AquaWorks DBO, Inc.
3252 Williams Street
Denver, Colorado 80205

(303) 477-5915
www.aquaworksdbo.com
info@aquaworksdbo.com

Mr. Bret Icenogle, P.E.
Water Quality Control Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246-1530

August 24, 2022

RE: Community of Phippsburg WWTP – Site Application

Dear Mr. Icenogle,

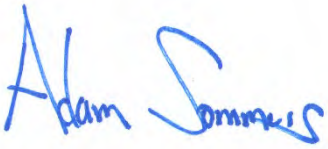
Routt County, on behalf of the Phippsburg Community, is submitting the attached Project Needs Assessment and Site Approval Amendment Application (Regulation 22.10) for its proposed wastewater treatment improvement project. The project is in unincorporated Routt County, Colorado. The current facility is in general compliance with CDPHE regulations; however, it is 40 years old, and the existing equipment has reached the end of its design life

In summary, the proposed project involves installing a new MBR treatment facility and removing the existing lagoons. The current hydraulic rating of 30,000 GPD and organic rating of 100 pounds per day of BOD will not change. The location of the discharge to the Yampa River will remain the same.

Please let me know if you require a hard copy of this document in addition to this electronic version.

Please feel free to contact me at (303) 477-5915 with any questions.

Sincerely,
AQUAWORKS DBO, INC.



Adam Sommers, P.E., AICP

cc. Routt County
James Wheatley, Grants & Loans Unit

AquaWorks DBO, Inc.
3252 Williams Street
Denver, Colorado 80205

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Mr. Scott Cowman
Environmental Health Department
Routt County Courthouse Annex
136 6th Street, Suite 201
Steamboat Springs, CO 80487

August 24, 2022

Re: Community of Phippsburg WWTP – Project Needs Assessment & Site Application

Dear Mr. Cowman,

Routt County, on behalf of the Community of Phippsburg, will be submitting a Site Approval amendment application to the Colorado Department of Public Health and Environment for improvements to its existing wastewater treatment system. In summary, the proposed project will involve installing a new wastewater treatment facility with upgraded treatment technology and removing the existing lagoons once the new project is operational. The existing facility is reaching the end of its design life and will be replaced with a technology that is capable of treating wastewater to a higher quality.

The new treatment facility will be designed to treat the same amount of hydraulic and organic loading as the current facility: 30,000 gallons per day of flow and 100 pounds per day of biological oxygen demand. The discharge to the Yampa will remain in the same location.

The Routt County Environmental Health Department is being provided with a copy of the Site Application document per CDPHE requirements. We request that you review the application. Comments, if any, can be directed to me and Mr. Bret Icenogle at bret.icenogle@state.co.us.

Sincerely,
AQUAWORKS DBO, INC.

Adam Sommers, P.E., AICP

AquaWorks DBO, Inc.
3252 Williams Street
Denver, Colorado 80205

(303) 477-5915
www.aquaworksdbo.com
info@aquaworksdbo.com

Mr. Jay Harrington
County Manger
Routt County
522 Lincoln Avenue, Suite #30
Steamboat Springs, CO 80487

August 24, 2022

Re: Community of Phippsburg – Project Needs Assessment & Site Application

Dear Mr. Harrington,

Routt County, on behalf of the Community of Phippsburg, will be submitting a Site Approval amendment application to the Colorado Department of Public Health and Environment for improvements to its existing wastewater treatment system. In summary, the proposed project will involve installing a new wastewater treatment facility with upgraded treatment technology and removing the existing lagoons once the new project is operational. The existing facility is reaching the end of its design life and will be replaced with a technology that is capable of treating wastewater to a higher quality.

The new treatment facility will be designed to treat the same amount of hydraulic and organic loading as the current facility: 30,000 gallons per day of flow and 100 pounds per day of biological oxygen demand. The discharge to the Yampa will remain in the same location.

The Routt County Environmental Health Department is being provided with a copy of the Site Application document per CDPHE requirements. We request that you review the application. Comments, if any, can be directed to me and Mr. Bret Icenogle at bret.icenogle@state.co.us.

Sincerely,
AQUAWORKS DBO, INC.

Adam Sommers, P.E., AICP

AquaWorks DBO, Inc.
3252 Williams Street
Denver, Colorado 80205

(303) 477-5915
www.aquaworksdbo.com
info@aquaworksdbo.com

Mr. David Torgler
Town Administrator
Town of Oak Creek
PO Box 128
Oak Creek, CO 80467

August 24, 2022

Re: Community of Phippsburg – Project Needs Assessment & Site Application

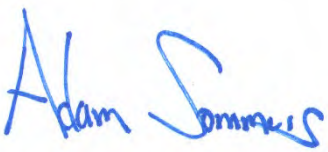
Dear Mr. Torgler,

Routt County, on behalf of the Community of Phippsburg, will be submitting a Site Approval amendment application to the Colorado Department of Public Health and Environment for improvements to its existing wastewater treatment system. In summary, the proposed project will involve installing a new wastewater treatment facility with upgraded treatment technology and removing the existing lagoons once the new project is operational. The existing facility is reaching the end of its design life and will be replaced with a technology that is capable of treating wastewater to a higher quality.

The new treatment facility will be designed to treat the same amount of hydraulic and organic loading as the current facility: 30,000 gallons per day of flow and 100 pounds per day of biological oxygen demand. The discharge to the Yampa will remain in the same location.

The Town of Oak Creek is being provided with a copy of the Site Application document per CDPHE requirements. We request that you review the application. Comments, if any, can be directed to me and Mr. Bret Icenogle at bret.icenogle@state.co.us.

Sincerely,
AQUAWORKS DBO, INC.



Adam Sommers, P.E., AICP

Project Needs Assessment, Capital Improvement Plan, Preliminary Engineering Report, and Amended Site Application Wastewater Treatment Improvement Project

August 2022

AquaWorks DBO, Inc.
3252 Williams Street
Denver, CO 80205
(303) 477-5915

Community of Phippsburg, Routt County Colorado

RCR #12 East of Hwy 131
Phippsburg, CO 80469

Unincorporated Routt County, Colorado
CDPES Permit COG588141

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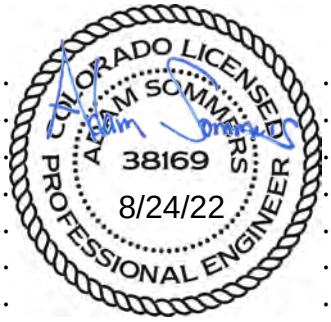

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ABBREVIATIONS

(Not all may be included in this report)

AWDBO	AquaWorks DBO, Inc.
BNR	biological nutrient reduction
BOD	biological oxygen demand
CBOD	carbonaceous biochemical oxygen demand
CDPHE	Colorado Department of Public Health and Environment
DMR	discharge monitoring report
EQR	equivalent residential
Ft	feet
GPD	gallons per day
GPM	gallons per minute
Hp	horsepower
I&I	inflow and infiltration
ICIS	Integrated Compliance Information System
KW	kilowatt
LS	lump sum
MBR	membrane bioreactor
MCL	maximum contaminate level
MLSS	mixed liquor suspended solids
MG	million gallons
MGD	million gallons per day
Mg/L	milligrams per liter
O&M	operation and maintenance
PEL	Preliminary Effluent Limits
PLC	programmable logic controller
POTW	Publicly Owned Treatment Works
PPD	pounds per day
RAS	return activated sludge
SBR	sequencing batch reactor
SCADA	supervisory control and data acquisition
SRF	State Revolving Fund
SRT	solids retention time
TSS	total suspended solids
WWTP	wastewater treatment plant
WAS	waste activated sludge
WQPT	water quality planning target

2. EXECUTIVE SUMMARY

Routt County owns and operates the wastewater treatment plant for the Community of Phippsburg, Colorado. The County is proposing to replace the lagoon treatment plant with a new mechanical treatment plant to address ongoing compliance issues experienced at the existing facility. This report documents the engineering evaluation associated with the project and is intended to meet the requirements of the State Revolving Fund Project Needs Assessment and the Regulation 22 site location amendment report.

The Community of Phippsburg is located in unincorporated Routt County and lies adjacent to US Highway 131, approximately 25 miles south of Steamboat Springs. The Phippsburg WWTP service area encompasses 63 acres. The WWTP serves 220 residents through 132 residential service connections and three commercial connections. The historic flow treated at the facility has an average annual rate of 19,400 gallons per day (GPD). The existing facility is rated to treat 30,000 GPD flow and 100 pounds of BOD per day under site approval 4955.

The current facility is a 46-year-old aerated lagoon system that was installed in 1976. Effluent is discharged from the site to the Yampa River. A compliance schedule to repair the liners is included in the facility's discharge permit. Furthermore, the lagoons have not been meeting the facility's discharge permit limits for Biological Oxygen Demand, and the lagoons likely need to be emptied of sludge. Additionally, the system occasionally exceeds limits for TSS, ammonia, and fecal coliform. Given the age of the system, the condition, and compliance issues, it is prudent for the County to plan an upgrade to the system with the objective of meeting long-term discharge permit requirements. In addition to treatment upgrades, improvements are also proposed for the collection system to reduce inflow and infiltration. The alternatives evaluated in this report include taking no action, interconnecting with another facility, and installing a new membrane bioreactor or sequencing batch reactor treatment technology.

Figure 1: WWTP Exterior

The membrane bioreactor was selected as the preferred alternative because of its filtration capabilities, modularity, small footprint, ease of installation, ability to meet future anticipated discharge permit limits, and simplicity of operation. The replacement facility will be rated for the same hydraulic and organic capacity as the existing lagoon. The discharge location to the Yampa River will remain the same.

The conceptual engineer's opinion of probable costs for this project is $4,086,816. Installation can be completed in 2024 if the implementation schedule is followed.

3. SYSTEM STRUCTURE AND OPERATIONS

3.1 LEGAL OWNERSHIP OF SYSTEM

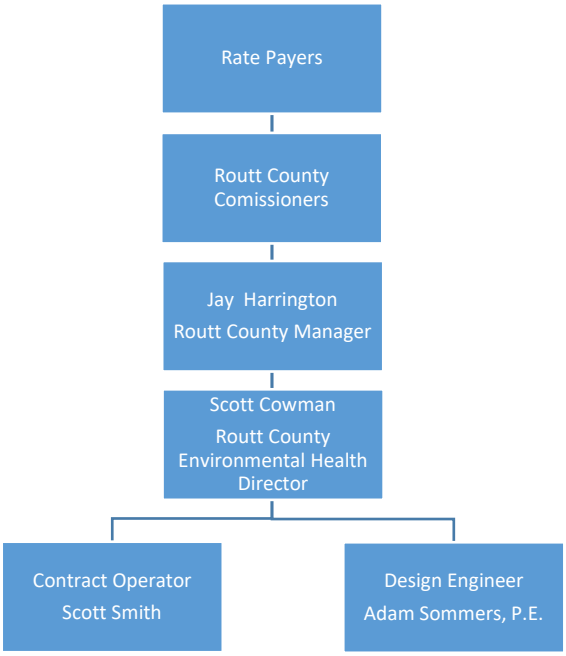
The system is a community facility owned by Routt County. The contact information is as follows:

B. Scott Cowman
Environmental Health Director
Routt County
136 6th Street
Phippsburg, CO 80487
(970) 870-5588

3.2 ORGANIZATIONAL CHART

The system's organizational chart is as follows:

Figure 2: Organizational Chart



3.3 CURRENT OPERATOR IN RESPONSIBLE CHARGE & CERTIFICATION

The facility has its own operator in responsible charge to manage, operate, and maintain the facility. Scott Smith maintains wastewater treatment Class A Treatment Certificate #CWP-XA-00013-0395 (Expires 3/18/2025) and Class 4 Collections Certificate CWP-C4-00221-0102 (Expires 1/1/2024). A Class A Treatment Certificate is the highest wastewater treatment certification available in Colorado and, therefore, adequate to operate any proposed treatment technology.

4. PROJECT PURPOSE AND NEED

4.1 COMPLIANCE

Discharge monitoring report records from the WWTP were obtained from the operator. In addition, a search of EPA's ICIS database was conducted for this report.

The facility was built in 1976 with the discharge to Little White Snake Creek. In 2012 the discharge was moved from the creek to the Yampa River. From 1976 to 2017, the discharge permit was written for 40,000 GPD and 127 PPD of BOD. In 2017, a permit modification was completed for 30,000 GPD and 100 PPD of BOD with the discharge directly to the Yampa River. These two changes were completed in compliance with the facility's site approval #4955 in 2007.

The Phippsburg WWTP has had a history of compliance challenges which the County has been working to address. In 2005, Stantec wrote a report evaluating the performance of the WWTP and recommended corrective actions. Based on information in this report, the County completed a construction project in 2008 which included laying pipe in preparation for the outfall to be moved to the Yampa River. This change was made to address upcoming low ammonia limits anticipated in the facility's COG589000 permit certification.

In 2010, as part of the permit renewal application, the County indicated that they planned to incorporate the suggestions that Stantec had in 2007, which included the following:

- Request rating reduction to 30,000 GPD and 100 pounds per day BOD
- Change BOD_5 to CBOD
- Modify lagoon design by installing baffles and creating an anaerobic treatment cell within existing lagoon #1 and dividing lagoon #3 into an aerated cell and a settling cell
- Retrofit lagoon #4 into constructed subsurface wetland for polishing
- Add bypass piping for operational and maintenance flexibility
- Upgrade electrical and mechanical systems
- Relocate outfall to Yampa River for compliance with future ammonia limit (the pipe was installed in 2008)

Although the discharge pipe was installed from the WWTP to the Yampa River in 2008, it was not until March 2012 that the outfall to the Little White Snake Creek was discontinued. As a result of moving the outfall to the Yampa River, a future low ammonia limit in the COG589026 permit was

avoided. The ammonia discharge limit in the COG588141 permit to the Yampa River became 50 mg/L as the mixing ratio in the Yampa is greater than the Creek. Despite the higher ammonia limits to the Yampa River, the plant is still challenged during the winter when lagoon temperatures decrease, resulting in freezing aerators and low temperatures inhibiting nitrification. As a result, the treatment plant continues to experience ammonia exceedances, primarily during the winter months.

Overall, the lagoons have not been meeting regulatory requirements. The system exceeded BOD in 2003, 2004, 2006, 2007, 2012, 2013, 2015, 2017, 2021, 2021, and 2022; TSS in 2003, 2004, 2018, 2020, 2021; ammonia in 2019, and 2020; and fecal coliform in 2005, 2007, 2021.

In addition to treatment violations, the treatment plant has experienced multiple flow rate capacity violations over time. The treatment plant measures influent flow via a Palmer-Bowlus flume that has only a couple of inches of fall to the lagoons' operating level. Plugging in the lagoon piping leads to backups in the first lagoon, which then backs up water into the flume leading to erroneously high flow measurements. In addition to this challenge, the ultrasonic meter calibration was a problem and was corrected in 2017. A third contributor to influent flow violations includes inflow and infiltration into the collection system, primarily during spring runoff. All three of these factors have contributed to influent flow capacity exceedances.

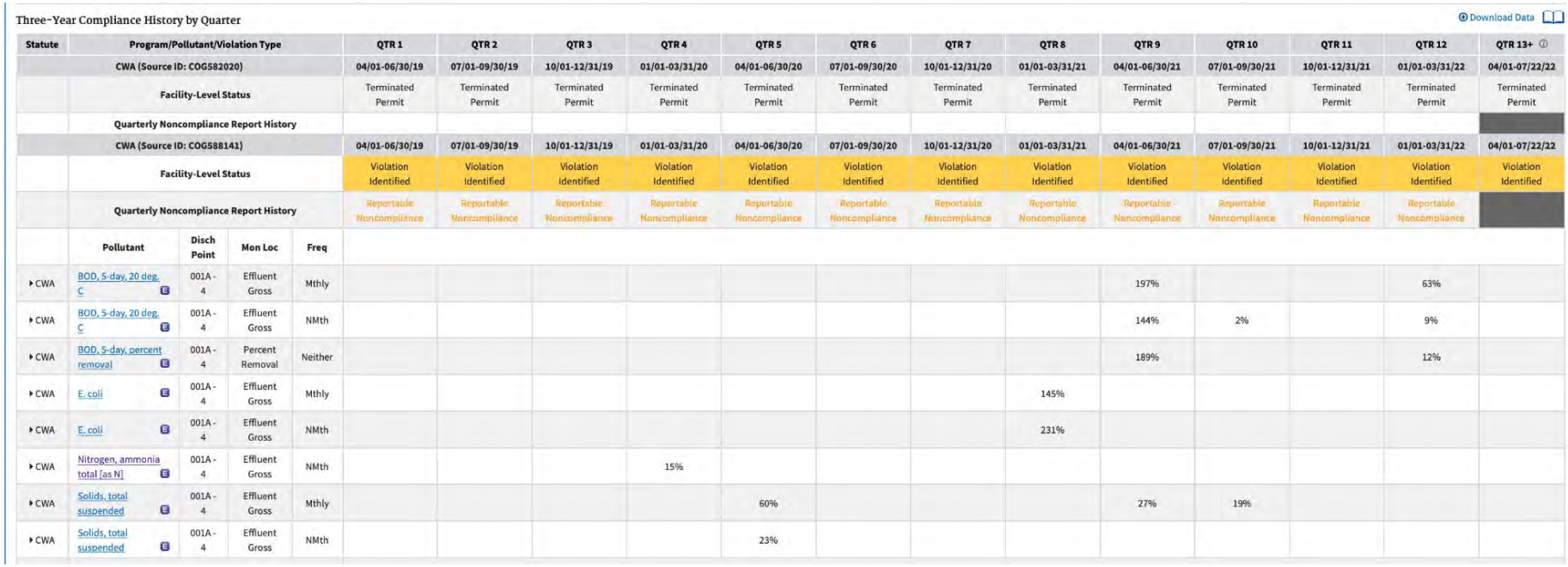
In 2011 and 2015, a compliance advisory was issued for the influent flow rate exceeding plant capacity. The County reported that record snowfall, increased spring runoff, and high groundwater created extreme I&I problems in both instances. In 2011, the County also identified and corrected a broken line in a vacant commercial lot that was discharging to the system.

Violations were issued for non-reporting events between 2008 and 2014 and also in 2021, which have been corrected. A violation was issued in 2017, noting that the new outfall to the Yampa and the reduced discharge capacity did not match the permit. This was resolved with a permit modification in 2017. A violation was issued to Routt County in 2022 for failing to submit the operator's certification, which has been resolved.

Table 1: ECHO Compliance History

Parameter Description	Years of Violations
BOD, 5-day, 20 deg C	2003, 2004, 2006, 2007, 2012, 2013, 2015, 2017, 2021, 2022
BOD, 5-day, percent removal	2003, 2004, 2007, 2012, 2013, 2015, 2016, 2017, 2021, 2022
TSS,	2003, 2004, 2018, 2020, 2021,
Coliform, fecal general	2005, 2007, 2021
Ammonia	2019, 2020

Figure 3: ECHO Compliance History



Three-Year Compliance History by Quarter

Download Data

Statute	Program/Pollutant/Violation Type					QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8	QTR 9	QTR 10	QTR 11	QTR 12	QTR 13+
	CWA (Source ID: COG582020)					04/01-06/30/19	07/01-09/30/19	10/01-12/31/19	01/01-03/31/20	04/01-06/30/20	07/01-09/30/20	10/01-12/31/20	01/01-03/31/21	04/01-06/30/21	07/01-09/30/21	10/01-12/31/21	01/01-03/31/22	04/01-07/22/22
	Facility-Level Status					Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit	Terminated Permit
	Quarterly Noncompliance Report History																	
	CWA (Source ID: COG588141)					04/01-06/30/19	07/01-09/30/19	10/01-12/31/19	01/01-03/31/20	04/01-06/30/20	07/01-09/30/20	10/01-12/31/20	01/01-03/31/21	04/01-06/30/21	07/01-09/30/21	10/01-12/31/21	01/01-03/31/22	04/01-07/22/22
	Facility-Level Status					Violation Identified	Violation Identified	Violation Identified	Violation Identified	Violation Identified	Violation Identified	Violation Identified	Violation Identified	Violation Identified	Violation Identified	Violation Identified	Violation Identified	Violation Identified
	Quarterly Noncompliance Report History					Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	Reportable Noncompliance	
	Pollutant	Disch Point	Mon Loc	Freq														
▸ CWA	BOD, 5-day, 20 deg. C E	001A - 4	Effluent Gross	Mthly										197%			63%	
▸ CWA	BOD, 5-day, 20 deg. C E	001A - 4	Effluent Gross	NMth										144%	2%		9%	
▸ CWA	BOD, 5-day, percent removal E	001A - 4	Percent Removal	Neither										189%			12%	
▸ CWA	E. coli E	001A - 4	Effluent Gross	Mthly									145%					
▸ CWA	E. coli E	001A - 4	Effluent Gross	NMth									231%					
▸ CWA	Nitrogen, ammonia total [as N] E	001A - 4	Effluent Gross	NMth					15%									
▸ CWA	Solids, total suspended E	001A - 4	Effluent Gross	Mthly						60%				27%	19%			
▸ CWA	Solids, total suspended E	001A - 4	Effluent Gross	NMth						23%								

In addition to challenges in meeting treatment requirements, the lagoon liners appear to be allowing excess seepage. The lagoons were installed in the 1970s when the liner design requirements were less stringent, allowing for 1/8 inch of seepage per day. Current requirements allow only 1/32 inches of seepage per day. In 2013, the CDPHE included a compliance schedule in the facility's discharge permit requiring a comprehensive investigation of the liner integrity and the rate of seepage from the lagoons.

From 2014 through 2015, the County worked with Civil Design Consultants to evaluate the lagoon treatment plant and seepage. In response to the compliance schedule, the County submitted a special report to the CDPHE in October 2014 with a letter from Civil Design Consultants (CDPHE 2014). The letter dated September 5, 2014, suggested that a seepage study would likely fail and recommended the funds may be better used to upgrade the lagoons.

After the CDC special report, RG and Associates investigated the lagoons and wrote the 2016 Community of Phippsburg Wastewater Treatment Plant Evaluation report. And then in June 2017, RG and Associates conducted a seepage study. The compliance schedule progress report submitted to CDPHE specified the results of the study indicated seepage was $1.5969\ 10^{-5}$ cm/sec, which was 10 times the allowable limit of $1.00\ 10^{-6}$ cm/sec. The report indicated that the pond liners needed to be replaced and design and bidding were planned for November 2017. However, after the study was completed, the pipe between Pond 3 and the treatment building was found to be leaking. This leak would have contributed to the high seepage result. Since these studies in 2015 and 2017, the County has decided upon a more comprehensive approach to meet long-term compliance objectives.

The project is necessary to return this facility to compliance and replace the 46-year-old lagoon system. The new facility is designed to comply with current water quality regulations and the discharge permit issued by the CDPHE for Phippsburg WWTP. A modern system that is more efficient and reliable will help the Community of Phippsburg to operate safely, eliminate seepage issues, and better meet water quality effluent limits.

4.2 EXISTING FACILITY LIMITATIONS

As discussed above, the Phippsburg WWTP is not meeting regulatory requirements. The existing facility is over 40 years old, and the equipment has reached the end of its design life.

The existing facility consists of a manual bar screen, three treatment ponds, an unused constructed wetland and chlorine disinfection. The first pond is divided into three cells. The first cell is approximately 1/3 of the pond and is operated as an anaerobic cell. The remaining two cells are operated as aerobic partial mix cells. The second pond is not divided and is entirely aerated. The third pond is divided so that the first two-thirds provides aeration, and the last third is sectioned

off as a settling pond. A constructed wetland follows the ponds but has not been used in years. Solids were pumped from the lagoons in 1999 and likely need to be pumped again.

The facility has a history of compliance challenges which are detailed in Section 4.1. The ponds were constructed in the 1970s when liner design requirements were less stringent. The existing liners are 6-inch-thick clay liners that cannot meet current requirements for seepage.

The treatment system is not efficient, particularly in the winter. In very cold conditions, the ponds sometimes partially freeze over, making it difficult to operate and repair aerators. In addition, the piping and influent flow metering system do not function correctly during extremely high flows or when lagoon interconnection pipes plug. At these times, the flume and flow meter become submerged, reporting erroneously high flow rates. When plugging occurs, the operator performs maintenance to unplug the pipes and provide accurate readings; however, once plugged, lagoon levels take time to respond and correct.

The County has been evaluating the performance of the system and making incremental upgrades over time. However, the system is still not meeting treatment requirements, and the lagoon seepage rate is out of compliance. The project is being driven by the current facility's age and condition and its ability to maintain compliance with both current and future anticipated effluent limits.

The facility is currently authorized to discharge under Permit #COG588141with an approved 100:1 mixing ratio according to the 2017 permit. Below is an excerpt of the 2017 discharge permit effluent limits.

The permit certification is split into two sets of limits, as shown in Figure 4.

Figure 4: Permit #COG588141 Limits

Aerated Lagoon Facilities With Design Flows Of Less Than Or Equal To 0.5 MGD						
ICIS Code	Parameter	Discharge Limitation			Sampling	
		30-day Avg.	7-day Avg.	Daily Max	Frequency	Type
50050	Flow, MGD	0.030[1]	NA	Report	Continuous [2]	Recorder [2]
00310	BOD_5, mg/l	30 [2]	45 [2]		Monthly	Grab
81010	BOD_5, percent removal	85% (min)			Monthly	Calculated
00530	Total Suspended Solids, mg/l	75	110		Monthly	Grab
50060	Total Residual Chlorine, mg/l			0.5	Weekly	Grab
00400	pH, s.u.			6.0-9.0	Weekly	Grab
84066	Oil and Grease, mg/l			Report	Weekly	Visual
03582	Oil and Grease, mg/l			10	Contingent	Grab
51040	*E. coli*, no/100 ml	2,000		4,000	Monthly	Grab
00610	Total Ammonia, mg/l as N	50		50	Monthly	Grab

Aerated Lagoon With Design Flows Of Less Than Or Equal To 0.5 MGD						
ICIS Code	Parameter	Discharge Limitation			Sampling	
		30-day Avg.	7-day Avg.	Daily Max	Frequency	Type
70295	Total Dissolved Solids, mg/l [1]	Report [2]		Report [2]	Quarterly	Grab
01309	Potentially Dissolved Arsenic, µg/l			Report	Monthly	Grab

For this Site Application, the County submitted a Permit Modification on April 24, 2022, to obtain approvals for the five chemicals in the proposed treatment system. The Modification triggered a conversion of the existing COG588141 permit to COG590000. The CDPHE has been preparing the new permit, which is expected to be issued shortly. The new permit will be used as the WQPT for Site Application.

4.3 OPERATIONS AND MAINTENANCE ISSUES

The existing facility is a 46-year-old aerated lagoon system that was built in 1976. Influent is collected, screened and gravity fed to the treatment plant through a flow metering station. The flow rate is measured through a Palmer-Bowlus flume and ultra-sonic recorder. Treatment is accomplished through an aerated lagoon system consisting of three ponds. The treatment ponds are followed by a constructed wetland that is currently bypassed due to functionality issues.

Figure 5: Photo of Existing Lagoons

Effluent disinfection and chlorine contact time are provided prior to the discharge to the Yampa River. The lagoons have not been meeting regulatory discharge permit limits for BOD, TSS ammonia, and fecal coliform, and the permit exceedances indicate accumulated biosolids likely need to be removed from the ponds.

The treatment plant operations and controls at the Phippsburg WWTP are basic and are typical of other lagoon treatment plants within Colorado. Due to the basic treatment configuration, the type of malfunctions are limited; however, operations and maintenance challenges do persist or arise regularly. Typical operation and maintenance issues experienced at Phippsburg WWTP are included in this document.

Maintaining a facility with aged equipment and 46-year-old lagoons, which is not meeting the discharge requirements, is a challenge for both the operator and owner. The equipment is antiquated, and wastewater equipment and treatment processes have evolved since the lagoons were constructed. To meet both current and future anticipated limits, the existing treatment plant needs improvements.

The influent is screened with a manually raked bar screen. This requires the operator to frequently visit and maintain the screen.

The plant has had problems with the influent flow metering. The influent Palmer-Bowlus flume becomes submerged when the lagoon interconnection pipe clogs and during extremely high flow events. This results in the meter reporting erroneous flow measurements. The meter was calibrated in 2017 and has increased the accuracy of the measured flow rates when the flume is free flowing.

The lagoon liners are a concern for the existing facility, and the facility has a compliance schedule within its CDPES permit that includes repairing or replacing the liners. The County has been working with the CDPHE to address the liners and upgrade the treatment plant.

Lagoon treatment systems have relatively large surface areas relative to mechanical treatment plants, and the large surface area allows heat loss from the wastewater to the atmosphere. In winter, Phippsburg's weather at high elevation causes water temperatures to drop significantly, and the ponds frequently freeze, causing the surface aerators to freeze and become inoperable. Aerators may be difficult to operate and maintain for a portion of the winter season due to freezing pond conditions. The inability to aerate or mix when aerators freeze leads to a greater possibility of discharge permit violations.

According to records on file at CDPHE, biosolids were last removed in the summer of 1999. Over the last 23 years, there appears to be a significant accumulation of biosolids in the ponds. The accumulation of biosolids is reducing treatment volume and is likely contributing to the facility's discharge permit exceedances and need to be removed.

Denali Water Solutions (formerly Veris) was hired to provide estimated solids accumulation, biosolids characterization and associated removal cost. Based on Denali's sampling and measurements, the accumulated solids are Class B biosolids. Depending on location, Lagoon Pond 1 has between three and four feet of sludge depth, Lagoon Pond 2 has between two and five feet of sludge depth and Lagoon Pond 3 (settling) has between one and a half to five feet of sludge depth. The full report from Denali is included in the Appendix.

Currently, only single-phase power is provided to the Phippsburg WWTP site limiting the equipment that can be used at the existing treatment plant site. Three-phase powered equipment is preferable to single phase. The power has had problems from lightning strikes and the operator has implemented lightning protection.

Finally, the treatment plant does not have telemetry to allow alarms or other plant operational data to be provided to the operator. The operator must visit the plant site and perform checks at the

facility to determine if the equipment is operating properly. The lack of telemetry and alarms limits the ability of the operator to receive current information and extends the period over which equipment may be malfunctioning. Telemetry is required by current design standards.

To meet discharge permit limits, the existing treatment plant needs to be improved. An upgraded treatment plant that includes modern treatment technologies, redundancy, and greater operational flexibilities will reduce the likelihood of a plant upset and improve the effluent water.

5. EXISTING FACILITIES ANALYSIS

5.1 AREA DISCHARGE PERMITS

Relative to the community of Phippsburg, its WWTP is located just over a mile north of the Community on Highway 131. Wastewater flows by gravity to the plant site. The Towns of Oak Creek and Yampa are the nearest towns. The Town of Oak Creek is located 3 miles downstream, and the Town of Yampa is located 6 miles upstream on the Yampa River. The 1-mile and 5-mile-radius maps are included below. AquaWorks DBO is not aware of any other WWTPs in a 5-mile-radius.

Figure 6: 1-Mile Radius Map

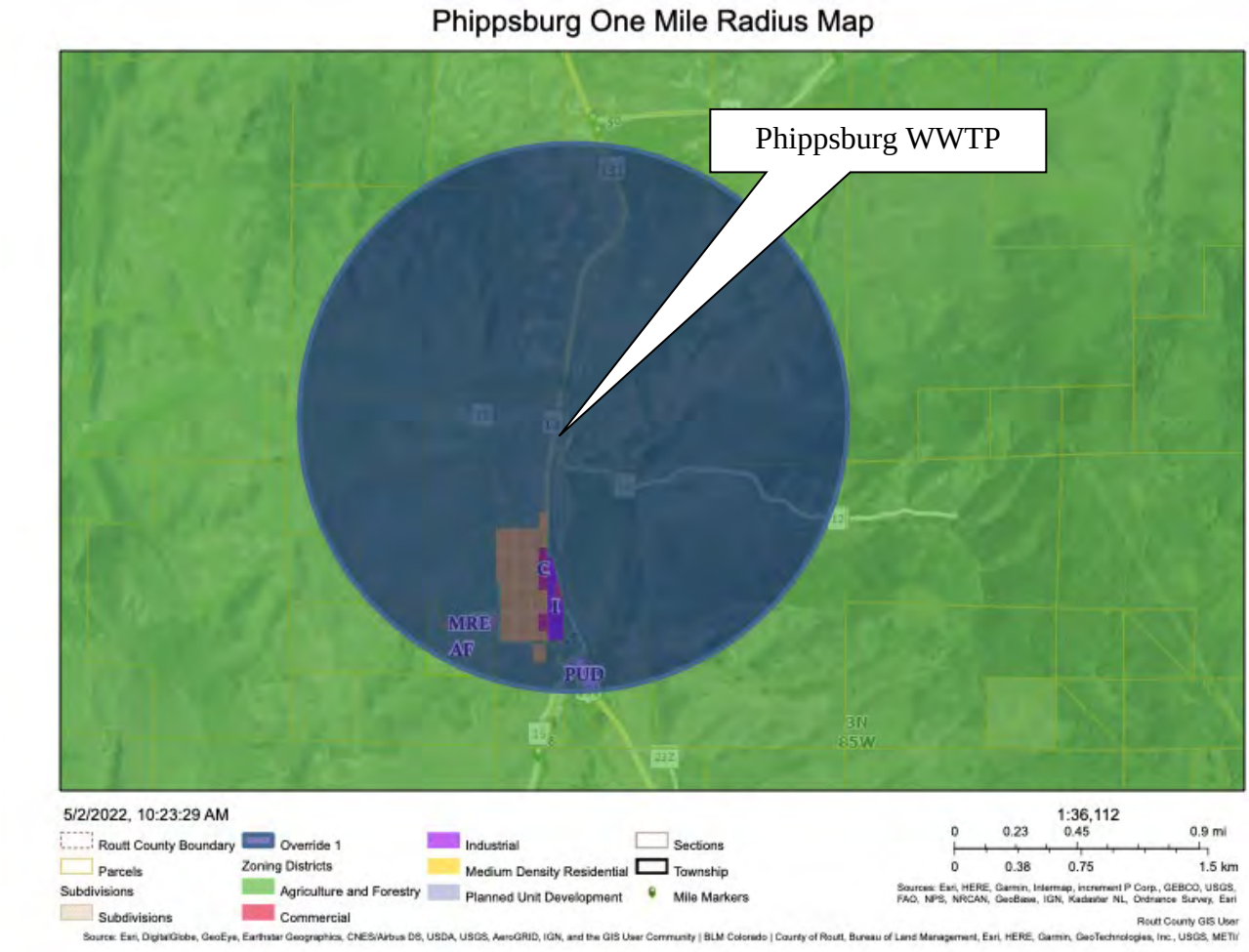
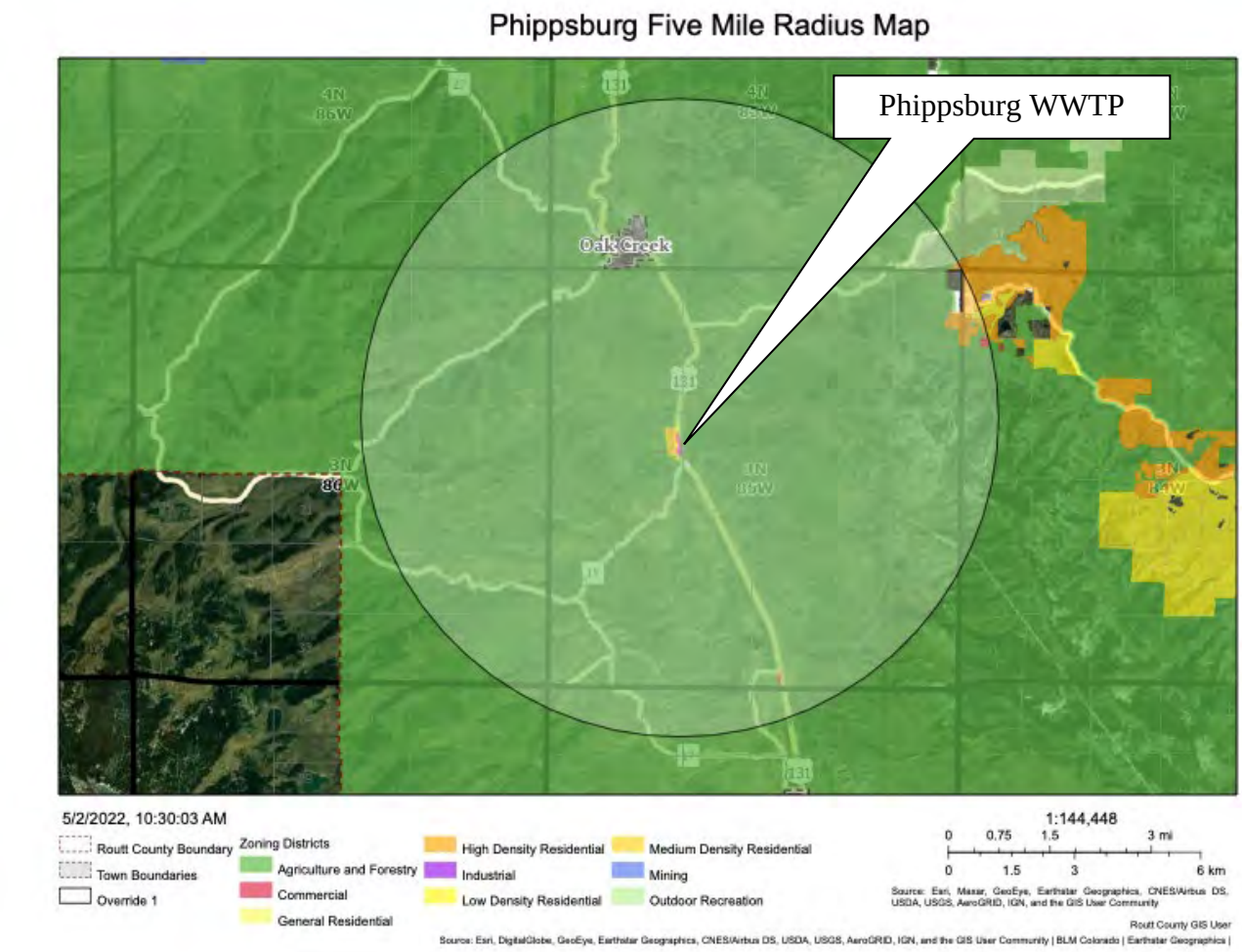


Figure 7: 5-Mile Radius Map



5.2 SERVICE AREA

The Community of Phippsburg WWTP serves 63 acres in unincorporated Routt County, Colorado. The Community lies 25 miles south of Steamboat on Highway 131.

The Phippsburg WWTP provides wastewater treatment services through 132 residential service connections and three commercial connections. The current population is estimated at 220 residents. The population has varied little since the plant was built in 1976. A more detailed discussion of the population trends can be found in Section 6.4, Population and Water Demand Projections.

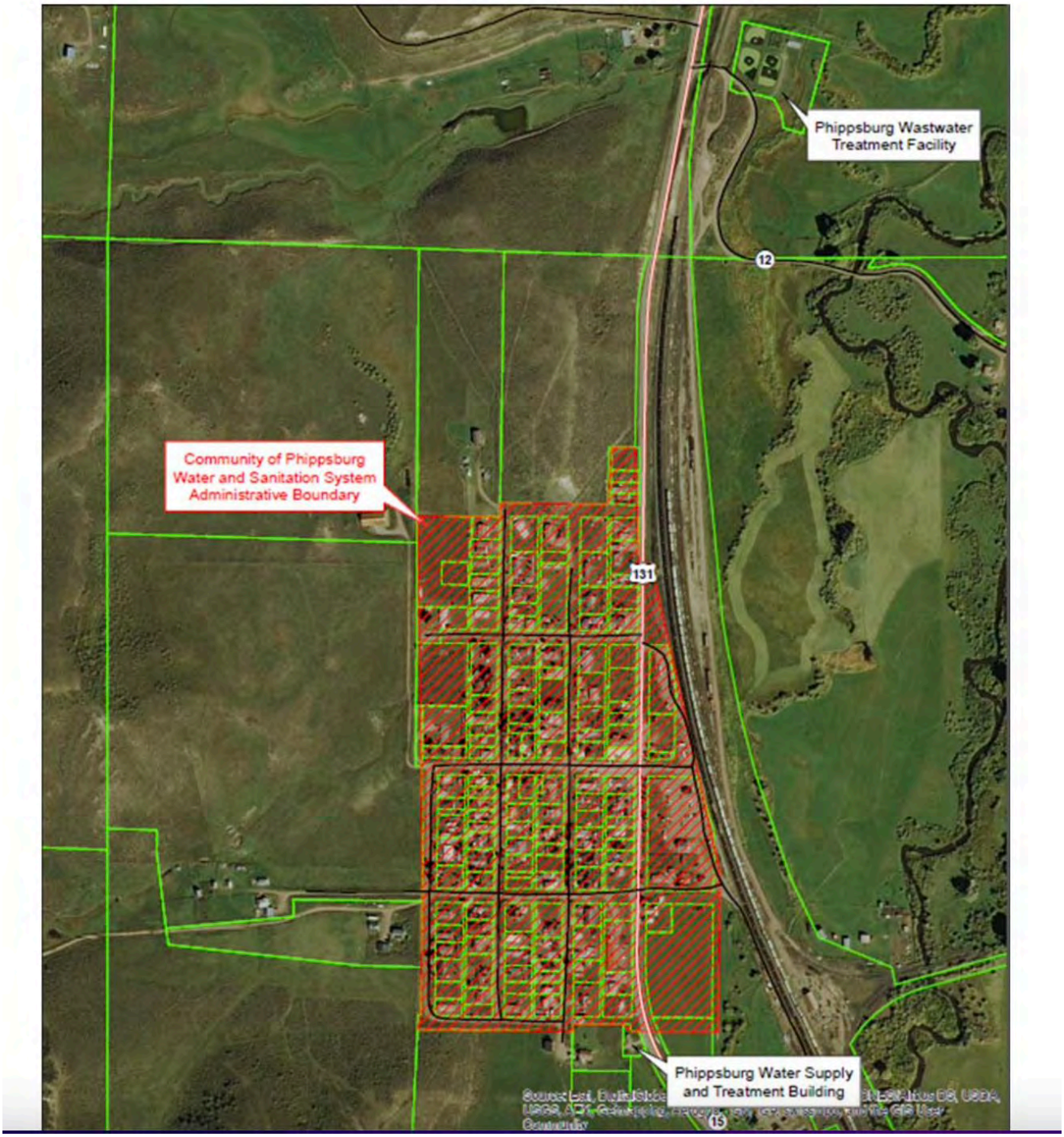
For Phippsburg, Routt County maintains approximately 11,000 feet of sewer line and a wastewater treatment plant with three lagoon ponds and an unused wetland.

Please see the Phippsburg WWTP service area map in Appendix B for additional detail.

5.3 FACILITIES LAYOUT AND DESCRIPTION

The WWTP site is located at RCR #12 east of Highway 131 in unincorporated Routt County, Colorado. The nearest incorporated town is Oak Creek which is 3 miles to the north. Access to the site is obtained from Highway 131. The existing WWTP is in the Northwest ¼ of Section 9, Township 3 North, Range 85 West, of the 6th Principal Meridian (40.239978° N, 106.938067° W).

Figure 8: Site Map



Wastewater flows by gravity from the service area's collection system in 11,000 feet of collection lines without the need for a lift station. Influent wastewater is initially screened in a manually raked bar screen, followed by flow measurement. The wastewater is metered using a 4-inch Palmer-Bowlus flume and ultra-sonic recorder.

The flow is routed to Lagoon #1. This pond is divided roughly into thirds by two baffle curtains. The first section of Lagoon #1 contains no aeration equipment and serves as an anaerobic influent cell. The second and third cells operate under partially aerated conditions. Each aerator contains one 3-horsepower surface aerator.

After flowing through Lagoon #1, wastewater flows to Lagoon #2. This pond is aerated and not separated with baffles.

From Lagoon #2, the wastewater flows on to Lagoon #3, which is split so that roughly one-third of the surface area is reserved for settling. The first cell of Lagoon #3 contains one 3-horsepower surface aerator that provides partial mix conditions. The total aeration provided throughout the entire system is 12 horsepower through four 3-horsepower surface aerators.

A constructed wetland follows the three secondary treatment ponds; however, the wetlands are bypassed due to functionality issues and the wetlands were not found to address the TSS issues.

The treatment plant has two sand filters downstream of the wetlands that were intended to remove algae. One filter is located outside and has been abandoned. The second filter is located inside and is connected to the remaining plant; however, the dosing siphon and filter are prone to plugging and are not used.

Effluent measurement is accomplished using a 90-degree V-notch weir with a depth gauge allowing the operator to read flow depth. Following flow measurement, effluent is disinfected in a 24-inch reinforced concrete pipe with sodium hypochlorite. From this point, wastewater is discharged by gravity in an 8” PVC effluent line to the Yampa River. The discharge location will remain the same with this project.

Figure 9: Existing Treatment Plant Schematic

The existing wastewater treatment plant was constructed in 1976. It consists of the following treatment components:

- **Collection system:** Approximately 11,000 feet of PVC
- **Influent Line:** 8" PVC
- **Influent Measurement:** Palmer-Bowlus flume
- **3 Lagoon Ponds:** Processed through an aerated lagoon system
- **Constructed wetland:** Currently not in use
- **Sand Filter:** Currently not in use
- **Effluent Measurement:** The flow rate is measured with a V-notch weir.
- **Chlorine Contact:** Disinfection achieved in a 24-inch reinforced concrete pipe
- **Discharge Line:** Effluent flows by gravity in a 4" PVC into the Yampa River

An updated system is needed to take advantage of new, more efficient technologies for multiple reasons. Most importantly, the County needs to be sure that the condition of the plant will serve the long-term needs of the community.

Due to the age, the condition of the mechanical equipment is unsatisfactory. Specifically, the lagoon pond liners are a top priority. The facility currently has a compliance schedule to address

the seepage from the lagoon liners. Additionally, accumulated biosolids have not been removed for 22 years and need to be emptied from the ponds.

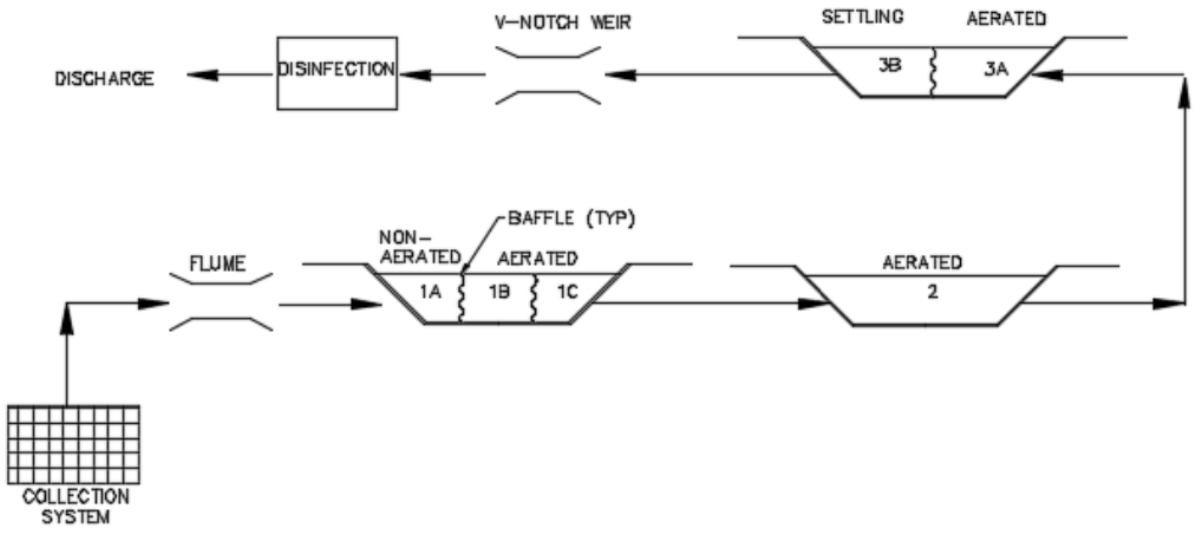
Lagoons at high elevations are not efficient, are difficult to maintain, and have difficulty meeting regulatory discharge limits. Therefore, Routt County recommends upgrading the existing lagoon treatment to a different treatment technology. The proposed facility would feature higher quality effluent with a greater ability to nitrify and disinfect the wastewater.

The new treatment facility would be located on the existing treatment plant site. The existing outfall to the Yampa River would continue to be used for discharge.

5.4 EXISTING PROCESS FLOW DIAGRAM

The County's existing process flow diagram is shown in the figure below. The figure does not include the wetlands or sand filters since they are not in operation and have not been in use for years.

Figure 10: Existing Process Flow Diagram



5.5 EXISTING WASTEWATER FLOWS

The facility monitors influent wastewater flow to the treatment plant using a Bowlus-Palmer flume and magnetic flow meter at the metering station. As discussed above, the flows have been highly

variable over time due to inaccuracies with the measurement technique. The operations staff has had problems with the line between Lagoon 1 and Lagoon 2, creating high water levels in Lagoon #1 and backing up water into the flume. In 2017, the meter was calibrated, leading to more precise readings to support the lagoon seepage study performed by RG and Associates. In addition, the operator reports that the last 5 years have been dry years with average or less than average snowfall and runoff and lower I&I.

There are many outliers in the historical data set, which is in part, related to past metering problems. Due to dry years and flow meter calibration in June 2017, the data since June 2017 is more representative of actual flow rates in the system. However, the full data set is presented here for historical reference. Only data after 2017 was used when drawing conclusions in this report.

Influent flow rates were evaluated for January 2001 through February 2022. As shown in Table 2, the 30-day average annual flow for this period was 19,367 GPD and the average of the peak days from 2001 to 2021 was 27,932 GPD. The period 2017-2022, after the meter was calibrated, is shown in Table 3. The 30-day average annual flow for this period was 12,400 GPD and the peak day was 18,200 GPD. The following tables show the average and maximum flow rates for each month over the period of 2001-2022 and 2017 respectively.

Table 2: Influent Monthly Flow Volume 2001-2022

Month	30-Day Average (GPD)	Max Day (GPD)
January	14,200	18,500
February	13,900	19,600
March	18,800	32,700
April	30,300	47,700
May	27,600	41,033
June	28,100	39,600
July	22,100	32,500
August	16,400	21,000
September	16,100	23,800
October	16,400	17,800
November	14,700	19,600
December	13,800	19,600
Average	**19,400**	**27,900**

For comparison, the flow rate data for the years after the flow meter was calibrated in Table 3 below. The information about the flow rates in the last 5 years are being taken into consideration in the design section of this report.

Table 3: Influent Monthly Flow Volume After Calibration (2017-2022)

Month	30-Day Average (GPD)	Max Day (GPD)
January	10,300	14,300
February	10,900	16,700
March	14,200	23,800
April	18,700	28,000
May	14,300	23,100
June	15,900	25,100
July	13,400	18,820
August	9,600	13,720
September	10,300	15,200
October	10,200	13,400
November	10,000	11,600
December	11,000	14,600
Average	**12,400**	**18,200**

As Figure 11 shows, Phippsburg WWTP receives higher influent flows during April through June, which indicates I&I during this period. The County has had some problems with the installation and calibration of the flow meter and reporting extremely high flow rates. For example, 2001, 2011, and 2014 were extremely high at 58,500 GPD, 73,000 GPD and 74,000 GPD, respectively. Furthermore, in 2011, the County identified and fixed a break in a line at a commercial property that had been discharging to the sewer system. Near Highway 131, a couple of point sources of groundwater inflow from sump pumps have been disconnected from the collection system.

The County has an ongoing program to decrease I&I and has identified locations to investigate and fix additional I&I problems. The County believes one source of I&I into the pipeline is an irrigated field called “Hay Meadow.” The manholes are sometimes submerged due to the irrigation. The County believes that tree root invasion on the upper roads in Community may be an issue.

Figure 11: Influent Wastewater 30-Day Average Flow Rates 2001–2021

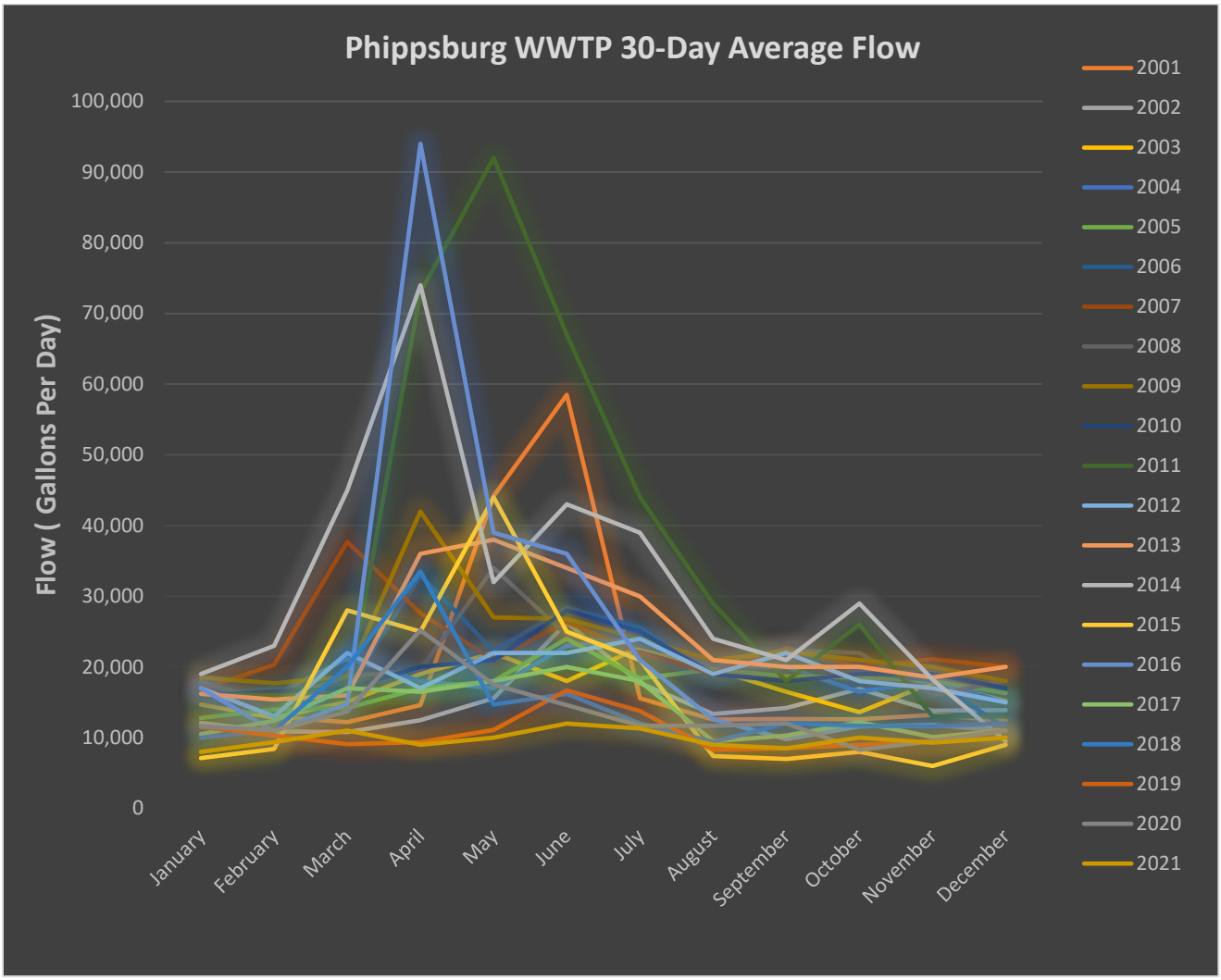
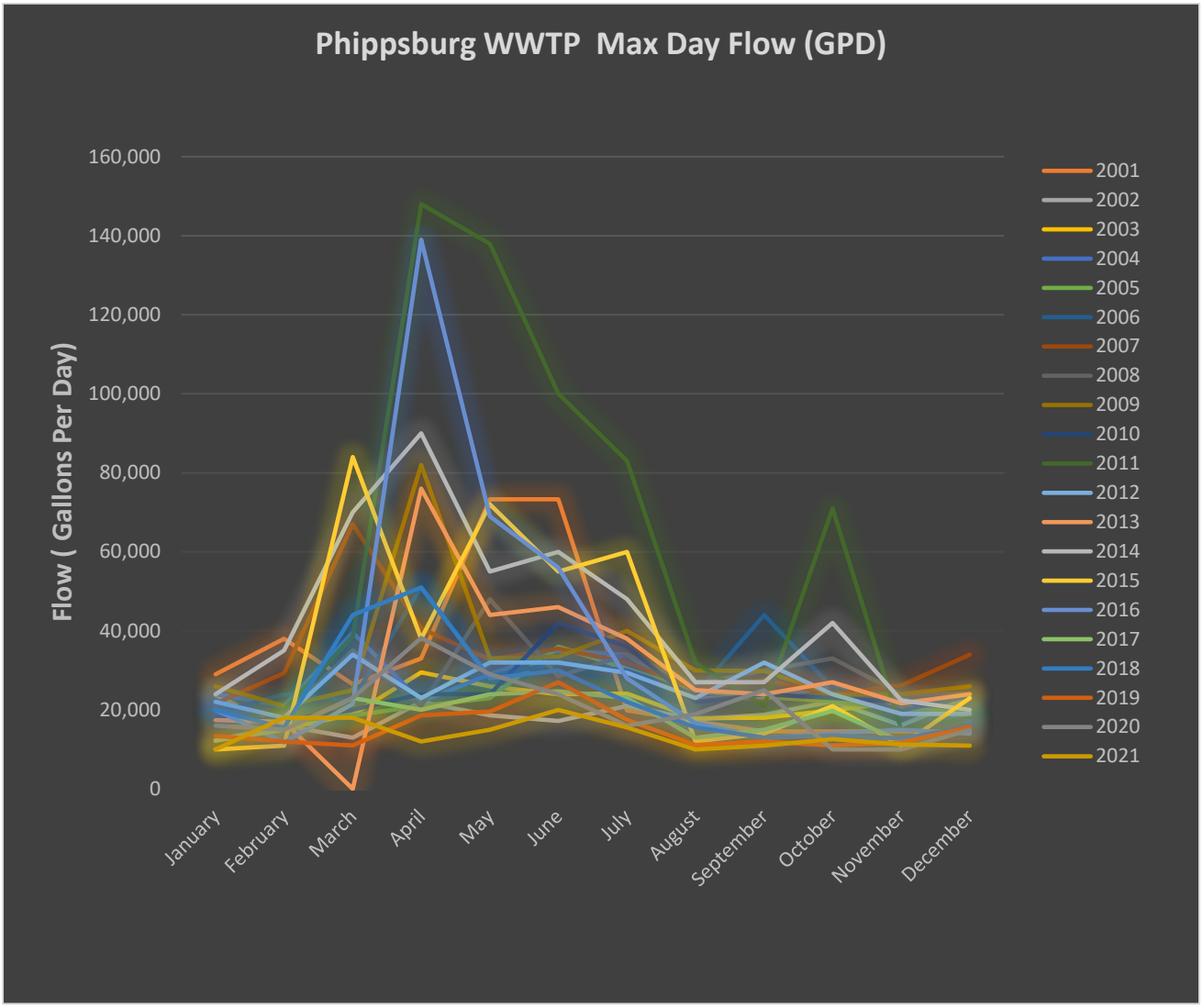


Figure 12: Influent Wastewater 30-Day Peak Flow Rates 2001–2021



The outlier in August 2013 low flow is likely an error in the reporting documentation. The outliers that are extremely high flow are due to the errors in the influent measurement discussed previously.

The County's current discharge permit (COG588141) is for 30,000 GPD flow and 100 pounds of BOD per day. The County desires to maintain this rating for the new Phippsburg facility.

The current peak hour flow was calculated using Figure 3.1 of the State of Colorado Design Criteria for Domestic Wastewater Treatment Works, Policy WPC-DR-1 peak hour based on Phippsburg's population. According to Figure 3.1, for populations of 200 – 300, the peaking factor is 4 (Section 3.2.2.d CDPHE 2012).

The numbers for the 30-day average and peak hour in Table 4 show how the flow rates were used to size the facility during the Site Application.

Table 4: Current and Future Maximum Wastewater Flows

	Current		Rating/Design	
Total Flow (30-day average)	12,400	GPD	30,000	GPD
30-day Average Flow in Minutes	8.6	GPM	21	GPM
Peak Hour (4 Factor) In Minutes	34.5	GPM	84	GPM

Existing Wasteload

The historic BOD concentration results from the DMR records for influent BOD were used to evaluate the current and proposed organic loading of the facility. As discussed above, the flow measurements before 2017 may have been inaccurate due to problems with the flow measurements during extreme events. Increased flow rates cause the BOD load to increase and the BOD treatment percent to decrease, leading to violations. The average concentration of BOD between 2001 and 2021 was 262 mg/L, and the average load was 37 PPD. The average concentration of BOD after the flow meter was calibrated was 263 mg/L, while the loading was 26 PPD.

Table 5: Historical monthly Average BOD Concentrations 2001-2021

Month	Average BOD (mg/L)	Average BOD (PPD)
January	277	33
February	312	37
March	219	31
April	152	32
May	200	40
June	187	39
July	224	41
August	310	41
September	277	39
October	333	43
November	328	40
December	317	34
Average	**262**	**37**

The historic average BOD concentration equates to an average BOD loading of 37 pounds per day, 37% of the approved capacity of 100 pounds per day. The County desires to maintain the 100 pounds per day rating for the new facility to accommodate seasonal variations and future growth

within the service area. At full design flow of 30,000 GPD, the concentration of the wastewater needed to amass the 100 pounds per day of BOD is 400 mg/l. This concentration is higher than the historic concentration and generally accepted contributions from residential strength wastewater. As the County continues to address I&I, the concentration is expected to increase.

The Figures below are graphs of influent BOD concentration and BOD loading in pounds:

Figure 13: Influent BOD Concentration 2001–2021

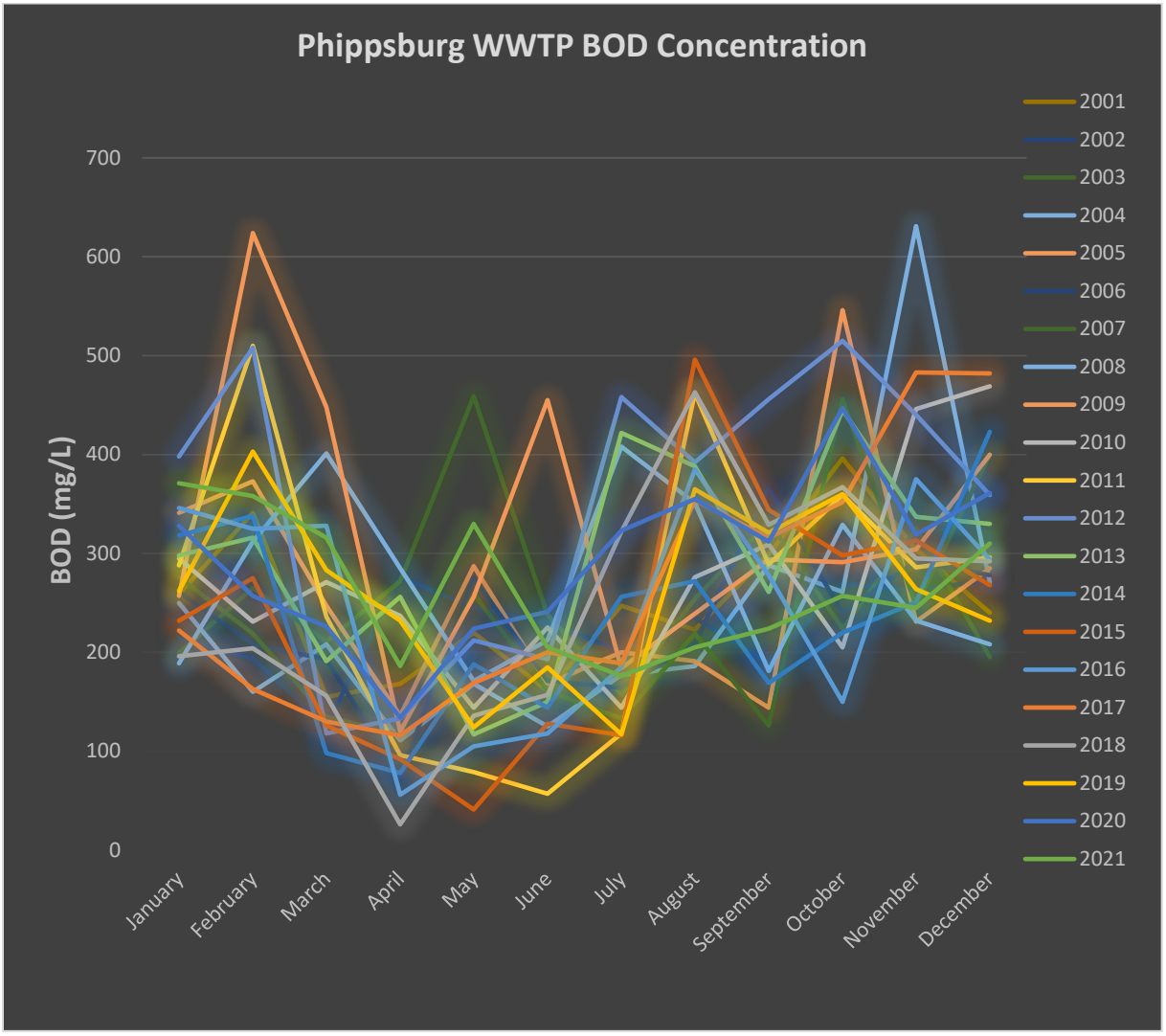
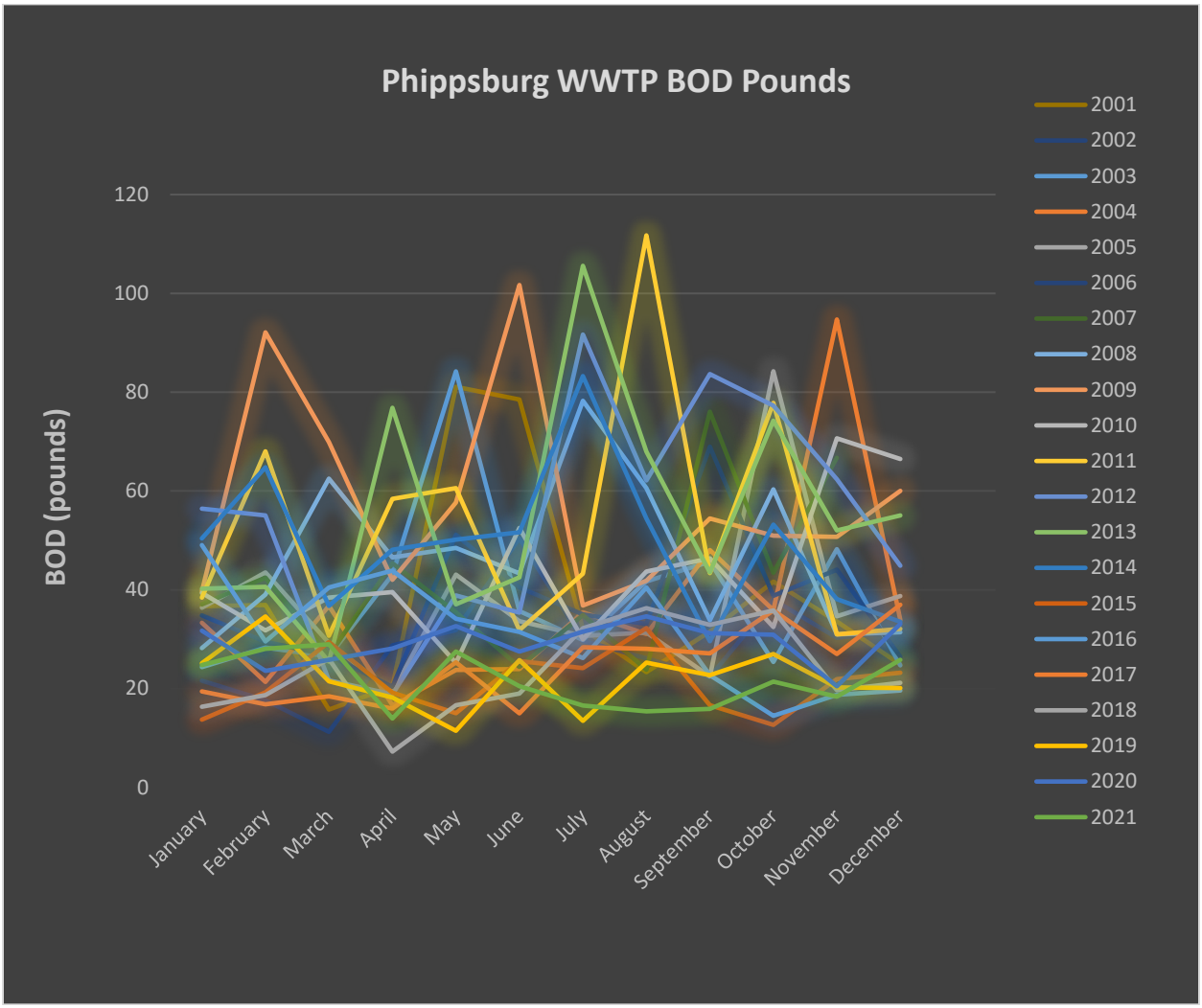


Figure 14: Influent BOD Pounds 2001-2021



The treatment plant's nitrogen wasteloads were also evaluated. The Community is comprised mostly of residential taps with three small commercial taps. Therefore, AquaWorks DBO anticipates the raw wastewater quality should conform to engineering standard concentrations for residential wastewater. Based on comparable projects, normal strength residential wastewater is generally within the range of 50-60 mg/L Total Kjeldahl Nitrogen (TKN) and 6-8 mg/L total phosphorus.

The County began taking samples of Total Kjeldahl Nitrogen. At this time, only one sample has been obtained. The sample result was 39.2 mg/L TKN in the June of 2022. This is typically a higher I&I month, as discussed previously, so AquaWorks DBO expects that actual wastewater may be higher than this single sample point suggests. Designing the replacement facility for 50 mg/L of TKN will provide conservatism in the design.

5.6 APPROPRIATENESS OF TREATMENT TECHNOLOGIES

The existing aerated lagoon system is 46 years old and consists of now outdated technology. Since 2008, Routt County has been evaluating treatment alternatives to upgrade or replace the wastewater treatment system.

The piping and manholes in “Hay Meadow” area are a suspected source of I&I due to the County’s previous investigation into sources of I&I. The County has other areas of homes using sump pumps that are likely point sources of I&I. When discovered, these sources have been removed from the wastewater collection system.

The facility consists of three treatment ponds. The first pond is divided into three cells, with 1/3 being an anaerobic cell and 2/3 being two aerobic partial mix cells. The second pond is not divided and is entirely aerated. The third pond is divided so that the first two-thirds provides aeration, and the second part is sectioned off as a settling pond. A constructed wetland follows the ponds but is currently bypassed.

Based on a permit application submitted to CDPHE in 2006, biosolids were removed in the summer of 1999 and do not appear to have been removed since. The ponds have a significant accumulation of biosolids over this period of time and need to be removed. The accumulation of solids diminishes treatment volume and causes treatment challenges. The treatment system is not efficiently removing BOD and has had violations in 2003, 2004, 2006, 207, 2012, 2013, 2015, 2021, and 2022.

When the plant was first constructed in 1976, permit limits in Colorado at that time typically did not include ammonia. As a result, the facility was not explicitly designed to provide nitrification treatment. Overall, lagoon treatment plants can struggle with nitrification, primarily in winter when air temperatures decrease, leading to cold water temperatures. Relative to mechanical treatment plants, lagoon systems are particularly susceptible to decreasing temperatures due to long hydraulic detention times and large pond surface areas, which allows heat to escape and results in freezing ponds and freezing aerators. Nitrification is significantly inhibited at these low temperatures. Phippsburg WWTP experiences seasonal drops in pond temperatures, and ponds can freeze during the winter months. As a result, the plant struggles to meet ammonia limits despite moving the outfall location from the creek to the Yampa River to obtain higher ammonia limits in 2012.

The continuing trend is tighter permit limits across the state and new effluent parameters will be added in the future. Overall, lagoon treatment plants have limited design and operational adjustments and are limited in their ability to treat for parameters like ammonia, total nitrogen, and total phosphorus.

In addition to challenges in meeting treatment requirements, the lagoons have problems with excessive seepage. The lagoons were installed in the 1970s when the liner design requirements were less stringent, allowing for 1/8 inch of seepage per day. Modern design requirements allow only 1/32 inches of seepage per day. CDPHE issued a compliance schedule that was included in the facility's discharge permit in 2013, requiring a comprehensive investigation of the liner integrity of the lagoons and the amount of seepage from the lagoons. The County previously investigated a project that focused on emptying the lagoons of biosolid and upgrading the liners. However, it was decided to follow a different path and upgrade to a mechanical treatment plant. The mechanical treatment plant was determined as the more advantageous return on investment for the incremental cost of the advanced treatment.

5.7 CAPACITY OF TREATMENT TECHNOLOGIES

In 2018, Routt County contracted RG and Associates to conduct a Wastewater Treatment Plant Evaluation and inventoried Phippsburg's treatment system components present at that time:

- Headworks included a manual bar screen with 7/8-inch openings and influent flow metering with Palmer-Bowlus flume.

- The lagoon system consists of three lagoons. Lagoon #1 is divided into three cells by a baffle curtain. The overall pond volume holds approximately 400,000 gallons and has a detention time of 10 days. Cell #2 and #3 each have one 3-horsepower mechanical surface aerator.

- Lagoon #2 is 320,000 gallons and has a detention time of 8 days. There is one 3-horsepower mechanical surface aerator.

- Lagoon #3 is divided into two cells by a baffle curtain. Cell 3A has an estimated volume of 132,000 gallons and 3.3 days of detention time. There is one 3-horsepower mechanical surface aerator. Cell 3B has an estimated volume of 66,000 gallons with a detention time of 1.7 days and is for settling.

- All three lagoons have surface aeration systems with a total of four 3-horsepower mechanical surface aerators.

- The constructed wetland is similar in surface area to Lagoon #3 and has a synthetic liner and a depth of 7.5 feet. It is not in use.

- The treatment plant has two sand filters downstream of the wetlands that were intended to remove algae. One filter is located outside and has been abandoned. The second filter is located inside; however, the dosing siphon and filter are prone to plugging and are not used.

- Sodium hypochlorite (5%) is dosed in a 24-inch concrete pipe, which creates a chlorine contact chamber where contact time is provided for disinfection before discharge to the Yampa River.

- Effluent flow is measured with a V-notch weir.

5.8 OPERATIONAL CONTROLS

The operational control of the current system is extremely basic and is consistent with other lagoon treatment systems within the state. The pumps and aerators function either as on or off and are controlled manually. The control structure that diverts flow to the lagoons is operated by turning valves to control flow to the lagoons.

PLCs do not automatically control any of the unit processes. Dissolved oxygen, water level, and other system variables are collected and reported manually. The operator has little control over manipulating the system variables.

A new mechanical system would have up-to-date automation controls with a PLC-based master control panel monitoring and governing most of the treatment equipment. Inline instrumentation would be installed to automatically optimize process control. A new SCADA system would be included to record historical data and allow the operator to remotely access the PLC. An autodialer would be included so that alarm notifications are automatically reported to the operators' phones.

6. FACILITY PLANNING ANALYSIS

6.1 PROJECT AREA MAP

A project area map is included in Appendix B. Routt County's Community of Phippsburg wastewater assets include:

- Approximately 11,000 feet of collection lines and 40 manholes
- One 30,000 GPD lagoon treatment plant comprising of three lagoons and a constructed wetland and sand filter that are not in use.

6.2 208 PLAN COORDINATION

Coordination of 208 Agencies will not be a factor for this project as the site is not within an established 208 Planning Area.

6.3 LOCAL AND REGIONAL ISSUES

Routt County will coordinate the Site Application Review with referral agencies, which are the County itself. The project's intent is to upgrade an antiquated facility with an updated, efficient system with reliable and technologically current equipment. The new system would treat wastewater to a higher quality within the permitted flow rate of the facility. This upgrade project is not intended to promote any further development of the service boundary or excessive population growth within the area.

Historically, AquaWorks DBO has experienced those projects upgrading treatment technology while maintaining the rated plant capacity have been welcomed by local and regional stakeholders. These projects support existing population projections without encouraging unplanned growth. In addition, water quality is improved.

6.4 POPULATION AND WATER DEMAND PROJECTIONS

The 20-year growth projections for the project were estimated based on the current treatment requirements, a review of the Community of Phippsburg's 2005, 2007, and 2018 treatment system evaluations, and a variety of growth rate scenarios. The historical data set for the wastewater flow rates was evaluated but, as discussed previously, is unreliable. Therefore, the projected wastewater flow rates were calculated based on standard design criteria and supported with last 5 years of actual flow rate data.

In the 2007 Stantec report, the population was estimated at 175 to 200 people with 125 sewer taps but only 115 used. The potential for additional 30 taps was assumed to be available to be added in the future. The projected growth scenario in 2007 was 145 taps and 252 people in 20 years.

Based on the 2010 treatment system evaluation, a total of 220 residents were served through 132 taps connected to the system at that time. The 2016 report by RG and Associates estimated the population at 204 people served through 135 taps which included 3 commercial connections.

The current system serves an estimated 220 people through 132 residential service connections and 3 commercial taps.

At the time of this report, the Community of Phippsburg's lots are nearly all built out, so growth scenarios differ only slightly. The most significant opportunities for growth are subdividing a few of the larger lots. The total population has varied little since 1976. Given the historical growth of fewer than 50 people since 1976, 75 people over the 20-year planning period is more than adequate to allow for growth.

The historic flow treated at the facility averages 19,400 GPD and peaks during the spring months. As discussed previously, the flow data up to 2017 is unreliable for the high flow events. The flow meter was calibrated in 2017. Additionally, the flow increases in April and June due to I&I. The period from 2017 to 2022 have been dry years with average and below average precipitation, so the I&I during this period is smaller than historical I&I contributions. The average flow rate between 2017 to 2022 is 12,400 GPD.

The County is evaluating the solutions to address the I&I. These solutions include lining the collection system pipe and manholes.

Other sources of I&I are possible throughout the aging collection system. The system has been inspected, and minor upgrades and incremental repairs have been made over time. However, the collection system is near the end of its life, and upgrades would address other I&I that may be occurring within the collection system. AquaWorks DBO suggests evaluating the opportunity to rehabilitate the lines with a trenchless system that uses liners inserted inside the existing pipeline and coating the interior of the existing manholes. The upgrades would include hiring a contractor to CCTV the lines with a robot and locating existing penetrations, connections, and breaks.

Table 6: Historic, Current, and Future Maximum Wastewater Flows

Year	Taps	Population	Flow Rate (GPD)
2005 Design Report (Actual)	125	200	17,500
2005 Design Report (Projected)	145	252	
2010 (Actual)	132	220	19,600
2016 (Actual)	135	204	24,100
2020 (Actual)	135	220	13,200
2022 (Actual)	135	220	10,500
System Rating			**30,000**

In 2005 the flow rate equated to 88 gallons per person per day, and in 2020 the flow rate equated to 48 gallons per person per day. This is lower than the design criteria of 75-100 gallons per day per person but still within reason for communities having smaller than average homes.

Since historical flow measurements are questionable standard design estimates are used to project future wastewater flows. According to the State Design Criteria Policy DR-1, the maximum month average daily per capita wastewater flow rates for residents should be between 75 and 100 gallons per day. In addition, the three commercial taps are included with the estimated flow rate. These taps, which are a Bee Grateful Honey, Union Pacific railroad offices, and ranch supply business, are expected to have low flow rates. Based on the State Design Criteria Policy DR-1, the flow rates for the commercial buildings on 0.5 acres are conservatively estimated at 2,250 GPD.

Based on these flow rate planning numbers and the existing plant capacity of 30,000 GPD, the existing plant hydraulic rating supports a future population ranging between 278 and 370 people. Since future growth is expected to remain similar to past population trends, this level of growth is expected to be adequate over the 20 to 30 year planning period.

Wasteload Forecasts

Table 7 presents a tabulation of the current and design wasteload generation rates. Wasteloads were calculated for both the current flow rate and the plant's design capacity:

Table 7: Wasteload Forecasts

	Current		Rating/Design	
Flow (30-day Average)	12,400	GPD	30,000	GPD
Population	220	people	278 to 370	people

BOD Loading	37	PPD	100	PPD

The current value for the BOD loading is less than a standard design value of 0.2 pounds per person per day. Using 0.2 PPD per person, the future BOD loading for the project population is 56 PPD to 74 PPD. The rating for the facility is currently 100 PPD which equates to 400 mg/L at design conditions. The organic capacity for the treatment plant is adequate to meet future population projections.

Future nitrogen and phosphorus loading are expected to remain consistent with typical residential strength wastewater. Design TKN concentrations are 50 mg/L and total phosphorus of 10 mg/L.

6.5 STAGING AND PHASING

The full 30,000 GPD treatment plant would be built and installed in one phase. The current wastewater treatment plant would remain operable as the new treatment plant is built. Once the new treatment plant is installed, the wastewater flow would be transferred to the new treatment plant. After starting up the new plant, the lagoon would be decommissioned. Decommissioning the lagoons would be performed in accordance with federal, state, and local requirements.

6.6 WATER QUALITY PLANNING TARGETS

The County currently holds a certification under the general discharge permit COG588000. The certification number is COG588141. In coordination with the Permits Section, the Phippsburg COG588141 certification will be renewed under the new general permit COG590000.

Table 8: Surface Water Discharge Permit Effluent Limits (COG-590000)

WQPT effluent limits would be provided to the Engineering Section once issued. The CDPHE Permits Unit is in the process of issuing a permit conversion, including approvals of the proposed chemicals.

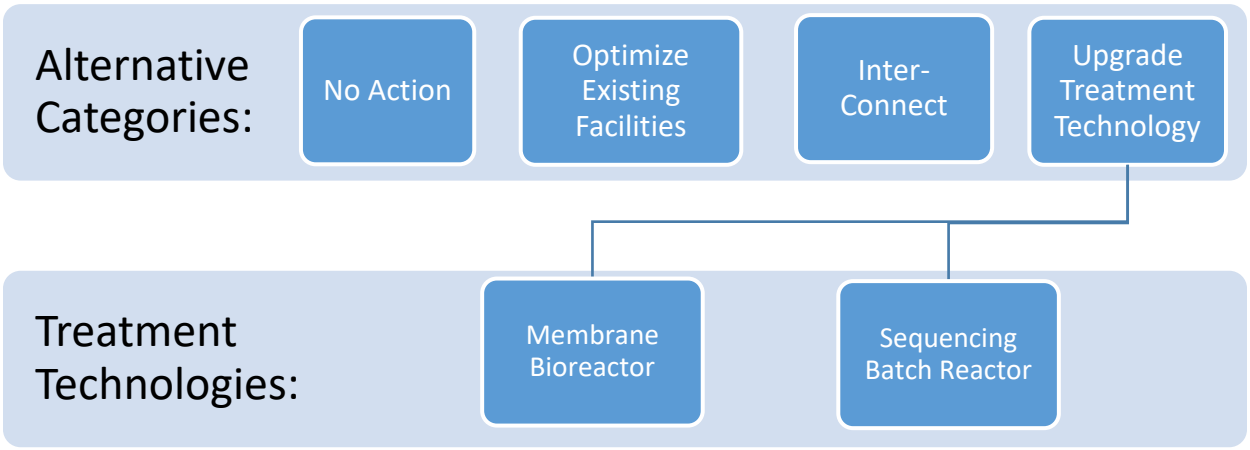
7. ASSESSMENT OF ALTERNATIVES

7.1 ALTERNATIVES

An analysis of potential reasonable alternatives was conducted for this project. The following alternatives were evaluated:

- No action.
- Optimizing the existing facilities.
- Interconnecting with the nearest facility.
- Upgrading the existing facility treatment technology with one of the following options:
    - Membrane Bioreactor (MBR)
    - Sequencing Batch Reactor (SBR)

Figure 15: Chart of Alternative Assessment Options



No Action: Since the 46-year-old aerated lagoon system is at the end of its design life and the system is not meeting discharge requirements, "No Action" is not a feasible long-term approach. Deferring action on the existing facility for a matter of years while the new plant is designed, permitted, and constructed is possible. However, it is not recommended to indefinitely postpone action on the facility replacement. Further, the County recognizes that the current opportunities for supplemental funding of wastewater projects incentivize pursuing a project at this time.

Optimizing the Existing Facilities: Optimizing the existing facility would involve making significant improvements to the lagoons. The lifespan of the existing lagoons could be extended if the accumulated sludge was removed.

A clay liner was installed when the plant was constructed in 1976. In 2013 the CDPHE issued a compliance schedule requiring a comprehensive investigation of the liner integrity of the lagoons and the amount of seepage from the lagoons. The seepage study results were reported to be 1.5969 10^{-5} cm/sec, which was 10 times the allowable limit of 1.00 10^{-6} cm/sec; however the results are questionable due to the leaky pipe after pond 3 found later.

The primary alternatives for synthetic liners were previously considered by Routt County in 2008 in the Master Plan. The liner would need to be either 45 mils or 60 mils in thickness and made of synthetic material such as polypropylene or HDPE. In order to remove the existing liners, the treatment equipment such as aerators and baffles would be taken out of the ponds. Then the sludge would be removed and hauled or land applied.

After removing the sludge, the lagoon bottom, banks, and berms would be cleaned and graded. Then the subgrade would be compacted. A geofabric venting system would be laid first and the liner installed on top. The treatment equipment would be replaced inside the lagoon with either new or existing equipment.

The lagoons were already modified in 2008 to increase treatment efficiency. Additional modifications could be made to optimize the system, such as mixing devices like submerged bubble diffusers and/or mechanical mixing, aeration equipment, warmers, and covers to help conserve heat to avoid freezing. These additions and modifications could improve the treatment plant performance. However, rehabilitating and improving the existing lagoons would be expensive and result in small treatment improvements. Lagoons are still not the best solution as the cold winter temperatures are so low that treatment efficiency is reduced. In addition, future regulatory limits are anticipated to decrease over time, and lagoon treatment systems have limited ability to meet more stringent limits.

The County prefers to invest funds to upgrade the facility to current technology capable of meeting both current and future anticipated discharge permit limits instead of spending money to optimize the existing treatment process.

Interconnecting with Existing Facilities: The CDPHE provides direction in Section 22.3(1)(c)(v), Consolidation Analysis of the Implementation Policy for Regulation 22 (Policy CW-14), for determining whether interconnecting with existing facilities is feasible. The Policy CW-14 states that meeting only one of five factors is required to preclude consolidation and make connecting to an existing facility infeasible. An evaluation for consolidating with another treatment facility was performed and found infeasible due to economics.

The Community of Phippsburg is isolated. The Towns of Oak Creek and Yampa are the nearest towns with wastewater treatment systems. The Town of Oak Creek is located approximately 3 miles downstream, and the Town of Yampa is located approximately 6 miles upstream on the Yampa River. The nearest town with a mechanical wastewater treatment system is the City of Steamboat Springs, which is approximately 25 miles away. Interconnecting from that distance would be cost-prohibitive, and based on item 7 of Section 22.3(1)(c) of Policy CW-14, an analysis of cost-effectiveness is not required because the nearest treatment works are greater than five miles away. Amended Site Applications, such as this one, do not require consolidation regardless of separation between facilities.

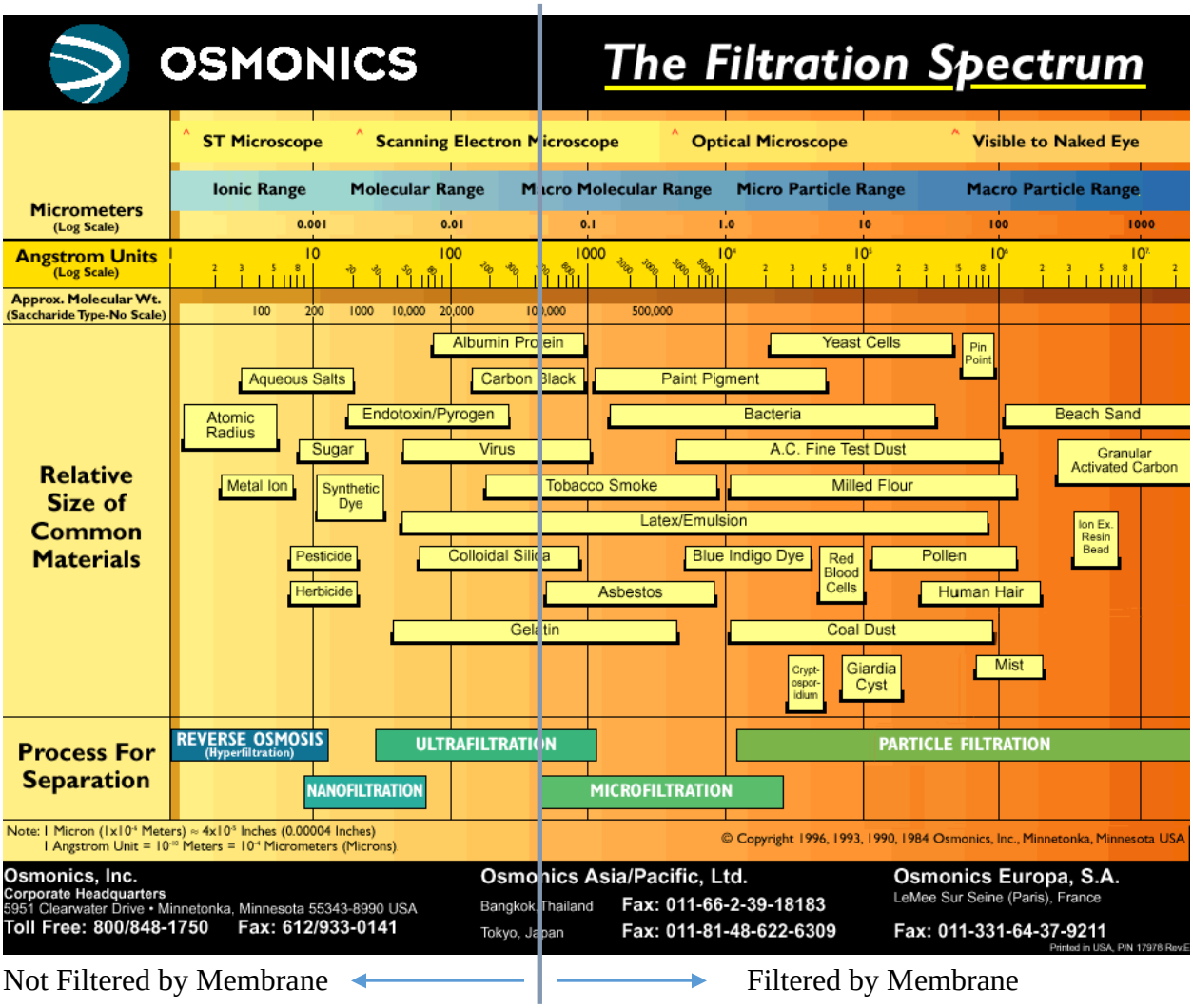
Upgrade Treatment Technology: The most desirable scenario is to replace the existing equipment with a different, more advanced treatment technology that is better suited to operate considering year-round site conditions and will perform for the anticipated future discharge permit limits. The County can implement new technologies developed and improved since the original facility was installed. New treatment technologies can allow for a smaller footprint, greater energy efficiency, simpler operations, greater operational control, and produce overall better effluent quality. Several treatment technologies are available. The two options evaluated for this project are the membrane bioreactor (MBR) and sequencing batch reactor (SBR).

7.2 ALTERNATIVE #1 – MEMBRANE BIOREACTOR

The MBR was evaluated as Alternative #1. MBR equipment packages would consist of an influent fine screening channel, equalization basin, anoxic zone, bioreactor tanks, membrane filtration, chemical addition, disinfection, and aerobic sludge digestion/holding. The configuration is typical for most MBR equipment manufacturers.

The use of the membrane provides advanced capabilities to produce high-quality effluent. MBR systems consist of aerobic sludge manipulation that uses semi-permeable membranes. The nominal pore size for many membranes is 0.04 µm. This porosity limits pathogenic flow-through and improves the ability to produce consistent, high-quality effluent. Figure 15 shows the additional particles and pathogens that are filtered out with the use of a membrane.

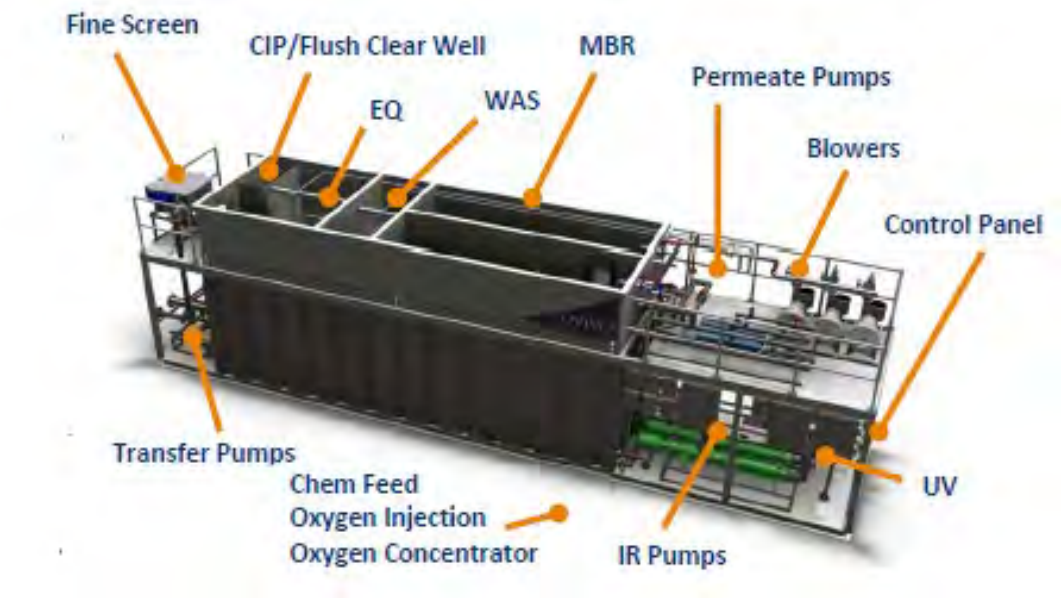
Figure 16: Filtration Spectrum



Not Filtered by Membrane ← → Filtered by Membrane

In this design, significant portions of the MBR equipment come installed in a containerized system. Any in-basin equipment comes shipped loose for installation in new concrete tankage. Packaging as much of the equipment as possible allows for expedited installation times and reduced construction costs, which is extremely valuable for this project, given the short construction season. The figure below depicts a completely skid-mounted system. Much of the equipment shown below would be installed in new concrete tanks or the containerized system

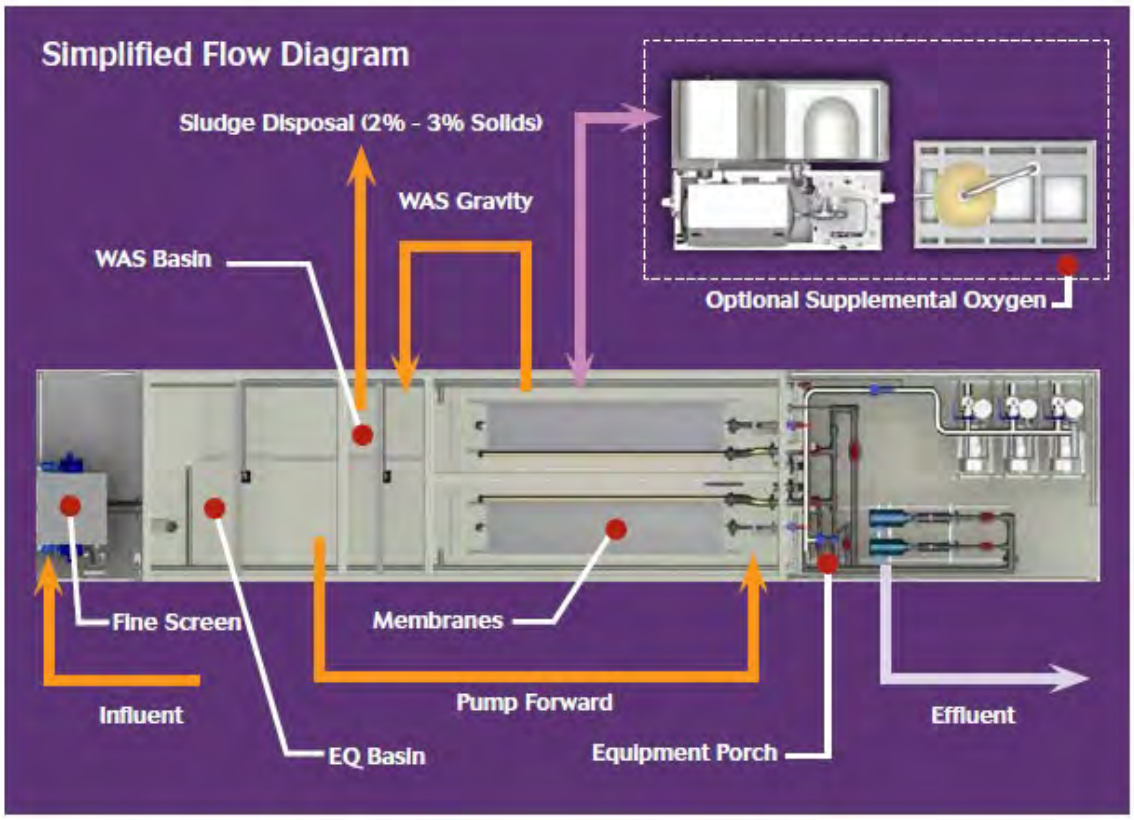
Figure 17: Overview of MBR Equipment



- Influent fine screening
- Influent flow measurement
- Equalization zone/aerated grit storage
- Aerated sludge holding
- Provisions for coagulant, carbon, and alkalinity addition, if needed
- Aeration treatment
- MBR basins
- Permeate pumps
- UV disinfection reactors
- Sodium hypochlorite and citric acid addition for membrane cleaning
- Real-time DO sensor equipment
- Pre-wired, factory-tested equipment
- Remote monitoring controls and alarm exporting

One treatment train is proposed for this facility, which is allowed by the CDPHE as the rated capacity is less than 40,000 GPD.

Figure 18: Sample MBR Design Flow Diagram



Influent Flow Conditions and Fine Screening

The influent enters the treatment train through a pretreatment fine screen first. This step is designed to meet peak flow rates. The screen's perforated opening is 2 mm for removing solids. Two fine screens are supplied, but only one would be used at a time. One automatic fine screen is supplied along with a shelf spare set of critical parts.

Screenings are processed into a bin for ease of removal and disposal in a solid-waste facility.

Equalization Zone/Transfer Pumps

An integrated influent storage basin accommodates peak flow and I&I events to circumvent short-circuiting of the above-peak events. Redundancy in the design includes at least two transfer pumps (one duty and one standby). The transfer pumps help to control the membrane permeable flow-through rates and maintain the minimum submergence of the membranes. The basin is designed for grit to settle to the bottom. Additional aeration pumps are installed to keep the liquid from becoming septic.

Biological Nutrient Reduction

The MBR treatment process can be designed for BOD and ammonia treatment and may be modified to include denitrification for nitrogen removal. The MBR includes an aerobic tank for nitrification and reduction of ammonia. The system's controls monitor dissolved oxygen levels and pH in the basin biomass to indicate the changing biological oxygen demand and nitrification needs. The MBR design can also be upgraded to include an anoxic tank for denitrification when discharge limits require nitrogen removal and coagulant dosing for phosphorous reduction.

Submerged Membranes

The MBR system's core treatment is housed in the two MBR basins. In the basins, an MLSS of 9,000 mg/L (or 12,000 mg/L for ceramic membranes) is maintained under constant aerobic conditions. Membranes use filtration to separate treated water from the mixed liquor. Regenerative blowers are supplied to provide constant aeration of the mixed liquor. The continuous scouring acts as a primary means of anti-fouling of the membranes. Typical operation of membranes calls for a set permeate period, determined by the manufacturer, followed by a rest function and/or a reverse flow. This alternating operation helps prevent overloading and fouling of the membrane cartridges.

Figure 19: Hollow Fiber Membrane

The membranes are installed in a parallel arrangement that use a permeate vacuum pump to achieve an optimal flow-through rate. Adjustments are made by the operator to achieve constant pressure. This feature provides optimal flux among flow-through capabilities, membrane surface area, and prevention of membrane fouling.

Effluent Operation

The effluent discharge rate is regulated by the permeate pumps. The pumps are controlled and monitored by the system's internal controls governed by the PLC. The flow rate is measured by an integral effluent magnetic flow meter and controlled with the PLC.

Operation & Maintenance

Process control of the MBR is performed through an integral HMI interface panel. The panel manipulates and monitors the operation of blowers, pumps, flows, and chemical addition.

Scheduled maintenance includes cleaning of the basins and sludge removal. The manufacturer suggests that the basins be cleaned with a chemical cleaner for organic and inorganic fouling. The

frequency of cleaning is dependent upon influent loading characteristics. The cleaning chemicals used consist of sodium hypochlorite and citric acid.

As with any process, the use of a proactive procedure provides optimal system performance for continuous quality treatment. Influent, effluent, and in-basin monitoring of wastewater conditions allows the system to evaluate trends and predictive measures to be taken to forecast possible interruptions in effluent quality. A scheduled routine of sludge removal is required at the intervals deemed necessary.

Waste sludge storage

The MBR alternative includes a separate storage tank for aerobic waste sludge. The storage tank is typically sized to provide approximately 30 days of storage to facilitate periodic sludge hauling. Solids are wasted from the aerated tank and pumped into the sludge holding tank. The sludge holding tank contains coarse bubble diffusers for aeration and decant pumps to allow for sludge thickening. Typical solids within the tank can be thickened to approximately 2% dry solids by weight. Level control in the tank indicates when solids must be decanted or removed by vacuum truck.

Chemical Addition

The MBR process requires the following five chemicals for operations and maintenance:

- Alum to promote the removal of phosphorus if needed.
- Carbon addition for denitrification, if needed.
- Caustic soda for pH and alkalinity adjustment.
- Sodium hypochlorite for back-pulsing of membranes.
- Citric acid for cleaning to prevent inorganic fouling of membranes

A Chemical Evaluation application was submitted with the General Permit Application for the above chemicals.

7.2.1 CAPITAL AND O&M COSTS – MEMBRANE BIOREACTOR

The following is a conceptual-level annual estimate of the O&M costs for the MBR alternatives:

Table 9: MBR O&M Annual Estimates

Item	Cost
Sludge Disposal	$15,000
Power (at $0.1 per kW/hr)	$6,000
Chemicals	$3,000
Membrane Replacement Budget	$10,000

Replacement Parts Budget	$20,000
Analytical Testing	$5,000
Contract Operations	$25,000
Miscellaneous	$10,000
Total:	$94,000

7.2.2 ADVANTAGES & DISADVANTAGES – MEMBRANE BIOREACTOR

The following is a summary of the advantages and disadvantages of the MBR:

Table 10: MBR Advantages/Disadvantages

Advantages	Disadvantages
Controls, pumps, chemical feed system, and blowers come mounted on a skid	High equipment cost
Uninterrupted quality effluent due to the physical nature of the membrane	High power costs due to continuous blower and permeate pump operation
High-quality effluent. High BOD and ammonia removal	Possible membrane fouling
Lower probability of coarse diffusers becoming plugged	Lower oxygen transfer rate due to the coarse diffusers
Increased MLSS concentration >9,000 mg/L or 12,000 mg/L (smaller footprint required)	Membranes require replacing approximately every 10 years (20 years for ceramics)
Can meet strict future phosphorous limits without additional equipment	Membranes do not perform well at cold temperatures (< 10°C)

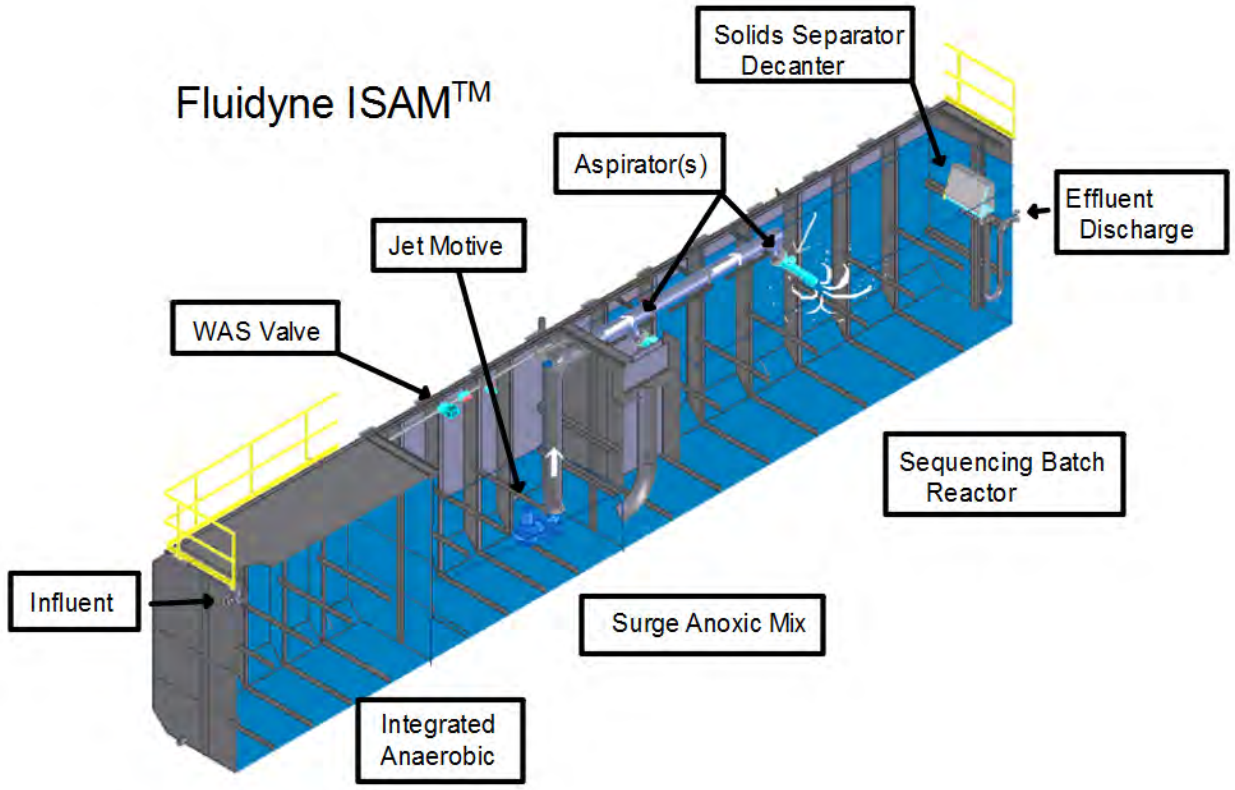
7.3 ALTERNATIVE #2 – SEQUENCING BATCH REACTOR

The SBR treatment facility alternative consists of an activated sludge system with most of the required equipment and controls supplied by a common manufacturer. The equipment features the following major components:

- Influent conditioning/equalization
- Anaerobic sludge handling
- Jet motive/wastewater transfer pumps
- Jet aspirator aeration system
- SBR basins
- Automated floating solids, excluding decanter
- UV disinfection
- PLC-based control system

The proposed system package consists of a single treatment train process. This configuration provides enhanced operator control and additional redundancy capabilities. The functions and basis of the design for each of these treatment steps are discussed below.

Figure 20: Overview of the SBR Process



The image above shows all the equipment in a metal tank.

Influent Conditioning/Sludge Storage Tanks

After the influent flow measurement and screening, raw wastewater flows by gravity into the first component of the biological process, the influent conditioning/equalization chamber. This chamber is a variable-level chamber where heavy influent solids and grit settle out, like a primary clarifier. Here, settleable solids are converted to soluble BOD. Underflow baffles are incorporated into the design to prevent direct short-circuiting, which causes uneven treatment and conversion rates.

Waste Sludge Storage

The SBR alternative includes a separate storage tank for aerobic waste sludge. The storage tank is typically sized to provide approximately 30 days of storage to facilitate periodic sludge hauling.

SBR manufacturers have documented significant volatile-solid reductions and typical sludge solid concentrations of 3–4%. This results in an extremely efficient sludge storage system and minimizes the frequency of hauling. Based on observations of the stored sludge levels, sludge would be removed as needed with a vacuum truck and hauled offsite to a permitted facility.

Jet Motive – Wastewater Transfer Pumps

The multipurpose jet motive pumps serve three essential functions for the SBR. First, the pumps act on an intermittent cycle to forward-feed partially treated water into the SBR while simultaneously acting as Venturi aerators. Second, the pumps cycle water between the SBR and the anoxic basin to denitrify the wastewater. Third, the jet motive pumps feed WAS to the front of the plant by siphoning a side stream of the sludge. Enough jet motive pumps would be supplied to provide redundancy.

Aeration System – Aspirating Nozzles

The motive pump also activates an aspirating jet aerator to oxygenate the SBR. The aerator nozzles are in the SBR's basin. The oxygen-delivery system is sized to exceed the calculated oxygen requirements to accomplish treatment (CBOD and ammonia conversion).

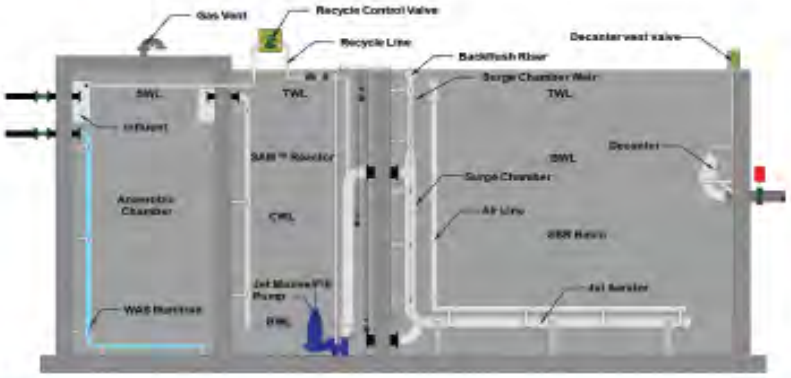
Sequencing Batch Reactor (SBR)

Each batch of wastewater is treated within a cycle in the SBR basin. Each cycle has five distinct phases:

1. Fill/react
2. Interact/react
3. Settle
4. Decant
5. Filled Decant

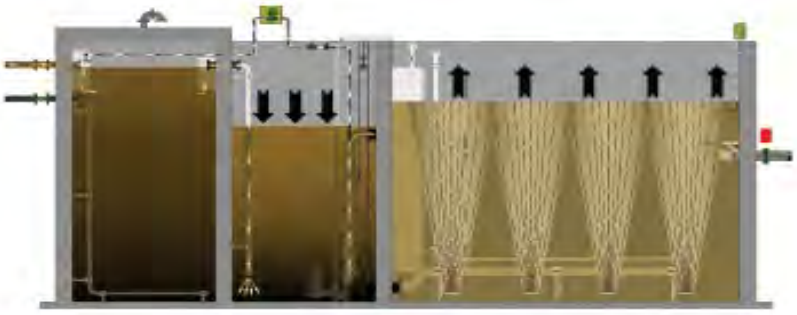
The following is a description and illustration of the five phases of the SBR process:

Figure 21: SBR Phases



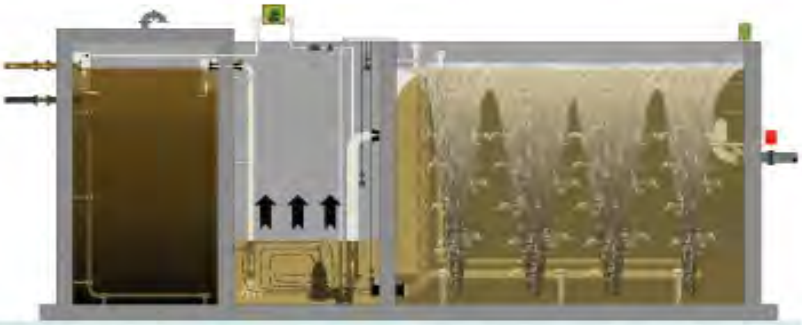
System Components:

Influent continuously enters the anaerobic chamber where solids settle. Settleable BOD is converted to soluble BOD. BOD is reduced by 30% and solids are reduced by 60%. The influent then flows to the SAM™ reactor. Mixed liquor is maintained in the SAM™ reactor to suppress orders and initiate and accelerate carbon and nitrogen reduction.



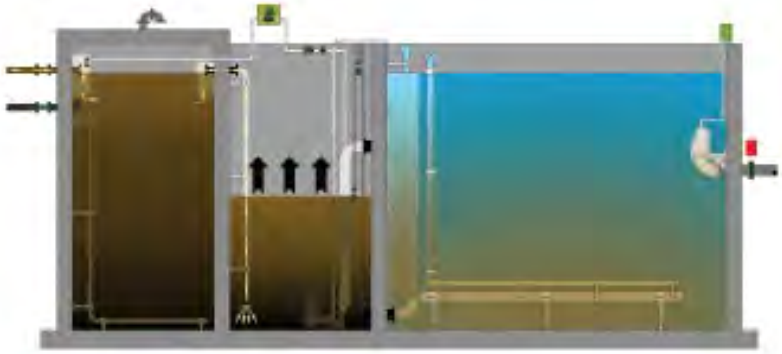
Fill Phase:

When the level in the SAM™ reactor reaches a predetermined "control level" the motive liquid pump is started. The SBR basin is filled and mixed. A percentage of the pumped flow is returned to the anaerobic chamber where biological solid settle. Settled solids in the anaerobic chamber are digested.



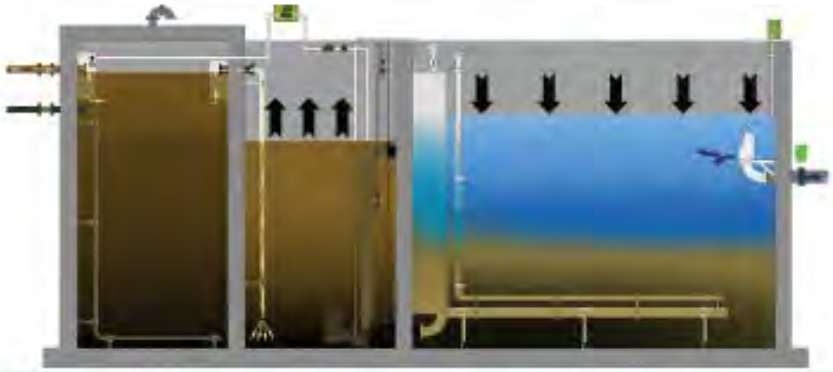
Interact Phase:

When the level in the SBR reaches TWL, nitrified mixed liquor overflows the surge chamber weir and is returned to the SAM™ chamber to mix and react with the raw influent. Aeration is cycled on and off to provide the required oxygen. Denitrification is reliable and complete. Scum is also removed from the SBR basin.



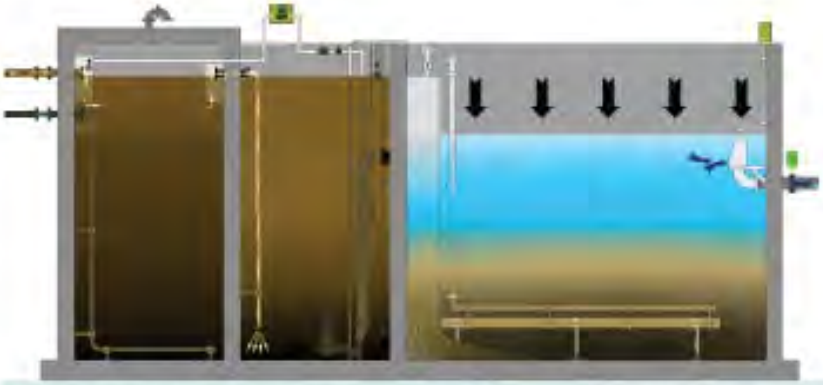
Settle Phase:

When the level in the SAM™ reactor again reaches "control level" aeration is discontinued and the SBR basin settles under perfect quiescent conditions.



Decant Phase:

When the settle timer expires, the decant valve is open and treated effluent is withdrawn from the upper portion of the SBR basin by means of a fixed solids excluding decanter.



Filled Decant Phase:

If, during peak flow events, the SAM™ reactor reaches TWL before the decant phase ends, influent flows in a reverse direction through the surge return line and overflows the surge chamber secondary weir and is diffused into the settled sludge at very low velocity as the decant phase continues.

Filtration
Filtration would not be included with this SBR alternative. Space in the facility's building could be provided in the event future strict phosphorous limits are implemented and filtration needs to be added to the SBR treatment.

Disinfection System
Decanted supernatant passes through a duplex (one duty/one standby) ultraviolet disinfection system. This equipment does not require any added chemicals.

Biological Nutrient Reduction
The SBR has features that allow for BNR through the modulation of the MLSS and react cycles. Uric nitrogen is removed first through anaerobic denitrification, which converts urea-based nitrogen into ammonia. The SBR then allows for nitrification via an aerobic process whereby the ammonia is converted to nitrite/nitrate molecules.

OPERATION & MAINTENANCE
The SBR system is highly automated but would require daily operation and maintenance by operators for optimal process control. The SBR is operated by a PLC with HMI manipulation. The process is automated and is optimized when the operator makes adjustments to achieve a quality effluent. As with all wastewater facilities, the SBR runs best with periodic supervision and provides consistent operation if a proactive regiment is implemented. A true understanding of influent/effluent and in-basin conditions allows the operator to make educated adjustments and predictions for wastewater treatment.

Daily or weekly maintenance may include settleability, MLSS testing of the SBR, and a monthly sludge judge analysis of the sludge storage basin. Pump maintenance should be performed in accordance with the manufacturer's O&M requirements.

Sludge dewatering or hauling is typically done monthly but is subject to influent loading conditions. Design criteria influence how frequently sludge must be removed.

Chemical Addition
The SBR process requires the addition of the following chemicals:

- Alum, to promote the removal of phosphorus.
- Soda ash, for alkalinity adjustment.
- Carbon addition for additional denitrification, if needed.

7.3.1 CAPITAL AND O&M COSTS – SEQUENCING BATCH REACTOR

The following is a conceptual-level annual estimate of the O&M costs for the SBR:

Table 11: SBR Annual O&M Estimates

Item	Cost
Sludge Disposal	$15,000
Power (at $0.1 per kW/hr)	$5,000
Chemicals	$3,000
Replacement Parts Budget	$20,000
Analytical Testing	$5,000
Contract Operations	$25,000
Miscellaneous	$10,000
Total:	$83,000

7.3.2 ADVANTAGES & DISADVANTAGES – SEQUENCING BATCH REACTOR

The following is a summary of the advantages and disadvantages of the SBR:

Table 12: SBR Advantages/Disadvantages

Advantages	Disadvantages
Lower equipment costs	Plant can gain too much MLSS and produce solids in effluent if not properly maintained
Reduced amount of sludge generated as well as the ability to store sludge	If the anaerobic tank is not maintained below a set sludge level, it can provide unsightly scum in the SBR, eventually causing poor settleability.
Lower electrical consumption	Larger buried concrete tanks would be required
No consumables (membranes) to replace	Does not have a membrane as a barrier to retain solids

8. SELECTED ALTERNATIVE

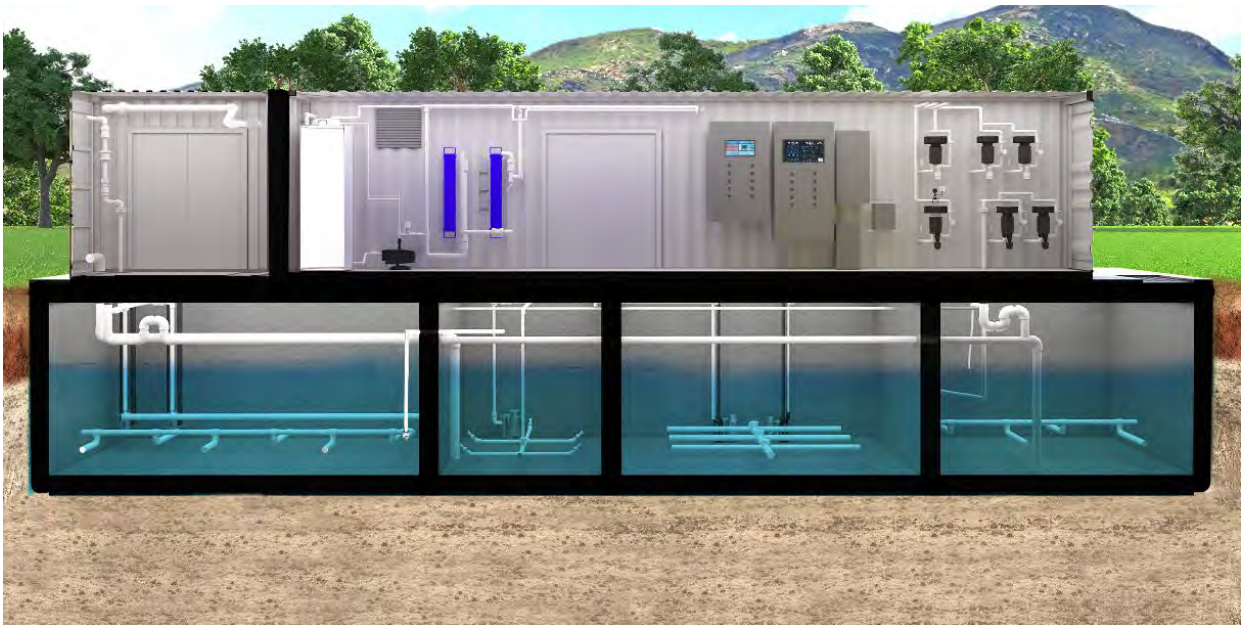
8.1 JUSTIFICATION OF SELECTED ALTERNATIVE

The County proposes implementing the membrane bioreactor (MBR) treatment technology for the Phippsburg WWTP facility. This approach provides the most robust practical level of wastewater treatment within a small footprint and low cost.

The MBR can produce consistent effluent quality better than other available technologies such as conventional activated sludge, rotating biological contactor, moving bed bioreactor, sequencing batch reactor, lagoon, and oxidation ditches. The MBR contains an ultrafilter membrane with 0.04 micron openings for the removal of particulates, bacteria, and viruses. Anything larger than this opening is unable to pass through the membrane and will not be discharged into the environment with the effluent.

The most significant reason why the MBR technology was selected is that this option offered a quick turn-key solution in the small footprint available at Phippsburg's location. This technology is supplied by Newterra as a made-to-order system. Most of the equipment is installed inside of a container offsite and shipped ready to operate. No further building is required to house the treatment equipment. The system can be manufactured off-site while sitework and concrete tanks are completed on site, significantly reducing construction time. Due to Phippsburg's schedule to upgrade the treatment system and the short construction window at this elevation, a quick, cost-effective solution is essential. The equipment installation process is greatly simplified with this approach as it does not require the onsite contractor to complete ordering and installing the specialized process equipment, electrical, and controls.

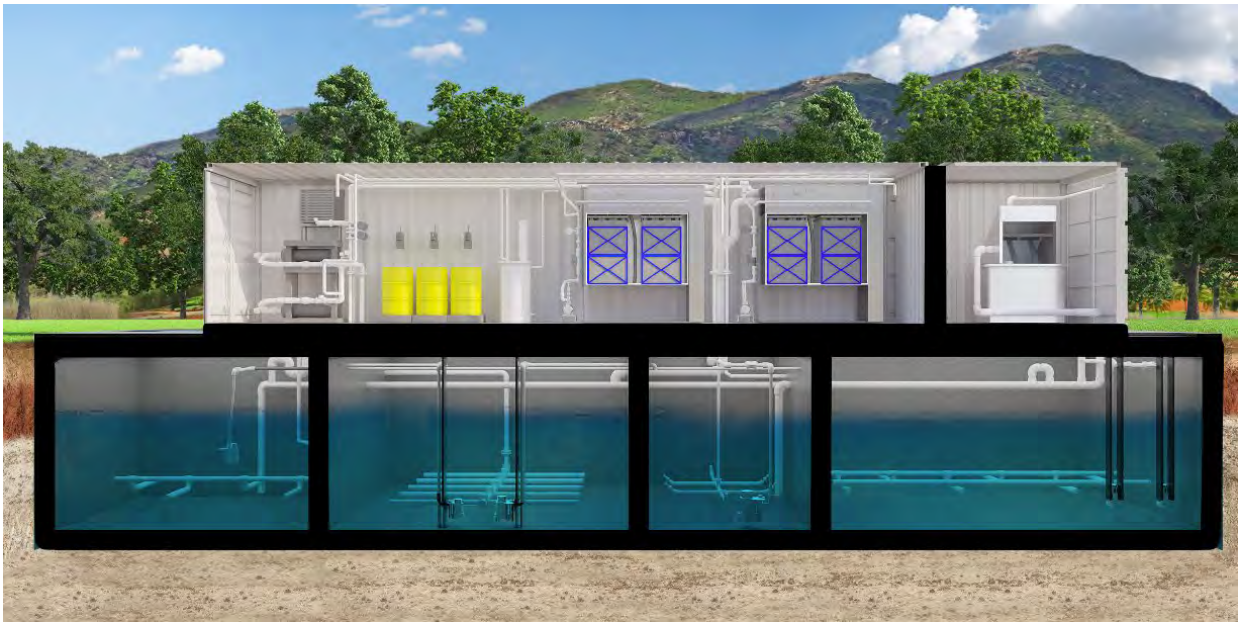
Figure 22: Cross-section View of Newterra Containerized MBR System



The small footprint that the MBR requires is desirable to the County because of the limited available land.

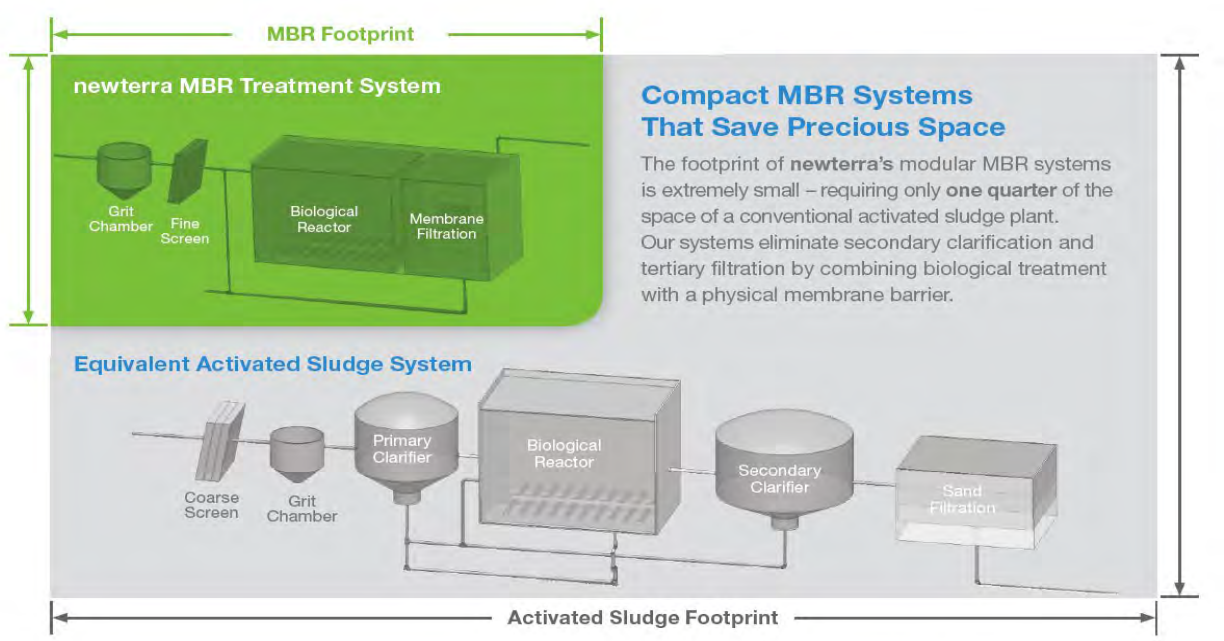
The EQ basin of the new facility would connect to the current collection system at the metering station. Cast-in-place concrete tanks would be installed and act as a foundation for the containerized MBR unit.

Figure 23: Cross-section View of Newterra Containerized MBR System



In addition, the operational hours needed to maintain the MBR is lower than many other treatment facilities. This is due to the high level of automation available through the PLC-operated controls floats and dissolved oxygen in-line measuring devices.

Figure 24: MBR Space Saving Features



Phippsburg can expect to see measurable improvements to WWTP treatment operations over the course of the new plant's life. It is anticipated that the MBR treatment plant would result in efficient use of time, higher-quality effluent production, and overall improved sustainable practices.

In addition to providing upgraded wastewater treatment technology, the proposed project would decommission existing lagoon ponds and related infrastructure. Biosolids would be removed from the lagoon ponds. Removed biosolids would be handled and disposed of according to federal, state, and local regulations.

The project includes a feasibility analysis of the costs and benefits of including solar power for the wastewater treatment plant in order to offset electrical needs from the grid and reduce operating costs for the proposed plant. The results of the solar study are included in Appendix Q.

The majority of the project would involve replacing the wastewater treatment lagoons with a new mechanical system. Upgrading the collection system to address the infiltration and inflow could

also be completed. Table 13 shows the percent of the cost of the project based on the categories of work.

Table 13: Cost Category Selection

Section	Item
Secondary Treatment	60
Advanced Treatment	30
Infiltration/Inflow	10
New Collector Sewers	0
New Interceptors	0
CSO Correction	0
Storm Sewers	0
Recycle Water Distribution	0
Nonpoint Source Pollution Control Activities	0
TOTAL (must equal 100%)	**100**

8.2 TECHNICAL DESCRIPTION AND DESIGN PARAMETERS

The proposed design for the Phippsburg WWTP consists of a 30,000 GPD MBR. The plant design uses the natural gravity flow to carry the influent through course screening to an equalization tank to even out peak flows. Influent transfer pumps convey wastewater from the equalization tank through fine screens to the aerated tank.

The wastewater flows to the aeration basin, where dissolved oxygen is added for BOD reduction and nitrification. After aeration, nitrified wastewater is conveyed to the MBR for filtration through the membranes. After filtration, the wastewater is treated using UV reactors for disinfection before being discharged to the Yampa River using the existing outfall. Effluent pumps would be sized to deliver effluent from the UV system to the existing Yampa River outfall.

The treatment process design includes chemical dosing for alkalinity and pH control to optimize nitrification and design provisions for alum addition for future phosphorus removal should it become necessary. Solids are wasted out of the aerobic basin and discharged into the aerated sludge storage tank. The sludge storage tank contains decant pumps to thicken solids and is operated to maintain adequate dissolved oxygen to minimize odors.

Solids may be handled in various methods. The solids handling methods for this project include hauling waste solids to a larger WWTP for further processing, onsite thickening to roughly 18% solids to dispose of thickened solids in a landfill, or treating solids to produce biosolids for beneficial reuse.

Treating solids for beneficial reuse requires that the biosolids treatment and quality meet the stringent requirements within Regulation 64 Biosolids Regulation. To meet even the least restrictive Class B biosolids requirements in Regulation 64, the solids must meet metals concentration limits, be aerobically treated to reduce fecal coliforms, and meet vector attraction reduction criteria. Phippsburg WWTP would need to digest the solids by maintaining aerobic digestion conditions for 60 days at 15^{o} C or 40 days at 20^{o} C. Vector reduction requirements would be achieved by providing at least 38% volatile solids reduction over this digestion period.

In lieu of an aerobic digestion system, the biosolids could be composted to achieve the necessary treatment. For composting, Regulation 64 requires the temperature of the biosolids be maintained at 40^{o} C or higher and greater than 55^{o} C for four hours for five days.

Sludge press systems and composting facilities that treat the solids are cost prohibitive for a small community and small treatment facility like Phippsburg. The lift station site is space constrained and there isn't enough property to construct a digester or composting facility. Therefore, it is recommended that the County hauls solids from the MBR solids holding tank to a larger WWTP.

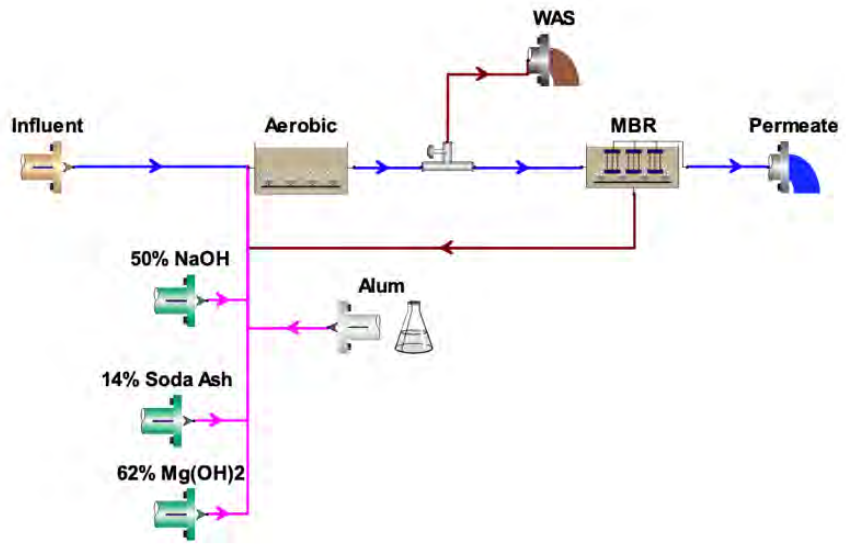
The design also includes odor control using an activated carbon adsorption system to remove odors and be a good neighbor for nearby residents.

Details of the individual process components are included in the Newterra proposal contained in Appendix N. These documents provide supplemental information to the Assessment of Alternatives section of this report.

8.3 PROPOSED PROCESS FLOW DIAGRAM

The detailed processes diagram for the proposed facility is included in Appendix N, Newterra Proposal.

Figure 25: MBR Process Flow



8.4 APPROPRIATENESS OF TREATMENT TECHNOLOGIES

MBRs are a proven and popular treatment technology, with several successful installations in Colorado. The design for the Phippsburg WWTP would have individual treatment processes similar to successful applications of other Newterra installations. Included in Appendix N are process calculations from Newterra showing that their technology can meet the anticipated effluent limits.

8.5 ENVIRONMENTAL IMPACTS

The proposed project would result in net improvements to the environment. The MBR technology would provide robust treatment for BOD, TSS, ammonia, and phosphorus. Treated effluent from the proposed MBR plant would be of significantly higher quality than the current lagoon effluent. The proposed system would result in reduced pounds per day of pollutants discharged into the environment. The seepage from the lagoons would stop when the lagoons are decommissioned and the land area rehabilitated.

It is not anticipated that this project would negatively impact threatened and endangered species or other wildlife. In fact, the lagoons in the floodplain and near wetlands would be removed.

Based on current information, AquaWorks DBO does not expect the project to have impacts to any cultural, historical, or archeological resources during construction.

Routt County is in compliance with all federal and state regulations for air quality. A project of this size, with minimal disturbance area, is not anticipated to impact air quality. The decommissioning of the lagoons will be completed in accordance with federal, state, and local regulations.

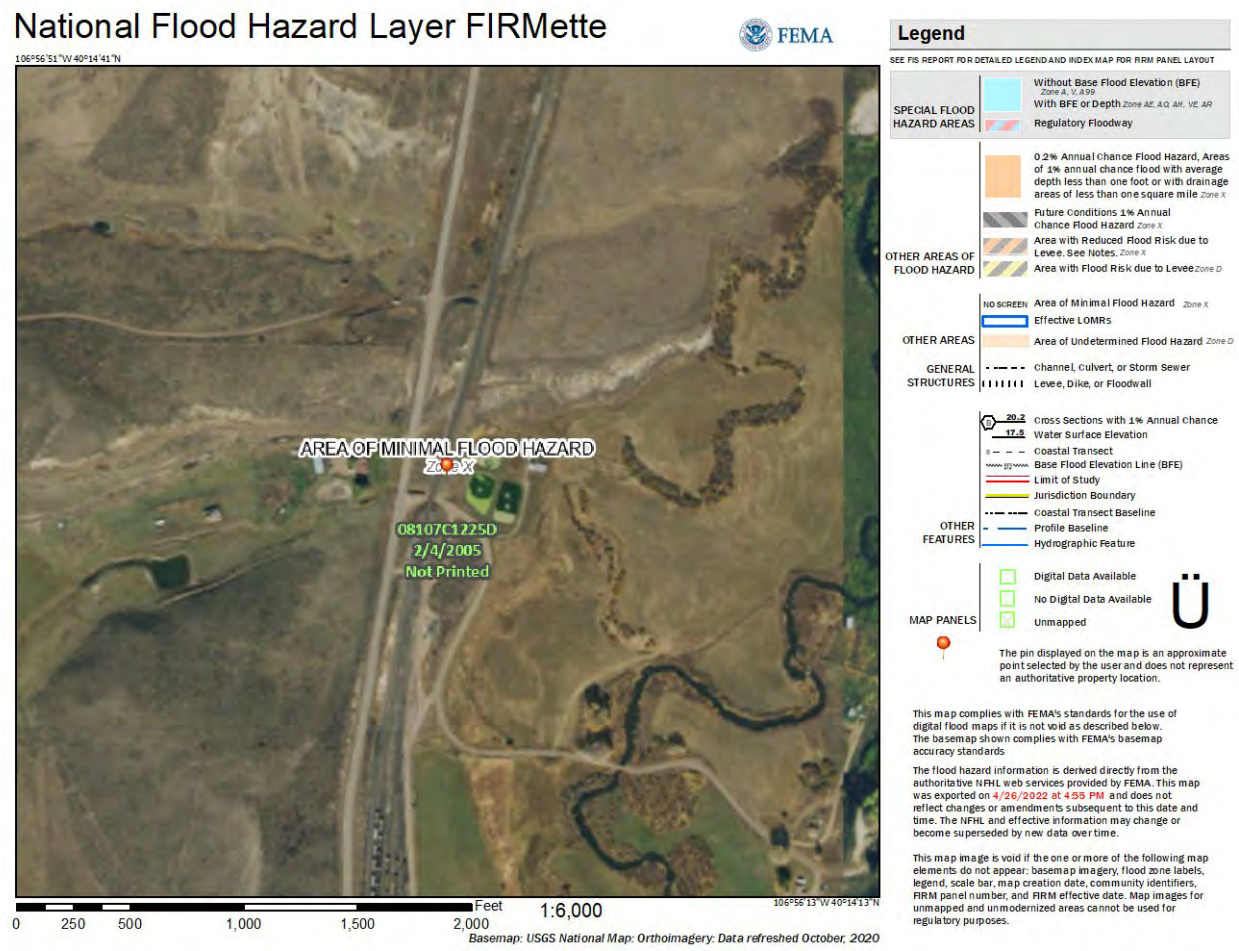
It is anticipated that the implementation of the project would have some unavoidable impacts, as with the construction of most public works projects. Construction methods would minimize these impacts by implementing measures such as implementing best stormwater management practices, limiting construction activities to daytime hours, and maintaining a traffic control plan.

The contractor will be required to obtain a CDPHE Construction Activities Stormwater Discharge Permit during the construction phase of the project if the area of disturbance is greater than 2 acres. The contractor would need to follow the erosion control measures and best management practices specified by the design engineer to minimize the amount of sediment that leaves the site during earthwork activities.

The current WWTP lagoons are not shown within the 100-year floodplain on the FEMA map. The project would include abandoning and reclaiming the existing lagoon treatment plant. Solids and liquid waste from the existing treatment plant would be treated and disposed of according to state, federal, and local regulations.

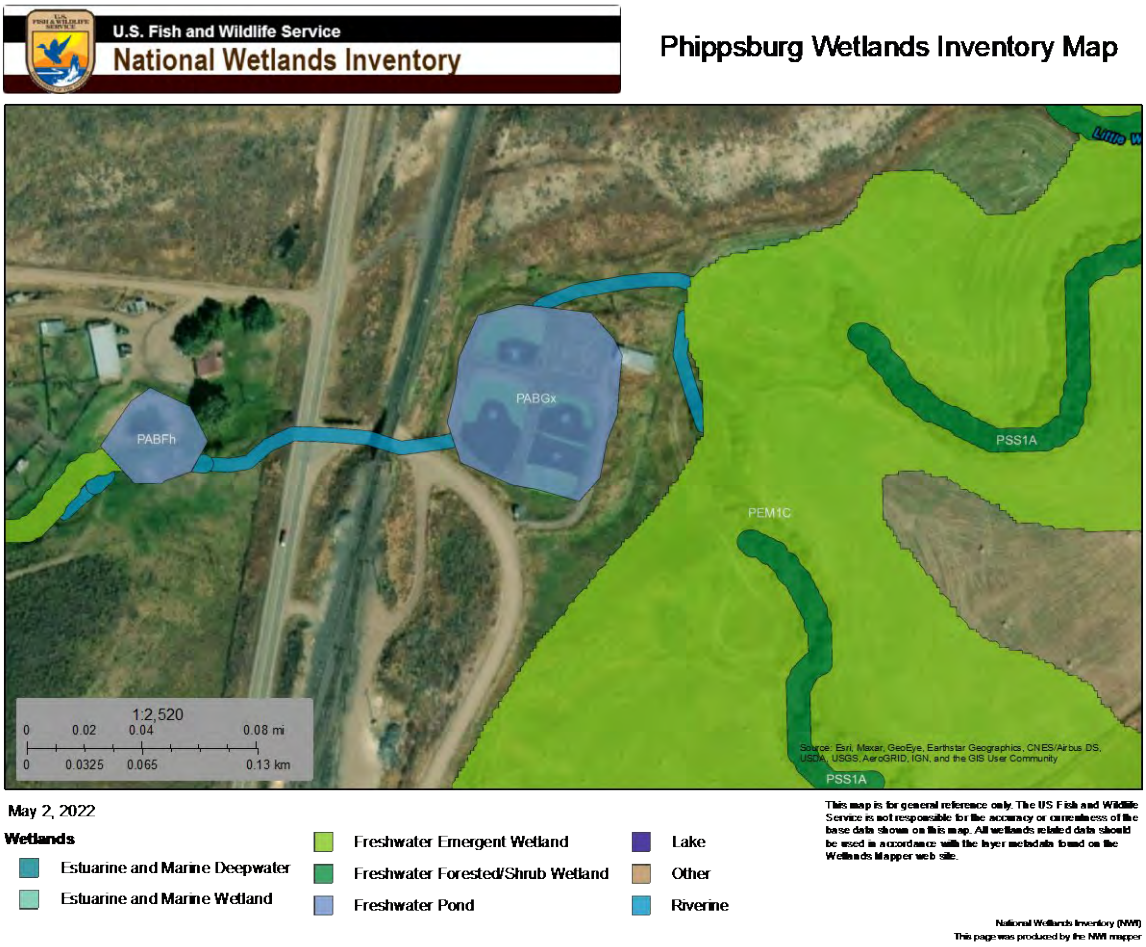
Figure 26 shows the project area location on the FEMA floodplain map of the area.

Figure 26: FEMA Floodplain Map



The wetlands inventory shows the treatment lagoons as freshwater ponds and influent lines as riverine. The irrigated hay fields to the east of the site are shown as freshwater forested and freshwater emergent wetlands. All construction would be within the current area of the WWTP boundary. As indicated in Figure 27, the National Wetlands Inventory map does not show any wetlands where the WWTP would be located:

Figure 27: National Wetlands Inventory Map

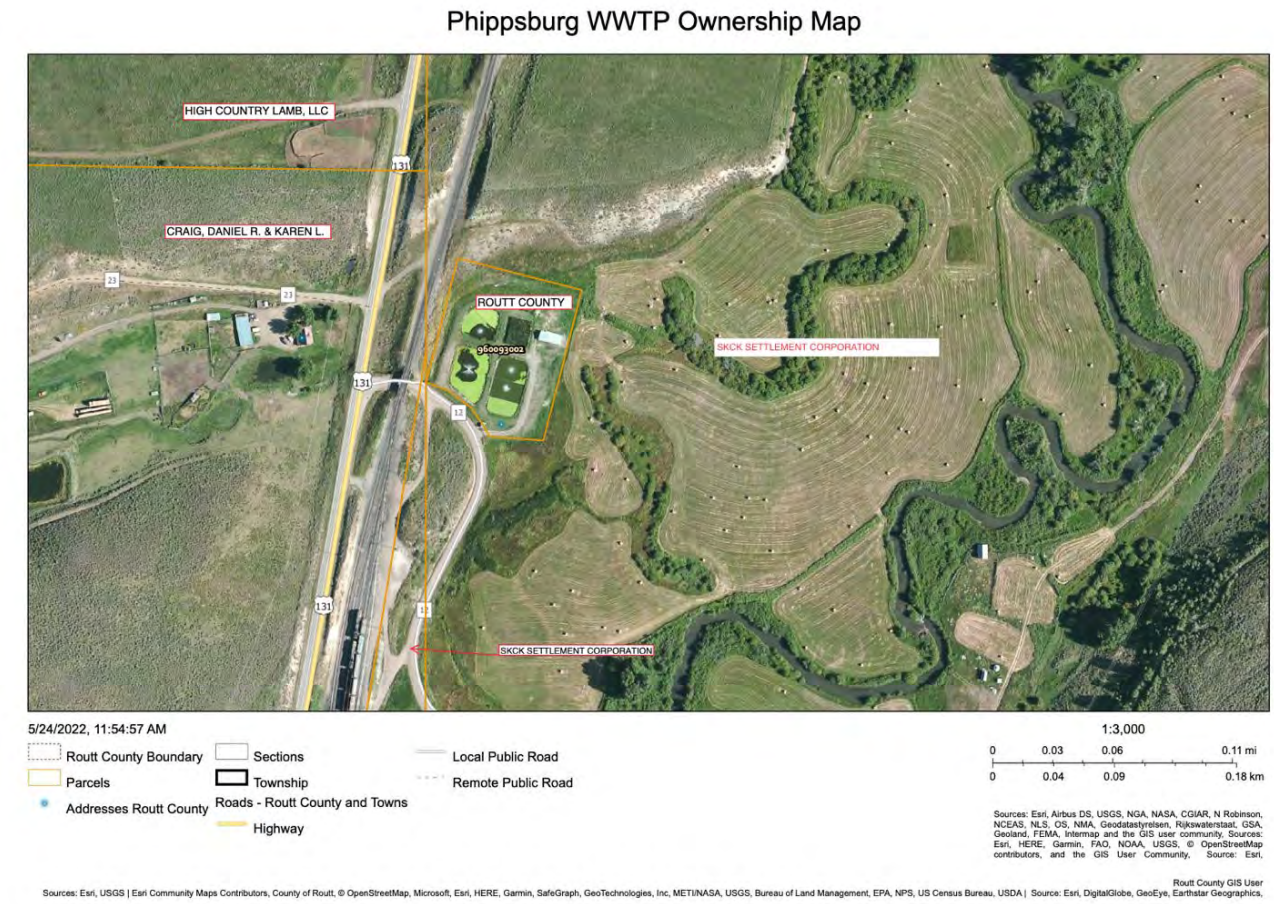


A completed Environmental Checklist is included in the Appendix H.

8.6 LAND REQUIREMENTS

The existing WWTP site is owned by Routt County. Figure 28 shows the existing wastewater treatment plant site. The land surrounding the facility is owned by SKCK settlement corporation and would not be impacted by the project. A Routt County Property Record card showing the County as the owner is included in Appendix G. The existing wastewater treatment ponds would be abandoned and reclaimed under this scenario.

Figure 28: Land Ownership Map



The new MBR facility would be constructed in the same location as the existing facility. The new infrastructure would be designed to avoid locating new structures in the existing floodplain or wetlands.

The treatment plant would not be built near any habitable structures. However, the treatment plant is fully enclosed within a building that includes activated carbon for odor control. Historically, WWTPs that are operated correctly do not receive odor complaints. Aerosols would not be present as there would be no uncovered basins, and noise-producing equipment such as pumps and blowers would be housed inside the building to reduce any noise. An emergency generator would be the only equipment outside and would only be used during emergencies or for brief periods of routine exercise.

On the project site, new concrete basins are installed before the containerized system arrives on site. The system is delivered ready to install on top of the concrete basins and would require about six weeks of setup prior to start-up. No additional buildings for the wastewater treatment equipment would be necessary.

Figure 29 is a rendering of the proposed system is shown in the figure below.

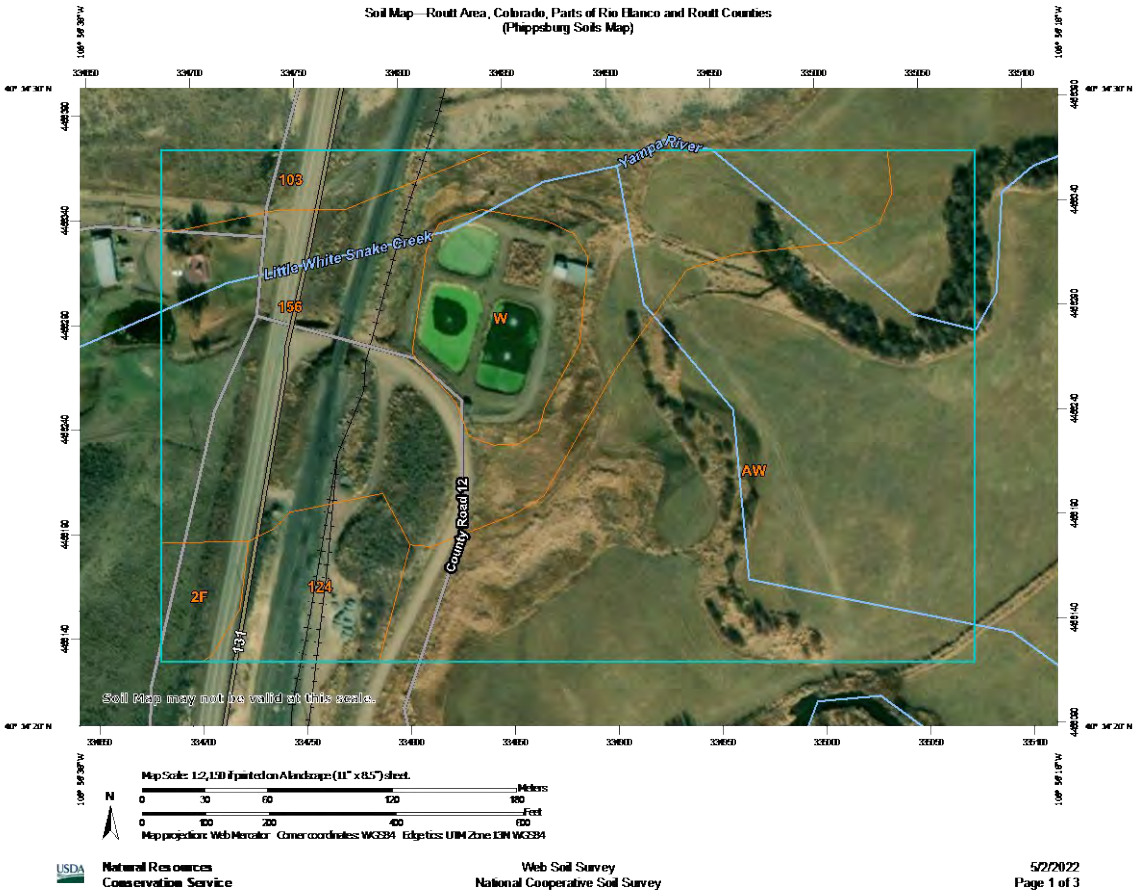
Figure 29: Above and Below Ground Image of Newterra Containerized MBR System

8.7 GEOTECHNICAL ANALYSIS

A site-specific geotechnical study has not been conducted yet. One will be completed during the final design phase to calculate the bearing capacity of the existing soil and determine if there are any adverse soil conditions. AquaWorks DBO will confirm with the geotechnical engineer during the final design phase that the design meets their recommendations.

The soils map for the surrounding area is presented below. According to the soils map, the project site is located in an area of egerari clay with a minimal slope of only 0 to 3 percent (map symbol 156). Any concerns about the clays will be identified by the site-specific geotechnical analysis and included in the structural design.

Figure 30: NRCS Soils Map



8.8 CONSTRUCTION CHALLENGES

Significant construction issues are not anticipated on the site. Although, construction challenges would be like other projects of this magnitude. Such challenges may include scheduling construction crews, obtaining materials in a timely manner, obtaining local and state approvals, and construction oversight.

This site is by the railroad tracks on the west and irrigated fields to the east. Construction will be scheduled to minimize challenges.

One item that will require consideration during the final design is maintaining operations at the existing facility while constructing the new one. The new treatment plant will be constructed onsite, but the lagoon treatment plant will need to continue operating unaffected during

construction. There is adequate space to accomplish this; however, planning is required. The design team will consider how to sequence the transfer of the operations to the new facility from the existing treatment plant facilities.

Other construction challenges are similar to other projects of this magnitude. Such challenges may include scheduling construction crews, obtaining materials in a timely manner, obtaining local and state approvals, and construction oversight.

8.9 OPERATIONAL ASPECTS

The recommended facility would have far more process control capabilities than the existing facility. Operators need to be trained to operate the new automated and manual equipment. The new facility would have a PLC to control most treatment equipment and processes. Instrumentation is provided to control the treatment process. Instrumentation includes flow metering, tank level monitoring and alarms, an online dissolved oxygen analyzer, a pH analyzer, pressure monitoring on membrane banks, and UV transmittance metering. Chemical feed systems are configured to dose chemicals based on flow monitoring and an operator set point dose. Telemetry would be installed to allow operators to access the plant's control panel remotely.

Emergency Provisions:
The telemetry system exports alarms automatically in the event an alarm condition is met. A generator, sized to operate 100% of the plant, provides a backup source of power in the event the primary electrical source fails. The generator would be equipped with an automatic transfer switch upon primary electrical source failure. A basic emergency plan is provided in Appendix F and a detailed emergency plan will be developed during the design and delivered with the facility's operation and maintenance manual.

8.10 COSTS

The following is an estimate of the probable costs for this project:

Table 14: Engineer's Conceptual Opinion of Probable Costs

Division:	Item:	Quantity:	Unit:	Unit Price	Total Price
1	**Contractor General Requirements**	1	LS	$100,000	$100,000
2	**Existing Conditions**				
	Clearing & Grubbing	1	LS	$5,000	$5,000
	Demo of Existing Structures	1	LS	$5,000	$5,000

3	**Concrete**				
	Buried Process Tank	1	LS	$450,000	$450,000
	Concrete Pads	1	LS	$10,000	$10,000
	Concrete Hatches to Access Buried Tanks	1	LS	$10,000	$10,000
9	**Painting**				
	Coat Influent Equalization Tank	1	LS	$30,000	$30,000
11	**Equipment**				
	MBR Process Treatment Equipment (Package by Newterra)	1	LS	$608,095	$608,095
	Portable Davit Crane & Bases	1	LS	$2,500	$2,500
	Coarse Screen	1	LS	$5,000	$5,000
	Equipment & Process Piping Installation	1	LS	$100,000	$100,000
26	**Electrical**				
	Line Voltage Electrical Improvements	1	LS	$50,000	$50,000
	Instrumentation & Controls	1	LS	$25,000	$25,000
	Backup Generator & ATS	1	LS	$75,000	$75,000
	New Transformer (If Required)	1	LS	$50,000	$50,000
31	**Earthwork**				
	Process Tank Excavation & Backfill	1	LS	$35,000	$35,000
	WWTP Site Work	1	LS	$10,000	$10,000
	Bollards	5	EA	$1,000	$5,000
33	**Utilities**				
	Site Piping	1	LS	$10,000	$10,000
	Import Material	1	LS	$15,000	$15,000
	Site Finishing	1	LS	$5,000	$5,000
	Erosion Control	1	LS	$10,000	$10,000
	Lagoon Grading & Restoration	1	LS	$50,000	$50,000
	Lagoon Mitigation				
	Removal of Biosolids	963,044	Gallons	$0.40	$385,218
	Onsite Solar Generation				
	Solar Equipment	1	LS	$148,439	$173,342
	Collection System Rehabilitation				
	Cured in Place Pipe Relining	11,000	LF	$45	$495,000
	Manhole Rehabilitation	40	MH	$5,000	$200,000

	Contractor Overhead & Profit:	12.0%			$350,299
	Subtotal:				$3,269,453
	Final Design Engineering:	10.0%			$326,945
	Bidding & Construction Engineering:	5.0%			$163,473
	Contingency:	10.0%			$326,945
	Grand Total:				**$4,086,816**

8.11 FINANCIAL SYSTEM AND RATE STRUCTURE CHANGES

The County expects to fund the project using the state revolving fund loan and grant program. Routt County intends to apply for disadvantaged community status to obtain a design and engineering grant to fund the design work of the project. The construction is expected to be funded through a combination of grants and SRF loan monies.

The operational costs of the WWTP would continue to be funded by the Community of Phippsburg. The monthly charges will be included in the regular utility bills sent to the individual property owners. The increase in costs to the individual residents will not be known until the amount of funding assistance is determined. The County is engaging Chris Brandewie with the Rural Community Assistance Corporation to conduct a rate study to evaluate the financial feasibility of the project. This rate study is expected to be complete in the fall of 2022 for review by the funding agencies.

Routt County will retain the management capabilities for maintaining the billing and operations of the facility.

8.12 ENVIRONMENTAL CHECKLIST

A completed Environmental Checklist is included in Appendix H so the CDPHE can determine if an Environmental Assessment is required.

8.13 PROJECT IMPLEMENTATION

Construction of the facility can occur as early as 2024. The following milestones highlight the anticipated schedule. However, the final schedule depends upon several factors, not all of which are under the control of the County, such as application review times, availability of funding, and weather.

Table 15: Implementation Schedule

Date	Item
Summer 2022	Submit PNA and Site Application to CDPHE
Summer 2023	Submit PDR and Final Plans and Specifications to CDPHE
Fall 2023	Submit SRF Loan Application
Late 2023	Obtain Final Design Approval from CDPHE and Bid Project
Spring 2024	Commence Construction
Fall 2024	Complete Construction

8.14 PUBLIC MEETING

The public meeting will be scheduled closer to when the SRF Loan Application is submitted. The public meeting advertisement, agenda, sign-in sheet, and meeting minutes will be provided to the Grants & Loans project manager once the meeting has been scheduled and completed.

REFERENCES

Baseline Engineering (2008). *Community of Phippsburg Wastewater Master Plan.* Golden, CO.

Dismuke & Dismuke, Inc. (1981), *Community of Phippsburg Sewage and Collection & Treatment Facilities*. Steamboat Springs, CO.

Colorado Department of Public Health & Environment (2014) *Special Report from Routt County* Retrieved August 10, 2022 from https://oitco.hylandcloud.com/CDPHERMPublicAccess/api/Document/AZdfy88NL3FoibjyARbXGRsTVE7dHtÁM3OoviueAh3WweÉcbXbRp2rcptxvwDpAv3yVg8SmH9EEx9fÉryWVH3ZM%3D/

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Metcalf & Eddy (1991), *Wastewater Engineering Treatment Disposal Reuse*. Third edition.

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United States Environmental Protection Agency (2022). *Enforcement and Compliance History Online.* Retrieved June 2, 2022 from https://echo.epa.gov/detailed-facility-report?fid=110027243533

APPENDIX – SUPPLEMENTAL INFORMATION

- Appendix A: Regulation 22.10 Site Application Form
- Appendix B: Service Area Map
- Appendix C: One & Five Mile Radius Maps
- Appendix D: Map of Adjacent Properties
- Appendix E: Zoning Map
- Appendix F: Emergency Response Plan Template
- Appendix G: Routt County Property Record Card
- Appendix H: Environmental Checklist for the Selected Alternative
- Appendix I: Cost and Effectiveness Evaluation Certification
- Appendix J: FEMA Floodplain Map
- Appendix K: National Ressources Conservation Service Soil Map
- Appendix L: National Wetlands Inventory Map
- Appendix M: Newterra Brochure
- Appendix N: Newterra Proposal
- Appendix O: Fluidyne ISAM SBR Brochure
- Appendix P: Preliminary Engineering Drawings
- Appendix Q: Solar Study
- Appendix R: Biosolids Report

APPENDIX A

SITE APPLICATION FORM

COLORADO
Department of Public Health & Environment

Water Quality Control Division
Engineering Section

4300 Cherry Creek Drive South, B2
Denver, Colorado 80246-1530
CDPHE.WQEngReview@state.co.us
303-692-6298

Regulation 22 Site Location Application Form
Section 22.10 – Amendment of Existing Treatment Plant Site Location Approval

A. Project and System Information			
System Name	Community of Phippsburg Wastewater Treatment Plant		
Project Title	WWTP Improvement Project		
County	Routt		
CDPS Permit No.	COG588141		
Date Fee Paid or payment attached		Invoice Number and Check Number	
Design Company Name	AquaWorks DBO, Inc.		
Design Engineer	Adam Sommers, P.E.	CO License Number	38,169
Address	3252 Williams Street Denver, CO 80205		
Email	adam@aquaworksdbo.com	Phone	(303) 477-5915
Applicant/Entity	Routt County		
Representative Name	B. Scott Cowman		
Address	136 6th Street, Suite 201 Steamboat Springs, CO 80487		
Email	scowman@co.routt.co.us	Phone	(970) 870-5588

B. Project Information

Location (existing or proposed site)		*Proposed Project Design Capacity*	
Brief location description	RCR #12 east of Highway 131	Hydraulic Capacity (Maximum Month Average)	0.03 MGD
Legal Description (e.g., Township, Range)	NW 1/4, Sec 9, T3N, R85W	Peak Hour Hydraulic Capacity	0.12 MGD
County	Routt		
Latitude	40.24040°	Organic Loading Capacity – Treatment Plant Only (Maximum Month Average)	100 lbs. BOD_5/day or lbs. cBOD/day
Longitude	-106.94174°		

Funding Process	Will the State Revolving Fund (SRF) loan program be used to finance any portion of the project?	Yes	☒	No	☐	If yes, please list project number	150460W

Project Schedule and Cost Estimate	
Estimated Bid Opening Date	Late 2023
Estimated Completion Date	Late 2024
Estimated Project Cost	$4,086,816

Project and System Information	
System Name	Community of Phippsburg Wastewater Treatment Plant
Project Title	WWTP Improvement Project
County	Routt
Original Site Location Approval No. (attach copy of approval)	#4955
Date of Site Location Approval	
CDPS Permit No.	COG588141
CDPS Permit expiration date	

1. Type of Site Amendment	
Changes in type of disinfection to include chlorine gas or from other types of disinfection to chlorination – Section 22.10(2)(a)(i).	☐
Other changes in the type of disinfection – Section 22.10(2)(a)(ii).	☐
Physical changes or additions to the liquid stream treatment processes that could impact hydraulic, pollutant(s), or solids loadings to the treatment process – Section 22.10(2)(a)(iii).	☒
Physical changes or additions to the unit processes in the solids stream treatment processes that would change the characteristics of the recycle stream or biosolids – Section 22.10(2)(a)(iv).	☐
Physical change to the treatment works that is similar in scope to those listed in Section 22.10(2)(a), but is not precisely covered by this list – Section 22.10(2)(a)(v).	☐
A decrease or increase in the approved, rated design capacity of the treatment works, as long as no construction is to take place, or a change in the design flow portioning that does not change the design capacity - Section 22.10(2)(b).	☐
The addition of, or increase of a treatment process to generate reclaimed domestic wastewater following secondary treatment at an existing treatment plant that has previously received site location and design approval, including treatment changes to achieve more restrictive reclaimed water categories and standards – Section 22.10(2)(c).	☐
Change in the type of discharge employed from a surface water discharge to a ground water discharge, or vice-versa, at the same approved site location, subject to appropriate water quality planning targets Section 22.10(2)(d)(i).	☐
Change in the type of discharge employed including a partial or complete change from a surface water or ground water discharge to reclaimed water use subject to the requirements in the Reclaimed Domestic Wastewater Control Regulation (5 CCR 1002-84) – Section 22.10(2)(d)(ii).	☐

2. Site Amendment Description

3. Comparison of Approved and Proposed Treatment Facilities

a. Treatment Capacity	Approved Treatment Facility	After Proposed Treatment Process Modification(s)
Hydraulic Capacity: Maximum Month Average	0.03 MGD	0.03 MGD
Hydraulic Capacity: Peak Hour	MGD	MGD
Organic Loading Capacity: Maximum Month Average	100 lbs. BOD_5/day or lbs. cBOD/day	100 lbs. BOD_5/day or lbs. cBOD/day

b. Treatment Facility Process Description		
c. Effluent disposal method (check all that apply)		
Surface Discharge to watercourse	☒	☒
Location of discharge (stream segment and legal description)	☐	☐
Groundwater Discharge	☐	☐
Land application	☐	☐
Treated Effluent Reuse (Regulation 84)	☐	☐
Evaporation	☐	☐
Other (enter description below)	☐	☐

4. Additional Factors

Please identify any additional factors that might help the Division make an informed decision on your site location application.

Response:

COLORADO
Department of Public Health & Environment

Water Quality Control Division
Engineering Section

4300 Cherry Creek Drive South, B2
Denver, Colorado 80246-1530
CDPHE.WQEngReview@state.co.us
303-692-6298

Applicant Certification and Review Agencies Recommendation
Section 22.10 – Amendment of Existing Treatment Plant Site Location Approval

Project and System Information	
System Name	Community of Phippsburg Wastewater Treatment Plant
Project Title	WWTP Improvement Project
County	Routt
CDPS Permit No.	COG588141

1. Applicant Certification

Applicant Legal Representative			
Position/Title Director of Environmental Health	Typed Name B. Scott Cowman	Signature B. Scott Cowman B. Scott Cowman (Aug 24, 2022 13:12 MDT)	Date Aug 24, 2022
Email scowman@co.routt.co.us		Phone (970) 870-5588	
The system legal representative is the legally responsible agent and decision-making authority (e.g. mayor, president of a board, public works director, owner). The Design Engineer is not the legal representative and cannot sign this form.			

2. Review Agency Notification

As required in Section 22.10(1), the site location application and any amendment proposal supporting documentation must be submitted to all appropriate local governments, local health authority, 208 designated planning and management agencies and other state or federal agencies, as defined in 22.6(2). The review agencies will have 15 working days from receipt of the application to review and comment directly to the Division unless a brief extension is requested in writing. Please list below the review agencies to whom the site location application and proposal has been submitted and attach a copy of the transmittal letter.

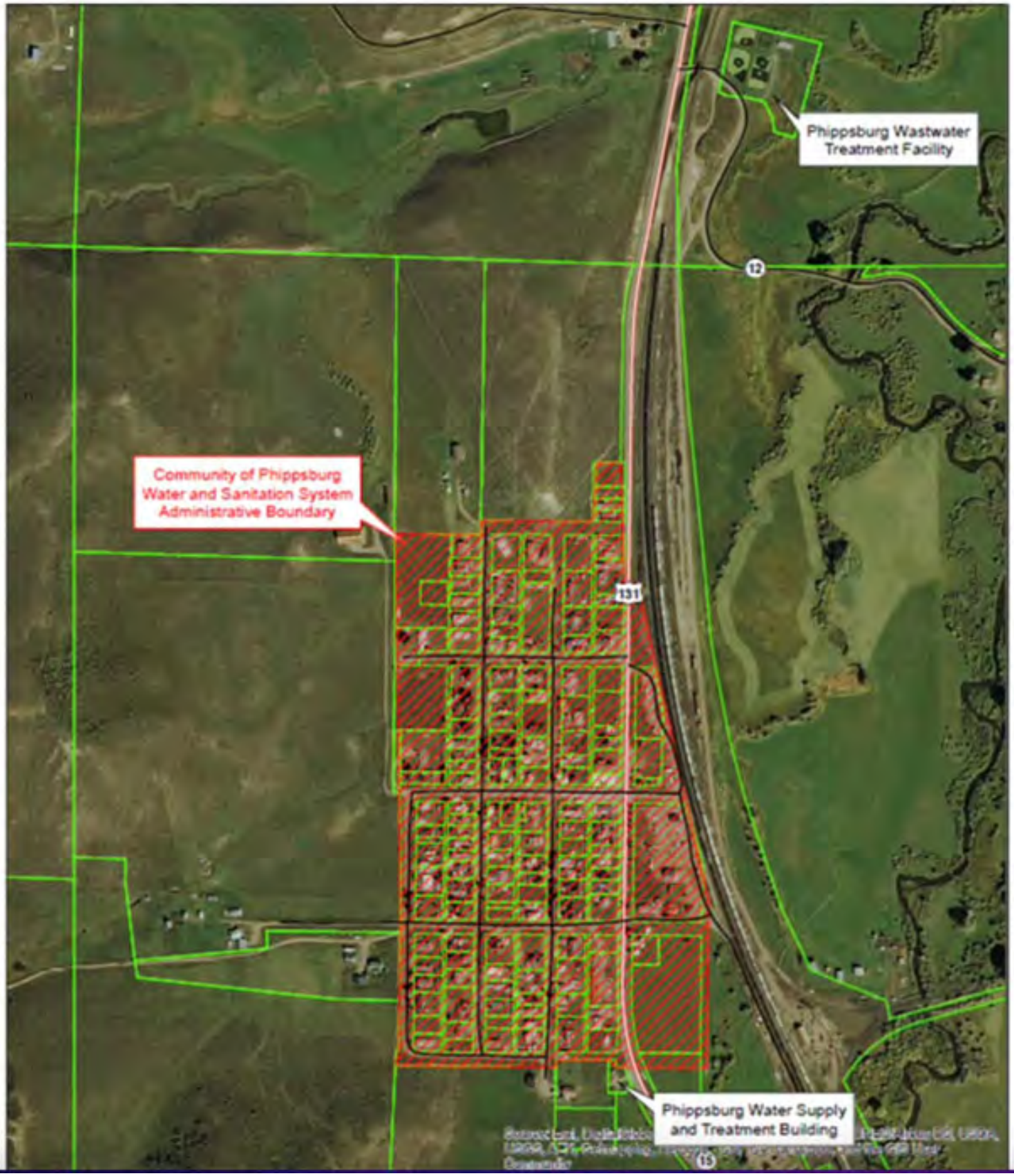
Designated Management Agency (i.e., Water Quality Authority, Watershed Association, Watershed Authority)		
Agency	Typed Name	Notification Date
Email		Phone
County, if the site is located in unincorporated areas of a county		
County Routt County	Typed Name Jay Harrington	Notification Date 8/24/22
Email jharrington@co.routt.co.us		Phone (970) 879-0108
City or Town, if the site is located within a City/Town boundary or within three miles of the City/Town boundary (if multiple, attach additional sheets as needed)		
City/Town Oak Creek	Typed Name David Torgler	Notification Date 8/24/22
Email david@townofoakcreek.com		Phone (970) 736-2422 ext. 202

Local Health Authority		
Agency Routt County Environmental Health	Typed Name B. Scott Cowman	Notification Date 8/24/22
Email scowman@co.routt.co.us		Phone (970) 870-5588
208 Designated Planning Agency		
Agency	Typed Name	Notification Date
Email		Phone

Other State or Federal Agencies, if treatment works is located on or adjacent to a site that is owned or managed by a federal or state agency.		
Agency	Typed Name	Notification Date
Email		Phone
Other undesignated Basin Water Quality Authority, Watershed Association, Watershed Authority, etc.		
Agency	Typed Name	Notification Date
Email		Phone

APPENDIX B

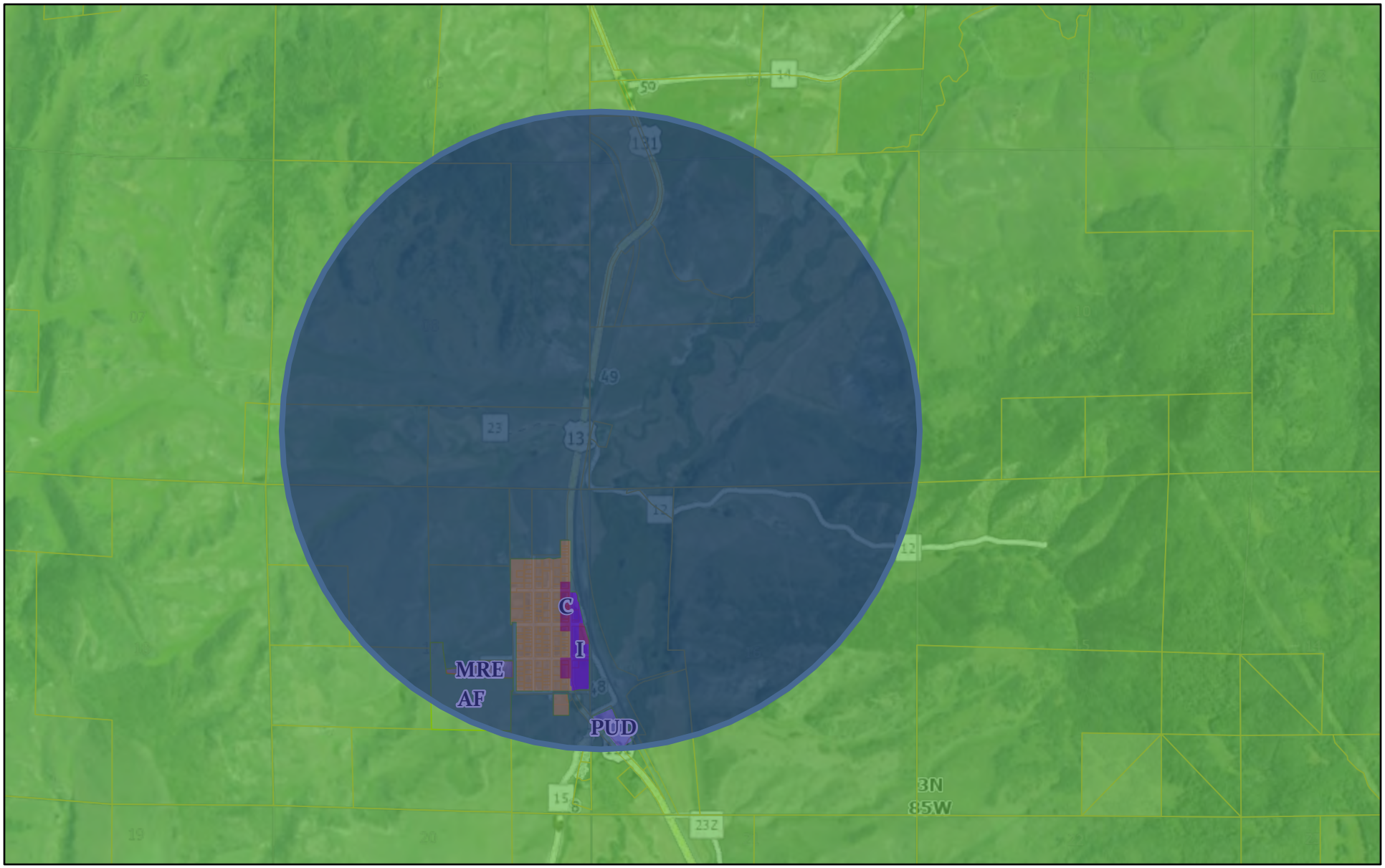
SERVICE AREA MAP


Phippsburg Wastewater Treatment Facility
12
Community of Phippsburg Water and Sanitation System Administrative Boundary
131
Phippsburg Water Supply and Treatment Building
15

APPENDIX C

ONE-MILE AND FIVE-MILE RADIUS MAPS

Phippsburg One Mile Radius Map



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0 0.23 0.45 0.9 mi

0 0.38 0.75 1.5 km

Routt County Boundary
Parcels
Subdivisions
Subdivisions
Override 1
Zoning Districts
Agriculture and Forestry
Commercial
Industrial
Medium Density Residential
Planned Unit Development
Sections
Township
Mile Markers

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri

Routt County GIS User

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community | BLM Colorado | County of Routt, Bureau of Land Management, Esri, HERE, Garmin, GeoTechnologies, Inc., USGS, METI/

Phippsburg Five Mile Radius Map

5/2/2022, 10:30:03 AM

Routt County Boundary
Town Boundaries
Override 1

Zoning Districts
Agriculture and Forestry
Commercial
General Residential
High Density Residential
Industrial
Low Density Residential
Medium Density Residential
Mining
Outdoor Recreation

1:144,448

0 0.75 1.5 3 mi
0 1.5 3 6 km

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Routt County GIS User

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community | BLM Colorado | Earthstar Geographics |

APPENDIX D

MAP OF ADJACENT PROPERTIES

Phippsburg WWTP Ownership Map

5/24/2022, 11:54:57 AM

Routt County Boundary
Parcels
Addresses Routt County
Sections
Township
Roads - Routt County and Towns
Highway
Local Public Road
Remote Public Road

1:3,000

0 0.03 0.06 0.11 mi
0 0.04 0.09 0.18 km

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Source: Esri,

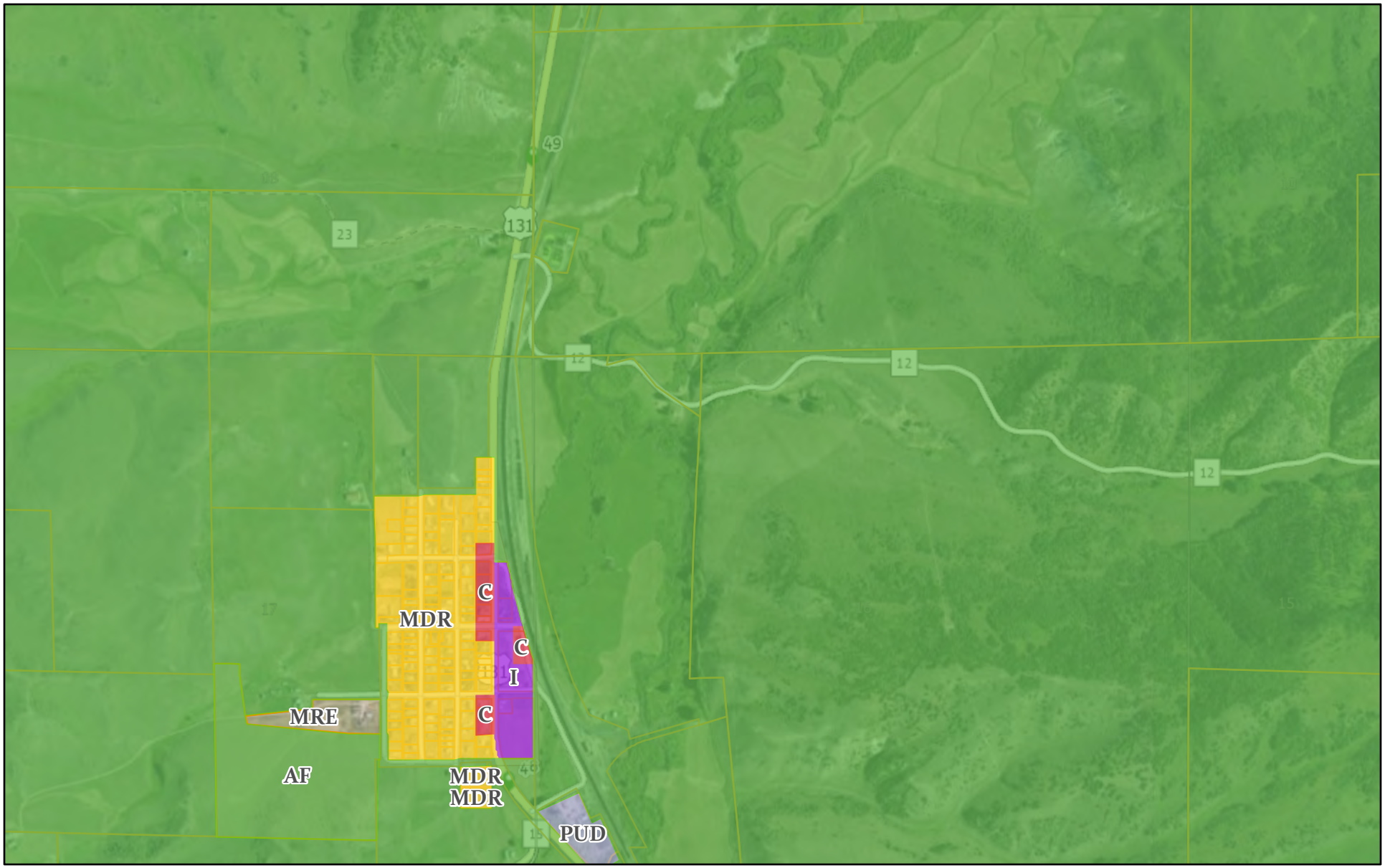
Routt County GIS User

Sources: Esri, USGS | Esri Community Maps Contributors, County of Routt, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA | Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics,

APPENDIX E

ZONING MAP

Phippsburg Zoning Map



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0 0.1 0.2 0.4 mi

0 0.17 0.35 0.7 km

Routt County Boundary

Parcels

Subdivisions

Subdivisions

Zoning Districts

Agriculture and Forestry

Commercial

Industrial

Medium Density Residential

Planned Unit Development

Sections

Township

Mile Markers

Roads - Routt County and Towns

Highway

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri

Routt County GIS User

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community | BLM Colorado | County of Routt, Bureau of Land Management, Esri, HERE, Garmin, GeoTechnologies, Inc., USGS, METI/

APPENDIX F

EMERGENCY RESPONSE PLAN TEMPLATE

Section 1.
System Information

Keep this basic information easily accessible to authorized staff for emergency responders, repair people, and the news media.

System information

System Discharge Number		
System Name and Address		
Directions to the System		
Basic Description and Location of System Facilities		
Location/Town		
Population Served and Service Connections	_____ people	_____ connections
System Owner		
Name, Title, and Phone Number of Person Responsible for Maintaining and Implementing the Emergency Plan		_____ Phone _____ Cell _____ Pager

Section 2.
Chain of Command – Lines of Authority

The first response step in any emergency is to inform the person at the top of this list, who is responsible for managing the emergency and making key decisions.

Chain of command – lines of authority

Name and Title	Responsibilities During an Emergency	Contact Numbers

Section 3.
Events that Cause Emergencies

The events listed below may cause wastewater system emergencies. They are arranged from highest to lowest probable risk.

Events that cause emergencies

Type of Event	Probability or Risk (High-Med-Low)	Comments

Section 4.
Emergency Notification

Notification call-up lists - Use these lists to notify first responders of an emergency.

Emergency Notification List				
Organization or Department	**Name & Position**	**Telephone**	**Night or Cell Phone**	**Email**
Local Law Enforcement				
Fire Department				
Emergency Medical Services				
Wastewater Operator (if contractor)				
Primacy Agency Contact				
Hazmat Hotline				
Interconnected Wastewater System				
Neighboring Wastewater System (not connected)				
RCAP Contact				

Priority Customers				
Organization or Department	**Name & Position**	**Telephone**	**Night or Cell Phone**	**Email**
Hospitals or Clinic(s)				
Public or Private Schools				
Public Water System				
Adult Care Facility				

State, Federal or Tribal Notification List

Organization or Department	Name & Position	Telephone	Night or Cell Phone	Email
State or Tribal Police				
Regulatory Agency State/Federal/Tribal				
Authorized Testing Laboratory				

Service / Repair Notifications

Organization or Department	Name & Position	Telephone	Night or Cell Phone	Email
Electric Utility Co.				
Electrician				
Gas/Propane Supplier				
Water Testing Lab.				
Sewer Utility Co.				
Telephone Co.				
Plumber				
Pump Supplier				
"Call Before You Dig"				
Rental Equipment Supplier				
Chlorine Supplier				
Pipe Supplier				

Media Notification List				
Organization or Department	**Name & Position**	**Telephone**	**Night or Cell Phone**	**Email**
Newspaper - Local				
Newspaper – Regional/State/Tribal				
Radio				
Radio				
TV Station				

Notification procedures

Notify wastewater system customers

Who is Responsible:	
Procedures:	

Alert local law enforcement, state, federal or tribal regulatory officials, and local health agencies

Who is Responsible:	
Procedures:	

Contact service and repair contractors

Who is Responsible:	
Procedures:	

Contact neighboring wastewater systems, if necessary

Who is Responsible:	
Procedures:	

Contact downstream water systems, if necessary

Who is Responsible:	
Procedures:	

Procedures for issuing a health advisory

Who is Responsible:	
Procedures:	

Other procedures, as necessary

Who is Responsible:	
Procedures:	

Section 5.
Effective Communication

Communication with customers, the news media, and the general public is a critical part of emergency response.

Designated public spokesperson

Designate a spokesperson (and alternate) and contact regulatory agency for delivering messages to the news media and the public.

Designate a spokesperson and alternates

Spokesperson	Alternate

Section 6.
The Vulnerability Assessment

This is an evaluation of each wastewater system component to identify weaknesses or deficiencies that may make them susceptible to damage or failure during an emergency. It also assesses facilities for security enhancements that may guard against unauthorized entry, vandalism, or terrorism.

Facility vulnerability assessment and improvements identification

System Component	Description and Condition	Vulnerability	Improvements or Mitigating Actions	Security Improvements
Collection System				
Sewage Pumping				
Treatment				
Effluent Disposal				
Computer and Telemetry System				
Other Consider-ations				

Section 7.
Response Actions for Specific Events

In any event there are a series of general steps to take:

1. Analyze the type and severity of the emergency;
2. Take immediate actions to save lives;
3. Take action to reduce injuries and system damage;
4. Make repairs based on priority demand; and
5. Return the system to normal operation.

The following tables identify the assessment, set forth immediate response actions, define what notifications need to be made, and describe important follow-up actions.

A. Power outage

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

B. Collection system blockage or line break

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

C. Collection system pumping facilities failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

D. Treatment system failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

E. Effluent disposal failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

F. Chemical contamination

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

G. Vandalism or terrorist attack

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

H. Flood

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

I. Earthquake

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

J. Hazardous materials spill into collection system

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

K. Electronic equipment failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

L. Cyber attack

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

M. Other

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

Section 8.
Returning to Normal Operation

Returning to normal operations

Action	Description and Actions

Section 9.
Plan Approval

Plan approval

This plan is officially in effect when reviewed, approved, and signed by the following people:

Name/Title	Signature	Date

APPENDIX G

ROUTT COUNTY PROPERTY CARD RECORD

Routt County Assessor's Office, Property Search

R0050155
22158 COUNTY ROAD 12

Owner:
ROUTT COUNTY
522 LINCOLN AVE STEAMBOAT SPRINGS, CO 80487

Actual Value
$48,500

KEY INFORMATION

Account #	**R0050155**	Parcel #	**960093002**
Tax Area	**50 - *RE3* SOUTH-ROUTT -County Line east of Stagecoach to 8mi west of Oak Creek**		
Neighborhood	**PHIPPSBURG**		
Subdivision	-		
Legal Desc	**TR IN SW4SW4 SEC 9-3-85 & SE4SE4 SEC 8-3-85 TOTAL 2.54A**		
Property Use	**UTILITY**		
Total Acres	**2.54**		
Owner	**ROUTT COUNTY**		
Situs Addresses	**22158 COUNTY ROAD 12**		
Total Area SqFt	-		
Business Name	**PBURG WATER TREATMENT**		

ASSESSMENT DETAILS

	Actual	Assessed
Land Value	**$0**	**$0**
Improvement Value	**$0**	**$0**
Total Value	**$48,500**	**$14,070**
Exempt Value	-	**$-14,070**
Adjusted Taxable Total	-	**$0**

PUBLIC REMARKS

PUBLIC REMARK	PUBLIC REMARK DATE
UPDATED LEGAL DESCRIPTION TO MATCH THAT ON DEED B423 P735. SH	3/20/2013

LAND DETAILS

LAND OCCURRENCE 1 - RES LAND

Property Code	**9138 - COUNTY MISC LAND**	Economic Area	**OUTLYING AREAS**
Super Neighborhood	-	Neighborhood	**RURAL SOUTH**
Land Code	**RURAL SOUTH 2 - 4.99 AC**	Land Use	**PRIME SITE**
Zoning	**AF**	Site Access	**YEAR-ROUND**
Road	**GRAVEL**	Site View	**AVERAGE**
Topography	**LEVEL**	Slope	**SLIGHT**
Wetness	**SEVERE**	Water	**NONE**
Utilities	**ELECTRIC**	Sewer	**NONE**
Acres	**2.54**	Description	-

BUILDINGS

EXTRA FEATURES / OUTBUILDINGS

No data to display

SALES HISTORY

No data to display

TAX AUTHORITIES

TAX AREA	TAX AUTHORITY ENTITY	AUTHORITY TYPE	2021 LEVY BY ENTITY	2021 TAX AREA LEVY	ENTITY % OF TAX BILLS
50	COLORADO RIVER WATER CONSERVANCY	Water Conservancy	0.501	81.293	0.60%
50	OAK CREEK CEMETERY	Cemetery District	0.259	81.293	0.30%
50	OAK CREEK FIRE PROTECTION DISTRICT	Fire Protection District	13.938	81.293	17.10%
50	ROUTT COUNTY	County	16.991	81.293	20.90%
50	SOUTH ROUTT LIBRARY	Library District	1.037	81.293	1.30%
50	SOUTH ROUTT MEDICAL CENTER SPECIAL DISTRICT	Health Service District (Hospital)	4.095	81.293	5.00%
50	SOUTH ROUTT SCHOOL DISTRICT	School District	42.652	81.293	52.50%
50	UPPER YAMPA WATER CONSERVANCY DISTRICT	Water Conservancy	1.82	81.293	2.20%

PRIOR YEAR ASSESSMENT INFORMATION

YEAR	ACTUAL VALUE	ASSESSED VALUE	MILL LEVY	AD VALOREM TAXES
2021	$48,500	$0	81.29	$0
2020	$47,400	$0	83.56	$0
2019	$47,400	$0	78.47	$0
2018	$41,500	$0	81.14	$0
2017	$41,500	$0	75.38	$0
2016	$44,100	$0	74.95	$0


R8171519
County Road 23
R4539632
R3501385
County Road 12
R5334491
R5335351
R8836360

APPENDIX H

PNA ENVIRONMENTAL CHECKLIST

COLORADO
Department of Public Health & Environment

ENVIRONMENTAL CHECKLIST

Use the Discussion and References space at the end of each section to document your responses. For example, explain how you determined the level of impact and document the reasoning if checking PA (possible adverse) for any resource. Attach additional pages if necessary.

1. Brief project description, including identification of selected alternative:

   Replace existing lagoons with a mechanical treatment plant.

2. Describe if the project will improve or maintain water quality, and if the project addresses a TMDL, and/or Watershed Management Plan.

   The project will improve the effluent quality leaving the facility. Right now, the community has a lagoon based treatment system. The new mechanical plant will remove more BOD, TSS, ammonia, total nitrogen, and phosphorous.

3. Provide latitude and longitude of the proposed project (if a transmission / distribution / collection line identify the center point not the whole line):

   40.2272°
   -106.943°

4. Provide discharge (WW) or source (DW) information: N/A □

   Effluent drain line to permitted location.

5. Provide NPDES/PWSID number:

   COG588141

6. Provide primary waterbody name and waterbody ID, secondary name (if available), and State designated surface water use:

   Yampa River

7. Did your analysis consider how this project impacts community planning efforts in other areas (i.e. transportation, housing, etc.)?

The proposed project will have limited community impacts as it is replacing an existing facility in the same location.

Y = Yes N = No PA = Possible Adverse

1. Physical Aspects - Topography, Geology and Soils

Y ☐ N ☑ PA ☐ a. Are there physical conditions (e.g., steep slopes, shrink-swells soils, etc.) that might be adversely affected by or might affect construction of the facilities?

Y ☐ N ☑ PA ☐ b. Are there similar limiting physical conditions in the planning area that might make development unsuitable?

Y ☐ N ☑ PA ☐ c. Are there any unusual or unique geological features that might be affected?

Y ☐ N ☑ PA ☐ d. Are there any hazardous areas (slides, faults, etc.) that might affect construction or development?

Discussion and References:

2. Climate

Y ☐ N ☑ PA ☐ a. Are there any unusual or special meteorological constraints in the planning area that might result in an air quality problem?

Y ☐ N ☑ PA ☐ b. Are there any unusual or special meteorological constraints in the planning area that might affect the feasibility of the proposed alternative?

Discussion and References:

3. Population

Y ☐ N ☑ PA ☐ a. Are the proposed growth rates excessive (exceeding State projections, greater than 6% per annum for the 20 year planning period)?

Y ☐ N ☑ PA ☐ b. Will additional growth be induced or growth in new areas encouraged as a result of facilities construction?

Y ☐ N ☑ PA ☐ c. Will the facilities serve areas which are largely undeveloped areas at present?

Discussion and References:

4. Housing, Industrial and Commercial Development and Utilities

Y ☐ N ☑ PA ☐ a. Will existing homes or business be displaced as a result of construction of this property?

Y ☐ N ☑ PA ☐ b. Will new housing serviced by this facility affect existing facilities, transportation patterns, environmentally sensitive areas, or be in special hazard or danger zones?

Y ☐ N ☑ PA ☐ c. Will new housing create strains on other utilities and services - policies, power, water supply, schools, hospital care, etc.?

Discussion and References:

5. Economics and Social Profile

Y ☐ N ☑ PA ☐ a. Will certain landowners benefit substantially from the development of land due to location and size of the facilities?
Y ☐ N ☑ PA ☐ b. Will the facilities adversely affect land values?
Y ☐ N ☑ PA ☐ c. Are any poor or disadvantaged groups especially affected by this project?

Discussion and References:

6. Land Use

Y ☐ N ☑ PA ☐ a. Will projected growth defeat the purpose of local land use controls (if any)?
Y ☐ N ☑ PA ☐ b. Is the location of the facilities incompatible with local land use plans?
Y ☐ N ☑ PA ☐ c. Will inhabited areas be adversely impacted by the project site?
Y ☐ N ☑ PA ☐ d. Will new development have adverse effects on older existing land uses (agriculture, forest land, etc.)?
Y ☐ N ☑ PA ☐ e. Will this project contribute to changes in land use in association with recreation (skiing, parks, etc.), mining or other large industrial or energy developments?

Discussion and References:

7. Floodplain Development

Y ☐ N ☑ PA ☐ a. Does the planning area contain 100 year floodplains?
If yes -
Y ☐ N ☑ PA ☐ b. Will the project be constructed in a 100 year floodplain?
Y ☐ N ☑ PA ☐ c. Will the project serve direct or indirect development in a 100 year floodplain anywhere in the planning area?

Discussion and References:

8. Wetlands

Y ☑ N ☐ PA ☐ a. Does the planning area contain wetlands as defined by the U.S. Fish and Wildlife Service?
If yes -
Y ☐ N ☑ PA ☐ b. Will any structure of the facility be located in wetlands?
Y ☐ N ☑ PA ☐ c. Will the project serve growth and development which will directly or indirectly affect wetlands?

Discussion and References:

9. Wild and Scenic Rivers

Y ☐ N ☑ PA ☐ a. Does the planning area contain a designated or proposed wild and scenic river?
If yes -
Y ☐ N ☑ PA ☐ b. Will the project be constructed near the river?

Y ☐ N ☑ PA ☐ c. Will projected growth and development take place contiguous to or upstream from the river segment?

Y ☐ N ☑ PA ☐ d. Will the river segment be used for disposal of effluent?

Discussion and References:

10. Cultural Resources (Archeological/Historical)

Y ☐ N ☑ PA ☐ a. Are there any properties (historic, architectural, and archeological) in the planning area which are listed on or eligible for listing on the National Register of Historic Places?

If yes -

Y ☐ N ☐ PA ☐ b. Will the project have direct or indirect adverse impacts on any listed or eligible property?

Discussion and References:

11. Flora and Fauna (including endangered species)

Y ☐ N ☑ PA ☐ a. Are there any designated threatened or endangered species or their habitat in the planning area?

Y ☐ N ☑ PA ☐ b. Will the project have direct or indirect adverse impacts on any such designated species?

Y ☐ N ☑ PA ☐ c. Will the project have direct or indirect adverse impacts on fish, wildlife or their habitat including migratory routes, wintering or calving areas?

Y ☐ N ☑ PA ☐ d. Does the planning area include a sensitive habitat area designed by a local, State or Federal wildlife agency?

Discussion and References:

12. Recreation and Open Space

Y ☐ N ☑ PA ☐ a. Will the project eliminate or modify recreational open space, parks or areas of recognized scenic or recreational value?

Y ☐ N ☑ PA ☐ b. Is it feasible to combine the project with parks, bicycle paths, hiking trails, waterway access and other recreational uses?

Discussion and References:

13. Agricultural Lands

Y ☐ N ☑ PA ☐ a. Does the planning area contain any environmentally significant agricultural lands (prime, unique, statewide importance, local importance, etc.) as defined in the EPA Policy to Protect Environmentally Significant Agricultural Lands dated September 8, 1978?

Y ☐ N ☑ PA ☐ b. Will the project directly or indirectly encourage the irreversible conversion of Environmentally Significant Agricultural Lands to uses which result in the loss of these lands as an environmental or essential food production resource?

Discussion and References:

14. Air Quality

Y ☐ N ☑ PA ☐	a.	Are there any direct air emissions from the project (e.g., odor controls, sludge incinerator) which do not meet Federal and State emission standards contained in the State Air Quality Implementation Plan (SIP)?
Y ☐ N ☑ PA ☐	b.	Is the project service area located in an area without an approved or conditionally approved SIP?
Y ☐ N ☑ PA ☐	c.	Is the increased capacity of the project greater than 1 mgd?
Y ☐ N ☑ PA ☐	d.	Do the population projections used in the facilities plan exceed the Sate or area wide projections in the SIP by more than 5%?
Y ☐ N ☑ PA ☐	e.	Does the project conform to the requirements of the SIP? (See EPA regulations under Section 316 of the Clean Air Act.)
Y ☐ N ☑ PA ☐	f.	Is the project inconsistent with the SIP of an adjoining State that may be impacted by the Project?
Y ☐ N ☑ PA ☐	g.	Does the project violate national ambient Air Quality Standards in an attainment or unclassified area?
Y ☐ N ☑ PA ☐	h.	Will the facilities create an odor nuisance problem?

Discussion and References:

15. Water Quality and Quantity (Surface/Groundwater)

Y ☐ N ☑ PA ☐	a.	Are present stream classifications in the receiving stream being challenged as too low to protect present or recent uses?
Y ☐ N ☑ PA ☐	b.	Is there a substantial risk that the proposed discharge will not meet existing stream standards or will not be of sufficient quality to protect present or recent stream uses?
Y ☐ N ☑ PA ☐	c.	Will construction of the project and development to be served by the project result in non-point water quality problems (sedimentation, urban stormwater, etc.)?
Y ☐ N ☑ PA ☐	d.	Will water rights be adversely affected by the project?
Y ☐ N ☑ PA ☐	e.	Will the project cause a significant amount of water to be transferred from one sub-basin to another (relative to the 7-day, 10 year flow of the diverted basin)?
Y ☐ N ☑ PA ☐	f.	Will stream habitat be affected as a result of the change in flow or stream bank modification?
Y ☐ N ☑ PA ☐	g.	Are stream conditions needed for deciding upon the required limitations inadequately specified in the 208 Plan? If so, have the wasteload allocations calculations been performed and approved by the State and EPA?
Y ☐ N ☑ PA ☐	h.	Is an Antidegradation Review required?
Y ☐ N ☑ PA ☐	i.	Will the project adversely affect the quantity or quality of a groundwater resource?
Y ☐ N ☑ PA ☐	j.	Does the project adversely affect an aquifer used as a potable drinking water supply?
Y ☐ N ☑ PA ☐	k.	Are there additional cost effective water conservation measures that could be adopted by community to reduce sewage generation?

Discussion and References:

16. Public Health

Y ☐ N ☑ PA ☐	a.	Will there be adverse direct or indirect noise impacts from the project?
Y ☐ N ☑ PA ☐	b.	Will there be a vector problem (e.g., mosquito) from the project?

Y ☐ N ☑ PA ☐ c. Will there be any unique public health problems as a result of the project (e.g., increased disease risks)?

Discussion and References:

17. Solid Waste (Sludge Management)

Y ☐ N ☑ PA ☐ a. Will sludge disposal occur in an area with inadequate sanitary landfills or on land unsuitable for land application?

Y ☐ N ☑ PA ☐ b. Are there special problems with the sludge that makes disposal difficult (hazardous, difficult to treat)?

Y ☐ N ☑ PA ☐ c. Is the technology selected for sludge disposal controversial?

Discussion and References:

18. Energy

Y ☐ N ☑ PA ☐ a. Are there additional cost effective measures to reduce energy consumption or increase energy recovery which could be included in this project?

Discussion and References:

19. Land Application

Y ☐ N ☑ PA ☐ a. Has a new or unproven technique been selected?

Y ☐ N ☑ PA ☐ b. Is there considerable public controversy about the project?

Y ☐ N ☑ PA ☐ c. Will the project require additional water rights or impact existing water Rights?

Y ☐ N ☑ PA ☐ d. Is the project multi-purpose?

Discussion and References:

20. Regionalization

Y ☐ N ☑ PA ☐ a. Are there jurisdictional disputes or controversy over the project?

Y ☐ N ☑ PA ☐ b. Is conformance with the 208 plan in question?

Y ☐ N ☑ PA ☐ c. Is the proliferation of small treatment plants and septic systems creating a significant health problem?

Y ☐ N ☑ PA ☐ d. Have inter-jurisdictional agreements been signed?

Discussion and References:

21. Public Participation

Y ☐ N ☑ PA ☐ a. Is there a substantial level of public controversy?

Y ☐ N ☑ PA ☐ b. Is there adequate evidence of public participation in the project?

Discussion and References:

22. Environmental Laws

Y ☐ N ☑ PA ☐ a. Does the project threaten to violate any State, Federal or local law or requirement imposed to protect the environment?

Discussion and References:

Prepared By: Adam Sommers, P.E. - Design Engineer
Name, Title, and Affiliation

Date: 8/15/2022

APPENDIX I

COST AND EFFECTIVENESS EVALUATION CERTIFICATION

COLORADO
Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

Cost and Effectiveness Certification

Project Name: Community of Phippsburg WWTP

Borrower: Routt County

As a condition for receiving assistance through the Colorado Water Pollution Control Revolving Fund (WPCRF), I certify that the cost and effectiveness evaluation has been performed per Section 602(b)(13) of the Water Resources Reform and Development Act of 2014 (WRRDA).

This cost and effectiveness evaluation included the following.

A. The borrower has studied and evaluated the cost and effectiveness of the processes, materials, techniques, and technologies for carrying out the proposed project or activity for which assistance is sought under this title; and

B. The borrower has selected, to the maximum extent practicable, a project or activity that maximizes the potential for efficient water use, reuse, recapture, and conservation; and energy conservation, taking into account:

   a. the cost of constructing the project or activity;
   b. the cost of operating and maintaining the project or activity over the life of the project or activity; and
   c. the cost of replacing the project or activity.

Adam Sommers, P.E.

Licensed Professional Engineer (Printed)

8/15/2022

Date

Signature and Stamp of Licensed Professional Engineer

APPENDIX J

FEMA FLOOD PLAIN MAP

National Flood Hazard Layer FIRMette

FEMA

106°56'51"W 40°14'41"N

106°56'13"W 40°14'13"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/26/2022 at 4:55 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX K

NRCS SOILS MAP

Soil Map—Routt Area, Colorado, Parts of Rio Blanco and Routt Counties
(Phippsburg Soils Map)

Map Scale: 1:2,150 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Routt Area, Colorado, Parts of Rio Blanco and Routt Counties
Survey Area Data: Version 11, Sep 2, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 30, 2013—Nov 1, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2F	Lintim loam, 25 to 65 percent slopes	0.5	2.1%
103	Foidel-Rock outcrop complex, 20 to 60 percent slopes	1.0	4.0%
124	Vabem-Rabbitears complex, 25 to 65 percent slopes	1.4	5.7%
156	Egeria clay, 0 to 3 percent slopes	8.4	35.5%
AW	Venable, mucky peat, 0 to 3 percent slopes, frequently flooded	10.7	45.2%
W	Water	1.8	7.4%
Totals for Area of Interest		**23.8**	**100.0%**

APPENDIX L

NATIONAL WETLANDS INVENTORY MAP

U.S. Fish and Wildlife Service
National Wetlands Inventory

Phippsburg Wetlands Inventory Map

May 2, 2022

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

APPENDIX M

NEWTERRA MBR BROCHURE

Modular Decentralized Water & Wastewater Systems

Scalable, cost-effective solutions for development projects and existing wastewater treatment plant retrofits.

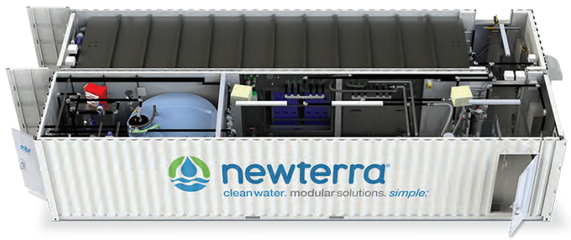
newterra®

clean water. modular solutions. *simple.*

newterra.com

Newterra Pre-Fabricated Modular Systems Are Designed To Grow As Your Development Grows

Newterra is leading the way with decentralized wastewater solutions that help you reduce project costs with a sustainable treatment approach. Our modular membrane bioreactor (MBR) systems are scalable – allowing treatment infrastructure to be added in stages as capacity requirements grow.



The Right Solution for a Wide Range of Projects

Newterra's innovative wastewater treatment systems are ideally suited to many types of projects, including:

- Greenfield & Retrofit Projects
- Existing Infrastructure Tie-ins
- Municipal WWTPs
- New Residential Developments
- Hotels, Resorts & Restaurants
- Campgrounds & Trailer Parks
- Mobile Home Communities
- Off-Grid & Remote Municipal Plants
- New Commercial Developments
- Service Area Expansions
- LEED® Certified & Green Buildings
- Schools & Hospitals
- Golf Courses
- Sports & Recreational Facilities
- Highway Rest Areas

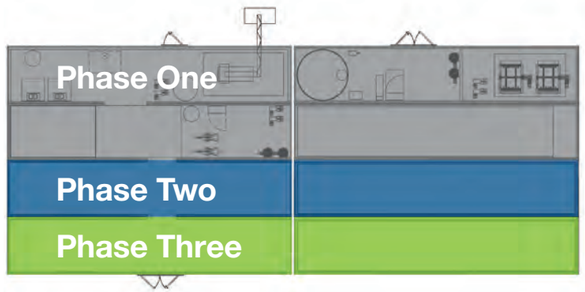
Self-Contained and Enclosed Systems

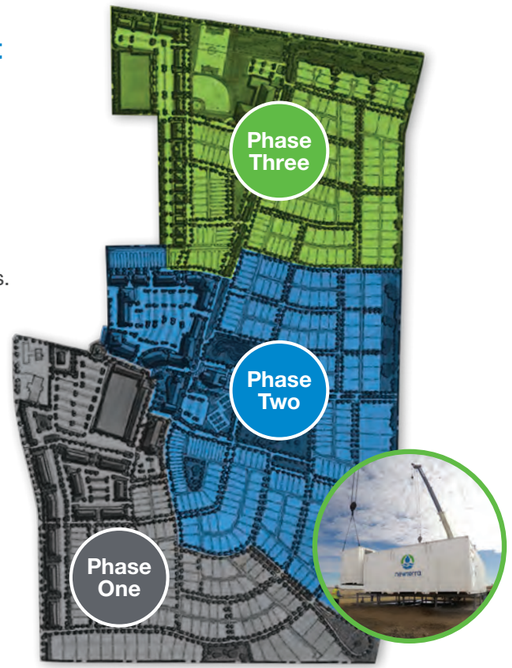
Newterra MBR wastewater systems are modular, and can be configured as fully self-contained units that can be clad with a variety of materials to blend in with surrounding structures, or integrated into new or existing treatment structures. They are built in our MET-certified manufacturing facility and have UL electrical certification.

Newterra systems can be clad to blend in with their surroundings *(above)*, or be loose-shipped for use with inground tanks and buildings *(inset, right)*.

Add Infrastructure with Each Phase of a Project

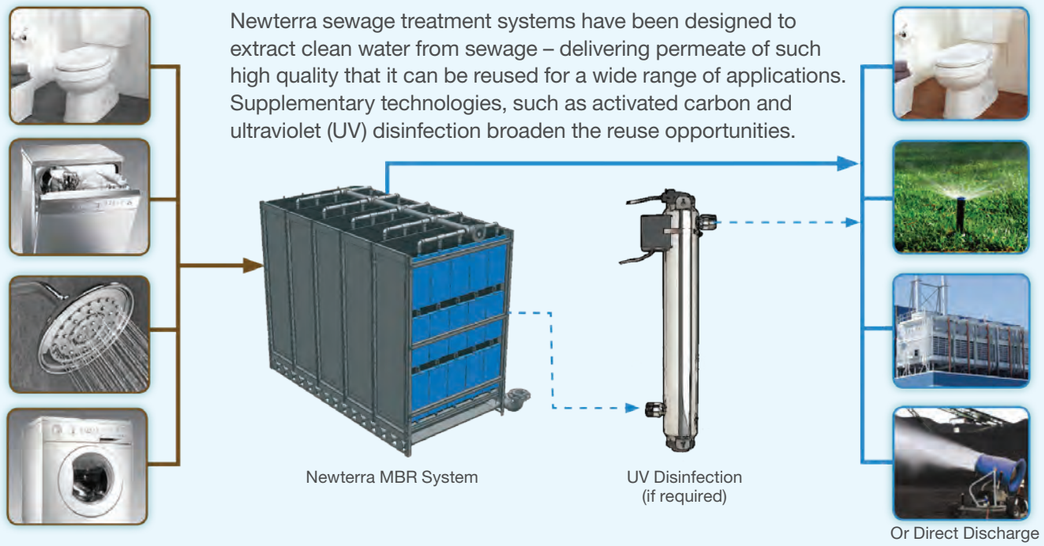
Our modular, scalable treatment technology allows you to phase in wastewater infrastructure in parallel with the treatment demands of your development. Newterra MBR systems can handle high loads, and are very resilient to flow and loading fluctuations. They are also extremely space efficient – reducing land requirements and providing more options of where the plant can be located. Newterra systems can be loose-shipped or pre-manufactured, and we offer you the option of renting or leasing to minimize your initial capital expenditures.





Sewage Treatment That Offers A Wide Range of Reuse Applications

Newterra sewage treatment systems have been designed to extract clean water from sewage – delivering permeate of such high quality that it can be reused for a wide range of applications. Supplementary technologies, such as activated carbon and ultraviolet (UV) disinfection broaden the reuse opportunities.



Compact, Operator-Friendly & Sustainable

Designed & Built for Minimal Maintenance

Newterra MBR systems are field proven in some of the most extreme conditions on the planet. Feedback from operators has been a key ingredient in the development and refinement of our low maintenance solutions:

- Intuitive, user-friendly controls and instrumentation
- Built-in telemetry & remote monitoring reduce plant visits by operator
- Air scouring & periodic membrane relaxation minimize CIP requirements
- Built-in redundancy to eliminate downtime
- Proven in a wide range of regions, climates and altitudes

Ambient Temperatures	High Altitudes
-40˚F to +104˚F	13,125 ft.
-40˚C to +40˚C	4,000 m

*Integrated cellular telemetry and our **SiteLink**™ technology allow 24/7 monitoring and operation by your staff, and proactive troubleshooting by our technical team*

Cost-Effective for New Facilities & Retrofits

At Newterra, we offer both custom-designed and pre-engineered, packaged MBR treatment systems for new facilities. Our technology is also very well suited to retrofitting conventional BNR and ENR plants to comply with higher regulatory standards or expand capacity. Newterra MBR modules can be easily incorporated into existing clarification tanks – more than tripling plant capacity within the current footprint and eliminating the need for costly infrastructure expansion.

A Global Water Technology Leader

Newterra is recognized as a leader in the development of modular treatment solutions for water, sewage, wastewater and groundwater remediation for industrial, municipal, land development, commercial & residential markets. Our heritage of innovation in providing clean water solutions dates all the way back to 1863. Over that time, Newterra has grown to over 200 people and we've installed thousands of treatment systems – some of which operate in the most extreme conditions on the planet.

Full Control from Start to Finish

At Newterra, we take full control of virtually every aspect of the treatment systems we build – from process design and engineering to manufacturing, installation, operations and ongoing parts & service support. That also includes manufacturing our own MicroClear® UF membranes in Newterra's ISO 9001:2008 certified facility. This award-winning approach ensures Newterra treatment systems meet our high standards for quality and on-time delivery.

200+ Employees

40+ Professional Engineers

10,000+ Installations Worldwide

newterra®
clean water. modular solutions. *simple.*

BEST MANAGED COMPANIES Platinum member

2015 Global Challenger 100

1.800.420.4056 | newterra.com

APPENDIX N

NEWTERRA PROPOSAL FOR PHIPPSBURG WWTP

clean water. modular solutions. simple.™

Community of Phippsburg MBR System
BUDGETARY PROPOSAL 2207814R1
30,000 US Gallons / Day

Newterra MEMBRANE BIOREACTOR WASTEWATER TREATMENT SYSTEM

Submitted To:

AquaWorks DBO

3252 N Williams St
Denver, CO 80205
USA

Adam Sommers
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Submitted By:

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Prepared By: Olena Mozharovska – Applications Engineering

2022-06-30

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(800) 420-4056/www.newterra.com

Contents

Our Pledge to You

At Newterra, we recognize that our performance will directly affect the outcome of your project. That's what drives our Total Commitment to Project Success. This means that if we do not live up to your expectations, we will do whatever it may take to resolve an issue immediately.

Newterra has the distinction of being a two-time recipient of the prestigious Global Cleantech Top 100 Companies and has been named as one of Canada's Best Managed Companies for eight consecutive years.

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1 Introduction

1.1 Advantages of Newterra MBR System

The Newterra MBR system employs membrane biological reactor (MBR) technology with submerged ultrafiltration membranes. The system is designed to be the simplest, most operator-friendly membrane technology available in the market. The Newterra MBR system produces ultra-clean water (solids free effluent) which effectively meets any water standards for discharge and reuse.

The Newterra MBR system is a packaged wastewater treatment plant with modular design features. The system comes complete with containerized screen, biological treatment, and membrane filtration. The plant is housed inside modified high-cube shipping containers or prefabricated buildings - completely pre-assembled, pre-piped, pre-wired and pre-tested, ready for a quick site installation and start-up. The advantages that the Newterra MBR system offers include:

- Absolute Physical Barrier for Contaminants
- Short Delivery Period
- Factory Assembled & Tested
- Minimal Site Work Required
- Reliable & Low Maintenance System
- Compact Footprint
- Minimal Noise & Odourless Operation

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2 Technical Proposal

2.1 Design Basis

Design Parameters

PARAMETER	DESIGN VALUE	UNIT
Average daily flow (ADF)	30,000	gpd
Maximum Month Flow (MMF)	36,000	gpd
Maximum Daily Flow (MDF)	60,000	gpd
Peak Instantaneous Inlet Flow	125	gpm
Site power[1]	Three-phase, 480VY, 60Hz Maximum Available Fault Current: 10,000 Symmetrical RMS Amps	
System area classification	According to NFPA 820, 2016 Edition	
Ambient temperatures	0 to 92	°F
Elevation	7,435	ft

NOTES:

1. The system will not be rated for service entrance but this can be provided. Please contact Newterra to discuss if this is desired.

Wastewater Characteristics

Parameter	UNIT	Design Value
Chemical Oxygen Demand (COD) [1]	mg/L	800
Biochemical Oxygen Demand (BOD_5) [1]	mg/L	400
Total Suspended Solids (TSS) [1]	mg/L	400
Total Kjeldahl Nitrogen (TKN) [1]	mg/L	50
Total Phosphorus (TP) [1]	mg/L	10
Fat, Oil and Grease (FOG) [1]	mg/L	30
Water Temperature [1]	°F	50 to 77
Prohibited Chemicals/Compounds [3]	Not Present	
Grinder Pumps	Not Present Upstream of MBR	

NOTES:

1. Noted values are assumed. ***Any variance to assumed parameter values may require system modification at the sole responsibility of the purchaser. A change order will be required to proceed with modifications and will delay delivery***
2. A complete list of prohibited chemicals is included in the membrane maintenance manual. ***Use of any of these chemicals will nullify all warranties.***

Effluent Quality

Parameter	Units	Regulatory Limits	Design Value
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	< 30	< 5
Total Suspended Solids (TSS)	mg/L	< 30	< 1
Total Ammonia Nitrogen (TAN)	mg/L	< 20	< 1

Chemical Consumption

CHEMICAL	CONCENTRATION	FUNCTION	DESIGN VALUE [1]	UNIT
Sodium Hypochlorite	12% Solution	Membrane cleaning	5.0	gal/week
Citric Acid	30% Solution	Membrane cleaning	4.0	gal/week
Sodium Hydroxide[2]	50% Solution	pH Correction / Alkalinity addition	-	gal/day
Aluminum Sulphate[3]	48% Solution	Phosphorous reduction	-	gal/day
MicroCgTM(2000) [3]		Carbon Source	-	gal/day

NOTES:
1. Chemical consumption values are estimated based on the system operating at ADF and average loading and will vary based on actual operational conditions.
2. It is assumed that there is sufficient alkalinity such that sodium hydroxide will not be required. However, a chemical dosing pump has been provided in the event that there is insufficient alkalinity.
3. It is not required based on design influent and effluent conditions, but dosing capabilities are included in the event that it is needed.

Waste Activated Sludge (WAS) Production

LOCATION/HANDLING STAGE	VOLUME [2]	UNIT	SOLIDS CONTENT [1]	UNIT
WAS Volume	521	gpd	2 %	w/w dry solids

NOTES:
1. WAS Production values are estimated based on the system operating at ADF and average loading and will vary based on actual operational conditions.

2.2 Process Description

Membrane bioreactor (MBR) treatment technology is a simple, yet effective combination of an activated sludge biological treatment process with membrane filtration. The ultrafiltration (UF) membranes act as a physical barrier against the passage of all particulate solids, unlike the gravity settling of mixed liquor in the conventional activated sludge process, where separation is not complete. As a result, the MBR can operate at a much higher mixed liquor suspended solids (MLSS) concentration (typically 8,000 to 12,000 mg/L vs. 2,000 to 4,000 mg/L in conventional activated sludge system). This results in a robust, versatile, and ultra-compact wastewater treatment system. In addition, the high concentration of biomass inventory in the MBR system provides resilience to changes in influent quality.

Flow-Equalization

Throughout the day the flow and strength of the wastewater will vary. To accommodate this, an equalization tank will buffer the flow and homogenize the loading. The equalization tank is aerated to maintain an aerobic environment to reduce odors and to maintain suspension of solids and pumps transfer wastewater to biological treatment.

Fine Screening

Raw wastewater entering the MBR system contains particulates and solids that could damage the equipment and membranes down-stream. Fine screening protects the down-stream equipment by removing large solids and fibrous material.

Biological Treatment

In the aerobic zone, the influent wastewater is combined with return activated sludge from the membrane tank. Fine bubble diffusers create an aerobic environment where the organics contributing to biological oxygen demand (BOD) and ammonia (TAN) are oxidized by the biology. Dissolved oxygen is continuously measured and aeration blowers controlled to maintain it in the range of 2 to 3 mg/L for process optimization and energy savings.

pH Correction and Alkalinity Addition

As organics and ammonia are oxidized alkalinity is consumed lowering the pH of the mixed liquor. To maintain the pH in the proper range and replenish alkalinity a sodium hydroxide solution is dosed into the mixed liquor, as required.

Membrane Filtration

After being treated biologically, the treated effluent is separated from the mixed liquor and solids by our membrane modules and the permeate extraction system. The membrane modules are continually air scoured to induce flow of mixed liquor over the membrane surface and prevent fouling and buildup of solids on the membrane surface without the use of chemicals.
The mixed liquor is then transferred to the inlet of the biological treatment to maintain even distribution of solids throughout the system and to introduce activated biology to the raw wastewater.

Effluent Disinfection

The UF membrane removes 99.9999% of bacteria and 99.99% of viruses. For additional disinfection and/or redundancy the effluent will pass through a UV reactor.

Waste Activated Sludge (WAS) Handling

As solids-laden wastewater enters the system, suspended bacteria grow and solids-free effluent is discharged, the suspended solids concentration in the mixed liquor (MLSS) will increase. To maintain the proper level of MLSS, solids must be removed from the system as Waste Activated Sludge (WAS) which is mixed liquor discharged from the aerobic tank at approximately 1% dry solids by weight.

WAS is discharged to a tank for holding and thickening. The holding tank is aerated to maintain an aerobic environment to reduce odors. In the thickening process, the WAS is allowed to settle and supernatant is pumped off, and returned to the MBR, thickening the sludge in the holding tank. By thickening the sludge to approximately 2% dry solids by weight, the total volume that must be disposed of is decreased, extending holding time and reducing operational costs. Level control in the tank indicates when the tank should be decanted or a vacuum truck should be scheduled to dispose of the WAS.

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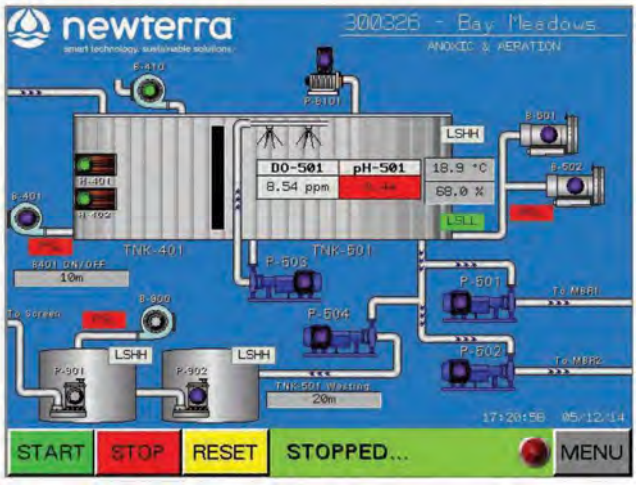
Modular Building

With 15 years of experience containerizing equipment Newterra has developed a modular building system that that includes insulation, HVAC, interior and exterior lighting, spill containment and sumps, access doors, and other features facilitating operations.
All equipment installation, wiring, and piping internal to a container is done in the ideal conditions of our climate-controlled, manufacturing facility with full access to proper tools, equipment and engineering support.

The full system will be assembled and undergo comprehensive Factory Acceptance Testing (FAT) before it leaves our facility. This rigorous testing prior to shipping to helps eliminate downtime when the system arrives on site.

Control & Automation System



Newterra's control and automation system combines a high level of instrumentation, an advanced PLC, and in-house custom programming to deliver a system that offers tremendous optimization capabilities yet requires no operator intervention for day to day operation.
The user interface can be accessed on-site from control panel mounted touchscreen HMIs or remotely from a computer over the internet with purchase of a telemetry package and annual subscription service.
Also with the telemetry package, alarm messages can be transmitted by email or text message to alert operators to issues, even when the operators are not on site.
All important information is logged so trends can be monitored to ensure the long term successful operation of the Newterra system.

2.3 Scope of Supply

2.3.1 Equipment Scope of Supply

Flow Equalization (Tank by others, equipment shipped loose for installation on site by others)

One (1) train total, each train includes:

- In-ground poured on site Equalization tank (Recommended working volume is at least 12,000 gal, maximum SWD of 8.20 ft)
  - Coarse bubble air diffuser grid
  - High level alarm switch
  - Low level alarm switch
  - Level transmitter
- Two (2) air mixing blowers (Installed in Newterra enclosure)
  - One (1) blower duty, one (1) blower common standby (shared with Sludge Holding Tank)
  - Regenerative
  - Inlet filter silencers
  - Check valves
  - Isolation valves
  - Temperature gauges
  - Pressure gauges
  - Low pressure alarm switch
- Two (2) screen feed pumps (Shipped loose, installed by others)
  - One (1) pump duty, one (1) pump standby
  - Myers
  - Submersible
  - Inlet flow transmitter (common between pumps – installed in Newterra enclosure)
  - Isolation valves
  - Check valves
  - Rail system for pumps removal

Fine Screening

One (1) train total, each train includes:

- One (1) fine screen
  - One (1) screen duty
  - Rotary brush
  - Automatic cleaning 2mm perforated plate
  - Critical spares (brushes and motor)
- Gravity discharge to Aerobic tank

Biological Treatment (Tank by others, equipment shipped loose for installation on site by others)

One (1) train total, each train includes:

- In-ground poured on site Aerobic tank (Recommended working volume is at least 17,812 gal, maximum SWD of 8.20 ft)
  - Fine bubble air diffuser grid
  - pH transmitter
  - Dissolved oxygen (DO) transmitter
  - High level alarm switch
  - Low level alarm switch
  - Level transmitter

- Two (2) aeration blowers (Installed in newterra enclosure)
  - One (1) blower duty, one (1) blower standby
  - Positive displacement
  - VFD controlled
  - Inlet filter silencers
  - Check valves
  - Isolation valves
  - Temperature gauges
  - Pressure gauges
  - Low pressure alarm switch
- Three (3) membrane feed pumps
  - Two (2) pumps duty, one (1) pump shelf spare
  - Barnes
  - Submersible
  - Isolation valves
  - Check valves
  - Rail system for pumps removal
- One (1) WAS pump
  - Barnes
  - Submersible
  - Isolation valve
  - Check valve
  - Rail system for pumps removal

Membrane Filtration

Two (2) trains total, each train includes:

- Membrane tank
  - All wetted components are stainless steel
  - Sample port for MLSS testing
  - Viewing window
  - Ground level access hatch
  - High level alarm switch
  - Level control switch
- Seven (7) submerged UF membrane modules with
  - Stainless steel housing
  - Air scouring diffusers
- Permeate extraction header
  - Clear PVC pipe sections for visual permeate monitoring
  - Membrane module isolation valves
- Two (2) permeate extraction pumps
  - One (1) pump duty, one (1) pump standby
  - Centrifugal
  - VFD controlled
  - Vacuum transmitter
  - Vacuum gauge
  - Isolation valves
  - Check valve
  - Pressure gauge
  - Sample port
  - Flow transmitter (Common between two permeate pumps)

- Membrane Backwash System (Common between membrane trains)
  - Holding tank with level switches
  - Automated permeate fill valve
  - Automated clean water fill valve
  - Flow transmitter
  - Automated 3-way backwash valves
- One (1) air bleed pump
- One (1) air scouring blower
  - Regenerative
  - Inlet filter silencer
  - Check valve
  - Isolation valve
  - Temperature gauge
  - Pressure gauge
  - Low pressure alarm switch
- Two (2) backwash pumps
  - One (1) pump duty, one (1) pump standby
  - Centrifugal
  - VFD controlled
  - Vacuum transmitter
  - Vacuum gauge
  - Isolation valves
  - Check valve
  - Pressure gauge
  - Sample port
  - Flow transmitter (Common between two backwash pumps)

Chemical Dosing

One (1) train total, each train includes:

- One (1) Sodium Hydroxide dosing pump
  - Diaphragm pump
  - Foot valve
- Spill containment for drum
- One (1) Citric Acid dosing system
  - Diaphragm pump
  - Foot valve
- Spill containment for drum
- One (1) Sodium Hypochlorite dosing system
  - Diaphragm pump
  - Foot valve
- Spill containment for drum
- One (1) Micro-C dosing system
  - Diaphragm pump
  - Foot valve
- Spill containment for drum
- One (1) Aluminum Sulphate dosing system
  - Diaphragm pump
  - Foot valve
- Spill containment for drum

Effluent Disinfection

One (1) train total, each train includes:

- Two (2) UV reactors Hallett 1000W
  - One (1) duty, one (1) redundant
  - Piped in parallel
  - Bypass valves

Sludge Holding & Thickening (Tank by others, equipment shipped loose for installation on site by others)

One (1) train total, each train includes:

- In-ground poured on site Sludge Holding Tank (Recommended volume is at least 10,472 gal, maximum SWD of 8.20 ft)
  - Coarse bubble air diffusers
  - High level alarm switch
  - Low level alarm switch
  - Level transmitter
- One (1) aeration blower (Installed in Newterra enclosure)
  - Regenerative
  - Inlet filter silencer
  - Check valve
  - Isolation valve
  - Temperature gauge
  - Pressure gauge
  - Low pressure alarm switch
- Two (2) decanting pumps
  - One (1) pump duty, one (1) pump standby
  - Barnes
  - Submersible
  - Isolation valve
  - Check valve
  - Rail system for pumps removal

Odour Control

Two (2) trains total, each train includes:

- One (1) activated carbon vessel
  - Pressure gauges
  - Vacuum gauges
  - Inlet moisture separator (only for one train)
  - Ventilation blower

System Enclosures

One (1) 40’x8’ Modified High-Cube Shipping Containers and one (1) 10’x8’ Framed Building with siding
MET certified, built to NEC standards with all wiring complete and all equipment pre-piped factory tested and mounted in enclosure.
New high-cube modified shipping containers with the following features:

- Exterior paint
- Lifting eyes on upper corners
- Coated plywood floor

    - Sump basins with drain
- Welded steel double doors with safety window and push/crash bar lever
- Barn-style double doors
- Interior lighting
- Exterior lighting
- Insulation
- Heating
- Ventilation fan
- Passive vent louvers with hood
- Low temperature alarm switch
- Emergency stop switch
- Duplex 15 Amp GFI receptacle for heat trace inlet and discharge

Control System Module

PLC based control panel with the following standard features:

- MET certification
- AIC rating of 10000
- NEMA 12 panel enclosure
- Primary circuit protection
- Main power block
- Branch circuit protection with circuit breakers for motors
- Motor starters with overload protection
- Variable frequency drives where required
- Branch circuit protection with circuit breakers for powered devices
- PLC control system
- 24 VDC IS power supply
- Intrinsically safe barriers for switches in classified areas
- Alarm notification in the event of a main power failure
- Wired and installed
- Factory tested prior to shipping

Outside cover of panel to contain the following:

- System ready light
- Red alarm indicator light
- Programmable touch screen with:
    - Colour P&ID display
    - Display of measurements recorded from any transmitters present in system
    - System on/off control
    - Safety control over all valves and motors with timed delay when in Hand position
    - Timers for solenoid valves and motors present in system
    - Alarm indicators with reset function
    - Run indicators for system components
    - USB port for datalogging download (USB key included)
    - Alarm reset button
- Emergency stop button

Operation and Maintenance Manual

- Operating instructions for all treatment system components
- Copy of operating manual for each piece of equipment *(Digital copy only)*

- Summary of system components
- Summary of system operation principles
- Summary of operation controls and failsafes
- Summary of maintenance requirements for each piece of equipment
- One digital copy provided
- All documentation provided in English

Factory Acceptance Testing (FAT)

- Material receipt inspection
- Assembly verification
- Leak test/set up verification
- Functional challenge
- FAT summary & deviation report

2.4 Customer's Scope of Supply

Newterra does not include the following unless expressly detailed in this proposal:

- Installation of loose shipped equipment supplied by Newterra
- Placement and anchoring (if required) of equipment
- Interconnecting piping supply and installation
- Interconnecting electrical and controls supply and installation including connection inside Newterra's control panel
- Electrical power supply to our electrical panel, lightning, grounding, etc.
- Permitting
- Potable water supply to the plant site for plant hydraulic test during startup
- Seed sludge
- Wastewater testing
- Chemicals supply and storage
    - NOTE: Based on local regulations, additional safety equipment may be required to store and handle chemicals on the site which have not been included as part of this proposal. This may include but be limited to: eye wash stations, safety showers, spill containment, secondary containment, isolation curtains, isolated ventilated bulk storage buildings, personal protective equipment, constant ventilation systems, vapor suppression equipment, and spill containment equipment. Newterra can provide pricing for these options upon request.
- Treated effluent and waste sludge disposal
- All civil work including design
    - Tank sizing as per Newterra supplied PFD, to be confirmed during detailed design
- Anything not mentioned in "Scope of Supply" above

3 Commercial Proposal

3.1 Price Breakdown

Pricing

ITEM	PRICE
Budgetary Equipment Purchase Price	$ 573,300
Sales Tax on Equipment	Not Included
Total System Price	**$ 573,300**

NOTES: Prices do not include any applicable taxes or duties unless otherwise stated.

Onsite visits

ITEM	PRICE
Estimated Onsite Startup	$ 26,200
Trip 1 • Includes two (2) 8-hour days of Site Acceptance Testing by one (1) factory trained **Newterra** representative • Includes expenses for travel, meals and accommodation • Additional days on-site to be billed at $1,200.00/day per technician plus expenses for travel, meals and accommodation	9,500
Trip 2 • Includes five (5) 8-hour days of onsite startup/commissioning by one (1) factory trained **Newterra** representative • Includes expenses for travel, meals and accommodation (weekend travel will be required with additional cost) • Additional days on-site to be billed at $1,200.00/day per technician plus expenses for travel, meals and accommodation	16,700

NOTES: Price is provided for general information and may be changed at time of order.

Freight Pricing

ITEM	PRICE
Estimated Equipment Freight to Site From Brockville, ON to Phippsburg, CO	$ 8,595

NOTES: Price is provided for general information and may be changed at time of order.

3.2 Pricing Notes

- The pricing provided is contingent upon acceptance of Newterra's payment terms and Terms & Conditions outlined in this proposal and may be adjusted if other payment terms or T&C's are applied at time of order
- Newterra's pricing is based on reasonable market variability in our supply chain. In the event of extreme volatility, defined as an increase of greater than 10% of the Industrial Product Price Index (IPPI) in value

from the month of the proposal date to the month of submission of engineering documentation for approval, Newterra reserves the right to adjust the project price. IPPI is obtained from Statistics Canada, reference table 18-10-0265-02.

- All prices are quoted in United States Dollars (USD)

3.3 Payment Terms

- 25% on order acceptance (Due net 30 days or prior to shipment whichever is first)
- 25% on submittal of drawings for approval (Due net 30 days or prior to shipment whichever is first)
- 25% on approval to order materials (Due net 30 days or prior to shipment whichever is first)
- 25% due prior to shipment (invoice to be supplied 30 days in advance)

3.4 Terms & Conditions

- **Newterra**'s attached standard terms and conditions apply
- **Newterra**'s attached standard warranty applies

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Brockville, ON, K6V 5Y6
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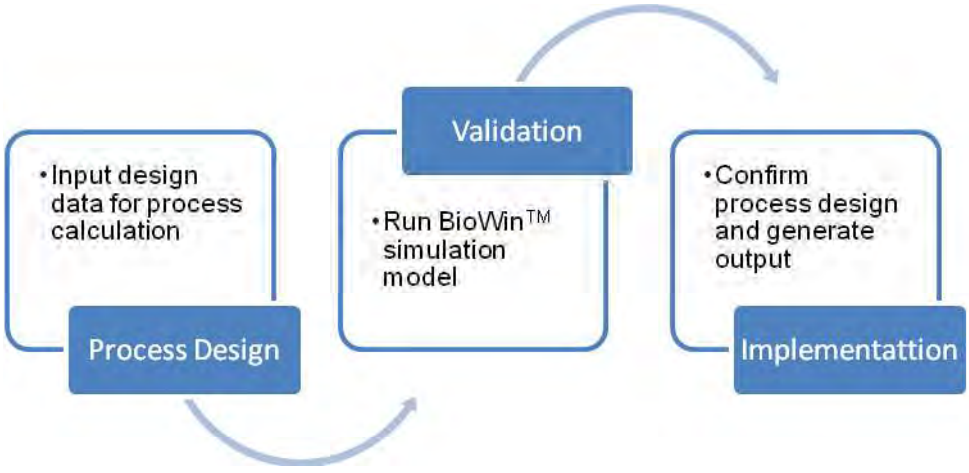
1.0 PROCESS DESIGN METHODOLOGY WITH BIOWIN™ MODELING

newterra utilizes an in-house MBR process design model based on a combination of empirical/heuristic data and biological kinetics constants/biochemical stoichiometry equations under steady state condition. The process design rationale incorporates elements from the Metcalf & Eddy Engineering Handbook, EPA's nitrogen control manual, nutrients removal guidelines developed by WEF, our systems field operating data and our conservative engineering practice and judgment.

The process design is further optimized and validated with BioWin™ modeling software, a proprietary wastewater treatment process simulator that is widely recognized for worldwide wastewater industry. BioWin™ is a wastewater treatment process simulator that ties together biological, chemical, and physical process models. The core of BioWin™ is its proprietary biological model which is supplemented with other process models (e.g. water chemistry models for calculation of pH, mass transfer models for oxygen modeling and other gas-liquid interactions).

Figure 1 depicts a systematic process design approach adopted by newterra when designing a MBR system. The multi-steps approach involves Process Design, Validation, and Implementation (see Figure 1).

Figure 1. newterra Process Design, Validation and Implementation (PVI) Flow Chart



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2.0 RESULTS

As illustrated in Table 1, the BioWin™ simulation run confirmed that all effluent parameters are well below the effluent targets.

Table 1. Comparison of BioWin™ Output and Effluent Targets

Effluent Parameters	BioWin™ Output	Effluent Targets
cBOD (mg/L)	0.83	< 30
TSS (mg/L)	0.00	< 30
NH_3-N (mg/L)	0.11	< 20

Please refer to the attachment for detailed information:

- Process Design Calculations
- BioWin™ Simulation Result

3.0 SUMMARY

In summary, newterra's MBR is capable of producing high quality effluent in accordance with the effluent targets of BOD/TSS/NH_3-N of less than 30/30/20 mg/L.

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newterra Project № 2207814R1
Subject: Douglas MBR WWTP
PROCESS DESIGN CALCULATION

Table 1: Influent Wastewater Characterization

Influent Flow Rate	Design Value	Metric Unit	Design Value	US Unit
Average Daily Flow (ADF)	114	m^3/d	30,000	gpd
Maximum Month Flow (MMF)	136	m^3/d	36,000	gpd
Maximum Daily Flow (MDF)	227	m^3/d	60,000	gpd
Peak Instantaneous Flow (PIF)	28.3875	m^3/h	125.00	gpm
Selected Design Flow, Q_D	5.68	m^3/h	25.00	gpm
Selected Peak Flow, Q_P	9.46	m^3/h	41.67	gpm

Influent Wastewater Characteristics	Design Value	Metric Unit	Design Value	US Unit
Chemical Oxygen Demand, COD, assumed	800	mg/L		
Biochemical Oxygen Demand, BOD	400	mg/L		
Total Suspended Solids,TSS	400	mg/L		
Volatile Suspended Solids, VSS	320	mg/L		
Total Kjeldahl Nitrogen, TKN	50	mg/L		
Ammonia nitrogen, NH_4-N	35	mg/L		
Total Phosphorus, TP	10	mg/L		
Fat, Oil and Grease, FOG	30	mg/L		
Minimum water temperature	10	˚C	50	˚F
Maximum water temperature	25	˚C	77	˚F
Alkalinity, assumed	300	mg/L		
Site elevation	2267	m	7435.76	ft

Table 2: Treated Effluent Specification

Effluent Water Specification	Effluent Limit	Metric Unit	Design Value	Metric Unit
$cBOD_5$	< 30	mg/L	< 5	mg/L
TSS	< 30	mg/L	< 1	mg/L
NH_4-N + NH_3-N	< 20	mg/L	< 1	mg/L

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Table 3: Design of Equalization tank

Design of Equalization tank	Design Value	Metric Unit	Design Value	US Unit
Total Working Volume	45.4	m^3	12,000	gal
HRT	8.00	h		
Aeration	0.015	$m^3/m^3.min$	0.015	$ft^3/ft^3.min$
	46.5	m^3/h		
Blower Capacity	44.8	Nm^3/h	28.3	scfm
Number of basins	1.00	-		
Working Volume/basin	45.4	m^3	12,000	gal
Liquid Volume/basin	51.6	m^3	13,636	gal
Tank Geometry	Rectangular			
Operating depth (max level - min level)	2.20	m	7.22	ft
Side Water Depth, SWD	2.50	m	8.20	ft
Length, L	4.6328	m	15.20	ft
Width, W	4.46	m	14.62	ft
Minor head loss, piping and fitting	8.0	kpa	1.16	psi
Total head loss	32	kpa	4.69	psi

Table 4: Membrane Calculation

Design of Membrane Tanks	Design Value	Metric Unit	Design Value	US Unit
1) Capacity				
Surface Area per Membrane Cassette	27.9	m^2	300	ft^2
Number of membrane tanks	2			
Number of membrane modules /membrane tank	7	-		
Selection of membrane module	500S	-		
Membrane cassettes per selected module	1	-		
Membrane surface area/module	28	m^2	300	ft^2
Total installed cassettes	14	-		
Total membrane area/ membrane tank	195.3	m^2	2101	ft^2
Total membrane area/ system	391	m^2	4202	ft^2

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Design of Membrane Tanks	Design Value	Design Value	Design Value	Design Value	Units
2) Flux Analysis	**ADF**	**MMF**	**MDF**	ADF (N-1)	
Influent flow rate (per tank)	56.78	68.13	113.55	113.55	m^3/d
Instantaneous flux	13	16	27	27	LMH
Net flux	12	15	24.2	24	LMH
Reference net flux at 10°C (suez)	18	20.0	28.2	28.2	LMH
	ADF	**MMF**	**MDF**	**ADF (N-1)**	
Influent Flow rate (per tank)	15,000	18,000	30,000	30000	gpd
Net flux	7.1	8.6	14.3	14.3	GFD
Reference net flux at 10°C (suez)	10.6	11.8	16.6	16.6	GFD

Design of Membrane Tanks	Design Value	Metric Unit	Design Value	US Unit
3) Scouring Aeration				
Air flow per membrane module	8	N m^3/h	4.63	cfm
Air flow per membrane tank	55	N m^3/h	32.43	cfm
Total MBR air flow	110	N m^3/h	64.86	cfm
Total MBR air flow,standard	118	m^3/h	69.62	scfm

Design of Membrane Tanks	Design Value	Metric Unit	Design Value	US Unit
4) Membrane Tank Design				
Tank Type	Containerized			
Length, L	1.0	m	3.35	ft
Width, W	1.6	m	5.39	ft
Side Water Depth, SWD	2.1	m	6.89	ft
Volume per tank	3.5	m^3	929	gal
Volume displaced per tank by membranes	0.3	m^3	79	gal
Percent volume displaced by membranes	8%	%		
Effective volume per tank	3.2	m^3	850	gal
Total effective MBR volume, V_m	6.5	m^3	1,701	gal
HRT_m	1.1	h		
Blower headloss	27.3	kPa	3.96	psi

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Table 5: Biological Operating Parameters

Biological Operating Parameters	Design Value	Metric Unit
Design aerobic Sludge Retention Time, SRT	15	day
MLSS in aerobic tank	8,000	mg/L
MLSS in membrane tank	10,000	mg/L
Mixed Liquor Volatile Suspended Solids, MLVSS, in aerobic tank	5362	mg/L
MLVSS/MLSS	67	%
Recirculation Ratio, RR: Membrane tank => Aerobic tank	4	-

Table 6: Kinetic Constants at Design Temperature

Kinetics Constants for BOD Removal	Value at 20°C	Value at design temperature	Metric Unit
K_s	32	32	g BOD/m^3
$k_{e\ or}\ k_d$	0.12	0.08	per day
Biomass yield, Y	0.40	0.40	g VSS/g BOD
μ_m	6	3.05	g VSS/g VSS.day
k		7.63	g BOD/g VSS/day
f_d		0.15	g /g
Y_{obs}		0.48	g VSS/g BOD
Y_H		0.50	g TSS/g BOD
Yobs-overall		0.73	gTSS/g BOD

Kinetics Constants for Nitrification	Value at 20°C	Value at design temperature	Metric Unit
$\mu_{m,n}$	0.75	0.38	g VSS/(g VSS.day)
K_n	0.74	0.44	g NH_4-N/m^3
$k_{en\ or}\ k_{dn}$	0.08	0.05	g VSS/(g VSS.day)
Y_n	0.12	0.12	g VSS/g NH_4-N
k_0		0.5	g/m^3
μ_n . Theoretical		0.11	g/(g/day)
Safety factor		1.5	
$SRT_{aerobic,\ theoretical}$		13.90	day

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Table 7: Sludge Yield

Sludge Yield	Design Value	Metric Unit	Design Value	US Unit
Effluent BOD, S_e	1.63	mg/L		
NO_x	32.2	mg/L		
$P_{x,bio}$	11.88	kg VSS/day	26.16	lb/d
X_0	14.53	kg/day	32.01	lb/d
$P_{x,vss}= P_{x,bio}+ X_0$	26.4	kg/day	58.17	lb/d
$P_{x,tss,\ biomass}$	39.41	kg/day	86.80	lb/d
$P_{x,TSS,\ total}$	39.41	kg/day	86.80	lb/d
$Q_{w,\ biomass}$	4.93	m^3/day	1,301	gal/d
Nitrogen uptake through sludge production	17.35	mg/L		
Phosphorus uptake through sludge production	4.3	mg/L		

Table 8: Design of Aerobic Tank

Design of Aerobic Tank	Design Value	Metric Unit	Design Value	US Unit
$V_{aerobic\ tank\ +\ membrane\ tank}$	73.89	m^3	19,521	gal
$HRT_{aerobic\ tank\ +\ membrane\ tank}$	13.01	h		
$V_{aerobic\ tank}$	67.42	m^3	17,814	gal
$HRT_{aerobic\ tank}$	11.88	h		
Number of trains	1	-		
Tank Geometry	Rectangular			
Tanks in series	1			
Volume/basin	67.42	m^3	17,814	gal
Length, L	6.05	m	19.85	ft
Width, W	4.46	m	14.62	ft
Side Water Depth, SWD	2.50	m	8.20	ft

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Table 9: Biological Parameters

Biological Design Summary	Design Value	Metric Unit	Design Value	US Unit
F:M ratio-aerobic	0.075	kg BOD/kg MLSS.d	0.075	lb BOD/lb MLSS.d
F:M ratio-aerobic	0.112	kg BOD/kg MLVSS.d	0.112	lb BOD/lb MLVSS.d
F:M ratio-overall	0.075	kg BOD/kg MLSS.d	0.075	lb BOD/lb MLSS.d
F:M ratio-overall	0.112	kg BOD/kg MLVSS.d	0.112	lb BOD/lb MLVSS.d
Organic Loading rate - Aerobic	1.48	kg COD/m^3.d	114.0	lb COD/1000 ft^3.d
Organic Loading rate - Aerobic	0.74	kg BOD/m^3.d	57.0	lb BOD/1000 ft^3.d
Organic Loading rate - Overall	1.48	kg COD/m^3.d	114.0	lb COD/1000 ft^3.d
Organic Loading rate - Overall	0.74	kg BOD/m^3.d	57.0	lb BOD/1000 ft^3.d
$HRT_{aerobic}$	11.9	h	91	% V/V_{Total}
$HRT_{membrane}$	1.1	h	9	% V/V_{Total}
HRT_{total}	**13.01**	**h**		
$HRT_{total, max day}$	**7.81**	**h**		
SRT_{total}	**15.0**	**d**		

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Table 10: Check Alkalinity

Check Alkalinity	Design Value	Metric Unit	Design Value	US Unit
Alkalinity in the feed water	300	mg/L as $CaCO_3$		
Amount of NH_4-N converted to NO_3-N	50	mg/L		
Effluent NO_3-N concentration	32.15	mg/L		
Residual alkilinity needed to maintain pH	80	mg/L as $CaCO_3$		
Alkalinity used for nitrification	233.11	mg/L as $CaCO_3$		
Alkalinity consumed by liquid alum	0.00	mg/L as $CaCO_3$		
Alkalinity produced	0.00	mg/L as $CaCO_3$		
Alkalinity needed	13.11	mg/L as $CaCO_3$		
Alkalinity needed	1.79	kg/day as $CaCO_3$	3.93	lb/d as $CaCO_3$
Chemical Selection	Sodium Hydroxide			
% by weight	50	%		
Density	1,530	kg/m^3	12.76	lb/gal
Daily caustic dosage (50%)	1.9	L/d	0.49	gpd

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Table 11: Aeration Requirement - Aeration Tank

Aeration Requirement in Aeration tank (Fine bubble)	Design Value	Metric Unit	Design Value	US Unit
BOD loading	54.50	kg/d	120.05	lb/d
TKN loading	6.81	kg/d	15.01	lb/d
TN in WAS	2.36	kg/d	5.21	lb/d
TP loading	1.36	kg/d	3.00	lb/d
S loading	0.00	kg/d	0.00	lb/d
Unit BOD oxygen demand	1.30	kg O_2/kg BOD	1.30	lb/lb
Unit nitrification oxygen demand	4.60	kg O_2/kg N	4.60	lb/lb
denitrification rate	0.00	%	0.00	lb/lb
Unit denitrification credit	-2.90	kg O_2/kg N	-2.90	lb/lb
Unit sulfide oxygen demand	2.00	kg O_2/kg S^{2-}	2.00	lb/lb
BOD oxygen requirement, R_1	70.86	kg O_2/d	156.07	lb O_2/d
Nitrification oxygen requirement, R_2	20.5	kg O_2/d	45.07	lb O_2/d
DeN oxygen credit, R_3	0.00	kg O_2/d	0.00	lb O_2/d
Sulfide oxygen requirement, R_4	0.00	kg O_2/d	0.00	lb O_2/d
Oxygen demand	91.32	kg O_2/d	201.14	lb O_2/d
Oxygen credit from membrane tanks	0.00	kg O_2/d	0.00	lb O_2/d
Design AOR for aeration tank	91.32	kg O_2/d	201.14	lb O_2/d
Alpha	0.50	-		
Beta	0.95	-		
Theta (Temp. correction)	1.02	-		
Tbasin, winter	10	°C	50	°F
Tbasin, summer	25	°C	77	°F
CsatT (surface sat DO at winter)	11.35	mg/L		
CsatT (surface sat DO at summer)	8.15	mg/L		
Effective depth correction factor	0.40	-		
Csat20	9.86	mg/L		
Target min operating DO	2.00	mg/L		
Psite	77.40	kPa	11.23	psi
SOR, winter	329.21	kg O_2/d	725.14	lb O_2/d
SOR, summer	361.79	kg O_2/d	796.90	lb O_2/d
AOR/SOR_{summer}	0.25	-		

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Aeration Requirement in Aeration tank (Fine bubble) (continued)	Design Value	Metric Unit	Design Value	US Unit
SWD	2.50	m	8.20	ft
SOTE at operating SWD	13.20	%		
Density of air	1.29	kg/m^3	0.01	lb/gal
% O2 in air	23.20	%		
	381.00	m^3/h		
Air Required	0.11	m^3/s		
Peaking Factor	1.50	-		
Design Air	532.36	Nm^3/h	336.1	scfm
Static headloss	21.6	kPa	3.13	psi
Minor loss	13.8	kPa	2.00	psi
Total headloss	35.4	kPa	5.14	psi

Table 12: AT Mixing Requirement

Aeration Tank Mixing Requirement	Design Value	Metric Unit	Design Value	US Unit
L or diam	6.05	m	19.85	ft
W	4.46	m	14.62	ft
SWD	2.50	m	8.20	ft
Area	27	m^2	290	ft2
Volume	67	m^3	17,814	gal
Number of aeration basins	1	-		-
Total AT volume	67	m^3	17,814	gal
Air supplied per area	0.24	m^3/min/m^2	1.16	scfm/ft^2
OUR avg	56	mg O_2/L.h	0.47	lb O_2/gal.h

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Table 13: Sludge Management

Design of Sludge Holding Tank	Design Value	Metric Unit	Design Value	US Unit
Thickened sludge wasting rate (2%)	1.97	m^3/d	2.58	yd^3/d
Required sludge storage volume, V	39.6	m^3	10,473	gal
Sludge storage with decanting (at 2%)	20	d		
Sludge storage without decanting (at 0.8%)	8	d		
Tank Geometry	Rectangular			
Number of Basins	1			
Volume / Basin	40	m^3	10,473	gal
Length, L	3.56	m	11.67	ft
Width, W	4.46	m	14.62	ft
Side Water Depth, SWD	2.50	m	8.20	ft
Area, S	15.86	m^2	170.59	ft^2
Mixing requirement	0.03	$m^3/min/m^3$	30.00	cfm/1000 ft3
Blower air flow rate	71.36	m^3/h		
	68.83	N m^3/h	43.47	scfm
Static headloss	21.38	kPa	3.10	psig
Minor loss	10.40	kPa	1.51	psig
Total headloss	31.78	kPa	4.61	psig

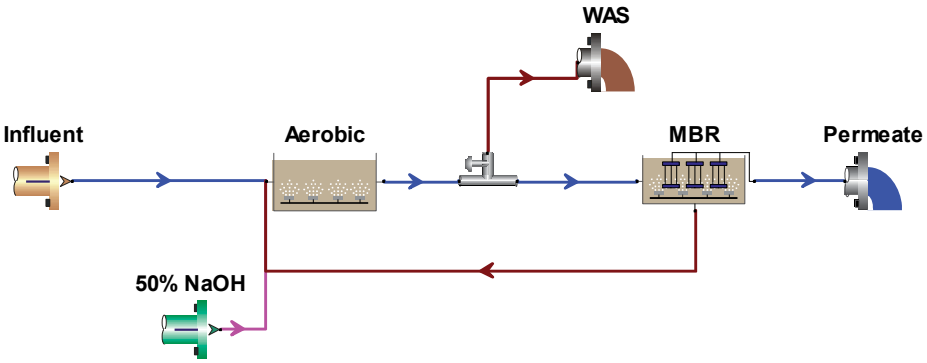
BioWin user and configuration data

Project details
Project name: Phippsburg **Project ref.: 2207814R1**

Saved: 6/29/2022

Steady state solution
SRT Ae+MBR: 14.99 days
Temperature: 10.0°C

Flowsheet



Configuration information for all Bioreactor units

Physical data

Element name	Volume [m3]	Area [m2]	Depth [m]	# of diffusers
Aerobic	67.4200	26.9680	2.500	54

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
Aerobic	2.0

Configuration information for all Bioreactor - MBR units

Physical data

Element name	Volume [m3]	Area [m2]	Depth [m]
MBR	7.0600	3.3619	2.100

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
MBR	Flow paced	400.00 %

Element name	Average Air flow rate [m3/hr (20C, 1 atm)]
MBR	110.0

Configuration information for all Influent - BOD units

Operating data Average (flow/time weighted as required)

Element name	Influent
Flow	136.26
BOD - Total Carbonaceous mgBOD/L	400.00
Volatile suspended solids mg/L	320.00
Total suspended solids mg/L	400.00
N - Total Kjeldahl Nitrogen mgN/L	50.00
P - Total P mgP/L	10.00
S - Total S mgS/L	0
N - Nitrate mgN/L	0
pH	7.00
Alkalinity mmol/L	6.00
Metal soluble - Calcium mg/L	80.00
Metal soluble - Magnesium mg/L	15.00

Gas - Dissolved oxygen mg/L	0

Element name	Influent
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.7425
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fcel - Cellulose fraction of unbiodegradable particulate [gCOD/gCOD]	0.5000
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
Fsr - Reduced sulfur [H2S] [gS/gS]	0.1500
FZbh - Ordinary heterotrophic COD fraction [gCOD/g of total COD]	0.0200
FZbm - Methylotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZao - Ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZno - Nitrite oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZaao - Anaerobic ammonia oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZppa - Phosphorus accumulating COD fraction [gCOD/g of total COD]	1.000E-4
FZpa - Propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZam - Acetoclastic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZhm - Hydrogenotrophic methanogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZso - Sulfur oxidizing COD fraction [gCOD/g of total COD]	1.000E-4
FZsrpa - Sulfur reducing propionic acetogenic COD fraction [gCOD/g of total COD]	1.000E-4
FZsra - Sulfur reducing acetotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZsrh - Sulfur reducing hydrogenotrophic COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
WAS	Flowrate [Side]	5.03066692084305

Configuration information for all Influent - State variable units

Operating data Average (flow/time weighted as required)

Element name	50% NaOH
Other Cations (strong bases) [meq/L]	19070.00
Flow	0.00187

BioWin Album

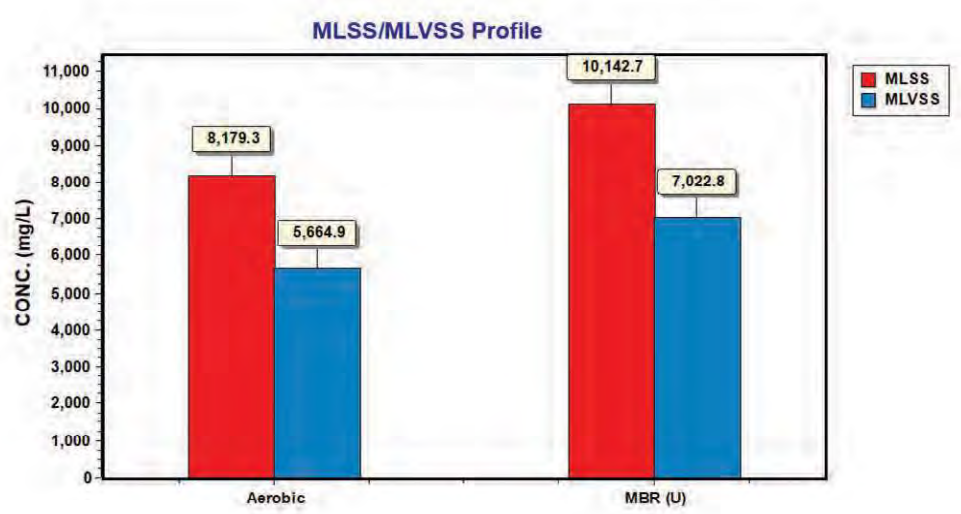
Album page - Summary

Elements	BOD - Total Carbonaceous [mg/L]	COD - Total [mg/L]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]
Influent	399.95	815.54	400.00	320.00
Aerobic	1970.42	8249.93	8179.32	5664.93
MBR	0.89	42.04	0	0
MBR (U)	2437.14	10214.92	10142.72	7022.83
Permeate	0.89	42.04	0	0

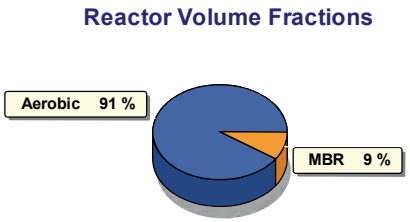
Album page - Influent

Elements	Flow [m3/d]	BOD - Total Carbonaceous [mg/L]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]	N - Total Kjeldahl Nitrogen [mgN/L]	P - Total P [mgP/L]	Alkalinity [mmol/L]	pH []
Influent	136.26	399.95	400.00	320.00	50.00	10.00	6.00	7.00

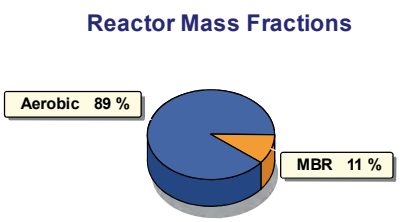
Album page - MLSS



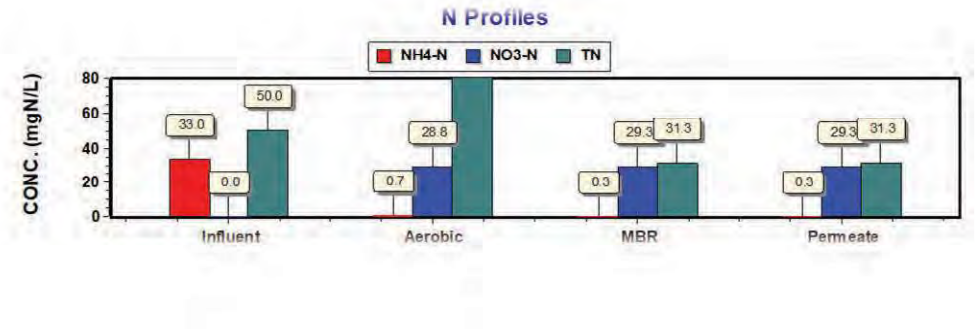
Album page - Fractions



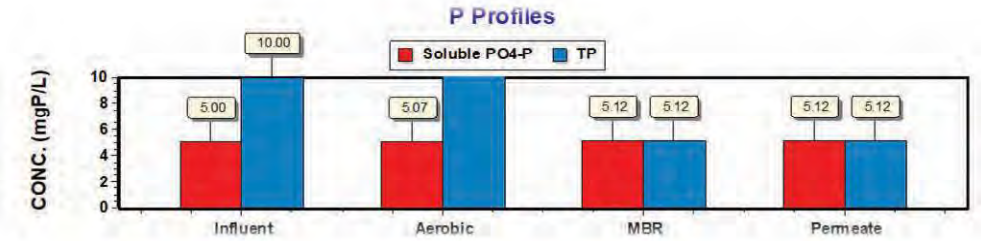
Album page - Fractions



Album page - N and P profiles



Album page - N and P profiles



Album page - Aerobic

Aerobic			
Parameters	Conc. (mg/L)	Mass rate (kg/d)	Notes
Alkalinity	1.93	1.32	mmol/L and kmol/d
BOD - Filtered Carbonaceous	1.48	1.01	
BOD - Total Carbonaceous	1970.42	1342.45	
COD - Filtered	43.03	29.32	
COD - Particulate	8206.90	5591.38	
COD - Total	8249.93	5620.69	
COD - Volatile fatty acids	0.02	0.01	
Influent inorganic suspended solids	2083.12	1419.23	
ISS cellular	430.56	293.34	
ISS precipitate	0	0	
ISS Total	2514.39	1713.06	
N - Ammonia	0.73	0.50	
N - Filtered TKN	2.34	1.60	
N - Nitrate	28.80	19.62	
N - Nitrite + Nitrate	28.97	19.74	
N - Particulate TKN	419.82	286.02	
N - Total inorganic N	29.70	20.24	
N - Total Kjeldahl Nitrogen	422.16	287.62	
N - Total N	451.13	307.36	
P - Phosphorus in HMO	0	0	
P - Soluble PO4-P	5.07	3.45	
P - Total P	137.38	93.60	
pH	6.59		
S - Total S	0.00	0.00	
Total aluminium (all forms)	0	0	
Total Calcium (all forms)	102.18	69.62	
Total iron (all forms)	0	0	
Total Magnesium (all forms)	34.82	23.72	
Total suspended solids	8179.32	5572.59	
Volatile suspended solids	5664.93	3859.53	

Album page - MBR tank

MBR			
Parameters	Conc. (mg/L)	Mass rate (kg/d)	Notes
Alkalinity	1.87	0.25	mmol/L and kmol/d
BOD - Filtered Carbonaceous	0.89	0.12	
BOD - Total Carbonaceous	0.89	0.12	
COD - Filtered	42.04	5.52	
COD - Particulate	0	0	

COD - Total	42.04	5.52
COD - Volatile fatty acids	0.00	0.00
Influent inorganic suspended solids	0	0
ISS cellular	0	0
ISS precipitate	0	0
ISS Total	0	0
N - Ammonia	0.33	0.04
N - Filtered TKN	1.91	0.25
N - Nitrate	29.35	3.85
N - Nitrite + Nitrate	29.42	3.86
N - Particulate TKN	0	0
N - Total inorganic N	29.75	3.90
N - Total Kjeldahl Nitrogen	1.91	0.25
N - Total N	31.33	4.11
P - Phosphorus in HMO	0	0
P - Soluble PO4-P	5.12	0.67
P - Total P	5.12	0.67
pH	6.65	
S - Total S	0.00	0.00
Total aluminium (all forms)	0	0
Total Calcium (all forms)	81.34	10.67
Total iron (all forms)	0	0
Total Magnesium (all forms)	14.51	1.90
Total suspended solids	0	0
Volatile suspended solids	0	0

APPENDIX O

FLUIDYNE ISAM SBR BROCHURE

ISAM™

INTEGRATED SURGE ANOXIC MIX

Proven Technology

FLUIDYNE'S ISAM™ IS A TOTAL TREATMENT SYSTEM

incorporating BOD, TSS and nitrogen removal along with sludge reduction in an integrated system. Raw (crude) sewage enters a covered anaerobic reactor for pretreatment, sludge thickening and sludge destruction. Complex organic solids undergo hydrolysis to simpler soluble organics which pass to the surge anoxic mix (SAM™) tank.

FLUIDYNE

The Experienced Leader in Wastewater Treatment Technology

fluidynecorp.com

319.266.9967

A TOTALLY NEW CONCEPT IN SBR DESIGN

FLUIDYNE ISAM™

In operation, all influent flow enters the anaerobic basin where influent solids are allowed to settle much like a primary clarifier. Elimination of primary solids in the anaerobic basin allows for much smaller SBR basins at equivalent SRT than conventional SBRs. The anaerobic selector also creates soluble carbon as a food source for biological nutrient removal through anaerobic conversion of settleable BOD to soluble BOD. The influent then flows to the SAM™ surge basin, or influent equalization basin. The surge basin provides flow and nutrient equalization to optimize treatment at the full range of flows and loadings.

100% ON-LINE STANDBY EQUIPMENT

Fluidyne's prepackaged ISAM SBRs are furnished with spare mixing/fill pump and aerator assembly installed for 100% redundancy.

REDUCES WASTE SLUDGE BY 75%

The Fluidyne ISAM™ Sequencing Batch Reactor incorporates an anaerobic selector chamber with the SAM™ SBR. The anaerobic selector not only provides consistent phosphorous removal by subjecting the recirculated biomass to anaerobic conditions, forcing the release of phosphorous, but also creates soluble carbon as a food source for phosphorous removal through anaerobic conversion of settleable BOD to soluble BOD. Additionally, anaerobic sludge digestion occurs in the anaerobic selector chamber, reducing waste solids production by up to 75% for the entire secondary process.

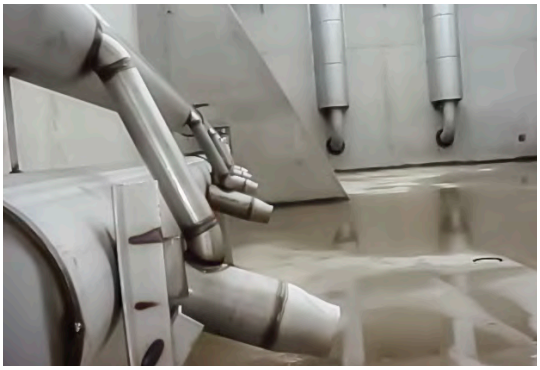
SEVERAL UNIQUE FEATURES

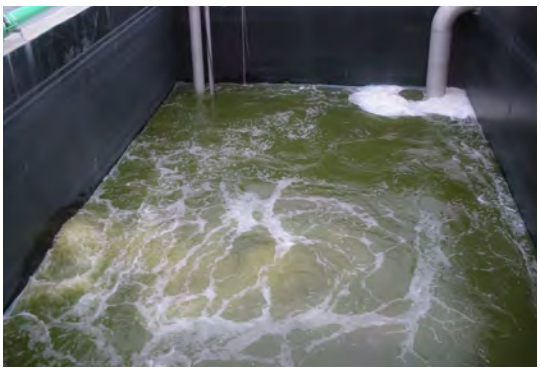
Several unique feature of the Fluidyne ISAM™ SBR include odor control and scum skimming. Mixed liquor is maintained in the SAM™ tank to immediately react with incoming flow from the anaerobic chamber to suppress odors and initiate and accelerate carbon and nitrogen reactions. Mixed liquor is recycled from the top of the SBR tank effectively removing scum by use of proprietary flow and scum control system. In addition, nitrates are recycled to the SAM™ tank for effective and rapid denitrification. Denitrification reactions are accelerated in the presence of the unreacted carbon from the raw sewage entering the SAM™ tank. Aeration and energy requirements are reduced as nitrates are fully reduced to nitrogen gas in the SAM™ tank.

EXPERIENCED LEADER IN
SEQUENCING BATCH REACTOR TECHNOLOGY

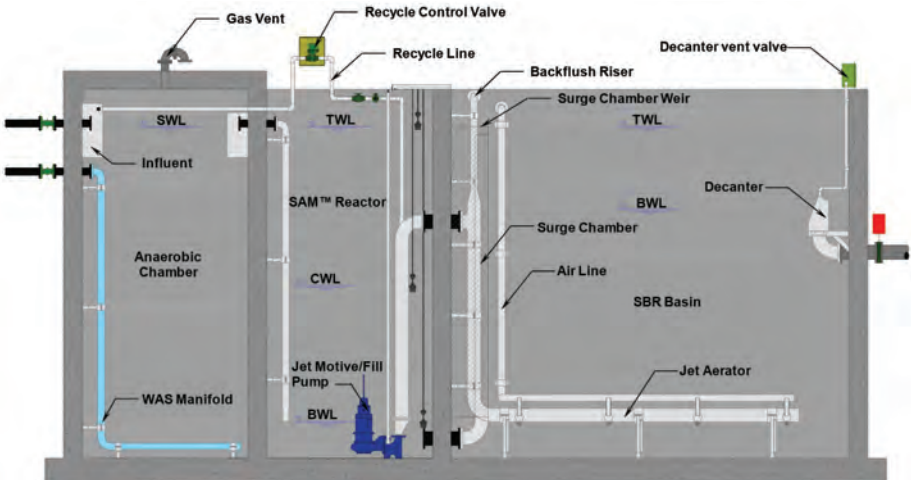
BENEFITS:

- Easy to operate and maintain
- Reduced operation and maintenance cost
- SBR basin has no moving parts that require maintenance.
- Power usage is controlled through the Fluidyne control panel
- Covered anaerobic selector chamber for odor control
- More flexible than continuous flow plants
- ISAM performs consistently regardless of influent flow changes
- Ability to handle highly variable flows and loading. Built in flow equalization is provided in the SAM™ reactor to handle peak hourly flows
- Built in sludge reduction system
- Aeration and mixing can automatically be adjusted to optimize power and prohibit filamentous growth
- Process utilizes quiescent settle and decant periods
- Small footprint with no digesters, secondary clarifiers,RAS piping and pumping
- Produces the highest quality effluent (Typical Fluidyne ISAM™ facilities are achieving less than 10 mg/L BOD5 and TSS, less than 1 mg/L NH3-N, less than 7 mg/L total N, and less than 2 mg/L phosphorus)
- Automatic scum skimming prior to effluent discharge provides highest quality effluent
- Easily expandable by adding additional flow trains



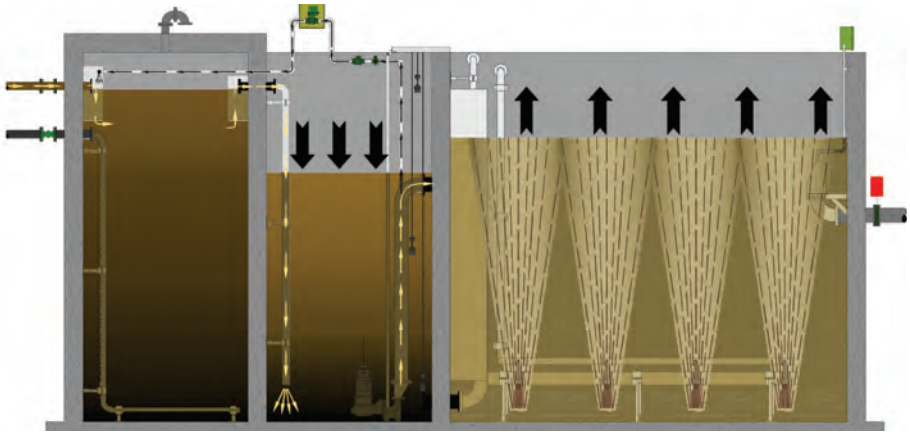


System Components:



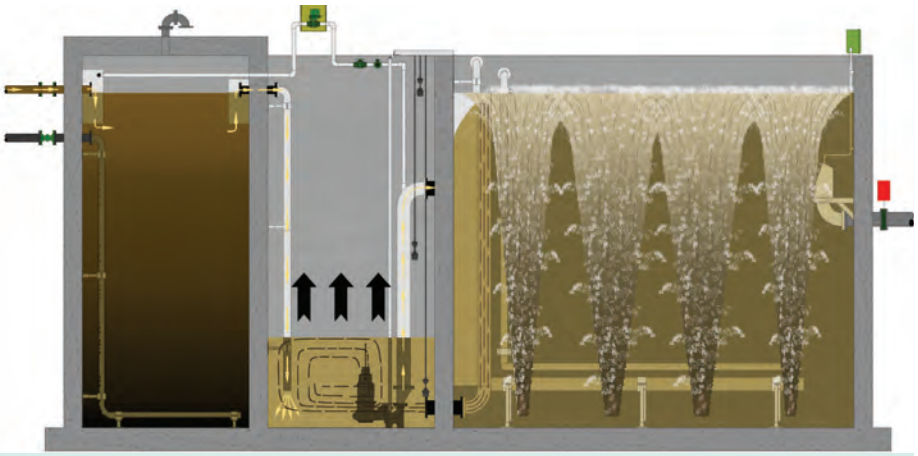
Influent continuously enters the anaerobic chamber where solids settle. Settleable BOD is converted to soluble BOD. BOD is reduced by 30% and solids are reduced by 60%. The influent then flows to the SAM™ reactor. Mixed liquor is maintained in the SAM™ reactor to suppress orders and initiate and accelerate carbon and nitrogen reduction.

Fill Phase:

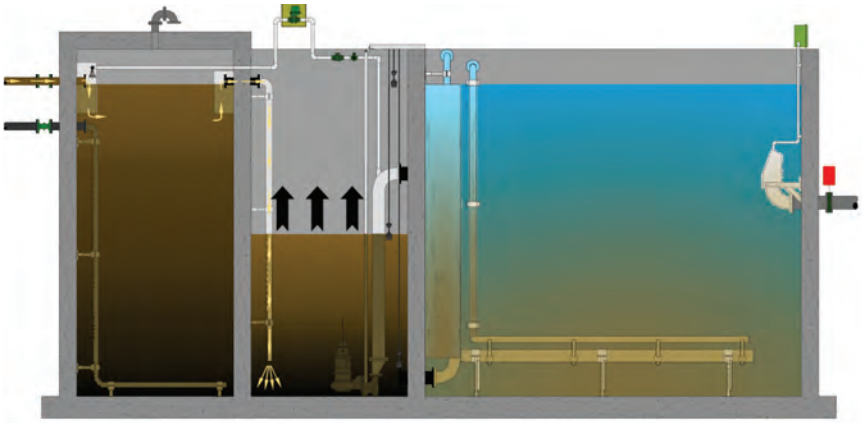


When the level in the SAM™ reactor reaches a predetermined “control level” the motive liquid pump is started. The SBR basin is filled and mixed. A percentage of the pumped flow is returned to the anaerobic chamber where biological solid settle. Settled solids in the anaerobic chamber are digested.

Interact Phase:

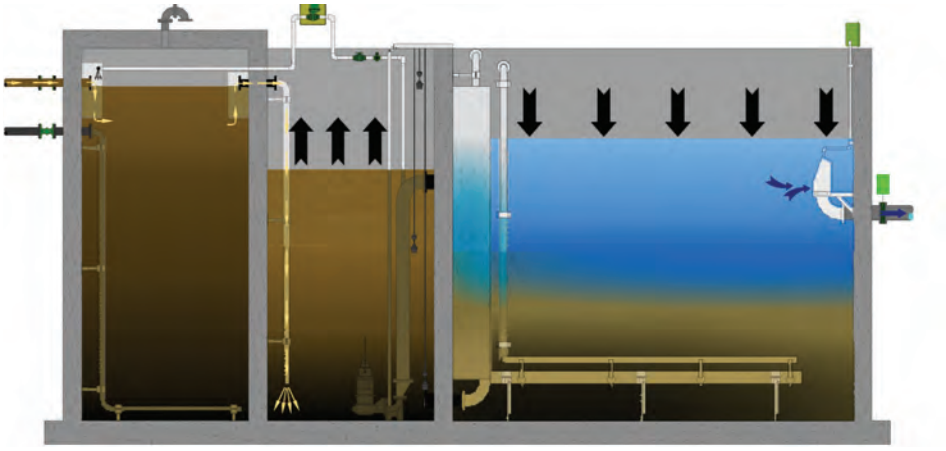


When the level in the SBR reaches TWL, nitrified mixed liquor overflows the surge chamber weir and is returned to the SAM™ chamber to mix and react with the raw influent. Aeration is cycled on and off to provide the required oxygen. Denitrification is reliable and complete. Scum is also removed from the SBR basin.



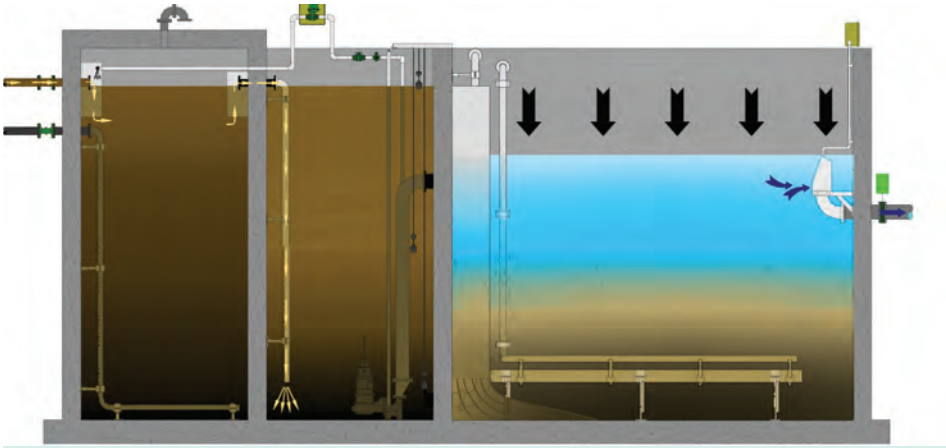
Settle Phase:

When the level in the SAM™ reactor again reaches “control level” aeration is discontinued and the SBR basin settles under perfect quiescent conditions.



Decant Phase:

When the settle timer expires, the decant valve is open and treated effluent is withdrawn from the upper portion of the SBR basin by means of a fixed solids excluding decanter.



Filled Decant Phase:

If, during peak flow events, the SAM™ reactor reaches TWL before the decant phase ends, influent flows in a reverse direction through the surge return line and overflows the surge chamber secondary weir and is diffused into the settled sludge at very low velocity as the decant phase continues.

FLUIDYNE

THE EXPERIENCED LEADER IN WASTEWATER TREATMENT TECHNOLOGY

THE EXPERIENCED LEADER IN WASTEWATER TREATMENT TECHOLOGY

FLUIDYNE CORPORATION

5436 Nordic Drive, Suite D
Cedar Falls, IA 50613

319.266.9967

fax: 319.277.6034
fluidyne@fluidynecorp.com

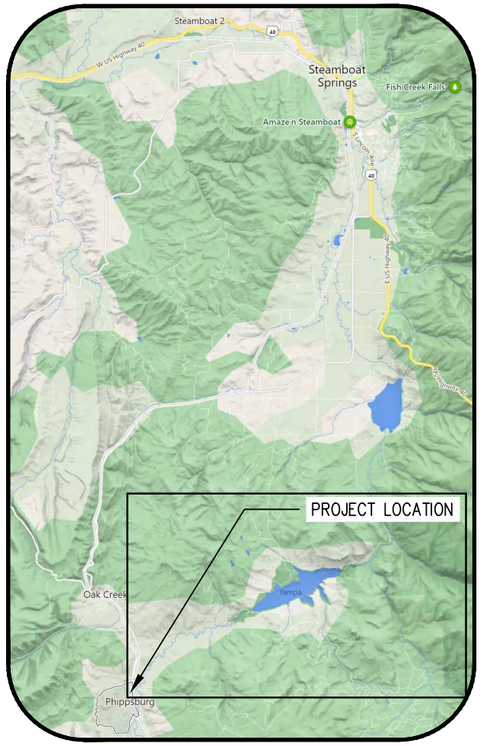
FLUIDYNECORP.COM

APPENDIX P

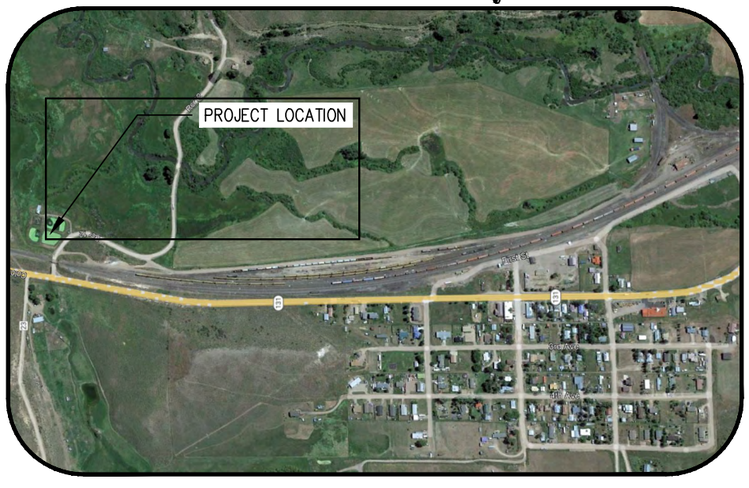
PRELIMINARY ENGINEERING DRAWINGS

COMMUNITY OF PHIPPSBURG
WASTEWATER TREATMENT IMPROVEMENT PROJECT
PRELIMINARY DRAWINGS
AUGUST 2022

SHEET LIST TABLE	
SHEET NUMBER	SHEET TITLE
1	COVER SHEET
2	SITE PLAN
3	PROCESS FLOW DIAGRAM
4	HYDRAULIC PROFILE



LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

AquaWorks DBO INC
DESIGN BUILD OPERATE
3252 WILLIAMS STREET | DENVER
COLORADO | 80205 | (303) 477-5915

REV. No:	DATE:	BY:	REVISION DESCRIPTION:

DRAWN BY: AS
DESIGNED BY: AS
FILE PRINTED ON: 8/15/2022 9:46:40 AM
COPYRIGHT: AQUAWORKS DBO, INC.
0 1 IF THIS BAR DOES NOT READ 1" DRAWING IS NOT LABELED TO SCALE

AquaWorks DBO INC
DESIGN BUILD OPERATE

PROJECT: WWTP IMPROVEMENT PROJECT
COMMUNITY OF PHIPPSBURG
ROUTT COUNTY, COLORADO

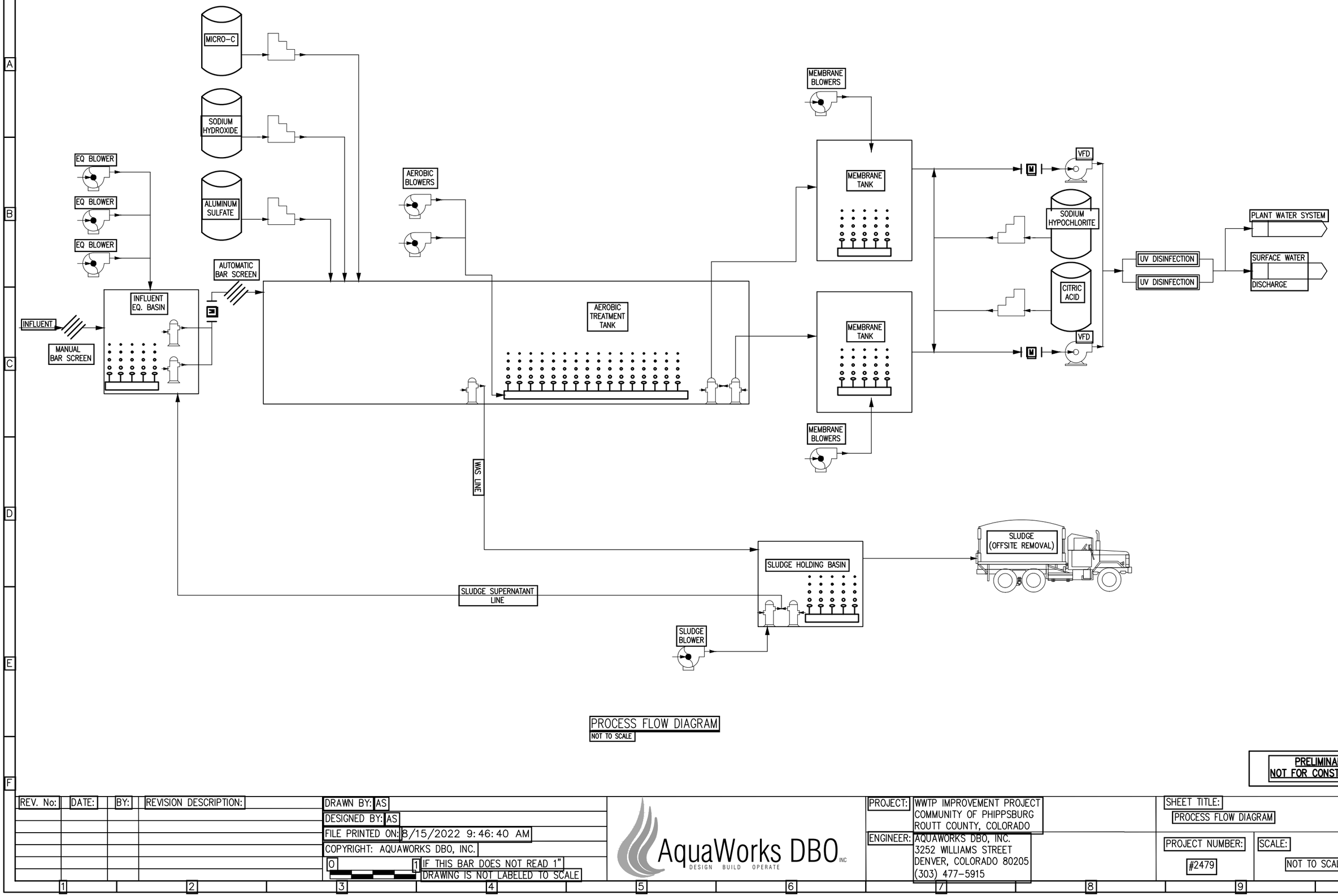
ENGINEER: AQUAWORKS DBO, INC.
3252 WILLIAMS STREET
DENVER, COLORADO 80205
(303) 477-5915

SHEET TITLE: SITE PLAN

PROJECT NUMBER: #2479

SCALE: 1" = 50'

SHEET: 2



PROCESS FLOW DIAGRAM
NOT TO SCALE

PRELIMINARY
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AquaWorks DBO INC
DESIGN BUILD OPERATE

PROJECT: WWTP IMPROVEMENT PROJECT
COMMUNITY OF PHIPPSBURG
ROUTT COUNTY, COLORADO

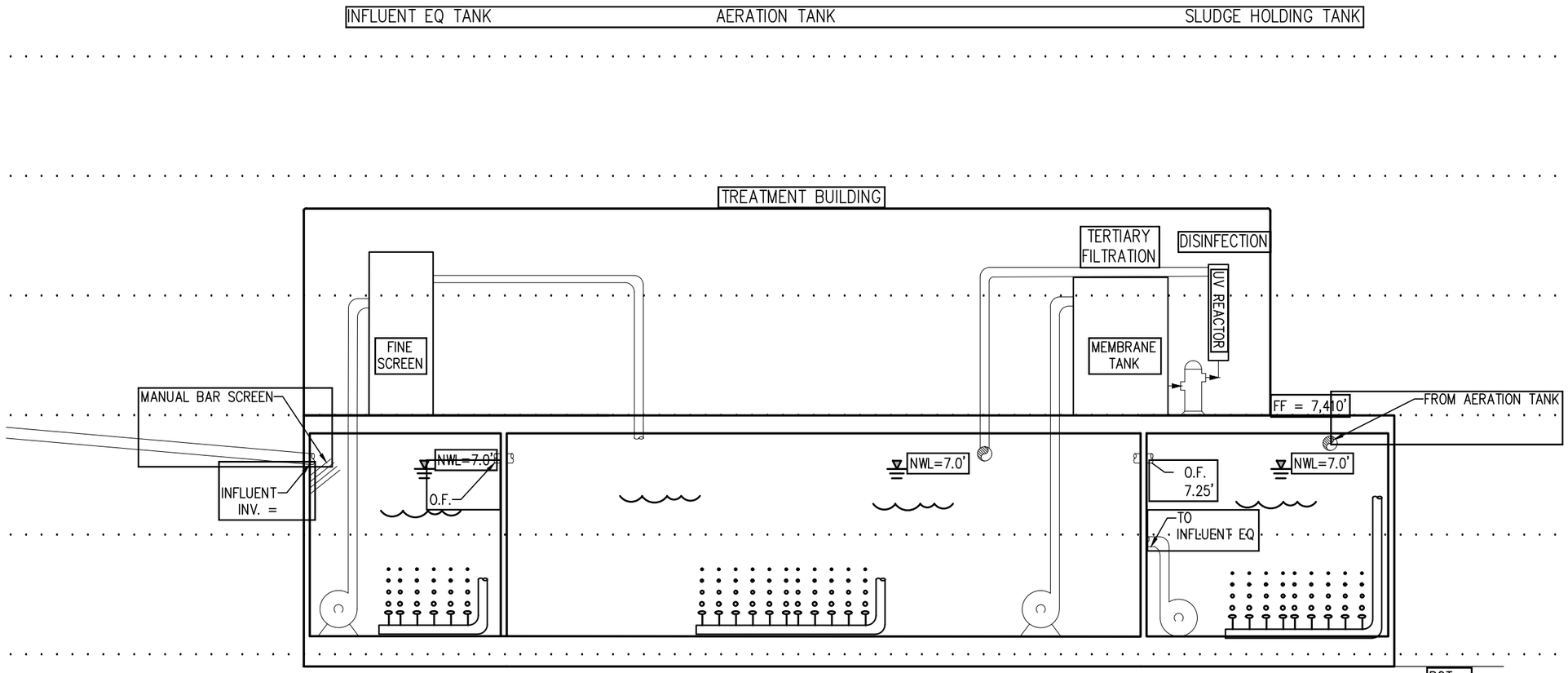
ENGINEER: AQUAWORKS DBO, INC.
3252 WILLIAMS STREET
DENVER, COLORADO 80205
(303) 477-5915

SHEET TITLE: PROCESS FLOW DIAGRAM

PROJECT NUMBER: #2479

SCALE: NOT TO SCALE

SHEET: 3



HYDRAULIC PROFILE
NOT TO SCALE

PRELIMINARY
NOT FOR CONSTRUCTION

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FILE PRINTED ON: 8/15/2022 9:46:40 AM

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AquaWorks DBO INC
DESIGN BUILD OPERATE

PROJECT: WWTP IMPROVEMENT PROJECT
COMMUNITY OF PHIPPSBURG
ROUTT COUNTY, COLORADO

ENGINEER: AQUAWORKS DBO, INC.
3252 WILLIAMS STREET
DENVER, COLORADO 80205
(303) 477-5915

SHEET TITLE: HYDRAULIC PROFILE

PROJECT NUMBER: #2479
SCALE: NOT TO SCALE
SHEET: 4

APPENDIX Q

SOLAR STUDY

Routt County PV Study 2022

Communities of Milner & Phippsburg
Wastewater Treatment Plants

STRAIGHTEDGE
The Connecting Line Between Design / Build
14526 W. 57th Place Arvada, CO 303-403-0531

William Brunner P.E.
Straightedge, Inc.
bill@str8edge.com

Electrical Solar PV Study Table of Contents

I. Study Executive Summary:

The goal for the Routt County Solar PV system is to offset Yampa Valley Electric utility costs for the wastewater plants in Milner and Phippsburg. The system study size and production are based on the YVEA maximum input for their net metering program, which is capped at 120% of present electrical consumption. From the YVEA and Colorado State information, the projects do not qualify for a solar energy rebate or tax deduction for the installation. The open market for renewable energy credits (RECs) might be an option to enter into a power purchase agreement (PPA) with a third-party aggregator, thereby altering the payback analysis we included in the study. Prior PPA projects we have worked on for Xcel Energy are typically 10-100 times as large as this project, so we are unsure of this opportunity.

The PV system design and cost opinions in the study are straightforward and can be reviewed by others. On the critical calculation of the cost and possible payback of the PV systems, we believe that it will be approximately 20 years each to recover the initial capital outlay. The life of the PV System components will be at or near their end in these scenarios and require the recycling and replacement of panels and parts. These projects make sense if the County can sell RECs to offset the initial costs of the installation. If RECs are unavailable, we would not recommend installing the PV systems from a cost and maintenance standpoint.

II. Analysis of Existing Plant Energy Usage and YVEA Data

A. YVEA PV Solar Standards, Procedures & Rates.
B. YVEA Milner Energy Usage 2021.
C. YVEA Phippsburg Energy Usage 2021.
D. Future Plant Energy Usage.

A. YVEA PV Solar Standards, Procedures & Rates

Qualifying Facility Energy System

The system size limits are set by the type of service the member now has or would qualify for with new construction. A medium or large service is allowed a system that is capable of producing up to 120% of the member's annual usage or 150 kW, whichever is less. The proposed PV design for each facility is under 120% of the yearly usage tables in this section.

Net Metering of PV System:

From the YVEA standards, net-metering is the process whereby energy usage and generation is resolved. This is an automated process through YVEA's revenue meters. For any generation above a given month's usage, the Producer will retain a credit and this credit will be applied to their next months bill. At the end of the calendar year, the Producer will be paid at the current rate for any generation above their usage of the previous year.

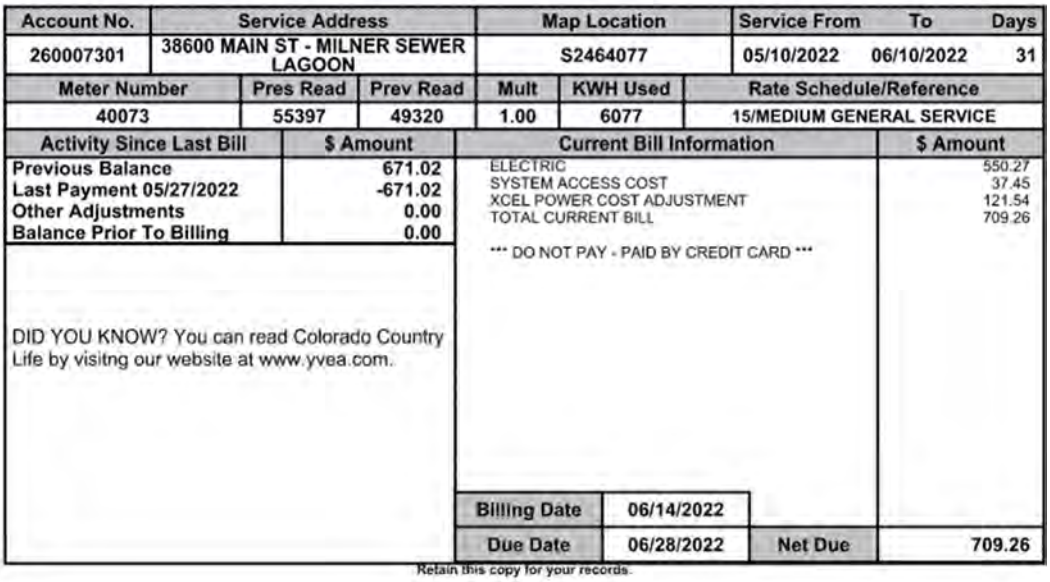
Since the PV can produce energy above the usage level, the generated kWh above the usage would be credited at “rate 50” which is $0.033 per generated kWh above that which was used during a calendar year.

B. YVEA Milner Energy Usage 2021.

The table below shows the past 12 months of energy usage for the Milner site:

Milner Lagoon/Sewer			
YVEA Account #	260007301		
Energy Consumption Period	Usage kWH (kiloWattHours)	Cost	Avg Daily kWH
May-21	5,773	522.75	186
Jun-21	5,657	512.24	189
Jul-21	5,862	530.8	189
Aug-21	4,690	424.68	151
Sep-21	3,685	333.68	123
Oct-21	4,773	432.2	154
Nov-21	6,420	581.33	214
Dec-21	4,306	389.91	139
Jan-22	4,019	363.92	130
Feb-22	6,114	553.62	218
Mar-22	6,173	602.18	199
Apr-22	6,301	633.57	210
12 Month Avg Totals	63,773	5,880.88	175
YVEA 120% Maximum	76,528		
Maximum Size PV	76.53		

The current electric bill for Milner is below:



Account No.	Service Address	Map Location	Service From	To	Days
260007301	38600 MAIN ST - MILNER SEWER LAGOON	S2464077	05/10/2022	06/10/2022	31

Meter Number	Pres Read	Prev Read	Mult	KWH Used	Rate Schedule/Reference
40073	55397	49320	1.00	6077	15/MEDIUM GENERAL SERVICE

Activity Since Last Bill	$ Amount
Previous Balance	671.02
Last Payment 05/27/2022	-671.02
Other Adjustments	0.00
Balance Prior To Billing	0.00

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Current Bill Information	$ Amount
ELECTRIC	550.27
SYSTEM ACCESS COST	37.45
XCEL POWER COST ADJUSTMENT	121.54
TOTAL CURRENT BILL	709.26

*** DO NOT PAY - PAID BY CREDIT CARD ***

Billing Date	06/14/2022		
Due Date	06/28/2022	Net Due	709.26

Retain this copy for your records.

Notes from the typical bill:

- There are no demand charges for this facility which are charged separately to supply peak power to the facility and will not be reduced by PV System.
- The system access cost and Xcel power cost adjustment could remain a charge even if the PV system supplies all of the electricity for the month.

C. YVEA Phippsburg Energy Usage 2021.

The table below shows the past 12 months of energy usage for the Phippsburg site:

Phippsburg Sewer Plant			
YVEA Account #	10067601		
Energy Consumption Period	Usage kWH (kiloWattHours)	Cost	Avg Daily kWH
May-21	7,536	682.38	243
Jun-21	8,640	782.35	288
Jul-21	8,256	747.58	266
Aug-21	8,640	782.35	279
Sep-21	7,536	682.38	251
Oct-21	7,632	691.08	246
Nov-21	9,600	869.28	320
Dec-21	2,832	256.44	91
Jan-22	4,464	404.22	144
Feb-22	4,800	434.64	171
Mar-22	3,264	318.41	105
Apr-22	3,840	386.11	128
12 Month Totals	77,040	7,037.22	211
YVEA 120% Maximum	92,448		
Maximum Size PV	92.45		

The current electric bill for Phippsburg is below:

Account No.	Service Address		Map Location		Service From	To	Days
10067601	SEWER PBURG		S29409005		05/06/2022	06/07/2022	32
Meter Number	**Pres Read**	**Prev Read**	**Mult**	**KWH Used**	**Rate Schedule/Reference**		
47153	10119	10016	48.00	4944	15/MEDIUM GENERAL SERVICE		

Activity Since Last Bill	$ Amount
Previous Balance	423.56
Last Payment 05/25/2022	-423.56
Other Adjustments	0.00
Balance Prior To Billing	0.00

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Current Bill Information	$ Amount
ELECTRIC	447.68
SYSTEM ACCESS COST	37.45
XCEL POWER COST ADJUSTMENT	98.88
TOTAL CURRENT BILL	584.01

*** DO NOT PAY - PAID BY CREDIT CARD ***

Billing Date	06/09/2022		
Due Date	06/23/2022	Net Due	584.01

Retain this copy for your records.

It appears that the electric rate per kHW from YVEA now stands at approximately @ $.11.

D. Future Plant Energy Usage and Rates

Future Plant Usage Based on Newterra Replacement System

The following energy usage is from Newterra for each site:

2207813 – Milner
15,000 GPD – 167 kWh/day
32,500 GPD – 261 kWh/day

2207814 - Phippsburg
10,000 GPD – 149 kWh/day
30,000 GPD – 286 kWh/day
Note, does not include power for HVAC

At the low GPD numbers above, the PV system will produce more than the original design values of 120%, and excess energy above usage will be credited at $.033 per kWh compared to offsetting the $.11 per kWh rate. As the daily GPD increases over time, the PV credit will be larger.

III. Solar PV Production Calculations and Design.

A. PVsys Site Calculations for Milner Plant.
B. PVsys Site Calculations for Phippsburg Plant.
C. PV System Design for Milner Plant.
D. PV System Design for Phippsburg Plant.

A. PVsys Site Calculations for Milner Plant.

Basis of Design

We determined the following PV system design made the most sense for the facilities that are remote from significant PV installation markets:

1. The PV system will be fixed tilt with a south-facing array layout.
2. The PV modules will be mid-range wattage and presently available in the marketplace.
3. The inverters will be standard wattage and available in the US
4. The system will include DC optimizers to allow the capture of the most solar energy.
5. The modules will sit on fixed racking with concrete precast ballast blocks for support.

Milner Site Calculations with PVSys:

The following report is from the industry-standard PVSys software version 7.2:

Version 7.2.16

PVsyst - Simulation report

Grid-Connected System

Project: Routt Milner

Variant: New simulation variant

No 3D scene defined, no shadings

System power: 40.6 kWp

Milner - United States

Author

PVsyst V7.2.16
VC0, Simulation date:
02/07/22 14:43
with v7.2.16

Project summary

Geographical Site
Milner
United States

Situation

Latitude	40.48 °N
Longitude	-107.02 °W
Altitude	1976 m
Time zone	UTC-7

Project settings
Albedo 0.20

Meteo data
Phippsburg
Meteonorm 8.0 (1999-2015), Sat=94% - Synthetic

System summary

Grid-Connected System

No 3D scene defined, no shadings

PV Field Orientation
Fixed plane
Tilt/Azimuth 30 / 0 °

Near Shadings
No Shadings

User's needs
Unlimited load (grid)

System information

PV Array		Inverters	
Nb. of modules	104 units	Nb. of units	2 units
Pnom total	40.6 kWp	Pnom total	40.2 kWac
		Pnom ratio	1.009

Results summary

Produced Energy	72.97 MWh/year	Specific production	1799 kWh/kWp/year	Perf. Ratio PR	89.89 %

Table of contents

General parameters

Grid-Connected System — **No 3D scene defined, no shadings**

PV Field Orientation

Orientation		Sheds configuration	Models used	
Fixed plane		No 3D scene defined	Transposition	Perez
Tilt/Azimuth	30 / 0 °		Diffuse	Perez, Meteonorm
			Circumsolar	separate

Horizon
Free Horizon

Near Shadings
No Shadings

User's needs
Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	Generic
Model	Q.Peak-Duo-L-G5.2-390
(Original PVsyst database)	
Unit Nom. Power	390 Wp
Number of PV modules	104 units
Nominal (STC)	40.6 kWp
Optimizer Array	4 Strings x 26 In series
At operating cond. (50°C)	
Pmpp	36.9 kWp
Output of optimizers	
Voper	750 V
I at Poper	49 A

Inverter

Manufacturer	Generic
Model	SE20.1K-BRA (380/220V)
(Original PVsyst database)	
Unit Nom. Power	20.1 kWac
Number of inverters	2 units
Total power	40.2 kWac
Operating voltage	750 V
Pnom ratio (DC:AC)	1.06

SolarEdge Power Optimizer

Model	P601 Worldwide
Unit Nom. Power	600 W
Input modules	One module

Total PV power

Nominal (STC)	41 kWp
Total	104 modules
Module area	210 m²

Total inverter power

Total power	40.2 kWac
Number of inverters	2 units
Pnom ratio	1.01

Array losses

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 20.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 208 mΩ
Loss Fraction 1.5 % at STC

Module Quality Loss
Loss Fraction -0.8 %

Module mismatch losses
Loss Fraction (Fixed voltage) 0.0 %

IAM loss factor
Incidence effect (IAM): Fresnel, AR coating, n(glass)=1.526, n(AR)=1.290

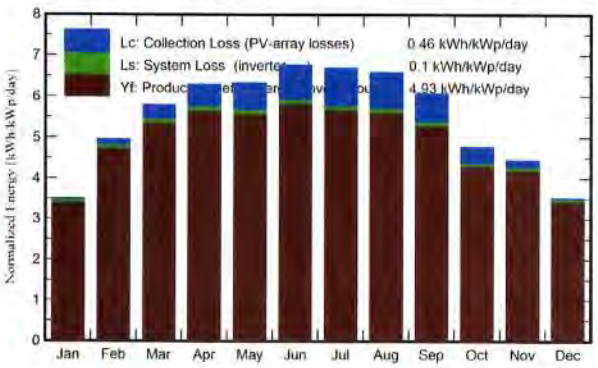
0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.962	0.892	0.816	0.681	0.440	0.000

Main results

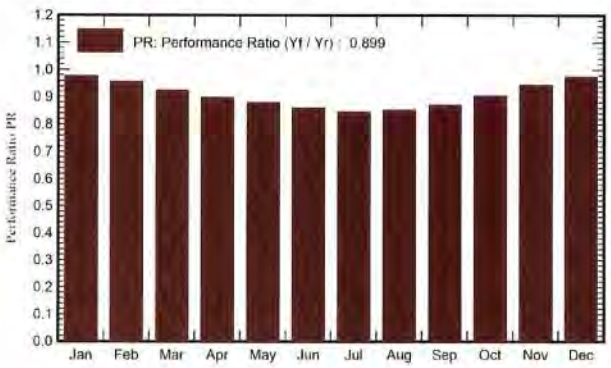
System Production

Produced Energy	72.97 MWh/year	Specific production	1799 kWh/kWp/year
		Performance Ratio PR	89.89 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

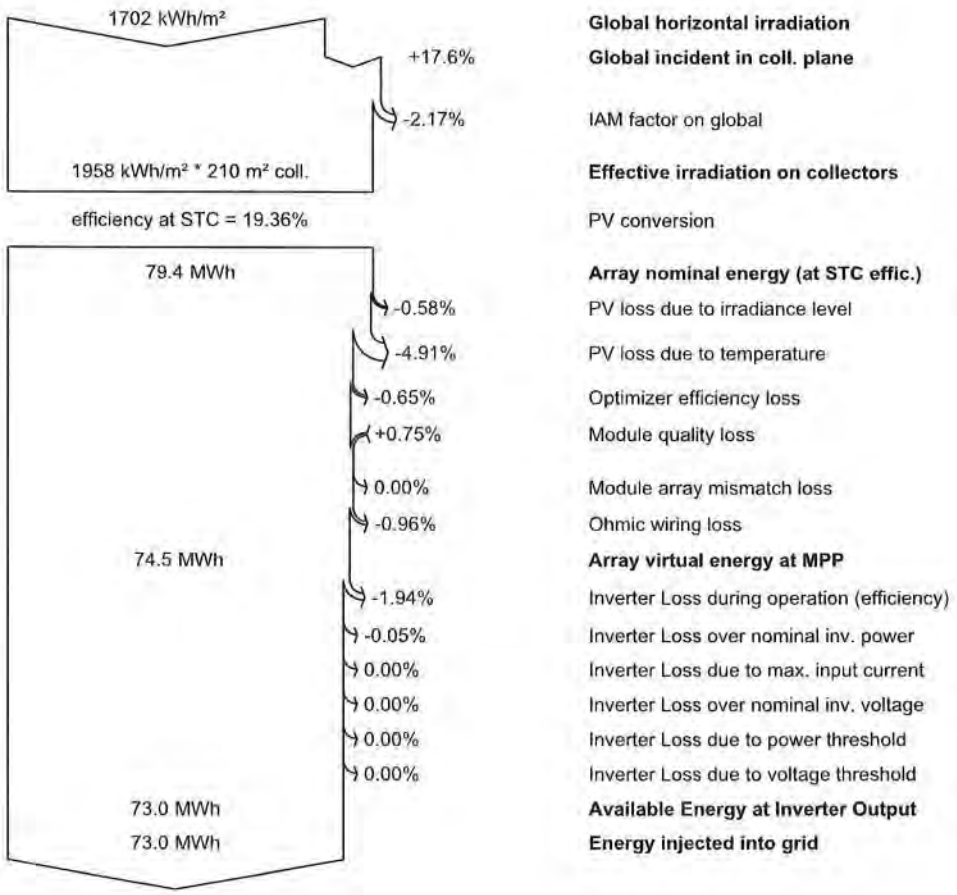
	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	65.4	27.22	-7.29	108.6	106.7	4.389	4.304	0.977
February	92.3	27.65	-5.47	138.8	136.7	5.497	5.392	0.958
March	140.8	47.82	-0.28	179.7	176.0	6.878	6.745	0.926
April	172.2	53.08	5.64	189.1	184.4	7.030	6.893	0.899
May	199.3	67.03	10.61	196.8	191.7	7.157	7.016	0.879
June	216.7	65.83	15.85	203.4	198.2	7.233	7.092	0.860
July	216.4	72.84	20.68	208.0	202.9	7.289	7.147	0.847
August	195.1	64.65	18.92	204.2	199.2	7.201	7.062	0.853
September	152.4	45.72	13.27	182.3	178.2	6.571	6.444	0.872
October	108.7	41.09	6.82	148.1	145.3	5.540	5.432	0.905
November	80.6	27.30	-1.00	133.5	131.3	5.224	5.124	0.946
December	62.5	24.90	-6.63	109.3	107.5	4.407	4.323	0.975
Year	1702.4	565.11	5.99	2001.6	1958.2	74.416	72.974	0.899

Legends

GlobHor	Global horizontal irradiation	EArray	Effective energy at the output of the array
DiffHor	Horizontal diffuse irradiation	E_Grid	Energy injected into grid
T_Amb	Ambient Temperature	PR	Performance Ratio
GlobInc	Global incident in coll. plane		
GlobEff	Effective Global, corr. for IAM and shadings		

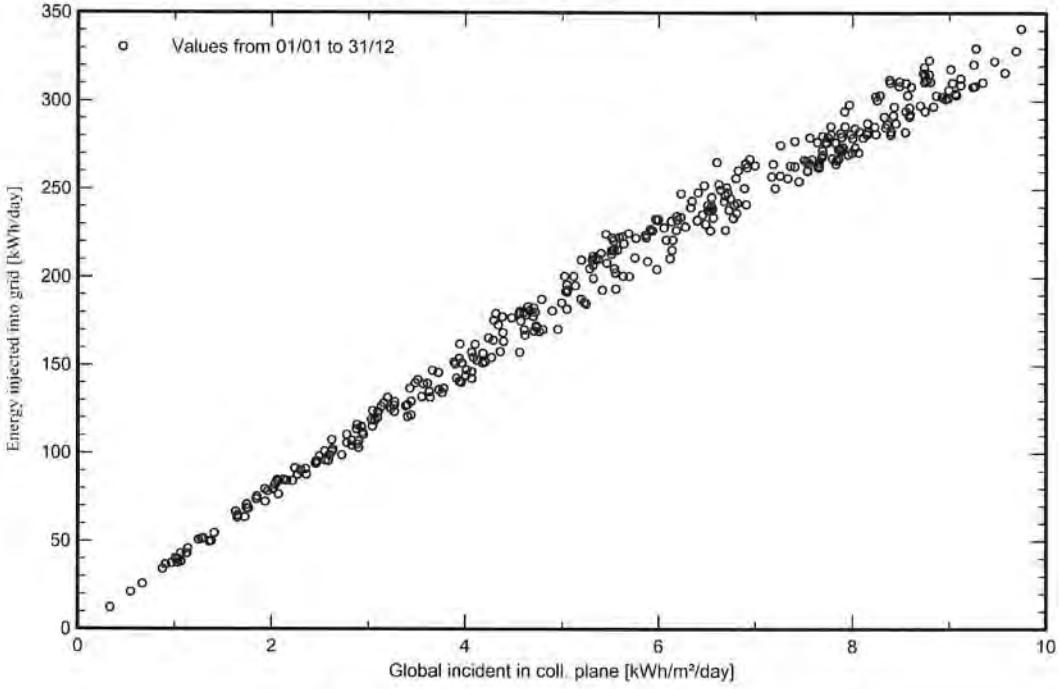
PVsyst V7.2.16
VC0, Simulation date:
02/07/22 14:43
with v7.2.16

Loss diagram

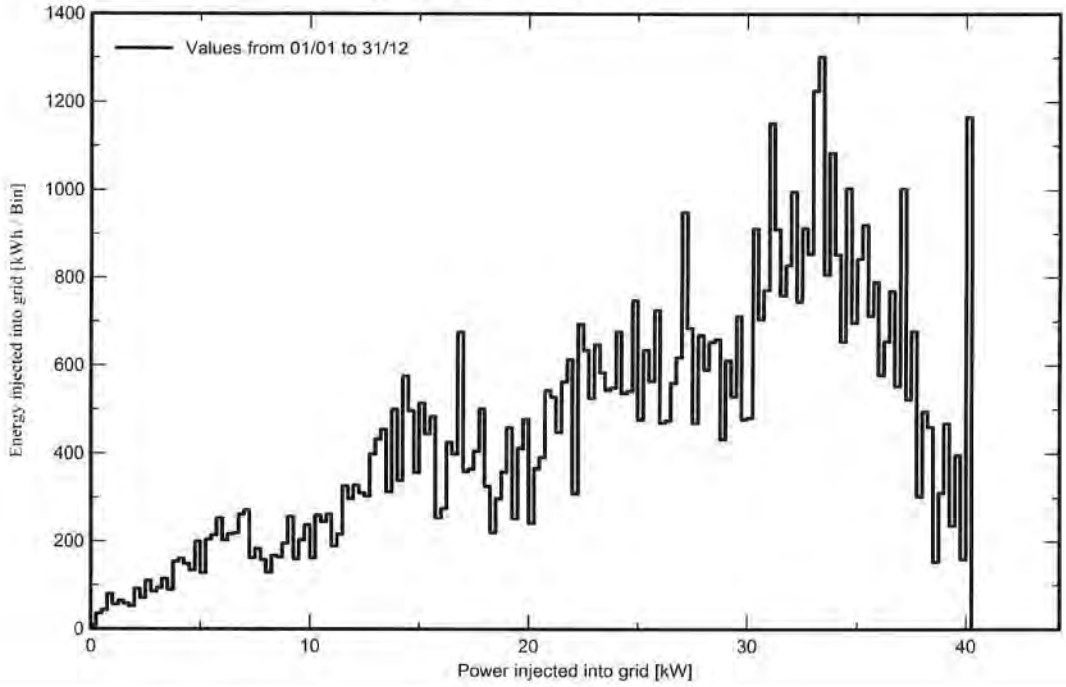


Special graphs

Daily Input/Output diagram



System Output Power Distribution



B. PVsys Site Calculations for Phippsburg Plant.

Phippsburg Site Calculations with PVSys:

Version 7.2.16

PVsyst - Simulation report

Grid-Connected System

Project: Routt Phippsburg

Variant: New simulation variant

No 3D scene defined, no shadings

System power: 48.4 kWp

Phippsburg - United States

Author

PVsyst V7.2.16
VC0, Simulation date:
02/07/22 11:25
with v7.2.16

Project summary

Geographical Site
Phippsburg
United States

Situation

Latitude	40.23 °N
Longitude	-106.94 °W
Altitude	2265 m
Time zone	UTC-7

Project settings
Albedo 0.20

Meteo data
Phippsburg
Meteonorm 8.0 (1999-2015), Sat=87% - Synthetic

System summary

Grid-Connected System

No 3D scene defined, no shadings

PV Field Orientation
Fixed plane
Tilt/Azimuth 30 / 0 °

Near Shadings
No Shadings

User's needs
Unlimited load (grid)

System information

PV Array		Inverters	
Nb. of modules	124 units	Nb. of units	2 units
Pnom total	48.4 kWp	Pnom total	66.6 kWac
		Pnom ratio	0.726

Results summary

Produced Energy	87.94 MWh/year	Specific production	1819 kWh/kWp/year	Perf. Ratio PR	89.21 %

Table of contents

General parameters

Grid-Connected System — **No 3D scene defined, no shadings**

PV Field Orientation

Orientation		Sheds configuration	Models used	
Fixed plane		No 3D scene defined	Transposition	Perez
Tilt/Azimuth	30 / 0 °		Diffuse	Perez, Meteonorm
			Circumsolar	separate

Horizon
Free Horizon

Near Shadings
No Shadings

User's needs
Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	Generic
Model	Q.Peak-Duo-L-G5.2-390
(Original PVsyst database)	
Unit Nom. Power	390 Wp
Number of PV modules	124 units
Nominal (STC)	48.4 kWp
Optimizer Array	4 Strings x 31 In series
At operating cond. (50°C)	
Pmpp	44.0 kWp
Output of optimizers	
Voper	710 V
I at Poper	62 A

Inverter

Manufacturer	Generic
Model	SE100K-JP Unit (400V)
(Original PVsyst database)	
Unit Nom. Power	33.3 kWac
Number of inverters	2 units
Total power	66.6 kWac
Operating voltage	710 V
Pnom ratio (DC:AC)	0.77

SolarEdge Power Optimizer

Model	P601 Worldwide
Unit Nom. Power	600 W
Input modules	One module

Physical inverters

SE100K-JP Unit (400V)
Inverter #1 with 3 strings
3 strings of 31 optimizers P601 Worldwide
SE100K-JP Unit (400V)
Inverter #2 with one string
1 strings of 31 optimizers P601 Worldwide

Total PV power

Nominal (STC)	48 kWp
Total	124 modules
Module area	250 m²

Total inverter power

Total power	66.6 kWac
Number of inverters	2 units
Pnom ratio	0.73

Array losses

Thermal Loss factor
Module temperature according to irradiance

Uc (const)	20.0 W/m²K
Uv (wind)	0.0 W/m²K/m/s

DC wiring losses

Global array res.	156 mΩ
Loss Fraction	1.5 % at STC

Module Quality Loss
Loss Fraction -0.8 %

Module mismatch losses
Loss Fraction (Fixed voltage) 0.0 %

Array losses

IAM loss factor

Incidence effect (IAM): Fresnel, AR coating, n(glass)=1.526, n(AR)=1.290

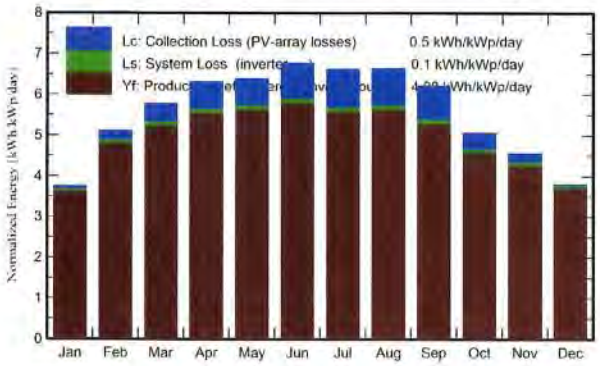
0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.962	0.892	0.816	0.681	0.440	0.000

Main results

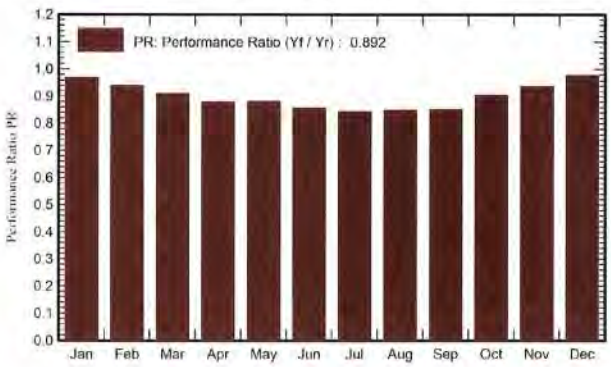
System Production

Produced Energy	87.94 MWh/year	Specific production	1819 kWh/kWp/year
		Performance Ratio PR	89.21 %

Normalized productions (per installed kWp)



Performance Ratio PR



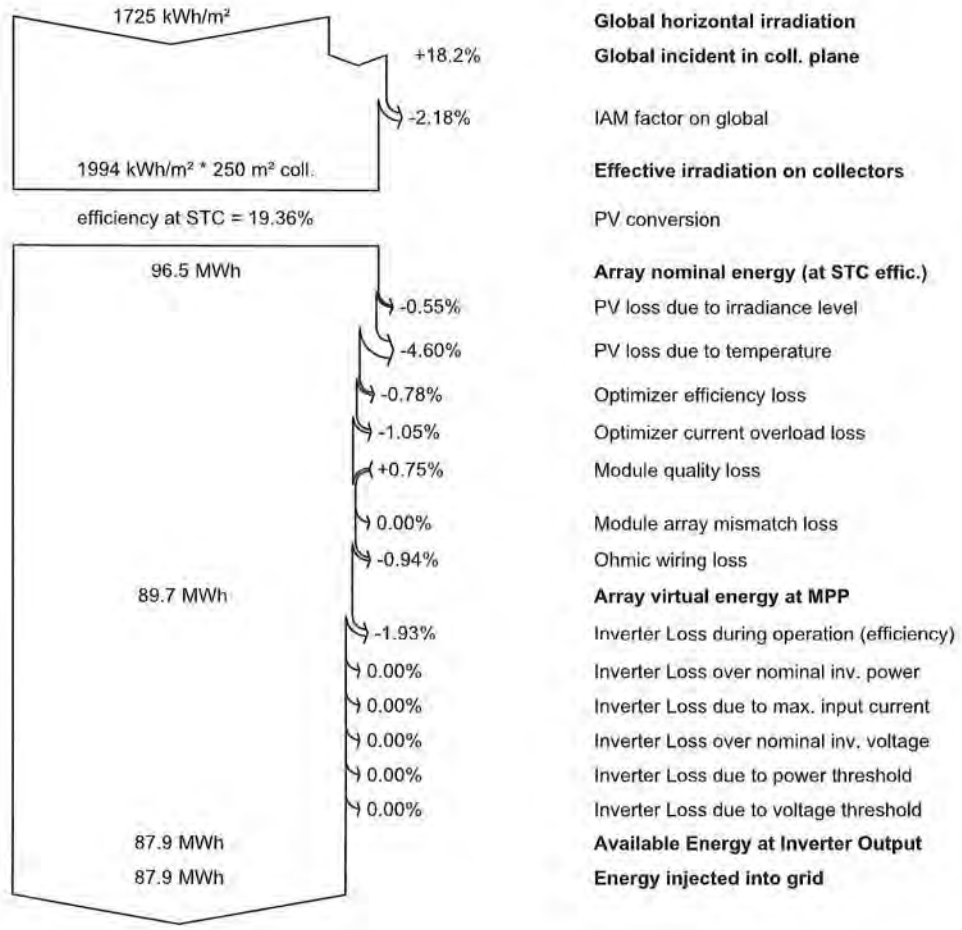
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	69.6	26.58	-8.58	116.2	114.2	5.548	5.441	0.969
February	95.5	28.01	-6.81	142.9	140.7	6.634	6.507	0.942
March	143.0	52.91	-1.48	178.9	175.0	8.024	7.871	0.910
April	173.9	64.37	4.40	189.6	184.8	8.221	8.062	0.879
May	201.9	78.50	9.36	198.4	193.3	8.628	8.460	0.882
June	216.0	69.65	14.83	203.1	198.0	8.590	8.423	0.858
July	213.0	76.53	19.65	205.5	200.3	8.545	8.379	0.843
August	194.8	60.51	17.75	205.7	200.6	8.620	8.453	0.850
September	154.8	46.72	12.23	186.5	182.4	7.835	7.683	0.852
October	112.6	41.27	5.52	157.0	154.2	7.007	6.874	0.905
November	83.7	27.88	-2.27	136.8	134.6	6.335	6.214	0.939
December	65.9	23.12	-8.08	117.9	116.1	5.684	5.576	0.978
Year	1724.6	596.05	4.78	2038.5	1994.1	89.671	87.944	0.892

Legends

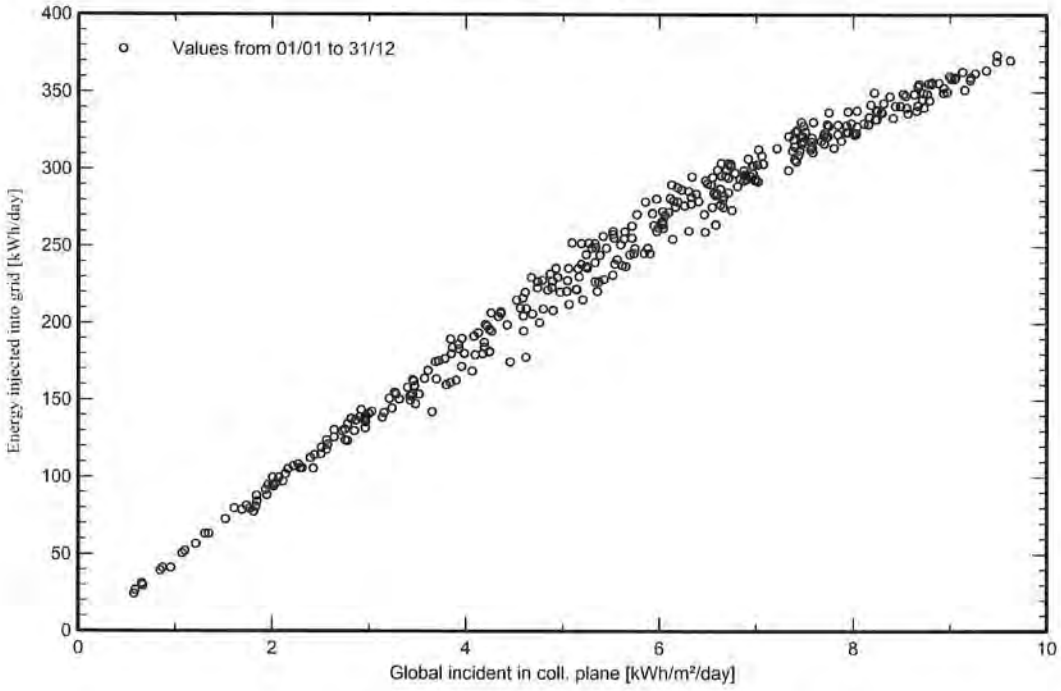
GlobHor	Global horizontal irradiation	EArray	Effective energy at the output of the array
DiffHor	Horizontal diffuse irradiation	E_Grid	Energy injected into grid
T_Amb	Ambient Temperature	PR	Performance Ratio
GlobInc	Global incident in coll. plane		
GlobEff	Effective Global, corr. for IAM and shadings		

Loss diagram

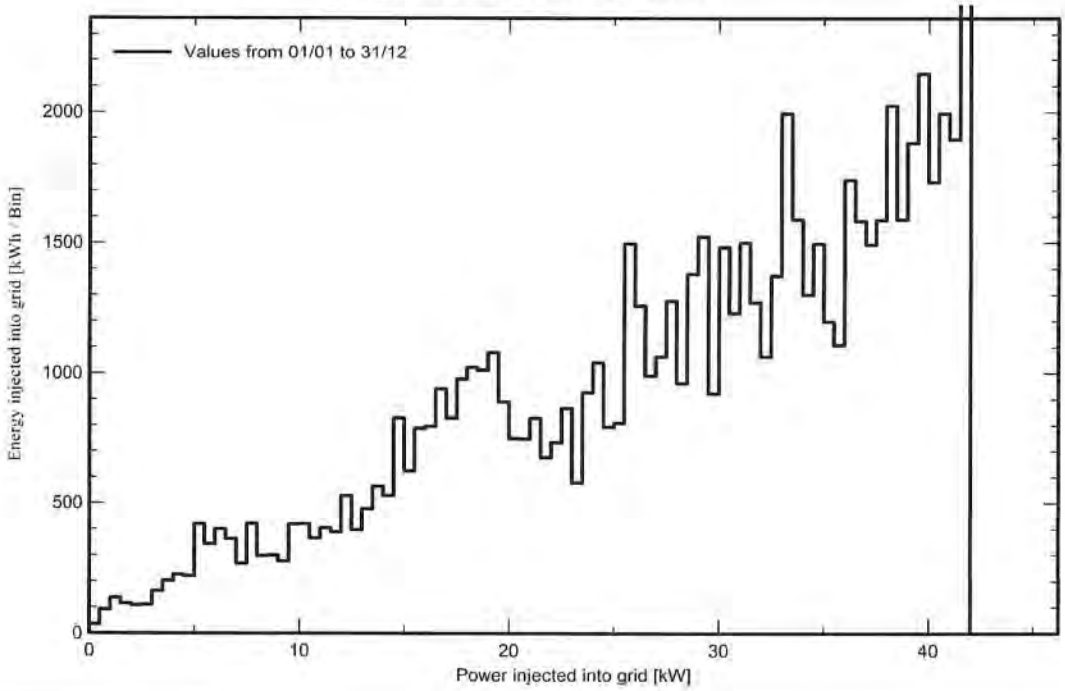


Special graphs

Daily Input/Output diagram



System Output Power Distribution



Cost of the system

Installation costs

Item	Quantity units	Cost USD	Total USD
Total			0.00
Depreciable asset			0.00

Operating costs

Item	Total USD/year
Total (OPEX)	0.00

System summary

Total installation cost	0.00 USD
Operating costs	0.00 USD/year
Produced Energy	87.9 MWh/year
Cost of produced energy (LCOE)	0.000 USD/kWh

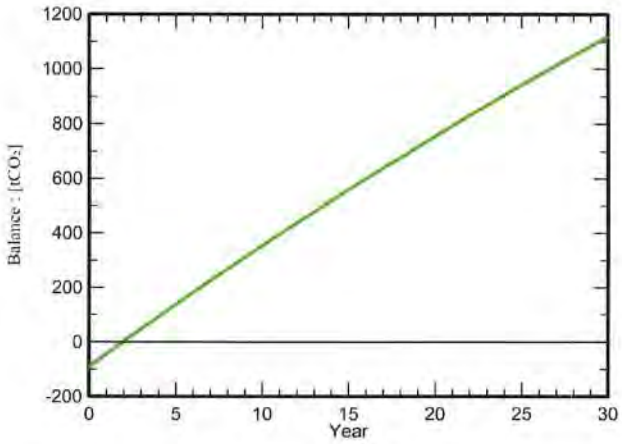
CO_2 Emission Balance

Total: 1118.0 tCO_2

Generated emissions
Total: 90.70 tCO_2
Source: Detailed calculation from table below:

Replaced Emissions
Total: 1393.0 tCO_2
System production: 87.94 MWh/yr
Grid Lifecycle Emissions: 528 gCO_2/kWh
Source: IEA List
Country: United States
Lifetime: 30 years
Annual degradation: 1.0 %

Saved CO_2 Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[$kgCO_2$]
Modules	1713 kgCO2/kWp	49.9 kWp	85499
Supports	3.52 kgCO2/kg	1280 kg	4508
Inverters	349 kgCO2/	2.00	698

C. PV System Design for Milner Plant.

The following is the PV design for the Milner Plant:

Full PV System Information			
Inverter	Item	Qty	Unit
SolarEdge SE20K-US	Module Wattage	390	W
	Number of Modules	104	EA
	Modules Per String	26	EA
	# of Strings	4	EA
	SolarEdge P601 Optimizer	104	EA
	Strings Per Inverter	2	EA
	Total DC Output	40.6	kW
	Maximum AC Output	40.0	kW

PV Site Plan Milner Routt County WWTP Option 1

Scale: 1" = 40'

PV Site Plan Milner Routt County WWTP Option 2

Scale: 1" = 40'

Milner Routt County WWTP

40.6kW AC Solar PV Project

Milner, Colorado

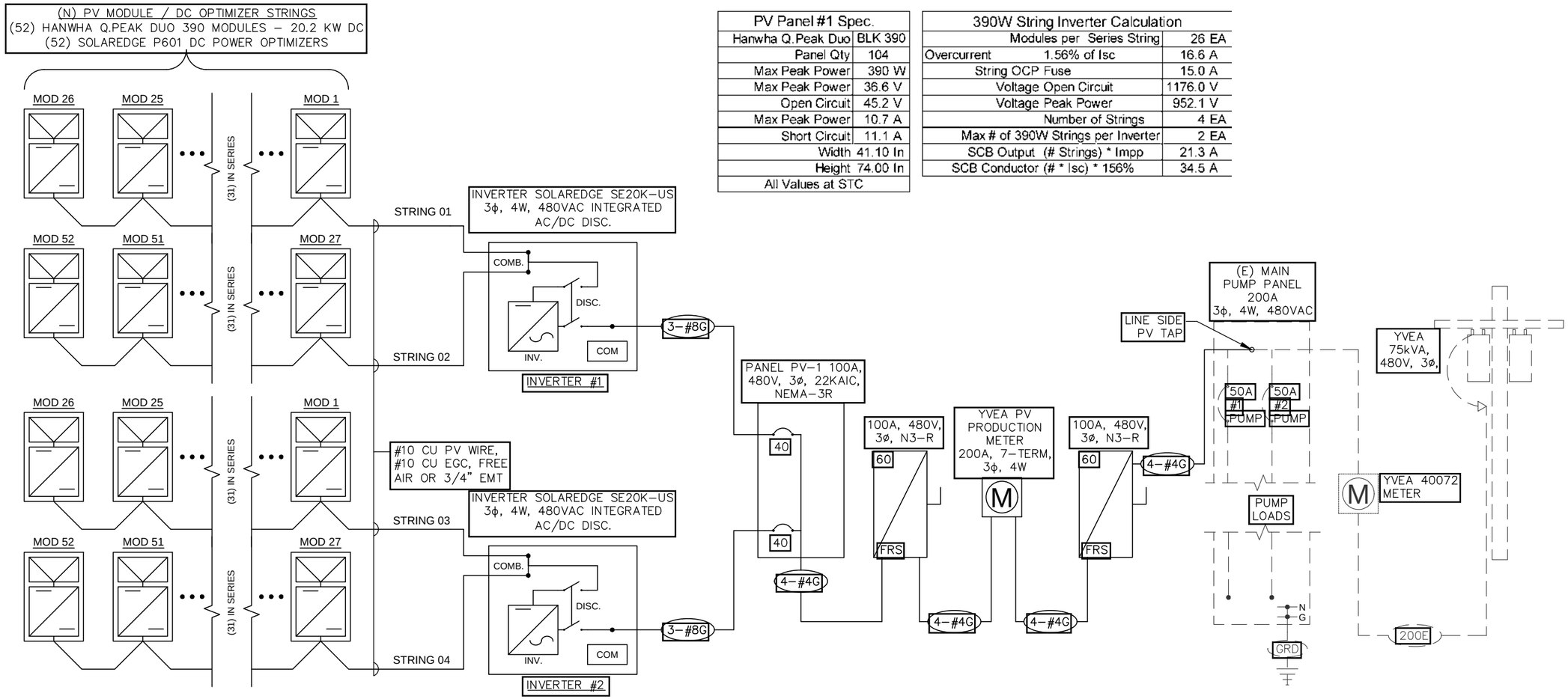
DRAWN BY:	BB
CHECKED BY:	
DATE:	7-1-22
SCALE:	NTS

Sheet Title

PV-1

ONE-LINE

- PANELBOARD
- WEATHERHEAD
- DRY-TYPE TRANSFORMER
- PADMOUNT UTILITY TRANSFORMER
- SHORT CIRCUIT VALUE
- WIRE SIZE
- METER AND CTs
- FUSED DISCONNECT
- NON-FUSED DISCONNECT
- MOTOR
- CIRCUIT BREAKER
- FUSED SWITCH
- MAGNETIC STARTER/CONTACTOR
- GENERATOR
- GROUND



PV Panel #1 Spec.	
Hanwha Q.Peak Duo	BLK 390
Panel Qty	104
Max Peak Power	390 W
Max Peak Power	36.6 V
Open Circuit	45.2 V
Max Peak Power	10.7 A
Short Circuit	11.1 A
Width	41.10 In
Height	74.00 In
All Values at STC	

390W String Inverter Calculation	
Modules per Series String	26 EA
Overcurrent 1.56% of Isc	16.6 A
String OCP Fuse	15.0 A
Voltage Open Circuit	1176.0 V
Voltage Peak Power	952.1 V
Number of Strings	4 EA
Max # of 390W Strings per Inverter	2 EA
SCB Output (# Strings) * Impp	21.3 A
SCB Conductor (# * Isc) * 156%	34.5 A

PV System One-Line Connection Diagram

Existing Service Equipment Is Shown As Light Dashed Line

Milner Routt County WWTP

40.6kWp AC Solar PV Project

Milner, Colorado

DRAWN BY:	BB
CHECKED BY:	
DATE:	7-1-22
SCALE:	NTS

Sheet Title

PV-2

solaredge

Three Phase Inverters for the 277/480V Grid for North America

SE10KUS / SE20KUS / SE33.3KUS[1]

	SE10KUS	SE20KUS	SE33.3KUS	
OUTPUT				
Rated AC Power Output	10000	20000	33300	VA
Maximum AC Power Output	10000	20000	33300	VA
AC Output Line Connections	4-wire WYE (L1-L2-L3-N) plus PE			
AC Output Voltage Minimum-Nominal-Maximum[2] (L-N)	244-277-305			Vac
AC Output Voltage Minimum-Nominal-Maximum[2] (L-L)	422.5-480-529			Vac
AC Frequency Min-Nom-Max[2]	59.3 - 60 - 60.5			Hz
Max. Continuous Output Current (per Phase)	12	24	40	A
GFDI Threshold	1			A
Utility Monitoring, Islanding Protection, Country Configurable Set Points	Yes			
INPUT				
Maximum DC Power (Module STC)	13500	27000	45000	W
Transformer-less, Ungrounded	Yes			
Maximum Input Voltage DC to Gnd	490			Vdc
Maximum Input Voltage DC+ to DC-	980			Vdc
Nominal Input Voltage DC to Gnd	420			Vdc
Nominal Input Voltage DC+ to DC-	840			Vdc
Maximum Input Current	13.5	26.5	40	Adc
Max. Input Short Circuit Current	45			Adc
Reverse-Polarity Protection	Yes			
Ground-Fault Isolation Detection	1MΩ Sensitivity		350kΩ Sensitivity[3]	
CEC Weighted Efficiency	98		98.5	%
Night-time Power Consumption	< 3		< 4	W
ADDITIONAL FEATURES				
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional)			
Rapid Shutdown – NEC 2014 690.12	Manual Rapid Shutdown[4]		Automatic Rapid Shutdown upon AC Grid Disconnect[5]	
STANDARD COMPLIANCE				
Safety	UL1741, UL1699B, UL1998, CSA 22.2			
Grid Connection Standards	IEEE1547			
Emissions	FCC part15 class B			
INSTALLATION SPECIFICATIONS				
AC output conduit size / AWG range	3/4" minimum / 12-6 AWG			
DC input conduit size / AWG range	3/4" minimum / 12-6 AWG			
Number of DC inputs	2 pairs		3 pairs (with fuses on plus & minus)[6]	
Dimensions (HxWxD)	21 x 12.5 x 10.5 / 540 x 315 x 260			in/mm
Dimensions with Safety Switch (HxWxD)	30.5 x 12.5 x 10.5 / 775 x 315 x 260			in/mm
Weight	73.2 / 33.2		99.5 / 45	lb/kg
Weight with Safety Switch	79.7 / 36.2		106 / 48	lb/kg
Cooling	Fans (user replaceable)			
Noise	< 50		< 55	dBA
Operating Temperature Range	-40 to +140 / -40 to +60			°F/°C
Protection Rating	NEMA 3R			

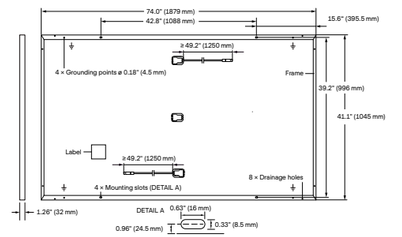
(1) For 208V inverters refer to: http://www.solaredge.com/files/pdfs/products/inverters/se-three-phase-us-inverter-208V-datasheet.pdf
(2) For other regional settings please contact SolarEdge support
(3) Where permitted by local regulations
(4) With installation of rapid shutdown kit; contact SolarEdge for kit P/N
(5) P/N of inverter with automatic rapid shutdown: SE33.3K-USR48NNF4
(6) Field replacement kit for 1 pair of inputs P/N: DCD-3PH-1TBK

SUNSPEC ALLIANCE **RoHS**

powered by Q.ANTUM DUO Z

MECHANICAL SPECIFICATION

Format	74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥ 49.2 in (1250 mm), (–) ≥ 49.2 in (1250 mm)
Connector	Stäubli MC4; IP68

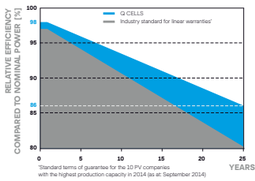


ELECTRICAL CHARACTERISTICS

POWER CLASS				385	390	395	400	405
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / −0 W)								
Minimum	Power at MPP[1]	P_{MPP}	[W]	385	390	395	400	405
	Short Circuit Current[1]	I_{SC}	[A]	11.04	11.07	11.10	11.14	11.17
	Open Circuit Voltage[1]	V_{OC}	[V]	45.19	45.23	45.27	45.30	45.34
	Current at MPP	I_{MPP}	[A]	10.59	10.65	10.71	10.77	10.83
	Voltage at MPP	V_{MPP}	[V]	36.36	36.62	36.88	37.13	37.39
	Efficiency[1]	η	[%]	≥19.6	≥19.9	≥20.1	≥20.4	≥20.6
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]								
Minimum	Power at MPP	P_{MPP}	[W]	288.8	292.6	296.3	300.1	303.8
	Short Circuit Current	I_{SC}	[A]	8.90	8.92	8.95	8.97	9.00
	Open Circuit Voltage	V_{OC}	[V]	42.62	42.65	42.69	42.72	42.76
	Current at MPP	I_{MPP}	[A]	8.35	8.41	8.46	8.51	8.57
	Voltage at MPP	V_{MPP}	[V]	34.59	34.81	35.03	35.25	35.46

[1] Measurement tolerances P_{MPP} ±3%; I_{SC}; V_{OC} ±5% at STC: 1000 W/m², 25±2 °C, AM 1.5 according to IEC 60904-3 • [2] 800 W/m², NMOT, spectrum AM 1.5

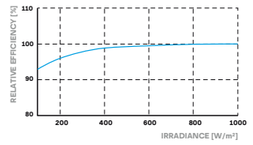
Q CELLS PERFORMANCE WARRANTY



At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Q CELLS sales organisation of your respective country.

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²)

TEMPERATURE COEFFICIENTS							
Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	−0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	−0.34	Nominal Module Operating Temperature	NMOT	[°F]	109±5.4 (43±3 °C)

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V_{SYS}	[V]	1000 (IEC) / 1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 2
Max. Design Load, Push / Pull[3]	[lbs/ft²]	75 (3600 Pa) / 55 (2660 Pa)	Permitted Module Temperature on Continuous Duty	−40 °F up to +185 °F (−40 °C up to +85 °C)
Max. Test Load, Push / Pull[3]	[lbs/ft²]	113 (5400 Pa) / 84 (4000 Pa)		

[3] See Installation Manual

QUALIFICATIONS AND CERTIFICATES

UL 61730, CE-compliant,
Quality Controlled PV - TÜV Rheinland,
IEC 61215:2016, IEC 61730:2016,
U.S. Patent No. 9,893,215 (solar cells),
QCPV Certification ongoing.

C Certified US UL 61730 | CE | TÜVRheinland CERTIFIED www.tuv.com ID 1111220277

PACKAGING INFORMATION

Horizontal packaging	76.4 in 1940 mm	43.3 in 1100 mm	48.0 in 1220 mm	1656 lbs 751 kg	24 pallets	24 pallets	32 modules

Note: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.
400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | **TEL** +1 949 748 59 96 | **EMAIL** inquiry@us.q-cells.com | **WEB** www.q-cells.us

Milner Routt County WWTP
40.6kW AC Solar PV Project
Milner, Colorado

DRAWN BY:	BB
CHECKED BY:	
DATE:	7-1-22
SCALE:	NTS

Sheet Title

PV-3

D. PV System Design for Phippsburg Plant.

The following is the PV design for the Phippsburg Plant:

Full PV System Information			
Inverter	Item	Qty	Unit
SolarEdge SE33.3K-US	Module Wattage	390	W
	Number of Modules	124	EA
	Modules Per String	31	EA
	# of Strings	4	EA
	SolarEdge P601 Optimizer	124	EA
	Strings Per Inverter	2	EA
	Total DC Output	48.4	kW
	Maximum AC Output	66.0	kW

PV Site Plan Phillipsburg Routt County WWTP

Scale: 1" = 40'

Phillipsburg Routt County WWTP

48.4kWp AC Solar PV Project

Phillipsburg, Colorado

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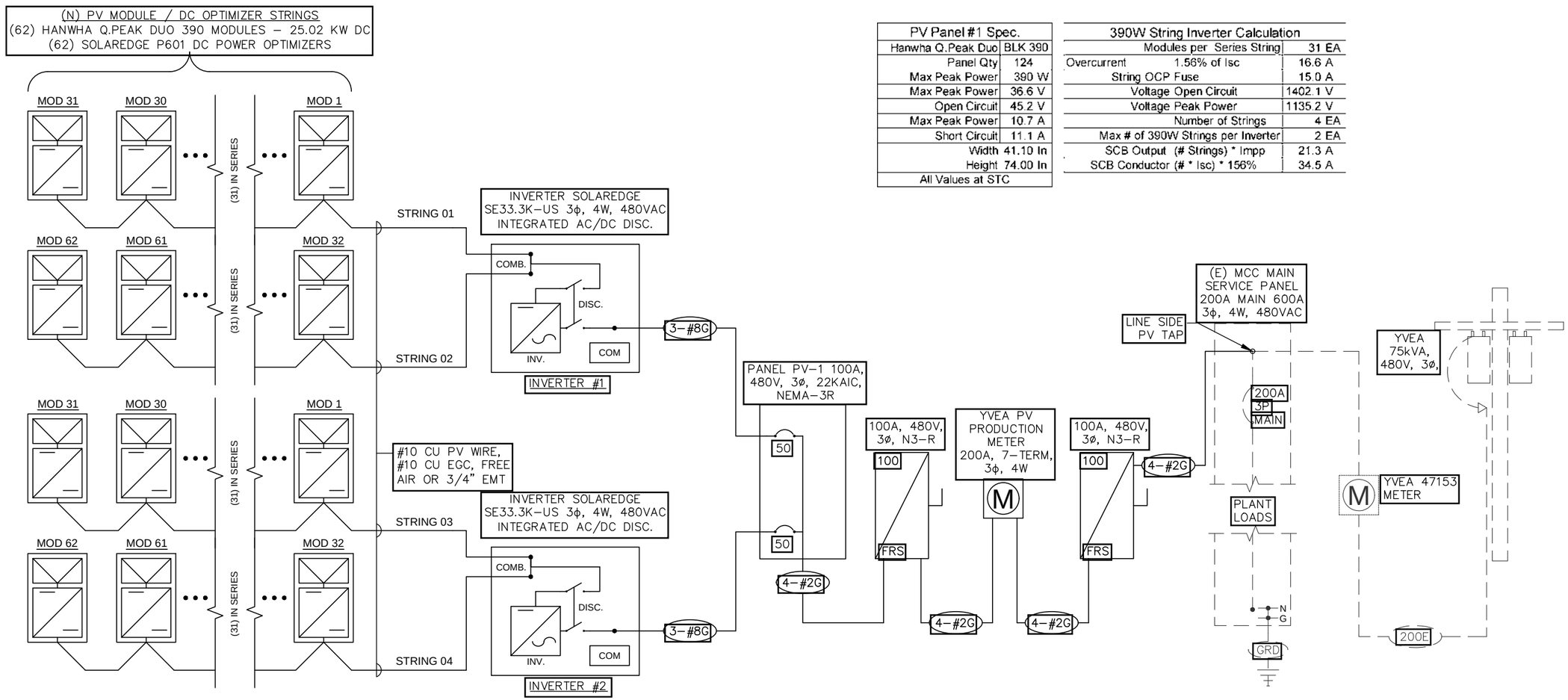
CHECKED BY:	
DATE:	7-1-22
SCALE:	NTS

Sheet Title

PV-1

ONE-LINE

- PANELBOARD
- WEATHERHEAD
- DRY-TYPE TRANSFORMER
- PADMOUNT UTILITY TRANSFORMER
- SHORT CIRCUIT VALUE
- WIRE SIZE
- METER AND CTs
- FUSED DISCONNECT
- NON-FUSED DISCONNECT
- MOTOR
- CIRCUIT BREAKER
- FUSED SWITCH
- MAGNETIC STARTER/CONTACTOR
- GENERATOR
- GROUND



PV Panel #1 Spec.	
Hanwha Q.Peak Duo	BLK 390
Panel Qty	124
Max Peak Power	390 W
Max Peak Power	36.6 V
Open Circuit	45.2 V
Max Peak Power	10.7 A
Short Circuit	11.1 A
Width	41.10 In
Height	74.00 In
All Values at STC	

390W String Inverter Calculation		
Modules per Series String		31 EA
Overcurrent	1.56% of Isc	16.6 A
String OCP Fuse		15.0 A
Voltage Open Circuit		1402.1 V
Voltage Peak Power		1135.2 V
Number of Strings		4 EA
Max # of 390W Strings per Inverter		2 EA
SCB Output (# Strings) * Impp		21.3 A
SCB Conductor (# * Isc) * 156%		34.5 A

PV System One-Line Connection Diagram

Existing Service Equipment Is Shown As Light Dashed Line

Phillipsburg Routt County WWTP

48.4kWp AC Solar PV Project

Phillipsburg, Colorado

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SCALE:	NTS

Sheet Title

PV-2

solaredge

Three Phase Inverters for the 277/480V Grid for North America

SE10KUS / SE20KUS / SE33.3KUS[1]

	SE10KUS	SE20KUS	SE33.3KUS	
OUTPUT				
Rated AC Power Output	10000	20000	33300	VA
Maximum AC Power Output	10000	20000	33300	VA
AC Output Line Connections	4-wire WYE (L1-L2-L3-N) plus PE			
AC Output Voltage Minimum-Nominal-Maximum[2] (L-N)	244-277-305			Vac
AC Output Voltage Minimum-Nominal-Maximum[2] (L-L)	422.5-480-529			Vac
AC Frequency Min-Nom-Max[2]	59.3 - 60 - 60.5			Hz
Max. Continuous Output Current (per Phase)	12	24	40	A
GFDI Threshold	1			A
Utility Monitoring, Islanding Protection, Country Configurable Set Points	Yes			
INPUT				
Maximum DC Power (Module STC)	13500	27000	45000	W
Transformer-less, Ungrounded	Yes			
Maximum Input Voltage DC to Gnd	490			Vdc
Maximum Input Voltage DC+ to DC-	980			Vdc
Nominal Input Voltage DC to Gnd	420			Vdc
Nominal Input Voltage DC+ to DC-	840			Vdc
Maximum Input Current	13.5	26.5	40	Adc
Max. Input Short Circuit Current	45			Adc
Reverse-Polarity Protection	Yes			
Ground-Fault Isolation Detection	1MΩ Sensitivity		350kΩ Sensitivity[3]	
CEC Weighted Efficiency	98		98.5	%
Night-time Power Consumption	< 3		< 4	W
ADDITIONAL FEATURES				
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional)			
Rapid Shutdown – NEC 2014 690.12	Manual Rapid Shutdown[4]		Automatic Rapid Shutdown upon AC Grid Disconnect[5]	
STANDARD COMPLIANCE				
Safety	UL1741, UL1699B, UL1998, CSA 22.2			
Grid Connection Standards	IEEE1547			
Emissions	FCC part15 class B			
INSTALLATION SPECIFICATIONS				
AC output conduit size / AWG range	3/4" minimum / 12-6 AWG			
DC input conduit size / AWG range	3/4" minimum / 12-6 AWG			
Number of DC inputs	2 pairs		3 pairs (with fuses on plus & minus)[6]	
Dimensions (HxWxD)	21 x 12.5 x 10.5 / 540 x 315 x 260			in/mm
Dimensions with Safety Switch (HxWxD)	30.5 x 12.5 x 10.5 / 775 x 315 x 260			in/mm
Weight	73.2 / 33.2		99.5 / 45	lb/kg
Weight with Safety Switch	79.7 / 36.2		106 / 48	lb/kg
Cooling	Fans (user replaceable)			
Noise	< 50		< 55	dBA
Operating Temperature Range	-40 to +140 / -40 to +60			˚F/˚C
Protection Rating	NEMA 3R			

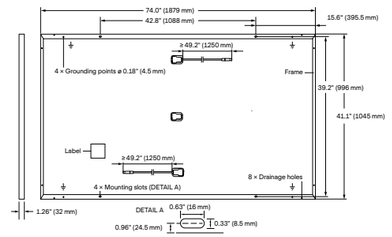
[1] For 208V inverters refer to: http://www.solaredge.com/files/pdfs/products/inverters/se-three-phase-us-inverter-208V-datasheet.pdf
[2] For other regional settings please contact SolarEdge support
[3] Where permitted by local regulations
[4] With installation of rapid shutdown kit; contact SolarEdge for kit P/N
[5] P/N of inverter with automatic rapid shutdown: SE33.3K-USR48NNF4
[6] Field replacement kit for 1 pair of inputs P/N: DCD-3PH-1TBK

ETL SUNSPEC ALLIANCE **RoHS**

powered by Q.ANTUM DUO Z

MECHANICAL SPECIFICATION

Format	74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥ 49.2 in (1250 mm), (−) ≥ 49.2 in (1250 mm)
Connector	Stäubli MC4; IP68

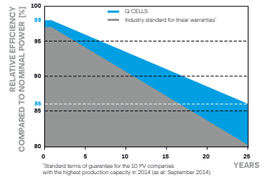


ELECTRICAL CHARACTERISTICS

POWER CLASS				385	390	395	400	405
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / −0 W)								
Minimum	Power at MPP[1]	P_{MPP}	[W]	385	390	395	400	405
Minimum	Short Circuit Current[1]	I_{SC}	[A]	11.04	11.07	11.10	11.14	11.17
Minimum	Open Circuit Voltage[1]	V_{OC}	[V]	45.19	45.23	45.27	45.30	45.34
Minimum	Current at MPP	I_{MPP}	[A]	10.59	10.65	10.71	10.77	10.83
Minimum	Voltage at MPP	V_{MPP}	[V]	36.36	36.62	36.88	37.13	37.39
Minimum	Efficiency[1]	η	[%]	≥19.6	≥19.9	≥20.1	≥20.4	≥20.6
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]								
Minimum	Power at MPP	P_{MPP}	[W]	288.8	292.6	296.3	300.1	303.8
Minimum	Short Circuit Current	I_{SC}	[A]	8.90	8.92	8.95	8.97	9.00
Minimum	Open Circuit Voltage	V_{OC}	[V]	42.62	42.65	42.69	42.72	42.76
Minimum	Current at MPP	I_{MPP}	[A]	8.35	8.41	8.46	8.51	8.57
Minimum	Voltage at MPP	V_{MPP}	[V]	34.59	34.81	35.03	35.25	35.46

[1] Measurement tolerances P_{MPP} ±3%; I_{SC}; V_{OC} ±5% at STC: 1000 W/m², 25±2 °C, AM 1.5 according to IEC 60904-3 • [2] 800 W/m², NMOT, spectrum AM 1.5

Q CELLS PERFORMANCE WARRANTY



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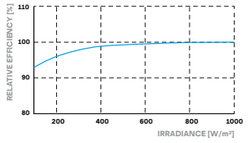
PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²)

TEMPERATURE COEFFICIENTS							
Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	−0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	−0.34	Nominal Module Operating Temperature	NMOT	[°F]	109±5.4 (43±3 °C)

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V_{SYS}	[V]	1000 (IEC) / 1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 2
Max. Design Load, Push / Pull[3]	[lbs/ft²]	75 (3600 Pa) / 55 (2660 Pa)	Permitted Module Temperature on Continuous Duty	−40 °F up to +185 °F (−40 °C up to +85 °C)
Max. Test Load, Push / Pull[3]	[lbs/ft²]	113 (5400 Pa) / 84 (4000 Pa)		

[3] See Installation Manual

QUALIFICATIONS AND CERTIFICATES

UL 61730, CE-compliant,
Quality Controlled PV - TÜV Rheinland, IEC 61215:2016, IEC 61730:2016,
U.S. Patent No. 9,893,215 (solar cells),
QCPV Certification ongoing.

C SP US Certified UL 61730 | CE | TÜVRheinland CERTIFIED www.tuv.com ID 1111220277

PACKAGING INFORMATION

Horizontal packaging	76.4 in 1940 mm	43.3 in 1100 mm	48.0 in 1220 mm	1656 lbs 751 kg	24 pallets	24 pallets	32 modules

Note: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.
400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | **TEL** +1 949 748 59 96 | **EMAIL** inquiry@us.q-cells.com | **WEB** www.q-cells.us

Phillipsburg Routt County WWTP

48.4kWp AC Solar PV Project

Phillipsburg, Colorado

DRAWN BY:	BB
CHECKED BY:	
DATE:	7-1-22
SCALE:	NTS

Sheet Title

PV-3

IV. PV System Cost Opinions and Payback.

A. Milner PV Cost Opinions, Unit Prices & Quotes.
B. Phippsburg PV Cost Opinions, Unit Prices & Quotes
C. Possible System Payback Calculations.

A. Milner PV Cost Opinions, Unit Prices & Quotes.

Basis of the Cost Opinion

The cost opinion for PV system installation at both sites is based on:

1. The PV system is installed in a remote location far from a larger marketplace, so travel costs and per diem for labor.
2. The cost for transportation and delivery of equipment is more than a large market installation.
3. Yearly monitoring and maintenance are not included in the estimate.
4. If the Owner wants to move forward, hiring a design/build installer makes the best sense.

Milner Site PV System Cost Opinion:

The following cost is from an industry expert with over 15 years of experience:

Project Cost Summary

Project Name	*Milner Routt County WWTP*	*7/8/2022*
Project Location	*Milner, CO*	
Project Description	*Fixed Tilt System*	
System Size (DC)	*40,560.00*	
kWh/kWp		
Estimated COD		

	Description	Cost	Cost/W		Contingency	Notes
Direct-Purchased Equipment						
Modules		34,476	0.85		-	*390 Watt Modules*
Racking		18,252	0.45		-	*Fixed tilt racking mounted on concrete blocks*
Inverter(s) and Hardware		7,301	0.18		-	*Based on Solaredge SE20K*
Inverter Skid		-	0.00		-	*N/A*
Inverter Warranty		-	0.00		-	*Manufacturers Standard Warranty*
DAS		3,245	0.08		-	*Minimum System*
BOS		1,622	0.04		-	*DC Wiring, Junction Boxes etc…*
		64,896	**1.60**		-	
Subcontractor/Installation Labor and Materials						
Electrical DC Material & Installation		8,673	0.21		-	*Non-Prevailing Wage*
Electrical AC Material & Installation		11,227	0.28			*Non-Prevailing Wage*
DAS/Inverter Material & Installation		3,514	0.09			*Non-Prevailing Wage*
Module Installation		6,330	0.16			*Non-Prevailing Wage*
Racking Labor		4,944	0.12			*Non-Prevailing Wage*
		34,688	**0.86**		-	
Site Improvement Subcontracts						
Equipment Foundation/Pads/Fence		2,335	0.06			*Electrical equipment mounting*
Site/Civil Work		2,799	0.07			*Minor site work and restoration (No overseeding)*
		5,134	**0.13**		-	
Utilty Expenses						
Utility Application/Impact Study		-	0.00			*excluded*
Utility Equipment & Installation		-	0.00		-	*excluded*
		-	**0.00**		-	
Professional Services Subcontracts						
In House and Third Party Services		3,732	0.09		-	*Project Engineering*
		3,732	**0.09**		-	
General Expenses						
Permits, Fees, Equip, Etc.		5,131	0.13		-	*Excluding project bond*
		5,131	**0.13**		-	*Permit fees are assumed to be $1,000 max.*
Indirect Labor						
Preconstruction		-	0.00		-	
Project Management		5,131	0.13		-	
		5,131	**0.13**		-	
Cost + Fees						
Cost Subtotal		**118,711**	**2.93**			
Contingency		**-**	0.00		**-**	0.0%
Sales Tax	3.90%	2,961	0.07			
Cost Plus Tax & Contingency		**121,672**	**3.00**			
Markup	22.00%	26,768	0.66		18%	Margin
Total		**148,439**	**3.66**			Cost plus labor, tax, contingency and fees

B. Phippsburg PV Cost Opinions, Unit Prices & Quotes.

Phippsburg Site PV System Cost Opinion:

Project Cost Summary

Project Name	*Phippsburg Routt County WWTP*	*7/8/2022*
Project Location	*Phippsburg, CO*	
Project Description	*Fixed Tilt System*	
System Size (DC)	*48,360.00*	
kWh/kWp		
Estimated COD		

	Description	Cost	Cost/W		Contingency	Notes
Direct-Purchased Equipment						
Modules		41,106	0.85		-	*390 Watt Modules*
Racking		21,762	0.45		-	*Fixed tilt racking mounted on concrete blocks*
Inverter(s) and Hardware		8,705	0.18		-	*Based on Solaredge SE33.3K*
Inverter Skid		-	0.00		-	*N/A*
Inverter Warranty		-	0.00		-	*Manufacturers Standard Warranty*
DAS		3,245	0.07		-	*Minimum System*
BOS		1,934	0.04		-	*DC Wiring, Junction Boxes etc…*
		76,752	**1.59**		-	
Subcontractor/Installation Labor and Materials						
Electrical DC Material & Installation		10,341	0.21		-	*Non-Prevailing Wage*
Electrical AC Material & Installation		13,386	0.28			*Non-Prevailing Wage*
DAS/Inverter Material & Installation		4,093	0.08			*Non-Prevailing Wage*
Module Installation		7,547	0.16			*Non-Prevailing Wage*
Racking Labor		5,894	0.12			*Non-Prevailing Wage*
		41,261	**0.85**		-	
Site Improvement Subcontracts						
Equipment Foundation/Pads/Fence		2,784	0.06			*Electrical equipment mounting*
Site/Civil Work		2,799	0.06			*Minor site work and restoration (No overseeding)*
		5,583	**0.12**		-	
Utilty Expenses						
Utility Application/Impact Study		-	0.00			*excluded*
Utility Equipment & Installation		-	0.00		-	*excluded*
		-	**0.00**		-	
Professional Services Subcontracts						
In House and Third Party Services		3,732	0.08		-	*Project Engineering*
		3,732	**0.08**		-	
General Expenses						
Permits, Fees, Equip, Etc.		6,118	0.13		-	*Excluding project bond*
		6,118	**0.13**		-	*Permit fees are assumed to be $1,000 max.*
Indirect Labor						
Preconstruction		-	0.00		-	
Project Management		5,132	0.11		-	
		5,132	**0.11**		-	
Cost + Fees						
Cost Subtotal		**138,578**	**2.87**			
Contingency		**-**	0.00		**-**	0.0%
Sales Tax	3.90%	3,506	0.07			
Cost Plus Tax & Contingency		**142,084**	**2.94**			
Markup	22.00%	31,258	0.65		18%	Margin
Total		**173,342**	**3.58**			Cost plus labor, tax, contingency and fees

C. Possible System Payback Calculations

The below cost and payback summary for the Milner Plant:

Description	Qty	Units
PV System Design	72.97	MWH
2021 Energy Usage	63.773	MWH
Delta Usage - Production	9.197	MWH
Savings at $.11kWH	$7,043	
Credit at $.033kWH	$304	
Total YVEA Yearly Savings	$7,346	
Estimated System $	$148,439	
Straight Line Payback	20.2	Years

The below cost and payback summary for the Phippsburg Plant:

Description	Qty	Units
PV System Design	87.94	MWH
2021 Energy Usage	77.04	MWH
Delta Usage - Production	10.9	MWH
Savings at $.11kWH	$8,508	
Credit at $.033kWH	$360	
Total YVEA Yearly Savings	$8,868	
Estimated System $	$173,342	
Straight Line Payback	19.5	Years

Notes on payback analysis

Items that can reduce the overall system life-cycle costs:

1. The future value of money.
2. The future increase of energy costs.
3. The future increase of wastewater processed leading to higher energy usage.

Items that will reduce the overall system life-cycle costs:

1. Yearly maintenance and monitoring.
2. Yearly testing and troubleshooting
3. The production loss of 1% for PV panel degradation.
4. The production loss for smoke from wildfires in the air.
5. Cost to replace inverters at 10-12 years.
6. Cost to replace panels at 25 years.

We typically see the above items will create a wash in costs, so hence our straight line payback analysis.

APPENDIX R

BIOSOLIDS REPORT

131

22158

Rcr 12

Rcr 12

Rcr 12

Phippsburg Lagoon Survey June 2022

	Cell 1	Cell 2	Cell 3	
	3.0	3.0	5.0	
	3.5	2.5	5.0	
	4.0	3.0	4.0	
	4.0	3.0	2.5	
	4.0	5.0	1.5	
Average	**3.7**	**3.3**	**3.6**	
Sq Ft	10,275	9,600	6,400	
Total Cu Ft Sludge	38,018	31,680	23,040	
Total Estimated Gallons in Place	284,371	236,966	172,339	
Total Estimated to Remove				693,677
				763,044.2
Amt of Excess Water to Clean out Lagoon				200,000
Total Estimated Amt To Remove				963,044
Estimated Price to Remove				$ 0.40
Total Estimated Cost for Lagoon Cleaning				$ 385,217.66

Prices are based upon known application site
Prices assume one mob to clean all lagoons
Prices assume the lagoons will be dewatered to within 6 inches of sludge line
Prices assume use of a sump in each lagoon to remove the sludge.

DENALI

PO Box 888
Longmont, CO 80920
303-651-7070

The biosolids data for pollutant concentration and fecal are valid for 12 months aftrer the data the samples were collected.

Pollutant Concentration

Biosolids Regulation 64 and 40 CFRF 503 set the pollutant concentrations allowed in biosolids. There are nine regulated heavy metals. Table 1 is the Ceiling Limit. No biosolids that have any one parameter above Table 1 can be land applied. Table 3 is the “Clean Biosolids Values” which provides for no tracking of cumulative metals if all of the concentrations of metals are below the values set in the table.

All three generators are well below Table 3 standards with many non-detects (ND) for each generator. There is no issue with the pollutant concentrations of any of the three tested biosolids.

Class B Determination

Section 64.B (8)(a) allows for Class B determination by taking the geometric mean of seven samples from a treatment facility.

Yampa had a geometric mean of 6,797 MPN/gm and is Class B.

Milner had a geometric mean of 15,786 MON/gm and is Class B.

Phippsburg had a geometric mean of 5,861 MON/gm and is Class B.

Rule 20 – TENORM

Rule 20 requires that the source be profiled only once if the material is determined to be exempt under the rule. The exemption level for biosolids is 5 pCi/gm.

The statical analysis required for Yampa determined that the upper limit of confidence interval was 0 pCi/gm for both Ra 226 and Ra 228 and therefore is exempt.

The statical analysis required for Phippsburg determined that the upper limit of confidence interval was 0 pCi/gm for both Ra 226 and Ra 228 and therefore is exempt.

The statical analysis required for Milner determined that the upper limit of confidence interval was 0 pCi/gm for Ra 228 and 3.46 pCi/gm for Ra 226 and therefore is exempt.

Volumes of Biosolids

The depth of sludge was measured in each lagoon when samples were collected. The volume is based upon the average depth of sludge and the surface area of the lagoon. Depending how the lagoon is lined, either with an HDPE liner or compacted clay, an estimated of the amount of

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biosolids was determined that would need to be removed in order to close out the lagoon. Typically clay liners require more removal since the bottom of the lagoon has been blurred over the years. Since all of the water above the sludge can't be removed, the volumes will be inflated by 10%. In addition, wash water is required to mix the sludge and remove. In the case of a lined lagoon, less water is needed.

Yampa has an estimated 303,000 gallons in place. For budget purposes, there will be an estimated 578,000 gallons of biosolids to remove.

Milner has an estimated 632,000 gallons in place. For budget purposes, there will be an estimated 907,000 gallons of biosolids to removed.

Phippsburg has an estimated 763,000 gallons in place. For budget purposes, there will be an estimated 963,000 gallons of biosolids to remove.

Pricing

Denali has been working on permitting land application sites west of Steamboat Springs for the past few years. The sites are located about 10 miles away from Craig, CO. At this point, this is where Denali would land apply the biosolids. The one- way distance to the sites are similar for Phippsburg and Yampa. It is 65 miles for Yampa and 60 miles. Milner is closer at 41 miles. Therefore, we would have similar pricing for Yampa and Phippsburg and a lower cost for Milner.

Parameter	Table 3	Table 1	Phippsburg
Arsenic	41	75	ND
Cadmium	39	85	ND
Copper	1500	4300	1250
Lead	300	840	ND
Mercury	17	57	ND
Molybdenum		75	ND
Nickel	420	420	16.6
Selenium	100	100	ND
Zinc	2800	7500	682.1

Fewcal Coliform	Phippsburg
Sample	
1	1,570
2	1,620
3	5,780
4	30,600
5	24,800
6	30,900
7	689
Geo Mean	**5,861**

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VERIS ENVIRONMENTAL
BIOSOLIDS - LUKE BOND
53036 HWY 71
LIMON CO 80828-

REPORT OF ANALYSIS

For: (16098) VERIS ENVIRONMENTAL
VERIS ENVIRONMENTAL SLUDGE PKG D

Analysis	Level Found As Received	Level Found Dry Weight	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: **SLUDGE COMP PBORG**	Lab Number: **70146520**		Date Sampled: **2022-06-29**				
Potash K2O (calculated)	269	4450	mg/kg	10	Calculation	Auto-2022/07/21	Auto-2022/07/30
Phosphate P2O5 (calculated)	1060	17500	mg/kg	10	Calculation	Auto-2022/07/21	Auto-2022/07/30
Organic nitrogen	1050	17400	mg/kg	0.1	Calculation	Auto-2022/07/20	Auto-2022/07/30
Total volatile solids (TVS)	29.9		%	0.01	SM 2540 G-(1997) *	jsa6-2022/07/19	jdb5-2022/07/20
Total Kjeldahl nitrogen (TKN)	1130	18700	mg/kg	125	PAI-DK01 *	Cay6-2022/07/19	mgn8-2022/07/19
Phosphorus (total)	465	7699	mg/kg	5	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Potassium (total)	223	3692	mg/kg	10	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Sulfur (total)	580	9600	mg/kg	10.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Calcium (total)	2603	43100	mg/kg	20.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Magnesium (total)	426.1	7055	mg/kg	5.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Sodium (total)	85.7	1419	mg/kg	1	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Iron (total)	923.2	15280	mg/kg	5.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Manganese (total)	12.6	209	mg/kg	1.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Copper (total)	75.3	1250	mg/kg	1.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Zinc (total)	41.2	682.1	mg/kg	2.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Ammoniacal Nitrogen	81	1340	mg/kg	10.0	SM 4500-NH3 C-(1997)	Cay6-2022/07/20	jdb5-2022/07/20
Nitrate/Nitrite nitrogen	n.d.	n.d.	mg/kg	0.2	EPA 353.2	akn1-2022/07/22	mgn8-2022/07/25
Arsenic (total)	n.d.	n.d.	mg/kg	0.50	EPA 6020	ras7-2022/07/28	kkh9-2022/07/30
Barium (total)	19.9	329	mg/kg	0.50	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30

The result(s) issued on this report only reflect the analysis of the sample(s) submitted.

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REPORT OF ANALYSIS

For: (16098) VERIS ENVIRONMENTAL
VERIS ENVIRONMENTAL SLUDGE PKG D

Analysis	Level Found As Received	Level Found Dry Weight	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: SLUDGE COMP PBORG	Lab Number: **70146520** (con't)						
Cadmium (total)	n.d.	n.d.	mg/kg	0.50	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Chromium (total)	1.47	24.3	mg/kg	1.00	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Lead (total)	n.d.	n.d.	mg/kg	5.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Mercury (total)	n.d.	n.d.	mg/kg	0.05	EPA 7471	mrs3-2022/07/29	kkh9-2022/07/30
Molybdenum (total)	n.d.	n.d.	mg/kg	1.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Nickel (total)	1.0	16.6	mg/kg	1.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Selenium (total)	n.d.	n.d.	mg/kg	0.50	EPA 6020	ras7-2022/07/28	kkh9-2022/07/30
Silver (total)	n.d.	n.d.	mg/kg	1.0	EPA 6010	ras7-2022/07/19	kkh9-2022/07/30
Percent solids	6.04		%	0.01	SM 2540 G-(1997) *	jsa6-2022/07/19	jdb5-2022/07/20
pH	6.5		S.U.	0.1	EPA 9045	Ppj2-2022/07/20	jdb5-2022/07/20

n.d. = not detected , ppm = parts per million, ppm = mg/kg

cc: Account(s) 15480 VERIS ENVIRONMENTAL LLC

For questions please contact:

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REPORT OF ANALYSIS

For: (16098) VERIS ENVIRONMENTAL
VERIS ENVIRONMENTAL SLUDGE PKG D

Detailed Method Description(s)

Calculation

Analytical results are entered into applicable formulas to provide a calculated result which is reported.

ME 042

Analysis follows MWL ME 042 which is based on EPA 6010b, Inductively Coupled Plasma (ICP). A light emission technique where prepared samples are injected into a high energy plasma that forces the elements in the injected sample to emit light energies which are proportional to the level of minerals and metals present. The light is then detected and correlated to the levels of minerals and metals in the original sample.

SM 4500-NH3 C (Ammonia titrimetric)

Sample analysis follows MWL EN 068 which is based on Standard Methods (SM) 4500-NH3 C. Samples are placed in a Nessler tube and made basic with the addition of alkalai and then the solution heated to distill the ammonia into a boric acid solution. The boric acid solution is titrated automatically using a standard sulfuric acid solution to an established endpoint.

Nitrate/nitrite by Cd reduction EPA 353.2

Sample analysis follows MWL EN 004 which is based on EPA 353.2 - automated cadmium reduction. Aqueous solutions are drawn into the instrument and passed through a copperized cadmium reduction column where any nitrate present is reduced to nitrite. The nitrite is reacted with sulfanilamide to produce an azo dye which is measured colorimetrically.

ME 081

Sample analysis is conducted by ICP-MS which follows an acid digestion/preparation of the sample which destroys and solublizes the sample. The ICP-MS analysis uses a plasma to induce energy into prepared samples so as to breakdown the compounds present and create a stream of elemental ions. The ions are then separated by a mass spectrometer in to their individual elements. The mass spectrometer measures the masses of the elements present and quantifies the levels present. These results are correlated to known levels of standards and calculated back to original concentration in the sample analyzed.

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REPORT OF ANALYSIS

For: (16098) VERIS ENVIRONMENTAL
VERIS ENVIRONMENTAL SLUDGE PKG D

ME 067

Samples are analyzed for mercury using MWL ME 067 which is based upon EPA 7471, cold vapor atomic absorption (CVAA).

Samples are prepared via MWL ME 037 that uses a series of digestion steps involving hot mineral acids and oxidizers so as to destroy organic matter and solubilize mercury. The mercury is reduced by use of stannous chloride to elemental mercury that is then aerated to the light path of a mercury light of an atomic absorption spectrometer (AAS). The absorption of the mercury light at 253.7 nm is then correlated to the level of mercury present in the original sample.

pH in soils or solids

Sample analysis follows MWL EN 002 which is based on EPA 9045. A sample of soil is mixed with DI water and allowed to equilibrate. A calibrated pH meter and probe is used to measure the pH of the sample.

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REPORT OF ANALYSIS

For: (16098) VERIS ENVIRONMENTAL
PHIPPSBURG
Veris Fecal and Solids

Analysis		Level Found As Received	Level Found Dry Weight	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: **P1**	Lab Number: **70138475**	Date Sampled: **2022-06-29 1400**						
Fecal coliforms		130		MPN/mL	0.2	SM 9221 E- (2006) / EPA 1681	Ljm8-2022/07/01	jzh4-2022/07/01
Fecal coliforms			1570	MPN/g	0.2	Calculation	Auto-2022/07/01	Auto-2022/07/01
Percent solids		8.29		%	0.01	SM 2540 G-(1997) *	drp0-2022/07/01	mgn8-2022/07/01
Sample ID: **P2**	Lab Number: **70138476**	Date Sampled: **2022-06-29 1407**						
Fecal coliforms		70		MPN/mL	0.2	SM 9221 E- (2006) / EPA 1681	Ljm8-2022/07/01	jzh4-2022/07/01
Fecal coliforms			1620	MPN/g	0.2	Calculation	Auto-2022/07/01	Auto-2022/07/01
Percent solids		4.33		%	0.01	SM 2540 G-(1997) *	drp0-2022/07/01	mgn8-2022/07/01
Sample ID: **P3**	Lab Number: **70138477**	Date Sampled: **2022-06-29 1414**						
Fecal coliforms		221		MPN/mL	0.2	SM 9221 E- (2006) / EPA 1681	Ljm8-2022/07/01	jzh4-2022/07/01
Fecal coliforms			5780	MPN/g	0.2	Calculation	Auto-2022/07/01	Auto-2022/07/01
Percent solids		3.82		%	0.01	SM 2540 G-(1997) *	drp0-2022/07/01	mgn8-2022/07/01
Sample ID: **P4**	Lab Number: **70138478**	Date Sampled: **2022-06-29 1420**						
Fecal coliforms		1720		MPN/mL	0.2	SM 9221 E- (2006) / EPA 1681	Ljm8-2022/07/01	jzh4-2022/07/01
Fecal coliforms			30600	MPN/g	0.2	Calculation	Auto-2022/07/01	Auto-2022/07/01
Percent solids		5.63		%	0.01	SM 2540 G-(1997) *	drp0-2022/07/01	mgn8-2022/07/01
Sample ID: **P5**	Lab Number: **70138479**	Date Sampled: **2022-06-29 1423**						
Fecal coliforms		2400		MPN/mL	0.2	SM 9221 E- (2006) / EPA 1681	Ljm8-2022/07/01	jzh4-2022/07/01
Fecal coliforms			24800	MPN/g	0.2	Calculation	Auto-2022/07/01	Auto-2022/07/01
Percent solids		9.66		%	0.01	SM 2540 G-(1997) *	drp0-2022/07/01	mgn8-2022/07/01

The result(s) issued on this report only reflect the analysis of the sample(s) submitted.

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REPORT OF ANALYSIS

For: (16098) VERIS ENVIRONMENTAL
PHIPPSBURG
Veris Fecal and Solids

Analysis		Level Found As Received	Level Found Dry Weight	Units	Reporting Limit	Method	Analyst-Date	Verified-Date
Sample ID: **P6**	Lab Number: **70138480**	Date Sampled: **2022-06-29 1430**						
Fecal coliforms		2400		MPN/mL	0.2	SM 9221 E- (2006) / EPA 1681	Ljm8-2022/07/01	jzh4-2022/07/01
Fecal coliforms			30900	MPN/g	0.2	Calculation	Auto-2022/07/01	Auto-2022/07/01
Percent solids		7.76		%	0.01	SM 2540 G-(1997) *	drp0-2022/07/01	mgn8-2022/07/01
Sample ID: **P7**	Lab Number: **70138481**	Date Sampled: **2022-06-29 1440**						
Fecal coliforms		33		MPN/mL	0.2	SM 9221 E- (2006) / EPA 1681	Ljm8-2022/07/01	jzh4-2022/07/01
Fecal coliforms			689	MPN/g	0.2	Calculation	Auto-2022/07/01	Auto-2022/07/01
Percent solids		4.79		%	0.01	SM 2540 G-(1997) *	drp0-2022/07/01	mgn8-2022/07/01

MPN = most probable number

cc: Account(s) 15480 VERIS ENVIRONMENTAL LLC

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REPORT OF ANALYSIS

For: (16098) VERIS ENVIRONMENTAL
PHIPPSBURG
Veris Fecal and Solids

Detailed Method Description(s)

Fecal Coliforms-MPN by SM 9221 E

Sample analysis follows MWL MI 131 which is based on Standard Methods (SM) 9221 E. A representative sample is obtained and homogenized with sterile buffers. It is aliquoted into fermentation tubes. The tubes are incubated for 22 hours and then examined for turbidity and gas production. Results are reported as most probable number per gram or mL (MPN/g or MPN/mL), which are calculated from the number of positive A-1 culture tubes and percent total solids.

Calculation

Analytical results are entered into applicable formulas to provide a calculated result which is reported.

Instructions: This spreadsheet allows an entity to enter in TENORM concentration data in order to determine the upper confidence limit of the data, establish that an appropriate number of samples have been taken and whether the materials meet the criteria related to regulatory or other thresholds, i.e exempt concentrations, registration limitations, acceptance criteria at a disposal facility, etc. According to the methods found within EPA's SW-846 document.

Step 1: Prepare your radionuclide data for entry into the "SW-846 Data Evaluation" tab within the spreadsheet

All concentration data entered into the "SW-846 Data Evaluation" tab must be net data, in other words, data must have the background value already removed, i.e. the concentration reported by the laboratory minus the established background.

You may use the tab marked "Data Preparation" to automatically subtract background from your laboratory data.

Step 2: Move to the "SW-846 Data Evaluation" tab.

Data Identification: You may enter in the facility name, isotope, and a description of the materials for your convenience.

Step 3: Establish what limit or regulatory threshold you will be comparing your data with. This may be an exempt concentration, a registration threshold, a waste acceptance value for a disposal facility, etc.

Enter the limit or threshold into the "Concentration Limit or Threshold" orange shaded cell

Step 4: Enter your net isotopic data into the Column Marked "X" in the blue shaded cells. (You may copy the data from the "Data Preparation" tab and use the "Values (V)" Paste option when right clicking in the uppermost blue shaded cell.)

Step 5: Establish whether you have an appropriate number of samples based on the varience of your data.

If the number of samples is appropriate the spreadsheet will indicate that at the top with a "Yes" next to the area marked "Appropriate number of Samples?" Additionally, the cell will be shaded green to indicate a positive and acceptable result.

If the materials meet the selected criteria for acceptance exemption registration etc. the spreadsheet will indicate that at the top with a "YES" next to the area marked "Is the Material Concentration Lower then the Threshold or Limit?" Additionally, the cell will be shaded green to indicate a positive and acceptable result.

If both of these items are shaded green and marked "YES" then your materials have been adequately characterized and have met the limits that you are using to make a determination. The upper limit of the confidence interval found in cell H10 is the value that you will use in pCi/g to describe your materials for the purposes of registration or any reporting to the department.

If the "Is the Material Concentration Lower then the Threshold or Limit?" cell is red and indicates "NO" then the upper limit of the confidence interval is in excess of the threshold value. This means that based on the data there is not sufficient confidence that the materials are less than the threshold. You may consider additional samples for analysis and addition to the existing data set.

If the "Appropriate number of Samples?" cell is red and indicates "NO" then the varience within the data is too extensive for this particular data test and more samples will likely need to be collected.

In this case the sheet will indicate the predicted number of additional samples that may be required to satisfy the statistical criteria.

Calculating Net Concentration Data

Step 1: Select your Isotope of Concern from the Drop Down

Step 2: Enter in Site Specific Background value if applicable

Step 3: Enter in your laboratory results in pCi/g

Step 4: You may use the values in the appropriate Net Concentration column for your data analysis

Please Note: Site Specific Net concentration values will be in the violet column if used

Isotope of Concern:	Ra-226

Sample	Laboratory Results (pCi/g)	Net Concentration (CDPHE Background) (pCi/g)	Net Concentration (Site Specific Background) (pCi/g)
1	0.4	0	0.4
2	0.3	0	0.3
3	0.3	0	0.3
4		0	0
5		0	0
6		0	0
7		0	0
8		0	0
9		0	0
10		0	0
11		0	0
12		0	0
13		0	0
14		0	0
15		0	0
16		0	0
17		0	0
18		0	0
19		0	0
20		0	0
21		0	0
22		0	0
23		0	0
24		0	0
25		0	0

Isotope	CDPHE Background Value (pCi/g)	Site Specific Background Value (pCi/g)
Pb-210	1.4	
Po-210	1.4	
Ra-226	1.4	
Ra-228	1.3	

Standard Analysis of Data to Determine Adequate Number of Samples and the Upper Limit of the Confidence Interval
SW-846 statistical determination of adequate characterization

Facility: ?
Isotope: Radium 226
Materials Description: Solids
Concentration Limit or Threshold 5

Appropriate Number of Samples? YES
Is the Material Concentration Lower then the Threshold or Limit? YES

Estimate X (x bar) / sample mean
(straight average of previous measurements)

Upper limit of the Confidence Interval (Reportable Value) 0.00 **pCi/g**

	estimated	calculated
Sample Mean equals	**6**	**0.0000**

Estimate S^2 Variance of sample

S^2
Variance of sample **0**

Sample Number or Date	X	X^2	sum of X^2	sum of X	$(\text{sum of X})^2$	n (number of samples)	$(\text{sum of X})^2/n$	$(\text{sum of } X^2) - [(\text{sum of X})^2]/n$	$\{(\text{sum of } X^2) - [(\text{sum of X})^2]/n\}/ n-1$
1	0	0	0	0	0	3	0	0	0
2	0	0							
3	0	0							
4		0							
5		0							
6		0							
7		0							
8		0							
9		0							
10		0							
11		0							
12		0							
13		0							
14		0							
15		0							
16		0							
17		0							
18		0							
19		0							
20		0							
21		0							
22		0							
23		0							
24		0							
25		0							

Appropriate number of samples to be collected

Δ=RT - X bar
RT = regulatory threshold
$n = t^2_{.20} * S^2 / \Delta^2$
$t_{.20}$ from table 9-2

RT	Δ	Δ^2	$t_{.20}$	$t^2_{.20}$	S^2	n
5	5.0000	25	1.886	3.556996	0	**0**

Confidence interval
$S=\sqrt{S^2}$
$S_{xbar} = S/\sqrt{n}$
CI = Confidence interval
$CI = X_{bar} \pm t_{.20} * S_{Xbar}$

S	S_{xbar}	CI		
0.00	0.00	0.00	±	0.00

Upper limit of CI 0.00

TABLE 9-2. TABULATED VALUES OF STUDENT'S "t" FOR EVALUATING Solid Waste

Degrees of freedom (n-1)	Tabulated "t" Value
	80%
1	3.078
2	1.886
3	1.638
4	1.533
5	1.476
6	1.440
7	1.415
8	1.397
9	1.393
10	1.372
11	1.363
12	1.356
13	1.350
14	1.345
15	1.341
16	1.337
17	1.333
18	1.330
19	1.328
20	1.325
21	1.323
22	1.321
23	1.319
24	1.318
25	1.316
26	1.315
27	1.314
28	1.313
29	1.311
30	1.310
40	1.303
60	1.296
120	1.289
Greater than 120	1.282

Calculating Net Concentration Data

Step 1: Select your Isotope of Concern from the Drop Down

Step 2: Enter in Site Specific Background value if applicable

Step 3: Enter in your laboratory results in pCi/g

Step 4: You may use the values in the appropriate Net Concentration column for your data analysis

Please Note: Site Specific Net concentration values will be in the violet column if used

Isotope of Concern:	Ra-228

Sample	Laboratory Results (pCi/g)	Net Concentration (CDPHE Background) (pCi/g)	Net Concentration (Site Specific Background) (pCi/g)
1	0.4	0	0.4
2	0.2	0	0.2
3	0.2	0	0.2
4		0	0
5		0	0
6		0	0
7		0	0
8		0	0
9		0	0
10		0	0
11		0	0
12		0	0
13		0	0
14		0	0
15		0	0
16		0	0
17		0	0
18		0	0
19		0	0
20		0	0
21		0	0
22		0	0
23		0	0
24		0	0
25		0	0

Isotope	CDPHE Background Value (pCi/g)	Site Specific Background Value (pCi/g)
Pb-210	1.4	
Po-210	1.4	
Ra-226	1.4	
Ra-228	1.3	

Standard Analysis of Data to Determine Adequate Number of Samples and the Upper Limit of the Confidence Interval
SW-846 statistical determination of adequate characterization

Facility: ?
Isotope: Radium 228
Materials Description: Solids
Concentration Limit or Threshold 5

Appropriate Number of Samples? YES
Is the Material Concentration Lower then the Threshold or Limit? YES

Estimate X (x bar) / sample mean
(straight average of previous measurements)

Upper limit of the Confidence Interval (Reportable Value) 0.00 **pCi/g**

	estimated	calculated
Sample Mean equals	**6**	**0.0000**

Estimate S^2 Variance of sample

S^2
Variance of sample **0**

Sample Number or Date	X	X^2	sum of X^2	sum of X	$(\text{sum of X})^2$	n (number of samples)	$(\text{sum of X})^2/n$	$(\text{sum of } X^2) - [(\text{sum of X})^2]/n$	$\{(\text{sum of } X^2) - [(\text{sum of X})^2]/n\}/ n-1$
1	0	0	0	0	0	3	0	0	0
2	0	0							
3	0	0							
4		0							
5		0							
6		0							
7		0							
8		0							
9		0							
10		0							
11		0							
12		0							
13		0							
14		0							
15		0							
16		0							
17		0							
18		0							
19		0							
20		0							
21		0							
22		0							
23		0							
24		0							
25		0							

Appropriate number of samples to be collected

Δ=RT - X bar
RT = regulatory threshold
$n = t^2_{.20} * S^2 / \Delta^2$
$t_{.20}$ from table 9-2

RT	Δ	Δ^2	$t_{.20}$	$t^2_{.20}$	S^2	n
5	5.0000	25	1.886	3.556996	0	**0**

Confidence interval
$S=\sqrt{S^2}$
$S_{xbar} = S/\sqrt{n}$
CI = Confidence interval
$CI = X_{bar} \pm t_{.20} * S_{Xbar}$

S	S_{xbar}	CI		
0.00	0.00	0.00	±	0.00

Upper limit of CI 0.00

TABLE 9-2. TABULATED VALUES OF STUDENT'S "t" FOR EVALUATING Solid Waste

Degrees of freedom (n-1)	Tabulated "t" Value
	80%
1	3.078
2	1.886
3	1.638
4	1.533
5	1.476
6	1.440
7	1.415
8	1.397
9	1.393
10	1.372
11	1.363
12	1.356
13	1.350
14	1.345
15	1.341
16	1.337
17	1.333
18	1.330
19	1.328
20	1.325
21	1.323
22	1.321
23	1.319
24	1.318
25	1.316
26	1.315
27	1.314
28	1.313
29	1.311
30	1.310
40	1.303
60	1.296
120	1.289
Greater than 120	1.282

ANALYTICAL SUMMARY REPORT

August 09, 2022

Denali Water Solutions
3308 Bernice Ave
Russellville, AR 72802-8465

Work Order: C22070099

Project Name: Not Indicated

Energy Laboratories, Inc. Casper WY received the following 3 samples for Denali Water Solutions on 7/5/2022 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C22070099-001	P1	06/29/22 14:20	07/05/22	Solid	Metals by ICP/ICPMS, Total or Soluble Moisture Digestion, Total Metals Digestion For RadioChemistry ELI_50-169 Drying/Grinding, Radiochemistry Radium 226 Radium 228
C22070099-002	P2	06/29/22 14:30	07/05/22	Solid	Same As Above
C22070099-003	P3	06/29/22 14:45	07/05/22	Solid	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager .

Report Approved By:

Alyson Degnan
Project Manager

Digitally signed by
Alyson T. Degnan
Date: 2022.08.09 19:07:52 -06:00

CLIENT: Denali Water Solutions
Project: Not Indicated
Work Order: C22070099

Report Date: 08/09/22

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client: Denali Water Solutions
Project: Not Indicated
Lab ID: C22070099-001
Client Sample ID: P1

Report Date: 08/09/22
Collection Date: 06/29/22 14:20
DateReceived: 07/05/22
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	92.5	wt%		0.20		A2540 G	07/11/22 13:32 / eli-b
Solids, Total	7.47	wt%		0.20		A2540 G	07/11/22 13:32 / eli-b
METALS, TOTAL							
Thorium	ND	mg/kg-dry		6		SW6020	07/21/22 13:09 / eli-b
Uranium	5	mg/kg-dry		1		SW6020	07/21/22 13:09 / eli-b
Uranium, Activity	3.1	pCi/g-dry		0.7		SW6020	07/21/22 13:09 / eli-b
RADIONUCLIDES							
Radium 226	0.4	pCi/g-dry				E903.0	08/01/22 15:57 / kdk
Radium 226 precision (±)	0.1	pCi/g-dry				E903.0	08/01/22 15:57 / kdk
Radium 226 MDC	0.05	pCi/g-dry				E903.0	08/01/22 15:57 / kdk
Radium 228	0.4	pCi/g-dry				RA-05	07/26/22 14:45 / trs
Radium 228 precision (±)	0.2	pCi/g-dry				RA-05	07/26/22 14:45 / trs
Radium 228 MDC	0.2	pCi/g-dry				RA-05	07/26/22 14:45 / trs

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client: Denali Water Solutions
Project: Not Indicated
Lab ID: C22070099-002
Client Sample ID: P2

Report Date: 08/09/22
Collection Date: 06/29/22 14:30
DateReceived: 07/05/22
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	95.2	wt%		0.20		A2540 G	07/11/22 13:32 / eli-b
Solids, Total	4.80	wt%		0.20		A2540 G	07/11/22 13:32 / eli-b
METALS, TOTAL							
Thorium	ND	mg/kg-dry		10		SW6020	07/21/22 13:15 / eli-b
Uranium	8	mg/kg-dry		1		SW6020	07/21/22 13:15 / eli-b
Uranium, Activity	5.6	pCi/g-dry		0.7		SW6020	07/21/22 13:15 / eli-b
RADIONUCLIDES							
Radium 226	0.3	pCi/g-dry				E903.0	08/01/22 15:57 / kdk
Radium 226 precision (±)	0.08	pCi/g-dry				E903.0	08/01/22 15:57 / kdk
Radium 226 MDC	0.05	pCi/g-dry				E903.0	08/01/22 15:57 / kdk
Radium 228	0.2	pCi/g-dry	U			RA-05	07/26/22 14:45 / trs
Radium 228 precision (±)	0.2	pCi/g-dry				RA-05	07/26/22 14:45 / trs
Radium 228 MDC	0.3	pCi/g-dry				RA-05	07/26/22 14:45 / trs

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client: Denali Water Solutions
Project: Not Indicated
Lab ID: C22070099-003
Client Sample ID: P3

Report Date: 08/09/22
Collection Date: 06/29/22 14:45
DateReceived: 07/05/22
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	95.1	wt%		0.20		A2540 G	07/11/22 13:32 / eli-b
Solids, Total	4.93	wt%		0.20		A2540 G	07/11/22 13:32 / eli-b
METALS, TOTAL							
Thorium	ND	mg/kg-dry		10		SW6020	07/21/22 13:27 / eli-b
Uranium	8	mg/kg-dry		1		SW6020	07/21/22 13:27 / eli-b
Uranium, Activity	5.4	pCi/g-dry		0.7		SW6020	07/21/22 13:27 / eli-b
RADIONUCLIDES							
Radium 226	0.3	pCi/g-dry				E903.0	08/01/22 15:57 / kdk
Radium 226 precision (±)	0.08	pCi/g-dry				E903.0	08/01/22 15:57 / kdk
Radium 226 MDC	0.05	pCi/g-dry				E903.0	08/01/22 15:57 / kdk
Radium 228	0.2	pCi/g-dry	U			RA-05	07/26/22 14:45 / trs
Radium 228 precision (±)	0.2	pCi/g-dry				RA-05	07/26/22 14:45 / trs
Radium 228 MDC	0.3	pCi/g-dry				RA-05	07/26/22 14:45 / trs

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Denali Water Solutions **Work Order:** C22070099 **Report Date:** 07/22/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2540 G**										Batch: R384549
Lab ID: **B22070456-001B DUP**	Sample Duplicate					Run: BAL #11_220711C				07/11/22 13:32
Moisture		95.2	wt%	0.20				0	10	
Lab ID: **B22070456-001B DUP**	Sample Duplicate					Run: BAL #11_220711C				07/11/22 13:32
Solids, Total		4.80	wt%	0.01				0.4	10	
Lab ID: **MBLK_MOISTHZW22**	Method Blank					Run: BAL #11_220711C				07/11/22 13:32
Moisture		100	wt%	0.01						
Lab ID: **MBLK_MOISTHZW22**	Method Blank					Run: BAL #11_220711C				07/11/22 13:32
Solids, Total		0.01	wt%	0.01						

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Denali Water Solutions **Work Order:** C22070099 **Report Date:** 07/22/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Analytical Run: ICPMS207-B_220720B	
Lab ID: **QCS**	2	Initial Calibration Verification Standard							07/21/22 11:32	
Thorium		0.0467	mg/L	0.0010	93	90	110			
Uranium		0.0476	mg/L	0.00030	95	90	110			
Lab ID: **ICSA**	2	Interference Check Sample A							07/21/22 11:38	
Thorium		0.0000125	mg/L	0.0010						
Uranium		0.0000257	mg/L	0.00030						
Lab ID: **ICSAB**	2	Interference Check Sample AB							07/21/22 11:44	
Thorium		7.22E-06	mg/L	0.0010						
Uranium		0.0000120	mg/L	0.00030						
Method: **SW6020**									Batch: 168299	
Lab ID: **MB-168299**	3	Method Blank				Run: ICPMS207-B_220720B			07/21/22 12:21	
Thorium		ND	mg/kg	0.05						
Uranium		0.007	mg/kg	0.006						
Uranium, Activity		0.005	pCi/g	0.004						
Lab ID: **LCS3-168299**	2	Laboratory Control Sample				Run: ICPMS207-B_220720B			07/21/22 12:27	
Thorium		48.7	mg/kg	2.0	97	80	120			
Uranium		49.9	mg/kg	1.0	100	80	120			
Lab ID: **B22070646-002ADIL**	3	Serial Dilution				Run: ICPMS207-B_220720B			07/21/22 14:52	
Thorium		5.44	mg/kg-dry	5.1					10	N
Uranium		0.462	mg/kg-dry	1.0					10	N
Uranium, Activity		0.313	pCi/g-dry	0.68						N
Lab ID: **B22070646-002APDS1**	2	Post Digestion/Distillation Spike				Run: ICPMS207-B_220720B			07/21/22 14:58	
Thorium		33.0	mg/kg-dry	1.1	104	75	125			
Uranium		28.3	mg/kg-dry	1.0	105	75	125			
Lab ID: **B22070646-002AMS3**	2	Sample Matrix Spike				Run: ICPMS207-B_220720B			07/21/22 15:17	
Thorium		60.1	mg/kg-dry	2.2	98	75	125			
Uranium		57.8	mg/kg-dry	1.0	103	75	125			
Lab ID: **B22070646-002AMSD**	2	Sample Matrix Spike Duplicate				Run: ICPMS207-B_220720B			07/21/22 15:23	
Thorium		60.7	mg/kg-dry	2.1	107	75	125	1.1	20	
Uranium		54.6	mg/kg-dry	1.0	105	75	125	5.8	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

N - Analyte concentration was not sufficiently high to calculate a Relative Percent Difference (RPD) for the serial dilution test

QA/QC Summary Report

Prepared by Casper, WY Branch

Client: Denali Water Solutions **Work Order:** C22070099 **Report Date:** 08/04/22

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: 67563
Lab ID: LCS1-67563	Laboratory Control Sample				Run: G5000W_220720B				08/01/22 12:44
Radium 226	2.0	pCi/g-dry		79	70	130			
Radium 226 precision (±)	0.38	pCi/g-dry							
Radium 226 MDC	0.049	pCi/g-dry							
Lab ID: MB-67563	Method Blank				Run: G5000W_220720B				08/01/22 12:44
Radium 226	0.002	pCi/g-dry							U
Radium 226 precision (±)	0.02	pCi/g-dry							
Radium 226 MDC	0.03	pCi/g-dry							
Lab ID: C22070098-003AMS1	Sample Matrix Spike				Run: G5000W_220720B				08/01/22 14:21
Radium 226	2.0	pCi/g-dry		63	70	130			S
Radium 226 precision (±)	0.40	pCi/g-dry							
Radium 226 MDC	0.048	pCi/g-dry							
Lab ID: C22070098-003AMSD1	Sample Matrix Spike Duplicate				Run: G5000W_220720B				08/01/22 14:21
Radium 226	1.9	pCi/g-dry		57	70	130	7.4	30	S
Radium 226 precision (±)	0.37	pCi/g-dry							
Radium 226 MDC	0.048	pCi/g-dry							

- The RER result is 0.25.

Qualifiers:

RL - Analyte Reporting Limit

S - Spike recovery outside of advisory limits

ND - Not detected at the Reporting Limit (RL)

U - Not detected at Minimum Detectable Concentration (MDC)

QA/QC Summary Report

Prepared by Casper, WY Branch

Client: Denali Water Solutions **Work Order:** C22070099 **Report Date:** 08/04/22

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **RA-05**									Batch: 67563
Lab ID: **MB-67563**	Method Blank				Run: TENNELEC-4_220720C				07/26/22 14:45
Radium 228	-0.02	pCi/g-dry							U
Radium 228 precision (±)	0.08	pCi/g-dry							
Radium 228 MDC	0.1	pCi/g-dry							
Lab ID: **C22070098-003AMS4**	Sample Matrix Spike				Run: TENNELEC-4_220720C				07/26/22 14:45
Radium 228	1.7	pCi/g-dry		49	70	130			S
Radium 228 precision (±)	0.36	pCi/g-dry							
Radium 228 MDC	0.24	pCi/g-dry							
Lab ID: **C22070098-003AMSD4**	Sample Matrix Spike Duplicate				Run: TENNELEC-4_220720C				07/26/22 14:45
Radium 228	1.8	pCi/g-dry		55	70	130	7.6	30	S
Radium 228 precision (±)	0.40	pCi/g-dry							
Radium 228 MDC	0.26	pCi/g-dry							
- The RER result is 0.25.									
Lab ID: **LCS4-67563**	Laboratory Control Sample				Run: TENNELEC-4_220720C				07/26/22 14:45
Radium 228	1.9	pCi/g-dry		83	70	130			
Radium 228 precision (±)	0.40	pCi/g-dry							
Radium 228 MDC	0.25	pCi/g-dry							

Qualifiers:

RL - Analyte Reporting Limit

S - Spike recovery outside of advisory limits

ND - Not detected at the Reporting Limit (RL)

U - Not detected at Minimum Detectable Concentration (MDC)

Work Order Receipt Checklist

Denali Water Solutions

C22070099

Login completed by: Kirsten L. Smith
Reviewed by: Chantel S. Johnson
Reviewed Date: 7/11/2022

Date Received: 7/5/2022
Received by: drb
Carrier name: UPS

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	26.2°C No Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES
Trust our People. Trust our Data.

Chain of Custody & Analytical Request Record

www.energylab.com

Page _____ of _____

Account Information *(Billing information)*

Company/Name	Denali Water
Contact	Mike Scharp
Phone	303-886-0572
Mailing Address	
City, State, Zip	
Email	mike.scharp@denaliwater.com
Receive Invoice	☐Hard Copy ■Email
Receive Report	☐Hard Copy ■Email
Purchase Order	
Quote	
Bottle Order	

Report Information *(if different than Account Information)*

Company/Name	
Contact	
Phone	
Mailing Address	
City, State, Zip	
Email	
Receive Report	☐Hard Copy ☐Email
Special Report/Formats:	☐ LEVEL IV ☐NELAC ☐ EDD/EDT *(contact laboratory)* ☐ Other_____

Comments

Project Information

Project Name, PWSID, Permit, etc.	
Sampler Name M Scharp	Sampler Phone 303-886-0572
Sample Origin State CO	EPA/State Compliance ☐ Yes ☐ No

URANIUM MINING CLIENTS MUST indicate sample type
☐ Unprocessed Ore
☐ Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11(e)2 Byproduct Material (Can ONLY be Submitted to ELI Casper Location)

Matrix Codes
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Biopsay
O - Oil
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

	Sample Identification *(Name, Location, Interval, etc.)*	Collection Date	Collection Time	Number of Containers	Matrix *(See Codes Above)*	Uranium	Thorium	Radium 226	Radium 228	% total solids	VOC	Semi VOC			See Attached	RUSH TAT	ELI LAB ID *Laboratory Use Only*
1	P1	6/29/22	220	2	S	✓	✓	✓	✓	✓							C22070099
2	P2	6/29/22	230	2	S	✓	✓	✓	✓	✓							
3	P3	6/29/22	245	2	S	✓	✓	✓	✓	✓							
4																	
5																	
6																	
7																	
8																	
9																	

ELI is REQUIRED to provide preservative traceability. If the preservatives supplied with the bottle order were **NOT** used, please attach your preservative information with this COC.

Custody Record MUST be signed							
	Relinquished by (print) Mike Scharp	Date/Time 6/29/22	Signature	Received by (print)	Date/Time	Signature
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print) Dakota Bowman	Date/Time 7/5/22 11:35	Signature

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check_____	Amount $	Receipt Number *(cash/check only)*

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.