CAPITAL ASSESSMENT REPORT:

Sewer Collection & Wastewater Treatment System

TOWN OF RIDGWAY

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Abbreviations

AF - Acre Feet
AGI - Applegate Group
BOD - Biochemical Oxygen Demand
CFS - Cubic Feet per Second
CWCB - Colorado Water Conservation Board
CDPHE - Colorado Department of Public Health and Environment
CIP - Clean in Place (of microfiltration modules)
DMR - Discharge Monitoring Report
DOLA - Department of Local Affairs
EPA - Environment Protection Agency
HAA5 - Haloacetic acids
IGA - Intergovernmental Agreement
IGB - Initial Growth Boundary
Lake O - Lake Otonowanda
MGD - Million gallons per day
NTU - Nephelometric Turbidity Units
PB - Polybutylene
PPD - pounds per day
RD - Rural Development
SDR – Standard Dimension Ratio.
SRF - State Revolving Fund (CDPHE grant and loans)
TCW - Tri County Water Conservancy District
TIN - Total inorganic nitrogen
TP - Total Phosphorus
THM - Trihalomethanes
TOC - Total organic carbon
TSS - Total suspended solids
UGB - Urban Growth Boundary
VIP - Voluntary Incentive Program
WQBEL - Water Quality Based Effluent Limits
WQCC - Water Quality Control Commission

SEWER COLLECTION SYSTEM ASSESSMENT

Background

The original sewer collection system was installed in 1974 using a mix of Standard Dimension Ratio (SDR) 35 and SDR 41 PVC pipe. Later additions to the system were constructed with SDR 35 PVC pipe. Some segments have bell and spigot and some are plain pipe with collar connections. It is important to note that the SDR 41 pipe has a much thinner wall than the SDR 35, the latter is now the minimum required by the Town. With thinner walled pipe, such as SDR 41, it is very important that the trench excavation, bedding zone material placement and compaction and the final fill of the trench follow proper installation process since the trench bedding provides the support for the pipe.

The Town's sewer system has had few noticeable issues over the years. Occasionally grease will plug a main line, lift station, or a service, and there have been some occasional tree root invasion issues, but otherwise the system has had mostly minor issues. Because there had been so few problems historically, the Town had not done a thorough inspection of the system since it was installed, until 2016. In 2016, the Town contracted with Southwestern Systems to clean and video the lines on Sherman Street and the lines south of Sherman Street in the historic part of Town. Then in 2017 Southwestern Systems videoed the lines north of Sherman Street in the historic part of Town. The videos revealed that although the system has not caused many issues for the Town, there are some areas of concern, which are most likely a result of the original installation work. Additional camera work is planned in 2019 to review additional lines in the Town's sewer collection system.

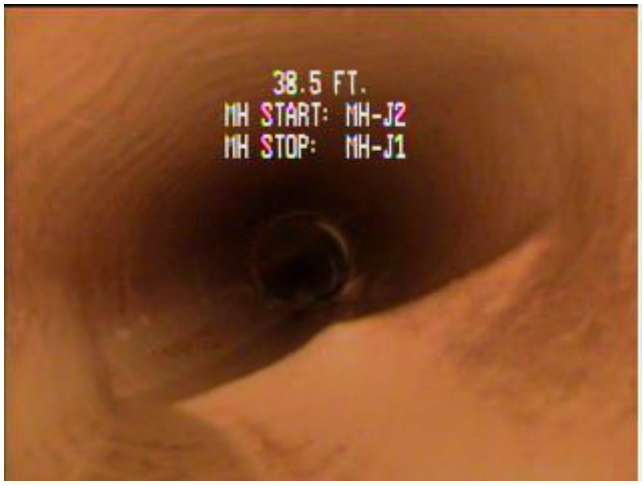
Sewer Main Review

Proper installation for sewer collection systems should include proper bedding of the pipe by placing the pipe at grade in a bed of sand, a small uniformly screen rock, or fine screened granular type material. Next bedding material is placed up to springline (half way up the side of the pipe) and compacted without displacing alignment and grade so as to create a cradle under the pipe. The final lift of bedding is placed to one foot above the top of pipe and compacted. With proper bedding the pipe is completely surrounded by compacted bedding material ensuring rocks do not push against the pipe, and giving the pipe uniform support to help keep the relatively thin walled sewer pipe round. When reviewing a video of a properly bedded pipe, the pipe will appear perfectly round and there will be few, if any, sags. With proper alignment, the pipe barrels will carry the flow at an even width and depth and the joints are centered and do not create disturbance of the flow.

The typical joining of the pipe segments is bell and spigot where the connection is secured by a gasket retained in the bell. Each joint of pipe has a bell on one end and a spigot on the other. The pipe is laid with the bells on the upstream end and the next joint's spigot is pushed home into the previous joint's bell. Sewer should be installed from the downstream end going upstream. If the pipe is pushed into the bell too hard, one will often get a rolled gasket. No rolled gaskets were observed in the videos. However, a good portion of the original Ridgway system is collar connected joints of pipe rather than bell and spigot. With collar connections, each pipe has a spigot on each end and the joining is done with a collar. The collar has two rubber gaskets, one sealing each pipe end so there are additional opportunities for joint issues. Other potential problems with this type joining include: The pipe can be pushed too far home, pushing the coupler over the adjoining pipe and not create the seal, or the collar can split. It is easier to have an offset joint with collar connections too.

One split collar was found. A number of connections were not fully home, and on a couple of the connections it appears the collar moved while joining and is all on one pipe leaving the second pipe barely within the rubber and not sealed. While the Town could probably live with the pipes not fully home, the other joining problems should be excavated and repaired with a wrap-around clamp as these issues leave the pipe open to infiltration,

exfiltration, and root and dirt intrusion. Some offset joints were observed, which are typically an alignment problem created by uneven pipe support or just careless assembly.

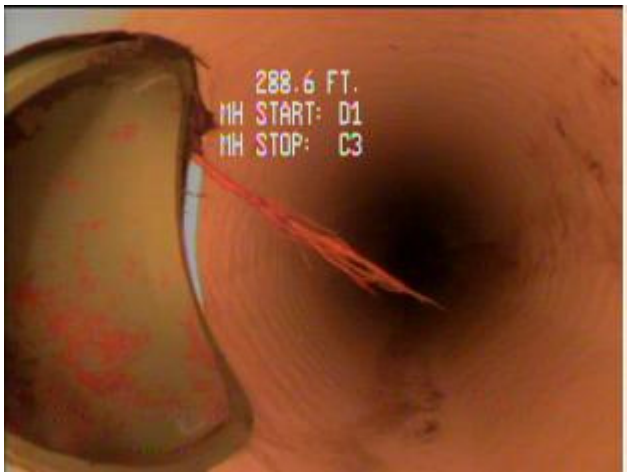


The videos reveal evidence that some of the installation of the pipe may not have been optimum. This conclusion is based on the number and severity of sags indicating vertical alignment is not accurate. There are also a number of minor, medium, and major indentations where rocks in the pipe bedding zone are pushing against the outside of the pipe and creating dimples into the interior of the pipe or deforming the pipe as shown on the photo to the left. There are areas where the pipe is deformed sufficiently that the pipe is cracked and/or broken, and in some places pieces of pipe are missing allowing gravel from outside of the pipe to enter the flow area. One of the worst such locations was on Sherman Street between Lena and Cora Streets where several feet of the pipe had pieces missing and there was a lineal crack that ran the full length of a piece of pipe into the next pipe. This section was repaired during the Downtown Improvement project in 2017, prior to the placement of the final lift of asphalt on Sherman Street.

There are also indications that in some locations the pipe zone bedding was not properly compacted during with the original installation. With flexible pipes such as PVC sewer pipes, some of the strength of the pipe comes from properly compacting the bedding especially below the center line (springline) of the pipe. Well compacted materials around the pipe support the pipe and help keep it round. The pipe should remain perfectly round if its properly bedded. When the compaction around the pipe is inadequate, the pipe cross section will compress due to the pressure of backfill over the pipe resulting in "egging" of the pipe where the top of the pipe is pushed down and the sides pushed out, creating an oval shape. In the extreme of this condition the pipe can be compressed to the point where it breaks. We observed two areas where egging was at the point that the pipe cracked. These areas should be excavated for the length the pipe that is oval and replaced with new round pipe since once the pipe starts to deflect it cannot be pushed back to round. The areas of cracked pipe needing repair are listed on Table WW-1. The Town has budgeted for some of these repairs in 2019.

Service Connections

There are a number of ways to make a service connection to the main. The Town standards call for the use of a full-bodied wye for service connections and these are used fairly consistently in Ridgway when installing a new mains. When full-bodied wyes are installed during the installation of the pipe, and the pipe is properly bedded, they are almost fool proof and almost always are in very good shape years after installation. Reviewing the videos, this is largely the case where full-bodied wyes were observed. The only problems where full-bodied wyes were installed after pipe installation are some grade and alignment problems and rough main line pipe cuts when a full-bodied wye for a new tap was cut into an existing main. The full-bodied wyes cut into an existing line still provides a water tight seal but it does require cutting the existing pipe to install the wye and adding a coupling. Such installations require very careful



bedding compaction to prevent grade and alignment issues between the wye and the existing main.

Some taps were installed with a strap-on-saddle or tap saddle connection. Proper installation of a tap saddle is to cut the hole into the main just slightly (approximately 1/8" to 1/4") larger than the tap saddle lip. After the hole is cut, the edges of the hole should be filed smooth to remove any ragged edges that would catch debris. When strapping the saddle to the main pipe, the gasket on the saddle then fits flat on the outside of the pipe and allows the lip of the saddle to fit into the cut hole. The saddle is secured by two stainless steel straps that tighten the saddle to the main, compressing the gasket. In reviewing the videos many of the tap saddle connections observed were constructed in a less than ideal manner. Problems observed on the videos (see photo at left) included rough irregularly shaped holes with some too small, others too large, and some were not cut to the shape of the saddle at all. Where the hole is too small or is irregular enough not to allow the lip of the saddle to fit into the hole, the lip will bridge and not allow the gasket to seal, thus becoming a source of roots and/or ground water infiltration. Where the hole is too large, the gasket is not large enough and again creates a source for root and ground water infiltration.

Another method of connection is a glue-on saddle connection. The main is prepared similarly to the strap on saddle, however there is no gasket and the saddle is glued directly to the main. The glue-on saddle still requires straps to hold the saddle while the glue cures and keep stresses from removing the saddle over time. Of the observed taps that were glue-on type there were a number that had irregular shaped holes that were not filed smooth.

We also observed taps where a hole was cut into the pipe, the service pipe inserted in the hole and there appears to be “rub-r-nek” wrapped (an elastomeric sealant used to seal manhole sections) around the connection then backfilled. With this type of tap, there is no physical connection of the service pipe to the main so the service line can push into the main and become an intruding tap as shown at right. This is the worst type of tap because of the lack of physical connection which allows for intrusion of dirt and roots, and because the tap pipe intrusion can interfere with cleaning and videoing of the line. There were not many intruding taps found on the Ridgway system but those observed are listed in Table WW-1. This one above is on Lena between Otto and Frederick and should be repaired before this section of Lena Street is paved. This repair is also planned and budgeted in 2019.

As with the main line pipe, providing good bedding and compaction to support each service connection is important. If the connection is not properly supported and protected by the compacted bedding, stress or rocks can damage the connection during the trench backfill. Some service connections showed stress cracks indicating they were not properly bedded. Although the camera cannot see very far up the service line, if the service line is not properly bedded and compacted, it too can experience pipe indents and even pipe breaks.

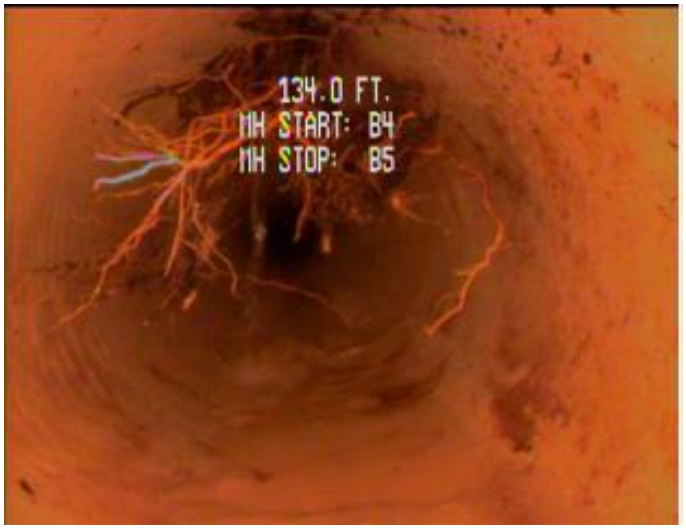
Tables WW-1 is an itemized list of the issues with the collection system except the pipe indents. It includes the location, nature of the deficiency, a ranking of the severity, a priority for repair and estimated costs to repair. Each of these issues is shown in Figure WW-1. Table WW-2 lists locations where improper bedding has caused the pipe to be dented. Table WW-3 is a comprehensive list of the all the sewer lines that has been video inspected and a condition summary of each inspected line.

Note that the detailed review of the collection system for this report is limited to the lines for which the Town has recent video recordings (2016-2017). The Town is encouraged to continue to inspect lines and to update the tables included with this report as more data is collected. Additional video is budgeted and planned in 2019.

Operations

Grease is typically prevented from getting into the collection system by requiring the installation and proper maintenance of grease traps. While the Town does not have specific grease trap regulations, the Town Code explicitly states that it is unlawful to permit or cause any liquid, solid, or gas, capable of obstructing flow through the Town's sewer system to be discharged into or flow through the Town's sewer system, and that it is unlawful to discharge anything to the Town sewer system which would inhibit, interfere, or otherwise be incompatible with operation of the sewage treatment or sewage system. In addition, the 2006 International Plumbing Code states that interceptors and separators shall be provided to prevent the discharge of oil, grease, sand and other substances harmful or hazardous to the building drainage system, the public sewer, the private sewage disposal system or the sewage treatment plant or processes. Obstruction of flow applies to grease such as the grease observed with the video inspections and also includes items that could interfere with the flow. Note that the lines were cleaned prior to video inspection and much of the grease that was in the line removed in advance of placing the video camera in the line. We observed lines where it was apparent there had been frequent grease blockages by the stains on the inside of the pipe.

In addition, many of the apparent line blockages were around taps where grease was a major contributor to the obstruction. Notes from the cleaning/inspection process indicated the private property or business owner removed large amount of grease from various lines typically on lines that received flow from restaurants. As grease cools, it can adhere to the pipe and create blockages, which are very difficult to remove. While the current code provisions and regulations are helpful to mitigate discharges into the system that are damaging, it is recommended that the Town adopt regulations that further specify grease trap requirements including design, location, service, maintenance and other details necessary to protect the collection and treatment systems. It is suggested that the Town work with restaurant owners, and other users whose taps indicate grease contribution, to properly remove grease before it is discharged to the Town's collection system. In advance of those specific regulations, or coincident with, it is suggested that the town staff meet with the owners and explain the challenges and requirements for the use of the collection system so as to facilitate grease trap installation and cleaning in order to minimize the discharge of grease into the system. As of early 2019, the Town is working on both new regulations and working with businesses to better understand existing conditions onsite, identify potential solutions to mitigate undesirable discharges into the collection system, and to identify opportunities for the updated grease trap and discharge regulations.



Tree roots can enter from the open tap connections and potentially from cracks in the main and/or service connections. Gravel and dirt can enter either from places where the pipe (main or service line) has failed or missing, from taps that are not properly sealed, or from the opening a manhole lid. Great care should be taken when opening and closing manhole lids to make sure gravel from around the manhole is not allowed to fall into the manhole. Taps that are not properly sealed should be repaired to provide a water-tight connection. Pipe breaks should be repaired with a repair clamp or with line replacement as appropriate.

Abandoned and unused taps that have been installed for future use can also create problems. It was observed that there are number of taps that have caps indicating they are unused and properly sealed. These taps should be logged and recorded, eventually in the GIS database, so if someone wants to use them the Town will know where they are located. At times it is difficult to determine from a video if a tap is abandoned especially when they are not capped close the main or not sealed at all. This can occur if a house is removed from a site and the location of the tap forgotten and then a new tap is installed. It also occurs when a service line does not work properly and rather than fixing the existing line, the property owner installs a new service line as the repair. Maintaining records of where the taps are located and requiring the property owners to connect to an existing tap when one is present is important. Alternatively, if a new tap is allowed, there needs to be a requirement that the property owner properly remove and seal the original tap. The Town's Standards and Specifications should be updated to specifically require doing this removal and seal. A table that summarizes all the taps identified from the videos is included in the Appendix WW-1. The excel sheet from which that Appendix is printed is provided to the Town so that the Town can update the information as things change.

Lift Stations

Where topography is such that sewage cannot flow downhill all the way to reach the plant, the sewage is collected at a local low point and then lifted by pumps to a grade at which it can flow by gravity to its destination. Sewage pumps stations are typically referred to as lift stations. The Town has several such stations as summarized below:

Lift Station Name/No.	Wet Well Volume	# of Pumps and Capacities (gpm and Hp)	Current Peak Daily Flow (MGD)
Fairgrounds	1000	3 - 5 hp 140 gpm	.025
RUSA #2	200	2 - 3 hp 80 gpm	.008
Yates #3	150	2 - 3 hp	.001
River Park #4	950	2 - 7.5 hp 300 gpm	0.025

The Fairgrounds lift station serves all the users east of the Uncompahgre River. A station at this location was originally installed when Ridgway USA was developed in the early 1990's. That station was replaced with a new, much larger and deeper station in the 2009-10 timeframe. The new station is located in the northwest corner of the Fairgrounds property. The station includes a two-chamber wet well with two solid handling submersible pumps in the north chamber of the wet well and one pump currently in the south chamber. In the longer term, as demand increases, the wet well is designed to have two pumps in each chamber. Each of the pumps can pump about 140 gallons per minute (gpm) and the new 8" force main (pressure sewer line) is sized for up to 3 pumps to be running. That force main is not currently in use. Instead at the current flows, the older 4" force main provides adequate capacity and is still in use. The reason for the two wet well chambers is to be able handle a wide range of flows over time. Current flows only require one chamber but as the usage increases more wet well capacity is available for use to keep pump cycles in the proper range. When the loading into the wet well requires two pumps to be running frequently at the same time, it is recommended that the Town switch to using the 8" force main. Note that the lift station was designed during the mid-2000's when the Town was growing very rapidly and there were several proposals for dense developments east of the river under review. With the recession in 2008, those developments did not materialize. Because of this, demands on this lift station have been much less than anticipated and there is significant capacity available for additional usage of this station.

The wet well and pump system at the fairgrounds is designed to be deep enough to serve not only the current properties due north of the fairgrounds in the Triangle Subdivision, but with a new deeper highway crossing east of the Triangle Subdivision could also eventually eliminate the need for the RUSA #2 lift station. The Town

installed a new collection line under SH 62 to facilitate the extension of the deeper line going north and east, but that is only the first step toward that solution. There is still about 1000 feet of collection line and another highway crossing that would be needed before the need for the RUSA #2 lift station could be eliminated. However as noted below the existing pumps and related equipment in RUSA #2 lift station were already past their useful life. Since expansion of the collection was not imminent, it is unlikely the RUSA #2 lift station can be removed for 25+ years, unless significant development comes forward sooner. The Fairgrounds pumps have only been in use for about 8 years and the demand and thus the pumping hours are much less than was anticipated during design. This means that the pumps have more remaining design life left than would be anticipated based on age alone. At this point, with proper routine maintenance, the pumps at the fairgrounds should not need to be replaced for 15-20 years.

The RUSA #2 lift station is situated on Lot 3 PUD of the Ridgway Land Company subdivision. This station includes a main wet well and overflow wet well. The overflow wet well provides capacity in case there is a pump or power failure. This station serves most of the parcels north of Hunter Parkway in that subdivision. There is also a collection line stubbed to the north that if easements were available could be extended and potentially serve the County property and/or Vista Terrace to the north.

Sewage flows from surrounding properties into a wet well in the Lot 3 PUD, and from there the sewage is pumped to Hunter Parkway. From Hunter Parkway it flows by gravity to the Fairgrounds lift station. The RUSA #2 lift station had been plagued with clogging issues from rags and wipes being discharged to the collection system, compromising the utility and functionality of the pumps in the station, resulting in significant manual labor. The town repeatedly reached out to users asking them to not flush such items but with limited success. In 2018, the Town removed the then 25-year old submersible pumps that were at the end of their useful life and replaced them with self-priming centrifugal pumps that are situated in a dry well next to the wet well. The impellers on the centrifugal pumps is more open and supposed to be better able to handle rags. There are also new controls for the new system and the electrical service includes a manual transfer switch so that a portable generator in an extended power failure. The pumps are new and have an expected service life in excess of 30 years. The motors need regular maintenance and are likely to need replaced in about 20 years. There is grating in the main wet well that is deteriorated to the point that it is recommended it be removed. With the pumps no longer in the wet well, there is much less need to be the in the wet well so rather than replacing the grating, it makes sense to just have ladder to use on the rare occasions when it is necessary to enter the wet well.

On the west end of Town on North Amelia there are about 5 residences that are too low to flow by gravity into the existing collection system. Sewage from those residences flows to the Yates lift station on the east side of North Amelia about as far north as Otto Street be if was extended to the west. This very small lift station was installed in the early 1990's and consists of a single wet well with two small grinder pumps. The force main from this station discharges into a manhole at Charles and Amelia. The control panel for this station was rebuilt about 5 years ago and after about 25 years of sitting in sewage, the pumps are at the end of their useful life and planned to be replaced in 2019. If a sewer line is extended west on Otto to Amelia, it might be possible to serve the Yates customers with a line in Otto and eventually eliminate the need for the Yates station.

Most of the land to the north of the existing wastewater treatment plant at Otto and Railroad Streets requires a lift station to reach the treatment works. The River Park lift station is located on the northeast corner of the wastewater treatment plant site outside the fence. This station serves all the developed properties to the north and west of the existing treatment plant. The station was constructed by the River Park developer's contract as part of the infrastructure for the River Park Subdivision in the 2000 timeframe. The station includes two 7.5 hp self priming centrifugal pumps each capable of pumping 300 gpm. Note however that the Town is required to have one backup pump so the functional capacity of the station is 300 gpm. This station discharges to a force main outside the fence of the wastewater plant on the west side of Railroad Street and then turns onto Otto Street and discharges to the main interceptor in Otto outside the Public Works facilities. That station runs about

10 hours per week and is operating at a small fraction of its design capacity. With self-priming pumps, the pumps have a 30+ year design life. The motors have more like a 20-year design life before major rebuilds could be necessary. With the station running at lower design capacity, the motors may go a bit longer but the Town should anticipate that those motors may need some expensive work in the next 3-5 years.

There are a few individual users that have private lift stations that pump sewage to the Town's collection system. The Town requires that these be designed by a licensed engineer. The Town reviews the plans for these stations but makes it very clear that the Town takes no responsibility for the adequacy of the design. The Town tries to have developers develop in a way that allows gravity flow to the collection system. However, when the Developer goes ahead with platting lots that are too low to flow by gravity to the collection system, the Town requires a plat note on the Final Plat Map indicating that the Town anticipates the platted lot will not be able to flow by gravity to the sewer. We recommend that the Town continue with this approach of discouraging private lift stations and being sure that lot buyers are aware of the issue when a private lift station might be necessary.

On Site Disposal Systems

Consistent with State law, if the lot is within 400 feet of sewer collection line, the Town Code requires that the lot connect to the Town's collection system. There are a few developments within the Town limits where the Town has allowed the use of on-site sewage disposal systems. When Vista Terrace Subdivision was platted in the early 1980's, there was no sewer line for thousands of feet so the subdivision was platted with larger lots and those lots were allowed to have on-site disposal systems. If a more dense subdivision is added in that area, it is recommended that the developer be required to extend municipal sewer lines to serve new and existing development.

There are also two other subdivisions farther north of the wastewater treatment plant, RiverSage PUD and Sweetwater Subdivision, that are in-Town but a long way from a sewer collection line. Both of these subdivisions were platted allowing for use of on-site disposal systems. All such systems must be designed and inspected by a licensed engineer. The Town allows the Ouray County Land Use Office to review and approve permits for these systems. It is recommended that the Town continue allowing these subdivisions to develop with septic systems, but try to keep development in locations where it is practical for the development to be served by the Town's collection system. If collection lines are extended to a point where any of the developed areas currently served by on-site systems could be served by the new lines, we recommend the Town work with these customers to have them connect to the collection system, as is required by the Town Code and State law.

Conclusions

The collection system is relatively new and many of the lines are in adequate condition; however, it is apparent that the installation may not have been as good as one would have liked for long-term performance and serviceability of the system. There are a number of service connections that are generally in poor condition, creating a source of root infiltration into the Town's system. From the video review, there were not large sections of mains that need total replacement, however there are areas where spot repairs are recommended, and some of these are planned in 2019. Several segments of the 12" and 8" lines installed with the 1974 project show signs of pipe egging, where the pipe is deformed due to poor bedding. One line on Sherman Street between Mary and Laura Streets has some extensive egging but is not quite to the point that it is breaking. There are also numerous sections where rocks against the pipe are causing indents of the pipe. The areas where dimpling (indents) of the pipe due to rocks outside of the pipe, could rupture over time, especially where the rocks are sharp and/or the dents are enough to obstructions flow or does not allow camera or cleaning equipment to get by. These should be fixed relatively soon. The smaller dimples should be monitored as over time as they may become worse as the soils settle around the pipe putting pressure on the pipe. The summary of the deficiencies lists a number of those recommended for repair (Table WW-5).

It is recommended the Town develop additional grease trap requirements and a monitoring program to protect the collection and lagoon systems. This will require working with entities that generate grease to not only be sure they have adequate equipment to remove grease but also have equipment or a service provider to insure the traps are maintained, serviced and functioning properly.

The quality of the cut in taps varies. A number of the cuts are smooth and match the saddle, but others are jagged, under cut, over cut, improperly seated etc. The ones that allowing root penetration and/or infiltration of water or dirt or obstructing flow should be repaired as funds and time allow. Going forward, the Town should either perform the tapping of the main work and charge the property owner for the work or develop an inspection program that ensures proper tapping.

WASTEWATER TREATMENT PLANT ASSESSMENT

Background

The original wastewater treatment plant was constructed in 1976 timeframe. It consisted of two earthen lined, approximately 8' deep lagoons. Initially the first cell operated as a partially mixed aerated lagoon and the second cell as a polishing pond. There was no influent flow measurement. A tablet feeder provided chlorine disinfection. When the plant was constructed it met the design requirements current at the time. By the early 90's, the scientific literature and CDPHE experience was concluding that lagoon cells needed to be deeper than 8 ft to control algae and that a minimum of 3 cells was recommended to provide more aerated detention time.

The hydraulic grade line of the interceptor into the plant is very flat, which complicated influent flow measurement and did not allow for the ponds to be raised much without adding a lift station at the plant. The Town did raise the cells a few inches by adjusting the height of the cell overflow weirs to improve the cell depth a little. This change causes a back-up of the hydraulic grade of the sewage to the point where it submerges the manhole immediately upstream of the first cell and almost submerges the manhole to the south of that. The Town thought about deepening the cells to improve performance; however, that would require draining the lagoons, allowing them to dry and then excavating and relining. The latter was impractical especially with only two cells. Adding a lift station that increased the depth of the water could cause the ponds to leak. For the most part, the plant was in compliance and with the challenges above and CDPHE did not ask the Town to bring the plant up to the updated design standards during the mid 1980's.

In the mid 1980's the Town had a number of issues with the chlorine tablet feeder. The tablets would get trapped in the feeder tube and insufficient chlorine would get into the effluent leading to effluent coliform violations. As a result, the Town converted to feeding hypochlorite in solution for disinfection. Although all treatment plants were supposed to be measuring both influent and effluent flow starting in the late 1980's, due to the flat hydraulic grade, the Town was granted a temporary waiver by CDPHE. When the plant was expanded in the late 1990's the waiver expired and the town installed an extra-large trapezoidal flume to monitor the influent flow because the extra-large trapezoidal flume can measure flows on a relatively flat slope. A V-notch weir was installed at the chlorine contact chamber outfall to measure the effluent flow.

In response to compliance issues and algal overgrowth in the early 1990's, the Town added a baffle curtain to separate the second cell into two separate treatment areas, creating functionally a three celled system. The upper (southern) two thirds ran as a partially mixed aerated cell and the downstream (northern) third was quiescent and functioned as the polishing pond. For a period of time, this polishing pond area was covered with shade cloth to try to better control algal growth.

As the Town continued to grow through the 1990s, plant capacity started to present a challenge. There were days in the summer in the late 1990's when the plant exceeded 80% of the plant's 0.1 million gallons per day (MGD) capacity.

The plant remained mostly in compliance but capacity challenges were looming. In the late 1990's the Town began planning for a plant expansion. In the 1999 timeframe the plant was expanded. The expansion included installing the new extra-large trapezoidal influent flume, adding a polypropylene lined third cell, a new chlorine contact-chamber with solution chlorination and dechlorination facilities, a new V-notch effluent flume and piping that allows the plant to run in series, parallel, or to bypass a cell. There is also a recirculation pump that can recirculate some of the effluent from the 3rd cell back to the front end of the first cell. The effluent from the 3rd cell that is not recirculated is disinfected with sodium hypochlorite (strong bleach), and if needed, can be dechlorinated and then discharged to the Uncompahgre River east of the plant. Piping for the plant expansion included provisions to add one more lagoon cell to the west of the current Cell 3, although flow into the cell to the west would come from cell 2 and the existing 3rd cell would become the 4th cell in the flow schematic. Figure WW-10 is the piping plan for the facilities, including existing conditions as well as showing the future full-build out with the fourth lagoon.

Cell 1 is the southern most cell. The 1999 expansion added sufficient aeration and mixing in the first cell for it to run as a complete mix pond. Note that at least in theory treatment is more rapid in a complete mix environment than in a partially mixed one but requires more mixing and thus requires more horsepower. Cell 1 at the high-water line is about 156’ long by 106’ wide by about 7-8’ deep. The pond has the physical and electrical assets to run up to four each 15 horse power (hp) surface splashers. The plant operators have determined that running two, 10 hp aerators (20 hp total) at a given time is adequate to keep the cell mixed and meet oxygen needs, as recently as 2018. Table WW-10 is list of the conduits and conductors to each of the cells.

Cell 2, to the north of cell 1, and hydraulically downstream of it, has overall normal high water line dimensions of about 140 feet long, 106 feet wide, and about 7-8 feet deep. As noted above there is a baffle curtain about two thirds of the way toward the north end of the cell. Cell 2 has the electrical and physical capacity for two 10 hp aerators upstream of the baffle curtain and one 10 hp aerator downstream of the baffle. There is also a conduit with a pull cord already installed to run additional wiring as needed from the motor control center to the edge of Cell 2. Currently there is a 10 hp aerator in the upstream side of the baffle curtain and a 7.5 hp aerator downstream of the baffle curtain that is only operated part of the time, which meets current plant demand. Both sections of the second cell are designed and operated as partial mix. There is adequate electrical infrastructure for the treatment regime to be changed so that either or both sections of the second cell could operate as fully mixed, although more horsepower will be required and that added horsepower might result in substantial bank erosion.

Cell 3, the northern most cell, was constructed in 1999. It is hydraulically downstream of Cell 2. Unlike the two original cells which have earthen liners, the newer cell has a synthetic, reinforced polypropylene liner. At the normal high water line, it is about 243 feet long, 135 feet wide, and about 12 feet deep. There are two baffle curtains in Cell 3. Upstream of the baffle curtains in Cell 3, the pond is designed and operated in a partial mix mode. The area within the baffle curtains is designed for plug flow, meaning that a drop of water enters the area and flows through it in the order it entered. Plug flow provides little BOD removal by microbial action; instead it is the section of the treatment system where the water is moving slowly enough (not mixed) that the solids have time to settle out. The design aeration pattern in Cell 3 is to have subsurface aspirator-type aerators in diagonal corners and a standard surface splasher in the middle. The volume of the baffled area was based on having adequate polishing pond for the plant if an additional cell was constructed to the west of current Cell 3, thus there is more quiescent (quiet, slow flow) area than is recommended for the current plant capacity. To limit the quiescent capacity (and the consequential algal growth and low oxygen levels at night), on the downstream side of the first baffle curtain, there is a single 10 hp surface splasher to keep the upstream half of the baffled area partially mixed and keep the volume that is quiescent appropriate to the current flows.

In addition to allowing for settling of the solids, the quiescent area also tends to allow for more algal growth. Note that excess algal growth increases the oxygen demand in the cell at night and also reduces oxygen levels in the river when it is discharged. One way to limit the algal growth is to shade the pond. At the Ridgway plant as currently operated, during the summer months when algal growth is most problematic, duckweed growth can provide shade, once it begins to cover the polishing pond section of cell 3. However, the duckweed growth is a biological process and staff has limited control over how early in the spring duckweed growth occurs or how dense the growth is. Some years it does not cover the pond soon enough to prevent an algal bloom in late spring or early summer. Other times it can be so dense that it creates shortages in dissolved oxygen. The other issue with duckweed is that it has a high organic and nutrient content and when it dies, which happens when it freezes, if not before that, it can put a significant load on the plant. Instead of letting the duckweed die in the pond, staff should remove the duckweed in the fall each year, which is currently being done. There are concrete structures on the northeast and southeast ends of Cell 3 to facilitate duckweed removal.

Lagoons are required to be lined so that they do not leak into the ground below and so that they not gain water from the groundwater table. The newer cell is lined with reinforced polypropylene and unless the material is torn, it is not likely to leak in the 20-25 year expected design life of the material which would mean the 2020 - 2025 range, perhaps even longer. The original two cells have a clay / earthen liner. Quality control during installation is critical to insuring a water tight seal with earthen materials. If the earthen materials are properly installed, the seal should remain functional unless the pond area is dried out or the earthen materials are disturbed. An example of the latter could be the result of removing vegetation that is rooted in the earthen liner material.

The Town's 2013 permit renewal required that the Town demonstrate that the existing facilities meet the leakage requirement (of less than 10^{-6} cm/sec or 0.034 inch per day). The Town was likely required to provide the documentation due to the discrepancies between the influent and effluent flow measurements. It should be noted that the flow measuring gauges are only required to be accurate to within 10% of their range, whereas the leaking requirement requires far more accuracy. In addition, the flat grade into the influent flume further reduces the reliability of the data from the influent flume. The Town staff prepared a report for CDPHE to demonstrate

that the ponds were meeting the limits required by CDPHE and in early 2016 CDPHE confirmed that the plant was meeting their requirements. A copy of the documentation is provided in Appendix WW-2. There is a possibility that a future permit may require an update to that documentation. The original study will hopefully be useful as guide for future requests.

If the cell liners remain adequate until about 2025 or later, before doing any liner rehabilitation, the Town will likely want to determine how it will meet the anticipated increasingly stringent nutrient effluent requirements that are anticipated in 2027 (see below and Appendix WW-6). It is possible that the nutrient requirements could be so stringent that a lagoon system would not be able to meet the new requirements and the entire plant may be subject to an upgrade, possibly requiring a mechanical plant. If there appear to be problems with the liner sooner than that, the Town will want to weigh the costs of fixing the liner issues versus modifying the overall treatment process in light of the changes in stream standards expected in 2027.

As mentioned above and as can be seen on Figure WW-10, the design for the 1999 expansion included the potential for one more lagoon cell that under the then current regulations, would increase the plant capacity by 50%. Hydraulically the additional cell is designed to be placed between the current cell 2 and cell 3. The construction in 1999 included pipe stubs to add in the additional cell. Although adding in the cell would be a relatively inexpensive way to significantly increase the plant capacity, there are a few reasons why that option might not be viable. The first is that if the effluent regulations become so stringent that a lagoon system cannot treat the waste sufficiently to meet the new requirements. Another is that the existing site and the new cell are close to current and proposed future development. To expand the plant would require getting site approval from CDPHE for the changes in plant design and capacity which given the development around the plant might be a challenge as the existing plant and proposed pond are within CDPHE recommended setbacks. Both potential effluent requirement changes and setbacks are discussed in more detail below.

Capacity

The treatment plant has a design capacity of 0.194MGD and 400 pounds per day (PPD) of biochemical oxygen demand (BOD), which is a measure of the organic content of wastewater. Note that different uses generate different wastewater loads. For design purposes loading is typically compared to a typical "single family residence". There are a number of commercial uses (eg: restaurants, drinking establishments) that have higher BOD concentrations. User fees for wastewater are based on both the flow and assumed BOD loads as different uses create different demands on the system, impacting system capacity. Table WW-11 is a summary of the last several years of discharge monitoring results. Because monitoring results are typically collected on a single day to represent a given month, the results, especially the real influent quality data, can fluctuate significantly from what is measured in the single sample each month; however flow is measured almost continuously so is more accurate than the loading. Table WW-11 has rows showing percent of design capacity for influent flow and influent BOD on the monthly basis for each year.

Capacity of the Ridgway plant as measured by influent flow (hydraulic capacity) is typically less than half the plant design capacity. Influent organic loading (as measured in pounds per day of BOD) is around half of the design capacity based on the single monthly samples. However there have been several months in the last 5 years where the organic loading was over 75% of the design capacity. These are likely a result of BOD being a little high during the time the wastewater was sampled for the month.

Figure WW-11 is a graph of the influent flow over the last 5 years compared to the design capacity. One can see that the flow is typically less than half the design flow capacity. Figure WW-12a shows the influent BOD in mg/l (concentration) and Figure WW-12b shows BOD loading in ppd, respectively. BOD seems to fluctuate significantly month to month. Typically, domestic sewage is in the 250-300 mg/l range. When there is substantial infiltration and inflow (I/I) the influent BOD is often in the 100 - 150 mg/l range. Looking at the Ridgway influent BOD data in

the Figure WW-12, BOD concentration is the 250-300 range and has been for several decades suggesting very low rates of infiltration or inflow. This is to be expected given the collection system is almost exclusively PVC with water tight joints. Most of the I/I seems to be related to rain events, when the Town does sometimes see a spike in influent flow. In response the Town has tried to locate the sources of the inflow and correct as needed. It is recommended that the Town continue to trace I/I sources as time and weather conditions allow, and follow up with the appropriate remedies and repairs.

There have been a few months with even higher BODs, most recently in the spring of 2017. The Town and lab staff at first thought the numbers in 600 mg/l range were a testing anomaly, but when a repeat test in the 500 mg/l range confirmed the results, the Town began trying to trace the source of the loading upstream. However, by the time the Town became aware of and confirmed the very high BOD and knew the problem was real after collecting the additional samples, the influent BOD concentration was back to normal, making it very difficult if not impossible to identify the source of the discharge to the system. The fact that the BOD was high for more than a week, suggests that the discharge of high concentration waste was not a single discharge or a single sample, but something that went on for several days. Note that because it takes 5 days to get results from BOD tests, it is difficult to locate the source a short-term high concentration discharge; however it is recommended that the town try to find the source when spikes occur by taking samples in manholes at dividing points in the collection system as soon as the a spike is identified rather waiting to confirm that the spike is real. The Town might also want to measure total suspended solids (TSS) if that is higher than normal, in part because that is a much faster test, which would make it easier to catch the location of the discharge before the discharge ceases. It is also recommended that when the influent BOD in a given month is above 350 mg/l the Town resample influent BOD to see whether the first sample is representative of the month as a whole. Currently the organic capacity is based on a 4 samples taken over a single 8 hour period for the whole month. Sampling over a 24 hour period and more than once a month would provide a higher level of confidence in the true plant loading.

The existing plant is running at about half of its rated capacity. It appears that BOD loading rather than flow will dictate when additional capacity is needed unless more testing of the influent BOD indicates that past sampling has given higher BOD results than are observed with 24 hour sampling. The Town needs to keep in mind that the Town's discharge permit from CDPHE requires the Town to begin planning for plant expansion when the plant reaches 80% of design capacity and implement the expansion plan to increase capacity before reaching 95% of capacity, or impose a moratorium on new construction. Note that the current plant has a design capacity of 0.194 MGD and 400 ppd (pounds per day) BOD. Looking at the data from the last 5 or so years, the plant is not approaching the 80% threshold, but if the Town continues to grow consistent with the more aggressive forecasts, the plant could reach 80% BOD capacity within the next 10-15 years. The Town also needs to be tracking proposed changes in regulations that could require the Town to meet more stringent effluent limits and could make the existing plant obsolete before the flows and loading into the plant reach 80% design capacity. This is not insignificant and is addressed in this assessment in the Regulatory subsection below.

Mechanical items at the plant include (but are not limited to) aerators, recirculation pumps, flow monitoring equipment and data loggers, backup genset (which currently does not run), and chlorine feed equipment. The life expectancy of most of the mechanical equipment is +/- 20 years. Some of the aerators purchased prior to the plant expansion were reused with the new plant. The generator was purchased used and has not worked well. All the other mechanical equipment was purchased with the plant upgrade in 1999. The flow measurement equipment and recirculation pump were replaced in the last 2-3 years. The aspirator style aerators, although purchased in the late 1990's have had issues as have some of the old surface splashers. Several of the older surface splashers have been rebuilt to good operating condition; however, the rebuild / shaft replacement on the aspirators did not last.

For the last 5 years or so, the Town has been considering whether to change to sub-surface air (which is discussed in detail below). Given that the plant has operated adequately without an aspirator due to shaft issues and that

the Town is considering changing the aeration system (see Aeration sub section below), that aspirator has remained out of service.

The Town should continue to track purchase and maintenance details for all the mechanical items at the plant. It is recommended that the Town's asset management system list each of the components individually for specific budgeting. In general, the Town should be setting aside money to replace the equipment as it wears out to the point that it is no longer cost effective to repair.

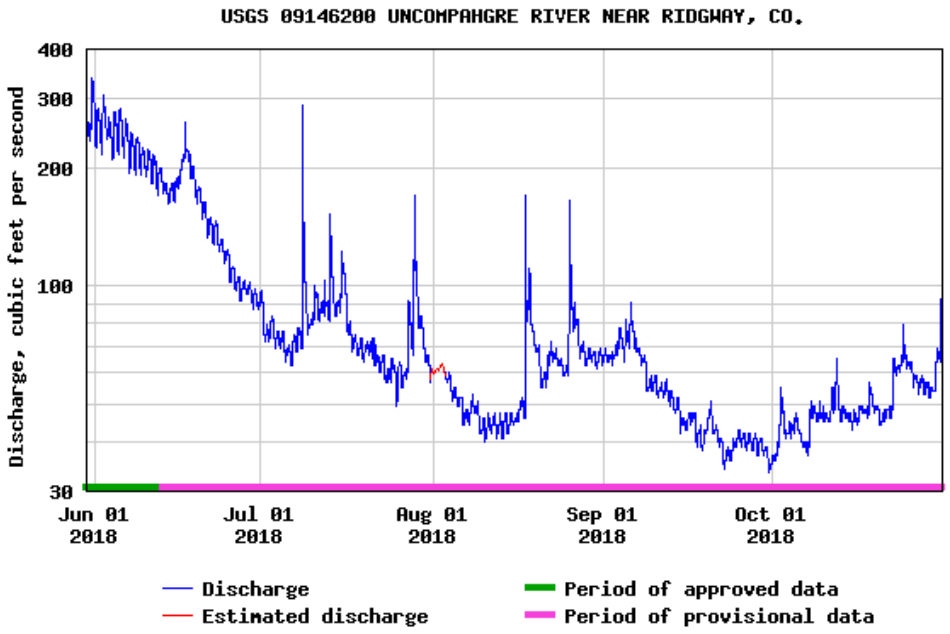
The existing facilities include a backup generator and the motor control center which is set up so that the Town can control which loads run on backup power. The generator was purchased used and has not operated since it was purchased. Typically, power outages at the plant have not been longer than a few hours, most are under an hour. The lagoons can go without air for a few hours on rare occasions without causing problems. Similarly, the recirculation pump and flow monitoring equipment can be idle for hours without adverse impacts. The one load that would be better to not have off line is disinfection, but it is hard to justify the cost of tens of thousands of dollars for a full genset for the plant to run the chemical metering pump for disinfection. Instead is it recommended that the Town consider a portable generator for the chlorine pump.

In the process of treating wastewater, biosolids are generated. With a mechanical system those are removed on a regular basis (as frequently as daily depending on the treatment system). With a lagoon system the solids (sludge) are only removed every 5-10 or so years. The Town last removed sludge in 2014 at a cost of approximately $85,000 for 95 dry tons. The Town should expect that it will be necessary to remove sludge again in the next 3 - 8 years, at significant expense. The last two times biosolids were removed the Town hired a contractor not only remove and haul the solids but also find a long term disposal site. Prior to that the Town had arranged for the disposal site. The Town switched because of difficulty in find a site and the liability for the Town. In 2018, the Mautz Brothers outside Olathe applied for permits to improve the Thunderbird Raceway property to accept not only green waste but eventually restaurant waste and biosolids, such as lagoon solids, for composting, and they have been communicating with the Town of Telluride to this end as a pilot location. This may be a good opportunity for the Town of Ridgway in the future as locations for sludge relocation can be difficult to find and expensive; however the Town should make sure that any facility with whom they work meets CDPHE requirements and does not create any new liability for the Town. A facility such as the raceway property is likely more appropriate for intermittent lagoon biosolids removal than for a long-term frequent removal as would be needed for a mechanical plant. For a mechanical plant we suggest that the Town have long term control of the land on which the biosolids are applied.

Regulatory Matters

Treatment requirements and effluent limits can change every five years when the Town's CDPHE-issued discharge permit is renewed or when the Town opts to make a substantial change at the plant which triggers an off-cycle permit update. The current permit which expired the end of May of 2018 was a General Permit for wastewater facilities with a dilution factor of greater than 100:1 comparing the low flow of the receiving stream to the design flow of the treatment plant. Note that if the dilution is less than 100:1, the Town's plant would need a site-specific permit. The site specific permit for a minor treatment plant like Ridgway's is not that different from the general permit, so that change is not a real concern. Having less dilution though could impact discharge requirements.

In 2013 when the last permit was issued, CDPHE determined that low flow in the river was 36 cfs using the CDPHE DFLOW model for the period from 2001 to 2013 as measured at the stream gauge upstream of Ridgway Reservoir. That resulted in a dilution of 120:1. Note that DFLOW provides a more conservative flow than the actual flows directly measured. Given the record-breaking low flows in the Uncompahgre in 2018 (see at left), if CDPHE uses the 2018 data, the dilution could drop below 100:1 and require a site-specific permit; however, even a dilution of a little less than 100:1 is a reasonable amount of dilution and water-quality based effluent limits (WQBEL) might still not be needed. The permit writer at CDPHE would need to check, and the Town will want to confirm CDPHE's assessment. Parameters that would be evaluated for potentially more stringent limits if dilution is less than 100:1 include ammonia, chlorine, selenium, temperature, and potentially other nutrients.



What is likely to be the most significant change in discharge requirements in the next decade could come in 2027-28 timeframe, when it is expected that the permits will have stringent limits for Phosphorus (TP), Total Inorganic Nitrogen (TIN), and total nitrogen. Nutrient limits were mandated by EPA about 10 years ago. Initially the Water Quality Control Commission (WQCC) only included the stricter limits for larger mechanical plants, with the thought that the smaller plants have less impacts on the receiving streams and that requiring all the wastewater treatment facilities to come into compliance at once would "bankrupt" the funding stream for plant upgrades. EPA did not agree with that plan and the State of Colorado has agreed with EPA that they will start to require nutrient limits as part of the effluent limits in almost all discharge permits starting in about 2027.

The State is aware that it takes a number of years to go through the permitting process, planning, design, environmental review, public input, and construction of a new or upgraded facility. They are planning to include a 5-year time frame (compliance schedule) for plants that receive nutrient limits for the first time in or after 2027 to come into compliance, which means dischargers should have until 2033 or a bit later depending on how soon after 2027 each discharge permit is renewed that include the more stringent nutrient limits. The compliance schedule in the 2027+ permits will include milestones during the 5 years to make sure that the permittees are on track to be able to meet the more stringent limits within the 5 years compliance schedule timeframe. However, CDPHE is aware that the timeframe for these sorts of upgrades is a slow process and with cause often allows for extra time. Note that the Colorado Water Quality Control Commission will hold a public hearing in 2027 to review and potentially adopt the anticipated changes. At that time, the limits adopted could be more or less stringent than the ones currently anticipated.

CDPHE still has concerns about how to review and / or fund that many plant upgrades all at once and about whether all entities will be able to meet the 5-year timeframe. At the same time, EPA and the State of Colorado would like to see some progress toward nutrient removal in the nearer term. CDPHE is currently offering a Voluntary Incentive Program (VIP). A permittee can sign up to test for phosphorus and / or nitrogen monthly and

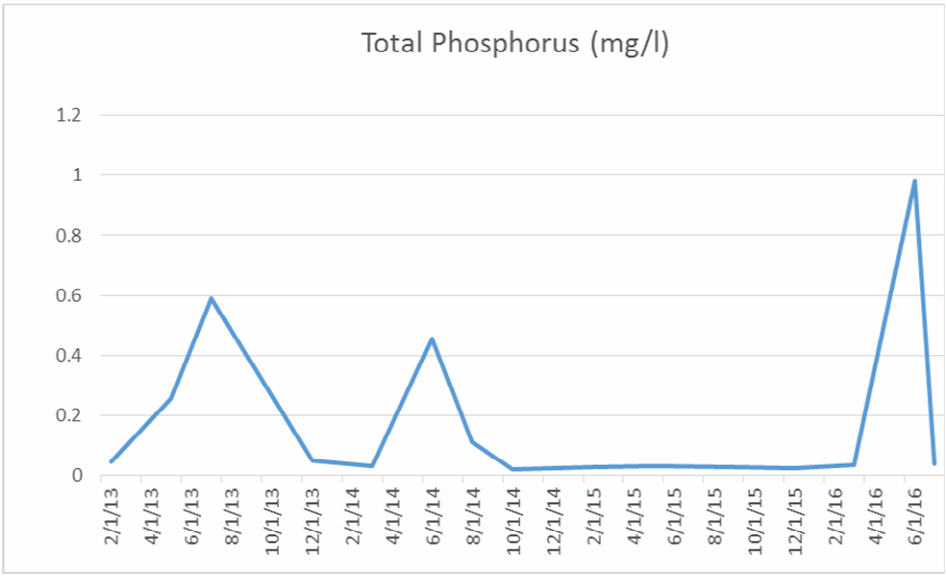
every month that the results meet the new standards and meets some associated criteria, CDPHE will add some time to the compliance schedule. To qualify for the incentive, the permittee needs to submit a nutrient reduction plan to CDPHE before 12/31/19. There is a template for the plan on the VIP website currently at:

https://www.colorado.gov/pacific/cdphe/nutrients/nutrients-incentive-program.

This voluntary compliance does not actually require a specific plan, just that the discharger sign up and to get the added time, meet certain criteria. Facilities need to achieve less than 1 mg/L of total phosphorus (TP) on an annual median to earn credit for phosphorus and less than 15 mg/l for total inorganic nitrogen (TIN). At a minimum, a monthly composite sample must be taken at the plant outfall to be eligible for credit. Credits are given on a sliding linear scale. Once a facility's annual median drops below 15 mg/L TIN and 1 mg/L TP, the facility starts earning incentive credits. The closer (or below) 7 mg/L TIN or 0.7 mg/L TP, the more incentive a facility may earn. More years operating at low levels also increases the incentive.

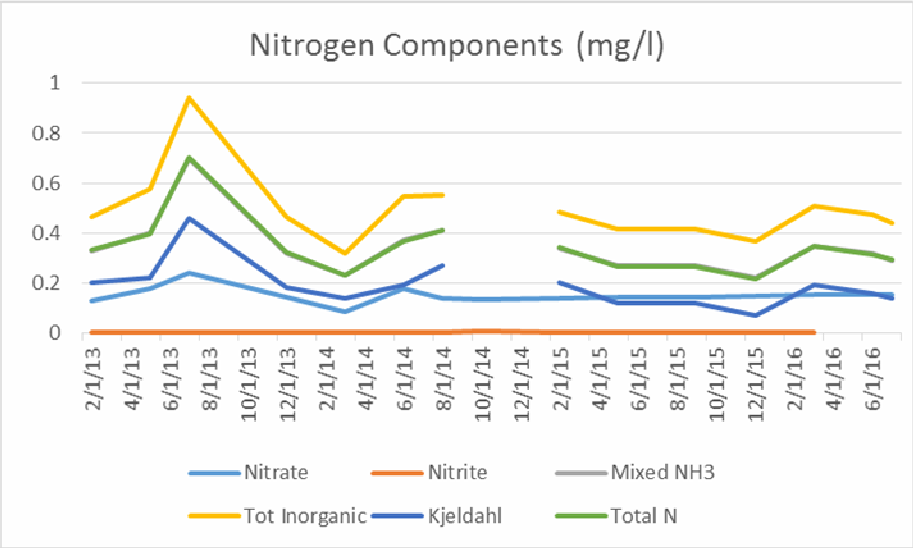
Signing up for the program is relatively easy and if the plant meets the limits demonstrating nutrient reduction, it would earn the Town additional time to meet the more stringent limits that are expected to be incorporated in the permits in about 10 years. It is not clear whether Ridgway's discharge would qualify for any incentive credits without significant changes. It is recommended that the Town sign up for the incentive program and start testing. If the results look like the Town is qualifying for incentive credits, it would pay to continue to sample monthly. If the results are significantly above the levels that would qualify for the incentive credits it is recommended that the Town consider whether it is worth the time and cost of the additional monitoring, but as will be discussed below, knowing the nutrient levels in the discharge has other value to the Town.

Because the dilution in the Uncompahgre is relatively high, it is likely the nutrient effluent limits to which the Town will be subject will be considerably higher than the stream standards that the Commission is expected to adopt in 2027. The Town will have a better idea of the amount of dilution in the receiving stream when they receive the pending discharge permit renewal in the coming months. It is recommended that the Town use the dilution in the new permit to calculate the mass balance for total nitrogen and total phosphorus to get a guestimate of how stringent the effluent limits might be in next decade. The Town will need to sample effluent TP and TN and have background stream levels (from CDPHE, USGS, and local Riverwatch efforts and/or by the Town sampling the river upstream of the plant) in order to calculate the mass balance, but having a better idea of the nutrient effluent limits would give the Town a better idea of what will be required going forward. The Division provided a limited amount of stream data for the Uncompahgre near Ridgway. A spreadsheet with the data will be provided electronically. The graphic summary at right is a summary of the Total Phosphorus data received.



Note that the currently anticipated stream standard for total Phosphorus for existing treatment facilities is 1 mg/l and for new treatment works is 0.7 mg/l on a rolling annual average. Thus the June of 2016 value of almost 1 mg/l would be tempered by the lower values the rest of the year. The anticipated stream standard for just inorganic Nitrogen (nitrate + nitrite +

ammonia), is 15 mg/l for an existing facility and 7 mg/l for new facilities. For inorganic nitrogen, there is likely to be sufficient dilution that at least under Regulation 85, the Nutrient Management Regulation, there is not likely to be an impact on the Town. Nitrogen data received for the river above the Town's outfall is shown graphically that the left.



Aeration

The existing aeration system, as noted above, is comprised of surface splashers and aspirators. As currently operated, for the most part, all installed aerators are run full-time. The power costs for the plant are in the $45,000 per year range, representing the Town's largest energy demand and expense by far with the water plant being the next largest municipal energy demand and expense, estimated at $10,000 for 2018 and budgeted at $12,000 in 2019. The Town has been concerned about the amount of power consumed at the wastewater plant for a number of years. To this end the Town has on several occasions attempted to do energy assessments of the wastewater plant to determine if changes to the aeration system would meet treatment needs and if the investment in the alternative system could be partially paid back by the energy savings realized. The Ameresco audit included recommendations for energy conservation but also determined that the energy savings for the full package of improvements would not alone pay for the improvements and did not pursue implementing the recommendations of the audit however, the Town continued to look for options.

One option the Town explored was whether installing a solar PV system that would offset the energy demand; however, the payback on the investment was excessive (decades) and the Town determined the investment would not be beneficial for cost savings over time. Instead the Town invested in the San Miguel Power Association solar farm project through a Power Purchase Agreement in 2014.

During the process of interviewing firms for the energy audits, the Town learned that subsurface aeration might improve energy efficiency. The theory is that the surface aeration loses oxygen (and heat) in the splashing process; whereas subsurface air is compressed which adds some heat and, if there is sufficient depth, allows for significant oxygen transfer, and can improve the amount of air added to the water per kilowatt. In addition, as discussed below, the setback requirements between the wastewater facilities and habitable structures is less with subsurface aeration than with surface splashers, which from a land use perspective is beneficial for the Town and has been an expressed desire from prior elected and appointed officials.

It is recommended that the Town consider some modifications to the aeration system. In the short term, the Town should consider adding continuous dissolved oxygen monitoring to each cell and adjusting the run time of the aerators to match the need for oxygen in the cell. For instance, in the summer, dissolved oxygen levels in the cells can be super saturated, meaning that adding more air is not adding to the air in the pond and the mixing and splashing from the aerators may actually be reducing the oxygen level in the pond. There is a need during the day for some mixing, but typically the cells do not require full time aeration to provide the needed mixing. Monitoring the dissolved oxygen levels would allow the Town to adjust aerator run times (adjusting the timers) which could reduce the power consumption. To monitor dissolved oxygen, the Town should purchase dissolve oxygen sensors

and data loggers and set them about 8' out from the outlet boxes in the 1st 2 cells and in Cell 3, set probes perhaps offset from the baffle curtains or duckweed boxes.

Typically, sub-surface aeration requires a water depth of about 10 feet or more to allow time for the air bubbles to diffuse into the water column and requires draining the ponds to set the diffusers. The Town's first two cells are only about 7-8 feet deep so would have limited time for oxygen transfer. The new cell is 10 - 12 ft deep and could accommodate standard sub-surface air, but the Town was hesitant to have blowers and sub-surface air in one cell and surface aeration in the older cells because of the additional O&M requirements.

As part of the investigation to try to reduce power consumption at the plant, staff looked into a few kinds of sub-surface aeration that used fine-bubble diffusion, which has more efficient oxygen transfer into the water column thus requiring less water depth. Because draining the cells to install air lines and diffusers on the cell floors seems impractical and could result in damage to the earthen and/or synthetic liners, staff focused on aeration systems that could be installed without draining the cells.

Because it did not require draining the cells, the Town requested pricing and design calculations for a proprietary Biolac system from Parkson. The Biolac system consists of diffusers suspended in the water from a cable system (see left). Air is delivered through air lines that are part of the support system. The system requires blowers to supply the air for the diffusers and if one wants to provide air based on oxygen demand in the lagoon one needs to include a dissolved oxygen monitoring system to the improvements package. The 2016 cost estimate for the equipment to convert all 3 cells to a Biolac system was in the $400,000 range.

We received an updated estimate for the Biolac system in early 2019. The cost for the system only increased about $15,000. Looking at the updated proposal, the total blower horsepower (hp) required for the system is around 62 hp. What is still not clear from the proposal is how much of the time that horsepower would run. If it runs full time it would result in a comparable power demand to current system. Parkson also provided a proposal for using just Cell 3 for organic treatment and limiting the Biolac aeration system to just that cell. There is sufficient capacity in Cell 3 with the Biolac system to provide treatment for the current permitted capacity. The proposal to just use Cell 3 had a price tag closer to $300,000 but would also require a clarifier and some piping changes. That is still expensive and that type change would require new CDPHE site approval. It's not clear whether CDPHE would allow the entire treatment process to be in a single basin. If the Town has interest in pursuing such a change, discussion with CDPHE staff is recommend.

There were no estimates of the resultant power saving from such a system and with the uncertainty regarding nutrient limits, the Town decided to wait a little longer before determining whether changing to sub surface air was warranted. It is recommended that the Town monitor for TP and TN and see whether the existing facilities will be capable of meeting the more stringent limits that might be imposed in the 2027 timeframe. If, with the dilution assumed in the new permit, which is likely to be issued in 2019, the effluent limits for the plant for TP and TN look to be achievable with minor modifications to the existing system, then we recommend continued investigation into whether conversion of the aeration system to a sub surface aeration system, possibly something

like the Biolac system could improve operational efficiency and be cost effective. If it looks like the lagoon system will not be able to meet the expected limits, then it probably makes sense to continue with the current aeration system until the Town determines how best to meet the new treatment requirements. While it is unlikely that the energy savings from any system improvements, either a PV solar system and/or a subsurface aeration system, will completely offset the cost of the investment, the Town can expect some resultant energy savings from PV's or sub surface aeration or both systems that could offset a portion of the upfront cost over time.

Setbacks

The guidance for Regulation 22 of the Water Quality Control Commission, which governs where one can place a wastewater treatment plant, includes a section (22.3(2)(e)) entitled "Guidance Specific to Odor, Noise, and Aerosol Mitigation from Domestic Wastewater Treatment Works" (a copy of this section is included in the Appendices). Several sections of Regulation 22 require that the Division review proposed treatment plant sites and any changes to existing plant sites to minimize foreseeable potential adverse impacts on public health, welfare and safety. The policy lists four factors to consider including:

1. Addressing potential concerns of neighboring property owners

2. Reducing the likelihood of public nuisance complaints from the operation and maintenance of the facilities including odors, noise, and aerosols,

3. Minimize the potential of airborne pathogens to be transmitted from the facility to neighboring habitable structures, and

4. Provide guidance if setback requirements cannot be met and mitigating factors must be incorporated into the design to mitigate potential odor, noise, and aerosol concerns.

Design of the treatment works and evaluation of the treatment type, process and location is required to include consideration of potential odor, noise, and aerosol issues. The regulatory guidance includes distances from treatment works to habitable structures that the Division will consider adequate. The following list if from that policy:

1. Non-aerated lagoons: ¼ mile
2. Aerated lagoons less than two (2) total surface acres (all basins combined) with no surface aeration: 250 feet
3. Aerated lagoons greater than two (2) total surface acres (all basins combined) with no surface aeration: 500 feet
4. Aerated lagoons less than or equal to two (2) total surface acres (all basins combined) with surface aeration: 500 feet
5. Aerated lagoons greater than or equal to two (2) total surface acres (all basins combined) with surface aeration: 1,000 feet
6. Mechanical plants 2,000 gpd maximum month capacity to less than 50,000 gpd capacity: 250 feet
7. Mechanical plants 50,000 gpd capacity to less than 100,000 gpd capacity: 500 feet
8. Mechanical plants 100,000 gpd or greater: 1,000 feet
9. All enclosed mechanical plants and lift stations: 100 feet
10. Lift stations 150,000 gpd capacity to less than 215,000 gpd capacity: 250 feet
11. Lift stations greater than 215,000 gpd capacity: 500 feet

Note that the Town's existing facilities as operated would fall in category 4 above and should be 500 ft from habitable structures. If the plant changes to sub surface aeration, it would fall under category 2 and only need 250 ft. Figure WW-13 is a graphic showing the 250' and 500' setbacks from the existing lagoons. Given the regulatory changes that are likely in the next decade, the next upgrade or plant replacement could require a mechanical plant which if not enclosed would have 1000 ft setback. If the mechanical plant facilities are totally enclosed, the distance drops to 100 ft. Given the value of land in Ridgway, it is likely that a mechanical plant would need to be fully enclosed.

It is important to note that the distances above are what CDPHE uses as a default. If one can not meet the distances, CDPHE's review would be specific to the facility assessing the specific impacts the facilities might have. There are some ways to mitigate when the setback distances are less than listed above which range from dense vegetation around the plant to very expensive equipment to treat the air around the plant.

The setback issue has come before the Planning Commission and Town Council many times over the years as land values and the cost of development increase. The appointed and elected officials have expressed a desire to minimize the setbacks as is reasonable to meet the mitigation requirements of the Town's CDPHE-issue permit. In the late 1990s the River Park Industrial Park was sited and regulated to be proximal to the lagoons and to prohibit residential uses both in the Town Code and on the River Park PUD plat map, solely because of these setback requirements and mitigation required. The Town now has the lagoon setbacks in GIS and can readily identify properties subject to such setbacks and mitigation requirements. It is recommended that the Town continue to adhere to the setbacks as any reduction without mitigation may require the Town to absorb the investment and maintenance cost of the mitigation. Alternatively the Town could consider requiring development to absorb the cost of investment and maintenance for any future private development that proposes to encroach into the setback areas. However, that would be difficult to enforce, especially long term. Continuing to prohibit habitable uses in the setback is recommended.

Relocation or "Stay in Place" options

When the existing facilities were initially constructed in the early 1970's they were on the north end of Town. There were a few homes near the plant off the corner Lena and Otto, but nothing to the north, south, or east of the plant. In the decades since, there has been considerable development to the west and north of the plant, placing the existing facilities now closer to the perceived center of town although the facilities have obviously not moved since initially installed. In the early 90's, the then current land owner to the north of the plant showed Town staff his property and suggested that there might be room to relocate the existing plant to a section of his property by the 40-acre BLM property along the east side of the Uncompahgre River. Staff had concerns about the proximity to the floodplain and the challenges with the size and access to the site as well as whether the sewage could reach the site without pumping. Without an urgent need to relocate the plant and no funding to do so, the Town opted not to proceed at that time.

In the late 1990's the property north of the existing facilities changed hands and the new owners began developing the properties to the west and north of the existing plant (River Park PUD and Ridgway Business Park). During the subdivision and zoning process for the River Park development, the areas within the recommended wastewater treatment plant setback were zoned Industrial 2 which restricts habitable structures and the River Park plat notes include some additional restrictions. With the development around the plant, the plant now seems to be in town rather than on the perimeter of Town resulting in an increased interest in relocating the treatment plant.

Looking downstream of the existing plant, there is not a lot of space that is out of the floodplain and to which the sewage could flow by gravity. Figure WW-14 shows the topography of the area downstream of the existing plant. There is an area on the east side of the bikepath just north of the bikepath trestle bridge (the old railroad bridge), about 1500 feet downstream of the existing plant, that is relatively flat and with an elevation about 6' lower than

the existing plant. The bikepath (the old railroad grade) likely protects the area from the floodplain as the FEMA map (Figure WW-15) shows the area as zone C, an area of minimal flooding risk. Note: the FEMA map is out of date and needs updated. Depending on how close one could get to the bikepath, there might be 3+ acres at that site. There is also a residence about 300 feet to the northeast of this site. This potential treatment site is quite a bit lower than the bikepath. A treatment plant at that this site would either need a very high privacy fence or dense, tall vegetation to keep the plant from being visible (eyesore) to those enjoying the bikepath. If the Town is interested in pursuing this site, conversations with the site's current land owner are recommended.

The Town has discussed acquiring the BLM parcel, however; it is likely in the floodplain given that it is quite a bit lower than the railroad grade and not protected by it. That site maybe a good acquisition for the Town for other purposes, but protecting the site from flooding would require raising the wastewater treatment improvements and a lift station for the sewage to reach the raised improvements. Access to the site would also be a challenge. The public and BLM might also have concerns about taking public access along the river and placing a wastewater treatment plant there would be the best use of public resources.

A contrarian site considered is the gravel pit site to the northeast of the River Park Subdivision. Gravel was extracted from that site and used for road construction in the River Park Subdivision. The developers have yet to backfill the site and still have gravel stockpiled on the site. The potential site as shown on Figure WW-14 could be up to 9 acres. The reason this would be a contrarian site is because it is about 60 feet higher than the elevation of the collection system as it enters the existing plant site. Pumping the sewage to the gravel pit site would likely require at least 20 hp pumps and annual pumping costs would be on order of $8,000-10,000 for flows in the range expected in about 10 years. Capital costs would include a large lift station, a force main from the lift station to the site and a pipe line from the site back to the river for discharge. Although not clear from the topo on Figure WW-14, the Google earth image in Figure WW-16 more closely reflects the extent of the gravel excavation. The excavation could provide an opportunity for a treatment basin or it could create a challenge in terms of siting improvements on the site. Figure WW-14 shows a hatched area on the west toward the north end which is less than 500 feet from the school. The site is large enough that improvements could exclude that encroachment. However, the school ballfields are even closer to this potential site and there could be some residences in the River Park Subdivision that could be closer than 500' from the site. If this option is to be pursued, the Town should commence conversations with the land owner as a first step to see if there is even any interest in selling the land to the Town for use as a wastewater treatment plant.

Plant relocation requires finding a site, acquiring it, and ultimately constructing the new facilities. In addition, before the plant can be relocated or even designed, the relocation requires new CDPHE site approval, anti-degradation review (a review of the impact on the river), and the issuance of preliminary effluent limits from CDPHE. If the new facilities would be something other than a lagoon, the Town would also need to find a way to handle the biosolids that are routinely removed from the treatment process. In most cases on the west slope, the biosolids are put to beneficial use on the agricultural lands. Because the Town would need to use the site for the life of the mechanical plant, would need to make use of the site on frequent basis, and because the Town is responsible for the impacts of biosolids on the land in perpetuity, it is recommended that if the Town constructs a mechanical plant, the Town acquire agricultural land for biosolids disposal. It is estimated that the time frame from start to finish for a new, mechanical plant, including the steps generally described above, could take a decade or longer depending on how complicated the project becomes. Finding the right location by itself could take considerable time.

It is also possible to continue to treat the Town's sewage at the existing site. If lagoon treatment remains viable and the Town wants to reduce the recommended setback, converting to subsurface aeration and keeping the pond area less than 2 acres would reduce the recommended setback to 250 feet. Should conversion to a mechanical plant become necessary to meet effluent requirements or be the preferred option for the Town, there is very likely sufficient room at the plant site to construct the facilities in the area where the future lagoon cell was

planned to go. All mechanical plants require 1000-foot setback unless they are enclosed or otherwise significantly mitigated. At the existing site, a mechanical plant would likely need to be enclosed. If the facilities remain at the existing site, the existing motor control building, chlorination and de-chlorination buildings, chlorine contact chamber, and effluent line could be re-used. This would be a savings of +/-$100,000.

There are a number of different types of mechanical plants. All are more complicated, time consuming, and expensive to operate than a lagoon system. All mechanical systems also require bio-solids handling which will require not only treating the removed solids but also having a disposal site. At the existing site, one would want to select a type of mechanical system, that not only could meet longer term projected effluent requirements, was relatively easy to operate, but also with a relatively small footprint to reduce enclosure costs. Mechanical systems tend to be designed with a series of unit processes each with specific functions and specific mechanical equipment and controls. Because the systems are a series of components it is more common to expand, supplement, or replace components than to replace the whole system, although there are circumstances where replacing a full mechanical plant makes sense. Most equipment in a mechanical plant has a design life of +/- 20 years. With the rapid improvements in control systems, it is likely that it will be advantageous to upgrade treatment system controls for a mechanical plant more frequently, perhaps in 10 years or so.

Wastewater Revenues and Expenses

The revenue and expense comparison is based on a "typical year" using the budgets from 2017, 2018, and 2019 to determine what would be normal revenues and expenses. Table WW-12 lists the assumed values for both revenues and expenses. On the revenue side there are the monthly charges for service, as well as penalties, investment income and tap or system investment fees. The expenses include standard day to day expenses as well as much larger capital investments, reserves for major future expenditures, etc.

As of early 2019, sewer rates for a single family house was $35 per month and in most cases $35 per month for each additional residential unit. The major exception to that is that the charge for accessory dwelling units is $25.20 (72% of the primary residential rate). There are a number of commercial uses (eg: restaurants, brewing facilities, drinking establishments etc.) that have higher BOD concentrations. User fees for wastewater are based on both the flow and assumed BOD loads because different uses create different demands on the system, impacting system capacity. For non-residential units, the fee is $35 per month per unit plus $1.75 per 1,000 gallons of water used per month over 6,000 gallons per month. There is also a surcharge for any non-residential users' discharging wastewater with BOD and/or TSS concentrations greater than those of the typical residential user (over 250 mg/l) of $0.80 per pound BOD. In 2018 accounted for about $31,600 or about 10% of the total revenue which was about $311,600.

For a quick and simplistic look at revenue versus expenses one can determine a cost per thousand gallons treated and compare that with the rates. Looking at typical operating expenses the cost per thousand treated is about $12.00 per thousand including both the flow and organic components. The median water use for a residential unit in the winter between 2016 and 2018 is about 3,000 gallons per month and the average is about 4,000 gallons per month. If one assumes that most of the winter usage does get to the sewer, it seems reasonable to assume a typical usage of about 3,000 per month per residential sewer user which at $12.00 per thousand comes out to $36.00 which is only a dollar more than the current rate.

A more detailed look at revenues versus expenses should look at fixed costs, the costs that the Town needs to be pay whether or not there is much usage and the variable costs, the costs that are proportional to the actual treatment costs. The total expenses are broken into fixed in variable costs in the far right columns in Table WW-12. With a lagoon system most of the costs are fixed. The power costs should at least in part be a function of the amount of organic matter and flow being treated, but as currently operated with all the aerators running all the time, even the power component of the budget is largely a fixed expense.

Summary

The existing treatment facilities are operating at about 50% of design capacity in terms of organic load and less than 50% of the design hydraulic load. The plant typically meets effluent limits and can likely continue to do so for several more years. With population projected to increase by about 50% by 2038, it is anticipated that the Town will need to begin planning for additional capacity in about 2030. This timing should work well with the anticipated regulatory changes anticipated in 2027 and having more certainty regarding the impacts of those changes on discharge permits in the following years. As noted above, if the cell liners should fail before 2027, the Town should try to determine what treatment changes will be required to meet the more stringent nutrient standards before investing in liner replacement which would like cost in the $250,000 range plus the cost to drain and clean the cells which could add another $100,000 to the costs.

The Town removed biosolids several years ago (2014) and will likely need to do so again in the next 3-8 years. This is a significant expense and the Town should budget for it. The cost in 2014 was $85,111. Many of the aerators are likely approaching the end of their useful life so the Town should budget for replacement of several of them in the coming years. The regulatory changes coming in 2027 could have a very significant impact on treatment requirements and may mandate that the Town construct a mechanical plant. Before the Town makes any significant investment in the existing facilities, it is recommended that the Town work with CDPHE to determine what effluent limits are likely to result from the adoption of stringent nutrient stream standards expected in 2027 timeframe.

Sewer rates for residential users are currently just a little less than the cost to treat the wastewater that is typically generated by a single family unit. The overage charges for commercial look to be less than the actual cost, but a more detailed rate assessment is recommended in the next year or so to determine whether adjustments are needed.

Figure WW-1

Sewer Line Deficiencies

Table WW- 1 Summary of Specific Collection System Significant Deficiencies (except pipe indents)											
Problem #	Under Asphalt	Video #	**From MH**	**feet from**	**To MH**	**Line Location**	**Description**	**Severity # (higher more severe)**	**Priority (lower # , higher priority)**	**Cost**	**Comments**
1		7	I2	145.0	I1	On Hyde fr alley W of Cora Mary	Broken piece of pipe at bell maybe it has fernco coupling over it	3	3		Fixed ?
2		8	I3	196.7	I2	S Laura fr Hyde to Moffat	Tap that is source of grease	2	2		Tap owner should address
3	x	9	F2	154.8	F1	Sherman Lena to Cora	Egg Shape	3	4	$$$	Under pavement too hard to address unless fails
4	x	9	F2	181.7	F1	Sherman Lena to Cora	Circular Crack Repaired W/Wrap Around Clamp				Fixed ?
5		8	I3	264.0	I2	S Laura fr Hyde to Moffat	Looks like a hole in the top of the pipe	3	2	$ 1,680	Staff can repair
6	x	12	F4	34 to 321	F3	Sherman Laura to Mary	Pipe Segments 'Egged'	3	2	$$$	Under pavement too hard to address unless fails
7		15	F7	93.4	F6	S Elizabeth Sherman to Hyde	Bad Cut in Tap	3	3	$ 1,680	Staff can repair
8		21	H1	251.7 to 253.2	F2	Hyde to Sherman on Cora	Root Intrusion from Bad Cut in Tap	2	3	$ 1,680	Staff can repair
9	x	36	R1	166.1	GR2	Lena Chipeta to Hyde	Root Intrusion from Bad Cut in Tap	3	3	$1000 /2 yrs	Staff can repair, but under asphalt -> frequently clean
10	x	39, 40, 41	B5	186.5	B4	N Lena Charles to Sherman	Tap Saddle Root Intrusion Grease Source	3	3	$1000 /2 yrs	Tap owner should address grease, under pavement so frequently cleaning of roots
11	x	48	CO-EC1	27.1	EC1	N Cora - fr x alley S of Clinton	Cut in Tap Cracked Pipe	3	3	$ 2,280	Staff can repair
12	x	48	CO-EC1	22.3	EC1	N Cora - fr x alley S of Clinton	Pipe Bell Repair Joint in Backwards			$ 1,680	Staff can repair
13		50, 51	C2	96.0	C1	N Cora - Otto to Frederick	Cracked Pipe Open to Dirt	4	2	$ 2,280	Staff can repair
14		52	C3	179.2	C2	N Cora - Frederick to Charles	Pipe Not Home Exposed Rubber	3	3	$ 1,680	Fix w/repair clamp if gets worse
15		53	C4	9.7	C3	N Cora - Charles to Alley S of Charles	Major Grease Source	4	2		Tap owner should address
16		60	CO-EH1	20.4	E6	Fr Charles N in alley west of Mary	Offset Joint	2	4	$ 1,260	Fix w/repair clamp if gets worse
17		62	D1	289.5	C3	Charles - fr Cora to Laura	Roots from Saddle/Main Connection	2	3	$ 1,680	Clean line to control roots, repair tap if gets worse
18		63	D2	56.1 to 61.2	D1	Charles - From Laura to Mary	Repair Offset Joints From Tap	2	3	$ 1,680	Staff repair if gets worse
19		64	D3	137.1	D2	Charles - Fr Mary to charlotte	Coupler not Home Exposed Dirt	4	2	$ 2,280	Staff repair break
20		65	D4	275.3 to 279.4	D3	Charles - Fr Charlotte to W Eliz	Pipe Not Home Cut Poorly in Bell	3	3	$ 2,280	Fix w/repair clamps & pipe if gets worse
21	x	69	E3	212.9	E2	Clinton fr Cora to Laura	Service Line Broke	4	2		Tap owner should repair
22	x	70	E4	MH E4 to 6.0	E3	Clinton fr Laura to Mary	Sag holding 1/2 Pipe	3	2	$$$	determine what needed to correct sag
23	x	73, 74	ED2	At new manhole	E3	N Laura	None of Pipes Grouted in Manhole	3	4	$300	Staff can grout pipes
24	x	74	ED2	48.5	E3	N Laura	Roots from Saddle/Main Connection	3	3	$ 1,680	Staff can redo tap
25	x	75	A3	84.4	A2	Fr Otto to S thru Park	Bell Broken Missing Pieces	4	2	$$$	Can it be slip lined, under pavement
26		82, 83	B1	126.1	B2	On Lena from Otto to Frederick	Intruding Tap, blocking camera	4	1	$ 1,680	Redo tap before pave Lena
26a		82, 83	B1	along the main	B2	On Lena from Otto to Frederick	Numerous sags some level 2 and 3	4	1	$$$	determine if sags can be corrected before pave
27		88	E8	130.5 to 132.5	E7	Clinton fr Charlotte to Elizabeth	Crack from Bad Tap, Open to Dirt, has roots	4	2	$ 1,680	Staff should repair
28		91	LD1	262.5	LD2	Lidell fr S end going north	Piece of Broken Pipe in Lateral	3	3	$ 1,680	Redo tap if blocks flow
29		93	LD3	63.3	LD4	Lidell going from S to Sherman	Tap in Backwards to Flow	3	3	$ 1,680	Staff should repair
30		78	A6	273.1	A5	Thru Park fr Charles to Clinton	Grease Source	3	2		Tap owner should address
31		87	E7	92.1	E6	Clinton fr W of Mary to Charlotte	Grease Source	3	2		Tap owner should address
32	x	49	C1	near MH B1	B1	Otto - Lena to Cora	Signifcant sags near MH B1	4	2	$$$	Under pavement too hard to address unless fails
33		63	D2		D1	Charles - From Laura to Mary	D1 has rough invert	3	3	$ 750	staff can repair
34		63	D2		D1	Charles - From Laura to Mary	Rubbernek intruding into tap	3	3	$ 1,500	Staff should repair
35		93 / 94	LD4	152.4	LD5	Fr Lidell to Creamery on Sherman	Line from south partially submerged	4	2	$$$	Under pavement too hard to address unless fails
36		97	AA-1 (LD6)	18,41, 50, 63, 77, 139	A8	On Sherman fr 2nd Chance to RR	Pipe egged	3	3	$$$	Under pavement too hard to address unless fails
37		23	J1	94.0	F4	Mary fr Sherman to Hyde	Intruding Tap, with roots	3	3	$ 1,500	Staff should repair
38	x	38	B4	67, 83.5, 138, 149, 172.7	B3	N Lena Charles to Clinton	Poor Taps	3	3	$$$	Under pavement too hard to address unless fails

Table WW-2 Summary of Significant Pipe Indents (dimples)										
Problem #	**Under Pavement**	**Video**	**Line Location**	**From**	**feet from**	**To**	**Description**	**Severity # (higher more severe)**	**Priority (lower # , higher priority)**	**Cost**
D1	X?	42	Alley W of Lena, S of Clinton	E1	9.0	COEA1	Large indent fr poor bedding	4	2	$ 1,680
D2	**X**	74	Laura fr S of Clinton going S	ED2	118.3	E3	Large sharp bedding indent can't get camera by	5	2	$ 3,000
D3		83	On Lena from Otto to Frederick	B1	126.1	B2	Large indent, **repair before pave**	5	1	$ 1,680
D4		24, 25	S Mary fr Moffat to Hyde	J2	39.3, 294.2	J1	Sharp bedding indent can not get camera by	5	1	$ 1,680
D5		93	Lidell going from S to Sherman	LD3	229.8	LD4	Sharp bedding indent can not get camera by	4	1	$ 1,680
D6		15	S Elizabeth Sherman to Hyde	F7	278.2	F6	Large bedding indent	4	2	$ 1,680
D7		49	Otto - Lena to Cora	C1	161.9	B1	Medium bedding intent bottom deformed	4	2	$ 1,680
D8	**X**	10	Sherman Lena to Cora	F1	24.4	F2	Medium indent fr bedding	3		$ 1,680
D9		54	Frederick - Lena toward Cora	B2	15.8	BA1	Medium bedding dimple, **repair before pave?**	3	2	$ 1,680
D10	**X**	74	Laura fr S of Clinton going S	ED2	157.8	E3	Medium bedding indents	3	2	$ 2,280
D11		77	Thru Park fr Frederick to Charles	A5	134.6	A4	3" rock indent @ 1:00	4	2	$ 1,680
D12		3	S Laura fr Sherman S	COFA1	163 & 174	F3	2 minor bedding indents	2	3	$ 1,680
D13	**X**	9	Sherman Lena to Cora	F2	112.2	F1	Small bedding indent	1		
D14	**X**	9	Sherman Lena to Cora	F2	149.6	F1	Small bedding indent	1		
D15	**X**	12	Sherman Laura to Mary	F4	209.8	F3	Small bedding indent	1		
D16	**X**	13	Sherman Mary to Charlotte	F5	370.7	F4	Small bedding indent	1		
D17	**X**	13	Sherman Laura to Mary	F5	385.8	F4	Small bedding indent	1		
D18		18	Sherman Mary to Charlotte	G2	58.9	G1	Small bedding indent	1		
D19		18	Sherman Mary to Charlotte	G2	70.4	G1	Small bedding indent	1		
D20		18	Sherman Mary to Charlotte	G2	109.9	G1	Small bedding indent	1		
		18	Sherman Mary to Charlotte	G2	311.5	G1	Small bedding indent	1		
D21		22	Moffat to Hyde on Cora	H2	23.1	H1	Small bedding indent	1		
D22		22	Moffat to Hyde on Cora	H2	148.1	H1	Small bedding indent	1		
D23		23	Mary fr Sherman to Hyde	J1	265.4	F4	Small bedding indent	1		
D24		33	Moffat to Hyde on S Amelia	H1	310.8	F2	Small bedding indent, **fix before pave?**	3	2	$ 1,680
D25		49	Otto - Lena to Cora	C1	161.9/172.	B1	Small bedding intent bottom deformed	1		
D26		53	N Cora - Charles to Alley S of Charles	C4	189.9	C3	Small bedding indent	1		
D27		55	Charles - Lena toward Cora	COBB1	113.3	B3	Small bedding indent	1		
D28		55	Charles - Lena toward Cora	COBB1	115.1	B3	Small bedding indent	1		
D29		64	Charles - From Mary to charlotte	D3	45.1	D2	Small bedding indent	1		
D30		64	Charles - From Mary to charlotte	D3	282.6	D2	Small bedding indent	1		
D31		65	Charles - Fr Charlotte to W of Elizabeth	D4	198.2	D3	Small bedding indent	1		
D32	**X**	74	Laura fr S of Clinton going S	ED2	93.6	E3	Multiple rock indents	2		$ 2,180
D32	**X**	74	Laura fr S of Clinton going S	ED2	118.3/157.	E3	Multiple rock indents	2		$ 2,430
D33		77	Thru Park fr Frederick to Charles	A5	141.6	A4	Small bedding indent	2		$ 1,680
D34		84	On Lena from Frederick to Chalres	B3	57.7	B2	Small bedding indent, **fix before pave?**	3	2	$ 1,680
D35		85	Clinton fr alley W of Laura to Mary	E5	93.8	E4	Small bedding indent	1		
D36		91	Lidell fr S end going north	LD1	243.8	LD2	Small bedding indent	2		
D37		93	Lidell going from S to Sherman	LD3	227.7	LD4	Small but sharp indent at 9:00	2	3	$ 1,680

	WW-3 Collection Line Condition Summary, Rating, and Recommendations (if needed) for each line video inspected									
Video No.	Location	U/S	D/S	TV Dir	Approx Len	Pipe Size	Rating	Solution	Overall	Summary of Issues
1	Alley W of Cora Frederick to Charles									
2	S Elizabeth & Moffat going S	L1	I2	U/S	93	8"	B+		Ok	
3	S Laura fr Sherman S	CO-FA1	F3	U/S	209.8	6"	B-		Mostly Ok	Has a couple of rock dimples, clean out rather than MH at end
4	Fr Hyde & Lena W on Hyde	CO-GA1	G1	U/S	241.7	6"	B		Mostly Ok	Has a minor rock dimple, clean out rather than MH at end
5	Fr alley W Cora at Hyde going S	CO-IA1	I1	U/S	281.4	6"	B+		Ok	Tap @ 267 has broken edge, line terminus is cleanout rather than manhole
6	On Hyde fr Cora to alley to West	I1	H1	D/S	188.6	6"	B+		Ok	
7	On Hyde fr alley W of Cora Mary	I2	I1	D/S	208.3	6"	B-		Mostly Ok	Piece of pipe broken and cracks radiating, level 2
8	S Laura fr Hyde to Moffat	I3	I2	D/S	325.8	6"	C+	Repair level 3 pipe indent	Numerous Minor Sags	Numerous Minor Sags
9, 10	Sherman Lena to Cora	F2	F1	Both	378	8"	C	Under pavement so prefered repair would be	Lots of issues, worst has been repaired	Pipe dimples from poor bedding, egg shaped pipe, cracks, some with repair clamps.
11	Sherman Cora to Laura	F3	F2	D/S	380	8"	B+		Mostly Ok	No issues observed other than pipe a little egged
12	Sherman Laura to Mary	F4	F3	D/S	365	8"	B-		Minor egging over most of the length	Minor sag, minor rock dimples, egging
13	Sherman Mary to Charlotte	F5	F4	D/S	407	8"	B-		Minor egging over most of the length	Level 2 sag, minor rock dimple, much of line egged
14	Sherman Charlotte to Elizabeth	F6	F5	D/S	362	8"	B		Mostly Ok, some minor egging	
15	S Elizabeth Sherman to Hyde	F7	F6	D/S	303	8"	B-	Repair taps	Mostly Ok, but some bad taps	
16	Hyde Elizabeth to Amelia	F8	F7	D/S	363	8"	B		Mostly Ok	Slight leak around tap @246
17	S Lena Sherman to Hyde	G1	F1	D/S	354	6	B-		sags lead to line being 1/4 full	
18	S Lena Moffat to Hyde	G2	G1	D/S	372	6"	B-		Several sags, dimples	
19	S Lena at Hyde	GR1	G1	D/S	9	10"	B+		No problems noted	
20	Moffat to Hyde on Lena	GR2	GR1	D/S	375.4	10	C+		Numerous minor issues	Numerous sags, several over cut taps, @ 275 rock in gasket?, minor egging

Video No.	Location	U/S	D/S	TV Dir	Approx Len	Pipe Size	Rating	Solution	Overall	Summary of Issues
21	Hyde to Sherman on Cora	H1	F2	D/S	352	6	C		Numerous level 2 sags, & other minor issues	bad tap with roots, taps with gaps, numerous minor sags
22	Moffat to Hyde on Cora	H2	H1	D/S	350.7	6	B		Couple of sags	
23	Mary fr Sherman to Hyde	J1	F4	D/S	355	6"	B		Mostly Ok	Some rock dimples, intruding tap 94' D/S of J1
24,25	S Mary fr Moffat to Hyde	J2	J1	both	433	6	C+	Replace deformed pipe & bed properly	Indent needs repaired, most of line OK	bad pipe indents at 39 ft and 41 ft D/S J2, camera stopped by rock intrusion
26,27	Charlotte fr Sherman to Hyde	K1	F5	both	272.4	6	B		OK	No real deficiencies, did have camera traction problems so ran in both directions
28	Moffat fr Charlotte W	K2A	K2	D/S	214	8	B+		OK	
29	S Charlotte Moffat to Hdye	K2	K1	D/S	378	6	B		Mostly OK	131 service has something hanging from the top
30	Elizabeth Mofft to Hyde	L1	F7	D/S	373.8	6	??		???	Video quality too poor to see indents if there are any, no observed problems
31	Sherman to Hyde on Amelia	M1	F8	D/S	237	6	B-	Repair what can be done **before pave**	Several sags, off set jt	couple of level 2 sags, an offset joint
32	S Amelia near S Elizabeth	N1	N1A	D/S	218	6	B		Mostly OK	@11.5 pipe not fully home
33	Moffat to Hyde on S Amelia	N1	F8	D/S	362	6	B		Mostly Ok	Small indent at 310,
34	Amelia S Eliz to Moffat	N2	N1A	D/S	196	6	B-	Before pave ck that it has not gotten worse	several offset joints	several level 1 offset jts, jt at 104 not home
35	Amelia Sabeta to S Eliz	N3	N2	D/S	237	6	B-	Cleaning needed	Minor issues	jt w/chip at 43, offset jt at 63, lots of junk in invert at N2
36	Lena Chipeta to Hyde	R1	GR2	D/S	335	10	C+	Routinely clean line, repair taps	Sags, roots, egging	some egging, level 5 roots at service at 166, some water running by taps @ 75 & 106, numerous sags
37	Elementary School @ Amelia & clinton		E9	U/S		6	??		???	@31.7 feet reach 45 elbow and can't get camera by
38	N Lena Charles to Clinton	B4	B3	D/S	370.5	8	B		Main Ok	Many poorly cut in taps.
39	N Lena Clinton to Sherman	B5	B4	D/S	188	8	B-	Routinely clean line	Mostly Ok	Roots at 186 going downstream blocked camera
40	N Lena Clinton to Sherman	B5	B4	U/S	134	8	B-		Same line as 39	
41	N Lena Clinton to Sherman	B5	B4	D/S	321	8	B-		Same line as 39	After they cleaned it again. Has some minor sags as D/S end
42	Alley W of Lena, S of Clinton	CO-EA1	E1	U/S	9	6	C+	Expose and correct bedding	Can't tell	Top deflected enough camera can't get by, cleanout not manhole at the end

Video No.	Location	U/S	D/S	TV Dir	Approx Len	Pipe Size	Rating	Solution	Overall	Summary of Issues
43	Laura S of Charles	CO-DA1	D1	U/S	210	6	B		Ok	Cleanout not manhole at the end
44	Mary, S of Charles	CO-DB1	D2	U/S	203	6	B		Ok	Cleanout not manhole at the end
45	Alley W of Lena, Alley S of Clinton	CO-EB1	EB1	U/S	88	6	B		Mostly Ok	Very minor sag at 76
46	E/W alley S of Clinton, W of Lena	CO-EB2	EB1	U/S	78	6	B		Mostly Ok	Line looks good, but constant flow from some taps. Cleanout not manhole at the end
47	E/W alley S of Clinton, W of Cora	CO-ED1	ED1	U/S	112	6	B-		Mostly Ok	Level 2 sag at D/S manhole, couple of minor sags up the pipe. Has cleanout not manhole at U/S end
48	N Cora - fr x alley S of Clinton	CO-EC1	EC1	D/S	164.8	6	B-	Clean regularly to keep solids fr accumlating in gaps	Gaps at coupling could be problematic	Several cracked taps. Joints look to be couplings and many have a gap between the pipes to could catch solids
49	Otto - Lena to Cora	C1	B1	D/S	365	6	C+		Numerous sags	Numerous sags a couple level 2, two indents in pipe bottom. Hydraulic jump near D/S end. Back up from MH B1. Poor cut in tap, mastic fr tap in flowline @151
50,51	N Cora - Otto to Frederick	C2	C1	D/S	355	6	C+	Repair break at 96. Can sag by C1 be fixed?	Mostly Ok, except at 96 & rough taps	Most of taps are rough, repair needed at 96 but under asphalt. Serious sag (level 4+) at 354 (by MH C1)
52	N Cora - Frederick to Charles	C3	C2	D/S	375	6	B-	Fix exposed gasket	Mostly Ok	Gasket exposed at 179 & 185, couple of rock indents, couple rough tapsm, couple minor sags
53	N Cora - Charles to Alley S of Charles	C4	C3	D/S	216	6	B-	Grease traps needed	Line looks OK, grease a big problem	Massive amts of grease in C4, in the line and the line that goes west. Pipe deformed at 6:00 from rock at 190
54	Frederick - Lena toward Cora	CO-BA1	B2	U/S	170	6	B		Mostly Ok	Camera lost traction at 170 of 250 feet, minor rock indent @16, Cleanout not MH at end
55	Charles - Lena toward Cora	CO-BB1	B3	U/S	198	6	B		Mostly Ok	Service line offset at 190 (level 3), 2 minor rock indents, cleanout not MH at the end
56	Clinton - W of Amelia	CO-E9A	E9	U/S	63	6	B		Mostly Ok	Tap at 60 flowing clean water
57	Alley W of Laura - Clinton going N	CO-EE1	E4	U/S	109	6	B		OK	Cleanout not manhole at the end
58	Alley W of Laura - Clinton going S	CO-EF1	E4	U/S	239	6	B		OK	Cleanout not manhole at the end
59	Mary - Fr Clinton S toward Sherman	CO-EG1	E5	U/S	~253	6	B			Camera lost traction at 192, to there looked OK, cleanout not manhole at end

Video No.	Location	U/S	D/S	TV Dir	Approx Len	Pipe Size	Rating	Solution	Overall	Summary of Issues
60	Fr Charles N in alley west of Mary	CO-EH1	E6	U/S	98	6	B		Mostly Ok	At 20 have offset lip, otherwise OK
61	Fr Charles S in alley west of Mary	CO-EI1	E6	U/S	255	6	B		Mostly Ok	Camera could only get to 228, to there looked OK, cleanout not manhole at end
62	Charles - fr Cora to Laura	D1	C3	D/S	383	6	B-		Looked OK this time	Line has history of roots, but didn't find many this time. Minor sags, roots from tap at 289
63	Charles - From Laura to Mary	D2	D1	D/S	375	6	C+	Fix would require reinstallation	Fair condition	Offset joints, several sags, D1 has rough inv
64	Charles - From Mary to charlotte	D3	D2	D/S	385	6	C	Repair pipe separations		One offset joint, one joint open , several minor rock dents.
65	Charles - From Charlotte to W of Elizabeth	D4	D3	D/S	483	6	B-		Mostly Ok	Minor sags, minor pipe dents
66	Charles - From W of Elizabeth to Amelia	D5	D4	D/S	242	6	B		OK	Cut in taps are OK condition, mostly good, includes Yates LS discharge
67	Clinton - Fr Lena to Alley W of Lena	E1	B4	D/S	206	6	B+		OK	All Ok
68	Clinton - Fr Alley W of Lena to Cora	E2	E1	D/S	178	6	B		Mostly OK	Cut in taps fair to poor condition
69	Clinton fr Cora to Laura	E3	E2	D/S	386	6	B-		Mostly OK	Several minor sags, service line break @ 213
70	Clinton fr Laura to Mary	E4	E3	U/S	179	6	C	Determine if sag can be repaired	Submerged at E3	Camera under water at sag at E3
71	Clinton fr alley W of Lena going S	EB1	E1	D/S	200	6	B+		OK	Nothing of note
72	Cora - fr Clinton going S	EC1	E2	D/S	129	6		Grease traps needed	Mostly Ok	One level 2 sag, lined was really greasy
73	Laura fr Clinton going S	ED1	new MH	D/S	18	6	B+	new manhole needs grouted	OK	Manhole added at the alley need grouted. Otherwise OK
74	Laura fr S of Clinton going S	ED2	E3	D/S	183	6	B-	Repair rock indent 118	Fair condition	Roots in the tap at 48, several rock indents. Indent at 118 almost blocked the camera
75	Fr Otto to S thru Park	A3	A2	D/S	99	12	B-	Repair broken bell	Mostly Ok	Bell broken at 84, piece missing, minor sag
76	Thru Park fr S of Otto to Frederick	A4	A3	D/S	302	12	B		Mostly Ok	Several minor sags
77	Thru Park fr Frederick to Charles	A5	A4	D/S	364	12	B-	Repair rock indent @134	Fair condition	Numerous sags, one indent ~3" deep, other one minor
78	Thru Park fr Charles to Clinton	A6	A5	D/S	370	12	B-	Town hall needs grease trap	Mostly OK	Numerous sags mostly at joints. Tap at 237 running water, some grease
79	In Park jog E/W on line of Clinton	A7	A6	D/S	43	12	B		OK	Nothing of note

Video No.	Location	U/S	D/S	TV Dir	Approx Len	Pipe Size	Rating	Solution	Overall	Summary of Issues
80	Thru Park fr Sherman to Clinton	A8	A7	D/S	353	12	B-		Mostly Ok	Numerous sags, pipe looks egged in places
81	On Otto fr Shop to Clinton	B1	A2	U/S	80	12	B-		Ok	Rocks, gravel, grease observed; several sags
82	On Lena from Otto to Frederick	B2	B1	D/S	381	8	C	Repair tap intrusion and rock indent, evaluate whether sags can be addressed	Fair condition	Numerous minor sags, intruding tap @254 blocks camera
83	On Lena from Otto to Frederick (same line as 82)	B2	B1	U/S	same line as above in opposite dir.				Fair condition	Numerous sags, with one level 3 by MH B1, rock indent at 126 by intruding tap
84	On Lena from Frederick to Charles	B3	B2	D/S	364	8	B-	Address grease and rock entry issues	Mostly OK but have rocks and grease	Removed about 10 gal of grease and rock mix when cleaning the line.
85	Clinton fr alley W of Laura to Mary	E5	E4	D/S	180	6	B		Mostly Ok	Small indent at flowline @ 94
86	Clinton fr Mary to alley W of Mary	E6	E5	D/S	193	6	B+		Good condition	No issues observed
87	Clinton fr W of Mary to Charlotte	E7	E6	D/S	197	6	B	Address grease and rock entry issues	Mostly Ok	Pipe in fully in collar by 1/2" @ 89, minor sag at 6, tap at 92 has grease
88	Clinton fr Charlotte to Elizabeth	E8	E7	D/S	380	6	B-	Repair taps	Mostly OK	Tap at 132 caused cracks in both directions. Roots at 132 & 242. Several minor sags Several taps rated fair to poor
89	Clinton fr Elizabeth to Amelia	E9	E8	D/S	355	6	B+		Good condition	Nothing of note
90	Fr Clinton S in Charlotte	EJ1	E7	U/S	290	6	B+		Mostly Ok	One very minor sag
91	Lidell fr S end going north	LD1	LD2	D/S	295	8	B	Address piece of pipe in tap at 262.5	Mostly Ok	1" x 1/2" rock indent @ 243, piece of pipe in tap at 262.5, the rest is OK
92	Lidell going from S to N	LD2	LD3	D/S	109	8	B		Mostly Ok	Pipe laid thru the manhole & cut out above springline, couple of minor sags
93	Lidell going from S to Sherman	LD3	LD4	D/S	406	8	B-	Address backwards tap?	Fair condition	Mostly rough cut in taps, several sags and pipe indents level 1 & 2
94	Fr Lidell to Creamery on Sherman	LD4	LD5	D/S	152	12	B		Mostly Ok	pulled out rocks and gravel when cleaning, 1 level1 and 1 level 2 sags, pipe jt @32 offset ~1"
95	Crossing Sherman fr Creamery	LD5	LD6 (AA-1)	U/S	78	12	C+	Not sure sag can easily be fixed	Fair condition	Pipe about half full near MH LD5 , sag 50 ft long, offset joint @ 14
96	Line in Second Chance Parking lot	LD6A (AB-1)	LD6 (AA-1)	U/S	131	8	B-		Mostly Ok	Has a reducer from 8" to 6" coming into MH LD6a (AB-1)
97	On Sherman fr 2nd Chance to RR	LD6 (AA-1)	A8	D/S	249	12	B-		Fair condition	Rock indent @88, 2 sags, looks egged about half of length

Table WW-4 Collection Lines Not Video'd in last 15 year			
Location	From	To	
Fredrick Cora to Mary	C2	CA2	
Alley West of Fred, west of Laur	CA2	CB1	
Crossing Sherman at RR	A9	A8	
RR to Lena on Sherman	A9	F1	
Market Alley	F1A	CO F1A	
Chipeta	R1	R5	
Sabeta and Tabernash	All		
RUSA	All but Palomino		
Le Ranch	All		
River Park	All		
Green St	All		

Table WW-5 Collection System - Summary of Needs			
Description	Priority	Urgency	Est Cost
Collection System			
Address Sags & Indents. See Collection System tables for specific locations	2	1-5 years	Mostly staff time
Frequent maintenance of lines with sags, grease accumulation, roots, and intruding taps that allow cleaning (see Figure S-4) (Consider purchasing cleaning equipment)	1	1-2 years depending on severity	$1-2/ft if contracted
Root killer treatment where have root infiltration (See Figure S-4)	1	at least annually	Staff time + chemicals
Replace sewer lines recommended for replacement	2	1-5 years	~$100/ft replaced
Locate sources inflow and infiltration during rain events	3	1-5 years	Mostly staff time
Lift Station Equipment Replacement	2	5-10 yrs	$ 35,000
Policy for installing taps on existing mains to insure all taps are clean cuts and water tight	1	6-18 months	Mostly staff time
Ridgway Municipal Code updates regarding installing taps and requiring when someone abandons a tap that it be capped.	2	6-18 months	Mostly staff time
Remove grating from RUSA #2 wet well and replace with a portable ladder	3	6-18 months	Mostly staff time, 350 for ladder
Yates Lift Station pump replacement	2	1-3 years	$ 12,500
River Park Lift Station - motor rebuild and/or replacement	2	3-10 years	$ 10,000
Fairgrounds lift station - pump rebuild /replacement	2	15-20 years	$ 20,000

Revisions: JULY 2000, RECORD DRAWINGS

TOWN OF RIDGWAY
WASTEWATER TREATMENT PLANT

PROCESS PIPE, UTILITIES & STRUCTURE LAYOUT

Consolidated Consulting Services
P.O. Box 738 Delta, CO 81416

Drawn By: RON ALEXANDER | Date: MAY 1999
Approved By: JOANNE FAGAN | Dwg No: C:\R_\WWTP\SITE.DWG

Drawing No: 5

Figure 11: Influent Flow

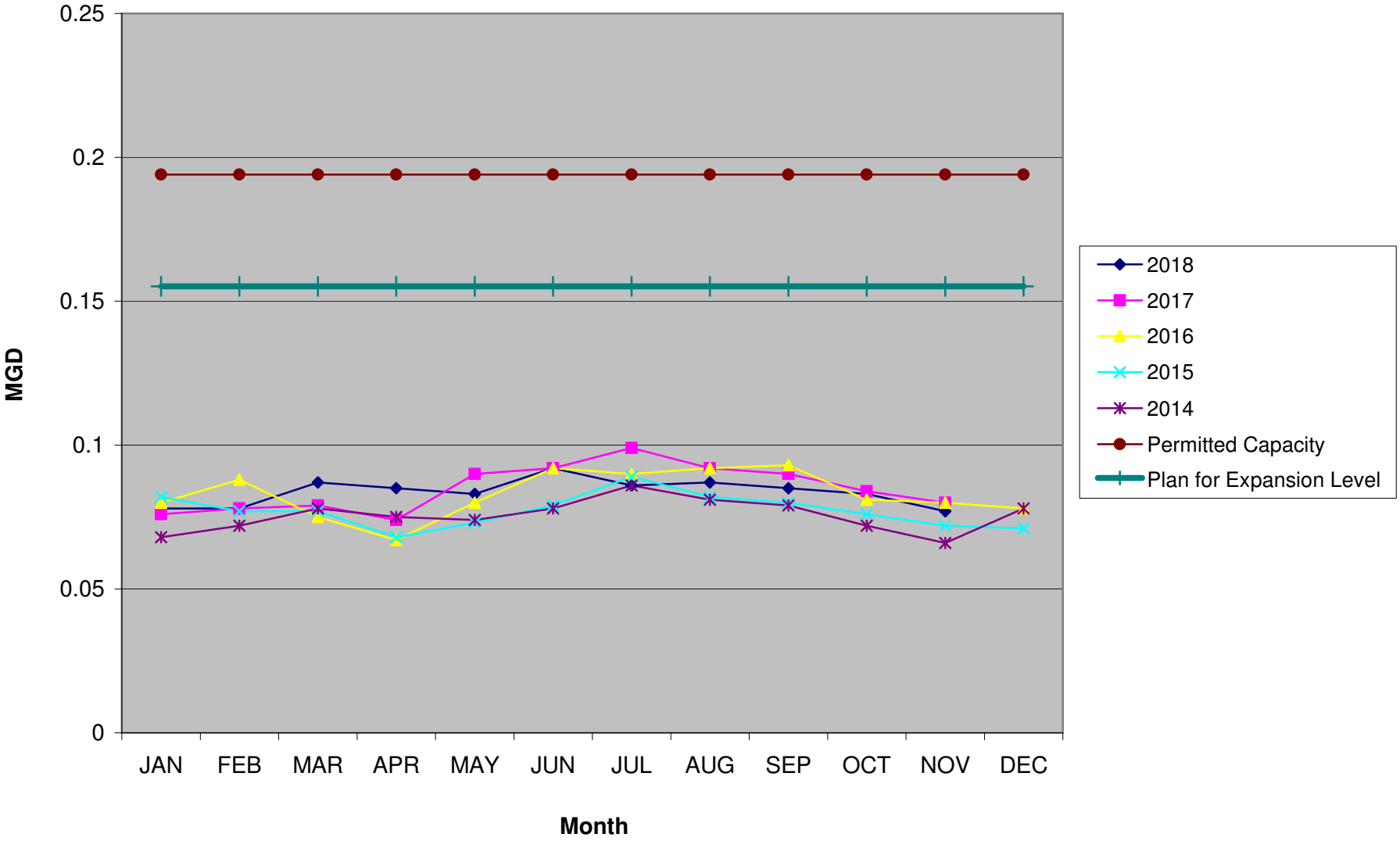


Figure WW 12a: Influent BOD Concentration

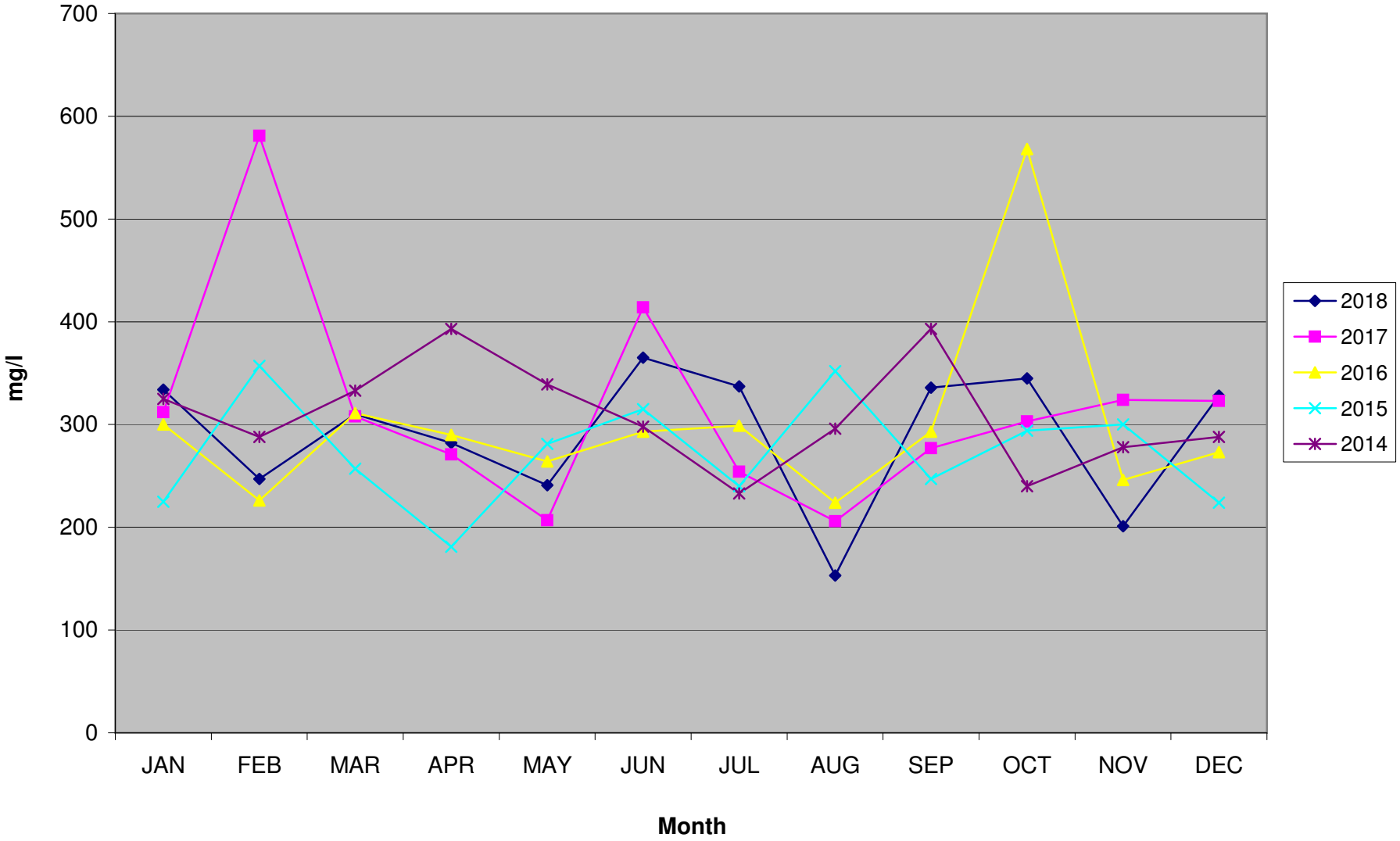
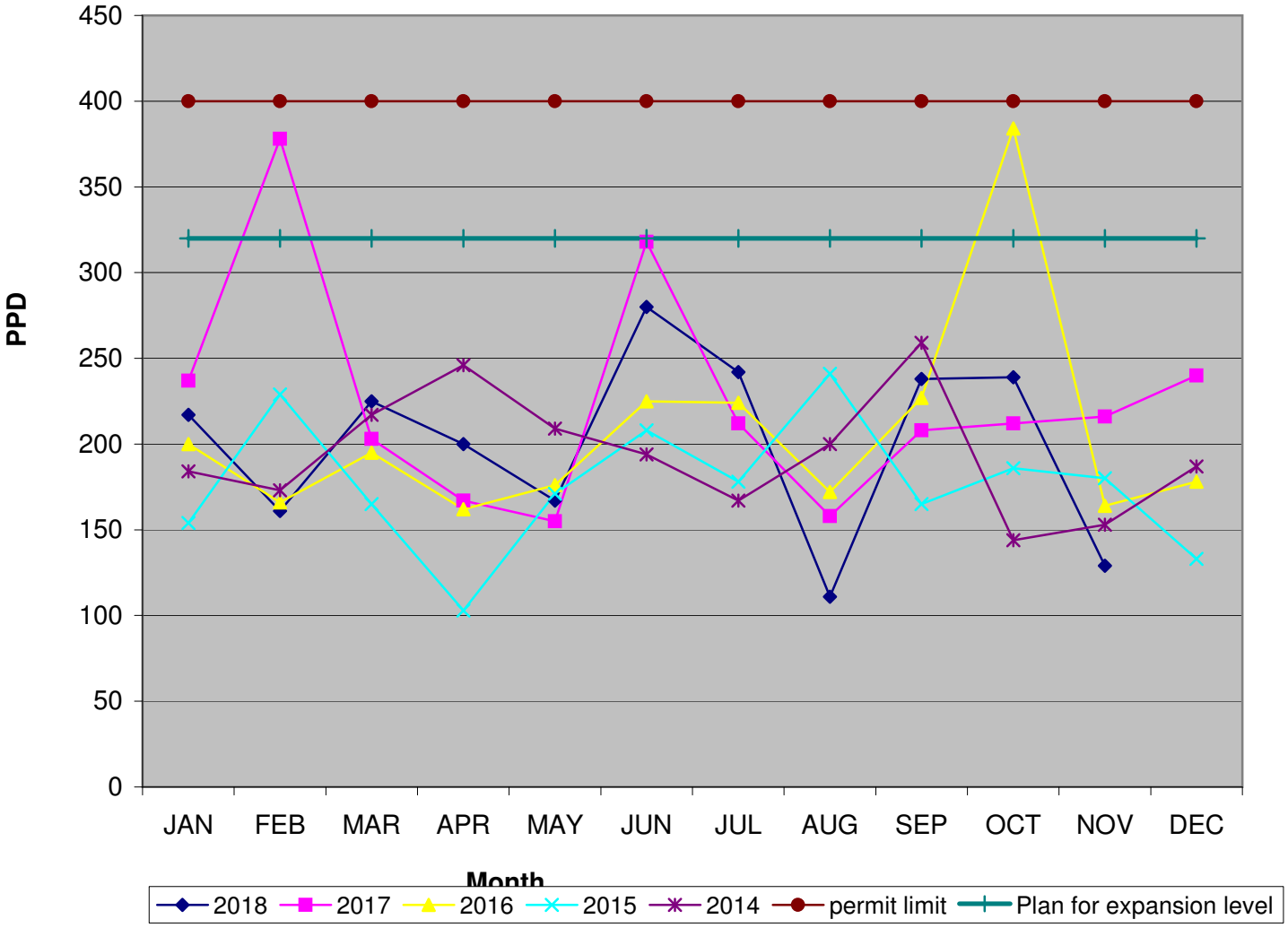
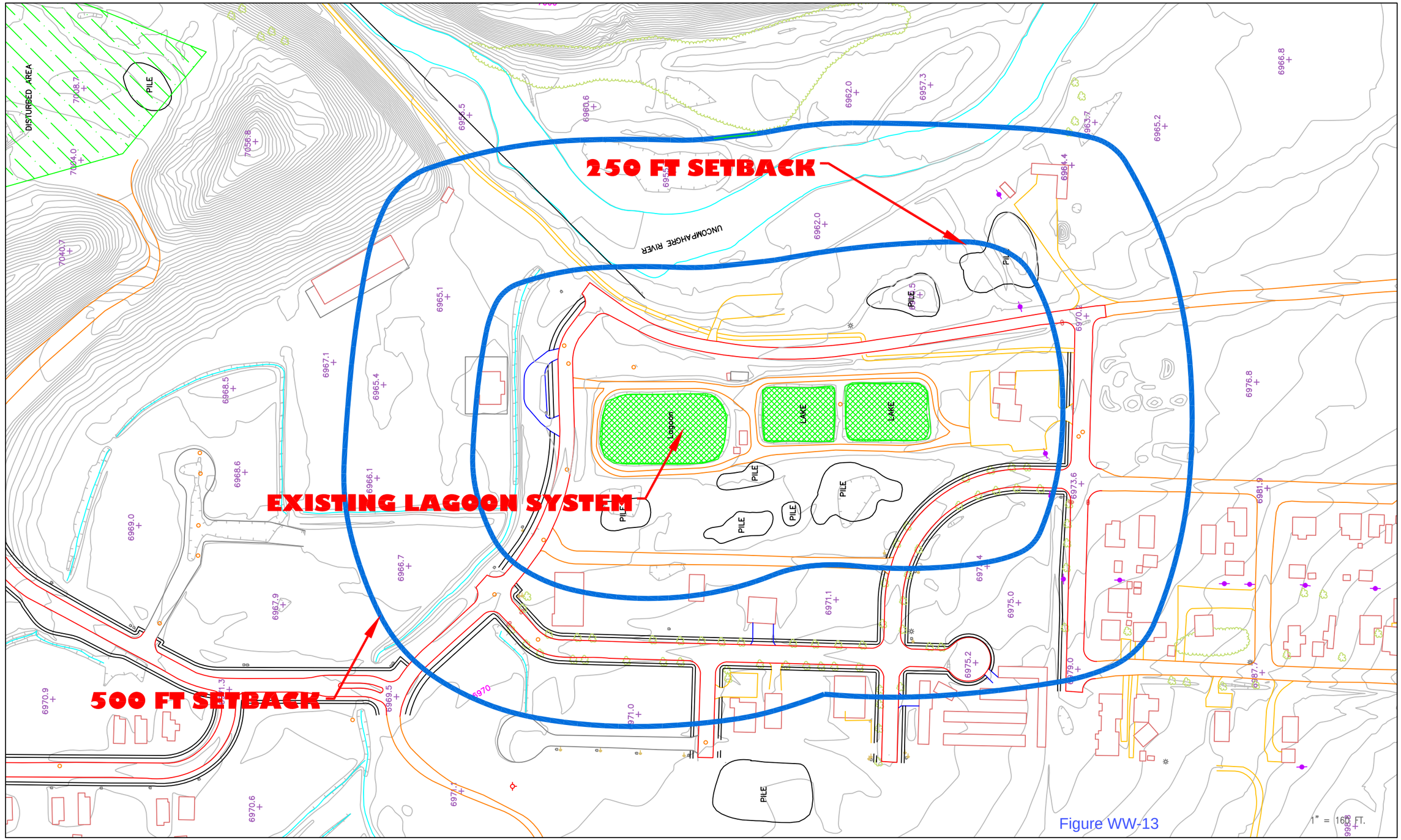


Figure WW-12b: Influent BOD Load





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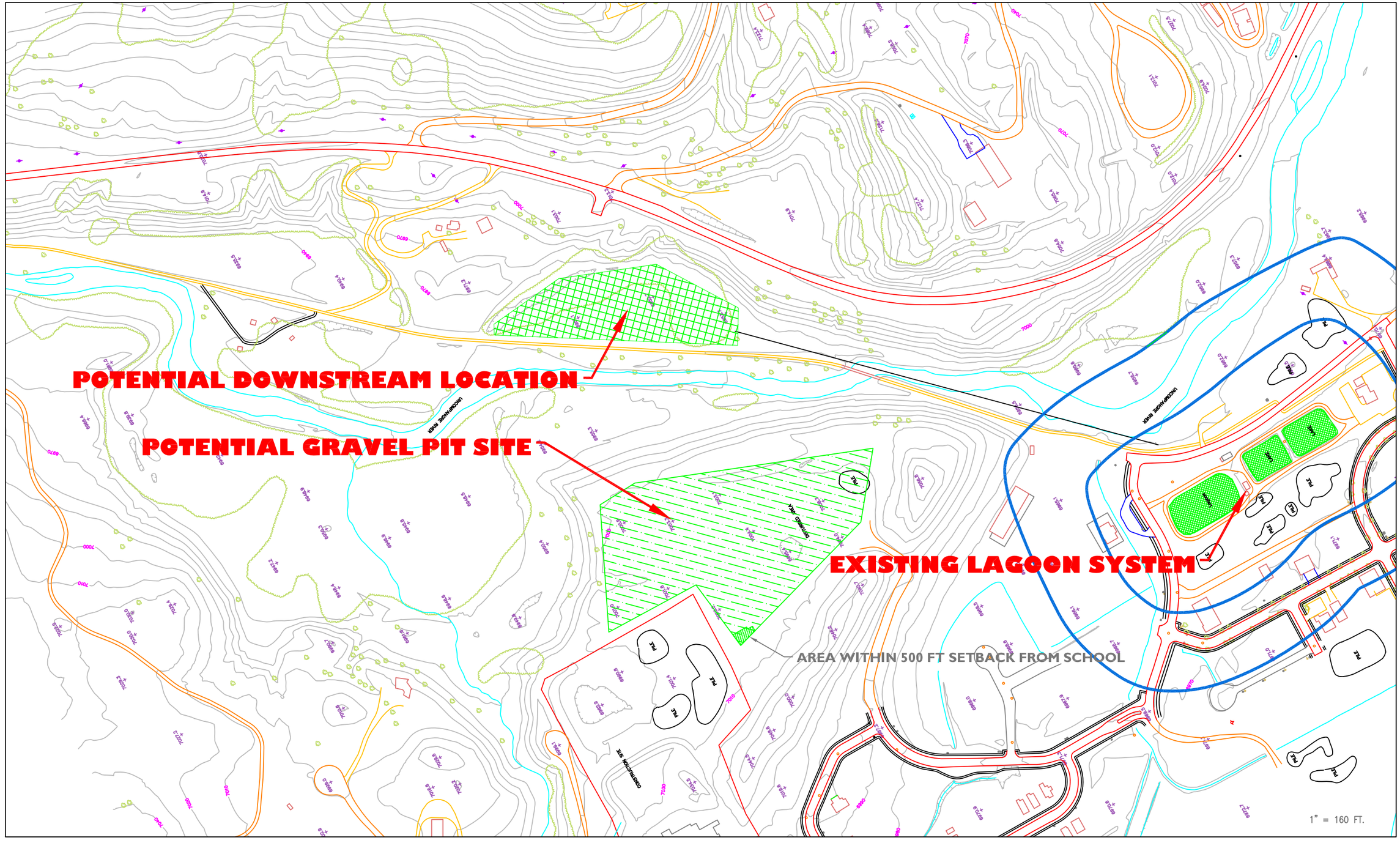
Drawing File Name:	R_cip ww ds topo				
Acad Ver.: R2000 Scale: NONE	Units: English				

CONSOLIDATED CONSULTING SERVICES P.O. BOX 1073 Ridgway, CO 81432 (970) 240-8510 JF	Town of Ridgway P.O. BOX 10 Ridgway, CO 81432 (970) 626 5308	As Constructed No Revisions: Revised: Void:	Ridgway Capital Assessment Wastewater Treatment Plant Setbacks Designer: jf Sheet Subset: Subset Sheets: 2 of 4	Project No./Code XXX XXXX–XXX XXXXX Sheet # Fig–WW–13



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Drawing File Name:	R_cip ww ds topo					
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As Constructed	
No Revisions:	
Revised:	
Void:	

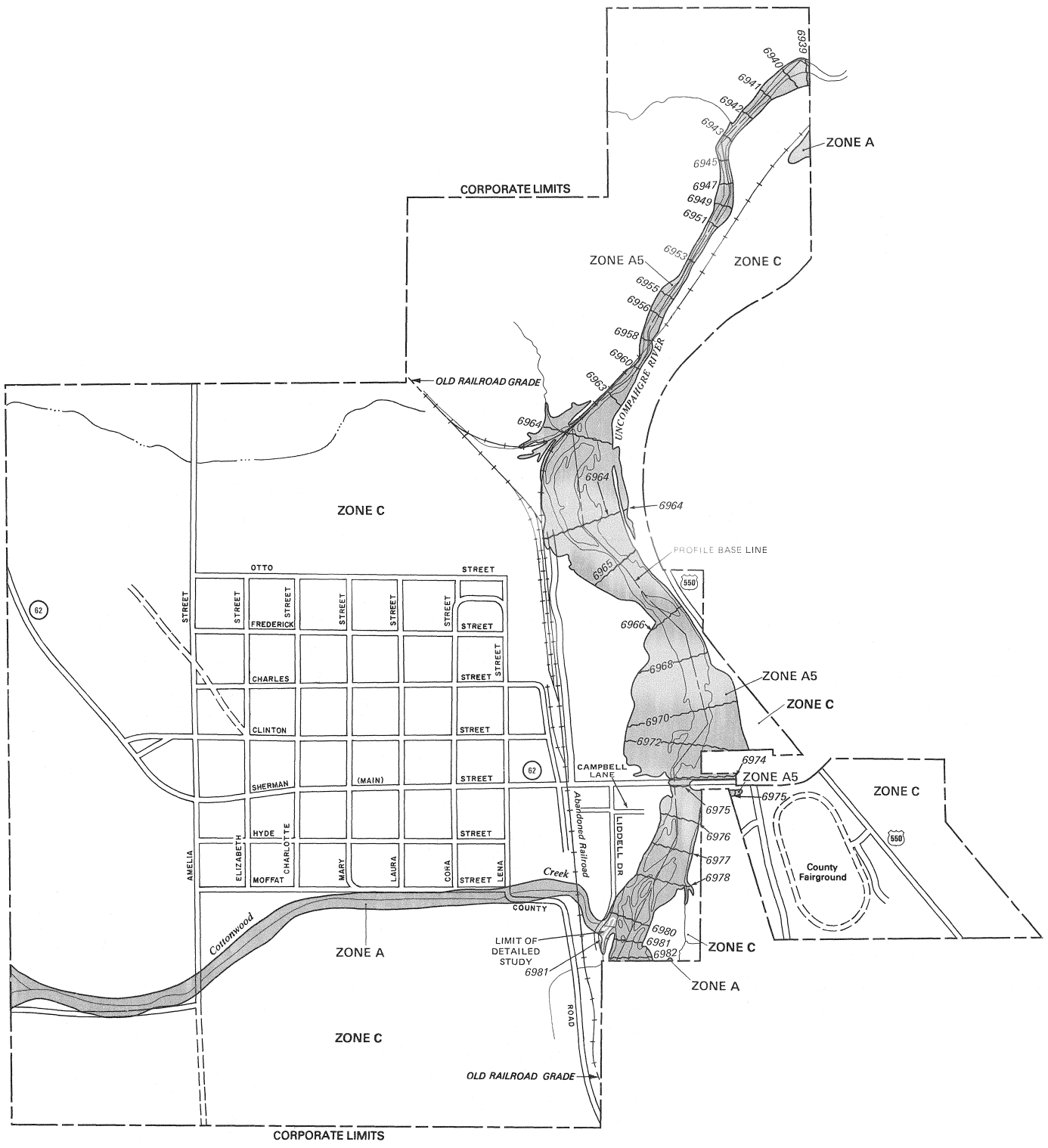
Ridgway Capital Assessment

Wastewater Treatment Plant Downstream Options

Designer: RA		
Sheet Subset:	Subset Sheets: 2 of 4	

Project No./Code
XXX XXXX-XXX
5' contours
Sheet # Fig-WW-14

FIGURE WW-15: FEMA Floodplain



KEY TO MAP

500-Year Flood Boundary
100-Year Flood Boundary
Zone Designations
100-Year Flood Boundary
500-Year Flood Boundary

ZONE B
ZONE A1
ZONE A5
ZONE B

Base Flood Elevation Line With Elevation In Feet** — 513
Base Flood Elevation in Feet Where Uniform Within Zone** — (EL 987)
Elevation Reference Mark — RM7×
Zone D Boundary
River Mile — •M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

INITIAL IDENTIFICATION:
NOVEMBER 8, 1974

FLOOD HAZARD BOUNDARY MAP REVISIONS:
JANUARY 23, 1976

FLOOD INSURANCE RATE MAP EFFECTIVE:
MARCH 18, 1977

FLOOD INSURANCE RATE MAP REVISIONS:
Map revised October 13, 1981 to change corporate limits, to add new special flood hazard areas, streets names, and streets.

Map revised September 27, 1985 to change flood plain boundaries, zone designations, base flood elevations, corporate limits, scale, cultural features, or map format.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE
600 0 600 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWN OF
RIDGWAY, COLORADO
OURAY COUNTY

ONLY PANEL PRINTED

COMMUNITY-PANEL NUMBER
080138 0001 D

MAP REVISED:
SEPTEMBER 27, 1985

Federal Emergency Management Agency

FOLD

Figure WW-16 Google Earth Image of Areas downstream existing treatment plant

Table WW-10

CONDUIT/CONDUCTOR SCHEDULE

CONDUCTORS SIZED PER TABLE 430-72B NEC-99

DESIGNATION	ORIGINATION	TO	CONDUIT	CONDUCTOR	LOAD	APPROX CONDUIT LENGTH	APPROX LOAD LENGTH (ft)
UTIL-1	POWER SOURCE	TRANSFORMER	6" PVC	PULL CORD (WIRE BY SMPA)		410'	
UTIL-2	TRANSFORMER	MAIN DISCONNECT	4" PVC	8 - #3/0, #3 GND	200 A	24'	30
UTIL-3	MAIN DISCONNECT	TRANSFER SWITCH	4" GRC	8 - #3/0, #3 GND	200 A	8"	3
MCC-1	TRANSFER SWITCH	MCC	4" GRC	8 - #3/0, #3 GND	200 A	11"	5
GEN-1	GENERATOR	TRANSFER SWITCH	2" PVC	PULL CORD		17'	
GEN-2	TRANSFER SWITCH	GENERATOR	3/4" PVC	PULL CORD		16'	
CV-3	TRANSFER SWITCH	MCC	3/4" EMT	4 - #12		12"	
CV-4	PANEL A	TRANSFER SWITCH	3/4" EMT	2 - #12, #12 GND		16"	
GEN-3	GENERATOR	AUTO DIALER	3/4" PVC	PULL CORD		28'	
GEN-4	PANEL A	GEN HEAT, CHG.	1" PVC	PULL CORD		18'	
CP-1	MCC	TRANSFORMER	1 1/4" GRC	3 - #4, #10 GND	40 A	4"	3
CP-2	TRANSFORMER	PANEL A	1 1/4" GRC	3 - #4, #10 GND	80 A	40"	6
CL2-1	PANEL A	CL2 PANEL	1 1/2" PVC	3 - #4, #6 GND	60 A	215'	219
MP-1A	MCC	MP-1A	1 1/4" PVC	3 - #8, #10 GND	16 A	332'	450
MP-1B1	MCC	MP-1B1	1 1/4" PVC	3 - #8, #10 GND	16 A	261'	346
MP-1B2	MCC	MP-1B2	1 1/4" PVC	3 - #8, #10 GND	16 A	261'	410
MP-1C	MCC	MP-1C	1 1/4" PVC	3 - #8, #10 GND	16 A	218	370
MP-2A	MCC	MP-2A	1 1/2" PVC	PULL CORD		200'	350
MP-2B	MCC	MP-2B	1" PVC	3 - #10, #10 GND	11 A	150'	245
MP-2C	MCC	MP-2C	1" PVC	3 - #10, #10 GND	11 A	100'	220
MP-2D	MCC	MP-2D	1" PVC	3 - #10, #10 GND	11 A	50'	160
MP-3A	MCC	MP-3A	1" PVC	PULL CORD		107'	
MP-3B1	MCC	MP-3B1	1" PVC	PULL CORD		154'	
MP-3B2	MCC	MP-3B2	1" PVC	PULL CORD		154'	
MP-3C	MCC	MP-3C	1 1/4" PVC	PULL CORD		245'	
MP-4A	MCC	MP-4A	1" PVC	3 - #10, #10 GND	16 A	82'	145
MP-4B1	MCC	MP-4B1	1 1/4" PVC	3 - #8, #10 GND	16 A	173'	325
MP-4B2	MCC	MP-4B2	1 1/4" PVC	3 - #8, #10 GND	16 A	173'	195
MP-4C	MCC	MP-4C	1 1/4" PVC	3 - #8, #10 GND	16 A	254'	400
DW-1	MCC	DEWATER SUMP	1 1/2" PVC	3 - #6, #10 GND	22 A	378'	393
RC-1	CL2 PANEL	RECIRC CONTROL	3/4" PVC	2 - #10, #12 GRD	15 A	24'	32
FR-1	FLOW RECORDER	FLOW SENSOR	3/4" PVC	SIGNAL (PROVIDED BY OTHERS)		22'	
SP-1	MCC	OUTSIDE BLDG	1 1/4" PVC	PULL CORD		9'	
SP-2	MCC	OUTSIDE BLDG	1 1/4" PVC	PULL CORD		9'	
SP-3	MCC	OUTSIDE BLDG	1 1/4" PVC	PULL CORD		9'	
SP-4	MCC	OUTSIDE BLDG	2" PVC	PULL CORD		9'	
SP-5	MCC	OUTSIDE BLDG	2" PVC	PULL CORD		9'	
RC-2	RECIRC CONTROL	RECIRC SUMP	1 1/2" GRC	PROVIDED BY OTHERS		5'	

PLACE 3/8" NYLON PULL CORD IN EMPTY CONDUITS
TIE END TO MOORING POST & LEAVE 18" MIN END IN MCC

Table WW-11 Discharge Monitoring Results 2014-2018

RIDGWAY DMR	LIMIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg
2018														
Influent Flow Ave	0.194	0.078	0.078	0.087	0.085	0.083	0.092	0.086	0.087	0.085	0.083	0.077		0.084
Max		0.084	0.091	0.1	0.092	0.09	0.1	0.091	0.1	0.1	0.1	0.085		
% Design Flow Capacity		40%	40%	45%	44%	43%	47%	44%	45%	44%	43%	40%	0%	
Effluent Flow Ave		0.088	0.082	0.081	0.082	0.078	0.09	0.09	0.088	0.088	0.087	0.073		0.084
Max		0.09	0.095	0.09	0.099	0.085	0.095	0.1	0.1	0.099	0.1	0.081		
Influent BOD		334	247	310	282	241	365	337	153	336	345	201	328	289.9
Effluent BOD avg		25	17	5	29	33	24	11	24	19	19	23	21	
Effluent BOD max		25	17	5	36	36.6	24	11	45	19	19	23	21	
BOD % Removal		93	93	98	87	86	93	97	85	94	94	88	94	
BOD ave inf. ppd	400	217	161	225	200	167	280	242	111	238	239	129		
% Design BOD Capacity		54%	40%	56%	50%	42%	70%	61%	28%	60%	60%	32%		50.2%
Influent TSS		241	354	272	298	173	276	253	164	267	381	258	295	
Effluent TSS		35	22	12	32	33	12	16	52	35	40	21	23	
Ecoli		1	150	40	253	210	1248	115	257	1927	960	952	1788	
TRC Max		0.35	0.3	0.3	0.3	0.3	0.21	0.29	0.25	0.21	0.22	0.38	0.35	
pH min		7.8	7.7	7.8	7.8	7.7	7.8	7.8	7.9	7.8	7.7	7.8	7.9	
pH max		8.2	8	8.1	8.1	8	8	8.1	8.2	8.1	8	8.1	8	
Influent NH3		47	33	49	53	51	48	49	33	52	54	50	44	46.92
Effluent NH3		35	38	43	37	18	1	1	6	0.08	0.08	1.1	26	
Eff NH3 Persigo					38.1		<0.2		0.661		<0.2		18.4	
NO3+NO2					1.27		45.8		35.9		33.4		17.1	
Kjeldahl N					44.9		7.86		7.48		5.6		25.5	
Kjeldahl P					6.45		8.18		8.57		7.17		6.31	
TDS raw				202			160			126			204	
TDS Eff				464			710			504			478	

RIDGWAY DMR	LIMIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg
2017														
Influent Flow Ave	0.194	0.076	0.078	0.079	0.074	0.09	0.092	0.099	0.092	0.09	0.084	0.08	0.089	0.0853
Max		0.1	0.095	0.11	0.1	0.1	0.11	0.1	0.11	0.1	0.11	0.089	0.097	
% Design Flow Capacity		39%	40%	41%	38%	46%	47%	51%	47%	46%	43%	41%	46%	
Effluent Flow Ave		0.085	0.08	0.078	0.078	0.087	0.094	0.1	0.095	0.092	0.087	0.09	0.094	
Max		0.099	0.1	0.088	0.1	0.094	0.1	0.11	0.1	0.1	0.09	0.096	0.1	
Influent BOD		312	581	308	271	207	414	254	206	277	303	324	323	315
Effluent BOD avg		18	15	28	82	19	19	15	17	15	22	26	21	
Effluent BOD max		18	15	28	132.6	19	19	15	17	15	22	26	21	
BOD % Removal		94	98	91	70	91	95	94	92	95	93	92	94	
BOD ave inf. ppd	400	237	378	203	167	155	318	212	158	208	212	216	240	
% Design BOD Capacity		59%	95%	51%	42%	39%	80%	53%	40%	52%	53%	54%	60%	56.3%
Influent TSS		278	291	333	230	231	237	357	239	244	263	261	241	
Effluent TSS		44	28	42	26	18	22	11	22	7	17	18	25	
Ecoli		8	4	129	225	1045	236	1393	560	896	1919	1190	1940	
TRC Max		0.34	0.3	0.24	0.26	0.23	0.28	0.2	0.2	0.2	0.21	0.2	0.16	
pH min		7.8	7.9	7.9	7.8	7.9	7.6	7.4	7.6	7.9	8	7.9	7.6	
pH max		8.1	8.2	8.2	8.2	8.3	7.8	7.8	8	8.1	8.3	8.1	7.9	
Influent NH3		44	36	46	35	47	36	61	48	44	49	55	46	
Effluent NH3		35	37	41	29	0.11	0.53	0.44	0.49	0.02	1	12	27	
Eff NH3 Persigo		28.5	37.6	36.9		<0.2		0.42		<0.2		8.44		
NO3+NO2		6.64	1.77	1.22		36.5		45.8		34.6		19.8		
Kjeldahl N		36.7	44.6	41.3		7.44		5.68		5.33		14.7		
Kjeldahl P		5.97	5.73	5.74		6.83		7.75		6.78		6.09		
TDS raw				202			190			160			206	
TDS Eff				552			746			608			488	

RIDGWAY DMR	LIMIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg
2016														
Influent Flow Ave	0.194	0.08	0.088	0.075	0.067	0.08	0.092	0.09	0.092	0.093	0.081	0.08	0.078	0.083
Max		0.089	0.1	0.086	0.08	0.091	0.1	0.1	0.1	0.12	0.088	0.088	0.085	
% Design Flow Capacity		41%	45%	39%	35%	41%	47%	46%	47%	48%	42%	41%	40%	
Effluent Flow Ave		0.082	0.093	0.079	0.074	0.082	0.1	0.094	0.085	0.095	0.084	0.086	0.082	
Max		0.093	0.1	0.1	0.09	0.1	0.12	0.12	0.1	0.11	0.088	0.09	0.085	
Influent BOD		300	226	311	290	264	293	299	224	293	568	246	273	298.92
Effluent BOD avg		28	18	14	8	29.5	21	12	15	28	42.7	26	30	
Effluent BOD max		28	18	14	8	31	21	12	15	28	42.7	26	30	
BOD % Removal		93	92	95	97	89	94	96	94	90	92	89	89	
BOD ave inf. ppd	400	200	166	195	162	176	225	224	172	227	384	164	178	
% Design BOD Capacity		50%	42%	49%	41%	44%	56%	56%	43%	57%	96%	41%	45%	51.5%
Influent TSS		167	218	243	332	352	255	341	201	287	374	216	243	
Effluent TSS		29	26	18	15	12	13	18	19	17	34	31	39	
Ecoli		1804	119	208	28	43	70	362	181	1208	1137	1880	20	
TRC Max		0.25	0.22	0.25	0.26	0.2	0.21	0.21	0.28	0.22	0.25	0.28	0.25	
pH min		7.9	7.9	7.8	7.8	7.9	7.8	7.8	7.9	7.8	7.8	7.7	7.8	
pH max		8.2	8.1	8.3	8.1	8.1	8.2	8.2	8.1	8.2	8	8	8.1	
Influent NH3		43	31	38	37	46	47	44	39	45	45	48	43	
Effluent NH3		37	27	44	41	26	1	0.5	1	1	1	0.07	19	
Eff NH3 Persigo								0.218		<0.1		0.116		
NO3+NO2								39.1		33.3		30.2		
Kjeldahl N								6.13		5.53		6.41		
Kjeldahl P								8.52		7.51		6.08		
TDS raw				212			94			178			212	
TDS Eff				556			692			568			486	

RIDGWAY DMR	LIMIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg
2015														
Influent Flow Ave	0.194	0.082	0.077	0.077	0.068	0.073	0.079	0.089	0.082	0.08	0.076	0.072	0.071	0.077
Max		0.094	0.088	0.097	0.074	0.085	0.094	0.1	0.09	0.085	0.088	0.083	0.08	
% Design Flow Capacity		42%	40%	40%	35%	38%	41%	46%	42%	41%	39%	37%	37%	
Effluent Flow Ave		0.089	0.085	0.081	0.073	0.079	0.081	0.094	0.088	0.087	0.081	0.081	0.075	
Max		0.1	0.1	0.091	0.08	0.098	0.089	0.1	0.1	0.099	0.092	0.084	0.081	
Influent BOD		225	357	257	181	281	315	240	352	247	294	300	224	
Effluent BOD avg		30	17	8	28	26	24	23	22	22	22	8	17	
Effluent BOD max		30	17	8	28	40	24	23	22	22	22	8	17	
BOD % Removal		87.0%	95	97	85	86	92	90	94	91	92	98	92	
BOD ave inf. ppd	400	154	229	165	103	171	208	178	241	165	186	180	133	176.08
% Design BOD Capacity		39%	57%	41%	26%	43%	52%	45%	60%	41%	47%	45%	33%	44.0%
Influent TSS		254	266	220	180	245	309	266	327	212	271	336	218	
Effluent TSS		40	27	444	42	38	14	30	27	25	24	31	32	
Ecoli		593	7	7	7	485	583	224	182	243	920	40	16	
TRC Max		0.2	0.22	0.28	0.2	0.18	0.2	0.22	0.21	0.24	0.2	0.25	0.2	
pH min		7.6	7.6	7.8	7.7	7.7	7.8	7.8	7.9	7.8	7.8	7.8	7.8	
pH max		8	8.2	8	7.9	8.1	8.1	8.2	8	8	8.1	8.1	8.1	
Influent NH3		33	37	37	37	43	41	52	63	51	44	41	38	
Effluent NH3		38	42	44	35	1	1	1	1	1	1	7	20	
TDS raw				220			100			84			194	
TDS Eff				444			580			528			468	

RIDGWAY DMR	LIMIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg
2014														
Influent Flow Ave	0.194	0.068	0.072	0.078	0.075	0.074	0.078	0.086	0.081	0.079	0.072	0.066	0.078	
Max		0.084	0.088	0.086	0.089	0.1	0.093	0.1	0.09	0.092	0.081	0.086	0.094	
% Design Flow Capacity		35%	37%	40%	39%	38%	40%	44%	42%	41%	37%	34%	40%	
Effluent Flow Ave		0.079	0.082	0.081	0.1	0.08	0.081	0.088	0.085	0.084	0.08	0.073	0.084	
Max		0.1	0.1	0.099	0.15	0.013	0.09	0.091	0.1	0.1	0.096	0.092	0.094	
Influent BOD		325	288	333	393	339	298	233	296	393	240	278	288	
Effluent BOD avg		16	16	7	23	55	39	29	22	23	5	24	12	
Effluent BOD max		16	16	7	23	55	47	35	22	23	5	24	12	
BOD % Removal		95.1%	94.4%	97.9%	94.1%	83.8%	86.9%	87.6%	92.6%	94.1%	97.9%	91.4%	95.8%	
BOD ave inf. ppd	400	184	173	217	246	209	194	167	200	259	144	153	187	
% Design BOD Capacity		46%	43%	54%	62%	52%	49%	42%	50%	65%	36%	38%	47%	48.6%
Influent TSS		380	303	233	412	209	302	227	228	258	244	310	81	
Effluent TSS		19	17	13	27	33	23	22	16	31	15	23	22	
Ecoli		580	734	20	50	22	3	87	33	72	718	116	584	
TRC Max		0.25	0.2	0.32	0.21	0.27	0.25	0.25	0.27	0.25	0.25	0.25	0.25	
pH min		7.8	7.9	8.1	7.9	8.1	8.2	7.9	8	8.1	7.5	7.5	7.9	
pH max		8.1	8.3	8.3	8.1	8.3	8.4	8.2	8.2	8.3	7.7	7.7	8.2	
Influent NH3		32	44	44	44	32	52.6	33	39	34	33	50	33	
Effluent NH3		33	41	41	36	31	3	1	1	1	1	2.6	23	
TDS raw				92			152			130			208	
TDS Eff				400			568			506			498	

Table WW-12: Typical Revenues and Expenses					
	Typ Total				
	Values	Fix %	Fixed	Variable	
BEGINNING SEWER FUND BALANCE					
REVENUES					
Sewer Service Charges	**310,000**	0.90	279000	31,000	
Penalty Fees on Sewer Charges	**2,500**	1.00	2500	0	
Transfer Fees - sewer	**500**	1.00	500	0	
Material/Labor Reimbursement - sewer	**2000**	0.85	1700	300	
Tap Fees - sewer	**50,000**	1.00	50000	0	
Other - sewer	**0**	0.50	0	0	
Investment Income - Desgn Reserves	**8,000**	0.50	4000	4,000	
TOTAL SEWER FUND REVENUES	**373,000**		337,700	35,300	
TOTAL AVAILABLE RESOURCES					
EXPENDITURES					
PERSONNEL					
Sewer Wages	**103,000**	0.95	97850	5,150	
Sewer-Seasonal Wages	**3600**	0.85	3060	540	
Employer Tax Expense	**7,880**	0.95	7486	394	
Health Insurance	**20,000**	0.95	19000	1,000	
Retirement Fund	**4,120**	0.95	3914	206	
Workers Compensation Insurance	**4,500**	0.95	4275	225	
ADMINISTRATIVE EXPENSE					
Insurance (Property & Casualty)	**7,400**	0.95	7030	370	
Workshops & Training	**1,500**	0.95	1425	75	
Consulting & Engineering Services	**7,500**	0.75	5625	1,875	
IT Services	**850**	0.90	765	85	
Auditing Services	**2,900**	0.90	2610	290	
Legal Services	**2,000**	0.90	1800	200	
Wellness Program	**1,650**	1.00	1650	0	
OFFICE EXPENSE					
Office - misc	**2,500**	0.90	2250	250	
Dues & Memberships	**400**	1.00	400	0	
Filing Fees/Recording Costs	**100**	0.75	75	25	
Office Supplies	**2,000**	0.75	1500	500	
Utilities	**45,000**	0.75	33750	11,250	
Telephone	**1,600**	0.90	1440	160	
Computer	**2,000**	0.90	1800	200	
Records Management	**150**	0.90	135	15	
Office Equipment - Leases	**500**	0.90	450	50	
Office Equipment - Maint & Repairs	**250**	0.67	167.5	83	
Postage - sewer	**2,200**	0.90	1980	220	
GIS Mapping - sewer	**4,000**	0.95	3800	200	

OPERATING EXPENSE						
Maintenance & Repairs		**32,000**		0.75	24000	8,000
Supplies & Materials		**10,000**		0.70	7000	3,000
Tools		**1,000**		0.70	700	300
Testing & Permits		**4,400**		1.00	4400	0
Other - sewer		**500**		0.50	250	250
Safety Equipment		**1,000**		0.80	800	200
Plant Improvements						
Weed Control		**500**		1.00	500	0
VEHICLE EXPENSE						
Gas & Oil		**4,000**		0.75	3000	1,000
Vehicle & Equipment Maint & Repairs		**6,000**		0.75	4500	1,500
DEBT SERVICE						
Equipment Leases - CAT Equipment						
Debt Service - DOLA		**15,915**		1.00	15915	0
CAPITAL OUTLAY						
Office Equipment Purchase		**500**		0.75	375	125
Equipment Purchase		**35,000**		0.75	26250	8,750
Bio-Solid Removal		**10000**		0.75	7500	2,500
Retirement & Severance Payout		**5000**		0.90	4500	500
Emergency Reserves		**20000**		0.70	14000	6,000
TOTAL SEWER FUND EXPENDITURES		**373,415**			317,927	55,487
Net Income/Loss with Taps Fees & all expenses		**-415**				
Net w/o Tap Fees		**-50,415**				
Net w/o Tap Fees & including debt service		**-34,500**				
Net w/o Tap Fees, debt service, & Equip Purchas		**501**				
Total WW treated (1000's of gallons)		**31025**				
Cost per thousand total expense		**$ 12.04**				
Cost per thousand w/o debt service		**$ 11.52**				
Cost per thousand total expense w/o leases,debt service, equip purchase		**$ 9.75**				

Table WW-13 Summary of Needs			
Wastewater Treatment Plant			
Description	Priority	Urgency	Est Cost
Catalog all mechanical equipment (in asset management software)	3	2-24 months	Mostly staff time + software
24 Hour Composite Sampler - Add to better measure influent loading, consider sampling more than once per month to get more accurate information on loading	4	2-24 months	$5,000
	2	when it happens	Mostly staff time + Lab costs
Sample influent BOD more than once per month especially when concentrations to see whether the single sample is representative	2	when it happens	Mostly staff time + Lab costs
Dissolved Oxygen Monitoring & Aeration control	2	6-18 months	$ 7,500
Misc WWTP Mechanical Equipment	2	5-10 yrs	$ 50,000
Backup power - replace generator	4	When power is needed at all times	$ 80,000
Portable generator for chlorine metering pump	3	1-2 years	$ 5,000
Review and comment on Discharge permit renewal	1	As soon as received	$ 1,500
Modify Aeration system - if determined to be worth the change before needing to meet more stringent nutrient limits			$ 425,000
Biosolids Removal	2	3-8 yrs	$ 100,000
Begin planning to upgrade the treatment system when loading reaches 80% of approved design capacity (0.194 MGD and 400 ppd of BOD.)	1	+/- 10 years	$ 100,000
Look for a new plant site farther from the Town core	3		$$$$$$
Look for land where biosolids could be put to beneficial use	3		$$$$$$
Note: estimates of costs to address the needs in the report are highly conceptual, based on very limited information and should be used as order of magnitude estimates.			

	APPENDIX WW-1												Sta				Dia	Mtl	d	Address
Video Number	Video file name	Date	Manhole Designation U/S	Manhole Designation D/S	U/S MH Location Or address	D/S MH Location	Camera Direction	Camera Dist	Survey Dist	76 as built dist	prorated dist bet mhs	Ratio prorate to camera	Tap location per video	Prorated tap dist in video direction	Dist from Downstream MH prorated	Direction fr main	Service Diameter	Type of Service Mate	depth in inches	
2	CAP - MH L1 S Eliza	10/20/16	L2	L1	S of Moffat on Eliza	Moffat & Eliza	U/S	93.1		99	93.1	1					L2 not surveyed			
													0+62.5	0+62.5	0+62.5	W				
													0+68.0	0+68.0	0+68.0	E				
3	CO FA1 - MHF3 Sherman St	10/25/16	COFA1	MH F3	Laura S of Sherman	Laura and Sherman	U/S	209.8		209	209	0.996								
													1+08.5	1+08.1	1+08.1	W				
													1+16.1	1+15.7	1+15.7	E				
													1+63.0	1+62.4	1+62.4	W				
													2+00.0	1+99.2	1+99.2	W				
4	CO GA1 - MH G1 Hyde	10/26/16	GA1	G1	On Hyde w of Lena	Hyde and Lena	U/S	241.7		239.4	239.4	0.990								
													1+30.2	1+29.0	1+29.0	S				
													2+01.7	1+99.8	1+99.8	S				
													2+30.8	2+28.6	2+28.6	N				
5	CO IA1 - MHI1 Hyde St	10/25/16	COIA1	MH I1	Alley E of Laura, S of Mof	Hyde & Alley E of Laura	U/S	281.4		279	279	0.991								
													1+58.4	1+57.0	1+57.0	W				
													2+11.3	2+09.5	2+09.5	W				
													2+67.8	2+65.5	2+65.5	W				
													2+74.5	2+72.2	2+72.2	W				
6	MH I1 - MH H1Hyde St	10/25/16	MH I1	MH H1	Hyde & Alley E of Laura	Hyde and Cora		188.8		188.3	188.3	0.997								
													0+91.0	0+90.8	0+97.5	S				
7	MH I2 - MH I1 S Laura	10/25/16	I2	I1	Hyde & Laura	Hyde & Alley E of Laura	D/S	208.3		206.5	206.5	0.992				don't have surveyed location of I2 or I1				
													1+44.8	1+43.6	0+63.0	S				
													1+46.5	1+45.3	0+61.3	N				
													1+73.1	1+71.6	0+34.9	N				
8	MH I3 - MH I2 S Laura	10/25/16	I3	I2	Moffat & Laura	Hyde & Laura	D/S	328.5		324.4	324.4	0.988				don't have surveyed location of I2				
													0+25.2	0+24.9	2+99.5	W				
													0+36.9	0+36.4	2+88.0	W				
													0+99.0	0+97.8	2+26.6	W				

Video Number	Video file name	Date	Manhole Designation U/S	Manhole Designation D/S	U/S MH Location Or address	D/S MH Location	Camera Direction	Camera Dist	Survey Dist	76 as built dist	prorated dist bet mhs	Ratio prorate to camera	Tap location per video	Prorated tap dist in video direction	Dist from Downstream MH prorated	Direction fr main	Service Diameter	Type of Service Mate	depth in inches	
													1+96.7	1+94.2	1+30.2	W				
													2+20.1	2+17.4	1+07.0	W				
													2+65.8	2+62.5	0+61.9	top				
9	MH F2- MH F1 Sherman	10/26/16	F2	F1	Sherman & Cora	Sherman Lena	D/S	378.5	375.7	376.8	376.3	0.994								
													1+63.7	1+62.7	2+13.5					
													1+78.5	1+77.4	1+98.8					
10	MH F2- MH F1 Sherman	10/26/16	F2	F1	Sherman & Cora	Sherman Lena	**U/S**													
													0+88.4	0+87.9	0+87.9					
11	MH F3- MH F2 Sherman	10/26/16	F3	F2	Sherman & Laura	Sherman & Cora	D/S	380.3	370	373.8	371.9	0.978								
													1+47.4	1+44.1	2+27.8	S				
													3+01.9	2+95.2	0+76.7	S				
12	MH F4 - MH F3 Sherman	10/26/16	F4	F3	Sherman & Mary	Sherman & Laura	D/S	365.4	*357.8*	357	357.4	0.978								
													0+92.0	0+90.0	2+67.4	S				
													2+57.3	2+51.6	1+05.7	S				
13	MH F5 - MH F4 S Charlotte	10/26/16	F5	F4	Sherman & Charlotte	Sherman & Mary	D/S	406.6	*399.3*	398.5	398.9	0.981								
													3+52.5	3+45.8	0+53.1	S		no shot for f4 avg of f5 to f3		
14	MH F6 - MH F5 S Elizabeth	10/26/16	F6	F5	sherman & Eliza	Sherman & Charlotte	D/S	362.4	355.4	355.8	355.4	0.981								
													1+61.3	1+58.2	1+97.2	S				
													3+14.4	3+08.3	0+47.1	S				
15	MH F7 - MH F6	10/20/16	F7	F6	Eliza & Hyde	Eliza & Sherman	D/S	302.6	299.0	298.5	299.0	0.988								
													0+69.9	0+69.1	2+29.9	E				
													0+93.4	0+92.3	2+06.7	W				
													1+99.5	1+97.1	1+01.9	W				
													2+47.6	2+44.6	0+54.3	E				
													2+79.4	2+76.0	0+22.9	W				
16	MH F8 - MH F7 S Amelia	10/20/16	F8	F7	S Amelia & Hyde	Hyde & Eliz	D/S	363.4	356.4	356.9	356.7	0.981								
													1+52.7	1+49.9	2+06.8	S				
													1+77.2	1+73.9	1+82.7	N				
													2+32.8	2+28.5	1+28.2	N				
													2+46.3	2+41.7	1+14.9	S				
17	MH G1 - MH F1 S Lena	10/26/16	G1	F1	Hyde and Lena	Hyde and Sherman	D/S	354.4		350.1	350.1	0.988					sags lead to line 1/4 full			
													0+67.9	0+67.1	2+83.0	W				

Video Number	Video file name	Date	Manhole Designation U/S	Manhole Designation D/S	U/S MH Location Or address	D/S MH Location	Camera Direction	Camera Dist	Survey Dist	76 as built dist	prorated dist bet mhs	Ratio prorate to camera	Tap location per video	Prorated tap dist in video direction	Dist from Downstream MH prorated	Direction fr main	Service Diameter	Type of Service Mate	depth in inches	
													1+18.0	1+16.6	2+33.5	W				
													1+71.7	1+69.6	1+80.5	W				
													1+84.9	1+82.7	1+67.4	W				
													2+27.9	2+25.1	1+25.0	W				
													2+54.4	2+51.3	0+98.8	W				
													2+71.1	2+67.8	0+82.3	W				
18	MH GR2 - MH GR1	10/26/16	GR2	GR1	Moffat & Lena	Hyde and Lena	D/S	375.4	368.7		368.7	0.982								
													0+70.5	0+69.2	2+99.5	E				
													1+34.1	1+31.7	2+37.0	E				
													1+58.0	1+55.2	2+13.5	E				
													2+12.4	2+08.6	1+60.1	E				
													2+65.2	2+60.5	1+08.2	E				
													3+30.9	3+25.0	0+43.7	E				
19	MH GR1 - MH G1 Hyde St	10/26/16	GR1	G1			D/S	9.1							No taps					
20	MH G2 MH G1 S Lena	10/26/16	G2	G1	Moffat and Lena	Hyde and Lena	D/S	371.8	364.8	364.9	364.9	0.981								
													0+20.3	0+19.9	3+44.9	W				
													1+15.9	1+13.7	2+51.1	W				
													1+60.2	1+57.2	2+07.6	W				
													2+20.7	2+16.6	1+48.3	W				
													2+51.7	2+47.0	1+17.9	W				
													3+22.2	3+16.2	0+48.7	W				
21	MH H1 - MH F2 S Cora	10/25/16	H1	F2	Hyde and Cora	Cora and Sherman	D/S	352	345	344.6	344.8	0.980								
													0+88.0	0+86.2	2+58.6	E				
													0+90.1	0+88.3	2+56.5	W				
													1+36.8	1+34.0	2+10.8	E				
													1+68.4	1+65.0	1+79.8	W				
													1+93.1	1+89.2	1+55.6	E				
													2+26.9	2+22.3	1+22.5	W				
													2+38.9	2+34.0	1+10.8	W				
													2+51.7	2+46.6	0+98.2	W				
													2+53.2	2+48.0	0+96.8	W				
													3+01.6	2+95.4	0+49.4	E				
22	MH H2 - MH H1 S Cora	10/25/16	H2	H1	Moffat & Cora	Hyde and Cora	D/S	350.7	347.9	345.5	346.7	0.989								
													0+41.7	0+41.2	3+05.5	E				
													0+87.6	0+86.6	2+60.1	W				
													0+94.4	0+93.3	2+53.4	E				

Video Number	Video file name	Date	Manhole Designation U/S	Manhole Designation D/S	U/S MH Location Or address	D/S MH Location	Camera Direction	Camera Dist	Survey Dist	76 as built dist	prorated dist bet mhs	Ratio prorate to camera	Tap location per video	Prorated tap dist in video direction	Dist from Downstream MH prorated	Direction fr main	Service Diameter	Type of Service Mate	depth in inches	
													1+29.3	1+27.8	2+18.9	W				
													1+66.9	1+65.0	1+81.7	E				
													2+06.9	2+04.5	1+42.2	W				
23	MH J1 - MH F4 S Mary	10/25/16	J1	F4	Mary Hyde	Mary Sherman	D/S	354.7		350.5	350.5	0.988				don't have surveyed location of f4				
													0+81.1	0+80.1	2+70.4	W				
													0+94.1	0+93.0	2+57.5	W	intgruding, roots in jt			
													1+08.8	1+07.5	2+43.0	E	ugly tap			
													1+79.7	1+77.6	1+72.9	W				
													1+97.6	1+95.3	1+55.2	E				
													2+61.1	2+58.0	0+92.5	W				
24	MH J2 - MH J1	10/25/16	J2	J1	Mary Moffat	Mary Hyde	D/S	39.3	330.4	331.5	330.4	0.991			stopped by rock intrusion					
25	MH J2 - MH J1	10/25/16	J2	J1	Mary Moffat	Mary Hyde	U/S	294.2					0+42.6	0+42.2	0+42.2	W				
													0+70.8	0+70.1	0+70.1	E				
													1+15.6	1+14.5	1+14.5	W				
													1+65.9	1+64.4	1+64.4	E				
													1+70.8	1+69.2	1+69.2	W				
													2+17.8	2+15.8	2+15.8	W				
													2+40.1	2+37.9	2+37.9	E				
													2+67.8	2+65.3	2+65.3	W				
													2+90.8	2+88.1	2+88.1	E				
26	MH K1 MH F5 S Charlotte	10/25/16	K1	F5	Hyde & Charlotte	Sherman & Charlotte	D/S	272.4	331.3	331.6	331.3	0.994								
													0+69.6	0+69.2	2+62.1	E				
													0+98.8	0+98.2	2+33.1	W				
													1+21.0	1+20.2	2+11.1	E				
													1+67.2	1+66.1	1+65.2	W				
													1+73.1	1+72.0	1+59.3	E				
27	MH K1 MH F5 S Charlotte	10/25/16	K1	F5	Hyde & Charlotte	Sherman & Charlotte	U/S	61						ran this way due to camera traction problme						
													0+27.2	0+27.0	0+27.0	E				
28	MH K2A - MH K2 S Charlotte	10/20/16	K2A	K2	Moffat w of Charlotte	Moffat & Charlotte	U/S	214.1	210.0		210.0	0.981								
													0+82.6	0+81.0	0+81.0	S				
													1+44.3	1+41.5	1+41.5	S				
													2+10.0	2+06.0	2+06.0	S				
29	MH K2 - MH K1 S Charlotte	10/20/16	K2	K1	Moffat & Charlotte	Hyde & Charlotte	D/S	377.8	370.5	371.8	370.5	0.981								
													0+72.5	0+71.1	2+99.4	W				

Video Number	Video file name	Date	Manhole Designation U/S	Manhole Designation D/S	U/S MH Location Or address	D/S MH Location	Camera Direction	Camera Dist	Survey Dist	76 as built dist	prorated dist bet mhs	Ratio prorate to camera	Tap location per video	Prorated tap dist in video direction	Dist from Downstream MH prorated	Direction fr main	Service Diameter	Type of Service Mate	depth in inches	
													0+90.6	0+88.8	2+81.7	E				
													1+31.7	1+29.2	2+41.3	E				
													1+40.9	1+38.2	2+32.3	W				
													1+79.4	1+75.9	1+94.6	E				
													2+38.1	2+33.5	1+37.0	E				
													2+48.1	2+43.3	1+27.2	E				
													2+80.1	2+74.7	0+95.8	W				
													3+04.3	2+98.4	0+72.1	E				
													3+33.4	3+27.0	0+43.5	W				
30	MH L1 - MH F7 S Eliza	10/20/16	L1	F7	Moffat & Eliza	Hyde & Eliz	D/S	373.8	365.8	367	366.4	0.980								
													0+70.6	0+69.2	2+97.2	E				
													0+87.0	0+85.3	2+81.1	E				
													1+25.7	1+23.2	2+43.2	W				
													1+40.5	1+37.7	2+28.7	E				
													1+47.9	1+45.0	2+21.4	W				
													1+70.5	1+67.1	1+99.3	W				
													1+97.0	1+93.1	1+73.3	E				
													2+52.4	2+47.4	1+19.0	E				
													3+13.5	3+07.3	0+59.1	E				
31	Sherman to Hyde on Amelia	10/20/16	M1	F8	S Amelia near SH 62	S Amelia & Hyde	D/S	237.4	235.9		235.9	0.994								
													0+11.4	0+11.3	2+24.6	E				
													0+50.4	0+50.1	1+85.8	E				
													0+62.8	0+62.4	1+73.5	W				
													1+26.4	1+25.6	1+10.3	E				
													1+73.5	1+72.4	0+63.5	W				
32	MH N1-N1A S Amelia	10/10/16	N1A	N1	S Amelia near Marie	S Amelia & Moffat	D/S	218.0	208.0		208.0	0.954								
													1+23.2	1+17.5	0+90.5	W				
33	MH N1A -F8 S Amelia	10/20/16	N1	F8	S Amelia & Moffat	S Amelia & Hyde	D/S	361.8	354.0	355.6	354.8	0.981								
													0+52.9	0+51.9	3+02.9	E				
													0+67.8	0+66.5	2+88.3	W				
													0+73.7	0+72.3	2+82.5	W				
													1+70.4	1+67.1	1+87.7	E				
													1+96.3	1+92.5	1+62.3	W				
													1+98.0	1+94.2	1+60.6	E				
													2+03.7	1+99.8	1+55.0	W				
													2+57.0	2+52.0	1+02.8	E				
													2+96.7	2+91.0	0+63.8	E				

Video Number	Video file name	Date	Manhole Designation U/S	Manhole Designation D/S	U/S MH Location Or address	D/S MH Location	Camera Direction	Camera Dist	Survey Dist	76 as built dist	prorated dist bet mhs	Ratio prorate to camera	Tap location per video	Prorated tap dist in video direction	Dist from Downstream MH prorated	Direction fr main	Service Diameter	Type of Service Mate	depth in inches	
													3+30.2	3+23.8	0+31.0	W				
34	MH N2-N1 S Amelia	10/10/16	N2	N1A	S Amelia N of Eliz	S Amelia near Marie	D/S	195.8	195.8		195.8	1.000								
													1+74.5	1+74.5	0+21.3	W				
35	MH N3-N2 S Amelia	10/10/16	N3	N2	S Amelia near LeRanch	S Amelia N of Eliz	D/S	237.3	233.9	234.3	234.1	0.987								
													0+12.0	0+11.8	2+22.3	W				
													1+98.8	1+96.1	0+38.0	E				
36	MH-R - MH G2	10/26/16	R	GR2	Chipeta and Lena	Moffat & Lena	D/S	335.8	330.4		330.4	0.984								
													0+75.5	0+74.3	2+56.1	E				
													1+06.1	1+04.4	2+26.0	E				
													1+66.1	1+63.4	1+67.0	E		intense roots		
													2+83.1	2+78.5	0+51.9	E				

Joanne Fagan

From: Mercer - CDPHE, Mandy <mandy.mercer@state.co.us>
Sent: Thursday, January 07, 2016 11:53 AM
To: Joanne Fagan
Cc: Douglas Camrud - CDPHE; Knope - CDPHE, Dave; Amy Zimmerman - CDPHE
Subject: Re: Ridgway WWTP Seepage Study

Good morning, all. The Division's Engineering Section has reviewed the Town of Ridgway's response letter dated September 24, 2015, which addressed Division questions and comments identified in the Town's April 21, 2015 Inflow/Infiltration Report. The Division has determined that all Division comments were adequately addressed, and agrees with the conclusion that the liners at the Town's wastewater treatment facility do not exceed the allowable seepage rate of 10^{-6} centimeters per second. Please contact Dave Knope or myself if you have additional questions.

Thank you,

Mandy Mercer
Enforcement Specialist
Clean Water Enforcement Unit
P 303.692.2283
4300 Cherry Creek Drive South, Denver, CO 80246-1530
mandy.mercer@state.co.us | www.colorado.gov/cdphe/wqcd

24-hour Environmental Release/Incident Report Hotline: 1-877-518-5608

On Wed, Dec 2, 2015 at 10:35 AM, Knope - CDPHE, Dave <dave.knope@state.co.us> wrote:

> Joanne:
>
> I was asked to respond to your request for information in regard to the status of the review for the Ridgway WWTP Seepage Study. I have started the review of the request for information response and plan on completing it later this week. I will at then forward my findings to Mandy Mercer.
>
> Thanks for your patience.
>
> **David W. Knope, P.E.**
> Senior Review Engineer

COLORADO
Department of Public
Health & Environment

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

August 21, 2015

CERTIFIED MAIL NUMBER: 7012 1640 0000 0801 9205

Town of Ridgway, COG588047
Attention: Jen Coates, Town Manager
PO Box 10
201 N. Railroad Street
Ridgway, CO 81432

RE: Inflow/Infiltration Report, April 21, 2015

Dear Ms. Coates:

The Water Quality Control Division (the "Division") received the above-referenced Inflow/Infiltration Report on April 21, 2015 (the "Report"). The Report was submitted in response to the permit requirement to evaluate seepage from the lagoons at the Town's wastewater treatment facility (the "facility"). The Division's Engineering Section has conducted a technical review of the Report and has the following comments that must be addressed:

1. The Report indicates that the Town experiences an average of 42 inches of pan evaporation from May through October, based on the NOAA Evaporation Atlas. The Report also states that the pan adjustment factor in western Colorado is zero. To estimate the evaporation from naturally existing surfaces such as shallow lakes, wet soil, or other moist natural surfaces, evaporation studies typically use a correction factor of 0.65 to 0.85 to adjust pan evaporation rates to actual conditions. The NOAA Evaporation Atlas indicates that a correction factor of approximately 0.75 applies to the Ridgway area. Consequently, the adjusted surface evaporation data from May through October for the facility appears to be 31.5 inches.

2. The Western Regional Climate Center lists the following precipitation data for the Town and estimated evaporation data for Montrose:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOT
Precipitation Data	0.87	0.86	1.57	1.45	1.58	1.04	2.07	2.17	1.77	1.47	1.37	0.79	17.01
Evaporation Data	1.68	1.49	3.34	5.69	7.49	9.47	9.04	7.39	5.54	3.45	1.61	1.26	57.45
Adjusted Evaporation Data (0.75 correction factor)	1.26	1.12	2.51	4.27	5.62	7.10	6.78	5.54	4.16	2.59	1.21	0.95	43.11

As indicated above, when the pan evaporation data is adjusted with a 0.75

effort.

In conclusion, the April 21, 2015 Inflow/Infiltration Report and related attachments did not conclusively demonstrate that the lagoon liners at the facility do not exceed the allowable seepage rate of 1×10^{-6} centimeters per second. **By no later than September 30, 2015, the above-listed comments should be addressed and the Report should be modified and resubmitted for further evaluation.** Please contact Dave Knope at 719-295-5075 or dave.knope@state.co.us with questions or concerns regarding the comments presented in this letter.

Please mail or email the revised report to:

Colorado Department of Public Health and Environment
Water Quality Control Division / WQCD-CWE-B2
Attention: Mandy Mercer
4300 Cherry Creek Drive South
Denver, CO 80246
Telephone: (303) 692-2283
Email: mandy.mercer@state.co.us

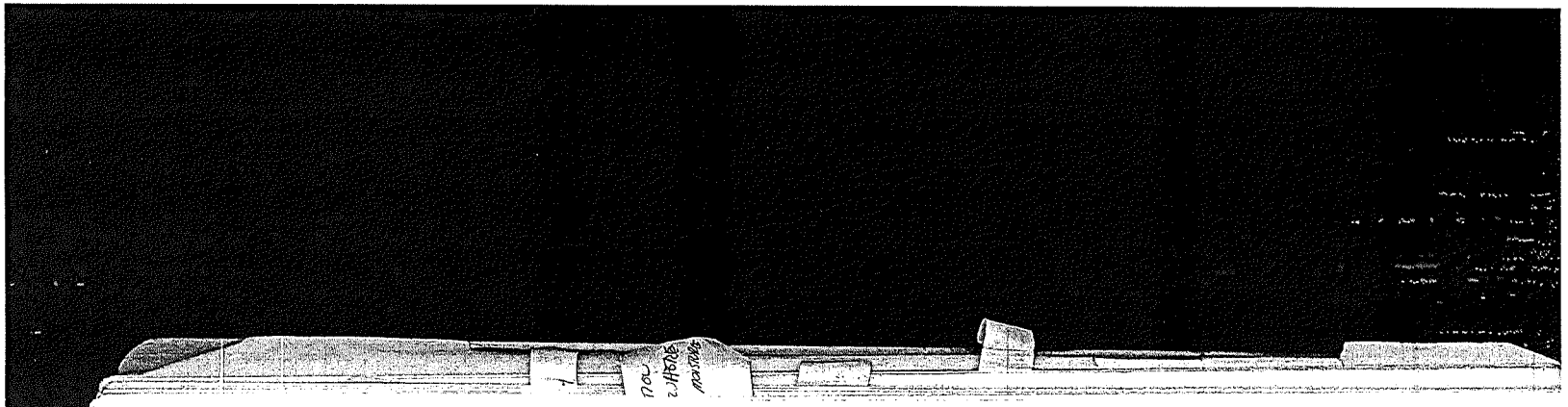
Sincerely,

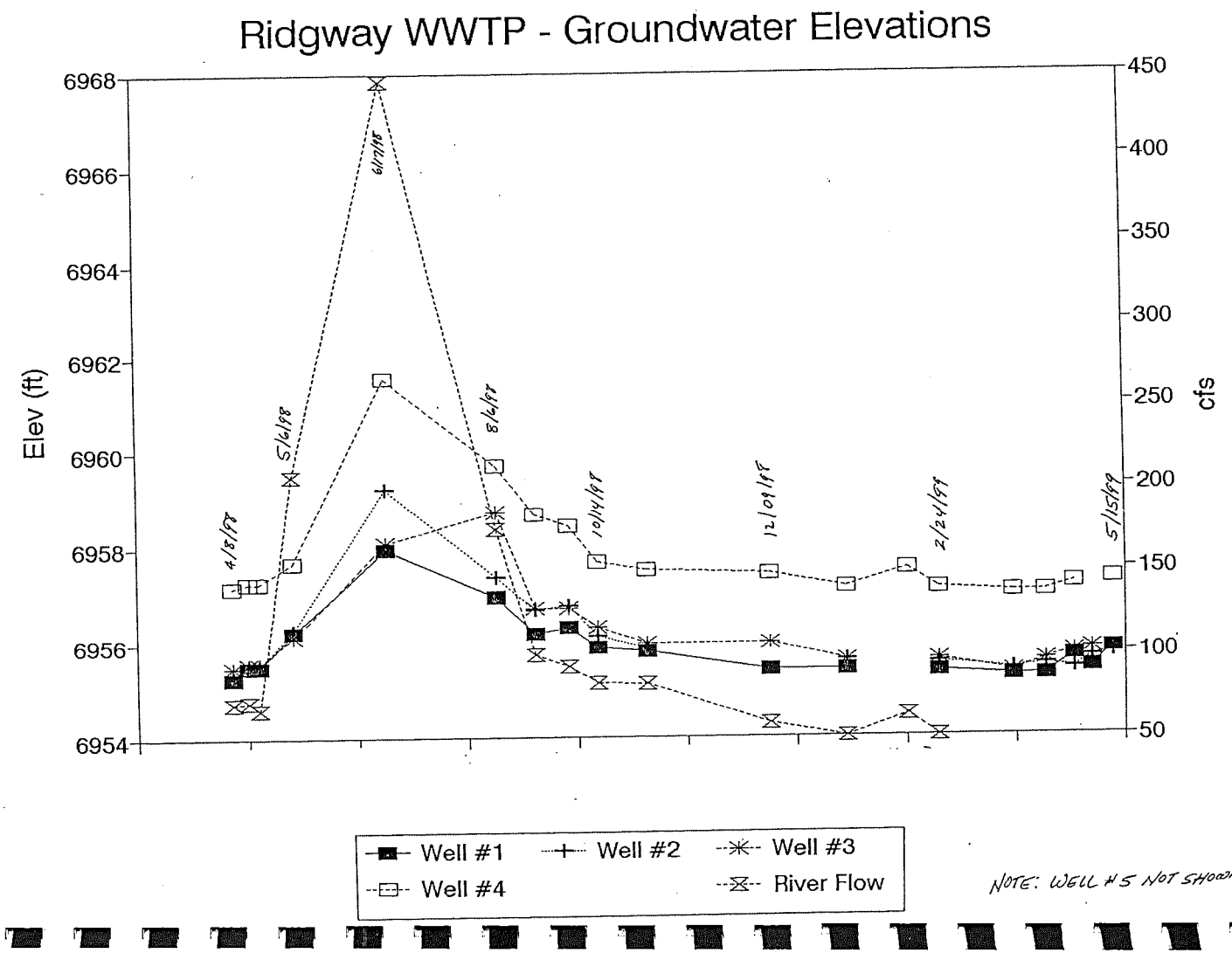
Mandy Mercer, Enforcement Specialist
Clean Water Enforcement Unit
WATER QUALITY CONTROL DIVISION

Cc: Permit File
Joanne Fagan, Ridgway Town Engineer (via email)
Eric Oppelt, WQCD, Assessment Based Permits Work Group Leader (via email)
Mike Harris, WQCD, Enforcement Unit Manager (via email)
Amy Zimmerman, WQCD, Engineering Services Review Unit I Manager (via email)
Dave Knope, WQCD, Senior Review Engineer (via email)

Ground Water Depths @ Test Wells

R_WWGRDW		1 NE	2 N	3 NW	4 W	5 SW
Top of Well		6965.91	6966.22	6967.49	6972.36	6977.84
Well Bottom		6953.4		6954.5	6956.6	6961.9
Grd @ Well		6962.75	6963.34	6964.78	6968.99	6974.72
	River flow (cfs)	Grd Water Depth	Grd Water Depth	Grd Water Depth	Grd Water Depth	Grd Water Depth
04/08/98	71	6955.2	6955.3	6955.5	6957.2	6966.5
04/15	72	6955.5	6955.6	6955.6	6957.3	6966.6
04/20	67	6955.5	6955.6	6955.6	6957.3	6966.6
05/06	207	6956.2	6956.3	6956.2	6957.7	6966.6
06/17	445	6958.0	6959.2	6958.1	6961.6	6966.1
08/06	175	6957.0	6957.4	6958.7	6959.7	6965.3
08/24	100	6956.2	6956.7	6956.7	6958.7	6963.5
09/08	93	6956.3	6956.8	6956.7	6958.4	6963.5
09/21	83	6955.9	6956.1	6956.3	6957.7	6963.5
10/14	82	6955.8	6955.9	6956.0	6957.5	6963.0
12/09/98	58	6955.4		6956.0	6957.4	6963.6
01/13/99	50	6955.4	6955.6	6955.6	6957.1	6964.2
02/10/99	63				6957.5	6964.9
02/24/99	50	6955.4	6955.6	6955.6	6957.1	6964.6
03/30/99		6955.2	6955.4	6955.3	6957.0	6964.7
04/14/99		6955.2	6955.5	6955.6	6957.0	
04/27/99		6955.7	6955.4	6955.7	6957.2	6964.7
05/05/99		6955.4	6955.6	6955.8		
05/15/99		6955.8	6955.7	6955.8	6957.3	6965.2





NOTE: WELL #5 NOT SHOWN

NCDC 1961-1990 Monthly Normals

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max. Temperature (F)	37.3	44.4	52.6	62.1	71.9	82.5	88.2	85.6	77.2	65.7	50.3	39.5	63.1
Highest Mean Max. Temperature (F)	47.3	50.9	61.9	69.2	76.9	88.1	91.4	89.3	83.9	72.9	56.1	48.8	65.5
Year Highest Occurred	1981	1972	1972	1989	1969	1977	1988	1985	1979	1963	1962	1980	1981
Lowest Mean Max. Temperature (F)	28.6	36.4	45.5	54.7	67.5	75.8	84.5	78.4	70.1	54.8	42.1	30.4	60.9
Year Lowest Occurred	1979	1974	1964	1970	1975	1969	1986	1968	1961	1969	1972	1978	1968
Mean Temperature (F)	24.8	31.6	39.5	48.0	57.2	66.6	72.5	70.0	61.5	50.4	37.7	27.6	49.0
Highest Mean Temperature (F)	34.2	37.4	46.2	53.9	61.8	71.8	74.9	72.6	66.0	56.3	42.7	37.0	51.7
Year Highest Occurred	1981	1986	1986	1981	1984	1977	1988	1988	1979	1963	1965	1980	1981
Lowest Mean Temperature (F)	15.4	22.2	32.6	40.9	53.5	60.4	68.9	63.2	56.3	42.3	32.1	19.3	45.8
Year Lowest Occurred	1963	1974	1964	1970	1975	1969	1968	1968	1961	1969	1979	1978	1968
Mean Min. Temperature (F)	12.3	18.8	26.2	33.8	42.4	50.6	56.7	54.4	45.7	35.0	25.0	15.6	34.7
Highest Mean Min. Temperature (F)	21.7	24.9	32.6	39.3	46.7	55.5	59.4	58.6	49.8	39.9	29.7	25.1	37.8
Year Highest Occurred	1980	1986	1978	1981	1984	1977	1984	1982	1990	1972	1965	1980	1981
Lowest Mean Min. Temperature (F)	1.2	8.0	19.5	27.0	39.1	45.0	52.0	48.0	38.9	29.1	20.1	8.2	30.7
Year Lowest Occurred	1963	1974	1962	1970	1968	1969	1968	1968	1968	1970	1969	1978	1968
Mean Precipitation (in.)	0.47	0.42	0.66	0.76	0.85	0.61	1.01	1.11	1.17	1.14	0.83	0.65	9.68
Highest Precipitation (in.)	1.96	0.99	1.99	2.42	2.09	2.26	2.98	3.22	3.22	2.60	2.75	1.98	14.98
Year Highest Occurred	1974	1968	1984	1990	1986	1969	1983	1964	1965	1972	1986	1978	1986
Lowest Precipitation (in.)	0.05	0.00	0.02	0.00	0.01	0.00	0.22	0.14	0.00	0.00	0.00	0.00	5.58

MONTROSE 2, COLORADO

NCDC 1981-2010 Monthly Normals

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max. Temperature (F)	38.8	44.3	54.0	62.2	72.2	82.7	88.0	85.1	77.0	64.6	49.6	38.8	63.2
Highest Mean Max. Temperature (F)													
Year Highest Occurred													
Lowest Mean Max. Temperature (F)													
Year Lowest Occurred													
Mean Temperature (F) '61-'90	27.2	32.4	41.2	48.5	57.7	66.8	72.3	70.1	61.7	50.2	37.5	27.7	49.5
Highest Mean Temperature (F)					57.2	66.6	72.5	70.0					
Year Highest Occurred													
Lowest Mean Temperature (F)													
Year Lowest Occurred													
Mean Min. Temperature (F)	15.6	20.6	28.4	34.7	43.1	51.0	56.6	55.2	46.4	35.8	25.4	16.6	35.9
Highest Mean Min. Temperature (F)													
Year Highest Occurred													
Lowest Mean Min. Temperature (F)													
Year Lowest Occurred													
Mean Precipitation (in.)	0.48	0.44	0.82	0.82	0.97	0.55	0.96	1.26	1.27	1.14	0.86	0.62	10.19
Highest Precipitation (in.)													
Year Highest Occurred													

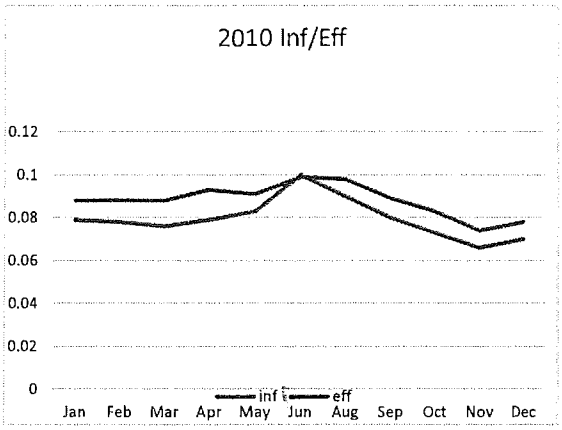
MONTROSE 2, COLORADO

NCDC 1971-2000 Monthly Normals

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Monthly
Mean Max. Temperature (F)	36.5	43.5	53.1	61.3	71.0	82.0	86.9	84.7	76.8	64.6	48.2	37.9	62.2
Highest Mean Max. Temperature (F)	45.2	53.5	62.2	68.0	76.4	87.0	90.5	87.7	82.4	69.6	57.3	46.8	90.5
Year Highest Occurred	1981	1995	1999	1992	2000	1977	2000	1985	1979	1988	1999	1980	2000
Lowest Mean Max. Temperature (F)	26.5	35.1	47.3	54.5	65.3	76.9	82.2	81.8	71.2	56.2	41.1	28.4	26.5
Year Lowest Occurred	1979	1974	1984	1983	1995	1983	1992	1993	1986	1984	1972	1978	1979
Mean Temperature (F)	25.6	32.1	41.0	48.2	57.0	66.7	71.8	70.1	62.0	50.4	36.7	27.3	49.1
Highest Mean Temperature (F)	33.4	40.4	46.8	53.7	61.1	71.4	74.2	72.1	66.4	54.9	41.6	36.3	74.2
Year Highest Occurred	1981	1995	1999	1992	1984	1977	1988	1995	1998	1988	1999	1980	1988
Lowest Mean Temperature (F)	17.3	21.9	36.4	43.9	52.5	62.3	68.1	67.5	58.0	45.3	31.1	18.6	17.3
Year Lowest Occurred	1979	1974	1977	1983	1995	1995	1995	1989	1971	1984	2000	1978	1979
Mean Min. Temperature (F)	14.7	20.6	28.8	35.0	43.0	51.3	56.7	55.4	47.1	36.1	25.2	16.6	35.9
Highest Mean Min. Temperature (F)	22.2	27.3	33.7	40.5	47.1	55.8	59.6	58.9	52.1	40.6	28.5	25.7	59.6
Year Highest Occurred	1980	1995	1978	1981	1984	1977	1984	1982	1998	1972	1981	1980	1984
Lowest Mean Min. Temperature (F)	6.1	8.6	24.0	30.9	39.7	47.2	52.3	52.2	42.3	32.3	18.9	8.8	6.1
Year Lowest Occurred	1973	1974	1977	1974	1995	1995	1995	1976	1971	1999	2000	1978	1973
Mean Precipitation (in.)	0.54	0.37	0.74	0.78	1.00	0.59	0.99	1.10	1.06	1.07	0.88	0.59	9.71
Highest Precipitation (in.)	1.96	0.98	2.25	2.42	2.48	1.79	2.98	3.14	3.36	2.60	2.75	1.98	3.36

Year Highest Occurred	1974	1987	1995	1990	1995	1984	1983	1999	1997	1972	1986	1978	1997
Lowest Precipitation (in.)	0.11	0.00	0.02	0.11	0.00	0.00	0.04	0.14	0.00	0.00	0.00	0.00	0.00
Year Lowest Occurred	1986	1972	1999	1982	1998	1980	1994	1978	1979	1999	1989	1976	1972
Heating Degree Days (F)	1222.	922.	745.	506.	258.	57.	2.	7.	128.	454.	849.	1170.	6320.
Cooling Degree Days (F)	0.	0.	0.	0.	9.	107.	214.	162.	35.	1.	0.	0.	528.

Western Regional Climate Center, wrcc@dri.edu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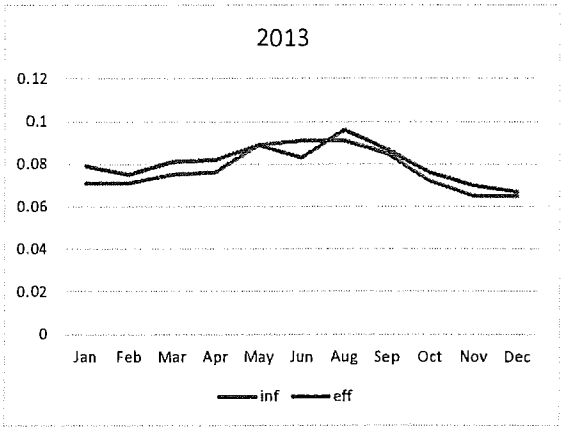
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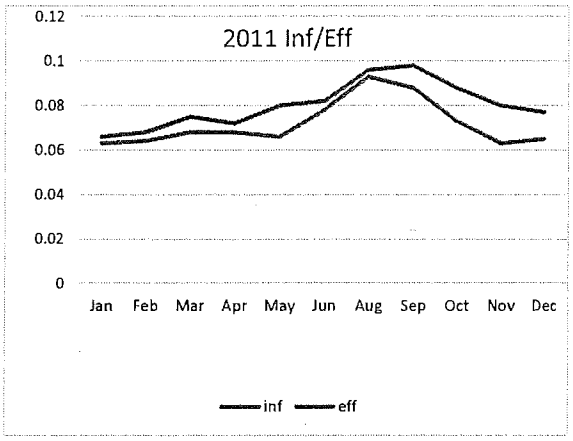
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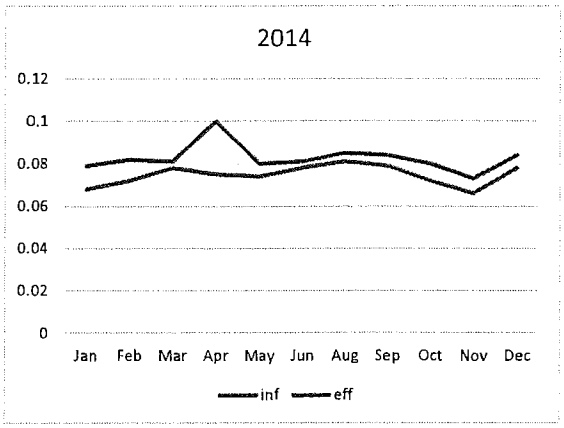
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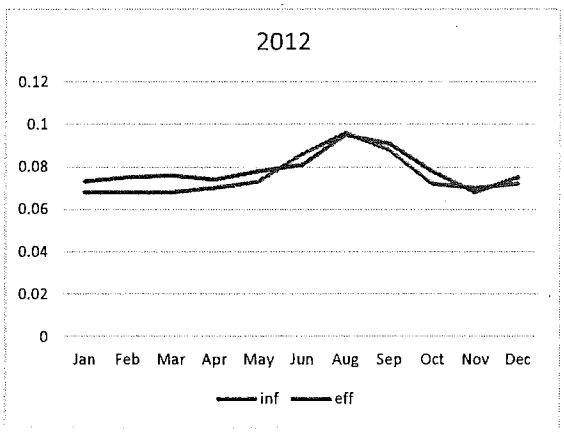
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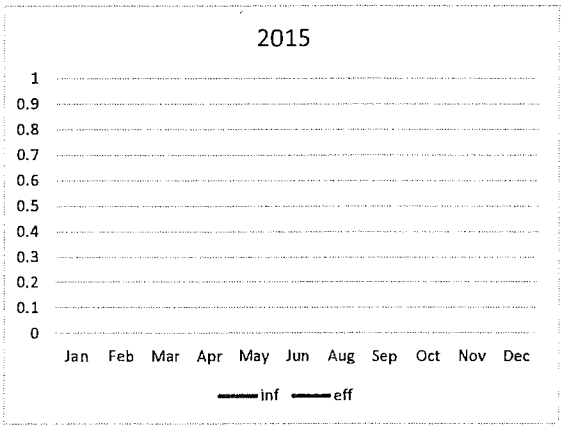
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Jan Feb Mar Apr May Jun Aug Sep Oct Nov Dec
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State of Oregon

Department of Environmental Quality Guidelines

Guidelines for Estimating Leakage from Existing Sewage Lagoons

PURPOSE AND SCOPE

EXCLUSIONS

GENERAL APPROACH

EQUIPMENT REQUIREMENTS

MEASUREMENTS AND CALCULATIONS

REPORT FORMAT

ANNUAL WATER BALANCE

NEW LAGOONS

PURPOSE AND SCOPE

These guidelines provide for relatively inexpensive test equipment and procedures to be used for prioritizing problem lagoons used for treating domestic sewage. Such tests are not definitive. They should be considered preliminary and approximate.

Tests based on these guidelines can only indicate whether the seal on an existing lagoon probably remains intact, or approximately how much it may be leaking. Preliminary tests of this type are not suitable for sewage lagoons where there is a strong likelihood of contamination, or an immediate urgency to protect a priority aquifer.

EXCLUSIONS

Such preliminary testing is not suitable for various types of lagoons which may contain stronger wastes than sewage. For example, leak tests for sludge, septage, strong industrial wastes, and landfill leachate lagoons may warrant a higher level of accuracy. To attain greater accuracy entails considerable time and expense, requires more equipment to develop wind and temperature records, and involves calculations outside the scope of these guidelines.

Such accuracy is seldom warranted for sewage lagoons. In critical groundwater pollution situations, where lagoon seepage is a known concern, immediate installation of monitoring wells and a formal program of groundwater monitoring are normally warranted. In such situations, no program of leak testing is probably accurate enough to substitute for direct groundwater monitoring. Leak testing would only delay the definitive determinations that must be made.

· Upwind and downwind evaporation pans

· Barometric pressure

If such equipment is available, its use will add precision and accuracy to the results. However, its use is not mandatory for preliminary leak tests used to screen and prioritize existing sewage treatment lagoons.

MEASUREMENTS AND CALCULATIONS

Measurements should be made on a schedule, at the same time each day, so that each set of data represents the duration of exactly one day. All measurements should be tabulated to aid calculation and reporting. We recommend using the attached form or a similar format.

Computations should be converted to compatible units of depth. Influent volume (gallons per day) is converted to inches per day through measurement of the actual water surface area. Rainfall will normally be near zero in July and August, but should be verified daily.

Evaporation will vary with wind and temperature. It should be measured daily, and the pan should be kept well filled.

Lagoon evaporation rates are invariably less than pan evaporation rates. Pan correction factors generally vary from 0.7 to 0.9. The larger the lagoon, the more its evaporation rate lags behind pan evaporation, so the smaller the numerical value of the pan correction factor.

In hot and windy summer weather, evaporation can be substantial. An erroneous pan correction factor can inject significant error. The result of computing seepage rates without any correction for pan evaporation is to overcalculate the evaporation rate. The effect of this error would be to underreport the seepage rate.

REPORT FORMAT

Leakage reports should be short and to the point. The main conclusion is to estimate the seepage rate from each lagoon cell, and from the lagoon as a whole. The methodology and equipment need to be described briefly but thoroughly. A copy of all field measurements and calculations should be tabulated and attached as supporting documentation.

Reports should be certified and signed by a registered engineer or professional hydrologist.

ANNUAL WATER BALANCE

The annual water balance prepared for each lagoon requires determinations of both seepage and evaporation. Leak tests performed according to these guidelines at average liquid depth can establish an average rate of seepage for the water balance. The rate of seepage will tend to vary with liquid level, and will remain constant if the level stays constant.

For the purpose of making water balance calculations, a monthly average evaporation rate should be obtained from local climatological records. Such records may then be applied with a suitable pan correction factor between 0.7 and 0.9, as previously described.

Rate of evaporation and pan correction factors both tend to vary throughout the year. To make accurate adjustments requires additional measurements be taken of all the pertinent factors. These include wind, water

LAGOON LEAK TEST

CITY OF _____

CELL NO._____ WATER SURFACE AREA_____

CELL WATER DEPTH @ TEST START_____ @ TEST END_____

Date	INFLUENT (in/day)	+PRECIP (in/day)	-EVAP (in/day)	- EFFLUENT (in/day)	=NET SEEPAGE

NOTES:

State of Oregon

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Such preliminary testing is not suitable for various types of lagoons which may contain stronger wastes than sewage. For example, leak tests for sludge, septage, strong industrial wastes, and landfill leachate lagoons may warrant a higher level of accuracy. To attain greater accuracy entails considerable time and expense, requires more equipment to develop wind and temperature records, and involves calculations outside the scope of these guidelines.

Such accuracy is seldom warranted for sewage lagoons. In critical groundwater pollution situations, where lagoon seepage is a known concern, immediate installation of monitoring wells and a formal program of groundwater monitoring are normally warranted. In such situations, no program of leak testing is probably accurate enough to substitute for direct groundwater monitoring. Leak testing would only delay the definitive determinations that must be made.

GENERAL APPROACH

The general objective of a leak test is to estimate the average rate of seepage through the bottom of the lagoon. Normally each lagoon cell is isolated and tested separately, which better pinpoints the location of any major leaks. The rate of seepage is expressed in inches per day or centimeters per second.

Leak testing should be restricted to July and August, when rainfall is minimal and the ground is dry enough to exclude significant runoff. Tests conducted at other times will have more variables and may underreport seepage due to runoff effects.

To obtain reasonable precision, each cell of a lagoon should be isolated and tested over a period of 10 - 15 days. Cell depth and pan evaporation measurements should be taken daily. If the lagoon cell cannot be isolated, then daily influent/effluent flows must also be measured. Daily measurements are preferred over weekly to improve precision and to minimize random measurement errors.

Lagoon liquid depth should suit the purpose of the test. To determine average seepage rates, lagoons should be at average operating depth.

In priority areas, any rate of seepage greater than zero may warrant direct sampling and monitoring of the groundwater. Seepage of 1/8" per day or less is normal. However, this low rate can cause groundwater contamination where lagoon contents are strong and background levels are high quality. Seepage exceeding 1/4" per day indicates a seal failure, or absence of adequate initial seal.

EQUIPMENT REQUIREMENTS

Each cell of a lagoon needs to be equipped with a staff gauge for level measurements. Stilling wells to dampen wave action are recommended, and will allow a staff gauge to be read to 1/8" - 1/16". Precipitation can be measured to about 1/100" with a good rain gauge. Evaporation can be measured to roughly 1/1000" with a hook gauge.

The following specifications for rainfall and evaporation equipment are based on Weathertronics equipment manufactured by Qualimetrics, Inc. of Sacramento, and available in Oregon through International Reforestation Supply, Eugene (345-0597). Equivalent equipment is acceptable.

1. Rain Gauge. Qualimetrics Model 6330. This is a plastic gauge with 11" capacity and 0.01" graduations, designed for post mounting.

2. Evaporation Pan. Qualimetrics Model 6821. This is a standard US Weather Bureau steel pan, 47.5" diameter by 10" deep.

3. Hook Gauge. Qualimetrics Model 6831. This is a brass gauge with 0.02" graduations.

To obtain accurate measurements, the equipment needs to be set up level and plumb in an unsheltered area near the lagoon. Equipment may have to be fenced to exclude animals.

The above list is a minimum. Various equipment needed to attain higher levels of accuracy is not listed. For example:

- Recording anemometer

- Max/min thermometers for air, for the evaporation pan, and for the lagoon surface

· Upwind and downwind evaporation pans

· Barometric pressure

If such equipment is available, its use will add precision and accuracy to the results. However, its use is not mandatory for preliminary leak tests used to screen and prioritize existing sewage treatment lagoons.

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Measurements should be made on a schedule, at the same time each day, so that each set of data represents the duration of exactly one day. All measurements should be tabulated to aid calculation and reporting. We recommend using the attached form or a similar format.

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Lagoon evaporation rates are invariably less than pan evaporation rates. Pan correction factors generally vary from 0.7 to 0.9. The larger the lagoon, the more its evaporation rate lags behind pan evaporation, so the smaller the numerical value of the pan correction factor.

In hot and windy summer weather, evaporation can be substantial. An erroneous pan correction factor can inject significant error. The result of computing seepage rates without any correction for pan evaporation is to overcalculate the evaporation rate. The effect of this error would be to underreport the seepage rate.

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Leakage reports should be short and to the point. The main conclusion is to estimate the seepage rate from each lagoon cell, and from the lagoon as a whole. The methodology and equipment need to be described briefly but thoroughly. A copy of all field measurements and calculations should be tabulated and attached as supporting documentation.

Reports should be certified and signed by a registered engineer or professional hydrologist.

ANNUAL WATER BALANCE

The annual water balance prepared for each lagoon requires determinations of both seepage and evaporation. Leak tests performed according to these guidelines at average liquid depth can establish an average rate of seepage for the water balance. The rate of seepage will tend to vary with liquid level, and will remain constant if the level stays constant.

For the purpose of making water balance calculations, a monthly average evaporation rate should be obtained from local climatological records. Such records may then be applied with a suitable pan correction factor between 0.7 and 0.9, as previously described.

Rate of evaporation and pan correction factors both tend to vary throughout the year. To make accurate adjustments requires additional measurements be taken of all the pertinent factors. These include wind, water

temperature, air temperature, and atmospheric pressure. Pan evaporation corrections should conform to established calculation methods, as presented in standard hydrology texts.

NEW LAGOONS

New sewage and sludge lagoons are designed to be effectively watertight and nearly leak-free. Lagoons which may jeopardize groundwater because of their contents, uses, or location are routinely installed with groundwater monitoring wells. In such applications, leak testing is not a practical or reliable alternative to direct monitoring of the groundwater.

All of the measurements in leak tests are approximations, especially liquid level, and the pan correction factor is usually a rough estimate. Consequently, seepage computed from a leak test cannot be used to prove or substantiate the existence of any actual leak. Leak testing as a basis for acceptance of lagoon construction is not feasible, too often has led to fruitless litigation, and should be discouraged.

As a practical matter, the engineer must design each lagoon for watertightness. Then the engineer must conduct thorough, intensive, and continuous construction inspection to verify that watertight construction is being attained. Inspection may include compaction, infiltrometer, smoke, and spark tests, and constant observation of workmanship and materials.

If leakage and contamination occurred from a properly inspected and certified lagoon, it would indicate a damaged liner or a failure of design. Assuming good design and inspection, the engineer's written certification of proper construction carries a presumption of watertightness. No leak testing program should be approved as a substitute for diligent construction inspection.

INQUIRIES

Inquiries about these guidelines should be directed to DEQ regional water-quality plan review engineers.

DSM:LAGOON2.TST

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Rev1. VIII.94

LAGOON LEAK TEST

CITY OF _____

CELL NO._____ WATER SURFACE AREA_____

CELL WATER DEPTH @ TEST START_____ @ TEST END_____

Date	INFLUENT (in/day)	+PRECIP (in/day)	-EVAP (in/day)	- EFFLUENT (in/day)	=NET SEEPAGE

NOTES:

b. Collection and transmission of wastewater to an existing treatment plant, or alternate plant site, downstream from the water supply intake;

c. The potential for an alternate drinking water source (e.g. groundwater or connection to another existing water system) for the water supply agency; and,

d. Relocation of the water supply intake to a point upstream from the wastewater treatment works discharge.

The Division recognizes that water rights issues may limit the feasibility of implementing such alternatives.

If no reasonable alternative to the discharge of wastewater treatment works effluent upstream and proximate to drinking water sources can be found, then additional considerations to reduce risk of impact to the water supply must be made in the design and management of the wastewater treatment plant to minimize public health risks.

The Division reviews such instances on a case-by-case basis. The Division suggests that entities involved with such potential circumstances contact the Division early in the planning process to arrange a meeting to set forth a detailed approach to facility siting and design. Where appropriate, the Division will participate in meetings between the entities involved.

3. Additionally, special design and operational issues may need to be considered to address emergency situations (such as an upset) at a wastewater treatment plant. These may include, but are not limited to:

   a. Having the capability for flow equalization at the wastewater treatment plant

   b. Having the capability for emergency storage at the wastewater treatment plant at a point prior to discharge.

   c. Having the ability to temporarily divert the discharge to an alternate treatment facility or other location during the emergency situation.

   d. Providing alarm systems to alert operator of upset conditions and/or equipment issues or failure.

   e. Having adequate staffing at the wastewater treatment plan to facilitate a timely response to emergency situations.

22.3(2)(e) – Guidance Specific to Odor, Noise and Aerosol Mitigation from Domestic Wastewater Treatment Works (previously included in WQSA-7)

Concerns regarding impacts from a proposed domestic wastewater treatment works have been expressed by potential neighbors in some cases and it is necessary for the Division to implement a consistent approach to addressing those concerns while protecting public health and the environment.

Regulation No. 22 sections 22.3(2)(e) and 22.9(1)(e) requires that the Division review site applications to ensure that the proposed treatment works can be operated and managed at the proposed site location to minimize foreseeable potential adverse impacts on the public health, welfare, and safety as related to wastewater treatment and/or water quality. This policy provides guidance for reviewing those factors and to specifically:

1. Address potential concerns of neighboring property owners to proposed domestic wastewater treatment facility construction;

2. Reduce the likelihood of public nuisance complaints stemming from the operation and maintenance of domestic wastewater treatment facilities (including odors, noise and aerosols);

3. Minimize the potential for the airborne transmission of pathogens from wastewater treatment facilities to the occupants of nearby habitable structures; and

4. Provide guidance if setback requirements cannot be met and mitigating factors must be incorporated into the design to address potential concerns from odor, noise, and aerosols.

In considering the approval of new and expanded domestic wastewater treatment works, domestic wastewater treatment works where a change in capacity (expansion or reduction) is requested, or for domestic wastewater treatment works where other facility modifications are proposed (i.e. those requiring site location approval per Regulation 22), the Division shall consider distances to habitable structures and, if impacts to public health or the environment are projected, may deny approval of a site location application or, in its approval of a site location application, may impose reasonable conditions on the design of a facility to minimize public health impacts associated with odors and aerosols. Habitable structures include residences, schools, and commercial structures.

Incorporating certain design elements can prevent most potential odor, noise, or aerosol problems at a treatment works. Any mitigation techniques incorporated as a condition of a site location application approval must be included in the design for that facility. In order to obtain design approval, the applicant is then required to operate and maintain those mitigation elements or other comparable equipment or mitigation method. Applicants must consider potential odor, noise, and aerosol issues and the potential costs associated with mitigation elements in their site selection process. Should the responsible, party for an existing domestic wastewater treatment works, allow mitigation elements required in a previous site approval to be operated incorrectly or deteriorate in their effectiveness, the Division may withhold approval of any request for plant expansion until the mitigation elements are improved to adequate operations.

Odors

Wastewater treatment works have the potential for odor generation simply based on the characteristics of wastewater and the processes used to treat wastewater. It has been demonstrated that odors generated in a wastewater treatment works can be contained and minimized by proper design and by active odor control technologies. Therefore, it is the applicant's responsibility to consider odor generation in choosing the location of the facility and selecting the processes to treat the wastewater and mitigate odors.

Odor emissions are addressed by Air Quality Control Commission, Regulation Number 2, *Odor Emission* (http://www.cdphe.state.co.us/regulations/airregs/100104aqccodoremission.pdf) Projected odor levels exceeding Air Quality Regulation Number 2 will not be approved.

It is difficult to predict where or under what conditions odors may travel; however, consideration of prevailing winds, localized inversion conditions and other physical characteristics of the proposed site and the treatment processes should be assessed by the applicant.

New Domestic Wastewater Treatment Works

Unless site specific factors exist which would tend to amplify odors, the Division will assume that the following setback distances from the treatment process location to habitable structures are adequate and that consideration of specific odor control requirements in the design is not necessary.

1. Non-aerated lagoons: ¼ mile

2. Aerated lagoons less than two (2) total surface acres (all basins combined) with no surface aeration: 250

feet

3. Aerated lagoons greater than two (2) total surface acres (all basins combined) with no surface aeration: 500 feet
4. Aerated lagoons less than or equal to two (2) total surface acres (all basins combined) with surface aeration: 500 feet
5. Aerated lagoons greater than or equal to two (2) total surface acres (all basins combined) with surface aeration: 1,000 feet
6. Mechanical plants 2,000 gpd maximum month capacity to less than 50,000 gpd capacity: 250 feet
7. Mechanical plants 50,000 gpd capacity to less than 100,000 gpd capacity: 500 feet
8. Mechanical plants 100,000 gpd or greater: 1,000 feet
9. All enclosed mechanical plants and lift stations: 100 feet
10. Lift stations 150,000 gpd capacity to less than 215,000 gpd capacity: 250 feet
11. Lift stations greater than 215,000 gpd capacity: 500 feet

For determining the appropriate setback distance above, surface aeration means aeration accomplished with equipment that generates splashing, i.e. throws the water into the air, not diffused aeration.

Absent site specific factors, if the proposed treatment works are far enough from habitable structures (as defined by the setback distances given above) then odor mitigating design features would not be required. However, if at the time of site location application action by the Division, habitable structures do exist within the setback distances listed above for a new domestic wastewater treatment works, the applicant must commit to incorporating reasonable and appropriate odor mitigation elements into the domestic wastewater treatment works design.

Incorporation of the odor control processes into the design, when appropriate, shall be a condition of the site location approval letter. Failure to construct the odor control processes would invalidate the site location approval, resulting in a violation to the Water Quality Control Act, 25-8-702 C.R.S.

Mitigating elements can include system features designed to prevent odor problems from occurring such as, but not limited to

1. Aeration system failure alarms with 24-hour autodialing to an appropriate responsible party;
2. Covering certain portions of the plant; and,
3. Enclosure and appropriate air handling treatment system (e.g. air filters) for certain processes that generate odors such as headworks and solids handling facilities.

The specific mitigating elements for a particular situation should be developed based on an analysis of the sequence of events that could lead to odor problems, Design features should then be developed to interrupt or control the generation of odors which would negatively affect nearby habitable structures.

<u>Increase or Decrease of Capacity or Amendment of Existing Domestic Wastewater Treatment Works</u>
Where the distances to habitable structures cited above in the New Domestic Wastewater Treatment Works section are not met for facilities being modified and required site location application approval, the applicant also has the obligation to consider odors. In the site location application, the applicant shall address the need for mitigation design elements to reduce the potential for odor from processes being added or modified. Reasonable odor mitigation facilities or strategies shall be proposed by the applicant to reduce the odor potential. Where a

new habitable structure(s) has been built near the original, approved site location boundary after the construction of the original domestic wastewater treatment works, the Division and the applicant shall consider whether the proposed changes will increase the already existing odor levels at those new habitable structures and whether the existing facility already impact public health, welfare, and safety as related to wastewater treatment and/or water quality.

Noise

Noise is generated by large, powered equipment at domestic wastewater treatment works including engine generators, blowers, fans, and mechanical aerators. The variation, pulse, and tone of the noise can affect the listener as much as or more than the decibel energy of the sound wave. Mitigation strategies must be employed consistent with State and Local Ordinances and should focus on equipment selection, acoustical architectural techniques, and the use of barriers or other sound-wave attenuation measures within buildings, surrounding structures, and plant grounds.

Aerosols

A plant site shall be of sufficient size that, under normally expected operating and climate conditions for the proposed processes, aerosols would not be expected to cross the property line of the plant. Aerosols shall be considered water droplets generated by active treatment processes in the plant. Aerosols do not include fog caused by temperature differences or odors carried through the movement of air across the property. Where aerosol drift may be reasonably expected to go off the plant site, the Division may deny site location approval or may impose appropriate design requirements as a condition of approval Where the treatment processes are more than 250 feet away from the habitable structures, the Division will assume that aerosol drift is not an issue unless the treatment process proposed would create significant aerosols or the aerosols may create public health concerns.

Expectations Regarding Existing Domestic Wastewater Treatment Works and Appurtenances

For **existing** domestic wastewater treatment works and appurtenances where –

1. No facility modifications (requiring site location and design approval per Regulation 22) are requested or have been made without first obtaining site location and design approval and
2. Where the Division is not aware of any odor, noise or other related complaints or non-compliance with regard to Colorado statute or discharge permit requirements,

As long as conditions 1. and 2. above are applicable, the Division does not expect that these existing facilities will comply with the ***Odor, Noise and Aerosol Mitigation*** requirements that are described in this Section.

22.4 APPLICATION PROCEDURES FOR CONSTRUCTION OF NEW DOMESTIC WASTEWATER TREATMENT WORKS (ALSO INCLUDES NEW OR RELOCATED OUTFALL SEWERS AND VAULTS)

An application for ***New Domestic Wastewater Treatment Works*** is required for the following situations:

- Proposed domestic wastewater treatment works with a design capacity to received greater than 2,000 gallons of domestic wastewater per day including onsite wastewater systems;
- Addition of a new discharge location (outfall sewer) at a domestic wastewater treatment works;

Parkson™
Treating Water Right

biolac®

Ridgway, CO

Preliminary Proposal

September 14, 2016

To:	**Joanne Fagan**	**Date:**	**September 14, 2016**
Company:	**Town of Ridgway**	**From:**	**Rakesh Desai**
Tel.:		**Tel.:**	**(954) 917-1818**
cc:	**Mark Rasor, Maiorana, Scott Marshall (MiscoWater)**		
Subject:	**Parkson Biolac® Treatment System, Preliminary Design Proposal for Ridgway, CO**		

Dear Ms. Fagan,

Thank you for your interest in Parkson's Biolac® Treatment System. Based upon the data provided for this project, we developed the Biolac® design described in this proposal. We believe that this Biolac® design not only provides the most cost effective solution for this municipality, but also meets effluent quality requirements.

We look forward to working with you on this project. Should you have any questions or need clarifications, please do not hesitate to contact me at (954) 917-1818. Thanks.

Sincerely,

PARKSON CORPORATION

An Axel Johnson, Inc. Company

Rakesh Desai
Sr. Applications Engineeer
RDesai@Parkson.com

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1. Design Basis

1.1. Influent Specifications

The proposed system design is based on wastewater influent with the following characteristics:

Table 1.1 – Design Influent flow requirements

PARAMETER	UNITS	AVERAGE
Design Flow	GPD	200,000

Note: Customer must confirm these final design flows to assure accuracy of the hydraulic calculations.

Table 1.2 - Influent Water Quality

PARAMETER	UNITS	AVERAGE
Design Temperature	Deg C	16
Minimum Temperature	Deg C	5

Note: Customer must confirm Influent loading conditions for any associated process warranty.

In order to offer this proposal, Parkson Corporation must make the following assumptions. Deviations from these assumptions should be brought to the attention of the designer of this system as modifications maybe required:

a. The wastewater will be pretreated to remove debris and grit.

1.2. Design Parameters Provided

The aeration layout is designed based on summer loads. Following design parameters were provided for aeration design.

	Cell #1	Cell #2	Cell #3
AOR for BOD Removal (lbs/day) summer	**1172**	**150**	**49**
AOR for NH_3 Removal (lbs/day) summer	**-**	**216**	**144**
AOR/SOR Ratio Summer	**0.3917**	**0.3917**	**0.3917**

2. System Description

The Biolac® process can be applied to a wide range of wastewater treatment applications, whether for municipal application or industrial application. Biolac® has over 800 installations in North American and over 1000 installations globally.

Some of the advantages of the Biolac® process include:

a. Economical construction: Most biolac® systems are installed in earthen basins which reduces construction cost tremendously by eliminating the need for sophisticated concrete structures and complex piping systems for recycling.

b. Economical process in terms of operation and maintenance cost.

c. Comprehensive electrical control system to control air delivery to provide peace of mind to plant operator.

d. Ease of aeration expansion capability simply by adding additional Biofuser® tubes to modules.

e. Elimination of the need to drain the aeration with the Biolac® system since all components can be cleaned and maintained from the surface

The Biolac® process uses fine bubble membrane diffusers attached to floating aeration chains, which are moved across the basin propelled by the air release from the diffusers. The moving aeration chains equipped with the Biofuser® diffuser assemblies provide efficient mixing of the basin contents as well as high oxygen transfer at low energy usage.

The Biofuser® system does not have submerged aeration piping or any other components to be installed, leveled, or secured on the basin floor. The BioFlex® chains with BioFusers do not contact or harm the basin liner. Each BioFlex® chain can be individually controlled by independent air valve providing excellent flexibility in fine-tuning the system to meet the oxygen demand. Inspection and service of the BioFusers is done quickly and easily without dewatering the basin, keeping maintenance costs low and eliminating the need for redundant aeration basins. In case of cold climates, the fine bubble diffusion beneath the water surface eliminates icing and minimizes wastewater cooling.

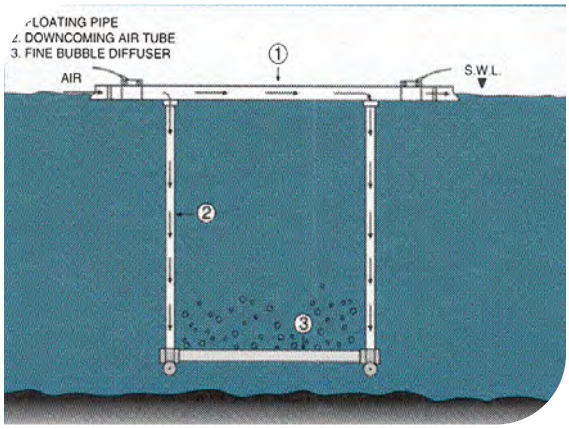
Earthen basins can be used rather than expensive concrete tanks making this design the lowest cost alternative available on the market.

3. System Components

The Biolac® aeration system for lagoon basins consists mainly of suspended aeration chains, fine bubble diffusers, motorized and controlled air valves, blowers and automatic electrical control system.

3.1. Moving Aeration Chain System

The moving aeration chain suspends fine bubble diffusers near the bottom of the basin. The aeration system is designed so that there are no points of attachment to the bottom of the basin. The aeration system is completely suspended above the basin bottom and is not supported or rested on the bottom. This arrangement allows for ease of access for service and maintenance without dewatering the basin or having a complete aeration system shut down.



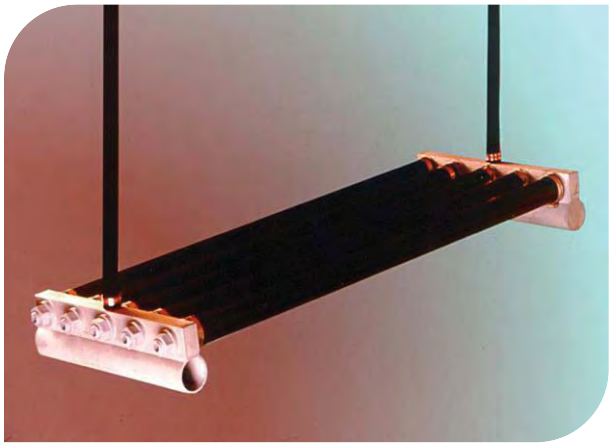
The aeration chain system is designed to be self-propelled and to move back and forth systematically in the wastewater to provide high mixing efficiency of the basin's content. This capability is critical to allow turndown flexibility in the aeration system while maintaining a completely mixed environment.

Air is delivered to each aeration chain from one side and connects to the air main through individual branches with butterfly valves. The butterfly valve provides individual control or isolation of the airflow to each chain.

The moving aeration chain is constructed of a single continuous polyethylene header. The moving aeration chain is connected to the Biofuser® by EPDM hose.

3.2. Diffuser Frame

The diffuser frame is formed from an extruded polypropylene compound with sufficient strength to prevent warping or deflection. The end connections of each frame shall be sealed using mechanical welding procedures providing a connection stronger than the unwelded tube.



The suspended air diffuser assembly consists of a fully functioning unit capable of housing up to five (5) diffuser tubes total.

3.3. Aeration Design

a. The aeration requirements for the Biolac® System are summarized in Table 1.

b. The estimated air and energy requirements and the number of BioFlex© moving aeration headers and Biofuser® units estimated are given in Table 1. A typical BioFlex aeration header and Biofuser® assembly is shown in Drawing SD-33.

c. The required air for both lagoons can be supplied by a total of five (5), 15 Hp positive displacement blowers. One (1) additional blower will be required as an installed spare. The blowers are expected to be located on a concrete pad next to the aeration basins or in a blower building as dictated by local requirements.

3.4. Biolac® Treatment System Preliminary Design Information

Biolac Lagoon Basin(s)	Cell #1	Cell #2	Cell #3
No. of Biolac® Basins (Lagoons)	3		
	Complete Mix	**Partial Mix**	**Partial Mix**
Side Slope	2.5:1	2.5:1	2:1
Side Water Depth (ft)	7	7	12
Diffuser Water Depth (ft)	6	6	6
Water Surface Dimensions (ft)	160 x 110	120 x 110	254 x 146
Volume (MG)	0.75	0.70	2.21
Estimated SOR (lbs/hr)	129	40	21
Estimated SCFM	1,155	399	210
Estimated Brake HP	41	14	7
# Diffusers	196	60	30
# Biofuser® Assemblies	49	20	15
# BioFlex© Headers	7	4	3

4. Equipment and Services Supplied

Parkson will supply the following equipment and services for the treatment system described above:

Complete BioFlex® moving chains with BioFuser® aeration units including, reinforced hi-temperature connecting hose, HDPE piping, restraining cable system and required hardware.

Lever operated butterfly valves for individual control of each BioFlex aeration chain.

Qty six (6) complete, 15 Hp, blower assemblies (PD blowers) including motor and required backflow prevention valves, pressure gauges and accessories (includes one installed spare blower for redundancy).

Two (2) dissolved oxygen probes and analyzer. One (1) each for cell #1 and Cell #2.

Remote-mounted control system for operation of the Biolac® System including control enclosure, timers, relays and control switches for all motors, and components in the system. Existing FVNR starters will be used. Dissolved oxygen monitoring and blower control are also provided.

Project design drawings on a disk, along with a submittal package for approval and operation and maintenance manuals.

Final installation inspection, start-up supervision and operator training extended training and plant operation supervision is also available.

5. Cost Estimate and Term

a. The budget price for the equipment and services supplied is $399,000

   Deduct for DO controls (Probe, Control panel) $72,000

   FOB Factory, Freight Allowed.

b. Terms are 90% net 30, 10% upon startup.

c. Approval drawings-typically 6-8 weeks after receipt of written order.

d. Equipment Shipment - typically 16-20 weeks after complete release for manufacture.

6. Supplemental Information and References

a. Typical Drawings

- SD-37 "BioFlex Moving Aeration Chain with Biofuser® Series 2004"
- SD-36 "BioFlex Moving Aeration Chain with Biofuser® Series 2003"
- SD-33 "BioFlex Moving Aeration Chain with Biofuser® Series 2002"
- SD-6 "Typical Moving Aeration Chain Connection"
- SD-7 "Anchor Post with Hook Detail"

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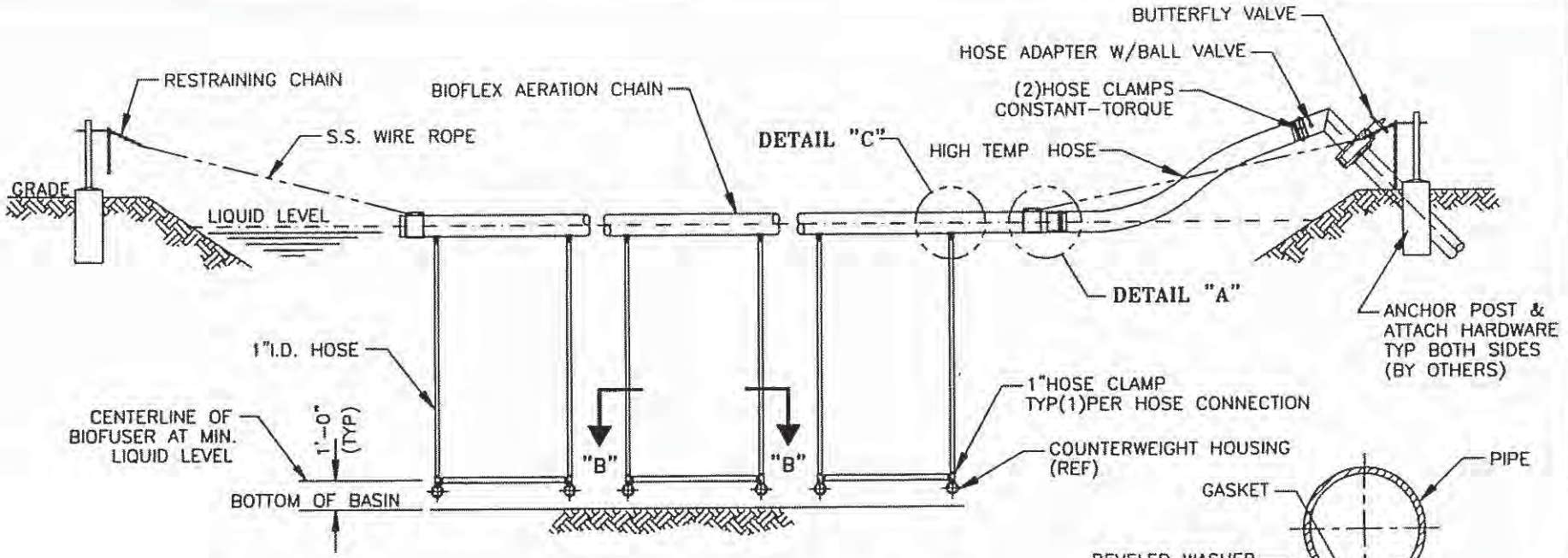
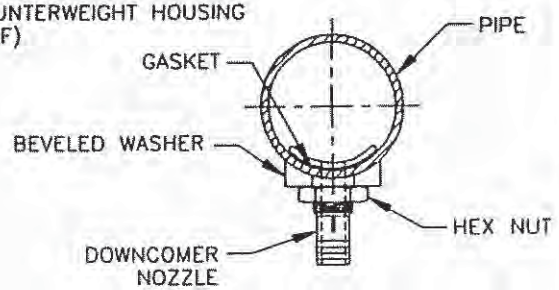


ELEVATION (BIOFLEX/BIOFUSER ASS'Y)



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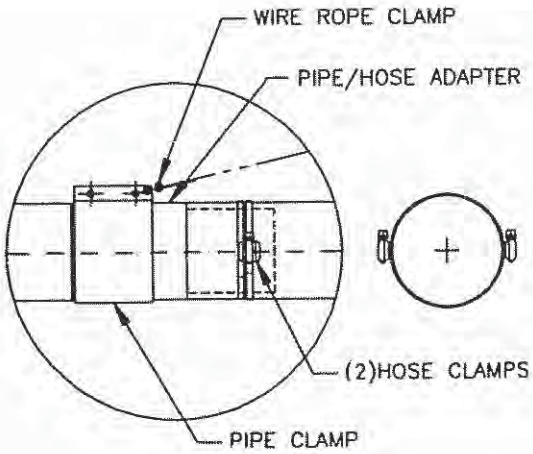

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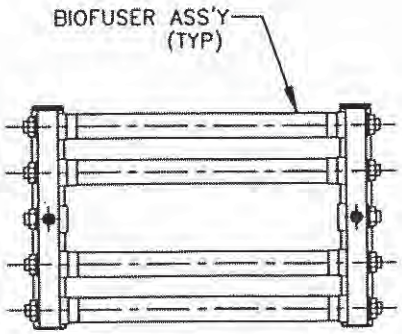

VIEW "B-B"

NOTES:

1. CIVIL & CONCRETE DESIGN NOT BY PARKSON CORP.
2. TWO(2)HOSE CLAMPS TO BE INSTALLED AT EACH HOSE CONNECTION. WHEN TIGHTENED, WORM GEARS SHOULD BE 180° FROM EACH OTHER.
3. BIOFLEX WILL BE PROVIDED IN STANDARD LENGTHS. FUSION WELDING & DRILLING DOWNCOMER HOLE IN FIELD WILL BE REQUIRED BY CONTRACTOR.

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
BIOFLEX MOVING AERATION CHAIN
WITH BIOFUSER SERIES 2004

Drawn By G.C.	Checked By	Approved By	Micro Rev.	CAD No. SD-33	Loc. status LS
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD unit scale 64
Location			Dwg. No. SD-37		Rev A

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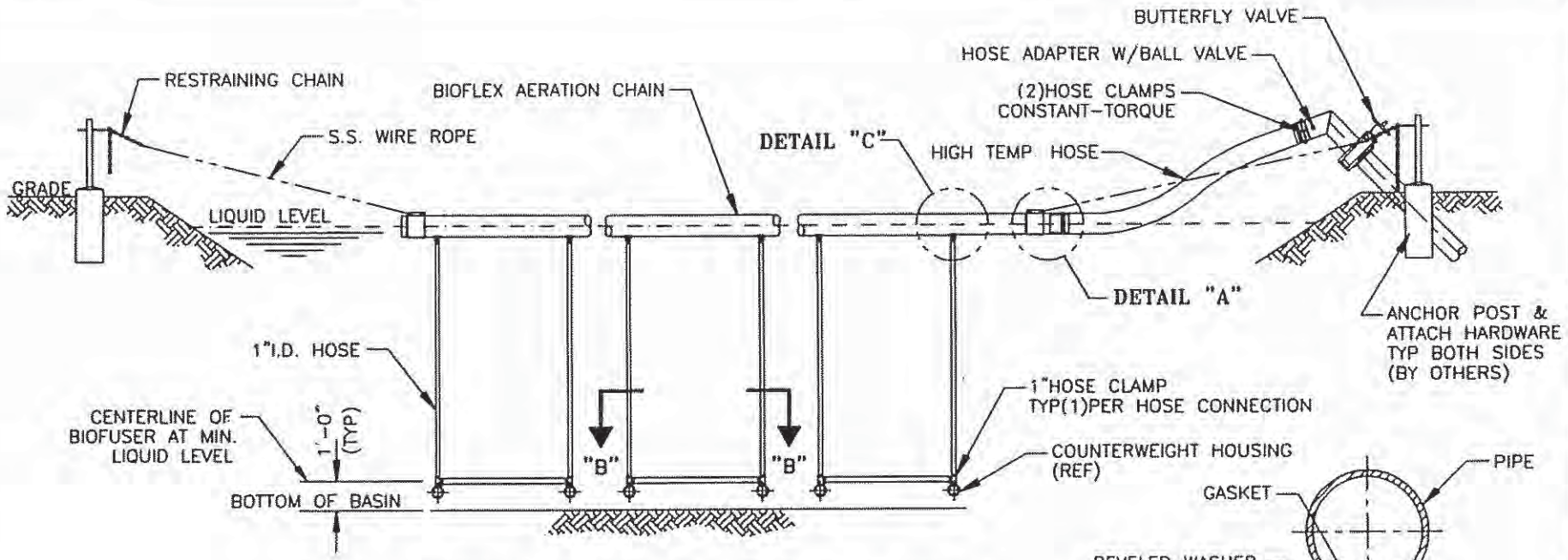

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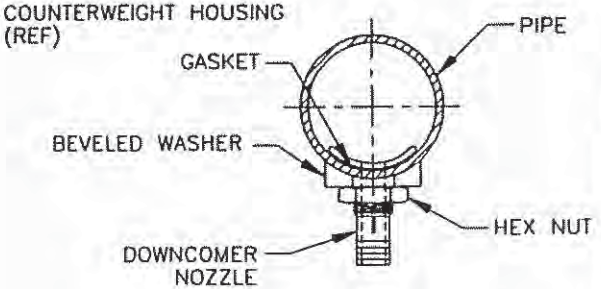

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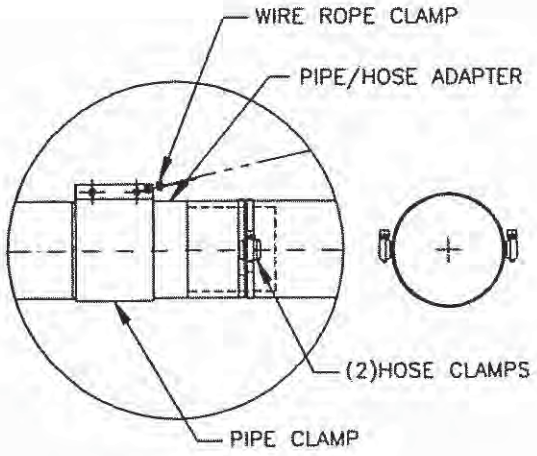

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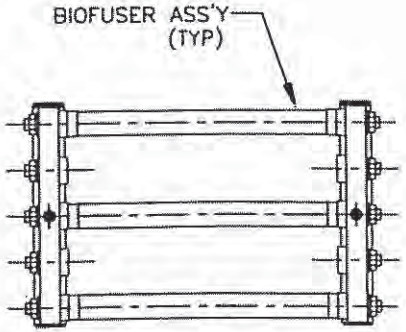

VIEW "B-B"

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PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
BIOFLEX MOVING AERATION CHAIN
WITH BIOFUSER SERIES 2003

Drawn By	Checked By	Approved By	Micro Rev.	CAD No.	Loc status
G.C.				SD-33	LS
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD int scale 64
Location			Dwg No. SD-36		Rev A

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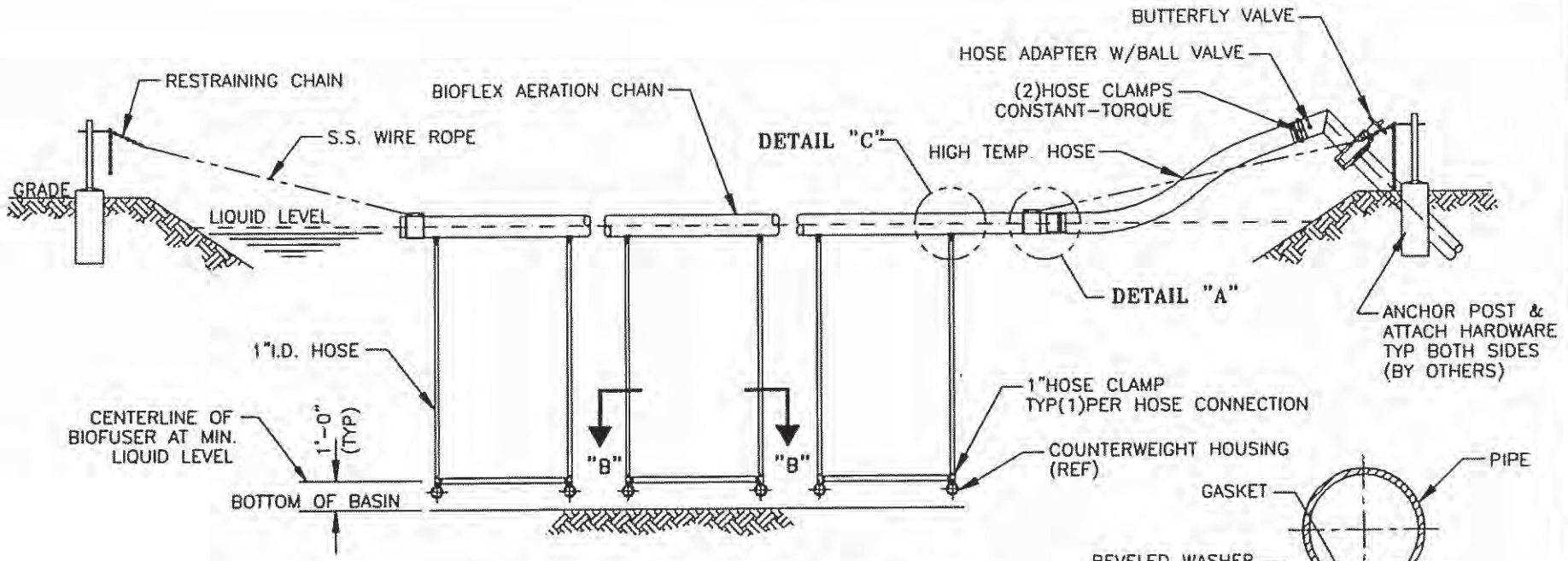
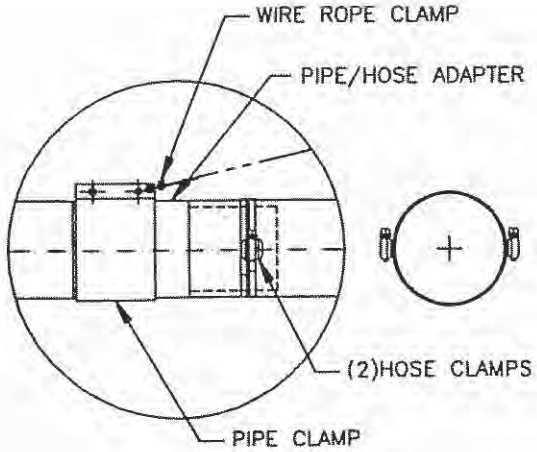


ELEVATION (BIOFLEX/BIOFUSER ASS'Y)

DETAIL "C"



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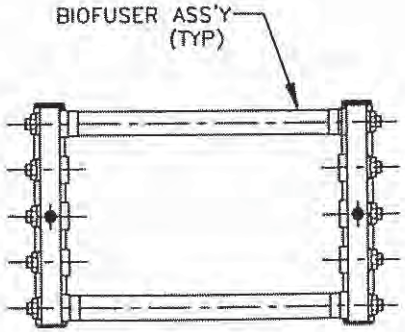

VIEW "B-B"

NOTES:

1. CIVIL & CONCRETE DESIGN NOT BY PARKSON CORP
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PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
BIOFLEX MOVING AERATION CHAIN
WITH BIOFUSER SERIES 2002

Drawn By	Checked By	Approved By	Micro Rev.	CAD No.	Loc. status
G.C.				SD-33	LS
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD int scale 64
Location			Dwg No SD-33		Rev C

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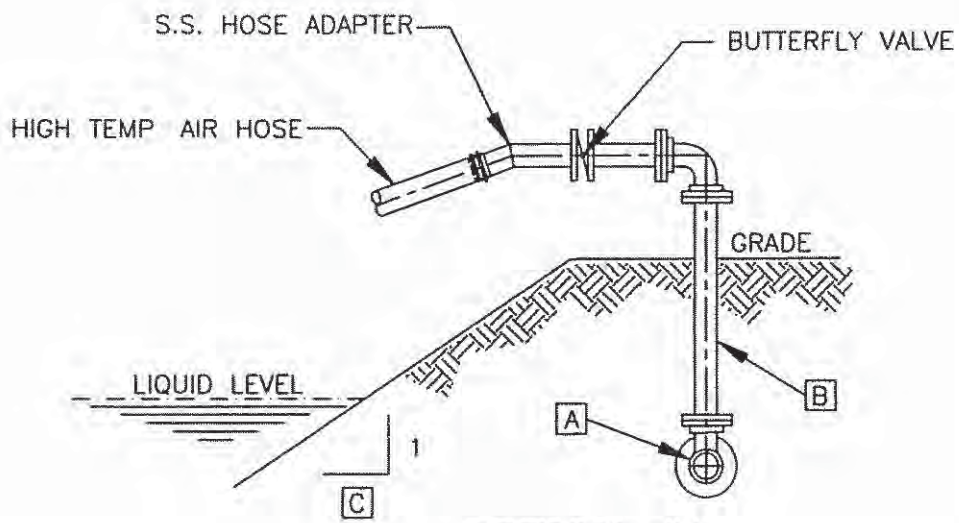
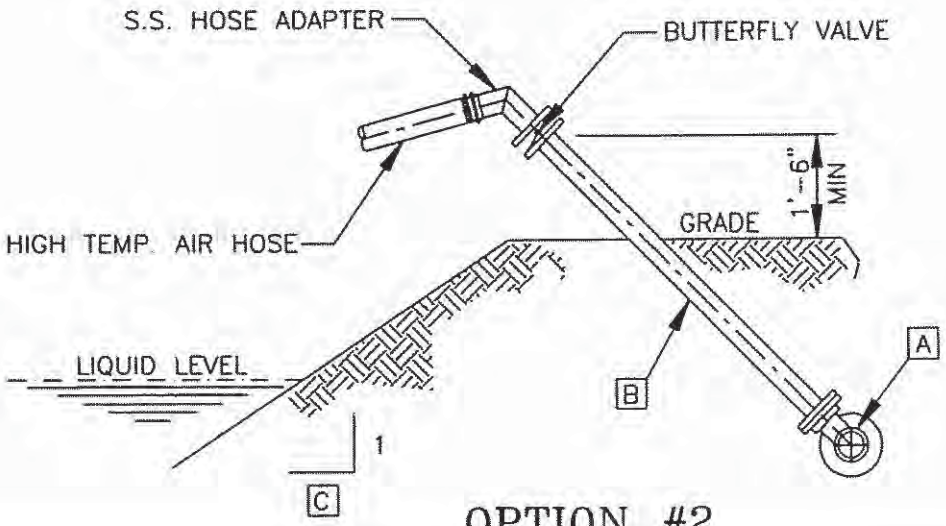


OPTION #1

ITEM	DESCRIPTION	DIM
A	AIR HEADER DIAMETER	
B	AIR FEED PIPE DIAMETER	
C	WALL SLOPE	

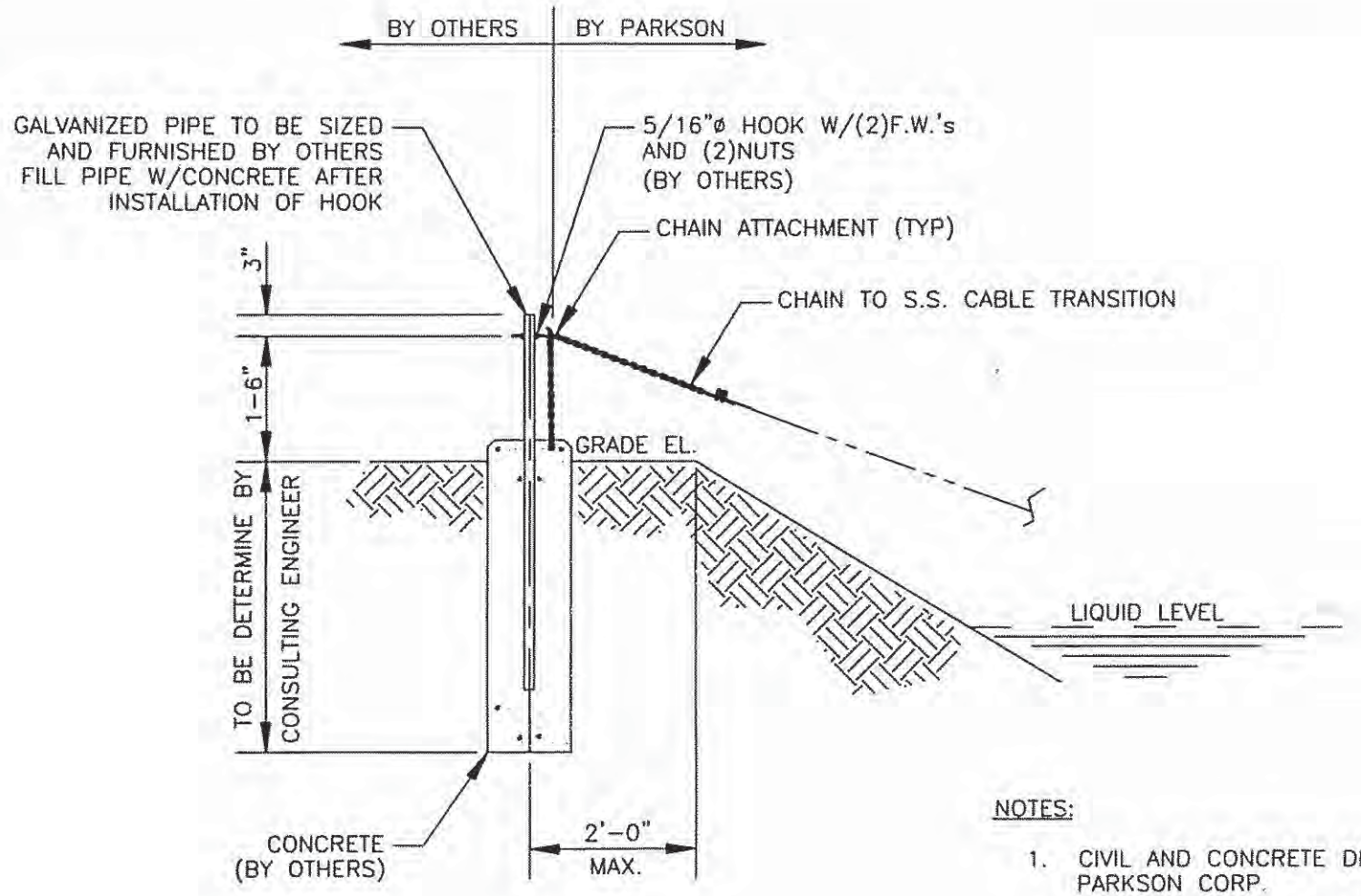


OPTION #2

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
TYPICAL MOVING AERATION CHAIN CONNECTION

Drawn By	Checked By	Approved By	Micro Rev.	CAD No.	Loc. status
G.C.				SD6	LS
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD int scale 32
Location			Dwg. No SD-6		Rev A



NOTES:

1. CIVIL AND CONCRETE DESIGN NOT BY PARKSON CORP.
2. PRELIMINARY DWG., NOT FOR CONSTRUCTION.

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
ANCHOR POST W/HOOK DETAIL

Drawn By	Checked By	Approved By	Micro Rev.	CAD No	Loc. status
G.C.				SD7	LS
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD int scale 24
Location			Dwg No. SD-7		Rev A

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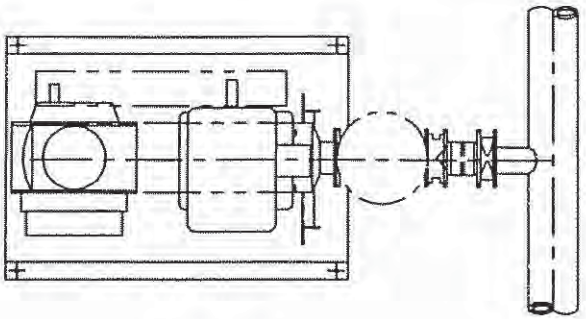
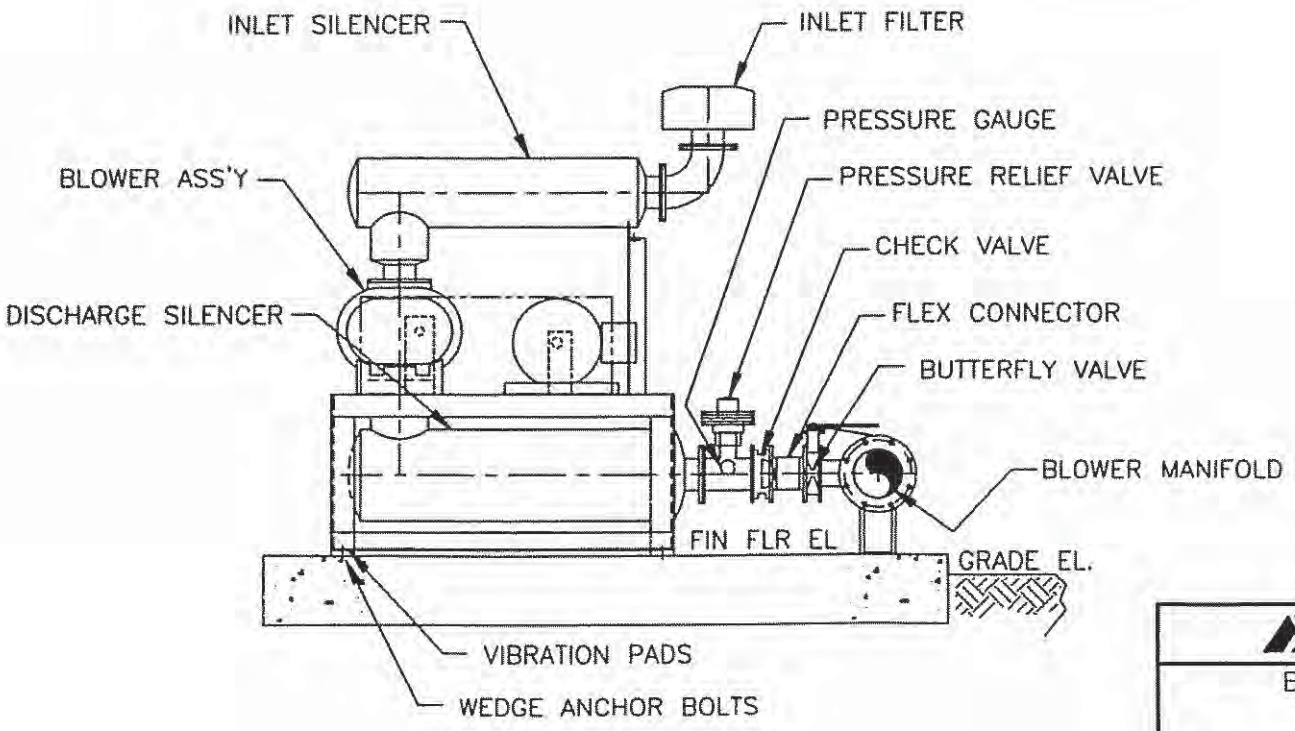


PLAN



ELEVATION

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
POSITIVE DISPLACEMENT
AERATION BLOWER ASS'Y

Drawn By	Checked By	Approved By	Micro Rev.	CAD No.	Loc. status
G.C.				SDB	
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD ini scale .32
Location			Dwg. No. SD-8		Rev A

Parkson™
Treating Water Right

biolac®

Ridgway, CO

Preliminary Proposal

January 03, 2019

To:	**Joanne Fagan**	**Date:**	**January 3, 2019**
Company:	**Town of Ridgway**	**From:**	**Rakesh Desai**
Tel.:		**Tel.:**	**(954) 917-1818**
cc:	**Mark Rasor, Maiorana, Scott Marshall (MiscoWater)**		
Subject:	**Parkson Biolac® Treatment System, Preliminary Design Proposal for Ridgway, CO**		

Dear Ms. Fagan,

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We look forward to working with you on this project. Should you have any questions or need clarifications, please do not hesitate to contact me at (954) 917-1818. Thanks.

Sincerely,

PARKSON CORPORATION

An Axel Johnson, Inc. Company

Rakesh Desai
Sr. Applications Engineeer
RDesai@Parkson.com

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1. Design Basis

1.1. Influent Specifications

The proposed system design is based on wastewater influent with the following characteristics:

Table 1.1 – Design Influent flow requirements

PARAMETER	UNITS	AVERAGE
Design Flow	GPD	200,000

Note: Customer must confirm these final design flows to assure accuracy of the hydraulic calculations.

Table 1.2 - Influent Water Quality

PARAMETER	UNITS	AVERAGE
Design Temperature	Deg C	16
Minimum Temperature	Deg C	5

Note: Customer must confirm Influent loading conditions for any associated process warranty.

In order to offer this proposal, Parkson Corporation must make the following assumptions. Deviations from these assumptions should be brought to the attention of the designer of this system as modifications maybe required:

a. The wastewater will be pretreated to remove debris and grit.

1.2. Design Parameters Provided

The aeration layout is designed based on summer loads. Following design parameters were provided for aeration design.

	Cell #1	Cell #2	Cell #3
AOR for BOD Removal (lbs/day) summer	**1172**	**150**	**49**
AOR for NH_3 Removal (lbs/day) summer	**-**	**216**	**144**
AOR/SOR Ratio Summer	**0.3917**	**0.3917**	**0.3917**

2. System Description

The Biolac® process can be applied to a wide range of wastewater treatment applications, whether for municipal application or industrial application. Biolac® has over 800 installations in North American and over 1000 installations globally.

Some of the advantages of the Biolac® process include:

a. Economical construction: Most biolac® systems are installed in earthen basins which reduces construction cost tremendously by eliminating the need for sophisticated concrete structures and complex piping systems for recycling.

b. Economical process in terms of operation and maintenance cost.

c. Comprehensive electrical control system to control air delivery to provide peace of mind to plant operator.

d. Ease of aeration expansion capability simply by adding additional Biofuser® tubes to modules.

e. Elimination of the need to drain the aeration with the Biolac® system since all components can be cleaned and maintained from the surface

The Biolac® process uses fine bubble membrane diffusers attached to floating aeration chains, which are moved across the basin propelled by the air release from the diffusers. The moving aeration chains equipped with the Biofuser® diffuser assemblies provide efficient mixing of the basin contents as well as high oxygen transfer at low energy usage.

The Biofuser® system does not have submerged aeration piping or any other components to be installed, leveled, or secured on the basin floor. The BioFlex® chains with BioFusers do not contact or harm the basin liner. Each BioFlex® chain can be individually controlled by independent air valve providing excellent flexibility in fine-tuning the system to meet the oxygen demand. Inspection and service of the BioFusers is done quickly and easily without dewatering the basin, keeping maintenance costs low and eliminating the need for redundant aeration basins. In case of cold climates, the fine bubble diffusion beneath the water surface eliminates icing and minimizes wastewater cooling.

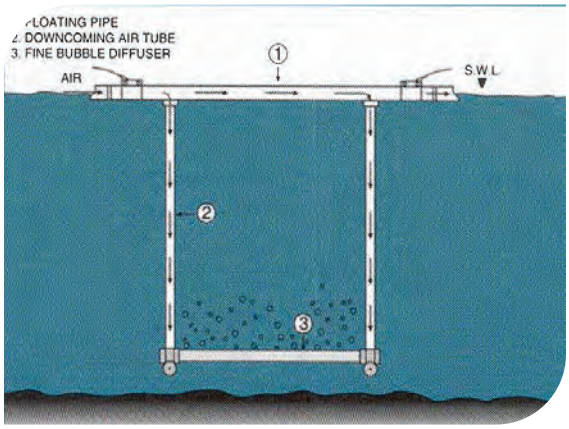
Earthen basins can be used rather than expensive concrete tanks making this design the lowest cost alternative available on the market.

3. System Components

The Biolac® aeration system for lagoon basins consists mainly of suspended aeration chains, fine bubble diffusers, motorized and controlled air valves, blowers and automatic electrical control system.

3.1. Moving Aeration Chain System

The moving aeration chain suspends fine bubble diffusers near the bottom of the basin. The aeration system is designed so that there are no points of attachment to the bottom of the basin. The aeration system is completely suspended above the basin bottom and is not supported or rested on the bottom. This arrangement allows for ease of access for service and maintenance without dewatering the basin or having a complete aeration system shut down.



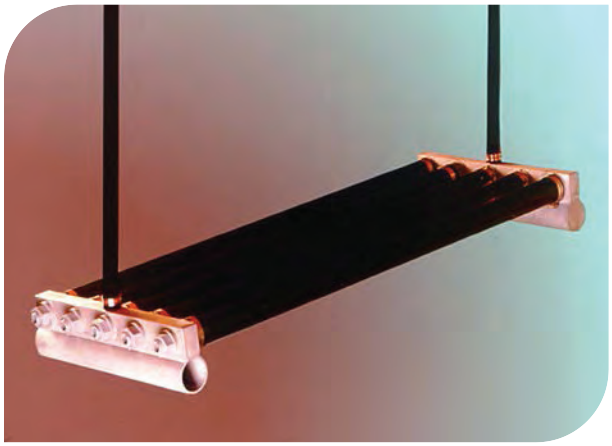
The aeration chain system is designed to be self-propelled and to move back and forth systematically in the wastewater to provide high mixing efficiency of the basin's content. This capability is critical to allow turndown flexibility in the aeration system while maintaining a completely mixed environment.

Air is delivered to each aeration chain from one side and connects to the air main through individual branches with butterfly valves. The butterfly valve provides individual control or isolation of the airflow to each chain.

The moving aeration chain is constructed of a single continuous polyethylene header. The moving aeration chain is connected to the Biofuser® by EPDM hose.

3.2. Diffuser Frame

The diffuser frame is formed from an extruded polypropylene compound with sufficient strength to prevent warping or deflection. The end connections of each frame shall be sealed using mechanical welding procedures providing a connection stronger than the unwelded tube.



The suspended air diffuser assembly consists of a fully functioning unit capable of housing up to five (5) diffuser tubes total.

3.3. Aeration Design

a. The aeration requirements for the Biolac® System are summarized in Table 1.

b. The estimated air and energy requirements and the number of BioFlex© moving aeration headers and Biofuser® units estimated are given in Table 1. A typical BioFlex aeration header and Biofuser® assembly is shown in Drawing SD-33.

c. The required air for both lagoons can be supplied by a total of five (5), 15 Hp positive displacement blowers. One (1) additional blower will be required as an installed spare. The blowers are expected to be located on a concrete pad next to the aeration basins or in a blower building as dictated by local requirements.

3.4. Biolac® Treatment System Preliminary Design Information

Biolac Lagoon Basin(s)	Cell #1	Cell #2	Cell #3
No. of Biolac® Basins (Lagoons)	3		
	Complete Mix	**Partial Mix**	**Partial Mix**
Side Slope	2.5:1	2.5:1	2:1
Side Water Depth (ft)	7	7	12
Diffuser Water Depth (ft)	6	6	6
Water Surface Dimensions (ft)	160 x 110	120 x 110	254 x 146
Volume (MG)	0.75	0.70	2.21
Estimated SOR (lbs/hr)	129	40	21
Estimated SCFM	1,155	399	210
Estimated Brake HP	41	14	7
# Diffusers	196	60	30
# Biofuser® Assemblies	49	20	15
# BioFlex© Headers	7	4	3

4. Equipment and Services Supplied

Parkson will supply the following equipment and services for the treatment system described above:

Complete BioFlex® moving chains with BioFuser® aeration units including, reinforced hi-temperature connecting hose, HDPE piping, restraining cable system and required hardware.

Lever operated butterfly valves for individual control of each BioFlex aeration chain.

Qty six (6) complete, 15 Hp, blower assemblies (PD blowers) including motor and required backflow prevention valves, pressure gauges and accessories (includes one installed spare blower for redundancy).

Two (2) dissolved oxygen probes and analyzer. One (1) each for cell #1 and Cell #2.

Remote-mounted control system for operation of the Biolac® System including control enclosure, timers, relays and control switches for all motors, and components in the system. Existing FVNR starters will be used. Dissolved oxygen monitoring and blower control are also provided.

Project design drawings on a disk, along with a submittal package for approval and operation and maintenance manuals.

Final installation inspection, start-up supervision and operator training extended training and plant operation supervision is also available.

5. Cost Estimate and Term

a. The budget price for the equipment and services supplied is $410,000

   Deduct for DO controls (Probe, Control panel) $74,000

   FOB Factory, Freight Allowed.

b. Terms are 90% net 30, 10% upon startup.

c. Approval drawings-typically 6-8 weeks after receipt of written order.

d. Equipment Shipment - typically 16-20 weeks after complete release for manufacture.

6. Supplemental Information and References

a. Typical Drawings

- SD-37 "BioFlex Moving Aeration Chain with Biofuser® Series 2004"
- SD-36 "BioFlex Moving Aeration Chain with Biofuser® Series 2003"
- SD-33 "BioFlex Moving Aeration Chain with Biofuser® Series 2002"
- SD-6 "Typical Moving Aeration Chain Connection"
- SD-7 "Anchor Post with Hook Detail"

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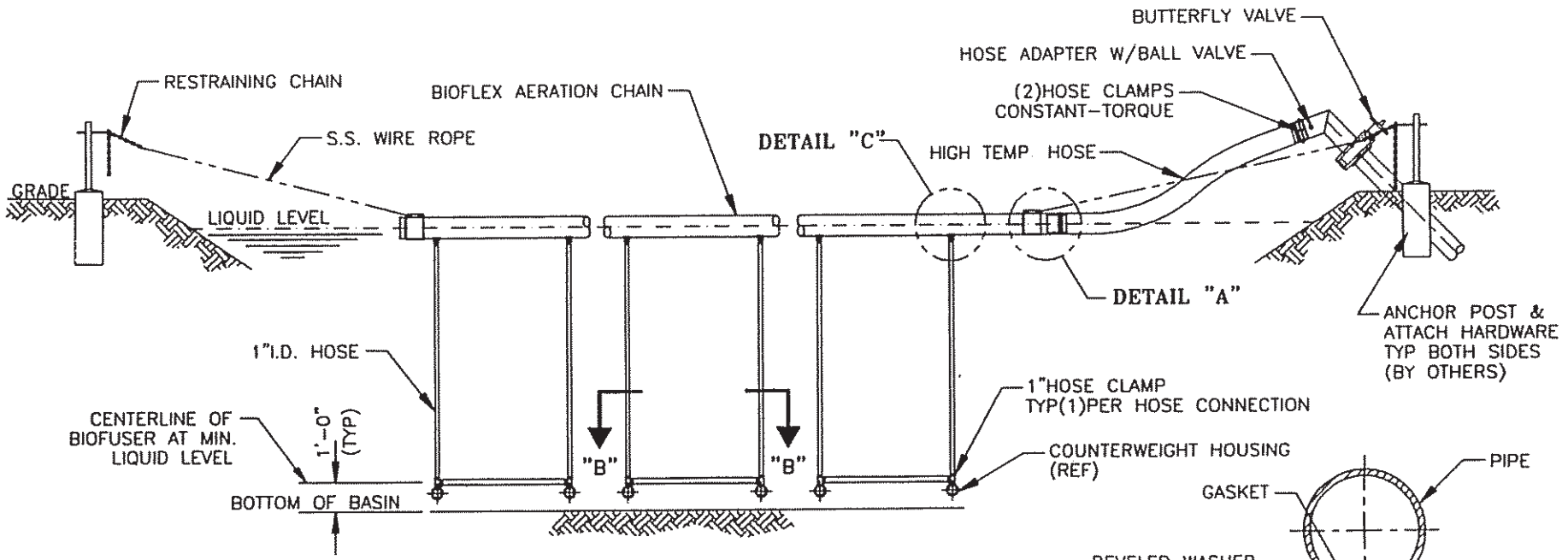
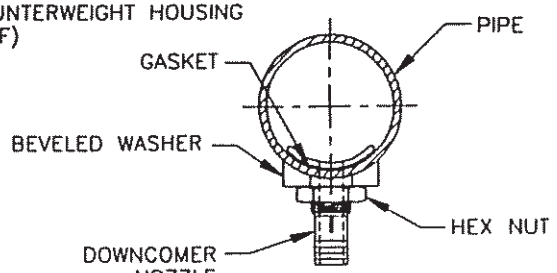


ELEVATION (BIOFLEX/BIOFUSER ASS'Y)



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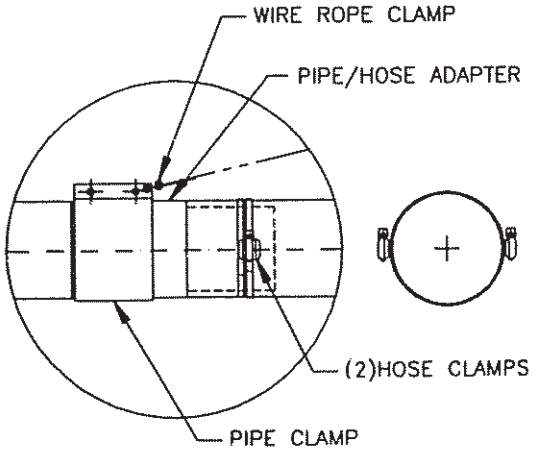

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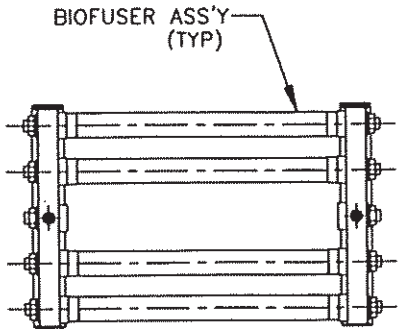

VIEW "B-B"

NOTES:

1. CIVIL & CONCRETE DESIGN NOT BY PARKSON CORP.
2. TWO(2)HOSE CLAMPS TO BE INSTALLED AT EACH HOSE CONNECTION. WHEN TIGHTENED, WORM GEARS SHOULD BE 180° FROM EACH OTHER.
3. BIOFLEX WILL BE PROVIDED IN STANDARD LENGTHS. FUSION WELDING & DRILLING DOWNCOMER HOLE IN FIELD WILL BE REQUIRED BY CONTRACTOR.

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
BIOFLEX MOVING AERATION CHAIN
WITH BIOFUSER SERIES 2004

Drawn By	Checked By	Approved By	Micro Rev.	CAD No.	Loc. status
G.C.				SD-33	LS
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD int scale 64
Location			Dwg. No. SD-37		Rev. A

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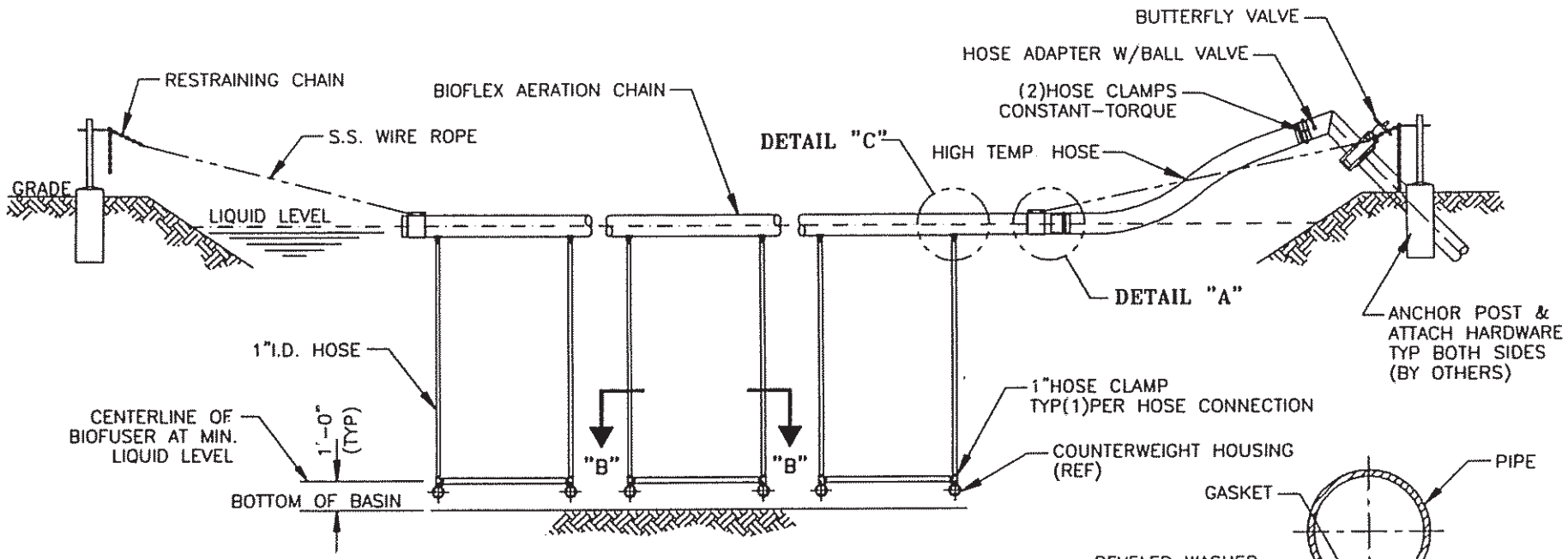

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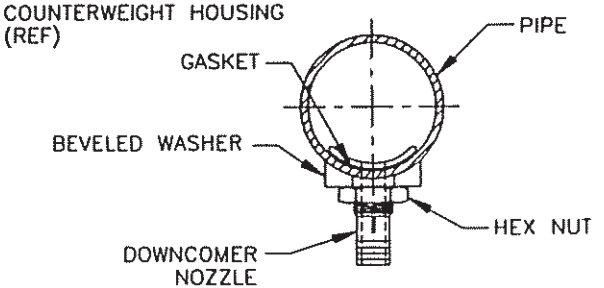

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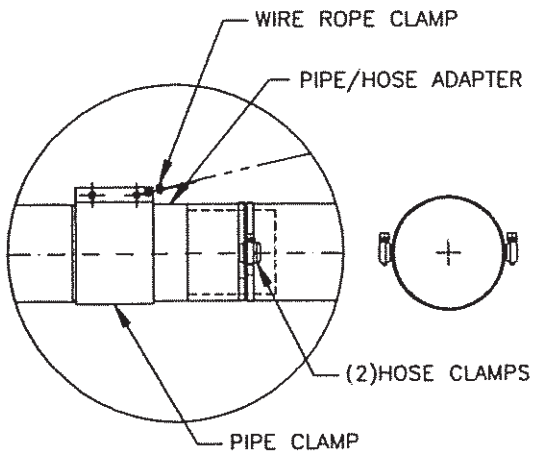

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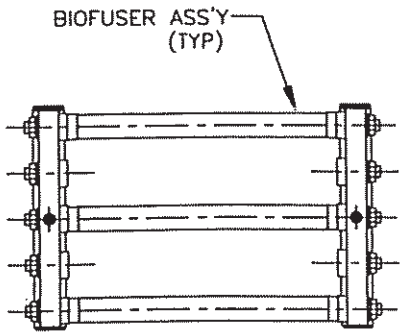

VIEW "B-B"

NOTES:

1. CIVIL & CONCRETE DESIGN NOT BY PARKSON CORP.
2. TWO(2)HOSE CLAMPS TO BE INSTALLED AT EACH HOSE CONNECTION. WHEN TIGHTENED, WORM GEARS SHOULD BE 180° FROM EACH OTHER.
3. BIOFLEX WILL BE PROVIDED IN STANDARD LENGTHS. FUSION WELDING & DRILLING DOWNCOMER HOLE IN FIELD WILL BE REQUIRED BY CONTRACTOR.

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
BIOFLEX MOVING AERATION CHAIN
WITH BIOFUSER SERIES 2003

Drawn By G.C.	Checked By	Approved By	Micro Rev.	CAD No. SD-33	Loc status LS
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD int scale 64
Location			Dwg No. SD-36		Rev A

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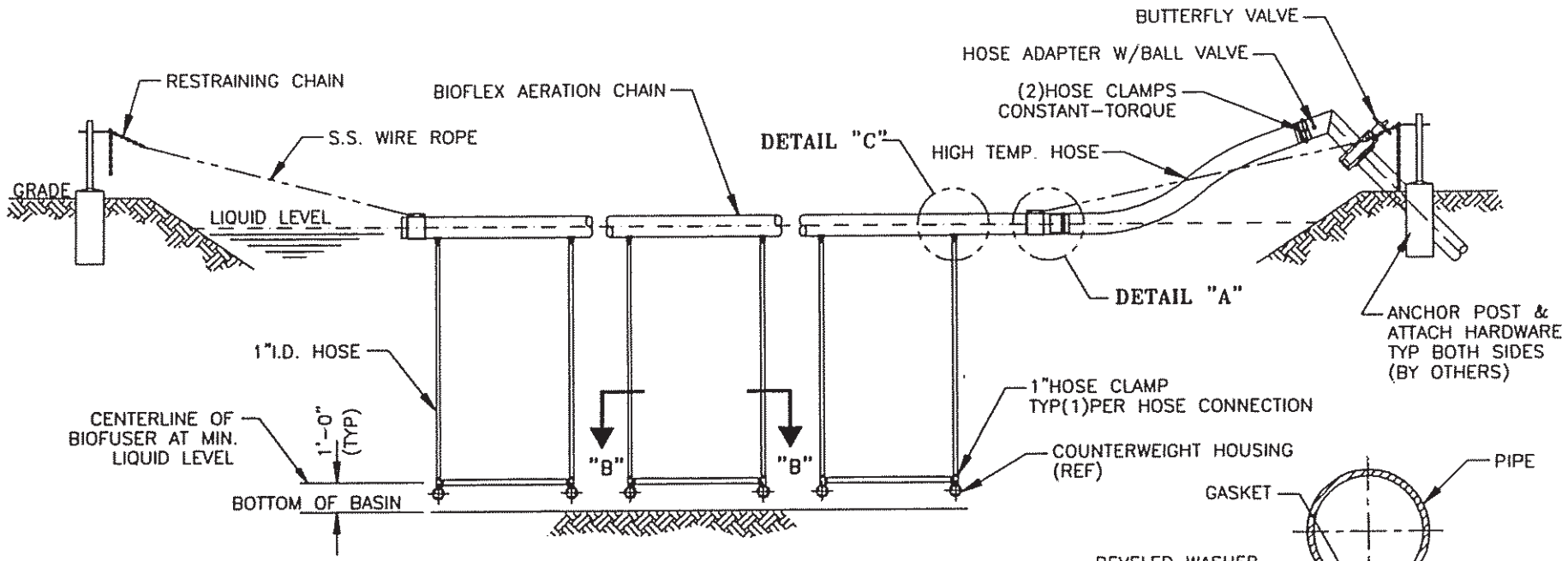

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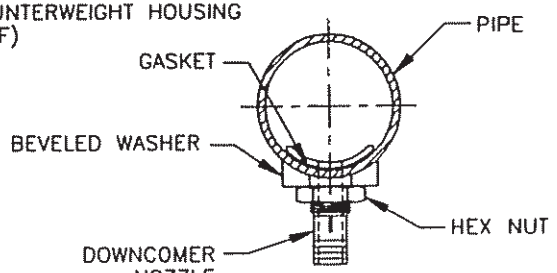

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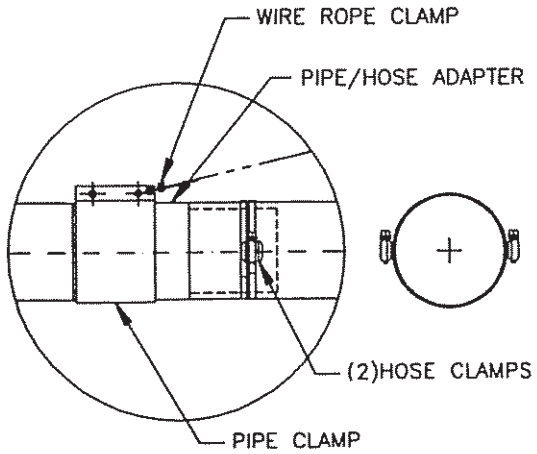

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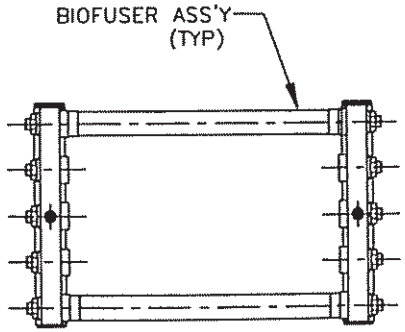

VIEW "B-B"

NOTES:

1. CIVIL & CONCRETE DESIGN NOT BY PARKSON CORP
2. TWO(2)HOSE CLAMPS TO BE INSTALLED AT EACH HOSE CONNECTION. WHEN TIGHTENED, WORM GEARS SHOULD BE 180° FROM EACH OTHER.
3. BIOFLEX WILL BE PROVIDED IN STANDARD LENGTHS. FUSION WELDING & DRILLING DOWNCOMER HOLE IN FIELD WILL BE REQUIRED BY CONTRACTOR.

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
BIOFLEX MOVING AERATION CHAIN
WITH BIOFUSER SERIES 2002

Drawn By	Checked By	Approved By	Micro Rev.	CAD No.	Loc. status
G.C.				SD-33	LS
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD int scale 64
Location			Dwg No SD-33		Rev C

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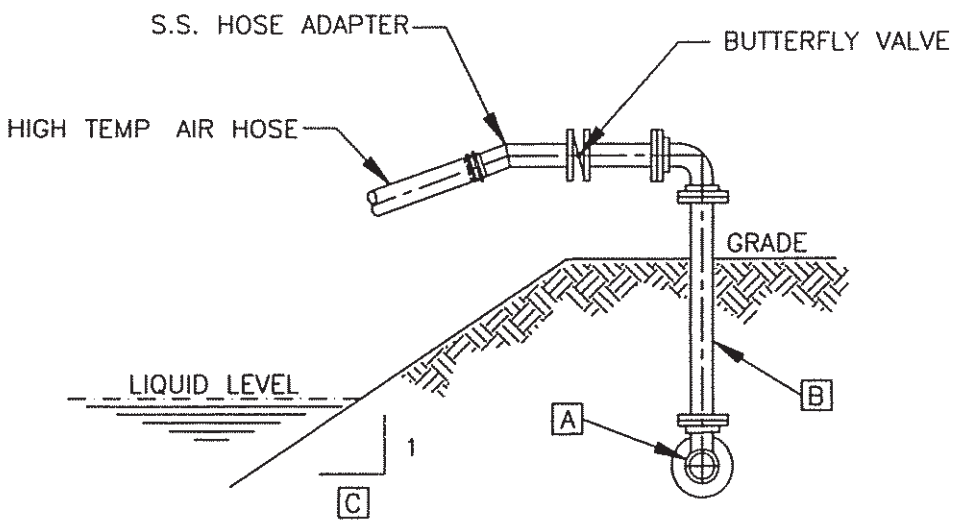
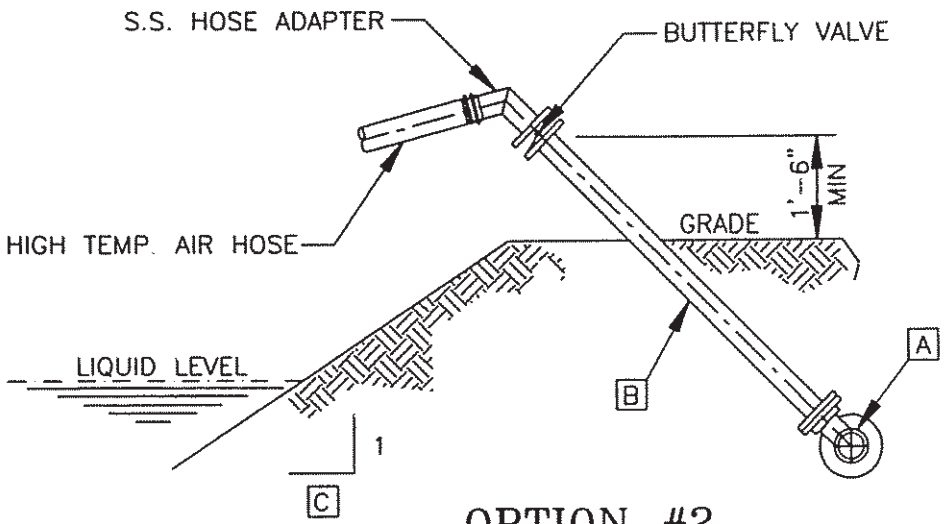


OPTION #1

ITEM	DESCRIPTION	DIM
A	AIR HEADER DIAMETER	
B	AIR FEED PIPE DIAMETER	
C	WALL SLOPE	



OPTION #2

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
TYPICAL MOVING AERATION CHAIN CONNECTION

Drawn By	Checked By	Approved By	Micro Rev.	CAD No.	Loc. status
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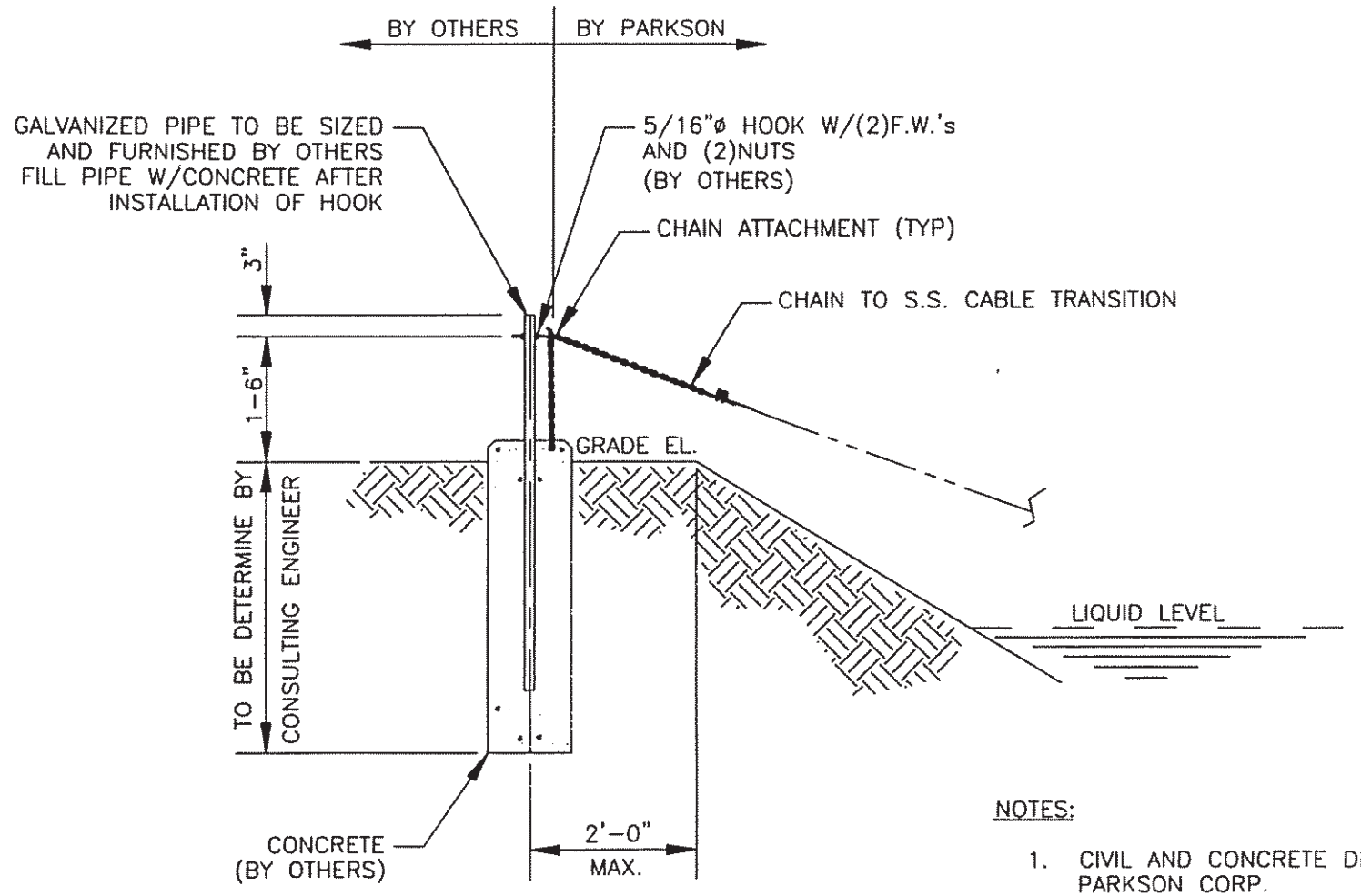
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD ini scale 32
Location			Dwg. No SD-6		Rev A



NOTES:

1. CIVIL AND CONCRETE DESIGN NOT BY PARKSON CORP.
2. PRELIMINARY DWG., NOT FOR CONSTRUCTION.

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
ANCHOR POST W/HOOK DETAIL

Drawn By	Checked By	Approved By	Micro Rev.	CAD No	Loc. status
G.C.				SD7	LS
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD int scale 24
Location			Dwg No. SD-7		Rev A

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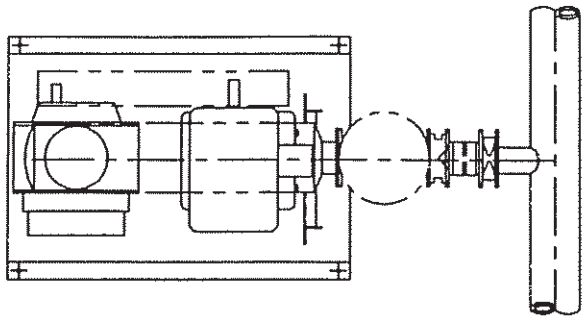
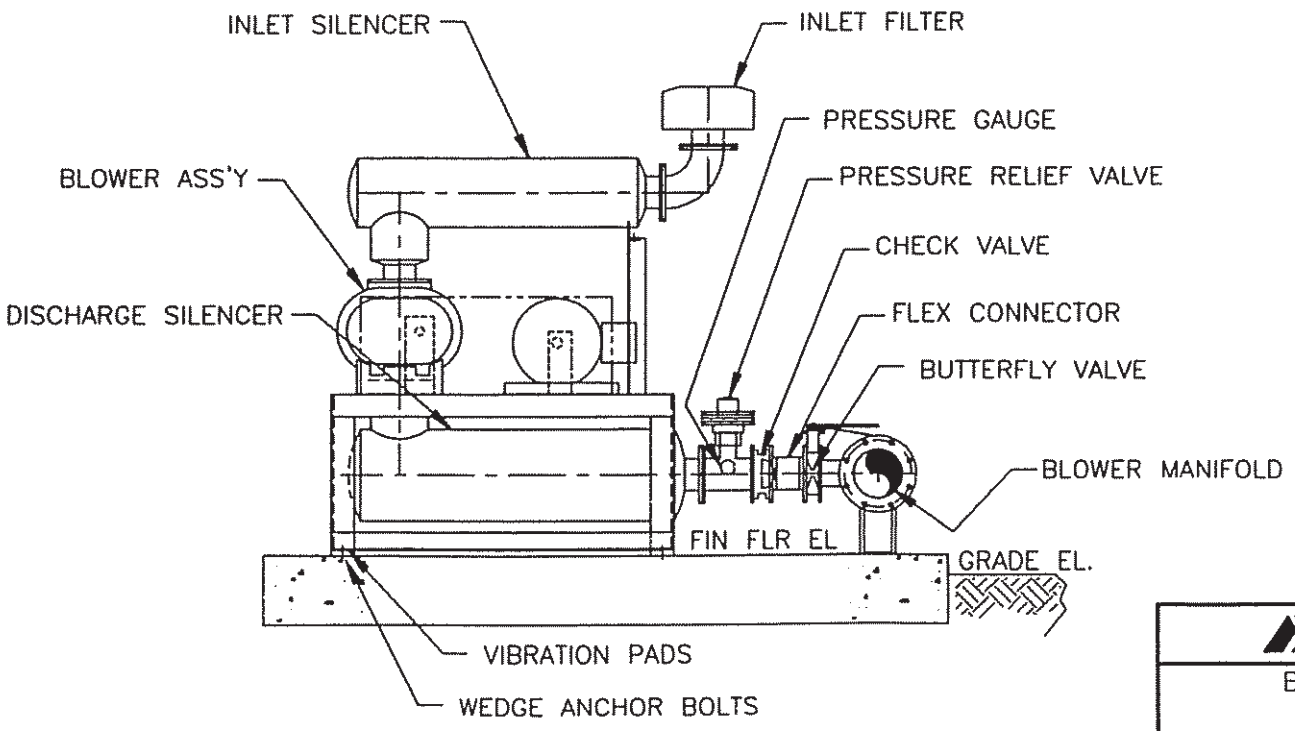


PLAN



ELEVATION

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
POSITIVE DISPLACEMENT
AERATION BLOWER ASS'Y

Drawn By	Checked By	Approved By	Micro Rev.	CAD No.	Loc. status
G.C.				SD8	
Date 2/1/96	Date	Date	Date	DWG Scale NONE	CAD int scale .32
Location			Dwg. No. SD-8		Rev A

Chrono

STATE OF COLORADO

Bill Owens, Governor
Jane E. Norton, Executive Director
Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80246-1530
Phone (303) 692-2000
Located in Glendale, Colorado

Laboratory and Radiation Services Division
8100 Lowry Blvd.
Denver CO 80220-6928
(303) 692-3090

http://www.cdphe.state.co.us

Colorado Department
of Public Health
and Environment

June 4, 1999

Barbara Cohen, Mayor
Town of Ridgway
P.O. Box 10
Ridgway CO 81432

RE: Site Application #4433
Ouray County

Dear Mayor Cohen:

The Water Quality Control Division has reviewed and evaluated your site application and supporting documentation to expand the existing wastewater treatment facility in the NW1/4, NW1/4, Section 16, Township 45N, Range 8W, Ouray County to serve the Town of Ridgway, and to discharge to an unnamed tributary of the Uncompahgre River.

We find your application to be in conformance with the Water Quality Control Commission's "Regulations for Site Applications for Domestic Wastewater Treatment Works". The Division has also reviewed the construction plans and specifications for the proposed expansion and finds the design to be consistent with the Division's general design guidance. Therefore, the site application and construction plans and specifications are approved with the following conditions listed below.

1. Based upon application information, the system design will be for:
Hydraulic Design Capacity - 0.194 MGD
Organic Design Capacity - 400 lbs BOD_5/Day
Treatment Processes to be used - Three cell aerated lagoon, first cell complete mix, third cell includes a polishing pond zone created by a baffle, chlorine disinfection.

2. Preliminary Effluent Parameter Values:

BOD_5 (mg/l)	30/45 (30-day average/7-day average)
BOD_5 (% removal)	85%
TSS (mg/l)	75/110 (30-day average/7-day average)
TSS (% removal)	85%
pH (std units)	6.5 - 9.0 (minimum - maximum)
Fecal Coliform (org/100 ml)	6,000/12,000 (30-day/7-day geometric mean)

Total Residual Chlorine (mg/l)	0.5 (daily maximum)
Oil and Grease	10 (daily maximum)

Design for values in excess of those contained above or failure to comply with any other conditions contained herein will render this approval void and another site application will have to be processed.

3. This site approval will expire one year from the date of this letter if the construction of the project has not commenced by that date. If expiration occurs, you must apply for a new site approval. Construction is defined as entering into a contract for the erection or physical placement of materials, equipment, piping, earthwork, or building which are to be a part of a domestic wastewater treatment works.

4. All construction change orders initiating variances from the approved plans and specifications must be approved by the Division.

5. The applicant's registered engineer must furnish a statement prior to the commencement of operation stating that the facilities were constructed in conformance with approved plans, specifications, and change orders.

In accordance with Colorado Water Quality Control Commission regulations, this approval is subject to appeal as stated under Section 22.8(7) of "Regulation No. 22, Regulations for the Site Application Process," effective April 30, 1998.

This approval does not relieve the owner from compliance with all county regulations prior to construction nor from responsibility for proper engineering, construction, and operation of the facility.

Sincerely,

David Akers

for J. David Holm
Director
Water Quality Control Division

JDH:MJH

cc: Joanne Fagan, P.E., Consolidated Consulting Services
Ouray County Sanitarian
Thomas Bennett, WQCD
Mike Havens, WQCD - Grand Junction
Dave Akers, WQCD, Acting Permits Unit Manager
Peggy Galligan, Financial Assistance, WQCD - Grand Junction
Dan Beley, Lower Colorado Watershed Coordinator

<table>
<tr><td rowspan="3">WATER QUALITY CONTROL DIVISION

IMPLEMENTATION POLICY

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT</td><td>Implementation Policy Number: CW 8</td></tr>
<tr><td>Statutory or Regulatory Citations:
Regulation No. 31 The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31)

Regulation No. 85 Nutrients Management Control Regulation (5 CCR 1002-85)</td></tr>
<tr><td>Key Words: nutrient management plan, water quality standards, discharger specific variance, nonpoint source, total maximum daily load</td></tr>
<tr><td rowspan="4">COLORADO NUTRIENT MANAGEMENT PLAN AND 10-YEAR WATER QUALITY ROADMAP</td><td>Approved by:
 
Nicole Rowan, Clean Water Program Manager</td></tr>
<tr><td>Drafted by: Blake Beyea, Ellen Howard-Kutzer, Bret Icenogle, Aimee Konowal, Kristy Richardson, and Nicole Rowan</td></tr>
<tr><td>Effective Date: September 30, 2018</td></tr>
<tr><td>Scheduled Review Date: March 31, 2018</td></tr>
</table>

Background

As part of the 2017 nutrients rulemaking hearing, the Water Quality Control Division developed a recommended plan for managing nutrients and a plan for developing recommendations for new and updated water quality standards between 2017 and 2027. These plans received support from the 2017 nutrients work group and the Water Quality Control Commission.

Purpose

This policy should be used to guide efforts to reduce point and nonpoint sources of nutrients, develop information that will be used to recommend new and updated water quality standards, and guide the implementation of new water quality standards discussed in this policy.

Authority

This policy applies to the division's clean water program staff as they implement the nutrients management plan and 10-year water quality roadmap. It also applies to and provides the regulated community and those parties who are interested in pursuing nonpoint source reductions an understanding of the key milestones for developing water quality standards over the next 10 years and how standards developed within the planning horizon will be implemented.

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1. Policy Introduction

This policy details the Water Quality Control Division's (division) recommended Colorado Nutrient Management Plan and 10-Year Water Quality Roadmap. This plan and roadmap were developed as part of the nutrients work group effort in 2016-2017. The plan:

- Provides an overview of Colorado's current nutrient management framework
- Discusses plans for further reducing nutrients from point source and nonpoint sources
- Outlines the major milestones the division, Water Quality Control Commission, and stakeholders will need to undertake over the next 10 years to implement the plan
- Provides an overview of how Colorado will continue to make progress on revising nutrient standards
- Summarizes other standards development efforts through 2027
- Details plans for developing feasibility information over the next 10 years
- Establishes how the division will monitor and measure progress related to nutrients controls

This plan was modeled after the 2011 memo from the Environmental Protection Agency's (EPA) Nancy Stoner titled "Working in Partnership with States to Address Phosphorus and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions" and EPA's 2016 memo from Joel Beauvais titled "Renewed Call to Action to Reduce Nutrient Pollution and Support for Incremental Actions to Protect Water Quality and Public Health".

2. Overview of Colorado's Current Nutrient Management Framework

Nitrogen and phosphorus are nutrients that are a part of all aquatic ecosystems and are necessary to support the growth of the algae and aquatic plants that provide food and habitat for fish and smaller aquatic organisms. However, excess nitrogen and phosphorus, or nutrient pollution, can cause water quality problems that result in serious risks to human and animal health and damage to the economy. Too much nitrogen and phosphorus in the water causes algae to grow faster than ecosystems can handle. Large growths of algae are called algal blooms. Some algal blooms are harmful to humans because they produce elevated toxins and bacterial growth that can make people sick if they come into contact with polluted water, consume tainted fish or shellfish, or drink contaminated water. Algal blooms can severely reduce or eliminate oxygen in the water, leading to illnesses in fish and other aquatic life and the death of large numbers of fish.

In June 2012, the commission adopted nutrients regulatory provisions composed of two major components:

1. A new nutrients management control regulation establishing technology-based treatment requirements for many domestic and some industrial wastewater dischargers, enhanced nutrients control requirements for stormwater dischargers, provisions encouraging voluntary controls of nonpoint sources, and monitoring requirements to develop better information to refine Colorado's nutrients management efforts over time. This control regulation is called Regulation #85.

2. Scientifically-based numerical values for nutrients at levels to protect classified uses of Colorado waters. Initially these standards are to be applied only to streams and lakes above dischargers and to protect municipal water supplies taken directly from lakes or reservoirs. Section 31.17 of Regulation #31 contains the numerical values.

2.1. Regulation #85

Regulation #85 contains a number of requirements. It includes provisions that:

- Establish technology-based treatment requirements for large domestic and some industrial wastewater dischargers
- Establish enhanced nutrients control requirements for stormwater dischargers
- Encourage voluntary controls of nonpoint sources
- Establish monitoring requirements to develop better information to refine Colorado's nutrients management efforts over time

Regulation #85 requires certain large wastewater treatment facilities to meet effluent limits for phosphorus and nitrogen based on levels determined to be achievable with available technology. It focuses control requirements on the major sources of nutrient pollution in Colorado and includes provisions to fine-tune application of the new treatment requirements. For example, there are exceptions for small facilities, delays for medium facilities, and exclusions for facilities in disadvantaged communities and facilities that have minimal impacts. Regulation #85 contains a voluntary approach for agriculture and other nonpoint sources, with the potential for additional regulatory requirements after 2022. It also includes monitoring requirements that will develop better information for future nutrients management decision making.

Regulation #85 effluent limits (shown in the following table) only apply to Colorado's largest domestic wastewater dischargers and some industrial dischargers until 2027. This includes domestic facilities that have a design capacity of over two million gallons per day (MGD) and that are located in a high priority watershed. High priority watersheds are those areas with a high ratio of treated wastewater

flow per square mile, which encompasses the highly urbanized areas in the Front Range and the most urbanized areas of the west slope. As of October 2017, approximately 47 domestic wastewater treatment facilities in Colorado meet both of those criteria. There are significant environmental benefits derived from this framework since the majority of the domestic wastewater flow comes from the larger facilities. The effluent limits in Regulation #85 do not apply to domestic wastewater facilities with a design flow of less than or equal to one MGD or facilities owned by a disadvantaged community.

Regulation #85 nutrient effluent limits (for facilities over 2.0 MGD in high priority watersheds)		
Parameter	**Annual Median[1]**	**95th Percentile[2]**
Total Phosphorus	1.0 mg/L	2.5 mg/L
Total Inorganic Nitrogen[3] as N	15 mg/L	20 mg/L
[1]Running annual median of all samples taken in the most recent 12 calendar months. [2]The 95th percentile of all samples taken in the most recent 12 calendar months. [3]Determined as the sum of nitrate as N, nitrite as N, and ammonia as N.		

Regulation #85 requires all domestic wastewater treatment facilities to monitor nutrient concentrations in their effluent. Facilities with a design flow greater than one MGD that are not located in an economically disadvantaged community are also required to conduct instream nutrient monitoring above and below their effluent discharge. The receiving water monitoring requirements apply to approximately 100 domestic facilities.

2.2. Section 31.17 of Regulation #31

In 2012, Regulation #31(the Basic Standards and Methodologies for Surface Waters) was revised to include interim numerical values for phosphorus, nitrogen, and chlorophyll *a* for rivers, stream, lakes and reservoirs as summarized in the following table. The numerical values are based on the maximum amounts of each pollutant that can be present in water and still protect the classified use.

Interim numeric values for total phosphorus, total nitrogen, and chlorophyll *a*					
Parameter	**Rivers and Streams**		**Lakes and Reservoirs**		
	Cold	Warm	Cold	Warm	Direct Use Water Supply
Total Phosphorus	110 ug/L[(1)]	170 ug/L[(1)]	25 ug/L[(2)]	83 ug/L[(2)]	not applicable
Total Nitrogen	1,250 ug/L[(1)]	2,010 ug/L[(1)]	426 ug/L[(2)]	910 ug/L[(2)]	not applicable
Chlorophyll *a*	150 mg/m^2 [(3)]	150 mg/m^2 [(3)]	8 ug/L[(4)]	20 ug/L[(4)]	5 ug/L[(5)]

[(1)]Annual median, allowable exceedance frequency 1-in-5 years
[(2)]Summer (July 1 – September 30) average in the mixed layer of lakes (median of multiple depths), allowable exceedance frequency 1-in-5 years
[(3)]Summer (July 1 – September 30) maximum attached algae, not to exceed.
[(4)]Summer (July 1 – September 30) average chlorophyll *a* in the mixed layer of lakes (median of multiple depths), allowable frequency 1-in-5-years.
[(5)]March 1-November 30 average chlorophyll *a* in the mixed layer of lakes (median of multiple depths), allowable frequency 1-in-5 years.

These numerical values were intended to be adopted as standards for individual water bodies in phases. Adoption of standards during the first phase was intended to protect waters upstream of current dischargers and protect direct use water supply (DUWS) reservoirs. During the first phase, the commission considered adopting standards for phosphorus or chlorophyll *a* to protect aquatic life, recreation, and water supply uses only in the following specific circumstances:

- In headwaters upstream of existing dischargers
- In DUWS Lakes and Reservoirs where this type of protection is determined to be appropriate (chlorophyll *a* only)
- Under other circumstances where the commission determined Regulation #85 will not provide sufficient control of nutrients

During Phase 2 (2017-2027), in addition to considering the adoption of phosphorus or chlorophyll *a* standards as described above, the commission adopted a voluntary incentive program to encourage dischargers to reduce phosphorus and nitrogen concentrations in their effluent below the Regulation #85 effluent limits. Starting in 2027, the commission plans to consider adopting numerical water quality standards for phosphorus and nitrogen for all Colorado surface waters.

2.3. Summary of EPA's action on 2012 regulatory package

In July 2016, EPA provided an action letter on revisions to Regulation #31 regarding nutrients. As part of the action, EPA approved the following provisions in Regulation #31:

- Critical low flows - 31.9(1)(c)
- DUWS sub-classification - 31.13(1)(d)(i)
- Chlorophyll *a* interim values for streams/rivers, lakes/reservoirs, and DUWS sub-classification - 31.17(d)
- Site-specific flexibility - 31.17 (h)

EPA also approved with recommendations the total phosphorus and total nitrogen interim values for lakes/reservoirs - 31.17(b), (c). EPA took no action on the total phosphorus and total nitrogen interim values for rivers/streams - 31.17(b), (c).

3. Reducing Point Sources of Nutrient Pollution

As discussed previously, Colorado has implemented a phased approach to nutrient reduction. From 2017-2027, all domestic and industrial wastewater facilities in Colorado are eligible to participate in the incentive program that should result in further nutrient reductions. After 2027, the division will utilize the traditional approach of developing water quality-based effluent limits based on revised nutrient criteria in Regulation #31.

4. Reducing Nonpoint Sources of Nutrient Pollution

Over the next 10 years, the division will continue to work with its partners to implement the voluntary nonpoint source provisions of Regulation #85. The division will collaborate with the agricultural community to implement best management practices, work with partners to implement public information and education programs focused on nonpoint source pollution prevention and restoration activities, collaborate on the development and implementation of nonpoint source management programs, evaluate trading proposals, and prepare for the 2020 Regulation #85 triennial review. These actions are summarized below.

Collaborate with the agricultural community to implement best management practices

- Pursue Colorado Water Resources and Power Development Authority funds to support implementation of nutrient best management practices
- Develop a strategy for use of Clean Water Act Section 319 nonpoint source funding to support implementation of best management practices in the absence of nutrient impairment listings
- Explore additional incentives such as certification programs that will encourage nutrient reduction activities by offering certainty that over a specified timeframe, such activities will continue to be voluntary rather than mandated
- Promote implementation of watershed-based or Total Maximum Daily Load (TMDL) alternative approach plans through use of funding and other incentives
- Prioritize projects that address the connection between nitrate and the mobilization of selenium
- Increase partnerships in the Lower Arkansas River Basin to maximize reduction of nonpoint sources of nutrients and selenium through best management practices
- Transfer lessons learned and utilize partnerships developed in the Lower Arkansas River Basin to solicit partnerships and nutrient best management practices in other areas of the state

Work with partners to implement public information and education programs focused on nonpoint source pollution prevention and restoration activities

- Utilize peer-to-peer information-sharing for dissemination of lessons learned from producer-implemented best management practices
- Promote effective messaging about nutrients and water quality from community leaders and early reducers
- Incorporate public information and education activities in all best management practices implementation projects
- Maximize partnership with the Colorado Department of Agriculture and Colorado State University to produce and effectively share information about nutrients and water quality

- Expand coordination and collaboration at all organizational and landscape scales (from federal partners to conservation districts and local growers, and from basin scale to watershed and field scales)
- Continue dialogue with the agricultural community in order to tell their stories of success and progress in preparation for the 2020 Regulation #85 triennial review
- Investigate opportunities to partner with municipalities outside of urbanized area boundaries to develop and implement nonpoint source nutrient reduction information and education programs
- Identify effective approaches for nutrient information and education programs through follow-up to the water quality public perception survey and focus groups projects

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Collaborate on the development and implementation of nonpoint source monitoring programs

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- Finalize nutrient and selenium data collection and best management practices effectiveness evaluation for an over 2,000 acre demonstration project in the Lower Arkansas River Basin
- Continue to require effectiveness monitoring for projects implementing nutrient best management practices
- Pursue Natural Resource Conservation Service and other funding for edge-of-field monitoring to evaluate effectiveness of best management practices at a field or project scale
- Continue to compile effectiveness information about nutrient best management practices such as reduced nitrogen application, improved irrigation systems, development of buffer strips and use of cover crops
- Incorporate best management practices effectiveness discussions into information and education activities
- Collaborate with partners to identify through monitoring or modeling priority nonpoint sources of nutrients for control
- Utilize and expand planning, prioritization, analysis and tracking tools such as the Nutrient Dashboard and Environmental Risk Assessment and Management System (eRAMS) Watershed Rapid Assessment Program

- Investigate opportunities to capitalize on selenium modeling in support of TMDL alternative approach planning and implementation to identify reasonable progress goals for nutrients reduction in the Lower Arkansas River Basin

Nonpoint source to point source trading

- Evaluate nonpoint source to point source nutrient trading proposals

2020 Triennial Review Hearing

- The next triennial review for Regulation #85 will occur in 2020. At that time, the division in collaboration with its partners will make recommendations regarding the effectiveness of the nonpoint source controls as identified in the regulation

5. Overview of 10-Year Water Quality Roadmap

Phase I of nutrients implementation (2012-2017) has been completed. Phosphorus and chlorophyll *a* standards have been applied throughout all basins as appropriate, and DUWS waters have been classified. The division is committed to continuing to make progress to develop and refine appropriate and protective nutrient criteria for Colorado and achieve additional nutrient reductions. In 2022, the division intends to propose adoption of the chlorophyll *a* standards for all state waters, revise standards for phosphorus and nitrogen for lakes and reservoirs (but to limit application to prioritized water bodies), and to consider nonpoint source controls. The division plans to propose revised standards for phosphorus and nitrogen for rivers and streams in 2027, along with standards for ammonia and selenium. At the same time, the division will develop tools to evaluate feasibility of treatment for all three parameters. Because this will require significant resources from the division as well as stakeholders leading up to 2027, the regular basic standards rulemaking hearings in 2021 and 2026 will be limited in scope. For nutrients, between 2017-2027, there will be a voluntary incentive program designed to encourage point source dischargers to voluntarily reduce their nutrient contributions.

The division has developed this 10-year water quality roadmap to continue to make progress on criteria development and memorialize Colorado's plan for continuing to make incremental progress on reducing nutrients. The success of this roadmap relies on a robust stakeholder process.

In the past, criteria development was prioritized by the division to occur within five years after EPA adopted new 304(a) criteria or disapproved standards. Past practice would have dictated that the division would plan to propose revisions to Colorado's selenium and ammonia standards in 2021, due

to new 304(a) criteria. This roadmap is a deviation from past practice. This longer planning horizon recognizes the need to address complex criteria development with adequate time. Through this 10-year water quality roadmap, rather than holding a major rulemaking hearing for Regulation #31 to consider new 304(a) criteria or disapproved standards every five years, Colorado will instead follow a new approach where rulemakings for new or revised water quality criteria will be scheduled separate from the basic standards (Regulation #31) triennial reviews. Regulation #31 triennial reviews will instead be focused on housekeeping items.

A key consideration in this draft roadmap is the division's understanding from stakeholders about the complexity of treatment if the commission adopts revised ammonia criteria, revised selenium criteria, and revised nutrient criteria. Thus, the division is proposing to hold a rulemaking for ammonia, selenium and nutrients in 2027, allowing time for in-depth discussions to occur amongst stakeholders and the regulatory agencies concerning the criteria and its eventual implementation.

The division is committed to an extensive stakeholder processes leading up to these rulemakings. Overall this will involve quarterly workgroup meetings for 10 years to serve as a guide for the criteria development efforts. These quarterly meetings will ensure that planning and communication is a key part to the path forward. It is anticipated that many efforts will require smaller, focused groups to draft criteria proposals, policy documents and the implementation framework. These smaller group efforts are included below in the 2017-2027 roadmap plan.

In addition to meetings, the division will provide communications through the water quality roadmap email distribution list and the division's website. Below is an overview of the major steps in the process. Sections VI and VII provide a more robust explanation of the steps outlined below.

2017-2027 outreach efforts

- Quarterly workgroup meetings from spring 2018-2027 to keep stakeholders informed
- Regular updates to the commission
- Information distributed through the water quality roadmap email distribution list

2019 rulemaking hearing to revise cadmium criteria in Regulation #31 and statewide cadmium standards in the basin Regulations #32-38

- Cadmium: EPA released new 304(a) criteria for cadmium in March 2016. The new 304(a) cadmium criteria are less stringent than the current cadmium criteria adopted statewide in Colorado. The commission adopted the new 304(a) criteria on a limited number of cold water segments in the San Juan and Gunnison river basins in the June 2017 rulemaking hearing. The division plans on making similar proposals in the basin rulemaking hearings in 2018 and 2019. As part of this effort, the division will work with parties interested in these segments leading up to the basin rulemaking hearings. In addition, the division will convene a technical advisory committee in mid to late 2018 to early 2019 to consider statewide revisions to the cadmium criteria. The number of meetings are yet to be defined but is anticipated to be minimal. The division proposes that a statewide hearing to adopt cadmium standards be held in December 2019.

2020 nutrients triennial review

- Division will request that a rulemaking hearing be scheduled for 2022 to consider:
    - the adoption of revised nitrogen and phosphorus standards for lakes and reservoirs in Regulation #31 and in lakes and reservoirs in Regulations #32 through #38 that are above dischargers, DUWS reservoirs, and lakes and reservoirs with public swim beaches
    - the adoption of chlorophyll *a* standards in Regulations #32 through #38 in all waters (rivers and streams, and lakes and reservoirs) downstream of dischargers as appropriate
- Commission to decide if nutrient controls are needed for nonpoint sources, specifically agricultural sources of nutrient pollution, or whether additional time is needed to measure reductions from existing projects. If it is determined that changes to the nonpoint source provisions in Regulation #85 are needed, these could be considered in the 2022 hearing. Leading up to the 2020 triennial review, the division will continue to work with interested parties to examine data and nonpoint source contributions to nutrients.
- Commission will determine the success of the voluntary incentive program and whether any modification to the nutrient reductions strategy is needed prior to 2027

2021 Regulation #31 Rulemaking

- Cleanup and corrections
- Arsenic: The division is waiting for EPA to release new 304(a) criteria for arsenic. Assuming that occurs by 2020, the division will convene a technical advisory committee from April 2020 through December 2020. It is anticipated that this effort will require two to three meetings. Proposed changes to Regulation #31 will be due in January 2021. The rulemaking hearing is scheduled for June 2021. This could occur earlier if the 304(a) criteria are released sooner.
- Ammonia and Selenium: Delay consideration of revised ammonia and selenium criteria to 2027
- Temperature: Small possibility of changes to temperature criteria in Regulation #31 based on work done in the temperature technical advisory committee and the basin site-specific hearings. The temperature technical advisory committee met three times in 2017 and 2018. In July 2018, the Water Quality Forum determined that the temperature technical advisory committee should continue to meet through June 2019 to advance work on a warm water fish temperature study and complete other pending work on transition zones and shoulder seasons.

2022 rulemaking hearing to (1) revise lakes and reservoirs nitrogen and phosphorus standards, (2) adopt chlorophyll *a* standards statewide, and (3) potentially adopt nonpoint source controls

- A technical advisory committee for lakes nutrient criteria will meet monthly from during 2020 and 2021. Draft criteria will be available in summer 2021
- Hold rulemaking to revise or update Regulation #31 Interim Nitrogen and Phosphorus Values for lakes and reservoirs
- Adopt revised nitrogen and phosphorus criteria for lakes and reservoirs in Regulations #32 through #38 that are upstream of permitted dischargers, for DUWS reservoirs, and where there is a public swimming beach
- Adopt chlorophyll *a* criteria in Regulations #32 through #38 in all waters (rivers and streams, and lakes and reservoirs) downstream of dischargers as appropriate

2025 nutrients triennial review

- Division will request that a rulemaking hearing be scheduled for 2027 to consider adoption of revised ammonia, selenium, and stream nitrogen and phosphorus criteria

2026 Regulation #31 Rulemaking

- Cleanup and corrections only

2027 Ammonia, Selenium and Stream Nutrient Criteria Rulemaking(s)

- Intent is to address the competing or confounding treatment challenges of ammonia, selenium, and nutrients
- Adopt criteria for nutrients, selenium, and ammonia into Regulation #31 as well as Regulations #32 through #38
- Intent would be for rulemaking package to include sector based variances, consideration of existing and new site-specific standards, or other standards tools such as resegmentation or changes in use classification
- Selenium: A technical advisory committee for selenium will be convened in 2022. Draft criteria will be available in 2024. Dischargers that anticipate challenges meeting the draft selenium criteria can explore discharger specific variance, site-specific standards, and other tools between 2024 through 2027.
- Ammonia: A technical advisory committee for ammonia will meet in 2022. The number of meetings is yet to be defined, but it is anticipated the effort will require monthly meetings for six months to a year. Draft criteria will be available in 2023. Dischargers that anticipate challenges meeting the draft ammonia criteria can explore discharger specific variance, site-specific standards, and other tools between 2023 through 2027.
- Nitrogen and phosphorus revised standards for streams and rivers: A technical advisory committee for stream nutrient standards will meet in 2024 and 2025. The number of meetings is yet to be defined, but it is anticipated the effort will require monthly meetings for at least a year. Draft criteria will be available in 2025. Dischargers that anticipate challenges meeting the draft nitrogen and/or phosphorus criteria can explore discharger specific variance, site specific standards, and other tools between 2025-2027 (or sooner).

6. Continued Progress on Developing and Implementing Nutrient Standards

There are three components to continued progress on nutrient standards: (1) total nitrogen and total phosphorus for lakes, which were approved with recommendations by EPA; (2) continued adoption of the chlorophyll *a* standard which was approved by EPA; and (3) modification of the interim numeric values for total phosphorus and total nitrogen for rivers and streams, on which EPA took no action. These three components will proceed on separate tracks, as each requires a different approach. In general, the division's process to develop or update nutrient criteria will include:

- Summarizing existing datasets and their utility for use in nutrient standards development
- Collecting data to bolster existing database and fill data gaps
- Reviewing new information and literature regarding nutrients
- Evaluating treatment alternatives and feasibility
- Developing nutrient standards that are scientifically defensible, appropriate, and protective
- Developing an implementation strategy for nutrients standards
- Conducting outreach and engaging interested stakeholders

6.1. Total nitrogen and total phosphorus for lakes

6.1.1. Approach for proposing refined standards

While the EPA has approved Colorado's nutrient criteria for lakes, it has also provided recommendations for application of these criteria and what potential revisions may be necessary for the standards to be adequately protective. In response to the recommendations, the division is developing a summary of available lake nutrients data (i.e., nitrogen, phosphorus, and chlorophyll *a*) to evaluate potential data gaps and the utility of existing data to support refinement of criteria to protect Colorado's lentic waterbodies. As necessary, additional sampling or studies will be conducted to bolster the database used in standards development. This effort will include a focus on warm lakes where environmental conditions may be more favorable to a strong algal response to nutrient pollution.

A review of recent literature will be conducted to better understand the relationships between nutrients and relevant endpoints in lakes (e.g., harmful algal blooms, algal response, recreation, aquatic life and disinfection byproducts) and what approaches in developing standards have been taken by other regulatory agencies. The division will engage stakeholders in the standards development process and timely communicate related progress.

The division will continue to work with EPA to understand its concerns and recommendations regarding nutrient standards for lakes, including variable algal response to nutrient pollution. At the 2020 triennial review for nutrient regulations, the division plans to recommend that the commission schedule a rulemaking hearing for 2022 to consider revisions to Regulation #31 to revise the lakes and

reservoir nutrient standards. By mid-2021, the division plans to have developed draft revisions to the lake and reservoir phosphorus and nitrogen criteria for consideration as part of a statewide rulemaking hearing in 2022. Also as part of the rulemaking hearing in 2022, the division plans to propose application of the revised criteria for lakes and reservoirs above dischargers, DUWS reservoirs and lakes, and lakes and reservoirs with public swimming beaches that meet the definition of natural swimming areas in C.R.S. § 25-5-801. The division plans to propose application of nitrogen and phosphorus criteria for the remaining lakes in 2027.

6.1.2. Standards implementation through 2027

During the first phase, the commission proceeded with a strategy to adopt standards for total phosphorus for lakes and reservoirs that are greater than 25 acres, and that are above a qualified discharger as noted in the basin regulations. This phase has been completed and total phosphorus standards have been adopted statewide in Regulations ##32 through 38. Nitrogen standards have not yet been adopted. As noted above, the plan is that in 2022, phosphorus and nitrogen standards for lakes will be revised in Regulation #31 and also adopted in the basins above dischargers, in DUWS reservoirs, and in lakes and reservoirs with public swimming beaches.

Currently the 2018 303(d) Listing Methodology defines assessment methods for lakes and reservoirs. For reservoirs where either total nitrogen or total phosphorus standards are adopted, the division will assess the average of available summer data (July 1-September 30) in the mixed layer. A lake or reservoir is determined to be impaired if the summer average exceeds the standards using three or more representative samples from that summer. If the summer average of the data exceeds the standard more than once in five years, the commission may add that lake or reservoir to the 303(d) List of Impaired Waters. The 303(d) Listing Methodology is updated every two years. It is anticipated that these methods will be reevaluated through discussions during the 303(d) Listing Methodology workgroup meetings.

Once a segment is listed on the 303(d) List of Impaired Waters, a TMDL may be developed for that waterbody. TMDL development priorities are reexamined periodically. If a listed segment for total nitrogen or total phosphorus is prioritized, a TMDL will be developed to identify the point source and nonpoint source loading to the impaired waterbody. Once the TMDL is approved by EPA, point source allocations in the TMDL must be translated into permit effluent limitations as applicable permits are renewed.

6.2. Chlorophyll *a*

6.2.1. Approach for proposing standards

While it is not expected that the existing interim chlorophyll *a* values to protect DUWS or recreation in streams will be revised prior to 2022, the division will review the information upon which these values were based, and may propose revisions to the standards if new or updated information makes

it necessary. The division will propose chlorophyll *a* standards for all waters (streams and rivers as well as lakes and reservoirs), as appropriate, as part of a statewide rulemaking hearing in 2022.

For lakes and reservoirs, the division plans to propose chlorophyll *a* standards for all previously classified DUWS waters. For DUWS waters downstream of qualified dischargers, the division will propose the DUWS use sub-classification and chlorophyll *a* standards to protect that use. The division will continue to be consistent with past implementation for the remaining lakes and propose chlorophyll *a* standards below dischargers in lakes that are larger than 25 acres in size and have a residence time of at least fourteen days, and for stream segments with a classified recreation use.

6.2.2. Standards implementation through 2027

During the first phase, the commission has proceeded with a strategy to adopt standards for chlorophyll *a* for lakes and reservoirs that are greater than 25 acres as well as for streams located upstream of all qualified dischargers as noted in the basin regulations. In addition, the DUWS use subcategory has been adopted where lakes meet the class description; however, the sub-category numeric values have not been applied. This phase has been completed and standards have been adopted statewide in Regulations #32 through #38. As described above, in 2022, the division plans to propose the adoption of chlorophyll *a* standards statewide as appropriate for all remaining segments in Regulations #32 through #38. The chlorophyll *a* standard would not be implemented directly into permit limits. If a waterbody is assessed and determined to be impaired using the chlorophyll *a* standard, a TMDL must be written first to determine if reductions in nutrient loading from point sources are required to bring the segment back in attainment of the chlorophyll *a* standard.

For streams where chlorophyll *a* standards are adopted, the division will assess the summer time maximum (July 1-September 30). Only one sample is required for assessment, and the allowable exceedance frequency is once in five years. For the reservoirs where chlorophyll *a* standards are adopted, the division will assess the average of the available summer data (July 1-September 30). A lake or reservoir is determined to be impaired if the summer average exceeds the standards using three or more representative samples from that summer. For lakes and reservoirs designated as DUWS, a minimum of five representative samples in a season is required for the assessments of chlorophyll *a* for that year. For lakes and reservoirs designated as DUWS, chlorophyll *a* must be collected from March 1 through November 20.

If the average of the data exceeds the standard more than once in five years, the commission may add that waterbody to the 303(d) List of Impaired Waters. The 303(d) Listing Methodology is updated every two years. It is anticipated that these methods will be reevaluated through discussions during the 303(d) Listing Methodology work group meetings. Sandy bottom streams have been identified as one area for which to further explore the assessment methods.

Once a segment is listed on the 303(d) List of Impaired Waters, a TMDL may be developed for that waterbody. TMDL development priorities are reexamined periodically. If a listed segment for

chlorophyll *a* is prioritized, a TMDL will be developed to identify the point source and nonpoint source loading to the impaired waterbody. Once the TMDL is approved by EPA, point source allocations in TMDLs must be translated into permit effluent limitations as applicable permits are renewed.

6.3. Total nitrogen and total phosphorus for streams

6.3.1. Approach for proposing refined standards

The interim numeric nutrient values in Regulation #31 for rivers and streams were developed for protection of the aquatic life use. These values were based on a stressor response relationship derived from the response of the macroinvertebrate community to nutrient concentrations. However, the development of nutrient criteria for streams using algal community endpoints has become increasingly common, and a multi-assemblage approach has been encouraged by EPA (e.g., algae, benthic macroinvertebrates, and fish). This algal assemblage approach would include developing a relationship between nitrogen and phosphorus concentrations and the response of the algal community using quantifiable and relevant ecological endpoints such as diversity, abundance and biomass.

To begin evaluating suitable methods for refinement of its nutrient values, a summary of the division's algal community data for streams (i.e., algal ID, chlorophyll *a*, ash-free dry mass) has been developed to evaluate potential data gaps and the utility of existing data to support refinement of criteria to protect Colorado's lotic waterbodies. Work is also ongoing to identify studies that may need to be conducted or additional sampling that may be necessary to supplement the division's routine sampling efforts and bolster the database used for standards development. Future efforts may include: additional characterization of nutrient conditions across stream types and disturbance intensities, analysis of detailed algal community characteristics and responses, development of a conceptual model of nutrient-periphyton-classified use interactions, evaluation of additional parameters (e.g.., pH and dissolved oxygen) that affect the aquatic life community, and development of biological indices that are responsive to nutrients and may help identify protective use-based thresholds.

A review of recent literature will be conducted to better understand the relationships between nutrients and relevant endpoints in streams (e.g., algal community response, impacts on aquatic life) and what standards approaches have been taken by other regulatory agencies. The division will engage stakeholders in the standards development process and timely communicate related progress.

The division will continue to work with EPA to understand its concerns regarding nutrient thresholds for streams, and to evaluate appropriate and relevant endpoints to protect the classified uses. The division plans to have draft revised rivers and streams phosphorus and nitrogen criteria for rivers and streams developed by fall 2025 for consideration as part of a statewide rulemaking hearing in 2027.

6.3.2. Standards implementation through 2027

During the first phase, the commission has proceeded with a strategy to adopt standards for total phosphorus in streams in waters located upstream of all qualified dischargers as identified in the basin regulations. Nitrogen standards have not yet been adopted. In 2027, total nitrogen and total phosphorus standards will be considered by the commission for individual segments where total phosphorus and total nitrogen standards have not yet been adopted. Once numeric standards are in place, the division will develop water quality based effluent limits based on the standards.

7. Other Water Quality Standards Development through 2027

7.1. Temperature

The division continues to work with stakeholders regarding the adoption of revised temperature standards in the basin rulemaking hearings. The division will continue to participate in a statewide temperature technical advisory committee to discuss data collection, future studies and refinements to statewide standards. The division will also continue to reexamine past temperature standards decisions to determine if new and relevant information is now available to either refine the uses or standards for segments in basin rulemaking hearings. These refinements may also include changes to the timing and duration of the shoulder season to protect sensitive life stages, but also to recognize where current standards may be overly protective. Additional work regarding the realized thermal niche will also be pursued to examine where refinements can be made in segments in the transition zone. There is a small possibility that the division will propose changes to temperature criteria in Regulation #31 in the 2022 hearing based on work done in the temperature technical advisory committee and the basin site-specific hearings.

7.2. Cadmium

EPA released updated recommended 304(a) criteria for cadmium in March 2016. In 2017, the commission adopted the division's proposal to apply the updated 304(a) criteria for cadmium to a select number of cold water segments in Regulations #34 and #35. The division supports continued adoption of the updated hardness-based criteria on a targeted, site-specific basis in cold waters because they reflect the most up-to-date science and are protective of sensitive cold water aquatic life (i.e., trout). The division plans to further evaluate the criteria and consider statewide adoption of these updated criteria and Colorado-specific adjustments of these criteria during the 2019 statewide rulemaking hearing. It is anticipated that the rulemaking hearing in 2019 will be limited in scope to cadmium and other minor issues. This change to past practice recognizes the need to focus resources on the work necessary to lead up to the 2027 rulemaking hearing.

7.3. Ammonia

EPA released updated recommended 304(a) criteria for ammonia in 2013. The new ammonia criteria reflect more recent information regarding the toxicity of ammonia for new and more sensitive

species, including unionid mussels and non-pulmonate snails. The division has not recommended adopting EPA's updated ammonia criteria in past hearings, as studies are currently underway to evaluate the applicability of these new criteria for Colorado's aquatic life communities. Specifically, these studies are focusing on the historical distributions of sensitive species in Colorado. Pending the results of these studies, additional toxicity data may need to be developed for sensitive species to support protective and appropriate ammonia criteria for Colorado.

The division plans to further evaluate the updated 304(a) criteria and review the results of ongoing and future studies. In addition, in light of the challenges for wastewater treatment facilities to treat for nutrients as well as ammonia and selenium at the same time, the division plans to propose ammonia criteria as part of the rulemaking hearing in 2027.

7.4. Selenium

EPA released updated recommended 304(a) criteria for selenium in June 2016. The new selenium criterion uses a multi-parameter, tissue-based approach that is much more complex and more stringent than Colorado's current water column-based standards. The division is currently working on studies with Colorado Parks and Wildlife and Colorado State University to evaluate whether the updated criterion is appropriate for Colorado and if there are approaches to facilitate future implementation of this complex criterion in Colorado. The division has not recommended adopting EPA's updated selenium criterion in past hearings. The division plans to further evaluate the criteria and the results of ongoing and future studies. In addition, in light of the challenges for wastewater treatment facilities to treat for nutrients as well as ammonia and selenium at the same time, the division plans to propose selenium criteria as part of the rulemaking hearing in 2027.

7.5. Unscheduled water quality standards development work

Along with the issues identified in this roadmap, the division anticipates additional pressures on standards development work in the next 10 years. These pressures will have to be evaluated based on the work required to implement this roadmap and, if needed, the roadmap may have to be revised to address a significant need. The division foresees the following issues that may be considered over the next 10 years:

- Review and potential adoption of EPA's Cyanobacteria Criteria for Recreational Uses
- EPA aquatic life use criteria refinement for chloride and development for sulfate
- Development and review of discharger specific variances not associated with the roadmap

8. Feasibility information

Stakeholders have expressed difficulty with planning for and meeting uncertain implementation timeframes and standards including but not limited to ammonia, total phosphorus, total nitrogen,

temperature, and selenium. Since treatment processes for all of these pollutants are interrelated, planning for only one parameter at a time may result in more inefficiencies (i.e. capital, treatment, infrastructure, and personnel resources) than planning for all aspects at once. Alternately, addressing all parameters at once may require capital expenditures that exceed available budget capacities. The division acknowledges these challenges and is working on various plans and projects to help address as many of the issues as possible related to implementing the various standards. As part of the approach, the division intends to undertake the following:

- Update the 2010 Technologies, Performance, and Costs for Wastewater Nutrient Removal and Implementation Recommendations between now and 2027
- Consider the need for sector-based discharger specific variances (DSV) for one or multiple parameters
- Evaluate Regulation #85 data to inform future decisions
- Develop a guidance and accompanying fact sheets designed to assist systems with the evaluation of alternatives related to DSVs

This 10-year water quality roadmap allows the division and the regulated community to plan for implementation of new standards over the next 10 years. These standards include selenium, ammonia, and temperature in addition to nutrients. If a stakeholder anticipates difficulty meeting the water quality standards that are expected to be adopted in 2027, the stakeholder should work with the division to develop a site-specific standard or pursue a DSV.

The division is in the process of developing additional guidance that will assist the regulated community and the commission with making decisions regarding DSVs. This guidance will provide additional tools to the guidance already provided in the commission's Policy 13-1, Interim Guidance for Implementation of Discharger Specific Variances Provisions. Newly developed materials will include information on lessons learned, helpful approaches and fact sheets meant to assist applicants with the alternatives analysis. The division is working with four different contractors on developing technology fact sheets to support the alternatives analysis for temperature, ammonia, nitrate, and selenium. These fact sheets will provide technical and cost information on various technologies critical to the decision making process related to DSVs. It is anticipated that most of the fact sheets will be completed in 2018. Once completed the division will work on whether to include these fact sheets with the current Policy 13-1 or develop a separate guidance or tool box to complement the existing policy document. The goal is to have these documents and guidance materials available in time to be used prior to the 2027 rulemaking hearing.

The division issued *Technologies, Performance, and Costs for Wastewater Nutrient Removal and Implementation Recommendations* in November 2010 to outline the technologically reliable and feasible treatment limits for nutrients using biological nutrient removal and enhanced biological

nutrient removal technologies specifically for domestic wastewater treatment works. This document was created to inform the commission during the initial adoption of Regulation #85. While the document is still relevant, technologies, instrumentation, and operational practices continue to evolve. Between 2017 and 2027, the division intends to update the technology paper to better represent the most recent science and practices and to assist with feasibility efforts.

With a more defined and earlier roll-out of standards over the next ten years, the division expects that stakeholders will use this time to plan and implement strategies that can be implemented without delay once the standard becomes effective. Strategies may include planning for additional treatment, the development of DSVs or other standards actions including resegmentation or changes in use classifications. If action needs to be taken early, such as for a site-specific standard development, the Phase 2 delay and roadmap allow time for advanced planning.

Coordination with stakeholders on these efforts will be ongoing. The division is already developing this information. The division will seek input and report on this information on a routine basis through the quarterly work group meetings, the email distribution list for the roadmap workgroup, and the division's website.

9. Monitoring and Measuring Progress of Colorado's Nutrient Management Plan

9.1. Establish a baseline for instream nutrient concentrations

An important part of Colorado's nutrient management approach is to show continued water quality improvements as Regulation #85 and eventual changes to Regulation #31 are implemented over the next 10 years. The division will establish a baseline for nutrient concentrations across the State. Since 2014, in order to supplement the existing body of data on nutrient levels in Colorado, the division has added total phosphorus and total nitrogen to its routine panel assessed at all monitoring sites. In addition, facilities with design capacities greater than one MGD have been collecting both instream and effluent data. All of this data can be used to establish a baseline.

The division plans to develop this information in 2018-2019. The division will work with stakeholders and report on this information on an annual basis through the roadmap work group effort, at commission meetings and through the division's website.

The division has partnered with Colorado State University's Center for Comprehensive, Optimal and Effective Abatement of Nutrients to develop online tools to assess and analyze nutrients statewide. Currently, the nutrient monitoring data collected by facilities to fulfill Regulation #85 requirements are publically available for visualization, download, or analysis through the center's Environmental Risk Assessment and Management System (eRAMS). The division may employ analysis tools within eRAMS to better understand or refine baseline conditions.

9.2. Tracking progress on nutrient reductions

The division will track the following information:

- Instream nutrient concentrations compared to the baseline
- Instream nutrient trend analysis
- Impacts of nutrients on designated uses such as percent of impaired waters, number of public water systems with nitrate maximum contaminant level (MCL) violations, hazardous algal blooms, and number of facilities treating or blending in order to meet the nitrate MCL
- Nonpoint source reduction efforts
- Progress on incorporating nutrient effluent limitations in permits
- Results of the voluntary incentive program

As the division develops the methodologies for how it will track the information, the division will seek input from stakeholders. It is anticipated that the division will report on this information on an annual basis through the roadmap work group effort, at commission meetings and through the division's website.