

**Fletchers Horse Farm Archimedes Screw Micro Hydro Project
Environmental Report
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A. Project Description

B. Name of Project – Fletchers Horse Farm Archimedes Screw Micro Hydro Project

C. Location of Project – 2173 Cockshutt Road, RR 1, Waterford, Ontario N0E 1Y0

D. Purposes of Project –

a. General –

- i. To move away from electricity produced from fossil fuel sources to electricity produced from renewable sources, specifically water.
- ii. To re-utilize the existing dam and mill facilities to produce electricity. About 50 years ago, they were used to produce electricity.
- iii. To establish the first site in Canada to demonstrate the Archimedes Screw Micro Hydro System technology.

b. Specifically –

- i. To install and connect a 7.4 kW (not MW) Archimedes Screw Micro Hydro System.
- ii. To generate electricity for the property owner's consumption on a long-term basis under a net metering arrangement. The annual dollar value of the electricity produced approximates \$7,500.
- iii. To demonstrate the technology to interested farmers, conservation authorities, municipalities, government agencies, waste water facilities and other parties.

E. Duration of Project – Up to and beyond 40 years

F. Watercourse – Nanticoke

G. Anticipated Zone of Influence –

Because the dam is in existence and has been in existence for many years, the anticipated zone of influence, in respect to installing a micro hydro-electric system in the existing water intake of a previously dismantled old mill adjacent to the dam, is believed to be the water impoundment area above the dam and the area immediately below the dam. The water flowing through the Archimedes Screw will be returned to the stream just below the dam.

With the system, the water level is allowed to flow more naturally. The existing dam and dam boards will be maintained. The intake weir height will be set 10" below the height of the dam. See Table of Contents – Comparison of Water Heights Pre and Post Installation of System.

H. Potential Effects to the Environment –

Overall, we believe the net effects are neutral. See Table of Contents – Potential Effects Identification Matrix.

I. Early Avoidance/Prevention/Mitigation Concepts –

Overall, we believe the net effects are neutral. See Table of Contents – Potential Avoidance/Prevention/Mitigation Measures.



J. Proposed Project Phasing –

We hope to complete the Class EA process on or before March 31st, 2012. Immediately thereafter we will begin manufacturing the system, preparing the site as water flow permits and then installing the system. We expect to have the system installed and connected by the end of the summer.



B. Project Location

A. Maps –

- a. Aerial view of property – see Table of Contents

B. Municipal address –

Fletchers Bros Performance Centres Limited
2173 Cockshutt Road, RR 1, Waterford, Ontario N0E 1Y0

C. Legal address –

2173 Cockshutt Road
TWN CON 8 PT LOTS 10 to 12
Norfolk County

D. Coordinates –

Latitude – 42 56 14.03
Longitude 0 80 15 6.92

C. Description of Site

- A. Existing Dam – Yes
- B. Former Mill - Yes
- C. Dam –
 - a. Head - 1.95 meters
 - b. Maximum Flow - 1690 liters per second
 - c. Minimum Flow - 186 liters per second



D. Description of Proposed System

A. Type – Archimedes Screw Micro Hydro System

B. Specifications -

Maximum Flow Capacity	475 Litres per Second
Maximum Output	7.4 KW
Outside Diameter of the Screw	52 Inches
Length of the Screw	17 Feet
Angle of Installation	22 Degrees
Max Revolutions per Minute (rpm)	43
Max Tip Speed of the Outside Edge of the Flights	2.96 Meters per Second
Head	1.95 meters
Screw Construction	Steel
Trough Construction	Concrete
Lower Bearing	Water Lubricated Composite or Wood
Power Connection	Single Phase, Grid tied, Net Metered
Type of system	Run-of-River; No Attempt to Manage Existing Flows

C. Other

We propose to utilize the existing former turbine intake, dam and part of the former structure to install an Archimedes Screw to generate electricity to be fed to the grid in a net metering arrangement. The existing dam will not be altered; the existing old intake will be put back into use to feed the Archimedes Screw with water.

E. Pictures

A. Site prior to development –

- i. Aerial picture provided by MNR
- ii. Existing dam and mill facilities
- iii. Existing dam

B. SolidWorks drawings of proposed project –

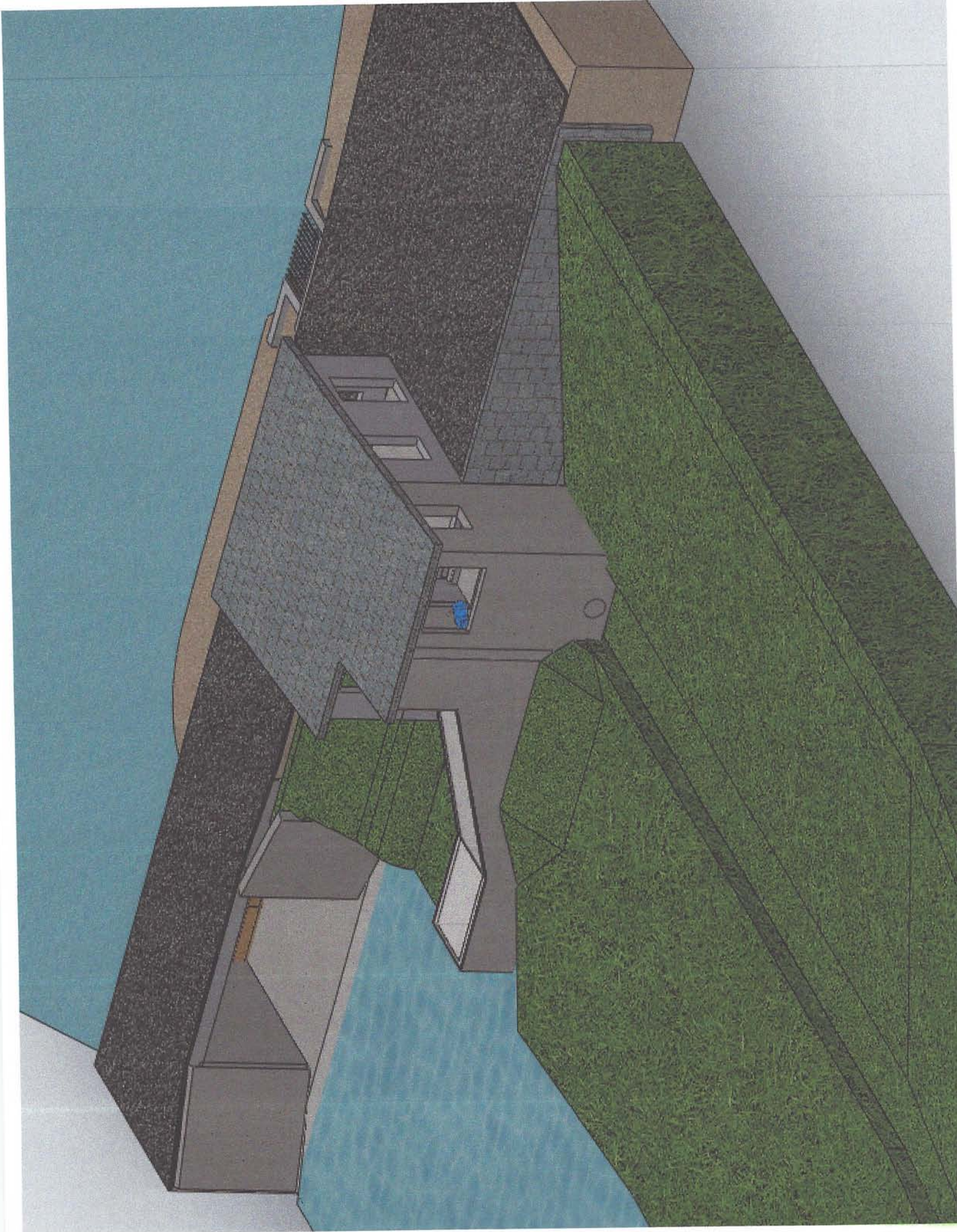
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- ii. Intake side
- iii. Outlet side
- iv. Cutaway of side of Archimedean Screw
- v. Close up of motor and post installation
- vi. Cutaway of intake channel



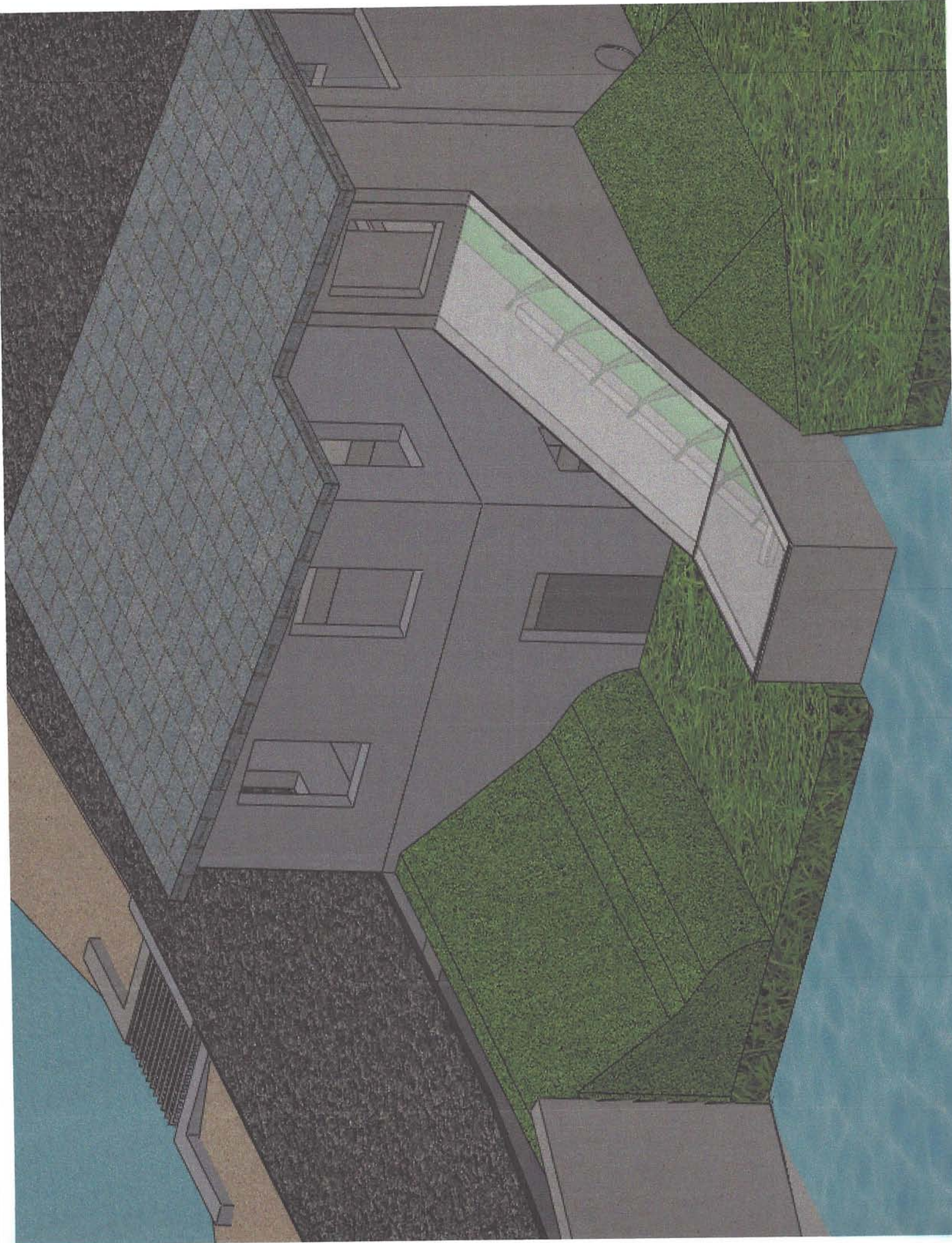


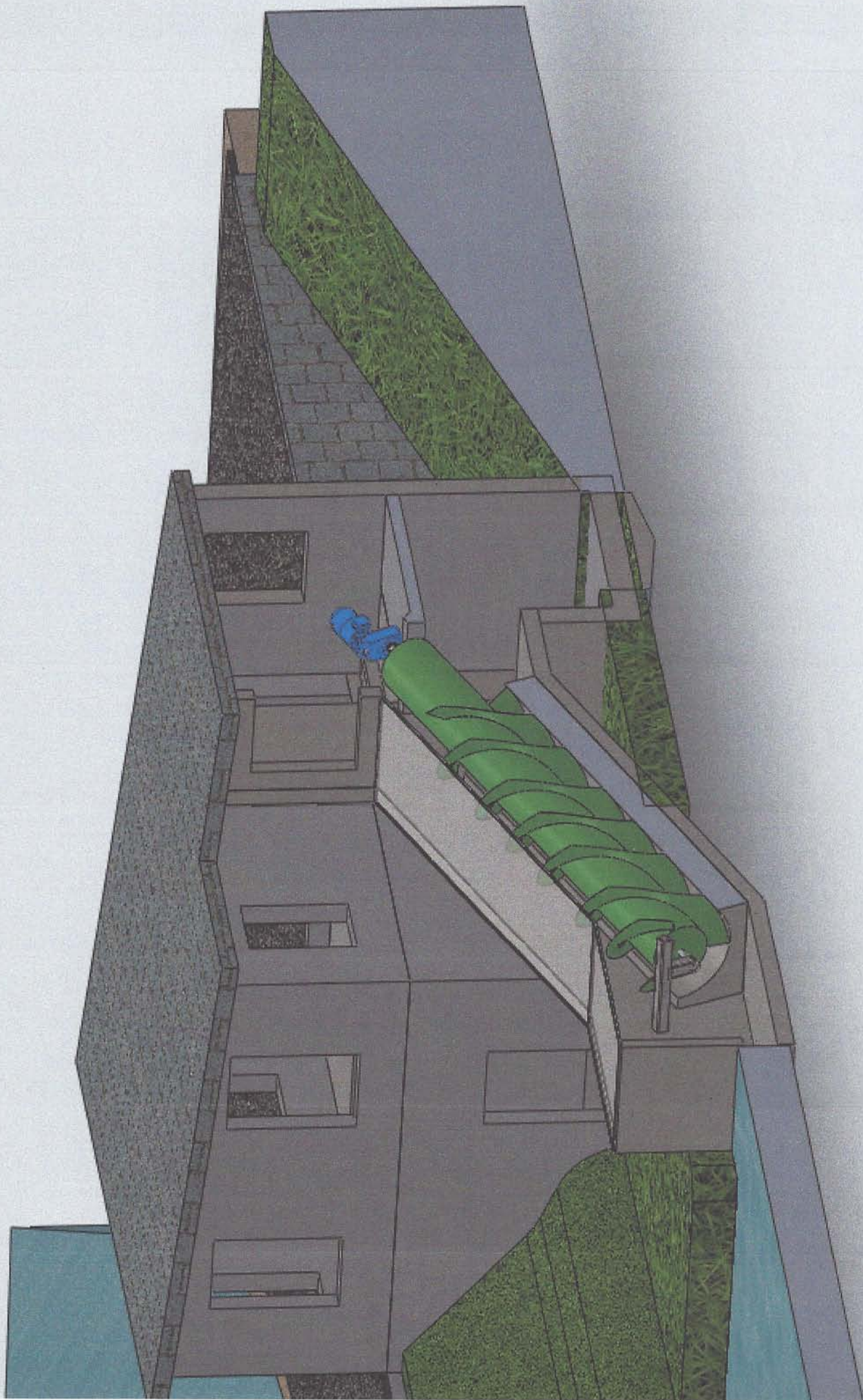


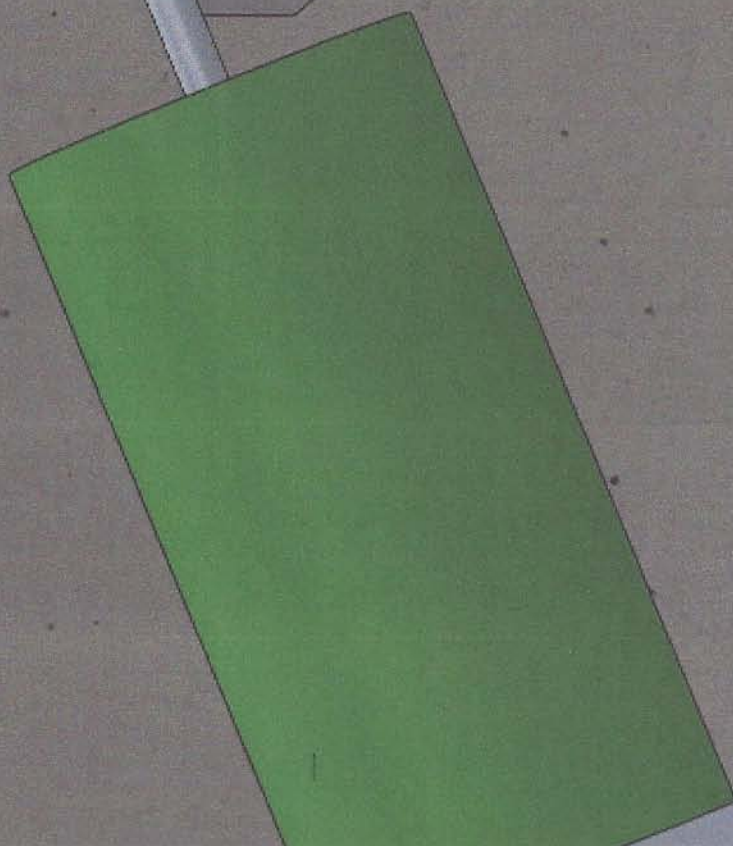
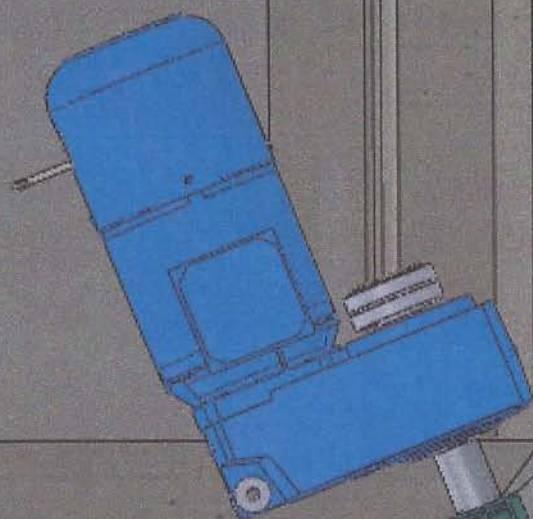


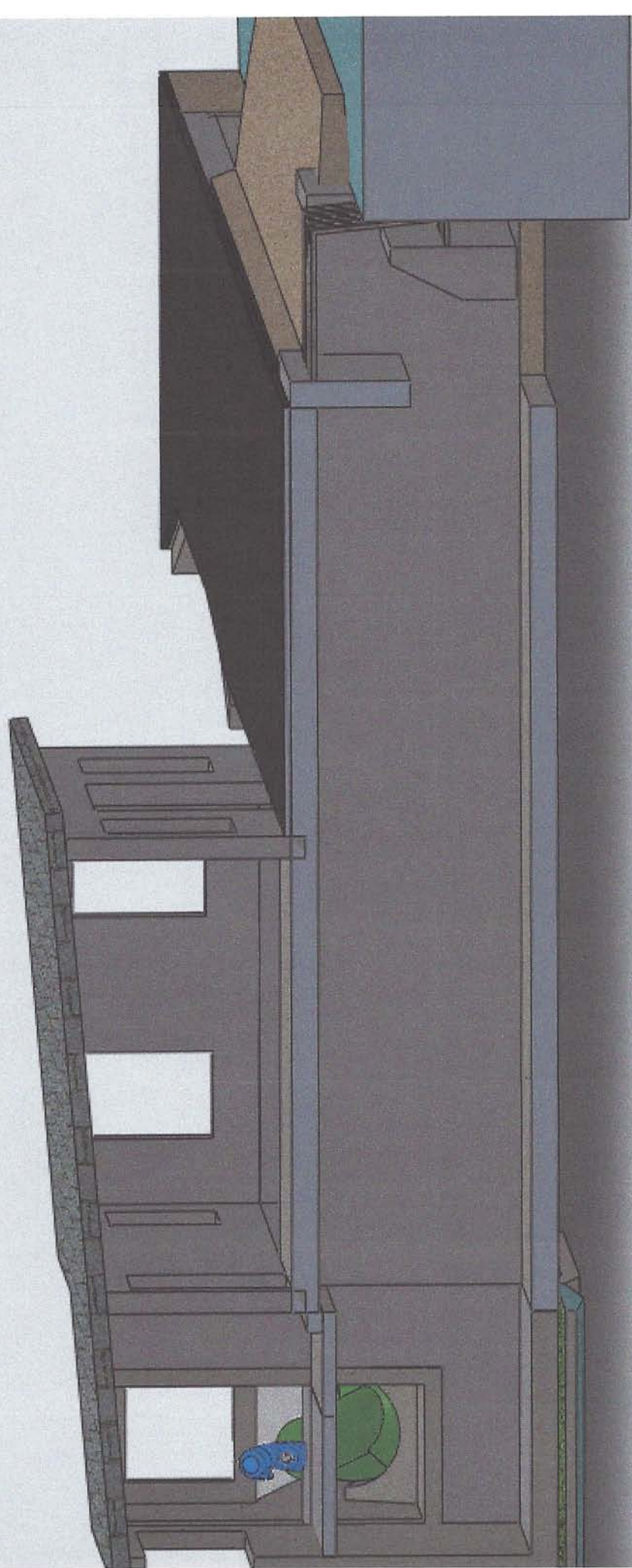












F. Comparison of Water Heights Pre and Post Installation

A. Current Water Heights Prior to Screw Installation -

- Minimum water height above the dam is maintained by the dam.
- The water fluctuates higher than that during increased flows.
- Minimum water height coming over dam at minimum site flow of 186 lps is 2 $\frac{3}{4}$ ".
- Maximum water height coming over the dam at maximum site flow of 1690 lps is 13".
- Total water fluctuation is 10 $\frac{1}{4}$ ".

B. Description of Proposed Installation as it Relates to Water Heights -

- Existing dam and dam boards are installed such that 1.95 meters of head exists, this will be maintained.
- The intake weir height for the Screw will be set 10" below that. This height allows maximum flow to be put to the screw (475 lps) before water starts to go over the existing dam.
- At minimum flow experienced (186 lps), water will be coming over the screw weir intake 5 $\frac{1}{4}$ " high. (or 4 $\frac{3}{4}$ " below the current dam board height).
- At maximum flow experienced (1690 lps), there is an excess 1215 lps that the screw won't accept ($1690 - 475 = 1215$), and therefore the water will continue to go over the existing dam structure. The water going over the dam in this case will be 10 $\frac{1}{4}$ " deep.
- This means that the water can fluctuate at total of 15 inches (approximately, if historical flows are representative of future flows).

C. Comparison of Water Heights Before and After Proposed Installation -

- Water fluctuates 4 $\frac{3}{4}$ " more inches after installation
- Maximum water height is 2 $\frac{3}{4}$ " inches below current maximum water height, due to the extra capacity provided by the Screw that no longer has to go over the dam.
- Minimum water height is 4 $\frac{3}{4}$ " below the current water height as currently maintained by the dam.



G. Information on Consultation with Public, Regulatory Agencies and Aboriginal Communities

- A Notice of Commencement was published in the Simcoe Reformer in early October, 2011.
- A Public Information Meeting was held on October 12, 2011 at 4077 Hwy # 3 East in Simcoe, Ontario. It was attended by 4 individuals who requested to be informed of future events. Although they expressed concern over the watercourse, all comments were supportive.
- A copy of the Notice of Commencement and Notice of Public Information Meeting was inserted in 30 mail boxes of adjacent and potentially affected riparian landowners/tenants.
- A Notice of Commencement, along with an Information Package, was couriered to each of the following –
 - Ontario Ministry of the Environment
 - Ontario Ministry of Natural Resources
 - Ministry of Tourism and Culture
 - Canadian Environmental Assessment Agency
 - Long Point Regional Conservation Authority
 - Norfolk County
 - Norfolk Power
- The following concerns/issues were raised –
 - Ontario Ministry of the Environment – None
 - Ontario Ministry of Natural Resources – None other than a permit would be required. A “neutral” assessment was indicated.
 - Ministry of Tourism and Culture – Suggested we also consider whether the project will impact areas of archaeological potential. We considered such.
 - Canadian Environmental Assessment Agency – No response
 - Long Point Regional Conservation Authority - None other than a permit would be required
 - Norfolk County – No response

- Norfolk Power – None
- Fisheries and Oceans Canada – Suggested any inwater work should not occur between April 1 to June 1 to protect fish during their spawning and nursery periods unless additional suitable mitigation measures are approved. We accepted the suggestion.

H. Changes to Original Proposal

Other than timing of installation as requested by Fisheries and Oceans Canada, no changes were proposed or are now contemplated.



I. Potential Effects Identification Matrix

See attached.



Potential Effects Identification Matrix

Criteria	Potential Level of Effect						Comments
	-H	-L	Nil	Unk	+L	+H	
A. General Natural Environment Considerations:							
1. Air quality, including GHG Offsets						X	The system replaces systems producing electricity from fossil fuel sources and will therefore improve air quality over the next 40 year plus life of the installation. Guidance and direction was requested from MOE, MNR and LPRCA.
2. Water quality or quantity (surface water)			X				The system will not affect the quantity of surface water because no water is removed, and all natural flows are maintained. The system uses the surface water that normally would have went over the dam and instead it passes some of it through the screw, with the screw chambers acting very similar to an escalator. Water turbidity or cloudiness is not impacted above or below the screw. In terms of the materials that come in contact with the water, they are either concrete or steel. The stainless steel trough the screw is mounted in and the concrete walls etc will not affect water quality. The screw itself has a coating on it, and it can be a potable water coating but potable water coatings are not used in Europe and we see no need to do so either given that the coating once applied is inert. The submerged lower bearing is a water lubricated composite or wood that requires no grease and therefore no contaminants can enter the water. The upper gear box contains food grade oil (for extra safety while in operation but also reducing risks transporting it to and from the screw during routine oil changes) and is contained in the concrete motor room in case any of this food grade oil ever did leak out. Guidance and direction was requested from MOE, MNR and LPRCA.
3. Water quality or quantity (groundwater)			X				The system does not come in contact with ground water directly only surface water and based on the nil affects to surface water explained above it will have nil effects on groundwater also. Guidance and direction was requested from MOE, MNR and LPRCA.
4. Species at risk and their habitat					X		Guidance and direction was requested from MOE, MNR and LPRCA to determine any possible species at risk in the area. We have researched a list of Species at Risk in the more general area of

							Norfolk County and have reviewed that list for species we may have seen in the area. However, many of the species are unknown to us and it is difficult to identify if they are present in the specific area or not, but none stand out as being present to us. We have also asked the property owner if they know of any species at risk in the area. We request direction from the local Species at Risk expert in this regard. Without knowing if there are species at risk in the area or what their specific needs are to make their situation better we have so far planned to keep the site as close to its current state as possible to ensure minimal disruption. Therefore, we have decided not to use the old mill tail race and instead orient the screw so that the outflows from the screw exit at the base of the current dam. This ensures that flows remain where they currently are and that any muscles or other small organisms that live at the base of the dam will experience the same flows that they do presently. We have also planned to keep water fluctuation levels from seasonal flooding consistent with what is experienced presently. Total water height fluctuation we estimate at 10.25" normally between high and low flow times, with minimum water height being maintained by the dam. After installation as currently planned the max water height is estimated to be 2 3/4" below current max height (because of flow capacity added by screw), and minimum water height is estimated to be 4 3/4" below current minimum water height for a total fluctuation of 15" seasonally. Please note that the setup that produces these fluctuations was chosen because it results in the least amount of civil work on the intake side and therefore less disruption, but we can accomplish either the same fluctuations as currently exist or even greater fluctuations than those described if it benefits possible species at risk that live in and around the area. In terms of fish, extensive fish passage tests in the U.K. have conclusively demonstrated that the large water chambers and slow rotation speed of the screw allow fish and eel of all sizes safe passage through the system. Copies of these studies have been provided. Tip speeds of the screw below 3.5 meters/ second were tested as safe to fish. The tip speed on the screw planned is 2.96 m/s. As a result, the Environment Agency in the U.K. has agreed that no screening is required. The species of fish and eel may vary here but the sizes of fish and eel tested will still apply here. Because the screw is safe to fish and eel it will allow the safe passage downstream but it does not allow upstream passage through the screw. Because we can effect different water height fluctuations that may be more desirable for the local ecosystem and due to the ability to pass fish downstream we believe this is a positive impact.
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5. Significant earth or life science features			X			No changes will be made to significant earth or life science features. The existing pond/ wetland area will remain as is. The small existing dam will remain as is. There will be no major movement or rearrangement of the topographical features that already exist. Guidance and direction was requested from MOE, MNR and LPRCA .
6. Land subject to natural or human-made hazards			X			There will be no effect on lands subject to natural or human made hazards. There will no major rearrangement or creation of new topographical features, the existing dam will be untouched, the pond and wetland area will remain as it is, and the existing old mill intake will be utilized, the effect will be to simply have some of the water now going over the dam, go down the screw instead and come out at the bottom of the existing dam. Minimal site work is required to install the system. A concrete addition (roughly 7 foot x 40 foot including the screw) will be made on the back of the old existing mill building and the screw itself will be manufactured off-site and installed using a crane parked on the driveway. The old existing mill intake is not marked or protected in any way, we plan on using signage to warn of this potential hazard as well as a coarse screening barrier in front of the intake. Guidance and direction was requested from MOE, MNR and LPRCA.
7. Terrestrial wildlife (including numbers, diversity and movement of resident or migratory species			X			No activities during construction or during long term operation will have an effect on terrestrial wildlife numbers, diversity or movement. As mentioned all existing features will be used and maintained including the pond and dam. We have planned to keep seasonal water fluctuations and pond levels very close to what they are now. This will result in the maximum water height being 2 ¾" below the current estimated max water height in the spring, and minimum water height in summer is estimated to be 4 3/4" below current minimum water height for a total fluctuation of 15" seasonally, which is estimated to be 4 ¾" more water level fluctuation seasonally. This allows for a more slightly more natural seasonal water fluctuation without affecting the overall nature of the existing pond and wetland as it exists currently because of the dam. As mentioned before, this setup with the corresponding water fluctuation levels was chosen because it minimizes site work on the intake side, keeps the nature of the existing pond and wetland the same but allows for a slightly more normal and increased water fluctuation level, but we can accommodate any required water fluctuation levels in our planning, such as maintaining the existing status quo. There will be no changes that will affect movement of terrestrial species.

							Guidance and direction was requested from MOE, MNR and LPRCA.
8. Natural vegetation and terrestrial habitat linkages				X			Natural vegetation will be unaffected, we may have to cut down one tree that is very close to the old mill building that may interfere with the small addition on the back of the old mill building, but all other vegetation will remain intact. The pond and wetland will remain intact. No terrestrial habitat linkages will be affected, as the mill pond already exists, there will be no additional areas flooded or changed. Guidance and direction was requested from MOE, MNR and LPRCA.
9. Soils and sediment quality				X			The site as is will remain intact unchanged, the only thing we plan on changing is to allow some of the water into the existing intake and run down the new screw instead of over the dam. There will be no dredging in the pond/wetland area. The existing intake only has to be repaired. The construction will take place in the form of an addition on the back of the existing old mill structure on dry ground. The footprint of this structure is roughly 7 feet wide by 40 feet long. Once out of the construction phase the lower end of the screw will be opened to the stream just below the dam by removing the last few feet of earth and preparing it to be similar to the rest of the surrounding shoreline. When operating, water will flow from the top of the pond down the screw the same as it goes over the dam currently. Therefore there will be no effect on soil and sediment quality. Guidance and direction was requested from MOE, MNR and LPRCA.
10. Significant natural heritage features and areas				X			All natural heritage features and areas will be left as they currently exist. No modifications will be made the general nature of the existing environment. Guidance and direction was requested from MOE, MNR and LPRCA.
11. Other (specify)							
B. Aquatic and Riparian Ecosystem Considerations:							

1. Shoreline dependant species			X		The shoreline below the dam will remain unchanged, some of the water now going over the dam will be diverted down the screw, but 100% of the water is returned to the watercourse directly below the dam. There is no depleted reach below the dam. By returning water directly below the dam, any species existing in the spillway of the dam will be unaffected. The existing dam will remain as is, with the stop logs installed in the same position they are currently. As currently planned water levels above the dam will vary slightly from what they are presently due to the addition of the screw. The maximum water level is estimated to be 2 ¾" below the current maximum water level (due to the additional capacity provided by the screw), and the minimum water level is estimated to be 4 ¾" below the current minimum level. We don't believe this is a material difference and therefore it will not affect shoreline dependent species above the dam. As stated previously, we can however change our intake structure to maintain either current water level fluctuations or we can increase water fluctuations even further than planned if this is deemed more appropriate for species in the area. The current planned setup allows slightly more overall water level fluctuation by allowing an estimated 15" fluctuation in wet spring months compared to dry summer months, whereas the existing dam only allows an estimated 10.25" fluctuation. Guidance and direction was requested from MOE, MNR and LPRCA.
2. Wetland dependant species			X		The pond and wetland area above the dam will remain as is with the exception of the small changes in the minimum and maximum water fluctuation levels described above and therefore wetland species will not be affected. Flows are not managed, whatever naturally existing flows exist will be maintained, the Archimedes screw only uses whatever naturally existing flows exist. No water is extracted from the waterway, some of the water that would have went over the dam, simply goes down the screw instead and ends up in the same place at the bottom of the dam, therefore there is no effect below the dam. Guidance and direction was requested from MOE, MNR and LPRCA.
3. Fish Habitat			X		The pond and wetland area above the dam will remain as is with the exception of the small changes in the minimum and maximum water fluctuation levels described above therefore fish habitat will not be affected. Flows are not managed, whatever naturally existing flows exist will be maintained, the Archimedes screw only uses whatever naturally existing

						flows exist. No water is extracted from the waterway, some of the water that would have went over the dam, simply goes down the screw instead and ends up in the same place at the bottom of the dam, therefore there is no effect on fish habitat below the dam. Guidance and direction was requested from MOE, MNR and LPRCA.
4. Fish Migration					X	The system does not affect the upstream passage of fish however it does allow safe downstream passage. The large water chambers between screw blades and the slow rotation speed of the screw acts much like an elevator and allows safe downstream passage. Tip speeds of the screw below 3.5 m/s have been proven safe for fish and eel passage in the UK without requiring rubber bumpers on the leading edges of the screw, the tip speed of this screw is 2.96 m/s. Archimedes Screws are also used as "fish pumps" in the aquaculture industry to move fish. Because this project will allow downstream migration of fish and eel, we believe this is a positive impact. Guidance and direction was requested from MOE, MNR and LPRCA.
5. Fisheries					X	As mentioned above, the Archimedes screw has been studied and proven safe for fish and eel passage. Also, water flows are not managed, all existing water flows will be maintained and no water is extracted from the waterway. Given these factors and the ability of the Archimedes screw to safely pass fish and eel downstream we believe this is a positive effect on fisheries by allowing unwanted species to move downstream. Guidance and direction was requested from MOE, MNR and LPRCA.
6. Erosion and Sedimentation			X			The system will not affect water turbidity - water is pulled from the top of the impoundment the same as water flowing over the dam. Some water that would have went over the dam will instead flow through the existing old intake and down the screw and end up in the same place at the base of the dam spillway. There will be no erosion or sedimentation effects. Guidance and direction was requested from MOE, MNR and LPRCA.

7. Fish Injury or Mortality (impingement and entrainment)			X		Extensive fish passage tests in the U.K. have conclusively demonstrated that the large water chambers and slow rotation speeds of the screw allow fish and eel of all sizes safe passage through the system. The large water chambers between screw blades and the slow rotation speeds of the screw act much like an elevator and allows safe downstream passage. As a result, the Environment Agency in the U.K. has agreed that no screening is required to prevent fish entry. The species of fish may change from the UK to Canada but the size of fish and eel are still applicable and therefore the results of the UK studies (attached) are appropriate for use here. Tip speeds of the screw below 3.5 m/s have been proven safe for fish and eel passage in the UK without requiring rubber bumpers on the leading edges of the screw (rubber bumpers on required on leading edges for tip speeds greater than 3.5 m/s), the tip speed of this screw is 2.96 m/s. Archimedes Screws are also used as "fish pumps" in the aquaculture industry to move fish. Guidance and direction was requested from MOE, MNR and LPRCA.
8. Water levels, flows and movement (surface or groundwater)			X		<u>Water Levels</u> - We have planned to keep water fluctuation levels from seasonal flooding consistent with what is experienced presently. Total current water height fluctuations are estimated at 10.25 inches difference between high and low flow water levels, with minimum water height being maintained by the dam. After installation, as currently planned, the max water height is estimated to be 2 3/4" below current max height (because of flow capacity added by the Archimedes screw), and minimum water height is estimated to be 4 3/4" below current minimum water height (because of the new lower intake height for the Archimedes screw) for a total fluctuation of 15 inches seasonally. Please note that the setup that produces these fluctuations was chosen because it results in the least amount of civil work on the intake side and therefore less disruption, but we can accomplish either the same fluctuations as currently exist or even greater fluctuations than those described if it benefits species that live in and around the area. This allows for slightly lower maximum and minimum pond levels than currently are experienced and slightly greater natural seasonal water fluctuation without affecting the overall nature of the existing pond and wetland as it exists currently because of the dam. Because these changes are relatively small they have nil to only a small positive effect because of the slightly larger and more natural seasonal water level fluctuations. <u>Flows</u> – water flows are unaffected, water flows are not managed in any way. Whatever flows are experienced at the site, are the flows that the

						Archimedes screw uses. No water is extracted from the watercourse or from groundwater. Some flows that would have went over the dam, simply go into the old intake connected to the old mill building. Those flows come into the old intake from the top of the pond. The water goes down the screw and back into the watercourse directly below the dam. <u>Movement</u> - We decided not to use the old mill tail race and instead orient the screw so that the outflows from the screw exit at the base of the current dam. This ensures that flows remain where they currently are and that any muscues or other small organisms that live at the base of the dam will experience the same flows that they do presently. On the intake side, some of the water that would have went over the dam will instead flow into the existing old intake (approx 40 feet to the side) and flow down the screw instead and exit at the same place as water going over the dam. Therefore movement of water is unaffected. Guidance and direction was requested from MOE, MNR and LPRCA.
9. Drainage, Flooding and Drought patterns			X			<u>Drainage Patterns</u> – drainage patterns are unaffected. Flows are not managed in any way. <u>Flooding Patterns</u> – flooding patterns will not be affected, but because the Archimedes screw adds some water flow capacity to the existing dam, the maximum water level now experienced when flooding in the spring, will be 2 ¾ inches lower (estimated). <u>Drought patterns</u> – drought patterns will not be affected, but because the planned intake is lower than the dam, the minimum water level now experienced in the low flow summer months, will be 4 ¾ inches lower (estimated) Guidance and direction was requested from MOE, MNR and LPRCA.
10. Water Temperature					X	The estimated lower water level in the pond in the summer months (4 ¾ inches lower) will have the effect of cooling the temperature of the pond water in the summer slightly because the water course flow will be a larger percent of the pond volume therefore the pond water will not remain in the pond as long to warm up. We believe this is a positive impact. Nevertheless guidance and direction was requested from MOE, MNR and LPRCA.
11. Other (specify)						
C. Aboriginal Community Considerations:						

1. First Nation reserves or other Aboriginal communities					X			No effect - the project is not on a First Nation reserve. Guidance and direction was requested from MNR.
2. Spiritual, ceremonial, cultural, archaeological or burial sites					X			No effect – the project is not a First Nation reserve and there are no known such sites on the property. Guidance and direction was requested from MNR.
3. Traditional land or resources used for harvesting activities					X			No effect – the lands in question are not used for aboriginal harvesting activities. Guidance and direction was requested from MNR.
4. Employment					X			No effect
5. Lands subject to land claims					X			No effect – the lands are not subject to any known land claims. Guidance and direction was requested from MNR.
6. Economic Development					X			No effect.
7. Other (specify)								
D. Land and Resource Use Considerations:								
1. Access to inaccessible areas (land or water)					X			The project will have no effect because the nature of the area will remain largely unaffected. The pond and dam all remain the same with the exception of minor (lower) water level changes on the pond. Guidance and direction was requested from MOE, MNR and LPRCA.
2. Navigation					X			The project will not affect navigation of the watercourse. Guidance and direction was requested from MOE, MNR and LPRCA.
3. Riparian rights or privileges					X			The project will not affect riparian rights or privileges. The zone of influence is completely contained within the property owners property. Guidance and direction was requested from MOE, MNR and LPRCA.
4. Recreational use – (land or water)					X			The project will not affect recreational use of the land or water in the area. The zone of influence is completely contained within the property owners property. The pond and waterway are not currently used for recreational purposes. Guidance and direction was requested from MOE, MNR and LPRCA .

5. Angling and hunting opportunities			X				The project will not affect angling or hunting opportunities but no hunting or angling take place within the zone of influence as it is completely contained with the property owners property. Guidance and direction was requested from MOE, MNR and LPRCA.
6. Trapping activities			X				The project will not affect trapping activities but no trapping takes place within the zone of influence as it is completely contained with the property owner's property. Guidance and direction was requested from MOE, MNR and LPRCA.
7. Baitfish harvesting activities			X				The project will not affect baitfish harvesting activities but no baitfish harvesting takes place within the zone of influence as it is completely contained with the property owner's property. Guidance and direction was requested from MOE, MNR and LPRCA.
8. Views or aesthetics					X		There will be an improvement. The existing old mill building and general area is in disrepair and the plan calls for repairing this building but keeping its historic appearance and cleaning up the garbage, old tires and debris in the area. The old mill building is directly adjacent to the property owners driveway and the dam is directly underneath the driveway. The owner wishes to "clean up" the site and the revenue generated by the project will allow this to happen.
9. An existing land or resource management plan			X				There is no effect. The surrounding land area will be unaffected. Guidance and direction was requested from MOE, MNR and LPRCA.
10. An existing water management plan			X				There is no effect. No water will be extracted from the waterway and flows will not be managed in any way. Guidance and direction was requested from MOE, MNR and LPRCA.
11. Protected areas			X				There are no protected areas within the anticipated zone of influence. Guidance and direction was requested from MOE, MNR and LPRCA
12. Other (specify)							
E. Cultural Heritage Resources Considerations:							

1. Archaeological sites			X			There are no archaeological sites in the affected area nor are any expected, therefore there is no effect. Guidance and direction was requested from MTC.
2. Buildings or structures				X		The old mill building and related intake will be restored. The building is made of concrete and is therefore in fairly good shape but the wood truss roof, window and door frames have all rotted and the roof has fallen in. The building will be restored with a new roof and windows and doors. The main floor interior of the existing structure will provide a small workroom for screw operations. When completed the existing mill building will look largely like it did when originally built although it will have an addition on the rear of it to extend the current water intake to accommodate the Archimedes screw. The site was obviously used for a long time and most recently to generate DC power, and the turbine from the old mill building is in the local museum according to the property owner. Restoring the site to be able to once again generate power is preserving the not only the building structure but also preserving the heritage of the site as a working mill/power production facility. The existing dam will be repaired but will remain.
3. Cultural heritage landscapes				X		The area is the site of an old mill located on the farm property which was later used to generate DC electric power. The property owner has a desire to see the heritage aspect of the site restored to preserve its original character (mill pond, dam, and mill building etc) with the accompanying views and landscapes and at the same time produce green energy to power his horse farm.
4. Other (specify)						
F. Social and Economic Considerations:						
1. The location of people, businesses, institutions or public facilities			X			The project will not affect the location of people, businesses, institutions or public facilities.
2. Community character, enjoyment of property or local amenities				X		The project is considered "green" and will contribute to the character and position of Norfolk as the Green Energy hub. Archimedes screws in general and this specific screw will be extremely quiet when installed and only the sound of the water will be heard and they always attract interested viewers when in public locations.

								This site is wholly contained within the confines of the property owners farm but it will still contribute to the character of Norfolk as the Green Energy Hub.
3. Employment							X	We intend to develop a business around the Archimedes screw system and design manufacture install and maintain systems locally, regionally and across Canada and export systems internationally. This will add to the local economy in terms of job creation.
4. Public health and/or safety							X	By partly offsetting other greenhouse gas producing electricity generation sources, the air will be cleaner having a positive public health effect. The annual output of kilowatt hours by the system is the equivalent to removing 37.4 metric tons of CO ₂ annually from atmosphere.
5. Local, regional, or provincial economies							X	We intend to develop a business around the Archimedes screw system and design manufacture install and maintain systems locally, regionally and across Canada and export systems internationally. This will add to the local economy in terms of job creation. The construction and operation of this individual Archimedes screw installation will also add to the local economy over its 40 year plus life, also saving the property owner approximately \$10,000 per year on electricity costs making his current farm business more viable as well. Norfolk is also part of the "Green Energy Hub", and is actively promoting green companies to be part of the local economy. This project and our business located in Norfolk County contribute to this goal.
6. Tourism values						X		The project will be a "demonstration site" where several field day open houses will be held to demonstrate the technology to interested parties, but the site is on private property and will not be open to public viewing other than on the prearranged field day open houses.
7. Water supply						X		The installation of the Archimedes screw will have no effect on the water supply, as no water is removed from the watercourse. Some water that currently goes over the dam will instead be directed through the old existing intake channel and down the screw, exiting at the bottom of the dam. Guidance and direction was requested from Norfolk County .

8. Aesthetic image of the surrounding area						X	The existing old mill building and general area is in disrepair and the plan calls for repairing this building but keeping its historic appearance and cleaning up the garbage, old tires and debris in the area during construction. The old mill building is directly adjacent to the property owners driveway and the dam is directly underneath the driveway. The owner wishes to “clean up” the site and the revenue generated by the project will allow this to happen.
9. Other (specify) Impact on the Farm community						X	The installation of the Archimedes screw will positively impact the farm property owner economically and the long term viability of the farm, and protect the farm owner from rising electricity costs used for farm operations. By installing the archimedes screw the farmer is fixing the price paid for electricity and therefore protecting the farm from rising electricity prices thereby contributing the stability of farm input prices.
G. Energy/Electricity Considerations:							
1. Reliability (e.g. voltage support)						X	Water power is an extremely reliable source of energy and runs 24/7 and is therefore considered part of the base power supply. This system will be connected to part of the distribution system not the transmission system but by generating will contribute to voltage support. Therefore this system, however small, will increase the reliability of the electricity grid.
2. Security (e.g. Black Start)			X				Often hydroelectric power plants are designated as the black-start sources to restore network interconnections. A hydroelectric station needs very little initial power to start and can put a large block of power on line very quickly to allow start-up of fossil-fueled or nuclear stations. However, the small archimedes screw generator planned for this site relies on grid power to keep operating. If the grid power goes out, the archimedes screw electrical controls immediately turn off the generator as a safety mechanism for the safety of power line workers and as anti-islanding protection and therefore will not be able to help in the event of a “black start”.
3. Electricity flow patterns			X				The planned installation is small at 7.5 KW, and will be net metered against the current on farm electricity usage. The farm will essentially be consuming all electricity produced by the Archimedes screw generator. Therefore the installation will not affect electricity flow patterns. Nevertheless guidance and direction was requested from Norfolk Power on

							September 15th.
4. Other (specify)							

J. Planned Avoidance/Prevention/Mitigation Measures

- We plan to use the existing intake, and channel such that minimal work will be required on the intake and therefore no disturbance will occur in water at the intake side other than cleaning out the intake area from debris that has accumulated there.
- We plan not to touch the current dam installation including the present height of the dam boards.
- We plan to orient the Screw such that water exits the screw just below the dam so that the flow and water level below the dam will match existing levels and flows immediately below the dam.
- We plan to do the necessary concrete work on the screw at the lower end within the current dry grassy bank area and when done remove the soil between the Screw exit and the water so as to minimize any disturbance to the stream. This lower area will then be lined with stones similar to the current banks.
- We plan to utilize the existing old mill building and intake channel under it to maintain and revitalize the heritage aspect of the site.
- We plan to install a weir on the intake channel to maintain water heights above the dam very close to their current fluctuating levels. This is not necessary for the Screw operation but it acts to maintain the current situation as close as possible and prevent disturbances to wildlife and vegetation that has inhabited and grown on the pond side.
- As requested by Fisheries and Oceans Canada, any inwater work will not occur between April 1st and June 30th.

K. Overall Net Effects
(after planned avoidance/prevention/mitigation measures)

As indicated on the Potential Effects Identification Matrix, no negative effects are contemplated. Instead any potential effects are expected to be either neutral or positive.

Overall, we consider the effects as being NEUTRAL.

L. Overall Advantages and Disadvantages of the Project

The project makes productive use of an existing dam and old mill to create electricity from a renewable energy source. In addition, it will be the first project in Canada to demonstrate the Archimedes Screw Micro Hydro System.

In due course, we plan to distribute such systems across Canada and internationally thereby building a viable Ontario-based business that does its share to improve the economy.

M. Listing of Required Approvals and Permits

- Ministry of Natural Resources – Application for Work Permit (*relating solely to alterations to the intake weir*)
- Long Point Regional Conservation Authority – Permit Application (relating to regulation of development, interference with wetlands and alterations to shorelines and watercourses)

N. Anticipated Timeliness for Project Implementation

- | | |
|----------------------------|--------------------|
| • Notice of Completion | February 28, 2012 |
| • Statement of Completion | March 31, 2012 |
| • Permits | April 30, 2012 |
| • Manufacture of Screw | May 31, 2012 |
| • Installation of System – | |
| ○ Out of water work | June 30, 2012 |
| ○ In water work | July 31, 2012 |
| • Connection of System | August 31, 2012 |
| • Commissioning | September 31, 2012 |

