

STAFF REPORT: ENGINEERING AND PUBLIC WORKS DEPARTMENT



REPORT TO: Infrastructure and Recreation Committee
MEETING DATE: September 8, 2009
REPORT NO.: EPW.09.080
SUBJECT: Fine Bubble Disc Aeration System at the
 Craigleith Wastewater Treatment Plant
PREPARED BY: John Caswell, Manager of Water &
 Wastewater Services/Asst. Director

A. Recommendations

THAT Council approve the purchase of a fine bubble disc aeration system from Aquarius Technologies Inc. as outlined in their Conceptual Design Proposal at a cost of \$14,450 per cell including PST and excluding GST for a total of \$43,350.00, as outlined in Report EPW.09.080 entitled "Fine Bubble Disc Aeration System at the Craigleith Wastewater Treatment Plant." and;

THAT Council approve increasing the 2009 Craigleith Wastewater Treatment Plant Aeration Cell Replacement from \$31,500 to \$43,350 for a total increase of \$11,850.00.

B. Background

The existing Stage I fine bubble aeration system originally installed in 1986 is outdated, inefficient and not meeting performance standards.

Staff previously met with the Manager of Purchasing and received approval to standardize the purchase of Fine Bubble Disc Aeration System from Aquarius Technologies Inc.

In 2008 staff from the wastewater group were successful in installing Aquarius Technologies aeration in cell # 2, clarifier 2. The system has worked extremely efficiently with air requirement for this cell being reduced by almost 35%. In February 2008 three blowers were required to operate the plant. Now February 2009, only two blowers are required.

The proposed aeration equipment being installed this year is the same as what was installed in cell #2 in 2008.

This purchase follows the Town's Purchasing of Goods & Services Policy under Section 14, Purchasing Procedures, Clause "h" Standardization Purchasing. Aquarius Technologies was chosen because they were preselected by price as a diffusion Aeration supplier by Stantec Consulting Ltd for the Thornbury Wastewater Treatment Plant.

C. The Blue Mountains' Strategic Plan

The Fine Bubble Disc Aeration System at the Craigleith Wastewater Treatment Plant Report furthers the Town's Strategic Plan Goal # 2 "Addressing the Town's Municipal Infrastructure needs."

D. Environmental Impacts

Oxygen transfer efficiency and mixing requirements are increased significantly with this upgrade due to a full floor aeration system. As a result, air blower load and therefore energy demands will be reduced. In the future, Staff will monitor the difference in air blower load to determine the payback.

Also, Staff will consider having a consultant provide an estimate for energy audit.

E. Budget Impact

Since the original proposal of July 2008 the exchange rate has substantially declined and therefore the original pricing of \$10,450 cannot be met. The new price for each grid is \$14,450.00 plus tax. The purchase of the Fine Bubble Disc Aeration System for \$43,350.00 including PST and excluding GST will be funded through the Craigleith Wastewater Treatment Capital Budget. Presently, there is \$31,350 available in the 2009 Budget under Craigleith WWTP Aeration Cells Replacement. Originally it was funded from the Craigleith Sewer Reserves and the estimated 2009 ending balance is \$4.9 million. The finance department was contacted and agree that the additional \$11,850 will not adversely affect future funding and therefore the reserve should be utilized to fund the additional budget requirements.

F. Attached

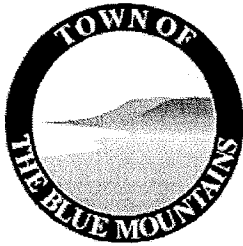
1. EPW.08.090 report entitled Fine Bubble Disc Aeration System at the Craigleith Wastewater Treatment Plant

Respectfully submitted,

John Caswell
Manager, Water & Wastewater Services/Asst. Director

Reg Russwurm
Director, Engineering and Public Works

STAFF REPORT: ENGINEERING AND PUBLIC WORKS DEPARTMENT



REPORT TO: **Engineering and Public Works Committee**
MEETING DATE: **August 12, 2008**
REPORT NO.: **EPW.08.90**
SUBJECT: **Fine Bubble Disc Aeration System at the
 Craigleith Wastewater Treatment Plant**
PREPARED BY: **Rob Fleming, Wastewater Overall Responsible
 Operator**

A. Recommendations

THAT Council approve the purchase of a fine bubble disc aeration system from Aquarius Technologies Inc. as outlined in their Conceptual Design Proposal at a cost of \$11,850.00 excluding GST and PST, as outlined in Report EPW.08.90.

B. Background

The existing Stage I fine bubble aeration system originally installed in 1986 is outdated, inefficient and not meeting performance standards.

It is noted that this procurement does not strictly follow the Town's Purchasing Policy. Aquarius Technologies was chosen because they have already been pre-selected by price as a diffuser aeration supplier by Stantec Consulting Ltd. for the Thornbury Wastewater Treatment Plant Expansion. The price was negotiated with Aquarius Technologies. The Aeration System will be installed by Wastewater Operations Staff.

C. The Blue Mountains' Strategic Plan

The Fine Bubble Disc Aeration System at the Craigleith Wastewater Treatment Plant Report furthers the Town's Strategic Plan Goal # 2 "Addressing the Town's Municipal Infrastructure needs."

D. Environmental Impacts

Oxygen transfer efficiency and mixing requirements are increased significantly with this upgrade due to a full floor aeration system. As a result, air blower load and therefore energy demands will be reduced. In the future, staff will monitor the difference in air blower load to determine the payback. Also, staff will consider having a consultant provide an estimate for energy audit.

E. Budget Impact

The purchase of the Fine Bubble Disc Aeration System for \$11,850.00 excluding GST and PST will be funded through the Craigeith Wastewater Treatment Capital Budget. Presently, there is \$15,000 available in the 2008 Budget under capital contingencies.

F. Attached

1. Conceptual Design Proposal for the Fine Bubble Disc Aeration System
2. Aeration System Retrofit memo from Aquarius Technologies Inc., July 11, 2008

Respectfully submitted,



Rob Fleming
Wastewater Overall Responsible Operator



Reg Russwurm
Director, Engineering and Public Works



**CONCEPTUAL DESIGN PROPOSAL
FOR THE
TOWN OF THE BLUE MOUNTAINS
FINE BUBBLE DISC AERATION SYSTEM**

**AQUARIUS REPRESENTATIVE:
ENVIROCAN
2 MARCONI COURT, UNIT 15
BOLTON, ON, CANADA L7E 1E5
(905) 951-9672**

AQUARIUS PROPOSAL #2320-08

JULY 11, 2008



INTRODUCTION

Aquarius is pleased to have the opportunity of presenting this conceptual design proposal to the Town of the Blue Mountains for a Fine Bubble Disc Aeration System. The Aquarius system proposed herein has been developed by a team of engineers with an unparalleled background of experience in the design, application and operation of wastewater treatment aeration systems. This experience comes with the knowledge that a high performance diffuser requires an equally well engineered piping system to support it. The Aquarius aeration system is the culmination of this experience. In reviewing and evaluating this proposal we suggest consideration of the following:

Aquarius System Advantages – Fine Bubble

Diffuser Holder

The Aquarius diffuser offers several advantages over alternate diffusion devices. The diffuser is mounted in a holder that is solvent welded in the factory to the crown of the air distribution header. This solvent welded bond is actually stronger than the pipe material itself, which results in long-term structural integrity. With some competitive designs, a metallic rivet is used to fix the diffuser holder to the pipe. The long-term mechanical reliability of this design is suspect, since the plastic will yield with force over time, resulting in leakage or failure at the metal/plastic connection. Moreover, this metallic rivet may not be corrosion resistant to acid cleaning of the diffusers, resulting in mechanical failure. Other competitive designs utilize a small diameter nipple connection and friction fit connection to the header piping. Once again the long-term mechanical reliability of this design is suspect, since plastic will yield with force over time, and the small diameter connection may be insufficient to resist the forces of normal operation and maintenance thereby also resulting in mechanical failure. Finally there are other competitive designs which utilize a clamping saddle to fix the diffuser holder to the pipe. Though this saddle is mechanical sound, it requires the contractor to perform the installation, resulting in the potential for field installation error and higher installed costs than factory installed holder designs.



Membrane Diffuser

The Aquarius membrane diffuser offers a high density of perforations per unit area resulting in smaller bubbles and higher oxygen transfer efficiencies. Therefore, the same surface area of Aquarius membrane discs provided will result in higher quantities of oxygen transferred than competitive 9" diffuser designs. Obviously two equally sized diffusers, one with 10 perforations and one with 100 will perform differently and wear differently. Thus diffuser surface area is no a valid means for specifying performance or durability. Aquarius's membrane disc's perforations are precision die formed slits punched perpendicularly to the membrane grain for greater resistance to elongation. This design eliminates the potential for tearing along the perforations under high stress.

The life and performance of a membrane diffuser is dependent on the environment in which it is operating. Some wastewaters are more aggressive to membrane diffusers than others. Our extensive experience has provided us the opportunity of analyzing environments that are especially aggressive toward membrane materials. By focusing on these environments, we are able to understand and analyze how the membrane diffuser element ages with time in service and how this affects diffuser life. By concentrating on these points, we were able to develop the advanced EPDM recipe that is our membrane diffuser. The Aquarius membrane will provide a longer duty of service and at a higher level of efficiency. The cost associated with replacing units sooner and incurring additional power charges should be considered when purchasing equipment. While it is impossible to predict how a specific wastewater will affect the Aquarius membrane diffuser, we can state with confidence that the diffuser life will be longer than our competitor's diffusers. Based on our experience we can estimate that the life of the Aquarius membrane diffuser will be in excess of seven years and most likely approach ten years.

System Efficiency

In concert with diffuser design is oxygen transfer efficiency. Equally important to diffuser design and density, the arrangement of the diffuser within the tank also effects oxygen transfer efficiency. For example, if an aeration basin contains 1,000 – 9" diameter diffusers spaced uniformly throughout the basin with diffusers 48" on center of the air distribution headers and



48" between air distribution headers, a certain performance will be yield. However, if the same 1,000 diffusers are installed at 24" on center and 96" between air distribution headers, the performance can be as much as 20% lower. The point of this example is that in order to maximize oxygen transfer efficiency, the diffusers should be uniformly distributed throughout the basin and the reviewer should consider this when evaluating competitive proposals.

Piping Grid

One of the significant differences between the Aquarius system and other manufacturers is our approach to the design of the piping grid. Since a diffused aeration system is only as good as the delivery method of the supplied air, we recommend that considerable time be spent evaluating the pipe jointing and pipe supporting system. As noted above, the Aquarius design approach has been extensively field-tested with proven effectiveness. Everything within the grid system from the 2% titanium dioxide used in the PVC to prevent ultraviolet degradation, to the joint and support system is an integral part of the design. No component is assumed to be trivial or considered simply good enough. As such, we have employed sound engineering concepts in the design and implementation of every piece of equipment. The type of pipe joining is an example of this attention to detail. The Aquarius fixed joint system is not only easier to install but helps prevent the "blow apart" problem found in other systems. For reference, "blow apart" is a condition where the mechanical integrity of the piping system is lost and the pipes actually become separated from the support system during operation. A typical cause of this condition would be a system filling with water when air is lost to the aeration grid and then suddenly reintroduced. This is likely to occur during a loss of power to the blower or other unexpected shutdowns common to most treatment facilities. When the air is resupplied to the gird, a significant water hammer is often created which causes considerable stress on the pipe joints. Any design that does not take these additional forces into account is prone to failure. The two most common forms of fixed joint connections are flanged assemblies or threaded couplings. To reduce the cost to the owner, Aquarius has made an investment in special tooling and designed a unique threaded coupling for use in lieu of the more expensive to install flange system. Other suppliers design their piping joining system with expansion couplings or slip joints. In this configuration, which typically has a maximum pipe engagement

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of no more than two inches, the ends of the connecting pipes are free to move within the joint. Considerable evidence is available to substantiate that this design significantly increases the chances of leaking and blow apart. The installing contractor must be cautious when installing this type of system. To prevent failure, proper alignment is crucial. Also, the pipe and joints must be installed tight enough to prevent leaking at the joints, yet loose enough to allow for expansion and contraction of the pipe. Under jobsite condition, where installation procedures are often compromised, this is difficult at best.

The mechanical integrity of a fine bubble system is extremely important to long term successful performance. Our system of guide type supports and threaded union joints is field proven in dealing with blower outages and variations in air temperature. These are two areas that have resulted in common mechanical failure of other piping designs. The Aquarius piping design eliminates the potential for blow apart or failure of expansion or slip on type joint fittings commonly occurring with other manufacturers systems.

We feel very confident in the design, manufacturing and performance of our system and believe that the Aquarius system will provide the customer with the most cost effective and highest performing aeration system on the market today.



BASIS OF DESIGN

Aeration Tanks

Number of Tanks	4
Outside Dia. (m):	18.75
Inside Dia. (m):	7.75
Angular Degrees:	170
Depth (m):	4.6
Diffuser Depth (m):	4.0

Design Criteria

Condition:	<u>Design</u>	<u>Larger Blower</u>
Flow (m ³ /day):	4,000	---
BOD Concentration (mg/l):	160	---
NH ₃ Concentration (mg/l):	24	---
Kg Oxygen per kg BOD	1.5	---
Kg Oxygen per kg NH ₃ :	4.6	---
Alpha:	0.6	---
Beta:	0.99	---
Theta:	1.024	---
Dissolved Oxygen Conc. (mg/l):	2.0	---
Site Elevation (m):	182	182
Wastewater Temperature (°C):	20	20
Blower Output (scfm):	---	2,250

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System Operating Parameters

Condition:	<u>Design</u>	<u>Larger Blower</u>
In-Waste Oxy. Delivered (kg/day):	6,819	---
Std. Oxy. Delivered (kg/day):	3,003	6,338
Airflow Required (scfm):	955	2,250
Std. Oxygen Transfer (%):	27.7	24.8
Drop Leg Pressure (psig):	6.1	6.5

Equipment Arrangement

# Grids/Tank:	3
# Diffusers/Grid:	76
# Air Distributors/Grid:	4
Distributor Spacing (m):	1.2
Drop Leg Diameter (mm):	75
Total Number of Diffusers:	912



DATE: JULY 11, 2008
TO: TOWN OF THE BLUE MOUNTAINS
RE: AERATION SYSTEM RETROFIT
PROPOSAL NO. 2320-08

Aquarius is pleased to provide a proposal for the following equipment and services in order to ensure provision of a complete, integrated, diffused aeration system.

A. EQUIPMENT & SERVICE

Aquarius will provide four (4) fine bubble aeration systems, each consisting of three (3) aeration grids for installation in Aeration Tanks 1 & 2.

A total of three (3) aeration grids are required for each system. Each grid of the fine bubble aeration system will consist of the following:

- One (1) 75 mm diameter x 1 m long Sch. 40 PVC drop pipe including horizontal flange for connection to the stainless steel drop pipe at elevation 177.6 and a connection to the manifold.
- One (1) 100 mm diameter x 3.5 m long Sch. 40 PVC manifold with a connection to the drop pipe and air distributors.
- Four (4) 100 mm diameter SDR 33.5 PVC air distributors with a connection to the manifold.
- Required PVC pipe joint connections.
- Required 304 stainless steel piping supports with vertical supports, clamps, adjusting mechanism and anchor bolts.
- (76) fine bubble diffusers.
- Required 304 stainless steel bolts, nuts and gaskets for field assembly.

B. FIELD SERVICES

Aquarius will provide one (1) day of service, for installation inspection, equipment start-up, and operator training as required. Additional field service is available at a cost of \$950.00/day plus travel, lodging, and meal expenses.



C. AQUARIUS EXCLUSIONS

Aquarius excludes the following from its proposal:

- Field installation of equipment.
- Gaskets, bolts and nuts for connecting manifold to drop pipe.
- Blowers, valves, air main piping.
- Anchor bolts and other embedded materials except for anchor bolts specifically included in the Section A of this proposal.
- Any equipment not specifically listed in Section A.

D. PROJECT SCHEDULE

Approval Drawings & Data: 2-3 Weeks After Order Acceptance

Equipment Ready to Ship: 4-5 Weeks After Receipt of Approved Drawings & Data

E. PRICING

Net sell price in Canadian dollars for the Aquarius Equipment as described above, FOB point of manufacture with freight allowed to jobsite:

One system consisting of three grids – 2008 delivery **\$9,950.00**

Each additional system consisting of three grids – 2009 delivery **\$10,450.00**

F. PRICE NOTES

- Taxes are not included. Purchaser to pay directly all applicable taxes separate from purchase order to Aquarius.
- Quoted price is valid for 30 days from date of proposal.
- Price is based on equipment being released for fabrication no later than the 3rdTH Quarter 2008.
- Terms of Payment: 95% Net 30 days after shipment
5% Upon start up, NTE 120 days after shipment
- An interest charge of 1-½% per month will be added to past due accounts.



F. WARRANTY

All equipment to be free from defects in material and workmanship for a period of eighteen (18) months from date of shipment. If within such warranty period any such equipment is proved to Seller's satisfaction to be defective, Seller shall, at its option, repair or replace the defective equipment without charge, or refund the purchase price of the equipment.

Should you have any questions, please do not hesitate to contact us or our local representative.

Very truly yours,

A handwritten signature in cursive script that reads "David D. Lauer".

David D. Lauer, P.E.
Vice President – Sales & Marketing

cc: **Aquarius Representative:**
Envirocan
2 Marconi Court, Unit 15
Bolton, ON, Canada L7E 1E5
(905) 951-9672



Terms & Conditions of Sale

1. Acceptance and Cancellation. This writing is a solicitation by **Aquarius Technologies Inc.** (the "Seller") of an order for the products and/or services described in Seller's quotation or sales form, subject to these terms and conditions. No orders shall be binding upon Seller until accepted in writing by an authorized official of Seller at its home office in Port Washington, Wisconsin. Each order shall be subject to these terms and conditions, and acceptance of an order by Seller is expressly conditioned on Buyer's assent to such terms and conditions, which assent shall be deemed given by the Buyer's placement of any order for the products and/or services so described. Seller hereby objects to any additional or different terms or conditions, whether contained in any purchase order or other communication from Buyer. No order accepted by Seller may be altered or modified unless in writing signed by an authorized agent of Seller in pen and ink; and no such order may be cancelled or terminated except upon payment of Seller's loss, damage and expense arising from such cancellation or termination.

2. Prices. The prices quoted by Seller automatically expire thirty (30) calendar days from the date of Seller's quotation unless specifically noted otherwise.

The prices stated on the quotation or sales form for the products and/or services are Seller's prices with all of the terms in this form, including the exclusive warranty and the various disclaimers and limitations of liability enforceable against Buyer. If Buyer wants a greater or additional warranty or wants Seller to be liable for some or all of the disclaimed or limited liability, Buyer must notify Seller. Seller will then make a new offer containing prices reflecting that additional exposure. By placing an order at the prices initially quoted by Seller, Buyer understands that it is foregoing the possibility, among other things, of recovering consequential damages from the Seller and of indemnity for tort liability, in exchange for Buyer obtaining a lower sales price for the products and/or services.

3. Changes. Seller may at any time make such changes in design and construction of products, components or parts as Seller deems appropriate, without notice to Buyer. Seller may furnish suitable substitutes for materials unobtainable because of priorities or regulations established by governmental authority or nonavailability of materials from suppliers.

4. Delivery, Claims and Delay. All delivery dates are approximate. Time is not of the essence. Delivery will be f.o.b. point of shipment, and all risk of loss or damage in transit shall be borne by Buyer. Seller reserves the right to make delivery in installments. All such installments shall be separately invoiced and paid for when due, without regard to subsequent deliveries. Delay in delivery of any installment shall not relieve Buyer of its obligation to accept remaining deliveries.

If shipment shall be deferred at Buyer's request, payment shall become due and payable upon notification by the Seller that the products provided for by this agreement are ready for shipment. In case of such delay in shipment, storage shall be at the Buyer's risk and expense. Prorata payments shall be made for partial shipments.

Claims for shortages or other errors in delivery must be made in writing to Seller within 10 days after receipt of shipment; and failure to give such notice shall constitute unqualified acceptance and a waiver of all such claims by Buyer. Claims for loss or damage to goods in transit should be made to the carrier and not to Seller.

Buyer is responsible for the maintenance, operation and, except as otherwise provided in the Seller's quotation or sales form, the installation of the products. Buyer shall keep and maintain said products in good condition and shall not permit waste to be committed thereon and shall keep products fully insured against loss or damage from the normal hazards of such installation, maintenance and operation until the balance of the purchase price is fully paid in cash. Injury or destruction of such property after delivery pursuant to this section shall not release the Buyer from its obligation to make payments as herein provided. Seller shall not be liable for any damage as a result of any delay due to any cause beyond Seller's reasonable control, including, without limitation, an act of God, act of the Buyer, embargo or other governmental act, regulation or request, fire, act of terrorism, accident, strike, slow-down, war, riot, delay in transportation or inability to obtain necessary labor, materials, transportation or manufacturing facilities. In the event of any such delay, the date of delivery shall be extended for a period equal to the time lost by reason of the delay. Buyer's exclusive remedy for other delays and for Seller's inability to deliver for any reason shall be rescission of the purchase agreement.

5. Payment Terms. Terms of payment shall be as specified in Seller's proposal. If not so specified, terms of payment for products shall be net cash, thirty (30) days after shipment of products. Where Seller is to provide installation, terms of payment for installation shall be as specified in Seller's quotation or sales form. If not so specified, terms of payment for installation shall be net cash, thirty (30) days after completion of installation of Seller's products. Interest at the rate of one and one-half percent (1 1/2%) per month (but not greater than the highest rate permitted by applicable law) will be charged on all accounts not paid when due.

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6. Title and Security Interest. Until Seller collects in full all amounts Buyer owes under the order and any other sales between the parties, Seller retains title to the products and Buyer grants to Seller a continuing security interest in and a lien upon the products and the proceeds thereof (including insurance proceeds), as security for the payment of all such amounts and the performance by Buyer of all of its obligations to Seller pursuant to the order and all such other sales, and Buyer shall have no right to sell, encumber or dispose of the products. Buyer shall execute any and all financing statements and other documents and instruments and do and perform any and all other acts and things which Seller may consider necessary, desirable or appropriate to establish, perfect or protect Seller's title, security interest and lien. In addition, Buyer authorizes Seller and its agents and employees to execute any and all such documents and instruments and do and perform any and all such acts and things, at Buyer's expense, in Buyer's name and on its behalf. Such documents and instruments may also be filed without the signature of Buyer to the extent permitted by law.

7. Limitations on Warranties and Remedies. Seller warrants all products manufactured by it and supplied hereunder to be free from defects in material and workmanship appearing within one (1) year from the date of shipment to Buyer. This warranty shall not apply to prime movers, starting products, electrical apparatus, parts, material and any other products not manufactured by Seller; such products are sold **AS IS**, except that the warranties, if any, of the respective manufacturers of such products, parts or material shall be assigned by Seller to Buyer. Seller has no liability for products installed by anyone other than it or its authorized agent. Decomposition by chemical action and wear caused by the presence of abrasive materials shall not constitute defects under the foregoing warranty, nor shall Seller have any responsibility hereunder with respect to products which have been repaired or altered by others without Seller's written consent.

Seller warrants that any services it provides hereunder against failures, appearing within thirty (30) days after completion thereof, by Seller to perform such services in a manner consistent with customary practice in Seller's industry.

If within the applicable warranty period any products or services warranted hereunder are proven to Seller's satisfaction to be defective, such products will be repaired, or at Seller's option, replaced without charge. Seller's obligation hereunder is further conditioned upon Seller's receipt of written notice of any alleged defect within ten (10) calendar days of its discovery and, at Seller's option, the return of the allegedly defective products to Seller at the place Seller directs.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER REPRESENTATIONS AND WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE, AND SELLER SHALL NOT BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES WHATSOEVER WITH RESPECT TO PRODUCTS, PARTS OR SERVICES MANUFACTURED OR FURNISHED BY IT, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO.

Any description of the products, whether in writing or made orally by Seller or its agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets or similar materials used in connection with Buyer's order are for the sole purpose of identifying the products and shall not be construed as an express warranty. Any suggestions by Seller or Seller's agents regarding use, application or suitability of the products shall not be construed as an express warranty unless confirmed to be such in writing by Seller.

8. Taxes and Other Charges. Any manufacturer's tax, retailer's occupation tax, use tax, sales tax, excise tax, duty, custom, inspection or testing fee, or any other tax, fee or charge of any nature whatsoever, imposed by any governmental authority, on or measured by any transaction between Seller and the Buyer, shall be paid by the Buyer in addition to the prices quoted or invoiced, unless Seller specifically states that such taxes or charges are included in such price. In the event Seller shall be required to pay any such tax, fee or charge, the Buyer shall reimburse Seller therefore (including any interest and penalties relating thereto), or, in lieu of such payment, the Buyer shall provide Seller at the time the order is submitted with an exemption certificate or other document acceptable to the authority imposing the same.

9. Patents, Trademarks and Copyrights. Seller will, at its expense, defend any suits that may be instituted by anyone against Buyer for alleged infringement of any United States patent, trademark or copyright relating to any products manufactured and furnished by Seller hereunder, if such alleged infringement consists of the use of such products, or parts thereof, in Buyer's business for any of the purposes for which the same were sold by Seller, and provided Buyer shall have made all payments then due hereunder and shall give Seller immediate notice in writing of any such suit and transmit to Seller immediately upon receipt all processes and papers served upon Buyer and permit Seller through its counsel, either in the name of Buyer or in the name of Seller, to defend the same and give all needed information, assistance and authority to enable Seller to do so. If such products are in such suit held in and of themselves to infringe any valid United States patent, trademark or copyright, then: (a) Seller will pay any final award of damages in such suit attributable to such infringement, and (b) if in such suit use of such products by Buyer is permanently enjoined by reason of such infringement, Seller shall, at its own expense and at its sole option, either (i) procure for Buyer the right to continue using the products, (ii) modify the products to render them non-infringing, (iii) replace the products with non-infringing goods, or (iv) refund the undepreciated portion of the purchase price and transportation costs paid by Buyer for the products or services, determined after depreciation on the basis of a five-year useful life.

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Notwithstanding the foregoing, Seller shall not be responsible for any compromise or settlement made without its written consent, or for infringements of combination or process patents covering the use of the products in combination with other goods or materials not furnished by Seller. **THE FOREGOING STATES THE ENTIRE LIABILITY OF SELLER FOR INFRINGEMENT; AND IN NO EVENT SHALL SELLER BE LIABLE FOR CONSEQUENTIAL DAMAGES ATTRIBUTABLE TO AN INFRINGEMENT.**

As to any products furnished by Seller to Buyer manufactured in accordance with drawings, designs or specifications proposed or furnished by Buyer or any claim of contributory infringement resulting from the use or resale by Buyer of products sold hereunder, Seller shall not be liable, and Buyer shall indemnify Seller against any award made against Seller for any and all patent, trademark or copyright infringements.

10. Substitutes. Seller may furnish suitable substitutes for products unobtainable because of priorities or regulations established by governmental authority or the non-availability of goods from suppliers.

11. Permits. The Buyer shall have full responsibility for securing the requisite permits and compliance with all health and sanitation laws, ordinances and regulations pertaining to the installation of the products involved in a sewage treatment plant or other products sold by Seller.

12. Limitations on Consequential Damages and Other Liability; Buyer's Indemnity. Except as otherwise agreed in writing, Seller's liability with respect to the products and/or services sold hereunder shall be limited to the warranty provided in Paragraph 7 hereof and, with respect to other performance of this contract, shall be limited to the contract price. **SELLER SHALL NOT BE SUBJECT TO AND DISCLAIMS ANY OTHER OBLIGATIONS OR LIABILITIES, WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES OF LAW, WITH RESPECT TO PRODUCTS SOLD OR SERVICES RENDERED BY SELLER, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO.**

Without limiting the generality of the foregoing, Seller specifically disclaims any liability for property or personal injury damages, penalties, special or punitive damages, damages for lost profits or revenues, loss of use of products or any associated products, cost of capital, cost of substitute products, facilities or services, down-time, shut-down or slowdown costs, or for any other types of economic loss, and for claims of Buyer's customers or any third party for any such damages. **SELLER SHALL NOT BE LIABLE FOR AND DISCLAIMS ALL CONSEQUENTIAL, INCIDENTAL AND CONTINGENT DAMAGES WHATSOEVER.**

Buyer shall indemnify Seller against any and all losses, liabilities, damages and expenses (including, without limitation, attorneys' fees and other costs of defending any action) which Seller may incur as a result of any claim by Buyer or others arising out of or in connection with the products and/or services sold hereunder and based on product or service defects not proven to have been caused solely by Seller's negligence.

13. Technical Information. Any sketches, models or samples submitted by Seller shall remain the property of Seller, and shall be treated as confidential information unless Seller has in writing indicated a contrary intent. No use or disclosure of such sketches, models and samples, or any design or production techniques revealed thereby, shall be made without Seller's express written consent.

14. Buyer's Property. No property of Buyer placed in Seller's custody for performance of this contract is covered by Seller's insurance, and Seller assumes no risk in the event of loss or damage to such property by fire, water, burglary, theft, civil disorder or any accident beyond Seller's reasonable control.

15. Tools. Any dies, jigs or tools which Seller manufactures or acquires for performance of this contract shall remain the property of Seller, notwithstanding any charges therefore. Tool charges convey to Buyer the right to have the tools used by Seller for performance of this contract, but do not convey title or right of possession. Seller shall be responsible for routine maintenance and repair of such tools, dies and jigs. Major overhauls, replacements or changes shall be charged to the Buyer.

16. Returns. Products may be returned to Seller only when Buyer obtains Seller's advance written permission therefore. Returned products must be securely packaged to reach Seller without damage; and any cost incurred by Seller to put products in marketable condition will be charged to Buyer.

17. Governing Provisions. **THE CONTRACT FOR SALE AND THESE TERMS AND CONDITIONS SHALL CONSTITUTE THE ENTIRE AGREEMENT BETWEEN BUYER AND SELLER AND SHALL BE GOVERNED BY AND CONSTRUED ACCORDING TO THE LAWS OF THE STATE OF WISCONSIN (WITHOUT REFERENCE TO PRINCIPLES OF CONFLICTS OF LAWS). THE RIGHTS AND OBLIGATIONS OF THE PARTIES HEREUNDER SHALL NOT BE GOVERNED BY THE 1980 U.N. CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS. SELLER RESERVES THE RIGHT TO IMPOSE DIFFERENT OR ADDITIONAL TERMS OF SALE ON INTERNATIONAL SALES AND/OR SALES OF SERVICES.**