# SITE VISIT REPORT

## FILTERBOXX WASTEWATER TREATMENT PLANT INSPECTION

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Prepared for Durum Capital

A Site Inspection Visit was conducted on March 11, 2020. The purpose of the visit was to provide a preliminary assessment of the condition of the FilterBoxx wastewater treatment plant acquired by Durum Capital.

## SYSTEM DESCRIPTION:

The FilterBoxx wastewater treatment plant is a large skid based treatment system. The system is installed on seven structural steel skids. The FilterBoxx wastewater treatment plant is an extended aeration activated sludge treatment plant with a rated capacity of 750 $m^3$/day.

The system consists of a Headworks/Equalization skid, three Aeration/Bioreactor skids, and Solids Control/HVAC skid arranged in parallel and Clarifier and Microstrainer skids arranged cross-wise to the other skids. The longitudinally oriented skids are 14' wide by 80' long and the transversely oriented skids are 13' wide by 60' long.

## GENERAL NOTES AND OBSERVATIONS

Overall buildings look to be in excellent condition. Despite having been moved several times, the building envelopes appear to be in good condition. Not buckling of any wall panels was observed. All of the doorframes appear to be square with the doors operating with no impingement. Accessible windows opened smoothly.

With few noted exceptions all equipment is in place and undamaged. Interconnecting wiring appears to be intact and neatly spooled. Some assembly hardware (nuts/bolts) is missing but most appears to be intact.

Aside from accumulated dust and the odd piece of trash, buildings are mainly clean. No evidence of rodent or other animal incursions was observed.

### Rotating Equipment

As noted above, the wastewater treatment equipment is almost 12 years old and has never been put into operation. It is unknown what if any preventative maintenance program was undertaken by the original purchaser (Suncor) between time of delivery in 2008 and the system being acquired by Canada North Camps in (2015?) and after said acquisition.

For shafted rotating equipment such as pumps and rotary blowers it is typically recommended that the shafts be rotated every month to prevent corrosion and to keep bearings from developing flat spots. It is expected that this routine maintenance has not been conducted in at least the past 5 years. Best practices dictate that all of the pumps, blowers and associated electric motors undergo a thorough bearing disassembly and inspection prior to be being placed into service. It is also possible that seals in the pumps, blowers and gear motors may need to be replaced. Although (except where noted later) rotating equipment appeared to rotate smoothly, it is possible that once equipment is placed into service and operating at speed premature bearing failure may occur.

The equipment skids have now been moved multiple times and it is possible that some rotating equipment has become slightly misaligned.

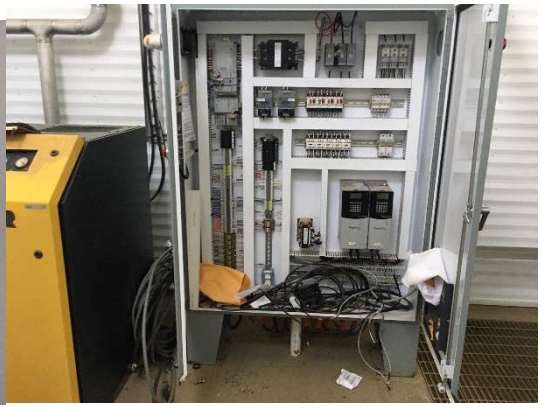
Given the lack of routine maintenance and possibility of equipment misalignment, it is recommended that the services of a millwright be engaged to make detailed checks on equipment once it has reached its final location and before it is put into service.

## Electrical Panels

There are a series of electric panels within the wastewater treatment system. There is a main power distribution panel and the main PLC control panel located in the HVAC/Solids Control Building as well as local power distribution panels that are located on individual equipment skids.

The main concern with the storage of electric panels is moisture accumulation that can lead to corrosion and failure of electrical components. Desiccant packs were placed in all of the panels but these cannot be expected to last for 10 years. There was however no observed indications of moisture or corrosion within the panels at the time of inspection. It is recommended that prior to energizing the panels, electric heaters be placed in the immediate vicinity of the panels for a period of time and the panels allowed to heat and dry.

A secondary concern is accumulation of dust within the panel components. Most of the panels appeared to be free of signs of significant dust accumulation but several panels were either left open or were of a type that did not seal and had significant dust evident.



Its recommended that the electrical panels be blown out with dry air prior to being placed into service.

## Aluminum/Stainless Steel Compatibility

The treatment plant is one of several that were originally built for Suncor put into service between 2008 and 2010. The process tanks are fabricated from marine grade aluminum while process piping is constructed of stainless steel. Several of the plants of this type put into service have shown varying levels of corrosion below the waterline that has at least partially been attributed to reactions of the dissimilar metals.

During the site inspection, it was observed that there is direct contact between these dissimilar metals within the process tanks of the wastewater treatment plant both above and below the waterline. In some cases there is isolation in place between the two dissimilar metals and in other cases there is direct metal-metal contact.

It is recommended that at a minimum, in cases below the waterline and where there are process connections below the waterline, that isolation/insulation be installed. This would include pipe wraps where stainless pipe is in contact with aluminum pipe supports and bolt isolation kits on flanges. As a further precaution an electro-galvanic protection system can be installed.

No pipe isolation present.

Pipe isolation present.

## Loose Equipment

There are several boxes of loose shipped equipment. Including the dissolved probes for the bioreactors as well as tank level transmitters.  It is recommended that this equipment be secured in some fashion as site access is relatively uncontrolled and the buildings are open.


## Structural Steel Skids

The majority of the skids are primarily supported only on the outside perimeter beams with some skids having partial support under mid-beams. However, there appears to be no noticeable skid deflection. Skid lifting lugs are still in place. The skids have external connection points for access stairs but no stairs were observed on site. There are also should be interconnecting platforms that connect doorways of each of the individual skids. These also appear to be missing. Its possible they as well as the stairs were set aside elsewhere onsite and possible covered with snow.

The underside of the beams show surface rust with no observed evidence that the underside of the beams received protective paint coating.  The underside of the skids has been sprayfoamed to provide floor insulation but the installation of the spray foam does not appear consistent in its application.

## HEADWORKS/EQUALIZATION BUILDING

The Headworks/Equalization building is the start of the wastewater treatment process train and houses the headworks screening equipment, equalization tank, process air blower and water transfer pumps. The building is equipped with enclosed florescent lighting, electric unit heaters and ventilation fans.

There is a catwalk platform installed along the one side of the equalization tank which allows connection from one end of the building to the other as well as access to the process air valves.

### Equalization Tank

The equalization tank is 56' long, 12' wide and 10' in height with a volume of 190 $m^3$. The tank is of aluminum construction. The tank is equipped with stainless steel aeration piping and coarse bubble diffusers. The aeration piping is not consistently isolated from the aluminum piping supports. The air flow to each of the aeration droplegs is controlled via a butterfly valve. One of the dropleg butterfly valves is missing. Although the diffusers are older than the typical replacement period for EPDM diffusers, since the diffusers have not been put into service and have been maintained indoors, it is expected that the diffusers will still operate effectively.

The operating level within the Equalization Tank is controlled via a submersible differential pressure (shipped loose) and two level switches which alarm on high/high and low/low level conditions.

### Headworks Equipment

The headworks equipment consists of an IPEC rotary drum screen with solids compactor. The inlet screen receives the raw sewage flow from the collection liftstations located off-skid. The inlet flow is monitored by a 6" Rosemount magnetic flowmeter.

The inlet screen is an IPEC Model IFM 4872 Rotary Drum screen with stainless steel drum and frame construction. The drum screen appears to be in excellent condition. One of the screen access panels and the chain guard were removed at some point but were located next to the screen.  The gear motor turned freely when the motor was turned by hand.


The screenings washer/compactor receives the raw screenings from the rotary drum screen. The screenings washer/compactor has a connection to the system potable wash water system and washes the raw screenings to remove organics prior to compaction and discharge to a storage bin.

The screenings washer/compactor is an IPEC model PLT 8100 with stainless steel construction and stainless steel screw-auger. The unit appears to be in excellent condition. The gearmotor appeared to turn freely when the motor was rotated by hand.


As mentioned above, rotating equipment should be checked by a millwright to ensure shaft alignment and that bearings have not been flattened by prolonged storage with no periodic rotation or lubrication.

## Equalization Process Air Blower

Process air is discharged to the Equalization Tank to provide mixing and to ensure that the inlet sewage does not become septic. The process air is supplied by a Kaeser CB130 C rotary lobe blower with acoustic enclosure. The process air blower appeared to be in excellent condition. No seal/oil leaks were observed, the drivebelts appeared in excellent condition and the blower rotated freely when rotated by hand. It should be noted that the drive belts on the blower were tensioned whereas it is more commonly recommended practice to relieve the tension on drive belts when equipment is placed in storage. The oil level was good and the oil looks pristine.

As mentioned above, rotating equipment should be checked by a millwright to ensure alignment and that bearings have not been flattened by prolonged storage with no periodic rotation or lubrication.


## Feed Pumps

The influent is transferred to each of the three bioreactors by the bioreactor feed pumps. There is one bioreactor feed pump for each bioreactor train. The pumps are Gorman-Rupp Series 11-1/2 self-priming solids handling centrifugal pumps constructed of cast iron and stainless steel with a capacity of 22 m3/hr. The pumps are each controlled by a variable frequency drive (VFD) operated from the main control panel. The discharge from the pumps are interconnected to allow for wastewater feed to all three bioreactors even in the event that one of the pumps is not down for maintenance. The flow to each bioreactor is monitored by a 2" Rosemount magnetic flowmeter.

One of the pumps has the drive coupling disconnected and missing. Two of the pumps (1 and 3) have a noticeable 'scrapping' noise and feel when the rotated by hand likely

indicative of some bearing damage. These pumps should definitely be inspected by a millwright to ensure alignment and to inspect/replace bearings and seals.

## AERATION/BIOREACTOR PROCESS BUILDINGS

There are three aeration/bioreactor trains in the wastewater treatment plant operating in parallel. Each of the bioreactor trains consists of a bioreactor, aeration blower, clarifier and microstrainer. The clarifiers and microstrainers are located in separate buildings. Each of the bioreactor trains can be operated independently.

## Bioreactors

Each bioreactor is constructed from 5053 aluminum and is 56' long, 10' wide and 10' tall with a total volume of 158 $m^3$. Each bioreactor provides approximately 14 hours of retention time at design flow rate. Each bioreactor can be accessed via a catwalk platform extending the length of the side of the bioreactor.

The bioreactors all appeared to be in excellent condition. As noted there is potential for dissimilar metal corrosion between the aluminum bioreactors and stainless steel process air piping once the bioreactors are placed into service requiring isolation between the process air piping and pipe supports.

## Bioreactor Process Air Blowers

The process air for each bioreactor is supplied by a Kaeser CB130 C rotary lobe blower with acoustic enclosure. Each blower is powered by a 15 hp electric motor and has a rated capacity of 300 CFM @ 6 PSI. Process air is supplied to the bioreactors via stainless steel piping and distributed via fine pore bubble diffusers. The dissolved oxygen level within each bioreactor is monitored by a HACH SC100 Controller with LDO Oxygen Probe. The operating speed of the aeration blower VFD is controlled by the PLC based on the indicated dissolved oxygen level. The aeration flow within the bioreactor tank is balanced via butterfly valves located on each drop-leg into the bioreactor tank. Although the diffusers are older than the typical replacement period for EPDM diffusers, since the diffusers have not been put into service and have been maintained indoors, it is expected that the diffusers will still operate effectively.

The process air blowers all appear to be in excellent condition. The blowers all turn smoothly when rotated by hand. Oil levels and condition appear excellent. Drive belts appear to be in good condition.

It should be noted that the drive belts on all the blowers were tensioned whereas it is more commonly recommended practice to relieve the tension on drive belts when equipment is placed in storage.

The acoustic enclosure on the process air blowers on bioreactor skid 1 and skid 3 were both removed at some time prior to inspection. And one of the blower enclosures has suffered some minor cosmetic damage.


The dissolved oxygen LDO probes have never been installed and remain within their original boxes within Bioreactor 1 building although one box has been opened. It should be noted that although these probes were never placed into service, the probe sensor have exceeded their expected life and may not function once placed into service. The LDO probes themselves are also obsolete and have been replaced by the LDO2 probes from HACH. At this time, it is not known if sensor caps or other spares for these probes are available.

The HACH SC100 controller has also been replaced by the SC200 controller. The SC100 was a universal controller capable taking input from a variety of instruments. It is

expected that the SC100 controller should still be capable of use with new LDO2 probes if it is necessary to replace the probes.


## CLARIFIER BUILDING

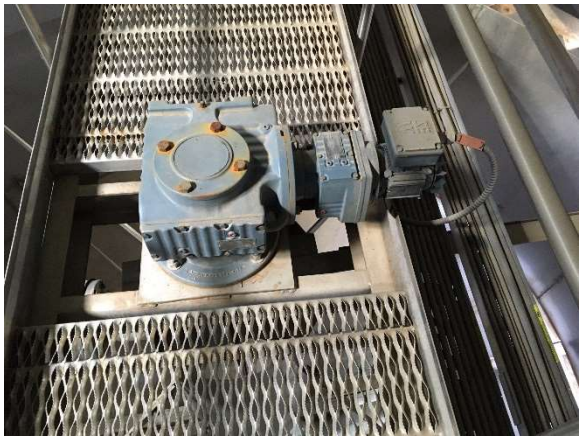
The clarifier skid/building contains the secondary clarifiers that are used to separate the biosolids from the effluent of the bioreactors as well as the sludge return pumps that send sludge back to each of the bioreactors or waste the sludge to the aerobic digester.

There is one secondary clarifier for each of the bioreactors. The clarifiers are 13' in diameter and are constructed of stainless steel. Each clarifier is equipped with a SEW Eurodrive gear motor that operates the skimmer/sludge rake for each clarifier.

There is one sludge return pump for each clarifier. The sludge return pumps are Gorman-Rupp Model T2A3 self-priming solids handling pumps with 3 hp TEFC motors. The pumps are equipped with variable frequency drives to control the return flow rate to the bioreactors via the main control panel. The flowrate is monitored by Rosemount magnetic flow meters. In order to maintain the proper amount of biosolids in the bioreactor, the return sludge is periodically sent to the digester for removal and dewatering through a process called wasting. The wasting process for each clarifier is controlled by a pair of automated valves with electric actuators that direct flow to the bioreactor or to the digester. The operation of these valves is set at the main control panel.

The clarifiers themselves appeared to be in excellent condition with no damage or corrosion observed. The rubber on the sludge scrapper/skimmer appeared to be in good condition. The sew eurodrive gear motors on each of the clarifiers turned freely when

rotated by hand. However, it should be noted that the fan covers for the gear motors had been removed prior to the time of inspection and were not seen onsite. There is minor corrosion present on the housing bolts but is largely cosmetic.



Like the feed pumps, all of the sludge return pumps had noticeable scrapping' noise and feel when the rotated by hand likely indicative of some bearing damage. These pumps should definitely be inspected by a millwright to ensure alignment and to inspect/replace bearings and seals.

One of the lights in the clarifier building has become dislodged from its ceiling attachment and is hanging by its wire. This should either be reattached or disconnected prior to moving the wastewater treatment plant to its final location.

## MICROSTRAINER BUILDING

The microstrainer skid/building houses the polishing microstrainers and effluent discharge pumps for the wastewater treatment plant. There is one microstrainer system for each of the three bioreactor process trains. The microstrainers receive effluent from the secondary clarifiers and provide a final polish by passing the effluent through a fine mesh drumfilter. A portion of the treated effluent is used to periodically backflush the drum filter while the remaining treated effluent is discharged. The backflush water is then pumped back to the equalization tank for reprocessing. The microstrainer system also receives the surface skimmings (scum) from the secondary clarifier which is also pumped back to the equalization tank for reprocessing.

All of the doors on this building were locked and no access was possible and thus no inspection of the equipment was possible.

## SOLIDS CONTROL/HVAC BUILDING

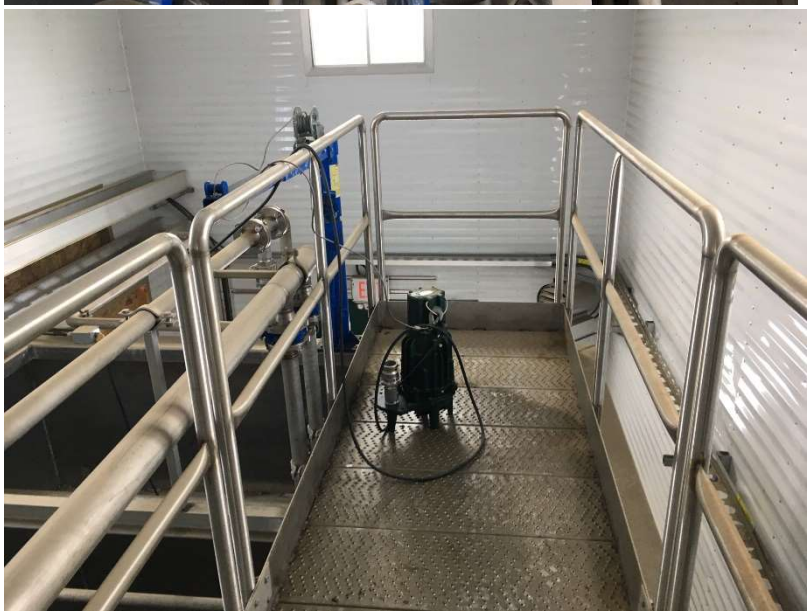
The Solids Control/HVAC building is split into two separate rooms. One room houses the sludge digester and solid dewatering equipment while the other houses the main air handling unit for the wastewater treatment plant as well as the system main PLC control panel and HMI.

## Sludge Digester

The sludge digester is constructed of 5053 aluminum and is 13'long, 10' wide and 10' tall with a total volume of 36.5 $m^3$. The biosolids (sludge) from all three bioreactor trains is wasted to the digester. The sludge digester is an aerobic digester and the process air is provided by two rotary lobe blowers (one service/one standby). The purpose of the digester is to age and reduce the volume of the wasted biosolids prior to dewatering. The digester is equipped with a decant pump. Periodically, the process air to the digester is ceased and the biosolids are allowed to settle to the bottom. The supernatant is then discharged back to the equalization tank for reprocessing. This process helps thicken the sludge prior to dewatering.

The sludge digester appears to be in excellent condition. No damage or corrosion was observed. The digester is equipped with stainless steel aeration piping with drop legs descending into the digester tank equipped with coarse bubble diffusers. As mentioned previously for the equalization tanks and bioreactors, there is potential for dissimilar metal corrosion on this system once it is placed in service. There will at a minimum require isolation between the stainless steel aeration piping and the aluminum pipe supports attached to the digester tank. Some of the connections are isolated with rubber pipe wraps but it appears to be inconsistently employed. The air flow to each of the aeration droplegs is controlled via a butterfly valve. Although the diffusers are older than the typical replacement period for EPDM diffusers, since the diffusers have not been put into service and have been maintained indoors, it is expected that the diffusers will still operate effectively.

The decant pump and davit are present. The decant pump should be removed and secured prior to movement of the wastewater treatment plant.

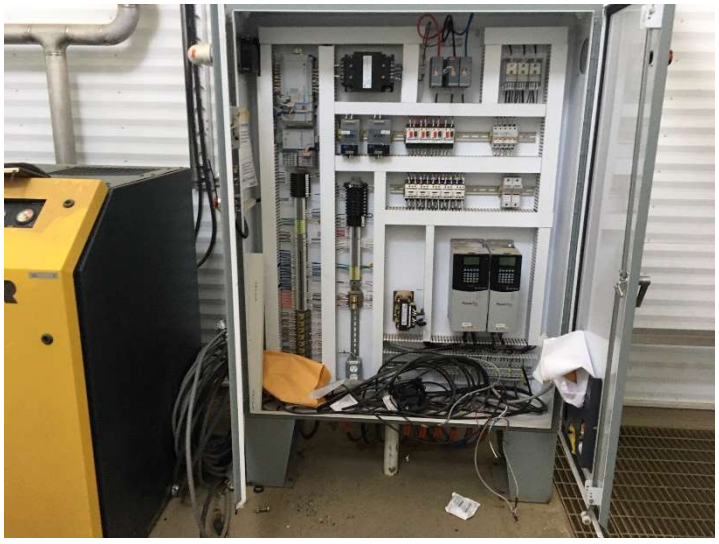


## Digester Process Air Blowers

The process air blowers are two Kaeser CB130 C rotary lobe blowers with acoustic enclosures.  The process air blowers both appeared to be in excellent condition. One of the check valves are missing from one the blowers. No seal/oil leaks were observed, the drivebelts appeared in excellent condition and the blower rotated freely when rotated by hand. It should be noted that the drive belts on the blower were tensioned whereas it is more commonly recommended practice to relieve the tension on drive belts when equipment is placed in storage.  The oil level was good and the oil looks pristine. As with he other blowers, these should be inspected by a millwright to ensure bearings are not damaged prior to the equipment being placed into service


## Sludge Dewatering System (Centrifuge Package)

The wastewater treatment plant was originally equipped with a centrifuge dewatering package that included a Peiralisi Baby centrifuge, Polymaster polymer make-up system, polymer dosing, pump, progressing cavity type centrifuge feed pump and main control panel. With the exception of the main control panel the entire dewatering package is missing. The panel was left wide open and is filled with dust but otherwise appears in good condition.



## Main System Control Panel

The wastewater treatment plant is controlled via the main control panel/HMI system. The main control panel houses the Allen Bradley Compact Logix PLC along with input/out modules as well as the Panel View touchscreen HMI. The HMI provides access to the graphic user interface through which the operator controls the operation of the wastewater plant.


The main control panel appeared to be in excellent condition.

## Power Distribution Panel

The main distribution panel receives the main power feed and distributes power to the wastewater treatment plant subpanels distributed on the various equipment skids.

Apart from seemingly missing the breaker cover panel and accumulated dust. The main power panel appeared to be in excellent condition.

## Main Make-Up Air Unit

While each of the equipment skids has supplemental on-skid unit heaters and ventilation fans, the main heating and ventilation for the wastewater treatment plant is provided by

the central Make-Up Air Unit.  The Make Up Air Unit is essentially a large ventilation fan combined with a large electric furnace. The circulation air is distributed among the equipment skids of the wastewater treatment plant via a system of air plenums.

## ESTIMATED COST TO COMPLETE

The table below provides an estimated cost to effect necessary repairs and replace missing equipment.  It will not be known if some of the items will be required until either inspection or testing of the equipment is completed. The highest value item is the solids dewatering centrifuge. It is not known why this equipment is missing from the equipment skid. It may be possible that it is elsewhere onsite or that Canada North camps otherwise knows the whereabouts of the equipment.

The other main cost item is to replace the dissolved oxygen sensors and controllers. While it is likely that the dissolved oxygen sensors may need to be replaced, it is much more likely that the existing SC100 controllers will still be suitable and will work with the new LDO 2 probes in the event that the existing sensors are non-functioning.

Costs to replace missing stairs and breezeway sections have not been included as it is expected that they are elsewhere onsite. Also not included in the cost estimate is the cost associated with the installation of a cathodic protection system to address potential dissimilar metals corrosion. It is expected that electrical isolation of the two metals will be sufficient. Replacement of the aeration piping below the waterline with non-metallic piping would also be a less costly alternative that installation of a cathodic protection system.

| Description | Qty | Unit | Est. Cost | Total |
|---|---|---|---|---|
| Millwright and Apprentice | 40 | hrs | $ 200.00 | $ 8,000.00 |
| Bearing and Seal Kits Gorman Rupp Series 10 Feed Pumps | 3 | each | $ 250.00 | $ 750.00 |
| Bearing and Seal Kits Gorman Rupp T Series Pumps | 3 | each | $ 250.00 | $ 750.00 |
| Kaeser Blower Bearing Kits (if Necessary) | 6 | each | $ 250.00 | $ 1,500.00 |
| Centrifuge Dewatering Package and Installation | 1 | each | $ 40,000.00 | $ 40,000.00 |
| Blower Check valve and hardware | 1 | each | $ 150.00 | $ 150.00 |
| 2" Butterfly Valve and hardware | 1 | each | $ 100.00 | $ 65.00 |
| Misc. Hardware | 1 | Lot | $ 100.00 | $ 100.00 |
| Hach LDO2 Oxygen Sensors (if Necessary) | 3 | each | $ 1,500.00 | $ 4,500.00 |
| Hach SC200 Controller (if Necessary) | 3 | each | $ 2,500.00 | $ 7,500.00 |
| Pipe wrap and Flange Bolt Isolation Kits | 40 | each | $ 25.00 | $ 1,000.00 |
| Installation Labour - Isolation kits/missing valves | 40 | hrs | $ 40.00 | $ 1,600.00 |
| Total | | | | $ 65,950.00 |

## CONCLUSION:

The FilterBoxx wastewater treatment plant overall is in excellent condition despite its age and lack of maintenance. Although minor repairs are required to some of the rotating equipment the primary costs associated with bringing the unit up to standard for use is the cost to replace the missing dewatering equipment.