

Technical Memorandum

Date: April 22, 2022

To: Mark Winkleman, Del Rio Springs Loan Partners, LLC

From: Duong Do, P.E., PACE
Matt Mills, E.I.T., PACE

Re: Del Rio Springs Wastewater Treatment and Disposal Option Analysis # B940

1 Project Description

1.1 Background

The Del Rio Springs Development (Development) is located within the Town of Chino Valley, Arizona encompassing 2,385 acres, consisting of single family, multi-family, commercial, and open space land use types. The development is planned to be constructed in multiple phases with two distinct development areas: Development Area 1 (West of Hwy 89) and Development Area 2 (East of Hwy 89). Development Area 1, mainly of low density lots, will consist of approximately 901 residential units, and Development Area 2, of mainly higher density lots, will consist of approximately 1,550 residential units. Currently, there are no wastewater infrastructure available within the proposed development. The location of the Development can be seen in Figure 1-1 below.

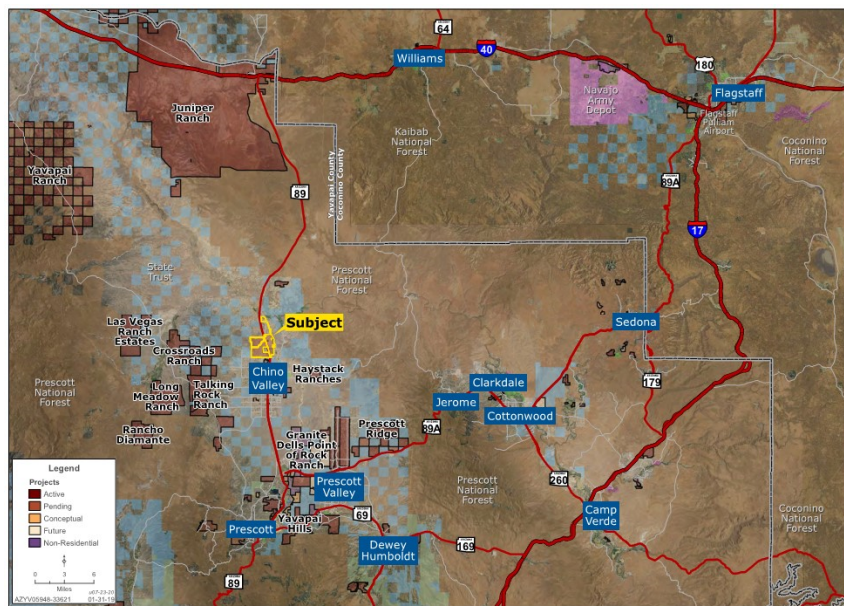


Figure 1-1: Del Rio Vicinity Map

The Town of Chino Valley, located south of the Development, collects and conveys sewage to the Chino Valley Water Reclamation Facility (CVWRF) or utilizes local septic tanks. Wastewater from the Town's collection system flows by gravity to the CVWRF influent pump station located near Granite Creek Lane and Tree Farm Lane. From the influent pump station, wastewater is pumped to the CVWRF via an 8" influent force main. The CVWRF is an activated sludge Membrane Bioreactor (MBR) facility with a design treatment capacity of 0.5 MGD with the capability to be expanded to 1 MGD. The facility produces effluent

meeting AZ Title 18 Class A+ Effluent Standards. The effluent is then discharged to rapid infiltration basins for subsurface recharge.

To accommodate the need for wastewater treatment, reuse, and disposal, the Development intends to evaluate the need to construct a new Water Reclamation Facility (WRF). This facility will be sized to accommodate mainly medium and high-density areas. Low-density areas with larger lots are anticipated to be on individual onsite septic systems. In addition, the Developer would like to evaluate conveying its wastewater to the CVWRF.

To provide the Development with the most cost effective strategy, the wastewater infrastructure requirements were analyzed based on (1) constructing a new WRF within the Development, or (2) conveying its wastewater to the CVWRF by utilizing a portion of the existing Town's existing conveyance infrastructure.

1.2 Development Location, Topography, and Geology

The Development is located north of the Town of Chino Valley with the average elevation of about 4,500-feet. The elevation decreases about 100-feet across the Development, while traveling from south to north. Figure 1-2 below shows the general topography of the development along with the Development Areas identified previously.

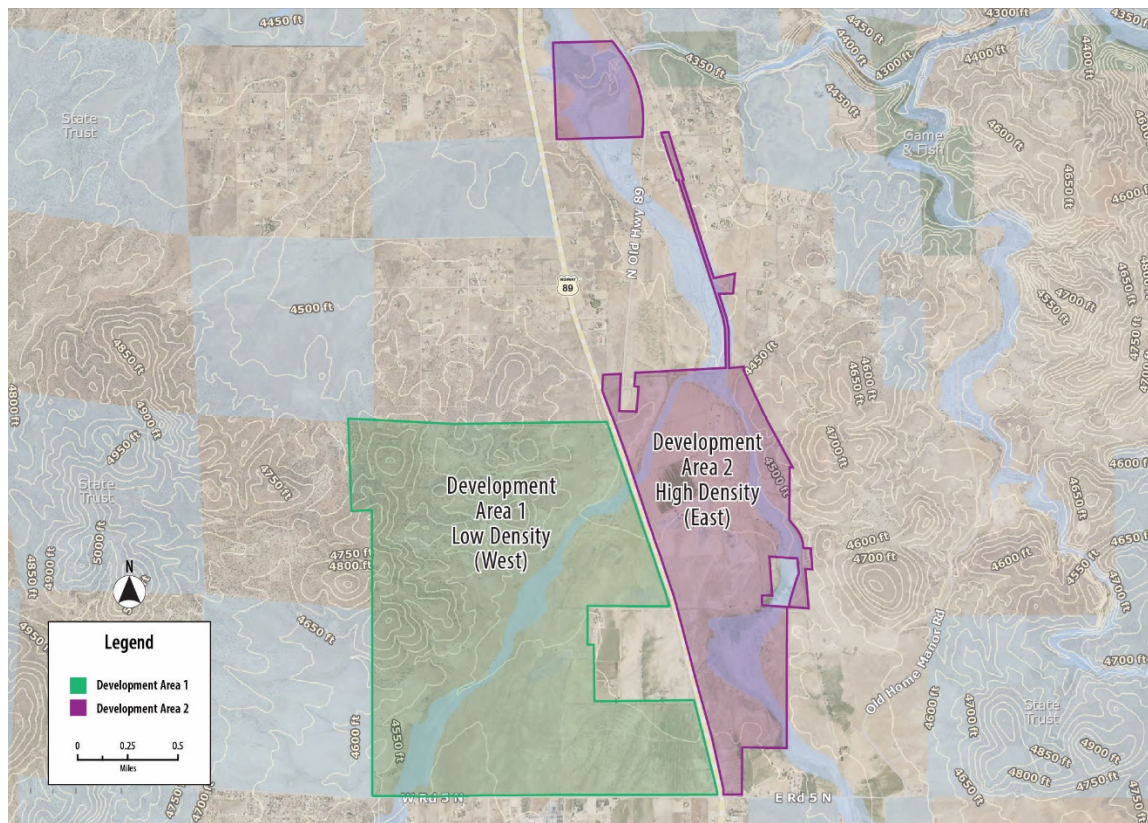


Figure 1-2: Del Rio Springs Topographical Map

1.3 Land Use and Phasing Plan

The Del Rio Springs Land Use Map provided by the Developer (see Figure 1-3) identified different land use areas within the development. In addition, the Developer proposed to phase the development starting with low density lots with minimal water and sewer infrastructure, followed by higher density and commercial developments that required heavier capital investment in water and sewer infrastructure. This phasing plan was used to preliminarily size the proposed Del Rio Springs WRF and the associated conveyance across the development. Development phasing breakdown is summarized below in Table 1-1.

DEL RIO SPRINGS, CHINO VALLEY, AZ LAND USE MAP

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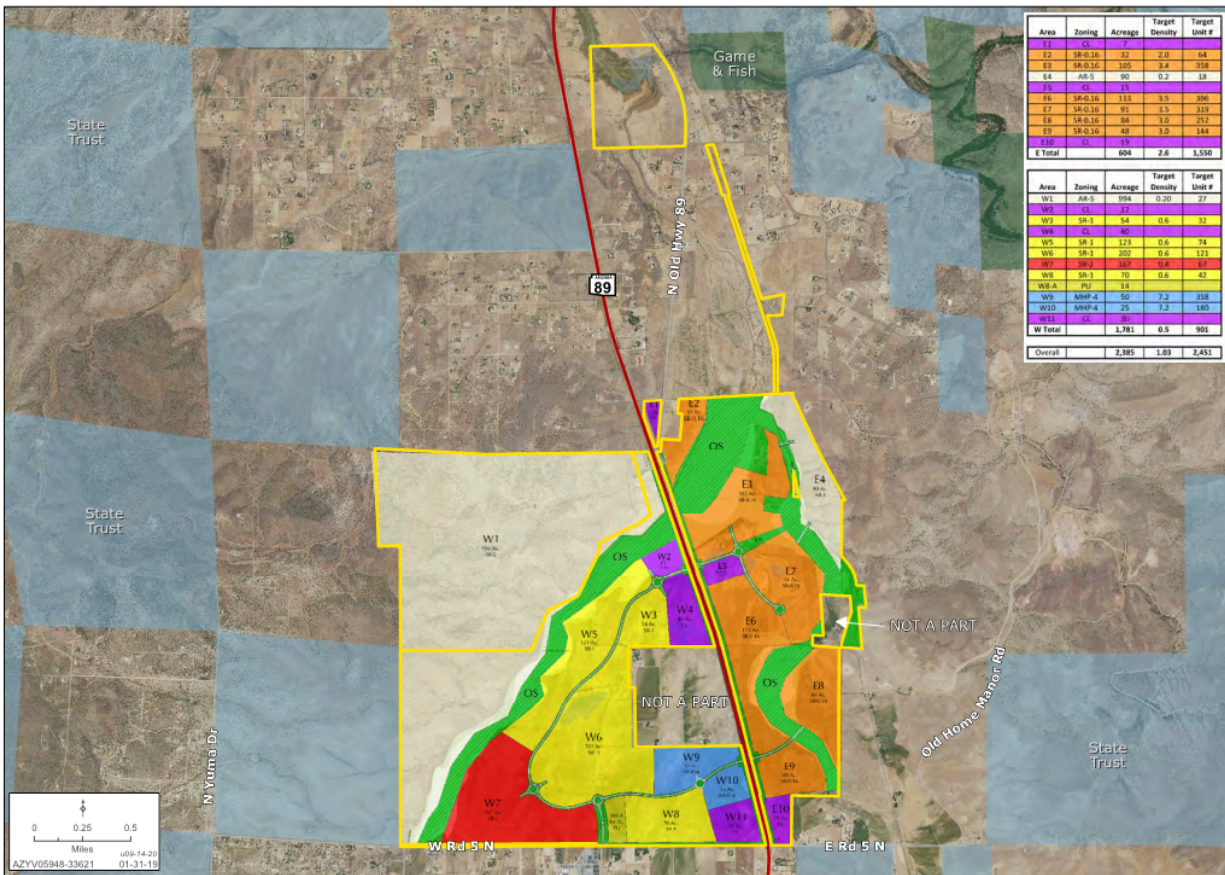


Figure 1-3: Del Rio Springs Land Use Map

Table 1-1: Development Phases and Wet Utility Requirements

Area	Land Use	Utility Requirements
Development Phase 1		
W3	1-Acre Low Density Lots	Potable Water Wells and Septic Systems
W5	1-Acre Low Density Lots	Potable Water Wells and Septic Systems
W6	1-Acre Low Density Lots	Potable Water Wells and Septic Systems
W8	1-Acre Low Density Lots	Potable Water Wells and Septic Systems
Development Phase 2		
W9	Manufactured Homes	Potable Water Distribution and Sewer Collection System
W10	Manufactured Homes	Potable Water Distribution and Sewer Collection System
E7	High Density Development	Potable Water Distribution and Sewer Collection System
E8	High Density Development	Potable Water Distribution and Sewer Collection System
E9	High Density Development	Potable Water Distribution and Sewer Collection System

E10	Commercial District	Potable Water Distribution and Sewer Collection System
Development Area 3		
E1	Commercial District	Potable Water Distribution and Sewer Collection System
E2	High Density Development	Potable Water Distribution and Sewer Collection System
E3	High Density Development	Potable Water Distribution and Sewer Collection System
E5	Commercial District	Potable Water Distribution and Sewer Collection System
E6	High Density Development	Potable Water Distribution and Sewer Collection System
W2	Commercial District	Potable Water Distribution and Sewer Collection System
W4	Commercial District	Potable Water Distribution and Sewer Collection System
W11	Commercial District	Potable Water Distribution and Sewer Collection System
Development Area 4		
W1	Ranchettes	Potable Water Wells and Septic System
W7	1-Acre Low Density Lots	Potable Water Wells and Septic System
E4	Agricultural	Potable Water Wells with a Supplementary Connection to Potable Water distribution and Septic System

Phases 1 and 4 will consist mainly of lower density, larger lots using septic systems for wastewater treatment and disposal. Phases 2 and 3 will be higher density and commercial development that will require sewer infrastructure and a wastewater treatment facility. Figure 1-4 illustrates the development phases for the Del Rio Springs Development.

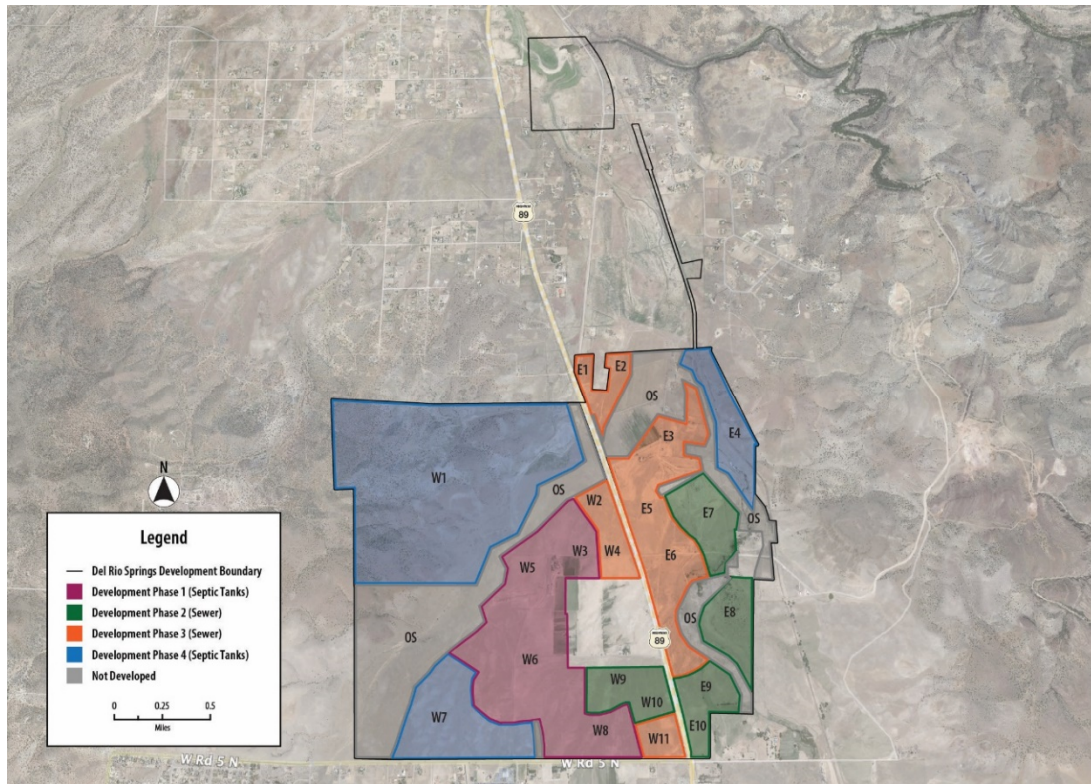


Figure 1-4: Del Rio Springs Development Phasing

2 Wastewater Generation Analysis

2.1 Wastewater Generation

To determine the wastewater generated from the Development, unit design flows were used for a sewage treatment facility under R18-9-B202(A)(9)(a) and sewage collection system under R18-9-E301(D) and R18-9-B301(K). The AAC Title 18 provides conservative design flows, which is industry standard for designing and planning for water and wastewater infrastructure. The applicable wastewater generation rates for the Development are given at 80 gallons per day (GPD) per person for a single family dwelling, 250 GPD per space for a mobile home, and 0.1 GPD per square foot of retail space for a shopping center. A typical median home size of three (3) people was used for a resulting total flow per dwelling at 240 GPD. To calculate the wastewater generated from a commercial space, half of the area was assumed to be retail space with the remaining half being used for parking, frontage, etc.

Table 2-1: Design Capacity Requirements

Design Parameter	Unit Flow
Single Family Dwelling	80 GPD per Person = 240 GPD*
Mobile Home	250 GPD
Shopping Center	0.1 GPD per ft ² of Retail Space

* Assume an average of three (3) people per Dwelling

The sewage generation design flow values provided in the AAC Title 18 do not include a peaking factor. To obtain peaking factors, the maximum daily flow and the maximum hourly flow are calculated using the following equations from the ADEQ Bulletin No. 11 Chapter IV.

- Maximum Daily Flow = 2 x Average Daily Flow
- Maximum Hourly Flow = 3 x Average Daily Flow

The development of the sewer infrastructure and wastewater treatment will be required for Development Phases 2 and 3 because of the higher density and commercial development. The wastewater generated from Development Phases 2 and 3 is summarized in Table 2-2.

Table 2-2: Wastewater Generation

Area	Zoning	Acreage	Target Density	Target Unit #	Classification	Flow/Unit	Flow/Zone
Development Phase 2 – (Interim Sewer Infrastructure Phase)							
E7	SR 0,16	91	3.5	318.5	Single-Family	240	76,440
E8	SR 0,16	84	3	252	Single-Family	240	60,480
E9	SR 0,16	48	3	144	Single-Family	240	34,560
E10	CL	19	-	-	Commercial	0.1	41,382*
W9	MHP-4	50	7.2	360	Motor Home	250	90,000
W10	MHP-4	25	7.2	180	Motor Home	250	45,000
Total		1,781	Average Daily Flow:				347,862 GPD
Maximum Daily Flow:							695,724 GPD
Peak Hourly Flow:							725 GPM
Development Phase 3 – (Build Out Sewer Infrastructure Phase)							
E1	CL	7	-	-	Commercial	0.1	15,246*
E2	SR 0,16	32	2	64	Single-Family	240	15,360
E3	SR 0,16	105	3.4	357	Single-Family	240	85,680
E4	AR-5	90	0.2	18	Agricultural	0	-
E5	CL	15	5	75	Commercial	0.1	32,670*
E6	SR 0,16	113	3.5	395.5	Single-Family	240	94,920
W2	CL	12	-	-	Commercial	0.1	26,136*
W4	CL	40	-	-	Commercial	0.1	87,120*
W11	CL	30	-	-	Commercial	0.1	65,340*
Total		604	Average Daily Flow:				422,472 GPD
Maximum Daily Flow:							844,944 GPD
Peak Hourly Flow:							880 gpm
Total Wastewater Flow at Development Build Out							
Average Daily Flow:							0.77 MGD
Maximum Daily Flow:							1.54 MGD
Peak Hourly Flow:							1,605 gpm

* Commercial Flow Calculated = $\frac{1}{2}$ of the Area Considered a "Retail Space" x 0.1 GPD per ft²

The estimated average daily wastewater flow generation for Development Phases 2 and 3 are 0.34 MGD and 0.46 MGD, respectively. Since both Development Phases generates approximately the same amount of wastewater flow, the sewer infrastructure can also be phased to match the Development phases. To differentiate Development Phases from sewer infrastructure phasing, wastewater infrastructure for Phase 2 will be referred to as the "Interim Sewer Infrastructure Phase", while the wastewater infrastructure for Phase 3 will be referred to as the "Build-out Sewer Infrastructure Phase".

3 Wastewater Treatment Options

3.1 Option 1: Del Rio Springs Water Reclamation Facility

3.1.1 WRF Site Selection

To utilize gravity in the sewer collection system, the topographic information described in Section 1.2 was analyzed to determine an optimal location for a new Del Rio Springs WRF. The lowest point in the proposed development area is located in the northeast portion of the development. The proposed location will put the WRF approximately 2 miles from the furthest service at the south end of the development.

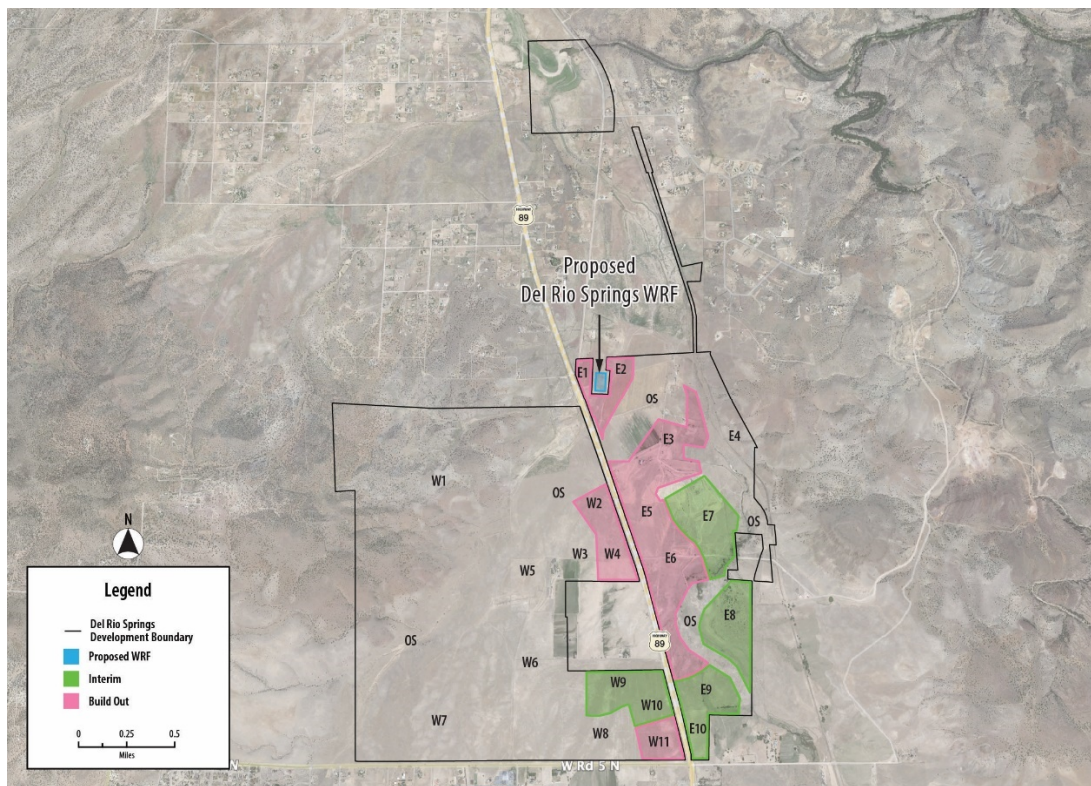


Figure 3-1: Proposed Del Rio Springs WRF Location

3.1.2 Treatment Process

The layout of a wastewater treatment facility will be compact, modular, and include common-wall construction, where applicable, to minimize footprint, reduce odor and noise, and improve operations, while achieving the treatment guidelines defined by Title 18. The Town of Chino Valley has seen success utilizing a 0.5 MGD activated sludge MBR to meet the effluent parameters for groundwater infiltration. Due to the uncertainty of the Development timing, utilizing multiple trains in parallel will be the most effective way to respond to the increase in flow over time. This approach allows the Developer to construct smaller facilities to meet the initial interim phase and thus reducing the capital investment. As the development builds out, additional capacity can be added, as needed.

For this evaluation, the proposed design flow rate for the interim and Build Out conditions will be equal to allow for a modular expansion. This will allow for an identical system to be installed when the development requires the additional flow without impacting the performance of the WRF. This is beneficial as the values used to calculate the flow generated from residential and commercial areas are conservative; however, if a high flow water source is constructed (e.g. hospital, school, etc.), then the modular facility can be modified to accommodate this. The interim condition will utilize one (1) 0.4 MGD packaged activated sludge MBR,

while the Build Out will require one (1) additional 0.4 MGD packaged activated sludge MBRs for a total of two (2) in parallel with a total capacity of 0.8 MGD. This total capacity will meet the wastewater generated from the proposed development at full build-out.



Figure 3-2: Example Packaged MBR

The proposed Del Rio Springs WRF will utilize a package Flat-plate, Membrane Bioreactor (MBR) activated sludge process to biologically treat wastewater generated from the development. The Flat-plate, MBR process is similar to the CVWRF MBR process, allowing for commonality between the two local WRFs. The Del Rio Springs WRF will consist of a headworks system with fine screening, secondary biological treatment, MBR filtration, disinfection, sludge holding and dewatering, and odor control. An equalization basin will also be installed to handle emergency high flow conditions. Details of a similar package MBR is provided in Attachment A. The facility will be required to meet at a minimum the Best Available Demonstrated Control Technology (BADCT) Standards; however, if the Development intends to reuse the effluent, the facility will be required to meet Class A+ Standards. Both standards are shown in Table 3-1 below.

Table 3-1: BADCT and Class A+ Effluent Quality Requirements

Effluent Parameter	BADCT and Class A+ Requirements
BOD (mg/L)	<10 ¹
TSS (mg/L)	<10 ¹
Total Nitrogen (mg/L)	<10 ¹
Fecal Coliform (CFU/100mL)	
4 of 7 Daily Samples	Non-Detect ²
Single Sample Maximum	Not to Exceed 23 CFU
Turbidity (NTU)	
Daily Average	<2
Maximum	5
Effluent Parameter	Additional Class A+ Requirements
Tertiary Filtration	Required

¹ Values not listed but assumed based on fecal coliform requirements.

² Non-detect is based on <1 CFU

3.1.3 Effluent Reuse and Discharge

The effluent from the WRF will be of high water quality, allowing for unrestricted reuse within the development to offset potable water demand. Parks and common landscape can be irrigated with reclaimed water. In addition to reuse, a second point of effluent discharge must be identified. There are two (2) primary options for effluent disposal for the Development: (1) discharge to a dry wash located to the northeast of the proposed WRF, or (2) utilize a rapid infiltration basin similar to that at the CVWRF.

To utilize the dry wash, the effluent from the WRF will need to be pumped about 1/2 a mile to the discharge location near the wash. An Arizona Pollution Discharge Elimination System (AZPDES) Permit will be required for wash discharge. The AZPDES permitting will be discussed further in Section 3.1.7.2.

The use of a rapid infiltration basin will require a hydrogeological investigation of the soils within the vicinity of the facility to determine the infiltration capacity and groundwater mounding effects.

3.1.4 Solids Disposal

Headworks screening and sludge will need to be disposed at a regular frequency. The closest landfill is located in Prescott Valley, AZ, which is approximately 40 miles from the Development. In order to minimize disposal cost, the waste activated sludge (WAS) should be dewatered to reduce the weight and volume prior to disposal.

3.1.5 Electrical

The WRF will require a 480 V, 3 Phase, 1200 Ampere service. This preliminary sizing is based upon the Build Out of the WRF at the 0.800 MGD capacity. The electrical service required will be similar to the capacity that was required for the CVWRF. The Developer will need to coordinate with the local electrical utility to confirm if there is sufficient capacity to provide power to the WRF. There are existing power poles that run adjacent to HWY-89, which is close to the proposed WRF location. To supplement power in the event of an outage, a 750 kW generator will need to be installed on site to provide power redundancy. The permitting requirements associated with the installation of a generator will be discussed in Section 3.1.7.

3.1.6 Utilities

To transport sewer flows to the Del Rio Springs WRF, a combination of gravity sewer pipeline and lift station will be utilized to transport flows across the development. The standard sewer collection system design criteria from the ADEQ Bulletin No. 11 has been defined in Table 3-2.

Table 3-2: Sewer System Design Criteria

System Characteristic	Design Requirement
Collection System	
• Minimum Pipe Size	• 8-inch
• Minimum Velocity	• 2.5 ft./sec.
• Maximum Velocity	• 10.0 ft./sec.
• Minimum Slope ¹	• 0.0052 for 8" • 0.003 for 12"
Lift Stations	
• Pump	• Minimum of 2 Pumps • Sized for Maximum Hourly Flow
• Wet Well	• Working Volume to Limit Starts to 4/Hour for Small Pumps • Working Volume to Limit Starts to 3/Hour for Large Pumps
• Force Main	• Minimum Velocity of 3.5 ft./sec. • Maximum Velocity of 6.0 ft./sec.

¹ Minimum slope is based on a Manning's "n" value of 0.013.

The proposed location of the WRF is designed to minimize the installation of sewer lift stations; however, due to the large distance across the development, the installation of three (3) sewer lift stations will be required to minimize the depth and cost of the gravity sewer. The number of lift stations in the Development may be modified based on a more accurate analysis of the sewer collection system. To avoid deep

manholes and lift stations within the sewer collection system, a lift station will be installed when the grade change exceeds 20-feet in depth. Gravity sewer lines are typically installed at a minimum depth of 6 ft cover to allow for crossing of other utilities and for proper separation from potable water lines. The total drop of 14-feet allows for approximately 2,700-linear feet of pipeline to be installed before the installation of a sewer lift station is required; however, the distance between lift stations can be increased substantially when utilizing gravity flow and the natural topography. Figure 3-3 displays a preliminary sewer watershed (sewershed) plan, along with proposed lift station locations. The sewer lift stations will be required to pump sewage to the adjacent sewershed's gravity main.

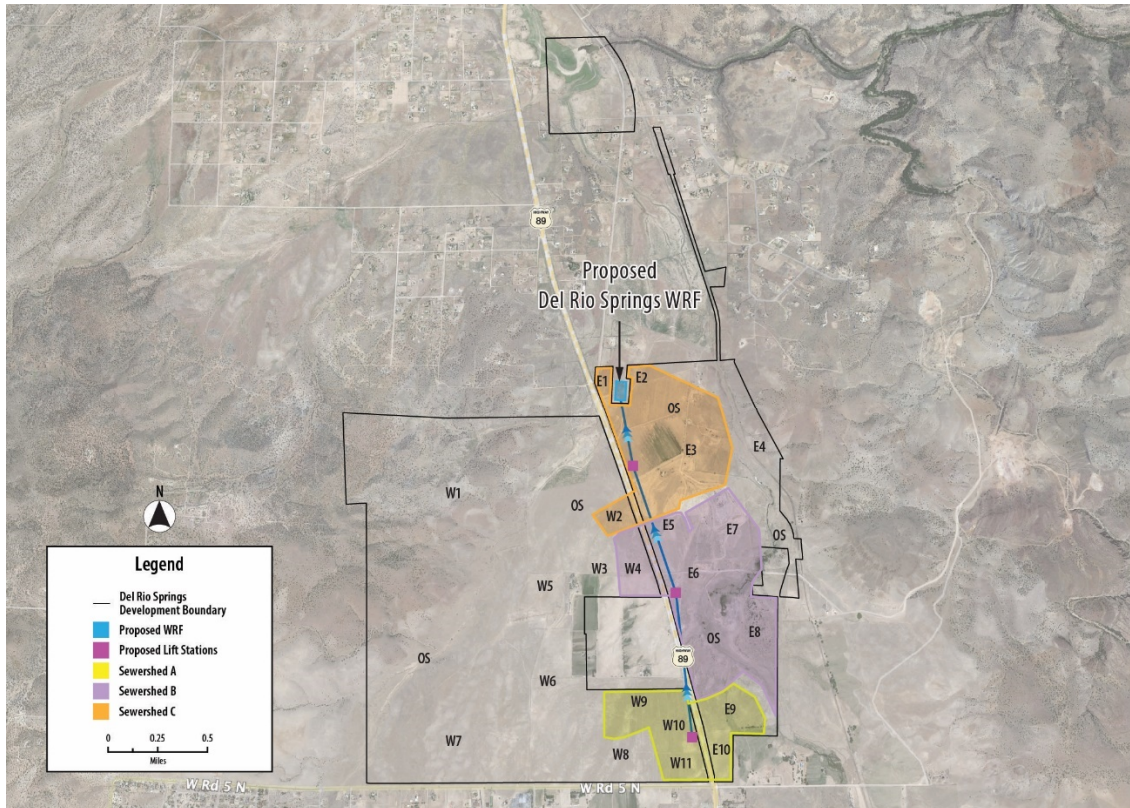


Figure 3-3: Del Rio Springs Lift Station Locations

The wastewater generated from “Sewershed A” will need to travel at approximately 2.25 miles (11,880-feet) across the development. The gravity pipeline and sewer force mains will work in series to transport flow across the development. The lift stations will need to be sized with the future development in mind to limit the cost associated with upgrades in the future.

3.1.7 Permitting

3.1.7.1 Aquifer Protection Permit

Wastewater treatment facilities in Arizona are required to obtain an Aquifer Protection Permit (APP), which is issued and administered by ADEQ. The intent of the permit is to protect the water and groundwater within Arizona, and in turn protect the health of the community and the environment. The permit regulates the capacity, process, and effluent quality and issues compliance and reporting schedules to ensure that the facility is operating and performing as designed and permitted. The compliance monitoring, called the Self-Monitoring Report Forms (SMRF), requires quarterly reports to be submitted to ADEQ. The APP is issued for the life of the facility with no renewal date required; however, any changes may require the permit to be amended. An APP permit will be required for the new Del Rio Springs WRF. Based on R19-9-A211 of the Arizona Administrative Code (AAC), a Significant Amendment to the APP permit will also need to be performed when the WRF expands to its buildout capacity.

3.1.7.2 Arizona Pollution Discharge Elimination System Permit

The Arizona Pollution Discharge Elimination System (AZPDES) permit authorizes effluent discharge into surface waters of the US. It regulates the quantity and quality of the effluent and requires additional monitoring, and reporting separate from the APP. AZPDES compliance monitoring, called the Discharge Monitoring Reports (DMR), are submitted to ADEQ on monthly basis. In addition to effluent quality, the AZPDES permit also regulates the processing, treatment, and disposal of biosolids produced by the WRF and requires annual reporting to ADEQ of biosolids production quantity, testing results, and disposal locations. The AZPDES permit has to be renewed every five years.

The effluent quality requirements for the AZPDES permit may be different from the APP depending on the type of surface water discharge. For the Del Rio Springs WRF, where the discharge may go to a dry wash, the effluent requirements are more lenient and the typical APP's BADCT or Class A+ effluent water quality requirements on Table 3-1 above will likely be sufficient to meet the AZPDES permit requirements.

3.1.7.3 Sewage Collection System Type 4.01 Permit

Sewage Collection System Type 4.01 General APP Permit is required for all sewer collection systems (both gravity or force main systems) and for all sewer collection lift stations. In addition, the permit is required for almost any expansion of the sewer collection system. This permit is administered by ADEQ and is valid for the life of the facility.

3.1.8 Preliminary Cost Estimate

The Interim Phase of the WRF is estimated to be approximately \$8.85M with estimated sewer collection infrastructure cost at \$7.46M. Estimated total cost for the Interim Phase of the Wastewater Infrastructure for the Del Rio Springs Development with a 30% contingency is \$21.2M.

At the Build Out Phase of Option 1, the estimate cost for expanding the WRF is approximately \$6.2M, which is lower than the interim phase since some of the upsizing and provisional work for expansion would have been performed in the Interim Phase. With a 30% contingency, the estimated cost for the Build Out Phase is \$8M. There will be minimal improvements to the sewer collection system. Table 3-3 and Table 3-4 detail the estimated capital costs for the wastewater infrastructure required for Option 1 - Interim and Build Out of the development, respectively.

Table 3-3: Option 1 - Interim Estimated Capital Cost

ITEM	QTY.	UNIT	UNIT PRICE	TOTAL COST
WRF Facility				
Civil Site Improvements	1	LS	\$250,000	\$250,000
Equalization Basin	1	LS	\$350,000	\$350,000
0.400 MGD Packaged MBR	1	LS	\$4,875,000	\$4,875,000
Ancillary Mechanical Process Equipment	1	LS	\$1,200,000	\$1,200,000
Effluent Disposal	1	LS	\$528,000	\$528,000
Electrical Equipment (Inc. Utility Improvements)	1	LS	\$1,000,000	\$1,000,000
750 kW Generator	1	LS	\$300,000	\$300,000
Integration and Controls	1	LS	\$350,000	\$350,000
WRF SubTotal				\$8,853,000
Sewer Collection Improvements				
Sewer Lift Stations	3	LS	\$1,250,000	\$3,750,000
Sewer Force Mains	3000	LF	\$200	\$600,000
Sewer Gravity Mains (Laterals Not Included)	8880	LF	\$350	\$3,108,000
Sewer Collection Subtotal				\$7,458,000
Preliminary Estimated Capital Cost				
Contingency @ 30%				\$16,311,000
Preliminary Estimated Total Cost				\$21,204,300

Table 3-4: Option 1 - Full Build Out Estimated Capital Cost

ITEM	QTY.	UNIT	UNIT PRICE	TOTAL COST
WRF Facility				
Civil Site Improvements	1	LS	\$50,000	\$50,000
0.400 MGD Packaged MBR	1	LS	\$4,875,000	\$4,875,000
Ancillary Mechanical Process Equipment	1	LS	\$600,000	\$600,000
Electrical Equipment (Inc. Utility Improvements)	1	LS	\$400,000	\$400,000
Integration and Controls	1	LS	\$250,000	\$250,000
Preliminary Estimated Capital Cost				\$6,175,000
Contingency @ 30%				
Preliminary Estimated Total Cost				\$8,027,500

3.2 Option 2: Conveying Wastewater to the Existing Chino Valley WRF

3.2.1 Site Selection and Topography

The location of the Development is, at a minimum, three (3) miles (15,840-feet) from the existing CVWRF. There is also an elevation change of about 100-feet from the southernmost point, with about a 200-foot grade change from the north most point. To convey the sewage generated by the Development to the CVWRF, the estimated locations of lift stations required to do so are shown in Figure 3-4. Section 3.2.5 describes the hydraulics behind the proposed lift station locations.



Figure 3-4: Lift Station Sites to Chino Valley WRF

3.2.2 Design Approach

The Del Rio Springs sewage collection system will operate as a series of sewer lift stations and gravity pipelines to the south end of the development. The design for the conveyance system in the development will be the same as described in Section 3.1.6 for Option 1. The sewage will then need to be transported by an additional series of lift stations to the CVWRF. In addition to lift stations at the development, the CVWRF and Chino Valley Lift Station will also need to be upgraded to handle the additional flow generated by the development. The following infrastructure will need to be constructed for the Interim, and subsequently upgrade for the Build Out:

- Three (3) New Del Rio Springs Lift Stations
- One (1) New Lift Stations to Transport Flow to the Town of Chino Valley
- Upgrade the Existing Chino Valley Lift Station and existing force main
- Upgrade the Existing CVWRF

To keep the system consistent at the CVWRF, an additional 0.5 MGD activated sludge MBR train will need to be installed at Interim and Build Out of the Development for a total of 1.0 MGD. This will increase the capacity of CVWRF to 1.5 MGD at Development Build Out. Phasing of CVWRF will also be dependent on the Town's future development.

3.2.3 Effluent Discharge

Option 2 would utilize the existing Chino Valley WRF discharge to rapid infiltration basins for subsurface recharge. The existing facility produces effluent meeting AZ Title 18 Class A+ Effluent. The quality of the effluent will need to be maintained with any upgrades to the system. Expansion of the infiltration basins will also need to occur as the facility increases in capacity.

3.2.4 Electrical

The CVWRF has a 480 V, 3 Phase, 1200 Ampere service. Since the existing CVWRF has capacity for an additional 0.5 MGD, the electrical service will not need to be upgraded. The Developer will need to coordinate with the local electrical utility to confirm if the local utility has sufficient capacity to provide power to the additional capacity that will be required for WRF past the initial design capacity of 1.0 MGD.

The developer will also need to install electrical services to the proposed lift stations and provide upgrades to the existing Chino Valley Lift Station; however, the required service will be significantly smaller to that required at the CVWRF.

3.2.5 Utilities

The sewage collection system for the development will be as described in Section 3.1.6. The facilities within the Development will be larger when conveying flow to CVWRF due to pumping against the natural grade. The design criteria for the lift stations to CVWRF follows the characteristics described in Table 3-2. The lift stations located within the Development will operate in series to pump the wastewater flow to the existing Chino Valley Lift Station. The distance between the final Development's lift station and the Chino Valley Lift Station is about 2.6 miles (13,728-feet). In addition, upgrades to the existing Chino Valley Lift Station's force main will need to be upsized.

Table 3-5: Lift Station Hydraulics

System Parameter		Value
• Pipe Size	•	• 8-12 inches
• Pipe Length	•	• Approx. 21,840-feet
• Force Main	•	• Minimum Velocity of 3.5 ft./sec. • Maximum Velocity of 6.0 ft./sec. • Material: HDPE/ PVC • Hazen-William Coefficient: 140/130
• Peak Flow	•	• 1600-gpm
• Static Head	•	• 100-feet
• Head Required (Static + Friction)	•	• 200-feet • 86.5-psi

3.2.6 Permitting

Upgrades to the CVWRF will require a Significant Amendment to CVWRF's existing APP. Similar to Option 1, the collection system will also require a 4.01 Permit from ADEQ.

3.2.7 Preliminary Cost Estimate

The initial cost associated with the upgrade of the CVWRF is lower due to the facility having some capacity and provisions for the Interim condition, which is estimated at \$6.85M. However, the majority of the cost is associated the installation of larger lift stations, the longer distance force main required to transport the flow to the CVWRF, and the upgrades to the Chino Valley Lift Station and force main, which is estimated at \$17.4M. Therefore, the combined estimated cost for the Option 2 – Interim Phase is approximately \$31.6M.

The cost associated with the Option 2 – Build Out is mainly from the installation of an additional 0.5 MGD MBR train adjacent to the existing system. The headworks, infiltration basins, sludge processing, and disinfection equipment will all need to be upsized, as the design capacity for that equipment will have been exceeded at that time. Option 2 – Build Out estimated cost is \$12.2M. All of the estimated costs included

a 30% contingency. Tables 3-6 and 3-7 provide Option 2 estimated costs of the existing CVWRF expansion at the Development Interim and Build Out, respectively.

Table 3-6: Option 2 - CVWRF Expansion (Interim) Estimated Capital Cost

ITEM	QTY.	UNIT	UNIT PRICE	TOTAL COST
CVWRF Upgrades (Interim Development)				
0.5 MGD Packaged MBR	1	LS	\$5,500,000	\$5,500,000
Ancillary Mechanical Process Equipment	1	LS	\$600,000	\$600,000
Electrical Equipment (Inc. Utility Improvements)	1	LS	\$500,000	\$500,000
Integration and Controls	1	LS	\$250,000	\$250,000
WRF Upgrades SubTotal				\$6,850,000
Sewer Collection System Improvements				
Sewer Lift Stations	4	LS	\$1,800,000	\$7,200,000
Sewer Force Mains	21840	LF	\$350	\$7,644,000
Upgrade Chino Valley Lift Station & FM	1	LS	\$2,580,000	\$2,580,000
Sewer Collection SubTotal				\$17,424,000
Preliminary Estimated Capital Cost				\$24,274,000
Contingency @ 30%				
Preliminary Estimated Total Cost				\$31,556,200

Table 3-7: Option 2 - CVWRF Expansion (Build Out) Estimated Capital Cost

ITEM	QTY.	UNIT	UNIT PRICE	TOTAL COST
CVWRF Expansion (Development Build Out)				
Civil Site Improvements	1	LS	\$250,000	\$250,000
0.5 MGD Packaged MBR	1	LS	\$5,500,000	\$5,500,000
Expansion of Infiltration Basins	1	LS	\$500,000	\$900,000
Mechanical Process Equipment	1	LS	\$1,200,000	\$1,200,000
Electrical Equipment (Inc. Utility Improvements)	1	LS	\$1,000,000	\$1,000,000
750 kW Generator	1	LS	\$300,000	\$300,000
Integration and Controls	1	LS	\$250,000	\$250,000
WRF Facility SubTotal				\$9,400,000
Contingency @ 30%				
Preliminary Estimated Total Cost				\$12,220,000

4 Recommendation

The installation of a Del Rio Springs WRF (Option 1) is the most practical and cost effective option for the proposed Development. Option 2 - Conveying the flow to the CVWRF requires much larger lift station and offsite infrastructure improvements that will increase the cost of the Interim Phase by almost 50% compared to Option 1. The Del Rio Springs WRF will also allow the Developer flexibility when expansion can occur without being tied to other developments within Chino Valley. In addition, the high quality effluent can be used to offset Development potable water demand, and with the facility being local to the development, it will reduce the size and cost of the Reclaimed Water infrastructure.

One drawback to Option 1 – Del Rio Springs WRF is the operation and maintenance of the facility. The Developer will need to staff the facility to operate and maintain a WRF. One option to avoid the operation and maintenance of the WRF by the Developer is to hand over ownership of the facility to the Town of Chino Valley. This type of transaction will require agreement with the Town but is common in Private-Public Partnership with Developer-driven construction of wastewater infrastructure and treatment facilities.



MEMPAC-M, MEMBRANE PACKAGE

CLIENT:

PACE Water
Michael Krebs, MBA, PE
7434 E McDonald Drive
Scottsdale, AZ 85250
480-991-3595
mikekrebs@pacewater.com

SUPPLIER:

Cloacina, LLC
Chris Nally, Sales Manager
2385 Precision Dr.
Arroyo Grande, CA 93421
805-540-1058
Chrisn@cloacina.com

PROJECT NAME:

TSC Tri Cities Phase 2 of 3

PROJECT NUMBER:

CL16-025

REVISIONS:

REVISION NO.	DATE	SUBMITTED BY	NOTES
1	8/31/18	CN	.5 MGD Phase 2 MBR Package



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1 Project Description

Cloacina will provide a MEMPAC-M MBR Treatment Train designed for domestic wastewater. The package will be designed to be supplied in a total of 3 phases. Phase 2 equipment will be installed in series with Phase 1, increasing plant capacity to 500,000 gpd.

1.1 Anticipated Process Flow

This proposal is based on the process flow as outlined. Additional project details related to hydraulic loading, organic loading, effluent limitations, effluent disposal location, construction constraints, cost savings and any factor that alters the process flow can result in changes to the proposed design and project costs shown below.

Raw influent will be pumped from an upstream equalization to a 2mm influent screen supplied on top of MEMPAC Train. Screened influent will flow by gravity to the Anoxic process, where it will mix with return activated sludge from the Membrane Chambers by a supplied mechanical mixer. Cloacina will provide monitoring equipment such as level and ORP in the Anoxic process.

Anoxic Chamber effluent will enter the Aeration process by gravity. The Aeration Chamber will be provided with level, dissolved oxygen and suspended solids sensors. The Aeration Chambers will have a dedicated blower and diffusers.

Activated sludge from the Aeration Chamber will be transferred to the Membrane Chambers at 4 times the average daily flow rate.

The package will utilize Fibracast, FibrePlate™ FPC500 membrane cassette. Activated Sludge will be returned, by gravity, to the Anoxic Chamber where it will be mixed with raw influent.

Membrane permeate will discharge to an integrated Clear Well Chamber. Integrated effluent pumps will discharge treated effluent to final disposal.

As required, effluent stored in the clear well tank will be pumped through each membrane cassette to perform a Backflush or Clean in Place. This will be done on a routine interval according to the manufacturer's requirements.

Solids concentration will be monitored by an on-line suspended solids meter located in the Aeration Chamber. Sludge wasting pumps will remove a portion of activated sludge to an exterior sludge storage (by others).



2 Design Specifications (Phase 2)

2.1 Influent Parameters

The Phase 2 MEMPAC Train will be designed to treat Average Flow and Loading outlined below.

The following tables summarize the main Design Specifications of Train:

CONSTITUENT	RANGE	UNIT	RANGE	UNIT
Average Design Flow	347	GPM	500,000	GPD
Maximum Day Flow	462	GPM	665,000	GPD
(BOD5) Average	340	mg/L	1,290*	lbs/day
Total Suspended Solids (TSS) Average	300	mg/L	1,025*	lbs/day
Total Nitrogen	60	mg/L	240*	lbs/day
NH3	35	mg/L	146	lbs/day
Phosphorous	10	mg/L	40*	lbs/day
pH	6.5-7.5			
Temperature	10-20			C

*After Screening

2.2 Effluent Parameters

The following performance parameters are expected upon equipment start-up and biological stabilization:

CONSTITUENT	RANGE	UNIT	RANGE	UNIT
Average Flow	347	GPM	500,000	GPD
Maximum Day Flow	462	GPM	665,000	GPD
(BOD5) Average	<10	mg/L	<50	lbs/day
Total Suspended Solids (TSS) Average	<10	291	<50	lbs/day
Total Nitrogen	<10	mg/L	<50	lbs/day
P*	<8	mg/L	<40	lbs/day
pH	6.5-8.5			



2.3 Package Parameters

Aside from influent loading and effluent limitations, following parameters were used in the design of the MEMPAC-M package system.

2.3.1 Package Specifications

PARAMETER	SINGLE TRAIN	UNIT
Hydraulic Residence Time (HRT)	9.8	hrs
Mean Cell Residence Time (MCRT)	22	Days
Food to Microorganism Ratio (F/M)	.14	
Average Suspended Solids Under Aeration	8,300	mg/L
Recirculation Rate (RAS) (4 Times Average Flow)	1,388	GPM
Sludge Yield (lbs Sludge/lbs Influent BOD)	7,500	GPD

2.3.2 Package Dimensions

The following are the estimated dimensions of Phase 2 process trains.

DESCRIPTION	HEIGHT	WIDTH	LENGTH	VOLUME (gallons)
Outside Dimension Total Package	10'	68'	86'	
Anoxic Chambers (Total)	10'	10'	100'	30,203
Aeration Chambers (Total)	10'	10'	225'	135,911
Membrane Chamber (Each)	10'	3.8'	7.6'	4,384
Clear Well Chamber	10'	9.5'	4.8'	2,900
Equipment Skid (MBR)		10'	12'	
Inspection Catwalk		36"	75'	

2.4 Influent Variability

In the event that the influent ever exceeds the specifications listed in Section 2, or the source of influent changes, the ability for the treatment system to produce the designed treated water quality and/or quantity may be impaired. The Client may continue to operate the system, but assumes all risk of damage to the system and/or additional costs due to increased membrane cleanings, potential for biological upset, increased consumables usage and/or regulatory agency violations, fines and penalties.

2.4.1 Collection System

It is assumed the collection system will be maintained sufficiently to prevent septic conditions, excessive flow related to rainwater or groundwater influences, unnecessary grit or debris.

2.4.1.1 Oil and Grease

Influent from restaurants, industrial kitchens and industry should be pretreated at the source to ensure Oil and Grease concentration is below 100 mg/L at all times.

2.5 Supplied Equipment

2.5.1 Influent Screen

A second 2mm self-cleaning screen will be provided for field integration into the screen platform of Phase 1.

EQUIPMENT	DESCRIPTION	QUANTITY
Influent Screen	2mm auger screen with wash bar and compaction zone (300 gpm)	1



Example Screen Installation

2.5.2 Anoxic Process

The Anoxic Process will be designed for average daily flow and loading in Section 2 above and will consist of two additional chambers.

To ensure mixing of influent and return activated sludge, a submerged mixer will be incorporated into each Chamber and mix when the RAS pumps are in operation.

The oxygen concentration within the Anoxic Chambers will be monitored to ensure denitrification conditions are met.

The following components will comprise the Anoxic portion of Package:

EQUIPMENT	DESCRIPTION	QUANTITY
Anoxic Mixers	Submerged, Rail Mounted Open Propeller Mixer	2
Controls	Level Probe	2
Controls	ORP probe	2



Example Anoxic Mixer Installation

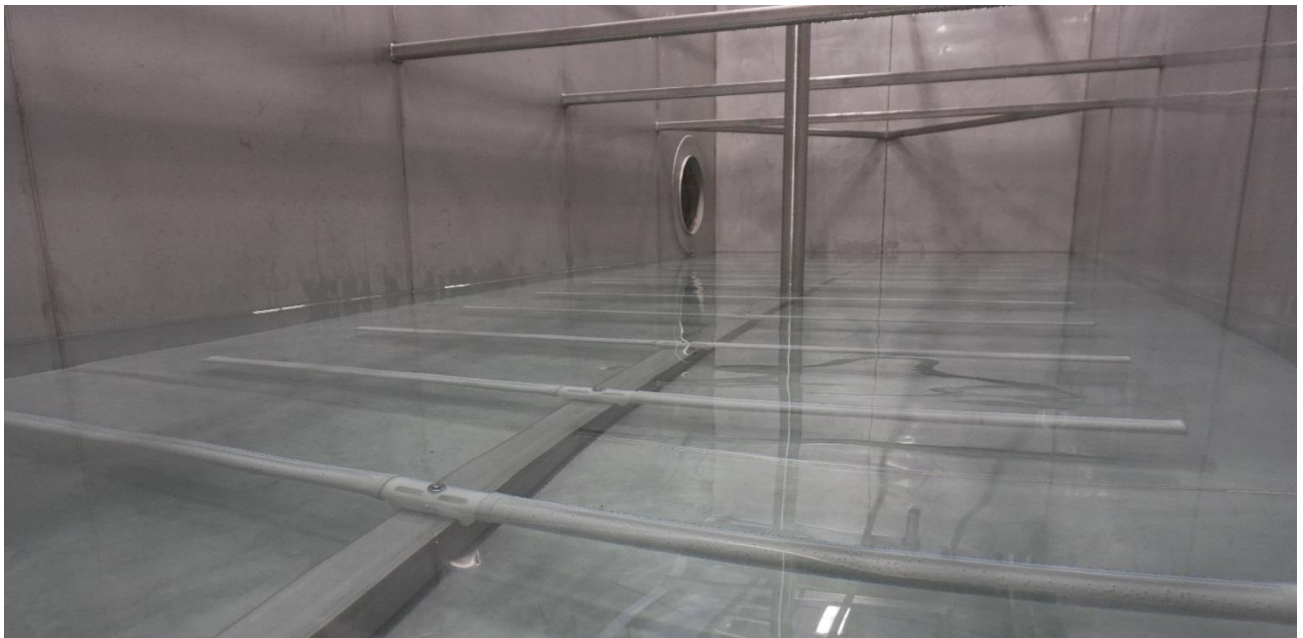


2.5.3 Aeration Process

The Aeration Process will be designed for average daily flow and loading in Section 2 above and will consist of two additional chambers. To ensure proper oxidation of influent organics the Aeration Chambers will utilize fine bubble diffusers distributed across the entire floor. Air supply will be monitored by on-line dissolved oxygen sensors to ensure performance. The air supply will be operated by the supplied controls package and continuously monitored by the SCADA system.

The following components will comprise the aeration portion of the treatment train:

EQUIPMENT	DESCRIPTION	QUANTITY
Aeration Blower	300 cfm	2
Aeration Diffusers	2 meter diffusers	30
MBR Feed Pumps	Centrifugal Pumps (400 gpm)	2
Pump Control	VFD controller	2
Controls	Level Probe	2
Controls	D.O. Probe	2
Controls	pH Probe	1



Example Aeration Diffuser Installation



2.5.3.1 Membrane Cassette

Cloacina will provide two membrane cassettes for field installation into membrane chambers 3 and 4 supplied with Phase 1.

The Membrane Equipment typically includes the following:

EQUIPMENT	DESCRIPTION	TOTAL
Cassette	FibrePlate™ FPC500-3X10	2
Modules	FPC500 Modules (Each Cassette)	30
Air Scour Blower	130 CFM	2
Permeate Pump	Rotary Lobe (350 gpm)	2
Pump Control	VFD controller	2
Pump Monitoring	Flow Meter, Pressure Sensor	2



Example Membrane Cassette Installation

2.5.3.2 Membrane Cleaning Equipment

The Clear well supplied with Phase 1 is sized appropriately for the addition of Phase 2 Membrane Cassettes.

The Backflush system typically includes the following:

EQUIPMENT	DESCRIPTION	QUANTITY
Pressure Transducer	Monitors Pressure of Backflush on Membrane Cassettes	2
Chemical Pumps	Peristaltic Chemical Pumps	4



2.6 Construction Materials

All supplied tanks and vessels will be constructed of 304 Stainless Steel, unless otherwise specified or required.

All supplied bases, skids supports etc. will be constructed of 6061 Aluminum, unless otherwise specified or required.

All piping, valves and fittings will be a minimum of Schedule 80 PVC, unless otherwise specified or required.

All equipment will be designed for continual use and/or industrial applications.



2.6.1 Installation

The package outlined in this proposal assumes the supplied MEMPAC-M package will be installed above grade on an engineered slab.

The following additional equipment will be provided as part of the above grade design:

EQUIPMENT	DESCRIPTION
Inspection Platform	Aluminum stairs and platform for inspection of the Train.
Equipment Skid	Skids integrated into Train Tanks





3 Controls

3.1 Central Control Panels

The control enclosures will be constructed of stainless steel, unless otherwise specified or required. The electrical controls will consist of magnetic starters and switches necessary to control all electro-mechanical components on the treatment system. The blower motor(s) will be controlled by HAND/OFF/AUTO (HOA) selector switches and magnetic starters in conjunction with the SCADA controls. Circuitry will be protected by properly sized circuit breakers and fuses. All duplex or stand-by equipment will be designed so that they may be operated by the controls system. The enclosure will be wired for 480 volt, 3 phase and 4 wire incoming power.

3.2 SCADA Control System

All PLCs are monitored by an all-inclusive process controls package which gives the operator an easy-to-use touchscreen Human Machine Interface (HMI) for monitoring, control of and adjusting the entire treatment process. All process parameters are easy to understand and adjust by the operator for varying conditions. Cloacina's control package includes a graphical representation of the entire process, user-defined control set points and alarm condition notifications. Additionally, the control program provides tabular and graphical logging of important parameters necessary for efficient operation and record keeping. Not limited to process control, Cloacina's SCADA system comes standard with the following:

3.2.1 Alarm Module

Uses email and/or text messaging for notification of alarm conditions to selected individuals.

3.2.2 Wasting Module

The MEMPAC-M controls system incorporates a module that will utilize the MLSS probe output to automatically adjust the duration of the wasting pump to ensure the solids concentration remains within the optimum range, regardless of fluctuations in flow and loading.

3.2.3 Report Module

Provides the operator with required information for inclusion in Self-Monitoring Reports (SMR) and allows easy look-back at any day since start-up of the wastewater treatment plant.

3.2.4 Maintenance Module

Tracks actual equipment runtime and generates maintenance-due reminders for all plant equipment in accordance with manufacturer's recommendations. The system also tracks and logs the resetting of maintenance reminders.

3.2.5 Remote Monitoring and Control

Provided for in every Cloacina controls package and is easy to implement using an existing high-speed Internet connection. Where high-speed Internet access is not readily available, a DSL Air-Card can be used. Using either method of Internet access, the entire treatment process can be monitored and controlled remotely from anywhere with an active Internet connection. This feature also allows Cloacina to assist the plant operator in troubleshooting the process, making adjustments to the plant and providing real-time on-line training during start-up and subsequently, on an as-needed basis.



3.3 Documents, Materials and Services Supplied

The following will be supplied by Cloacina as part of the package treatment system:

3.3.1 Project Drawings

Examples of project drawings include, process and instrumentation drawings, process flow drawings, general arrangement drawings, etc.

3.3.1.1 Drawing Disclaimer

All drawings are the property of Cloacina. The drawings and illustrations submitted to the Client show the general type, arrangement and approximate dimensions of the equipment to be furnished for the Client's information only. Cloacina makes no representation or warranty regarding their accuracy. Unless expressly stated to the contrary, all drawings, illustrations, specifications and/or diagrams form no part of this agreement. Cloacina reserves the right to alter such details in design or arrangement of its equipment which, in its judgment, constitute an improvement in construction, application or operation. After Client's acceptance, any changes in the type of equipment, the arrangement of the equipment or application of the equipment requested by the Client will be made at the Client's expense. Instructions necessary for the installation, operation and maintenance of the equipment will be supplied by Cloacina.

3.3.2 Operation and Maintenance Manual (OMM)

This includes the Cloacina MEMPAC-M OMM and all ancillary equipment OMM's, cut sheets, project drawings and process description.

3.3.3 Equipment Submittal Package

Manufacturer equipment specifications, drawings and calculations.

3.3.4 Factory Inspection Form

The Cloacina quality assurance inspection form will be provided.

3.3.5 Start-up/Commissioning Services

A single trip consisting of ten (10), eight-hour days of on-site start-up/commissioning will be provided after the Cloacina Pre-Commission Checklist is completed and submitted by the Client and received and approved by Cloacina.



4 Assumptions

4.1 Municipal Waste

The system will be designed to receive only municipal wastewater, as outlined in Section 2, above.

4.2 Unnecessary Waste

All unnecessary process waste will be diverted from entering the treatment system. Examples of unnecessary process waste are:

4.2.1 Water Treatment Byproducts

Water softener regeneration, reverse osmosis reject water, backwash water etc.

4.2.2 Water softener regeneration, reverse osmosis reject water, backwash water etc.

4.2.3 Rain water

All outdoor areas should have a separate storm water collection system.

4.2.4 Inorganic solids

The collection system should be maintained to ensure excessive amounts of sand, grit, dirt and inorganic debris does not enter the treatment system.

4.2.5 Toxic materials

Due to the small volume of the reactor, materials that can “shock” the system should be properly managed; these include concentrated cleaning chemicals, cooling chemicals (glycol, ammonia), etc.

4.3 Effluent Disposal

Effluent will be pumped from Clear Well, the final disposal location is to be determined.

4.4 Installation Location

The package outlined above is designed for installation indoors on an engineered concrete slab. The site will have sufficient access to allow the delivery of the treatment trains fully assembled.



5 Exclusions

5.1 Installation

Treatment package quoted does not include installation costs.

5.2 Engineering

Site civil and structural engineering is not provided as part of this budgetary estimate.

5.3 Slab

Equipment slab design and construction is not included as part of this budgetary estimate.

5.4 Permitting

Permit costs are not included as part of this budgetary estimate, however, construction permitting is often reduced due to the package design.

5.5 Seismic

Seismic Restraints are not included in this budgetary estimate.

5.6 Secondary Containment

Secondary containment is not included in this budgetary estimate.

5.7 Thermal Protection

Thermal protection of hydraulic piping is not included

5.8 Security

Safety and security items such as fencing, locking ladders, lighting etc. are not included in this budgetary estimate.

5.9 Shipping

Shipping and crane costs are not included in this budgetary estimate.

5.10 Dissolved Solids (TDS)

The unit will not address dissolved solids through biological treatment. Dissolved Solids should be managed through source control in the facility.