Sumas Gro Media Ltd. Runoff Water Management System: Operation Manual

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1. Introduction

Sumas Gro Media Ltd. operates a custom soil mixing facility at 42481 industrial way, Chilliwack BC, where it has constructed a runoff water treatment system. Henceforth referred to as 'the system,' this work has been done to bring Sumas Gro Media Ltd.'s facility into compliance with all relevant regulations regarding the management of runoff water. Specifically, the system is designed to achieve zero discharge of runoff water from the facility, capturing and retaining it onsite instead. For the system to function effectively, proper maintenance and operation procedures will be required. The smooth operation of the system will be key to the continued business success of Sumas Gro Media Ltd., allowing the company to remain in regulatory compliance. To this end, this manual has been written with two objectives: firstly, to provide any prospective system operator with a broad overview of the system, its components, and how it functions, and secondly, to outline in concrete terms the duties of a system operator, from daily inspection procedures to monthly or seasonal maintenance requirements.

2. Relevant Regulatory Standards

The performance requirements of the system are determined in large part by regulatory requirements. A granular, and detailed understanding of these standards is not required for the day-to-day management of the system, but general familiarity is of benefit to an operator. Listed below are the regulatory acts that are of pertinence to the system, accompanied by a brief description thereof. For more information consult the full regulatory texts.

- **Environmental Management Act (EMA)**
  The facility will not discharge air contaminants or stormwater/leachate to the environment without an authorization (permit/approval) under the EMA.
- **Soil Amendments Code of Practice (SACoP)**
  On-site stored inputs qualify under Category (e): industrial wood residue that has not been treated with glue, paint, preservatives, or other harmful substances. Storage, siting, setbacks, covering, runoff control, and record-keeping will comply with SACoP's storage requirements.
- **B.C. Field Sampling Manual**
  All field water sampling (planning, collection, preservation, QA/QC, and chain-of-custody) follows the B.C. Field Sampling Manual.
- **Federal Fertilizers Act & Regulations (CFIA)**
  Products offered for sale or distribution will meet CFIA safety and labelling requirements (and registration where applicable).

- **WorkSafeBC (OHS Regulation)**
  Implement written safe-work procedures, worker training, and exposure controls consistent with the OHS Regulation (e.g., dust/bio-aerosols, equipment, traffic, and confined-space hazards, as applicable).

3. Facility Information/Design

The facility receives trucks of feedstock materials to the products building for sorting. Sorted feedstocks are stored uncovered in paved lock block bunkers outdoors. Any mulch delivered is screened outdoors and stored in large piles on unpaved ground. Blending operations take place in the products building before being bagged or piled and stored outdoors. Products sold are used for gardens and yards as growth media.

Feedstock materials received at the facility include sawmill wood residuals, sand, coconut husk, clean aggregates such as pumice, and nutrient blends. A complete list of materials stored onsite, including both feedstocks and finished products, is provided in the Appendix. The mixing process at the facility is computer-controlled, allowing for thousands of customized recipes to be produced on a made-to-order basis.

The blended soil products are intended for use in gardens, yards, landscaping, and similar purposes as growth media. Products are shipped to customers throughout the Lower Mainland, including the Greater Vancouver Area and as far east as Agassiz. Volumes of feedstocks and products vary significantly due to customer demand and seasonal factors. Typically, demand is highest in spring and summer, with stockpiles replenished during winter months.

The facility is located in an area designated for industrial and agricultural land use. Odour is not a major concern due to the relatively low proportion of odour-generating materials handled and the distance from sensitive receptors, allowing for effective air dilution. Electricity, water, and gas services are connected to the site. Potable water is used only in the lunchroom. The electrical system is equipped with an automatic transfer generator set to maintain operation of the effluent collection system during power outages. A groundwater well supplies non-potable water for general site use, and the facility is not connected to a sanitary sewer system.

4. System Overview

The system is designed on a zero-discharge principle, meaning that there is no overland surface discharge of runoff water from the site. In order to do this, the system must achieve two outcomes:

1. Intercepting and capturing any runoff water before it is discharged from the site.

2. Managing the volume of captured runoff water to ensure that it remains captured, and doesn't exceed the system's storage, evaporation, and recycling capacity.

These two outcomes — capturing and managing all onsite runoff water — are in turn accomplished through a set of 4 subsystems. In order to successfully operate the system, an operator will firstly have to be able to properly operate each individual subsystem and secondly integrate the capabilities of each subsystem into a cohesive whole. The four main subsystems are described below in section 3.2., followed by a discussion in section 3.3. on subsystem integration.

4.1. Main Subsystems

Each subsystem is distinct in regard to its function, operational characteristics, and maintenance requirements. Listed below is a description of the main features and capabilities of each sub system, as well as its role in the overall system:

4.1.1. Capture and conveyance (subsystem 1)

Across the site there are three pump stations that serve as the capture and collection points for runoff water: the north pump station, east pump station, and west pump station. Runoff water is directed to these capture points passively, via the slope of the pavement. Once the water enters the pump stations, it can then be pumped to any of the three other subsystems for storage, evaporation, or recycling/reuse. All three of the pump stations are equipped with two 10hp KTZ47.5 submersible pumps. This subsystem also features a series of three mulch filters to try and filter sediment and large debris out of the runoff water. Two of these mulch filters are paired with the pump bays, while one is standing alone. Lastly, there are two force mains, a gravity main, and a clay lined ditch to facilitate the conveyance of water once it has been captured and pumped.

4.1.2. Storage (subsystem 2)

A major component of the runoff water system is an 9700m3 clay lined pond that has been built at the north end of the site. This pond has two main functions. Firstly, during the wet season, it allows a significant amount of water to be stored and carried over into the dry season. Said stored water is not only easier to evaporate during the dry season, but carrying to over from the rainy season reduces the load placed on the remainder of the system during the rainy season. Secondly, the pond provides the system with surge capacity for major rainstorms. Filling the pond is done via the pumps in the north pump bay. They are equipped with cam lock fittings which can be connected to fill pipes for the pond.

4.1.3. Evaporation (subsystem 3)

The system is equipped with an EcoMister HD 30 evaporation unit. The Ecomister operates by spraying water into a fine mist that can easily evaporate and then blowing this mist into the air to maximize evaporation. The Ecomister can evaporate significant quantities of water but is weather dependent. The warmer the temperature, and the lower the humidity, the more effective the system becomes. It can be run in non optimal conditions, but in this case, it can function more as a sprinkler in aid of subsystem 4. Irrigation sprinklers are also used in this system throughout the mulch piles to aid with mulch conditioning.

4.1.4. Recycling/reuse (subsystem 4)

Much of the runoff water that gets captured can be recycled back onto the facility's wood mulch inventory via a sprinkler system. Using runoff water in this manner helps manage the moisture levels in the inventory, limits fugitive dust generation, and minimizes fire risk. Much of the wood mulch inventory also has significant absorption capacity, so sprinkling water on it can be viewed as a different form of ‘storage’. The wood mulch inventory is not static. As existing wood mulch inventory is used up, and new wood mulch inventory is moved into place, an operator will be able to reposition sprinklers to avoid overwatering existing inventory and take advantage of new inventory as fresh material for water absorption. In addition to being a form of ‘storage’, the wood mulch inventory is also a source of ‘evaporation.’ The inventory will naturally generate heat which will cause water absorbed by the inventory to evaporate.

The map displayed on the next page as Figure 1 locates all of the equipment and infrastructure associated with each subsystem.

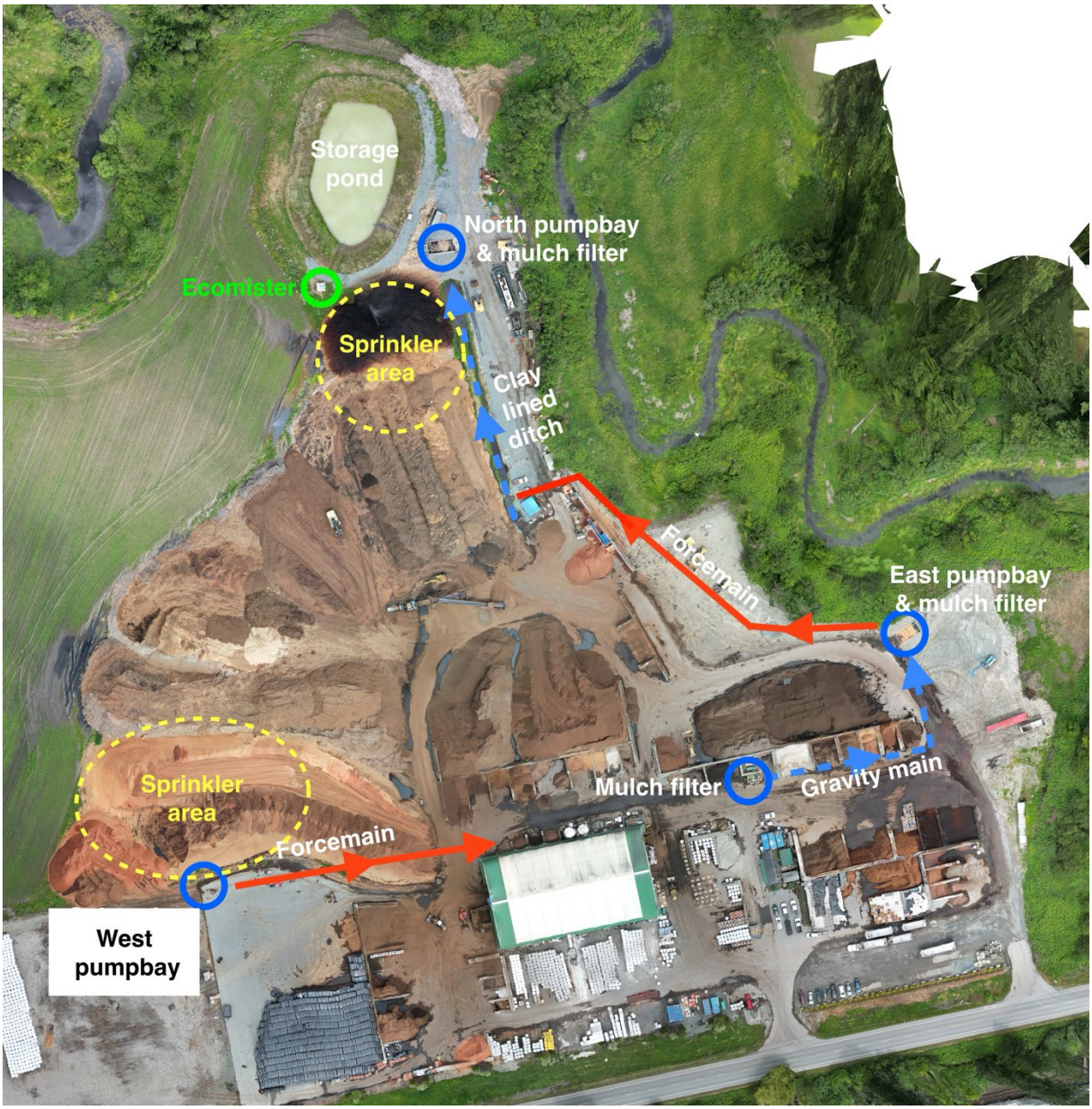


Figure 1 Site map with runoff water system infrastructure and equipment locations.

4.2. Sub-system integration

Successful operation of the system — capturing and managing all onsite runoff water — requires an operator to integrate the capabilities of each subsystem. Collectively, all four subsystems have more than enough capacity to deal with storm events. Subsystem integration is about the bringing the capabilities of each subsystem together to achieve a robustly preforming system. The Table 1 outlines the functions and limitations of each subsystem.

Table 1 Functions and limitations of runoff water management subsystems

Subsystem:	Function/Limitation:
1. Capture and conveyance	Has robust spare capacity/redundancy. Can only capture and convey water.
2. Storage	Pond maximum capacity: 9700 m^3.
3. Evaporation	Ecomister yearly capacity: 35,800 m^3 is weather dependent. Irrigation supplementation needs yearly capacity: ~50,000 m^3
5. Reuse/recycle.	Wood mulch inventory can 'store' and 'evaporate' runoff water. Requires rotating and management to maximize capacity.

Accounting for subsystem functions and limitations can be accomplished by the following subsystem integration procedure:

1. Maintain an awareness of the current status of each subsystem by following proper inspection procedures (outlined in section 5).
2. Maintain awareness of the current 7- and 14-days forecast, to develop a prediction of future runoff water flow.
3. Develop plan to direct runoff water flow to the subsystem(s) with the most capacity available, preventing any one system from reaching capacity.
4. If a sub system is near reaching capacity, ensure that there is another sub system available with spare capacity.

Properly done, subsystem integration allows an operator to utilize all four of the subsystems to back up and reinforce one another. Runoff water can be distributed across all the subsystems as required so that they support one another to maximize the system's performance. Moreover, should one system reach capacity, other systems are available as back up. This provides the overall system with a significant amount of redundancy and spare capacity. Therefore, under standard conditions the system will perform as expected — capturing and managing all onsite runoff water — and in the event of a large storm or atmospheric river, the system will have more than enough capacity to absorb any runoff water surges.

Figure 2 visualizes the relationship between each of the four subsystems, and how water flows between them. This helps operators identify what subsystems they can divert water to, should one subsystem be reaching capacity.

It should be noted that subsystem integration has a significant seasonal dynamic. How runoff water is distributed across the system will change as weather patterns change throughout the year. How this impact's the running of the system is described in the following section 3.4.

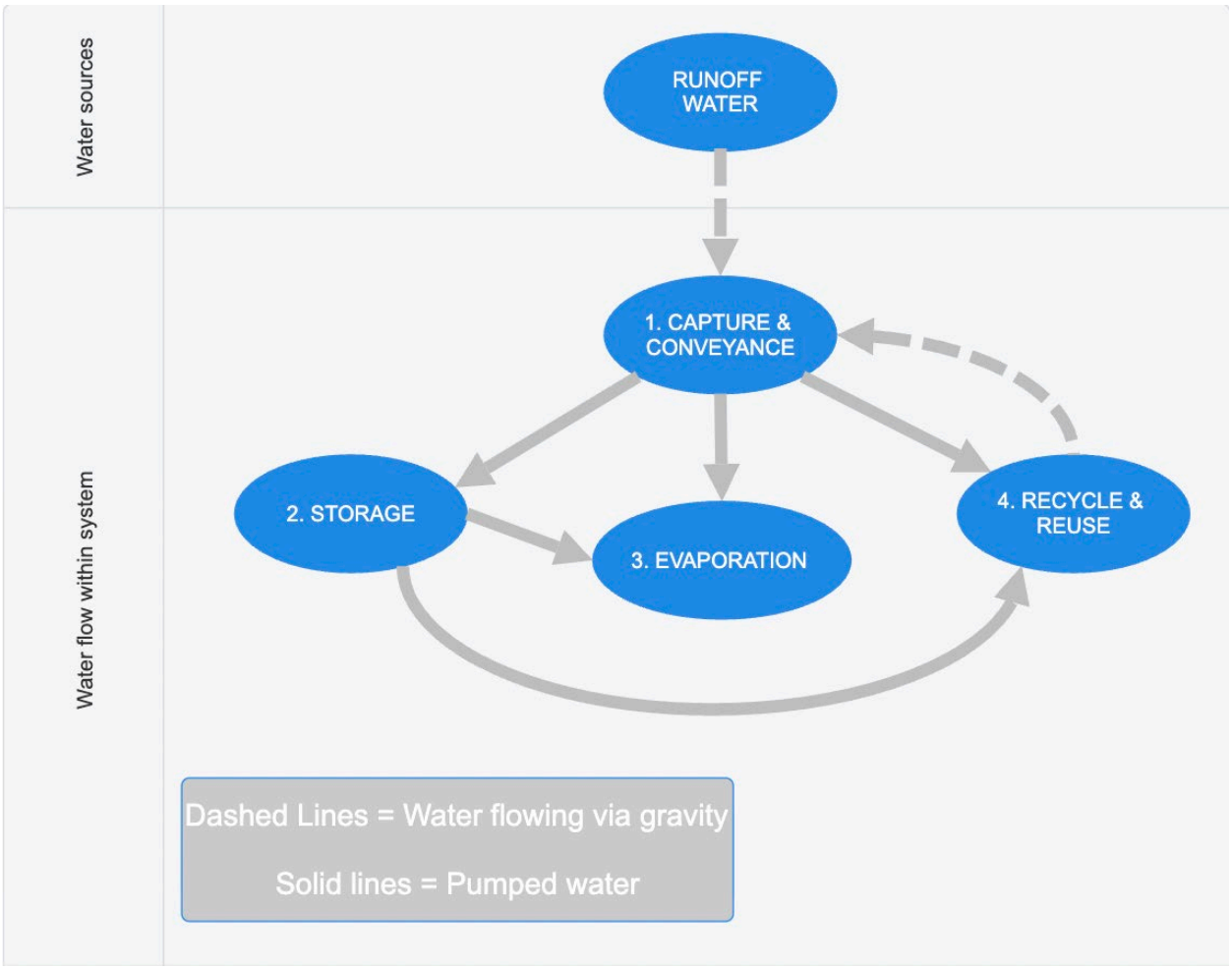


Figure 2 Water flow path and subsystems relationship

5. Seasonal Weather fluctuations

Chilliwack experiences significant seasonal variation in terms of rainfall and temperature. Both rainfall and temperature are critical weather parameters to consider when operating the system. As such, having a good understanding of the seasonal variation of these parameters is important for success. The full scale of seasonal variation is illustrated Figure 3:

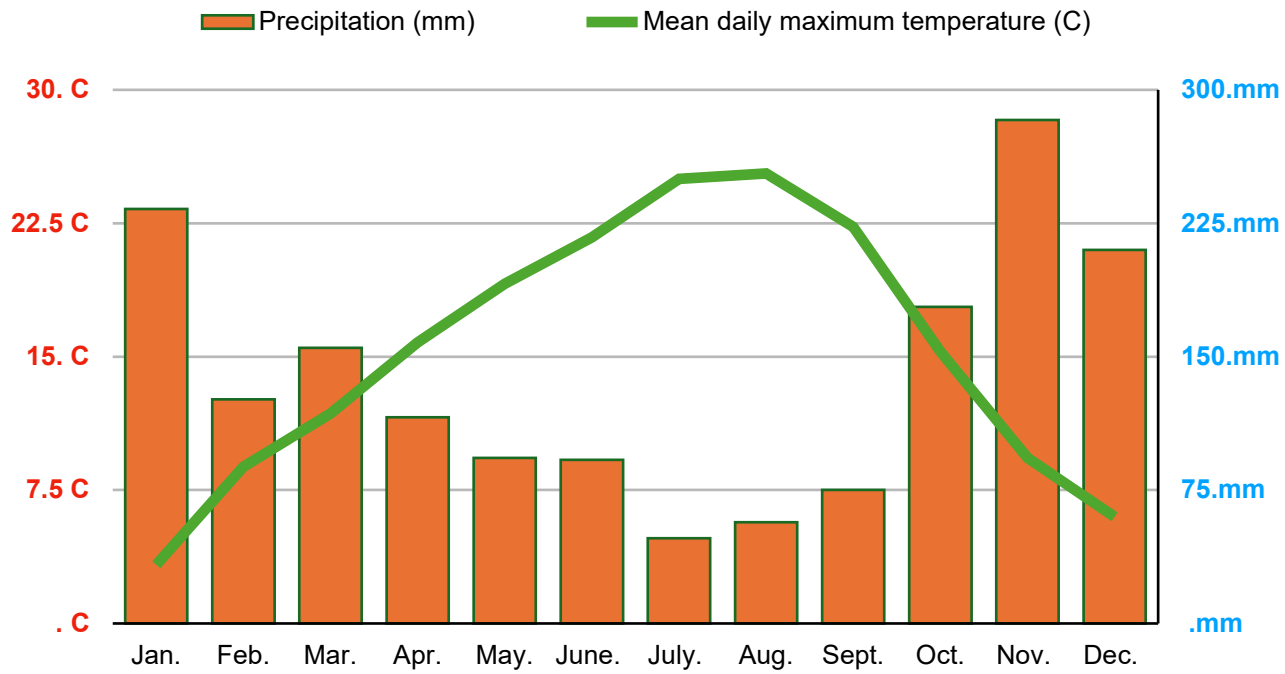


Figure 3 Seasonal Temperature and Rainfall

Precipitation and temperature are inversely correlated; rainfall is highest when temperature is lowest, and temperature is highest when rainfall is lowest. When rainfall is highest, the system will be under maximum load, and the least amount of evaporation will be available due to low temperatures. Meanwhile, when rainfall is lowest, the system will be under almost no load, and high temperatures mean that evaporation potential will be at its greatest. This creates a cyclical dynamic that will play out over the course of a year, where how the system is operated changes with the seasons to account for changing weather conditions. This cyclical dynamic is explained in more detail below, where it is broken down into 4 stages:

5.1. Dry season

During the summer, rainfall will be so low that any runoff water generated on site will pose almost no demand on the system. As the inventory is rotated, it will dry out substantially, which will be beneficial for the winter when rainfall increases significantly.

Meanwhile, because temperatures are high and days are long, this season is the best for evaporating runoff water with the Ecomister. Any runoff water still left in the storage pond from the prior winter should be evaporated now, and having the storage pond is empty by early summer will put the system in a strong position for the wet season.

Completing any significant repairs, modifications, or maintenance that the system may require is also best done during this season.

By the end the dry season, the system the system should be in a 'neutral' state:

The least amount of demand is being placed upon it, all mechanical systems are in good working order, and the highest amount of storage space and absorption capacity is available.

5.2. Fall shoulder season

While rainfall will start to pick up, the wood mulch inventory will still be dry enough to absorb and evaporate a significant amount of onsite runoff water.

Furthermore, while the cooler temperatures and higher number of rainy days will make the Ecomister less effective, conditions will still be good enough that running the Ecomister is worthwhile. Particularly, if effort is made to pay attention to the forecast, and run the Ecomister on the best days, meaningful results can be achieved.

Any significant repairs, modifications, or maintenance that have not yet been completed must be completed now in preparation for the wet season.

5.3. Wet Season

This is when rainfall will be heaviest. For the purpose of managing the system the months of November through to March constitute the wet season. Historically this period has an average rainfall of 1,007mm, which would produce approximately 15,300 m^3 of onsite runoff water. Because this season will also have conditions that are the least favourable for running the Ecomister, most of this water will have to either be pumped into the storage pond or run through the sprinkler system onto the mulch piles. Any clear, sunny days should be taken as opportunities to run the Ecomister, but storage in the pond and processing runoff water via the wood mulch inventory will be the main avenues through which the runoff water is managed during this season.

By the end of the wet season, an operator can expect the water level in the storage pond to be at the highest point it will reach, and the wood mulch inventory to have a relatively high moisture content. Continuing to rotate and replenish wood mulch inventory, as well as periodically adjusting the location of the sprinkler will help ensure that the wood mulch inventory absorbs water effectively

5.4. Spring Shoulder Season

This season is the final stage in the cycle. Relative to the wet season, weather conditions will become more favourable. Decreases in rainfall will mean less of the system's capacity is required, and opportunities for evaporation will increase with higher temperatures and more sun. The improving weather conditions also mean an operator can start to empty water out of the pond that had been pumped in during the wet season. Overall, the improvement in conditions, coupled with good management on the part of an operator, means the system will start returning to a neutral state.

6. Residuals management

The operation of the system will produce over time a minuscule amount of residuals that will need to be managed. There is one source for residuals:

1. Pump bays: A portion of the sediments and suspend solids not trapped by the mulch filters will end up accumulating in the system's pump bays. This will have to be monitored and periodically cleaned out with a Vac truck.
2. The residuals generated will be retained on site and recycled back into onsite inventories.
3. Any recyclable materials (used plastic piping, broken pumps, steel plumbing fittings, etc.) generated by system operations will be appropriately recycled.

7. Contingency Plan

The contingency plan outlines emergency procedures and operational responses for the Sumas. The purpose of this plan is to ensure safe and environmentally responsible operation of the facility under abnormal or emergency conditions, including equipment malfunction, fire, spill, flood, nuisance, or if water-quality benchmarks are exceeded

7.1. Emergency Response Plan

In the event of a fire, flood, or spill, the operators will contact the facility manager first and contact all parties who are responsible for the site or are critical to the response or reporting of accidents on environmental emergencies see Table 2 below for emergency contacts.

Table 2 Emergency Contacts

Agency	Number
Sumas Gro-Media Ltd. Chilliwack Facility Manager	Bert Bischoff 604-619-7996
Emergency Services	911

LOCAL Environment or Operations Emergency: Regional District of Fraser Valley (wildland fire, freshet flooding, river ice jams)	1-800-663-5555
LOCAL non-emergency RCMP	604-792-4611
LOCAL non-emergency fire	604-792-8713
Provincial Emergency Program	1-800-663-3456

Potential emergencies that may occur onsite and in relation to the stormwater management system include fires, reportable spills, and flooding.

In the event of any environmental emergency, Sumas will record and assess all incidents and will determine corrective actions. Significant emergencies will be reported to Fraser Valley Regional District's environment emergency department. Fire emergencies that result in damage to property or persons will be reported immediately to the Fire-Rescue Department, the Fire Chief, or a police officer.

In the event of flooding onsite, the retention pond is at risk of overflow. The overflow is designed to be overflowing into the cornfield adjacent to the facility preventing it from direct discharge into the aquatic system.

7.2. Episode Management

7.2.1. Spills

Sumas has diesel fuel stored on site in two double walled enviro-tanks with a capacity of approximately 5000L. Both tanks are equipped with automatic shit off valves. In case of a spill of fuel, oil, or other contaminants, it will be managed per the steps below:

- Stop the source and contain using absorbent pads or booms.
- Prevent entry to the environment.
- Collect and store contaminated material in sealed drums for disposal at an approved facility.
- Notify Emergency Management BC and the QP immediately.

7.2.2. Nuisance, Litter, and Odour

In 21 years of operation, there has never been a single nuisance, litter, or odour complaint generated by the site. However, should this ever happen, the complaint will be document and appropriate corrective actions will be taken.

7.2.3. Fire

Fire suppression and extinguishment procedure is as follows:

- 24/7 on site security is trained to monitor for fires, especially at night when regular staff are not present.
- If a fire is detected, the site manager will be contacted and appropriately trained company personnel dispatched.
- Excavators will utilize wet wood mulch inventory to smother fire area.
- Once smothered, sprinkler system will be used to saturate fire area with water. Sumas Gro Media Ltd. has three water sources: city water, well water, and runoff water.
- Should these efforts be insufficient, 9/11 can be called as a last resort. From historical experience this has never been required.
- After containment, the effected volumes will be excavated and processed to ensure fire has been extinguished.

7.2.4. Flooding

During extreme precipitation events or pump failure:

- Inspect pump bays and force mains for blockages.
- Monitor site boundaries to ensure that there is no surface discharge.

7.3. Trigger and Response Plan

In the event that contaminant concentrations in in water samples from the slough nearby exceed applicable water quality guidelines, an investigation into the cause will be conducted in consultation with a QP. The QP can determine if the exceeded guidelines are due to ambient conditions or activities from the site. If determined to be from site's activities, the following mitigation measures should be undertaken until it is found that contaminants in the receiving environment return to below guideline levels:

- Examine and enhance source prevention strategies. These include:
    - Making sure all storage of feedstock soil only are within catchment areas that direct runoff to retention pond.
    - Proper vehicle and machinery maintenance.
- Regular site housekeeping

8. Operator Duties and Training.

8.1. Operator Duties

The system operator's duties are as follows:

1. Perform all their duties in manner that is safe for themselves and their coworkers, in compliance with WorksafeBC.
2. Develop and maintain a high level of understanding of the system's operating principles and sub-systems.
3. Develop and maintain a high level of understanding of how seasonal weather variations affect the system.
4. Perform daily weather forecast checks and utilize forecast information to plan effective system operation.
5. Perform all inspection procedures as necessary.
6. Perform basic maintenance as necessary.
7. Identify and communicate the need for more extensive or specialized maintenance; assist in the completion of said maintenance.
8. Maintain and manage an inventory of spare parts.
9. Record and maintain all necessary records and documents to facilitate all reporting requirements. Generate reports as necessary
10. Be able to identify any gaps in their knowledge and be comfortable asking for assistance as necessary.
11. When taking time off, prepare the system for your absence, and develop a plan to effectively delegate the operation of the system.

8.2. Operator Training

All system operators must be properly and fully trained before being allowed to carry out their duties independently. The training protocol for new operators entails the following steps:

1. New system operators (trainees) must fully read this manual to familiarize themselves with the operating principles of the system.
2. An existing qualified system operator (trainer) will verbally review the content of the manual with the trainee to verify understanding and answer any questions.
3. The trainer will then provide the trainee with an on-site orientation of the system. This orientation will include:
    - A safety meeting to outline any potential on site hazards, procedures to mitigate said hazards, and the locations of all necessary PPE.

- A tour of all on site equipment and infrastructure associated with the runoff water system.
- A demonstration of all mechanical equipment associated with the system.
- A walk through/demonstration of all system inspection procedures.

4. Following the completion of steps one through three, the trainee will spend one month shadowing their trainer. During this period, the trainee will learn from the existing skilled operator and increase their familiarity with the mechanical components and daily procedures of the system. Ultimate responsibility for the smooth operation of the system will however remain the responsibility of the existing skilled operator.
5. Following the one-month shadowing period, there will be a second one-month period wherein the trainee takes the lead in the operation and maintenance of the system. During this period the trainee will be shadowed by their trainer. The trainer will help where necessary, and ultimate responsibility for the system will remain in the trainer's hands, but they should stand back as much as possible and foster the trainee's ability to operate the system independently.
6. A final one-month training period will occur wherein the trainer will still help if needed, but full responsibility for the smooth operation of the system will now lay with the trainee.
7. To conclude training, the trainer will conduct an interview with the trainee where the trainer will review the trainee's performance and assess the trainee's ability to carry out all of the duties of a system operator, as outlined in section 5.2. of this manual. Should the trainee's knowledge and ability be to the trainer's satisfaction, then both the trainer and trainee will sign the Training Completion Certificate (see Appendix A), recognizing that the trainee is fully prepared to operate all aspects of the system safely and effectively.

9. Inspection Schedule/Procedure

Diligently following a system of inspection procedures will, over the course of a year, constitute the bedrock of effective system operation. The table below outlines the yearly inspection schedule for the system:

Table 3. Inspection Schedule

Inspection type	Frequency
Subsystem inspections	Daily during rainy season and storm events. Twice a week during shoulder seasons. Weekly during dry season.
Ecomister maintenance	Monthly during operation.
Parts inventory audit	Once per year, prior to rainy season.
Winterization inspection	When freezing temperatures occur.

9.1. Subsystem inspection procedure

Actively monitoring the performance of all subsystems is critical to ensuring the smooth operation of the system. The daily inspection procedures outlined below will be central to providing an operator with the information needed to assess the status of the system and make necessary adjustments.

9.1.1. Capture and conveyance subsystem inspection procedure

1. Surface flow of runoff water is direct to pump stations and is unobstructed.
2. Walk site perimeter to ensure that there is no surface runoff.
3. Mulch filters can filtrate incoming runoff water flow and not clogged with sediments.
4. Pump bays are not clogged with sediments
5. Pumps are in good working order.
6. Float system is properly actuating pumps.
7. Force mains are free from obstructions or jams.
8. Pumped water is being conveyed to appropriate next subsystem (storage/ evaporation/recycle)
9. Flow meters are checked and total water quantity pumped from prior day's inspection, as well as gallons per minute are recorded.

9.1.2. Storage subsystem inspection procedure.

1. Assess current water level in pond.
2. Inspect Slopes of pond interior are for any damage/erosion.
3. Estimate future rainfall from weather forecast and compare against available pond storage.

9.1.3. Evaporation subsystem inspection procedure.

1. Assess weather to determine if conditions are favourable for Ecomister usage.
2. If Ecomister is being run, ensure that it is properly primed and engaged. (consult Ecomister operation section of manual for more detail)
3. Ensure Ecomister spray cone is staying within acceptable boundaries. Adjust physical Ecomister angle, or software set points if necessary. (Consult Ecomister manual for more detail)
4. Listen to main Ecomister pump for any abnormal sounds that may indicate damage/wear. (Only applicable if Ecomister is running)

9.1.4. Recycling/reuse subsystem inspection procedure

1. Check sprinkler heads for blockages and obstructions. Clear if necessary.
2. Check hoses from force mains to sprinklers for kinks that could reduce sprinkler flow.
3. Assess sprinkler location and wood mulch inventory for water saturation. Adjust sprinkler location if necessary.
4. Develop daily plans to rotate and adjust wood mulch inventory if saturated.

9.2. Ecomister Maintenance.

From a mechanical perspective, the Ecomister requires relatively little maintenance. Proper monthly maintenance procedures entail only the following:

1. Grease Ecomister. (Consult owner's manual for details)
2. Run Ecomister and Inspect Ecomister nozzle ring to see if any nozzles are plugged. Clean or replace if necessary.

9.3. Inventory checklist

In order to minimize downtime, and ensure that repairs can be completed in a timely manner, an inventory of the following spare equipment and supplies should be maintained:

1. Spare 1.5" fire hose 50' & 100' lengths X 5 each.
2. Fire hose repair components (fittings x 50, clamps x 100, and repair tool x 1).
3. Spare sprinkler stands X 3.
4. Spare sprinkler heads X 3.
5. Spare ecomister nozzles X 20.
6. Spare ecomister pump stack X 1.
7. Spare KTZ 47.5 pump X 1.
8. Spare 4" suction line 10' length X 2 length.

9. Spare 4” cam lock fitting sets x 3.
10. Spare 4” HDPE pipe 20’ lengths x 4.

The list covers the basics but is not exhaustive and may change as system operators develop more experience with the system.

9.4. Winterization Inspection

Should freezing temperatures occur, it will be necessary to shut down and winterize the system for the duration thereof to prevent damage to the system. The winterization inspection is as follows:

1. Shut off any pumps that pump to water lines above ground.
2. Disconnect all above ground water lines.
3. Blow out all above ground water lines.
4. Open all above outdoors ball valves and drain all outdoors check valves.
5. Turn on heaters in any indoor locations where Runoff water system piping is located.
6. Ensure that Ecomister floating intake is sufficiently submerged to be protected from freezing.

While temperatures remain freezing, there will be no flowing runoff water. However, once temperatures rise and ice started to thaw, it will be necessary ti promptly reactivate the system to handle runoff water from thawing ice.

9.5. Record Keeping and Reporting

Maintaining relevant and accurate records is an important requirement for operating the system. These records uphold the integrity and credibility of the system, as they allow Sumas Gro Media Ltd. to demonstrate to the British Columbia Ministry of Environment or other regulatory agencies that the system is being properly run and maintained. All records must be kept in a secure location in Sumas Gro Media Ltd.’s main office. The following table outlines the records that will need to be kept:

Table 4 Record type description

Record type	Description	Relevant form (if applicable)
Weekly subsystem inspection	While each subsystem should be checked on daily, a formalized inspection record is only required once per week. See appendix B for the inspection form.	Appendix B
Yearly Inventory Audit	Count system inventory and order any spare parts/components	Appendix C
Maintenance and repairs log	Significant maintenance or repair work should be logged to establish a record that the system is being maintained.	Appendix D
Water Sample Testing results	Every time water sampling is done — either for surface water or ground water — a copy of the results should be kept.	N/A
Training Completion Certificate	If a new operator is being trained, their Training Completion Certificate should be retained.	Appendix A

There is no current requirement to produce periodic reports based on these records. However, these records must be on hand to provide to a regulatory agency should they ask for a report on the status of the system.

10. Troubleshooting

Listed below are some common issues that may be encountered with the system and corresponding troubleshooting guides to alleviate said issues:

10.1. Pumps not working

1. Check that pumps have electrical power:
    A. ensure they are plugged in.
    B. ensure that no breakers/fuses have been blown.
2. Check that pumps are turned on their control system. If the control system is off, then the pumps will not run. If it is on, then when the pumps run by governed by the float control system.

3. Check to ensure that floats are working properly. They can get hung up on objects preventing them from properly actuating the pumps, or they can (rarely) fail and will no longer engage/disengage the pumps at all.
4. Check to ensure that pump intakes are not plugged. In some of the sump bays fine sediments can build up to such a level that they clog the pump intakes. Routine checks should prevent this.
5. Ensure that pump impeller is not jammed. This is highly unlikely, but if all other steps haven't worked, it isn't impossible.

10.2. Sprinklers not working (no flow or very limited flow)

1. Ensure that pumps are on/working. Refer to section 5.1.
2. Check that fire hose that connects sprinkler stand to pump/main distribution line is not kinked. One hard kink is enough to severely decrease the flow to a sprinkler.
3. Check that sprinkler's head is not jammed with debris. This will usually have a visual tell, where water spray is shorter than usual or also jetting out to the sides.

10.3. Ecomister not working

See Ecomister operator's manual in Appendix E.

11. Technical Data & Spec Sheets

11.1. KTZ 47.5, 600V, 3 phase, 10hp, dewatering pump

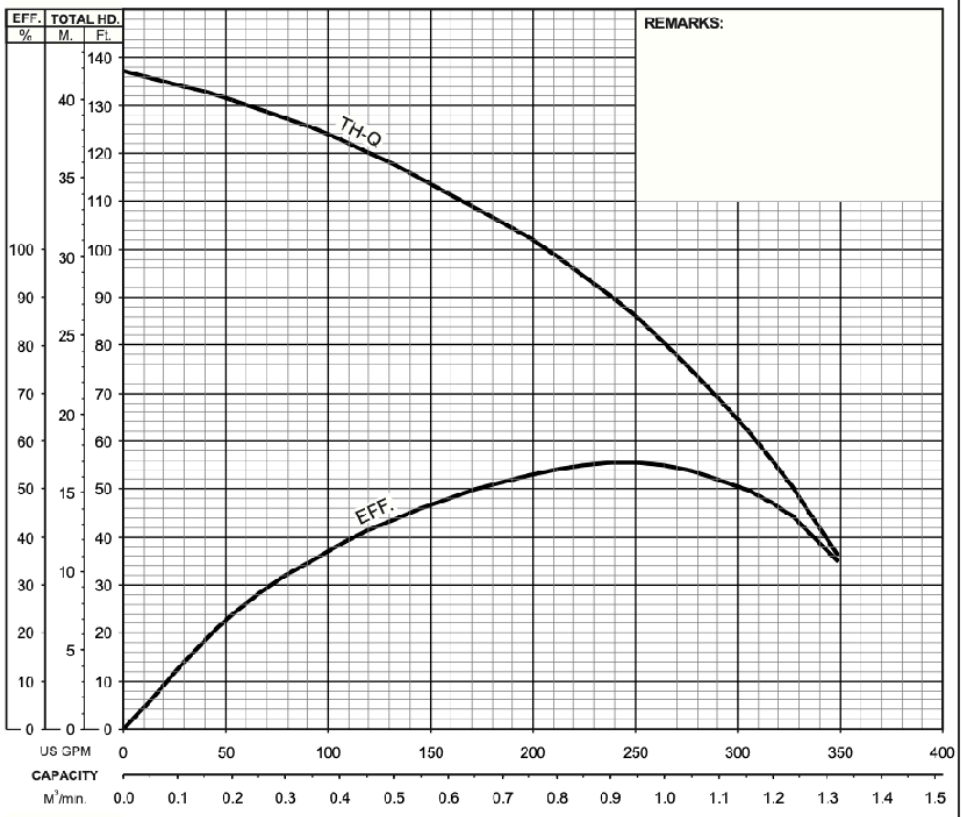
Mar. 13 60-PC-KTZ-10

TSURUMI PUMP | **KTZ - SERIES** DEWATERING PUMPS | **PERFORMANCE CURVE**

MODEL	BORE	HP	KW	RPM	SOLIDS DIA	LIQUID	SG.	VISCOSITY	TEMP.
KTZ47.5-63	4"/100mm	10	7.5	3545	0.472"/12mm	Water	1.0	1.123 cSt.	60°F

PUMP TYPE	PHASE	VOLTAGE	AMPERAGE	HZ	STARTING METHOD	INS. CLASS
Dewatering Pump	3	208-230/460/575	29.8-27.3 / 13.3 / 10.4	60	Direct On Line	F

CURVE No.	DATE	PHASE	VOLTAGE	AMPERAGE	HZ	STARTING METHOD	INS. CLASS
-	-	-	-	-	-	-	-



11.2. Ecomister pump stack.

See Ecomister operator's manual in Appendix E.

12. Conclusion

This manual has been written with the intent of being as comprehensive as possible. Fully reading it should provide a prospective system operator with a significant amount of information regarding the system, and they should be able to operate it at a basic level. Nonetheless, the manual is not exhaustive, and to properly prepare an operator, the manual should be paired with in person training from an existing skilled operator. Additionally, the system in its current state is the product of multiple years of iterative development and improvement. As the system continues to be operated it is likely that further improvement will be made. Also, as the system's operators improve and become more proficient, it is likely that best practices will change and improve.

This manual should be interpreted as a starting point; a successful operator will eventually outgrow it. Lastly, the importance of maintaining Sumas' Gro Media's regulatory compliance cannot be overstated. For an operator, this means that successfully operating the runoff system will allow them to make a significant positive contribution to the success of the business. Your hard work will be much appreciated.

Appendix A: Training Completion Certificate

Trainer:

Trainee:

Date:

It is hereby recognized that the trainee has fully completed all steps of their training. In doing so, they have demonstrated the skills and knowledge necessary to fulfill all of the duties and responsibilities of a Runoff Water System Operator for Sumas Gro Media Ltd. Accordingly, they are henceforth able to independently operate the Runoff Water System, keeping it in good working order, and in compliance with all regulatory standards.

Signed:

Trainer _____

Trainee_____

Appendix B: Weekly Subsystem Inspection Record

Operator:

Date:

Capture and conveyance subsystem inspection.

1. __ Surface flow of runoff water is being direct to pump stations and is unobstructed.
2. __ Site perimeter walked to ensure that there is no surface runoff.
3. __ Mulch filters can filtrate incoming runoff water flow and not clogged with sediments.
4. __ Pump bays not clogged with sediments
5. __ Pumps in good working order.
6. __ Float system is properly actuating pumps.
7. __ Force mains free from obstructions or jams.
8. __ Pumped water is being conveyed to appropriate next subsystem (storage/evaporation/recycle)
9. __ Flow meters are checked and total water pumped from prior day's inspection, as well as gallons per minute are recorded.

Storage subsystem inspection.

1. __ Measure and record current water level in pond.
2. __ Calculate and record remaining pond storage capacity
3. __ Inspect Slopes of pond interior are for any damage/erosion.
4. __ Estimate future rainfall from weather forecast and compare against available pond storage.

Evaporation subsystem inspection.

1. __ Assess whether to determine if conditions are favorable for Ecomister usage.
2. __ If Ecomister is being run, ensure that it is properly primed and engaged. (consult Ecomister operation section of manual for more detail)
3. __ Ensure Ecomister spray cone is staying within acceptable boundaries and not drifting off site. Adjust physical Ecomister angle, or software set points if necessary. (Consult Ecomister manual for more detail)
4. __ Listen to main Ecomister pump for any abnormal sounds that may indicate damage/wear. (Only applicable if Ecomister is running)

Recycling/reuse subsystem inspection.

1. __ Check sprinkler heads for blockages and obstructions. Clear if necessary.
2. __ Check hoses from force mains to sprinklers for kinks that could reduce sprinkler flow.
3. __ Assess sprinkler location and wood mulch inventory for water saturation. Adjust sprinkler location if necessary.
4. __ Develop daily plans to rotate and turn wood mulch inventory if saturated.

Appendix C: Yearly Inventory Audit

Operator:

Date:

Item	Recommended stock	Current stock	Resupply ordered?
1.5” fire hose	50’ lengths x 5 100’ lengths x 5		
Fire hose repair components (fittings, clamps, and repair tool)	Fittings x 50 Clamps x 100 Repair tool x 1		
Sprinkler stands	3		
Sprinkler heads	3		
Ecomister nozzles	20		
Ecomister pump stack	1		
KTZ 47.5 pump	1		
4” suction line 10’ lengths	2		
4” cam lock fitting set	2		
HDPE pipe	20’ lengths x 4		

Appendix D: Maintenance and Repairs Log

Issue/breakdown:	Date identified:	Repairs done:	Date completed:	Operator:

Appendix E: Ecomister Operator Manual