# Project Description Report

**August 2013**

## Toronto Zoo Anaerobic Digester

Riepma Consultants Inc.

# Project Description Report

## Toronto Zoo Biogas Project
## Table of Contents

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## Toronto Zoo Biogas Project

### 1.0 Introduction

#### 1.1 Purpose

The purpose of this draft Project Description Report is to outline the proposed digester project to be located at the Toronto Zoo as required in the Renewable Energy Approval process. The proposed biogas plant is a Class 3 Anaerobic Digester as defined in Ontario Regulations 359/09 and 521/10.

#### 1.2 Approvals Required

The Project has received a FIT contract (F-003038-BIG-211-203). Connection approval, currently in process, is required from Toronto Hydro to connect to their grid.

#### 1.3 Federal Approvals

No federal government approvals are required.

#### 1.4 Water Taking

No water taking is required for this project.

#### 1.5 Project Location

The location of the proposed 500kW biogas plant is shown on the drawing in Appendix 1. The land required is currently part of the Zoo's composting operation and will occupy an area of approximately 50m x 100m (5000 sq. m. or 1.3 acres) of the site. The digester will replace the zoo's current composting operation.

It is located on the east side of Meadowvale Road, south of the access road to the former Beare Road land fill site and is described as Lot 4, Concession 3, Scarborough.

The point of common coupling for the grid connection is located at the northeast corner of Meadowvale Road and the Beare landfill access road, approximately 200 meters north of the project site. (GPS coordinates: 43°49'06.16"N, 79°10'23.76"W). An overhead pole line will be constructed from the new digester, along the existing access road to the connection point.

#### 1.6 Property Ownership

The property on which the Biogas plant is to be constructed is owned by the Toronto Region Conservation Authority (TRCA) and is leased to the City of Toronto for the purpose of operating a Zoo. The Zoo Board has agreed to

enter into a ground lease with the Zoo Biogas Co-op for the facility. TRCA has approved the construction of the plant on the site. The City of Toronto has also confirmed their approval of the project.

### 1.7 Project Ownership

On completion the Biogas plant will be owned by a community owned co-operative organization called ZooShare Biogas Cooperative Inc.. The sale of shares in the co-op is currently underway and it is expected that many Zoo members as well as members of the public will be acquire ownership in the co-op.

### 1.8 Development Team

The team that has been contracted by the Zoo to develop the project is a Joint Venture consisting of:

Regenerate Biogas
Angus Power
Kronos Project Management Group Inc.
Riepma Consultants Inc.

The principle contact for the project REA is Clare Riepma, P.Eng.,RPP., 13041 Highway 7, Georgetown, Ontario, L7G 4S4. Phone 905-877-6751, email riepma@riepma.ca

## 2.0 Project Description

### 2.1 Site Description

The site is located on an isolated peninsula of land located between wooded slopes down to Meadowvale Road on the west, the existing composting operation and a hydro corridor in the valley to the south and the Rouge River valley to the east. See also the air photo located in Appendix 1. To the north is a vacant field used for overflow parking and further north are additional parking lots associated with the zoo.

The site of the Biogas plant is located on the lands currently used for the Zoo's composting operation. It is flat and devoid of vegetation cover and has been modified to accommodate the composting operation. The site is surrounded by a 2 meter high berm that was constructed as part of the compost operation. The area slopes slightly to the south and is over 200 meters from the water's edge of the Little Rouge River.

### 2.2 Surrounding Land Uses

The nearest structure is a restored brick farmhouse (Pearce House) located some 230m to the north east and is used as the Rouge Valley Conservation Centre. The nearest residential area is located 750 meters to the south west on the opposite side of Meadowvale Road. The nearest home is located 420

meters to the southwest. Appendix 1 demonstrates the land use within 300m of the site. Lands immediately to the north of the site have been graded and are used for overflow parking for the Zoo. While designated for parking purposes, these lands are not in fact actually ever used for parking.

### 2.3 Land Use History

Discussions with Zoo and TRCA staff indicate that the composting operation to the south of the site commenced in the late 1980's. Prior to that time the land was vacant and historically had been used for agricultural purposes. As these uses are not of environmental concern and there are no petroleum or industrial uses in the vicinity, the preparation of a Record of Site condition is not considered to be necessary.

### 2.4 Anaerobic Digestion

As organic materials decompose in an anaerobic (non-oxygen) environment, at 38 or 52 degrees C, they produce a gas called biogas. The de-composition (digestion) of these materials is by naturally occurring microbes. Biogas is 55% to 65% methane ($CH_4$), with the remainder being Carbon Dioxide ($C0_2$) and trace $H_2S$. Biogas can be used to run an engine genset to produce electricity and heat.

### 2.5 Project Description

The biogas plant to be built at the Toronto Zoo site consists of two 21m diameter vessels, a 38m diameter storage vessel and an engine / control building housing the initial 500kW engine as well as a series of smaller input and processing tanks. 100% of the fuel for the engine is renewable biogas.

### 2.6 Site Design

The design of the site is shown in Appendix 2. The major components of the biogas plant include:

- 1 engine / control room with room for 1 engine, a small standby backup generator with ATS, heat recovery system, electrical switchgear and transformer, computer control system.
- 1 sealed concrete digester with double membrane roof
- 2 concrete digestate storage vessels. The first vessel is designed to be converted into a digester should the plant be expanded in the future.
- 1 liquid input tank, a hydrolysis tank and a buffer tank
- 3 tanks in series that can be used for pasteurization if required.
- Automatic flare
- 1 roof water storage tank
- 1 solids separator on a concrete pad
- A 200 meter long overhead pole line to the point of common coupling

## 2.7 Input Materials

### 2.7.1 Solids

Solid material will be approximately 3,000 tonnes of manure provided by the Zoo annually from their current operations. This manure is currently composted on the site. Additional solid materials may be available in the area.

### 2.7.2 Liquids

Approximately 12,000 tonnes of grocery store wastes will be provided by a major retailer in the Toronto area. This material will be vegetable waste and/or Fats, Oils and Greases (FOG). Other liquids may also be available in the area.

### 2.7.3 Roof Water Collection

The building is designed to collect much of the roof water. While this water is not generally used in the process, it is used for general cleanup and for washing down equipment.

## 2.8 Engine Room Design

### 2.8.1 Engine

The genset will be a 500kW machine. The major suppliers of these engines are MWM, Martin Machinery, GE Jenbacher, 2G etc. The building is designed to be expanded to permit the eventual doubling of capacity if that becomes possible in the future. The design of the building, exhaust fans and silencers will meet provincial standards with respect to noise and emission levels.

A small (20kW) diesel powered genset with an Automatic Transfer Switch is also included in the building. This engine operates as a backup should access to the grid not be available. This engine will keep the essential pumps, sensors, flare and control system powered in the event of a power outage.

### 2.8.2 Heat Recovery

The engine will produce approximately 500kW of thermal energy in addition to the electrical energy produced. In order to utilize the heat produced, the engine will be equipped with a heat recovery system. The engine room will contain a heat recovery manifold to distribute the hot water. The digester will require approximately 100 to 150 kW of heat to maintain it at temperature. Additional heat will be used by the pasteurization and hydrolysis systems. The remaining heat will be available for use by the Zoo. There is some possibility that the Zoo will construct a greenhouse beside

the digester location in the future. The heat from the digester can be used to offset natural gas for greenhouse heating and the CO2 can be captured for the promotion of plant growth.

#### 2.8.3 Control System

The digester system is electronically controlled. The engine / control room provides desk space for a computer that controls and records all aspects of the operation of the system. The system is also capable of being remotely controlled over the internet or by smart phone.

#### 2.8.4 Switchgear

The engine room also contains the electrical switchgear that controls the quality of the power exported to the grid. A transformer is located outside of the building.

### 2.9 Pasteurization

#### 2.9.1 Pasteurization System

Should incoming materials require pasteurization, the material will be held at $50^{o}$ C for 20 hours. The material will be received in a 100 $m^3$ tank. The pasteurizer is 45 $m^3$ in size and the buffer tank is 90$m^3$ in size. From the buffer tank the material will be pumped into the digester on a pre-programmed timed basis.

### 2.10 Input System

#### 2.10.1 Solids

Zoo staff will deliver solid manure approximately three times per week by truck to the site. The manure will be dumped into the receiving tank where it will be chopped and mixed with liquid vegetable material

#### 2.10.2 Liquid

Arriving liquid materials will also be received in the in-ground 160 $m^3$ receiving tank. The tank is equipped with a camlock quick connection for easy, air tight connection to the truck. This tank will be heated and equipped with a chopper pump and mixer. The tank is sealed and the displaced air can be directed to an activated carbon filter if necessary. This vessel can also be used to return the liquid fraction of the digestate to reduce solids in the digester.

### 2.11 Digester Design

#### 2.11.1 Structure

The digester is constructed of reinforced concrete and has a centre column. It is 21 meters in diameter and 6 meters high. Total

volume is 2,077 cubic meters; operating capacity is 1,731 cubic meters. Design retention time is 38 days. It is insulated and metal clad and the floor is 1.2m to 2m (4 to 6 feet) below grade. Interior exposed concrete in the headspace is sealed to prevent corrosion. Structural drawings will be designed and stamped by a Professional Engineer and regular inspections during construction are required.

### 2.11.2 Foundation drainage

Foundation design is by the structural engineer based on the geotechnical report. All vessels are provided with a foundation drainage system that is connected to a pump in a shallow well. This permits the well to be examined daily to determine if any leaks are occurring.

### 2.11.3 Heating

Hot water heat lines are imbedded in the walls and floors of the digester. A three way mixing valve and a computer controlled pump system, controls the temperature of the vessel. Temperature control is critical to ensure a productive and healthy biology in the digester.

### 2.11.4 Roof

The digester will be equipped with a biolene (or equivalent) gas storage membrane with a porosity consistent with MOE requirements. Gas storage in the vessel is approximately 1,000 cubic meters. This membrane will be weather protected by a second roof.

### 2.11.5 Over/ under pressure relief

The digester will be equipped with an over/under pressure relief valve in the event of a malfunction. The valve is connected to the computer recording device that records occurrences.

### 2.11.6 Sulfur Removal

A wooden floor is located at top of the digester, below the gas membrane. A small amount of oxygen is introduced into the headspace of the digester. Sulfur reducing bacteria utilize the oxygen to grow on the wooden floor structure and remove H2S from the biogas. Eventually the elemental sulfur falls into the digestate and is removed into the storage. H2S in the biogas should be below 200 ppm to minimize the potential for engine damage.

## 2.12 Digestate Storage

The first digestate storage vessel is the same size and dimensions as the digester. This vessel will have heat lines in its walls to permit it to be converted to a digester at a later date. The second storage vessel is 39 meters in diameter and 4.3m high with a storage capacity of 4,700 $m^3$. Both vessels are also constructed of reinforced concrete and are equipped with piping to permit them to be filled and emptied. Each will also be equipped with a mixer to keep solids suspended.

Digestate storage volume is sufficient for approximately 180 days before it is field applied.

## 2.13 Flare

The flare is designed with a blower, flame arrester and an automatic start with the capacity to burn 150% (400 cubic meters per hour) of the biogas expected from the plant. The flare is used only when the engine is down and the gas storage is full.

## 2.14 Separator

The design includes a separator unit to separate the solid fraction from the liquid in the digestate after digestion is complete. The liquid fraction will be stored in the two storage vessels. The separated solids will be bagged and sold as a soil conditioner by others. The bagging and associated handling is not within the project scope.

## 2.15 Transformer

The transformer used in this application will be a 500KVA dry type transformer with no oil and therefor requiring no secondary containment.

## 2.16 Outputs

### 2.16.1 Liquid

The liquid digestate is an odour free, nutrient rich fertilizer. It will be field applied at local farms. Several members of the Ressor family operate farms in the area and have indicated their interest in receiving the liquid material. They operate in excess of 1000 acres of cash crops.

### 2.16.2 Solid

The intention is that the solid material will be separated, bagged and marketed as a soil amendment by others. Separated material will be stored on a small pile before being transported to the bagging operation. Should no market develop for this material, separation will not occur and the material will be field applied.

### 2.16.3 Electrical Grid Connection

The location of the point of common coupling has is at the northeast corner of Meadowvale Road and the Beare road landfill access road. The

pole line will be constructed along the existing access road to the compost site.

#### 2.16.4 Biogas

The biogas is used to fuel the engine. Between the digester and the engine the gas flows through a cooling field installed in the ground. This field functions to cool the gas and remove the moisture. The moisture that is removed is collected in a condensate pit and pumped into the hydrolysis input tank for recycling into the digester.

#### 2.16.5 Heat

The engine produces approximately 500kW of thermal energy. Between 100kW and 150kW is needed to heat the digester. The remainder of the heat is available for use by others. The Zoo is considering the construction of a greenhouse immediately adjacent to the digester site. Surplus heat from the engine can be used to offset natural gas required to heat the greenhouse.

## 3.0 Construction

### 3.1 Timing

Construction of the project is scheduled to commence in Summer 2014 and be completed in the fall of 2014. Start up and commissioning will require an additional two months and full power is expected shortly after that.

### 3.2 Excavation

The first construction activity on site will be the excavation for building footings and the vessels. No stripping, clearing or grubbing is required because the site is clear and the topsoil has been removed as part of the composting area construction.

No excavated materials will be transported off site. All materials will be stored and used as part of the final grading. As the site is entirely surrounded by an existing berm, no additional siltation control is required.

### 3.3 Construction

#### 3.3.1 Building

Construction of the building will be commenced first. The intent is to complete the shell of the building so that it can be used as the construction office and lay down area.

#### 3.3.2 Vessels

The concrete for the vessels will be poured immediately after the foundations of the building are completed. The digester will then be completed with its wooden deck, mixers, insulation and cladding.

Electrical and piping work will be undertaken in the next step and the interior equipment in the building will be completed.

#### 3.3.3 Electrical Grid Connection

The electrical grid connection will be constructed as soon as the building is completed.

### 3.4 Completion

Final grading, cleanup, topsoil and seeding will be delayed until suitable fall weather is available.

### 3.5 Start Up and Commissioning

All of the Biogas plant components will be tested to ensure that they work according to specification. The digester will be filled with liquid dairy manure and heated with a portable boiler over a period of time, to start the biological process. Slowly solid zoo manure will be added and then finally the grocery wastes will be included.

Unsuitable gas will be flared until it meets engine specifications. When the gas quantity and quality is suitable, the engine will be started and commissioned.

## 4.0 Facility Operation

### 4.1 Input materials

#### 4.1.1 Solids

The solid manure (13.6 cubic meters per day) used in the digester will arrive by zoo truck and will be dumped into the receiving tank and mixed with liquid. From there it will be pumped into the hydrolysis tank

#### 4.1.2 Liquids

Liquid manure, used to start the digester, will be received in the input receiving tank. From there it is pumped into the hydrolysis tank and then into the digester as needed.

Materials requiring pasteurization are received in the pasteurization receiving tank before being placed into the pasteurizer.

#### 4.1.3 Pasteurization

Incoming materials requiring pasteurization will be pumped into the pasteurizer and held at 50 degrees C for 20 hours. On completion, the material will be pumped into the buffer tank before being pumped into the digester at the pre-selected rate.

### 4.2 Output materials

#### 4.2.1 Solids

As the digestate continuously leaves the digester it passes through a separator unit (screw press). The solid fraction is separated out and piled on a concrete slab or into a roll off box. The solid material will be further processed and bagged by others and marketed as a soil amendment material. The process after the separator is beyond the project scope. Should the bagging and marketing of the solid material not materialize, separation would not occur and the complete digestate would be stored and later field applied.

#### 4.2.2 Liquids

After separation, the liquid fraction is stored in the digestate storage vessels. Twice per year (in the spring and fall) the vessels will be emptied and the material delivered to local farmers (or the Zoo) for field application. Liquid digestate is a desirable organic substitute for fertilizer. Its nutrient value is dependent on the input materials.

### 4.3 Hazardous materials

#### 4.3.1 Disposal

No hazardous materials are used or produced in the digestion process. Engine oil and filters are changed regularly and will be disposed of in accordance with applicable requirements.

### 4.4 Groundwater Monitoring

#### 4.4.1 Groundwater

All in-ground tanks are equipped with foundation drains. These drains are connected to a monitoring well which is inspected daily. Should a leak occur in a vessel, it will be readily apparent in the monitoring well. In that event, the vessel can be emptied and the monitoring well pumped out to ensure that groundwater is not affected.

### 4.5 Air Emissions

#### 4.5.1 Digester

The digester gas membrane will have a porosity of less than $500 cm^3/m^2/day/bar$. As the nearest odour receptor is over 125 meters to the north, the requirements of Regulation 359/09 are satisfied.

#### 4.5.2 Engine

Engine emissions are provided by the engine manufacturer. Emissions and dispersion modeling will conform to applicable provincial standards.

#### 4.5.3 Flare

The operation of the flare will only occur when the engine is down and the gas storage is full. The flare will also be designed to conform to

provincial standards. The location of the flare exceeds the setback distances required in regulation 359/09.

#### 4.5.4 Input materials

Solid input materials on the site will be dumped directly into the receiving tank and mixed with liquid. No manure will be stored on site in the open. Any odour generated will be considerably less than that currently occurring as a result of the existing composting operation. There are no sensitive receptors in the vicinity.

Liquid inputs are delivered on site by truck and received in the input tanks. These tanks are sealed in order to prevent odour emissions and displaced air can be filtered through a charcoal filter if necessary.

#### 4.5.5 Output materials

The output materials are generally odour free. As the nearest receptor (office) is over 230 meters to the north and the nearest residence is 430 meters to the southwest, odour concerns are unlikely. Any odour generated will likely be considerably less than is currently generated by the compost operation.

### 4.6 Noise

#### 4.6.1 Engine

Engines in this size range will produce 90 to 100 dBa at 1 meter when operating at full power. The engine room, heat dump radiators and exhaust stacks will be designed to meet provincial standards.

#### 4.6.2 Operations

The only noise generated by the operation of the biogas plant is produced by the small motors and pumps. As most of these are inside of vessels no audible noise occurs on the site.

### 4.7 Traffic

#### 4.7.1 Truck Movement

Solid zoo manure (on average approximately 14 cubic meters per day) will be delivered by truck 2 or 3 times per week. Liquid inputs (30 cubic meters per day) will be delivered by truck once per day.

In the spring and fall the digestate storage vessels will be emptied. This will result in approximately 185 truck trips each time the

vessels are emptied. It is expected that the work would occur over a six to eight week period resulting in an average of 3 or 4 truck trips per day.

As access is directly to the former Beare Road landfill site access road and Meadowvale Road, the volume of truck traffic can easily be accommodated and will not impact the surrounding uses.

## 5.0 Environmental Effects

### 5.1 Manure Treatment

Currently the Zoo's manure is composted. Anaerobic Digestion will result in a liquid digestate that is superior in nutrient quality and desirable for field application. This reduces the need for chemical fertilizers in agricultural operations.

### 5.2 Methane Destruction

Currently the Zoo's manure is composted releasing harmful greenhouse gases. The other waste materials are currently shipped to landfill or out of province for disposal. Both result in the use of fossil fuels and the creation of leachates and greenhouse gases. Anaerobic Digestion replaces fossil fuels used in electricity and heat production while consuming methane ($CH_4$) which is 23 times more damaging as a greenhouse gas than $CO_2$

### 5.3 Landfill Diversion

Currently many organics are sent to landfill. This practice uses scare and valuable landfill capacity. Anaerobic Digestion offers a productive alternative use for these waste resources.

### 5.4 Weed Seed Destruction

All weed seeds in the manure are destroyed as a result of the heat used in Anaerobic Digestion. This reduces the amount of herbicides required by the agricultural industry to control weeds.

### 5.5 Pathogen Destruction

Almost all pathogens, particularly ecoli, are destroyed by the heat in Anaerobic Digestion. As a result the potential for ground water contamination is reduced.

### 5.6 Surface Water

There are no creeks or watercourses in the vicinity of the proposed construction. The composting site is completely surrounded by an earthen berm which will be maintained. As a result all surface water is retained on site. Existing grades will be maintained to the extent possible. As all input materials will be in sealed tanks, no impact on surface water quality is anticipated. As the structures represent a very small footprint on a large open

area, storm water management is not warranted. In addition two of the vessels are open topped and will not shed water. As a result flow from the site will not be measurably increased. All areas of the site that were disturbed during construction will be top soiled and seeded. The existing man made shallow pond in the northeast corner of the site will not be affected by construction or operations.

### 5.7 Ground Water

The Zoo had drilled one borehole within the construction area previously. In August 2011 four test pits were excavated to examine local soil conditions. Throughout the construction area the materials are relatively consistent. The top 1 to 2.5 feet is a layer of imported gravel that is dense and compacted. From 2.5 feet to 3 feet below the surface is a layer of topsoil. Below 3 feet is a silty-sand with some stones, representative of a former shoreline feature. The material at this elevation is looser than the material above. In only one test hole was groundwater encountered in a small gravel vein at a depth of 5 feet. This is considered a localized condition.

All in-ground vessels are equipped with foundation drains and monitoring wells. This ensures that ground water contamination will not occur. There are no domestic wells in the vicinity that could be impacted. The construction and operation of the biogas facility is not expected to have any impact on the ground water environment.

### 5.8 Air Emissions

Air emissions, including noise and other emissions from the engine and flare, will conform to current Ontario regulations. Separate Odour and ESDM reports will be provided for MOE approval. Odour and noise emissions will be controlled in the design of the project to minimize any potential negative environmental effects from air emissions.

## 6.0 Cultural Heritage Assessment

### 6.1 Assessment

Part of the site has been filled and the area is heavily impacted by the current composting operation. As a result there is a low probability of locating archeological materials on the site. Should materials be found as construction proceeds, work will cease and the appropriate experts will be retained to undertake retrieval operations. The archeological study prepared for the site concludes that no further assessment is required.

### 6.2 Heritage Resources

Heritage Toronto and the Ministry of Culture and Tourism have confirmed that there are no cultural or archeological heritage resources in the vicinity that would be affected by the project.

## 7.0 Natural Heritage

### 7.1 Existing Site Conditions

The site is heavily impacted by the existing parking lots and the composting operation. It is also well removed from the top of the valley slopes. No trees will be removed and changes to existing grade will be minimal. The site is not suitable as a wildlife habitat as a result of current human activity. A Species At Risk (SARA) review has concluded that there is no suitable habitat for endangered mammals or birds at the site or in the immediate vicinity of the project. MNR has confirmed this assessment.

### 7.2 Impact

There are no water bodies, watercourses, wetlands, woodlots, slopes or other significant natural features in the vicinity of the project. As a result no impact on Natural Heritage resources is likely.

## 8.0 Ground and Surface Water Regimes

### 8.1 Ground Water

Initial boreholes conducted by the Zoo suggest that the water table is approximately 1 meter below grade at this location. This is considered to be a localized perched condition and additional testing is required to confirm site soil and groundwater conditions. Construction will be undertaken so that there will be no impact of the ground water regime.

All in-ground vessels are equipped with foundation drains and monitoring wells. This ensures that ground water contamination will not occur. There are no domestic wells in the vicinity that could be impacted.

### 8.2 Surface Water

There are no creeks or watercourses in the vicinity of the proposed construction. Existing grades will be maintained to the extent possible. As all input materials will be in sealed tanks, no impact on surface water quality is anticipated. As the structures represent a very small footprint on a large open area, storm water management is not warranted. All areas of the site that were disturbed during construction will be topsoiled and seeded and perimeter siltation fencing will be installed prior to construction.

## 9.0 Land Use Considerations

### 9.1 Land Use Policy

#### 9.1.1 Provincial Policy

##### 9.1.1.1 Provincial Policy Statement 2005

The Provincial Policy Statement in Sections 1.7 and 1.8 supports the provision of renewable energy systems and alternative energy systems in both settlement and rural areas. The statement indicates that long term economic prosperity and improved air quality is supported by these uses.

##### 9.1.1.2 Greenbelt Plan

The subject lands are designated as Protected Countryside in the Greenbelt Plan. They are not part of the Natural Heritage designation in this area. The Greenbelt Plan includes renewable energy systems within the definition of infrastructure. New infrastructure is permitted throughout the Protected Countryside and within Natural Heritage Areas provided impacts on the natural environment are minimized.

#### 9.1.2 Municipal Official Plan

The City of Toronto Official Plan designates the general area as Parks and Open Space. Utilities, the zoo and its accessory uses are permitted uses in the designation. A change to the Official Plan is not required to permit the Biogas project to proceed.

#### 9.1.3 Municipal Zoning

The subject property is zoned I-ZG in the City of Toronto Bylaw 218-2008. Renewable Energy projects are specifically permitted in all zones. The City has confirmed that the anaerobic digester project is permitted pursuant to the bylaw.

#### 9.1.4 Conservation Authority

The Toronto and Region Conservation Authority has approved the biogas plant. A permit form the Authority will not be required before construction as the project is not within the regulated area.

### 9.2 Surrounding Land Uses

The only nearby structure is an office use that is some 230 meters distant from the proposed digester. The nearest residential neighbour is 320 meters to the

south west on the other side of Meadowvale Road which is a major 4 lane roadway. The system is designed to meet all provincial standards with respect to emissions, noise, setbacks and odour. As well, truck traffic for the operation of the site is minimal and well within the capacity of the roadway and does not impact any neighbouring uses.

Consequently negative impacts on surrounding land uses are not likely.

### 9.3 Setbacks

Pursuant to Regulation 359-09, a separation distance to the nearest odour receptor of 250 meters is required. Alternatively this distance may be reduced to 125 meters if the membrane porosity required is maintained. As the total volume of liquid storage is 6,500 cubic meters, regulation 359/90 requires a setback of 230m for the storage vessels.

The digester is located approximately 250m from the nearest odour receptor (Pearce House) and meets the membrane porosity standard. All of the storage vessels and the bunker also exceed the minimum 230 meter setback requirement from Pearce House.

## 10.0 Public Health and Safety

### 10.1 Explosion Control

The explosive range for methane is between 5% and 15 %. Concentrations of methane in the biogas plant are between 55% and 65% which is well beyond the explosive limits. As a result there is very little potential for explosion. Notwithstanding this, all equipment within the explosion zone is required to be explosion proof. Also all pipelines with potentially active microbial material cannot be valved closed at both ends. This prevents pressure from building up in contained spaces with the possibility of pipeline rupture.

### 10.2 Emissions

Emissions from the engine will meet provincial standards. Noise standards will also be met in the design of the engine building.

### 10.3 Fire

Methane is a non-toxic, flammable gas. However the digester can only store approximately 1,000 cubic meters of biogas. Should this amount of gas catch fire, it would be consumed in seconds. The digester is designed to produce only 260 cubic meters per hour which would not be enough to support sustained combustion.

## 11.0 Decommissioning

### 11.1 Plant Removal

The concrete components of the biogas plant have a life expectancy exceeding 50 years. As a result decommissioning of the plant is not likely in the near term. Should decommissioning be required, the equipment can be removed and reused or scrapped and the building and structures can be demolished. Concrete and steel can be recycled, and the site re-graded and restored to its current condition.

## 12.0 Appendices

### 12.1 Project Location Map

### 12.2 Site plan