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ABYDOZ

A Canadian Based Wastewater Treatment Firm Specializing in Engineering Wetlands

Environmental Assessment Registration Engineered Wetland Bishop's Falls, Newfoundland

ABYDÖZ
ENGINEERED WETLANDS

December 2012

Environmental Assessment Registration

Engineered Wetland Bishop's Falls, Newfoundland

Prepared for:

Department of Environment
Environmental Assessment Division
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Bishop's Falls Engineered Wetland Sewage Treatment Facility

2.0 Proponent

2.1 Name of Corporate Body

Town of Bishop's Falls

2.2 Address

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2.3 Chief Executive Officer

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3.0 The Undertaking

3.1 Name of the Undertaking

Bishop's Falls Engineered Wetland Sewage Treatment Facility

3.2 Purpose/Rationale/Need for the Undertaking

Purpose:

It is proposed to install an Engineered Wetland Sewage Treatment Facility as the new Wastewater Treatment Facility (WWTF) in Bishop's Falls, Newfoundland and Labrador with a collection system from the town's existing six (6) outfalls. This system will provide sewage treatment for the town's wastewater that is currently being discharged directly through a series of six (6) outfalls into the Exploits River.

Rationale:

The wetland system will offer Bishop's Falls onsite wastewater treatment technology that is a sustainable solution for its sewage wastewater. The system will reduce the environmental impact of raw sewage being discharged into the exploits river and protect the environment by using a natural green solution that uses less electricity for wastewater treatment.

Need for the Undertaking:

Currently, there are no wastewater treatment facilities for the main effluent of Bishop's Falls. The town's sewage is currently discharged via six (6) separate outfalls. These outfalls are untreated and discharged directly into the Exploits River. These outfalls will be collected and directed to the wetland treatment facility system that will provide onsite treatment of wastewater that meet the Department of Environment's requirements. This undertaking is needed for the Town of Bishop's Falls to comply with the Provincial and new Federal sewage regulations.

4.0 Description of the Undertaking

4.1 Geographical Location

The collection system will be compromised if a main trunk line that will run through Bishop's Falls with branch lines from each existing outfall. The main line will generally follow the old railway bed through Bishop's Falls. This can be seen in detail in the drawings in Appendix A.

The WWTF will be constructed at the east end of the town in the location of the former race track. The site also has an old dump site, an old drive in movie theatre and currently unused land. Based on the site selected and the sizing of each component the overall configuration has been determined.

Site Dimensions: 152.6m x 192.4m
Site Area: 60702 .8 m2 (15 acres)

The site can be seen in Figure 1 and 2 below.

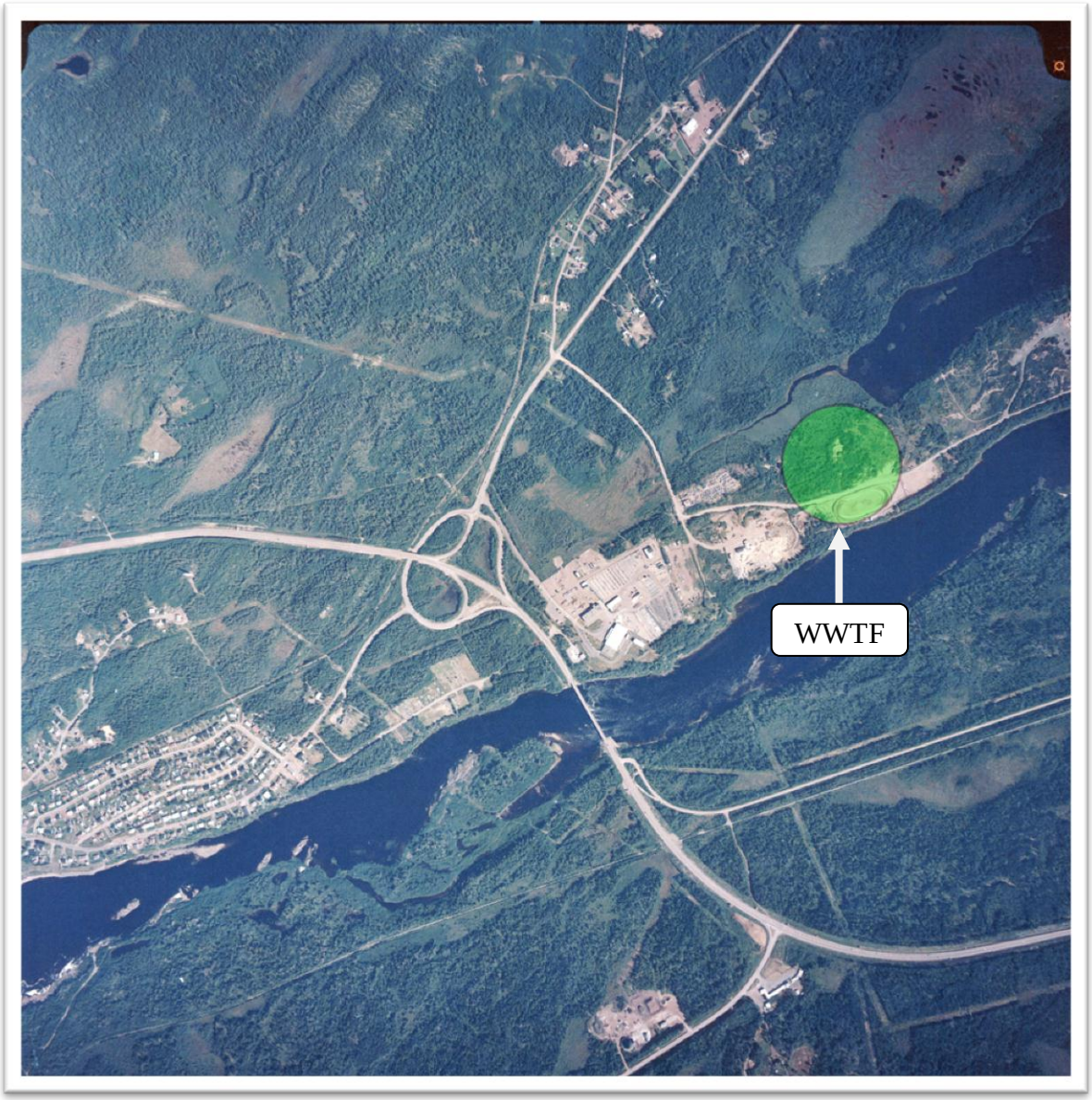


Figure 1: Location of Wastewater Sewage Treatment Facility in Bishop's Falls

Proposed treatment plant location

Figure 2: Land Allocation for proposed Wastewater Sewage Treatment Facility location in Bishop's Falls

Complete site location

4.2 Physical Features

4.2.1 Major Physical Features

The access to the proposed WWTF site will be via an existing roadway(Sunset Drive) that connects the existing site to the Bay Despair highway. A roadway of approximately 600 m will be required to bypass the site as the existing Sunset Drive roadway going through the property will be removed, a new entrance will be established off of this new roadway to give direct access to the site. The overall site with roadways and space around all beds will take up an area of approximately 9.5 hectares, and will be comprised of the following elements:

- Access road re-alignment Sunset Drive - 600 m
- Screening building -5 x 15 m
- Settling Chamber-60 x 5 m
- 2 – Vertical beds 37 x 68 m
- 1 – Stormwater Bed 40 m x 93 m
- 8 – Horizontal beds 30 x 84m
- 4 – Sludge Treatment Cells 20 m x 50 m
- Outfall to the Exploits River
- Additional space is available within this site for future expansion, if required.

Figure 3: Appleton/Glenwood WWTF

The site will have all trees and overburden removed as required. The land will then be cleared and grubbed, in order to facilitate site preparation. The surrounding vegetation consists of wooded, barren, and alder covered areas. There are no water bodies, ponds or rivers located within the proposed site, There will be minimal wildlife displaced due to the proposed site having previous been used for a dump, raceway and drive-in theatre.

The proposed undertaking has two main components:

1) Transmission/ collection sewer line from existing outfalls to the new WWTF.
2) New WWTF for sewage treatment with an outfall to the Exploits River.

The transmission/ collection sewer line will be comprised of a series of lift stations to pump the sewage to the new WWTF. The route of the new collection line is shown in figure (3) and is detailed in the drawings in the appendix. This transmission/collection line will generally follow the old railway bed as much as possible to limit the tear up of the existing roadways and town services. The rail bed will be reinstated over the pipework and walking and biking trails will be established for social and community use.

Proposed Wastewater Treatment Components

Sewage Lift Stations

Six untreated sewage outfalls into the Exploit's River will be closed and replaced with a sewage lift station at each outfall. Each of the lift stations will contain sufficient volume in its wet well to contain a minimum of one hour's storage during peak run off conditions. A seventh larger lift station will be constructed on Mayor Avenue and will receive flows from Lift Stations 1-5 for repumping. An eighth lift station will be located at the WWTF on Sunset Drive.

The existing six (6) outfalls will remain in place, and not be removed, but will only be used as a safety if the lift stations and pumps malfunction or experience power outages which will give the transmission system a bypass option if it is needed in extreme conditions.

Collector Mains

A total of 8.3 km of collector mains will be installed as part of the project. The collector mains will consist partially of pumping mains and partially of gravity mains. The five more westerly lift stations will pump to a common location on Mayor Avenue where a larger lift station will pump across the TCH to a gravity manhole on the Botwood Highway. Lift Station # 6 will pump through a separate pumping main to the same manhole on Botwood Highway. From Botwood Highway the sewage will flow by gravity to the WWTF where an eighth lift station will pump the sewage into the headworks building and settling tank.

The Wastewater Treatment Facility (WWTF)

The WWTF will be constructed over the land indicated in figure (2) and as detailed in the drawings in the Appendix. Part of this site has had previous usage which include; Drive-in Theatre, racetrack and a former town dump. Part of the site still has the race track and berms and a small building from the race track operation which shall be removed. The garbage that has been identified as below grade in certain locations will be interfered with as little as possible. The system will be designed to reduce interference with this material as much as possible. When garbage is encountered during excavations it will be removed and relocated on the exciting site and recovered and stabilized as part of this project. The vast majority of the area will be simple left as is or will be cleared over and stabilized with the new WWTF activities.

Also, as part of the new WWTF the existing dirt roadway (Sunset Drive) through the property to the Cemetery and Hi Point Commercial Peat operation will be re-routed to go around the WWTF to the north of the site. This new roadway will be similar to the existing roadway and provide access for the public and commercial operation to the existing facilities beyond the project location.

Engineered Wetland Systems

Abydoz Engineered Wetland systems are based on technology invented in Germany by Dr. Reinhold Kickuth, they use sub-surface flow engineered wetland technology, or the “root-zone” method. Dr. Kickuth is recognized as the founding developer of sub-surface wetland systems. Abydoz Environmental is the licensed representative of the Kickuth technology in Canada and the Caribbean.

The Abydoz Engineered Wetland creates areas of aerobic digestion by the use of plants transferring air from the surface part of the plant to its root zone, the rhyzone. This way, the plants used in the wetland act like a catalyst to create the environment for millions of bacteria to live and digest the waste as it moves through the wetland. It is actually the bacteria that provide the cleaning mechanism for the waste, which is common to all sewage treatment systems. One of the primary functions of the plant is to pump air below the surface. The wetland itself provides a hosting capability in its matrix to allow the bacteria to multiple and flourish as required to digest the waste of any system.

Oxygen is transferred by the reed plants into the soil matrix, this fosters aerobic and also anaerobic microbial activity which biologically and chemically breaks down contaminants. This method is capable of purifying a wide variety of municipal, industrial and domestic wastewater as well as municipal sludge. The treatment sites are stable, engineered ecosystems and are based on complex inter-relationships between the plants, soils, and micro-organisms. This is illustrated in Figure 3.

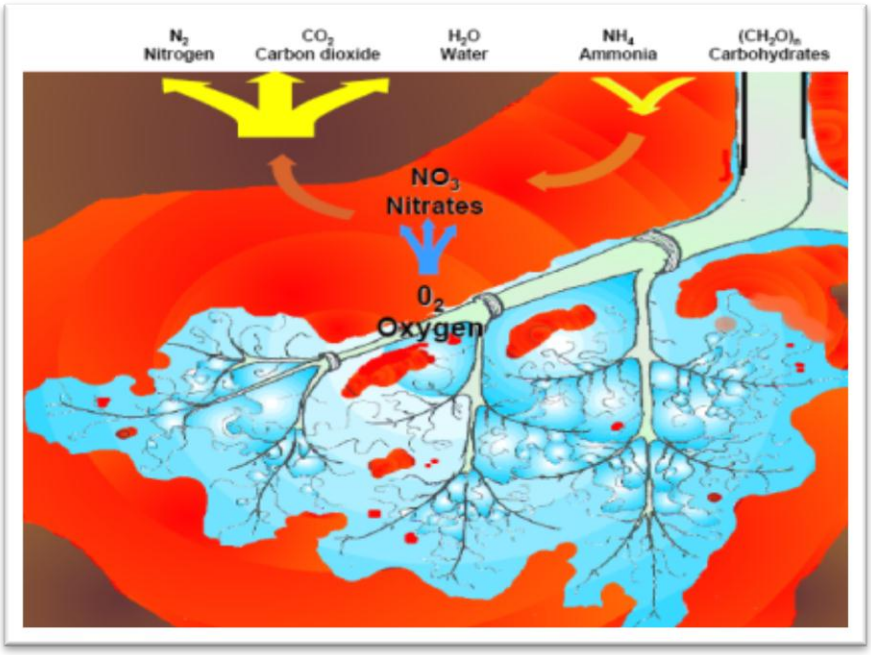


Figure 4: Gaseous Pathways of Reed Plants Used in Engineered Wetland Technology.

Primary Screening

Sewage effluent will flow through a small head-works building where it is screened to remove plastics and debris. A spiral lift screening unit sits inline and screens all material as it passes through the building. Non-organic materials are removed from the wastewater stream and spray washed while being augered upwards before being discharged into a receiving bin. Waste collected in this bin will be disposed in a landfill. A spiral lift screen is shown in Figure 5, which is similar to the unit selected for this operation.

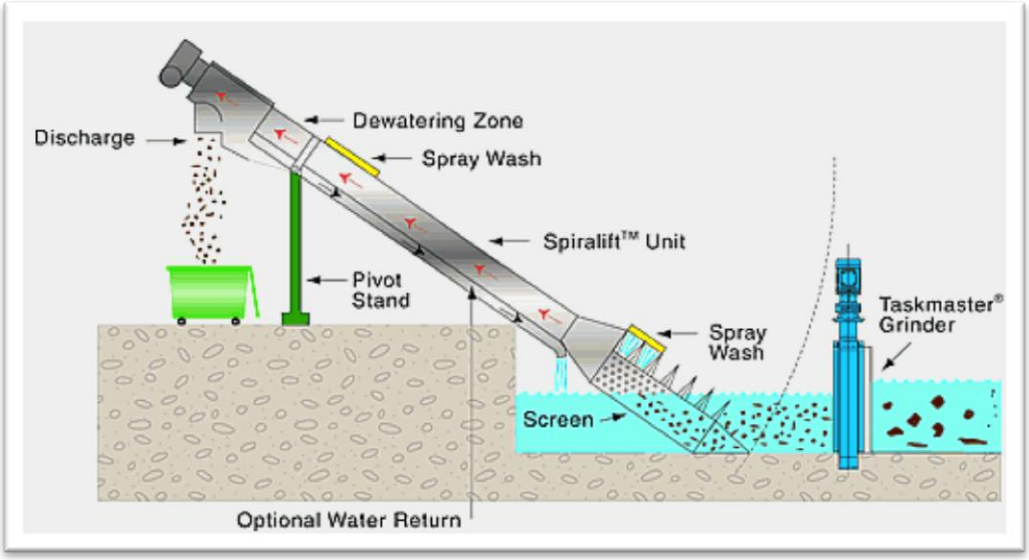


Figure 5: Spiral Lift Screen

Primary Removal of Solids – Settling Tank

After the sewage effluent has been screened in the head-works building it will move into a settling / clarifier tank where the majority of the solids will be removed by settlement. The retention time in the tank will be designed to remove the majority of the suspended solids. The settling tank will be designed to have two trains through the sedimentation tank so one side can be taken off line, without restricting the overall flow. The tank will have an internal chain and flight system to remove the solids from the tank which will be pumped to the Wetland Sludge Treatment cells.

The tank will also be designed to buffer the overall flows and to direct the excessive flows experienced during stormwater events to the storm water beds through the use of fixed weirs.

Figure 6 : Typical Settling Tank During Construction

The method for stormwater separation allows for limited diversion during daily fluctuations by providing for a buffering capacity in the main sedimentation tank.

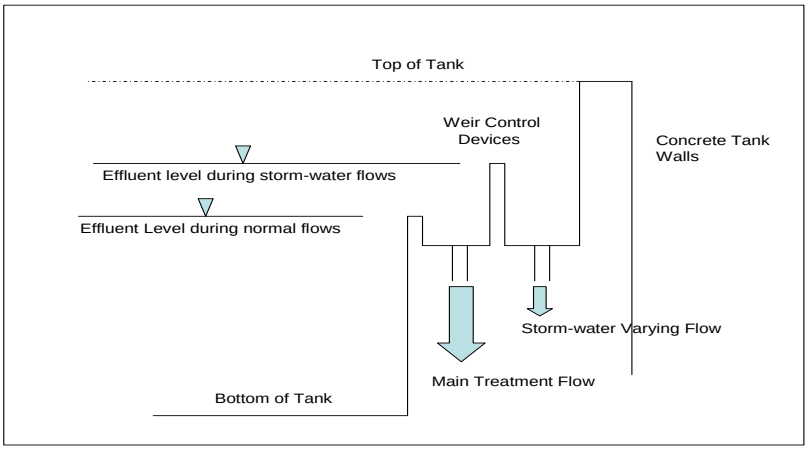


Figure 7: Weir Controls in Sedimentation Chamber

The sedimentation chamber is designed with a set of fixed weirs at the end of the chambers. The elevation difference between these weirs allows the main chamber to provide the dual purpose of holding daily surges and at the same time redirecting excessive storm water flows as they occur. The weirs are duplicated on each train of the main tank to maintain the ability to take one side off line as required.

A storm water spillway after the weirs will receive all flows exceeding the required design. This allows the flow to be separated into two individual streams, the main effluent and the stormwater effluent.

Storm Water Treatment

The design calculation for this system and the resulting physical configuration is based on separating the high concentration low flows from the low concentration high flows in order to provide a more specialized treatment for each flow. This design separates the storm water runoff from the regular treatment system thus reducing the size of the system required and preventing the typical push-through created in a conventional treatment system.

Figure 8: Storm Water Bed

The first components of the storm water treatment are similar to the main flow. The effluent passes through the grinder and spiral screen and then through the main sedimentation tank where the solids and suspended solids are removed. The flow is then separated by the weirs. The flow then enters the storm water bed which initially has a containment zone to store the storm water. The effluent stream then passes through a combination of horizontal and vertical pathways through a reed bed designed to handle high flows with low concentrations.

The storm water bed provides treatment to the excessively large flows during storm surges. Also, with the set design flow on the main beds never exceeded, the retention time in the main system is always maintained, preventing the common push-through and resulting lower treatment experienced in typical lagoons and other treatment systems.

Bilateral Engineered Wetland Bed

The main effluent flow moves from the settling tank into the Wetland treatment beds. The Wetland Treatment Beds will be a combination of Vertical and Horizontal wetland beds. Once the solids are removed in the settling tank the main effluent will enter a Vertical Wetland bed followed by a group of parallel Horizontal Wetland beds for treatment. The main Horizontal treatment beds will be designed as a bilateral treatment zone. Both treatment zones will be fed by one inlet channel; each zone however will have its own outlet, as shown in Figure 8.

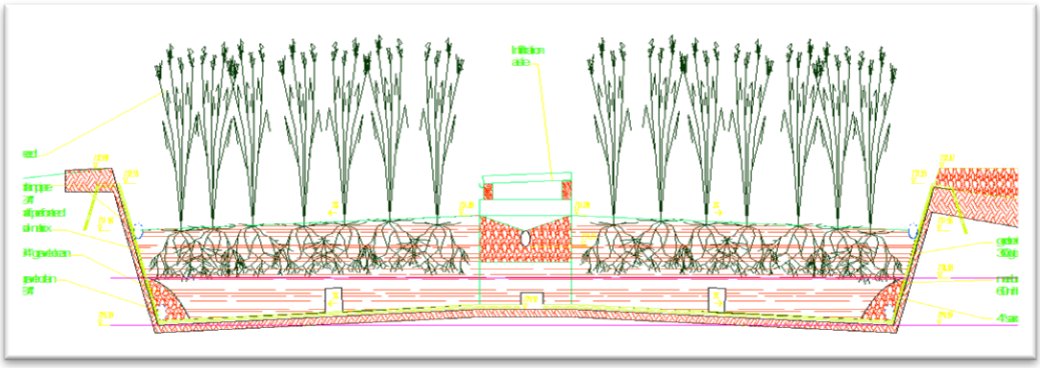


Figure 8: Bilateral Wetland Bed (Central Inlet).

The bilateral operation of the inlet channel is supported by an external hydraulic gradient (bottom slope) of 3.0%, which will divide the phreatic line of the bed into two symmetric halves, this will divide the flow into two halves, with each one flowing to a respective outlet.

Each horizontal bed, if there are several will be separated from the next by an aisle or roadway of 6 m to facilitate operational work as well as construction. Each bed has its own set of man-holes, pipes and flow regulators which are required to control effluent levels during operation. The cross section of each treatment zone will have a trapezoidal shape. This shape will provide the needed matrix volume, and will further increase the specific biochemical and microbial activity of the beds which occurs in the upper 30 cm of the soil.

Treatment occurs by means of biological degradation as the effluent flows through a myriad of aerobic and anaerobic zones. This creates similar biological and chemical activity by way of a natural process that traditionally a mechanical sequential bath reactor would produce. Microbial populations in these zones average in the area of 10,000 per cubic inch as compared to 3000 found in traditionally activated sludge systems. These highly elevated populations of microbes result in excellent degradation rates which in turn produce low retention times. An actual photograph of soil dwelling microbes next to a grain of soil is pictured in Figure 10.

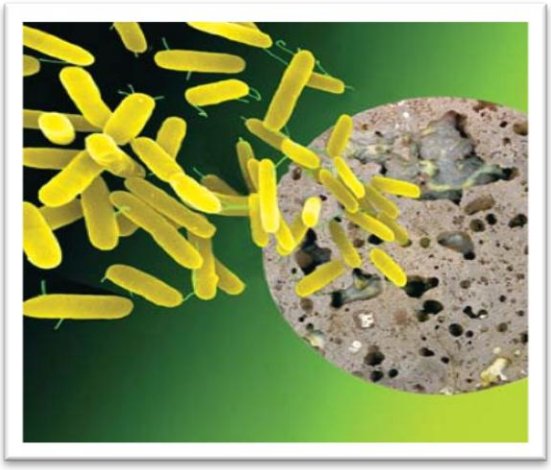


Figure 10: Soil-Dwelling Microorganisms next to a Grain of Sand.

The microbial populations are self-regulating in relation to oxygen demands. The microbes themselves determine the amount of air that will be transferred to the root zone. The amount of air required by these microbes is directly correlated with the contamination levels of the load entering the treatment zone.

The initial area at the inlet side of the reed bed will have oxygen transfer rates of up to 150g of air per m^2 per day. This rate will continuously reduce until you reach the outlet side of the bed where it is generally between 8g and 1g of air transferred per m^2 per day. The low rate of transfer in this area is indicative of the low aerobic rate and the higher anaerobic rate of treatment taking place, especially in the last third of the bed.

Designing treatment systems for complex waste waters which require an oxygen transfer rate higher than 150 g/m^2 per day requires a different configuration. When a higher oxygen transfer rate is required the immediate oxygen demand (IOD) is so great that the microbes will actually consume the oxygen required by the plants, resulting in the plants dying from suffocation. This however is not an issue when dealing with domestic wastewater, which is easily degraded with the proposed reed bed oxygen transfer rate.

Another feature this system has over traditional mechanical systems, as it relates to microbial degradation, is the retention time. Many contaminants will bind to the substrate as the water is passed through the treatment matrix and will remain in the treatment zone longer than the actual residential time of the effluent. This will allow for longer degradation times and provides the microbes even more time to degrade these contaminants. This can happen in two ways, the first is by binding through filtering and the second is by the binding of positive and negative charged ions.

A third feature as compared to mechanical treatment systems is the number of aerobic vs. anaerobic zones within the system. Most mechanical systems use one of two methods for creating these zones: either they repetitively turn the air on and off; or they transfer the water from a compartment which is aerated to a compartment which is not. Operationally both of these functions are easily performed however require pumping and electricity, resulting in higher operational costs. From a microbial management perspective, it is a shotgun approach to managing the required oxygen demand of your microbial population.

In a reed bed system, the microbes manage their own oxygen demand in two separate and distinct ways. The first is by location, the microbes that thrive in aerobic conditions live closer to the roots than those that thrive in anaerobic condition which live further away. Note the density and distribution of the roots in Figure 11.

Figure 11: Cross-Section of Wetland Showing Root-Zone of Plants.

The second way which wetlands manage oxygen demand is by actually drawing the air down through the stems of the reeds. As loading increases, so will the activity and the rate of oxygen transfer. As effluent passes through the bed it also passes through countless numbers of these zones. There are millions of locations with varying oxygen levels providing the microbes with the ability to find and live in the conditions that are ideally suited to their individual needs. The result is maximum biological activity being created and maximum treatment achieved. As loadings constantly change so does the environment, and the microbes are able to adapt accordingly. Because of this ability the system is considered self-regulating and does not require computers, compressors or operators to regulate the oxygen transfer or microbial populations. Instead of trying to duplicate these complex microbial interactions with mechanical machinery, this system actually incorporates the natural process into the treatment path. Thus the treatment is achieved in a green natural fashion without the use of electricity or chemicals.

Sludge Treatment

The sludge collected in the settling chamber will be collected and pumped to the Wetland Sludge Treatment Cells. The same microbes found in the wetlands are used to treat the solid sludge waste, mineralizing it into treated biosolids that can be used as a fertilizer. Figure 12 shows a dormant and dried Sludge Treatment Cell that is ready for removal operations.

Figure 12: Abydoz Engineered Wetland Sludge Treatment Cell ready for removal.

After the sludge is deposited in the wetland sludge cells the sludge is treated and de-watered through three natural processes: plant water consumption, evaporation and evapotranspiration, and microbial treatment. Overtime the sludge is reduced in volume by approximately 90% and is mineralized into an inert, compost-like material. Due to the reduction in volume, new sludge can be continuously layered over pervious applications. The reed plants do not need to be harvested as they annually die back at the start of winter dormancy and re-grow every spring, multiplying from their original roots, and adapting to the new sludge levels.

Once the solids have been mineralized and dried, they can be removed and combined with soils to be used as a horticultural fertilizer. Natural regeneration of the plants will occur in the remaining matrix material, due to leftover root stock, without replanting after the solids are removed.

Treated Wastewater Outfall into Exploit's River

The treated effluent will receive final polishing as it flows through a cascade aerator structure during its descent down to river level. The outfall will consist of a series of pipes laid beneath the river bottom during the low river season and will be located under a strong current. The effluent will be dispersed through a large number of small openings from where it will flow upwards through the rocks above and mix with the down river flow of the Exploit's.

Additional Information or Engineered Wetlands and Company Experience

Over 700 Engineered Wetlands are in use throughout Europe and around the world for treating many different types of waste including municipal sewage and sludge, landfill leachate, hydrocarbons, glycol, and other industrial wastes.

In Newfoundland, Abydoz has constructed systems for single-family homes, multi occupancy units, camps and other facilities as well as several municipal systems. A small municipal system serves as a pilot project in Marystown, a full scale municipal system is servicing the combined towns of Appleton and Glenwood, and the largest municipal engineered wetland system in Atlantic Canada services the entire town of Stephenville (Figure 13). Also, a system was constructed in 2011 to treat the landfill leachate at the new Central Newfoundland landfill in Norris Arm. All systems are in operation, and are working well and providing better results than Provincial and National regulations.

Figure 13: Stephenville Engineered Wetland System

In September of 2002 the Canadian Manufacturers and Exporters Association (CME) awarded Abydoz the Innovation Award for Sustainable Development for the region of Newfoundland and Labrador.

In the summer of 2005 the Abydoz system in Marystown, was instrumental in Marystown receiving the Newfoundland Environmental Award for Municipalities. The system in Appleton-Glenwood was awarded the Provincial Environment Award (2008) from the Provincial Department of Environment, the Environment Award from the Professional Engineers and Geoscientists of Newfoundland and Labrador (2010), and the Federation of Canadian Municipalities (FCM) Award for Leadership in Storm Water and Wastewater Management in Atlantic Canada (2010), among others.

Engineered Wetland Treatment Results

Recently, Abydoz Environmental Inc. partnered with the National Research Council (NRC) to test the effluent from the Stephenville Wastewater Treatment Facility, featuring an Abydoz Engineered Wetland system (Figure 14). The testing results from January 2010, to December 2010, for BOD and TSS are shown in Figures 14 and 15, respectively.

The Stephenville system is designed for ocean discharge so the treatment regulations are less stringent than other systems discharging to fresh bodies of water. The required levels of treatment for discharge are; 40 mg/L BOD and 60 mg/L TSS. As shown, the system is meeting and exceeding these requirements every month, with a yearly average of 87% BOD reduction and 93% TSS reduction. The average BOD discharge for the year of 2010 was 11 mg/L including the winter period.

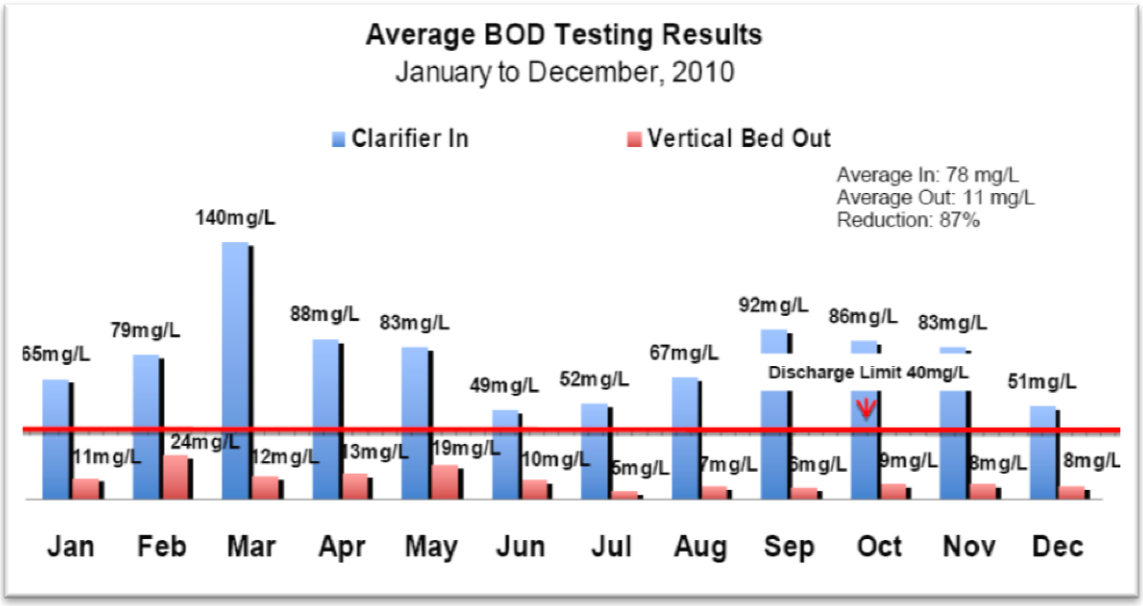


Figure 14: BOD Reduction through Abydoz Engineered Wetland Stephenville Wastewater Treatment Facility.

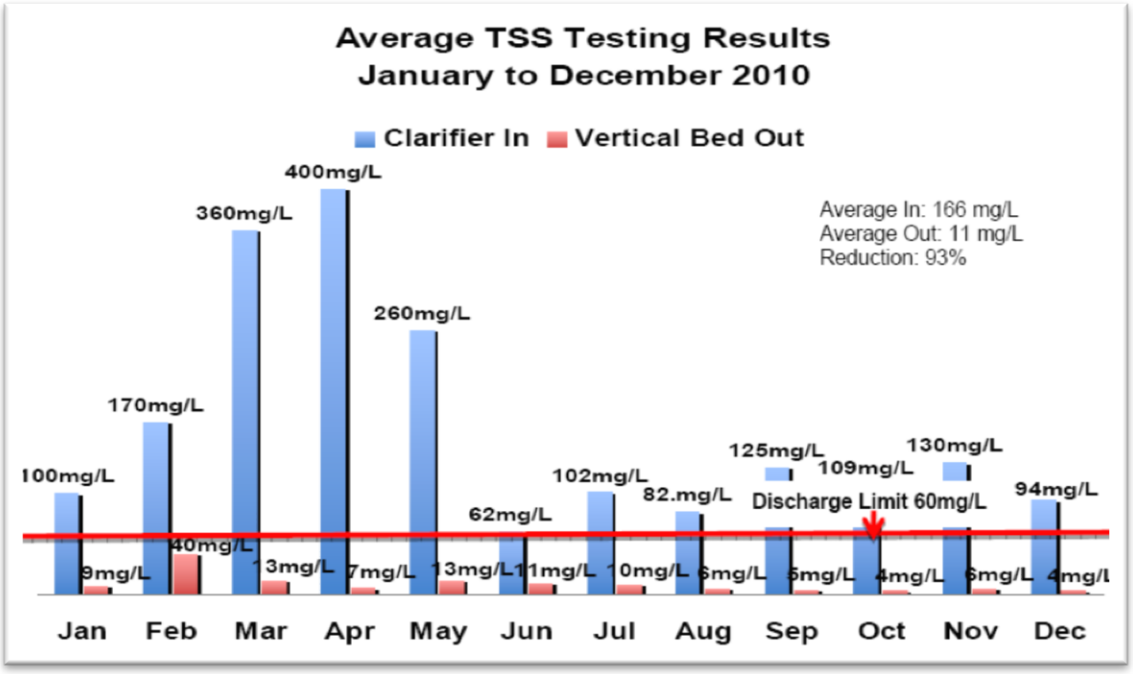


Figure 15: TSS Reduction Through Abydoz Engineered Wetland Stephenville Wastewater Treatment Facility.

Where regulations are more stringent, the Abydoz Engineered Wetland can be designed to achieve higher treatment levels. This was the case for the Appleton-Glenwood system (Figure 16) which discharges directly into the Gander River (a prominent salmon fishing river).

Figure 16: Appleton-Glenwood Abydoz Engineered Wetland System.

The treatment results for the Appleton-Glenwood system are shown in Table 1. It can be seen that the system is achieving over 97% reduction for all parameters and is satisfying all down river standards for nitrogen, phosphorous, total and faecal coliforms, as well as BOD and TSS. No disinfection units are contained in this system.

Table 1. Appleton-Glenwood Treatment Results for First 2 Years of Operation.

Average Test Data (2007-2008) - Appleton /Glenwood Engineered Wetland Project						
Parameter	Inlet	Wetland		Down River		Down River
		Outlet	% Reduction	Outlet	% Reduction	Standard
BOD (mg/l)	158.3	8.18	94.43%	3.25	97.28%	20 mg/l
TSS (mg/l)	1,506.3	4.53	99.70%	1.52	99.90%	30 mg/l
Nitrogen (ammonia) (mg/l)	14.3	5.96	56.52%	0.37	97.47%	2.0 mg/l
Total Phosphorus (mg/l)	1.8	0.48	70.07%	0.01	99.39%	1.0 mg/l
Total Coliform (MPN/100ml)	1,907,000	35,450	98.35%	480	99.97%	5000/100ml
Faecal Coliform (MPN/100ml)	1,170,700	14,150	98.80%	136	99.98%	1000/100ml

Figure 17: Corner Brook LTC Facility featuring two Abydoz Engineered Wetlands for Sewage Treatment (Prior to Plant Establishment).

The Corner Brook Long Term Care Facility required tertiary treatment for its wastewater, and used the Abydoz wetland system to gain LEED points for the project. This system is not yet fully established but is achieving approximately 90% reduction for BOD and TSS, to date. It is designed for a discharge of 10 mg/L BOD and 10 mg/L TSS discharge. This system is shown in Figure 16 (prior to the plants becoming fully established). Within the next few years, the system will propagate and fill in with plants growing over 1 meter in height.

Additional background literature or information on awards or past projects using the Abydoz Engineered Wetland systems is available by contacting Abydoz directly at info@abydoz.com.

4.3 Construction

4.3.1 Construction Period

The construction is expected to proceed after the two components (transmission/ collection line and WWTF) have been tendered and awarded in the spring of 2013. The anticipated construction schedule is from April 2013 to March 2015 with the majority of work expected to be completed prior to November 2014.

Figure 17: Appleton/Glenwood WWTF

4.3.2 Potential Source of Pollutants during Construction

The potential sources of pollutants during this construction are generally the same as those associated with any major civil construction activity. Adherence to permit conditions and application of good construction practices by the contractors will protect against the release of pollutants into the surrounding environment.

4.3.3 Environmental Impacts During Construction (WWTF)

Strict monitoring and sound construction practices will control activities to minimize risks associated with:

- Silt and sedimentation runoff
- Smoke from brush burning
- Dust;
- Construction debris;
- Sewage; temporary toilets
- Risk of fuel, lubricant and hydraulic fluid release;
- Airborne emissions from construction equipment;
- Noise pollution from construction activities;

Silt fences and mitigation measures typical to general civil construction activities will be enforced to eliminate and reduce all of the possible sources of pollutants.

Environmental Impacts during Construction:

Typical impacts during construction are as follows:

Inadvertent Damage to Utilities and Structures

During trenching operations, existing water service lines, sewers, telephone cables etc; are subject to damage.

Interference with Surface Drainage

Construction activities along the roadside might interfere with existing surface drains and cause local flooding during heavy rains. Silty materials might be washed into the Exploit's River or other small streams flowing into the Exploit's.

Damage to Trees and Vegetation along the Trailway

The pipeline route follows the picturesque abandoned Botwood rail bed and damage could occur to mature trees that line the route.

Dust

Dust generation due to trenching in traffic areas can be a nuisance to residents and businesses in the construction area.

Road Crossings

Trenching across roads can cause disruption to traffic and pedestrians and temporarily prevent driveway access to residents and businesses.

Safety

Open trenches are potential safety hazards to traffic and pedestrians particularly at night.

River Works

Construction of the treated wastewater outfall will involve construction along the river bank down river from the Bond Bridge. Construction of the outfall will involve work in the river during the period when the river is low and could interfere with the migration and spawning of salmon. There is also a risk of river bank erosion and of the introduction of sediments into the river.

4.3.4 Mitigation Measures during Construction- Collection Line

The following mitigation measures are proposed for significant environmental impacts.

Lift Stations and Pipe Laying

Inadvertent Damage to Utilities and Structures

Coordination with the Town, the telephone authority, Newfoundland Power and Works Services and Transportation and safe construction practices will significantly reduce the risk of inadvertently disrupting utility services. This may involve the obtaining of trenching approvals from the authorities or having a designated utility inspector carry out a daily inspection of the construction work and identifying the location of buried utilities to the contractor.

Interference with Surface Drainage

Immediate restoration of surface drainage works will reduce the risk of localized flooding due to construction activities. Monitoring the construction site both before and after heavy rains will ensure that prompt corrective action can be taken where necessary to prevent washouts, flooding or trench settlement.

Dust

Dust mitigation measures might include watering of the construction areas and sweeping and washing of paved road surfaces.

Road Crossings

The number of road crossings will be minimized in the design by following the old Botwood railway wherever possible. During construction signing and flagging or detouring of traffic will sometimes be necessary. Reinstatement of damaged roads will be carried out as quickly as possible. Construction under the TCH will be conducted under the supervision and with all of the necessary permits from Works, Services and Transportation.

Safety

Adequate traffic warning signs and night lighting will be required around open trenches and other construction activities along the road right-of-way. Construction workers will wear hard hats, safety vests and other safety equipment. Flagmen, traffic signs, traffic cones etc; as required by the standards of WST and OH&S will be enforced at all times.

River Works

Construction activities within the riverbed and on the riverbank will be carefully monitored to ensure that environmental impacts on the river are minimized. Construction will be scheduled for the low runoff months and temporary cofferdams erected for construction in the river. Riverbank construction activities will include erosion and sedimentation mitigation procedures.

4.3.5 Potential Resources Conflicts

Fish and Fish Habitat

Construction activities will not interfere with any body of water and therefore do not affect any fish or fish habitat areas except for the installation of the new outfall. As such all activities related to the outfall construction item will be coordinated with the Department of Fisheries both Provincial and Federal. It is proposed that the outfall will be installed in the river bed in a dry environment with cofferdoms installed to isolate the river during outfall installation.

Wildlife

The location of the proposed (WWTF) is next to industrial activities and has an existing road going through the center of the property as such, no wildlife is suspected to be in this area because of its current use. There may be some minor wildlife conflicts but they will be minimal.

Forestry

The project area consists of grass, scrub growth, and forested areas that were previously cleared for other purposes so there are no conflicts expected. The site is inside the town limits and is not a cutting permit area.

Construction Equipment

During construction operation equipment will not be permitted to operate outside the construction zone in order to prevent damaging adjacent areas. Good safety and environmental practices will be enforced to prevent and reduce conflicts caused by construction equipment.

Human Activities

The existing access road will be realigned prior to closure of the existing roadway so access will be maintained at all times. As such there is not expected to be any human conflicts.

4.4 Operation

4.4.1 Description of Operation

The WWTF will operate year round and will be a permanent piece of town infrastructure. The WWTF will operate with minimal electricity and will not directly burn any fossil fuels. The transmission/ collection line will use electric pumps to transport the sewage to the WWTF in a below ground piping system. Only during periods of power failure will diesel portable generators be used to continue operation of the lift stations.

The WWTF will include sludge cell for dewatering and composting of the sewage sludge removed in the primary clarifier/settling tank of the headwaters. The sludge pumped into the sludge cells will produce a high odor during pumping operations for movement of the sludge. After the sludge is moved into the sludge cells this odour will diminish and be minimal thereafter until further pumping is required.

4.4.2 Period of Operation

This is a permanent facility that will operate year round.

4.4.3 Potential Sources of Pollutants during Operation

Environmental Impacts during Operation (WWTF)

Potential sources of pollutants during operation are:

- Treated Effluent
- Dewatered and Biodegraded Solids
- Odours
- Noise Pollution
- Health and Safety
- Storm water runoff from site

Environmental Impacts during Operation-Collection/ Transmission Line

Sewage Lift Stations

Six of the lift stations will be located close to the existing sewer outfalls along the river bank and will be subject to untreated sewage spills during periods of power interruption.

Mitigation Measures during Operation

WWTF

Effluent will be treated to the Provincial and Federal required regulations. No bypass of a untreated effluent will be allowed from the WWTF.

The effluent from the dewatering of the sludge solids will be contained and returned to the main WWTF settling tank for process through the wetland system.

Odors will be minimized be pumping of solids out of the settling tank into the sludge cells in the best appropriate fashion. Also the sludge cells will be located on the site to minimize impacts.

Noise pollution will be minimized with designing for equipment and pumps that produce the least noise possible. The wetlands having no mechanical components will add in this objective.

Health and safety practices will be followed at all times with the appropriate safety gear required by all people on site during work activities.

Stormwater surface runoff from the site will be collected and will go to a surface stormwater detention pond to reduce risks of sediments and containment leaving the site. After the surface runoff had been contained in this pond for a sufficient duration it will be released in the environment.

Sewage Lift Stations

A minimum of one hours storage during peak storm flow will be provided at each lift station. The smaller of the lift stations will be capable of operating from an external hookup with an portable generator. The larger of the lift stations will be serviced with a permanent emergency generator that will start automatically on loss of power. The lift stations will be monitored remotely via SCADA so that a problem at any lift station will immediately trigger an alarm at the Town Hall or some other central location.

4.4.4 Potential Causes of Resource Conflicts

Procedures will be established and monitored to minimize all potential resource conflicts.

Treated Effluent

The effluent from the proposed Engineered Wetland Sewage Treatment Facility will meet or surpass the Department of Environment Guidelines for the Discharge of Municipal Wastewater. A sampling procedure for tests will be initiated with the Department of Environment to confirm that the effluent meets or exceeds the requirements for discharge into the environment. Initially this testing scheme is proposed to be conducted every three months for the first year of operation.

Fish and Fish Habitat

The outfall will be both designed and scheduled for installation to reduce and minimize the impact on fish and fish habitat. All of the outfall work will be coordinated with the Department of Environment and the Department of Fisheries and Oceans.

Wildlife

There are no expected wildlife in either the area of the WWTF, or the transmission line.

Forestry

There is no significant forestry or forestry activities in the area of the construction site.

Operational Equipment

The proposed Wastewater Treatment Facility is a passive environmental system which has no requirements for electricity or mechanical equipment other than for a small screening building and for equipment to collect and pump sludge from the settling tank. The main wetland requires no electrical or mechanical parts. There is not expected to be any equipment operational concerns or conflicts.

Human Activities

Limited human activity is expected to occur in this industrial zone. There are no homes or cabins in the vicinity of the proposed project. With the proponent selecting a remote location for the proposed Wastewater Treatment Facility, operational activities are not expected to cause conflicts with other human activities.

An existing active grave yard is located past the WWTF location along with a commercial operation. As such continuous access to these areas past the WWTF will be maintained at all times during construction and road re-routing to reduce any human conflict.

4.5 Occupations

4.5.1 Required Number of Employees

Construction will be through tendering of the two components of the project. As such the successful contractors will ultimately decide on the number and type of employees working on the project. A projected estimate of the number and type of employees has been created for this review.

4.5.2 Enumeration and Breakdown of Employees

A) Transmission/ Collection Line

Employees	Number of Employees	Duration	
Excavation Operators	4	10 months	40 man months
Laborers	10	10 months	100 man months
Pipefitters	6	10 months	60 man months
Truck Drivers	8	10 months	80 man months
Foreman	2	10 months	20 man months
Engineers	2	10 months	20 man months
Surveyor	2	1 month	2 man months
Technicians	2	2 months	4 man months

Total: Man months of work= 326

B) Wastewater Treatment Facility

Employees	Number	Duration	
Excavators	4	2 months	8 man months
Labours	2	2 months	4 man months
Carpenters	2	2 months	4 man months
Electricians	2	2 months	4 man months
Pipefitters	2	2 months	4 man months
Welders	2	2 months	4 man months
Foreman's	2	8 months	16 man months
Engineers	2	10 months	20 man months
Surveyors	2	2 months	4 man months
Technicians	2	4 months	8 man months

Total: Man months of work = 184

Grand Total of man months of work = 510

4.5.3 Contracting

Employment equity will be the responsibility of the successful contractors
For further information on gender equity, contact the Women's Policy Office at 709-729-5009 or visit the website at **www.gov.nl.ca/exec/wpo.**

Construction Phase

It is expected there will be approximately five hundred and ten man moths (510) of employment created during the construction phase of the project. Construction will be co-ordinated by the proponent and the successful contractors and the engineering management firm DMG (Design Management Group) providing engineering and construction supervision.

Operational Phase

It is expected that approximately two people will be employed part time during the operation of the facility. Abydoz Environmental Inc. will use their existing labour force to provide maintenance as required at the facility. Abydoz Environmental Inc. will provide all maintenance support and consulting services as required to operate the facility. The town of Bishop's Falls will provide two individuals to check and monitor the facility on a daily basis.

4.6 Project Related Documents

4.6.1 Bibliography of Related Reports

Design Management Group, (March 23, 2000). "*Surface Investigation"*

Design Management Group, (April, 2000). "*Wastewater Treatment Study*"

Abydoz (November 30th, 2007). "*Kitckuth Engineered Wetland – Second Proposal"*

Design Management Group, (March 2008). "*Wastewater Treatment Study Review"*

Design Management Group, (May 2008)." Inflow and Infiltration: *Study Review"*

Abydoz (June 20th, 2009). "*Kitckuth Bioreactor Engineered Wetland"*

5.0 Approval of the Undertaking

The permits, approval and authorizations which may be necessary for the undertaking include;

PERMIT, APPROVAL OR AUTHORIZATION	ISSUING AGENCY
Certificate of Approval – Solids Composting Facility and WWTF	Dept. of Environment and Labour
Construction permit under the National Building Code of Canada	Dept. of Government Services and Lands
Outfall Installation	Department of Fisheries and Oceans

6.0 Schedule

The detailed engineering for the proposed project is currently underway and stated as of June 2012, and is scheduled to be completed so the project can go to tender in the spring of 2013.

It is expected that construction and commissioning of all facilities will take in the order of 10- 16 months.

The proposed construction start date is April 2013 and is scheduled to be completed by December 2014, with expected delays that may be extended to March 2015.

Operations will commence after commissioning activities have been completed.

7.0 Funding

Financing of the project will be from: The Federal Infrastructure Fund
The Provincial Municipal Affairs
The Town of Bishop's Falls

The total current budget for the project is approximately $13 million including all items, engineering and HST.

Proponent

_____ _____

Town of Bishop's Falls
Mr. Randy Drover, Town Manager

Date

Consultant

_____ _____

Abydoz Environmental Ltd.
Mr. Glenn Sharp, P.Eng

Date

_____ _____

Design Management Group Ltd.
Mr. Reg Hedges, P.Eng

Date

Appendix A:

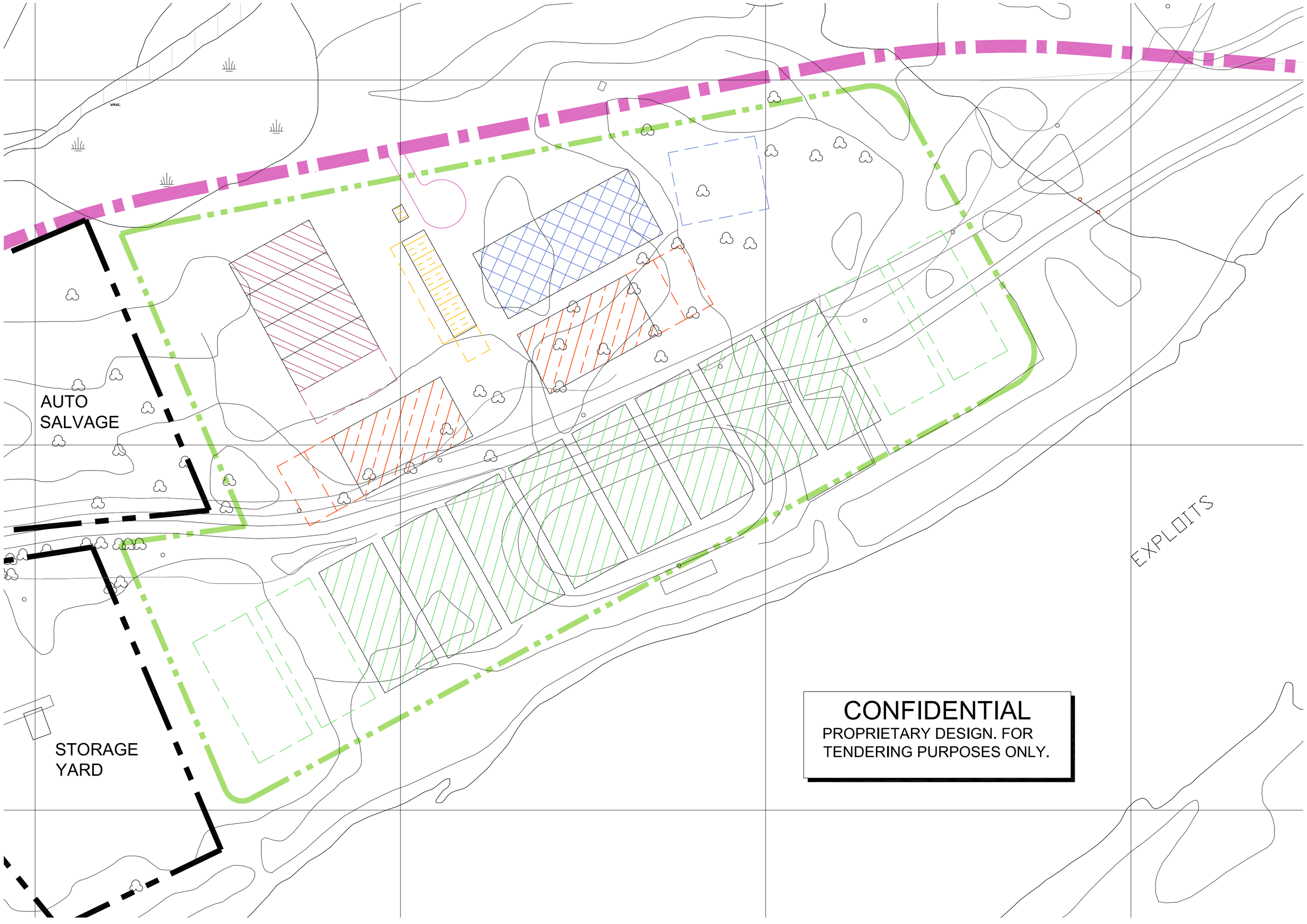
Drawing of WWTF
Site Layout

and

Drawing of Collection Piping System

LEGEND

- SETTLING TANK 14x60m (840 sq.m.)
- TANK EXPANSION 7x60m/14x30m (420 sq.m.)
- VERTICAL BEDS 2 @ 37x68m (5,032 sq.m.)
- VERTICAL BED EXPANSION 1 @ 37x68m (2,516 sq.m.)
- HORIZONTAL BEDS 8 @ 33.5x75.3m (20,180 sq.m.)
- HORIZONTAL BED EXPANSION 4 @ 33.5x75.3m (10,090 sq.m.)
- STORM WATER BEDS 40x92.5m (3,700 sq.m.)
- STORM WATER BED EXPANSION 1 @ 29.5x70.5m (2,080 sq.m.)
- SLUDGE CELLS 4 @ 20x50m (4,000 sq.m.)
- SLUDGE CELL EXPANSION 1 @ 20x50m (1,000 sq.m.)
- ROADWAY
- EXTENT OF REQ'D 15m BUFFER



CONFIDENTIAL
PROPRIETARY DESIGN. FOR TENDERING PURPOSES ONLY.

SITE PLAN

1
C1

0 15m 30m 45m 60m 75m
1:1500

ABYDOZ
ABYDOZ ENVIRONMENTAL INC.
Treating Wastewater...Naturally.™

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Fax: 709-895-2911
email: info@abydoz.com
website : www.abydoz.com

PROVINCE OF NFLD.
PERMIT HOLDER
CLASS "A"
This Permit Allows
ABYDOZ ENVIRONMENTAL
To practice Professional Engineering in this Province
NO. F0280 Permit No. — 2012 Year

STAMP
REGISTERED PROFESSIONAL ENGINEER
R. G. SHARP
SIGNATURE
DATE
PROVINCE OF NEWFOUNDLAND

DRAWN BY:	DATE:
CH	SEPT. 2007
CHECKED BY:	APPROVED BY:
GLENN SHARP, P.ENG.	GLENN SHARP, P.ENG.

NO.	DESCRIPTION	MM/DD/YY
1	TENDER DESIGN	Mar.15/05
	REVISIONS	

NOTES:

1) This drawing is for tendering purposes only.

2) Only figured dimensions are to be used. Any discrepancies are to be reported to the Engineer before proceeding.

3) All materials and workmanship to comply with the National Building Code of Canada.

4) This system is patented and confidential. Duplication or reproduction of the drawing without express written permission from "ABYDOZ ENVIRONMENTAL INC." is strictly prohibited.

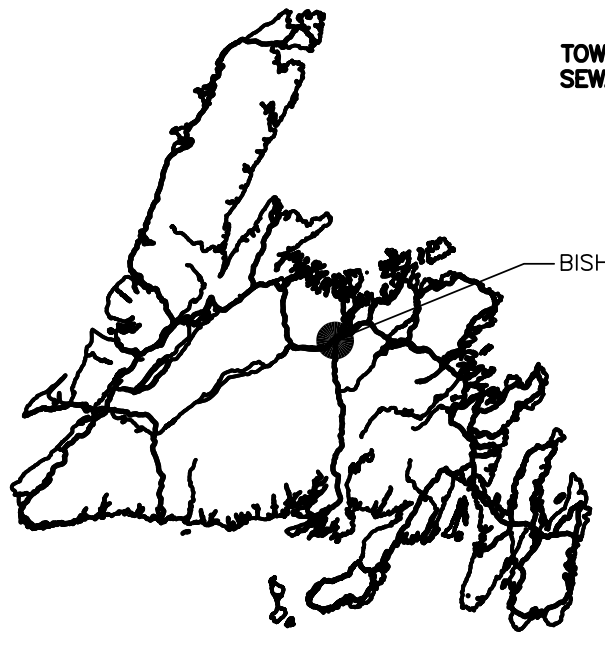
CLIENT:
TOWN OF BISHOP FALLS

PROJECT TITLE:
WASTEWATER TREATMENT FACILITY
FOR THE TOWN OF BISHOP FALLS, NL

DRAWING TITLE:
SITE PLAN

SCALE:	DRAWING NO.:
1:1500	C1
PROJECT: 314	
REVISION NO.: A	

TOWN OF BISHOP'S FALLS
SEWAGE SYSTEM UPGRADE
2012



LEGEND

PROPOSED SEWER ROUTE—

SCALE=1:20000