PEACE RIVER REGIONAL DISTRICT

Evaluation of Reclaimed Water Use

Final Report

December, 2017

URBAN systems

10808 – 100th Street,
Fort St. John, BC, V1J 3Z6

Contact: Dr. Joanne Quarmby, R.P.Bio.
T: | 250.374.8311
jquarmby@urbansystems.ca

File: 0601.0073.01

urbansystems.ca

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Peace River Regional District
Box 810
Dawson Creek, BC V1G 4H8

Attention: Shawn Dahlen, Deputy CAO

RE: OPTIONS ANALYSIS FOR THE DEVELOPMENT OF A RECLAIMED WATER FACILITY – FINAL REPORT

Please find attached the final report for the reclaimed water options analysis. This report includes an analysis of both on-site (process) and off-site uses. The following components are included in this report:

1. Identification of potential uses, both on-site and off-site.
2. An estimation of the potential quality requirements.
3. An assessment of infrastructure needs.
4. An overview to the regulatory requirements.

Please do not hesitate to contact us if you have any further questions regarding the information presented in this report.

Sincerely,

URBAN SYSTEMS LTD.

Jaime Adam, P. Eng.
Project Leader

Dr. Joanne Quarmby, R.P.Bio.
Water and Wastewater Specialist

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Attachment

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EXECUTIVE SUMMARY

The wastewater treatment plant at the Charlie Lake wastewater treatment facility produces a standard secondary treatment effluent quality which is discharged through an outfall to the Peace River. The Peace River Regional District (PRRD) is keen to explore opportunities for creating reclaimed water, which is a valuable resource that can be used in place of freshwater, rather than continue with the approach of disposal of all of the effluent to the Peace River. There are both on-site and off-site reclaimed water use opportunities. For the on-site opportunities, the PRRD currently budgets for approximately $25,000/year to haul water to the Charlie Lake Trucked Waste Receiving Facility (TWRF) for use within the treatment process. There are various situations within a wastewater treatment plant where potable water is used, including wash-down and cleaning, site irrigation and chemical make-down. For some of these uses it is acceptable for the effluent from a wastewater treatment plant to be used in place of potable water. For the off-site uses, given the water supply constraints for the general area and the increasing demand for water, especially from the oil and gas sector, options could include industrial and agricultural uses. The off-site uses may also provide the potential for cost recovery as a result of sales of the reclaimed water. The purpose of this report is to assess the feasibility of developing alternative approaches to the traditional release of effluent to the Peace River.

The following have been identified as potential on-site uses for reclaimed water:

- Equipment process water.
- Wash-down water for equipment, trucked waste vehicles and infrastructure.
- Make-down water for the centrifuge polymer.
- A water source should a biosolids compost operation be developed on the site immediately adjacent to the wastewater treatment facility. The water would be used to ensure that the composting piles do not become too dry, especially during the high temperature phase of composting.
- Dust control.
- Irrigation of landscape and planters.

The following have been identified as potential off-site uses for reclaimed water:

- Use in the oil and gas sector, including hydraulic fracturing, drilling of oil and gas wells, dust control, hydrostatic testing of pipelines and facility piping, soil compaction during construction and washing of site equipment.
- Agricultural uses, including irrigation of crops and as make-down water for pesticides and fertilizers.
- Dust control on roads that are managed by the BC Ministry of Transportation and Infrastructure.

From a high level review, it is anticipated that the reclaimed water quality would need to meet "lower exposure potential" standards for uses around the wastewater treatment plant. For the off-site uses, while the "lower exposure potential" standard is suitable for uses within the oil and gas sector, a higher quality would be required for the agricultural uses (moderate or greater exposure potential) and for dust control on public roads (greater exposure potential). However, the outcomes of an environmental impact study and the use of additional mitigation measures may result in a lower reclaimed water quality being acceptable for the agricultural uses and dust control on public roads.

On-site uses could utilize existing storage within the wet well of the TWRF for chlorine contact time for disinfection and overall storage. A separate potable water cistern and pumps would be required to provide the remaining water for the bathroom and shower.

Off-site uses would need a separate treatment/truckfill station located next to the existing standby lagoon. UV disinfection, followed by chlorination is proposed to treat to a moderate exposure potential, and the existing standby lagoon is proposed for storage of treated water.

There will be the need to amend the current MWR registration, with a registration amendment possibly required for on-site uses and a re-registration possibly required for off-site uses. This would need to be discussed with the BC Ministry of Environment. The process of changing the authorisation could take a year or two. Unless the PRRD develops a local service by-law, there will be the need to involve the local health authority. The local health officer has the ability to authorise or prohibit the use of reclaimed water.

Storage or an alternative discharge approach is a requirement of the MWR. The most common approach is an alternative discharge approach, as storage is often not cost effective or practical. Therefore, there is the need to ensure that the outfall line to the Peace River remains operational, as an emergency or back-up approach to effluent/reclaimed water management.

The following are recommended:

- An environmental impact study should be completed to confirm the reclaimed water quality for each of the intended uses.
- A preferred concept for reclaimed water (on-site/off-site or both) should be selected to complete further pre-design and detailed design assessments on.
- Undertake discussions with the BC Ministry of Environment regarding the process for amending the current MWR authorisation. These discussions will assist in any decisions that need to be made with respect to the viability of the proposed reclaimed water uses.

1.0 INTRODUCTION

The Charlie Lake wastewater treatment facility produces a standard secondary treatment effluent which is discharged through an outfall to the Peace River. The Peace River Regional District (PRRD) is interested in pursuing opportunities by which the effluent can be used in place of freshwater or potable water sources. Both on-site and off-site uses are to be considered. The purpose of this report is to assess the feasibility of developing alternative approaches to the traditional release of effluent to the Peace River.

2.0 BACKGROUND INFORMATION

2.1 Existing Facility

The Charlie Lake wastewater treatment facility consist of two components: a trucked waste receiving facility (TWRF) and biological treatment for the incoming wastewater from the domestic community collection system and the partially treated wastewater from the TWRF.

The trucked waste receiving facility consists of the following components:

- A mechanical screen and grit removal channel;
- An anaerobic lagoon;
- A facultative lagoon; and
- A sludge dewatering system, which is operated on a periodic basis to control the build-up and deposition of solids from the incoming trucked waste.

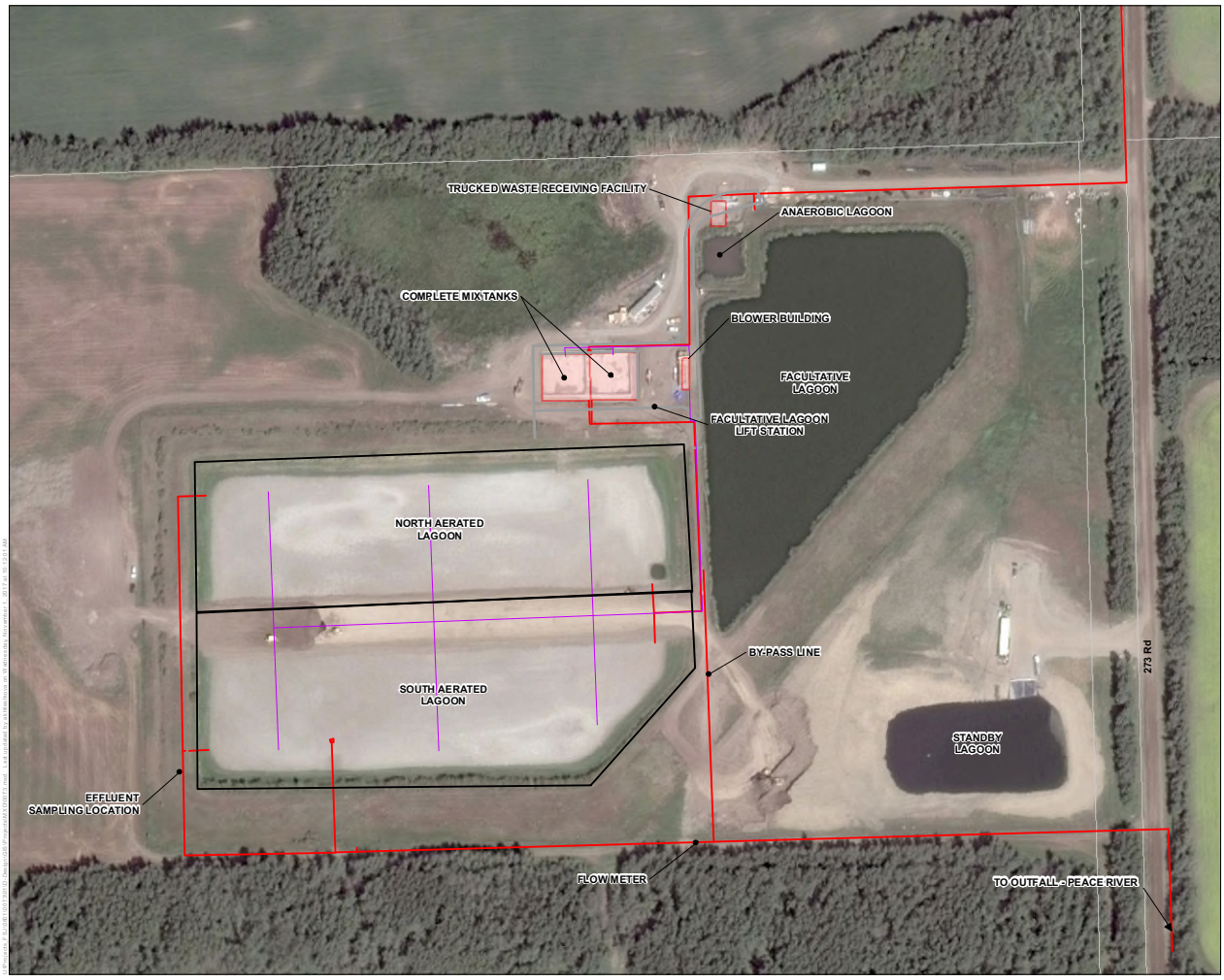
The biological treatment facility consists of the following components:

- A pump station from the facultative lagoon to the complete mix tanks;
- Two complete mix tanks operated in parallel;
- Two aerated lagoons, operated in parallel; and
- An outfall into the Peace River.

Figure 2.1 shows an overview to the wastewater facility.

The facility is registered under the Municipal Wastewater Regulation (MWR), authorisation number 108540, to produce a secondary quality effluent for discharge to the Peace River. As the effluent is released to a fisheries environment, there is also the need to comply with the Federal Wastewater Systems Effluent Regulations. The effluent quality to meet the regulatory requirements is summarised below:

- 5 day carbonaceous biochemical oxygen demand ($CBOD_5$): ≤ 45 mg/L maximum and ≤ 25 mg/L average.
- Total suspended solids (TSS): ≤ 45 mg/L maximum and ≤ 25 mg/L average.
- Ammonia: < 1.25 mg/L as un-ionised ammonia to meet Federal requirements and < 600 mg/L as total ammonia to meet chronic concentrations at the edge of the initial dilution zone, as per the Provincial requirements. Nitrification is not required to meet these effluent ammonia concentrations. Therefore, there is no biological ammonia treatment at this site.
- Phosphorus: treatment not required.



Peace River Regional District

Evaluation of Reclaimed Water Use

Site Plan

Sanitary Main

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

20 10 0 20 40
Meters

Coordinate System: NAD 1983 UTM Zone 10N

Scale: 1:1,750

Data Sources:
- Imagery provided by Google Earth Pro.

Project #:	0601.0073.01
Author:	AK
Checked:	
Status:	
Revision:	A
Date:	2017 / 11 / 1

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FIGURE 2.1

- Disinfection: effluent faecal coliform concentration to be < 338,000 counts/100 mL. Given the effluent faecal coliform concentration, the required effluent quality can currently be met without the need for a managed disinfection process, such as ultra-violet (UV) light or chlorination.

2.2 Regulatory Framework

In addition to being the regulatory framework for the release of the effluent to the Peace River, the BC Municipal Wastewater Regulation (MWR) is also the governing regulation for the production and use of reclaimed water. There is no Federal regulation for reclaimed water use.

The MWR was published in April 2012, and replaced the Municipal Sewage Regulation, which was promulgated in 1999. The initial concepts for reclaimed water use and development were included as part of the now repealed Municipal Sewage Regulation, and form the basis of what is now required in the MWR. The MWR categorises reclaimed water according to risk to public health and/or the environment, with a higher quality being required in cases where the risk is higher. There are four risk categories: Indirect Potable Use (highest risk category), Greater Exposure Potential, Moderate Exposure Potential and Lower Exposure Potential (lowest risk category). The four categories are discussed in greater detail below, and the effluent criteria associated with each risk category are summarised in Table 2.1.

Table 2.1: Quality Criteria – Reclaimed Water Categories

Parameter	Quality Requirement			
	Indirect Potable Use	**Greater Exposure Potential**	**Moderate Exposure Potential**	**Lower Exposure Potential**
$CBOD_5$	≤ 5 mg/L	≤ 10 mg/L	≤ 25 mg/L	≤ 45 mg/L
TSS	< 5 mg/L	≤ 10 mg/L	≤ 25 mg/L	≤ 45 mg/L
Turbidity	≤ 1 NTU	≤ 2 NTU (average); ≤ 5 NTU (maximum)	Not applicable	Not applicable
Faecal Coliforms	< 1 CFU/100 mL or < 2.2 MPN/100 mL (as median of 5 consecutive samples)	< 1 CFU/100 mL or < 2.2 MPN/100 mL (as median of 5 consecutive samples); Maximum of 14 CFU/100 mL	100 CFU/100 mL (as median of 5 consecutive samples); Maximum of 400 CFU/100 mL	200 CFU/100 mL (as median of 5 consecutive samples); Maximum of 1,000 CFU/100 mL
pH	Site specific	6.5 to 9	6.5 to 9	6.5 to 9

Indirect Potable Use is the highest standard of reclaimed water identified in the MWR, as this end use is seen as being of greatest risk. The Indirect Potable Use risk category would apply to reclaimed water which is being used to replenish a potable water source.

Greater Exposure Potential is the second highest standard of reclaimed water identified in the MWR, and is defined as a use where public contact with the reclaimed water is likely, or where there is a risk to the receiving environment. In addition to the quality requirements outlined in Table 2.1, this category of reclaimed water also requires treatment to remove viruses.

Moderate Exposure Potential is the third highest standard of reclaimed water identified in the MWR, and is defined as a use where public contact with the reclaimed water is likely to be minimal, or where public access to the reclaimed water is restricted and the users are educated as to the risks associated with reclaimed water. The risk to the receiving environment is also considered to be moderate, as a result of the intended use. In addition to the quality requirements outlined in Table 2.1, there may be additional quality requirements, monitoring and access restrictions, depending on the use of the reclaimed water.

Lower Exposure Potential is the lowest standard of reclaimed water identified in the MWR, and is defined as a use where public access is restricted and users are unlikely to come into contact with the reclaimed water. The uses are intended to be commercial or industrial in nature and the users must be educated with respect to the risks associated with reclaimed water. There must also be a low risk to the receiving environment. In addition to the above quality requirements, as with the moderate exposure risk category, worker contact should be minimised, with additional disinfection being required to ensure a maximum faecal coliform concentration of 14/100 mL in cases where frequent worker contact is expected.

For all three exposure categories (Greater, Moderate and Lower), the MWR indicates that a total residual chlorine concentration of 0.5 mg/L is to be maintained at the point of use unless there are risks to fauna/flora at the point of use. In the case where there is no chlorine residual in the reclaimed water, there is the need for either an increased awareness of the end user with respect to the risks associated with the reclaimed water, or the ability to prove that adequate disinfection was achieved before the reclaimed water is distributed.

In addition to the quality requirements for reclaimed water, the MWR also indicates the following:

1. Although the BC Ministry of Environment has jurisdiction over the MWR, the local health authority must be notified of the intent to use reclaimed water, as there is a provision in the MWR for the local health authority to authorise or prohibit the use of the reclaimed water.
2. There is a requirement for an alternative method of disposal. This requirement is based on the need to address an emergency situation where the reclaimed water cannot be used. A standard alternative method of effluent disposal is the release to a surface water, such as the Peace River, or a release to ground.

3. Monitoring, reporting and precautionary measures, depending on the quality and use of the reclaimed water.

The Reclaimed Water Guideline[1] was published in 2013. The intent of this guideline is to serve as a key reference and guidance document for the use of reclaimed water in BC. The guideline covers several aspects of reclaimed water use, including potential uses and best management tools.

[1] BC Ministry of Environment (2013). Reclaimed Water Guideline. A Companion Document to the Municipal Wastewater Regulation Made under the *Environmental Management Act*. July, 2013.

3.0 POTENTIAL OPPORTUNITIES

3.1 On-site Uses

As there is no on-site water supply to the Charlie Lake wastewater treatment facility, water is trucked in at an annual cost in the order of $20,000 to 25,000/year. Water uses on-site have been reviewed to identify which activities could replace the trucked water with reclaimed water. The outcome of this review is summarised in Table 3.1.

Table 3.1: Summary of On-site Uses

Potential Use	Comments	Suitability for Using Reclaimed Water
Equipment Process Water	For the operation of the screen and centrifuge	This is an acceptable use of the reclaimed water. It is not uncommon for reclaimed water to be used as process water for the operation of equipment such as screens and centrifuges.
Wash-down water	For the following activities: • Cleaning equipment and floors inside buildings. • Wash out tanks and clean any debris or splashes for the trucked waste vehicles. • Cleaning the exterior concrete pad. • Clean-out of the facultative pond lift station. • Control of foam in the complete mix tanks.	These activities are potentially acceptable for reclaimed water use. Confirmation was received that the vehicle wash-down was for the commercial vehicles that are used to haul the trucked waste. There is no intent to use the reclaimed water for personal vehicles or vehicles used on-site.
Chemical Make-down	This relates to the make-down of polymer for use in the centrifuge.	This is an acceptable use of the reclaimed water. Discussion needed with the polymer supplier to confirm whether there will be any adverse interactions between the polymer and chemical constituents of the reclaimed water. Options for changing the type of polymer can be assessed, if needed.

Table 3.1: Summary of On-site Uses (continued…)

Potential Use	Comments	Suitability for Using Reclaimed Water
Compost Site Operations	In the event that a biosolids composting operation is developed close to the wastewater treatment facility, reclaimed water could be used to ensure that the composting material does not become too dry. The main water use is expected to occur during active composting or the early stages of curing, when the temperature is the most elevated.	This is an acceptable use of the reclaimed water.
Dust Control	This would be to control dust on the gravel access roads located within the perimeter of the wastewater treatment plant.	This is an acceptable use of the reclaimed water.
Site Irrigation	This would be for landscaping purposes only, i.e. grassed areas and planters or baskets.	This is an acceptable use of the reclaimed water.
Domestic Uses (toilet, sink and shower)	Discussion with operations and PRRD staff indicated that there is a low interest in pursuing using reclaimed water for any of these uses. The only viable potential use is for toilet flushing, and it is expected that significant infrastructure changes will be needed to plumb the toilets to a reclaimed water system. This raises the question as to whether the benefit of this use can be balanced by the work needed to plumb in a separate reclaimed water system.	These potential uses of the reclaimed water are not considered viable for this site and will not be considered further.

3.2 Off-site Uses

There are many different potential uses for reclaimed water. The most common use throughout BC is irrigation, and includes both privately-owned lands and public lands. The irrigation options can range from landscape maintenance through to crop growth. In the Peace area, with the water supply constraints, there are also a wide range of options for using reclaimed water in the oil and gas sector. This will replace the use of potable or freshwater sources and has been practiced using reclaimed water from the City of Dawson Creek facility for approximately 5 years. While cost recovery may be challenging for irrigation uses,

especially in the Peace area, where irrigation of crops is not common, there is a clear possibility of cost recovery for uses within the oil and gas sector. A summary of the identified and potential off-site uses is discussed further below.

3.2.1 Uses in the Oil and Gas Sector

There are a number of uses of reclaimed water in the oil and gas sector, including hydraulic fracturing, drilling of oil and gas wells, dust control, hydrostatic testing of pipelines and facility piping, soil compaction during construction and washing of site equipment. Out of these uses, hydraulic fracturing has the single highest demand for water. In all cases, the reclaimed water would be used on sites which are designated for industrial use and where there are access restrictions. Site personnel need to complete safety training and the precautions and safe handling of the reclaimed water can easily be incorporated into existing site orientation and training. There is a possibility that dust control could occur on roads which are under the control of the oil and gas companies but could be accessed by members of the public. This would need to be considered when developing precautions relating to the use and when considering a suitable quality of reclaimed water.

Other uses which could also be included in the oil and gas sector are emergency response such as fire-fighting and irrigation to re-establish vegetation on lands which have been disturbed. As fire-fighting is an emergency situation, there is an increased possibility that personnel who may not have received appropriate training in the use of reclaimed water may access the water. There is also an uncertainty as to the use of the reclaimed water for the irrigation of disturbed lands. There could be a large number of such sites, with a wide range of land ownership, intended use, site topography, soil types, proximity to surface water/wells and type of vegetation. These factors would all need to be considered to assess whether a site-specific approach is needed and what precautions would be required.

3.2.2 Agricultural Uses

The lands surrounding the wastewater treatment plant are used largely for agricultural purposes. Immediately to the west is land that is owned by the PRRD. This land contains mainly grasses and it is understood that the site is used by a contractor for a hay crop for private use/sale. This use is not expected to change. As far as the PRRD is aware, this land has not been used for grazing. It is possible that this land could also be used for biosolids applications, depending on the direction that is developed for the management of the waste organic solids that are produced from the wastewater treatment plant. However, depending on land constraints, the preference at this stage from the PRRD is that the land would be used for reclaimed water irrigation, should there be a potential conflict between the irrigation and biosolids application activities.

Other lands in the area are also used for growing hay, with the standard being that one crop a year is harvested due to the short growing season. Other crops grown in the area include cereal crops such as wheat, barley and oats, which could all be used for human consumption, canola, which would be used for oil production, and peas, which are used as an animal feed.

In addition to the use of reclaimed water for irrigation, the other potential agricultural use is to replace freshwater as the make-down water for pesticides and fertilizers. Spraying in this area occurs in the spring and fall.

3.2.3 Additional Potential Uses

In addition to the uses outlined above, it is possible that the reclaimed water could be used for dust control on the roads in the area. The user could be the PRRD/contractor to the PRRD, but it is also possible that the BC Ministry of Transportation and Infrastructure could use the reclaimed water for dust control. The Ministry holds water licences in the area which allows the use of freshwater for dust control on the roads. Given the current drought situation, it is reasonable to assume that the Ministry would be interested in a more secure and environmentally sustainable water source.

4.0 QUALITY REQUIREMENTS

4.1 Introduction

The quality requirements for a specific reclaimed water use is evaluated through the completion of an environmental impact study. The environmental impact study assesses the potential level of risk to human health and the environment as a result of the intended use and determines an appropriate level of reclaimed water quality. The intent of this overview report is to provide guidance on the potential quality requirements of the various uses, in order to allow a feasibility engineering assessment to be completed. Should the PRRD wish to move forward with reclaimed water use, an environmental impact study will be required as one of the technical supporting documents for the engineering design and changes to the existing MWR registration.

4.2 On-Site Uses

The potential reclaimed water quality for each identified on-site use is summarised in Table 4.1.

Table 4.1: Potential Quality – On-site Uses

Potential Use	Anticipated Quality Required	Additional Comments
Equipment Process Water	Lower exposure potential	The activity is contained within a process with limited operator contact. Any operators will be trained to handle untreated wastewater, so there are low concerns that the operator will have a lack of understanding of the precautions needed when handling treated reclaimed water.
Wash-down water	Lower exposure potential	The activity is contained within the wastewater treatment plant site. Any operators will be trained to handle untreated wastewater, so there are low concerns that the operator will have a lack of understanding of the precautions needed when handling treated reclaimed water. Risk of contact can be further managed by measures such as use of low pressure hoses.

Table 4.1: Potential Quality – On-site Uses (continued…)

Potential Use	Anticipated Quality Required	Additional Comments
Chemical Make-down	Lower exposure potential	The activity is contained within the wastewater treatment plant site. Any operators will be trained to handle untreated wastewater, so there are low concerns that the operator will have a lack of understanding of the precautions needed when handling treated reclaimed water. Discussions with the current chemical supplier have indicated that there are low concerns with the moderate and lower exposure potential $CBOD_5$ and TSS concentrations and interference with polymer. There are concerns relating to the presence of chlorine. The chlorine concentration needs to be below 1 mg/L so that there is no interference with the polymer properties. Interference from chlorine could reduce the efficiency of the polymer, however, based on the low existing usage of polymer at the facility, this is not expected to be a significant cost difference.
Compost Site Operations	Lower exposure potential	The activity is contained within a site which will be designated for sludge/biosolids processing. The operators will be trained to handle sludge/biosolids, so there are low concerns that the operator will have a lack of understanding of the precautions needed when handling treated reclaimed water.
Dust Control	Lower exposure potential	The activity is contained within the wastewater treatment plant site. Any operators will be trained to handle untreated wastewater, so there are low concerns that the operator will have a lack of understanding of the precautions needed when handling treated reclaimed water.
Site Irrigation	Lower exposure potential	The activity is contained within the wastewater treatment plant site. Any operators will be trained to handle untreated wastewater, so there are low concerns that the operator will have a lack of understanding of the precautions needed when handling treated reclaimed water. Risk of contact can be further managed by the irrigation methodology and equipment.

4.3 Off-site Uses

The potential reclaimed water quality for each identified off-site use is summarised in Table 4.2.

Table 4.2: Potential Quality – Off-site Uses

Potential Use	Anticipated Quality Required	Additional Comments
Hydraulic fracturing	Lower exposure potential	The activity is contained within a site which has restrictions for access and all site personnel are trained appropriately. Mitigation measures can be put in place to further protect workers and the environment, as needed, and can be developed based on each activity.
Drilling of oil and gas wells		
Dust control (oil and gas sites)		
Hydrostatic testing of pipelines and piping		
Soil compaction		
Equipment washing (oil and gas sites)		
Irrigation and agricultural uses	Moderate or greater exposure potential	Moderate exposure potential is likely to be acceptable in most cases, but is dependent on the type of crop to be grown and site-specific factors. If moderate exposure potential quality is deemed suitable, additional operational constraints are likely required. These additional operational constraints will likely not be required if a high quality reclaimed water (i.e. greater exposure potential) is used.
Dust Control – public roads	Greater exposure potential	There is an increased risk of contact with the public which could result in the need for a higher reclaimed water quality. However, it may be possible to use a lower reclaimed water quality (i.e. moderate exposure potential) depending on whether it is possible to implement mitigative measures (e.g. timing of the application).

5.0 ASSESSMENT OF TREATMENT AND INFRASTRUCTURE NEEDS

Upgrades to the Charlie Lake wastewater treatment facility occurred in 2015 to improve treatment and capacity. Due to filling times within the lagoon, the full plant has only been operating as per design since early 2016. Additionally, the facility underwent operational adjustments in the summer of 2016 to allow for erosion protection to be implemented. As such, there is currently just over one year of complete effluent quality data for the facility.

The design of the facility was to meet an effluent quality of TSS < 25 mg/L and $CBOD_5$ < 25 mg/L. These criteria meet both the lower and moderate exposure potential quality requirements for reclaimed water as outlined above. Further, the effluent quality data obtained to date indicates that all samples meet this requirement, with the exception of two samples. The two sample data exceedances were during start-up or non-standard operating procedures which could have caused the results.

There is potential for TSS to increase during summer months as a result of algal blooms. This is a natural factor of a lagoon system. The result of this is being out of compliance for moderate exposure quality reclaimed water, however, the quality would most likely remain within the lower exposure quality requirements.

5.1 Infrastructure Needs for On-site Lower Exposure Potential Uses

During construction of the TWRF, attempts at finding an on-site water source were unsuccessful. Currently, water for on-site uses is hauled from potable truck loading facilities in Fort St. John. However, the majority of water uses on-site do not require potable water so there is an opportunity to replace potable water for non-potable uses on-site.

5.1.1 Existing Infrastructure

The existing TWRF has a wet well beneath the building that has the capacity for 88 m^3 of water storage. Two vertical turbine pumps and a hydro-pneumatic tank operate based on pressure differentials within the building and flow demands from process equipment. Currently, all water use within the building is plumbed to this infrastructure, with a main water service going to each room.

A 50 micron Amiad filter is installed to protect the solenoid valves within the building from damage by particulates in the water.

The bathroom contains a sink (including an under-sink, on-demand, hot water heater), toilet, and shower (including on-demand hot water heater).

5.1.2 Reclaimed Water Infrastructure Requirements

A retrofit of the existing infrastructure to use reclaimed water on-site would require minimal retrofits to the existing building.

To use reclaimed water within the building the following retrofits are proposed:

- Distribution Piping

  Distribution piping from the aerated lagoon outlets (located on the west side of the site) to the TWRF will be required. A small duplex pump station, similar to the existing facultative pump station, is proposed to pump from the lagoons to the wet well. Installing a pump station will allow simple control of the flow when required by usage within the building. Flow by gravity from this location may be feasible, however, further studies will need to be conducted to determine the hydraulic grade line and controls to prevent excess flow from entering the wet well when water demand within the facility is low and to determine if that would be more or less costly than pumping.

- Filtration

  The existing Amiad filter will be sufficient to provide filtering of the reclaimed water to prevent fouling of the solenoid valves. Additionally, the Claro screening equipment has an additional Y-strainer to protect the equipment from particulates in the water.

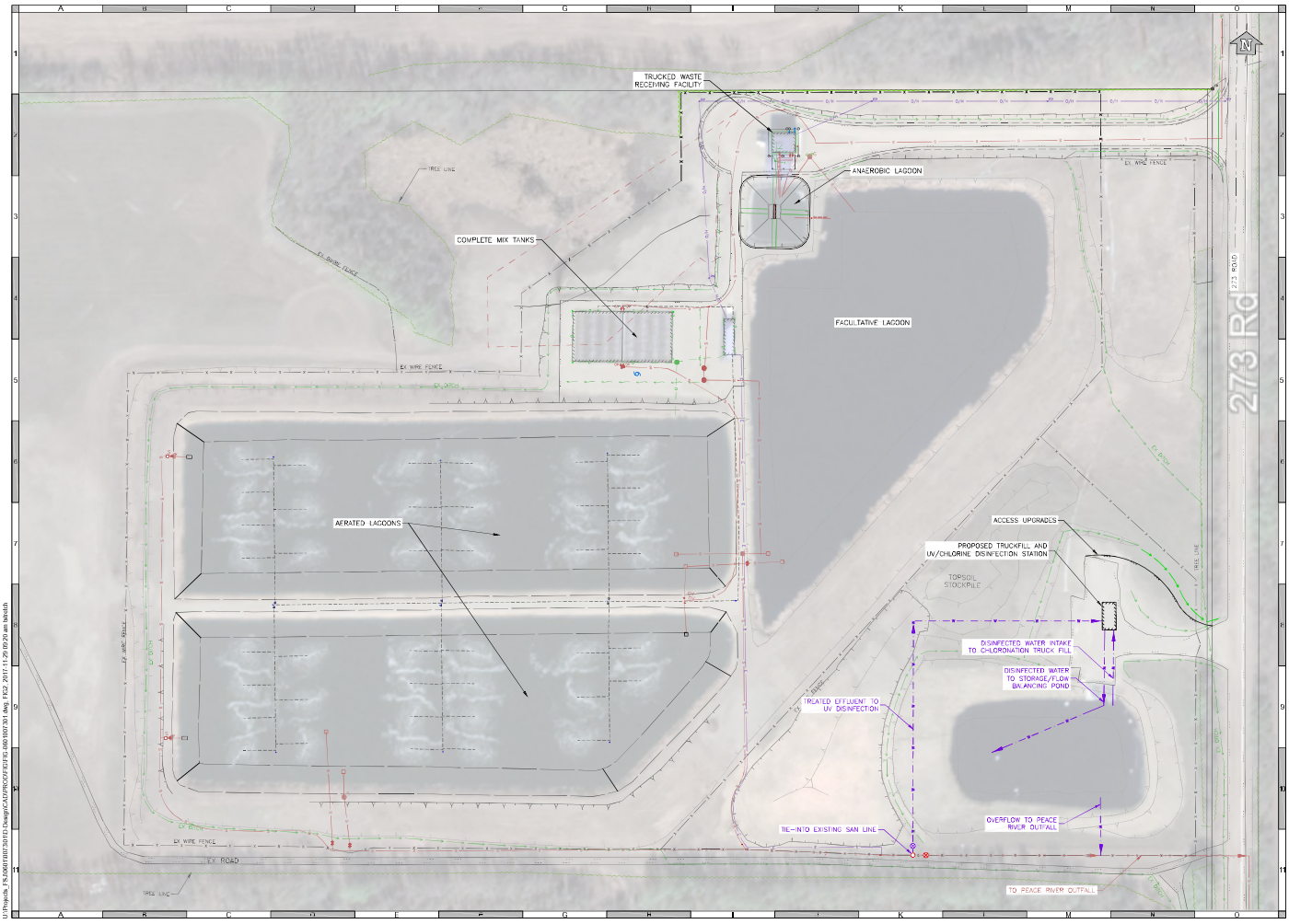
- Chlorine Disinfection

  Chlorine disinfection is required in the MWR to meet moderate or lower exposure potential reclaimed water quality. The faecal coliforms in the effluent are currently low during summer months (when more bacteriological activity is present within the complete mix tanks and aerated lagoons), however, the concentrations spike during winter months. The size of the existing tank allows for sufficient contact time for disinfection by chlorine injection prior to distribution within the building. A system of mixing/and or baffles would be needed to prevent short circuiting and ensure adequate disinfection prior to use of the water. An eyewash and safety shower station will be required in the room with chlorine for personnel protection.

- Potable Water Service

  To maintain potable water service for the bathroom, a separate potable water service is proposed. On-site potable water storage would be required, in the form of a cistern. A distribution pump and hydro-pneumatic tank would be required to provide pressure to the sink and shower. Additionally, the water service to the bathroom is required to be re-plumbed. This system would be much smaller than the existing system because a relatively small amount of potable water is required compared to process water.

Figure 5.1 shows the proposed upgrades for on-site reclaimed water use at a lower or moderate exposure potential quality.



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#	Date	Issue / Revision	App
A	2017-11-30	Issued For Preliminary	KZ

PRRD

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Scale 7.5m 0 7.5 15 22.5

Quality Control by: M. Smith
Designed by: K. Zackodnik
Drawn by: T. Nitsch

Evaluation of Reclaimed Water Use
Off-site Use - Moderate Exposure

Sheet Number 2 of 2

Project Number	Drawing Number	Revision
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NOT FOR CONSTRUCTION

5.1.3 Cost Estimate

A Class 'D' cost estimate for the proposed upgrades is identified in Table 5.1 below. These cost estimates include 15% engineering and 30% contingency, consistent with a Class D estimate.

Table 5.1: On-Site Uses – Lower Exposure Potential Upgrades Class D Cost Estimate

Item	Units	Quantity	Unit Cost	Extended Cost
Reclaimed Water Upgrades				
Mixing/Baffling for Wet Well	LS	1	$ 15,000	$ 15,000
Piping from Discharge to Wet Well	lm	400	$ 300	$ 20,000
Power and Control Conduit/Cable	lm	400	$ 30	$ 12,000
Chlorine Injection including dosing skid, etc.	LS	1	$ 30,000	$ 30,000
Duplex Pump Station from Discharge to Wet Well	LS	1	$ 100,000	$ 100,000
Eyewash and Safety Shower Station	LS	1	$ 25,000	$ 25,000
Potable Water Upgrades				
Cistern	LS	1	$ 5,000	$ 5,000
Water Pump	LS	1	$ 2,500	$ 2,500
Hydro-pneumatic tank	ea	1	$ 500	$ 500
Piping allowance to re-route bathroom piping	LS	1	$ 2,000	$ 2,000
Piping cistern to building (19 mm service)	LS	1	$ 5,000	$ 5,000
			Sub-Total	$ 317,000
			Engineering (15%)	$ 47,600
			Sub-Total	$ 364,600
			Contingency (30%)	$ 109,400
			Total	**$ 474,000**

5.2 Infrastructure Needs for Off-site Uses

As identified above, the existing effluent quality from the Charlie Lake wastewater treatment facility is sufficient to meet the $CBOD_5$/TSS requirements of a moderate exposure reclaimed water quality under normal conditions. The design of the facility is to meet these requirements to the 20 year (2034) design horizon. The remaining requirements for effluent quality are disinfection and to provide a chlorine residual.

Based on the uses identified, it has been assumed that off-site users will obtain the reclaimed water through a truckfill station. Further, it is our understanding that the PRRD would like to see all current effluent be diverted to reclaimed water, and this was considered during the feasibility assessment.

There are two potential sites located within the existing property lines for the Charlie Lake lagoon site – one just south of the main access road to the TWRF in the field to the east of the facultative cell, and the other at the standby lagoon location.

The first location could potentially utilize the wet well at the TWRF for storage (if the infrastructure for the on-site uses of reclaimed water is installed), however, this would require additional pumps and piping along the access road to the truckfill site. This site would need significant site upgrades to be suitable for a roadway (gravels/earthworks) and fencing. Additionally using the same access for the TWRF may cause a mix of sewer and water trucks along the access and could result in congestion. For these reasons, the standby lagoon location was identified as preferable, and is the subject of the further analysis.

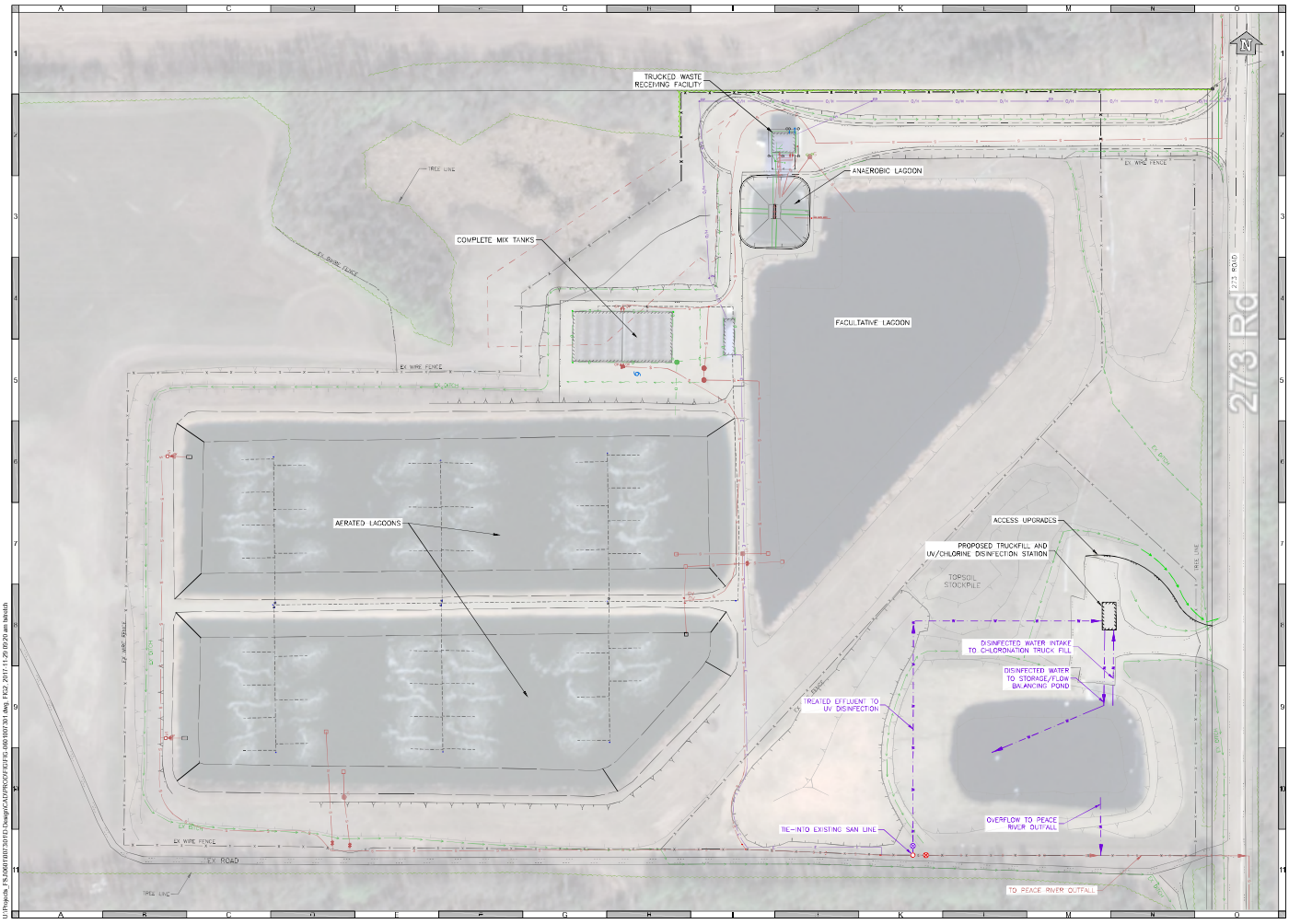
The preferred location identified is at the south side of the wastewater treatment facility, at the standby lagoon site. Existing infrastructure at this site, and separating from the TWRF traffic, make this site desirable. It should be noted that during operation of the standby lagoon, some truck drivers had difficulty with the northbound slope of the hill from the standby lagoon driveway to the TWRF driveway but there are alternate access points to avoid this. Future asphalting and upgrades by the Ministry of Transportation and Infrastructure on this road may assist with northbound egress. The proposed and existing infrastructure for this site is outlined below and shown in Figure 5.2.

5.2.1 Existing Infrastructure

The standby lagoon was built in December 2014 for use by trucked waste haulers until the TWRF was constructed and commissioned in December 2015. The existing infrastructure includes a chain-link gate fence across the gravelled “T” shaped access road. The entire site is fenced on all sides, separate from the main wastewater treatment facility.

There is a clay lined storage pond with approximately 8,100 m^3 of storage. A small section on the north side has a HDPE liner which was installed to prevent erosion during waste disposal. There is ditching and culverts to divert surface water around the pond and away from the storage pond. The pond is currently listed in the MWR registration for the plant as emergency infrastructure, however, it is not currently used for any operational purpose.

The current outfall line runs from the control manholes at the west end of the aerated lagoons, along the southern property boundary, and then turns 90 degrees and travels south along the 273 road to the existing outfall at the Peace River. The outfall line is 200 mm HDPE.



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SURVEY INFORMATION
Prepared by: -
Coordinate System: -
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#	Date	Issue / Revision	App
A	2017-11-30	Issued For Preliminary	KZ

PRRD

URBAN systems

Scale 7.5m 0 7.5 15 22.5

Quality Control by: M. Smith
Designed by: K. Zackodnik
Drawn by: T. Nitsch

Evaluation of Reclaimed Water Use
Off-site Use - Moderate Exposure

Sheet Number 2 of 2

Project Number	Drawing Number	Revision
0601.0073.01	5.2	A

NOT FOR CONSTRUCTION

5.2.2 Reclaimed Water Infrastructure Requirements

To meet the moderate exposure potential and provide reclaimed water for off-site uses, the following upgrades are required:

- Distribution Piping and Valves

  Supply

  The proposed supply piping for the treatment and truckfill station would be from the existing outfall line which runs along the south side of the property boundary for the Charlie Lake wastewater treatment facility. A manhole and two isolation valves would accompany a tie-in to the gravity line. A gravity line is assumed from the existing outfall to the treatment/truckfill station.

  A 200 mm line is proposed to match the existing discharge line.

  Storage

  Two reclaimed water lines would be required to and from the truckfill and treatment station and the storage pond to discharge and draw from the pond.

  Discharge

  An overflow/discharge line from the storage pond to the existing outfall line is proposed. If all of the treated water is not used by truckfill users, the remaining will be discharged to the river. This water will not be chlorinated, so will be suitable for discharge to the River.

- Disinfection

  Two different methods of disinfection could be used to meet the quality guidelines. Because a chlorine residual is required prior to distribution, either ultraviolet (UV) light plus chlorine or just chlorine could be used. However, if excess water is not used by truckfill users, the reclaimed water will need to be discharged to the river. Chlorinated water cannot be discharged to the Peace River and, therefore, it would need to be dechlorinated before discharge. The additional costs for UV are sometimes off-set by reducing the infrastructure and chemical costs for dechlorination. For the purposes of this feasibility, UV and chlorination was assumed.

  Ultra Violet Light

  UV light would be sized to meet peak day demands and disinfect the reclaimed water prior to discharge to the storage pond. During more detailed studies, sizing could be optimized to take advantage of available storage for reaching peak demands. UV disinfection is proposed to meet the moderate exposure potential requirements for faecal coliforms. This would increase the usage of the reclaimed water, and the difference in infrastructure between 100 CFU/100 mL to meet moderate exposure potential quality and 200 CFU/100 mL to meet lower exposure potential quality is minimal.

Chlorination

Chlorine injection is proposed to provide a chlorine residual. This would be injected immediately before distribution through the truckfill ports. A minimum total chlorine residual of 0.5 mg/L is required as per the MWR.

- Storage

  The existing standby lagoon has more storage than would be required to allow for the entire maximum daily flow to be stored in this pond. This would allow for truck drivers to use this volume over a shorter period (working hours), without treatment delays. Because reclaimed water is not potable, a liner and cover is not required for the pond. An allowance in the cost estimates has been included to clean the existing pond to remove sludge from the bottom.

  At this feasibility stage, it has been assumed no further upgrades would be required in the pond, and that the volume could be optimized by depth, however there is the potential that a berm could be required to reduce the storage volume.

- Truckfill Station

  It is proposed that the treatment/truckfill station be housed within the same building. Service levels that are similar or better to similar facilities across the region would be provided from this station. A duplex truckfill station is proposed to reduce wait times and increase flow out of the station to meet demands. A concrete pad is proposed for the building and a sidewalk, however no pads for the truck drivers are currently proposed.

- Access Upgrades

  The current access road is a “T” shape (as shown on Figure 5.2) which requires a truck driver to back up to turn around. This is not ideal and inhibits flow of traffic and the ability to have trucks line-up on-site. To alleviate these issues, some access upgrades would be required to allow one-way flow on the site.

  Access road improvements (including ditching) on the north side of the site are proposed to facilitate this. Additionally, the treatment building is proposed in the centre of the road to allow for filling on either side of the building. Trucks would be able to line up along the access road.

- Power

  This site currently does not have power. The three phase power terminates at the TWRF, approximately 200 m to the north. There is also single phase power approximately 500 m south of the site. Due to the

pump and equipment sizing, it would be expected that the preference is three phase power. An allowance for power to be brought from the TWRF driveway has been included.

5.2.3 Cost Estimate

A Class 'D' cost estimate for the proposed upgrades is identified in Table 5.2 below. These cost estimates include 15% engineering and 30% contingency, consistent with a Class D estimate.

Table 5.2: Off-Site Uses - Moderate Exposure Potential Upgrades Class D Cost Estimate

Item	Units	Quantity	Unit Cost	Extended Total
Piping from Discharge line to Treatment Building	lm	162	$ 300	$ 48,600
Piping to and from storage pond	lm	40	$ 300	$ 12,000
Overflow line to discharge line	lm	25	$ 300	$ 7,500
Valves	ea	2	$ 7,500	$ 15,000
Tie-in Manhole	ea	1	$ 7,000	$ 7,000
Power from TWRF site	LS	1	$ 100,000	$ 100,000
UV Disinfection (including pumps)	LS	1	$ 150,000	$ 150,000
Chlorine Injection including dosing skid, etc.	LS	1	$ 30,000	$ 30,000
Eyewash and Shower Station	LS	1	$ 25,000	$ 25,000
Truckfill Station (including pumps)	LS	1	$ 150,000	$ 150,000
Concrete Pad for truckfill	LS	1	$ 20,000	$ 20,000
Clean Temp. Lagoon	LS	1	$ 25,000	$ 25,000
Access Road Upgrades - Subgrade Prep/Stripping	m^3	225	$ 5	$ 1,125
Access Road Upgrades - 300 mm Subbase Gravels	m^2	750	$ 30	$ 22,500
Access Road Upgrades - 150 mm Base Gravels	m^2	750	$ 20	$ 15,000
Re-route Ditching	lm	50	$ 12	$ 600
			Sub-Total	$ 629,325
			Engineering (15%)	$ 94,400
			Sub-Total	$ 723,725
			Contingency (30%)	$ 217,200
			Total	**$ 940,925**

6.0 REGULATORY REQUIREMENTS

The current facility is registered under the MWR for the release of a secondary quality effluent to the Peace River. There is no recognition in the current MWR registration for reclaimed water use, either on-site or off-site. The authorisation of reclaimed water use will require an amendment to the MWR registration, with the scope of the amendment to be clarified with the BC Ministry of Environment. However, based on past situations, it is expected that the on-site uses can be authorised by an amendment to the existing MWR registration, but that the off-site uses could need an MWR re-registration. The information requirements and the processing timing of the authorisation changes are unlikely to be significantly different whether just on-site or off-site uses are requested or whether these two types of uses are amalgamated into a single MWR application. Therefore, it is advised that the application should include as many uses as are viable and realistic for the PRRD. It is also reasonable to expect that the processing time could be in the order of a year or two, but this will need to be confirmed with the Ministry.

The authorisation changes will require the following supporting information:

1. Application forms
2. Site figures and layout
3. An environmental impact study
4. Operations and commissioning plans, which may also include the need for an irrigation plan
5. Design drawings
6. Documentation that the local health officer has been notified of the intent to use reclaimed water; and
7. An application fee of $200.

The current approach with the Ministry is to submit an application form indicating the intent to amend the authorisation, followed by a meeting with a Ministry representative to confirm all the information requirements for the application submission. Therefore, it is possible that there could be changes to the list of information requirements outlined above.

The following should also be noted with respect to the authorisation of reclaimed water use under the MWR:

1. Notification must be given to the local health officer at least 60 days before registering the proposed reclaimed water use under the MWR. The local health officer has the ability to authorise or prohibit the use of reclaimed water. However, there is no need for involvement from the local health officer if the PRRD authorises the use of the reclaimed water under a local service area by-law. This by-law indicates that the PRRD is responsible for ensuring compliance with the MWR and that proper operation and maintenance will occur.
2. The treatment processes must meet the redundancy requirements outlined in the MWR.

3. There is the requirement for an alternative discharge route or storage, should there be any issue with the reclaimed water system or a reduction in the demands. Demands for irrigation activities are seasonal, as the water is only required during the growing season. The amount of water used for irrigation over the growing season will vary depending on the timing of the spring/freeze-up, crop harvesting and whether the summer is hot and dry or cool and wet. It is important that irrigation is undertaken at an appropriate rate and is not viewed as an opportunity for the maximum disposal of effluent. Demands for an industrial user also vary and will depend on the activity at the time and the need for down-time or maintenance. It is quite possible that an industrial user may require significant amounts of reclaimed water over a short period of time followed by long periods where little or no water is needed. It is important that there is sufficient storage to accommodate periods of high user demands and periods of little to no demand. The required storage capacity is likely to be significant and may not be practical to achieve. An alternative release approach needs to be in place, which would not only address time periods where there is the inability to store all the reclaimed water but would also address an emergency situation when there is a quality issue. This would result in the need to ensure that the outfall line to the Peace River remains operational, as an emergency or back-up approach to effluent/reclaimed water management.

7.0 SUMMARY AND RECOMMENDATIONS

To summarise:

- The following have been identified as potential on-site uses for reclaimed water:
  - Equipment process water.
  - Wash-down water for equipment, trucked waste vehicles and infrastructure.
  - Make-down water for the centrifuge polymer.
  - A water source should a biosolids compost operation be developed on the site immediately adjacent to the Charlie Lake wastewater treatment facility.
  - Dust control.
  - Irrigation of landscape and planters.
- The following have been identified as potential off-site uses for reclaimed water:
  - Use in the oil and gas sector, including hydraulic fracturing, drilling of oil and gas wells, dust control, hydrostatic testing of pipelines and facility piping, soil compaction during construction and washing of site equipment.
  - Agricultural uses, including irrigation of crops and as make-down water for pesticides and fertilizers.
  - Dust control on roads that are managed by the BC Ministry of Transportation and Infrastructure.
- From a high level review, it is anticipated that the reclaimed water quality would need to meet "lower exposure potential" standards for uses around the wastewater treatment plant. For the off-site uses, while the "lower exposure potential" standard is suitable for uses within the oil and gas sector, a higher quality would be required for the agricultural uses (moderate or greater exposure potential) and for dust control on public roads (greater exposure potential). However, the outcomes of an environmental impact study and the use of additional mitigation measures may result in a lower reclaimed water quality being acceptable for the agricultural uses and dust control on public roads.
- On-site uses could utilize the existing wet well and water distribution equipment for treatment, with the addition of chlorine and baffling. A potable water service (including on-site storage and pumps) would be required to provide water for the bathroom and shower.
- Off-site uses could require a truckfill and treatment station. The existing standby lagoon could provide storage volume for reclaimed water treated by UV light, prior to chlorination and discharge through the truckfill.
- There will be the need to amend the current MWR registration, with a registration amendment possibly required for on-site uses and a re-registration possibly required for off-site uses. This would need to be discussed with the BC Ministry of Environment. The process of changing the authorisation could take a year or two.

- Unless the PRRD develops a local service by-law, there will be the need to involve the local health authority. The local health officer has the ability to authorise or prohibit the use of reclaimed water.
- Storage or an alternative discharge approach is a requirement of the MWR. The most common approach is an alternative discharge approach, as storage is often not cost effective or practical. Therefore, there is the need to ensure that the outfall line to the Peace River remains operational, as an emergency or back-up approach to effluent/reclaimed water management.

The following are recommended:

- An environmental impact study should be completed to confirm the reclaimed water quality for each of the intended uses.
- A preferred concept should be selected for which upgrade option the PRRD would like to proceed with. A pre-design level of detail should be completed on either the on-site, off-site, both or no option presented.
- Undertake discussions with the BC Ministry of Environment regarding the process for amending the current MWR authorisation. These discussions will assist in any decisions that need to be made with respect to the viability of the proposed reclaimed water uses.