HILL
MURRAY
&
ASSOCIATES INC.

ENVIRONMENTAL
SYSTEMS ENGINEERS

March 19, 1998

Ian Mosher
Director, Engineering and Planning
Municipality of Iqaluit
P.O. Box 460
Iqaluit, NT
X0A 0H0

Dear Ian:

Re: Response to Request for Qualification and Proposals
Sewage Treatment Options

Please find enclosed eight (8) copies of HM&A's plans to provide the Municipality of Iqaluit with the highest level of treatment attainable. Membrane-Bioreactor technology offers the Municipality several distinct advantages including phasable, just-in-time infrastructure, treatment that easily exceeds the most stringent discharge criteria, the option for re-use and expandability within a foot print typically four times smaller than conventional secondary and several orders of magnitude smaller than lagoon systems.

HM&A installed two MBR systems in the Arctic in 1995 and continues to provide operations and maintenance support through our operating division, the Canadian Wastewater Corporation (CWC).

I would be pleased to arrange a visit for you or your staff to any of our facilities and look forward to hearing from you in the future.

Sincerely,

HILL, MURRAY & ASSOCIATES INC.

Trevor T. Hill, P.Eng.
President

Enclosures

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&
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ENVIRONMENTAL
SYSTEMS ENGINEERS

March 19, 1998 Our File: 08800-20/IQAL

Ian Mosher
Director, Planning and Engineering
Municipality of Iqaluit
P.O. Box 460
Iqaluit, N.W.T.
X0A 0H0

Dear Ian:

Re: Approval to Verify Information
Response to Request for Qualification and Proposal

This letter will authorize your staff to verify information included in this report. This authority exists only for the purposes of evaluation HM&A's proposal.

This authority shall expire 30 April 1998, or on the award of any contract to parties other than HM&A. Extensions may be granted on written request.

Sincerely yours,

HILL, MURRAY & ASSOCIATES INC.

Trevor T. Hill, P.Eng.
President

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Annexes

1 EXECUTIVE SUMMARY

This proposal is submitted to meet the opportunity to serve the needs of The Municipality to develop a long-term plan for the treatment of sewage generated by the Iqaluit community.

Our intention is meet or exceed the specification suggested in the Request for Qualification and Proposal. Hill, Murray & Associates has built many plants of the exact size suggested and as such detailed specifications are available - some of which have been enclosed. We have also taken the liberty to provide two options: One providing for immediate tertiary quality and a second providing a phase increase in quality in line with the changes in legislated discharge criteria.

Hill-Murray has developed many plants in the province of British Columbia and two in the Arctic which embody the concept of 'just-in-time' infrastructure. This concept relies on providing infrastructure as and when needed, in step with the expansion of the community.

Hill, Murray & Associates Inc. (HM&A) has provided herewith a comprehensive design and construction plan for an advanced Water Reclamation Facility, capable of treatment which easily exceeds the required discharge criteria for marine discharge and beneficial reuse applications. This proposal details both a facility for 2,000 m^3/day and a facility for unlimited expansion.

We further offer complete design, built, operate services. Our operations company, CWC - the Canadian Wastewater Corporation, currently operates nine plants in B.C. and two in the Arctic with six further plants under construction. CWC has a skilled staffed of Professional Engineers and certified operators and technicians ensuring that all plants may be operated under a performance contract - guaranteeing effluent quality and ensuring plant reliability 24 hours a day, 7 days a week. All plants are remotely operated and monitored from our corporate offices in Victoria.

1.1 Automated Operations

The plant is actively controlled by a Programmable Logic Controller that activates systems as required by the plant's sensors. An autodialer notifies CWC if the plant is not operating at peak performance. The control systems are accessed through a modem link, allowing the company's technicians to alter systems remotely.

1.2 Odourless Operation

The HM&A designed and built facility is an odour free process. The process, inclusive of sludge digestion which occurs in the bioreactor, is fully aerobic thereby assuring local residents of the elimination of odour.

1.3 Sludge Production

Due to long solid retention times (SRT's) and a high level of digestion within the bioreactor, sludge yield is typically less than one half of that normally seen in a conventional activated sludge process.

1.4 Redundancy

The facility features fully redundant operating modes. All process equipment necessary for operation has been duplicated within the bid. Should any single piece of equipment fail, the plant could run continuously at 100% capacity until such time as repairs may be effected.

1.5 Effluent Quality

Due to the positive barrier provided by the membranes, the plant produces consistently excellent effluent quality. The effluent is non-toxic to fish (see Bioassay results included in Annex D). Further, as membrane filtration occurs at the molecular level, viruses, bacteria and pathogens (coliform) are removed at the membrane surface. This allows for consistent coliform levels of 2.2 MPN or less.

1.6 Phasing

The technology is highly phasable. While the tendered price calls for a system, capable of treating 2,000 m^3/day in 1998 in steady-state, there exists the opportunity for more users to hook on; reducing per unit capital and O & M costs. It is recommended that a phased approach to infrastructure be considered; equipment supplied, and fitted if or when needed.

1.7 Guarantee

Hill, Murray & Associates Inc. and ZENON, the technology provider, offer the only effluent quality guarantee (see Annex F)available in the treatment of municipal wastewater. The facility produces consistently excellent effluent quality. Operation and Maintenance through the Canadian Wastewater Corporation, the operations arm of HM&A, guarantees this fail safe mode of operation for the entire life of the plant.

1.8 Northern Experience

Hill, Murray & Associates Inc. provided a fully recycling, wastewater treatment system in 1995 for the Department of National Defence in Cambridge Bay and Hall Beach that was especially designed for the high Arctic. The membrane and bioreactor components, transfer mains for sewage and recycled water, and other auxiliary equipment were designed, assembled and shipped to the site in less than seven weeks. The equipment was housed in Canadian-built containers that were designed for a harsh climate. Plants are controlled by a Programmable Logic Controller that activated systems as required by the plant's sensors. An autodialer notifies the plant is not operating at peak performance, the control system can be accessed through a modem link allowing the company's technicians to alter systems remotely. HM&A performed all project management and site supervision for the completion of this project.

1.9 Liability Insurance & Bonding

A copy of HM&A's current liability insurance coverage, including the terms of the coverage are included in Annex J, along with a copy of our Performance Bond and Labour and Material Payment Bond.

1.10 Plant Location

Membrane-bioreactor technology allows HM&A the flexibility of building a wastewater reclamation facility at any location, depending on the preferences of the Municipality of Iqaluit.

2 EXPERIENCE AND MANAGEMENT HISTORY

2.1 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 the Arctic, 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 B.C. Ministry of Environment, Lands and Parks, B.C. 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, and in 1997 won the Ministry of the Environment, Lands and Parks - Award of Excellence for our work in advanced treatment and water reuse (see Annex E for References).

2.2 Design Capability

HM&A has extensive work experience on design-build systems for municipal facilities, developers, 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 Jerzak - Engineering Manager

Mr. Jerzak has many years of construction management experience. He has complete understanding of client needs and requirements and drives down costs through tactical purchasing and facilitation.

Gary Griffiths - Design Coordinator

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 division, 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, any site staff will be provided with a full line of technical support for the completion of maintenance activities. Further, 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 - Facilities Manager

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.

Lorne Cowley - Utility Manager

Mr. Cowley has twenty years of experience in the electrical field combined with complete business management understanding. He provides liaison with customers and ensures their satisfaction.

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 in addition to our construction team 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). HM&A has a current registration with WCB NWT as a result of our on-going commitments in the North. 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 Canada Building, Plumbing and Electrical Codes, and 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. This work will be conducted under HM&A's operations division, Canadian Wastewater Corporation (CWC). 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 (references are included in Annex E). We have designed and built 12 tertiary tertiary quality sewage treatment facilities in Canada; all of these plants are operated and maintained by Canadian Wastewater Corporation (CWC), the operations arm of Hill, Murray & Associates Inc. By employing advanced technology, HM&A offers powerful treatment capability, producing treatment to BOD < 10 mg/L, TSS < 10 mg/L, fecal coliform < 2.2 MPN/100 ml. Our innovative solutions have met the challenge at all points, providing developers, owners and regulatory officials with safe, reliable and consistent treatment.

Specific experience includes (see Annex H for details):

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 - $750,000 (each) with a flow of 2,500 USgpd.

Design, supply, install and maintain treatment facilities for **Thetis Lake Trailer Park**. Commissioned August 1995 - $225,000 with a flow of 12,000 USgpd.

Design, supply, install and maintain treatment facilities for **Sooke Social Services Building**. Commissioned April 1996 - $85,000 with a flow of 1,000 USgpd.

Design, supply, install and maintain septage treatment facilities for **Burgoyne Bay,** Salt Spring Island. Commissioned Summer 1997 - $260,000 with a flow of 1,000 Igpd.

Design, supply, install and maintain treatment facilities for **Mt. Washington Ski Resort**. Commissioned November 1996 - $3,000,000 with a design flow of 500,000 USgpd.

Design, supply, install and maintain upgraded municipal facilities at **Ganges, Salt Spring Island**. Commissioned November 1996 - $730,000 with a flow of 90,000 Igpd.

Design, supply, install and maintain treatment facilities for **Kingfisher Oceanside Inn**, Courtenay, B.C. Commissioned June 1997 - $325,000 with a flow of 12,000 USgpd.

Design, supply, install and maintain treatment facilities for **Salt Spring Island Village Resort**. Commissioned September 1997 - $600,000 with a flow of 30,000 USgpd.

Design, supply, install and maintain treatment facilities for **Lake O'Hara Lodge,** Banff, Alberta. Commissioned July 1997 - $155,000 with a flow of 4,000 USgpd.

Design, supply, install and maintain treatment facilities for **Sooke Harbour House,** Sooke. Commissioned September 1997 - $275,000 with a flow of 5,000 USgpd.

Design, supply, install and maintain treatment facilities for **Huband Park Elementary School**, Courtenay, B.C. Design complete, permit in place. Construction began December 1997 - $270,000 with a flow of 4,000 USgpd.

Design, supply, install and maintain treatment facilities for **Powell River Water Reclamation Facility**, Powell River, B.C. Design complete, permit in place. Construction begins December 1997 - $4,950,000 with a flow of 1,000,000 Igpd.

Design, supply, install and maintain treatment facilities for ***The Falls Golf and Country Club***, Chilliwack, B.C. Design complete, permit in place. Construction begins December 1997 - $485,000 with a flow of 25,000 Igpd.

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
Fæcal Coliform	< 1000 MPN/100 mL (with disinfection via UV < 2.2 MPN/100 mL is easily achievable)	< 500 MPN/100 mL

Further, the reactor will be fitted with the required air to ensure complete nitrification of ammonia to nitrates and nitrites. Denitrification is available as an option.

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 detailed schematic and layouts are included in Annex A). 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 operational checks and validations are well within the capability of custodial staff, as no detailed process

[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.

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 discharged to a ground disposal.

Membrane bioreactor facilities 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 for 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 fitted with an automated, PLC driven auger type trash removal unit capable of removing all inorganic material and ensuring all organics pass through to the reactor.

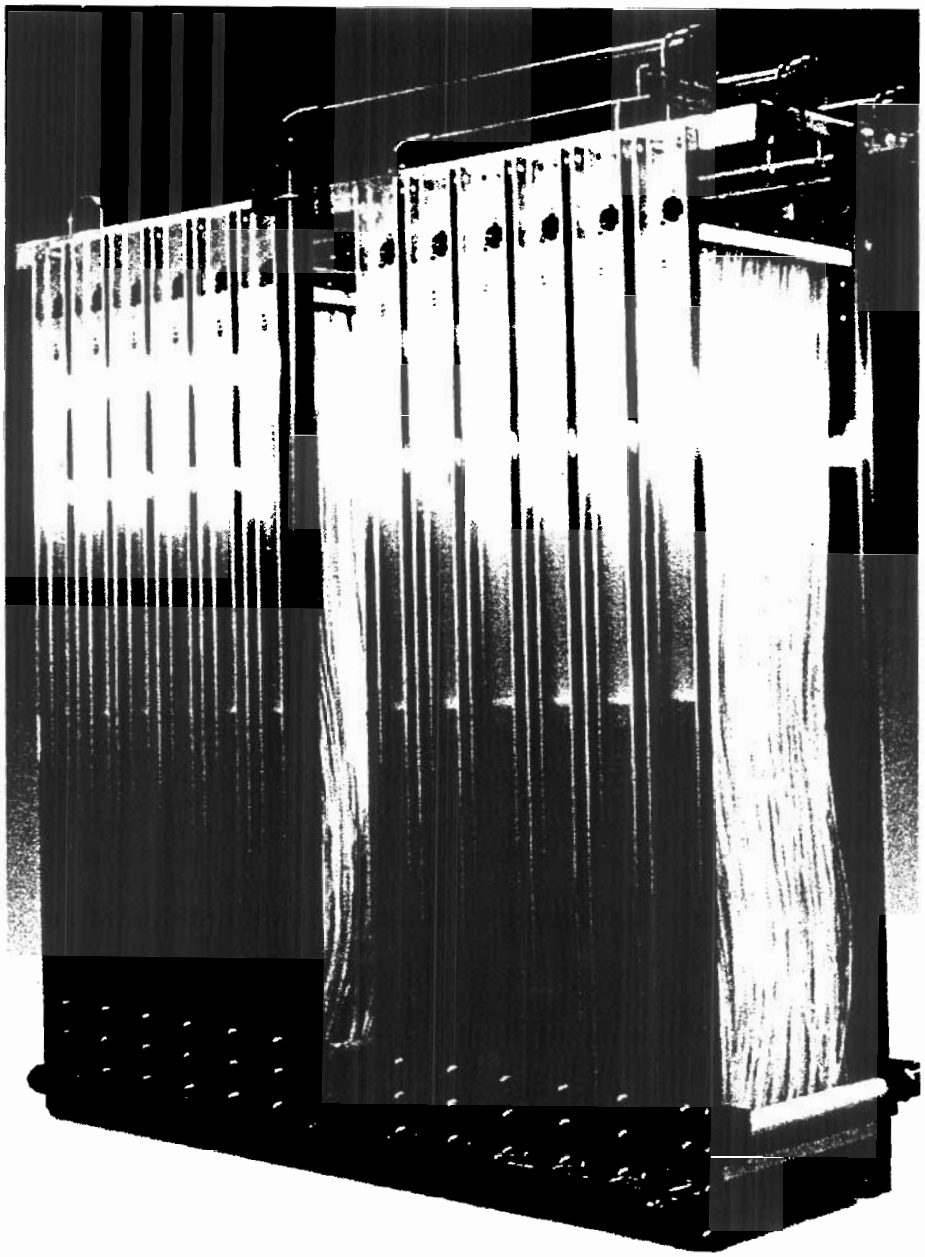


Figure 1: ZeeWeed™ Membranes - The Heart of the System

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 (Annex I). 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]

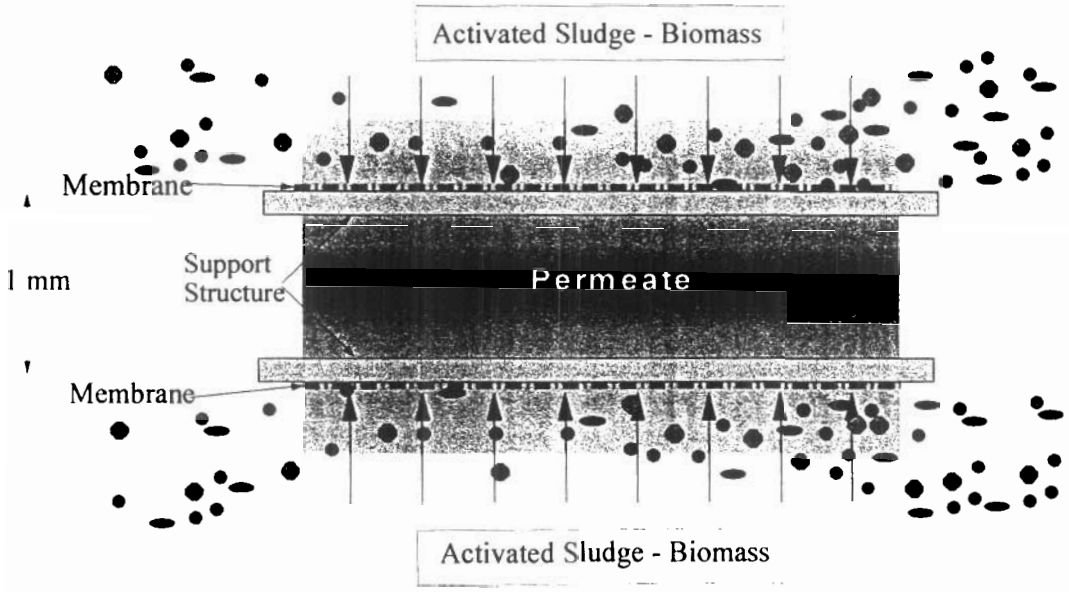


Figure 2:Hollow-Fibre Membrane Technology - An "Outside-In" Process

[2] The effluent quality (BOD_5 < 10 mg/L, TSS < 10 mg/L, Coliform < 1000 CFU/100 mL) will ensure that the environmental impact on the discharge area is minimized.

4.1.3 The Reduction or Elimination of Other 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 ***50%*** 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. HM&A will install a sludge dewatering system consisting of a Fournier Rotary Press. This will render any sludge from the plant landfillable or compostable, with the filtrate being passed back to the ZenoGEM for further treatment. In effect, this completes the cycle of treatment: no additional 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 entire life, is costly. HM&A will upgrade the plant so that it is operated at full capacity, every year, maximizing infrastructure use.

4.1.5 Inherent System Safety

The ZeeWeed 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 isolates 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 and Aesthetics

Conventional plants can often produce odour. This is very significant in the proximity of new developments when sales are paramount or when the facility must be located next to a residential or commercial area. The membrane bioreactor is an aerobic process which eliminates odour, giving the developer comfort now, and the residents quality of life in the future. In addition, the treatment facility is completely enclosed in a building that complements the local architecture. No odour as well as attractive facilities ensure that neighbours are unaffected by the presence of the water reclamation facility. See Annex A for an example of aesthetically conceived water reclamation facility designs.

4.1.7 Space Advantage

Conventional 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. These 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.

4.1.8 Control, Monitoring and Instrumentation

The ZenoGEM® system is ideally suited for stand-alone and automated applications. The system is inherently safe due to the positive barrier provided by the membranes and the system's ability to withstand spikes in both hydraulic and biological loadings without the loss of effluent quality. As a result, the systems are readily automated.

Operation of the system will be controlled by a Programmable Logic Controller, which will control all equipment on-site (local H-O-A switches will be included near all pumps and blowers to provide for manual isolation).

Due to the high level of automation, the systems are easily monitored. An autodialer will sense any failure of fitted equipment or any alarm condition. This unit will notify CWC staff via a pager system. At CWC offices in Victoria, our technicians will log onto the system via a modem integrated with the PLC. From this position, we are able to determine the exact alarm condition. Most alarm conditions can be rectified through logical restructuring of the PLC ladder logic. In the event that this is not the case, a technician will be dispatched to the site to rectify the problem.

Substantial system redundancy and bufferage will ensure that the system will continue to function in the event of a failure of a primary system.

4.2 Summary of Benefits

The net benefits of the ZenoGEM system operating parameters are:

- phased approach to building infrastructure;
- odourless process;
- a greatly reduced system size;
- a much greater concentration of biomass;
- 50% less sludge produced;
- greatly improved resistance to spikes or "non-conventional wastestreams";
- guaranteed effluent quality;
- effluent stream independent of influent rate and concentration; and,
- a highly reliable system in all operating conditions.

5 MUNICIPALITY OF IQALUIT

The Municipality of Iqaluit is in a growth phase. With the designation of Iqaluit as the Capital of Nunavut, it is anticipated that the local population will increase, as will the commercial and business opportunities in the area. Already the commercial and cultural centre, and transportation hub in the Eastern Arctic, Iqaluit will now be in a position to serve the entire Nunavut region. As a result of this anticipated growth, Iqaluit is a prime candidate for the infusion of "just-in-time" infrastructure by employing HM&A's nodal expansion community concept.

Northern communities are typically very remote and in most cases are poorly serviced from what southerners would consider essential amenities: Sewer and Water. Additionally, the lack of infrastructure, the dispersed nature of rural communities and a minimal tax base usually precludes the option of municipal scale treatment facilities. In addition, most communities suffer from very short building seasons, limited access a lack of skilled operators.

5.1 Discharge Criteria

The Municipality of Iqaluit discharge permit currently allows the discharge of effluent meeting a BOD/TSS of 120/180 mg/L. This level of discharge will be mandated as unacceptable in the near future. It is expected that the Municipality will be expected to meet a limit of 30/35 mg/L, requiring a minimum of secondary treatment. As the effluent is discharged to a marine outfall, a real requirement for complete nitrification exists to eliminate any toxic effects on the receiving environment. In addition, meeting the fecal coliform criteria without disinfection will eliminate the toxic effects of chlorine on the marine ecosystem.

5.2 Conventional Arctic Treatment

The primary method of sewage treatment in the north begins with collection from individual houses and facilities via sewage trucks, followed by discharge into a lagoon for treatment. The effluent quality from these lagoons is very dependent on the time of year and the influent constituents. Typically they discharge a higher level of contaminants in the spring and gradually improve over the summer period (a result of the interruption of the treatment process during the winter freeze-up period). During this freeze-up period, almost no natural disinfection occurs and the biological degradation of solids comes to a standstill. In the high arctic, where the length of the summer season is very short, adequate treatment is rarely achieved, with possible contamination of groundwater supplies. These facts make the operation of lagoon systems highly variable and land intensive propositions.

In order to address these shortcomings, a system is required that addresses these problems, specifically one that:

- provides compact treatment in easily transportable components;
- is easily automated, fail safe and requires minimal attention;
- provides high quality effluent to allow for ease of discharge and to protect the arctic environment; and,
- provides the opportunity to conserve other resources.

Hill, Murray & Associates Inc. has pioneered the introduction of containerized wastewater recycling systems into the arctic, and installed two fully recycling systems at NWS sites LSS CAM Main (Cambridge Bay, NWT) and LSS FOX Main (Hall Beach, NWT) in 1995. These plants have been in service for 30 months and have provided excellent and reliable treatment.

5.3 Advanced Treatment

MBR technology offers the only treatment solution that results in treated water quality that exceeds the requirements for unrestricted re-use. As such, much of the treated water produced by the treatment plant is re-introduced into buildings as a water source for flush water, industrial purposes or other non-potable applications.

These systems provide tertiary quality treatment in a compact arctic ready configuration. 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 on-site operators, and allowing the treatment system to be fully automated. These factors make the technology ideal for *turn-key* installations. On-line system monitoring including auto-dialers and modem connections reinforce the turn-key, stand-alone concept.

By employing membranes, the solids concentration in the bioreactor can be substantially increased, further reducing the size of the system, and improving biodegradation, thereby dramatically decreasing sludge yield. Built in redundancy and appropriate factors of safety enhance the operational availability of the plant. Highly automated systems mean that no detailed process knowledge is required on-site, making the plants easy to operate and maintain.

5.4 Opportunity for Conservation and Sustainability

MBR technology offers its own stand-alone energy conservation possibilities, most notably a reduction in potable water consumption. This has substantial energy effects, especially in communities where fresh water is produced by melting ice and snow. We have completed a very successful BC 21 Power Smart campaign focusing on the benefits of harnessing the new commodity of "recycled water".

This is a unique opportunity for northern communities to enhance the living conditions and protect the fragile Arctic environment. For the first time, the ability to actively treat sewage in an economical and environmentally sound manner is within the reach of Arctic communities.

5.5 Just-in-Time Infrastructure

MBR technology provided by HM&A provides many distinct advantages for expanding communities. Through a phased approach, the municipality can provide the wastewater treatment services to meet the current needs and expand in a predictable and efficient manner when (and only if) the population growth meets the expected curve.

The overall scale of the plants is much reduced, allowing a unique phasing capability, reducing high up-front capital costs. Also, it allows the treatment systems to immediately operate at their optimum parameters, rather than requiring several years to achieve steady state.

5.6 Conceptual Design

Option 1: Full Tertiary Quality Immediately

Effluent Quality: BOD < 10 mg/L
TSS < 10 mg/L

It is anticipated the Iqaluit Water Reclamation Facility will begin as a phasable WRF-NEC-5000 plant. The hydraulic and biological design flow meets the needs of the community for today's flow. In this phase, the following equipment is provided:

- Process Equipment for 2000 m^3/day
  - Aeration Module
  - Permeation Module
- Modular tankage
  - Equalization Module
  - Process Modules
- Aesthetic building
- Vacuum Truck Receiving Station Module
- Trash Removal (Screenings) Module

In addition, all necessary Arctic HVAC is provided.

To reduce costs, all modular equipment will be fabricated and shipped via barge to the site. Infrastructure upgrades are based on actual flows and are also shipped as modular units consisting of the appropriate volume of tankage and process equipment. Other modules include:

- Sludge Pressing Module
- Recycled Water Module
- Emergency Power Generation Module

Option 2: Phased Tertiary - Blended Effluent Option

Effluent Quality MBR	BOD	< 10 /mg/L
	TSS	< 10/mg/L
Effluent Quality Microscreen	BOD	< 40 mg/L (40% removal on Lagoon Discharge - 80 mg/L)
	TSS	< 30 mg/L (60% removal on Lagoon Discharge - 70 mg/L)
Blended Effluent Quality	BOD	< 25 mg/L
	TSS	< 20 mg/L

As a lower cost option, the Municipality has the option of meeting the discharge criteria by employing HM&A's Dilution Strategy. In this option, design flow would be initially set for the sewered flow (with trucked wastewater still going to the lagoon). The inclusion of a microscreen at the lagoon discharge will reduce effluent to levels that meet when blended with allowing dilution by MBR treated water. This strategy was employed at our Westview Water Reclamation Facility in Powell River, BC. A paper detailing this strategy is included in Annex K.

As with Option 1, all components are modular in construction.

With Option 2, the Municipality can achieve the goals of full tertiary quality in a phased approach: meeting the forthcoming discharge criteria, and phasing treatment capacity to full tertiary in a controlled manner. Option 2 is easily phasable into Option 1.

Costs for design/build and operations are included in Annexes B and C along with conceptual layouts. The costs are based on our understanding of the project and site conditions and are subject to summer site inspection.

5.7 Financing

The Municipality of Iqaluit, through the introduction of just-in-time infrastructure, can capitalize expansion of the plant through the administration of DCCs or Development Cost Charges (DCCs) or hook-up fees to new customers. In this way, expansion is funded only by the additional development, rather than assessing the entire tax base.

In addition, HM&A has the backing of financial partners and is capable of providing a complete Design/Build/Own/Operate solution. A letter of financial stability has been included in Annex G.

6 OPERATIONS AND MAINTENANCE

As with any mechanical system, maintenance is required to ensure that the plant is operating at its required availability. HM&A requires that a comprehensive planned maintenance program be established and conducted by a qualified, authorized service agent in order to offer the effluent quality and equipment guarantees. HM&A's operations arm, the Canadian Wastewater Corporation (CWC) performs this service. Corrective maintenance, when required, must also be conducted by an authorized service agent. Equipment specified in the treatment plant has been chosen not only on the basis of its ability to meet the performance requirements of the plant, but also in consideration of minimizing maintenance.

All our systems are highly automated, with built-in alarm channels and annunciators that notify our staff in the event of any problems. Also, the process is, by definition, operator-independent due to the positive filtration achieved by the membranes.

6.1 Provision of Maintenance Services

CWC will perform maintenance management and supervisory services. These services are intended to ensure that the plants are operating in a manner that is both compliant with the discharge requirements and within sound operating ranges. Specifically, CWC will provide the following:

- ✓ Data analysis and review
- ✓ Technical support
- ✓ Response to alarm conditions
- ✓ On-line monitoring of PLC alarms
- ✓ On-site effluent testing
- ✓ Biomass monitoring
- ✓ Membrane performance monitoring
- ✓ Operator's Manual amendment and control
- ✓ Provision of walk-through tours to new facilities maintenance technicians/site staff
- ✓ Assessment of spares status
- ✓ Reviewing the state of the plant and making recommendations to the Owner for improvement
- ✓ PLC maintenance and alteration
- ✓ Refinement of the treatment process, including alteration of pumping cycles
- ✓ Provision of expert knowledge services for wastewater treatment and maintenance issues (including the introduction of advanced equipment health monitoring techniques to the sites)

The provision of services to the site are classified into three categories: operations; maintenance management; and advanced command, control, communications and information systems.

6.2 Operations Management

CWC will manage the operation of the plant, including the following:

- ▸ Determination of sludge wasting intervals
- ▸ Determination of appropriate energy conservation measures
- ▸ Commissioning and refinement of control algorithms
- ▸ Evaluation of process parameters
- ▸ Determination of action required to return process to nominal state after any upset condition
- ▸ Determination and implementation of membrane cleaning regimes and rotation schedules

The operation of the plant will be effected through a close-controlled PLC-driven logic base. In the main, the plant will operate in an automated state and no direct operator intervention into the process is required.

6.3 Maintenance Management

Maintenance management refers to the assumption of responsibility for ensuring the plant maintains the required state of operational availability. In the performance of this task, CWC staff will ensure that the machinery in the plant is subjected to the appropriate level of maintenance. Maintenance at the plant is based on a combined time-based/condition-based philosophy. The delineation between the two is determined on the

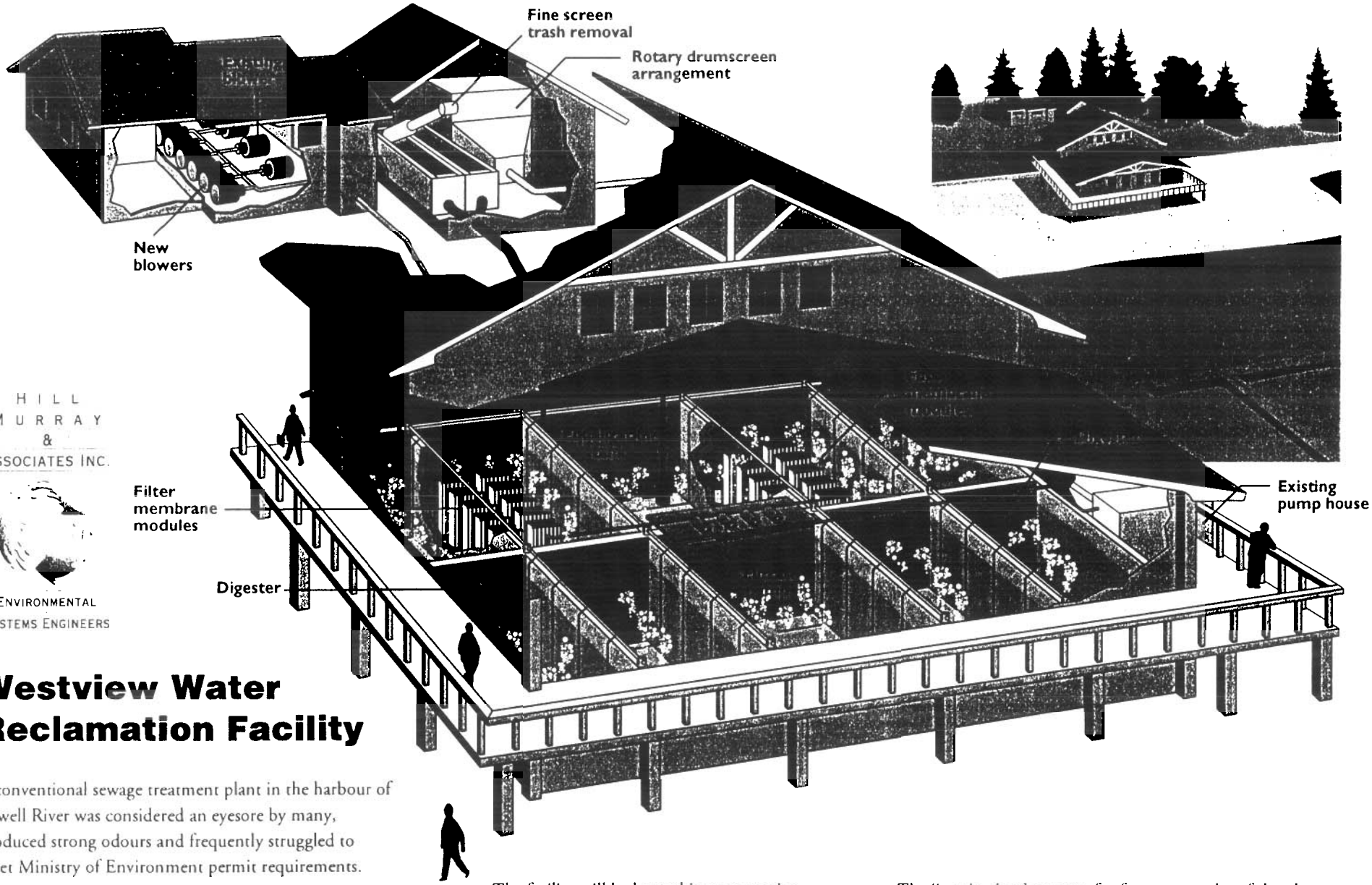
basis of capital cost, expected reliability, expected hazard-rate, and implications of failure. Similarly, equipment is designated as RxR (repair by replacement) or RxO (repair by overhaul).

In addition, CWC provides technical support activities for the plant, evaluating and implementing changes in protocols.

6.4 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.



HILL
MURRAY
&
ASSOCIATES INC.

ENVIRONMENTAL
SYSTEMS ENGINEERS

Westview Water Reclamation Facility

A conventional sewage treatment plant in the harbour of Powell River was considered an eyesore by many, produced strong odours and frequently struggled to meet Ministry of Environment permit requirements.

Hill, Murray & Associates proposed an affordable solution – a membrane-bioreactor system, to be installed in the existing tanks and buildings of the old plant. The new system will be clean and odourless and will produce treated water which exceeds Ministry of Environment regulations.

The facility will be housed in an attractive 1920s-style boathouse with a public walkway.

A key feature of the design of the water reclamation facility is flexibility. In the future, the plant can be expanded with additional membranes to accommodate increased sewage volumes within the existing tanks.

The 'just-in-time' concept for future upgrades of the plant means that capital costs for new equipment can be spread over a number of years and the impact on taxpayers is minimized. Upgrading this plant means there is no need to purchase more land, and most important, the high level of treatment of the discharge ensures that the fragile marine environment is protected.

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 & Ommissions Excepted

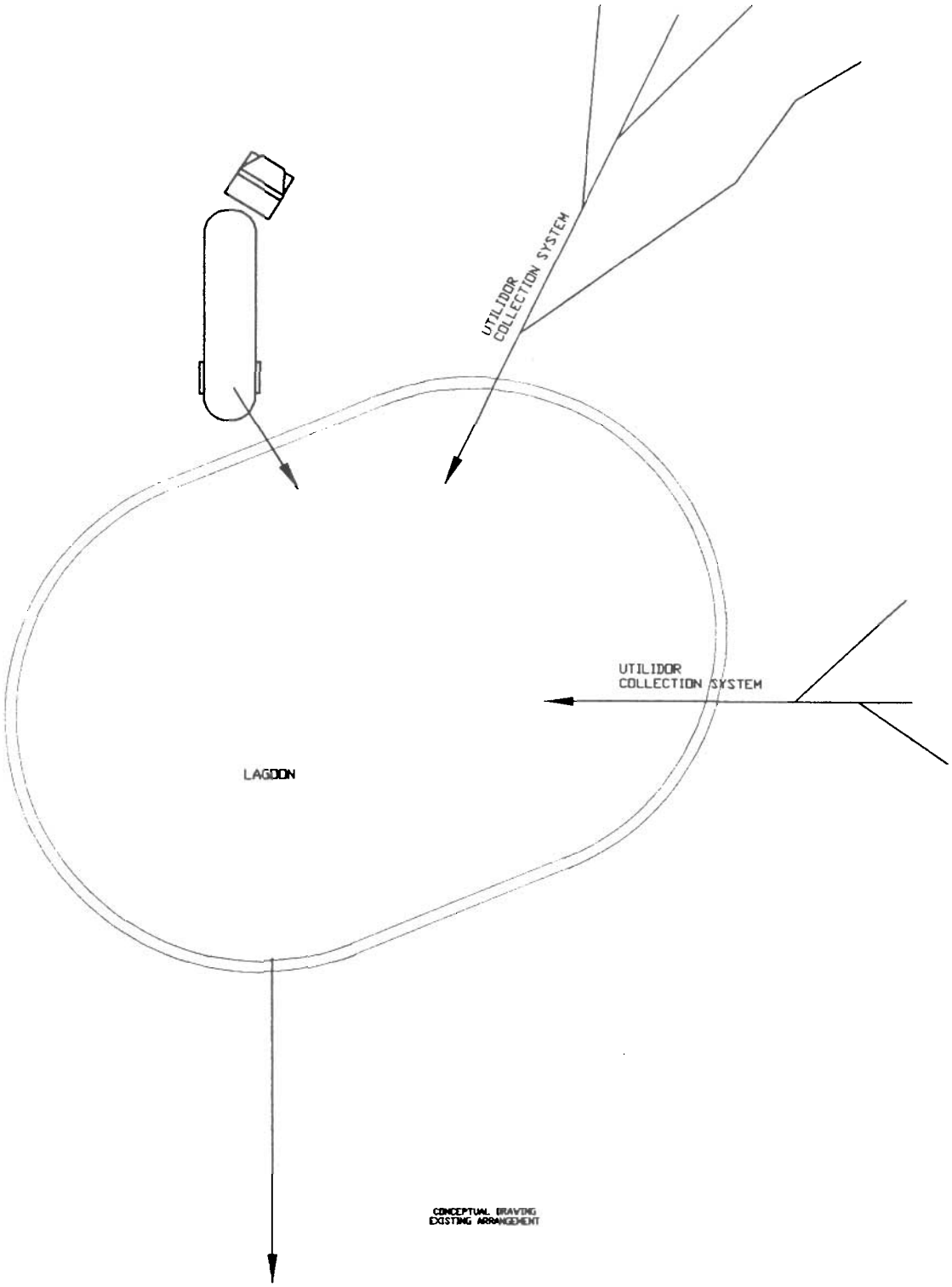
Option 2 - Minimum Budget Compliance
Phased Tertiary

MBR Flow 1000 m^3/day
Microscreen Flow 1000 m^3/day

Blended Flow 2000 m^3/day

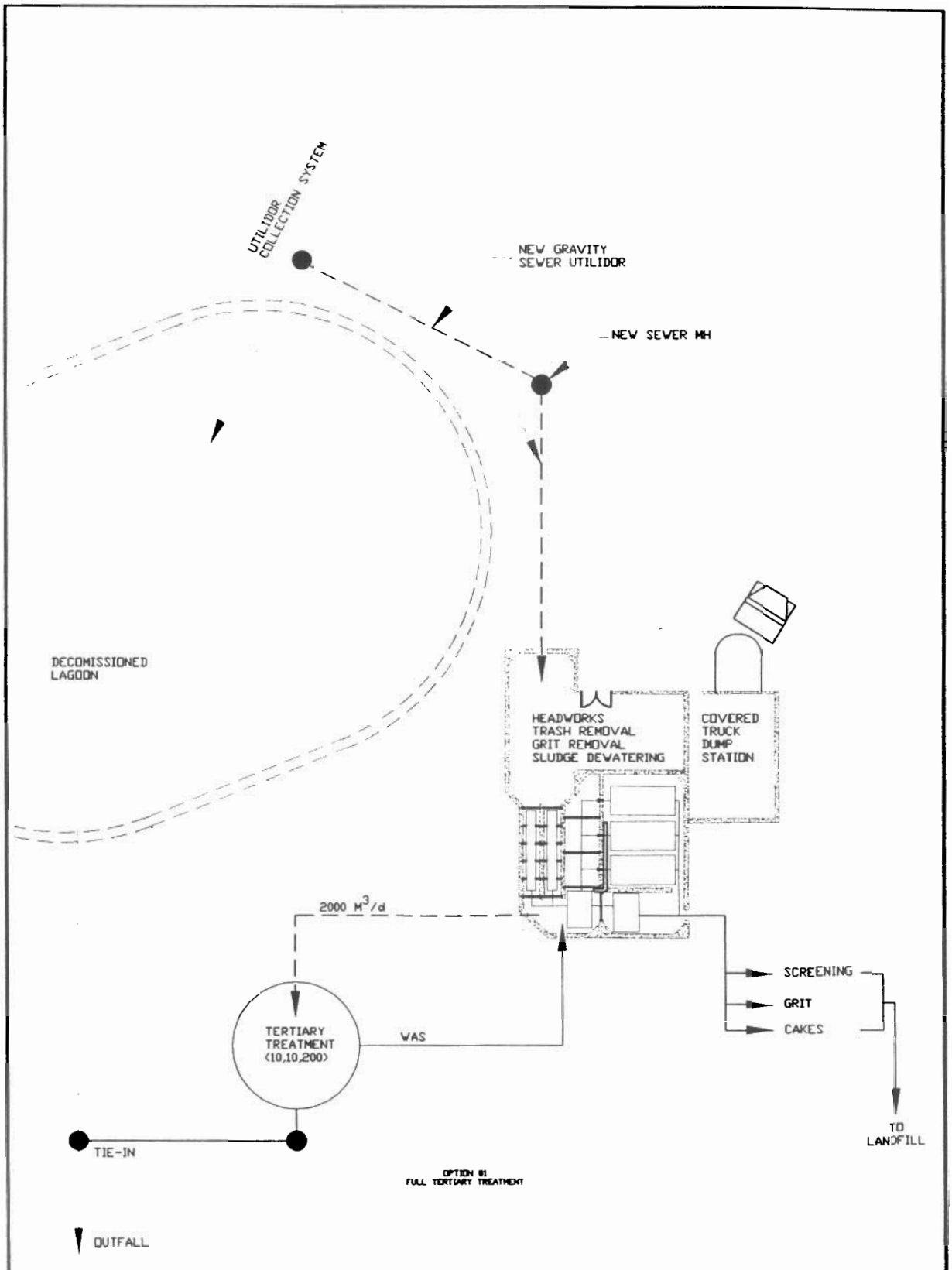
Item	Cost ($M)
Engineering/Design	0.8
Permitting	0.3
ZenoGEM Equipment	1.8
Drum Screen Equipment	0.15
Sludge Pressing Equipment	0.3
Headworks Equipment	0.1
Headworks Tanks	0.15
Headworks Building	0.15
Treatment Tanks	0.4
Treatment Building	0.4
Civil Improvements	0.5
Mobilization & Shipping	0.3
Installation & 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 & Ommissions Excepted



Hill, Murray, & Associates, Inc.

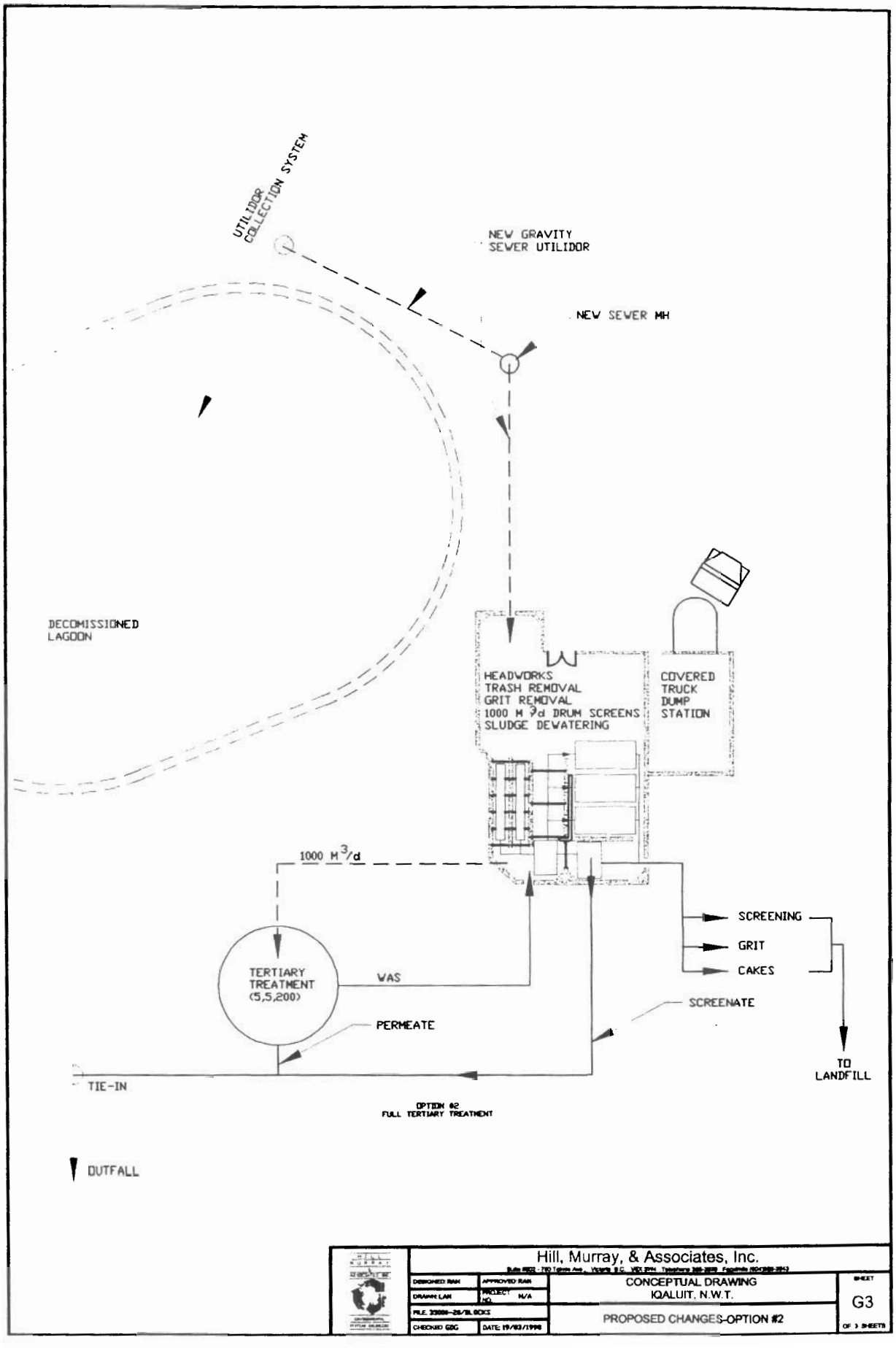
DESIGNED: RMH	APPROVED: RMH	CONCEPTUAL DRAWING IQALUIT, N.W.T.	SHEET G1
DRAWN: LAR	PROJECT NO. N/A		
FILE: 53980-28/BLOCK1		EXISTING ARRANGEMENT	OF 3 SHEETS
CHECKED: DBG	DATE: 17/03/1998		



OPTION #1
FULL TERTIARY TREATMENT

Hill, Murray, & Associates, Inc.

DESIGNED: RAM	APPROVED: RAM	CONCEPTUAL DRAWING IQALUIT, N.W.T.	SHEET G2
DRAWN: LAH	PROJECT NO. N/A		
FILE: 33800-08/BLOCKS		PROPOSED CHANGES-OPTION #1	OF 3 SHEETS
CHECKED: GBG	DATE: 19/03/1998		



Hill, Murray, & Associates, Inc.			
DESIGNED RAH	APPROVED RAH	CONCEPTUAL DRAWING IQALUIT, N.W.T.	SHEET G3
DRAWN LAH	PROJECT NO. N/A		
FILE: 23888-28/BLOCKS		PROPOSED CHANGES-OPTION #2	OF 3 SHEETS
CHECKED GDG	DATE: 19/03/1998		

Estimated Operating Costs - Iqaluit Water Reclamation Facility

Errors & Ommissions Excepted

Year	Estimated Annual Increase in Population	Total Dwelling Units Annual	Total Dwelling Units Accum	Total Sewage Flows Iqpd	Membrane Replacement Costs Annual Charge	Labour	Power Cost	Chemicals	Sludge	Local Overhead & Admin	Monitoring & Mngment Fees	Total Operating Costs Actual	Total Operating Costs NPV	Monthly Actual Operating Costs/D.U.	Monthly NPV Operating NPV
1998	4,538	2,269	2,269	399,824	59,707	75,000	587,763	6,645	261,779	75,000	111,941	1,172,835	1,172,835	43.07	43.07
1999	4,690	76	2,345	413,251	61,712	75,000	602,209	6,700	270,570	75,000	112,342	1,198,534	1,175,033	42.59	41.75
2000	4,848	79	2,424	427,129	63,785	75,000	617,010	6,757	279,657	75,000	112,757	1,224,965	1,177,398	42.11	40.48
2001	5,011	81	2,505	441,472	65,927	75,000	632,175	6,816	289,048	75,000	113,185	1,252,151	1,179,930	41.65	39.25
2002	5,179	84	2,589	456,298	68,140	75,000	647,713	6,877	298,755	75,000	113,628	1,280,114	1,182,627	41.20	38.06
2003	5,353	87	2,676	471,621	70,429	75,000	663,633	6,940	308,788	75,000	114,086	1,308,875	1,185,488	40.75	36.91
2004	5,533	90	2,766	487,459	72,794	75,000	679,943	7,005	319,157	75,000	114,559	1,338,459	1,188,513	40.32	35.80
2005	5,718	93	2,859	503,829	75,239	75,000	626,990	7,073	329,875	75,000	115,048	1,299,224	1,131,053	37.87	32.96
2006	5,911	96	2,955	520,749	77,765	75,000	642,400	7,142	340,953	75,000	115,553	1,328,814	1,134,130	37.47	31.98
2007	6,109	99	3,054	538,237	80,377	75,000	731,321	7,214	352,403	75,000	116,075	1,432,391	1,198,561	39.08	32.70
2008	6,314	103	3,157	556,312	83,076	75,000	749,296	7,289	364,238	75,000	116,515	1,465,513	1,202,231	38.68	31.73
2009	6,526	106	3,263	574,994	85,866	75,000	767,712	7,366	376,469	75,000	117,173	1,499,586	1,206,062	38.30	30.80
2010	6,745	110	3,373	594,303	88,749	75,000	786,581	7,445	389,112	75,000	117,750	1,534,638	1,210,051	37.92	29.90
2011	6,972	113	3,486	614,261	91,730	75,000	805,914	7,527	402,179	75,000	118,346	1,570,696	1,214,199	37.55	29.03
2012	7,206	117	3,603	634,890	94,810	75,000	825,722	7,612	415,685	75,000	118,962	1,607,792	1,218,505	37.19	28.18
2013	7,448	121	3,724	656,211	97,994	75,000	846,017	7,700	429,645	75,000	119,599	1,645,954	1,222,968	36.83	27.37
2014	7,698	125	3,849	678,247	101,285	75,000	866,810	7,790	444,073	75,000	120,257	1,685,216	1,227,589	36.49	26.58
2015	7,957	129	3,978	701,024	104,686	75,000	888,115	7,884	458,986	75,000	120,937	1,725,609	1,232,365	36.15	25.81
2016	8,224	134	4,112	724,566	108,202	75,000	909,943	7,981	474,400	75,000	121,640	1,767,166	1,237,298	35.81	25.08
2017	8,500	138	4,250	748,899	111,836	75,000	932,308	8,081	490,331	75,000	122,367	1,809,923	1,242,387	35.49	24.36

JB LABS
827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364

DATE. April 30, 1997

JOB NO: JB 1750
LR NO: 23704

SAMPLING DATE: See Below
SAMPLING AGENT. Perrault

The sample(s) submitted by the agent have been tested as requested and we report as follows:

CLIENT: Canadian Wastewater Corp.
#202, 780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

Attn: Graham Symmons

SAMPLE
Sample # 1: Mt.Washington STP - Effluent Apr 23/97
Sample # 2: Mt.Washington STP - Mixed Liquor

			Sample 1	Sample 2
Tot Suspended Solids	mg/L		< 1	1 4,400
BOD_5	mg/L		< 5	
Phosphorus, Total	mg/L	P	0.155	
Nitrite	mg/L	N	0.005	
Nitrate	mg/L	N	16.8	
Ammonia	mg/L	N	0.11	
T.Kjeldahl Nitrogen	mg/L	N	0.61	
Faecal Coliform	CFU/100ml		< 1	
Fixed Susp.Solids	mg/L			3,240
Volatile Susp Solids	mg/L			1 1,160

< = less than

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.

JB LABS
827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364

RECEIVED
MAR 03 1997
Hall, Murray & Associates Inc

DATE February 26, 1997

JOB NO JB 1750
LR NO 23351

SAMPLING DATE See Below
SAMPLING AGENT D. Perrault

The sample(s) submitted by the agent have been tested as requested and we report as follows

CLIENT Canadian Wastewater Corp
#202, 780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

Attn: Graham Symmons

SAMPLE Sample # 1: Mt. Washington Effluent Feb 20/97
Sample # 2: Mt. Washington Bioreactor Cell #1
Sample # 3: Mt. Washington Bioreactor Cell #2

		Sample 1	Sample 2	Sample 3
Tot Suspended Solids	mg/L	< 1	12,300	10,200
BOD-5	mg/L	< 5		
Faecal Coliform	CFU/100ml	< 1		
Fixed Susp.Solids	mg/L		1,800	1,500
Volatile Susp Solids	mg/L		10,500	8,700

< less than

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

IRC
Integrated Resource Consultants Inc.

CLIENT CONFIDENTIAL

Suite 160
14480 River Road
Richmond, BC
Canada V6V 1L4
Tel. (604) 278-7714
Fax (604) 278-7741
e-mail: IRC@mindlink.bc.ca

RECEIVED
JAN 20 1997
Hill, Murray & Associates Inc.

FAX

TO: Graham - Hill, Murray & Associates

FROM: Marian Zazzi

IRC Integrated Resource Consultants Inc.

NUMBER OF PAGES, INCLUDING THIS PAGE: 1

DATE: 20 January 1997

BIOASSAY UPDATE:

SAMPLE NAME:	Mt. Washington Permeate
SAMPLE DATE:	12 January 1997
DATE RECEIVED:	14 January 1997
ANALYSIS:	96 HOUR RAINBOW TROUT TOXICITY
96 HOUR UPDATE:	100% TROUT ALIVE IN 100% CONCENTRATION The 96 Hour LC50 was greater than 100%

The LC_{50} is defined as the mean lethal concentration or the concentration at which there is 50% fish mortality. Results are calculated using the method described by Stephan (Methods for calculating an LC_{50} in: Aquatic Toxicology and Hazard Evaluation, American Society for Testing and Materials, 1977).

The test method followed was as per "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout" EPS 1/RM/13, 1990, amended May 1996.

Please call should you have any questions
Full report to follow in the mail

TOTAL P.01

North Island Laboratories
#3-2946 Kilpatrick Avenue, Courtenay, B.C V9N 7S7
Tel 338-7786 Fax: 338-7553

RECEIVED
JAN 2 7 1997
Hill, Murray & Associates

Report To: Graham Symmons
Graham Symmons
Hill Murray & Associates
202-780 Tolmie Ave

Sample Number: 1840-01
Date Reported: 1/17/97
Date Received: 1/8/97 13:58
Date Collected: 1/8/97

Collected by: Graham Symmons
Source: Waste Water Tmt Plant
Sample point: New

Water Analysis Results

Parameter	Result	Units
Ammonia		
Ammonia (N)	0.011	mg/L
BOD,TSS,Fecal Coliforms		
5 day BOD	< 5	mg/L
Total Suspended Solids	1	mg/L
Fecal Coliforms	< 1	CFU/100mL
Nitrate		
Nitrate (N)	35.5	mg/L
Nitrite		
Nitrite (N)	0.284	mg/L
Total Kjeldahl Nitrogen		
TKN (mg/L)	0.80	mg/L
Total phosphate		
Total Phosphate (P)	0.148	mg/L

IRC
Integrated Resource Consultants Inc.

Suite 160
14480 River Road
Richmond, BC
Canada V6V 1L4
Tel. (604) 278-7714
Fax (604) 278-7741
e-mail IRC@mindlink.bc.ca

CLIENT CONFIDENTIAL

FAX

TO: Graham - Hill, Murray & Associates

FROM: Marian Zazzi

IRC Integrated Resource Consultants Inc.

NUMBER OF PAGES, INCLUDING THIS PAGE: 1

DATE: 30 DEC. 1996

BIOASSAY UPDATE:

SAMPLE NAME:	Mt. Washington Permeate
SAMPLE DATE:	19 DEC. 1996
DATE RECEIVED:	23 DEC. 1996
ANALYSIS:	96 HOUR RAINBOW TROUT TOXICITY
96 HOUR UPDATE:	100% TROUT ALIVE IN 100% CONCENTRATION The 96 Hour LC50 was greater than 100%

The LC_{50} is defined as the mean lethal concentration or the concentration at which there is 50% fish mortality Results are calculated using the method described by Stephan (Methods for calculating an LC_{50} in: Aquatic Toxicology and Hazard Evaluation, American Society for Testing and Materials, 1977).

The test method followed was as per "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout" EPS 1/RM/13, 1990, amended May 1996.

Please call should you have any questions
Full report to follow in the mail

TOTAL P.01

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364

RECEIVED
DEC 06 1996

(1)

DATE December 5, 1996

JOB NO JB 1750
LR NO 22920

SAMPLING DATE Nov 26/96
SAMPLING AGENT Perreault

The sample(s) submitted by the agent have been tested as requested and we report as follows

CLIENT Hill, Murray & Associates
#202, 780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

Attn: Graham Symmons

SAMPLE Sample # 1: Mt. Washington Resort STP - Startup Nov 26/96

			Sample 1
Tot Suspended Solids	mg/L	<	1
BOD_5	mg/L	<	5
Phosphorus, Total	mg/L P		1.39
Nitrite	mg/L N		0.34
Nitrate	mg/L N		11.7
Ammonia	mg/L N		0.12
T.Kjeldahl Nitrogen	mg/L N		0.43
Faecal Coliform	CFU/100ml	<	1

(2) File
ME [illegible]

< = less than

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

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827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364

RECEIVED
APR 28 1997
Hill, Murray & Associates Inc.

DATE: April 21, 1997

JOB NO: JB 1750
LR NO: 23650

SAMPLING DATE: See Below
SAMPLING AGENT: Client

CLIENT: Canadian Wastewater Corp.
#202, 780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

Attn: Graham Symmons

The sample[s] submitted by the agent have been tested as requested and we report as follows

FIG
Thetis Lk
Lab Report.

SAMPLE: Sample # 1: Thetis Lake Campground: Effluent Apr 16/97
Sample # 2: Thetis Lake Campground: Biomass

			Sample 1	Sample 2
Tot Suspended Solids	mg/L	<	1	7800
BOD_5	mg/L	<	5	
Faecal Coliform	CFU/100ml	<	1	
Fixed Susp.Solids	mg/L			950
Volatile Susp Solids	mg/L			6850

< = less than

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

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364

RECEIVED
MAR 03 1997
Hill, Murray & Associates Inc.

DATE February 24, 1997

JOB NO: JB 1750
LR NO: 23337

CLIENT
Canadian Wastewater Corp.
#202, 780 Tolmie Avenue
Victoria, B. C.
V8X 3W4

Attn: Graham Symmons

SAMPLING DATE: Feb 18/97
SAMPLING AGENT: D. Perreault

The sample(s) submitted by the agent have been tested as requested and we report as follows.

SAMPLE.

Sample # 1: Thetis Lake: Effluent Feb 18/97
Sample # 2: Thetis Lake: Mixed Liquor

		Sample 1	Sample 2
Total Suspended Solids	mg/L	< 1	11,600
BOD_5	mg/L	< 5	
Faecal Coliform	CFU/100mL	< 1	
Fixed Suspended Solids	mg/L		1,510
Volatile Suspended Solids	mg/L		10,090
Phosphorus, Total	mg/L P		121

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

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364

DATE: January 20, 1997

JOB NO: JB 1750
LR NO: 23125

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 Canadian Wastewater Corp.
#202, 780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

Attn: Graham Symmons

SAMPLE Sample # 1: Thetis Lake STP: Effluent Jan 13/97
Sample # 2: Thetis Lake STP: Biomass

			Sample 1	Sample 2
Tot Suspended Solids	mg/L	<	1	19,400
BOD_5	mg/L	<	5	
Faecal Coliform	CFU/100ml		5	
Volatile Susp Solids	mg/L			17,000

[illegible] & ASSOCIATES INC.
PAYMENT AUTHORIZATION
This item is approved for payment
by: _____
Date Goods Received: _____
Account: _____ Sub-Account: _____
Project No. _____ P.O. No: _____
Billable: _____ Non-Billable: _____
[illegible] _____ Issued Date: _____

< = less than

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

JB LABS

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (250) 385-6112
Fax: (250) 382-6364

DATE: October 15, 1996

JOB NO: JB 1750
LR NO: 22630

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
#202, 780 Tolmie Avenue
Victoria, B.C.
V8X 3W4

Attn: Graham Symmons

SAMPLE: Sample # 1: Thetis Lake Campground - Plant Effluent Oct 8/96
Sample # 2: Thetis Lake Campground - Eff After Filt
Sample # 3: Thetis Lake Campground - Biomass

		Sample 1	Sample 2	Sample 3
Tot Suspended Solids	mg/L	< 1		9650
BOD_5	mg/L	< 5		
Faecal Coliform	CFU/100ml		< 1	
Fixed Susp.Solids	mg/L			1280
Volatile Susp Solids	mg/L			8370

< = less than

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.

JB LABS

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (604) 385-6112
Fax: (604) 382-6364

(1)

RECEIVED

APR 19 1996

Hill, Murray & Associates Inc.

DATE: April 17, 1996

JOB NO: JB 1750
LR NO: 21627

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
#1 - 1131 Collinson St.
Victoria, B.C.
V8V 3C2

Attn: Graham Symmonds

SAMPLE: Sample # 1: Membrane Discharge - Thetis Lake Apr 12/96
Sample # 2: Bio-reactor mixed liquor
Sample # 3: Discharge to field

		Sample 1	Sample 2	Sample 3
Tot Suspended Solids	mg/L	< 1	8520	
BOD_5	mg/L	< 5		
Fixed Susp.Solids	mg/L		1100	
Volatile Susp Solids	mg/L		7420	
Faecal Coliform	$CFU/_{100}ml$			< 10

(2) Thetis Lk Lab

< = less than

John E Evanoff, M Sc
Barbara M Klassen, B Sc

JB Laboratories Ltd.
water/wastewaters

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

JB LABS

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (604) 385-6112
Fax: (604) 382-6364

(1)

RECEIVED

APR 0 2 1996

Hill, Murray & Associates Inc.

DATE: April 1, 1996

JOB NO: JB 1750
LR NO: 21521

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
#1 - 1131 Collinson St.
Victoria, B.C.
V8V 3C2

Attn: Graham Symmonds

SAMPLE:
Sample # 1: Thetis Lake - Membrane Bank #1 Mar 25/96
Sample # 2: Thetis Lake - Membrane Bank #2
Sample # 3: Thetis Lake - Membrane Chamber
Sample # 4: Thetis Lake - Chlor. Ring Inlet

			Sample 1	Sample 2	Sample 3	Sample 4
Tot Suspended Solids	mg/L	<	1	1	6100	
BOD_5	mg/L	<	5	5		
Faecal Coliform	$CFU/_{100}ml$					10

(2) Trev
Rob
Mary
File in Thetis Maintenance file please.
B.

< = less than

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

JB LABS

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (604) 385-6112
Fax: (604) 382-6364

(1)

DATE: January 16, 1996

JOB NO. JB 1750
LR NO: 21411

SAMPLING DATE: See Below

CLIENT: Hill, Murray & Associates
#1 - 1131 Collinson St.
Victoria, B.C.
V8V 3C2

SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

Attn: Graham Symmonds

RECEIVED
JAN 23 1996
Hill, Murray & Associates Inc.

SAMPLE: Sample # 1: Thetis Lake - Aeration Jan 8/96
Sample # 2: Thetis Lake - Membrane Discharge

		Sample 1	Sample 2
Tot Suspended Solids	mg/L	8700	5
BOD_5	mg/L		< 5
Faecal Coliform	$CFU/_{100}ml$		< 10

(2) Many
File Please
TL.

< = less than

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

Ministry of Social Services Building 6868 West Coast Rd						
Date	Total Daily Flow	Flow to Field	Recycle Ratio	Permeate Analytical		
				BOD	TSS	FC
17-Apr-96				<5	<1	<1
22-Apr-96				<5	<1	<10
24-Apr-96				<5	<1	<10
26-Apr-96				<5	<1	<10
29-Apr-96				<5	<1	1
01-May-96				<5	2	<1
03-May-96				<5	2	<1
06-May-96				<5	<1	<1
08-May-96				<5	3	<1
10-May-96	152			<5	2	<1
13-May-96				<5	<1	<1
15-May-96				<5	2	<1
17-May-96				<5	<1	<1
21-May-96	162			<5	<1	<1
24-May-96	231			<5	<1	<1
24-May-96						
27-May-96				<5	<1	<1
30-May-96	223					
03-Jun-96	155			<5	<1	<1
11-Jun-96	218			<5	<1	<1
13-Jun-96	257					
20-Jun-96	214	38	82%	<5	<1	<1
24-Jun-96	183	22	88%			
26-Jun-96	244	16	93%	<5	<1	<1
27-Jun-96	655	48	93%			
03-Jul-96	172	8	95%			
09-Jul-96	283	24	92%	<5	<1	<1
10-Jul-96	546	47	91%			
15-Jul-96	325	8	97%			
16-Jul-96	316	0	100%			
19-Jul-96	403	16	96%			
21-Jul-96	211	0	100%			
30-Jul-96	266	14	95%	<5	<1	<1
31-Jul-96	169	0	100%			
01-Aug-96	510	0	100%			
02-Aug-96	136	47	65%			
03-Aug-96	672	0	100%			
06-Aug-96	223	29	87%			
07-Aug-96	228	4	98%			
08-Aug-96	214	0	100%			
09-Aug-96	286	49	83%			
11-Aug-96	124	0	100%			
12-Aug-96	115	0	100%			
13-Aug-96	199	0	100%	<5	<1	<1
14-Aug-96	154	45	71%			
15-Aug-96	152	0	100%			
20-Aug-96	194	19	90%			
21-Aug-96	166	49	70%			
22-Aug-96	256	0	100%			
23-Aug-96	131	42	68%			
26-Aug-96	139	0	100%			
27-Aug-96	521	90	83%	<5	<1	<1
28-Aug-96	194	46	76%			
29-Aug-96	198	0	100%			
30-Aug-96	365	43	88%			
03-Sep-96	179	0	100%			
04-Sep-96	278	0	100%			
05-Sep-96	406	45	89%			
06-Sep-96	390	0	100%			
09-Sep-96	279	0	100%	<5	<1	<1
13-Sep-96	310	21	93%		<1	
16-Sep-96	384	0	100%			
24-Sep-96	311	16	95%	<5	<1	<1
29-Sep-96	381	18	95%			
01-Oct-96	237	0	100%			
03-Oct-96	454	44	90%			
07-Oct-96	271	0	100%			
08-Oct-96	289	43	85%	<5	<1	<1
15-Oct-96	368	6	98%			
23-Oct-96	339	20	94%			

01-Nov-96	303	10	97%			
05-Nov-96	254	22	91%		3	<1
11-Nov-96	203	15	93%			
15-Nov-96	237	11	95%			
20-Nov-96	244	26	90%			
28-Nov-96	276	20	93%			
02-Dec-96	185	10	94%			
09-Dec-96	164	18	89%			
10-Dec-96	328	130	60%			
16-Dec-96	181	15	92%	<5	<1	1
24-Dec-96	169	21	87%			
09-Jan-97	60	19	68%			
13-Jan-97	49	11	77%			
18-Jan-97	154	44	72%			
03-Feb-97	84	22	74%			
06-Feb-97	162	30	82%			
17-Feb-97	65	16	76%			
18-Feb-97	159	88	45%	<5	<1	1
24-Feb-97	64	21	67%			
25-Feb-97	130	93	29%			
27-Feb-97	119	38	68%			
03-Mar-97	163	43	74%			
04-Mar-97	369	44	88%			
10-Mar-97	121	44	63%			
14-Mar-97	213	33	85%			
17-Mar-97	60	14	77%	<5	<1	1
23-Mar-97	71	29	59%			
27-Mar-97	205	33	84%			
08-Apr-97	70	14	80%			
15-Apr-97	161	19	88%			
16-Apr-97				<5	<1	1
21-Apr-97	83	22	73%			
05-May-97	131	11	92%			
15-May-97	134	126	6%			
26-May-97	65	12	81%			
27-May-97	88	0	100%	<5	<1	1
28-May-97	226	0	100%			
29-May-97	293	88	70%			
02-Jun-97	141	10	93%			
05-Jun-97	101	15	85%			
06-Jun-97	549	39	93%			
10-Jun-97	213	0	100%			
17-Jun-97	81	18	77%			
02-Jul-97	73	12	84%			
07-Jul-97				<5	<1	1
08-Jul-97	50	14	71%			
18-Jul-97	90	17	81%			
23-Jul-97	127	8	94%			
30-Jul-97	162		100%			
08-Aug-97	59	11	82%	<5	<1	1
21-Aug-97	75	9	87%			
02-Sep-97	140	7	95%			
09-Sep-97	59	18	69%			
19-Sep-97	542	16	97%			
22-Sep-97	68	25	63%			
24-Sep-97	31	0	100%			
29-Sep-97	156	24	85%			
30-Sep-97	282	0	100%			
07-Oct-97	83	12	86%	1	<1	1
16-Oct-97	97	9	91%			
17-Oct-97	776	37	95%			
22-Oct-97	85	9	90%			
28-Oct-97	94	7	92%			
29-Oct-97	412	37	91%			
30-Oct-97	197	43	78%			
04-Nov-97	66	16	76%			
20-Nov-97	83	16	81%			
25-Nov-97	94	16	83%			
26-Nov-97	138	85	39%	<5	<1	1
27-Nov-97	0	0				
28-Nov-97	117	39	67%			
07-Dec-97	89	22	75%			
10-Dec-97	76	13	82%			
12-Dec-97	91	21	77%			

Average Flow to Field 23 USG

CYCLE-LET

ENHANCED NITROGEN REMOVAL

The enclosed laboratory data is from one of several Cycle-Let facilities in New Jersey which is currently being run in an enhanced nitrogen removal mode. Through internal recirculation, pH control and a final polishing denitrification filter (where necessary) we can consistently achieve an effluent of less than 10 mg/l total nitrogen.

Zenon Municipal Systems Inc.
P.O. Box 1285, Ann Arbor, MI 48106 Telephone: (313) 769-9574 (800) 443-3006 Fax: (313) 761-7842

NITDATA 4/20/94

ZENON

EFFLUENT NITROGEN MONITORING

WILMAD			
Ave Flow	739 gpd		
Peak Flow	3250 gpd		
Date	NO3-N	NH3-N	Total
8/20/91	4.80	0.54	5.34
9/6/91	8.80	0.14	8.94
9/11/91	0.24	0.08	0.32
9/13/91	7.80	0.23	8.03
9/20/91	0.65	0.83	1.48
9/30/91	2.5	0.31	2.81
10/7/91	6.00	0.06	6.06
10/15/91	5.00	0.06	5.06
12/10/91	0.1	0.39	0.49
3/19/92	0.73	0.56	1.29
3/25/92	0.14	0.20	0.34
4/2/92	1.90	0.14	2.04
5/7/92	0.63	0.20	0.83
6/2/92	0.03	1.09	1.12
7/9/92	0.10	0.20	0.30
8/6/92	3.90	0.80	4.70
9/8/92	0.04	0.47	0.51
10/27/92	0.04	0.31	0.35
11/3/92	0.04	0.18	0.22
12/1/92	1.64	0.44	2.08
1/7/93	1.00	0.54	1.54
2/23/93	1.31	0.06	1.37
3/2/93	0.86	1.44	2.30
4/20/93	3.89	1.75	5.64
5/4/93	1.38	0.34	1.72
6/10/93	0.13	0.30	0.43
7/12/93	2.05	0.02	2.07
8/11/93	0.94	0.10	1.04
9/7/93	0.13	0.01	0.14
10/7/93	0.58	0.24	0.82
11/11/93	4.05	0.01	4.06
12/15/93	0.62	0.80	1.42
1/6/94	0.15	0.24	0.39
2/4/94	0.52	0.61	1.13
3/1/94	0.16	0.88	1.04
AVERAGE	1.80	0.42	2.21

FMI			
Ave Flow	232 gpd		
Peak Flow	550 gpd		
Date	NO3-N	NH3-N	Total
1/10/92	5.8	0.3	6.10
1/17/92	5	0.2	5.20
1/19/92	5.6	0.5	6.10
3/5/92	5.9	0.3	6.20
4/9/92	6	0.3	6.30
5/20/92	0.1	0.2	0.30
6/1/92	3	0.27	3.27
6/8/92	0.5	0.2	0.70
7/13/92	0.5	0.2	0.70
8/3/92	0.5	7.97	8.47
9/8/93	0.58	2	2.58
10/6/92	2.87	0.2	3.07
11/5/92	5.68	0.2	5.88
12/22/92	0.5	0.2	0.70
1/4/93	0.5	0.44	0.94
2/2/93	2.83	0.68	3.51
3/1/93	2.01	0.2	2.21
4/5/93	1.7	0.39	2.09
5/10/93	0.5	0.2	0.70
6/8/93	0.5	0.2	0.70
7/6/93	1.91	0.2	2.11
9/15/93	2.03	0.0	2.03
10/11/93	2.87	0	2.87
11/8/93	3.1	0	3.10
12/8/93	3.78	0	3.78
1/17/94	4.2	0	4.20
2/10/94	0	0	0.00
AVERAGE	2.54	0.57	3.10

TRAP ROCK			
Ave Flow	720 gpd		
Peak Flow	1700 gpd		
Date	NO3-N	NH3-N	Total
2/27/92	0.1	0.09	0.19
4/1/92	0.1	0.1	0.20
4/10/92	0.1	0.2	0.30
4/15/92	0.1	0.2	0.30
5/6/92	0.1	0.15	0.25
5/11/92	0.1	0.33	0.43
6/1/92	2	0.2	2.20
6/30/92	0.1	0.27	0.37
7/7/92	0.11	0.24	0.35
7/29/92	0.1	0.3	0.40
10/9/92	9.5	0.16	9.66
11/3/92	2	0.2	2.20
12/11/92	3.7	0.2	3.90
1/5/93	2.9	0.29	3.19
2/8/93	2	0.25	2.25
3/2/93	3.3	0.2	3.50
4/5/93	3.6	0.2	3.80
5/3/93	2.5	0.22	2.72
6/16/93	0.56	0.84	1.40
7/6/93	3.7	0.2	3.90
8/3/93	4.9	0.2	5.10
9/10/93	3.6	0.2	3.80
10/5/93	2.7	0.2	2.90
11/9/24	3.6	0.2	3.80
12/8/93	4	0.2	4.20
1/12/94	4.7	0.2	4.90
2/11/94	3	0.2	3.20
3/8/94	3.2	0.42	3.62
AVERAGE	2.37	0.24	2.61

Zenon Municipal Systems Inc.
P.O. Box 1285, Ann Arbor, MI 48106 Telephone: (313) 769-9574 (800) 443-3006 Fax: (313) 761-7842

ZENON

TCI/UACC			
Ave Flow	1147 gpd		
Peak Flow	2800 gpd		
Date	NO3-N	NH3-N	Total
4/20/93	4.62	0.95	5.57
5/4/93	3.42	0.20	3.62
6/8/93	2.87	0.20	3.07
7/6/93	0.5	0.2	0.70
8/4/93	1.50	0.00	1.50
8/10/93	4.30	0.51	4.81
9/8/93	1.25	2.42	3.67
10/12/93	0.91	8.71	9.62
11/18/93	4.32	0	4.32
12/7/93	2.62	0	2.62
1/20/94	2.06	0	2.06
2/9/94	1.72	0	1.72
3/1/94	3.56	0	3.56
AVERAGE	2.59	1.01	3.60

ARAMIS			
Ave Flow	1501 gpd		
Peak Flow	1800 gpd		
Date	NO3-N	NH3-N	Total
6/14/93	1	0.7	1.70
7/6/93	14.2	1.76	15.96
7/27/93	3.64	0	3.64
8/4/93	1.84	0	1.84
9/8/93	1.62	0	1.62
10/5/93	3.05	0	3.05
11/16/93	4.56	0	4.56
12/7/93	2.72	0	2.72
1/28/94	2.68	0	2.68
2/9/94	2.68	0	2.68
3/1/94	1.22	0	1.22
AVERAGE	3.56	0.22	3.79

GATEWAY/MANALPAN			
Ave Flow	3032 gpd		
Peak Flow	5100 gpd		
Date	NO3-N	NH3-N	Total
9/20/93	0.8	0.5	1.30
9/30/93	2	trace	2.00
10/11/93	2	2.5	4.50
10/18/93	2	0	2.00
10/24/93	2	trace	2.00
11/8/93	1.95	0.2	2.15
12/1/93	3.01	0.2	3.21
1/10/94	2.15	0.2	2.35
2/9/94	1.72	0	1.72
3/11/94	2.21	0.2	2.41
AVERAGE	1.98	0.48	2.36

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P.O. Box 1285, Ann Arbor, MI 48106 Telephone: (313) 769-9574 (800) 443-3006 Fax: (313) 761-7842

IRC
Integrated Resource Consultants Inc.

CLIENT CONFIDENTIAL

Suite 160
14480 River Road
Richmond, BC
Canada V6V 1L4
Tel. (604) 278-7714
Fax (604) 278-7741
e-mail: IRC@mindlink.bc.ca

FAX

TO: Graham - Hill, Murray & Associates

FROM: Marian Zazzi

IRC Integrated Resource Consultants Inc.

NUMBER OF PAGES, INCLUDING THIS PAGE: 1

DATE: 20 January 1997

BIOASSAY UPDATE:

SAMPLE NAME:	Mt. Washington Permeate
SAMPLE DATE:	12 January 1997
DATE RECEIVED:	14 January 1997
ANALYSIS:	96 HOUR RAINBOW TROUT TOXICITY
96 HOUR UPDATE:	100% TROUT ALIVE IN 100% CONCENTRATION The 96 Hour LC50 was greater than 100%

The LC_{50} is defined as the mean lethal concentration or the concentration at which there is 50% fish mortality. Results are calculated using the method described by Stephan (Methods for calculating an LC_{50} in: Aquatic Toxicology and Hazard Evaluation, American Society for Testing and Materials, 1977).

The test method followed was as per "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout" EPS 1/RM/13, 1990, amended May 1996.

Please call should you have any questions
Full report to follow in the mail

TOTAL P.01