondence and after a brief discussion, the following motions were tabled:

- **Motion: 01-414**

Moved by: Councillor Chris Wilson
Seconded by: Councillor Lynda Gunn
That:

" Council donate $200.00 to Iqaluit Rotary Club for their Hamper X-Mas Drive for the needy."

Unanimously Carried

- **Motion: 01-415**

Moved by: Councillor Lynda Gunn
Seconded by: Councillor Kirt Ejesiak
That:

" Council donate $200.00 to an Association of Montreal Inuit for their Christmas feast planned for Inuit as requested."

Unanimously Carried

Action

- **Motion: 01-416**

Moved by: Councillor Lynda Gunn
Seconded by: Councillor Keith Irving
That:

" Council donate $200.00 to Iqaluit Speed Skating Club as they prepare for Arctic Winter Games 2002."

Unanimously Carried

6. COMMITTEE REPORTS

a) Administrator's Report

Chief Administrative Officer, Rick Butler provided a verbal report on his recent trip to finalize financial strategy details and option with consultants and potential financing partners, stating he will be providing a written report for council consideration and asked that a Special Council Meeting be set this week. After some questions, responses and clarification, Council set Thursday, November 29, 2001 at noon to go over the report. A/Mayor Spence thanked Chief Administrative Officer Rick Butler for his report.

b) RCMP Report: Staff Sergeant Michael Jefferies

Covered under delegation.

c) Emergency Services

A/Deputy Fire Chief, Cory Chegwyn, provided an overview of their monthly report for Emergency Services, that they are continuing to have a computer problems and hope to have it fixed for next monthly report. After some questions and responses, A/Mayor Spence thanked Cory Chegwyn for his report.

d) By-law Report

Chief By-law Officer, Terry Augustus, provided their October By-law Report to Council. After questions and responses to report, ranging from business licensing, construction sites, dog pound facility to sealift containers, A/Mayor Spence thanked Terry Augustus for his presentation.

e) Recreation Report

Ookalik Curley, DSAO on behalf of Director of Recreation, Dave St. Louis, apologized that he was not able to be in the meeting tonight, provided an overview of the departmental report to Council. The monthly report now contains a portion on the Youth Centre and included also is schedule of events for Christmas. After some questions and responses, to the report, A/Mayor thanked Ookalik Curley for her time and report.

f) Planning Committee Report/Recommendation

Councillor Keith Irving provided an overview of documents for Council information. After questions and clarifications, the following motions were table for Council consideration:

- **Motion: 01-417**

Moved by: Councillor Keith Irving
Seconded by: Councillor Lynda Gunn
That:

" Council approve the development permit submitted by Steenberg Construction on Lot 6, Block 216, Plan 3317, to complete the building as a 3 storey, single family dwelling once they receive written acceptance from the affected neighbours."

Carried
Against: Cr. C.Wilson

- **Motion: 01-418**

Moved by: Councillor Keith Irving
Seconded by: Councillor Lynda Gunn
That:

Action

" In the matter of the violation of the Development Permit by Steenberg Construction on Lot 5, Block 216, Plan 3317 and future violators that Council use its authority under section 3.15 of the Zoning By-law to seek a fine (Administration will define to Council by correspondence or e-mail based on the by-law)."

Unanimously Carried

Councillor Gunn took the chair and A/Mayor Spence left the premises while Council dealt with the next item and motion.

- **Motion: 01-419**

Moved by: Councillor Keith Irving
Seconded by: Councillor Kirt Ejesiak
That:

" Council approve in principle the location of the new hospital to the north of the existing hospital with the conditions that the green space of the creek be protected and that study begin immediately on the traffic issues associated with the location for the hospital."

Unanimously Carried

A/Mayor Spence returned to the Chair after Council passed motion # 01-419 accordingly.

g) Community Economic Development Committee Report

Cheri Kemp-Kinnear, Community Economic Developer, provided an overview of their various activities for the month. She indicated that clarification is required of Committee responsibilities and overlaps between CED and Planning Committee. Council will review and make a decision in January, 2002.
After questions and responses, to the report, A/Mayor Spence thanked Community Economic Developer, Cheri Kemp-Kinnear for her time and presentation.

h) Finance Report

John Hussey, Finance Controller, provided Council, an updated report on the financial status of the city up to the end of September 30, 2001, with financial projections of O & M Budget surplus at the end of fiscal year. After clarifications and responses to questions, A/Mayor Matthew Spence thanked Mr. Hussey for his time and report.

7. DEFERRED BUSINESS AND TABLED ITEMS: None

8. BY-LAWS:

a) First Reading of By-law(s): By-law 550 Amendment to Land Administration

- **Motion: 01-420**

Moved by: Councillor Chris Wilson
Seconded by: Councillor Kirt Ejesiak
That:

" Council give By-law 550 Amendment to Lands Administration By-law first reading."

Unanimously Carried

b) Second Reading of By-law(s): None

c) Third Reading of By-law(s):

As noted, under adoption of agenda, By-law 540, Amendment to Zoning By-law (Parking) was deleted. It will be dealt with once City receives the by-law with Minister's signature (CG & T of GN).

Break at 5:40 P.M. Meeting resumed at 5:55P.M.

9. OLD BUSINESS

Action

a) Arctic Winter Games 2002

A/Mayor Matthew Spence and CAO, Rick Butler provided a verbal presentation on various activities for AWG 2002. After no further comments, A/Mayor Matthew Spence proceeded with the next agenda item.

b) Sewage Treatment Plant Review

Director of Engineering, Matthew Hough provided Council an overview of the above item. After some questions and responses, the following motion was tabled for Council consideration:

- **Motion: 01-421**

Moved by: Councillor Keith Irving
Seconded by: Councillor Chris Wilson

"Whereas it is necessary to do a review of the Sewage Treatment Plant;

Whereas a public RFP was held;

And Whereas Earth Tech has the experience in the requirements of this project, superior project team, and an understanding of the scope of work required to meet the objectives of this project;

Be it resolved that Earth Tech be awarded the contract to review the Sewage Treatment Plant for $86,130.00 plus GST."

Unanimously Carried

10. NEW BUSINESS

a) Nunavut Liquor Act recommendations

CAO, Rick Butler provided the copy of the Nunavut Liquor Act recommendations submitted to the Minister of Finance by the Nunavut Liquor Licensing Board which describes the role of the Liquor Licensing Board and the Nunavut Liquor Commission. The Board submitted results of their visits to eight Nunavut communities consultation meetings and ranked them in three separate groupings. After some discussion as to what role council should have, Council asked Administration to follow up on the process the Government of Nunavut will expect from the communities.

b) In Camera session

- **Motion: 01-422**

Moved by: Councillor Lynda Gunn
Seconded by: Councillor Chris Wilson
That:

" Council approve to go in camera session at 6:30 P.M."

Unanimously Carried

- **Motion: 01-423**

Moved by: Councillor Keith Irving
Seconded by: Councillor Chris Wilson
That:

" Council approve to revert back to regular City Council Meeting at 7:12 P.M. with nothing to report from Committee of the Whole."

Unanimously Carried

11. ADJOURNMENT

- **Motion: 01-424**

Moved by: Councillor Keith Irving
Seconded by: Councillor Chris Wilson

Action

That:

" Council adjourn City Council Meeting # 29, November 27, 2001 at 7:13 P.M."

Unanimously Carried

_____
Mayor

_____
Chief Administrative Officer

Approved by City Council on _____day of_____, 2001

TAB GG

Full Story

Firm hired to get Iqaluit sewage plant working

WebPosted Feb 25 2004 11:52 AM CST

IQALUIT - Earth Tech will begin to rebuild Iqaluit's idle wastewater treatment plant.

City council unanimously approved Earth Tech's proposal at a council meeting Tuesday night.

Iqaluit's multi-million dollar sewage plant has never treated a litre of waste water

The city has approved the company's bid of $712,000, which will go towards converting and expanding the existing plant.

It was built in 1999 but has never operated because of a design flaw.

The money will come from the city of Iqaluit and Nunavut government.

Three companies submitted bids on the project.

Earth Tech's proposal was the lowest of the three, coming in $180,000 less than the highest bidder.

Earth Tech is a California-based engineering company with offices across Canada. Their bid covers phase one of the project.

The city has said the plant may be operational as early as 2005.

Back to Top Stories

E-mail or Print this story

TAB HH

Earth Tech Canada Inc. 17203 – 103 Avenue, Edmonton, Alberta T5S 1J4 Canada

March 29, 2004 Refer to File: 75360
Document6

City of Iqaluit
P. O. Box 460
Iqaluit, NU X0A 0H0
Attention: Brad Sokach, P.Eng.

Dear Brad:

Re: Effluent Quality Guidelines for Iqaluit WWTP

We have had discussions and exchanges over the past two weeks with a variety of individuals seeking to clarify the effluent quality criteria for the Iqaluit Waster Water Treatment Plant (WWTP).

Telephone
780.488.6800
Facsimile

Our conclusions of these discussions, regarding the effluent quality criteria, are as follows.

1. The current draft effluent quality guidelines for municipal wastewater discharges in marine embayed areas in Nunavut (120/180 - BOD/SS with 150 to 600 L/c/d water consumption) are not appropriate to Iqaluit .
2. Ammonia reduction is required in order to produce an effluent that is "not acutely lethal" to fish.

In responding to these conclusions to establish design criteria upon which to proceed with the process pre-design of the Iqaluit WWTP improvements, we are recommending the following effluent quality guidelines.

A. 45 mg/L BOD_5.
B. 45 mg/L Suspended Solids.
C. 10 mg/L Ammonia.

We recommend that this letter be circulated to the regulatory authorities, namely the Nunavut Water Board, Environment Canada, Fisheries and Oceans Canada, and the Nunavut Health Authority in order to obtain their feedback on this recommendation as soon as possible.

Very truly yours,

EARTH TECH (CANADA) INC.

Per:

Ken Johnson, M.A.Sc., MCIP, P.Eng.
Senior Environmental Planner

APPENDIX 2

DISTRICT OF POWELL RIVER WASTEWATER TREATMENT PLAN

District of Powell River Wastewater Treatment Plant

The following is a description of the events and circumstances surrounding Hill-Murray's involvement with the Corporation of the District of Powell River (CDPR).

Definitions

CDPR	Corporation of the District of Powell River
HM	Hill Murray & Associates
Reid-Crowther	CDPR's original consultant (now Earth Tech)
MoELP	Ministry of the Environment, Lands and Parks
AAF	Average Annual Flow
ADWF	Average Dry Weather Flow
I&I	Infiltration and Inflow
MSR	Municipal Sewage Regulation
MMAH	Ministry of Municipal Affairs and Housing

Introduction

Hill-Murray was a design-build engineering firm specializing in the field of high quality treatment using membrane technology. HM had many successful projects throughout its life, including Powell River. The fact that the flows were twice what the contract called for led to a number of challenges in completing this project. The fact remains that the plant as designed and built met all performance objectives and permit requirements, and continues to do so to the best of our knowledge.

Background

Powell River is a town at the northern end of the Sunshine Coast in British Columbia. CDPR was under considerable pressure from the regulatory agencies to provide treatment for, or rectify a combined sewer overflow condition that had been ignored for much of the previous decade. As part of the new Municipal Sewage Regulations, communities faced with significant infiltration and inflow problems were no longer simply able to dump overflows to receiving waters, and were now required to treat twice their average dry weather flow to secondary standard. Powell River's Westview treatment plant was overloaded, and consequently raw wastewater was routinely bypassed into the Malaspina Strait with no treatment.

The CDPR staff had retained the engineering firm Reid-Crowther to complete a preliminary design report. Its purpose was to identify potential treatment options and to determine the design flows for CDPR, collectively, and individually for the three treatment plants: Westview, Townsite and Wildwood (**SEE TAB A, in particular Section 2.7**). While it was Reid-Crowther's intent to segue directly from report to design to infrastructure deployment, the CDPR Council chose to use this information to review alternatives for the best available technologies and financial/infrastructure deployment strategies. In this process, it was vital that the method chosen not only meet the requirements of the new Municipal Sewage Regulation (MSR), it was imperative that CDPR acquire provincial infrastructure grant monies, and meet the obligations of that program. From the design report, the Reid-Crowther plan could not be completed until October 1999 (one year beyond the window of availability of funding from MMAH), and would cost $7.24 MM. In addition, as the plant was to be located in the hills surrounding CDPR, *all* the wastewater would be required to be pumped via a lift station to the new plant. As a result of the fact that the design report did not meet the objectives of CDPR, the Council decided to review other options.

CDPR staff had developed a substantial rift with the Council of the time over this issue. Staff felt that means afforded by the Reid-Crowther proposal was sufficient, despite the fact that the capital expenditure was well in excess of what CDPR could afford. Council, guided not only by the technical requirement, but cognizant of the looming infrastructure grant deadlines and the impacts of the pending MSR, felt alternative infrastructure deployment methodologies were preferred to the Design-Bid-Construct process offered by Reid-Crowther. Council directed staff to review alternatives. This resulted in an adversarial relationship between staff and Council, which continued to deteriorate throughout the project.

As a result of Hill-Murray's accomplishments in the field of tertiary treatment and alternative infrastructure deployment, the Council called Hill-Murray to provide a proposal for services. This public process was successful, primarily on the basis of meeting CDPR's needs in a one-stop mode: HM could perform permitting, finance acquisition, design-build services, and operations support – all within the extremely tight timeline. HM and CDPR entered into a Memorandum of Understanding to develop a complete solution for the Westview facility in June 1997 (**SEE TAB B**).

The MOU gave HM the authority to negotiate with the Ministry of the Environment, Lands and Parks, and with the Ministry of Municipal Affairs and Housing on behalf of CDPR. HM structured the foundation of the regulatory environment to meet the needs of the various stakeholders in the project (CDPR, MoELP and MMAH). Of critical importance was the acceptance of the technical plan by MoELP (that is, the plan met the requirements of the MSR, which was achieved at **TAB C**) and the deployment schedule by MMAH (that is, the plan could be completed – reach substantial completion – by 31 October 1998, which was achieved at **TAB D**).

Success in these venues resulted in a design-build contract with CDPR in September 1997 to provide a 931,000 USGPD average annual flow (AAF) wastewater treatment plant upgrade. This system was designed to have a 2 x peaking factor (the equivalent of 1,862,000 USGPD) for periods not exceeding 12 hours in any one day, and to be employed such that the AAF did not exceed 931,000 USGPD. This was incorporated into the performance specification for the contract (**SEE TAB E**). Of note, CDPR was required to provide flow data for the development of the design (**SEE TAB F**) which they provided (**SEE TAB G**)

CDPR and HM developed a strategy that allowed for treatment of the average dry weather flow (ADWF) to tertiary standards, and a primary treatment combined with blending of tertiary effluent during peak flow periods. This strategy was demonstrated in the paper entitled "Meeting the Draft Municipal Sewage Regulation Standards for Discharge to Water for Combined Sewer Overflow Conditions through the Combination of Membrane-Bioreactor and Micro-Screening Technology" (**SEE TAB H**). This concept received tremendous support from the MoELP and met the requirements of meeting a secondary standard (BOD/TSS of 45/45 mg/L) for 2 x ADWF (at the time of the project, the MoELP had just issued its draft municipal sewage regulation which required that systems subject to significant I&I problems were required to treat combined sewer overflows up to and including 2 x ADWF to a minimum of secondary standards).

Based on the design data supplied by Reid-Crowther to CDPR, CDPR applied for an amendment to their discharge permit to account for an ADWF of 607,200 USGPD, which under the MSR, required that CDPR treat a minimum of 1.2 USMGD to the 45/45 secondary standard. This permit was drafted in March 1999 for later release (**SEE TAB I**).

Construction of the project began in January 1998 and the project received substantial completion from CDPR staff in July 1998. Shortly thereafter, Jim Greenwood, CDPR's engineer, quit his position, leaving the project without any guidance from CDPR[1].

As a design-build project is performance-based, HM developed a comprehensive tests and trials program (**SEE TAB J**) designed to prove that all systems (mechanical, control, biological, civil) met their design objectives. This program culminated with the stress test of the membrane bioreactor system in December 1998. The performance specification in the contract is very clear:

AAF	931,000 USGPD
Peaking Factor	2 x 931,000 USGPD for not more than 12 hours

During commissioning, it became apparent that the flows to the plant even during the dry season were substantially greater than an AAF 931,000 USGPD, and the ADWF value provided by Reid-Crowther (and subsequently used by CDPR in the generation of their discharge permit) was significantly greater than 607,200 USGPD. Indeed through the ensuing two year period that Hill-Murray operated the plant (without compensation from CDPR), the AAF turned out to be 1.7 USMGD, and the ADWF was 1.2 to 1.4 USMGD (**SEE TAB K**). Significant modifications were made to the plant (again without compensation from CDPR) to allow the plant to treat the ADWF in order to allow CDPR to remain in compliance with its discharge permit.

During the commissioning period, CDPR staff hired Reid-Crowther to act as third party engineer despite HM's objections[2]. Reid-Crowther completed their initial review of the project in complete isolation from HM and did not request any contractual or technical information for the completion of their report. Their report centered on interpretation of the contract documents and the permit documents. As a result of their interpretation (developed without consultation with HM), Reid-Crowther advised CDPR staff that the contracted performance specification was not appropriate and that the plant was incapable of meeting their interpretation (**SEE TAB M**). Hill-Murray responded to each allegation (**SEE TAB N**).

Despite the completion of three full flow trials (**SEE TAB O**), witnessed by CDPR's third-party engineers[3], CDPR continued to believe that the plant was not capable of meeting its design objectives, and failed to take any responsibility for the increased flow to the plant.

As a result of the significant changes in contractual control on the part of CDPR, CDPR's staff took the opportunity to attempt to change the performance specification: CDPR staff now maintained that meeting

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[1] At various times throughout the next two years, HM was receiving direction from Richard Byrd, Richard Stogre, Ian Fremantle, and Gino Francescutti as well as a host of Council members. Of note as well, was the election process of November 1998 that resulted in the turn-over of a large number of the original Town Council members. This change in control is significant, as it put in charge those staff members originally overruled by the Council, and those responsible for the conduct of the Reid-Crowther flow study – a key point of contention throughout the resolution phase of this project.

[2] Reid-Crowther had developed a history of adversarial relationships with design-build firms in the past, and in particular had confronted HM on the Ganges PCC project and the Westbank project. In addition, Reid-Crowther employed questionable business practices by trying to interfere with contractual relationships at Iqaluit (**SEE TAB L**). Reid-Crowther was also in a significant conflict of interest position, with the primary discrepancy in the contract completion being based on work performed by Reid-Crowther under contract with CDPR.

[3] Reid-Crowther was employed from September 1998 to January 1999, and again from April 2000 to June 2000; CH2M Gore & Storrie was employed from January 1999 to April 2000. Reid-Crowther was removed initially because of their conflict of interest in the flow debate and their unethical practices on other HM projects. Interestingly, the second time Reid-Crowther was hired, part of their terms of reference was to review the actions of CH2M Gore & Storrie.

the contracted flows (performance specification) was not sufficient, and irrespective of the design flow and the actual flow, the plant should be capable of treating the entire flow at all times. Clearly, flow is a primary element in the design of a wastewater treatment facility, and has direct impact on kinetic performance, sludge generation, chemical and consumable costs as well as labor.

At various times throughout the ensuing process, CDPR charged that HM was not recording flow properly. In order to address the flow question, HM retained Southwestern Flow Tech to confirm the flows in September 1999 (**SEE TAB P**). Ultimately, CDPR also hired this consultant yet again to confirm the confirmation in March 2000. In April 2000, Reid-Crowther indicated that the plant could meet the performance specification.

Changing tactics, CDPR staff chose to set out to allege that certain contract deficiencies existed in the deployment of the infrastructure (**SEE TAB Q**). Hill-Murray again responded in detail, refuting all claims (**SEE TAB R**). CDPR attempted to activate the performance bond, which was also rejected by the bonding company (**SEE TAB S**).

While HM and CDPR continued to argue over completion, HM operated the plant fully, providing all labor, chemicals, and consumables for operation. CDPR staff took no role in operating the plant until HM pulled its staff from the site in June 2000 – 22 months after commissioning the plant, and 24 months after substantial completion. Throughout this period, HM provided upgrade services for systems in order to meet the additional flows, performed all planned and emergency maintenance activities, and continued to refine operations and performance.

After several legal forays in which HM liened the project for failure to pay, and ultimately sued the District, the project came to a close in November 2000 with the full and complete release of HM, and the payment of a portion of the costs of operations for the 22 month period (CDPR paid only the chemical costs – no labor costs) (**SEE TAB T**).

Conclusions & Facts

The contractual obligations of HM were to provide a treatment plant capable of treating an AAF of 931,000 USGPD with a 2 x peaking factor. This was proven in service many times, and indeed the plant has operated at 1.5 x the AAF since commissioning.

It is evident that the change in contractual control from the Engineer through to various members of the CDPR staff had a significant impact on the relationship between CDPR and HM. The loss of a project champion is difficult at all times. Loss of both the technical champion, and the political vision subscribed to by the Council particularly difficult in this case, and drastically reduced the possibility of a successful outcome.

At no time did CDPR succeed in calling HM's bonds for completion of the work – an indicator the bonding company felt HM was in a strong position, and the loss of credibility CDPR had received. In addition, no formal legal action was commenced by CDPR against HM, nor did CDPR proceed with any other form of action against HM.

Without a doubt, HM was instrumental in acquiring a new, compliant water reclamation facility for the District, which allowed the District a reprieve to forward their I&I rectification plan. In addition, HM acquired funding approval for the project and negotiated the necessary MoELP permits and approvals for this innovative approach to a serious problem faced by CDPR. HM, at its own expense, increased the design flow from 931,000 USGPD to 1.2 USMGD, and modified all of the ancillary services to meet this

new flow criterion. Throughout the long dispute period, HM operated the plant at no cost to the District, and only chose to remove those services to force closure of the project.

It is my belief that HM did its utmost, and responded in an extremely professional and dedicated manner to solve a problem for one of its clients.

Unfortunately, throughout the project, some Councilors and CDPR staff made uninformed and incorrect statements to the local press. While these comments resulted in a few unfortunate news articles, HM received an equal number of news articles extolling the plant as a paradigm of innovation and success.

The following summarizes the facts with respect to HM and CDPR:

- HM competed in an open process to win the design-build work at Powell River
- Powell River had approached HM for an alternative to what had been presented in a report prepared and submitted by Reid Crowther of British Columbia
- The Powell River (Westview facility) was out of compliance when HM contracted with Powell River.
- HM was solely responsible for the preservation of government funds to allow Powell River to be able to afford to upgrade their plant.
- HM was solely responsible for obtaining a Ministry of Environment discharge permit for the new plant
- The Ministry of the Environment approved the plan for Powell River
- Reid Crowther, HM's largest critic not only competed for the work at Powell River and lost but made serious and critical errors in their previous work at Powell River characterizing the flows which Powell River relied on, had a right to rely on, and entering into a contract specifying the flows from the Reid Crowther report.
- The actual flows at the Powell River plant were nearly 2 times higher than the contracted flows.
- HM met the design specifications of the contract and over 2 years upgraded the plant at their and Zenon's expense to meet the actual flows;
- HM supported the project in adversarial conditions at their sole cost for nearly 2 years;
- HM finally had to sue Powell River to pay for the upgrades associated with flow and to bring about closure to the project;
- Powell River finally offered to settle with HM and the parties did settle;
- The facilities still run in compliance;
- It was the largest membrane-bioreactor in the world at the time;
- HM's bond was never called and when insurance companies where put on notice, the insurance companies rigorously defended HM's position.
- Reid Crowther who was in financial difficultly eventually was acquired by Earth Tech (Canada) Inc., a Tyco subsidiary.

This project should be characterized as a design-build project which would deploy some of the most advanced technology in the world for wastewater treatment. With the use of Zenon membrane-bioreactor technology, this project represented the largest of its kind in the world. The project experienced some difficulty as a result of contractual obligation with respect to wastewater flow when HM discovered upon commissioning of the new facility that the actual flows entering the plant were double the flows which the city contracted with HM for. The problem was exacerbated because Powell River had relied on a 3rd party engineering report (Reid Crowther) for the characterization of flows which was fatally flawed – the 3rd party engineer had failed to calibrate the flow measurement devices and were deeply concerned with their own exposure and liability. It is believed that Reid Crowther encouraged Powell River to attempt to blame HM for this problem in an attempt to protect themselves and Powell River from public scrutiny and

their failure to contract effectively. Further, as HM and Zenon were very concerned with protecting their extremely good reputations made every conceivable effort to ensure the project was ultimately a success. These efforts included providing onsite project support for two years and expending nearly $2.0 MM in additional funds to meet the actual flows, which far exceeded the contractual obligations. Powell River never expressed any gratitude for the efforts HM and Zenon put into resolving Powell River's issues, but the Westview facility does show prominently on CDPR's website, and the upgrade is mentioned as having eliminated odors in the area, and as running in compliance (**SEE TAB U**).

Detailed Timeline

Note: Shaded column indicates the period of HM operations for Westview.

ITEM		DATE
CDPR contacts HM to determine if there is an opportunity to have HM supply a membrane-bioreactor upgrade to the existing Westview WWTP. The plant was unsightly, located in CDPR's marina district, could not achieve permit compliance and generated significant odors.		
In order to expedite the process, CDPR provided HM with their consultants flow projections in order to work up the preliminary design and costing. Reid-Crowther had performed an extensive flow study so that CDPR could move forward with an upgrade to the plants (Westview & Townsite). In addition, CDPR provided three years' of historical data from the existing treatment plant. These data and the flow study performed by Reid-Crowther became the basis for the hydraulic design of the plant. This was primarily due to the requirement for an extremely quick infrastructure deployment dictated by CDPR. All monies were required to be expended prior to 31 October 1998, leaving no time to perform a confirmation of flows measured by CDPR and Reid-Crowther.		CDPR supplies data to HM 6 May 1997
On preliminary investigation, Hill-Murray discovers: • There are insufficient funds for CDPR to complete any upgrade to the Westview facility. Provincial infrastructure grant money is required. • There is insufficient time to perform a Design/Bid/Build process. • Permit reporting for the Westview plant is irregular. • An I&I problem exists that needs to be addressed. As a result, a very innovative approach was required with respect to permitting, financing, infrastructure delivery and design. This was a non-trivial exercise, undertaken by HM to align all the stakeholders with the plan.		
Proposal. HM provides a proposal to provide an upgrade to the Westview wastewater treatment plant. Preliminary design concepts are presented.		25 June 1997
Memorandum of Understanding is signed with the intent that both CDPR and HM would work toward obtaining MoELP approval for the design, and obtain grant funding for a potion of the project.		17 July 1997
MoELP provides authorization to proceed with proposed modifications. This is equivalent to an Approval to Construct and endorses the innovative approach to solving treatment of I&I storm flows in concert with sewer flows.		27 August 1997
HM submits documentation to acquire provincial infrastructure grant funding for the Westview upgrade. On 3 September 1997, Powell River receives notification that the Westview project has been allocated funds from BC government for Westview upgrade. Funds must be expended prior to 31 October 1998. This was a condition precedent to signing the Head Contract.		CDPR receives notification of funding 3 September 1997

Head contract signed. In the Head Contract, the owner was obligated to provide design documentation (including flows) for the existing plant and had done so in May 1997.		12 Sep 1997
Detailed Design. Plant was designed to the flow projections of Reid-Crowther (now Earth Tech) Preliminary Design Report commissioned by CDPR in 1996. The MBR was designed to meet the requirements of the dry season, with primary screening and blending being provided as a means by which the wet weather flows could be handled. A permitting strategy was formulated and work began on the design, including pilot testing for the primary screening devices. The AAF for the year 2010 was identified as 3950 m3/day. HM chose a design target of 3520 m3/day for the year 1998. Contract included the complete overhaul and conversion of an existing plant to an MBR process, and required significant upgrades to odor, noise and aesthetic controls. The plant design was fully enclosed to meet these requirements. In addition, MoELP required that a primary treatment system be installed during the construction period, and approved the PRA Microscreens for this use.		Reid-Crowther Report issued September 1996. Pilot study on PRA screens October 1997
Substantial Completion received. An intensive walk-through with Jim Greenwood (CDPR engineer) of the plant identifies a punch-list of items which HM begins to work on. These items are minor (painting, etc). Commissioning commences.		13 July 1998 (SC signed 27 June 1998)
Commissioning begins, with the build up of a viable biomass, and a progressive start of the membrane systems.		August 1998
Jim Greenwood resigns (CDPR Engineer)		August 1998
CDPR hires Reid-Crowther to act as third-party engineer		September 1998
First MoELP Permit issued. This permit contained a flaw in the requirements for tertiary treated water. The permit was amended in March 1999 to rectify this issue.		6 October 1998
CDPR declares HM is in default and notifies the bonding companies of intent to proceed with action to call bonds. Interestingly, this action precedes the publication of the deficiency list. CDPR did not inform HM that Reid-Crowther was to review the plant. Once this was known, HM vehemently objected to their selection, as they had a corporate history of being anti-MBR, and had been beaten out of the Westview project by HM. HM felt there was no way to get an impartial review from such an organization.		29 October 1998

Reid-Crowther provides Stage 1 Report detailing a list of deficiencies. HM was not consulted at all for the preparation of this report. This reaffirmed our belief the Reid-Crowther could not act impartially. The report contained significant mistakes and errors. Differences in design solutions are readily evident in this report, as is the desire to incite fear. Membrane performance is a high profile issue, but HM had already insisted that Zenon immediately upgrade the membrane complement to deal with any performance problems that were initially identified in the commissioning period. This assisted CDPR in meeting their permit requirements (which were based on the flawed Reid-Crowther design report) by increasing steady state capacity above 4600 m3/day, and dealt partially with what we were beginning to understand to be a significant issue: the flawed data supplied by Reid-Crowther to CDPR in completion of their flow studies.	31 October 1998
HM Replies to Reid-Crowther report, remains committed to both rectifying perceived issues and continues to operate the plant.	6 November 1998
Detailed flow analyses were conducted, and demonstrated that the flows were well in excess of the design flows. The data indicated that the flows were: ADWF: Reid-Crowther Study 2820 m3/day in 2010 ADWF : HM Design 3520 m3/day + 2 x Peaking Factor for the membrane system ADWF: Actual 6274 m3/day in 1999 The peak hour flow was 42,000 m3/day – 2.25 times the expected peak hour flow from the Reid-Crowther design report. This put extreme pressure on the membrane system, which ultimately led to the provision of additional membranes (at no cost to CDPR).	
Full Flow Trials were conducted December 1998. This proved that the system was capable of meeting the design criteria. Reid-Crowther staff witnessed this trial.	3 December 1998
Full Flow Trials were conducted January 1999.	5 – 6 January 1999
Reid-Crowther terminated from position of third-party representative because of their conflict of interest (Reid-Crowther had originally bid on the Westview expansion, and had provided the design data used in the HM expansion) and because of the unethical activities of Reid-Crowther partners with respect activities designed to de-rail other HM projects, including Iqaluit.	
Amended permit issued to amend the discharge criteria to align with the MSR (secondary standard for 2 X ADWF), to deal with the increased flows (total flow increased from 13,640 m3/day to 20,000 m3/day) and to clarify the disinfection requirement (disinfection only required in dry months – 1 May to 15 Oct).	9 March 1999
CH2M Gore & Storrie chosen as third party representative. A detailed completion schedule is developed (22 June 1999) and HM works to complete items, even though some are outside the original contract.	10 May 1999

Southwestern Flow Tech contracted to confirm accuracy of the plant's meters.		September to December 1999
Full Flow Trial conducted in January 2000. The plant succeeded again in meeting the contractual obligations for flow. Report submitted to CDPR and CH2M.		5-6 January 2000
CDPR re-hires Reid-Crowther to review the performance of the plant, *including* a review of the activities of CH2M – the contractually defined third-party reviewer. This indicates that CDPR had no intention of honoring their obligations under the completion agreement.		February 2000
CDPR engages Southwestern Flow Tech to perform a flow study – a study HM had already commissioned and completed in December 1999. This study confirms the flows are much higher than the design called for.		10 April 2000
Reid-Crowther Final Report indicates the plant can meet the flow criteria, but continues to suggest there were other design or operational issues.		24 April 2000
HM liens the Project for failure to pay outstanding amounts on the project. $1.9 MM		26 April 2000
CDPR provides a list of "deficiencies". This is a restatement of the Reid-Crowther deficiency list, and shows a change in tactic from flows (which the Reid-Crowther report finally admitted were being met) to more obscure items such as the requirement for a redundant control system. HM's response is also included.		12 May 2000
HM stops providing operations staff at CDPR. In the end, the only leverage HM had was that HM staff had been operating the plant free of charge for CDPR for 22 months. With no end in sight, or any perceived recourse to fund the operations, HM chose to terminate these services. This appears to have been the catalyst to begin settlement talks. In hindsight, this action, avoided because of Hill-Murray's desire to meet the admittedly ever-changing goal posts of success, should have been instituted much sooner in the process.		15 June 2000
CDPR proposes a settlement.		20 June 2000
HM proposes a second form of settlement which was considered at an *in-camera* meeting of the council 21 August. The council rejected the offer but the council authorized continued discussion, and the addition of a $37,000 payment for chemicals used at Westview throughout the period HM operated the facility.		26 July 2000
Hill-Murray sues CDPR.		17 August 2000
CDPR offers the second settlement.		24 August 2000
CDPR proposes third settlement		20 September 2000
CDPR declares HM in default and takes contract out of HM's hands. HM responds.		10 October 2000
CDPR threatens to call bonds – bonding company vigorously defends HM's position.		31 October 2000
CDPR and HM agree to the terms of the settlement..		28 November 2000
CDPR releases HM. Performance bond released and CDPR pays a portion of the outstanding amounts owed to HM ($37,000).		November 2000

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TAB A

SECTION 1.0
INTRODUCTION

1.1 BACKGROUND

The District of Powell River is a town of about 14,000 people, located on British Columbia's Sunshine Coast, about 135 km northwest of Vancouver. The community's economic base is the pulp and paper industry in the area, including the MacMillan Bloedel Limited mill in the north end of the District. As well, some commercial fishery and limited agricultural and cottage industry contribute to the welfare of the community.

Powell River operates three treatment plants – Westview, Townsite, and Wildwood. The Westview Sewage Treatment Plant is a high rate activated sludge facility with a nominal capacity of 5.0 ML/d. It is adjacent to the downtown area close to the main marina, serving the Westview area. The Townsite Sewage Treatment Plant is three kilometres north of the Westview plant, adjacent to the MacMillan Bloedel mill. It serves the original Townsite and the Cranberry areas of the Town. It uses the same process as the Westview plant, but has only half the capacity, about 2.0 ML/d. The Wildwood plant is an aerated lagoon which serves the area north of the river.

The Westview and Townsite plants both experience high wet weather flows. Approximately 16 to 20 percent of all wastewater arriving at the plants bypasses treatment before being discharged. In addition, the community is experiencing steady growth. The current population is estimated to be 13,800 of which about 50 percent are served by the Westview plant and 25 percent by the Townsite plant.

The District has planned modifications of their systems based on the following three factors: growth, anticipated more stringent effluent criteria, and aesthetic problems at the Westview plant. A study completed in 1988 recommended that treatment be consolidated at the Townsite plant and that the plant be upgraded to handle the additional flow. The chosen scheme had an estimated cost of about $2.99M. In 1994, the District received funding under the Canada/British Columbia Infrastructure Works Program for this work, escalated to account for changes in the interim to $4.1M.

Reid Crowther was engaged in April 1995 to provide the engineering services for the Predesign, Detailed Design, Construction Services, and Post Construction Services required for the completion of this project.

One of the first services provided was to formulate a preliminary cost estimate. The most probable costs determined for the plant were in the order of $7.35M, including engineering, contingencies, GST, etc. Because this cost estimate was much higher than Powell River's initial estimate of about $4.1M, Reid Crowther were instructed in June 1995 to delay work until funding issues could be explored further.

In January 1996, Reid Crowther was given the go-ahead to proceed with the Predesign and Functional Design of the plant. This report summarizes the first phase of that work - the Predesign.

1.2 OBJECTIVES

The intent of this report is to review and establish the major management concepts to be adopted for the treatment of wastewater in Powell River. These goals may be summarized as follows:

1. Review historic plant flows and loads and predict future trends.
2. Assess likely effluent criteria that will be applied to the District's wastewater treatment facilities in the future.
3. Review and confirm the findings of the 1988 Sewerage Study to verify that the planned consolidation of treatment at the Townsite location is the most appropriate.
4. Determine the most feasible processes for the treatment of liquids and solids at the new plant.
5. Determine the most appropriate method of managing residuals generated at the new facility.
6. Develop a plan for the implementation of the new plant.

1.3 REPORT ORGANIZATION

To meet the requirements for this project, the work has been segregated according to the major topics. Following this introductory section, eight

additional sections identify and discuss the basic issues faced by the community and provide the evaluations necessary to allow selection of the most viable alternatives and provide a framework for implementation. These sections are as follows:

Section 2.0 - Wastewater Characteristics: Historic flows and loads are compared to the populations and used to project wastewater flows and loads that might be expected within the planning period.

Section 3.0 - Regulatory Requirements: Provincial and federal regulations that govern the management of wastewater in B.C. are reviewed and the likely future approach discussed to determine the most likely criteria that will be stipulated for Powell River.

Section 4.0 - Existing Plant Audit: The condition and expected service life of the existing plants will be reviewed.

Section 5.0 - Sewerage Plan Review: The results of the 1988 Sewerage Plan will be assessed in the light of changes since that time. Planning level cost estimates will be used to determine whether the recommended approach is most appropriate.

Section 6.0 - Secondary Treatment Alternatives: Liquid treatment alternatives will be assessed to determine which would be the most appropriate.

Section 7.0 - Residuals Management: An approach to treatment residuals management will be developed which allows the most cost effective method of disposal. Treatment processes compatible with this approach will be evaluated and the most feasible determined.

Section 8.0 - Recommended Plan: The results of the liquid treatment and residuals management assessments are compiled and plant ancillaries are defined.

Section 9.0 - Implementation Program: Cost estimates and schedules are derived for the wastewater treatment program.

A summary of these sections, highlighting the major findings of the report, is included in the Executive Summary at the beginning of the document.

SECTION 2.0
WASTEWATER CHARACTERISTICS

2.1 INTRODUCTION

The District of Powell River is located at the north end of the Sunshine Coast. For most of the last two decades, growth has been minimal and the population has not changed significantly. Future growth may occur as the community diversifies or as Powell River becomes a destination for retirees who are looking for more reasonable accommodation than can be found further south along the coast.

The wastewater flows and loads generated by the tributary population will have to be treated by the community's plants. This section examines population trends and potential; considers the wastewater flows and loads from recent years; and based on this baseline information, estimates future flows and loads.

2.2 DESIGN POPULATIONS

The population of the District of Powell River has been changing very slowly for the last 20 years. A major downsizing of the workforce at the MacMillan Bloedel mill in the early 1980s caused a reduction in the population immediately afterward. Since about 1990, the population has been rebounding. These factors have been discussed in some detail in the "Official Community Plan - Technical Background Report" recently prepared by the District's planners - Graham Farstadt Associates. Table 2.1 summarizes the census populations since 1971 and predicts populations for the next 20 years, as extracted from that report.

The low, median and high population predictions indicate that Powell River will likely experience growth varying from a slight negative rate to about 2 percent annually. The selected design population will influence costs and project staging. If the selected population growth rate is significantly less than that which occurs, the District will have to expand facilities shortly after commissioning the new or expanded plant. Conversely, if the population projection is much higher than originally anticipated, then the District will invest in infrastructure that is unnecessary for an extended period. Because of

the uncertainty surrounding growth in Powell River, it is suggested that a relatively short design horizon be chosen for the new facility.

Table 2.1: Estimated Populations[1]

Year	Low Population Growth	Median Population Growth	High Population Growth
1971		13,726	
1976		13,694	
1981		13,423	
1986		12,440	
1991		13,368	
1994		13,555	
1999	13,459	14,246	14,966
2004	13,176	14,973	16,524
2009	12,841	15,737	18,244
2014	12,520	16,540	20,143

Notes: 1. Past and future population figures were extracted from the "Official Community Plan - Technical Background Report, April, 1995.

Powell River presently has three plants - Townsite, Westview, and Wildwood. The population in 1994 was distributed between these three plants, approximately as follows:

Westview	8,275 people
Cranberry	2,895 people
Townsite	1,085 people
Subtotal	3,980 people
Wildwood	1,300 people
Total	13,555 people

These values were obtained by applying the 1991 population distribution to the 1994 populations. This approach is somewhat unrealistic as the Townsite area has experienced substantial population reductions in the last 10 years, Wildwood and Westview have remained relatively constant, and Cranberry has grown substantially. To project future growth, it has been assumed that both Townsite and Wildwood remain at the above values while growth is split equally between Cranberry and Westview. This assumption should be reviewed when the Official Community Plan update is completed.

Based on the median population projection and the population distribution developed above, the expected populations to the year 2014 in the three major catchments have been derived and are listed in Table 2.2.

Table 2.2: Estimated Catchment Populations[1]

Year	Westview	Townsite[2]	Wildwood[3]
1994	8,275	3,980	1,300
1999	8,620	4,325	1,300
2004	8,984	4,689	1,300
2009	9,366	5,071	1,300
2014	9,768	5,472	1,300

Notes:
1. Total future population figures were extracted from the median projections of the "Official Community Plan - Technical Background Report, April, 1995.
2. Townsite includes both Cranberry and Townsite areas.
3. Wildwood is assumed to experience no net growth in the next 20 years.

Design of the plant(s) must account for the potential growth while not overbuilding and causing undue expenditures which may not be required in the near future. Because Powell River may grow anywhere from zero to 50 percent within the next thirty years, this is a difficult choice. It is recommended that the selected design population be based on the median growth projection, for a 15 year design life. The design population for the Westview catchment then becomes about 9,400 and for the Townsite catchment, 5,100. In addition, the plant should be designed to allow easy expansion by 50 percent. A plant designed to accept these flows would enjoy a reasonable service life if the community experienced the median population growth projection. If the population remained stagnant, the unused capacity would be about 15 percent of the total. If the population increased at a growth rate that approached the optimistic projection, the plant would have to be expanded earlier, by about 2001. This expansion would be manageable within the time frame possible. In summary, the design populations are as follows:

Design Year	**2010**
Westview	9,400 people
Townsite (Including Cranberry)	5,100 people
Subtotal	14,500 people
Wildwood	1,300 people
Total	15,800 people

2.3 MEASURED WASTEWATER FLOWS

The unit rate of flow is that proportion of the flow attributed to each resident in the tributary area. Parshall flumes fitted with ultrasonic flow sensors measure the flow at both the Townsite and Westview plants. Average annual, average dry weather, maximum month, and maximum week flows are listed in Table 2.3 for both plants.

The flow entering the Westview plant is much more variable than that entering the Townsite plant. This characteristic is due to the bypass of storm flows at the Townsite plant at a manhole upstream of the facility. Return flows are metered into the plant at a rate which ensures that the plant does not become overloaded. If the storm flows were included in the measured flows, it is expected that the variability would be similar or greater than that measured at the Westview site.

Table 2.3: Measured Flows at Townsite and Westview Plants

Description	1993	1994	1995	Ratio to AAF[1]
Townsite				
AAF[2], m^3/d	2,633	2,562	2,875	1.00
ADWF[3], m^3/d	2,235	2,068	2,192	0.80
MMF[4], m^3/d	3,010	3,214	4,335	1.30
MWF[5], m^3/d	3,613	3,777	5,565	1.60
MDF[6], m^3/d	4,706	5,000	5,832	1.92
Westview				
AAF[2], m^3/d	3,246	3,473	3,704	1.00
ADWF[3], m^3/d	2,385	2,581	2,294	0.70
MMF[4], m^3/d	5,455	5,417	6,930	1.67
MWF[5], m^3/d	8,698	7,028	9,709	2.44
MDF[6], m^3/d	12,358	10,406	11,769	3.31

Notes:
1. Ratio of flow from the years 1993-1994 to the average annual flow during that year.
2. AAF = average annual flow.
3. ADWF = average dry weather flow, determined as the minimum 30 day running average during a calendar year.
4. MMF = maximum month flow, determined as the maximum 30 day running average during a calendar year.
5. MWF = maximum week flow, determined as the maximum 7 day running average during a calendar year.
6. MDF = maximum day flow, determined as the maximum daily flow measured during a calendar year.

The peak hour flows define the required hydraulic capacity of the facility. Based on an analysis of the flows noted in Table 2.3, the projected peak hour flow ratio to the annual average flows for the two facilities are as follows:

Westview	6.60
Townsite	2.75

These values will be further refined prior to detailed design of the facilities by inspecting the flow charts available at the two plants.

2.4 UNIT WASTEWATER FLOWS

The flows indicated above can be associated with the tributary population by dividing the flow by the number of residents served by the system. There are very few residences not connected to the system in Powell River. It has been assumed for this calculation that all people are connected. Table 2.4 indicates the flows per capita at each plant.

Table 2.4: Unit Rates of Flow in Townsite and Westview Catchments

Description	Value
Townsite	
AAF[1], L/c·d	680
ADWF[1], L/c·d	545
MMF[1], L/c·d	885
MWF[1], L/c·d	1,085
MDF[1], L/c·d	1,300
PWWF[2], L/c·d	1,850
Westview	
AAF[1], L/c·d	420
ADWF[1], L/c·d	300
MMF[1], L/c·d	700
MWF[1], L/c·d	1,025
MDF[1], L/c·d	1,390
PWWF[2], L/c·d	2,765

Notes: 1. Refer to Table 2.3 for explanation of abbreviations.
2. PWWF = Peak hour flow.

The average unit rates of flow are significantly different in the two catchments. This is likely due to at least two causes; the affect of the MacMillan Bloedel mill and the base flow associated with the combined sewer. Domestic wastewater from the mill is routed to the Townsite plant. Almost 1,500 staff

work at that location. If it is assumed the mill workforce adds about 150 L/c·d to the flow, the revised unit rate of flow in the Townsite catchment would be about 625 L/c.d. It has been assumed that this value is appropriate. Assuming that the mill flow is relatively consistent, the variability in the remaining flow would have to be completely attributed to the remaining tributary area. Accordingly, the design unit rates of flow would be modified as shown in Table 2.5.

Table 2.5: Modified Unit Rates of Flow in Townsite and Westview Catchments

Description	Value
Townsite	
Mill staff, L/c·d	150
AAF[1], L/c·d	625
ADWF[1], L/c·d	490
MMF[1], L/c·d	830
MWF[1], L/c·d	1,030
MDF[1], L/c·d	1,245
PWWF[2], L/c·d	1,795
Westview	
AAF[1], L/c·d	420
ADWF[1], L/c·d	300
MMF[1], L/c·d	700
MWF[1], L/c·d	1,025
MDF[1], L/c·d	1,390
PWWF[2], L/c·d	2,765

Notes:
1. Refer to Table 2.3 for explanation of abbreviations.
2. PWWF = Peak hour flow.

2.5 MEASURED WASTEWATER LOADS

The influent 5-day biochemical oxygen demand (BOD) and the total suspended solids (TSS) are measured once per month. There is significant variation in these measurements due to the method of sampling, the test procedures, and the fact that they are taken as a grab sample during the day and are not representative of the entire days flow. Nonetheless, the total BOD and TSS loads for 1992, 1993, and 1994 were calculated to determine average values. These are listed in Table 2.6.

Table 2.6: Measured Loads at Townsite and Westview Plants

Description	1992	1993	1994	1995	Average
Townsite					
BOD, kg/d	248.7	246.6	235.2	318.0	262
TSS, kg/d	263.9	259.1	266.9	363.3	281
Westview					
BOD, kg/d	387.0	396.6	458.9	572.8	454
TSS, kg/d	417.4	377.4	439.8	427.7	416

2.6 UNIT WASTEWATER LOADS

The loads measured at the plant can be assessed in a manner similar to the unit flows derived for the two catchments. A similar assumption must also be made regarding the mill workforce. For the load generated from that source, a unit load of 0.0175 kg/c·d has been assumed for both the BOD and TSS loads. The selection of this value is based on experience at other similar locations. After allowing for this contribution, the unit loads can be derived by dividing the measured load by the actual population. The average loads derived for the two catchments are listed in Table 2.7.

Table 2.7: Unit Loads for the Townsite and Westview Catchments

Description	Average
Mill Staff	
BOD, kg/c·d	0.0175
TSS, kg/c·d	0.0175
Townsite	
BOD, kg/c·d	0.060
TSS, kg/c·d	0.065
Westview	
BOD, kg/c·d	0.055
TSS, kg/c·d	0.050

The noted unit loads are suspiciously low. Typically for a community such as Powell River where there are no major industrial inputs to the sewerage system, the values range from 0.070 kg/c·d to 0.080 kg/c·d for both BOD and TSS. The deviation from the norm should be investigated to determine whether it is real

whether it is real or whether it is a result of the test shortcomings noted earlier. Until this anomaly is resolved, it is recommended that unit BOD and TSS loads be based on a more 'normal' value of 0.075 kg/c·d.

2.7 DESIGN FLOWS AND LOADS

Based on the design populations and the unit rates of flow and load derived in the preceding sections, design flows and loads can be derived for the two plants. These are listed in Table 2.8.

Table 2.8: Design Flows and Loads for the Townsite and Westview Plants

Description	Westview Plant	Townsite Plant	Combined Catchments
Design Population	9,400	5,100	14,500
Mill Staff		1,500	1,500
Design Flows			
AAF, m^3/d	3,950	3,410	7,360
ADWF, m^3/d	2,820	2,725	5,545
MMF, m^3/d	6,580	4,460	11,040
MWF, m^3/d	9,635	5,480	15,115
MDF, m^3/d	13,065	6,575	19,640
PWWF[2], m^3/d	25,990	9,380	35,370
Design Loads			
BOD			
Average, kg/d	705	410	1,115
Max. Month, kg/d	845	490	1,335
TSS			
Average, kg/d	705	410	1,115
Max Month, kg/d	880	515	1,395

TAB B

MEMORANDUM OF UNDERSTANDING

WESTVIEW WASTEWATER PLANT UPGRADE

This Agreement dated for reference July 17, 1997 is

BETWEEN:

HILL MURRAY AND ASSOCIATES INC., a British Columbia company incorporated under number 441605, 202 - 780 Tolmie Avenue, Victoria, B. C. V8X 3W4

("HMA")

AND:

DISTRICT OF POWELL RIVER, 6910 Duncan Street, Powell River, B. C., V8A 1V4

("District")

A. On June 25, 1997, the Council of the District received from HMA a proposal ("Proposal") for the design and construction by HMA of an upgrade to the existing Westview wastewater treatment facility owned and operated by the District ("Westview Facility"), with that upgrade being as generally described in Schedule A to the Agreement ("Westview Upgrade");

B. HMA and the District wish to enter into this Agreement to provide a framework for their negotiations to attempt to settle one or more agreements for HMA to design and construct the Westview Upgrade,

THIS AGREEMENT is evidence that in consideration of the mutual promises exchanged below, and in consideration of payment of $10.00 by the District to HMA (the receipt of which is acknowledged by HMA), the parties agree with each other as follows:

Agreement to Negotiate

1. HMA and the District agree to negotiate with each other in good faith, using reasonable efforts, to attempt to conclude and enter into one or more written, and not oral, agreements providing for the design and construction of the Westview Upgrade by HMA for the District, on such terms and conditions as the parties agree ("Westview Upgrade Agreements"). Without limiting the generality of the foregoing, the Westview Upgrade Agreements must provide for the following:

(a) design and construction of the Westview Upgrade by HMA in accordance with a design build contract between the District and HMA on terms and conditions acceptable to both of them, including terms and conditions such as those contained in the document described as *Design-Build Stipulated Price Contract (Canadian Construction Association Document CCA14-1975)*, and any revision to or replacement for that document current at the relevant time as issued by the Canadian Construction Association;

(b) the Westview Upgrade Agreements must contain a condition precedent for the benefit of the District that the previously approved Federal/Provincial Infrastructure grant be approved, for the design and construction of the Westview Upgrade and must have been received, by the District from the relevant Government Agencies (as hereinafter defined) on or before December 31, 1997;

(c) a stipulated, maximum price for the complete design and construction of the Westview Upgrade, such that the Westview Upgrade and the Westview Facility as upgraded are put into operation in accordance with all Approvals and all Applicable Laws, of $4,950,000.00, plus applicable taxes on services and certain supplies and equipment; and

(d) such financial and other guarantees and assurances as are acceptable to the District, in its sole reasonably excercised discretion, that the Westview Upgrade and the Westview facility as upgraded:

(i) will receive all existing or necessary Approvals (both as hereinafter defined), including by providing for holdback of final payment by the District under the Westview Upgrade Agreements until receipt of all existing or necessary Approvals; and

(ii) will operate for their designed life expectancy in accordance with their design, subject to reasonable wear and tear, and in accordance with all Approvals and Applicable Laws in existence at the date on which the Westview Upgrade is put into operation.

Start of Design Work

2. The District agrees that this Agreement authorizes HMA to begin engineering and other necessary work for the design of the Westview Upgrade. If HMA and the District enter into Westview Upgrade Agreements, both the cost and the value of any design work under this section forms part of them, and the District is not obliged to remunerate, reimburse or compensate HMA, or anyone else, for the cost or value of any such design work. If HMA and the District do not enter into Westview upgrade Agreements, the District agrees to reimburse HMA only for the actual costs reasonably incurred by HMA in carrying out the design work contemplated by this section, but the District is obliged to do so only to the extent that the District is lawfully entitled, as against HMA and all others, to use the design work without obligation or liability of any kind

to HMA or anyone else in respect of that use. HMA and the District agree that the reimbursement obligation of the District created under this section cannot exceed $50,000.00 in aggregate. HMA must from time to time, and on the request of the District, keep the District informed in writing, in reasonable detail, of the nature and extent of any design work being performed by or on behalf of HMA under this section and of the costs associated with that work.

Grant Applications

3. As soon as is practicable, the District, under HMA consultation, must apply to amend its existing grant application such that funding may be considered under the projects new definition.

Timeline for Agreements

4. HMA and the District agree to negotiate in good faith, and to use reasonable efforts, to attempt to conclude and enter into Westview Upgrade Agreements by August 31, 1997, and they agree that this Agreement terminates after October 31, 1997, if the Westview Upgrade Agreements have not been entered into between them by that later date. For clarity, HMA agrees that if this Agreement terminates in accordance with this section, the District is entitled to cease all negotiations and other dealings with HMA without obligation to HMA. The District will provide a draft of the Westview Upgrade Agreement to HMA as soon as reasonably practical.

Permit Matters

5. HMA must, as soon as is practicable, undertake all necessary discussions and consultations with the Ministry of Environment, Lands and Parks ("MOE") and all other relevant Government Agencies, with respect to application for, and receipt of, all necessary permits, plans and certificates, and amendments to any such thing ("Approvals"), required for the Westview Upgrade under all applicable rules of law, laws and enactments, including under the *Environmental Assessment Act* (British Columbia) and the *Waste Management Act* (British Columbia) ("Applicable Laws"). HMA must keep the District informed at all times as to all discussions and consultations, including by promptly providing the District, without charge, with copies of all documents received or created by HMA in connection with those discussions or consultations. HMA must consult with the District from time to time with respect to discussions and consultations and must consider the District's comments in that regard. The District must cooperate with, and assist HMA with any such discussions and consultations.

Further Assurances

6. HMA and the District agree to do everything reasonably necessary, including the execution and delivery of documents reasonably necessary, to give effect to the intent of this Agreement. For Clarity, this section does not require HMA and the District to enter into the Westview Upgrade Agreements.

Entire Agreement

7. This Agreement is the entire agreement between HMA and the District and it supersedes and replaces all previous representations, warranties, agreements and other obligations of any kind between them regarding its subject.

Successors and Assigns

8. This Agreement benefits and binds HMA and the District and their successors. For clarity, this Agreement cannot be assigned or subcontracted by HMA without the express prior written consent of the District, which the District may withhold in its absolute and unfettered discretion.

Merger of this Agreement

9. Upon the Westview Upgrade Agreements becoming effective, this Agreement merges in and is superseded by them and is of no further force or effect, and the parties agree to deliver to each other full releases of their respective obligations under this Agreement.

Lawful Requirements

10. HMA acknowledges and agrees that the District can act only through its Council and that the District cannot be bound contractually, or otherwise be subject to or bound by any other legal or equitable duties or obligations, other than by the appropriate express action of its Council. HMA also acknowledges and agrees that any such action of the District's Council is subject to all applicable legal requirements, including those under the *Municipal Act* (British Columbia) and the *Waste Management Act* (British Columbia). Nothing in this Agreement fetters or otherwise affects the discretion of the Council of the District under the *Municipal Act* (British Columbia) or any other law.

Notice

11. Any notice or other communication hereunder will be in writing and will be given by its delivery by hand, by prepaid first class mail, or by facsimile transmission, to the addresses set below:

If to HMA:

Hill, Murray & Associates Inc.
202 - 780 Tolmie Avenue
Victoria, B. C.
V8X 3W4

Attention: Trevor Hill, P. Eng. Facsimile: (250) 388-3943

If to the District:

District of Powell River
6910 Duncan Street
Powell River, B. C.
V8A 1V4

Attention: Administrator Facsimile: (604) 485-2913

Any notice or other communication so given will be deemed to have been received at the time of its delivery if delivered by hand, five business days after the date of mailing if mailed; and at the time the sender received a confirmation of dispatch if transmitted by facsimile transmission. Each party will notify the other parties of any change of address.

Time is of the Essence

12. Time is of the essence of this Agreement.

As evidence of their agreement to be bound by the above terms, the District and HMA have executed and delivered this Agreement effective from and after the date of its last execution by the parties:

HILL, MURRAY AND ASSOCIATES
INC. by its authorized signatories:

Name:

Name: N/A

Dated: July 18, 1997

DISTRICT OF POWELL RIVER by its
authorized signatories:

Mayor

Acting Clerk

Dated: July 18, 1997

Approved by resolution of the Council of the District of Powell River: July 17, 1997

SCHEDULE "A"
TO THE WESTVIEW WASTEWATER PLANT UPGRADE
MEMORANDUM OF UNDERSTANDING DATED FOR REFERENCE JULY 11, 1997

The purpose of this Schedule is to define, generally, the Westview Upgrade for the purposes of the Memorandum of Understanding dated for reference July 11, 1997 between the District and HMA,

1. The parties agree that the Westview Upgrade is as generally described in the document prepared by HMA and submitted to the District entitled *Proposal for the Design, Installation and Operation of a Municipal Treatment Plant Upgrade for Westview Treatment Plant at Powell River, B. C.* and dated June 2, 1997. Without limiting the generality of the foregoing, the Westview Upgrade must include such plant, equipment, facilities, buildings and structures as are generally described in the document just described and as are necessary to implement the technical parameters as set out in that document.

2. Without affection section 1 of this Schedule, the parties agree that the Westview Upgrade must upgrade the Westview Facility to a tertiary wastewater treatment and disposal facility that:

   (a) complies with all Applicable Laws,

   (b) obtains all necessary Approvals for its operation (including any waste management permit amendment required under the *Waste Management Act* (British Columbia) and any operating certificate required under the *Waste Management Act* (British Columbia), and

   (c) is designed and constructed in accordance with plans, drawings and specifications that comply with all Applicable Laws and Approvals and that have been prepared and implemented in accordance with generally accepted municipal engineering standards and practices in British Columbia;

3. Subject to section 2 of this Schedule, the Westview Upgrade must be of a design, and construction, that meets the criteria set out in the *Draft Discharge Criteria* for wastewater treatment facilities, as they apply to tertiary wastewater treatment facilities, issued by the MOE and dated November 5, 1996, and any replacement or amendment thereto.

TAB C

BRITISH COLUMBIA

RECEIVED
SEP - 4 1997
Hill, Murray & Associates Inc.

August 27, 1997

Your File: 08800-20/POWRVR
Our File: PE-00073

Hill, Murray & Associates Inc.
Suite 202, 780 Tolmie Avenue
Victoria, BC V8X 3W4

Attention: Trevor Hill, P.Eng.
President

Dear Sir:

Re: Waste Management Permit PE-73;Westview Sewage Treatment Plant

Thank you for your letter, dated August 25, 1997, outlining your plans to modify the existing works at the Westview sewage treatment plant in Powell River.

The planned modifications appear to be an acceptable means to improve the sewage treatment system. The resulting improvements to the effluent quality and sludge management should substantially reduce the impact of these discharges on the receiving environment. You have indicated that the proposed modifications will be done within the terms and conditions of existing Permit PE-73, and the work must commence soon in order to take advantage of an infrastructure grant.

You may consider this letter as authorization to proceed with your proposed modifications, provided that certified engineering drawings are submitted to this office prior to commencing any work at the site. Also, we require certification by a professional engineer that the modified works were built in accordance with the plans before commissioning the works. All requirements of Permit PE-73 must be met during construction and commissioning of the modified works, unless deviations are expressly authorized by the Regional Waste Manager.

.../2

Ministry of Environment, Lands and Parks

Environment and Lands
Lower Mainland Region

Mailing/Location Address:
10470 152 Street
SURREY BC V3R 0Y3

Telephone: (604) 582-5200
Facsimile: (604) 930-7119

Waste Management Permit PE-73 will be updated to reflect the enhancements to the treatment works which are being undertaken, and to reflect current ministry guidelines. Ministry technical staff will be contacting you as the agent for The Corporation of the District of Powell River in this regard.

I also encourage the District to immediately initiate the liquid waste management plan rather than waiting until the Spring of 1998. Development of such a plan is expected to take some time and there are a number of liquid waste issues which need addressing, such as the inflow and infiltration problem identified by the Mayor.

Please contact me at 582-5270 or Jeff van Haastregt at 582-5275 if you have any questions.

Yours truly,

H.G. Maxwell
Assistant Regional Waste Manager

cc: Corporation of the District of Powell River
6910 Duncan Street, Powell River, BC V8A 1V4

TAB D

BRITISH COLUMBIA

RECEIVED
SEP - 5 1997
Hill, Murray & Associates Inc.

September 3, 1997

V. H. PETERSEN
ADMINISTRATOR
DISTRICT OF POWELL RIVER
6910 DUNCAN ST
POWELL RIVER BC V8A 1V4

Dear V. H. Petersen:

Re: Infrastructure Project M95IW0486 - Sewage Treatment Upgrade

We have received a letter dated August 29, 1997, from Hill Murray & Associates Inc., forwarded on your behalf, explaining a proposed modification to the above project with a total budget of $5,218,263.00 plus GST.

This proposal to upgrade the Westview Treatment Plant falls within the scope of the original project approval, and is an acceptable modification to it. No further formal approvals are required. The substantial completion date of June 1, 1998 is noted. This appears to satisfy earlier concerns that the project might not fit within program time constraints. You are reminded that the program will not share in any costs incurred after October 31, 1998.

The project budget exceeds the original budget of $4,110,080 on which grants were approved, and we remind you that no further program funding is available for costs in excess of the original budget.

The ministry endorses your Council's resolutions to commence a Liquid Waste Management Plan, and to resolve I&I issues.

Best wishes for successful completion of your infrastructure project.

Sincerely,

Andrew MacTaggart
A/Executive Director
Municipal Financial Services

pc: Hill Murray & Associates Inc. ✓
Harvey Maxwell, Assistant Regional Waste Manager, MELP-Surrey

Ministry of Municipal Affairs and Housing

Municipal Financial Services

Mailing Address:
PO Box 9490 Stn Prov Govt
Victoria BC V8W 9N7
Telephone: (250) 387-4067
Facsimile: (250) 356-1873

Location:
800 Johnson Street
Victoria BC

TAB E

Trevor's Copy

DISTRICT OF POWELL RIVER

AND

HILL, MURRAY AND ASSOCIATES INC.

DESIGN-BUILD CONTRACT

DESIGN AND CONSTRUCTION OF AN UPGRADE TO THE WESTVIEW WASTEWATER TREATMENT PLANT

1997

EXECUTION VERSION
September 12, 1997

DESIGN-BUILD CONTRACT

WESTVIEW WASTEWATER PLANT UPGRADE

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DESIGN-BUILD CONTRACT

WESTVIEW WASTEWATER PLANT UPGRADE

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WESTVIEW PLANT UPGRADE
DESIGN-BUILD CONTRACT

This Agreement dated for reference September 1, 1997 is

BETWEEN:

DISTRICT OF POWELL RIVER, 6910 Duncan Street, Powell River, B.C. V8A 1V4

("Owner")

AND:

HILL, MURRAY AND ASSOCIATES INC., a British Columbia company incorporated under number 441605, and registered for GST purposes under number 137606125RT, Suite 202, 780 Tolmie Avenue, Victoria, B.C. V8X 3W4

("Contractor")

GIVEN THAT:

A. The Owner wishes to have designed and constructed for it a wastewater treatment plant upgrade to its existing municipal wastewater treatment plant known as the Westview Plant,

B. The Owner has caused certain performance requirements, described in this Contract, to be created for that project,

C. The Owner and the Contractor entered into a Memorandum of Understanding dated for reference July 17, 1997, and the Contractor has complied with that document, and

D. The Contractor has agreed to design and construct the wastewater treatment plant upgrade for the Owner in accordance with the terms and conditions of the Contract,

THIS AGREEMENT is evidence that in consideration of the promises exchanged below, and in consideration of payment of $2.00 by the Owner to the Contractor (the receipt of which is acknowledged by the Contractor), the Owner and the Contractor agree with each other as follows:

GC1 DEFINITIONS AND INTERPRETATION

1.1 In the Contract, the following words and expressions have the following meanings:

(a) "Approval Letter" means, collectively, the August 27, 1997 letter to the Contractor from H.G. Maxwell, Assistant Regional Waste Manager of the MOE and the September 2, 1997 letter to the Owner from the Ministry of Municipal Affairs and Housing;

(b) "Authorized", "directed", "required", "requested", "approved", "ordered", "sanctioned" and "satisfactory" mean, unless some other meaning is expressly given in the Contract, respectively authorized, directed, required, requested, approved, ordered or sanctioned by, or satisfactory to, the Owner's Representative;

(c) "Completion" means completion of the Work in accordance with all Drawings and Specifications and so that it meets all Performance Specifications, as determined in accordance with Schedule G;

(d) "Completion Date" means the date of Completion, as determined in accordance with the Contract Documents;

(e) "Construction Schedule" means the construction schedule set out in Schedule F;

(f) "Contract" means the contract between the Owner and the Contractor, for the design and construction of the Project, comprised of the Contract Documents;

(g) "Contract Documents" means the Contractor's Proposal, Performance Specifications, Specifications, Drawings and this document;

(h) "Contract Price" means the price set out in GC2.3;

(i) "Contract Time" means the date by which the Contractor shall reach Completion and which is set out in GC2.1;

(j) "Contractor's Consultant" means any architectural or engineering firm or person, including any Professional Engineer, engaged by the Contractor to prepare the Drawings and Specifications or to otherwise consult to the Contractor on the Project;

(k) "Contractor's Proposal" means the proposal of the Contractor submitted to the Owner, dated June 2, 1997, a copy of which forms Schedule D;

(l) "Contractor's Representative" means the representative of the Contractor designated under the Contract;

(m) "Day" means a calendar day;

(n) "Default" means, in respect of the Contractor, if the Contractor:

(i) neglects to prosecute the Work in accordance with the Design;

(ii) is adjudged bankrupt, makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of its insolvency;

(iii) refuses or fails to supply sufficient properly skilled workers or proper material after 7 Days' written notice from the Owner;

(iv) fails to make prompt payment in accordance with GC 15 when properly due to its Subcontractors, suppliers or workers;

(v) has delivered a statutory declaration in support of application for a progress payment under the Contract that the Owner's Representative, acting reasonably, determines was materially false or was materially inaccurate;

(vi) breaches any Standards;

(vii) breaches the provisions of the Contract, including by failing to adhere to the Construction Schedule or by failing to construct any of the Work in accordance with the Contract Documents;

(viii) has made an assignment of the Contract without the required consent of the Owner; or

(ix) abandons the Work other than as a result of suspension of the Work under GC11;

(o) "Design" means the design for the Upgrade, and all Work comprised in it, that is set out in the Drawings and Specifications;

(p) "Drawings" means all construction drawings for the Project that are prepared by or for the Contractor as provided in the General Conditions;

(q) "GCs" and "General Conditions" each mean the General Conditions, which are comprised in this document;

(r) "GST" means the goods and services tax under the *Excise Tax Act* (Canada);

(s) "Insurance Conditions" means the Contract conditions set out in Schedule A;

(t) "Laws" means the common law and any and all laws, statutes, enactments, bylaws, regulations, rules, orders, directives, policies, permits, licences, codes and rulings of any government, and any ministry, agency, board, commission or tribunal of any government, including the *Waste Management Act*, the Permit, and the Approval Letter, but excluding the land use bylaws of the Owner;

(u) "MOE" means the British Columbia Ministry of Environment, Lands and Parks;

(v) "Month" means a calendar month;

(w) "Other Contractor" means any person employed by or having a separate contract directly or indirectly with the Owner for work related to the Upgrade other than the Work;

(x) "Owner" means the District of Powell River;

(y) "Owner's Representative" means the representative of the Owner designated under the Contract;

(z) "Owner's Work" means the work to be performed and completed by the Owner that is described in Schedule I;

(aa) "Payment Schedule" means the schedule for Monthly progress payments to the Contractor set out in Schedule J;

(ab) "Performance Specifications" means the requirements for performance of the Westview Facility after Completion of the Upgrade, all as set out in Schedule B;

(ac) "Permit" means the permit issued by the MOE to the Owner under the *Waste Management Act* under number PE-00073, as amended;

(ad) "Professional Engineer" means a professional engineer registered and in good standing under the *Professional Engineers & Geoscientists Act* (British Columbia);

(ae) "Project" means the project to design and construct the Upgrade on the Work Site to Completion in accordance with the Performance Specifications and

Contract Documents;

(af) "Quality Control Plan" means the quality control plan of the Contractor under GC33.1;

(ag) "Specifications" means any construction specifications that are prepared for the Project by or for the Contractor;

(ah) "Standards" means any and all Laws, professional standards and specifications (including American Waterworks Association and Canadian Standards Association standards) applicable to the Work or to work such as the Project, as they are in force from time to time or in the latest current version thereof, as the case may be;

(ai) "Subcontractor" means Zenon and any other person having a contract with the Contractor to perform a part or parts of the Work or to supply products worked to a specific design according to the Contract Documents, but does not include one who only supplies products not so worked;

(aj) "Substantial Completion" means substantial completion as determined in accordance with the *Builder's Lien Act* by the Owner's Representative in accordance with these GCs;

(ak) "Upgrade" means the upgrade to the Westview Facility that is to be designed by the Contractor to meet the Performance Specifications and that is to be constructed by the Contractor to Completion in accordance with the Contract Documents, as generally described in the Proposal and in Schedule H;

(al) "Westview Facility" means the wastewater treatment plant owned and operated by the Owner on the Work Site on the reference date set out on page 1 of this document;

(am) "Work" means:

(i) the performance of all design and construction, and all other services and acts (including the training by the Contractor of the Owner's employees, and provision by the Contractor of the operation and maintenance manual, described in Schedule H),
(ii) the supply and creation of all personal property, and
(iii) anything else necessary,

as set out in the Contract Documents, to design and construct the Upgrade

to Completion so that it meets all Performance Specifications, but excludes, for clarity, the Owner's Works;

(an) "Work Site" means, collectively, the parcels of land in the District of Powell River on which the Westview Facility is located, those parcels of land being legally described as follows:

(i) Lots 3 through 5, Blocks 6 and 7, District Lot 5307, Plan 6825;

(ii) Lot 8, Except Part In Plan 6824, District Lot 5307, Plan 5097;

(iii) Lot 1, Block 9, District Lot 5307, Plan 7075;

(iv) Lot E, District Lot 5914; and

(v) Foreshore Lease 236145; and

(ao) "Zenon" means Zenon Environmental Inc.

1.2 In the Contract:

(a) reference to the singular includes a reference to the plural, and vice versa, unless the context requires otherwise;

(b) where a word or expression is defined, other parts of speech and grammatical forms of the same word or expression have corresponding meanings;

(c) reference to a particular numbered section or article, or to a particular lettered Schedule, is a reference to the correspondingly numbered or lettered article, section or Schedule of this document;

(d) article and section headings have been inserted for ease of reference only and are not to be used in interpreting this Contract.

(e) the word "enactment" has the meaning given to it in the *Interpretation Act* (British Columbia) on the reference date of this Contract;

(f) reference to any enactment is a reference to that enactment as consolidated, revised, amended, re-enacted or replaced, unless otherwise expressly provided;

(g) reference to a "party" or the "parties" is a reference to a party, or the parties, to this Contract and their respective successors, assigns, trustees,

administrators and receivers;

(h) where a party, the Owner's Representative or the Contractor's Representative is entitled or required to make a decision, exercise discretion, give approval, give consent, give instructions, give directions, or to act in any other way in respect of the Contract, that person must do so acting reasonably, unless the Contract expressly provides that person may do so in its "sole discretion", in which case that person is entitled to act in its absolute, unfettered and unreviewable discretion and is under no obligation to act reasonably; and

(i) where a party is required to do anything, that party must act promptly unless the time within which that party must act is expressly provided in the Contract, including by reference to a specific period or by requiring that party to act "immediately".

1.3 The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. If there is any conflict or inconsistency between the Contractor's Proposal and the Contract, the provisions of the Contract prevail to the extent of the conflict or inconsistency. If there is any conflict or inconsistency within the Contract Documents, then the order of priority of documents from highest to lowest, shall be the General Conditions, the Specifications, the Drawings and the Contractor's Proposal, with a document of higher priority prevailing over any document of lower priority to the extent of the conflict or inconsistency. For the purposes of this section, the Contract is defined to include all of the Contract Documents except the Contractor's Proposal.

1.4 The intention of the Contract Documents is to provide for all design, labour, products, personal property, material, equipment and services necessary to design and construct the Project to Completion in accordance with the Performance Specifications.

1.5 Words and expressions which have generally recognized technical or trade meanings are used in the Contract Documents in accordance with the recognized meanings.

GC2 CONSTRUCTION OF PROJECT

2.1 The Contractor shall execute the Contract by executing this document and delivering it to the Owner within 5 Days after the Owner has delivered this document, executed on behalf of the Owner, to the Contractor, and the Contractor shall commence construction at the Work Site within 42 Days after the Owner has executed and delivered this document to the Contractor. The Contractor shall commence the Work within 5 Days after the Contractor delivers this executed document to the Owner, and shall thereafter diligently perform the Work in accordance with the Contract Documents so that the Project has reached Completion on or before the Completion Date, which is the date that is the last

Day of the tenth full Month after the Month in which the Contractor delivers this executed document to the Owner, provided that, subject to GC9, the Completion Date shall not be later than September 30, 1998. The Contractor shall, in accordance with the Contract Documents, perform and provide all labour, services and other acts, and provide all personal property, construction equipment and machinery, required for performance of the Work to Completion in accordance with the Contract Documents. The Contractor also shall perform the Work in accordance with all Laws.

2.2 The Contractor and the Owner agree that the terms and conditions of the Contract are those set out in the Contract Documents.

2.3 Subject to any adjustment under GC16 or GC17, the Owner agrees to pay the Contract Price of $5,218,263.00 in Canadian dollars, exclusive of GST, which shall be paid by the Owner to the Contractor, but inclusive of all other applicable taxes (including social services tax under the *Social Services Tax Act*), to the Contractor for satisfactory performance of the Work to Completion, for satisfactory performance of all aspects of the Contractor's Proposal, and for satisfactory performance of all of the Contractor's other obligations under the Contract. The Contractor acknowledges, and agrees, that it has already received from the Owner a payment of $27,745.47 (plus $1,942.18 for GST) for engineering portions of the Work performed by the Contractor before execution of this document, on account of, and as part of the Contract Price, and the Contractor and the Owner further agree that the Owner, concurrent with execution and delivery of this document by the Contractor to the Owner, shall pay the Contractor for engineering portions of the Work performed by the Contractor before execution of this document a further $406,678.13 (plus $28,467.47 for GST) on account of, and as part of, the Contract Price. For clarity, the Owner and the Contractor acknowledge and agree that any items of Work shown in Schedule H marked with an asterisk have been chosen by the Owner as options that shall be performed as part of the Work, but that the Contract Price does not include the prices for such options, which prices are shown in Schedule H and shall be added to the Contract Price.

2.4 The Owner must pay the Contract Price to the Contractor as provided in these General Conditions.

2.5 The Owner grants to the Contractor a licence to enter and be upon the Work Site until Completion, to:

(a) construct the Project on it in accordance with the Contract Documents; and

(b) do anything else on or to the Work Site which is necessary for performance of the Work.

The intent of this section is to ensure that the Contractor has the right to do anything on and to the Work Site which is necessary for design and construction of the Project.

2.6 In exercising its rights under GC2.5, and in performing the Work, the Contractor shall not do, or permit anything to be done (including by any Subcontractor), on the Work Site (including the Westview Facility) that damages the Westview Facility, except as contemplated by the Design. If the Contractor or any Subcontractor damages the Westview Facility, the Contractor shall immediately repair the damage, at the expense of the Contractor. In exercising its rights under GC2.5, and in performing the Work, the Contractor shall comply with all MOE requirements with respect to the operation of the Westview Facility, as set out in all applicable Laws and as negotiated with MOE from time to time.

2.7 The Contractor covenants with, and represents and warrants to, the Owner that:

(a) the Contractor has the power and capacity to enter into the Contract and to comply with every term and condition of the Contract;

(b) all necessary proceedings have been taken to authorize the Contractor to enter into the Contract and to execute and deliver this Contract;

(c) the Contract has been properly executed by the Contractor and is enforceable against the Contractor in accordance with its terms;

(d) the Contractor has filed all tax, corporate information, and other returns required to be filed by all Laws, has complied with all workers' compensation legislation and other similar legislation to which it is subject, and has paid all taxes, fees, and assessments due by the Contractor under those Laws as of the reference date of the Contract;

(e) the Contractor holds all permits, licences, consents, and authorities issued by any level of government, or any agency of any level of government, that are required by all Laws to conduct its business and perform the Work;

(f) the Contractor pays punctually, as they become due, all accounts, expenses, wages, salaries, taxes, rates, fees and assessments required to be paid by it on any of its undertakings;

(g) the Contractor has investigated and satisfied itself of every condition affecting the Work, including the labour and materials to be provided, the Permit, and the Performance Specifications, but excluding the Work Site conditions;

(h) the Contractor's investigation described in GC2.7(g) has been based on its own examination, knowledge, information and judgment and upon the information given by the Owner to the Contractor as described in Schedule H;

(i) the Contractor accepts the risks assigned within the Contract to the Contractor;

(j) the Contractor acknowledges that it has the responsibility for informing itself of all aspects of the Project and all information necessary to perform the Work; and

(k) the Contractor is registered for the purposes of the goods and services tax under the *Excise Tax Act* (Canada) under the number set out on page 1 of this document.

2.8 The Owner covenants with, and represents and warrants to, the Contractor that:

(a) the Owner has the power and capacity to enter into the Contract and to comply with every term and condition of the Contract;

(b) all necessary proceedings have been taken to authorize the Owner to enter into the Contract and to execute and deliver this Contract;

(c) the Contract has been properly executed by the Owner and is enforceable against the Owner in accordance with its terms;

(d) the Owner possesses, or shall promptly obtain, all temporary or permanent easements, statutory rights of way, and other access, necessary for the Contractor to perform the Work;

(e) the Work Site is zoned under applicable land use bylaws of the Owner to permit the existing use of the Work Site for the Westview Facility and to permit Completion and operation of the Upgrade;

(f) the Owner shall perform all of the Owner's Work in a timely and competent manner so as to enable the Contractor to perform the Work in accordance with the Contract Documents;

(g) the Owner shall promptly pay all Other Contractors and contractually cause all Other Contractors to be subject to the supervision and direction of the Contractor to the extent reasonably necessary for the Contractor to Complete

the Work; and

(h) the entering into the Contract by the Owner does not violate the terms of any other contract to which the Owner is a party.

2.9 The Owner and the Contractor agree to use reasonable efforts to negotiate and enter into an operation and maintenance agreement between the Owner and the Contractor for operation and maintenance services for the Westview Facility (including the Upgrade) to be provided by the Contractor (or an affiliate, as defined in the *Company Act*, of the Contractor) as generally described in the Contractor's Proposal and in Schedule H.

2.10 For clarity, as part of the Work, the Contractor shall provide to the Owner and employees of the Owner the training in operation of the Westview Facility after Completion of the Work as is described in Schedule H and shall prepare and provide to the Owner a complete operation and maintenance manual for the Upgrade, as generally described in Schedule H.

GC3 RISK REGARDING SUBSURFACE CONDITIONS AT WORK SITE

3.1 The Contractor and the Owner acknowledge and agree that the Owner has provided to the Contractor information in the possession of the Owner as to subsurface conditions at the Work Site, with that information being as generally described in Schedule H and they also acknowledge and agree that, although the Contractor has undertaken preliminary investigations as to subsurface conditions at the Work Site, the Contract Price, Contract Time and Construction Schedule are all conditional upon the assumption that the Work Site is comprised of uniform structural fill suited to the Work and that any variation from that assumption entitles the Contractor to a change in the work under GC16.

GC4 DESIGNATED REPRESENTATIVES AND DISPUTE RESOLUTION

4.1 Promptly after its execution of the Contract, and in any case not more than five Days thereafter, the Owner shall give written notice to the Contractor designating the Owner's Representative for the purposes of the Contract.

4.2 Promptly after its execution of the Contract, and in any case not more than five Days thereafter, the Contractor shall give written notice to the Owner designating the Contractor's Representative for the purposes of the Contract.

4.3 A party may change its representative by giving written notice to the other party of the new representative, effective on the date notice is given.

4.4 The parties agree that the following apply to any dispute regarding the interpretation

of the Contract, performance of the Contract, or any alleged breach of the Contract, any determination of default under the Contract, and any inability by the parties to agree on a matter in respect of which the Contract calls for their agreement:

(a) if there is any such dispute, either party may give written notice of the dispute to the other party and the Contractor's Representative and the Owner's Representative shall meet within three Days after the notice of dispute is given and shall attempt in good faith, and using reasonable efforts, to resolve the matter equitably to the satisfaction of both parties;

(b) if the parties' representatives cannot resolve the dispute within 5 Days after they first meet, it shall be referred for arbitration by the single arbitrator appointed and acting under the *Commercial Arbitration Act*, in accordance with this GC, and the arbitrator shall issue a final decision regarding the dispute within 10 Days after his or her appointment, subject to extension of that time by agreement of the parties;

(c) the parties shall, within 15 Days after execution of this document by the last party to do so, appoint an arbitrator, and one alternative arbitrator, for the purposes of this GC;

(d) the arbitrator to whom any dispute is referred under this GC is entitled to, by notice given to the parties, amend the rules set out under the *Commercial Arbitration Act* with respect to arbitrations, including by abridging the times set out therein in order to meet the time requirements of this GC; and

(e) the arbitrator to whom a dispute is referred under this GC is entitled to make an order as to payment of legal fees and disbursements.

GC5 DESIGN PREPARATION

5.1 The Owner acknowledges and agrees that the Contractor has delivered to the Owner's Representative three sets of the preliminary drawings and specifications for the Upgrade prepared by or for the Contractor, in accordance with this GC and that the Owner has reviewed them.

5.2 The Owner's Representative shall, within 10 Days after the date of execution of this document by the Owner, deliver notice to the Contractor of any comments which the Owner's Representative may have on the submittal. The Contractor shall consider any comments of the Owner's Representative and shall revise the submittal as the Contractor considers necessary in order to ensure that the Work conforms with the Performance Specifications. Notwithstanding the rest of this GC, the Contractor shall revise the

preliminary drawings and specifications delivered to the Owner under this GC in order to implement any changes required by the Owner's Representative, notice of which shall be given by the Owner's Representative to the Contractor within 30 Days after the date of execution of this document by the Owner, with respect to the form, character, design, details of finish and exterior cladding, and other design matters, regarding any building or other structure comprised in the Upgrade. The Owner and the Contractor agree that the form and character, and appearance, of new buildings and structures comprised in the Upgrade shall generally conform with the appearance thereof shown in Schedule H. The Owner agrees that if the costs to the Contractor of performing the Work described in this GC are, by virtue of any changes required by the Owner's Representative regarding design, increased from the costs comprised in the Contract Price on the reference date of this document on page 1, the Owner shall issue a written order for change in the Work in accordance with GC16.

5.3 If the Contractor revises the submittal under this section, it shall complete the revision within 10 days after the Owner's Representative provided comments on the submittal. Upon their revision, the revised drawings and specifications shall be the Drawings and Specifications for the Work.

5.4 The Contractor shall

(a) cause all portions and aspects of preliminary drawings and specifications, and of the Drawings and Specifications, to be prepared under the direction of, and to be sealed under the professional seal of, a Professional Engineer; and

(b) cause a Professional Engineer to certify to the Owner, under his or her professional seal, that:

(i) the Drawings and Specifications implement the Performance Specifications and otherwise conform to them;

(ii) the Drawings and Specifications implement the Contractor's Proposal and otherwise conform to them;

(iii) the Drawings and Specifications have been prepared in accordance with, and comply with, all Standards; and

(iv) the Work has been Completed in accordance with the Drawings and Specifications.

5.5 The Contractor shall not construct any part of the Work that is not based on the Drawings and Specifications and that does not meet the Performance Specifications.

5.6 The Contractor shall make, or cause the Contractor's Representative to make, any revisions or changes to the Drawings or Specifications as are necessary from time to time due to changes to the Work, and, for clarity, the Contractor shall comply with GC5.4 with respect to any such revisions or changes.

5.7 The Contractor shall not commence any Work at the Work Site unless the Contractor has delivered a copy of the Drawings and Specifications to the MOE before commencing any such Work.

5.8 Nothing in this GC, or otherwise in or under the Contract, makes the Owner's Representative or the Owner responsible for the Design of the Upgrade, including with respect to compliance of the Drawings and Specifications with the Performance Specifications and all Standards, and the Contractor shall, notwithstanding any act of the Owner or Owner's Representative under the Contract, remain solely liable and responsible for compliance of the Drawings and Specifications with the Performance Specifications and all Standards.

GC6 DOCUMENTS ON THE SITE

6.1 The Contractor shall keep one copy of all current Drawings and Specifications, Contract Documents, and all shop drawings, at the Work Site, in good order and available to the Owner's Representative.

GC7 OWNERSHIP OF DOCUMENTS AND MODELS

7.1 The Contractor agrees that the Owner is hereby granted an unconditional and irrevocable perpetual licence to use, in whole or in part, for the purposes only of the Westview Facility, all matters contained in or set out in the Contractor's Proposal, and all Drawings and Specifications and all models furnished by the Contractor, and the Contractor and the Owner agree that the licence granted by this GC comprises only the copyright, industrial design, trademark and all other intellectual property of the Contractor therein, and, for clarity, the Owner acknowledges the intellectual property rights of Zenon with respect to such components of the Work as have been supplied by Zenon.

GC8 CONTROL AND SUPERVISION OF THE WORK

8.1 The Contractor shall have complete control of, and be solely responsible for, the Work and shall effectively direct and supervise the Work using its best skill and attention and in accordance with generally accepted construction management and supervision practices in British Columbia. The Contractor shall be solely liable and responsible for all design and all construction means, methods, techniques, sequences and procedures with respect to the Work, and for coordinating all parts of the Work under the Contract and for

coordinating the Work with work of Subcontractors and of Other Contractors.

8.2 The Contractor shall have the sole responsibility for the design, erection, operation, maintenance and removal of temporary structural and other temporary facilities and the design and execution of construction methods required in their use. The Contractor shall engage and pay for a registered Professional Engineer, skilled in the appropriate discipline, to perform these functions where required by Law, and in all cases where such temporary facilities and their method of construction are of such a nature that a Professional Engineer's skill is required to produce safe and satisfactory results.

8.3 The Contractor shall employ a competent superintendent, and necessary assistants, at the Work Site at all times during the progress of the Work.

8.4 The superintendent shall be satisfactory to the Owner and shall not be changed except for good reason and only then after consultation with the Owner.

8.5 The Contractor's superintendent shall represent the Contractor at the Work Site and directions given to them by the Owner's Representative or the Owner shall be deemed to have been given to the Contractor, provided that the Owner's Representative shall wherever possible give such directions through the Contractor's Representative directly.

8.6 The Contractor shall at all times maintain good order and discipline among its employees engaged on the Work and shall not employ on the Work any unfit person nor anyone not skilled in the task assigned to him or her.

GC9 PROSECUTION OF THE WORK AND DELAYS

9.1 If the Contractor is delayed in the performance of the Work by any act or neglect of the Owner or any party for whom the Owner is in law responsible, the Contract Time and the Construction Schedule shall be extended for such reasonable time as may be agreed by the Owner and the Contractor, acting reasonably, and the Contractor shall be reimbursed for any costs directly incurred by it as the result of such delay, determined in accordance with GC18.

9.2 If the Contractor is delayed in the performance of the Work by an order issued by any court or public authority having jurisdiction, and providing that such order was not issued as the result of any act or fault of the Contractor or of anyone employed by it, the Contract Time shall be extended for such reasonable time as the Owner and the Contractor may agree, acting reasonably, that the Work was delayed.

9.3 If the Contractor is delayed in the performance of the Work by labour disputes, strikes, pickets, lock-outs (including lock-outs decreed or recommended for its members by

a recognized contractors' association of which the Contractor is a member), fire, unusual delay by common carriers, unavoidable casualties, inclement weather or, without limit to any of the foregoing, by any cause of any kind whatsoever beyond the Contractor's reasonable control, then the Contract Time and the Construction Schedule shall be extended for such reasonable time as may be agreed by the Owner and the Contractor, acting reasonably, but in no case shall the extension of time be less than the time lost as a result of the event causing the delay, unless a shorter extension of time is agreed to by the Contractor.

9.4 No extension shall be made for delay under this GC unless written notice is given to the Owner within 7 Days of its commencement, but in the case of a continuing cause of delay only one notice is necessary.

9.5 In the case of any delay under GC9.2 or GC9.3, the Contractor shall use reasonable best efforts to remove the cause of the delay as promptly as is practicable.

GC10 TAKING WORK OUT OF THE CONTRACTOR'S HANDS

10.1 If the Owner determines that the Contractor is in Default, or that a Default has occurred with respect to the Contractor, the Owner may give notice of the Default to the Contractor and the Contractor shall correct the Default within 7 Days after receiving the notice or within 7 Days after any arbitration determination regarding a matter described in GC. 1.1(n)(i), (iii), (v), (vi) or (vii).

10.2 If the correction of the Default cannot reasonably be completed when required by GC10.1, the Contractor shall be considered to be in compliance with the Owner's instructions if it:

(a) commences correction of the default within the 7 Days;

(b) provides the Owner with a schedule for correction of the default as promptly as is practicable, and in any case within the Contract Time, that is reasonably acceptable to the Owner's Representative; and

(c) completes the correction in accordance with the accepted schedule.

10.3 If the Contractor fails to comply with GC10.1 and GC10.2, the Owner may, without prejudice to any other right or remedy it may have, take all or part of any of the Work out of the Contractor's hands, and in whole or in part terminate the Contract, and may employ such means as the Owner sees fit to make good the default or complete the Work, or both.

10.4 Despite GC10.6, where the Work or any portion thereof has been taken out of the Contractor's hands under GC10.3 and the portion is subsequently completed by a surety

under a bond provided by the Contractor under the Contract, or by the Owner, the Owner shall determine the amount, if any, due and payable but not paid at the time of taking the Work out of the Contractor's hands that is not reasonably necessary to hold the Owner harmless from all loss and damage suffered by the Owner by reason of the default of the Contractor and by reason of non-completion of the Work by the Contractor, and the Owner shall, if no financial prejudice to the Owner will result, pay that amount to the Contractor.

10.5 Exercise by the Owner of its rights under GC10.3 does not relieve or discharge the Contractor from any obligations under the Contract or imposed upon it by any Standards, except the obligation to perform the portion of the Work so taken out of its hands.

10.6 If the Owner terminates the Contract under this GC:

(a) the Owner is entitled to take possession of the Work Site, and all material and equipment of the Contractor, and Work, and to utilize the Contractor's construction equipment at the Work Site (subject to the rights of third parties), and to Complete the Work by whatever method it may deem expedient;

(b) the Owner is entitled to withhold any further payments to the Contractor until the Work is Completed, other than amounts then due to the Contractor; and

(c) upon Completion of the Work the Owner:

(i) is entitled to charge the Contractor the amount by which the full cost of Completing the Work, as certified by the Owner's Representative (including compensation to the Owner's Representative for services and a reasonable allowance as determined by the Owner's Representative to cover the cost of any corrections required by GC34, exceeds the unpaid balance of the Contract Price; or

(ii) shall, subject to the rest of this GC, if the cost of Completing the Work is less than the unpaid balance of the Contract Price, pay the Contractor the difference, less a reasonable amount for fulfilment of the Contractor's warranty obligations under the Contract, as determined by the Owner, acting reasonably;

(d) is entitled to compensation by the Contractor equal to loss and damage suffered by the Owner by reason of the Default of the Contractor and by reason of non-completion of the Work by the Contractor; and

(e) shall return to the Contractor all of the Contractor's construction machinery

and equipment, and all excess materials, upon Completion, in good condition (reasonable wear and tear excepted).

10.7 The Contractor may, after giving 5 Days' written notice to the Owner, suspend the Work or terminate the Contract, without prejudice to any other right or remedy it may have, if the Owner fails to pay the Contractor in accordance with the Contract or in accordance with any arbitration award under the Contract.

10.8 If the Contractor terminates the Contract under GC10, the Contractor is entitled to be paid:

(a) in accordance with the terms of the Contract, for all Work properly performed and for all of the Contractor's obligations under subcontracts which it was unable to cancel, less any progress payments made by the Owner prior to termination; and

(b) all costs reasonably incurred by the Contractor as a result of the termination, determined in accordance with GC18, plus compensation for damages suffered by the Contractor as a direct result of the Owner's breach, including for loss of profit (subject to mitigation).

10.9 Notwithstanding the rest of the Contract, a Default consisting of failure by the Contractor to deliver the bonds as and when required by these GCs shall not be arbitrated and, if notice is given by the Owner to the Contractor under GC10.1 in respect of such a Default, the rest of this GC applies.

GC11 SUSPENSION OF WORK

11.1 The Owner may, in an emergency, where the safety or life of others is in jeopardy or where the performance of the Work by the Contractor causes, or threatens to cause, the Westview Facility to violate any Laws, by notice to the Contractor, do either or both of the following:

(a) suspend the Work, effective in the manner and at the time specified in the notice, whenever in its opinion such suspension may be necessary to ensure the safety or life of others, or of the Work or neighbouring property, or if performance of the Work by the Contractor causes, or threatens to cause, the Westview Facility to violate any Laws, not including the land use bylaws of the Owner, to ensure that the Westview Facility does not violate any Laws; or

(b) make changes in the Work, and order, assess and award the cost of such work, extra to the Contract or otherwise, as may in its opinion be necessary.

11.2 The Owner shall, within 2 Days after a change under GC11.1(b), confirm in writing any change instructions and if a change in the Work has been or is performed by order of the Owner, the Owner shall pay the Contractor the value of such work, determined under these GCs.

11.3 The Contractor upon receiving notice of suspension from the Owner shall immediately suspend all operations except those which, in the Contractor's reasonable opinion, are necessary for the safety of personnel or for the care and preservation of the Work, or any personal property, or for the care and preservation of the Westview Facility or compliance with any Laws. Subject to any directions in the notice of suspension, the Contractor shall discontinue ordering equipment and materials, shall not enter into any further subcontracts (except such subcontracts as are necessary for the safety of personnel or for the care and preservation of the Work), and shall make every reasonable effort to suspend or cancel existing subcontracts and orders on the best terms available.

11.4 During the period of suspension the Contractor shall not remove from the Work Site any of the Work, or any equipment or material, without the prior written consent of the Owner's Representative.

11.5 If the period of suspension is 30 Days or less, the Contractor, upon the expiration of the period of suspension, shall resume the performance of the Work and shall be paid for all costs reasonably incurred by the Contractor in complying with suspension, determined in accordance with GC18.

11.6 If after 31 Days from the date of notice of suspension of the Work the Owner and the Contractor agree to continue with and Complete the Work, the Contractor shall resume operations and complete the performance of the Work in accordance with any terms and conditions agreed upon by the Owner and the Contractor that are necessary to remove or mitigate the emergency conditions that led to the suspension.

11.7 If after 31 Days from the date of notice of suspension of the Work, but before 120 Days from the date of notice of suspension, the Owner and the Contractor do not agree to continue with and complete the Work, or they fail to agree on, or have arbitrated, the terms and conditions upon which the Contractor is to resume operations and complete the performance of the Work, the Contract shall be deemed to have been terminated.

11.8 If the Contract is terminated pursuant to this GC, the Owner shall pay the Contractor:

(a) in accordance with the Contract Documents, for all Work performed and for all of the Contractor's obligations under subcontracts which it was unable to cancel, or asked by the Owner not to cancel, less any progress payments made

by the Owner prior to termination; and

(b) all costs reasonably incurred by the Contractor in complying with the suspension and termination order, determined in accordance with GC18, less any costs already paid to the Contractor pursuant to GC11.6.

11.9 The Contractor's obligations as to quality, correction and warranty of any Work performed continue in force after termination under this GC, except to the extent that such Work as has been performed by the Contractor to the date of termination is altered at any time by or on behalf of the Owner or by the effect on such Work of the suspension or termination of the Contract under this GC.

11.10 The Contractor, by giving written notice to the Owner, may suspend performance of the Work or terminate the Contract if the Work is stopped for a period in excess of 30 Days by an order of any court or public authority having jurisdiction, excluding the Owner, through no act or fault of the Contractor or of anyone employed by it.

GC12 SEPARATE CONTRACTS WITH OTHER CONTRACTORS

12.1 The Owner reserves the right to enter into separate contracts in connection with the Project with Other Contractors provided that the Owner shall first obtain the approval of the Contractor as to the subject matter and timing of such contracts and identity of any Other Contractors.

12.2 The Contractor shall:

(a) co-ordinate the Work with that of Other Contractors and connect the Work with their work and shall ensure that the Design enables that to be done without disruption to the Work or the work of Other Contractors; and

(b) ensure that performance of the Work is carried out in accordance with the Construction Schedule so that Other Contractors are not delayed in their Work.

12.3 The Contractor shall promptly report to the Owner any apparent deficiencies in Other Contractors' work which could affect the Work as soon as they come to the Contractor's attention, and shall confirm such report in writing promptly. Failure by the Contractor to so report promptly shall invalidate any claims for delay by reason of the deficiencies of Other Contractors' work.

GC13 ASSIGNMENT AND SUBCONTRACTS

13.1 The Contractor shall not assign the Contract or any portion of it without the prior written consent of the Owner, which consent shall not be unreasonably withheld. The Contractor agrees to employ only those Subcontractors proposed by it in writing and approved by the Owner and only in relation to stated portions of the Work to be carried out by that Subcontractor.

13.2 The Contractor shall preserve and protect the rights of the Owner under the Contract with respect to any Work to be performed by a Subcontractor, so that the subcontracting does not prejudice the Owner's Contract rights, and the Contractor shall be responsible to the Owner for the performance of all its Subcontractors and shall require its Subcontractors to perform in accordance with the terms and conditions of the Contract.

13.3 The Contractor shall be as fully responsible to the Owner for acts and omissions of its Subcontractors and of persons directly or indirectly employed by them as for the acts and omissions of persons directly employed by the Contractor. The Contractor shall, despite any partial or entire assignment of the Contract by the Contractor pursuant to GC13.1, remain fully liable to the Owner under the Contract unless the Owner has executed an express release of the Contractor therefrom, and then only to the extent of any such release.

13.4 The Owner shall be as fully responsible to the Contractor for acts and omissions of Other Contractors and of persons directly or indirectly employed by them as for the acts and omissions of persons directly employed by the Owner.

13.5 The Owner may, upon reasonable request by a Subcontractor and in the Owner's discretion, provide to a Subcontractor information as to the percentage of the Subcontractor's work for which payment has been made to the Contractor, and the Owner shall inform the Contractor of any such request and of the information given to any Subcontractor.

13.6 Nothing contained in the Contract Documents shall create any contractual or other relationship between any Subcontractor and the Owner or any Subcontractor employee and the Owner.

GC14 INDEMNIFICATION

14.1 The Contractor shall indemnify and hold harmless the Owner, its elected and appointed officials and its employees and agents, from and against all liability, claims, damages, losses, costs, actions, causes of action, suits, proceedings and expenses, including reasonable legal fees and disbursements, arising out of or attributable to the performance of the Work, provided any such claim, damage, loss or expense is:

(a) attributable to bodily injury, sickness, disease or death, or to injury to or destruction of, tangible property (other than the Work itself); and

(b) is caused by a negligent act or omission, or other wrong, of the Contractor or any Subcontractor, or their employees, or anyone for whose acts they may be responsible in law.

14.2 The Owner shall indemnify and save harmless the Contractor from and against all liability, claims, damages, losses, costs, actions, causes of action, suits, proceedings and expenses, including reasonable legal fees and disbursements, arising which are caused by lack of, or a defect in, title or an alleged lack or defect in, title to the Work Site or the lack of conformity, or alleged lack of conformity, of the Work Site, and the use of the Work Site, with the Owner's zoning and land use bylaws.

14.3 For the purposes of GC14.1 and GC14.2, as the case may be, the Owner and the Contractor shall diligently and reasonably defend any claims, actions, suits and proceedings, and shall diligently and reasonably mitigate any liability, damages, losses, costs and expenses, in full consultation with the other party.

GC15 CONTRACTOR'S DISCHARGE OF LIABILITIES

15.1 The Contractor shall discharge all liabilities incurred by it, including for labour, equipment, materials or services used or reasonably required for use, in the performance of the Contract, on the date upon which each becomes due, except those which the Contractor has contested in good faith, in which case the Contractor shall pay the disputed amount into court or otherwise secure the payment of the disputed amount.

15.2 The Contractor shall use its best efforts to cause every Subcontractor to discharge all liabilities incurred by it, including for labour, materials or services used or reasonably required for use, in the performance of the Subcontract, on the date upon which each becomes due, except those which the Subcontractor has contested in good faith, in which case the Subcontractor shall pay the disputed amount into court or otherwise secure the payment of the disputed amount.

15.3 Workers employed by the Contractor shall be paid in full at intervals not less frequently than required by law. Without limiting GC20, at the request of the Owner, the Contractor shall furnish the Owner with satisfactory evidence that the Contractor's liabilities relating to the Work, and shall use its best efforts to cause all Subcontractors to establish that liabilities of Subcontractors relating to their Work, have been discharged, such satisfactory evidence to be a statutory declaration sworn by a knowledgeable officer or senior management employee of the Contractor or Subcontractor, as the case may be, provided that the Owner may, if it considers any such statutory declaration not to be

satisfactory evidence, require the Contractor to provide to the Owner forthwith, and to use best efforts to cause every Subcontractor to provide to the Owner forthwith, such other evidence as is satisfactory to the Owner with respect to discharge of such liabilities.

GC16 CHANGES IN THE WORK

16.1 The Owner, without invalidating the Contract, having consulted with the Contractor, may by notice to the Contractor make changes to the scope of the Work by altering, adding to, or deducting from the Work, with the Contract Price, Contract Time and Construction Schedule being adjusted in accordance with GC17.

16.2 No change to the scope of the Work shall be made without a written order from the Owner, and no claim for an addition or deduction to the Contract Price, or change in the Contract Time or the Construction Schedule, shall be valid unless so ordered and valued or agreed to be valued as provided for in these GCs.

16.3 Despite the rest of this GC, if subsurface conditions at the Work Site differ from those contemplated by the Contract, the Owner, having consulted with the Contractor, shall make a change to the scope of the Work under this GC.

16.4 The Owner agrees that it shall not change the scope of the Work such that it is materially reduced from that set out in the Contract Documents on the reference date of this document on page 1.

GC17 VALUATION AND CERTIFICATION OF CHANGES IN THE WORK

17.1 The value of any change in the Work shall be determined by one or more of the following methods:

(a) by estimate and acceptance in a lump sum; or

(b) by unit prices agreed upon.

17.2 When a change in the Work is made under GC16, the Contractor shall promptly, and in any case within 10 Days after the change in the Work is proposed or required by the Owner, present to the Owner its claims for any change to the Contract Price, the Contract Time or the Construction Schedule, or all of them, which arise from the change.

17.3 In the case of changes in the Work to be paid for under GC17.1(b), the form of presentation of costs and methods of measurement shall be agreed to by the Owner and the Contractor before proceeding with the change. The Contractor shall keep accurate records of quantities or costs as agreed upon and shall present an account of the costs of the change

in the Work, together with vouchers where applicable, at least once each Month during performance of the change in the Work, which shall be paid by the Owner in accordance with the payment provisions of these GCs, and shall present a final account upon completion of the change in the Work.

17.4 If the methods of valuation, measurement and value of any change cannot be promptly agreed upon, and in any case within 5 Days after the proposed change, and the change is required by the Owner to be proceeded with, then the value of the change shall be determined by arbitration as set out in these GCs and the change shall be performed promptly after such arbitration.

17.5 It is intended in all matters involving changes in the Work that both the Owner and the Contractor shall act promptly and in accordance with the times set out in this GC.

GC18 DETERMINATION OF COST

18.1 Subject to GC18.2 whenever it is necessary for the purposes of the Contract to determine the cost of labour, equipment or material, the cost of such labour, equipment or material shall be the amount agreed upon by the Contractor and the Owner from time to time within a reasonable time, in any case within 30 Days, after the issue arises in any given instance.

18.2 If the Contractor and the Owner cannot agree as to the cost of labour, equipment or material as contemplated in GC18.1, the cost of labour, equipment or material for the purposes of these GCs shall be equal to the aggregate of:

(a) all reasonable and proper amounts actually expended by or legally payable by the Contractor in respect of the labour, equipment or material which fall within one of the classes of expenditures described in GC18.3, (being costs which are directly attributable to the performance of the Work and are not costs in respect of which the allowance in GC18.2(b) is made); and

(b) 18% of the total of the expenditures of the Contractors that meet the test in GC18.2(a), being an allowance for all other expenditures by the Contractor and for profit, and without limiting the generality of the foregoing, being also an allowance for payment and charges related to overhead, head office expenses and general administration costs of Contractor, including finance and interest charges to the due date.

18.3 Classes of expenditure that are allowable for the purposes of GC18.2 are:

(a) payments to Subcontractors that comply with GC18.2(a), but despite

GC18.2(b) the percentage applied to such payments to Subcontractors shall, for the purposes of GC18.2(b), be 10% and not 18%;

(b) wages, salaries and travelling expenses of employees of the Contractor while they are actually and properly engaged on the Work, other than wages, salaries, bonuses, living and travelling expenses of personnel of the Contractor generally employed at the head office, or at a general office, of the Contractor unless such personnel are necessarily and properly engaged at the site of the Work;

(c) payments for materials necessary for and incorporated in the Work or necessary for and consumed in the performance of the Work;

(d) payments for equipment necessary for and incorporated in the Work;

(e) payments for tools, other than tools customarily provided by tradesmen, necessary for and used in the performance of the Work;

(f) payments for preparation, inspection, delivery, installation and removal of plant and materials necessary for the performance of the Work;

(g) assessments payable under any statutory scheme relating to workers; compensation, unemployment insurance, or holidays with pay;

(h) payments for renting equipment and tools and allowances for equipment and tools owned by the Contractor, necessary for the performance of the Work, provided that such payments or allowances are reasonable or have been agreed to by the Contractor and the Owner; and

(i) other payments, made with the approval of the Owner, that are necessary for the performance of the Work, as determined by the Owner in its reasonable discretion.

GC19 APPLICATIONS FOR PAYMENT

19.1 Applications for payment may be made not more than one each Month as the Work progresses, at the end of each Month shown in the Construction Schedule.

19.2 Applications for payment shall be dated the last Day of the Month and the amount claimed therein shall be for the amount shown for that Month in the Payment Schedule.

19.3 The Payment Schedule shall be used as the basis for all applications for payment,

unless it is found at any time to be in error, in which case it shall be corrected in accordance with directions by the Owner's Representative.

19.4 Claims for equipment or material delivered to the Work Site but not yet incorporated into the Work shall be supported by such evidence as the Owner's Representative may reasonably require to establish the value and their delivery.

19.5 Applications for release of holdback monies and the application for final payment, shall be made at the time and in the manner set forth in GC20.

19.6 If the Contractor has given the Owner a written direction to pay any payment due to the Contractor by the Owner under the Contract to any Subcontractor, or other person with whom the Contractor has a contract necessary for performance of the Work by the Contractor, the Owner may pay in accordance with that direction to pay, and if the Owner does that the Owner's obligations to the Contractor hereunder are satisfied and reduced to the extent of that payment, subject to any necessary GST or other tax adjustments necessitated by that payment.

GC20 CERTIFICATES AND PAYMENTS

20.1 The Owner's Representative shall, not later than 10 Days after the receipt of an application for payment from the Contractor submitted in accordance with GC19, issue a certificate for payment in the amount applied for or in such amount as the Owner's Representative determines to be properly due. If the Owner's Representative amends the application, the Owner's Representative shall promptly notify the Contractor in writing and give reasons for the amendment, provided that, for clarity, the Contractor is entitled to dispute any such amendment and may submit the matter for arbitration at that time or within 90 Days after Completion.

20.2 The Owner shall make each progress payment to the Contractor on account no later than 15 Days after the issuance of a certificate for payment by the Owner's Representative.

20.3 The Owner's Representative shall, not later than 10 Days after the receipt of an application from the Contractor for a certificate of Substantial Completion, make an inspection and assessment of the Work to verify the validity of the application. The Owner's Representative shall, not later than 7 Days after the inspection, notify the Contractor of approval, or the reasons for disapproval, of the application, which the Contractor may dispute or instead remedy by correcting the Work to which the payment relates. If the Contractor remedies any such deficiency, the Owner shall, within two days after completion of the remedy, approve or disapprove of the remedial measures, and so on, until Substantial Completion is reached. When the Owner's Representative finds that Substantial Completion of the Work has been reached, the Owner's Representative shall immediately issue a

certificate of Substantial Completion. The date of Substantial Completion of the Work shall be the date of Substantial Completion of the Work by the Contractor and as stated in that certificate. Immediately following the issuance of the certificate of Substantial Completion of the Work, the Owner's Representative, in consultation with the Contractor, shall establish a reasonable date for Completion.

20.4 Immediately following the issuance of the certificate of Substantial Completion, the Owner's Representative shall issue a certificate for payment of holdback monies, but the holdback monies shall only become due and payable on the Day following the expiration of the statutory period under the *Builders' Lien Act*. The Owner may retain out of such holdback monies any sums required by Law to satisfy any claims of lien or liens against the Work Site or Work, or other monetary claims against the Contractor and enforceable against the Owner. The holdback monies are payable only if the Contractor has submitted to the Owner a sworn statement of an officer or senior management employee of the Contractor that all accounts for labour, subcontracts, materials, construction machinery and equipment, and other indebtedness, which may have been incurred by the Contractor and for which the Owner might in any way be held responsible (including by lien) have been paid in full, except holdback monies properly retained by the Contractor.

20.5 The Owner's Representative shall, not later than 10 Days after the receipt of an application from the Contractor for payment upon Completion of the Work, make an inspection and assessment of the Work to verify the validity of the application. The Owner's Representative shall, not later than 7 Days after the inspection, notify the Contractor of approval or the reasons for disapproval of the application, which the Contractor may dispute or instead remedy by correcting the Work to which the payment relates. If the Contractor remedies any such deficiency, the Owner shall, within two days after completion of the remedy, approve or disapprove of the remedial measures, and so on, until Completion is reached. When the Owner's Representative finds that Completion of the Work has been reached, the Owner's Representative immediately shall issue a certificate of Completion and certify for payment the monies due to the Contractor under the Contract, less holdback monies which are retained in accordance with GC20.4. The date of Completion of the Work shall be the date of Completion of the Work by the Contractor and as stated in that certificate. Subject to the provisions of GC20.6, the Owner shall, not later than 30 Days after the issuance of such certificate, make final payment to the Contractor in accordance with the provisions of the Agreement.

20.6 Without limiting the generality of GC14, the Contractor shall, at its sole risk and expense, do everything necessary, including through the institution, prosecution or defence of legal proceedings, to promptly discharge from title to the Work Site any claims of builders' lien, other liens, or certificates of pending litigation. If the Owner becomes aware that a claim of builders' lien, other lien, or certificate of pending litigation has been registered against title to the Work Site, the Owner may, in its sole discretion, pay to the

Contractor's solicitor, in trust, on that solicitor's undertaking to discharge any such claim of builder's lien, builder's lien or certificate of pending litigation, out of any monies payable to the Contractor, in excess of any holdback monies retained under the *Builders' Lien Act*, such amounts as the Owner reasonably considers necessary in order to secure the discharge of the claim of builders' lien, builders' lien or certificate of pending litigation.

20.7 If because of conditions reasonably beyond the control of the Contractor there are items of Work that cannot be performed, payment in full for Work which has been performed as certified by the Owner's Representative shall not be withheld or delayed by the Owner on account thereof, but the Owner may withhold until the remaining Work is finished only such monies as the Owner's Representative determines are sufficient and reasonable to cover the cost of performing such remaining Work and to adequately protect the Owner from claims for payment relating to the Work, by Subcontractors or material or equipment suppliers, including claims of builder's lien.

20.8 No payment made by the Owner under this Contract, or partial or entire use or occupancy of the Work by the Owner, shall constitute an acceptance of Work not in accordance with the requirements of the Contract Documents.

20.9 By issuing any certificate, the Owner's Representative and the Owner do not guarantee, or otherwise become liable or responsible in any way for, the correctness or completeness of the Work, including the Design, and no certificate makes the Owner's Representative or the Owner in any way responsible or liable for adequacy of the Design or for the Work.

20.10 As of the Completion Date, the Owner expressly waives and releases the Contractor from all claims against the Contractor, including those that arise from the negligence or breach of Contract by the Contractor, except any one or more of the following:

(a) those made in writing prior to the date of Completion of the Work and still unsettled;

(b) those arising from the provisions of GC14 or GC28, or both, provided that the Owner shall notify the Contractor of any claim, loss, damage or expense as soon as the Owner is aware thereof; or

(c) those made in writing within a period of two years from the date of Completion, as set out in the certificate of Completion, and arising from any liability of the Contractor for damages resulting from performance of the Contract with respect to defects or deficiencies in the Work for which the Contractor is proven responsible, including design, construction, or failure of the Work to comply with the Performance Specifications, or all of them.

20.11 As of the date of Completion, subject to payment in full of the Contract Price together with all amounts payable to the Contractor for changes in the Work, all in accordance with the Contract, the Contractor expressly waives and releases the Owner from all claims against the Owner, including without limitation those that might arise from the negligence or breach of Contract by the Owner, except those made in writing prior to the Contractor's application for payment upon Completion and still unsettled, and except for those arising from the provisions of GC14, provided that the Contractor shall notify the Owner of any claim, loss, damage or expense as soon as the Contractor is aware thereof.

20.12 The Owner may deduct from any payment to the Contactor under this GC the amount paid by the Owner to put the Contractor into compliance with the Insurance Conditions if the Contractor has defaulted in complying with the Insurance Conditions.

20.13 In the event of conflict between the provisions of this GC and any other GC or the Agreement, the provisions of this GC govern.

GC21 TAXES AND DUTIES

21.1 The Owner shall pay to the Contractor any goods and services tax under the *Excise Tax Act* (Canada) on materials and services provided to the Owner by the Contractor as part of the Work and such taxes shall be shown separately on progress payment applications made by the Contractor under these GCs. The Contractor shall remit to Canada all goods and services tax as and when required by the *Excise Tax Act* (Canada) and shall, without limiting GC14, indemnify and hold the Owner harmless from and against any GST, and other taxes, the Contractor fails to remit as and when due, and from and against any penalties that may be levied against the Owner, and any costs, in respect thereof.

21.2 Unless otherwise expressly provided in the Contract, the Contractor shall pay all government goods and services tax under the *Excise Tax Act* (Canada), social services tax under the *Social Services Tax Act* (British Columbia), customs duties and excise taxes under the *Excise Tax Act* (Canada), payable in accordance with any enactment with respect to any component of the Work.

21.3 Any increase or decrease in material or equipment costs to the Contractor due to changes in taxes or duties after the reference date of this document on page 1 shall increase or decrease the Contract Price accordingly.

21.4 Where an exemption or refund of taxes, customs duties or excise taxes is applicable to the Contract by way of the Contractor filing claims for, or cooperating fully with the Owner and the proper authorities in seeking to obtain such exemption or refund, the Contractor shall make such applications and provide such cooperation at the Owner's expense, provided that the Contractor has no obligation to investigate or pursue any such

exemption or refunds and the Owner accepts such responsibility.

21.5 Refunds that are properly due to the Owner and have been recovered by the Contractor shall be promptly refunded to the Owner.

GC22 LAWS, NOTICE, PERMITS AND FEES

22.1 The Contractor shall apply, and pay, for all permits and licences required by Law for the performance of the Work (but this shall not include the obtaining of permanent or temporary easements or rights of way). The Contractor shall give all necessary notices and pay all fees required by Law and comply with all Standards.

22.2 All Laws in force in British Columbia, excluding the land use bylaws of the Owner, govern the Work and the Contract Documents shall be deemed to include any such Laws from time to time.

GC23 INTELLECTUAL PROPERTY FEES

23.1 As part of the Contract Price, the Contractor shall pay to the owner, including Zenon, of any intellectual property rights (including of any patent, copyright, industrial design, trademark or trade secret) all royalties and licence fees required for the performance of the Contract and shall, without limiting GC14, hold the Owner harmless from and against all claims, demands, losses, costs, damages, actions, suits or proceedings arising out of the Contractor's performance of the Work under the Contract which are attributable to an infringement or an alleged infringement of any intellectual property by the Contractor or anyone for whose acts it may be liable.

23.2 As part of the Contract Price, the Contractor shall, in any contract with Zenon, secure from Zenon such licences and other permissions in the name of, or for the use and benefit of, the Owner as are necessary for the Owner to use, operate, maintain and repair those components of the Upgrade that have been supplied by Zenon as part of the Work.

GC24 WORKERS' COMPENSATION

24.1 Prior to commencing the Work at the Work Site, and as a condition of receiving the second progress payment shown on the Payment Schedule and to receiving payment on Substantial Completion and on Completion, the Contractor shall provide the Owner satisfactory written evidence of compliance by the Contractor with all requirements under the *Workers' Compensation Act*, including payments of assessments due under it to the Workers' Compensation Board. Without limiting the foregoing, the Owner's Representative may at any time require the Contractor to provide evidence of compliance with all requirements under the *Workers' Compensation Act*, or payment of assessments due under

it to the Workers' Compensation Board, or both.

24.2 When required to do so by the Owner, the Contractor shall request evidence of compliance and compliance of any or all of its Subcontractors under GS24.1 and deliver any such evidence to the Owner.

GC25 PROTECTION OF WORK AND PROPERTY

25.1 The Contractor shall protect property adjacent to the Work Site from damage arising from the Contractor's work and, without limiting GC14, shall hold the Owner harmless from any claims which may arise as the result of its operations under the Contract, or from its failure to provide such protection, or both.

25.2 The Contractor shall protect the Work and the Owner's property on the Work Site necessarily connected with the Upgrade, including the Westview Facility, from damage and shall be responsible for any damage which may arise as the result of its operations under the Contract except damage which occurs as the result of actions of the Owner, its agents, employees or Other Contractors.

25.3 Should any damage occur for which the Contractor is responsible under GC25.1 or GC25.2, the Contractor shall promptly make good such damage at its own expense or pay all costs incurred by others in making good such damage.

25.4 Should any damage occur to the Work or the Owner's property, or both, for which the Contractor is not responsible under GC25.1 or GC25.2, the Contractor shall make good such damage to the Work and, if the Owner so directs, to the Owner's property, and the Contract Price, Contract Time and Construction Schedule shall be adjusted in accordance with GC18, provided that if such damage requires an expense which in the Contractor's opinion is major the Owner shall pay such expense directly.

GC26 DAMAGES AND MUTUAL RESPONSIBILITY

26.1 If the Contractor has caused damage to any Other Contractor on the Work, the Contractor agrees upon due notice by the Owner to settle with such Other Contractor by agreement or arbitration. If an Other Contractor sues the Owner on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor and, without limiting GC14, may require the Contractor, or at the Contractor's election the Contractor may elect, to defend the action at the Contractor's expense. If any final order or judgment against the Owner arises therefrom, the Contractor shall pay or satisfy it and pay all reasonable costs incurred by the Owner as provided in GC14.

26.2 If the Contractor becomes liable to pay or satisfy any final order, judgment or award

against the Owner, then the Contractor shall have the right, upon undertaking to indemnify the Owner against any and all liability for costs, to appeal in the name of the Owner such final order or judgment to any and all courts of competent jurisdiction.

26.3 If the Owner has caused damage to any Other Contractor on the Work, the Owner agrees upon due notice by the Contractor to settle with such Other Contractor by agreement or arbitration. If any Other Contractor sues the Contractor on account of any damage alleged to have been so sustained, the Contractor shall notify the Owner and, without limiting GC14, may require the Owner, or at the Owner's election the Owner may elect, to defend the action at the Owner's expense. If any final order or judgment against the Contractor arises therefrom, the Owner shall pay or satisfy it and pay all reasonable costs incurred by the Contractor as provided in GC14.

26.4 If the Owner becomes liable to pay or satisfy any final order, judgment or award against the Contractor, then the Owner shall have the right, upon undertaking to indemnify the Contractor against any and all liability for costs, to appeal in the name of the Contractor such final order or judgment to any and all courts of competent jurisdiction.

GC27 BONDS AND INSURANCE

27.1 Before commencing any construction on the Work Site, the Contractor shall deliver to the Owner executed performance bonds and executed labour and materials payment bonds substantially in the forms attached as Schedule B and C, respectively, to these General Conditions, or in substantially equivalent forms acceptable to the Owner, acting reasonably.

27.2 The bonds under GC27.1 shall cumulatively be in the amount of $4,710,000.00, being agreeable to both parties given that such amount is exclusive of the engineering work that has been completed by the Contractor and reviewed, approved and paid for by the Owner as provided in GC2.3 and shall be issued by a surety licensed to transact the business of a surety in British Columbia and acceptable to the Owner, acting reasonably.

27.3 Upon entering into a contract with a Subcontractor, the Contractor shall advise the Subcontractor that a labour and material payment bond is in effect and shall supply a copy of the bond to the Subcontractor on request.

27.4 The Contractor shall, as part of the Contract Price, obtain and maintain the insurance required by the Insurance Conditions, and otherwise shall comply with the Insurance Conditions.

27.5 Before commencing any construction on the Work Site, the Contractor shall deliver to the Owner certified copies of all insurance obtained by the Contractor in accordance with

the Insurance Conditions, or such other proof of that insurance as is satisfactory to the Owner, acting reasonably, provided that the Contractor shall provide the professional liability insurance required by section 2(f) of the Insurance Conditions immediately.

GC28 WARRANTIES

28.1 The Contractor shall correct, at its own expense:

(a) any Work which is found by the Owner's Representative or the Owner to not comply with the Performance Specifications or to be not in accordance with the Contract Documents, including performance of the Westview Facility after Completion, for a period of 12 Months from and after Completion, or such longer period as may be agreed by the parties by any separate written operation and maintenance agreement entered into as contemplated by GC2.9; and

(b) any defects in the Work due to faulty products or workmanship appearing within a period of two years from the date of Completion, or within two years from the date of termination of the Contract if the Contract is terminated prior to Substantial Completion, provided such defect is not caused by termination in accordance with the provisions of the Contract.

The obligations of the Contractor under this GC28.1 apply only if the Owner maintains and operates the Westview Facility (including the Upgrade) completely in accordance with the operations manual supplied by the Contractor to the Owner under the Contract.

28.2 The Contractor shall correct or pay for any damage to other work resulting from any corrections required under GC28.1.

28.3 Issuance of the certificates of Substantial Completion and of Completion, and final payment to the Contractor, do not relieve the Contractor from its responsibility under this GC.

28.4 As part to the Contract Price, the Contractor shall, in any contract with Zenon, secure for the benefit of the Owner, as between the Owner and Zenon, such warranties as Zenon customarily offers to purchasers of products from Zenon and the Contractor shall provide the Owner with copies of all such warranties and relevant documents as are received by the Contractor from Zenon.

GC29 PRODUCTS AND EXPENSE OF WORK

29.1 Unless otherwise expressly provided in the Contract, the Contract Price is the sole

consideration to, and remuneration of, the Contractor for performance of its obligations under the Contract, and the Contractor shall provide and pay for all labour, products, materials, tools, equipment, plant, machinery, water, heat, light, power, transportation, and all other facilities, things and services whatsoever, without limitation, necessary for the proper performance of the Work, provided that, for clarity, the Contractor's obligation under this GC does not apply with respect to the Owner's Work and provided further that the Owner shall provide an operator for the Westview Facility, and all water, power, light and heat necessary to and for the Work on the Work Site as part of the Owner's Work.

29.2 All products, equipment or materials provided shall be new unless otherwise expressly specified in the Contract Documents.

29.3 Any products, equipment or materials which are not specified shall be of a quality best suited to the purpose required.

GC30 USE OF WORK SITE

30.1 The Contractor shall confine its tools, equipment and plant, the storage of materials and products, and the operations of its workers, to limits indicated by or under all Laws, or as agreed with the Owner, and shall not unreasonably encumber the Work Site.

30.2 The Contractor shall not load or permit to be loaded any part of the Work with a weight that will endanger its safety.

30.3 The Contractor shall enforce the Owner's directions regarding signs, advertisements, fires and smoking.

30.4 Without having made any inquiry, the Owner is not aware of the presence on, in or under the Work Site of any pollutant, contamination or toxic substance. If the Contractor, after commencing the Work, encounters or has reason to believe in the existence of any such thing on, in or under the Work Site, the Contractor shall at once take all reasonable steps as are necessary to ensure that no person or property suffers injury, sickness, death, damage or destruction as a result of exposure to, or the presence of, any such thing, and the Contractor shall immediately report such matter to the Owner. If the Contractor is delayed in performing the Work, or incurs additional costs, due to any such matter, adjustment in the Contract Time, Construction Schedule or the Contract Price, or all of them, shall be agreed upon, in the case of the Contract Price as set out in GC18.

GC31 CLEANUP AND FINAL CLEANING OF WORK

31.1 The Contractor shall maintain the Work in a tidy and safe condition and free from the accumulation of waste products and debris, other than that caused by the Owner, Other

Contractors or their employees.

31.2 When the Work reaches Completion, the Contractor shall promptly remove all surplus products, tools, construction machinery and equipment, and any waste and debris, and leave the Work and Work Site clean and suitable for occupancy by the Owner unless otherwise specified.

GC32 CUTTING AND REMEDIAL WORK

32.1 The Contractor shall do all cutting and remedial work that may be required to make the several parts of the Work come together properly.

32.2 The Contractor shall co-ordinate the Construction Schedule for the Work to ensure that the requirement under GC32.1 is kept to a minimum.

32.3 Cutting and remedial work shall be performed by specialists familiar with the materials affected and shall be performed in a manner to neither damage nor endanger any Work.

GC33 QUALITY CONTROL AND INSPECTION OF WORK

33.1 Without affecting any other GC, the Contractor is solely responsible for the quality of the Work and shall diligently implement a quality control plan throughout performance of the Work. The Contractor shall provide the Owner a copy of the Quality Control Plan, and any revisions thereto, at commencement of the Work.

33.2 The Contractor shall, in its reasonable discretion, as required, appoint one or more independent consultants, with the relevant professional education, skill and experience, to carry out and report upon all testing and other quality control activities comprised in the Quality Control Plan.

33.3 The Contractor shall ensure that independent consultants appointed under GC33.2 implement the Quality Control Plan, including by reporting to the Owner's Representative on implementation of the Quality Control Plan.

33.4 Despite the rest of this GC, the Owner may at any time, at the Owner's expense, carry out independent quality control testing at any time, provided that at all times the Owner shall use best efforts to avoid, or minimize, any interference with the Contractor's performance of the Work or with performance by Subcontractors and Other Contractors at the Work Site.

33.5 Nothing in this GC, and no action or inaction by the Owner or the Owner's

Representative, shall relieve the Contractor from its sole responsibility for the quality of the Work, for the Quality Control Plan, or for implementation of the Quality Control Plan.

33.6 The Owner and the Owner's Representative shall have access to the Work at the Work Site for testing and the Contractor shall provide reasonable access. No inspection by the Owner or the Owner's Representative shall relieve the Contractor from its sole responsibility for the quality of the Work, for the Quality Control Plan, or for implementation of the Quality Control Plan.

33.7 If the results of any testing (including Owner's testing) or of the Quality Control Program disclose that any part of the Work is incomplete or defective in any way, the Owner may order the Contractor to complete that part of the Work or correct the defect and the Contractor shall do so forthwith at its own expense. If the Owner determines, based on the results of any aspect of the Quality Control Program's implementation or otherwise, that any part of the Work is incomplete or defective in any way, and such determination is not disputed by the Contractor, the Owner may order the Contractor to complete that part of the Work or correct the defect and the Contractor shall do so forthwith at its expense.

33.8 The Contractor shall cause a Professional Engineer to certify to the Owner, under his or her professional seal, that the Quality Control Plan has been implemented and in accordance with all Standards applicable to the Quality Control Plan.

33.9 Promptly after Completion, the Contractor shall deliver to the Owner all test samples and results taken for, and generated by, implementation of the Quality Control Plan.

GC34 REJECTED WORK

34.1 Defective Work, whether the result of poor design, poor workmanship, use of defective equipment or materials, or damage through default of the Contractor or any Subcontractor, and whether incorporated in the Work or not, which has been rejected by the Owner as failing to conform to the Performance Specifications or the Design, or both, shall be removed promptly by the Contractor and replaced and re-executed promptly and properly at the Contractor's expense, unless the Contractor disputes that action of the Owner. If the Contractor does not remove such defective Work within the time fixed by written notice by the Owner, the Owner may remove it and store it at the expense of the Contractor.

34.2 Other Contractor's work destroyed or damaged by such removals or replacements shall be made good by the Contractor promptly at the Contractor's expense.

34.3 If in the opinion of the Owner it is not expedient to correct defective Work or Work not done in accordance with the Contract Documents, the Owner may deduct from the

Contract Price the difference in value between the Work as done and that called for by the Contract. If requested by the Contractor, any such contemplated deduction shall be placed in trust with the Owner's solicitor and the matter shall be referred to arbitration.

GC35 DRAWINGS

35.1 Before issuance of the certificate of Completion, the Contractor shall provide to the Owner the following:

(a) 2 complete sets of Drawings and Specifications, showing the as-built Work;

(b) 1 set of disks with the as-built Drawings on them; and

(c) 3 complete sets of maintenance manuals for all equipment comprised in the Work.

GC36 NOTICE AND OTHER GENERAL PROVISIONS

36.1 Any notice which may be or is required to be given under this Agreement shall be in writing and either be delivered or sent by facsimile transmission, addressed as follows:

(a) To the Owner:

Attention: Mr. Jim Greenwood, P.Eng.
District of Powell River
6910 Duncan Street
Powell River, B.C.
V8A 1V4

Fax No.: (604) 485-2913

(b) To the Contractor:

Attention: Mr. Trevor Hill, P.Eng.
Hill, Murray and Associates Inc.
202 - 780 Tolmie Avenue
Victoria, B.C. V8X 3W4

Fax No.: (250) 388-3943

(c) With A Copy To:

Mr. Michael Holmes
Jones, Emery, Hargreaves
1212 - 1175 Douglas Street
Victoria, B.C. V8W 2E1

Fax No.: (250) 382-5436

or to such other address or facsimile number of which notice has been given as provided in this section. Any notice which is delivered is to be considered to have been given on the first Day after it is dispatched for delivery. Any notice which is sent by fax transmission is to be considered to have been given on the first business Day after it is sent and may be copied by delivery. If a party changes its address or facsimile number, or both, it shall promptly give notice of its new address or facsimile number, or both, to the other party as provided in this section.

36.2 An alleged waiver of any breach of the Contract is effective only if it is an express waiver in writing of that breach. A waiver of a breach of the Contract does not operate as a waiver of any other breach of the Contract.

36.3 If any term of the Contract is held to be void or unenforceable by a court, that term is to be severed from the Contract and the rest of the Contract remains in force unaffected by the severance of that term.

36.4 All amounts due under the Contract from one party to the other, including any amount assessed by the arbitrator, shall bear interest from their due date until paid, at the rate of 1.0% per month, calculated monthly not in advance.

36.5 The Contract is the entire agreement between the parties regarding its subject.

36.6 The Contract binds the parties to it and their respective successors, heirs, executors and administrators.

36.7 The parties must do everything reasonably necessary to given effect to the intent of the Contract, including execution of further instruments.

36.8 Time is of the essence of the Contract.

36.9 The Contractor shall, as a condition precedent to the obligation of the Owner to make any further payment hereunder other than for engineering work as provided in GC2.3, that the Contractor must have delivered to the Owner a statutory declaration sworn on

behalf of the Contractor in accordance with *Skills Development and Fair Wage Act* (British Columbia), and the Contractor further acknowledges and agrees that it is the sole responsibility of the Contractor to comply with that Act.

As evidence of their agreement to be bound by the terms, the parties have caused this Agreement to be executed and delivered under seal by their authorized signatories as of the date set out above:

The Corporate Seal of the Corporation of the District of Powell River was hereunto affixed in the presence of:

Lee Lorenzen
Mayor

Acting

J. Spurrier LEd
Acting Clerk

C/S

Date signed by the Corporation of the District of Powell River: September 12, 1997

Approved by resolution of the Council of the Corporation of the District of Powell River on September 12, 1997.

The Corporate Seal of Hill, Murray and Associates Inc. was hereunto affixed in the presence of its authorized signatories:

Name:

Name:

C/S

Date signed by Hill, Murray and Associates Inc.: September 12, 1997

SCHEDULE A - INSURANCE CONDITIONS

1. The Contractor shall provide and maintain insurance as required by the rest of this GC and the rest of this section. All policies shall be in the joint names of the Owner and the Contractor, shall include all Subcontractors, the Owner's Representative and the Contractor's Consultants as unnamed insureds, and shall otherwise comply with the rest of these Insurance Conditions. All policies shall preclude subrogation claims by the insurer against anyone insured thereunder.

2. The insurance that the Contractor shall provide and maintain is as follows:

(a) the Contractor shall provide and maintain comprehensive general liability insurance subject to limits of not less than $3,000,000.00 inclusive per occurrence, and a deductible of not more than $5,000.00 per occurrence, for bodily injury, death and damage to or loss of property, including loss of use thereof, and including coverage for:

(i) premises and operations liability;

(ii) contractor's contingent liability with respect to the operations of persons, firms or corporations having a contract for the execution of a part or parts of the work included in the Contract;

(iii) products or completed operations liability;

(iv) blanket contractual liability;

(v) cross liability;

(vi) elevator and hoist liability;

(vii) contingent employer's liability;

(viii) personal injury liability;

(ix) shoring, blasting, excavating, underpinning, demolition, pile driving and caisson work, work below ground surface, tunnelling and grading, as applicable;

(x) liability with respect to non-owned licensed vehicles; and

(xi) liability with respect to owned and non-owned aircraft and watercraft, as applicable.

(b) the Contractor shall provide and maintain liability insurance in respect of vehicles owned, leased or rented by the Contractor, subject to limits of not less than $3,000,000.00 inclusive per occurrence.

(c) the Contractor shall provide and maintain property insurance, insuring the full value of the Work in the amount of the Contract Price, plus the value of Owner-supplied materials and things, if any, and the insurance shall

(i) be in the joint names of the Owner and the Contractor, and shall include the interest of the Owner, the Contractor, Subcontractors and all others having an insurable interest in the Work;

(ii) include all Subcontractors as unnamed insureds or, if they specifically request, as named insureds;

(iii) preclude subrogation claims by the insurer against anyone insured thereunder;

(iv) be provided for by either an all risks builders' risk policy, or by a combination of a standard builders' risk fire policy, including extended coverage and malicious damage endorsements, and a builders' risk difference in conditions policy providing equivalent coverage;

(v) insure against all risks of direct loss or damage, subject to any exclusion expressly specified in the Contract and shall apply to all material, equipment, machinery, labour and supplies of any nature whatsoever, the property of the insureds or others for which the insureds may have assumed responsibility, to be used in or pertaining to the site preparations, demolition of existing structures, erection, fabrication, reconstruction, or repair of the Work, on the Work Site and in transit, subject to the exclusions of the property specified; and

(vi) apply to both the installation and testing phases.

(d) the Contract shall provide and maintain all-risks contractors' equipment insurance protecting all machinery and equipment used by the Contractor in the performance of the Work for the replacement value of any such machinery and equipment.

(e) the Contractor shall provide and maintain machinery insurance acceptable to the Owner in the amount of $3,000,000.00, with a deductible of not more than $5,000.00 per claim, and the policy

(i) shall be in the joint names of the Owner and Contractor and shall include the interest of the Owner, the Contractor, Subcontractors and all others having an insurable interest in the Work;

(ii) preclude subrogation claims by the insurer against anyone insured thereunder;

(iii) include all Subcontractors as unnamed insureds or, if they specifically request, as named insureds;

(iv) become effective immediately upon the certification of the first boiler or pressure vessel and before they are put into operation and shall be extended to provide coverage on all subsequent certifications of similar equipment; and

(v) be provided by a standard boiler and machinery policy and the coverage provided thereunder shall as a minimum cover the equipment itself against direct damage loss as well as cover damage to the Work caused by an accident to or explosion of any boilers or pressure vessels forming a part of the Work.

SCHEDULE B - CONTRACTOR'S FORM OF PERFORMANCE BOND

PERFORMANCE BOND

No. Bond No. SAmount

KNOW ALL MEN BY THESE PRESENTS THAT Principal as Principal, hereinafter called the Principal, and the Bond Company a corporation created and existing under the laws of Canada, and duly authorized to transact the business of Suretyship in Canada, as Surety, hereinafter called the Surety, are held and firmly bound unto Obligee as Obligee, hereinafter called the Obligee, in the amount of Written Amount Dollars (SAmount) lawful money of Canada, for the payment of which sum, well and truly to be made, the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a written contract with the Obligee, dated the Contract Day day of Contract Month, Contract Year for

Description

in accordance with the Contract Documents submitted therefor which are by reference made part hereof and are hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall promptly and faithfully perform the Contract then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Whenever the Principal shall be, and declared by the Obligee to be, in default under the Contract, the Obligee having performed the Obligee's obligations thereunder, the Surety may promptly remedy the default, or shall promptly

(1) complete the Contract in accordance with its terms and conditions or

(2) obtain a bid or bids for submission to the Obligee for completing the Contract in accordance with its terms and conditions, and upon determination by the Obligee and the Surety of the lowest responsible bidder, arrange for a contract between such bidder and the Obligee and make available as work progresses (even though there should be a default, or a succession of defaults, under the contract or contracts of completion, arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the Contract price," as used in this paragraph, shall mean the total amount payable by the Obligee to the Principal under the Contract, less the amount properly paid by the Obligee to the Principal.

Any suit under this Bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due.

The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

No right of action shall accrue on this Bond, to or for the use of, any person or corporation other than the Obligee named herein, or their heirs, executors, administrators or successors of the Obligee.

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond dated this Day Sign day of Month Sign, Year Sign.

SIGNED AND SEALED
in the presence of:

Principal

Principal

Bond Company

Underwriter

Attorney-in-Fact

Endorsed by: B.A.I.C., A.C.R.C., C.C.A., R.I.C., C.B.C.
Approved by: INSURANCE BUREAU OF CANADA
Form B-1 (Revised 12/95)

B-2

ZENON'S FORM OF PERFORMANCE BOND

PERFORMANCE BOND

No. _____ Amount $

KNOW ALL MEN BY THESE PRESENTS THAT

as Principal, hereinafter called the Principal,

and a corporation created and existing under the laws of and duly authorized to transact a business of Surety ship in as Surety, hereinafter called the Surety, are held and firmly bound unto

as Obligee, hereinafter called the Obligee,

in the amount of Dollars ($) lawful money of Canada, for the payment of which sum, well and truly to be made, the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a written contract with the Obligee, dated the day of 199 , for

SPECIMEN WORDING

in accordance with the Contract Documents attached thereto which are by reference made part hereof and are hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall promptly and faithfully perform the Contract then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Whenever the Principal shall be, and declared by the Obligee to be, in default under the Contract, the Obligee having performed the Obligee's obligations thereunder, the Surety may promptly remedy the default, or shall promptly

(1) complete the Contract in accordance with its terms and conditions or

(2) obtain a bid or bids for submission to the Obligee for completing the Contract in accordance with its terms and conditions, and upon determination by the Obligee and the Surety of the lowest responsible bidder, arrange for a contract between such bidder and the Obligee and make available as work progresses (even though there should be a default, or a succession of defaults, under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the Contract price", as used in this paragraph, shall mean the total amount payable by the Obligee to the Principal under the Contract, less the amount properly paid by the Obligee to the Principal.

Any suit under this Bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due.

The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

No right of action shall accrue on this Bond to or for the use of, any person or corporation other than the Obligee named herein, or the heirs, executors, administrators or successors of the Obligee.

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond this day of 199 .

SIGNED AND SEALED
In the presence of:

_____

_____
Attorney-in-fact

C-1

SCHEDULE C - CONTRACTOR'S FORM OF LABOUR AND MATERIALS PAYMENT BOND

No. Bond No.

LABOUR AND MATERIAL PAYMENT BOND
(Trustee Form)

NOTE: This Bond is issued simultaneously with another Bond in favour of the Obligee conditioned for the full and faithful performance of the Contract.

KNOW ALL MEN BY THESE PRESENTS THAT Principal as Principal, hereinafter called the Principal, and Bond Company a corporation created and existing under the laws of Canada and duly authorized to transact the business of Suretyship in Canada as Surety, hereinafter called the Surety etc, subject to the conditions hereinafter contained, held and firmly bound unto Obligee as Trustee, hereinafter called the Obligee, for the use and benefit of the Claimants, their and each of their heirs, executors, administrators, successors and assigns, in the amount of Written Amount dollars ($Amount) of lawful money of Canada for the payment of which sum well and truly to be made the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a written contract with the Obligee, dated the Contract Day day of Contract Month, Contract Year for

Description.

which Contract Documents are by reference made a part hereof, and are hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall make payment to all Claimants for all labour and material used or reasonably required for use in the performance of the Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

(1) A Claimant for the purpose of this Bond is defined as one having a direct contract with the Principal for labour, material, or both, used or reasonably required for use in the performance of the Contract, labour and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment directly applicable to the Contract provided that a person, firm or corporation who rents equipment to the Principal to be used in the performance of the Contract under a contract which provides that all or any part of the rent is to be applied towards the purchase price thereof, shall only be a Claimant to the extent of the prevailing industrial rental value of such equipment for the period during which the equipment was used in the performance of the Contract. The prevailing industrial rental value of equipment shall be determined, insofar as it is practical to do so, in accordance with and in the manner provided for in the latest revised edition of the publication of the Canadian Construction Association titled "Rental Rates on Contractors Equipment" published prior to the period during which the equipment was used in the performance of the Contract.

(2) The Principal and the Surety, hereby jointly and severally agree with the Obligee, as Trustee, that every Claimant who has not been paid as provided for under the terms of his contract with the Principal, before the expiration of a period of ninety (90) days after the date on which the last of such Claimant's work or labour was done or performed or materials were furnished by such Claimant, may as a beneficiary of the trust herein provided for, sue on this Bond, prosecute the suit to final judgment for such sum or sums as may be justly due to such Claimant under the terms of his contract with the Principal and have execution thereon. Provided that the Obligee is not obliged to do or take any act, action or proceeding against the Surety on behalf of the Claimants, or any of them, to enforce the provisions of the Bond. If any act, action or proceeding is taken either in the name of the Obligee or by joining the Obligee as a party to such proceeding, then such act, action or proceeding, shall be taken on the understanding and basis that the Claimants or any of them who take such act, action or proceeding shall indemnify and save harmless against all costs, charges and expenses or liabilities incurred thereon and any loss or damage resulting to the Obligee by reason thereof. Provided still further that, subject to the foregoing terms and conditions, the Claimants, or any of them, may use the name of the Obligee to sue on and enforce the provisions of this Bond.

(3) No suit or action shall be commenced hereunder by any Claimant:

(a) unless such Claimant shall have given written notice within the time limits hereinafter set forth to each of the Principal, the Surety and the Obligee, stating with substantial accuracy the amount claimed. Such notice shall be served by mailing the same by registered mail to the Principal, the Surety and the Obligee, at any place where an office is regularly maintained for the transaction of business by such persons or served in any manner in which legal process may be served in the Province or other part of Canada in which the subject matter of the Contract is located. Such notice shall be given

(1) in respect of any claim for the amount or any portion thereof, required to be held back from the Claimant by the Principal, under either the terms of the Claimant's contract with the Principal, or under the Mechanics' Lien Legislation applicable to the Claimant's contract with the Principal, whichever is the greater, within one hundred and twenty (120) days after such Claimant should have been paid in full under the Claimant's contract with the Principal;

(2) in respect of any claim other than for the holdback, or portion thereof, referred to above, within one hundred and twenty (120) days after the date upon which such Claimant did, or performed, the last of the work or labour or furnished the last of the materials for which such claim is made, under the Claimant's contract with the Principal;

(b) after the expiration of one (1) year following the date on which the Principal ceased work on the Contract, including work performed under the guarantees provided in the Contract;

(c) other than in a Court of competent jurisdiction in the Province or District of Canada in which the subject matter of the Contract, or any part thereof, is situated and not elsewhere, and the parties hereto agree to submit to the jurisdiction of such Court.

(4) The Surety agrees not to take advantage of Article 1959 of the Civil Code of the Province of Quebec in the event that, by an act or an omission of a Claimant, the Surety can no longer be subrogated in the rights, hypothecs and privileges of said Claimant.

(5) Any material change in the contract between the Principal and the Obligee shall not prejudice the rights or interest of any Claimant under this Bond, who is not instrumental in bringing about or has not caused such change.

(6) The amount of this Bond shall be reduced by, and to the extent of any payment or payments made in good faith, and in accordance with the provisions hereof, inclusive of the payment by the Surety of Mechanics' Liens which may be filed of record against the subject matter of the Contract, whether or not claim for the amount of such lien be presented under and against this Bond.

(7) The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond this Day Sign day of Month Sign, Year Sign.

SIGNED and SEALED
In the presence of

Principal

Witness as to Principal

Principal

Bond Company

Underwriter

Attorney-in-fact

Endorsed by: - R.A.I.C. - A.C.E.C. - C.C.A. - R.I.C. - C.E.C.
L79 - (11-97)

C-3

ZENON'S FORM OF CONTRACT MAINTENANCE BOND

No: "

Amount $"

KNOW ALL MEN BY THESE PRESENTS, That, "

as Principal and "

created and existing under the laws of the Province of " and duly authorized to transact the business of Suretyship in the Province of ", and held and firmly bound unto "

as Obligee, in the full and just sum of "

19 "

lawful money of Canada, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

SIGNED, SEALED with our Corporate Seals and dated this "

day of " 199" ,

WHEREAS, the said Principal entered into a certain written contract with the said Obligee dated "

SPECIMEN WORDING

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully maintain, repair and keep in repair this work, in accordance with the said Contract, and according to the terms, covenants and conditions thereof, reasonable wear and tear excepted, until October 15, 1998, then this obligation shall be void; otherwise to remain in full force and effect in law.

PROVIDED HOWEVER,

a That in the event of a failure on the part of the Principal in the maintenance or repair of the said work, written notice thereof, with a verified statement of the particular facts, showing such failure and the date thereof, reasonable wear and tear excepted, shall within thirty days after such failure shall have come to the notice of the said Obligee, be delivered to the Surety at its Head Office.

b That in case of such default on the part of the Principal the Surety shall have the right, if it so desires, to complete or procure the completion from time to time of any necessary repairs.

c That in no event shall the Surety be liable for any maintenance or repair of work damaged or destroyed by an act of God, or the public enemies, or mobs, or riots, or civil commotion; nor in any event shall the Surety be subject to any suit, action or other proceeding upon this bond that is instituted later than one " day of " 199" .

AND PROVIDED FURTHER, that the Surety shall not be liable under any other bond issued with respect to the said contract or extensions as above set forth.

SIGNED AND SEALED
In the presence of

Witness: as to Principal

ATTORNEY-IN-FACT

D-1

SCHEDULE D - CONTRACTOR'S PROPOSAL

Proposal for the Design, Installation and Operation of a

Municipal Treatment Plant Upgrade
for the
Westview Municipal Wastewater Treatment Plant
at
Powell River, B.C.

Prepared for

Jim Greenwood
Director of Engineering
The Corporation of the
District of Powell River

June 2, 1997

Suite 202, 780 Tolmie Avenue, Victoria, British Columbia CANADA V8X 3W4
PHONE: (250) 388-3930 FAX: (250) 388-3943

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Proposal for the Design, Installation and Operation of a

Municipal Treatment Plant Upgrade of the Westview Wastewater Treatment Plant in Powell River, B.C.

1 INTRODUCTION

Hill, Murray & Associates Inc. has undertaken a detailed study of the cost implications to provide a tertiary quality wastewater treatment for Powell River. During our many tours and discussions with both Council and staff, we have perceived three very clear but sometimes mutually exclusive issues: Quality, Capital, and Esthetics. Infiltration, a fourth issue, is never solved cheaply by construction of larger plants. This proposal is focused on what we believe is the best solution; upgrading the Westview wastewater treatment plant now, while continuing the long slow process of addressing the inflow and infiltration (I&I) problems in this area. This proposal will allow for all process equipment procured for the upgrade to be transferred to a new location, should this become a requirement in the future. Costs have been considered for the construction of a new Hill Top plant; however it would appear that these costs are prohibitive. The fixed price cost models are outlined in Annex B.

1.1 Overview

This proposal will outline the framework for the upgrade of the existing Westview facility both in terms of effluent quality and flow capability. With a membrane upgrade, this facility will have the capacity to handle all flows from the sewered areas in the District of Powell River which is currently served by the facility. Further, as the nature of the process will be changed to a membrane bioreactor (MBR) facility, the Westview plant will have the capacity to treat all the flow anticipated to year 2016 (Annex A). The following are the highlights of our proposal:

- The elimination of odour at the Westview Facility;
- The complete utilization of existing infrastructure;
- An expansion capability and plan to 2016 (Annex A);
- Guaranteed Tertiary quality effluent;
- Eliminate the need for outfall expansion;
- Guaranteed permit compliance and a performance oriented contract;
- Fixed price contracting through design-build with HM&A;
- A "Just-in-Time" approach to infrastructure;
- The reduction or elimination of the borrowing of money, now and in the future;
- The ability to utilize the existing infrastructure grant;
  - the upgrade will be finished by Christmas 1997;
- No new land acquisition now or in the future;
- An opportunity to utilize the newly acquired land for a solids and composting facility.

1.2 Minimum Capital Investment Through Use of Existing Infrastructure

The location of the Hill Top plant (high relative elevation) implies higher costs to build and operate due to extensive forced mains required. We wish to propose the highest quality effluent for the least possible cost, and phase that cost over as many years as possible. When the city outgrows the upgraded Westview Plant, all the process equipment can be reused in the new Hill Top plant. Membrane filtration provides the clarification phase of treatment *within* the treatment tankage. The upgrade of the clarifier and digester tankage to membrane treatment tanks provides the opportunity for 400% - 500% increase in the capacity of the existing plant. This beneficial use of existing infrastructure at the Westview plant will be considerably more economical than the construction of a new plant

The opportunity to upgrade an existing facility offers a significant savings over new construction now and over many years of population growth. In a "just-in-time" approach, we replace only what is needed today, and through the careful creation of a new DCC or "hook-on" bylaw, the cost of all future upgrade modules can be completely offset by new users.

Throughout this proposal, there are references to "Net Present Value" (NPV). This financial tool takes the cost of borrowing and the consumer price index (CPI) into account and allows us to assess the benefits of borrowing less today, and purchasing modules to increase capacity only when they are needed, making smaller, incremental investments in the treatment process over time. The Net Present Value benefits of this "time value of money" are as follows:

- Eliminate the need to borrow money,
- A full user-pay system,
- Upgrades only when needed and paid by new users,
- Defers spending evenly over time, drastically reducing the cost of borrowing.

1.3 Esthetics

Esthetics is a non-trivial issue; it affects the quality of life of local residents, as well as industry, such as tourism. The issue of odour invading the nearby residents and downtown area has made the issue very sensitive. Time has shown us that no matter how far away from residents you build the plant, future generations will eventually grow around it. *Distance is not the solution.* An HM&A upgrade to the Westview plant will address the esthetics issue in detail; *from odour to visual appeal, the plant will add to the esthetical value of the property.* It is of paramount concern to the success of our company to demonstrate our ability to succeed in solving these non-trivial concerns of today's society.

1.4 Infrastructure Grant

The District is currently in the excellent position having received an infrastructure grant in the amount of $4.1M. This means the District will have to $1.37M for their third of the Capital investment. Through the first $4.1M the District is spending 33 cents per dollar; however, after $4.1M, the cost of infrastructure will be borne fully by the tax-payer. It is for this reason that the capital costs have been minimized to reflect both the budget and our ability to work to a fixed price contract. By reducing or eliminating the cost of borrowing, the operating costs may be dramatically reduced.

1.5 Proposal

In this proposal, *HM&A will outline the solution that supports the highest effluent quality, the lowest cost, and yet will remain esthetically pleasing.* HM&A has a proven ability to provide design, installation, start-up and monitoring services for municipal upgrade projects. Our contracts are fixed price cost. We have a track record of completing all projects on time and on budget with no extra costs.

The upgrade of the Westview plant is the cheapest option, and will exceed the expectations of the residents of Powell River today, and allow for cost effective solutions for tomorrow.

We have experience with upgrades for municipal and regional governments. Our services include operator training and system monitoring and maintenance management via on-line connections.

2 CORPORATE PROFILE

Hill, Murray & Associates Inc. (HM&A) is a "design-build" company providing economical tertiary quality wastewater treatment facilities. HM&A is at the forefront of advanced wastewater treatment technology, specializing in the use of technology in "turn-key" applications. There are currently over 100 wastewater systems of this type in service throughout North America, including British Columbia, treating all manner of wastewater constituents in all manner of conditions.

HM&A is a total service company, delivering the "whole product" to the client, including all aspects of the project, from permitting, through design and construction, to long term maintenance and monitoring. HM&A has a longstanding relationship with ZENON Environmental Inc. of Burlington, Ontario. This partnership offers the very best in membrane manufacturing, kinetic design and product support, combined with local representation, integration and project management. The technology has a proven track record demonstrated by many discharge permits for sensitive receiving environments from the BC Ministry of Environment, Lands and Parks, BC Ministry of Health, Government of the Northwest Territories and Environment Canada. By combining detailed technical understanding of the technology, strong design-build experience and appreciation for the administrative requirements of municipal and regional governments, HM&A offers economical, sustainable solutions to all clients. HM&A has excellent references from previous projects.

Employing a membrane/bioreactor configuration, our systems are the compact answer to complex sewage treatment and disposal problems. The membranes provide a positive barrier between influent and effluent, ensuring excellent effluent quality, reducing the requirement for full-time operators and making the technology ideal for *turn-key* installations. On-line system monitoring including auto-dialers and modem connections reinforce the turn-key, stand-alone concept. HM&A and equipment manufacturers fully guarantee the product and the process and will ensure that the effluent quality requirement is met.

By employing membranes, the solids concentration in the bioreactor can be substantially increased, further reducing the size of the system, improving biodegradation, and thereby dramatically decreasing sludge yield. Built-in redundancy and appropriate factors of safety enhance the operational availability of the plant. Routine operational checks and validations are well within the capability of custodial staff, as no detailed process knowledge is required. Support services, planned maintenance and system monitoring routines are designed to be complementary with the site's activities.

2.1 Guarantees and Bonding

HM&A understands the need for a municipality to seek mechanisms that will ensure the success of the plant in the long term. We have been instrumental in the facilitation of agreements with local and regional governments through which sufficient comfort may be provided to a municipality by means of one or more of the following mechanisms:

- Performance Oriented Contracts: providing legal and financial remedies for non-compliance.
- Operations and Maintenance Bonds: conventional security arrangements through licenced Canadian bonding corporations.
- Performance Warranties: provided through the equipment manufacturer and extended through O&M contracts.
- Equipment Warranties: provided through manufacturers and extended through operations contracts.

In addition, HM&A combines a strong combination of manufacturers guarantees, a process and membrane guarantee from ZENON and project and performance bonding to all clients;

- Effluent quality is guaranteed by ZENON via a maintenance bond
- Membrane and process performance is guaranteed by the manufacturer; Zenon Municipal Systems Inc.
- Plant operation and control can be guaranteed for the life of the plant by the operating arm of HM&A — Canadian Wastewater Corporation

2.2 Design Capability

HM&A has extensive work experience on design-build systems for municipal facilities, ski resorts, the High Arctic and other remote sites. HM&A has proven its ability to supply all design, drawings, equipment lists and materials, project management and field co-ordination services necessary to complete the project.

HM&A's team consists of experienced and dedicated professionals, all working toward the client's goal of meeting the strictest permit limitations on discharge.

The Design Team consists of:

Robert A. Murray, P.Eng. - Director of Engineering

Mr. Murray has many years of design experience with advanced wastewater treatment systems. He has detailed understanding of plant kinetics, design requirements, control and instrumentation. Mr. Murray leads the HM&A design team.

Garth N. Nye - Project Manager

Mr. Nye brings to HM&A detailed understanding of mechanical systems and their integration into the design. A licensed Cross Connection Inspector, he has detailed experience in the management of construction processes.

Gary Griffiths - CADD Technician

Mr. Griffiths provides CAD services and mechanical equipment specification services for the design team. He also provides interference item checks for the design layout.

In addition, HM&A's operations arm, the Canadian Wastewater Corporation (CWC), provides on-going operations and maintenance management services for all our plants. Their mandate is to ensure all plants are in compliance with their permitted criteria, as well as providing expert knowledge and technical support. Through this team, the custodial staff will be provided with a full line of technical support for the completion of maintenance activities. In addition, CWC will monitor biomass condition, equipment performance and effluent quality, instructing staff on any required action.

The Operations and Maintenance Team consists of:

Graham S. Symmonds, P.Eng. - Director of Operations

Mr. Symmonds provides advanced equipment and process monitoring services for all of our plants. He combines a detailed understanding of wastewater treatment plant operations, advanced control system knowledge and detailed experience in the application of machinery health monitoring techniques.

Denis J.N. Perreault - O&M Technician

Mr. Perreault has over twenty years of experience in the operations and maintenance of wastewater treatment systems. He has comprehensive technical aptitude and performs set-to-work, performance monitoring, inspection and maintenance services.

2.3 Permitting

HM&A directs considerable effort to obtaining the required permits from the regulatory agencies. We have had marked success in this regard, providing permits for *all* our projects and plant installations. In many cases, we have resurrected permits from certain failure, and in record time. We accomplish this through direct facilitation of the permits, providing all documentation and information required by the regulatory agencies in a timely manner, as well as fostering a relationship with the Ministries that identify HM&A as experts in the implementation of a leading edge technology.

2.4 Equipment Supply

HM&A specifies and purchases all equipment and materials for the completion of the construction of our projects. This includes hands-on project management facilitation of the delivery of not only critical path items, but all equipment. HM&A has extensive lines of communication with all equipment suppliers, including extensive lines of credit, and in the case of advanced membrane filtration and sludge de-watering systems, retains exclusive representation agreements.

2.5 Construction of Works

HM&A will contract with various local contractors to ensure the construction of this facility is completed. All work will be completed to the applicable codes, and all workers will be insured by the Workers' Compensation Board (WCB). On-site supervision will be provided by HM&A's Director of Engineering or Project Manager.

Design and construction will be in accordance with the WCB Industrial Health and Safety Standards applicable to this industrial facility.

2.6 Commissioning

HM&A has extensive commissioning experience from our operating plants. We will provide all services needed to bring the plant to an operational state, including the provision of equipment-specific field service representatives as required.

2.7 Previous Treatment Facilities Experience

HM&A is a leader in the application of advanced technology for wastewater treatment. By employing advanced technology, HM&A offers powerful treatment capability, producing treatment to BOD < 5 mg/L, TSS < 5 mg/L.

Specific experience includes:

Design, supply, install and maintain treatment facilities for North Warning Systems Sites CAM-M and FOX-M (two complete systems, including infrastructure). Commissioned December 1995.

Design, supply, install and maintain treatment facilities for Thetis Lake Trailer Park. Commissioned August 1995.

Design, supply, install and maintain treatment facilities for Sooke Social Services Building. Commissioned April 1996.

Design, supply, install and maintain treatment facilities for Mt. Washington Ski Resort. Project currently under construction. Commissioned November 1996.

Design, supply and install upgraded municipal facilities at Ganges, Salt Spring Island. Commissioned November 1996.

Design, supply, install and maintain treatment facilities for Huband Park Elementary School, Courtenay, B.C. Design complete, permit in place. Awaiting capital funding from Ministry of Education.

Design, supply, install and maintain treatment facilities for Kingfisher Oceanside Inn, Courtenay, B.C. Permitting complete. Construction began February 1997.

Design, supply, install and maintain treatment facilities for Sooke Harbour House, Sooke, B.C. Permitting complete. Construction began April 1997.

Design, supply, install and maintain treatment facilities for Salt Spring Island Village Resort. Permitting complete. Construction began February 1997.

Design, supply, install and maintain treatment facilities for Lake O'Hara Lodge, Banff, Alberta. Construction to being June 1997.

2.8 "Turn-Key" Installations

Hill, Murray & Associates Inc. is uniquely positioned in the market to offer "Turn-Key" project implementation. Our experience with advanced treatment and recycling applications within Canada is significant as is our detailed knowledge of the Plumbing Code amendments which allow for dual plumbing within buildings (potable and non-potable mains)[1]. We have extensive experience with equipment installation, and now operate several ZenoGEM systems within Canada.

3 EFFLUENT QUALITY GUARANTEE

HM&A offers the only treatment solution that results in treated water quality that exceeds the requirements for unrestricted re-use. The treated water from a ZenoGEM plant is guaranteed to meet the following:

	Guarantee	Expected
BOD_5	< 10 mg/L	< 5 mg/L
TSS	< 10 mg/L	< 1 mg/L
Faecal Coliform	< 2.2 MPN/100 mL	< 1 MPN/100 mL

Further, the reactor will be fitted with the required air to ensure complete nitrification of ammonia to nitrates and nitrites.

4 WASTEWATER TREATMENT

4.1 General Process Description

Employing a membrane/bioreactor configuration, our systems are the compact answer to most sewage treatment and disposal problems. The membranes provide a positive barrier between influent and effluent, ensuring excellent effluent quality, reducing the requirement for full-time operators and making the technology ideal for *sensitive receiving environments*. On-line system monitoring including auto-dialers and modem connections reinforce the automated, stand-alone concept. HM&A and equipment manufacturers fully guarantee the product and the process and will ensure that the effluent quality requirement is met.

By employing membranes, the solids concentration in the bioreactor can be substantially increased, further reducing the size of the system, improving biodegradation, and thereby dramatically decreasing sludge yield. Built-in redundancy and appropriate factors of safety enhance the operational availability of the plant. Routine

[1] Hill, Murray & Associates drafted amendments to the British Columbia Plumbing Code in October 1994 specifying the technical requirements for dual water main applications within commercial and residential buildings. These amendments were approved and will be part of the British Columbia Plumbing Code to be issued in the spring of 1998.

operational checks and validations are well within the capability of custodial staff, as no detailed process knowledge is required. Support services, planned maintenance and system monitoring routines are designed to be complementary with the site's activities.

In general, the treatment system consists of the headworks, the treatment plant and the effluent disposal system. By using an engineered integration of proven, robust equipment, this facility will process sanitary waste to the highest standards possible. Treatment will be effected continuously in the bioreactor. The treated water (effluent) will be disposed of to the existing outfall.

In each case the facilities have had to meet or exceed the most rigorous discharge criteria, resulting in the system being certified under NSF 41 (National Sanitation Foundation) and California's Administrative Code Title 22, the world standards for treated effluent reclamation and re-use. In many cases substantial water savings are achieved through wastewater re-use or toilet flushing or landscape irrigation. These systems are ideally suited for the treatment of high strength wastewater, producing superior quality effluent.

4.1.1 Headworks

The headworks in this facility will be upgraded to a highly automated, PLC driven Lakeside unit capable of removing all inorganic material and ensuring all organics pass through to the reactor.

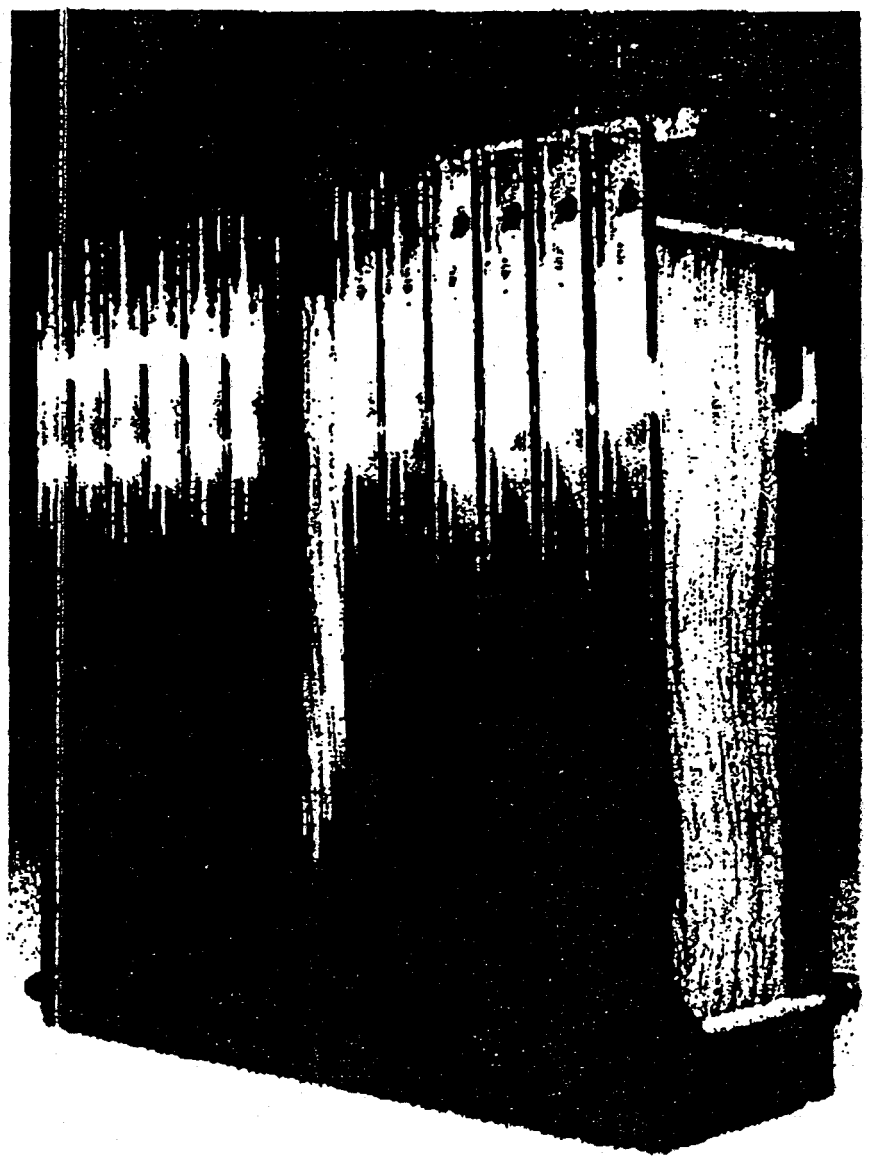


Figure 1: ZeeWeed™ Membranes - The Heart of the System

4.1.2 ZenoGEM Process

The ZenoGEM system is a patented process consisting of a suspended growth activated sludge system (biological reactor) integrated with a ZENON ultrafiltration membrane system. Ultrafiltration utilizing the ZeeWeed (Figure 1) membranes is a vacuum-driven process in which the wastewater is drawn through the surface of a membrane capable of separating both insoluble materials (bacteria, colloids, suspended solids, oils) and higher molecular weight soluble matter from the influent. As the membranes act as a physical barrier

between the feed and the permeate (influent and effluent), effluent quality is consistently above the requirements of the legislated discharge criteria.[2]

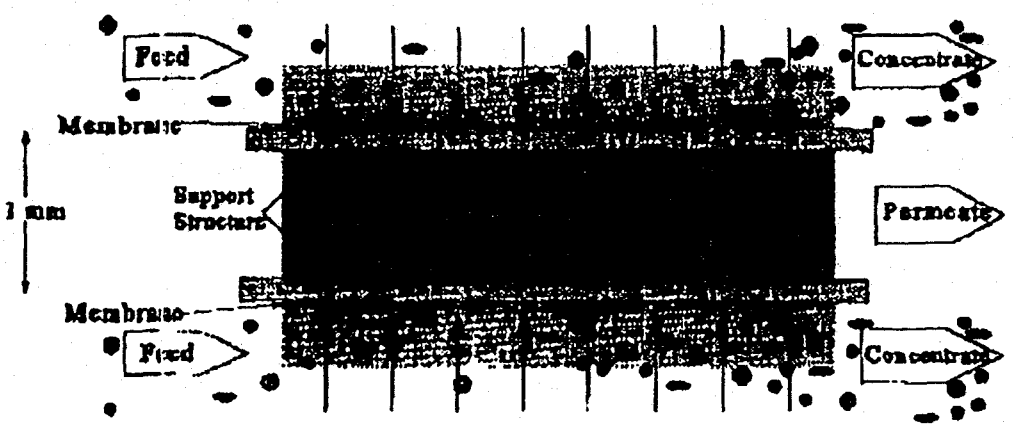


Figure 2: Hollow-Fibre Membrane Technology - An Outside-In Process

4.1.3 The Reduction or Elimination of Tertiary Wastestreams

ZenoGEM achieves the highest effluent quality attainable. By treating the waste stream with the ZenoGEM system and biologically destroying the bulk of the organic contaminants in the bioreactor, a substantial increase in the efficiency of destruction is achieved. In fact, the ZenoGEM produces in the order of 80% less sludge than conventional secondary treatment systems. Further, as ZenoGEM is a destruction technology, not a separation technology, real cost savings may be realized in the reduction or elimination of tertiary waste streams that normally require post-treatment processes.

The use of membranes also eliminates the requirement for chemical addition for the flocculation and coagulation of solids in the filtrate treatment systems. As an option, HM&A has the opportunity to install a sludge dewatering system consisting of a Fournier Rotary Press. This will render any sludge from the plant

[2] The effluent quality (BOD$_5$ < 10 mg/L, TSS < 10 mg/L, Coliform < 10 MPN/100 mL) will ensure that the environmental impact on the discharge area is minimized.

landfillable, with the filtrate being passed back to the ZenoGEM for further treatment. In effect, this completes the cycle of treatment: no tertiary wastestreams are generated from a plant with this configuration.

4.1.4 Flexibility

Better flexibility in the rate of upgrading reduces the risk of unused infrastructure. Population growths are affected by many factors, of which, very few are under our control. Building infrastructure that will not be used to capacity for its useful life, is costly. HM&A will upgrade the Westview plant so that it is operated at full capacity, each year, until 2016, or in the event that the Hilltop project proceeds, the process equipment may be moved to the new site with very little in unrecoverable costs.

4.1.5 Inherent System Safety

The ZenWood membrane provides a fail-safe capability to the ZenoGEM system. Under no mode of failure is raw effluent discharged to the environment. Membrane based technology provides a physical separation based on molecular weight, eliminating the risk of carryover to the effluent (permeate). Also, if the membranes fail, it is in a mode that shuts off flow as opposed to a by-pass mode. The simplicity of the system also allows for an increased amount of remote process control. Each system is monitored by a PLC alarm circuit providing notification of alarm conditions to site custodial staff, HM&A and the manufacturer.

Additionally, the ZenoGEM system is able to handle spikes and irregular waste stream constituents, both by volume and concentration, without risk of losing control of effluent flow or quality.

4.1.6 Odour

The existing Westview treatment plant functions adequately, however, due to its proximity to housing, odour has been a significant issue. The proposed upgrade is an aerobic process which eliminates odour. This will allow this site and existing infrastructure to be used without problematic odour for neighbours.

4.1.7 Space Advantage

Municipal style treatment systems are typically land intensive, as they must provide adequate tankage such that the biological component of the treatment remains stable, while the hydraulic component is kept at low enough velocities to ensure settling. Those two components of wastewater treatment are referred to as Solids Retention Time (SRT) and Hydraulic Retention Time (HRT). In gravity-reliant treatment technologies these two parameters are coupled together. A conventional plant must therefore be designed to ensure a long HRT (in the order of 24 hours) to ensure settling and flocculation of the solids, resulting in large process tanks.

The ZenoGEM process does not rely on gravity for settling of solids, decoupling the traditional connection between SRT and HRT. As the membranes provide a physical barrier and are permeable to only low molecular weight molecules, the solids, organics, viruses and bacteria, are contained in the bioreactor, while allowing the hydraulic phase (the water, or treated effluent) to be continuously removed from the system. This ability allows the bioreactor to be run at a much greater concentration of solids and allows for a much longer retention of solids, while allowing the aqueous phase to pass, minimizing the tankage requirements.

SCHEDULE E - PERFORMANCE SPECIFICATIONS

The following are the Performance Specifications for the purposes of the Contract, being the quantitative and qualitative characteristics of treated effluent as it leaves the Westview Facility after Completion of the Upgrade, with the compliance of the treated effluent with the following Performance Specifications being determined in accordance with the Contract:

1. For flow less than 931,000 US gallons per day: 2 X Peaking Factor

   - BOD_5 < 10 mg/L
   - TSS < 10 mg/L
   - Faecal Coliform < 25 MPN / 100 ml

2. For flow greater than 931,000 US gallons per day: 2 X Peaking Factor

   - Primary Bypass
   - No disinfection

In addition, the treated effluent discharged by the Westview Facility after Completion of the Upgrade must in all respects meet applicable criteria set out in the *Draft Discharge Criteria* for wastewater treatment facilities, as they apply to tertiary wastewater treatment facilities, issued by the MOE and dated November 5, 1996, and any replacement or amendment thereto.

Rob

← As requested

PK

SCHEDULE F - CONSTRUCTION SCHEDULE

Date	Action to be Taken
July 15, 1997 - August 30, 1997	Preliminary Design
August 11, 1997 - August 12, 1997	Negotiate with MELP; Confirm all pricing
August 14, 1997 -	Submit Change of Works Request to MELP
August 28, 1997 - Sept. 11, 1997	Negotiate Terms of Contract with DOPR; Detailed Design Part I (HM&A)
Sept. 01, 1997 - Sept. 12, 1997	DOPR Design Review; Sign Contract with DOPR
Sept. 15, 1997 - Sept. 30, 1997	Submit Building Permit Application; Issue ELT Purchase Orders (Zenon, Fournier, Lakeside, PRA, Pre-Engineered Building Components)
Sept. 20, 1997 - October 15, 1997	Draft Sub-Contract Specifications and Sub-Contract Tender Documents
October 10, 1997 - October 30, 1997	Detailed Design Part II (Consultation); Public Sub-Contract Tenders
October 30, 1997	Issue Sub-Contracts
Sept. 15, 1997 - Nov. 15, 1997	Detail Design Part III (Zenon)
Nov. 15, 1997	Zenon Design Review
Nov. 20, 1997	Zenon Design Approval
Nov. 1, 1997 - Nov. 30, 1997	Upgrade Electrical Service; Forcemain Extension
Nov. 1, 1997 - Nov. 30, 1997	Footings, Trash Channels
[illegible]	Place Frames in Digesters

F-2

Date	Action to be Taken
Dec. 15, 199[illegible] - January 15, 1998	Erect Building over main tanks; Install Monorails
Noc. 30, 199[illegible] - Dec. 30, 199[illegible]	Erect Trash Building; Upgrade MCR Electrical Panels; Electrical Rough-in
Dec. 20, 199[illegible] - Dec. 30, 199[illegible]	Flex
January 1, 1998 - February 15, 1998	Outfit Trash Room/Headworks; System Pre-Wiring
	Zenon Equipment Installation
April 1, 1998 - April 15, 1998	Subcontract Work; Final Wiring; System Plumbing (Air, Permeate, Sludge)
April 15, 1998 - April 30, 1998	Flex, Catch-up
March 15, 1998 - March 20, 1998	Empty and Clean East Tank Sections; Inspect Tank Wells
March 15, 1998 - June 15, 1998	Operate Existing Treatment Plan on West Section Only; Level and Secure Frames; Tank repairs and coatings as required
March 15, 1998 - March 30, 1998	Terminations
April 1, 1998 - April 15, 1998	End to End Checks; Wet Testing
April 1, 1998 - May 15, 1998	Seeding and Start-up (Commissioning)
April 15, 1998 - May 30, 1998	Biomass Monitoring & Start-up
June 15, 1998 - June 30, 1998	Flex
June 30, 1998	Completion (meet Performance Specifications)

SCHEDULE G - DETERMINATION OF SUBSTANTIAL COMPLETION AND COMPLETION

For the purposes of the Contract, achievement of Substantial Completion and Completion is to be determined in accordance with the following:

Determination of Substantial Completion

Substantial Completion of the Work is reached on the date on which the Contractor's Representative issues a certificate of Substantial Completion to the Owner, which the Contractor's Representative shall do as of the date on which the Contractor's Representative has determined the Work has reached Substantial Completion determined in accordance with the *Builders Lien Act*.

Determination of Completion

Completion of the Work is reached on the date on which both of the following have occurred:

(a) a Professional Engineer, acceptable to the Owner, has certified to the Owner under professional seal that Completion has been reached; and

(b) not less than three consecutive treated effluent samples, taken at least two days apart on discharge from the Westview Facility, have been shown to meet the Performance Specifications by having been tested by an independent professional testing laboratory acceptable to the Owner, with the results of those tests having been confirmed in writing by that laboratory to the Owner.

SCHEDULE H - GENERAL DESCRIPTION OF UPGRADE AND OTHER MATTERS

I. UPGRADE

This section describes, in general terms, the major components that are to be comprised in the Upgrade in order to meet the Performance Specifications and achieve Completion and includes the components and options set out in the August 28, 1997 Contract review meeting between the Contractor and the Owner. (An asterisk indicates an option chosen by the Owner at the August 28, 1997 meeting and sets out the price therefor, which is extra to the Contract Price.)

A. Services Supplied by Contractor

1. Design
2. Project Management
3. Start-up
4. Operator Training

B. Infrastructure and Equipment Supplied and Performed

1. Headworks Facility

1. 3 Concrete Channels for Trash Removal
2. 2 Grit Removal Channels
3. 3 Drum Screen Channels
4. Flow Measurement Appliance (Main)
5. Flow Measurement Appliance (Drum Screens)
6. All Flow Control Stop Gates
7. Treatment Plant Flow Control Valve
8. Ultrasonic Level Measurement Equipment
9. Sludge Dewatering Bay With Access Ramp
10. Inlet and Outlet Manholes
11. Headworks Building (57ft 6in.) by 36ft 6in.) meeting all B.C. Building Code and WCB standards. (Exterior finish and roofing material matching other buildings on site.)
12. Access Driveway and Cake storage bins
13. Screening Storage Containers
14. Bulking Agent Storage Bin
15. Perforated Plate Auger Type Trash Removal Equipment Rated for 5,000 US gallons per day
16. Manual Barscreen for Emergency Bypass Channel

17. Drum Screens rated for 3.0 MGPD (US)
18. Fournier Sludge Dewatering Press
19. Polymer Handling Equipment

2. Existing Machinery Control Building

1. Back-up Diesel Generator rated at 200 KW
2. Integral Fuel Tank for 1.5 days continuous running at full load
3. *Underground Electrical Service (Price: $54,00.00 plus GST)
4. New Main Power Panels and Transfer Switch
5. New PLC and MCC Panel
6. New PC and MMI Software
7. 3 Lamson Centrifugal Blowers
8. Exterior cladding to match other buildings on site
9. Pitched Roof Trusses and Roofing Materials to match other buildings on site

3. Treatment Plant Building Over Existing Tanks

1. New 93ft by 90ft building on top of existing tank walls as shown in drawing approved by Owner and reproduced on page H-7 of this schedule
2. New 12ft wide walkway on North West and South sides of New Building
3. 16 cassettes of Zenon ZW-500 membrane modules
4. Stainless steel membrane frames
5. 4 permeate extraction pumps
6. UV disinfection unit rated at 2,000 US gallons per day
7. 2 Membrane Backwash and Clean-in-place Systems
8. 2 Membrane Soaking tanks
9. Membrane hoist for inspection and removal

The parties agree that the design matters discussed at the September 8, 1997 building design meeting, the minutes from which form page H-6 of this schedule, are relevant in determining the design of the treatment plant building.

4. Composting Facility

1. In vessel composting unit rated at 3.0 m^3 per day

C. Further Options Available To Owner

The Contractor and the Owner agree that any one or more of the following items shall be added to the Work, but only if the Contractor and the Owner first agree on the price for any such item:

1. Forcemain Extension to Headworks Building
2. Entrance Pillars and Fence for Work Site
3. Grease Decant Chamber and Plumbing at Lift Station

II. ASSUMPTIONS UNDERLYING CONTRACT

Any variation from the following assumptions is to be dealt with by a change in the scope of the Work pursuant to the general conditions. The Owner acknowledges and agrees that the following assumptions have formed the basis for the Contractor's Proposal and the Contract Price

1. Uniform structural fill existing at the Work Site.
2. No pollutants, contaminants or toxic substances in fill or anywhere on the Work Site.
3. The structural integrity of existing tanks is in accordance with design drawings therefor, and that no deterioration has occurred that will affect their strength (provided that a professional engineer to inspect these matters is at the sole option of the Contractor and at the sole risk and expense of the Contractor).
4. The Owner has a suitable disposal method for screenings that is satisfactory to MOE.

III. INFORMATION TO BE PROVIDED BY THE OWNER TO THE CONTRACTOR

The following information is to be provided by the Owner to the Contractor as promptly as is practicable after execution of the Contract by the Owner:

1. Design documentation for the existing Westview Facility with regard to treatment processes, showing capacity of entire plant (permit compliant), main parshall flume, bypass parshall flume, main/bypass channels, trough feeding east half of treatment plant, trough feeding west half of treatment plant, east half of plant independently (permit compliant), and west half independently (permit compliant).
2. Design drawings for the Westview Facility with regard to treatment processes, including hydraulic profile.
3. Geotechnical report on fill located below the existing treatment tanks and existing equipment building on the Work Site.
4. Drawings displaying the electrical power, distribution and control for the Westview Facility.
5. Structural drawings for the existing tanks and buildings at the Work Site comprised in the Westview Facility.
6. Schematic drawings of the Owner's sanitary sewer collection system.
7. Drawings of the Grief Point lift station arrangement comprised in the Owner's sanitary sewer system.

IV. TRAINING AS PART OF WORK

As part of the Work, and included in the Contract Price, the Contractor shall provide the classroom and hands-on training services described on page H-5 of this Schedule.

H-5

Supplementary Schedule to Contract

Training Provided by Hill, Murray and Associates Inc.

Hill, Murray and Associates Inc. will provide classroom and hands-on training services for up to three personnel from the Owner. Hands-on training will be provided by both Zenon and HM&A instructors. Both classroom and hands-on training services are included in the contract price. Additional training if requested by the Owner will be considered extra work under the terms of the contract.

Classroom Training

Topics covered:	Development of Membrane Systems Basic Membrane Theory Basic System Design Operator Requirements Limits of Operation Reporting Procedures (Zenon) Advanced System Design
Format:	Classroom training and question & answer periods Two days - 8:00 a.m. - 4:00 p.m.
Material supplied:	Membrane System Handbook
Evaluation:	An examination is administered with results forwarded to the Owner.
Location:	Classes are conducted in Victoria at HM&A offices. Transportation, accommodation and meals are responsibility of the Owner.

Hands-On Training

Topics covered:	Aeration System Permeate System Sludge System Membrane Handling Electrical and Control Ventilation System Sludge Dewatering System In-Vessel Compost System
Format:	Field training is conducted one on one by Zenon and HM&A staff on site on actual equipment during testing and start-up phases of the project.
Material Supplied:	Sample Round Sheets
Evaluation:	Participants will be given pass/fail indication at the end of the training sessions. Failed sessions will have to be repeated.
Location:	Westview Treatment Plant

September 9, 1997

WESTVIEW WATER RECLAMATION FACILITY

Building Design Meeting - September 8, 1997

Minutes

Present:	Gino Francescutti	Rob Murray
	Sandi Carmen	John Bell
	Gerry Gray	Glenn Kerr
	Gord Crawford	
	Jim Greenwood	

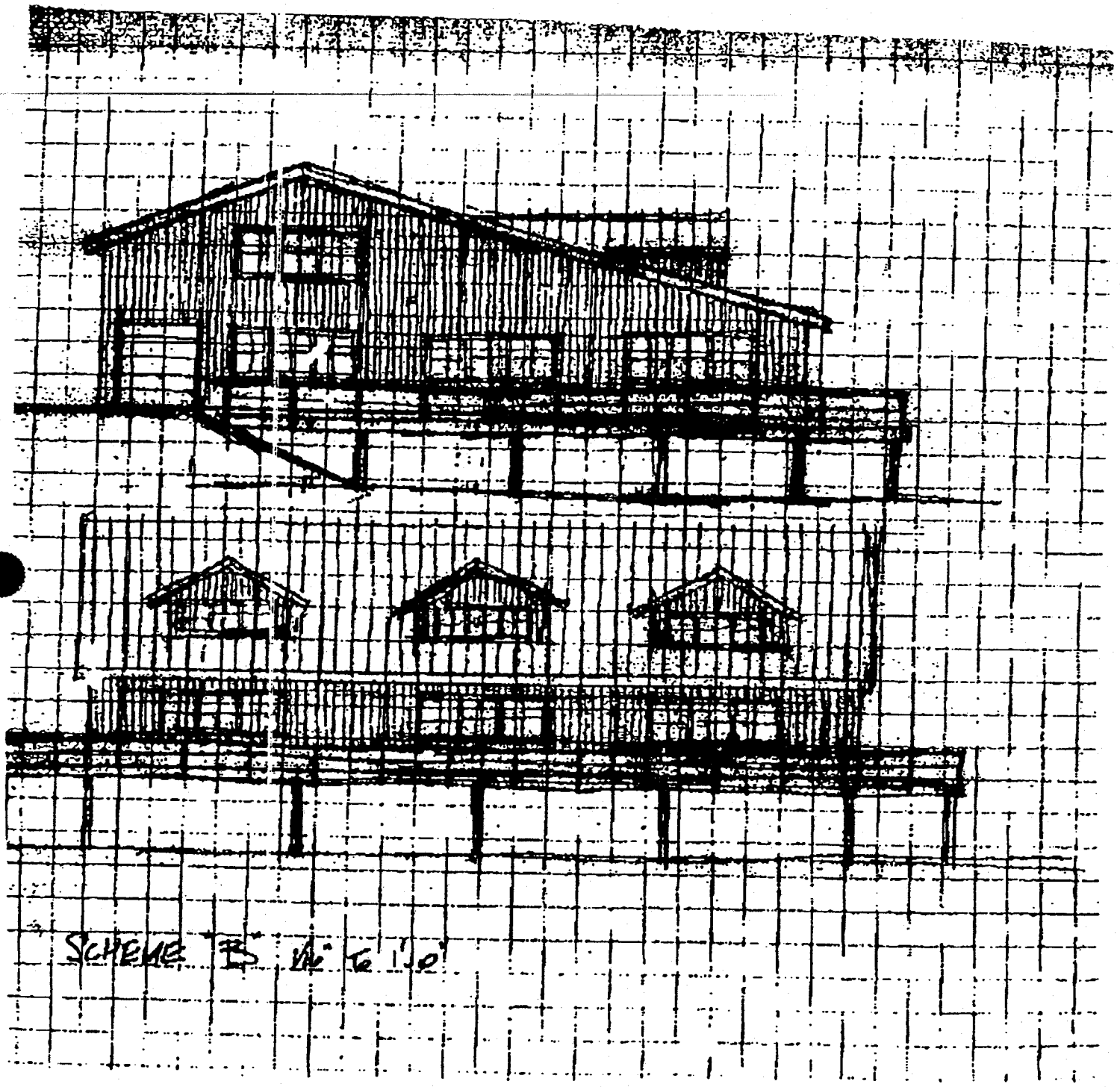
Rob Murray and John Bell of Hill, Murray and Associates (HMA) presented colored drawings of the treatment plant building and a color site plan of the Westview Wastewater Treatment Plant site.

The main building and surrounding walkway were discussed. Color drawings showing two color schemes were shown. The preferred design shown included a dual pitch roof with 6/12 pitch facing Willingdon Avenue and 3/12 pitch facing the waterfront. Three large false dormers were shown on the front and back of the building. Standing seam metal roofing material was specified. Several options for exterior cladding including concrete stucco and cedar siding were discussed. Several points were put forward regarding exterior cladding and construction materials.

Cedar Siding:	Higher maintenance requirements, more susceptible to deterioration. Creosote based stain would offer the longest time between staining.
Roof Insulation:	Roof insulation would be a requirement to reduce condensation and noise transmission.
Guardrail Detail	Building code requirements would have to be met.

There was substantial agreement on the overall design with the blue roof, grey cladding option being generally preferred.

H-7



SCHEDULE I - OWNER'S WORK

The following describes, in general terms, the Work to be performed by the Owner as the "Owner's Work" for the purposes of the Contract:

1. The Owner shall survey the Grief Point lift station and correct the odour of incoming sewage connected with that lift station.
2. The Owner shall eliminate or intercept grease from the Owner's sanitary sewer collection system so that it does not enter the Westview Facility.
3. The Owner shall be solely responsible for additions or improvements to landscaping beyond any landscaping altered or damaged by the Contractor in connection with the Work, which landscaping shall be repaired by the Contractor to as close as is practicable to its pre-Work Condition.
4. The Owner shall remove fencing around the Work Site as necessary for the Contractor to perform the Work and the Owner shall remove that fencing at Completion.
5. The Owner shall operate the Westview Facility as necessary during the Work, including by transferring the functions of the Westview Facility to the west half of that facility, having closed the east side of the Westview Facility. The Owner shall also empty and clean the west side of the Westview Facility immediately after Completion.
6. The Owner shall service the compost site contemplated as a consequence of the Upgrade, including by providing electrical service thereto, fencing and control of access, and covered storage of composted material, all to the satisfaction of the MOE.
7. The Owner shall, at its expense, provide an operator for the Westview Facility, and all water, power, light and heat necessary to and for the Work on the Work Site.

SCHEDULE OF DRAWS

Project: Waterview Plant Upgrade
Rep/Engineer: Hill, Murray & Associates Inc.
Client: Municipality of Powell River
Date: 17-Jul-97

1997 | 1998 Schedule of Draws

DRAWS LINE ITEMS	BUDGET	%	1997 JUL	%	AUG	%	SEP	%	OCT	%	NOV	%	DEC	%	JAN
ENGINEERING	[illegible]	5%	27,741.47	60%	[illegible]	10%	73,604.05	0%	0.00	0%	0.00	0%	0.00	0%	0.00
SUB-CONTRACTS	[illegible]	0%	0.00	0%	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PROCESS EQUIPMENT	[illegible]	0%	0.00	0%	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10%	[illegible]	10%	[illegible]
PROJECT MANAGEMENT	[illegible]	0%	0.00	0%	0.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10%	[illegible]	10%	22,003.55
GOODS & SERVICES TAX	[illegible]		1,842.16		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]
PROJECT TOTALS	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]

%	FEB	%	MAR	%	APR	%	MAY	%	JUN	%	JUL	%	TOTAL
0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	[illegible]	[illegible]
10%	[illegible]	10%	[illegible]	0%	[illegible]	0%	0.00	0%	0.00	0%	0.00	[illegible]	[illegible]
10%	[illegible]	10%	[illegible]	0%	[illegible]	0%	0.00	0%	0.00	0%	0.00	[illegible]	[illegible]
10%	22,003.55	10%	22,003.55	10%	22,003.55	0%	0.00	0%	0.00	0%	0.00	[illegible]	[illegible]
	[illegible]		[illegible]		[illegible]		0.00		0.00		0.00		[illegible]
	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]

J-1

SCHEDULE J - PAYMENT SCHEDULE

SCHEDULE OF DRAWS

Project: ***Westview Plant Municipal Upgrade***
Rep/Engineer: Hill, Murray & Associates Inc.
Client: Municipality of Powell River
Date: 17-Jul-97 1997 | 1996 Schedule of Draws

DRAWS LINE ITEMS	BUDGET	%	1997 JUL	%	AUG	%	SEP	%	OCT	%	NOV	%	DEC	%	JAN
ENGINEERING	$508,348	5%	27,745.47	80%	406,678.13	15%	73,924.06	0%	0.00	0%	0.00	0%	0.00	0%	0.00
SUB-CONTRACTS	$849,240	0%	0.00	0%	0.00	25%	212,310.04	15%	127,386.03	15%	127,386.03	10%	84,924.02	10%	84,924.02
PROCESS EQUIPMENT	$3,640,640	0%	0.00	0%	0.00	25%	910,159.92	15%	546,095.95	15%	546,095.95	10%	364,063.97	10%	364,063.97
PROJECT MANAGEMENT	$220,035	0%	0.00	0%	0.00	15%	33,005.32	15%	33,005.32	15%	33,005.32	15%	33,005.32	10%	22,003.55
GOODS & SERVICES TAX	$365,278		1,942.18		28,467.47		86,057.95		49,454.11		49,454.11		33,739.53		32,969.41
PROJECT TOTALS	$5,583,541		$29,687.65		$435,145.60		$1,315,457.30		$755,941.41		$755,941.41		$515,732.84		$503,960.94

%	FEB	%	MAR	%	APR	%	MAY	%	JUN	%	JUL	%	TOTAL
0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	100%	$508,347.66
10%	84,924.02	10%	84,924.02	5%	42,462.01	0%	0.00	0%	0.00	0%	0.00	100%	$849,240.17
10%	364,063.97	10%	364,063.97	5%	182,031.98	0%	0.00	0%	0.00	0%	0.00	100%	$3,640,639.68
10%	22,003.55	10%	22,003.55	10%	22,003.55	0%	0.00	0%	0.00	0%	0.00	100%	$220,035.49
	32,969.41		32,969.41		17,254.83		0.00		0.00		0.00		$365,278.41
	$503,960.94		$503,960.94		$263,752.37		$0.00		$0.00		$0.00		$5,583,541.41

TAB F

1. Forcemain Extension to Headworks Building
2. Entrance Pillars and Fence for Work Site
3. Grease Decant Chamber and Plumbing at Lift Station

II. ASSUMPTIONS UNDERLYING CONTRACT

Any variation from the following assumptions is to be dealt with by a change in the scope of the Work pursuant to the general conditions. The Owner acknowledges and agrees that the following assumptions have formed the basis for the Contractor's Proposal and the Contract Price

1. Uniform structural fill existing at the Work Site.
2. No pollutants, contaminants or toxic substances in fill or anywhere on the Work Site.
3. The structural integrity of existing tanks is in accordance with design drawings therefor, and that no deterioration has occurred that will affect their strength (provided that a professional engineer to inspect these matters is at the sole option of the Contractor and at the sole risk and expense of the Contractor).
4. The Owner has a suitable disposal method for screenings that is satisfactory to MOE.

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6. Schematic drawings of the Owner's sanitary sewer collection system.
7. Drawings of the Grief Point lift station arrangement comprised in the Owner's sanitary sewer system.

TAB G

The Corporation of the District of Powell River

MUNICIPAL HALL
6910 DUNCAN STREET
POWELL RIVER, B.C.
V8A 1V4

MUNICIPAL HALL (604) 485-6291
ENGINEERING SERVICES (604) 485-8604
FAX (604) 485-2913

RECEIVED
MAY - 7 1997
Hill Murray & Associates Inc.

OFFICE OF
ENGINEERING TECHNICAL MANAGER

May 6, 1997

Hill Murray & Associates Inc.
Suite 202, 780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

VIA COURIER

Attention: Trevor T. Hill, P. Eng.
President

Dear Sir:

Please find enclosed "As Constructed" drawings for the Westview Sewage Treatment Plant and the Townsite Sewage Treatment Plant. Also included are photocopies of design flows as calculated by Reid Crowther & Partners Ltd.

If you require any further information please do not hesitate to call the undersigned.

Yours truly,

R. Stogre

Richard Stogre, A.Sc.T.
Engineering Technical Manager

RS/lf

enclosures:

Rob/
For your review
- MBR upgrade
- existing extended operation
facility
Trev

whether it is real or whether it is a result of the test shortcomings noted earlier. Until this anomaly is resolved, it is recommended that unit BOD and TSS loads be based on a more 'normal' value of 0.075 kg/c·d.

2.7 DESIGN FLOWS AND LOADS

Based on the design populations and the unit rates of flow and load derived in the preceding sections, design flows and loads can be derived for the two plants. These are listed in Table 2.8.

Table 2.8: Design Flows and Loads for the Townsite and Westview Plants

Description	Westview Plant	Townsite Plant	Combined Catchments
Design Population	9,400	5,100	14,500
Mill Staff		1,500	1,500
Design Flows			
AAF, m^3/d	3,950	3,410	7,360
ADWF, m^3/d	2,820	2,725	5,545
MMF, m^3/d	6,580	4,460	11,040
MWF, m^3/d	9,635	5,480	15,115
MDF, m^3/d	13,065	6,575	19,640
PWWF[2], m^3/d	25,990	9,380	35,370
Design Loads			
BOD			
Average, kg/d	705	410	1,115
Max. Month, kg/d	845	490	1,335
TSS			
Average, kg/d	705	410	1,115
Max Month, kg/d	880	515	1,395

TAB H

HILL, MURRAY & ASSOCIATES INC.

ENVIRONMENTAL SYSTEMS ENGINEERS

Meeting the Draft Municipal Sewage Regulation Standards for Discharge to Water for Combined Sewer Overflow Conditions through the Combination of Membrane-Bioreactor and Micro-Screen Technology

February 25, 1998

Suite #202 - 780 Tolmie Ave, Victoria, British Columbia CANADA V8X 3W4
(250) 388-3930 FAX: (250) 388-3943

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3.0 Concept of Operations 1

4.0 Pilot Unit Set Up 2
- 4.1 Basic Operation 3
- 4.2 Operational Data 4
- 4.3 Operations 4

5.0 Effect of the Application of MBR and Micro Screen Technology to the I&I-Limited Municipal Plant 5

6.0 Conclusions 6

1.0 Introduction

Many municipal wastewater treatment plants suffer excessive peaking flows due to infiltration and inflow (I&I). In many cases, these peaking flows can exceed the treatment capacity of the plant by many times, resulting in discharges of raw, unscreened influent or carryover from the treatment process to the receiving environment. The nature of these discharges can result in non-compliance with permit regulations.

The sewage collection infrastructure at a municipal site is typically of varying ages and in various stages of serviceability. In addition, there are usually unauthorized (or in the case of Combined Sewer Overflows, or CSO, authorized or accepted) connections of the storm sewer to the sanitary sewer. Typically, the costs associated with repairing and maintaining the collection system are staggering, as are the costs of upgrading an existing or building a new treatment facility to treat the I&I problem. As a result, an effective means of treating the full flow to the permit levels is required.

2.0 The Draft Regulation

The BC Ministry of Environment has undertaken a comprehensive re-write of the sewage discharge regulation to address advances in technology and increased environmental concern over sewage discharges. Included in the new assessment is the realization that many municipalities are faced with a CSO condition, which could require significant investment in capital dollars to address a problem which could require 10 years for successful resolution. As a result, the draft regulation recognizes the need for a stepped approach to treatment in these conditions of high infiltration and inflow (I&I). For applications in open marine waters, the following criteria are applied:

Flows < 2.0 ADWF	Treatment Required: Secondary BOD_5 < 45 mg/L TSS < 45 mg/L
Flows > 2.0 ADWF	Treatment Required: Primary (may be interpreted as) BOD_5 < 130 mg/L TSS < 130 mg/L

This paper will show that through the selection of a treatment system that provides an exceptionally high level of treatment, I&I flows can be managed through screening, dilution and mixing: allowing I&I flows to be superimposed on the treated volume or "base" flow. In this way, "peaking" flows can be handled without sacrificing total flow quality. The key, then, is to provide a dilution medium of sufficient quality to meet permit requirements during peak flows. Membrane Bioreactor (MBR) technology offers great advantage in this regard.

Provided the base flow can consistently meet very high treated water quality, the concept of treatment by screening and dilution can be an effective means of dealing with exceptionally high peaking factors.

3.0 Concept of Operations

In order to effectively employ a screening and dilution operational philosophy, the following are required:

A highly renovated "base" flow (base flows are up to 2.0 x ADWF)
A means of screening the peak flows to remove a portion of TSS and particulate BOD
A means of controlling the flows to meet the required permit levels.

By employing MBR technology for the base flow, the first requirement is easily met (MBRs consistently

produce exceptionally high effluent quality: BOD < 5 mg/L, TSS < 5 mg/L and act as the ideal base for an effective dilution strategy).

The second criteria can be established through a raw sewage screening mechanism whose mesh size provides for the proper removal of contaminants. The thrid aspect is simplya means of controlling flows to ensure compliance with regulations (i.e. treatment to 2.0 ADWF).

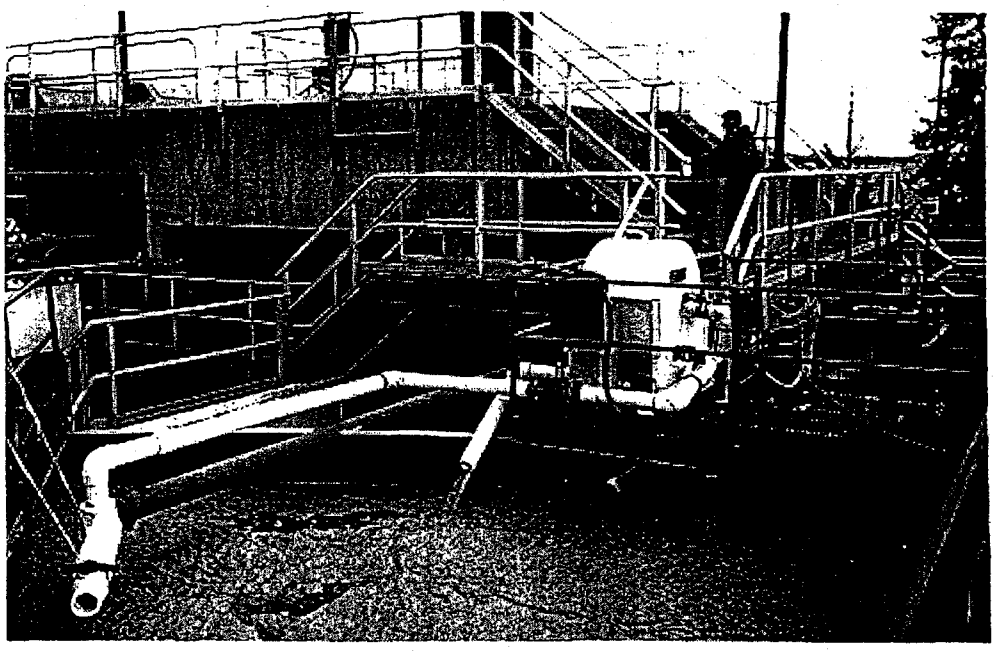
4.0 Pilot Unit Set Up

In order to meet the screening or polishing requirement, a pilot operation was initiated to determine the effect of micro-screening on influent raw wastewater, and to determine if any adverse operational effects were encountered. For the trial, the micro-screen was supplied by PRA Manufacturing Ltd. While numerous tests had been performed by PRA and other firms on various influent wastestreams, there was concern over the ability of the screens to handle raw wastewater of the constituent level expected in a typical municipal plant (BOD/TSS ~ 170 mg/L). Other concerns were whether the particle size encountered in raw wastewater would cause permanent fouling of the mesh screens. In addition, the background data required to determine the flow capacity of micro screens in raw wastewater did not exist.

PRA's pilot micro screen was installed at CRD's Central Saanich Wastewater Treatment Plant on 9-10 October 1997. This unit is supplied at the following specifications:

Mesh Area 5 ft^2
The screen size for the pilot unit was 20μ.

The system was installed to receive wastewater from the treatment module #2 flow splitter via a Sensus turbine flow meter. Both screenings and screened wastewater were discharged back to the treatment module #2.

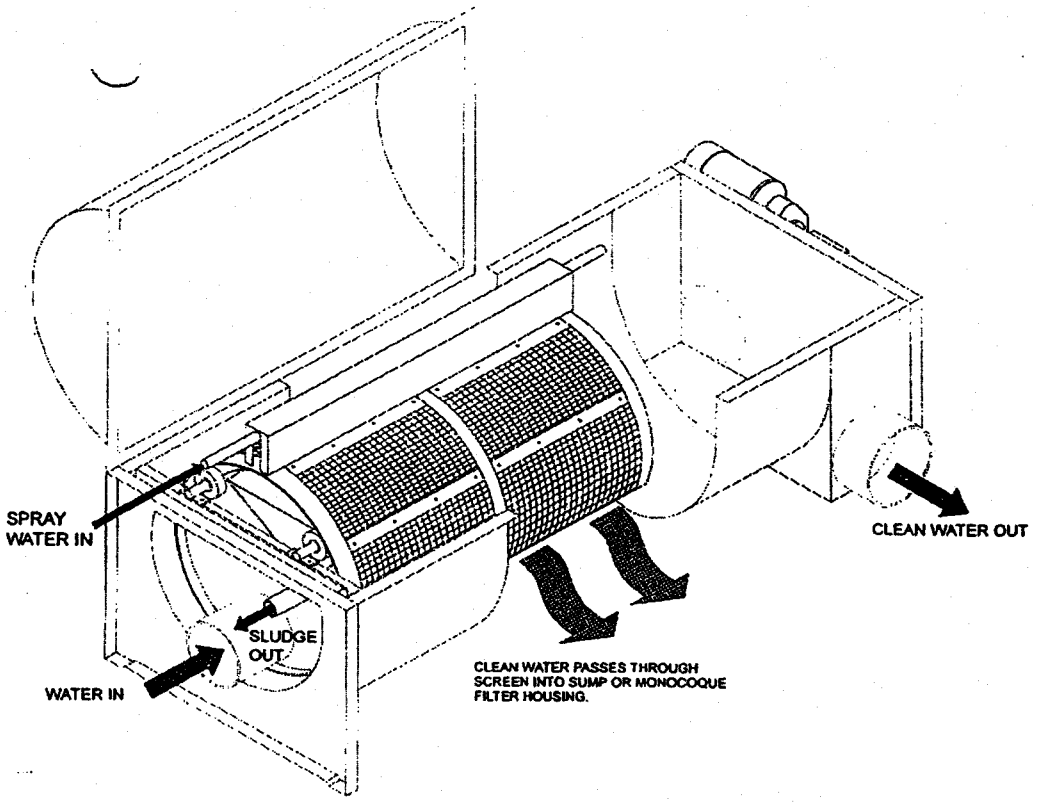


Pilot Installation of PRA Micro-Screen

4.1 Basic Operation

The micro screen acts as a continuous filtering mechanism for suspended solids in the raw wastewater (see figure 1). The meshing material is located around the circumference of the drum. The raw wastewater flows into the unit through a fitting that directs the water to the interior of the drum. As the wastewater enters, it flows through the mesh and the mesh traps suspended solids. As the mesh gets progressively more fouled, the water level in the drum rises, activating a float switch. This float switch activates the drum rotation and the washwater spray solenoid valve, which operate for a preset period of time or until the liquid level is below the float switch. As the drum rotates, the screen carries solids collected by the lower portion of the screen. The solids built up on the screen are washed onto a tray assembly and discharged from the side of the unit, leaving the mesh clean to collect more solids from the wastewater. Filtered water leaves the unit from the bottom of the annulus surrounding the drum mechanism. After a preset time, the drum stops rotating and the wash water is isolated. Once the level in the micro screen again trips the float, the process is repeated.

Any flows that exceed the capacity of the unit spill over the top of the unit and are directly discharged. The sealing elements for the drum are rubber seals bearing against the drum assembly.



Schematic of Micro-Screen - Figure 1

4.2 Operational Data

During the Central Saanich trial, the pilot micro screen was operated at an influent flow of approximately 170 L/min. The flow varied from 193 L/min at the start of a cycle (when the drum was clean) to 164 L/min as the screen was blocked off. The screen consistently began rotating as the influent flow reduced to 170 L/min.

In order to assess the effectiveness of the treatment provided by the micro screen, an analytical sampling regime was instituted to determine the constituent reduction. Samples were taken at various intervals from the system and at various points in the separation process. These samples were analyzed at JB Laboratories in Victoria.

The following lab data was collected for the trial:

Date	Parameter	Influent	Effluent	% Reduction
10 Oct 97	BOD	250	150	40%
	TSS	176	70	60%
15 Oct 97 - 100% Washwater	BOD	210	130	38%
	TSS	204	84	59%
15 Oct 97 - 10% Washwater	BOD	260	144	45%
	TSS	208	83	60%
15 Oct 97 - 10% Washwater	BOD	206	142	31%
	TSS	196	74	62%

All BOD & TSS results in mg/L

The results show a significant level of BOD and TSS reduction (38% and 60% respectively).

In addition, TSS samples from the screenings discharge were taken as were TSS samples from the internal drum area:

Screenings	Sample #1	3150 mg/L
	Sample #2	3010 mg/L
Drum Liquid	Sample #1	322 mg/L
	Sample #2	256 mg/L

These analytical results show that the solids were in fact being captured by the screen and discharged from the unit (rather than simply collecting in the drum).

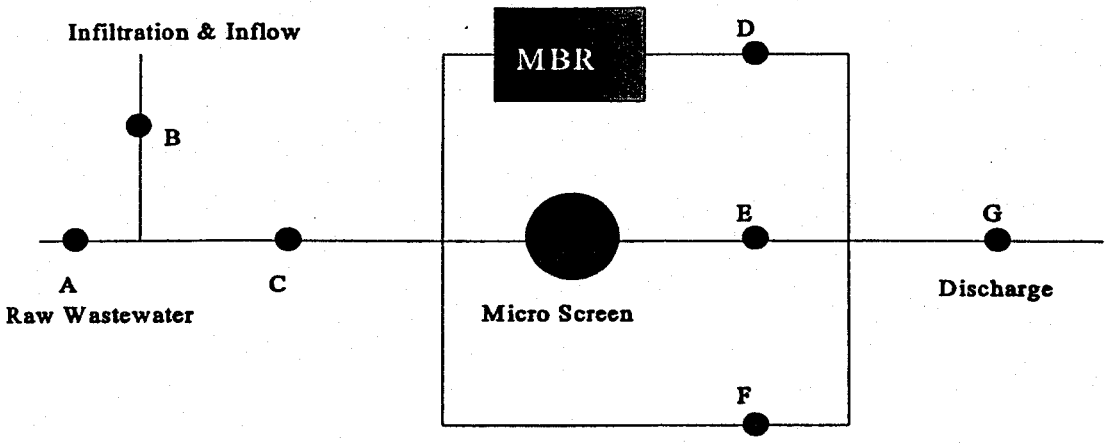
4.3 Operations

The PRA Micro Screen operated without difficulty after commissioning. The unit was operated in automatic mode for the duration of the trial. No significant fouling of the mesh surfaces was encountered, nor was there any bypassing of raw wastewater to the discharge. It is anticipated that the unit can operate unmanned, except for routine operational checks consistent with other machinery.

5.0 Effect of the Application of MBR and Micro Screen Technology to the I&I-Limited Municipal Plant

In order to assess the suitability for the combination of MBR and micro screen technologies to meet the needs of treating I&I in a municipal application, a model was developed to determine the treated water quality at all points in the treatment process and at all flow rates.

For the purposes of this model, a plant was schematically modeled as shown:



Schematic Model of Plant - Figure 2

In order to run the model, the following parameters were input:

Influent (Point A)	BOD	170 mg/L
	TSS	170 mg/L
	Flow	Variable Peak flow: 3000 m^3/day
Infiltration & Inflow (Point B)	BOD	30 mg/L
	TSS	30 mg/L
	Flow	Variable Peak Flow: 26000 m^3/day
MBR Discharge (Point C)	BOD	5 mg/L
	TSS	5 mg/L
	Peak Treatment Capacity	7500 m^3/day
Micro Screen Discharge (Point E)	BOD	38% reduction
	TSS	60% reduction
	Peak Treatment Capacity	6500 m^3/day

Using the data collected from this trial, and applying a mass balance to each point, the constituent components of the discharge can be predicted:

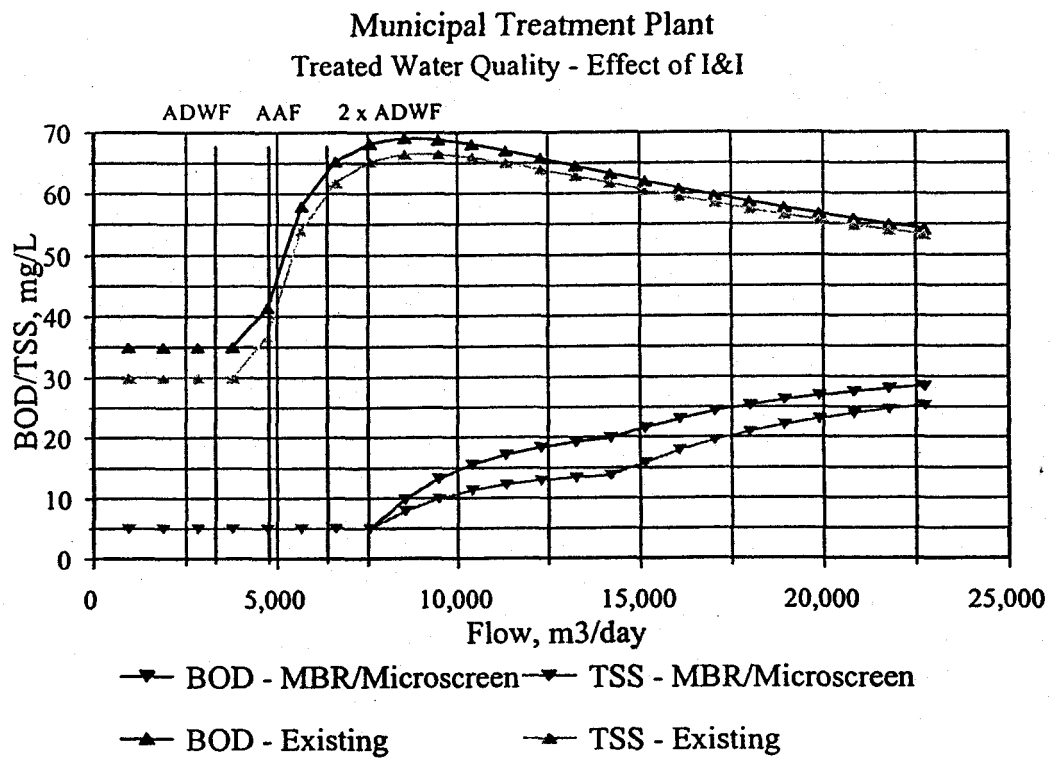


Figure 3

In this analysis, the sewage flow was assumed to peak at the ADWF, with the remainder of the flow being composed of I&I (at BOD/TSS of 30/30 mg/L). Superimposed on this analysis is the expected results from operating an existing plant (assuming the same flows, and a nominal treatment ability of BOD/TSS of 35/30 mg/L to a design capacity of 4500 m^3/day.

6.0 Conclusions

The combination of MBR and Micro-Screen technologies offers significant improvements to the level of treatment provided in extreme peaking events and allows for the extension of the "treatment envelope" to include I&I flows. The micro screen is very effective in reducing the influent BOD and TSS, effecting an average 38% removal of influent BOD and 60% removal of influent TSS.

The application of a treatment/screening/dilution philosophy is a valid method of meeting the requirements of the new regulation, provided a high quality treated water source is used as the base flow.

TAB I

NEW PERMIT for P. R.

BRITISH COLUMBIA

Date:	Tuesday, March 09, 1999	# of pages (including this sheet)	9
To:	**Richard Stogre/ Rob Murray**	Fax #	**(604) 485-2913/ (250)-655-8954**
Office:	District of Powell River/Hill Murray & Associates	Phone #	(604) 485-8604/ (250)-665-8953
From:	**Ed Lai** Pollution Prevention Lower Mainland Region, Surrey	Phone # Fax #	(604) 582-5269 (604) 584-9751
Re:	Draft Westview STP amended Waste Management Permit PE-73		

SPECIAL INSTRUCTIONS:

Enclosed please find a copy of a draft amended permit for the Westview STP to reflect discussions and new information we received. Please note the proposed changes and/or additions. The number in parenthesis refers to the relevant sections in the draft document.

1. Maximum discharge quantity has now been changed to 20,000 m^3/day (1.1.1) with an effluent quality of 45/45 for BOD_5/TSS. (1.1.2)
2. The requirement to meet 10/10 BOD_5/TSS and non toxic effluent for discharge quantity equal to or less than 4600 m^3/day has been replaced by Section 2.3 Optimization of Membrane Filtration Process.
3. Designated treatment works and authorized works have been modified. (1.1.3)
4. Disinfection requirement has been modified.(2.4)
5. Changes have been made to the Bypass clause to reflect bypassing of secondary treatment plant and treatment by rotating drum screens during rainfall events.(2.5)
6. Minor wording changes to Sludge Wasting and Disposal clause. (2.9)

Ministry of Environment, Lands and Parks

Environment and Lands
Lower Mainland Region
Pollution Prevention

Mailing/Location Address:
10470 152 Street
SURREY BC V3R 0Y3

Telephone: (604) 582-5247
Facsimile: (604) 584-9751
or (604) 582-5335

7. New requirements for Toxicity Assessment (2.12) and Membrane Filtration Backwash (2.13)

8. Revised toxicity monitoring requirement (3.1.4)

9. Revised report frequency (2.10) and submission date for Infiltration and Inflow strategy (3.3)

Please review the above changes and provide comments by March 29, 1999.

URGENT: No CONFIDENTIAL: No ORIG. IN MAIL: No

Material contained in this fax transmission may be confidential, and should only be delivered to the addressee. If you do not receive all pages, please call 582-5247.

PROVINCE OF
BRITISH COLUMBIA

BRITISH COLUMBIA

Pollution Prevention
10470 - 152 Street
Surrey, British Columbia
V3R 0Y3
Telephone: (604) 582-5200
Fax: (604) 584-9751

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

PERMIT
PE-00073

Under the Provisions of the Waste Management Act

THE CORPORATION OF THE DISTRICT OF POWELL RIVER

6920 Duncan Street

Powell River, British Columbia

V8A 1V4

is authorized to discharge effluent to the waters of Malaspina Strait from a municipal sewage treatment plant located near Willingdon Avenue and Courtenay Street, Powell River, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the *Waste Management Act* and may result in prosecution.

1 AUTHORIZED DISCHARGES

1.1 This section applies to the discharge of effluent from a **MUNICIPAL SEWAGE TREATMENT PLANT SERVING THE WESTVIEW AREA OF POWELL RIVER**. The site reference number for this discharge is E100924.

1.1.1 The maximum authorized rate of discharge is 20,000 cubic metres/day.

1.1.2 The characteristics of the discharge shall be:

5-day biochemical oxygen demand (BOD_5),	45 mg/L, maximum;
Total suspended solids (nonfilterable residue),	45 mg/L, maximum.

DRAFT

H.G. Maxwell
Assistant Regional Waste Manager

Date Issued: June 24, 1963
Date Amended:

1.1.3 The designated treatment works, approximately located as shown on attached Site Plan A, are:

- influent screens;
- grit removal works;
- secondary treatment plant including membrane filtration; and
- submerged outfall extending a minimum of 485.8 metres offshore and discharging to a depth of approximately 53.4 metres below low water.

Other authorized works include ultraviolet disinfection system, rotating drum screens, sludge handling, dewatering and digestion system.

1.1.4 The location of the facilities from which the discharge originates is Lot 3 Blocks 6 & 7, Plan 6825; Lot 8, Block 9, Plan 5096; Lot 1, Block 9, Plan 7075; all of District Lot 5307, and Lots D & E, Water Lot 5914, NWD.

1.1.5 The location of the point of discharge is Malaspina Strait approximately 490 metres northeast of Lot 8 Plan 5096, District Lot 5307, NWD.

2 GENERAL REQUIREMENTS

2.1 Maintenance of Works

The permittee shall inspect the authorized works regularly and maintain them in good working order. Notify the Regional Waste Manager of any malfunction of these works.

2.2 Process Modifications

The Regional Waste Manager shall be notified prior to implementing changes to any process that may adversely affect the quality and/or quantity of the discharge.

2.3 Optimization of Membrane Filtration Process

The permittee shall optimize utilization of the membrane filtration component of the secondary treatment plant to the fullest extent of the design capacity in a manner acceptable to the Regional Waste Manager.

2.4 Disinfection

Disinfection of the effluent shall be carried out between May 1 and September 30, inclusive, by ultraviolet radiation or other alternatives acceptable to the Regional Waste Manager.

DRAFT

2.5 Bypasses

The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing. For the purpose of this permit, bypassing does not include bypass of the secondary treatment plant for the portions of the flow exceeding the optimum design capacity of the secondary treatment plant during rainfall events provided that the bypassed effluent is treated by the authorized rotating drum screens.

2.6 Emergency Procedures

In the event of an emergency which prevents compliance with a requirement of this permit, that requirement will be suspended for such time as the emergency continues or until otherwise directed by the Regional Waste Manager provided that:

a. Due diligence was exercised in relation to the process, operation or event which caused the emergency and that the emergency occurred notwithstanding this exercise of due diligence;

b. The manager is immediately notified of the emergency; and

c. It can be demonstrated that everything possible is being done to restore compliance in the shortest possible time.

Notwithstanding (a), (b), and (c) above, the manager may require the operation to be suspended or production levels to be reduced to protect the environment while the situation is corrected.

2.7 Posting of Outfall

A sign shall be erected along the alignment of the outfall above high water mark. The sign shall identify the nature of the works. The wording and size of the sign shall be acceptable to the Regional Waste Manager.

2.8 Outfall Inspections

The permittee shall have the outfall inspected once each five years by independent qualified personnel to ensure it is in good condition. An inspection report shall be submitted to the Regional Waste Manager within 30 days after the inspection date. The next report shall be submitted by **June 30, 2003**.

DRAFT

H.G. Maxwell
Assistant Regional Waste Manager

2.9 Sludge Wasting and Disposal

Sludge wasted from the treatment plant shall be processed by mesophillic digestion and dewatering prior to disposal or utilization in a manner approved by the Regional Waste Manager, or as authorized by regulation under the *Waste Management Act*.

2.10 Infiltration and Inflow Strategies

The permittee shall prepare annual reports on works undertaken to minimize infiltration and inflow of stormwater and groundwater into the sanitary sewer system. The report shall include, but is not limited to, initiatives such as identification and elimination of stormwater connections to sanitary sewer, replacement and repairs of leaking pipes and appurtenances, standardization of construction standards, development and enforcement of local bylaws, education initiatives, identification of management options, and performance measures of each initiative.

2.11 Facility Classification and Operator Certification

The permittee shall have the works authorized by this permit classified by the Environmental Operators Certification Program Society (Society). The works shall be operated and maintained by persons certified within and according to the program provided by the Society. Certification must be completed to the satisfaction of the Regional Waste Manager. In addition, the manager shall be notified of the classification level of the facility and certification levels of the operators, and changes of operators and/or operator certification levels within 30 days of any change.

Alternatively, the works authorized by this permit shall be operated and maintained by persons who the permittee can demonstrate to the satisfaction of the Director, are qualified in the safe and proper operation of the facility for the protection of the environment.

2.12 Toxicity Assessment

The Regional Waste Manager may require an evaluation of the causes of effluent toxicity and/or the impact of toxic discharges on the receiving environment. Based on the evaluation, the manager may require that the permittee take steps to reduce effluent toxicity or its impact on the receiving environment.

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2.13 Membrane Filtration Backwash

Any effluent from the membrane filtration backwash operation shall be dechlorinated prior to discharge to reduce the chlorine residual below detectable limits. Spent backwash solution must be disposed of to the satisfaction of the Regional Waste Manager.

3 MONITORING AND REPORTING REQUIREMENTS

3.1 Discharge Monitoring

3.1.1 Flow Measurement

Provide and maintain suitable flow measuring devices and record **once per day** the effluent volume discharged over a 24-hour period from a) the rotating drum screens, b) the secondary treatment plant, and c) the final discharge point.

3.1.2 Grab Sampling

Suitable sampling facilities shall be installed and grab samples of the final effluent authorized by Section 1.1 shall be obtained **once each week**. Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

3.1.3 Analyses

Obtain analyses of the samples for the following:

5-day biochemical oxygen demand, mg/L;
Total suspended solids (nonfilterable residue), mg/L; and
Fecal coliform, MPN/100 mL, between May 1 and September 30, only.

DRAFT

H.G. Maxwell
Assistant Regional Waste Manager

3.1.4 Grab Sampling

A suitable sampling facility shall be installed and a grab sample of the final effluent authorized by Section 1.1 shall be obtained during **February** and **August** for fish bioassay (rainbow trout), toxicity test, LT50, hours. If the toxicity test results in a failure, the permittee is required to notify the Regional Waste Manager immediately and conduct a confirmation test within one week. If two consecutive toxicity tests result in failure, monitoring shall be increased to **once per two months**. Upon passing three consecutive tests, testing frequency then reverts to twice per year. Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

3.2 Monitoring Procedures

3.2.1 Sampling Procedures

Sampling is to be carried out in accordance with procedures described in the latest version of "British Columbia Field Sampling Manual for Continuous Monitoring plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples, 1996 Edition (Permittee)," or by suitable alternative procedures as authorized by the Regional Waste Manager.

A copy of the above manual may be purchased from Queen's Printer Publications Centre, P. O. Box 9452, Stn. Prov. Govt. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or (250) 387-6409). A copy of the manual is also available for inspection at all Pollution Prevention offices.

3.2.2 Chemical Analyses

Analyses are to be carried out in accordance with procedures described in the latest version of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials (March 1994 Permittee Edition)", or by suitable alternative procedures as authorized by the Regional Waste Manager.

A copy of the above manual may be purchased from Queen's Printer Publications Centre, P. O. Box 9452, Stn. Prov. Govt. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or (250) 387-6409). A copy of the manual is also available for inspection at all Pollution Prevention Offices.

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3.2.3 Quality Assurance

All data analyses required to be submitted by the permit shall be conducted by a laboratory acceptable to the Regional Waste Manager. At the request of the manager, the permittee shall provide the laboratory quality assurance data, associated field blanks, and duplicate analysis results along with the submission of data required under Section 3. of the permit.

3.3 Reporting

Maintain data of analyses and flow measurements for inspection and submit the data, suitably tabulated, to the Regional Waste Manager for the previous quarter. The reporting period ends **March 31, June 30, September 30, and December 31**, of each year. The first reporting period for the Infiltration and Inflow strategy status report pursuant to Section 2.10 ends **June 30, 1999**. All reports shall be received by the manager within 31 days of the end of the reporting period.

DRAFT

BRITISH COLUMBIA

Date: OCT 06 1998

File: PE-00073

REGISTERED MAIL

THE CORPORATION OF THE
DISTRICT OF POWELL RIVER
6920 Duncan Street
Powell River, British Columbia V8A 1V4

Dear Permittee:

Enclosed is amended Permit PE-00073 issued under the provisions of the *Waste Management Act*. Your attention is respectfully directed to the conditions of the permit. An annual permit fee for the permit will be determined in accordance with the Waste Management Permit Fees Regulation.

This permit does not authorize entry upon, crossing over, or use for any purpose of private or crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the permittee. It is also the responsibility of the permittee to ensure that all activities conducted under this permit are carried out with due regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This decision may be appealed by persons aggrieved by the decision in accordance with Part 7 of the *Waste Management Act*. Notice of the appeal must (1) be in writing, (2) include the grounds for appeal, (3) be directed by registered mail or personally delivered to the Chair, Environmental Appeal Board, 4th Floor 836 Yates Street, Victoria, British Columbia, V8V 1X5, (4) be delivered within 30 days from the date notice of the decision is given, and (5) be accompanied by a fee of $25.00, payable to the Minister of Finance and Corporate Relations.

Administration of this permit will be carried out by staff from our regional office located at 10470 - 152nd Street, Surrey, British Columbia, V3R 0Y3. Plans, data and reports pertinent to the permit are to be submitted to the Regional Waste Manager at this address.

Yours truly,

H.G. Maxwell
Assistant Regional Waste Manager

enclosure

cc: Environment Canada

Ministry of Environment, Lands and Parks

Environment and Lands
Lower Mainland Region
Pollution Prevention

Mailing/Location Address:
10470 152 Street
SURREY BC V3R 0Y3

Telephone: (604) 582-5247
Facsimile: (604) 584-9751
or (604) 582-5335

PROVINCE OF
BRITISH COLUMBIA

BRITISH COLUMBIA

Pollution Prevention
10470 - 152 Street
Surrey, British Columbia
V3R 0Y3
Telephone: (604) 582-5200
Fax: (604) 584-9751

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

PERMIT
PE-00073

Under the Provisions of the Waste Management Act

THE CORPORATION OF THE DISTRICT OF POWELL RIVER

6920 Duncan Street

Powell River, British Columbia

V8A 1V4

is authorized to discharge effluent to the waters of Malaspina Strait from a municipal sewage treatment plant located near Willingdon Avenue and Courtenay Street, Powell River, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the *Waste Management Act* and may result in prosecution.

1 AUTHORIZED DISCHARGES

1.1 This subsection applies to the discharge of effluent from a **MUNICIPAL SEWAGE TREATMENT PLANT SERVING THE WESTVIEW AREA OF POWELL RIVER.** The site reference number for this discharge is E100924.

1.1.1 The maximum authorized rate of discharge is 13 640 cubic metres/day.

1.1.2 The characteristics of the discharge for discharge quantities less than 4 600 m^3/day shall be:

5-day biochemical oxygen demand (BOD_5),	10 mg/L, maximum;
Total suspended solids (nonfilterable residue),	10 mg/L, maximum;
Fish bioassay (rainbow trout), LT50,	96. hours, minimum.

H.G. Maxwell
Assistant Regional Waste Manager

Date Issued: June 24, 1963
Date Amended: OCT 06 1998

1.1.3 The characteristics of the discharge for discharge quantities greater than 4 600 m^3/day but less than 13 640 m^3/day shall be:

5-day biochemical oxygen demand (BOD_5),	45 mg/L, maximum;
Total suspended solids (nonfilterable residue),	45 mg/L, maximum.

1.1.4 The authorized works are effluent treatment works, sludge digestion and dewatering works, and related appurtenances approximately located as shown on attached Site Plan A.

1.1.4.1 For discharge quantities less than 4 600 m^3/day, the designated treatment works include:

- influent screen;
- grit removal works;
- new secondary treatment plant complete with membrane filtration;
- new ultraviolet disinfection system; and
- submerged outfall extending a minimum of 485.8 metres offshore and discharging to a depth of approximately 53.4 metres below low water.

1.1.4.2 For the portion of the discharge quantities greater than 4 600 m^3/day, the designated treatment works include:

- influent screen;
- grit removal works;
- new rotating drum screen; and
- submerged outfall extending a minimum of 485.8 metres offshore and discharging to a depth of approximately 53.4 metres below low water.

1.1.5 The location of the facilities from which the discharge originates is Lot 3 Blocks 6 & 7, Plan 6825; Lot 8, Block 9, Plan 5096; Lot 1, Block 9, Plan 7075; all of District Lot 5307, and Lots D & E, Water Lot 5914, NWD.

1.1.6 The location of the point of discharge is Malaspina Strait approximately 490 metres northeast of Lot 8 Plan 5096, District Lot 5307, NWD.

H.G. Maxwell
Assistant Regional Waste Manager

2 GENERAL REQUIREMENTS

2.1 Maintenance of Works

The permittee shall inspect the authorized works regularly and maintain them in good working order. Notify the Regional Waste Manager of any malfunction of these works.

2.2 Bypasses

The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing.

2.3 Process Modifications

The Regional Waste Manager shall be notified prior to implementing changes to any process that may adversely affect the quality and/or quantity of the discharge.

2.4 Emergency Procedures

In the event of an emergency which prevents compliance with a requirement of this permit, that requirement will be suspended for such time as the emergency continues or until otherwise directed by the Regional Waste Manager provided that:

a. Due diligence was exercised in relation to the process, operation or event which caused the emergency and that the emergency occurred notwithstanding this exercise of due diligence;

b. The Regional Waste Manager is immediately notified of the emergency; and

c. It can be demonstrated that everything possible is being done to restore compliance in the shortest possible time.

Notwithstanding (a), (b), and (c) above, the Regional Waste Manager may require the operation to be suspended or production levels to be reduced to protect the environment while the situation is corrected.

H.G. Maxwell
Assistant Regional Waste Manager

2.5 Posting of Outfall

A sign shall be erected along the alignment of the outfall above high water mark. The sign shall identify the nature of the works. The wording and size of the sign shall be acceptable to the Regional Waste Manager.

2.6 Outfall Inspections

The permittee shall have the outfall inspected once each five years by independent qualified personnel to ensure it is in good condition. An inspection report shall be submitted to the Regional Waste Manager within 30 days after the inspection date. The next report shall be submitted by June 30, 2003.

2.7 Disinfection

Disinfection of the effluent shall be carried out between May 1 and October 15 inclusive by ultraviolet radiation or other suitable alternatives acceptable to the Regional Waste Manager.

2.8 Sludge Wasting and Disposal

Sludge wasted from the treatment plant shall be disposed of to a site and in a manner approved by the Regional Waste Manager, or as authorized by regulation under the *Waste Management Act.*

2.9 Plans - New Works

Plans and specifications of the new works authorized in Subsections 1.1.4.1 and 1.1.4.2 shall be certified by a qualified professional licensed to practice in the Province of British Columbia, and submitted to the Regional Waste Manager by **November 30, 1998.** A qualified professional must certify that the works have been constructed in accordance with the plans.

2.10 Infiltration and Inflow Strategies

The permittee shall prepare semi-annual reports on works undertaken to minimize infiltration and inflow of storm water and groundwater into the sanitary sewer system. The report shall include, but is not limited to, initiatives such as identification and elimination of stormwater connections, replacement and repairs of leaking pipes and appurtenances, standardization of construction standards, development and enforcement of local bylaws, education initiatives, identification of management options, and performance measures of each initiative.

H.G. Maxwell
Assistant Regional Waste Manager

2.11 Facility Classification and Operator Certification

The permittee shall have the works authorized by this permit classified by the Environmental Operators Certification Program Society (Society). The works shall be operated and maintained by persons certified within and according to the program provided by the Society. Certification must be completed to the satisfaction of the Regional Waste Manager. In addition, the Regional Waste Manager shall be notified of the classification level of the facility and certification levels of the operators, and changes of operators and/or operator certification levels within 30 days of any change.

Alternatively, the works authorized by this permit shall be operated and maintained by persons who the permittee can demonstrate to the satisfaction of the Director, are qualified in the safe and proper operation of the facility for the protection of the environment.

3 MONITORING AND REPORTING REQUIREMENTS

3.1 Discharge Monitoring

3.1.1 Flow Measurement

Provide and maintain suitable flow measuring devices and record **once per day** the effluent volume discharged over a 24-hour period from a) the rotating drum screen, b) the secondary treatment plant, and c) the final discharge point.

3.1.2 Grab Sampling

Suitable sampling facilities shall be installed and grab samples of the effluent authorized by Subsection 1.1 shall be obtained **once each week** from a) the secondary treatment plant discharge point, b) the rotating drum screen discharge point, and c) the final discharge point. Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

3.1.3 Analyses

Obtain analyses of the samples for the following:

5-day biochemical oxygen demand, mg/L;
Total suspended solids (nonfilterable residue), mg/L;
Fecal coliform, MPN/100 mL.

H.G. Maxwell
Assistant Regional Waste Manager

3.1.4 Grab Sampling

A suitable sampling facility shall be installed and a grab sample of the final effluent authorized by Subsection 1.1 shall be obtained once each six months. Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

3.1.5 Analyses

Obtain analyses of the sample for the following:

Fish bioassay (rainbow trout), LT50, hours.

3.2 Monitoring Procedures

3.2.1 Sampling Procedures

Sampling is to be carried out in accordance with procedures described in the latest version of "British Columbia Field Sampling Manual for Continuous Monitoring plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples, 1996 Edition (Permittee)," or by suitable alternative procedures as authorized by the Regional Waste Manager.

A copy of the above manual may be purchased from Queen's Printer Publications Centre, P. O. Box 9452, Stn. Prov. Govt. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or (250) 387-4609). A copy of the manual is also available for inspection at all Pollution Prevention offices.

3.2.2 Chemical Analyses

Analyses are to be carried out in accordance with procedures described in the latest version of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials (March 1994 Permittee Edition)", or by suitable alternative procedures as authorized by the Regional Waste Manager.

A copy of the above manual may be purchased from Queen's Printer Publications Centre, P. O. Box 9452, Stn. Prov. Govt. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or (250) 387-4609). A copy of the manual is also available for inspection at all Pollution Prevention Offices.

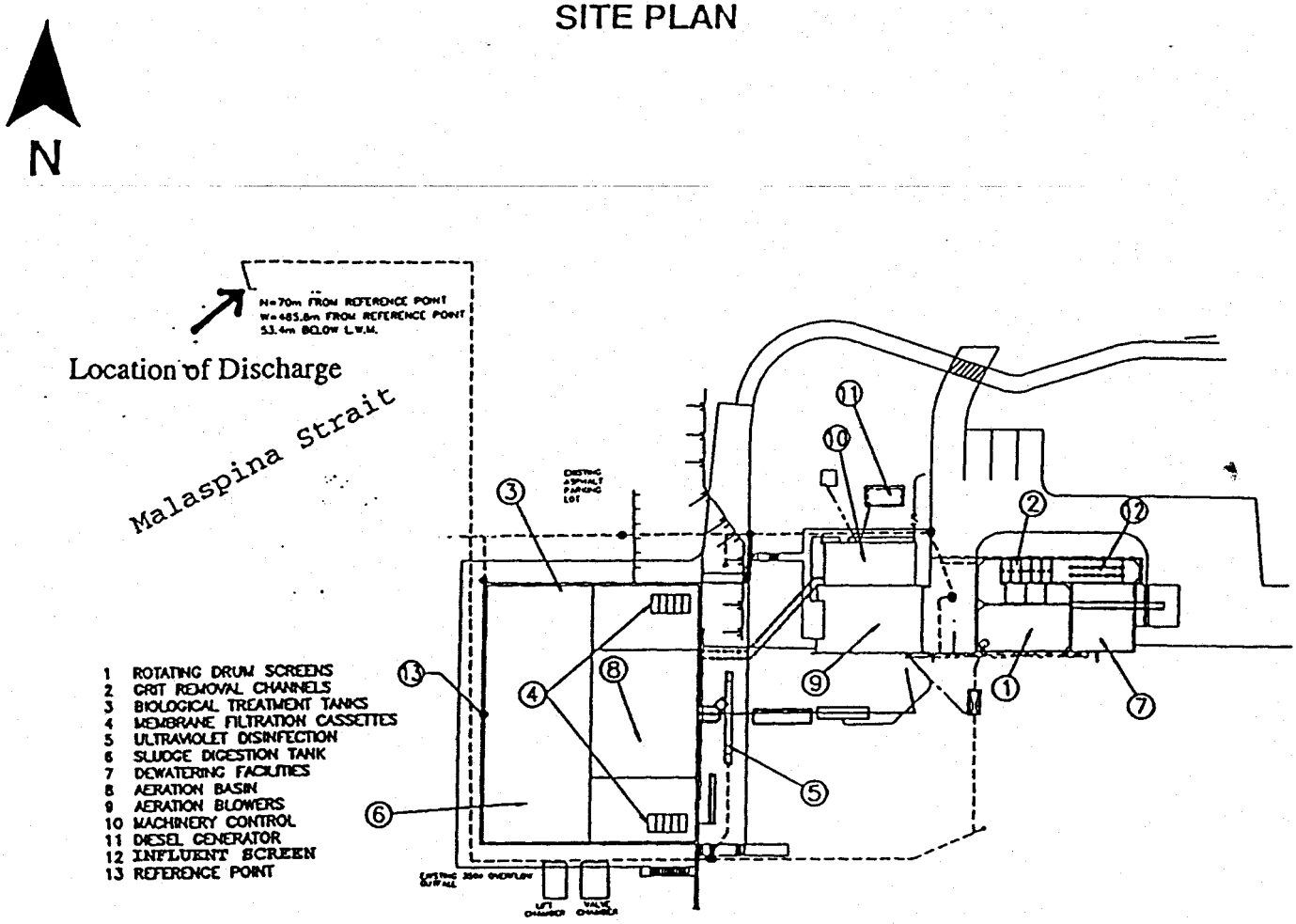
3.3 Reporting

Maintain data of analyses and flow measurements for inspection and submit the data, suitably tabulated, to the Regional Waste Manager for the previous quarter. The reporting period ends **March 31, June 30, September 30, and December 31,** of each year. The first reporting period for the Infiltration and Inflow strategy status report pursuant to subsection 2.10 ends **December 31, 1998.** All reports shall be received by the manager within 31 days of the end of the reporting period.

H.G. Maxwell
Assistant Regional Waste Manager

PERMIT: PE-00073

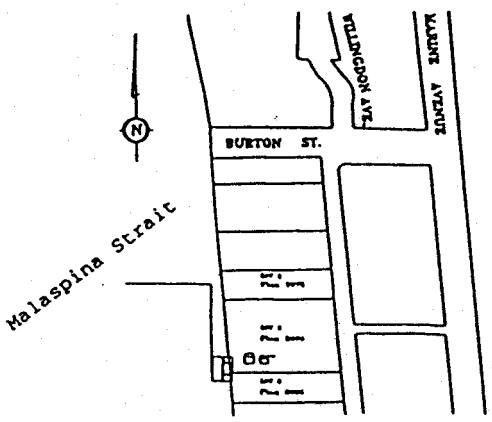
SITE PLAN



Legal Description:

Lot 3 Blocks 6 & 7, Plan 6825; Lot 8, Block 9, Plan 5096; Lot 1, Block 9, Plan 7075; all of District Lot 5307, and Lots D & E, Water Lot 5914, NWD.

Location Map



Scale: NTS

Site Plan: A	PERMIT: PE-00073

OCT 06 1998

H.G. Maxwell
Assistant Regional Waste Manager
Lower Mainland Region

TAB J

Tests and Trials

Trial Categories:

Functional Trial

The purpose of the functional trial is to prove that the system is correctly installed and wired and operates within the parameters of normal operation as determined by the manufacturer. The functional trial proves that the control algorithms and logic for the system in steady state are satisfactory.

Typical tests completed during the functional trial include:

- Start/Stop/Emergency Stop
- Measurement of steady state performance parameters
- Hand-Off-Auto Operation
- Stand-by System Operation
- Confirmation of steady state operational parameters such as level switches, limit switches, start/stop levels etc.

The completion of the functional trial is a pre-requisite for the commencement of the full load stress trial.

Functional Trials are completed by Canadian Wastewater Corporation staff and are witnessed by an Owner's Representative

Full Load Stress Trial

The purpose of the Full Load Stress Trial is to prove the system is capable of operation at the design point for the time period specified in the contract documents.

Full Load Stress Tests are completed by CWC and Manufacturer's staff and are witnessed by an Owner's Representative.

Full Load Stress Trials should be repeated by site staff on an annual basis

Note: In all cases, the Owner's Representative shall have the authority to accept the trial on behalf of the owner.

H-M/CWC Acceptance Trial
Storm Flow Screening System
CWC-0010
Full Load Stress Trial

System: PRA Microscreens

Purpose of System: PRA Microscreens provide the screening of infiltration-diluted raw wastewater during wet weather flows.

Number of Primary Systems Fitted: 2

Design Parameters: 37μ panels
9213 m^3/day per unit = 2.4 USMGD per unit = 1690 USGPM
Continuous unmanned operation (normal maintenance required)
BOD removal - 30%
TSS removal - 44%

Trial Objectives: The objective of this trial is assess the capability of the drumscreens to process the required flow rate to the required standards. The following shall be considered the minimum acceptable standard:

Average flow 1690 USGPM for a 24 hour period for influent of BOD/TSS = 64 mg/L

In the absence of a sustained 1690 USGPM flow for the 24 period, flow assessment may be projected through the monitoring of water depth inside the drum.

Trial Duration: 2 days

Precautions/Notes: The PRA microscreens are designed to treat infiltration-diluted wastewater. Use in full strength wastewater will require close monitoring of the cleanliness of the screens. Pressure washing is REQUIRED should the differential in depth from the inside to the outside of the screens exceed 12".

MoELP permit limits will require that during the performance of this trial, a minimum flow is maintained to the MBR for generation of the blending flow.

In the case of full strength wastewater, the trial shall be conducted on a mass balance basis:

1690 USGPM @ 64 mg/L = 636 USGPM @ 170 mg/L

In the case of full strength wastewater, a minimum 4 hour trial shall be conducted irrespective of the mass balance loading criteria.

Design/Contract Number: **Date:**

Trial Procedure:

Item	Description	Notes
1	Drumscreen #1 Trial Install a stop gate in the inlet pipe to Drum Screen #2	
2	Increase flow to the drum screens by throttling the Flow Control Valve to the MBR. Increase flow to the Trial Objective Flow. Based on the levels in the MBR tankage, it may be necessary to maintain a flow of 400 USGPM to the MBR.	
3	Record water depth at the inlet to, and outlet of, the drum screens. Record bypass flow via Parshall Flume	
4	Take lab samples for BOD and TSS at 8 hour intervals.	
5	Repeat for Drumscreen #2	
6		
7		

Date of Trial:

CWC Staff:

Manufacturer's Representative:

Owner's Representative:

P.R.A. Manufacturing Ltd.
Post Office Box 774, Station A, Nanaimo, B.C., Canada, V9R 5M2
Tel. 250-754-4844, Fax 250-754-9848, e-mail pramfg@island.net

16 November, 1998

PRA ROTOFILTER™ MAXIMUM FLOW CAPACITY TEST CHECKLIST

1. Ensure that downstream weirs/valves are positioned/opened to receive the rated maximum flow with allowance for surge flows.

2. Ensure that downstream level control measures are in place to limit the maximum head differential that can be placed on the screens to 12 inches or less.

3. Check back wash pressure and ensure that spray nozzles are clean.

4. Perform system lubrication as per maintenance manual.

5. Visually inspect support wheels on drum for wear and alignment.

6. Initiate "manual" rotation of drum and backwash spray.

7. Slowly open valves/weirs upstream to allow flow to pass through the isolated filter while allowing the water level outside the filter to also rise limiting overall head differential.

8. Continue this procedure until the water level inside the drum is at the level of the drum seal (just prior to emergency bypass).

9. Observe flow rate and record.

10. Repeat steps 6 through 9 three times and average results.

11. Return filtration system to normal operational settings as per maintenance manual.

Notes:

a. Flow capacity testing should be performed under the supervision of PRA Manufacturing Ltd. personnel or their designated representatives.
b. Rotofilter™ screens should be pressure washed thoroughly prior to initiating test.
c. TSS samples of the influent should be taken at least three times during each test to correlate flow data with solids loadings.

H-M/CWC Acceptance Trial
Trash Removal System
CWC-0011
Full Load Stress Trial

System: PRO-AQUA ML Trash Augers

Purpose of System: PRO-AQUA ML Trash Augers provide coarse screening and trash removal for the influent to the plant.

Number of Primary Systems Fitted: 2

Design Parameters:

#1	#2
3 mm	5 mm
100 L/sec = 1585 USGPM	140 L/sec = 2219 USGPM
= 2.3 USMGD	= 3.2 USMGD

Continuous unmanned operation (normal maintenance required)

Trial Objectives: The objective of this trial is assess the capability of the trash augers to remove trash and inorganics from the influent flow stream. Also included in this trial is the trial of the Manual Bar Screen. The following shall be considered the minimum acceptable standard:

3 mm Screen
Sustained Peak Flow of 1585 USGPM during the diurnal (0730 to 1030)
5 mm Screen
Sustained Peak Flow of 2219 USGPM during the diurnal (0730 to 1030)
Manual Bar Screens
1100 USGPM during the diurnal period

Trial Duration: 3 days

Precautions/Notes: During trial of the Manual Bar Screens, operator attendance in the headworks building is MANDATORY.

Manual Bar Screens are not as effective as the ML Screw Augers for removing trash. Their use should be kept to the minimum requirement to satisfy the needs of the trial.

Design/Contract Number: **Date:**

Trial Procedure:

Item	Description	Notes
1	3 mm Screen Install full height stop gates at the inlet to the manual bar screens and the 5 mm Screen at 0730 hrs. Isolate power to the 5 mm screen. Install a clean garbage bag at the auger discharge. Record the flow rate over the time period 0730 to 1030. Observe the amount of material collected. Weigh the material and record.	
2	Repeat for 5 mm Screen	
3	Manual Bar Screen Install full height stop gates in the 3 and 5 mm screen influent channels. Isolate power to the 3 and 5 mm Screens. Record the flow rate over the time period 0730 to 1030. Monitor performance of the Bar Screens with respect to frequency of cleaning required.	
4		
5		
6		
7		

Date of Trial:

CWC Staff:

Manufacturer's Representative:

Owner's Representative:

H-M/CWC Acceptance Trial
MBR System
CWC-0012
Full Load Stress Trial

System: ZENON Membrane Bioreactor

Purpose of System: The ZENON system provides tertiary quality treatment to the influent wastewater.

Number of Primary Systems Fitted: 2

Design Parameters: 931,000 USGPD Steady State
1,862,000 USGPD Peak (12 hours of 24)
Continuous unmanned operation (normal maintenance required)

Trial Objectives: The objective of this trial is assess the capability of the ZENON MBR to treat the steady state and peak flows. The following shall be considered the minimum acceptable standard:

Peak Flow Rate:

Requirement = 1,862,000 USGPD PEAK
12 hours of 24

Instantaneous Flow Rate = 1540 USGPM TOTAL
Each Bank must therefore produce = **770 USGPM** for 12 hours of 24.

Average Flow Rate:

Requirement = 931,000 USGPD TOTAL
24 hours of 24

Instantaneous Flow Rate = 931,000/1440/0.84 = 770 USGPM TOTAL
Each Bank must therefore produce = **385 USGPM** for 24 hours of 24.

Trial Duration: 3 days

Precautions/Notes: The service factor for water-made-good is 84%.

Design/Contract Number: **Date:**

Trial Procedure:

Item	Time	Description	Notes
1	T	Perform In-Situ Clean	
2	T+1	Throttle MBR production to 770 USGPM. Operate for a minimum of 4 hours at this set point.	
3	 T+5 T+6 T+7 T+8 T+9	Increase MBR flow to 1540 USGPM over an 8 hour period in accordance with the following schedule: 770 USGPM 960 USGPM 1155 USGPM 1350 USGPM 1540 USGPM	
4	T+9	Operate at 1540 USGPM for 6 hours	
5	T+15	Reduce production to 770 USGPM	
6	T+15 T+20	Perform In-Situ Clean. Operate for a minimum of 4 hours before returning to auto.	
7			

Date of Trial:

CWC Staff:

Manufacturer's Representative:

Owner's Representative:

Westview Water Reclamation Facility
Performance Report
Membrane Stress Test
December 3, 1998

Introduction

The purpose of this report is to provide details of the stress tests performed on membrane train #1 and #2 at the Westview Water Reclamation Facility in Powell River. This report will provide analysis of the membrane performance on full load stress tests over a 12 hour period.

Membrane Performance

Membrane performance was very stable throughout the test. Several factors contributed to this:

- Rotation of membrane cassettes through recovery cleans;
- sludge maturation; and
- MLSS levels at 12,000 mg/L.

Performance showed sustained operation at the 1350-1400 USGPM (.976 MGD GROSS) over a 12 hour period. This represents a water made good total of .933 MGD.

Treatment Plant Flows

Data was collected via Parshall Flumes measurement for total bypass flows and total flows to the MBR. Total permeate flows and derated permeate flows were collected via the mag meters located on the discharge side of the process pumps. Data from December 3, 1998 at 22:08 hrs was as follows:

Total influent flow:	1,843,085 USG
Total bypass flow:	481,174 USG
Total permeate flow (Mag Meters):	976,179 USG
Derated Permeate Flow (0.956 x Mag Meters):	934,203 USG

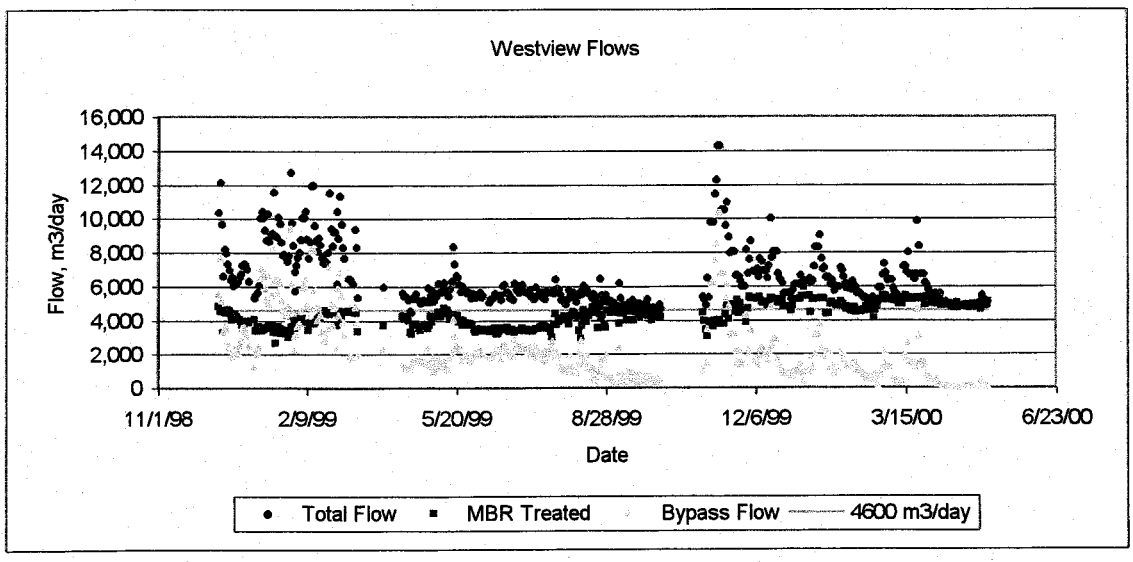
The derated permeate flow percentage factor was calculated as per the following:

Back pulse flow rates:	2.2%
Processing back pulse water:	2.1%
Process pump ramp up time:	0.1%

MBR Trials

See Annex A, B and C.

TAB K



	1999	
	m3	USGPD
Average Annual Flow	6614	1746151
AAF Treated by MBR	4065	1073265
MBR AAF Since Upgrade	4968	1311568

TAB L

CANADA	)	IN THE MATTER OF STATEMENTS MADE
	)	BY AN EMPLOYEE OF REID CROWTHER &
	)	PARTNERS LTD. TO DENNIS BEDARD
NORTHWEST	)	
TERRITORIES	)	
	)	
	)	

STATUTORY DECLARATION

TO WIT:

I, DENNIS BEDARD, Professional Engineer, of the Town of Iqaluit, in the Northwest Territories, Canada, DO SOLEMNLY DECLARE that:

1. I am the Municipal Engineer for the Town of Iqaluit and have been so employed since early 1998, having previously worked as a consulting engineer throughout Canada's Arctic over the past several years.

2. In my capacity of Municipal Engineer and with the expansion of local infrastructure to accommodate the new Nunavut government seat, I deal extensively with engineering consultants and contractors, including Reid Crowther & Partners Ltd. ("Reid Crowther") and Hill, Murray & Associates Inc. ("Hill, Murray").

3. Both Hill, Murray and Reid Crowther have recently provided engineering consultancy and contracting services to the Town of Iqaluit, through competitive processes and under my direction. As well, both engineering firms have been competitors for additional infrastructure work, as explained below.

4. In the past year I have also had occasion to visit and inspect Hill, Murray's recently completed Westview wastewater treatment plant at the District of Powell River, in British Columbia. My visit was partly intended to assess the application of similar treatment processes by Hill, Murray for the Town of Iqaluit. I am aware that Hill, Murray had won a competitive contract for construction of this plant, in preference to Reid Crowther.

5. Subsequently, both Hill, Murray and Reid Crowther bid on engineering services for a new wastewater treatment plant at Iqaluit. Hill, Murray also won this competitive process.

6. Further, during contract competition for an upgrade to the potable water treatment plant at Iqaluit, Reid Crowther attempted to introduce confidential information pertaining to Powell River's Westview waste water treatment plant to influence my town's RFP process.

7. In mid-October 1998, I was visited by an employee of Reid Crowther, Mark Cronk, of its Yellowknife office. He made remarks to me which I considered to be unprofessional and provocative. I set them out here to the best of my recollection. I emphasize that Mr. Cronk's visit, and his remarks, were unsolicited.

8. Mr. Cronk entered my office, closed the door, and said words to the effect "We have to talk about something", explaining that "Hill, Murray was having problems with its Powell River plant". At this point, I advised Mr. Cronk that I had previously visited the Westview waste water treatment plant.

9. Mr. Cronk's comments continued, indicating or implying serious engineering and contractual problems with the Westview treatment plant. I interpreted his remarks to be more than casual, being directed to further Reid Crowther's work and competitive prospects in Iqaluit.

10. Considering such remarks to be inappropriate and possibly unprofessional, I advised Mr. Cronk of my discomfort. He also related to me that his firm had been retained to review or "look at" performance of the Westview plant built by Hill, Murray.

11. These statements were made within hearing distance of my assistant.

12. I have not heard similar remarks from any employee of Reid Crowther since that occasion, possibly given my cautioning of Mr. Cronk.

13. These remarks have caused me concern, in part for their possible slanderous content and the continuing disclosure of what is or appears to be confidential municipal and business information as well as the fact that I may be required in future to deal with both Reid Crowther and Hill, Murray for competitive bids in the Town of Iqaluit.

AND I make this solemn declaration, conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath and by virtue of the Canada *Evidence Act.*

DECLARED before me at the Town of Iqaluit, in the Northwest Territories, Canada, this 20 day of January 1999.

Commissioner of Oaths Kathi Seigel
In & For the NWT exp: Nov. 21, 1999
A Commissioner for taking Affidavits
for the Northwest Territories

Dennis Bedard

DENNIS BEDARD

L:kls\jan\149.doc

TAB M

The Corporation of the District of Powell River

OFFICE OF THE
MUNICIPAL CLERK

MUNICIPAL HALL
6910 DUNCAN STREET
POWELL RIVER, B. C.
V8A 1V4
TELEPHONE (604) 485-6291
FAX (604) 485-2913

November 18, 1998

Mr. Rob Murray
Hill Murray & Associates Inc.
Suite 202
780 Tolmie Avenue
Victoria, B. C.
V8X 1W4

Dear Rob:

Please find enclosed a final copy of the Westview Water Reclamation Plant Stage 1 - Contract and Completion Review, prepared by Reid Crowther for the District. This report was received on November 18, 1998.

Yours truly

IHadford

Isabell Hadford
Municipal Clerk/Personnel Officer

IH:dh

Enclosure

RECEIVED
NOV 18 1998
THE CORPORATION OF
THE DISTRICT OF POWELL RIVER

WESTVIEW WATER RECLAMATION PLANT STAGE 1 - CONTRACT AND COMPLETION REVIEW FINAL REPORT

Prepared for:

The Corporation of the District of Powell River
Municipal Hall
6910 Duncan Street
Powell River, BC
V8A 1V4

Prepared by:

Reid Crowther & Partners Ltd.
Consulting Engineering Worldwide
300 - 4170 Still Creek Drive
Burnaby, BC
V5C 6C6

Phone: (604) 298-6181
Fax: (604) 294-8597

October 31, 1998

Project No. 3292906

Reid Crowther

Reid Crowther

Refer to File: 32929-06
\\RCPLVAN1\VOL1\DATA_2\PROJECTS\ENV\3292906\04A\br10_29a.doc

November 17, 1998

The Corporation of the District of Powell River
Municipal Hall
6910 Duncan Street
Powell River, BC
V8A 1V4

Attention: Mr. Gino Francescutti, A.Sc.T.
Development Services Manager

Dear Gino:

Re: Westview Water Reclamation Plant
Stage 1 Contract and Completion Review
Final Report Submission

Please find attached four copies of our Final Report for Stage 1 of the above project. The report is an update of the Draft Report submitted on October 19, 1998, and presented to Council on October 20, 1998.

The Final Report details the status of the project as of October 16, 1998, and lists several deficiencies that need to be addressed by the Contractor prior to Final Completion. Since issuing the Draft Report, we have been involved in the following activities:

1. Met with the Contractor in the District offices on October 20, 1998.
2. Responded in writing to a letter from Michael Holmes of Jones Emery Hargreves Swan & Hall dated October 26, 1998, to Michael Quattrocchi of Lidstone Young & Anderson regarding the above project.
3. Reviewed the comments on our Draft Report by the Contractor in a letter dated November 6, 1998.
4. Attended a meeting at the District offices with the Contractor on November 10, 1998 to discuss their proposed completion schedule for correcting the deficiencies noted.
5. Met with the Contractor in their offices on November 16, 1998 to provide input into their plan for correcting the deficiencies noted.

Reid Crowther & Partners Ltd.
Suite 300, 4170 Still Creek Drive, Burnaby, British Columbia V5C 6C6 Phone: (604) 298-6181 Fax: (604) 294-8597 www.reid-crowther.com

It should be noted that since October 16, 1998, progress has been made correcting some of the deficiencies and areas of concern listed in our Draft Report. The following table summarizes, to the best of our knowledge, areas where significant progress has been made by the Contractor to date:

Deficiency Noted by Reid Crowther in Stage 1 Report	Contractor's Action	Comments
Plant had not proven capable of reliably meeting contractual design flows while remaining within normal operating parameters	Significant progress has been made in this regard. A flow equalization basin has been commissioned.	Performance testing to be carried out during 30 day monitoring period.
Influent auger screens do not appear to function as intended; they do not remove sufficient screenings quantities.	Screw auger mechanism has been modified to improve transportation of screenings. Other modifications to the equipment are planned.	Screenings removal efficiency and hydraulic capacity testing to be carried out during 30 day monitoring period.
The grit removal system does not appear to function as intended; grit quantities removed from the wastewater are substantially less than would be anticipated	Contractor to provide details of proposed modifications to system and revised operating procedures for review by District.	Issue remains unresolved.
The membrane system has not satisfactorily demonstrated the ability to treat the flows stipulated in the Contract	A rigorous membrane cleaning schedule has been implemented and additional membrane cassettes have been provided. System now appears to be capable of exceeding average design flows, but has not been proven capable of meeting peak flows for sustained periods.	Performance testing to be carried out during 30 day monitoring period
Sludge quantities generated are expected to be substantially greater than indicated in the design information provided.	Contractor and plant operators to monitor sludge wastage rates.	Sludge quantities and operation of sludge press to be evaluated during 30 day testing period.

Deficiency Noted by Reid Crowther in Stage 1 Report	Contractor's Action	Comments
Odour control biofilters are too small and are unlikely to effectively control odours from the headworks area and sludge press room.	Contractor has made a minor modification buy adding 150 mm layer of activated carbon underneath biofilter media.	Issue remains unresolved.
Disinfection not provided for bypass flows.	MOELP to issue amended permit which requires disinfection of tertiary treated flows only.	Issue has been resolved, subject to receipt of amended permit.
No containment is provided for sodium hypochlorite storage containers in the main process building, as required by WCB regulations.	Contractor to provide spill containment vessels.	Issue resolved, subject to District approval.
No emergency eyewash/shower, with a 20 minute supply of tempered water, is provided at the sodium hypochlorite storage area, as required by WCB regulations.	Contractor to provide required facility.	Issue resolved, subject to District approval.
No gas detection sytem has been installed in either the headworks or the membrane treatment area, as required by NFPA 820.	Contractor to provide required gas detection equipment.	Issue resolved, subject to District approval.
Electrical components do not appear to satisfy exposure requirements for a Class 1 Division 1, or Class 1, Division 2 area classification, as required by NFPA 820 and the Canadian Electrical Code.	Contractor to provide plan of remedial action.	Issue remains unresolved.
Record drawings have not been submitted.	Contractor to provide all required record and as-built drawings.	Issue resolved, subject to District approval of drawings provided.

Deficiency Noted by Reid Crowther in Stage 1 Report	Contractor's Action	Comments
Operating manuals, maintenance manuals, and/or operation & maintenance manuals have not been submitted for review by District.	Several manuals for individual pieces of equipment have been provided and are in use at the plant. Contractor to provide complete set of manuals for review by the District.	Issue resolved, subject to District approval of manuals provided.
Substantial changes and modifications have been made without record of the District approving the change or modification.	Contractor has submitted technical information on replacement screw augers. Contractor has submitted letter from Zenon explaining change in bioreactor configuration.	Contractor to provide justification for all substantial changes made to plant design, and all replacement equipment provided.
Seismic bracing in main process building appears minimal.	Contractor has provided letters of assurance by the engineers responsible for supplying the precast panels and roof cross-bracing.	Reid Crowther has recommended to the District that a review of all structures and cranes be carried out by an independent professional engineer prior to final completion.
Ventilation rates in the headworks area may not be sufficient as evidenced by the condensation that occurs when the doors are closed.	Contractor has agreed to evaluate ways of increasing ventilation rates in headworks and sludge press room to 12 air changes per hour.	Issue is resolved, subject to District approval.
The control system may not incorporate sufficient equipment protection as evidenced by the operation of one of the new 100 hp blowers at well below the manufacturer's published flow rate., i.e. under surge conditions.	No remedial action has been proposed.	Equipment protection provided by control system to be evaluated during 30 day testing period.

We confirm that the deficiencies and areas of concern listed in our report are both substantial and serious. However, we note that that the Contractor has made progress in correcting many of these deficiencies. Once again, we recommend that the Contractor be given every reasonable opportunity to address the remaining deficiencies prior to Final Completion. Meanwhile, we will endeavour to provide the District with the assistance it requires to verify that the plant is able to meet its contractual performance requirements, and that the Contractor rectifies all physical deficiencies in a timely manner. We remain committed to providing the District with the high level of service required to bring this project to a satisfactory completion.

Should you have any questions regarding our report, please contact the undersigned or our Mr. M. Kim Fries, P.Eng., at any time.

Sincerely,

REID CROWTHER & PARTNERS LTD.

Barry Rabinowitz, Ph.D., P.Eng.
Senior Environmental Engineer

cc M. Kim Fries, P.Eng., RCPL Winnipeg

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SECTION 1.0
INTRODUCTION

The Westview Water Reclamation Plant was built under a Design/Build contract between the District of Powell River and Hill, Murray & Associates (HMA) of Victoria, B.C. The plant is currently being commissioned and a Substantial Completion Certificate was issued by the District on July 13, 1998. As the plant was to be turned over to the District, it became apparent that the status of the project should be reviewed by an external engineer. On September 25, 1998, the District commissioned Reid Crowther and Partners Ltd. (RCPL) to conduct a Contract and Completion Review of the plant. The plant was inspected by Reid Crowther on September 26, and again on October 13, 1998. The objective of the review was to provide the District with some assurance that the facility they are about to receive meets or exceeds their Contract with HMA. If there are deficiencies or problems with the new facility, these must be identified and a plan of remedial action developed to ensure that the facility works as anticipated. Powell River staff themselves have developed two lists of deficiencies that they have requested be rectified prior to project completion. To the best of our knowledge, this report details several other deficiencies noted during the short duration of the study. Reid Crowther Partners Ltd. does not accept any liability for deficiencies not noted during the study. All deficiencies related to the new wastewater treatment facility remain the responsibility of the Contractor.

SECTION 2.0
PROJECT BACKGROUND

The District of Powell River has two wastewater treatment plants that were constructed in the 1970s to serve the two major catchments – Townsite and Westview. A third aerated lagoon plant serves the Wildwood area of the community. The Townsite and Westview plants are both high-rate activated sludge facilities which have experienced several difficulties treating the wastewater flow reliably and consistently, especially during the wet winter months when extraneous flows increase substantially. Another treatment problem was related to the handling of waste sludge from these facilities. The waste secondary sludge is placed in aerobic digesters at both plants and when stabilized, is discharged through the plant outfall together with plant effluent. This practice has been prohibited at other B.C. plants over the last few years and it was expected that the provincial environmental authorities would proscribe this practice in the future. A third treatment issue is related to the fact that the effluent from the plants is not disinfected prior to discharge. It is believed that the discharge of this waste stream has added to the faecal coliform counts in nearshore waters in the area and likely has contributed to shell fish harvesting prohibitions over the last few years.

In addition to these treatment problems, the Westview plant generated odours during the warmer summer months that became a source of complaints from nearby residences and commercial enterprises. To address these issues, Powell River considered various wastewater treatment options. A Predesign Report in the late 1980's by Dayton and Knight suggested consolidating treatment at the Townsite location, providing primary treatment for the combined flow from the two catchments. In 1995, Powell River engaged Reid Crowther to develop this concept further, considering the Provincial Government's anticipated secondary treatment requirements. In a report submitted in 1996, Reid Crowther recommended the construction of a consolidated secondary treatment plant at the Townsite location, with effluent disinfection prior to discharge. The Westview plant was to be abandoned and replaced with a pump station and forcemain to convey wastewater to the Townsite plant.

The cost associated with this scheme exceeded the community's spending capacity and the project stalled for a time. During this period, various alternatives and staging scenarios were considered which might reduce initial costs and the aesthetic impact of the plant on the community. Ultimately, Powell River elected to proceed with the plant through the next phase of the work – the Functional Design.

Prior to Reid Crowther completing the Functional Design, the community elected to accept an unsolicited proposal from Hill, Murray & Associates to construct a plant at the location of the existing Westview plant. Reid Crowther's involvement in the project was terminated at that point. In September, 1997, Hill-Murray entered into a 'Design-Build' contract to provide Powell River with an operating wastewater treatment plant based on certain performance warrantees and minimum equipment and quality assurances.

That plant is now nearing completion. On July 13, 1998, the Contractor applied for and was granted Substantial Completion. Since that time, they have been involved in commissioning the facility. In the near future, the Contractor intends to achieve Final Completion.

SECTION 3.0
DESIGN FLOWS

3.1 AVERAGE ANNUAL FLOW AND AVERAGE DRY WEATHER FLOW

The average annual flow (AAF) is the amount of flow expected through a calendar year. The average dry weather flow (ADWF) only accounts for those days when rainfall induced extraneous flows do not occur. The Reid Crowther Preliminary Design Report (September, 1996) predicted an ADWF of 2,820 m^3/d and an AAF of 3,750 m^3/d for the Westview catchment. The contract between HMA and the District was based on an AAF of 3,524 m^3/d (931,000 US gpd). No reason for this discrepancy has been cited in the documentation provided to Reid Crowther.

3.2 MAXIMUM DAILY FLOW

The design Maximum Daily Flow (MDF) for the Westview catchment was identified in the 1996 Reid Crowther Preliminary Design Report as 13,065 m^3/d. This concurs with the new permit for the plant issued by the British Columbia Ministry of Environment, Lands and Parks (MOELP) on October 6, 1998. This permit states that the maximum daily discharge will be 13,640 m^3/d. Reid Crowther's Preliminary Design Report predicted a Peak Wet Weather Flow (PWWF), which is the expected peak flow in any one hour, to be 25,990 m^3/d, or 1,080 m^3/h (4,770 gpm). For permit applications, the maximum daily flows are normally listed. Therefore, new Permit reflects the previously predicted maximum daily flows to the plant. However, all elements of the plant must have sufficient hydraulic capacity to handle the PWWF.

3.3 SECONDARY TREATMENT FLOW

There is some uncertainty regarding the required amount of flow through secondary treatment. In Schedule E - Performance Specifications of the Execution Version of the Contract, HMA proposed an average annual flow of 931,000 US gallons per day (3,524 m^3/d). They indicated that this flow was subject to a peaking factor of 2.0, resulting in a peak treated flow of 7,056 m^3/d. The MOELP Permit (PE00073) indicates the maximum flow expected to be treated through secondary treatment is 4,600 m^3/d. District staff have indicated that the secondary treated flow listed in the MOELP permit resulted from discussions between HMA and MOELP. Reid Crowther have received no documentation

outlining the rationale for the relatively low maximum day flow through secondary treatment (4,600 m^3/d, or 1.21*AAF) noted in the permit, when compared with the flow noted in the Contract. Nonetheless, HMA has a contractual obligation to provide a plant capable of treating 7,048 m^3/d (1,862,000 US gpd) through secondary treatment.

Higher secondary treatment flows are mentioned in the Zenon proposal to HMA, dated August 29, 1997, and included in the HMA Preliminary Design Package. The Process Warranty included in the Zenon submission states that their system is capable of treating and average flow of 3,785 m^3/d (1.0 M US gpd), and a peak flow of 7,570 m^3/d (2.0 M US gpm) with 16 membrane cassettes (128 ZW-500 membrane modules). The Process Description included in the Zenon submission states that the peak flow should not be sustained for more than 12 hours in a 24 hour period.

3.4 FLOW MONITORING

One issue related to the design flows is the reliability of plant flow monitoring. The approach conditions to the secondary treatment flow measuring flume are poor, which will produce inaccurate results. Turbulence was observed in the region where the water level is monitored by an ultrasonic level sensor. Flow volumes should be reconciled to ensure that the flow entering the plant equates reasonably with the flow leaving the plant.

Another factor which confounds the flow monitoring is the internal recycle and flushing flows in the plant. For example, influent screen washing adds 60 to 120 m^3/d to the influent, which is measured in either the secondary treatment or bypass flumes. Bypass screen washing adds approximately 275 m^3/d to the bypass flow.

Membrane backwash flows are included in the treated flow measurements taken from the magnetic flow meters mounted on the discharge of the permeate pumps. Readings taken on October 13, 1998 indicate that the backwash flow may be between 10 and 20% of the flow through secondary treatment. Thus, treated flow measurements taken from these flow meters significantly overstate the amount of flow actually treated in the secondary treatment process.

SECTION 4.0
EFFLUENT REQUIREMENTS

Schedule E - Performance Specifications of the Execution Version of the Contract with HMA clearly states that the plant will provide treatment (BOD < 10 mg/L; TSS < 10 mg/L; and faecal coliform < 25 MPN/100 mL) for a flows less than 931,000 US gallons per day (3,524 m^3/d) with a 2 X peaking factor. Flows greater than this value are to receive primary treatment and no disinfection. The Discharge Permit (PE00073) specifies this effluent quality, but only for flows less than 4,600 m^3/d. For periods when daily flows exceed 4,600 m^3/d, the Permit requires the blended effluent to have BOD and TSS concentrations below 45 mg/L. Schedule E of the contract states that *"the treated effluent from the Westview Facility after completion of the Upgrade must in all respects meet applicable criteria set out in the Draft Discharge Criteria for wastewater treatment facilities as they apply to tertiary wastewater treatment facilities, issued by the MOE and dated 5, 1996 and any replacement or amendment thereto".*

Regarding disinfection, the wording of the MOELP Permit suggests that all flows be disinfected prior to discharge. The Contract does not conform to this requirement, clearly stating that only flows treated to a tertiary standard will be disinfected. It should be noted that, as the bypass is not disinfected, as soon as any by-pass takes place it renders disinfection of the treated flow to be immaterial. The following example, based on the approximate maximum day flows and maximum values listed in the Permit for flow to secondary treatment and disinfection (assumed secondary effluent faecal coliform density of 10 cfu/100 mL) illustrates the resulting high faecal coliform density in the blended flow when the primary bypass (assumed faecal coliform density of 10^6 cfu/100 mL) is not disinfected:

Effluent Stream	Flow Rate	Faecal Coliform Density	Total No. of Faecal Coliforms
Tertiary Effluent	4,400 m^3/d	10 cfu/100 mL	$4.4*10^8$ cfu
Primary Bypass	8,600 m^3/d	10^6 cfu/100 mL	$8.6*10^{13}$ cfu
Blended Flow	13,000 m^3/d	$6.6*10^5$ cfu/100 mL	$8.6*10^{13}$ cfu

It is our understanding that both the Permit and the 1996 Draft Discharge Criteria require that the entire effluent stream (i.e. tertiary effluent plus bypass) require disinfection. In addition, Appendix 1 to Schedule 3 of the 1996 Draft Discharge Criteria states that discharges to shellfish bearing waters are required to have faecal coliform densities below 14/100 mL.

SECTION 5.0
CONTRACT REVIEW

5.1 BACKGROUND

This section of the report provides an overview to the status of the contractual issues of this project. The source documentation used for this review is the Execution Version of the Design Build Contract between the District of Powell River and Hill, Murray and Associates for the "Design and Construction of an Upgrade to the Westview Wastewater Treatment Plant" dated September 12, 1997. This document was based on the Agreement between the two parties to the contract dated September 12, 1997. The Table of Contents for the Contract is as follows:

General Conditions

Schedule A - Insurance Conditions
Schedule B - Contractor's Form of Performance Bond
Zenon's Form of Performance Bond
Schedule C - Contractor's Form of Labour and Materials Payment Bond
Zenon's Form of Contract Maintenance Bond
Schedule D - Contractor's Proposal
Schedule E - Performance Specifications
Schedule F - Construction Schedule
Schedule G - Determination of Substantial Completion and Completion
Schedule H - General Description of Upgrade and Other Matters
Schedule I - Owner's Work
Schedule J - Payment Schedule

5.2 CERTIFICATE OF SUBSTANTIAL COMPLETION

A Certificate of Substantial Completion was received and was approved by the District, effective on July 13, 1998. As a result of this approval, the District commenced release of the holdback monies under a phased approach agreed with the Contractor.

Based on the Project Status Review presented in Section 6 below, Reid Crowther considers that Substantial Completion, as defined by the Builder's Lien Act, had not been achieved by the end of September, 1998, and therefore, this Certificate of Substantial Completion was issued in error.

The pertinent clauses in the Contract are the following:

- Definitions and Interpretation

  GC 1.1. (aj) *"Substantial Completion" means substantial completion as determined in accordance with the Builder's Lien Act by the Owner's Representative in accordance with these GCs.*

- Certificates and Payments

  GC20.3 *The Owner's Representative shall, not later than 10 Days after the receipt of an application from the Contractor for a certificate of Substantial Completion, make an inspection and assessment of the Work to verify the validity of the application. The Owner's Representative shall, not later than 7 Days after the inspection, notify the Contractor of approval, or the reasons for disapproval, of the application, which the Contractor may dispute or instead remedy by correcting the work to which the payment relates.*

  GC20.4 *Immediately following the issuance of the certificate of Substantial Completion, the Owner's Representative shall issue a certificate for payment of holdback monies, but the holdback monies shall only become due and payable on the Day following the expiration of the statutory period under the Builders' Lien Act.*

- Warranties

  GC28.3 *Issuance of the Certificates of Substantial Completion and of Completion, and final payment to the Contractor, do not relieve the Contractor from his responsibility under this GC.*

A definition of Substantial Completion is documented as Schedule G - Determination of Substantial Completion and Completion of the Contract which states:

Substantial completion of the Work is reached on the date on which the Contractor's Representative issues a certificate of Substantial Completion to the Owner, which the Contractor's Representative shall do as of the date on which the Contractor's Representative has determined the Work has reached Substantial completion determined in accordance with the Builder's Lien Act..

However, as defined in Clause GC1.1 (aj), Substantial Completion shall be as determined in the Builder's Lien Act which states the following:

(2) For the purposes of this Act, a head contract, contract or subcontract is substantially performed if the work to be done under that contract is capable of completion or correction at a cost of not more than:

(a) 3% of the first $500 000 of the contract price,

(b) 2% of the next $500 000 of the contract price, and

(c) 1% of the balance of the contract price

(3) For the purposes of this Act, an improvement is completed if the improvement or a substantial part of it is ready for use of is being used for the purpose intended.

The definition of Substantial Completion in the Contract and that in the Builder's Lien Act are contradictory. Reid Crowther asserts that the Builder's Lien Act should govern where a conflict or inconsistency is identified. Based on the definition in the Builder's Lien Act, the work would be substantially complete if the contract is capable of completion or correction at a cost of approximately $78,000 on the $6.4 M contract value, and the improvement is ready for use or is being used for the purpose intended. Based on Reid Crowther's visits to the wastewater treatment plant site on September 25, 1998 and on October 13, 1998, neither of these conditions had been met. For example, the membrane system did not treat the design flows so the intended purpose is not being satisfied. Further, the sludge handling system has not yet been commissioned and so has not been demonstrated to fulfill its intended purpose.

The proposal for the membrane system provided by Zenon Municipal Systems to HMA, and included in the Preliminary Design Package (Proposal #160-97 Revision 1, August 29, 1997) also contains a contradictory definition of Substantial Completion as follows:

> *Substantial Completion is defined as the date when the equipment supplied first meets the required treatment quality and quantities as defined in accordance with Performance Warranties.*

To the best of Reid Crowther's knowledge, as of October 16, 1998, the membrane system had not been able to achieve the design flows for any period in excess of four days without exceeding the maximum allowable trans membrane pressure (TMP) of 7 psi. Reid Crowther would not accept this performance as sufficient to prove compliance with the design requirements.

5.3 OWNER'S REPRESENTATIVE

The Contract allows for a designated Owner's Representative. Commonly on a Design-Build contract of this nature, an independent, Professional Engineer is assigned this task. In this instance, the District elected to appoint Mr. Jim Greenwood P.Eng., of the District of Powell River, as the Owner's representative.

5.4 QUALITY CONTROL PLANS

As identified in GC33, the Contractor is solely responsible for the quality of the work and shall implement a Quality Control Plan for the performance of the work. This plan includes the appointment of independent professionals who shall report to the Owner's Representative.

A Quality Control and Inspection of Work Plan, dated January 27, 1998, was submitted by HMA to the District in accordance with GC33 of the Contract. The total plan is less than three pages long and contain less than two pages of text. It is Reid Crowther's opinion that the Quality Control Plan is inadequate for a project of this cost and complexity, and lacks many of the basic elements normally included in Quality Control Plan. For example, the Plan does not include the following elements incorporated into

Quality Control Plans for wastewater treatment plant upgrading projects recently carried out by Reid Crowther for the Greater Vancouver Regional District:

1. Name of the Quality Control Manger, his responsibilities, duties and authority.

2. Organization chart showing the project staffing, clear lines of authority, and responsibilities, and assigned alternates in times of staff absence.

3. Procedures for peer review of design.

4. A list of standards and guidelines used for the design of the facility.

5. Procedure for coordinating specified and proposed testing and inspection activities during the construction period.

6. Responsibilities and procedures for assuring requirements arising from regulatory agencies, codes, and reference standards are met.

7. Procedures on how submittals from manufacturers, suppliers, contractors and other parties will be reviewed for compliance with the contract documents prior to submission to the Owner.

8. Procedures to be used to identify and report deficiencies and corrective actions.

9. Testing procedures for verifying that the completed project meets the requirements of the Contract.

5.5 RECORD DRAWINGS

GC 5 Design Preparation of the Contract lays out the procedure and form for design drawing submittal, review, correction and modification, and final submission. GC35 Drawings of the Contract states:

35.1 *Before issuance of the Certificate of Completion, the Contractor shall provide the Owner with the following:*

(a) *2 complete sets of Drawings and Specifications, showing the as-built Work;*

(b) *1 set of disks with the as built Drawings on them;*

Reid Crowther has reviewed the drawings submitted to the District for the plant. These include the structural and some piping drawings, all noted to be "Issued for Construction" or "Issued for Reference". No "As Constructed" drawings had been received as of October 16, 1998. In addition, those drawings that have been received by the District do not detail any of the electrical, plumbing, ventilation and minor piping details.

As per the Contract, an entire set of drawings will be required prior to accepting that the facility is complete.

5.6 OPERATING MANUALS

GC35 Drawings, of the Contract, states:

35.1 *Before issuance of the Certificate of Completion, the Contractor shall provide the Owner with the following:*

c) 3 complete sets of maintenance manuals for all equipment comprised in the Work

As of October 16, 1998, the District had not received any operating manuals for the plant for review. It is believed that some of the necessary documentation has been prepared, as it is being used for start-up and commissioning of plant processes. Formal submittal, review, correction and modification, and final submission is required prior to Final Completion.

5.7 PERFORMANCE BONDS

GC27 Bonds and Insurance require that the Contractor deliver to the Owner executed performance bonds and labour and materials payment bonds with a cumulative value of $4,710,000. Schedules B and C of the Contract list two bonds in the name of Hill, Murray and Associates, and two bonds in the name of Zenon Environmental Inc. with a total value of $4,878,057.54.

Should the District of Powell River have concerns resulting from performance of the work in respect to defects or deficiencies, then at some point, if not satisfied, they may want to invoke the Performance Bonds by placing the bonding companies on notice. This should by at the discretion of the District after consultation with their legal council.

SECTION 6.0
PLANT STATUS REVIEW

6.1 HEADWORKS

6.1.1 Auger Screens

The headworks are equipped with two screw auger screens (one with 3 mm openings and the second with 5 mm openings), and two manually raked bypass screens with 6 mm and 12 mm openings in a single bypass channel. The screw auger screens are ML Engineering Screw Screens manufactured by Pro Aqua Engineering of Toronto, Ont. We have noted the following issues related to these screens:

1. The proposed screen presented in the HMA Preliminary Design Package was a Rotomat Microstrainer manufactured by Lakeside Equipment Corporation. (However, the letter from the local Lakeside representative, Promag Enviro Systems Ltd., refers to the Ganges WWTP rather than the Westview WWTP).

2. The 16" screens referred to in the Preliminary Design Package have a maximum capacity of 750 US gpm (4,090 m^3/d). Therefore, the capacity of two screens (1,500 US gpm, or 8,180 m^3/d) is lower than the maximum daily flow to the plant (13,640 m^3/d) and significantly lower than the estimated peak wet weather flow to the plant (24,000 to 26,000 m^3/d).

3. No technical information was provided on the hydraulic capacity of the screens installed. Further, we have not yet been provided with any documentation indicating the District's approval to change, or that the installed screens are considered to be an equal and approved substitute.

4. The screens are not effectively transporting material to the compaction zone. We understand the Contractor is in the process of installing a central shaft to the screens to attempt to improve performance.

5. The screens are not removing substantial volumes of screenings. For reference, Lakeside (the screen included in the Preliminary Design Package) claims that their equipment removes 96% of screenings from the wastewater flow. The actual volume of screenings in the flow is difficult to determine as it can vary significantly between systems depending on the screen opening, wastewater flow, characteristics of the collection system, type of screen used etc. The WEF Manual of Practice No. 8

identifies typical volumes of screenings for various plants. Extrapolating from the graph presented in the manual, the volume of uncompacted screenings removed on a 3 mm screen is expected to be approximately 0.1 m^3 per 1,000 m^3 of wastewater treated. When compacted, screenings volumes are halved, so one would expect about 0.05 m^3 per 1,000 m^3 of wastewater treated. The Westview screens appear to remove approximately 0.003 m^3 per 1,000 m^3 of wastewater treated, or less than 10 percent of the anticipated quantity.

6. Visual inspection and the experience of the plant operators indicates that a significant fraction of the influent screenings escape capture and enter the downstream units.

6.1.2 Grit Removal Channels

The Contract required that grit removal be incorporated in the plant. The inlet works are equipped with two grit removal channels. Each channel is equipped with six manually removed stainless steel grit collection troughs. We have noted the following issues related to these grit channels:

1. Typical grit quantities generated from a wastewater treatment system are approximately 0.013 m^3 per 1,000 m^3 of wastewater treated, based on grit dewatering to about 80% solids content. The WEF Manual of Practice No. 8 lists the volume of grit expected in wastewater collected in a separate sewer system to be between 0.004 and 0.037 m^3 per 1,000 m^3 of wastewater treated. In mid-October, the grit channels had not been cleaned although operating for more than 60 days. At the rate of accumulation noted above, approximately 3.1 m^3 of grit would be expected. However, manual probing of the channels and visual inspection of the collection troughs did not suggest any significant grit accumulations.

2. Removal of grit from the channels is a labour intensive operation. In addition, entry into the channels for the purposes of cleaning will require that the operators comply with "Confined Space Entry" regulations.

3. If grit is not efficiently removed upstream of the main process, it will, over time, accumulate in the bioreactor. Eventually, this accumulation will need to be removed as it could damage the aeration system as the volume accumulates - it should not be allowed to build up to a depth of more than 300 mm in the first aerobic cell. Grit removal is a manual job involving digging the grit out of the bioreactor.

4. Little or no information on the design and operation of the grit removal channels has been provided in any submission to the District.

6.1.3 By-Pass Screens

All flows not directed to the bioreactor for secondary treatment pass through two Model RF60120 in-channel rotary drum screens with 37 micron apertures, manufactured by PRA Manufacturing Ltd. of Nanaimo, B.C. There is provision for the installation of a third screen. These screens have an in-to-out operation with regular high pressure potable water spray cleaning applied to the exterior of the drum. Issues noted regarding these units include the following:

1. According to the Specification Sheet provided in the Preliminary Design Package, the capacity of these screens when treating effluent with 40 mg/L of TSS (municipal effluent polishing) is 6,748 m^3/d (1,238 US gpm). However, wastewater TSS concentrations in the bypass flows will vary between 50 and 200 mg/L. For this reason, the screen capacity at these higher TSS concentrations will be lower than the rated capacity of 1,238 US gpm. With two units in service, the bypass screens are unlikely to be able to treat the fraction of the expected PWWF not directed to secondary treatment.

2. Screen panels in one of the screens shows signs of 'bulging'. The Contractor provided the District with a removable standpipe to artificially raise the water elevation in the outlet channel and reduce the head across the screen. Submerging the screens causes backup within the headworks channel and could contribute to the perceived poor performance of the auger screens.

3. Examples of broken screen panels caused by excessive pressure build-up on the screens were noted.

4. At the time of the September 26 site visit, one of the screens had a bearing that was generating noise and warranted investigation and repair.

5. The high pressure potable water spray cleaning system is fabricated predominantly from PVC pipe. Waterhammer occurring on shut-down and start-up has caused several line ruptures.

6. The drum screen water spay has a flow rate of approximately 50 US gpm. If used 50% of the time, the potable water consumption will be approximately 50,000 m^3 per year, which will incur significant ongoing costs to the District.

6.1.4 Oil and Grease Removal

The headworks do not include oil and grease removal. All oil and grease passing through the auger screens either will flow directly to the bioreactor, or will be trapped on the bypass screens, from where it will be returned to the flow entering the bioreactor. We note that Point (2) of Schedule I - Owner's Work of the Contract Document states that the District is responsible for "*eliminating or intercepting grease from the sanitary collection system so that it does not enter the Westview Facility*". The District mandates and enforces grease removal from commercial and institutional establishments through its sewer use bylaw. This practice is reasonable and consistent with wastewater practice elsewhere. Nonetheless, oil and grease is present in domestic wastewater and, normally, must be managed at the wastewater treatment facility.

6.1.5 Bypass Flow Measurement

Screened by-pass flow passes through a parshall flume before being blended with tertiary treated flow prior to marine discharge through the outfall. The liquid level in the inlet to the flume is measured and converted to a flow to provide a measure of the bypass flow. Issues related to this flume are as follows:

1. Turbulent flow conditions exist where the flow enters the flume, despite an upstream flow stilling structure. As a result, the accuracy of the bypass flow measurement is questionable.

6.2 BIOREACTOR

6.2.1 Process Configuration

The design drawings submitted to the District indicate a pre-denitrification process configuration. The raw wastewater enters a common anoxic zone, from where it splits into two aerobic zones, each followed by a second aerobic cell equipped with filter membrane modules. Mixed liquor is continuously recycled from the third cell to the anoxic zone. In a pre-denitrification process, the bulk of BOD utilization and all of the nitrification (biological oxidation of the influent ammonia to nitrate/nitrite) occur in the aerobic cells. Denitrification (biological reduction of the nitrate to nitrogen gas) takes place in the anoxic reactor, with the bacteria using the incoming wastewater as a carbon source. Issues related to the process configuration are as follows:

1. The plant was built in a post-denitrification configuration, with the raw wastewater and the recycled mixed liquor being blended in a common aerobic cell at the head end of the process. Mixed liquor from the aerobic cell flows into an anoxic cell and then on to the aerobic cells having the filter membrane modules. We have received no documentation discussing or indicating the District's approval of this change from a pre-denitrification to a post-denitrification configuration.

2. Minor concerns with the post-denitrification configuration include reduced denitrification efficiency, lower process alkalinity, and higher oxygen requirements.

3. A more serious concern is the use of the single common aerobic cell which receives all of the influent wastewater and feeds the north and south anoxic cells. All grit escaping the headworks will settle in this cell where it will accumulate and interfere with proper operation of the aeration system. It is difficult to remove this cell from service for maintenance while keeping the secondary treatment process in operation.

6.2.2 Membranes

Originally, the plant was equipped with 16 membrane cassettes. In September, 1998 another four cassettes were added. In October, another two were provided to allow one pair to be regularly removed from service for recovery cleaning. Each cassette consists of eight membrane modules, and each module has 500 ft^2 of membrane surface area. Issues related to these membranes include the following:

1. Schedule E - Performance Specifications of the Contract states the plant will treat flows less than 931,000 US gal/day (3,528 m^3/d) with a peaking factor of 2X (1,862,000 US gpd, or 7,056 m^3/d) to a tertiary level (BOD and TSS < 10 mg/L, faecal coliform, 25 MPN/100 mL). The proposal from Zenon Municipal Systems dated August 29, 1998, and included in the Preliminary Design Package, for the supply of the ZenoGem/ZeeWeed membranes confirm these design criteria with a small factor of safety. The design criteria listed in the Zenon proposal are as follows:

Parameter	Influent	Effluent
Average Day Flow	1,000,000 US gpd (3,785 m^3/d)	
Instantaneous Peak Flow	2,000,000 US gpd (7,570 m^3/d)	
BOD	250 mg/L	<10 mg/L
TSS	250 mg/L	<10 mg/L
TN	40 mg/L	
pH		6.0-9.0
Toxicity		100% LC_{50} 96 hour
Faecal Coliform		<2.2 100 mL

1. Note: Peak flows should not be sustained for more than 12 hours in a 24 hour period

2. The above design was based on the use of 128 ZW-500 membrane modules housed in 16 membrane cassettes, i.e. 8 modules per cassette. The membrane design flux is 15.6 US gal/ft^2/day at average day flow. On the basis of the Zenon proposal, the secondary treatment plant equipped with 16 membrane cassettes should be capable of treating a flow of 2.0 US MGD (7,570 m^3/d), or 1,390 US gpm, for up to 12 hours without exceeding the maximum allowable trans membrane pressure (7 psi).

3. The setpoint transmembrane pressures (TMPs) are 3.0 psi (low) and 5.0 psi (high). Extended operation above 5.0 psi apparently will shorten membrane life. District operators have noted that during start-up, the TMP exceeded 7.0 psi on several occasions.

4. During the plant visit on October 13, 1998, the TMP was 3.5 to 3.7 psi and the system effluent flow 650 to 660 US gpm (936,000 US gpd to 950,400 US gpd) with all 20 membrane cassettes in operation. This flow includes the membrane backwash flow which appears to account for 10 to 20 percent of the measured amount. Thus, the membrane treatment portion of the plant was treating less than the contractual average capacity and significantly less than the peak flow through secondary treatment stipulated in the contract. Nonetheless, approximately 50 percent of the plant influent was bypassing secondary treatment.

5. The membrane cleaning system includes backwashing of the membranes with a sodium hypochlorite solution. The WCB requires that an eyewash and shower (with 20 minutes warm water storage) and spill containment facilities be provided. These safety provisions have not been included at the plant.

6.2.3 Process Sludge Age

The design calculations provided in the Zenon Proposal, that was included in the Preliminary Design Package, are based on the plant being operated at a sludge age (SRT) in excess of 50 days. Our review of the calculations was carried using a well recognized activated sludge process computer simulator (BioWin), developed by EnviroSim Associates of Oakville, Ontario. The model predicts that at the design flows and loads, and an MLSS concentration of 15,000 mg/L in the bioreactor, the maximum SRT at which the plant can be operated is approximately 30 days. This implies that the estimated waste sludge production at the plant may be significantly higher that the design value. However, at an SRT of 30 days, the plant will still maintain year round nitrification, thus satisfying the requirement to produce a non-toxic effluent (assuming there is no bypass of primary effluent). During the October 13, 1998 visit to the plant, we noted that the operators were adding approximately 12.5 kg Na_2CaCO_3 and 12.5 kg Na_2HCO_3 per day to the plant, presumably to raise the process pH and sustain nitrification.

6.2.4 Aeration System

Process air is provided to the aerobic and membrane zones of the bioreactor by three new 100 hp Lamson centrifugal blowers, and two existing Hoffman units. During our October 13 site visit, three new blowers were operating; although one of the blowers was running at flows substantially below the stipulated minimum for the machines, i.e. under surge conditions. This mode of operation is of concern as it leads to accelerated wear due to relatively high vibration.

One of the blowers delivers air to the aerobic zone while the remaining air is delivered to the membrane zones where it agitates the liquid in the membrane area.

In the aerobic zone, the air apparently is supplied to fine bubble diffusers. Dissolved oxygen concentrations were relatively high at greater than 2 mg/L in the aerobic zones indicating that the system had sufficient capacity under the operating conditions at the time to satisfy the oxygen demand.

6.3 DISINFECTION

6.3.1 UV Disinfection System

The Preliminary Design Package contains a proposal from Trojan Technologies Inc. dated September 5, 1997. The proposal is based on providing a Trojan UV3000B system with 72 low pressure, low intensity UV lamps, and a peak design flow rate of 3.0 US MGD. The system provided has 48 lamps. As of October 16, 1998, no documentation had been provided outlining the rationale for this change in the design, nor had the necessary approvals been granted by the District.

During the October 13, 1998 site visit, it was noted that the UV intensity being displayed on the system control screen at a flow rate of approximately 3,540 m^3/d (650 US gpm) was between 4.1 and 4.3 mW/cm^2, which is considered to be low for a system that is required to meet a limit of 25 FC/100 mL. Subsequent communication from the UV system vendor (Trojan Technologies) indicated that the system was designed to provide a UV dosage of 22,000 $\mu ws/cm^2$ at a peak flow rate of 1.86 US MGD. Initial monitoring data indicate that the system is capable of meeting the effluent limit of 25 FC/100 ml in the tertiary treatment flow stream.

6.4 SOLIDS HANDLING STREAM

At the time of the October 13, 1998 site visit, mixed liquor from the process was being wasted to an aerated sludge storage tank, but the sludge dewatering system had not been commissioned. However, the Contractor was planning to commission the sludge handling system "within a few days". Once the system is put into operation, it will be possible to evaluate its performance. The following paragraphs provide a brief summary of the components.

6.4.1 Sludge Holding Tank

Mixed liquor, at a concentration between 1.5 and 2.0 percent, is pumped from the bioreactors to the sludge holding tank. In that tank, the waste sludge is aerated by a dedicated 10 hp blower through the an aeration system constructed of diffusers saved from the existing plant, and thickened by withdrawing supernatant using dedicated membrane modules.

6.4.2 Rotary Press

From the sludge holding tank, the thickened sludge is pumped to a flocculation tank from where it is conveyed by a progressive cavity pump to the rotary press. The press is a two channel, Model 1200 unit manufactured by Fournier.

Sludge is conditioned by the addition of polymer and woodchips. Woodchips are added via a feed hopper and screw conveyor to the sludge storage tank. A diluted polymer solution also is added just prior to the sludge press. The polymer feed system was not reviewed during Reid Crowther's two plant visits. No provision has been made for polymer storage in the sludge dewatering room.

6.5 BUILDINGS

During the September and October site visits, several areas of concern were identified regarding the plant buildings. Many of these have been noted in deficiencies lists prepared by the District and presented to the Contractor. Areas of concern noted by Reid Crowther include:

1. Lack of sufficient ventilation and excessive condensation in the headworks building.
2. Several crane beams supported on top of doorways.
3. Support bolts missing from the main crane beam in blower room.
4. Visible deflection in the support beam of the cantilever crane in the main process building, and reports that this crane has failed on at least three occasions.
5. The normal provisions for seismic restraint appear to be absent in the main process building. There was no cross bracing or shear walls. Possibly, the roof structure was designed as a diaphragm to allow the building to resist seismic forces. Major pieces of mechanical equipment, such as the aeration blowers, were not provided with seismic restraints.

6.6 VENTILATION & ODOUR CONTROL

In order to comply with the "Standard for Fire Protection in Wastewater Treatment and Collection Facilities" (NFPA 820), enclosed headworks and secondary treatment areas not proceeded by primary treatment must be ventilated at 12 air changes/hour in order to

obtain a Class 1, Division 2 rating. At ventilation rates lower that 12 air changes/hour, these areas receive a Class 1 Division 1 rating. In the latter case, all lighting, electric equipment, motors and starters, HVAC and operator's equipment must be intrinsically safe, i.e. explosion proof. In addition, the areas must be equipped with combustible gas monitoring. To address safety concerns, combustible gas monitoring is generally augmented by sulphide and oxygen monitoring.

Our experience indicates that minimal odour is generated at the secondary treatment stage of an activated sludge type of wastewater treatment plant. Most odours are generated at the headworks and sludge handling facilities. Issues related to the design of the ventilation and odour control systems for the headworks and sludge press rooms are as follows:

1. The headworks building has a total enclosed volume of approximately 24,250 ft^3. In order to provide 12 air changes/hour, the total blower capacity would have to be 4,850 cfm. The two 2.0 hp blowers have been provided with an estimated combined capacity of 1,700 cfm at low speed, and 3,700 cfm at high speed. As the two blowers operating at high speed would only be capable of providing approximately approximately 9 air changes/hour, the headworks building should receive a Class 1, Division 1 rating.

2. The headworks room and sludge press room each have a dedicated 4' by 4' by 1' deep biofilter. Biofilters are normally designed with an empty bed retention time of 60 seconds, and a minimum retention time of 45 seconds. When operated at low and high blower speeds, the East Biofilter has an empty bed retention time of 1.2 seconds, and 0.6 seconds, respectively. The West Biofilter has an empty bed retention time of 1.1 seconds and 0.5 seconds, respectively, when operated at low and high speed.

3. A paper on the design of biofilters presented in the Preliminary Design Package (Odor Control - Biofiltration by Tom Richard of Cornell Composting Science and Engineering) states that literature values for biofilter airflows are typically 0.015 to 0.02 m/s (3 to 4 cfm/ft^2). Given that the enclosed volume of the headworks building is 24,250 ft^3, and assuming a design airflow rate of 3 cfm/ft^2, the total area of biofilter required to provide 12 air changes per hour is 1,600 ft^2. The two biofilters provided have a total area total of 32 ft^2 and are, therefore, severely undersized.

4. The Cornell Composting paper also states that: "*Biofilter bed depths typically range from 1 to 1.5 meters deep, with shallower beds subject to short-circuiting of gas flow and deeper beds more difficult to keep uniformly moist.*" The media depths of the two biofilters provided was approximately 0.3 m and the airflow rate excessively high. On both the September 26 and October 13 site visits, a hole approximately 300 mm in diameter was observed in the biofilter media, indicating extreme short-circuiting and failure of the odour control system.

SECTION 7.0
CONCLUSIONS AND RECOMMENDATIONS

Reid Crowther has undertaken Stage 1 of the Contract and Completion Review of the Westview Water Reclamation Plant project, as outlined in our proposal to the District of Powell River dated September 22, 1998. This report summarizes our findings and provides what is essentially a snapshot of the project status as of October 16, 1998. It should be understood that, although Substantial Completion was granted by the District on July 13, 1998, significant work remains to be done prior to Final Completion.

Reid Crowther, within the time frame permitted, has reviewed the available information related to the Westview plant to determine its status within the context of the Contract between the Contractor, Hill, Murray & Associates, and the Owner, the District of Powell River.

The Stage 1 Contract and Completion Review has led to the following conclusions:

1. The effluent from the Zenon membrane treatment portion of the plant is of excellent quality and appears to surpass the permit and contractual requirements for BOD, TSS and faecal coliforms.

2. To October 16, 1998, Reid Crowther has identified numerous deficiencies in the facility. To gain an appreciation of the priority allocated to these deficiencies, we have arranged them in three categories of Design/Performance, Regulatory/Code and Contractual Obligations. A summary of noted deficiencies is provided in the following:

   <u>Design/Performance Deficiencies</u>

   i. As of October 16, 1998, the plant had not proven capable of reliably treating the contractual design flows while remaining within normal operating parameters.
   ii. The influent auger screens do not appear to function as intended; they do not remove sufficient screenings quantities.
   iii. The grit removal system does not appear to function as intended; grit quantities removed from the wastewater are substantially less than would be anticipated.
   iv. The membrane treatment system has not satisfactorily demonstrated the ability to treat the flows stipulated in the Contract.
   vi. Sludge quantities generated are expected to be substantially greater than indicated in the design information provided.

vii. The odour control biofilters are too small, and are unlikely to effectively control odours from the headworks area and sludge press room.

viii. Disinfection is not provided for bypass flows.

ix. The 1.5 ton crane in the secondary treatment area, and the associated crane rail has failed on several occasions and must be repaired or replaced to ensure adequate safety and service.

Regulatory/Code Deficiencies

i. No spill containment is provided for the sodium hypochlorite storage containers in the main process building, as required by hazardous materials handling and WCB regulations.

ii. No emergency eyewash/shower, with a 20 minute supply of tempered water, is provided at the sodium hypochlorite storage area, as required by WCB regulations.

iii. No gas detection system has been installed in either the headworks area or the membrane treatment area, as required by NFPA 820.

iv. Electrical components do not appear to satisfy exposure requirements for a Class 1, Division 1, or Class 1, Division 2 area classification, as required by NFPA 820 and the Canadian Electrical Code.

Contractual Obligations Deficiencies

i. Record Drawings have not been submitted.

ii. Operating manuals, maintenance manuals, and/or operation & maintenance manuals have not been submitted for review by the District.

iii. Substantial changes and modifications have been made without record of the District approving the change or modification. Examples include the change in auger screen manufacturer and the change of the bioreactor configuration.

3. The above Deficiencies are in addition to those identified by District staff and separately communicated to the Contractor.

4. In addition to the above deficiencies, Reid Crowther has the following concerns which, due to insufficient information, we are unable to investigate in full at this time:

i. Seismic bracing of the main process building structure appears minimal. An independent check of this aspect of the structural design should be conducted together with a check of the crane support structure. Seismic restraints have not been provided for major items of mechanical equipment, e.g. aeration blowers.

ii. Ventilation rates in the headworks area may not be sufficient as evidenced by the condensation that occurs when the room openings (doors) are closed.

iii. The control system may not incorporate sufficient equipment protection as evidenced by the operation of one of the new 100 hp blowers at well below the manufacturer's published minimum flow rate, i.e. under surge conditions.

The deficiencies and possible deficiencies noted above are substantial and serious. The potential costs associated with their rectification are significant.

As a result of the above findings, Reid Crowther recommends the following:

1. The Contractor should be given every reasonable opportunity to rectify the deficiencies previously noted by the District and those noted in this report, as well as any other deficiencies that are identified in subsequent review.

2. Until the deficiencies are rectified to the satisfaction of the District, Final Completion should not be granted.

3. The Contractor should be directed to establish a program, which when approved by the District, can be implemented to verify that the plant is able to meet its contractual performance requirements. Third party monitoring of performance should be an integral component of the verification program to provide an adequate level of quality assurance.

4. The Contractor should be directed to establish a program, which when approved by the District, will be implemented to rectify all physical deficiencies in a timely manner. Third party monitoring of performance should be an integral component of the program to provide an adequate level of quality assurance.

5. Should the Contractor not expeditiously and conscientiously develop and implement the performance verification program and deficiency rectification program described above, the District of Powell River should, with the advice of their legal counsel, pursue their rights and remedies under the Contract.

Due the substantial and serious nature of the deficiencies, the District should keep their legal counsel fully apprised of the ongoing situation and, if legal counsel should suggest, advise other interested parties (bonding companies, etc.) of the potential for dispute.

TAB N

Confidentiality

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Comments on Draft Report #1
Contract and Completion Review
Westview Water Reclamation Facility
by Reid Crowther and Partners Ltd.
Dated October 19, 1998

Submitted to:

Gino Francescutti
Director Development Services
District of Powell River

Submitted by:

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November 6, 1998

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INTRODUCTION

Hill-Murray has reviewed the draft report referenced above, prepared by Reid Crowther & Partners Ltd., dated October 19, 1998. Hill-Murray has also reviewed the proposal submitted to the District by Reid Crowther dated September 22, 1998 and a letter submitted to the District by Reid Crowther dated October 29, 1998.

Hill-Murray's first reaction to the draft completion review report was one of frustration since the report contains several mistakes, erroneous information, and flawed conclusions. The recommendations of the report are also potentially damaging to our company. Many of the points raised in the report stem from the review of preliminary design documents which do not form part of the contract documents. Further, many of the conclusions and recommendations in the draft report, based on this review of preliminary documents which have been superceded by more recent submissions, are not accurate. Hill-Murray feels that had Reid Crowther been given the correct documents and had they contacted Hill-Murray to discuss any of the areas covered in the report, their conclusions and recommendations would have been different. Reid Crowther states, in their October 29, 1998 letter, that the tight time-line given to them limited their ability to discuss the design with Hill-Murray. In fact, it was not discussed at all with Hill-Murray. They stated that they were attempting to elicit feedback on issues that they allege were serious, but did not contact Hill-Murray. Hill-Murray requested and was granted a meeting with Reid Crowther on October 20, 1998, the day after the draft report was written and the day before the daft report was released to Council. At that time, Reid Crowther refused to discuss the report with Hill-Murray.

A draft report, based on an incomplete review was forwarded to Council before Hill-Murray had a chance to see it. Attached herein are documents that show that the District was in possession of the proper material for Reid Crowther to review. Reid Crowther, despite their vast experience, have not done the comprehensive review that is indicated in their proposal and yet presented 'draft' conclusions and recommendations to Council. Staff and Council have reacted out of fear and an abundance of caution, and have taken actions, including placing Hill-Murray on notice of default and putting Hill-Murray's bonding company on demand.

Worthy of mention is the fact that Reid Crowther have acted in a way which may indicate that they cannot act impartially. This is perhaps due to previous involvement with the Westview facility as well as their relationship to Hill-Murray as a competitor on this and many other projects in both BC and the North West Territories. The draft report evokes fear and concern, and is potentially damaging to Hill-Murray. Until the report is researched fully by Reid Crowther, circulated to Hill-Murray, ZENON, and the District of Powell River, and then revised and submitted to the District in its final corrected form, it should be treated as a *draft* and not released to anyone due to inaccurate, potentially damaging statements.

Reid Crowther should review their own 'terms of reference' with respect to this contract and completion review, and determine if they have completed a comprehensive review. Since Hill-Murray was not consulted at all by Reid Crowther during the review, and review documents were incomplete or simply not requested by Reid Crowther, Hill-Murray does not see how this report can be released. The timing and inaccuracy of this draft report and completion review have created significant interference to Hill-Murray in its completion of the project.

Notwithstanding the above, there have been certain points brought forward in the Reid Crowther draft report that are valid. While Hill-Murray is fully capable of meeting its contract requirements without any modifications or additions, Hill-Murray has considered all points and recommendations carefully and will implement some of the recommendations in order to provide the District with a better end product.

Documentation

The 'preliminary design' documentation reviewed by Reid Crowther has been superceded by final design submittals. The preliminary design information does not define the contractual obligations of Hill-Murray. This appears to be the root of the problem. Record keeping, both on Hill-Murray's and the District of Powell River's part, could have been better. This can easily be cleared up by forwarding the proper, final equipment submittals (which have been received, reviewed, and approved by the District) to Reid Crowther. Hill-Murray has attached several transmittal forms which show that the District received and reviewed and approved all final equipment submittals (see Annex B).

Annex B to this document contains copies of letters and notes between Hill-Murray, the MoELP, and the DOPR. Unfortunately, these were not given to Reid Crowther nor did Reid Crowther request them from Hill-Murray.

Communication

Overall communications regarding this situation have been poor. Hill-Murray requested and was given a meeting with Reid Crowther before the release of the draft report. Hill-Murray asked if there were any major issues and was told by Reid Crowther that the report could not be discussed with Hill-Murray until after the report was released to Council. The draft report was sent directly to Council and Hill-Murray was put on notice of default without an opportunity to refute the findings of the report.

The amended MoELP permit was received by the District, shown to Reid Crowther but not shown to Hill-Murray. It was found, however, that the amended permit contained some simple errors which the Ministry has indicated that they will correct immediately. Lack of communication made a small issue appear to be serious.

Standard Manuals of Practice

Reid Crowther cites several 'standard manuals of practice'. They hold up Standard Manual of Practice #8 in reference to screenings. They make reference to 'typical' grit quantities and a 'well recognized' activated sludge process computer simulator. They make reference to NFP 820 'standard for fire protection in wastewater treatment and collection facilities'. While these are interesting references, they do not define contractual obligations. This project has been designed, supervised, and certified as meeting all applicable codes by a team of registered professional engineers and architects who have submitted signed, sealed letters of assurance that all applicable codes and laws have been met. Hill-Murray will endeavour to incorporate any improvements suggested in the Reid Crowther review process, nonetheless, manuals of standard practice are not code, therefore, they do not define contractual commitments. Reid Crowther must focus on the simple performance criteria defined in the contract. Hill-Murray, as a designer-builder, must meet these criteria within all provincial and federal construction, electrical, and fire codes. The contract does not

require Hill-Murray to subscribe to any particular manuals of standard practice. The advanced technologies provided in the Westview upgrade are not standard technologies. The Hill-Murray approach is not the standard approach.

REBUTTALS

Design Flows (Section 3 of Reid Crowther Report)

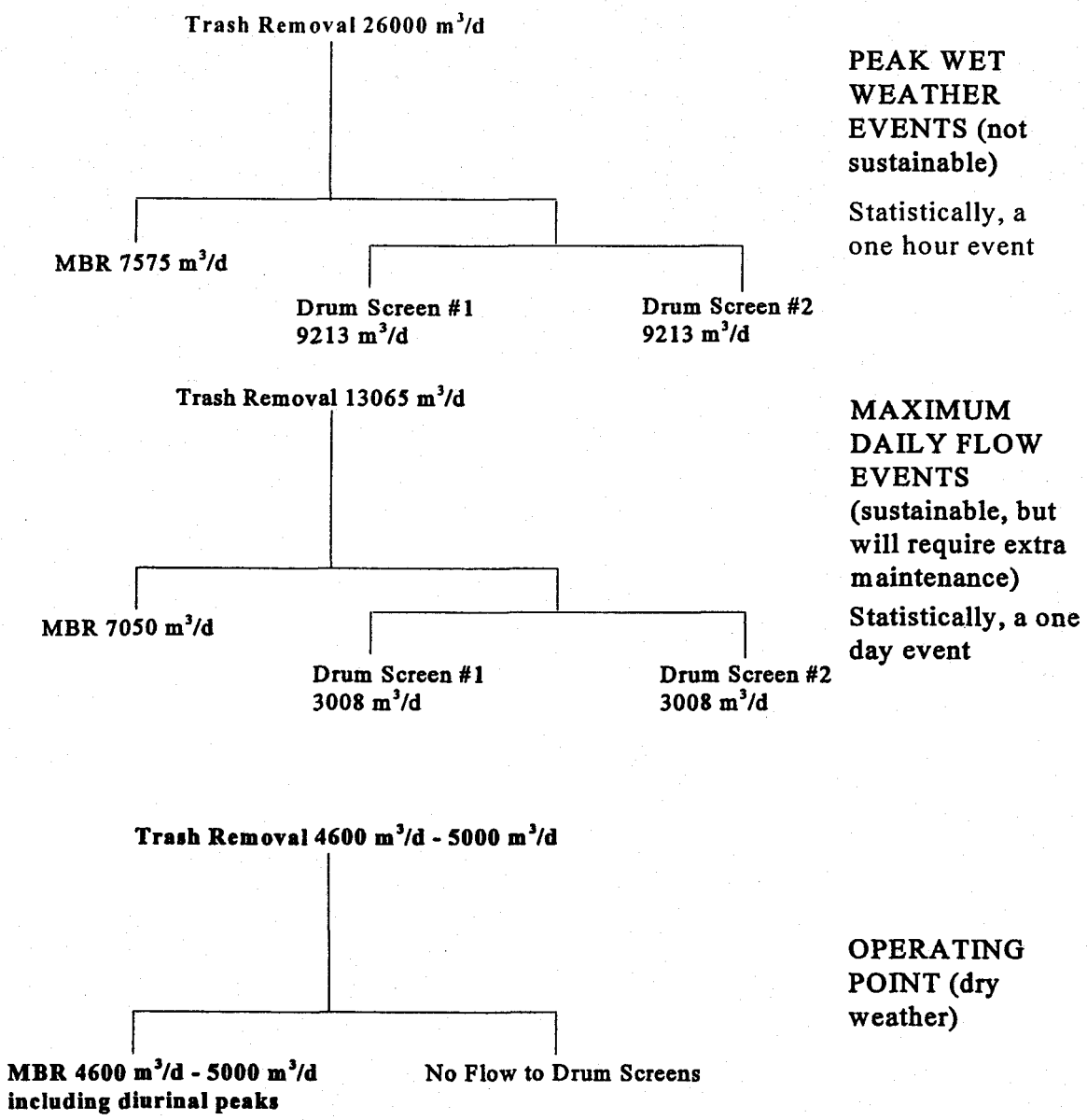
It is suggested in the Reid Crowther letter of October 29, 1998 that the issue of design flows is a red herring. This is certainly not true. The Reid Crowther Preliminary Design Report (September 1996) was used (with the permission of the District) as a guideline in determining design flows, contract performance specifications, and permitted flows. The fact that actual daily flows both in dry weather and wet weather conditions at the Westview Plant exceed the flows predicted in the Reid Crowther report by 30% to 40%, is very significant. Hill-Murray acknowledges that performance of the ZENON system at the time of the site inspections by Reid Crowther was below specification and below the performance requirement of the contract. Full recovery, however, has been achieved by manual cleaning and soaking of the filter cassettes, removal of cassette shrouds, and modification to the auto-clean and backpulse software. Reid Crowther makes an important and valid observation that washwater for the drum screens and backpulse water for filter cassette cleaning can confuse the flow measurement issue. In dry weather, in the steady state, with the ZENON system operating at 100% capacity, the drumscreens are not used. Drumscreen washwater, therefore, does not contribute to the 'flow measurement' issue and does not represent any significant ongoing cost as the Reid Crowther report suggests.

The intention of the performance criteria in the head contract is to provide the District with sufficient treatment capacity and some reserve capacity in the ZENON system to meet the requirements of Section 21 of the draft discharge criteria, two times ADWF. To provide reserve capacity and safety margin, and to ensure operation for low TMP, the ZENON specification purchased was at a maximum capacity of 7575 m^3/day. Hill-Murray contracted with the District for 7053 m^3/day, which in our professional opinion is the maximum recommended peak flow for the ZENON system. Hill-Murray, with the express knowledge and consent of the District, negotiated with the Ministry for a maximum sustained flow through the ZENON system of 4588 m^3/day. This will reduce operating costs and extend the life of the membranes and the entire ZENON system. It does not in any way influence the performance criteria of the contract. In summary, Hill-Murray has worked to put the District in the best possible position by purchasing a system with 7575 m^3/day capacity (peak flow), by committing to a performance specification of 7053 m^3/day (peak flow) and by negotiating a steady state flow requirement of 4588 m^3/day. This has provided reserve capacity for the district over the predicted AAF of 3950 m^3/day and the actual observed dry weather flow of 5000 m^3/day. The table below illustrates the rationale behind the various flow criteria and shows corresponding instantaneous flow rates which have been corrected for the consumption of treated water by auto washing and auto-backpulsing of membranes.

ZENON SYSTEM FLOW PARAMETERS		
Flow (m^3/d)	Description	Instantaneous Flow per side of the ZENON system Corrected to Allow for All Auto Wash Cycles (USGPM)
7575	Manufacturers' maximum capacity of treatment system. The manufacturer has indicated that this will not be sustainable without significant operator intervention (cleaning and soaking). This is not a contract requirement. Each side of the ZENON system will be capable (at maximum TMP) of 790 USGPM.	790
7050	Contracted maximum flow in the Design-Build contract between Hill-Murray and the District of Powell River. This is the specified peak flow capability and not the recommended operating point, 734 USGPM is the actual water production rate required per side to meet the total net water production rate of 7050 m^3/d (88% service factor). Continuous operation at this flow rate is not recommended as it will require higher TMP and more frequent cleaning and soaking of cassettes. Continuous operation at this flow rate will seldom, if ever, be required.	734
5000	This is the actual steady state dry weather flow which was observed during start-up, it is higher than the AAF predicted by Reid Crowther (3950 m^3/d) and higher than the point at which use of the rotating drum screens is authorized by the amended permit (4588 m^3/d). The membrane system has been operating at this point for many weeks. An increased frequency of cassette rotation and soaking has been instituted to ensure that operating TMP remains low. It should be recognized that increased sludge production, man hours and electrical power consumption result from this higher than expected daily flow. In order to meet this flow, 521 USGPM per side is the steady state requirement. This does not account for daily diurnal peaks which, during dry weather must be treated by the ZENON system. It is for this reason that start-up has been prolonged and Hill-Murray has had to convert the West Aeration Basin to an equalization tank. Instantaneous diurnal peak flow not previously measured by Hill- Murray, the District, or Reid Crowther are in the order of 2000 USGPM.	521
4600	The point at which use of the rotating drumscreens is authorized by the amended permit. This is the maximum recommended operating point of membrane system. The steady state operating point during wet weather is 504 USGPM per side from the ZENON system.	480

Maximum Daily Flow and Peak Wet Weather Flow (Section 3.2 of Reid Crowther Report)

The trash removal equipment is designed to treat the peak wet weather flow of approximately 26000 m^3/day (peak hour). During peak wet weather events (statistically, the largest single one hour flow in a year), the flow to the ZENON system will be maximized to 7575 m^3/day. This requires each drum screen to have a capacity of 9213 m^3/day.



Secondary Treatment Flow (Section 3.3 of Reid Crowther Report)

The upgrade can meet all requirements of estimated PWWF, MDF, AAF, and the Ministry's requirement of secondary treatment for two times ADWF. The upgrade will meet the permit requirements of BOD <10 mg/L, TSS < 10 mg/L for flows less than 4600 m^3/d and BOD < 45 mg/L, TSS < 45 mg/L for flows greater than 4600 m^3/d. This is illustrated in our first operational report attached as Annex A.

Flow Monitoring (Section 3.4 of Reid Crowther Report)

The accuracy of the main flow flume and drum screen discharge flume were checked with a portable flow measurement device (Q-Tracker). The results are included in Annex A.

Trash washing does add up to 1.5% of the total flow. Performance checks must take this into account so that net flow is considered.

Drumscreen wash water adds up to 275 m^3/day to the flow treated by the MBR. Performance checks must take this into account.

Membrane backwash flows are allowed for by derating membrane capacity by 12%. Performance checks must take this into account.

Effluent Requirements (Section 4 of Reid Crowther Report)

Contract

Flows ≤ 7050 m^3/day	BOD ≤ 10 mg/L TSS ≤ 10 mg/L Fæcal Coliform ≤ 25 MPN/100mL
Flows ≥ 7050 m^3/day	Primary treatment, no disinfection

Permit

Flows ≤ 4600 m^3/day	BOD ≤ 10 mg/L TSS ≤ 10 mg/L UV Disinfection *
Flows ≥ 4600 m^3/day	BOD ≤ 45 mg/L TSS ≤ 45 mg/L No Disinfection *

**The Current amended permit dated October 6, 1998, contains some errors which the Ministry acknowledges and indicates will be corrected within one to two weeks by letter or amendment.*

Note: The amended permit # PE00073 issued by the MoELP to the District on October 6, 1998 has not been reviewed by Hill-Murray. The values above are based on discussions between Hill-Murray and the MoELP, and on drafts of the amended permit. It appears that a discrepancy exists between the drafts of the amended permit and the actual amended permit dated October 6, 1998 — Hill-Murray will remedy this discrepancy. The MoELP does not expect the drum screen discharge to be disinfected. The MoELP will be issuing corrections to the permit document to reflect this.

Substantial Completion (Section 5.2 of Reid Crowther Report)

Substantial completion was reached and approved by the Owners' representative in mid-July 1998. Continuous operation of the plant, compliance during construction, and live changeover issues have caused fluctuations in performance. Software problems resulting in poor function of the auto backwash and in situ clean functions compounded performance shortfalls after substantial completion. Hill-Murray has continued to provide compliance during construction and has returned the membrane system to 100% performance.

Quality Control Plan (Section 5.4 of Reid Crowther Report)

This plan was submitted to the District on January 27, 1998.

Record Drawings (Section 5.5 of Reid Crowther Report)

Final as-built drawings have not been submitted. In accordance with the head contract, these will have to be submitted before completion. This is addressed in the completion schedule (November 20, 1998). Preliminary as-built drawings were submitted on November 5, 1998.

Operating Manuals (Section 5.6 of Reid Crowther Report)

Several manuals have been submitted to the District (see Annex B). The requirements of the contract have not been met. This is addressed in the completion schedule (November 20, 1998).

Trash Removal Equipment (Section 6.1.1 of Reid Crowther Report)

The District reviewed the submittal for the ML trash removal screens on February 5, 1998. Comments and notes from the District operators are included in Annex B. The 3 mm screen has 100 L/s capacity while the 5 mm machine has 140 L/s capacity. The total capacity of 240 L/s provides 20736 m^3/day capacity. Wing plates will be added to the machines to provide increased capacity for a total PWWF of 26000 m^3/day. In addition, there are two manual bar screens, one with 6 mm spacing and one with 12 mm spacing, which can be used to supplement the automated trash augers. Both automated trash augers were retrofitted with centre shafts and additional flytes to increase the efficiency of the screenings transport. Wash water spray intervals were monitored and modified to minimize residence time of screenings on the open flytes.

Grit Removal (Section 6.1.2 of Reid Crowther Report)

Grit removal channels are designed for the interception of coarse grit and sand during heavy inflow and infiltration events. Lighter suspended solids which pass through the grit channels will pass into the primary

aeration basin. The accumulation of sand and grit in the channels are expected in winter months only.

For the most part, solids will stay in suspension due to the high degree of mixing in the primary aeration or east basin. The west basin or equalization basin can be used in conjunction with the rotating drum screens to take the primary aeration basin off-line for inspection and cleaning if necessary.

Grit channel wiers contain integral grit traps for removal of removed grit. Periodically, the grit channels will need to be cleaned out by a vacuum truck. The second grit channel allows the first channel to be taken off-line for cleaning.

Rotating Drum Screens (Section 6.1.3 of Reid Crowther Report)

Rotating drum screens are installed in the headworks building of the Westview facility for the purpose of filtering diluted wastewater flows during inflow events. Since up to two times ADWF or 4600 m^3/day will be treated in the steady state by the MBR process, only that portion of the flow above 4600 m^3/day will be directed to the drum screens for filtration. Concentrate removed by the drum screens is directed to the MBR process. Filtrate is recombined with MBR effluent to produce a blended effluent. Under normal conditions the drum screens will be used infrequently — only during storm events. Under normal conditions, these screens will see diluted wastewater in the range of BOD 75-125 mg/L and TSS 75-125 mg/L. These screens will provide a reduction in TSS in the order of 44% and a reduction of BOD in the order of 30%. While the manufacturer's data indicates a specified capacity at a certain influent concentration, Hill-Murray, in cooperation with the manufacturer, has extensively tested the machine with both 21μ mesh and 37μ mesh on full strength municipal wastewater. Many areas of concern are being raised (noise, wash water, consumption, bulging, condensation, and moisture) due to the continuous use of the drum screens during construction and start-up. The drum screens have provided supplemental treatment during construction to meet the Ministry's requirement of compliance (no-bypass) during construction. The continuous operation of these machines on full strength wastewater is an improvised use of the units which is quite different from their intended steady state use. This continuous use will cease upon completion and will become intermittent use only, eliminating many of the areas of concern such as noise, water consumption, and condensation build-up in the headworks building. Drum screen capacity will easily achieve the PWWF requirement of 9213 m^3/day on diluted wastewater with 37μ panels in use. The standpipe recommended by the manufacturer reduces the pressure across the panels, but also reduces the flow through the units. With regular cleaning by pressure washer with hot water, the sand pipe will not be required.

Grease build-up on the inside of the panels created difficulties during full-strength operation. This build-up created excessive loading on screen panels and caused bulging. Hill-Murray supplied a hot water pressure washer to allow operators to remove grease build-up and keep the units operating without a high water level on the inside of the drum. The standpipe is therefore not required, except in the case where a screen is in operation and has not been cleaned properly with the pressure washer.

Hill-Murray is consulting with PRA and ZENON on the possibility of providing new drum screen panels to the District due to the heavy use the current panels have received during construction and start-up. A full report and review on drum screen operation is in the completion schedule. Performance trials indicated in the completion schedule will include full-flow use of the drum screens to prove capacity up to 9213 m^3/day.

Bioreactor (Section 6.2 of Reid Crowther Report)

The membrane system is operating at 100% efficiency, exceeding contractual requirements. During October 1998, one blower was operating below design flows in manual for start-up purposes only. ZENON has addressed the issues raised in this section in a letter included in Annex F.

UV System Performance (Section 6.3.1 of Reid Crowther Report)

Hill-Murray consulted carefully with Trojan Technologies Inc., the equipment manufacturer, to determine the UV system requirements. Several samples of Membrane Bioreactor (MBR) effluent (already very low in Fæacal Coliform) were tested by Trojan Technologies. The UV installation at Westview is guaranteed by Trojan to achieve Fæcal Coliform counts of less than 25 MPN/100mL with MBR effluent. There is no requirement for, nor was there ever any intent to indicate, a requirement for 72 UV lamps. See Trojan Technologies letter included in Annex F, as well as lab results in Annex A showing Fæcal Coliform counts of less than 1 CFU/100mL at full flow rates.

Biosolids Management (Section 6.4 of Reid Crowther Report)

Annex C contains a summary of predicted performance of the Fournier Industries Rotary Press. With the higher than anticipated flows, approximately 6000 - 8000 imperial gallons of activated sludge at 1.5% solids will be wasted from the ZENON process per day. This volume will be reduced by the dedicated membrane thickener in the sludge holding tank. Sludge at approximately 2% - 4% solids will be de-watered by the Rotary Press with the addition of wood pellets and polymer, resulting in approximately 5.3 m^3/day of cakes per day, depending on the cake dryness. Dryness will be variable depending on many parameters. Operations to date indicate a cake dryness of 17 - 20 % solids. To date, Hill-Murray has done all pressing. The press is now fully operational, however, and should be operated by District staff.

Buildings (Section 6.5 of Reid Crowther Report)

See Annex F for Supplemental Letters.

Ventilation and Odour Control (Section 6.6 of Reid Crowther Report)

NFPA 820 is not part of the National Fire Code or the BC Fire Code. The headworks room, sludge room, and main building are all ventilated at appropriate air exchange rates. This is confirmed in actual measurements shown in Annex D. Gas monitoring equipment will be added by Hill-Murray in the headworks and main building. Biofilters have been provided to reduce possible odour emissions from the headworks and sludge room. This is to achieve a commitment from Hill-Murray for a no odour operation at Westview. If there is no odour being discharged from the facility, then the discussion becomes academic, standard design parameters not withstanding. Hill-Murray will review all ventilation rates with Reid Crowther and, if necessary, may increase fan sizes or provide supplemental fans to reduce condensation in the headworks building.

SUMMARY

The draft report by Reid Crowther was prepared on a very short time-line and presented a very conservative "wort case" position to the District of Powell River. Documents made available to Reid Crowther were preliminary in nature. Final documents must be made available to Reid Crowther so that they may finalize their report.

Observations by Reid Crowther at the Westview plant in early October 1998, were during a period of poor performance related to start-up difficulties. Plant performance has been significantly improved and Reid Crowther should be given the opportunity to inspect the facility again to update their report . Reid Crowther have made some recommendations which will be implemented by Hill-Murray as indicated in the completion schedule.

SUMMARY OF DRAFT REPORT		
Section	Description	Action
3	Design Flows	• More detailed investigation by Reid Crowther. • Re-inspection of facility. • Consultation with Hill-Murray.
4	Effluent Requirements	• Review corrections to amended permit when published by the Ministry. • Review operational reports and performance data.
5	Contract Review	• Hill-Murray has outstanding items which are addressed in the proposed completion schedule. • Reid Crowther to review completion schedule and discuss with Hill-Murray.
6	Plant Status Review	• Reid Crowther to review supplemental information provided herein. • Reid Crowther to review all final equipment submittals. • Reid Crowther to review this report and comment on rebuttals. • Reid Crowther to review completion schedule containing outstanding items which need to be rectified by Hill-Murray.
7	Conclusions and Recommendations	• These should be revised by Reid Crowther and published in "final" form after consultation with Hill-Murray and the District of Powell River.

Westview WRF
Operations Report — to 4 November 1998

Introduction

The purpose of this report is to provide details of the operations and maintenance activities of the Westview Water Reclamation Facility. These reports, to be completed weekly, will provide analysis of the following:

Membrane Performance
Treatment Plant Flows
Effluent Quality
including Drum Screens and blended flow analysis
Rotary Press
Operations and Maintenance Support
Equipment Status

During this reporting period, the main focus of Hill-Murray, CWC and ZENON staff has been the recovery of flux for the ZW-500 series membranes. This action, started in mid-September, was a result of reduction in membrane performance during start-up. The results have been very good, resulting in the flow control valve being placed in AUTO on 30 October 1998. Drumscreen use is limited to very large instantaneous flows (> 1200 USGPM).

Membrane Performance

The commissioning of the MBR plant commenced in August 1998. This period included the assembly of an appropriate biomass for the membranes via seeding from the west digesters and steadily increasing the flow of raw wastewater to the MBR. During this time, flow was gradually increased to the MBR, allowing the membranes to see a steadily increasing duty cycle.

During the commissioning phase, membrane performance monitoring tracked flows and pressures to determine the amount of work required to process the wastewater and permeate and biomass analytical work to determine the state of the biomass. The commissioning brought the biomass from 2,000 mg/L to 12,000 mg/L over a short time frame. Laboratory data suggested that the nitrification and denitrification processes were well established, consistently producing ammonia and nitrate levels of less than 5 mg/L. After operating for several days with the MBR controlled to 400 USGPM, it was decided to increase the flow. At this point, the plant was capable of treating 1500 - 1600 USGPM (instantaneous) at a TMP of -7 psi. After several days of operation at the increased flow to the MBR, it became apparent that the flux and permeability parameters were not following the guidelines established by ZENON. The result was that performance declined to the point where total permeate flow approached the steady state requirement of 931,000 USGPD. Also, the pumps were operating at 100% speed continuously, leaving no reserve capacity to treat diurnal peaks.

At this point, in consultation with ZENON specialists, it was decided that a recovery clean procedure was required on the membranes. Recovery cleans are a high strength chlorine soak that allows any foulant on the surface of the membranes to be oxidized, recovering flux. It is suspected that the foulant in the case of the Westview WRF was a combination of:

Low sludge age — resulting in less than fully activated sludge, allowing components of the sludge to bind to the membranes.

Stress on the membranes — flux/TMP maintained at high levels.

Sludge blinding — fibres matted together with dewatered sludge due to insufficient agitation. This has been resolved through removal of the Lexan shrouds by ZENON.

Soaking was accomplished using the west tankage as soaking tanks (the stainless steel soaking tanks had not been installed at that time) and soaking four cassettes from each bank in succession. The soaking solution was limited to 400 mg/L because of the large volume of the west digester tankage.

ZENON issued an additional four cassettes to bring the total complement to 10 cassettes per train in order to reduce the overall TMP on individual modules. The completion of this routine saw an increase in permeability from 1.9 USGFD/psi to 3.8 USGFD/psi.

The recovery of membrane performance following this procedure was good, but did not achieve the level of recovery expected by ZENON. As a result, ZENON ordered a second, higher strength soak, and the supply of an 11th cassette for rotation purposes. This work was completed the week of 26 October 1998 and has resulted in substantial performance improvement:

	Before Cleaning #1		After Cleaning #1		After Cleaning #2	
	Train A	Train B	Train A	Train B	Train A	Train B
Flow	420	370	324	327	529	611
GFD	18.9	16.65	11.664	11.772	19.044	21.996
Permeability	2.4	2.1	3.32	3.42	3.88	4.58

The result of the work completed is as follows:

A substantial increase in the instantaneous treatment capacity of the plant (to > 1200 USGPM.)

A substantial reduction in operating pressure — equating to less work on the membranes.

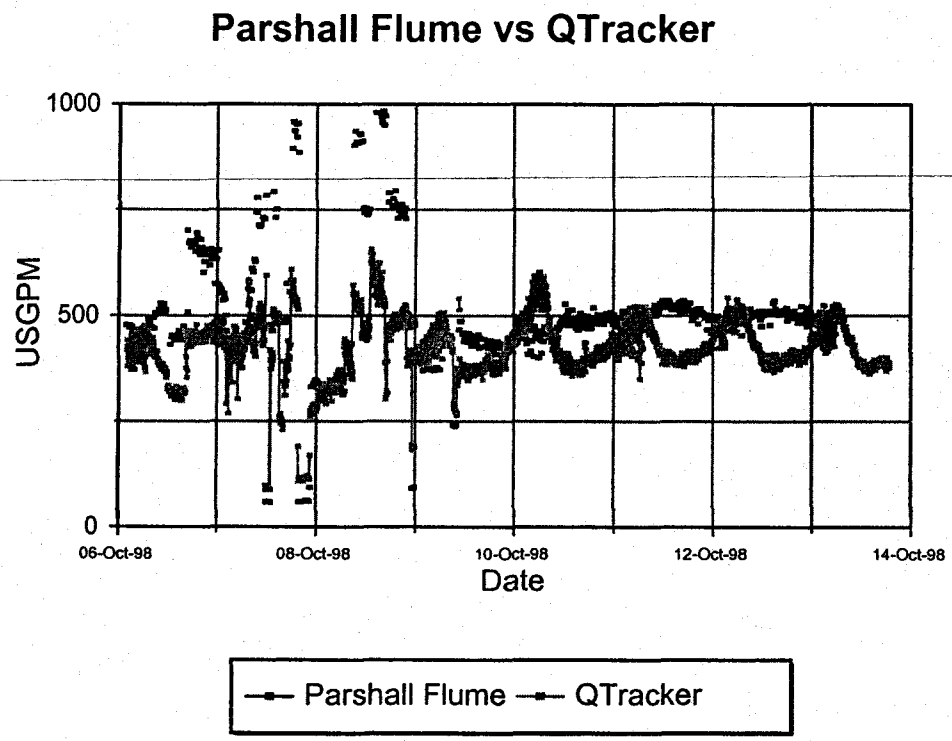
A substantial increase in the plant's ability to meet the demands of the diurnal peak.

Current instantaneous permeabilities are in the order of 4.3 to 4.6 USGFD/psi.

Treatment Plant Flows

The Westview WRF was designed to meet the stated flow of 931,000 USGPD, with 2x peaking factor and the facility to handle wet weather flows. During the commissioning phase, a large discrepancy between influent flow to the MBR and adjusted permeate flow was observed (the adjusted permeate flow is the "water-made-good" taking into account the backpulse, aerator flush, in-situ cleans. This value is in the order of 88% of the instantaneous treated flow rate.)

In order to address this discrepancy, H-M and ZENON installed a in-pipe flow measurement device known as a Q Tracker just upstream of the influent Parshall flume. Data collected over the course of a 14 day period suggested that the Parshall flume required recalibration. The flume was recalibrated and as a result the average flows measured by the flume and the Q Tracker were much more closely aligned.

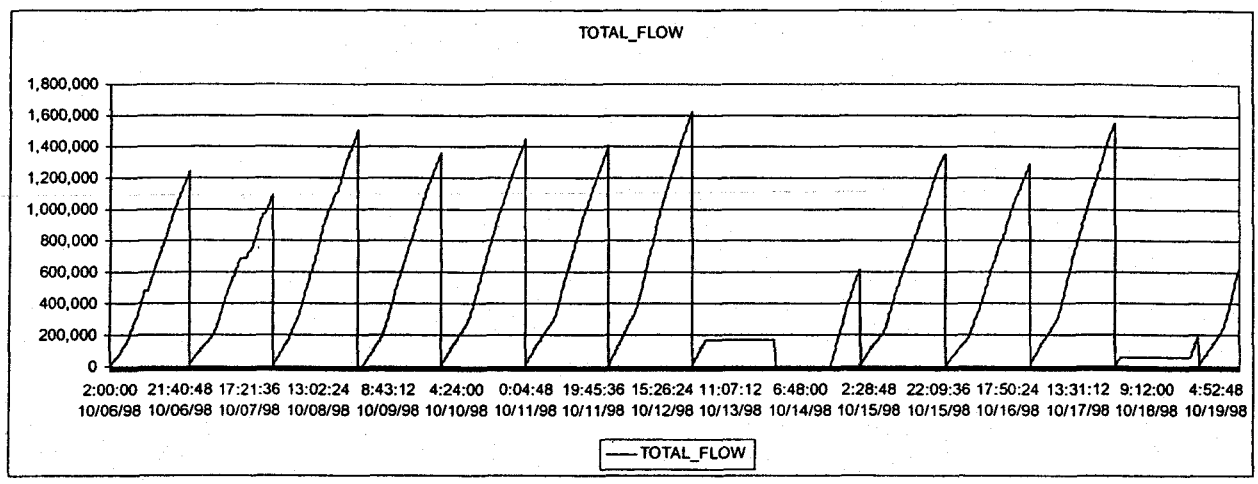


At present, the Parshall flume is considered accurate to ±100 USGPM. It is less accurate at low flows. At higher flows, accuracy approaches that of the Q Tracker.

The Mag meters installed on the permeate flow meters were tested by pump-down test of the backpulse tank. These meters were proven to be accurate to ±5%.

The Bypass Parshall Flume has been recalibrated. As of yet, no comparison flow measurement has taken place.

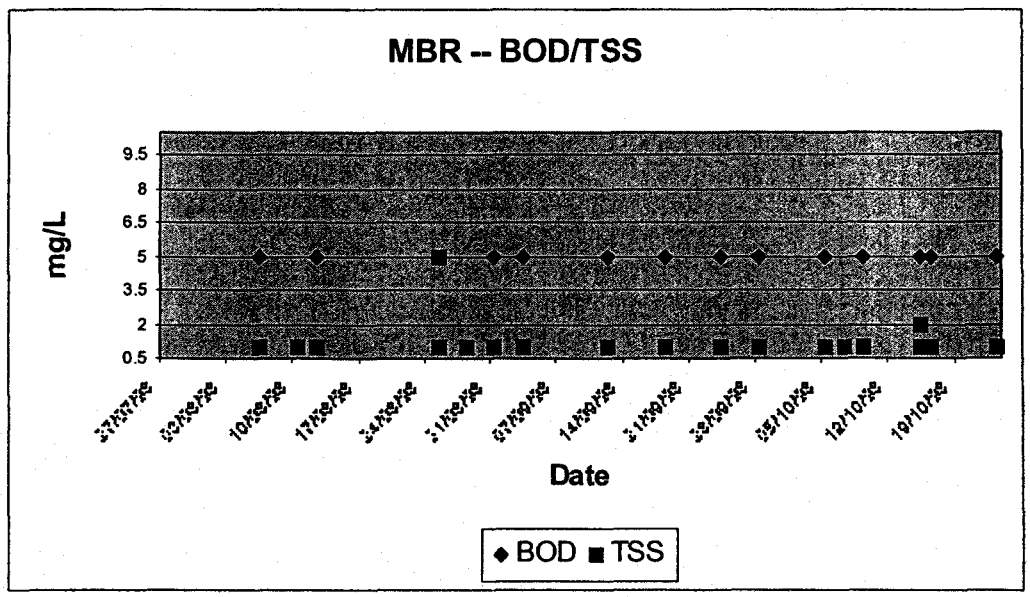
Average flow to the plant is in the order of 1.2 to 1.4 USMGD. This is a substantially higher flow than the 931,000 USGPD average expected. As a result, the MBR duty cycle is increased, and its response to diurnal flows reduced. At present, the MBR is set-up to maintain a sliding TMP set-point based on bioreactor tank level. These set-points are 3 to 5.5 psi. As a result, the MBR works harder as the tank levels increase. At peak values, the plant will produce > 1400 USGPM at TMPs of 5.5 psi. This equates to an instantaneous flow equivalent of 2.01 USMGD. Membrane performance at the plant continues to improve. CWC and ZENON have instituted a membrane cassette rotation schedule. This schedule will be refined as membrane performance plateaus. In addition, H-M is in the process of installing equalization equipment in the west aeration tankage to deal with the diurnal loads.



Effluent Quality During Commissioning

The Westview WRF is designed to meet the criteria established in the amended MELP Permit. In order to accomplish this, the plant employs a combination of treatment technologies: Membrane filtration and micro screening. The premise for this combination is that the micro screens can effectively remove enough of the wastewater constituents such that when combined with the high quality effluent from the MBR, the resultant product meets MELP guidelines at all flows.

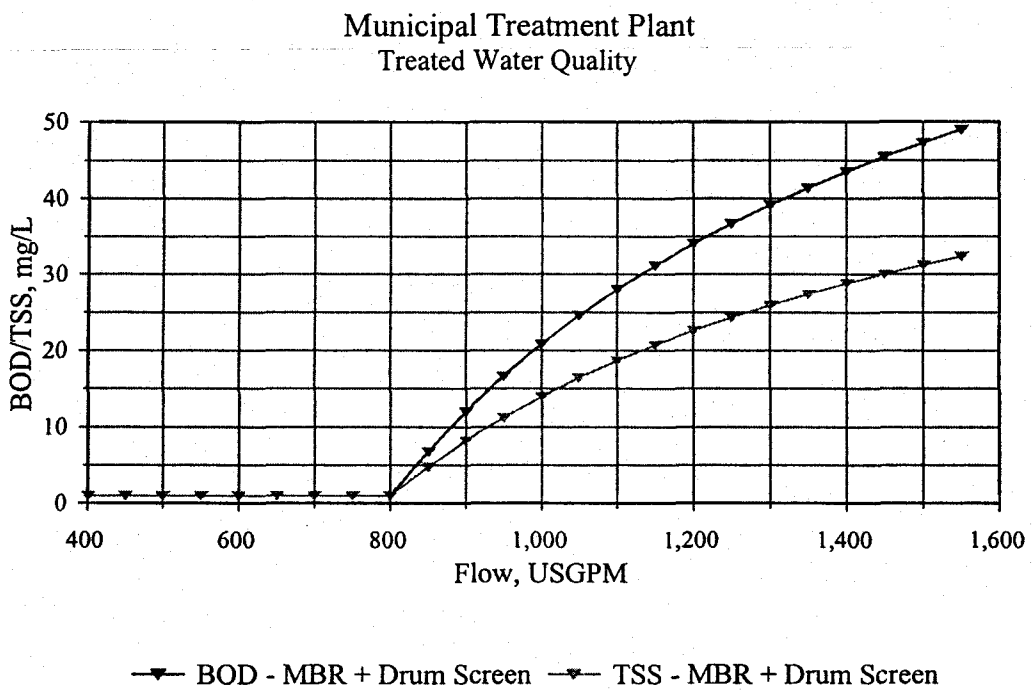
The MBR continues to produce excellent laboratory results:



The MBR treated water is consistently at levels of $BOD_5 < 5$ mg/L and TSS < 1 mg/L. Average drum screen reductions for BOD and TSS are 30% and 44% respectively.

The following graph shows effluent quality as a function of flow rate during the commissioning period. It

assumes that the MBR permeate flow is 800 USGPM and all other flow is bypassed (note that presently the MBR is capable of sustained operation > 1200 USGPM and peak operation > 1400 USGPM at low TMP values.) As shown, even at the highest flow rates, effluent quality during this commissioning phase meets the current permit requirements.



Rotary Press

The Westview WRF employs a consolidated sludge management plan utilizing a Fournier Rotary Press. This unit dewaters sludge wasted from the MBR, returning the liquid (or filtrate) to the MBR and depositing the cakes into a disposal bin.

During the commissioning phase, no sludge was wasted from the reactor until it had achieved sufficient MLSS to activate the membrane system. As a result, no sludge was wasted to the outfall from August 1998. All the sludge generated in the treatment process accumulated in the reactors and the designated sludge holding tankage until the press was commissioned. The press was commissioned during the week of 12 - 16 October. Test results have been excellent. The press is exhibiting a capture rate of 96 to 99% of all solids, and has been effective in eliminating BOD_5 from the filtrate stream. Cake dryness has been > 20%. As a result, the filtrate is only slightly stronger than raw wastewater entering the plant. No polymer has been detected in the filtrate stream.

On completion of dewatering the accumulated sludge from the commissioning phase, the plant will waste in the order of 6,000 USG per day. In conjunction with the membrane dewatering system installed in the sludge holding tank, the anticipated manpower requirements will be reduced to steady state values. Note that it is imperative that MLSS monitoring and control be maintained.

Note: Sludge production numbers are directly proportional to influent flow and inversely proportional to solids retention time. As flows increase, the sludge production increases, requiring more sludge to

be wasted. This effectively drives down the SRT, further increasing sludge production. As a result, the plant will be producing more sludge at the higher flows.

It is our intention to operate this plant at an MLSS in the order of 13,500 mg/L.

Operations and Maintenance Support

CWC and ZENON continue to provide comprehensive operations support for the Westview WRF. CWC staff monitor the alarm status of the plant and respond accordingly. CWC/ZENON staff have performed all sludge pressing to date, have performed all maintenance on equipment (membrane cleaning & soaking, blowers, process pumps, DO probes) and has performed all process adjustments (pH, alkalinity, air adjustment) and on-site testing (NH_3, NO_3, alkalinity etc).

There are currently 59 outstanding PM routines for the Westview WRF (see enclosed).

Equipment Status

All systems in AUTO with the following exceptions:

Sludge recirculation pumps — currently HAND because AUTO can cause erratic tripping of the pumps, resulting in a requirement to shut down the associated membrane train. This is being rectified through PLC logic amendment.

Calibrate pH Probe		0	27/08/98	(Unknown)			Westview WRF
Calibrate DO Probe		0	27/08/98	(Unknown)			Westview WRF
Instrument Air Compressor - Weekly Routines	PM	0	31/07/98	(Unknown)	AIRCOMP0001	Instrument Air Compressor #1	Westview WRF
Instrument Air Compressor - Weekly Routines	PM	0	31/07/98	(Unknown)	AIRCOMP0002	Instrument Air Compressor #2	Westview WRF
Instrument Air Compressor - Monthly Rouines	PM	0	27/08/98	(Unknown)	AIRCOMP0001	Instrument Air Compressor #1	Westview WRF
Instrument Air Compressor - Monthly Rouines	PM	0	27/08/98	(Unknown)	AIRCOMP0002	Instrument Air Compressor #2	Westview WRF
Clean DO Probe Membrane	PM	0	31/07/98	(Unknown)			Westview WRF
Weekly Maintenance	PM	2	31/07/98	(Unknown)	DRUM0001	PRA Drum Filter #1	Westview WRF
Weekly Maintenance	PM	2	31/07/98	(Unknown)	DRUM0002	PRA Drum Filter #2	Westview WRF
60 Day Maintenance	PM	2	28/08/98	(Unknown)	DRUM0001	PRA Drum Filter #1	Westview WRF
60 Day Maintenance	PM	2	28/08/98	(Unknown)	DRUM0002	PRA Drum Filter #2	Westview WRF
Weekly Maintenance	PM	0	07/08/98	(Unknown)	EMDG0001	Emergency Diesel Generator	Westview WRF
Monthly Maintenance	PM	0	27/08/98	(Unknown)	EMDG0001	Emergency Diesel Generator	Westview WRF
Test of Emergency Generator	PM	0	31/07/98	(Unknown)	EMDG0001	Emergency Diesel Generator	Westview WRF
Weekly Inspections	PM	0	31/07/98	(Unknown)	PERM0022	*Membrane Process Pump #P35-A1*	Westview WRF
Weekly Inspections	PM	0	31/07/98	(Unknown)	PERM0023	Membrane Process Pump #P35-B1	Westview WRF
Weekly Inspections	PM	0	31/07/98	(Unknown)	PERM0024	Membrane Process Pump #P35-A2	Westview WRF
Weekly Inspections	PM	0	31/07/98	(Unknown)	PERM0025	Membrane Process Pump #P35-B2	Westview WRF
Lubrication Routine	PM	2	03/08/98	(Unknown)	TRASH0001	Trash Auger #1 - 3mm	Westview WRF
Lubrication Routine	PM	2	03/08/98	(Unknown)	TRASH0002	Trash Auger #2 - 5mm	Westview WRF
Amp Probe Readings	PM	0	24/08/98	(Unknown)			Westview WRF
Sampling - BOD, TSS, FC, MLSS, MLVSS.	PM	1	24/08/98	(Unknown)			Westview WRF
Biomass assessment - microbiology report		0	24/08/98	(Unknown)			Westview WRF
Field Analysis - Turbidity, NH4, DO		0	24/08/98	(Unknown)			Westview WRF
Drain water from Air Compressor Discharge	PM	5	17/08/98	(Unknown)			Westview WRF
Inspect Influent Channel Grit Collectors	PM	2	21/08/98	(Unknown)			Westview WRF
Control Air Dryer	PM	2	31/08/98	(Unknown)			Westview WRF
Perform Y2k Test on PLC	PM	1	(Unknown)	(Unknown)			Westview WRF
Inspect blower inlet air filter	PM	2	18/09/98	(Unknown)	BLOW0022	Membrane Blower #1	Westview WRF
Inspect blower inlet air filter	PM	2	18/09/98	(Unknown)	BLOW0023	Membrane Blower #2	Westview WRF
Inspect blower inlet air filter	PM	2	18/09/98	(Unknown)	BLOW0024	Membrane Blower - STBY	Westview WRF
Inspect blower inlet air filter	PM	2	18/09/98	(Unknown)	BLOW0025	Process Blower #1	Westview WRF
Inspect blower inlet air filter	PM	2	18/09/98	(Unknown)	BLOW0026	Process Blower #2	Westview WRF
Biofilter Inspection	PM	4	27/09/98	(Unknown)			Westview WRF
Inspect All Safety Gear	PM	2	27/09/98	(Unknown)			Westview WRF
3 Monthly Inspections	PM	0	27/09/98	(Unknown)	PERM0022	Membrane Process Pump #P35-A1	Westview WRF
3 Monthly Inspections	PM	0	27/09/98	(Unknown)	PERM0023	Membrane Process Pump #P35-B1	Westview WRF
3 Monthly Inspections	PM	0	27/09/98	(Unknown)	PERM0024	Membrane Process Pump #P35-A2	Westview WRF
3 Monthly Inspections	PM	0	27/09/98	(Unknown)	PERM0025	Membrane Process Pump #P35-B2	Westview WRF
Weekly Maintenance	PM	0	07/10/98	(Unknown)	FLOC0001	Flocculator	Westview WRF
Replace air filters on aeration blowers X 3.	BILL	3	(Unknown)	(Unknown)			Westview WRF
Install compound guages on Train A & B permeate lines.	BILL	3	(Unknown)	(Unknown)			Westview WRF
Lubricate Blower Bearings	PM	2	27/10/98	(Unknown)	BLOW0022	Membrane Blower #1	Westview WRF
Lubricate Blower Bearings	PM	2	27/10/98	(Unknown)	BLOW0023	Membrane Blower #2	Westview WRF
Lubricate Blower Bearings	PM	2	27/10/98	(Unknown)	BLOW0024	Membrane Blower - STBY	Westview WRF
Lubricate Blower Bearings	PM	2	27/10/98	(Unknown)	BLOW0025	Process Blower #1	Westview WRF
Lubricate Blower Bearings	PM	2	27/10/98	(Unknown)	BLOW0026	Process Blower #2	Westview WRF
Check Blower Alignment	PM	0	27/10/98	(Unknown)	BLOW0022	Membrane Blower #1	Westview WRF
Check Blower Alignment	PM	0	27/10/98	(Unknown)	BLOW0023	Membrane Blower #2	Westview WRF
Check Blower Alignment	PM	0	27/10/98	(Unknown)	BLOW0024	Membrane Blower - STBY	Westview WRF
Check Blower Alignment	PM	0	27/10/98	(Unknown)	BLOW0025	Process Blower #1	Westview WRF
Check Blower Alignment	PM	0	27/10/98	(Unknown)	BLOW0026	Process Blower #2	Westview WRF
Cleaning	PM	0	27/10/98	(Unknown)	FLOC0001	Flocculator	Westview WRF
Lubrication of Shaft Seal	PM	0	27/10/98	(Unknown)	FLOC0001	Flocculator	Westview WRF
Lubrication of Gear Reducer	PM	2	30/10/98	(Unknown)	PRESS0003	48" Rotary Press - Dual Channel	Westview WRF
Emergency Stop Test	PM	1	27/10/98	(Unknown)	PRESS0003	48" Rotary Press - Dual Channel	Westview WRF
Test Pressure Transducers	PM	3	27/10/98	(Unknown)	PRESS0003	48" Rotary Press - Dual Channel	Westview WRF
Flygt Submersible Pump	PM	0	27/10/98	(Unknown)	SRPP0002	Sludge Recirculation Pump #1	Westview WRF
Flygt Submersible Pump	PM	0	27/10/98	(Unknown)	SRPP0003	Sludge Recirculation Pump #2	Westview WRF

JB LABS

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364
jblabs@islandnet.com

DATE: November 2, 1998

JOB NO: JB 1750A
LR NO: 268871

SAMPLING DATE: See Below
SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

CLIENT: HILL MURRAY & ASSOCIATES
CONSTRUCTION DIVISION
780 TOLMIE AVE UNIT 202
VICTORIA BC V8X 3W4

Attn: Robert A. Murray

SAMPLE:

Sample # 1: Westview RF - MBR Aeration Tank Biomass Oct 20/98
Sample # 2: Westview RF - Permeate
Sample # 3: Westview RF - MBR Aeration Tank Biomass Oct 23/98
Sample # 4: Westview RF - Permeate
Sample # 5: Westview RF - MBR Biomass Membrane Tk #1
Sample # 6: Westview RF - MBR Biomass Membrane Tk #2
Sample # 7: Westview RF-Bio aft waste Membrane Tk#1 Oct 26/98
Sample # 8: Westview RF-Bio aft waste Membrane Tk #2
Sample # 9: Westview RF - Permeate
Sample # 10: Westview RF - Permeate Oct 28/98
Sample # 11: Westview RF - MBR Aeration Biomass
Sample # 12: Westview RF - Biomass Cell #1

		Sample 1	Sample 2	Sample 3	Sample 4
Tot Suspended Solids	mg/L	1 6300	< 1	1 6300	< 1
Fixed Susp.Solids	mg/L	2800		2700	
Volatile Susp Solids	mg/L	1 3500		1 3600	
BOD_5	mg/L		< 5		< 5
pH			7.1		7.5
Alkalinity, Total	mg/L $CaCO_3$		46.0		65.6
Nitrite	mg/L N		0.057		0.042
Nitrate	mg/L N		1.40		1.14
Ammonia	mg/L N		0.84		1.34
T.Kjeldahl Nitrogen	mg/L N		1.31		1.62
Total Nitrogen	mg/L N		2.77		2.80
Faecal Coliform	CFU/100ml				****

< = less than
**** Oil & Grease results pending
Faecal Coliform - sample too old for analyses

JB LABS

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
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SAMPLING DATE: See Below
SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

Attn: Robert A. Murray

SAMPLE:

Sample # 1: Westview RF - MBR Aeration Tank Biomass Oct 20/98
Sample # 2: Westview RF - Permeate
Sample # 3: Westview RF - MBR Aeration Tank Biomass Oct 23/98
Sample # 4: Westview RF - Permeate
Sample # 5: Westview RF - MBR Biomass Membrane Tk #1
Sample # 6: Westview RF - MBR Biomass Membrane Tk #2
Sample # 7: Westview RF-Bio aft waste Membrane Tk#1 Oct 26/98
Sample # 8: Westview RF-Bio aft waste Membrane Tk #2
Sample # 9: Westview RF - Permeate
Sample # 10: Westview RF - Permeate Oct 28/98
Sample # 11: Westview RF - MBR Aeration Biomass
Sample # 12: Westview RF - Biomass Cell #1

		Sample 5	Sample 6	Sample 7	Sample 8
Tot Suspended Solids	mg/L	1 7800	1 8000	1 8800	1 7900
Fixed Susp.Solids	mg/L	3000	3200	3200	3200
Volatile Susp Solids	mg/L	1 4800	1 4800	1 5600	1 4700

		Sample 9	Sample 10	Sample 11	Sample 12
Tot Suspended Solids	mg/L	< 1	< 1	1 3600	
BOD_5	mg/L	< 5	< 5		
pH		7.4	7.0		
Alkalinity, Total	mg/L $CaCO_3$	87.9	69.2		
Nitrite	mg/L N	0.015	0.028		
Nitrate	mg/L N	0.217	1.04		
Ammonia	mg/L N	3.37	3.74		
T.Kjeldahl Nitrogen	mg/L N	3.58	4.50		
Total Nitrogen	mg/L N	3.81	5.57		
Faecal Coliform	$CFU/_{100}ml$	< 1	< 1		
Fixed Susp.Solids	mg/L			2400	
Volatile Susp Solids	mg/L			1 1200	
Oil & Grease	mg/L				****

< = less than
**** Oil & Grease results pending
Faecal Coliform - sample too old for analyses

JB Laboratories Ltd.
water/wastewaters

John E. Evanoff, M.Sc.
Barbara M. Klassen, B.Sc.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of Water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods/Water and Wastewater", American Public Health Association.

North Island Laboratories
2755 B Moray Avenue, Courtenay, B.C. V9N 8M9
Tel: (250) 338-7786 Fax: (250) 338-7553

Report To: Graham Symmons
Graham Symmons
Hill Murray & Associates
202-780 Tolmie Ave

Lab Number: 8497
Date Reported: 11/03/98
Date Received: 10/23/98 15:15
Date Collected: 10/23/98

Collected by: Graham Symmons
Source: Cake Samples
Sample point:

Soil Analysis Results

Parameter	Result	Units
Channel #1 14:00		
Moisture Content	80.4	
Channel #2 14:00		
Moisture Content	74.2	
Channel #1 16:00		
Moisture Content	78.8	
Channel #2 16:00		
Moisture Content	78.7	

FAXED

23 of 68

North Island Laboratories
2755 B Moray Avenue, Courtenay, B.C. V9N 8M9
Tel: (250) 338-7786 Fax: (250) 338-7553

Report To: Graham Symmons
Graham Symmons
Hill Murray & Associates
202-780 Tolmie Ave

Lab Number: 8498
Date Reported: 11/03/98
Date Received: 10/23/98 15:15
Date Collected: 10/23/98

Collected by: Graham Symmons
Source: Composite sample
Sample point:

Soil Analysis Results

Parameter	Result	Units
Westview Fournier Press - com		
Fecal Coliforms	> 7273	MPN/g dry wt.
Moisture Content	78.0	%

FAXED
TOTAL P.02

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ANNEX B

DOCUMENTS SUBMITTED TO THE DISTRICT

- **OPERATING MANUALS**
- **TRANSMITTALS**
- **VARIOUS CORRESPONDENCE PERTAINING TO PERMIT AMENDMENT**

HILL MURRAY & ASSOCIATES INC.
ENVIRONMENTAL SYSTEMS ENGINEERS

Suite 202 • 780 Tolmie Avenue • Victoria • B.C. • Canada • V8X 3W4
☎ (250) 388-3930 • Fax (250) 388-3943 • Email: hma@islandnet.com

TRANSMITTAL # 01797-14

LETTER OF TRANSMITTAL

TO CORP OF POWELL RIVER
6910 DUNCAN
POWELL RIVER

Date: FEB 5/98	Phone # 604-485-6291
	Fax #
Attention: JIM GREENWOOD	
Re: POWELL RIVER	

WE ARE SENDING YOU the following items: ☒ Attached ☐ Under separate cover via _____

☐ Shop drawings ☒ Submittals ☒ Plans ☐ O & M Manuals
☐ Copy of letter ☐ Purchase Order ☐ Specifications ☐ Other

No.	Date	Copies	Description
1	5/2/98	1	PRO AQUA SUBMITTALS BINDER
2	5/2/98	1	TROJAN TECH SUBMITTALS BINDER
3	5/2/98	1	PRA DWG # RF6012OINST DATED FEB 3/98
4	5/2/98	1	PRA LETTER DATED 05 FEB 98
			RE: ROTOFILTER INFO FOR WP, P.R.
5	5/2/98	1	SEE NOTES HMA DRAWINGS

THESE ARE TRANSMITTED as checked below:

☐ For your use ☐ Approved as submitted ☐ Resubmit ☐ copies for approval
☐ As requested ☐ Approved as noted ☐ Submit ☐ copies for distribution
☒ For approval ☐ Returned for corrections ☐ Return ☐ corrected prints
☐ For review and comment ☐ For signature ☐ Other

REMARKS 1 SET "ISSUE FOR CONSTRUCTION" REVISION
DATED 4-02-98 DWG'S - 01797-A-001, 01797-A-02
- 01797-S-001 THRU 01797-S006
- 01797-M-001

Copy to _____

SIGNED R.J.
Please sign and return acknowledgment
Transmittal No. _____ Sheet _____ of _____

I:\ADMIN\FORMS\Letter of Transmittal.wpd

H.L.C. MURRAY & ASSOCIATES INC.
ENVIRONMENTAL SYSTEMS ENGINEERS

Suite 202 • 780 Tolmie Avenue • Victoria • B.C. • Canada • V8X 3W4
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01797-34

LETTER OF TRANSMITTAL

TO POWELL RIVER
6910 DUNCAN ST
POWELL RIVER
V8A 1V4

Date: 8/6/98	Phone # 485-6291
	Fax # 485-2913
Attention: GINO FRANCESGUTTI	
Re: POWELL RIVER.	

WE ARE SENDING YOU the following items: ☒ Attached ☐ Under separate cover via _____

Note change

☐ Shop drawings ☐ Submittals ☒ Plans ☐ O & M Manuals
☐ Copy of letter ☐ Purchase Order ☐ Specifications ☐ Other

Copies	Date	No.	Description
1	8/6/98	1	PRECAST DRAWING ~~87-90~~ P8479
1		–	ENTRANCE FENCE
1	8/6/98	2	CANFER DRAWINGS - MAIN BUILDING.
			SHEETS E1 THRU E7 #98018001
1	8/6/98	3	CANFER DRAWINGS · MAIN BUILDING
			SHEETS E1 THRU E3 #98018002

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☐ For review and comment ☐ For signature ☐ Other

REMARKS _____

Copy to _____

SIGNED _____
Please sign and return acknowledgment
Transmittal No. _____ Sheet _____ of _____

[illegible]

*VIA FAX

HILL MURRAY & ASSOCIATES INC.
ENVIRONMENTAL SYSTEMS ENGINEERS

Suite 202 • 780 Tolmie Avenue • Victoria • B.C. • Canada • V8X 3W4
☎ (250) 388-3930 • Fax (250) 388-3943 • Email: hma@islandnet.com

TRANSMITTAL # 01797-31

LETTER OF TRANSMITTAL

TO CITY OF POWELL RIVER
MUNICIPAL HALL
6910 DUNCAN ST
POWELL RIVER

Date: APR 16/98	Phone # 485-6291
	Fax #
Attention: GINO FRANCESCUTTI	
Re: POWELL RIVER	

WE ARE SENDING YOU the following items: ☒ Attached ☐ Under separate cover via _____

☒ Shop drawings ☐ Submittals ☐ Plans ☐ O & M Manuals
☐ Copy of letter ☐ Purchase Order ☐ Specifications ☐ Other

No.	Date	Copies	Description
1	4-16-98	2	ADVANCE PRECAST DWG'S
			MAIN BUILDING DETAILS
			SHEETS S29-1 P1 TO S29-7 P7
			DATED FEB 4/98
			REVISION A.

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☐ For approval ☐ Returned for corrections ☐ Return ☐ corrected prints
☐ For review and comment ☐ For signature ☐ Other

REMARKS _____

Copy to _____

SIGNED _____
Please sign and return acknowledgment
Transmittal No. _____ Sheet _____ of _____

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MURRAY
&
ASSOCIATES INC.
ENVIRONMENTAL
SYSTEMS ENGINEERS

Suite 202 • 780 Tolmie Avenue • Victoria • B.C. • Canada • V8X 3W4
☎ (250) 388-3930 • Fax (250) 388-3943 • Email: hma@islandnet.com

TRANSMITTAL # 01797-30

LETTER OF TRANSMITTAL

TO BUILDING INSPECTOR
CITY OF POWELL RIVER
6910 DUNCAN ST.
POWELL RIVER B.C.

Date: MAR 27/98	Phone # 485-6291
	Fax #
Attention: GINO FRANCESCUTTI	
Re: POWELL RIVER BUILDING PERMIT	

WE ARE SENDING YOU the following items: ☒ Attached ☐ Under separate cover via _____

☐ Shop drawings ☐ Submittals ☒ Plans ☐ O & M Manuals
☐ Copy of letter ☐ Purchase Order ☐ Specifications ☐ Other

No.	Date	Copies	Description
1	3/26/98	1	SCHEDULE B-1, B-2 FOR PRECAST
			BUILDING STRUCTURAL
2	3/26/98	4	CANFER DWGS # E1, E2, E3 REV C
			ISSUE FOR APPROVAL DATED JAN 98
3	3/26/98	4	ADVANCE BUILDING DWGS # P1, P2, P3
			FOR HEADWORKS PRECAST
			DATE STAMPED MAR 3/98

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REMARKS _____

Copy to _____

SIGNED _____
Please sign and return acknowledgment
Transmittal No. _____ Sheet _____ of _____

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HILL MURRAY & ASSOCIATES INC.
ENVIRONMENTAL SYSTEMS ENGINEERS

Facsimile Transmittal

FAXED
JAN 20 1998
#Pages 11

Suite 202 • 780 Tolmie Avenue • Victoria • B.C. • Canada • V8X 3W4
(250) 388-3930 • Fax (250) 388-3943 • Email: hma@islandnet.com

Our File: 16420-20/ Powell River

To: Jim Greenwood
Fax: 485-2913
From: Robert A. Murray, Partner
Date: January 20, 98
Subject: Design Transmittals
Total pages this fax (including cover sheet):

MESSAGE

Jim,

Further to my meeting with Richie and Peter on Friday Jan 16, 98. I forward the following notes -

Transmittal # 01797-02

1. Power monitor location - please see attached schematics. The physical location is on the east wall of the existing MCC room
2. The acoustic liner for this enclosure costs $9500.00 plus mark-up. It only reduces noise from 92 dB to 80 dB. It would be an extra and I suggest that we run the unit without first to see if it is required

20268

1/2

3. Fournier will provide spares support information seperately

4. The ML screw screen shop drawings are not here yet. I will forward them by seperate transmittal when they arrive

5. PRA Rotofilters - PRA will provide spares support information seperately

6. I have asked Trojan to clarify

Transmittal # 01797-04

1. No further questions
2. Zenon will address
3. Zenon will address
4. Zenon will address
5. No further questions
6. Zenon will address
7. Zenon will address
8. No further questions
9. No further questions
10. Zenon will address
11. Zenon will address

Transmittal # 01797-04 (continued)

12. No further questions

13. Zenon will address

14. No further questions

15. Zenon will address

16. No further questions

17. Please clarify exactly what the question is

18. No further questions

19. No chart is provided

20. - 25. No further questions

Jim. Please pass this to Richie and Peter. So that they know that we are answering <u>all</u> questions

Rob

3/3

P.S. please provide letter approving diesel gen...

01797-02

✓ ① ICN - 1300 POWER METER - INSTALLED WHERE ?

✓ ② - ONAN - 300 KW GEN SET - CUMMINS 6 CYL.
- WEATHER PROTECTIVE HOUSING - INSULATED FOR NOISE ?

✓ ③ FOURNIER - ROTARY PRESS - QUEBEC.
- ARE PARTS EASY ACCESSABILITY - TYPE OF ELEC. MOTOR

④ - PRO AQUA ENG. - SCREW SCREEN
- IS SCREW S.S.
ML IS ? - NOT USED INFORMATION.

✓ ⑤ ROTO FILTER
- PARTS AVAILABLE FROM MANAINO - SCREENS ETC
- TYPE OF MOTOR

⑥ - PROPOSED ULTRAVIOLATE - UV 3000B ?
- PAGE 3 - ITEM 6 - 304 ST. ST. - WHY NOT 316 ST. S.
- PAGE 4 - SUPPLIED BY OTHERS
- PARTS EASY TO GET.

22 Jan 00

① DESILBAISS - AIR COMPRESSOR

② GOULDS - PERCOLATOR PUMPS
- STANDARD STUFFING BOX - USES PACKING
Z → IS DYNAMIC SEAL AN EXTRA - PAGE 8
- DO WE HAVE OPTION ON STUFFING BOX / + SEAL CHAMBERS

③ ITT FLUID MIXERS
- CAST IRON WITH GAL STEEL SKIN OR.
Z → 316 S.S.

④ LAMSON BLOWERS
- BLOWERS - ARE THEY - AIR GREASE LUBRICATION OR
→ AIR/GAS - OIL LUBRICATION
- FLEX COUPLERS

⑤ PROMINENT - SOLIO - DRIVEN METERING PUMP
?

⑥ SIHI - AIR EXTRACTION PUMP
PAGE 2 - WHICH PUMP - HIGH GRADE CAST IRON + BRONZE IM
Z → OR - CAST IRON WITH PRECISION 316 SS IMP.

⑦ AERCOR - FINE BUBBLE DIFFUSERS
- VANCOUVER FIRM
Z - PLASTIC + RUBBER DISC.

⑧ BURKERT - SOLENOID VALVES
?

CUSER →

~~TERM.~~ ~~WY~~
FOUR STAR WATER WORKS - AVK S
S.S.
BOLTS
ELOXED
ENS. OR
OTHER.

✓ (9) CHEMLINE - BUTTERFLY VALVES
- O.K

(10) KEYSTONE ACTUATORS - BUTTERFLY VALVES
? - S.S. SHAFTS + EPOXY COATED.

R ?

(11) SANITAIRE - FINE BUBBLE DIFFUSERS
- VANCOUVER FIRM - P.S.C

? →

(12) SOLBURG SCIENCES
- O.K

(13) SSI - STRAINERS
?

? →

(14) VCI - BALL VALVES
O.K

(15) WHITEY - NEEDLE VALVES
- WHICH STYLE - 316 S.S
- ALLOY 400
- BRASS OR
- PLATED CARBON STEEL

Z

(16) DWYER ANEMOMETER
?

(17) BAILY - FISHER + PORTER MAG METER
- SAME MAG METER FROM MILTRONICS

(18) FLOTECT - FLOW SWITCH.
O.K

(19) HACH - TURBIDITY METER
24 HOUR CHART OR SEVEN DAY

Page 2

(20) Hydronatic - Flow Switch
O.K

(21) Microtechnics Probe - Ultrasonic Sensor
O.K.

(22) Royce - Oxygen Meter.

(23) Unitron Elec Pressure Switch.
O.K

(24) Wika - Pressure Gauges
O.K

(25) ACO Containers
O.K.

(20) HYDRONAUTIC - FLOW SWITCH
O.K

(21) MICROTECHNICS PROBE - ULTRASONIC SENSOR
O.K.

(22) LOYCE - OXYGEN METER.

(23) UNITED ELEC PRESSURE SWITCH.
O.K

(24) WIKA - PRESSURE GAUGES
O.K

(25) ACO CONTAINERS
O.K.

Page 2

(20) Hydronatic - Flow Switch
O.K

(21) Microtechnics Probe - Ultrasonic Sensor
O.K.

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Page 2

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O.K

(24) Wika - Pressure Gauges
O.K

(25) Aco Containers
O.K.

HILL MURRAY & ASSOCIATES INC.
ENVIRONMENTAL SYSTEMS ENGINEERS

Suite 202 • 780 Tolmie Avenue • Victoria • B.C. • Canada • V8X 3W4
☎ (250) 388-3930 • Fax (250) 388-3943 • Email: hma@islandnet.com

LETTER OF TRANSMITTAL

Date: DEC 29/97	Phone # 485-8608
	Fax # 485 - 2913
Attention: JIM GREENWOOD	
Re: POWELL RIVER	

TO THE CORPORATION OF THE DISTRICT OF POWELL RIVER
6910 DUNCAN STREET
POWELL RIVER BC V8A 1V4

WE ARE SENDING YOU the following items: ☒ Attached ☐ Under separate cover via _____

☐ Shop drawings ☐ Submittals ☐ Plans ☐ O & M Manuals
☐ Copy of letter ☐ Purchase Order ☒ Specifications ☐ Other

Copies	Date	No.	Description
1	DEC 29/97	1	EQUIPMENT SPEC BINDER
			POWER MONITOR
			DIESEL GENERATOR
			SLUDGE PRESS
			TRASH SCREW SCREENS
			INFLOW TREATMENT DRUM SCREENS

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☒ For review and comment ☐ For signature ☐ Other

REMARKS _____

Copy to _____ SIGNED _____

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TRANSMITTAL # -01797-02

27.01.0

Westview Water Reclamation Facility
District of Powell River
Post-Commissioning Documentation

Item	Description	Qty	Notes	Date	Signed
1	Material Safety Data Sheets Binder	2		5-Aug-98	
2	Fournier Rotary Press - Volume 1 - Mechanical	1		5-Aug-98	
3	Fournier Rotary Press - Volume 2 - Technical Data Sheets (Mechanical)	1		5-Aug-98	
4	Fournier Rotary Press - Volume 3 - Instrumentation Control	1		5-Aug-98	
5	Fournier Rotary Press - Volume 4 - Technical Data Sheets (Instrumentation and Control)	1		5-Aug-98	
6	Trojan UV 3000 Operation and Maintenance Manual	3		5-Aug-98	
7	ProAqua ML Engineering Screw Screen Operations and Maintenance Manual	2		5-Aug-98	
8	PRA Manufacturing Ltd - PRA Rotofilter Owner's Manual	1		5-Aug-98	
9	Zenon Powell River Vender Data	2		5-Aug-98	
10	CWC Operations and Maintenance Manual	3		TBD	
11	Jarek Tipping Bucket Rain Gauge	3		5-Aug-98	
12	ProSoft 3100/3150-MCM Modbus Communications	3		TBD	
13	Building Maintenance Information	3		17-Aug-98	
	Maintenance Tasks				
	Equipment List				

HILL
MURRAY
&
ASSOCIATES INC.

ENVIRONMENTAL
SYSTEMS ENGINEERS

January 22, 1998

Our File: 38140-01/POWRVR

VIA FACSIMILE: (604) 485-2913

FAXED
JAN 22 1998
Pages 2

Jim Greenwood
Director of Engineering Services
The Corporation of the District of Powell River
Municipal Hall
6910 Duncan Street
Powell River, B.C.
V8A 1V4

Dear Jim:

Re: Westview Water Reclamation Facility

Attached is a copy of the January 22nd, 1998 letter from Paul Aubé at Les Industries Fournier which includes a list of the recommended spare parts for their model 2-1200/3000A with a flocculator.

Please feel free to contact me should you have any questions.

Kindest regards,

HILL, MURRAY & ASSOCIATES INC.

Robert A. Murray, P.Eng.
Director of Engineering

Attachment

/jlr
I:\PROJECTS\CURRENT\Powell River\greenwoodlet32 fournier.wpd

Suite 202
780 Tolmie Avenue
Victoria
British Columbia
Canada
V8X 3W4
Telephone:
250-388-3930
Facsimile:
250-388-3943
Email:
hma@islandnet.com

fournier

Black Lake (Québec)
January 22nd, 1998

Hill, Murray & Associates Inc.
780 Tolmie Avenue, Suite 202
Victoria, B.C. V8X 3W4

Attention: Mr. Robert A. Murray
Vice-President, Corporate Marketing
Fax No.: (250) 388-3943

Subject: Powell River

Gentlemen:

In answer to your fax of January 20th, 1998, the following is a list of the recommended spare parts for our model 2-1200/3000A with a flocculator (*).

(1) Actuator
(8) Seals
(2) Scraper assemblies
(1) Deflector liner
(1) Pressure transducer
(*) (1) Wear sleeve
(*) (2) Shaft seals
(*) (1) Pressure transducer

Since all the above parts are kept in inventory in sufficient quantities in our warehouse along with the filtering elements, in our opinion, it is not necessary for the End-User to carry them in his stock.

For the drive arrangement, the electrical motors are standard electric motors easily available, while the speed reducer, operating at such a low speed, will not need replacement parts before many years, except if some very unforeseen condition occurs and even then, parts should be easily available because those reducers are selected from reliable suppliers.

Yours truly,

LES INDUSTRIES FOURNIER INC.

Paul Aubé
Sales Director

PA/ld

LES INDUSTRIES FOURNIER INC., 325, BOUL. FRONTENAC, BLACK LAKE (QUÉBEC) CANADA G6H 2B5 / TÉL.: (418) 423-4241 / FAX: (418) 423-7366
Malle E: fournier@megantic.net

40 of 48

HILL
MURRAY
&
ASSOCIATES INC.

ENVIRONMENTAL
SYSTEMS ENGINEERS

FAXED
FEB 05 1998
Pages 1

February 5, 1998

Our File: 38140-01/POWRVR

VIA FACSIMILE: (604) 485-2913

Jim Greenwood
Director of Engineering Services
The Corporation of the District of Powell River
6910 Duncan Street
Powell River, B.C.
V8A 1V4

Dear Jim:

Re: Powell River Wastewater Treatment Plant
Preliminary Design Report

We request that two copies of the Powell River Wastewater Treatment Plant Preliminary Design Report prepared by Reid Crowther & Partners dated September 1996, Project No. 32929-00 be forwarded to HM&A.

We would like permission to release copy of the report to Jeff Van Haagstregt in our upcoming submission to the Ministry of Environment, Lands and Parks.

Your prompt consideration to this matter is appreciated. Please feel free to contact me should you have any concerns.

Kindest regards,

HILL, MURRAY & ASSOCIATES INC.

Robert A. Murray, P.Eng.
Director of Engineering

RAM/sc
I:\PROJECTS\CURRENT\Powell River\Greenwoodlet34 prelim design report.wpd

Suite 202
780 Tolmie Avenue
Victoria
British Columbia
Canada
V8X 3W4
Telephone:
250-388-3930
Facsimile:
250-388-3943
Email:
hma@islandnet.com

Rob
2 of 2 copies

BRITISH COLUMBIA

RECEIVED
MAY 15 1998
Hill, Murray & Associates Inc.

May 12, 1998

Our File: PE-73
Xcopy 76780-30/LWMP Powell River

The Corporation of the District of Powell River
6910 Duncan Street
Powell River, BC V8A 1V4

Attention: Jim Greenwood, P. Eng.
Director of Engineering & Development

Dear Sir:

Re: Waste Management Permit PE-73 amendment

I am writing to follow-up on the discussions we had recently with your consultant, Hill Murray & Associates concerning amendment to the Waste Management Permit for the Westview sewage treatment plant to reflect the current treatment works upgrading. It is our understanding that the upgrading work at the plant is proceeding well and is targeted for commissioning in early summer. In this regard, we are proposing the following changes and additional requirements to the present permit:

- Maximum discharge rate to be 13 640 m^3/day.

- Discharge characteristics shall be:
  - For discharge quantities less than or equal to 4 588 m^3/day:
    BOD_5 = 10 mg/L, maximum; TSS = 10 mg/L, maximum; Fish bioassay (rainbow trout), LT50, 96 hours minimum.

  - For discharge quantities greater than 4 588 m^3/day and less than or equal to 13 640 m^3/day:
    BOD_5 = 45 mg/L, maximum; TSS = 45 mg/L, maximum; Fish bioassay (rainbow trout), LT50, 96 hours minimum.

- Update list of authorized designated treatment works to include the proposed secondary treatment plant plus filtration, and proposed rotating drum screen with proposed works completion date of on or before September 30, 1998.

Ministry of Environment, Lands and Parks

Environment and Lands
Lower Mainland Region
Pollution Prevention

Mailing/Location Address:
10470 152 Street
SURREY BC V3R 0Y3

Telephone: (604) 582-5247
Facsimile: (604) 584-9751
or (604) 582-5335

- Update monitoring program to include daily flow measurement consisting of daily discharge quantity from the sewage treatment plant and the rotating drum screens, weekly analyses for BOD_5 and TSS, semi-annually for toxicity, and semi-annual data submission.

- New standard clauses to be added include Disinfection by ultraviolet radiation, Posting of Outfall, Outfall Inspection requiring inspection once every five years, Sludge Wasting and Disposal, Maintenance of Works, Emergency Procedures, Bypasses, Process Modifications and Facility Classification and Operator Certification.

- Add new clause requiring submission of semi-annual reports on works undertaken to minimize infiltration and inflow of storm water and groundwater into the sanitary sewer system.

The above proposed changes and additions are consistent with discussions we had with your agent. Should you wish to comment on the proposed changes for the permit amendment, please do so before May 29, 1998.

Also, we are encouraged by council's recent decision to initiate a liquid waste management plan. In this connection, I have enclosed a copy of a document entitled "*Guidelines for Developing a Liquid Waste Management Plan*" for your reference. Your attention is directed to Section 5 of this document concerning the procedural requirements and the necessary steps to be followed in preparing a LWMP.

Do not hesitate to call me at 582-5269 if you have any other questions.

Yours truly,

H. E. Lai, P. Eng.
Sr. Pollution Prevention Officer

Enlc.

1) criteria
2) monitoring
3) biosolids management
4) headworks HVAC (biofilter)

cc: Hill, Murray & Associates Inc
Suite 202, 780 Tolmie Avenue,
Victoria, BC V8X 3W4
Atten.: Mr. Rob Murray

Graham: Classification
Harrays letter.
42 of 68

HILL
MURRAY
&
ASSOCIATES INC

ENVIRONMENTAL
SYSTEMS ENGINEERS

FAXED
MAY 27 1998
#Pages 6

May 27, 1998

Our File: Powell River

VIA FACSIMILE: 604-485-2913

Jim Greenwood
Director of Engineering Services
The Corporation of the District of Powell River
Municipal Hall
6910 Duncan Street
Powell River, B.C.
V8A 1V4

Dear Jim:

Re: Letter to Ed Lai, MOELP

Attached is a copy of the draft letter to Ed Lai at MOELP regarding the upgrades to the Westview Sewage Treatment Plant.

This letter has the intent of reducing the frequency of analytical testing during dry weather flows. A reply to Ed Lai from yourself is required by Friday, May 29, 1998.

Please feel free to contact the office should you have any questions.

Regards,

HILL, MURRAY & ASSOCIATES INC.

for: Robert A. Murray, P.Eng.
Director of Engineering

Attachment

/jlr
I:\PROJECTS\CURRENT\Powell River\greenwoodlet52.wpd

Suite 202
780 Tolmie Avenue
Victoria
British Columbia
Canada
V8X 3W4
Telephone:
250-388-3930
Facsimile:
250-388-3943
Email:
hma@islandnet.com

HH-68

DRAFT

May 27, 1998

Our File: Powell River

VIA FACSIMILE: 604-584-9751
(through Jim Greenwood)

Ed Lai
Ministry of Environment, Lands and Parks
15326 - 103 A Avenue
Surrey, B.C.
V3R 7A2

Dear Ed:

Re: Your Letter of May 12, 1998, regarding the Upgrades to the Westview Sewage Treatment Plant in Powell River

We forward the following comments in response to the above letter.

Permitted Discharge Criteria

For flows less than 4588 m^3/day, we recommend the following permit parameters:

- BOD ≤ 10 mg/L
- TSS ≤ 10 mg/L
- Toxicity, Fish Bioassay, 96 Hr LT_{50}
- Fæcal Coliform ≤ 25 MPN/100mL

For flows above 4588 m^3/day, the following permit criteria are valid:

- BOD ≤ 45 mg/L
- TSS ≤ 45 mg/L

Note that in this case, toxicity criterion is not valid since drum screen filtrate receives neither biological treatment nor disinfection.

Monitoring Program

Daily flow data will be collected by the MMI system. This information will be plotted and submitted to the ministry as required by the permit.

.../2

45 L68

Analytical Process Data

For flows less than 4588 m^3/day, the following analytical regime is proposed:

BOD:	Monthly by certified analytical laboratory
TSS:	Monthly by certified analytical laboratory
Fæcal Coliform:	Monthly by certified analytical laboratory
Toxicity:	Semi-annually by certified laboratory

During rain events, or whenever the drum screens are in operation, samples of the combined effluent will be collected at a minimum of weekly intervals and tested for BOD and TSS by a certified analytical laboratory.

The Westview plant upgrade will also include the following on-line quality monitoring equipment:

- Turbidity
- pH
- Rainfall

Biosolids Management

Waste sludge from the ZenoGem process will be de-watered on-site with a Fournier press. De-watered sludge will meet all of the criteria for distribution under the 1983 guidelines for biosolids management. De-watered sludge will be transported off site to a composting facility. Composted material will be distributed or sold in accordance with the attached letter by Harvey Maxwell regarding the Lower Mainland Region policy on biosolids dated February 12, 1998.

Operations and Maintenance Monitoring

The plant will be operated and maintained jointly by the District of Powell River and the Canadian Wastewater Corporation (CWC). CWC will publish and oversee the operational plan. CWC will be involved through on-line support and on-site supervision with any major operational evolutions including any actions required under the Emergency Procedures and Contingency Action section of the operational plan. CWC will prepare semi-annual operational reports for the Ministry on behalf of the District of Powell River.

All equipment maintenance, including outfall inspections, will be monitored by CWC. Planned maintenance activities, corrective maintenance actions and equipment sinking funds will be administered by CWC and reported to the Ministry in summary form with the semi-annual operational report.

Influent strength, waste sludge quality and Inflow & Infiltration status will be reported semi-annually by CWC on behalf on the District of Powell River.

.../3

DRAFT

Ventilation

The new headworks building at the plant will be fitted with a forced ventilation system which will discharge through a biofilter to safeguard against odours. The main treatment building is also fitted with a forced ventilation system.

Facility Classification

CWC has submitted an application for classification of the facility under the Environmental Operator's Certification Board. The EOCP has classified this plant to Level III.

These comments are respectfully submitted for your consideration. Please contact the undersigned should there be any further questions.

Kindest regards,

HILL, MURRAY & ASSOCIATES INC.

Robert A. Murray, P.Eng.
Director of Engineering

cc. Jim Greenwood

RAM/jlr
I:\PROJECTS\CURRENT\Powell River\lailet04 - Upgrades.wpd

HILL MURRAY & ASSOCIATES INC.
ENVIRONMENTAL SYSTEMS ENGINEERS

Facsimile Transmittal

Suite 202 • 780 Tolmie Avenue • Victoria • B.C. • Canada • V8X 3W4
(250) 388-3930 • Fax (250) 388-3943 • Email: hma@islandnet.com

Our File: 16420-20/ Powell River.

To: Jim Greenwood cc: Joanne (HMA)
Fax: 604-485-2913 250-388-3943
From: Robert A. Murray, Partner
Date: May 28, 98
Subject: Response to fax from Ed Lie
Total pages this fax (including cover sheet): 1

MESSAGE

We have reviewed Ed's letter carefully and find it to be generally consistent with the discussions which we had with Jeff Vanhaastregt. We have suggested minor changes including changes to the sampling frequency which will save money from the "operations" budget.

Please call Joanne, if you are in agreement, she will send you the letter in final form. You should forward it to Ed under a DOPR cover letter. — Rob.

11:46

The Corporation of the District of Powell River

MUNICIPAL HALL
6910 DUNCAN STREET
POWELL RIVER, B.C.
V8A 1V4

MUNICIPAL HALL (604) 485-6291
ENGINEERING SERVICES (604) 485-8604
FAX (604) 485-2913

OFFICE OF DIRECTOR
OF OPERATIONAL SERVICES

May 29, 1998

Ministry of Environment, Lands & Parks
15326 - 103A Avenue
Surrey, B.C.
V3R 7A2

Attention: Mr. H.E. Lai, P. Eng.

Dear Mr. Lai:

Re: Westview Wastewater Treatment Plant – Your Letter of May 12th, 1998

The attached is a response from Hill Murray & Associates Inc. to your letter of May 12th, 1998 regarding the work now in progress to upgrade Powell River's Westview Wastewater Treatment Facility.

Would you please review the information and advise me if you require anything further.

Yours truly,

Jim Greenwood, P. Eng.
Director of Operational Services

JGG/lf

xc: Hill Murray & Associates, Attn: Mr. Rob Murray, P. Eng.

attachments: 5

HILL
MURRAY
&
ASSOCIATES INC.

ENVIRONMENTAL
SYSTEMS ENGINEERS

May 27, 1998

Our File: Powell River

VIA FACSIMILE: 604-584-9751
(through Jim Greenwood)

Ed Lai
Ministry of Environment, Lands and Parks
15326 - 103 A Avenue
Surrey, B.C.
V3R 7A2

Dear Ed:

Re: Your Letter of May 12, 1998, regarding the Upgrades to the Westview Sewage Treatment Plant in Powell River

We forward the following comments in response to the above letter.

Permitted Discharge Criteria

For flows less than 4588 m^3/day, we recommend the following permit parameters:

- BOD ≤ 10 mg/L
- TSS ≤ 10 mg/L
- Toxicity, Fish Bioassay, 96 Hr LT_{50}
- Fecal Coliform ≤ 25 MPN/100mL

For flows above 4588 m^3/day, the following permit criteria are valid:

- BOD ≤ 45 mg/L
- TSS ≤ 45 mg/L

Note that in this case, toxicity criterion is not valid since drum screen filtrate receives neither biological treatment nor disinfection.

Monitoring Program

Daily flow data will be collected by the MMI system. This information will be plotted and submitted to the ministry as required by the permit.

.../2

Suite 202
780 Tolmie Avenue
Victoria
British Columbia
Canada
V8X 3W4
Telephone:
250-388-3930
Facsimile:
250-388-3943
Email:
ia@islandnet.com

Analytical Process Data

For flows less than 4588 m³/day, the following analytical regime is proposed:

BOD:	Monthly by certified analytical laboratory
TSS:	Monthly by certified analytical laboratory
Faecal Coliform:	Monthly by certified analytical laboratory
Toxicity:	Semi-annually by certified laboratory

During rain events, or whenever the drum screens are in operation, samples of the combined effluent will be collected at a minimum of weekly intervals and tested for BOD and TSS by a certified analytical laboratory.

The Westview plant upgrade will also include the following on-line quality monitoring equipment:

- Turbidity
- pH
- Rainfall

Biosolids Management

Waste sludge from the ZenoGem process will be de-watered on-site with a Fournier press. De-watered sludge will meet all of the criteria for distribution under the 1983 guidelines for biosolids management. De-watered sludge will be transported off site to a composting facility. Composted material will be distributed or sold in accordance with the attached letter by Harvey Maxwell regarding the Lower Mainland Region policy on biosolids dated February 12, 1998.

Operations and Maintenance Monitoring

The plant will be operated and maintained jointly by the District of Powell River and the Canadian Wastewater Corporation (CWC). CWC will publish and oversee the operational plan. CWC will be involved through on-line support and on-site supervision with any major operational evolutions including any actions required under the Emergency Procedures and Contingency Action section of the operational plan. CWC will prepare semi-annual operational reports for the Ministry on behalf of the District of Powell River.

All equipment maintenance, including outfall inspections, will be monitored by CWC. Planned maintenance activities, corrective maintenance actions and equipment sinking funds will be administered by CWC and reported to the Ministry in summary form with the semi-annual operational report.

Influent strength, waste sludge quality and Inflow & Infiltration status will be reported semi-annually by CWC on behalf on the District of Powell River.

Ventilation

The new headworks building at the plant will be fitted with a forced ventilation system which will discharge through a biofilter to safeguard against odours. The main treatment building is also fitted with a forced ventilation system.

Facility Classification

CWC has submitted an application for classification of the facility under the Environmental Operator's Certification Board. The EOCP has classified this plant to Level III.

These comments are respectfully submitted for your consideration. Please contact the undersigned should there be any further questions.

Kindest regards,

HILL, MURRAY & ASSOCIATES INC.

fa: Robert A. Murray, P.Eng.
Director of Engineering

cc. Jim Greenwood

RAM/jlr
[illegible]

BRITISH COLUMBIA

February 12, 1998

File: 50100-25/Sludge
PB-00073

The Corporation of the District of Powell River
6910 Duncan Street
Powell River, BC
V8A 1V4

Attention: Mr. Jim Greenwood, P.Eng.

Dear Sir:

Re: Update on the Lower Mainland Region Policy on Biosolids

For your information, we now have a lower mainland regional policy for the beneficial reuse of biosolids in our region.

All biosolids are considered a waste in British Columbia, and discharges require a permit or approval under the *Waste Management Act* until the proposed *Municipal Organic Matter Recycling Regulation* comes into effect.

In order to encourage improved treatment and utilization of high quality treated biosolids, the Lower Mainland Region has adopted a policy of allowing these biosolids to be utilized without a permit or approval under certain conditions. These conditions are that the high quality treated biosolids must meet the RHG classification of the draft *Guidelines for the Disposal of Domestic Sludge Under the Waste Management Act* with additional restrictions being developed for the draft *Municipal Organic Matter Recycling Regulation*.

To ensure that high quality treated biosolids meeting our policy do not cause pollution, we require specific notification of proposed discharges where more than 5 cubic metres of biosolids would be applied to a particular site to determine if a permit or approval is warranted. Notification of a proposed discharge would include the total quantity, proposed rate of discharge, the location of the site to receive the discharge and details on the receiving environment, such as domestic wells or sensitive watercourses in the area.

Ministry of Environment, Lands and Parks

Environment and Lands
Lower Mainland Region
Pollution Prevention

Mailing/Location Address:
10470 152 Street
SURREY BC V3R 0Y3

Telephone: (604) 582-5247
Facsimile: (604) 584-0761
or (604) 582-5335

Limits for biosolids which may not require a permit or approval are:

- arsenic ≤ 75 mg/kg,
- cadmium ≤ 5-20 mg/kg depending on TKN content,
- cobalt ≤ 150 mg/kg,
- copper ≤ 757 mg/kg,
- chromium ≤ 1060 mg/kg,
- mercury ≤ 5 mg/kg,
- molybdenum ≤ 20 mg/kg,
- nickel ≤ 180 mg/kg,
- lead ≤ 500 mg/kg,
- selenium ≤ 14 mg/kg,
- zinc ≤ 1850 mg/kg,
- PCBs ≤ 2 mg/kg,
- moisture ≤ 70%,
- fecal coliforms < 1000 MPN/g dry weight and
- salmonella < 3 MPN/4g dry weight.

Under our policy, biosolids must meet the quality requirements based on analyses of the biosolids prior to dilution with any materials, such as chipped woodwaste. Management of lower quality biosolids not meeting our policy should include segregation from those high quality biosolids which are managed under our policy. Lower quality biosolids must be managed under a permit or approval.

It should be noted that our lower mainland regional policy will be superseded by the draft regulation when it comes into effect.

If you have any questions, please do not hesitate to contact Lynn Belanger at 582-5382.

Yours truly,

H.G. Maxwell
Assistant Regional Waste Manager

LCB/

cc: Jack Bryden, Pollution Prevention and Remediation Branch, Victoria

ANNEX C

PREDICTED PERFORMANCE OF ROTARY PRESS

CAKE PRODUCTION CALCULATION				Hours to fill 20 cu. yards		
Sludge flow:	**1000** ig/hr or	3785 l//hr		100%	70%	50%
Solids content:	**2.20%** Solids input	83 kg/hr	Kgs:	15,160	10,612	7,580
Pellet addition:	**60.00%** or	50 kg/hr	lbs:	33,352	23,346	16,676
Cake dryness:	**15.00%** Cake production	888 kg/hr		17.1	11.9	8.5
Cake dryness:	**17.00%** Cake production	784 kg/hr		19.3	13.5	9.7
Cake dryness:	**20.00%** Cake production	666 kg/hr		22.8	15.9	11.4
Cake dryness:	**25.00%** Cake production	533 kg/hr		28.4	19.9	14.2
Cake dryness:	**30.00%** Cake production	444 kg/hr		34.1	23.9	17.1

ANNEX D

VENTILATION RATES

HEADWORKS BUILDING

West Area and Trash Channels		11,800 ft³
Sludge Press Room		4,830 ft³
Ceiling		7,616 ft³
	TOTAL	24,246 ft³

Biofilter:

	Low Speed	
East	790 cfm	1,697 cfm x 60 min = 101,820 cf/hour = 4.2 exchanges/hour
West	907 cfm	
TOTAL	1,697 cfm	

	High Speed	
East	1,577 cfm	3,732 cfm x 60 min = 223,920 cf/hour = 9.2 exchanges/hour
West	2,155 cfm	
TOTAL	3,732 cfm	

MAIN TREATMENT BUILDING

Floor Area		115,290 ft³
Ceiling Area		59,340 ft³
	TOTAL	174,630 ft³

Two Fans - Model Cook XLWH42:

Low Speed

13,700 cfm
x 2
27,400 cfm

27,400 cfm x 60 min = 1,644,000 cf/hour = 9.4 exchanges/hour

High Speed

20,545 cfm
x 2
41,090 cfm

41,090 cfm x 60 min = 2,465,400 cf/hour = 14.1 exchanges/hour

SCHEDULE A

ANNEX E

WESTVIEW WATER RECLAMATION FACILITY
COMPLETION SCHEDULE
NOVEMBER 1998

DATE	DESCRIPTION	NOTES
Nov 1/98	QC Plan has been submitted per Jones Emery letter of October 26, 1998.	
Nov 2/98	New or revised drawings required for the following schedule.	To be discussed at November 9, 1998 meeting
Nov 5/98	Completion of installation of wider wheels and truck stops on main crane. Meeting Hill-Murray, District of Powell River, and Reid-Crowther Review Reid-Crowther draft report in detail Discuss oil and grease removal - drum screens Review purpose and approval of grit channels Procedure for inspection of aeration basin Operations support provided by CWC Maintenance support provided by CWC Status of Permit No Disinfection of Drum Screen Effluent Required	
Nov 6/98	**Submit Performance Report #1:** Summary and details of Operational Data to date, including: Flow Analyses MBR/Bypass Flows Q Tracker vs Parshall Flume Main Flume Analysis Performance Review of MBR Lab Analyses MBR Drum Screens Rotary Press Assessment of Equipment Status Effluent Blending Assessment	
Nov 6/98	Turnover of Sludge Management Review of Sludge Generation Numbers Operation of Rotary Press Analytical Requirements for Press Seismic Certification, Certification of Cranes (except Main Crane).	

DATE	DESCRIPTION	NOTES
Nov 9/98	Completion of equalization system components and automation. Functional trials of trash machines - review submittals including rated capacity. Functional trials of ZENON system under operational conditions. Completion of Headworks Building ventilation cross-connection. Issuance of SWL Certificate for Main Crane and P.Eng. certification.	
Nov 9/98	ZENON to report on post nitrification vs pre-nitrification and operation of process blowers	
Nov 9/98	Submit report of drum screen operation, use of stand-pipe. Bearing Defect Bulging of Panels	
Nov 9/98	Completion of assessment of effectiveness of modification of Biofilters Air Diffusion Plenum Increased media depth	
Nov 10/98	Completion of ZENON MBR System and Control Logic.	
Nov 11/98	**Submit Performance Report #2:** Prove effluent quality Prove ability to meet contracted flows (two times ADWF) (PWWF) Prove drumscreens at 100% flow	
Nov 12/98	Publish recommended spares list and storage requirements.	
Nov 13/98	Installation of Ventilation Failure Sensors. Spill Containment of NaOCl containers. Installation of Gas Detectors in Headworks and main Building Methane Oxygen Hydrogen Sulphide	
Nov 14/98	Review UV submittal and UV performance	
Nov 15/98	Deliver Composter	Final Portion of holdback: $166,563.65 GST incl. Composter: $64,200.00 GST incl. TOTAL: $230,763.65 GST incl.
Nov 16/98	Completion of H-M Control Logic items: Gas Sensors Ventilation Fan Sensors Trash Auger Machine Wing Plate Extension Installation	

DATE	DESCRIPTION	NOTES
Nov 17/98	Completion of CWC SMART MMI System. Training course on SMART (4 hours) Operation of system Data recording Alarm protocols Installation of CDPR Pager Watch	
Nov 18/98	**Submit Performance Report #3:** Prove effluent quality Prove ability to meet contracted flows (two times ADWF) (PWWF) Prove drum screens to 100% flow	
Nov 19/98	Provide control narrative for blended flows.	
Nov 20/98	Operations Manuals Vendor Data Immediate Response Chart Operations & Control Summary Maintenance Information and Tracking As-Built Drawings Mechanical Architectural Structural Civil Electrical Control	
Nov 21/98	Submit Report on Ventilation and Gas Monitoring.	
Nov 22/ 98	Report on Biofilter Performance	
Nov 23/98	Install column caps.	
Nov 24/98	Owner Inspection and Walkaround Operations Turnover	
Nov 25/98	**Submit Performance Report #4:** Prove effluent quality Prove ability to meet contracted flows (two times ADWF) (PWWF) Prove drum screens to 100% flow	
Nov 26/98	Seal electrical chase at tank building	
Nov 27/98	Submit Completion Certificate for approval.	
Nov 28/98		
Nov 29/98		

DATE	DESCRIPTION	NOTES
Nov 30/98	Start 30 day monitoring period.	
Dec 30/98	End 30 day monitoring period	Balance of contract amount: $160,212.63 GST incl. *(Note: This does not allow for any adjustments for additions, changes, deletions, and credits to be negotiated before November 30, 1998)*

ANNEX F

SUPPLEMENTAL LETTERS FROM DESIGN ENGINEERS AND SUPPLIERS

Hill, Murray & Associates Inc.
Suite 202 - 780 Tolmie Avenue, Victoria, BC V8X 3W4
Telephone: 250-388-3930 Facsimile: 250-388-3943 E-mail: info@hillmurray.com

November 05, 1998

Mr. Graham Symmonds
Hill Murray & Associates
Suite 202
780 Tolmie Avenue
Victoria, British Columbia
Canada

Dear Graham:

Re: Westview Water Reclamation Facility: Faxed Correspondence of November 03

A discussion of the issues raised in the referenced correspondence is presented below:

- The ZenoGem® process at Westview is treating wastewater at higher than design flows. Initial estimates for AAF and ADWF were 3,750 m3/d and 2,820 m3/d. Actual data from the site over the last 60 days indicates that ADWF is in the order of 4,950 m3/d, suggesting that AAF will also be much greater than originally estimated. Safety design factors used by Zenon will allow steady state operation of the ZenoGem® process at daily average flow rates up to 4,950 m3/d. Peak flow capabilities remain as specified at 7,575 m3/d. However, long term operation at peak flow rates is not recommended and will result in significant operating costs due to the requirements for increased frequency of manual cassette rotation and soaking.

  Obviously, the large difference between actual ADWF and predicted ADWF will result in higher sludge production and operating costs. High instantaneous dry weather diurnal flowrates coupled with continuous operation above initial design values may require upstream flow equalization.

- Reid-Crowther are correct in their assertion that denitrification rates in pre-denitrification zones are typically greater than denitrification rates in post-denitrification zones. With pre-denitrification, the soluble organic material in the raw wastewater is readily available for denitrification. With post-denitrification, the soluble organic material is generated principally from microbial endogenous decay. The rate of endogenous decay becomes the rate limiting step, lowering the overall denitrification rate. However, this fact does not preclude post-denitrification as an enitrely functional method for denitrification, if the post anoxic zone is sized appropriately for the anticipated denitrification rate. In fact, most conventional bionutrient processes employ a post denitrification zone to ensure the achievement of low effluent nitrate concentrations.

  For the Westview Water Reclamation facility, it was decided to proceeed with post denitrification design (without pre-denitrification) because of the existing tank configuration [it would have been difficult to efficiently aerate the existing anoxic zone because of the highly tapered floor]. Based on a review of anticipated post-denitrification kinetics, it was concluded that at an operating MLSS concentration of 15,000 mg/l, the post-denitrification zones would be adequately sized to fully denitrify nitrates generated in the common-aerated zone and the two membrane filtration zones.

  Since process start-up, analysis of the plant effluent has been conducted daily using ChemMet Analytical kits. Sampling and analysis have been conducted by Hill-Murray. Samples of the effluent have been submitted to an external laboratory on a regular basis to confirm the accuracy of the daily measurements. Both the daily analysis and the laboratory analysis indicate that effluent total nitrate-N concentrations have been consistently less than 4.5 mg/L and typically less than 3 mg/L (tabulated data

ZENON Environmental Systems Inc.
845 Harrington Court, Burlington, Ontario, Canada L7N 3P3 Tel: (905) 639-6320 Fax: (905) 639-1812

available upon request). The consistent achievement of these low effluent nitrate analysis confirm the success of the denitrification process design.

- I believe that the 50 day SRT that Reid Crowther refer to is taken from a kinetic analysis in the August 29, 1997 proposal from Zenon to HMA. The kinetic analysis was based on incorrect estimates of tank volume.

The tank volumes used for subsequent kinetic analysis are presented below:

Aerobic Volume = 180,000 US gallons
Anoxic Volume = 77,000 US gallons

Historical wastewater analysis data were reviewed and the following values used for sludge yield analysis:

Flow = 1 MGD;	BOD = 200 mg/L; TSS = 200 mg/L
Flow = 1.5 MGD;	BOD = 160 mg/L; TSS = 180 mg/L
Flows = 2.0 MGD;	BOD = 120 mg/L; TSS = 160 mg/L

At high flows, the BOD concentration was reduced to account for rain water dilution. The suspended solids concentration was not reduced by the same extent because of the impact of BOD and TSS from the rotary drum filters.

Results from the analysis are presented below:

Flow = 1 MGD	Net yield = 0.56 kg SS/kg BOD; WAS = 7,198 gpd; SRT = 36 days
Flow = 1.5 MGD	Net Yield = 0.63 kg SS/kg BOD; WAS = 9,755 gpd; SRT = 27 days
Flow = 2.0 MGD	Net Yield = 0.70 kg SS/kg BOD; WAS = 10,637 gpd; SRT = 24 days

The kinetic analysis was based on a proprietary steady state model based on Classical Monod kinetics. A true yield coefficient of 0.6 (kg TSS/kg BOD applied) was selected and an endogenous decay coefficient of 0.06 day^{-1}. The endogenous decay coefficient is reduced as SRT increases based on equations presented in the referenced paper "Comprehensive Activated Sludge Process Design, W. Eckenfelder, M. Goronszy and A. Watkins, 1985". In the analysis it was assumed that 20% of the influent suspended solids were non volatile. A full presentation of the model assumptions can be prepared upon request.

The greatest impact on sludge generation rates will result from the "higher than design" flowrates under dry weather conditions. These "higher" flowrates directly increase the BOD and TSS load as well as reducing the SRT and digestion capacity for the process. A comparison of estimated sludge generation rates for an average flowrate of 1 MGD versus 1.35 MGD is presented below (based on 200 mg/L BOD and 200 mg/L TSS).

Flow = 1 MGD;	Net Yield = 0.56 kg TSS/kg BOD; WAS = 7,198 gpd; SRT = 36 days
Flow = 1.35 MGD	Net Yield = 0.61 kg TSS/kg BOD; WAS = 10,800 gpd; SRT = 24 days

- Because of the extended SRT at which the process is operated, Zenon believes that the facility could likely achieve a substantial degree of nitrification and has attempted to start the process in a fashion to maximize the nitrification potential. There is no intention to sustain supplemental alkalinity addition

beyond process start-up. The anticipated date for stopping supplemental alkalinity addition is November 13.

The reason for the chemical addition employed to date is to maintain pH in a range where nitrification rates are not severely inhibited. The influent alkalinity of the raw wastewater is approximately 100 mg/L. With substantial nitrification, the mixed liquor alkalinity would be less than 50 mg/L (even with substantial denitrification), resulting in bioreactor pH values sufficiently low to inhibit nitrification rates. During process start-up, alkalinity has been added to supplement the raw wastewater alkalinity to allow for a fully nitrifying population to develop and potentially acclimate to the relatively low mixed liquor pH. The intention was to slowly reduce alkalinity addition rates to a value of zero.

Without supplemental alkalinity addition, the permeate pH has been in the range of 6.0 to 6.2. With approximately 25 mg/L of supplemental alkalinity addition the permeate pH has been in the range of 6.2 to 6.5. With full flow to the ZenoGem® process and supplemental alkalinity addition, the effluent ammonia concentration has been in the range of 3.5 to 9.0 mg/L (tabulated data available upon request). The intention is to slowly reduce the supplemental alkalinity addition rate over the next ten days and determine the effluent ammonia concentration that can be achieved.

- Hoffmann blowers were contacted in April , 1998 to comment on throttling of the blowers in order to operate at the Supplemental Airflow Design Flow Range presented below:

  1100 ICFM @ 4.5 psig discharge pressure
  1350 ICFM @ 4.5 psig discharge pressure
  1100 ICFM @ 5.6 psig discharge pressure

Mr. Rob Mears of Hoffmann Industries Canada (Toronto, Ont.) produced blower curves and commented that the blowers would be operated within an acceptable range. A copy of the correspondence between Zenon and Hoffmann is available on request.

Sincerely,

D. Thompson

Doug Thompson, P.Eng.
Municipal Wastewater Process Manager

c.c. R. Murray (Hill-Murray)
D. Mourato (Zenon)
H. Kaissi (Zenon)

Trojan

TROJAN TECHNOLOGIES INC.
3020 Gore Road,
London, Ontario N5V 4T7 CANADA
Tel: (519) 457-3400 / Fax: (519) 457-3030
Internet: http://www.trojanuv.com
E-mail:

Fax **Number of Pages Including Coversheet:** 1

To: Graham Symmonds / Hill Murray / 1-250-388-3943
Cc: Ted Thrush/ Ramtech/ 048
Kevin Wylie/ Trojan
From: Christine Zimmer
Date: 11/05/98
Re: Powell River, BC

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply**

Dear Graham,

In response to your fax regarding Reid-Crowther's inspection of the Powell River WWTP, please review the following comments:

- Looking through our file, Trojan has provided 5 budget proposals, two of which were proposed on Sept. 5, 1997. The UV system that was proposed with a total of 72 lamps was based on a peak flow of 3 MGD. The UV3000B that has been installed at Powell River has been designed for a Peak Flow of 1.862 MGD.

- The readings displayed on the System Control Screen of the UV3000B are UV intensities **NOT** UV dosages (Dose = Intensity x Time). The system was designed to deliver a UV dose of 22,000 uws/cm^2. This design dose was based upon a collimated beam result that Trojan performed on effluent from a similar WWTP (effluent treated by a Zenon system). Collimated beam results showed that a dose of 7.2 uws/cm^2 was sufficient to meet a limit of 25 FC/100 ml. Trojan's standard practice is to design a system to deliver a dose to achieve ½ of the disinfection limit (or 13 FC/100 ml) as an extra safety for fluctuations in effluent quality. Thus a design dose of 22,000 uws/cm^2 was selected.

I hope the above information is helpful in addressing the issues raised by Reid-Crowther. Please contact me if you have any further questions.

Regards

Christine Zimmer, P.Eng.
Regional Manager-Trojan West

ISO 9001

FAXED

LEBIHAN
ENGINEERING
INC.
STRUCTURAL
ENGINEERING
#240 - 1854 KIRSCHNER ROAD, KELOWNA, B.C. V1Y 4N6
TELEPHONE (604) 861-6687 * FAX (604) 861-6609

BY FAX

Hill Murry & Associates Inc.
Victoria, BC

ATTN: Gary Jazek

Dear Sir:

RE: Westview Water ReclamationFacility, Powell River, BC

In reply to your letter of November 3, 1998 regarding seismic bracing for the above project.

The precast panels are designed to the seismic requirements of the BC Building Code and the loads supplied by the steel designer.

If you have any further questions please call.

Regards,

H.G. Le Bihan, P.Eng.
for LEBIHAN ENGINEERING INC.

CANFER
ROLLING MILLS LTD

6215-86 AVENUE SOUTH EAST,
P.O.BOX 24, SITE 1, R.R.5
CALGARY, ALBERTA, CANADA. T2P 2G6
PHONE: (403) 236 9293 FAX: (403) 279 3140

FAX TRANSMISSION SHEET

DATE: November 3, 1998

COMPANY: Hill Murray and Associates Inc. FAX NO: (250) 388 3943

ATT: Mr. Gary Jerzak, Engineering Manager FROM: Naser Rabbani

NUMBER OF PAGES: 1 (including this sheet)

RE: Westview Water Reclamation Facility, Powell River, B.C. Project No: 98-01B-001and 002

In reply to your letter in regard to seismic bracing for the above projects, please refer to our drawings E-5 for job 98-01B-001 and E-1 for job 98-01B-002 where roof x-bracing and struts are shown. The struts consist of W6x15.5 and C8x13.2 at the wall elevations. X-bracing are 1" round steel bar. The provided framed x-bracing will transfer the seismic forces of the roof to the shear walls around the building. Please note that the concrete walls are not designed by Canfer Rolling Mills Ltd.

Please call to discuss should you require further information..

Regards,

Naser Rabbani

c. Collin Lee, Advance Building Systems Inc. Fax: (250) 861 1034
c. Bob Ferguson, Bifer Holdings BC Ltd

TOTAL P.01

CANCO
CRANES & EQUIPMENT LTD.

OFFICES & MANUFACTURING PLANT:
335 LYNN AVENUE,
NORTH VANCOUVER, B.C. V7J 2C4
TELEPHONE: (604) 988-1181
FACSIMILE: (604) 988-6160

HILL MURRAY & ASSOCIATES INC.
Suite 202-780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

Your Ref: P.O. # 246735-01797
Our Ref: CEV-98-11,107
Date: November 4, 1998

Attention: Mr. Gary Jerzak

Dear Sir:

Please accept this letter as confirmation that the crane serial # CEV-98-11,107, was built in accordance with all CSA and CMAA specifications and designed to operate with a safe working load capacity of 3000 lbs. in a full cantilever position.

As we have stated previously, the bridge travel cannot be driven down shop with cantilever in full position until cantilever has travelled back to underside of bridge girder.

I trust this meets with your requirements in regard to this project and remain,

Yours very truly,
CANCO CRANES & EQUIPMENT LTD.

Barry L. Bell
Sales Manager
BLB:hdk

FAXED

SALES & MANUFACTURERS

60 of 68.

TAB O

HILL
MURRAY

ENGINEERING
WATER
SOLUTIONS

FULL FLOW TRIAL

WESTVIEW WATER RECLAMATION FACILITY

5 – 6 JANUARY 2000

PROFESSIONAL
PROVINCE OF
G. S. SYMMONDS
BRITISH COLUMBIA
ENGINEER

Full Flow Trial
Westview WRF
5 – 6 January 2000

Trial Performed by: Graham Symmonds, P.Eng.

Trial Reference: CWCF0012B

Purpose: The purpose of this trial was to prove that the Zenon MBR system could meet the peak flow requirements of the contract.

Criteria: The contract documents specify the following MBR production capacities:

Average Annual Flow:	931,000 USGPD
Peak Flow:	1,862,000 USGPD for 12 hours maximum

INTRODUCTION

The trial consisted of two elements: single pump trial and parallel pump trials. This was instituted to establish the best operating conditions to meet the peak flow requirements.

The Westview WRF control sequence has a number of control elements designed to both meet the flow requirements of the design, and to protect equipment. The two primary control elements are:

1. Control by Weather; and
2. Control by Flow.

In Control by Weather, the PLC calculates flows entering the facility over a one hour period, a three hour period and a 12 hour period. This information is used to determine when the plant is seeing high flows due to infiltration and inflow, rather than simply a diurnal peak. This is normal mode of operation.

In the Control by Flow mode, a flow set point can be entered, and the PID loop will drive the pumps to meet that flow (subject to constraints on transmembrane pressure, NPSH requirements of the pumps, tank levels etc).

Note that both these modes have effects on the flow control valve, and the permeate production pump operations.

CONSTRAINTS

During this trial, the following criteria were maintained as operational limits:

TMP	> -9.0 psi
GFD	< 30 USGFD

OPERATING CONDITIONS

During the trial, the following conditions existed in the reactor:

MLSS	14,600 mg/L (average of four membrane tanks – data from 4 Jan 00)
Temperature	12.5 C
Aerobic DO	2.0 to 3.0 mg/L
Anoxic DO	< 0.3 mg/L
Permeate pH	6.07

During the trial, the area recorded 1.5 mm of rainfall.

PROCEDURE

Single Pump Trial

5 Jan 2000

1330 Changed plant from Weather Control to Manual Control
Adjusted set point (FCV 7660) to 1200 USGPM
This controls the influent to the plant to 1200 USGPM

1343 Adjusted FCV 7660 from 1200 to 1320 USGPM
1320 USGPM = 1.9 USMGD equivalent
Plant controlling to set point

1415 Adjusted FCV 7660 from 1320 to 1400 USGPM
This was done to get additional flow to the plant

1430 MLSS samples of east and west aeration tanks taken.
BOD and TSS samples taken of mixed effluent.

1437 Adjusted FCV 7660 from 1400 to 1500

1451 Adjusted FCV 7660 from 1500 to 1600
Flow not increasing to plant because of lack of influent flow.

1725 Headworks V-notch weir raised slightly (0.5 – 1.0")
This was done because V-notch weir requires final adjustment and was causing overflow to the Drumscreens when influent flows were at about 1100 USGPM. By raising the V-notch and allowing flow underneath, the levels dropped and more flow entered the MBR.
Adjusted FCV 7660 back to 1400 USGPM

1830 Changed ZW-1 to "Controlled by Flow"
On Settings 4, changed FAH-3520-1 (Flow Alarm High) from 650 to 800 USGPM
Changed FC-3520-1 (Flow Controller) from 648 to 750 USGPM.

Changed ZW-2 as above.

1950 Changed FC-3520-1 and FC-3520-2 from 750 to 790 USGPM.

2020 Changed FC-3520-2 from 790 to 850 USGPM.

At this point, the max one pump flow was attained – ZW-1 was capable of sustaining a flow in the order of 735 USGPM at a TMP of –5.2 psi. ZW-2 was capable of sustaining 695 USGPM at a TMP of –5.1 psi. Both pumps were operating at approximately 81% speed.

6 January 2000

0125 Reverted to Level Control and returned amended control parameters to pre-trial values, with the exception of which remained in Manual Control at 1400 USGPM to allow plant to take as much flow as possible (ie reduce bypass). Flow values returned to 648 USGPM at –4.5 psi for both systems.

Parallel Pump Trial

6 January 2000

1022	Changed ZW-1 to Controlled by Flow Changed FAH-3520-1 (Flow Alarm High) from 900 to 1000 USGPM Changed FY3H-3520-1 from 850 to 720 USGPM. This changes the permeate flow rate that determines when parallel pump operation is called for. Changed FY2H-3520-1 from 400 to 650 USGPM. This changes the return to single pump operations parameter. Changed FC-3520-1 from 648 to 735 USGPM. Two pumps were activated.
1027	Changed FC-3520-1 from 735 to 800 USGPM. ZW-1 controlling to 800 USGPM.
1034	Changed to Manual Control from Weather Control FCV 7660 set at 1400 USGPM.
1039	Changed ZW-2 as per ZW-1 at 1022 hrs.
1756	Increased FCV 7660 from 1400 to 1600 USGPM. Influent flow reducing – tank levels dropping.
1945	Changed FC-3520-1 from 825 to 850 USGPM
1947	Changed FC-3520-2 from 850 to 895 USGPM
1950	Changed FC-3520-1 from 850 to 895 USGPM
2010	Changed FC-3520-1 from 895 to 810 USGPM to try to have PID control better. Reverted back to 850.
2143	Changed BP frequency from 10 minutes to 11 minutes.
2243	Flow Check: @10:39:56 Discharged Volume = 589,646.38 USG @22:39:32 Discharged Volume = 1,525,371.5 USG
	Total Treated Flow = 935,725.2 USG
2307	Revert to Normal Ops (Control by Level in Weather Control Mode)

7 January 2000

0315	MLSS samples taken from east and west aeration tanks.

DISCUSSION:

Single Pump Operations

This trial was performed to establish the maximum production from the system when using single pump operations. Maximum sustained single pump flow attained was:

ZW-1 ~ 735 USGPM at a TMP of –5.2 psi.
ZW-2 ~ 695 USGPM at a TMP of –5.1 psi.

Both pumps were operating at approximately 81% speed.

Parallel Pump Operations

The plant is not fitted with the capability of directly inputting a controlled transmembrane pressure. TMP is calculated within the PLC ladder logic. This means that the trial was conducted under true operational condition, not at an artificially high TMP. This does, however, result in a trial that is more complicated to manage.

Flows

Flow data was recorded from the following systems:

Permeate Production Mag Meters
UV Discharge Mag Meters (representaive of Water-Made-Good)
MBR Influent Parshall Flume
Bypass Parshall Flume

The total production during the 12 hour parallel pump trial was 936,284 USG. This was accomplished at a maximum TMP of –6.1 psi. Permeate production was measured form the UV Discharge Mag Meters. Permeate Mag Meters recorded a production of 1,081,449 USG. By comparing the change in tank levels, and adding the MBR Influent Parshall Flume totalizer, a third total flow produced can be determined. This method yielded a flow of 937,159 USG.

It is important to note that the data from all three methods of flow calculation agree. The parshall flume and the UV discharge data are within 0.1%. The permeate production and UV meters indicate a service factor of 86%. This indicates the relative accuracy of the measuring methods, and confirms the findings of Southwestern Flowtech and Environmental during their flow studies.

Westview WRF
Full Flow Trial
January 6, 2000
10:39 hrs to 22:39 hrs

Analysis

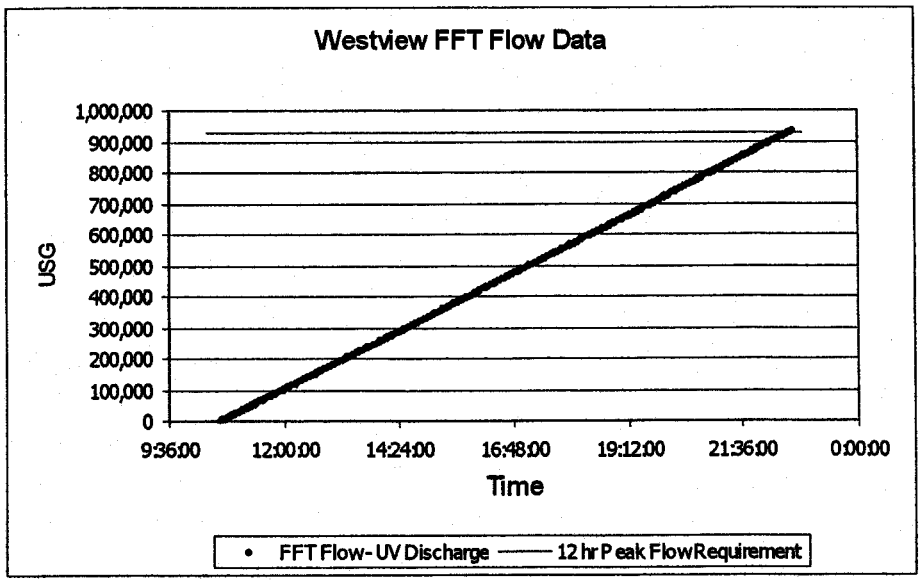
Flows

		Meter Readings Start	Stop	Total Production During Trial	
Permeate Discharge - Water Made Good		589,347	1,525,631	936,284.2	USG
Permeate Production (incl BP)		726,986	1,808,435	1,081,449.3	USG
MBR Influent Flow					
Parshall Flume		530,738	1,437,499	906,760.7	USG
Tank Level (average)		13.13	12.35		
Tankage Area	5400 ft2 - 90 x 60 tanks				
Tank Level Delta	0.78 ft				
Total Volume Removed from Reactor	4,222 ft3				
				30,399	USG
		Total Treated Out of MBR		937,159.4	USG
Bypass Flow		57,977	96,385	38,407.7	USG

Power Consumption

kW-hrs	Start	Stop	Total kW-hrs Used	
	32846.43	35996.72	3150.29	in 12 hour trial

As shown on the graph below, permeate production throughout the trial was linear, indicating consistent performance.

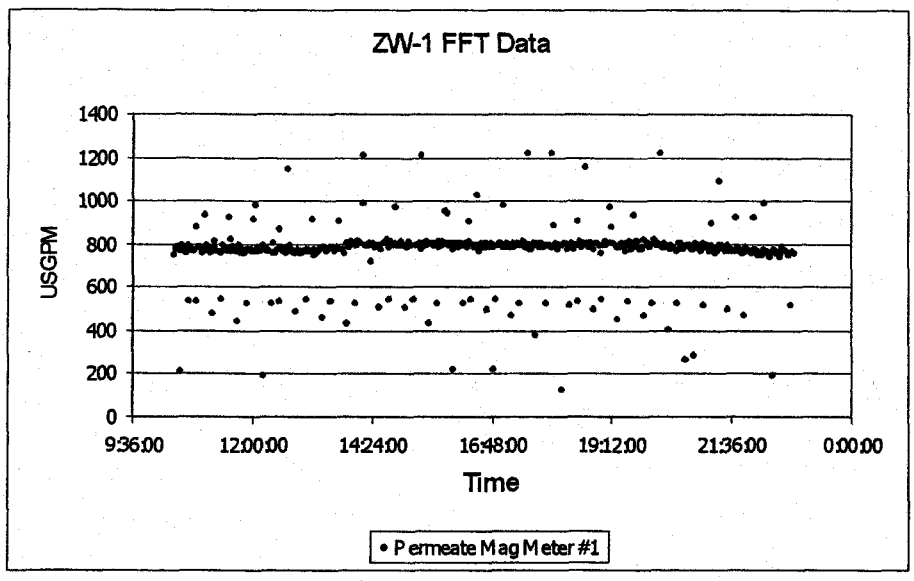


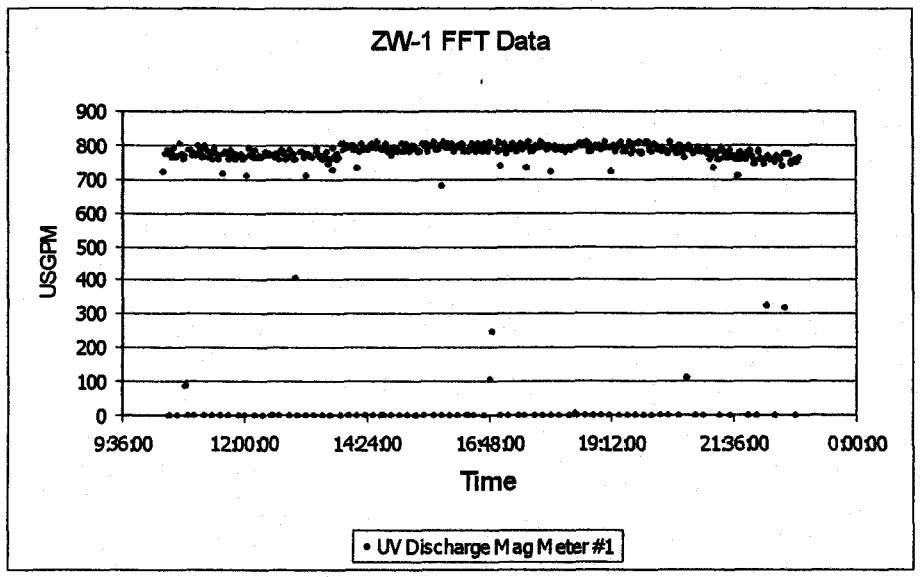
Membrane Performance

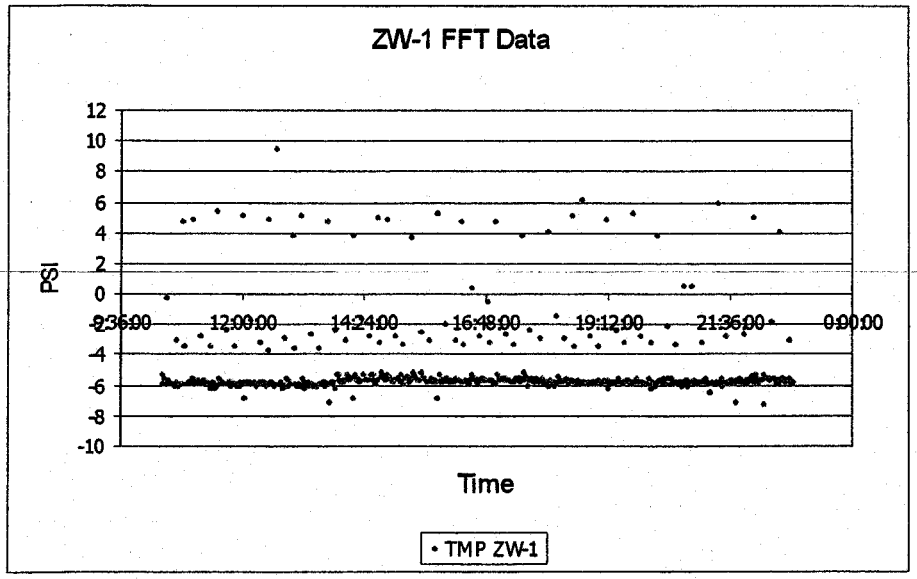
The performance of the Zenon ZeeWeed membrane system was evaluated by examining the flow, flux and permeability sustained during the trial.

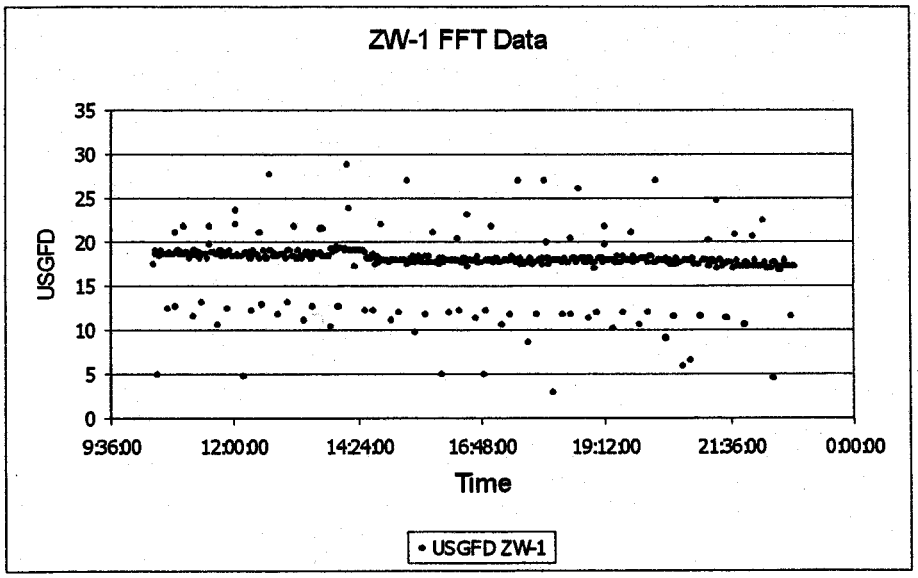
The following graphs show membrane performance for ZW-1 and ZW-2 during the trial.

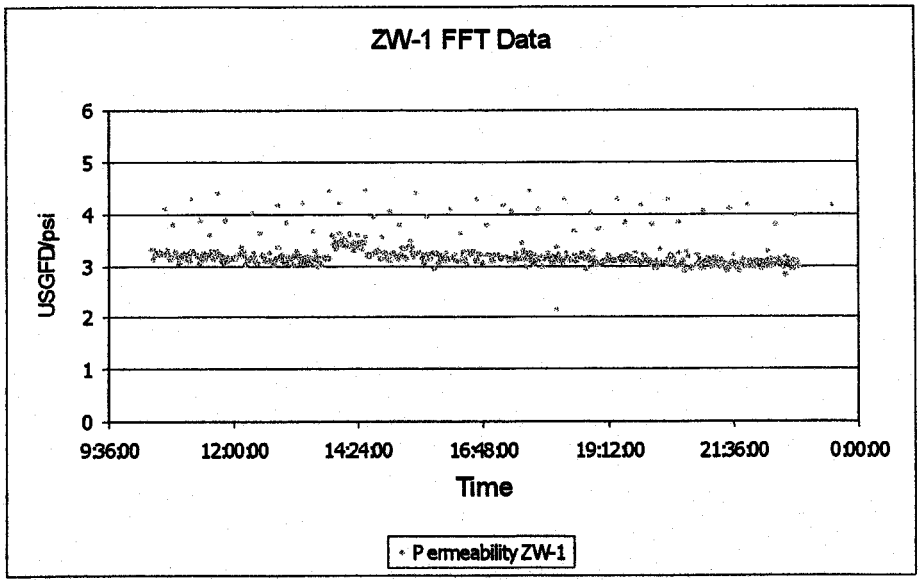
ZeeWeed #1 (North)



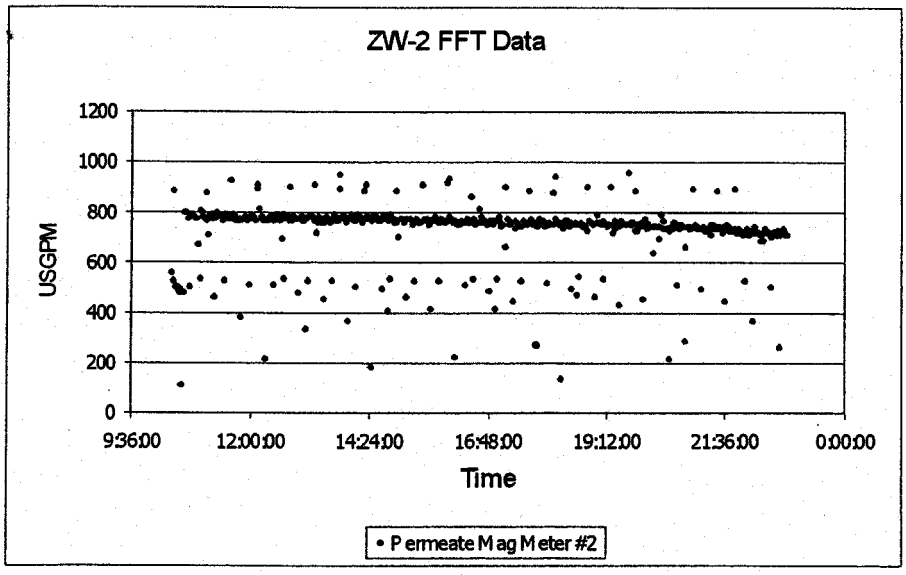


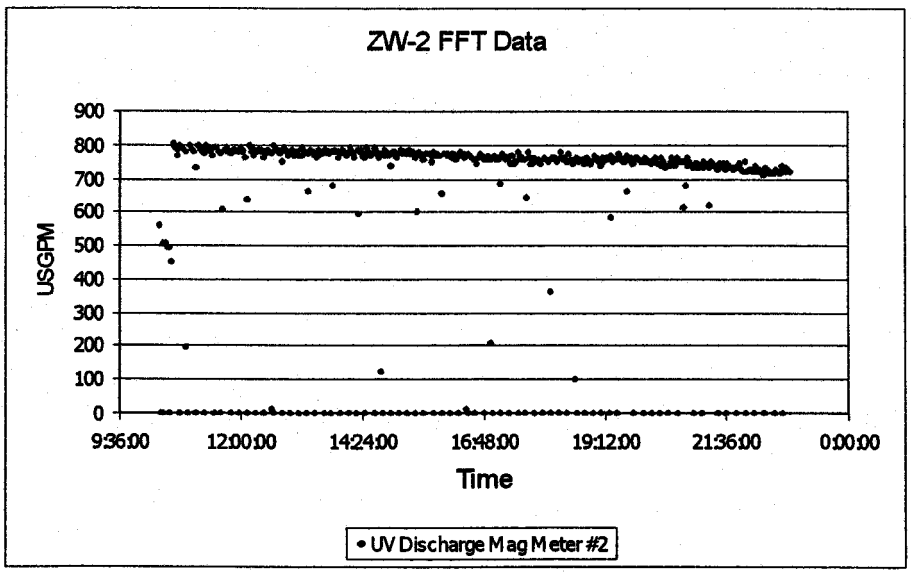

ZW-1 FFT Data
PSI
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
9:36:00
12:00:00
14:24:00
16:48:00
19:12:00
21:36:00
0:00:00
Time
TMP ZW-1

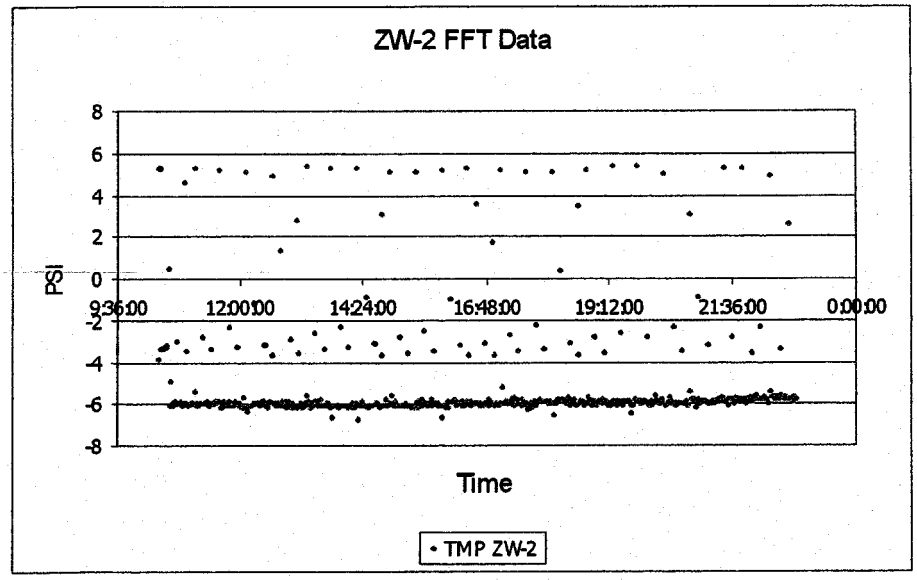

ZW-1 FFT Data
USGFD
35
30
25
20
15
10
5
0
9:36:00
12:00:00
14:24:00
16:48:00
19:12:00
21:36:00
0:00:00
Time
USGFD ZW-1

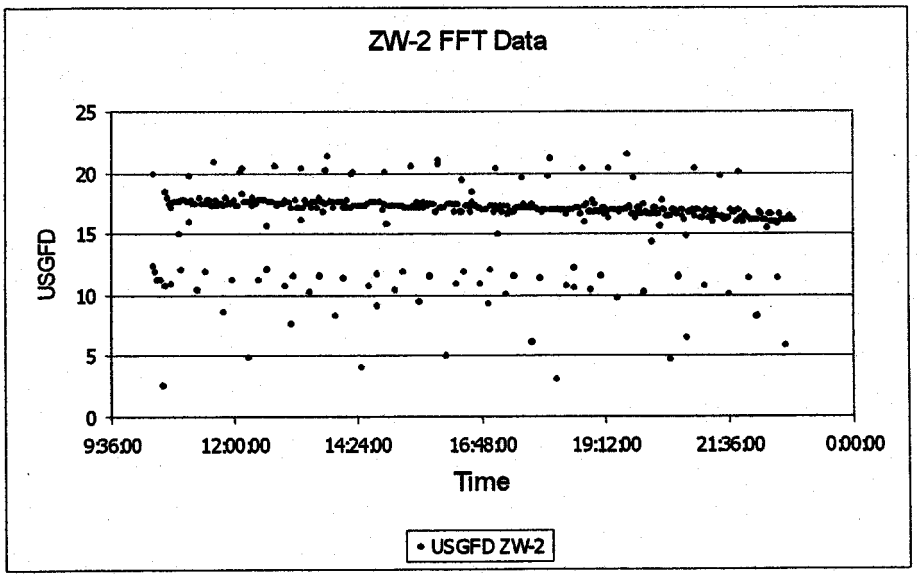

ZW-1 FFT Data
USGFD/psi
6
5
4
3
2
1
0
9:36:00
12:00:00
14:24:00
16:48:00
19:12:00
21:36:00
0:00:00
Time
Permeability ZW-1

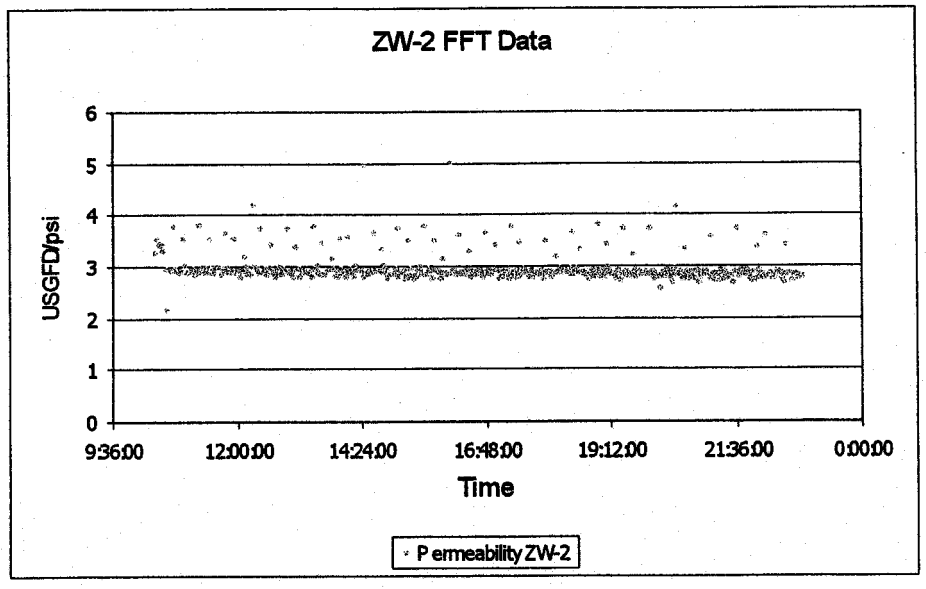
ZeeWeed #2 (South)






ZW-2 FFT Data
PSI
8
6
4
2
0
-2
-4
-6
-8
9:36:00
12:00:00
14:24:00
16:48:00
19:12:00
21:36:00
0:00:00
Time
TMP ZW-2


ZW-2 FFT Data
USGFD
25
20
15
10
5
0
9:36:00
12:00:00
14:24:00
16:48:00
19:12:00
21:36:00
0:00:00
Time
USGFD ZW-2

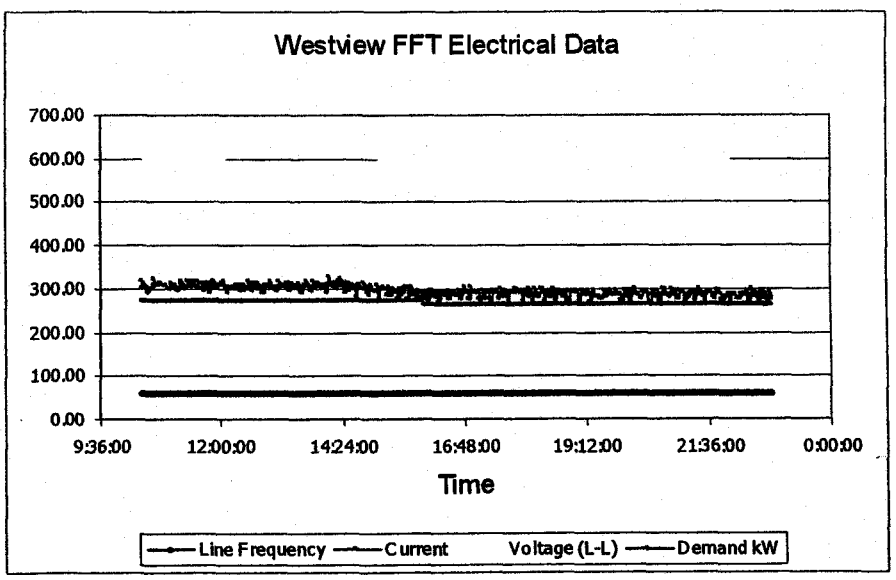

ZW-2 FFT Data
USGFD/psi
6
5
4
3
2
1
0
9:36:00
12:00:00
14:24:00
16:48:00
19:12:00
21:36:00
0:00:00
Time
Permeability ZW-2

In general, both ZW-1 and ZW-2 maintained stable operations throughout the trial. ZW-1 performed better, likley due to the inclusion of OKC membranes (ZW-2 consists of 16 cassettes of 8 modules each of OCP membranes. ZW-1 consists of 11 cassettes of OKC and 5 cassettes of OCP modules).

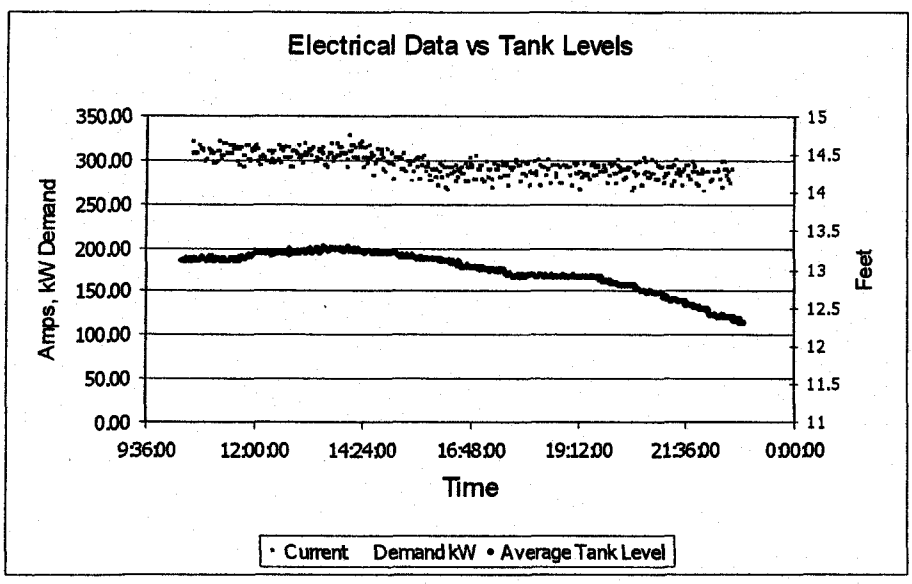
It is interesting to note that as the flow reduced to the plant, and the tank levels receded, a drop in production rate (flow) was observed. This can be explained by the effective reduction of head on the membranes, resulting in an increased suction head on the pumps, and can be seen on the graphs as a decrease in the absolute value of the TMP (ie as the tank levels decreased, TMPs in the system changed from –6.0 to –5.6 to –5.7 psi). Permeabilities (flux divided by transmembrane pressure) remained constant, indicating that the degradation was not due to membrane performance, but rather external factors.

Other Operational Data

Data was collected on the electriacl power consumption during the trial. The plant consumed 3150 kW-hrs during the 12 hour trial. This represents a monthly equivalent of 189,000 kW-hrs per month, were the plant to be operated continuosly at this peak flow condition. Peak demand was consistently in the 270 kW range. Power factor averaged 86.5% (ranging from 85 to 87%).



The following graph shows current drawn and kW deamnd at the plant against tank levels. It is apparent that the electrical load at the plant varies with tank levels. This effect is likely due to the change in the operating head o fthe blowers (ie lower tanks provide less back pressure against the blower discharge). This data is useful in determining an optiumum level of operation for the plant. From this graph, ot would appear that controlling level to approximatley 13.13 feet reduces the demand charges, and results in the optimimum reduction in current draw (resulting in an equivalent drop in kW).



CONCLUSIONS and RECOMMENDATIONS

1. The plant met the obligations of producing 931,000 USG water-made-good in a 12-hour period. Water-made-good was 936,284 USG

2. Membrane performance was stable throughout the trial.

3. When the plant is in Level Control, consideration of setting a controlled level in the order of 13.13 feet should be made.

4. The operational MLSS of the plant was high. The new Zenon specification is 10,000 to 12,000 mg/L. CDPR staff must take action to reduce MLSS to specification.

5. The membrane cassettes should be subjected to a recovery clean in the normal course of activities (ie 2 cassettes per day).

TAB P

Preliminary Briefing Note
Westview Flow Analysis

Background

In order to verify the accuracy of the flow measuring devices, Hill Murray commissioned Sothwestern Flowtech and Environmental (SWFT) of Surrey, BC to install additional flow meters and evaluate the flows.

This report details the preliminary findings.

Methodology

SWFT installed the meters for the period 13 September to 27 September. Flow meters were installed as follows:

1. The manhole immediatley upstream of the headworks building (doppler area-velocity meter)
2. The bypass parshall flume (ultrasonic flow meter)
3. The inlet to the MBR area of the plant (doppler area-velocity meter)

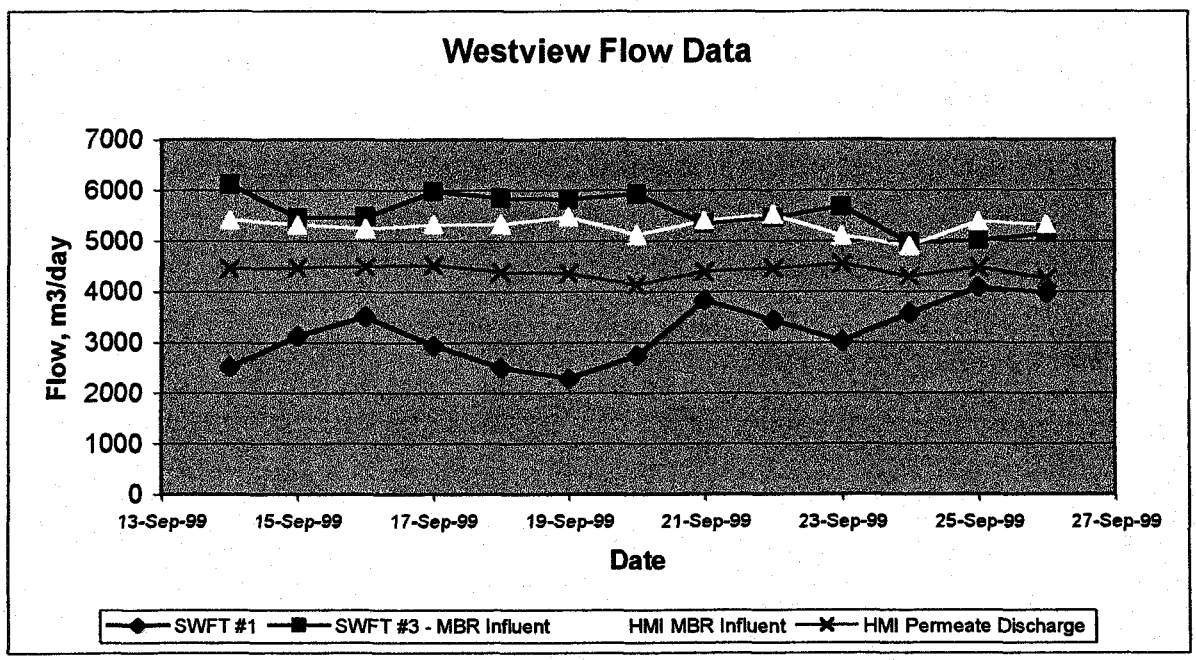
Flow data (depth and velocity) was collected at five-minute intervals throughout the trial. This data represented the average flow over the five-minute interval.

Data was downloaded and analyzed using standard data correlation techniques (depth vs velocity scatter plots etc).

Data

The data collected is shown in the following chart. Of note is the marked correlation between the SWFT #3 flow meter monitoring the flow to the MBR and the HMI totalizer operating from data from the MBR influent parshall flume. This contrasts dramatically with the SWFT #1 Headworks flow meter, which consistently reads an average of 41% lower than the HMI and the SWFT #3 flow meters. This can be explained by the influence of the lift station: the lift station causes dramatic variations in the depth and velocity in the influent pipe. It is felt that the combination of rapidly changing parameters results in a less accurate data curve. The velocity-depth scatter plot clearly reveals a bi-modal flow characteristic. The influent parshall flume and the SWFT #3 meter, on the other hand, are subjected to a much more steady flow (due to the flow dampening effects of the headworks facility) and are therefore considered to be more accurate. There is still an effect on the flow characteristics from the lift station, and this causes variation in the velocity-depth scatter plot.

Also plotted on the same graph is the mag-meter discharge volume from the UV discharge, as totaled by the HMI. These meters, when installed according to the manufacturer's instructions can achieve accuracies in the order of 0.5% of span – far superior to any open-channel flow measurement device. There are four mag-meters installed on the permeate discharge system, two measuring total permeate production, and two measuring permeate discharged. Comparing instantaneous flows, the mag-meters read the same values when measuring the same flow. In addition, the ratio of totalized production to totalized discharge is 0.83, the expected ratio when all the backpulses, maintenance cleans, aerator flushes etc are taken into account.



Data Conclusions

The third-party data supports and validates the flow measuring techniques employed at Westview. This data suggests that the actual flows to the plant are substantially higher than that recorded during the design parameter evaluation performed by Reid-Crowther.

Analysis of Flows against Design

Design Criteria

The Westview design is based on flow data supplied from the District in the initial contracting period. The Corporation had commissioned a detailed assessment of the condition of the Westview, Townsite and Wildwood treatment plants, and a determination of the design parameters for a new facility. A comparison of the Reid-Crowther Preliminary Design Parameters, the Hill Murray Design Parameters and the Actual Flow to the Facility is shown below (flows in m^3/day):

	1993	1994	1995	1998	1999	**2010**
Reid Crowther Preliminary Design Data						
Population		8275				**9400**
RC Average Annual Flow	3246	3473	3704			**3950**
RC Average Dry Weather Flow	2385	2581	2294			**2820**
RC Maximum Month Flow	5455	5417	6930			**6580**
RC Maximum Weekly Flow	8698	7028	9709			**9635**
RC Maximum Day Flow	12358	10406	11769			**13065**
Peak Wet Weather Flow						**25990**
Hill Murray Design Data						
HM Design Average Annual Flow				3520		
HM Design Average Dry Weather Flow				2300		

Actual Data

Actual Average Annual Flow	**6432**
Actual Average Dry Weather Flow	**4902**
Actual Maximum Month Flow	**9038**
Actual Maximum Weekly Flow	**9946**

Observations

The actual ADWF seen by the Westview facility in 1999 is 1.73 times that expected in the year 2010. The AAF in 1999 is 1.6 times that expected in 2010. The MMF in 1999 is 1.4 times that expected in 2010.

Impact on Operations

Clearly, the flows to the plant are substantially higher than expected, and well in excess of the design parameters. This will have a significant operational, as well as a permit, impact.

MBR Impact

The plant is currently configured (post-expansion) with 240 operational ZW-500 modules. Assuming that the plant is maintained to a standard to meet an average GFD of 15, the plant will be able to produce a totalized "water-made-good" value in the order of 5,500 m3/day (0.83 SF). While this represents a totalized flow above the actual ADWF (4,902 m3/day), there are still days between 1 May – 31 October that will result in bypass of screened sewage. This contravenes the permit requirement of disinfection of all flow during this period. In addition, the plant is incapable of treating the required 2 x ADWF of the Municipal Sewage Regulation (see permit discussion below).

Operation of the plant at greater than the design AAF requires both a higher TMP and a higher flux. This results a greater cake deposition on the membrane surface, and a greater flux of solids approaching the membranes. Both of these conditions increase membrane maintenance requirements.

Sludge Impact

Sludge production is proportional to influent flow and BOD loading. As flows increase, a linear increase in sludge is expected.

Drum Screen Operational Philosophy

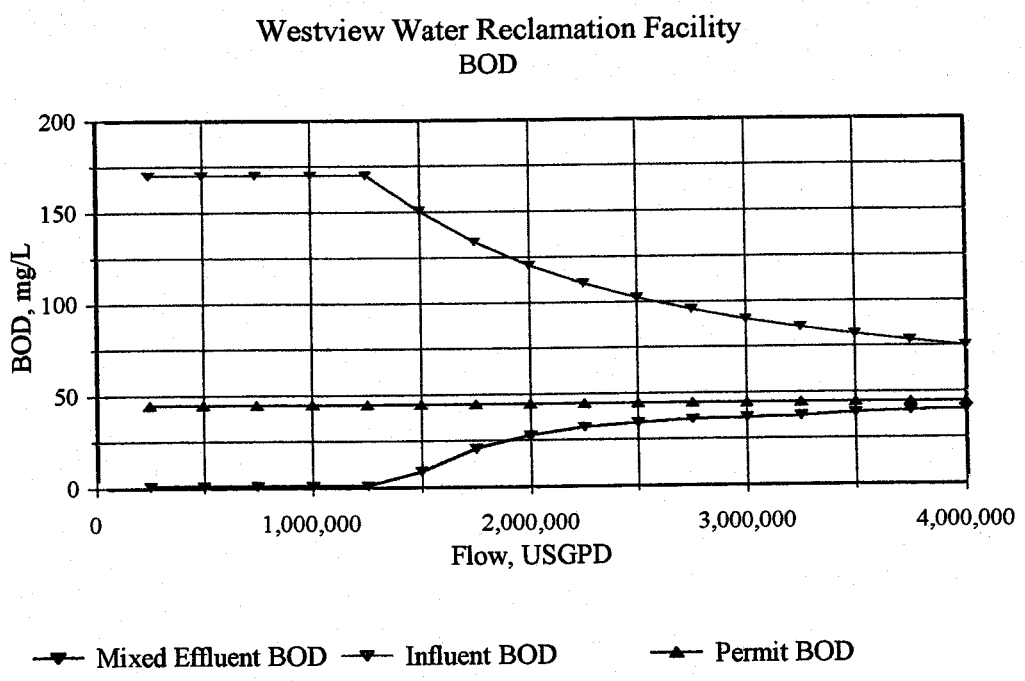
The design philosophy of employing Drum Screens to treat the I&I flow in wet weather is predicated on a reduction in BOD/TSS loading as I&I occurs. An increased AAF and ADWF means that the dilution effect is delayed, subjecting the Drum Screens to full strength wastewater. This has an effect on the overall efficiency of the system (as the effluent is dependent on the influent strength) and increases Drum Screen maintenance.

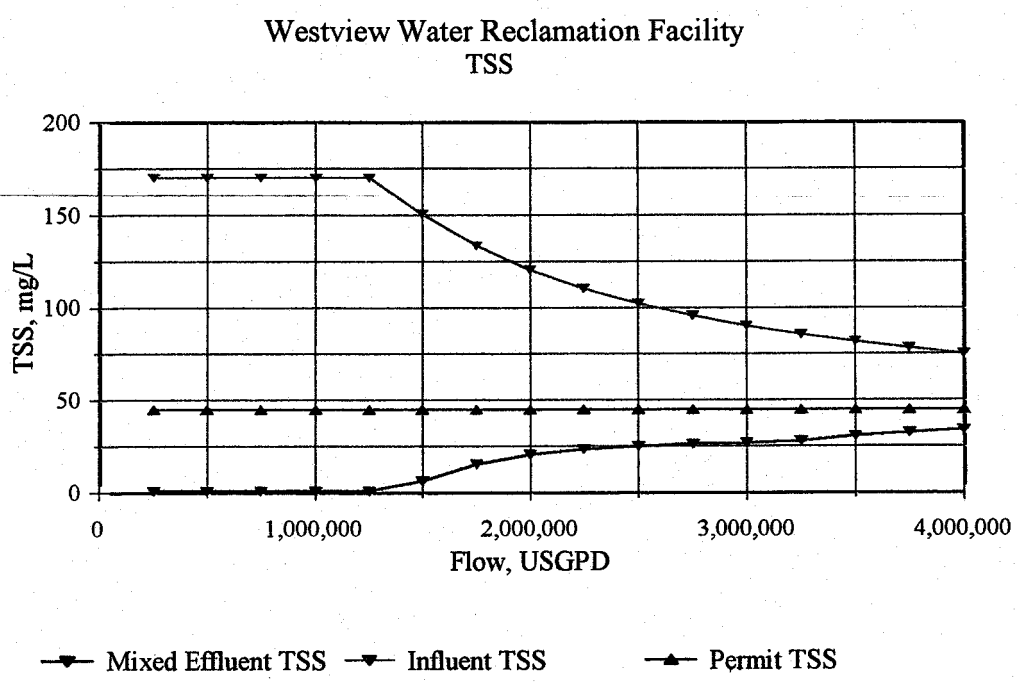
Permit Impact

While the ADWF in the permit is stipulated as 2,300 m^3/day, the actual ADWF is in the order of 4,900 m^3/day. The current permit requires that "discharge quantities" less than 4,600 m^3/day (ie total flow to the plant) must meet a BOD/TSS of 10/10 and a fecal coliform value of 25 CFU/100 mL. With an ADWF of 4,900 m^3/day, this value, by extension, would have to be 9,800 m^3/day – a value likely not to be reachable by the plant. It is, however, possible to meet the secondary standard (BOD/TSS 45/45) for up to 2 x ADWF, provided the MBR treat a water-made-good value of 5,300 m3/day – a value possible with GFD of 14, a service factor of 0.83 and 240 modules.

This is shown in the accompanying graphs, based on the following:

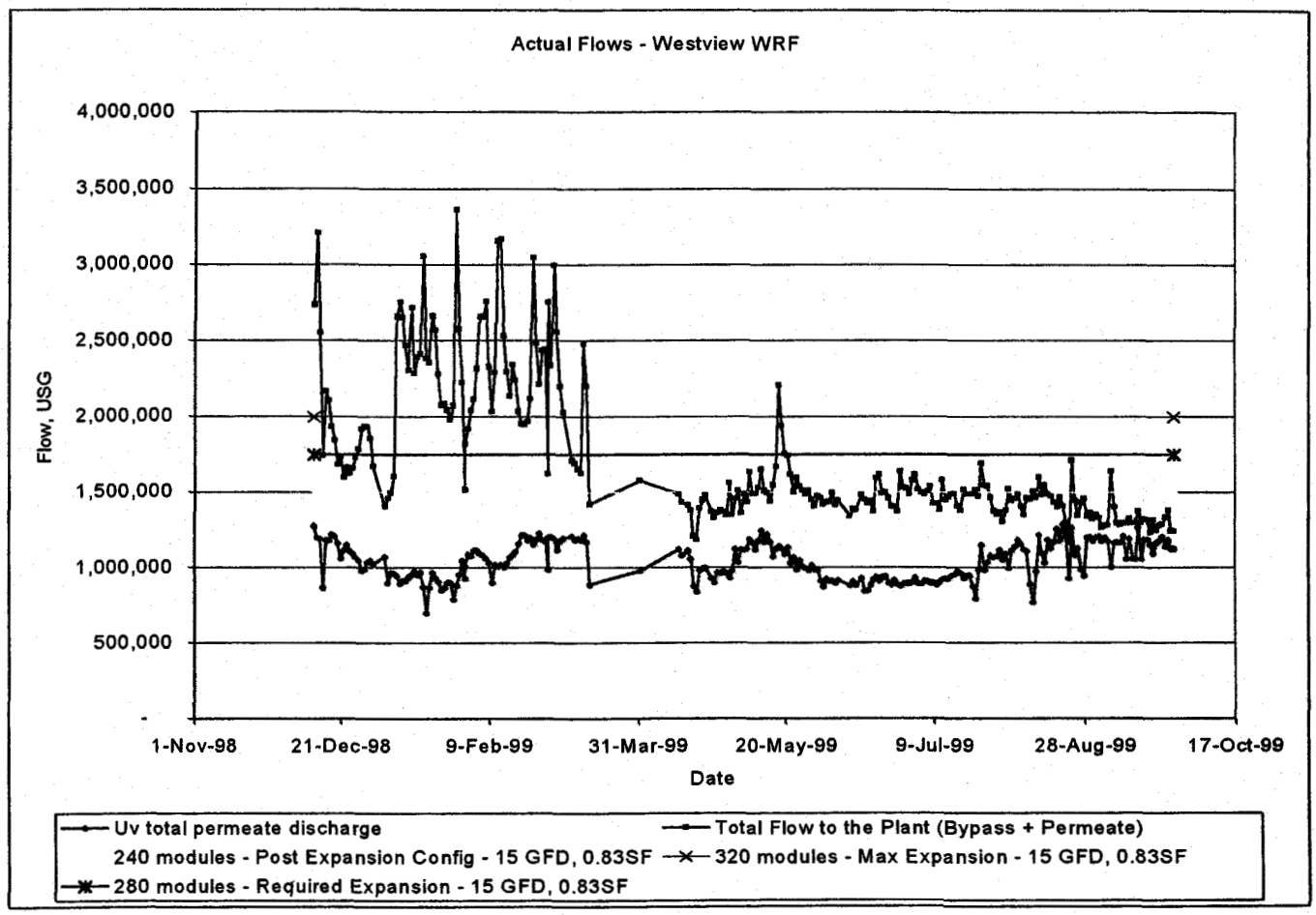
Treatment Capacity		1,400,000	USGPD
Micro-Screen Capacity		1,782,720	USGPD
Peak Wet Weather Flow		6,873,840	USGPD
Average Dry Weather Flow		1,293,600	USGPD
Wastewater Influent BOD		170	mg/L
Wastewater Influent TSS		170	mg/L
Infiltration BOD		30	mg/L
Infiltration TSS		30	mg/L
MBR Effluent Quality			
	BOD	1	mg/L
	TSS	1	mg/L
Fine Screen Removal		25%	BOD
		45%	TSS





At all flows, including observed Peak Wet Weather Flow of 13,000 m3/day (3,430,000 USGPD), the blended effluent can meet the secondary requirement.

While this method would meet the 2 x ADWF requirement, the disinfection of the entire flow from 1 May to 31 October is not possible without augmentation to a minimum of 320 ZW-500 modules, as shown in the accompanying graphs.



Conclusions and Recommendations

1. Augment membrane modules to 280 ZW-500 modules. This will result in a treatment capacity of 6,600 m3/day (1,743,000 USGPD, @ 0.83 SF and 15 USGFD) and an ability to meet the requirements of the May to October permit.

2. Commence permit negotiations to enable the plant to operate under a realistic permit.

TAB Q

LIDSTONE, YOUNG, ANDERSON

BARRISTERS & SOLICITORS

1616 - 808 Nelson Street
Box 12147, Nelson Square
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VIA FACSIMILE

May 12, 2000

Mr. Marvin R.V. Storrow, Q.C.
Blake, Cassels & Graydon LLP
Barristers & Solicitors
Suite 2600, Three Bentall Centre
595 Burrard Street
Vancouver, BC V7X 1L3

Dear Mr. Storrow:

Re: Design-Build Contract for Upgrade of Westview Treatment Plant ("Contract") between the District of Powell River ("the District") and Hill Murray and Associates ("Hill Murray")
Our File No. 00003-0331

We write further to our letter dated May 1, 2000, wherein we advised that we would be providing you with a list of the deficiencies remaining in the work performed by Hill Murray under the Contract.

Please be advised that, to date, our client's review of the work performed by Hill Murray under the Contract indicates the following deficiencies in relation to the same:

(1) the lack of a backup system for the central control system of the plant; ??

(2) the lack of a primary flow measuring device prior to the inlet screw auger screens; Right, size wrt?

(3) the lack of a mechanical screenings compaction/dewatering device between the areas of screen discharge and screenings storage; ??

(4) the lack of suitable grit removal devices in the headworks and bioreactor portions of the plant;

(5) the insufficiency of the two rotary drum screens to handle peak wet weather bypass flows; untrue - tested and trialed to appropriated flow as per design

(6) the lack of a permanent device for draining the rotary drum screen concrete enclosures to allow for the cleaning of, and elimination of biological growth in, the enclosures;

(7) the lack of dissolved oxygen probes in the westerly membrane bioreactor;

(8) the lack of suitable tank isolation gates for the westerly membrane bioreactor;

(9) the lack of suitable sludge storage facilities prior to the sludge dewatering process; – consumed by the requirement to treat higher flows

(10) the lack of magnetic flow meters in respect of the flow of sludge from the membrane bioreactors to the sludge press; Req'd?

(11) the lack of a fully enclosed flow-through in-vessel sludge composting unit and the unauthorized replacement thereof with an open trough style composting unit (which has not yet been installed);

Credited. (12) the lack of a 72 lamp UV effluent disinfection system and the unauthorized replacement thereof with a 48 lamp UV effluent disinfection system;

(13) the lack of a disinfection system in respect of effluent flows which bypass the membrane treatement process; Not required – not in Permitted Treatment works.

(14) the lack of as-built drawings in respect of the work performed by Hill Murray under the Contract; ?

(15) the lack of verification of the effectiveness of the biofilter system; ?

(16) the lack of local hand-off-auto switches and hour meters on various machines and other equipment in the plant (e.g., the screw auger inlet screens in the headworks portion of the plant);

(17) the lack of covers in respect of the rotary drum screens to capture the deflected water spray from the spraybars and reduce the moisture in the headworks portion of the plant;

(18) the lack of a connection of the rotary drum screen spraybars to a hot water supply; – we supplied an in-line heater

10" Line Pacific Group Issue (19) the lack of verification of the hydraulic capacity of various portions of the plant (e.g., the cause of the surcharging of a manhole along the effluent discharge piping);

(20) various structural deficiencies (e.g., the installation of various crane beams and the construction of the membrane cleaning tank); and ?

(21) various electrical deficiencies.

In addition to the foregoing deficiencies in the work performed by Hill Murray under the Contract, there are a number of other issues between our clients that remain outstanding.

First, our client remains concerned that the plant remains unable to both effectively treat the expected flows of wastewater entering the plant and meet the performance specifications set out in the Contract. To date, our client has not received any confirmation from Hill Murray that the plant will be able to do the same. In these circumstances, our client is currently undertaking its

own investigations to determine the ability of the plant to effectively treat the expected flows of wastewater entering the plant and meet the performance specifications set out in the Contract. We will advise you of the results of such investigations in due course.

Second, our client is concerned that the costs of operating the plant are drastically higher than represented by Hill Murray. From the beginning of this project, Hill Murray promised our client a highly automated and cost effective sewage treatment facility. To date, the plant has proven to be extremely labour intensive and expensive to operate. In fact, the operating costs for the plant are more than double the cost of operating a conventional sewage treatment facility.

Third, our client is concerned that the expandability of the plant has been significantly diminished in Hill Murray's efforts to make it effectively treat the expected flows of wastewater or entering the plant and meet the performance specifications set out in the Contract. Hill Murray initially represented to our client that the plant would have sufficient expandability to provide effective sewage treatment for our client for in excess of 20 years. With the installation of 32 membranes in the plant in an effort to effectively treat the current flows of wastewater entering the plant and meet the performance specifications set out in the Contract, it seems that the promised future expandability of the plant has been lost.

2010 issue on the RC report

Finally, through an internal audit of the monies paid out by our client under the Contract, it has come to our client's attention that it has overpaid Hill Murray in respect of the work actually performed by Hill Murray under the Contract.

We look forward to meeting with you in the near future to discuss your client's intentions in respect of remedying the aforementioned deficiencies or compensating our client in respect of the same.

If you have any questions regarding the foregoing, please do not hesitate to contact the undersigned at (604) 689-7400.

Yours truly,

LIDSTONE, YOUNG, ANDERSON

Sukhbir Manhas
manhas@lya.bc.ca

SM/tr

cc: Ian Freemantle, Chief Administrative Officer
Gino Francescutti, Director of Development Services, District of Powell River

TAB R

Powell River Deficiency List

General Comments:

1. The comment with respect to flows is incorrect. We are fully capable of meeting the "expected" flows in the contract. The trouble is that what was expected has not come to fruition – ie rather than an ADWF of 2300 m3/day, the actual ADWF is in the order of 4500 m3/day. Peak wet weather flows were expected to be 27,000 m3/day (peak hour). In reality, the peak hour flow is > 43,000 m3/day.

2. Operating costs are directly proportional to flows.

3. Expandability – the plant was designed for the AAF of 931,000 USGPD. The RC report stated that in the year 2010, the AAF would be 745,000 USGPD. Expandability has been sacrificed not because of performance, but because flows are actually at the levels expected in 2010. In other words, the starting point for the plant is 12 years in the future.

Specific Comments:

1. The lack of a backup system for the central control system of the plant.

It is safe to say that no PLC driven WWTP is fitted with redundant PLCs – the costs would be prohibitive. The Allen-Bradley SLC 5/04 CPU provided is an industry standard system – very reliable and robust.

2. The lack of a primary flow measuring device prior to the inlet of the screw auger screens.

The original specification called for flow measurement to be tabulated from the MBR and Bypass Parshall flumes. Had the flows been in accordance with the data submitted, the flows during the dry season (ADWFs) would have all gone to the MBR and the Bypass would only be used during extreme wet weather. There is no requirement to supply a third flow measuring device, as all the flows exit the headworks and either go to the MBR or through the Bypass.

3. The lack of mechanical screenings and compaction/dewatering device between the areas of screen discharge and the screenings storage.

I believe they may be referring to the "plug" in the auger. The manufacturer's rep (ProAqua Engineering) states "these type of units are not designed to form a plug".

4. The lack of suitable grit removal devices in the headworks and bioreactor portions of the plant.

Grit separation is supplied. Grit removal system to be assembled.

5. The insufficiency of the two rotary drum screens to handle peak wet weather bypass flows.

Each drum screen was tested in 1998 to > 1800 USGPM, and indeed the headworks has been subjected to > 8000 USGPM (11 Nov 99). This is well in excess of the 4950 USGPM peak hour flow expected.

6. The lack of a permanent device for draining the rotary drum screen concrete enclosures to allow for the cleaning of, and eliminate the biological growth in the enclosures.

The enclosures were expected to be emptied via portable submersible pump.

7. The lack of dissolved oxygen probes in the westerly membrane bioreactor.

This was never part of any specification.

8. The lack of suitable tank isolation gates for the westerly membrane bioreactor.

???

9. The lack of suitable sludge storage facilities prior to sludge dewatering process.

This tank was consumed by the expansion required to meet the actual flows.

10. The lack of magnetic flow meters in respect of the flow of sludge from the membrane bioreactors to the sludge press.

MLSS control is based on solids levels, not WAS flow.

11. The lack of a fully enclosed flow through in-vessel sludge composting unit and the unauthorized replacement thereof with an open trough style compositng unit (which has not yet been installed).

Credited.

12. The lack of a 72 lamp UV effluent disinfection system and the unauthorized replacement thereof with a 48 lamp effluent disinfection system.

The original spec was generated prior to transmissivity tests being performed on the permeate. 48 lamps is sufficient. CDPR credited with $10k.

13. The lack of a disinfection system in respect of effluent flows which bypass the membrane treatment process.

The permit is inconsistent here. The treatment works for flows in excess of 4600 m3/day DO NOT INCLUDE disinfection (section 1.1.4.2). The requirement to disinfect from 1 May to 15 Oct is based on the assumtion that the ADWF is 2300 m3/day (section 2.7).

14. The lack of as-built drawings in respect of the work performed by Hill Murray under the contract.

As-builts are being completed.

15. The lack of verification of the effectiveness of the biofilter system.

The biofilter is designed to industry standards.

16. The lack of hand-off-auto switches on various machines and other equipment in the plant.

H-O-A switches are supplied on the HMI system.

17. The lack of covers in respect of the rotary drum screens to capture the deflected water spray from the spraybars and reduce the moisture in the headworks portion of the plant.

If desired, CDPR can install. This was never part of any specification. Spray is considerably reduced with modifications to containment walls.

18. The lack of connection of the rotary drum screen spraybars to a hot water supply.

HM supplied an in-line heater and pressure washer.

19. The lack of verification of the hydraulic capacity of various portions of the plant.

This is a well known issue – the 10" line form the SW manhole was marked incorrectly on the Pacific Group drawings. A resolution plan has been developed by HM and CDPR.

20. Various structural deficiencies.

The membrane soaking tank lifted as a result of buoyancy when emptied. The crane beams comment is not understood.

21. Various electrical deficiencies.

This is not understood.

TAB S

Borden Ladner Gervais LLP
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BORDEN LADNER GERVAIS

October 31, 2000

FILE NO: 30942/01400

CHRISTOPHER J. O'CONNOR
direct tel: (604) 640-4125
direct fax: (604) 622-5825
email: coconnor@blgcanada.com

DRAFT

Lidstone, Young, Anderson
1616 - 808 Nelson Street
Box 12147, Nelson Square
Vancouver, B.C. V6Z 2H2

Attention: Sukhbir Manhas

Dear Sirs/Mesdames:

Design-Build Contract (the "Contract") for the Upgrade of the Westview Wastewater Treatment Plant (the "Plant") between the District of Powell River (the "District") and Hill Murray & Associates Inc. ("HM") Performance Bond No. VS6006020 (the "Bond")

We write on behalf of the Guarantee Company of North America ("GCNA") and reply to your letter dated October 23, 2000. It is the position of GCNA that it is not obligated to take any steps pursuant to the Bond on the grounds that:

a) no work remains to be performed by HM;

b) all deficiencies have been addressed by HM;

c) any continuing problems with the Plant are design or performance issues and not covered under the Bond; and

d) HM accepted the District's settlement offer dated August 24, 2000 and the District is now estopped from changing its position with respect thereto. As a result, the claims against GCNA are moot and unenforceable.

In response to the items specifically enumerated in your October 23, 2000 letter, it is GCNA's position that:

1. HM has installed a total of five measurement devices, the combined readings from which measure the influent flows. These measuring devices were installed pursuant to, and in compliance with, the terms of Schedule H of the Contract, and specifically section B1(4) and B1(5) therein. The reason that the District felt it necessary to hire a third party to review flows was to confirm the accuracy of the fitted equipment. As a result of this process, sufficient data was provided to confirm that the flow measurement equipment was functioning in

Calgary Canada London England Montréal Canada Ottawa Canada Toronto Canada Vancouver Canada

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accordance with specifications. As such, HM has complied with the terms of the Contract and the District should be, and is, able to determine influent flows. There is no further contractual term or requirement pursuant to which HM is required to provide a further primary flow measuring device prior to the inlet screw auger screens, and as such, Reid Crowther is holding HM to a fictitious standard or, in the alternative, raising a design issue with respect to which GCNA has no obligation. Further, there is no mention whatsoever of flow measurement devices in the substantial completion documentation accepted and signed by the District on July 27, 1998.

2. Schedule H of the Contract calls for grit removal channels. These channels were provided in accordance with the design. There were never any specifications suggested or implied with respect to these channels, nor was their efficiency quantified in any way. There is no evidence to suggest that the grit removal channels have been ineffective and any continued challenges thereto are either a design or performance issue with respect to which GCNA has no obligations.

3. HM has reviewed the completion report and agrees that a pump and screening device was to be provided. This equipment has been purchased but not delivered. Upon final sign-off of the project and payment in full, this pump will be delivered. There are no specifications or efficiencies cited in the completion report and any concern with respect thereto is a design or performance issue with respect to which GCNA has no obligation. Further, as the main process tanks were made redundant with the addition of more membranes, the District can now take either side of the process offline to conduct inspections or degritting routines as they see fit. This requirement has been more than fulfilled.

4. HM has no obligation to provide an in-vessel composting unit as provided for in Schedule H to the Contract. HM selected PGL Organix to head up the selection process for a composter which included taking councillors and Jim Greenwood to virtually every composting site in the province at HM's expense. The District then selected the trough-style composter as the most suitable for the District's purposes. The equipment selection and acquisition has been thoroughly discussed, agreed to, purchased and delivered. The trough-style composter has been delivered but was never installed because of the District's inability to locate a suitable property on which to perform bio-solids composting. HM's obligations did not include the locating of the compost facility. When the site selection process became politically embroiled, HM offered a credit of $64,200 for site work which we understood was accepted. HM's contractual obligation to provide a composter is based on the District finding a suitable site. No site has to date been found so there is consequently no contractual obligation on HM to provide a composter. The deficiency list attached to the certificate of

Either eliminate that clause or add which when taken in the context of the completion schedule and all change orders 13 through 45 was accepted

substantial completion clearly indicates that delivery of the composter is only to take place once the District has an approved site. As a result, HM has no further obligations with respect to the composter at this time.

5. Schedule H does not specify a 72-lamp UV effluent disinfection system. Schedule H refers to a UV disinfection unit rated at 2000 US gallons per day. Clearly, since the fitted unit is treating 1,500,000 US gallons per day, this requirement has been achieved. The reference to a 72 bulb UV system refers back to a pre-design document provided by Trojan Technologies to treat 3.0 MUSGD of a standard secondary quality water. Trojan redefined their bid based on the contractual flows and highly treated water with a submittal document no. SU450121, effectively replacing the previously described system with a 48 bulb system. These were never contractual documents. The performance requirement of disinfection has been continuously achieved. Any further issue with respect to the disinfection system is thus a design or performance issue with respect to which GCNA has no obligation.

6. The as-built drawings are complete. HM will be submitting these when the unpaid bills are agreed to.

It is the position of GCNA that the Plant is currently exceeding performance criteria specified in the Contract, including criteria for expansion. Pursuant to the proposal attached to and forming part of the Contract, HM was required to ensure an average annual flow of 3528 cubic metres upgradeable to 5000 cubic metres. On January 5, 2000, a full flow trial was performed by Graham Symmonds, P. Eng., to demonstrate the peaking ability of the membrane bio-reactor. The trial results indicate that current ability exceeds the peak ~~total~~ for a 12 hour period which is the contractual obligation. On an ongoing basis, the plant has been treating over 5,000 ~~cm^3 of average annual flow~~ m^3/day which is significantly in excess of the contractual Average Annual Flow. As a result, the District has been provided with almost double the capacity it paid for, and HM is neither in default under the Contract, nor is there any remaining work left to be performed by it.

If the District feels there are still ongoing problems with the Plant, these are clearly the result of misrepresentations on flow estimates provided to HM by the District and Reid Crowther in May 1997, and on the basis of which HM developed a technical plan which was presented to the District in July, 1997. The flow estimates provided to HM by the District were the basis for the permits for the plant. These estimates were relied upon in the preparation of the technical plan and were subsequently incorporated into the Contract. The actual flows have been significantly higher. It appears clear that the original flow estimates were misrepresented to HM relieving it of any contractual obligation to meet performance targets.

We note also that the alleged deficiencies referred to in your October 23, 2000 letter stem from a report dated April 24, 2000. It is the position of GCNA that the CH2M Gore & Storrie Limited ("CH2M") report represented the final deficiency list and we question the basis on which the District continues to provide HM with new and revised deficiency lists or the contractual authority of the District itself to

determine acceptability of the work. Pursuant to section 20.5 of the Contract, the owner's representative is required to assess the work and either approve completion or provide HM with reasons for disapproval.

Jim Greenwood was the designated owner's representative until his resignation in 1998. Pursuant to section 4.3 of the Contract a party may change its representative by giving written notice to the other parties of the new representative, effective on the date notice is given. The District never replaced Mr. Greenwood with another representative and now purports to use the services of Reid Crowther in the capacity of owner's representative notwithstanding that no written notice was provided to the other parties and in breach of contract.

Furthermore, we have serious concerns regarding the continued involvement of Reid Crowther in this matter and the District's reliance on the April 24, 2000 Reid Crowther report. Reid Crowther was initially involved in the project in 1996. It was commissioned at that time by the District to develop a solution to the sewage treatment problems. In September 1996, Reid Crowther developed a preliminary design package that proposed the amalgamation of the Townsite, Westview and Wildwood plants into one new facility. The District considered Reid Crowther's proposal to be financially unfeasible. HM was consequently retained to see what services could be extended to ensure that the District received its best value for money. HM thus competed against, and ultimately replaced Reid Crowther in 1997. As such, Reid Crowther cannot be regarded as an independent and unbiased party. We also note that Reid Crowther has previously been removed from acting in the capacity of third party engineer by Court order and we object to the current attempts by the District of Powell River (the "District") to again use Reid Crowther as its representative.

In addition, we understand that there are still significant issues between HM and the District with respect to the balance of contract funds. We understand that a large number of change orders have not been finalized and that substantial monies may be payable to HM. Certainly this is true on the basis of the contractual amounts and those amounts approved in change orders 1-13 @ $222K outstanding.

Furthermore, the conduct of the District in this matter has to date proven prejudicial to GCNA for the following reasons:

a) a certificate of substantial completion was granted on the Project on July 27, 1998 as a result of which GCNA released a $400,000 letter of credit;

b) settlement discussions were entered into between the District and HM without notice to GCNA; and

c) the District removed and replaced its representative with no notice to GCNA.

Finally, on the issue of settlement, on August 24, 2000, the District offered to pay HM the sum of $37,001.89 in full settlement of this matter. The District requested that HM accept the offer by no later than 4:00 p.m. on Wednesday, August 30, 2000. On August 30, 2000, HM requested an extension to Friday, September 8,

2000, in order to make representations on behalf of all concerned parties. On Friday, September 8, 2000, HM accepted the offer telephonically and followed up with a letter dated September 12, 2000, referencing the September 8, 2000 acceptance.

At no time prior to September 20, 2000, did the District inform HM that an extension would not be granted. On September 20, 2000, HM was advised by the District that the offer had expired on August 30, 2000, and was not open for acceptance by HM as it purported to do on Friday, September 8, 2000.

Where one person makes a representation to another in words, acts or by conduct, silence or inaction, and on the basis of such representation the representee alters his position to his detriment, the representor is estopped from behaving contrary to its own representation (see S.M. Waddams, *The Law of Contracts* (1984) at 143). It is the position of GCNA that the District, by its conduct, accepted the extension period and is now estopped from raising the August 30, 2000 deadline as a defence. As a result, the District is bound by the terms of the settlement agreement and any claim against GCNA is moot and unenforceable.

Taking into account all of the above, it is our view that the District should finalize the settlement made on August 24, 2000 rather than engage in litigation with Guarantee which will be vigorously defended.

Yours truly,

Borden Ladner Gervais LLP

By:

Christopher J. O'Connor

PJZ/hm

TAB T

R E L E A S E

KNOW ALL MEN BY THESE PRESENTS that the Corporation of the District of Powell River (the "Releasor"), for and in consideration of Hill Murray & Associates Inc. releasing the Releasor in respect of the subject matter of an action in the British Columbia Supreme Court issued out of the Powell River Registry under No. S. 1299, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, does hereby remise, release, and forever discharge Hill Murray & Associates Inc., CWC Canadian Wastewater Corporation, the Guarantee Company of North America, their directors, officers, servants, employees, agents, and assigns (collectively the "Releasees") of and from any and all actions, causes of action, claims, proceedings, suits, debts, contracts, demands, and damages of any nature or kind whatsoever which the Releasor now has against the Releasees arising out of, or connected with, any cause, matter, or thing in relation to, or in any way connected to:

1. the contract dated September 1, 1997, between Hill Murray & Associates Inc. and the Releasor for the design and construction of an upgrade to the existing municipal wastewater treatment plant known as the Westview Wastewater Treatment Plant (the "Plant");

2. the Plant, including the assessment, construction, repair, remediation, and operation of the Plant, whether such claim or cause of action be in contract, tort, equity, or otherwise; and,

3. performance bond no. VS6006020 dated November 17, 1997, issued by the Guarantee Company of North America in respect of the contract between Hill Murray & Associates Inc. and the Releasor dated September 12, 1997.

IT IS UNDERSTOOD AND AGREED that the Releasor will not at any time hereafter commence, maintain, continue, or assign any action, suit, complaint, or proceeding of any kind whatsoever in any court of law or equity or before any regulatory body, board, or tribunal or before any arbitration tribunal or arbitrator against the Releasees in respect of the subject matter of this Release, and if the Releasor should do so, this Release may be raised as a complete bar.

IT IS UNDERSTOOD AND AGREED that nothing contained in this Release shall be deemed to be an admission of liability on the part of the Releasees.

IT IS FURTHER UNDERSTOOD AND AGREED that, for the consideration expressed herein, the Releasor, or any person on its behalf, shall not make any claim or take any proceeding against another person or corporation who might claim contribution or indemnity from the Releasees with respect to the subject matter of this Release, and, if such a claim is made or proceeding taken, the Releasor shall indemnify and hold harmless the Releasees in relation to such claim or proceeding, including the costs of the Releasees in defending against the same.

IT IS FURTHER UNDERSTOOD AND AGREED that the contract dated September 1, 1997, between Hill Murray & Associates Inc. and the Releasor for the design and construction of an upgrade to the Plant is hereby terminated.

IT IS FURTHER UNDERSTOOD AND AGREED that the Releasor is under no legal disability, and has read this Release and fully understands the terms of this settlement and it voluntarily accepts the terms hereof for the purposes of making a full and final compromise and settlement of all such claims against the Releasees. It is hereby acknowledged that the Releasor has consulted with, and has been advised by, its solicitor before entering into this settlement.

IT IS FURTHER UNDERSTOOD AND AGREED that this Release contains the entire agreement between the Releasor and the Releasees, and the terms of this Release are contractual, and not mere recitals.

IN WITNESS WHEREOF, the Releasor has hereunto set its hand and seal this 29th day of November 2000, at the District of Powell River, in the Province of British Columbia.

The Corporate Seal of Powell River was hereunto affixed in the presence of:

Mayor:

Clerk:

C/S

TAB U

Corporation of the District of Powell River

Operational Services

WELCOME TO THE OPERATIONAL SERVICES DEPARTMENT

Overview

The Operational Services Department manages the development, maintenance and upgrading of District of Powell River infrastructure which consists of 112km of roads, 130km of water mains, 120km of sanitary mains, 78km of storm mains, 2 water reservoir sources, 3 treatment facilities and 12 pumping stations. A wide variety of engineering projects are undertaken in support of the above municipal infrastructure including:

- Design and project administration of the districts capital and maintenance projects including roads, water, sanitary and storm systems.
- Review of subdivision and development proposals with respect to current district design and bylaw standards.
- Developing district engineering and construction standards and bylaw requirements.
- General engineering support to maintenance staff, other departments, developers and the public.
- Management of the district mapping, geographical information system and engineering infrastructure data.

Location

6910 Duncan Street
Powell River, BC
V8A 1V4

Department Mission Statement

To deliver appropriate services to the public and other departments in an efficient and cost effective manner and to ensure that a reasonable standard of transportation systems, utilities and civic facilities are provided to the citizens of Powell River.

Department Goals and Objectives

- Refine project management procedures.
- Establish polices and procedures to assure all department services are

administered fairly.
- Short and long term capital planning.
- Enhance Operational Services staff skills through training.

Sanitary Sewer System

The Powell River Sanitary Sewer System collects and treats the wastewater that we flush down household or building's sinks, drains or toilets. The system includes a network of pipes and pumping stations that collect the wastewater at one of the three Treatment facilities.

Powell River has two sewage treatment plants (STP) that were originally constructed in the 1970's to serve two major catchment areas – Townsite and Westview. An aerated lagoon facility serves the north portion of the community – Wildwood. Each plant has an outfall to Malaspina Strait. An overview of each treatment location is listed below:

Westview Sewage Treatment Plant

The Westview STP was built in 1971 and serves approximately 8000 people in the area of Westview. It is located on the waterfront near the Westview Boat Harbour on Willingdon Avenue. The original high rate activated sludge plant was upgraded in 1998 using membrane ultrafiltration technology. The improvements have helped eliminate almost all odors associated with the treatment process, while at the same time improving the quality of the effluent. The plant currently treats between 4600 and 9500 m3 per day and presses 5m3 (20% solids) per day of biosolids, which is shipped to Vancouver Island for use as fertilizer.

Townsite Sewage Treatment Plant

The Townsite STP was built in 1973 and serves approximately 4000 people in the areas of Townsite and Cranberry. The plant is located on the waterfront in Townsite, south of the Powell River Paper Mill. The treatment process is high rate activated sludge, which treats between 2000-3500m3 per day.

Wildwood Sewage Lagoon

The Wildwood plant was built in 1965 and serves approximately 1270 people in the area of Wildwood. The plant is located at the north boundary of the district near Highway 101.
The treatment process is a 36,000 m3 single cell aerated lagoon, which treats between 500 and 1500 m3 per day.

All three facilities use natural treatment to process the wastewater. No chemicals are added to the water. Instead an aeration system is used which enhances the natural bacterial breakdown of the nutrients in the water. The air is used by naturally occurring bacteria in the sewage to break down the organic compounds into carbon dioxide, nitrogen gas and a sludge. The sludge is removed from the plant and disposed of off site.

The Norske Powell River Paper Mill operates its own treatment facility that treats all sewage associated with the operation of the mill.

All three treatment facilities have been issued permits of operation by the Ministry of Environment. The permit allows the discharge of municipal effluent to Malaspina Strait. The effluent is tested by the district monthly and must meet strict guidelines set out by the Ministry. Failure to meet these guidelines can result in fines against the district.

Collection System

The Sanitary Sewer System includes a network of underground pipes, which collects wastewater from existing homes and businesses. These pipes range in size from 4" to 18" in diameter and flow downhill by gravity to treatment facilities or pumping stations. There are currently approximately 5000 service connections to the system and approximately 120 km of sanitary main. A flushing program is also carried out to cleanse distribution mains to reduce the chance of blockages in the system.

Pump Stations

Pump Stations are used through out the sanitary distribution system to lift sewage from areas that cannot drain by gravity. The stations collect the wastewater at low areas of the system and pumps move the wastewater to a section of the system where flow can continue by gravity. The pump stations are alarmed to warn of power failure to ensure that overflow does not occur. Pump Station are currently located in the following areas:

Grief Point (Hernando/Malaspina)
Churchman's Corner (Marine/Penticton)
Padgett Road
Willingdon Beach
Lindsey Park
Powell Place
Waddingdon Avenue
Abbotsford Street
Mowat Bay Park
Wildwood Heights

Westview Treatment Plant
Townsite Treatment Plant

Water System

The District of Powell River currently has two sources that distribute water in the municipality. The water supplied to consumers is screened and treated to ensure that all provincial and federal regulations are met. The District ensures that there is an adequate supply at sufficient pressure for residential, commercial and fire flow needs and that the water is as clean and pure as possible. The two water sources for the District of Powell River are as follows:

Haslam Lake

Haslam Lake is located 1 km East of Powell River and the water surface covers an area of approximately 1170 hectares. The lake serves the areas of Westview, Cranberry and Townsite with a combined population of 12,400 and average use of 9 million litres per day. The system has been in place since 1959 and is capable of servicing over 25,000 people. The water is chlorinated and screened at the head works building located at the Haslam Lake intake and distributed through a piping system by gravity to consumers.

Powell Lake

Powell Lake is located at the northeast boundary of the district and the water surface covers approximately 11,192 hectares. The lake serves the area of Wildwood with a population of 1,237 and average use of 1 million litres per day. Water is pumped 120 meters up from the lake then chlorinated before it reaches a 380,000 liter reservoir located at the top of Chilco Avenue. From the tank it is distributed to the majority of the residents via gravity with the exception of the residents above Seton Avenue who's water must travel via a booster pump to provide them with an adequate operating pressure.

From the two sources water is distributed through a series of main ranging in size from 4" to 30" and pressure is maintained between 40 and 120 psi with the use of 24 Pressure Reducing Valves.

Both the Haslam and Powell Lake systems are monitored via daily staff inspections and with alarms to notify staff in the event of power or equipment failures. The system is tested weekly to monitor chlorine levels and bi-monthly to analysis bacteriological levels. A flushing program is also carried out to cleanse distribution mains, particularly those that are dead-ended, to ensure that the effects of the chlorine are not reduced by the build-up of sediment or impurities.

The Powell River WaterWorks By-law No. 935, adopted 1978, regulates water use in Powell River and sets up the terms and conditions of providing service to customers.

Although the Ministry of Health has assigned a low hazard rating to Haslam and Powell Lake, and others have reported on the excellent quality of our water, we remain vigilant to maintain the high quality of our water. We continue to monitor the lake for human and animal activity on an ongoing basis to ensure water quality is not compromised, and as well, an annual inspection is carried out with the Coast Garibaldi Health Inspector.

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