Preliminary Engineering Evaluation

For

Mt. Lemmon Water Reclamation Facility
Rehabilitation and Future Projects

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1.0 INTRODUCTION
The Mt. Lemmon WRF was constructed in 1982 by Pima County after a series of events that took place in the late 1970’s and early 1980’s, and led to water pollution, caused by inadequately treated sewerage in the Sabino Creek and Marshall Gulch areas. Subsequently, and pursuant to the PAG 208 Plan, the surface discharge of treated effluent was prohibited in the Upper Sabino Creek watershed (Sabino Creek). Instead, a new treatment plant was constructed that would discharge on National Forest land, into the San Pedro River watershed. The facility began operations in 1984.

Prior to the commissioning of the current Mt. Lemmon WRF, the facility was discharging to the Sabino Creek, but due to poor quality effluent, the County entered a consent decree that prohibited effluent discharges into the Sabino Creek. The Mt. Lemmon WRF currently irrigates the effluent onto the side of a hill in the San Pedro watershed. The current treatment facilities have been in operation for more than 34 years. It is the understanding throughout this report that those prohibitions are still in place.

On April 30, 2018 the condition of the Mt. Lemmon WRF was evaluated after careful planning efforts by RWRD Treatment and Conveyance Division staff. It was presumed that the reactor tank was going to be greatly dilapidated and RWRD would need to begin extensive efforts to plan and design for the installation of an entirely new treatment facility. After evaluation (See Appendix A), it was discovered that the facility was in great condition and could serve the Mt. Lemmon community for many years to come. RWRD recoated many of the treatment areas in order to ensure this extended life expectancy.

This report quickly evaluates other improvements that have been proposed by the Treatment Division’s Sub-Regional Facility Unit, which is responsible for the day-to-day decision making and operation of the WRF.

2.0 CURRENT FACILITIES
2.1 Treatment facility description
The treatment facility consists of a pump station to force wastewater up to the treatment facility, a single oxidation ditch reactor (15,000 gallons) for biological treatment, with a spiral flow clarifier (3,250 gallons) in the center to remove treated effluent to a disinfection chamber (1,000 gallons) and return the activated sludge back to the reactor or waste them to the solids storage aeration holding tank (2,150 gallon). The oxidation ditch reactor utilizes one aeration rotor to splash air into the mixed liquors and maintain the motive rotation of solids in the tank. There is an emergency mixer that is used in the event of the rotor failure. The effluent is chlorinated before being measured through a Parshall flume. Currently, all the treated effluent from the Mt. Lemmon WRF is reused via spray-field irrigation on forest vegetation, or is disposed via underground pipes leading to three combined outfalls, all within the San Pedro Watershed. Pneumatic lift pumps are used to remove solids from the clarifier, and air blowers push air through two diffusers to entrain air into the solids retention tank. Sludge is removed by truck and is deposited into the County collection system at Manhole 8716-03 for subsequent treatment at the Tres Ríos WRF.
Due to the harsh weather conditions this WRF experiences, all treatment equipment is housed indoors. Snow and extremely low temperatures in winter also create problems in terms of effluent disposal. Spray heads in the six effluent spray fields that normally distribute treated effluent to the surrounding woods may freeze over, and if this happens effluent must be dispensed into the Upper San Pedro watershed through one of three discharge locations, per the AZPDES special use permit.

The effluent disposal system consists of a one mile long effluent pipeline, storage tank, booster pumping station, four spray fields with 5 spray heads in each field, an upgraded spray header that automatically drains the system to prevent freezing of the lines, three surface discharge points, a fence line enclosing the 10 acre disposal field, an access road to the facilities, requisite power and control wiring, as well as pressure and gravity pipelines, valving, etc., for the proper operation of the effluent disposal component of the Mt. Lemmon WRF.

2.2 Current Permits

The Mt. Lemmon WRF was constructed in 1982, and is governed by four permits (See Table 1). Prior to the Aquifer Protection Permit (APP) program, the facility was regulated by both the Arizona Department of Health Services, Division of Environmental Health Services and the U.S. Environmental Protection Agency (EPA), but is now regulated by the Arizona Department of Environmental Quality which is the delegated authority by the EPA. The WRF is considered an “Existing Facility” under the current Aquifer Protection Permit (APP) Program as defined by Arizona Revised Statutes ARS 49-201(16).

The WRF operates under an ADEQ General APP Permit No. P-100345 and an Arizona Pollution Discharge Elimination System (AZPDES) Permit No. AZ0022250. The General APP regulates discharges to the local aquifer. The AZPDES permit allows for the discharge of effluent from the facility to three unnamed washes in the Upper San Pedro Watershed, which is permitted only during freezing or inoperable conditions of the spray fields. The discharge flow records show that the facility has not discharged to the washes since 2002 (AZPDES, Fact Sheet, pg. 2). Discharge from the facility is currently prohibited from entering the Upper Sabino Creek Watershed by both environmental rule and also the current amended 208 Certified Area-wide Water Quality Management Plan (EEC et. al., 2008). The current AZPDES permit is valid through 2021.

The facility holds a U.S. Forest Service Special Use Permit USFS SAN0139, dated February 18, 2003 and amended through four amendments in 2004, 2009, 2011, and 2012 to allow disposal of effluent onto Forest Service land; the permit is for use of a 10-acre area in the San Pedro Watershed.
Table 1 - Permits

<table>
<thead>
<tr>
<th>Permit/Program</th>
<th>Expiration Date</th>
<th>Flow Limits</th>
<th>Renewal or Replacement Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>APP General Permit (P-100345)</td>
<td>R18-9-B301(l) Conditions</td>
<td>15,000 GPD</td>
<td>~ 18 months</td>
</tr>
<tr>
<td>AZPDES (AZ0022250)</td>
<td>July 11, 2021</td>
<td>15,000 GPD</td>
<td>~ 18 months</td>
</tr>
<tr>
<td>USFS Special Use (SAN0139)</td>
<td>June 1, 2022</td>
<td>12,500 GPD Mo, Ave; 17,000 GPD Daily Peak</td>
<td>NEPA – up to 2 yrs.</td>
</tr>
<tr>
<td>PAG 208 Plan</td>
<td>NA</td>
<td>18,189 GPD (1981) &amp; no Discharge to Sabino Creek</td>
<td>~ 9-18 months</td>
</tr>
</tbody>
</table>


3.0 PROJECT PLANNING AREA

3.1 Service Area
The service area encompasses less than one square mile and consists of the residential subdivision of Summerhaven, served by 1.73 miles of public sewer. A few commercial properties such as restaurants and gift shops are also served by public sewer. There are 27 manholes and 2 cleanouts in the service area (See Figure 1).

(The service area was severely destroyed by the Aspen Fire in 2003. The majority of damaged properties have since redeveloped.) Larger residential lots in the adjacent East and West Summerhaven are served by on-site treatments systems (septic tanks).

3.2 Facility Location
The Mt. Lemmon WRF is located at 12633 N. Sabino Park Road in the town of Summerhaven, on the west side of Sabino Creek, in the Upper Sabino Creek Watershed. The facility sits on Lots 2 and 3 of Block 40 of the Summerhaven subdivision (a one square mile area with a high density of lots). The East and West Summerhaven communities are located on the hills on either side of the square mile area. Sabino Creek flows from the north to the south bisecting Summerhaven into two halves. The Creek is the lowest point in the terrain; all drainage in Summerhaven is towards the Creek.

The effluent disposal spray fields are located in the Coronado National Forest, within the Alder Canyon watershed which is tributary to the San Pedro River (See Figure 2). The spray fields sit in the northeastern portion of the service area.

3.3 Land Ownership
The community of Summerhaven is bounded on all sides by Coronado National Forest which is managed by the United States Department of Agriculture, Forest Service (USFS). The land ownership in and adjacent to the service area is primarily private surrounded by national forests.
The Mt. Lemmon WRF is located on the west side of Sabino Creek, in the Upper Sabino Creek Watershed. It sits on Lots 2 and 3 of Block 40 of the Summerhaven subdivision (See Figure 3). The treatment building sits on Parcel 205147300 (12633 N. Sabino Canyon Park Rd.). Part of the parking area, diesel fuel tank for the generator and operator living quarters sit on Parcel 205147290 (12617 N. Sabino Canyon Park Rd.). The living quarters are used as a break room and living space when operators are stranded because of weather, road and/or fire conditions. A third Parcel, Parcel 205147310 (12601 N. Sabino Canyon Rd.) is also owned by the County with an inactive schoolhouse. This parcel could be used for future expansion or upgrade. The land south of the Mt. Lemmon WRF is owned by the United States of America, is downstream in elevation and does not appear that it will be developed in the future.

**Figure 1 – Mt. Lemmon WRF Conveyance System**
The Effluent disposal field permitted for use by the USFS is located on Parcel 20513008A owned by the United States of America. The permit covers 10 acres and is described at T11S, R16E, Section 30, SE ¼, N ¼ (disposal Site and Access Road) and T11S, R16E, Section 30, SW ¼ N ½, (Hitchcock Highway).

3.4 Land Use and Zoning
The service area land use is primarily residential with few commercial uses serving the community of Summerhaven and its transient population. Zoning in Summerhaven is a mixture of Rural Village Center (RVC) and Mount Lemmon (ML). RVC zoning is limited to the lots adjacent to Sabino Canyon Park and Turkey Run Lane (See Figure 4). RVC is generally designated to provide a mixed-use village center including commercial and residential uses, planned and designed for the convenience of a suburban or rural area, with the purpose of preserving the suburban character of the “downtown” Summerhaven.
The surrounding ML zoning provides for a minimum lot size of 36,000 square feet; however, the zoning regulations allow for smaller lot sizes for lots recorded prior to June 19, 2003 (EEC, et. al., 2008). The primary use of land in the ML zoning is individual home sites.

South of Summerhaven is the Pusch Ridge Wilderness Area, an area habitat to several threatened and endangered species. The presence of these species affects development and land use options and impacts costs for regulatory compliance (EEC, et. al, 2008). The United States Fish and Wildlife Service designated that the Mexican Spotted Owl breeding season begins February 1st and end August 31st. Any construction with motorized equipment must occur outside of this season. The Mt. Lemmon WRF is located at approximately 8,000 feet elevation and serves a small population of users in the Summerhaven community in the Catalina Mountains. It is approximately an hour and fifteen minutes north of Tucson. The East and West Summerhaven communities are located on the hills on either side of the square mile.
area. Sabino Creek flows from the north to the south bisecting Summerhaven into two halves. The Creek is the lowest point in the terrain; all drainage in Summerhaven is towards the Creek.

**Figure 4 - Service Area Zoning**

3.5  **Wastewater Flow Calculations**

In 2016 there were 31 active connections to the Mt. Lemmon WRF. Currently there are 49 connections. The USFS allows for up to 77 connections which included 47 connections originally with an additional 33 that were approved to be added in 2004. The issue is the terrain and the fact there are many existing homes that have on-site treatment systems. Although the wastewater treatment plant has 49 actual connections, the residences attached to the conveyance system are not inhabited year round. The flows of the plant are mostly governed by transient populations during the summer and winter months. People visit Mt. Lemmon to cool off during the summer and are frequently drawn to the mountain for snow in the winter months.

3.6  **Service Area Expansion**
The current system has a total of 49 connections. Based on the average monthly water use data, there are currently 21 to 22 active connections on any given day. Figure 5 shows that in addition to 47 original USFS special use permits, 35 more lots could potentially be connected to sewer. Five of these lots (marked dark blue) already have a connection permit (EEC, et. al, 2008).

According to EEC’s study (2008), the expansion of the sewer service planning area does not seem to be economically feasible. Many destroyed larger lots that were previously served by septic are still waiting to be redeveloped and possibly connected to extended sewer. However, expanding a gravity sewer to most of these lots would be expensive due to topography and distance from the existing system (EEC, et. al, 2008). The same assumption is made for the lots in Summerhaven West and Ski Valley. All three areas could however, be potential areas of new customers to RWRD, if conveyance were cost effective (EEC, et. al, 2008).

Figure 5 – Mt. Lemmon Wastewater Parcels
3.7 Treatment Capacity

The Mt. Lemmon WRF is rated to treat a total of 15,000 gallons per day (GPD) and has permit limits of average daily flow (ADF) 12,500 GPD (USFS special use permit), peak flow (PF) of 17,000 GPD, and total daily flow of 20,000 GPD limited by the treatment capacity of 15,000 GPD (Type 1.09 General APP).

The average typical daily influent flows that could potentially be conveyed to the facility are shown in Table 2 below. Currently, the base influent flow is approximately 1,600 GPD (as of February 2012). An average annual flow of 2,600 GPD, as measured in the past six years (See Table 3, which shows the average, maximum and minimum daily flows for 2008 through 2017), indicates the facility operates well below the permit limits. However, peak flows on holidays and weekends can reach up to three times the base flow to the WRF (EEC, et al., 2008). Peak flows are currently below permit limits. RWRD will typically begin planning, design, and permit application/amendments for expansion when flows approach 80% of current WRF capacity. The 80% level for this facility is 12,000 GPD.

The spray field discharges Class B effluent at a minimum of 2,500 gallons per day. Actual daily discharges vary considerably depending on tourist use and other fluctuations (e.g. weekend and holiday visitor use).

**TABLE 2 - Flows from Mt. Lemmon Community**

<table>
<thead>
<tr>
<th>Current Flows</th>
<th>gal/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Center</td>
<td>500</td>
</tr>
<tr>
<td>Residential</td>
<td>500</td>
</tr>
<tr>
<td>Commercial</td>
<td>1100</td>
</tr>
<tr>
<td><strong>The Alpine</strong></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>700</td>
</tr>
<tr>
<td>Restaurant</td>
<td>580</td>
</tr>
<tr>
<td><strong>The Ponderosa</strong></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>1800</td>
</tr>
<tr>
<td><strong>The Orchards</strong></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>1600</td>
</tr>
<tr>
<td><strong>The Lodge Summerhaven</strong></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>2500</td>
</tr>
<tr>
<td>Retail</td>
<td>200</td>
</tr>
<tr>
<td>Restaurant</td>
<td>0</td>
</tr>
<tr>
<td><strong>Zimmerman’s Other</strong></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>2600</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>12080</td>
</tr>
</tbody>
</table>
Table 3 - Annual Influent Flow

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg Annual Influent (GPD)</th>
<th>% of Capacity AAI GPD 15,000 GPD</th>
<th>Peak Influent Month (GPD)</th>
<th>% of Capacity PIM GPD 15,000 GPD</th>
<th>Lowest Influent Month (GPD)</th>
<th>% of Capacity LIM GPD 15,000 GPD</th>
<th>% Difference Peak to Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>3,339</td>
<td>22.26%</td>
<td>Feb. – 6,203</td>
<td>41.35%</td>
<td>May – 2,198</td>
<td>14.65%</td>
<td>64.57%</td>
</tr>
<tr>
<td>2009</td>
<td>2,211</td>
<td>14.74%</td>
<td>Jan. – 3,631</td>
<td>24.21%</td>
<td>Oct. – 1,734</td>
<td>11.56%</td>
<td>52.24%</td>
</tr>
<tr>
<td>2010</td>
<td>3,079</td>
<td>20.53%</td>
<td>Mar. – 7,211</td>
<td>48.07%</td>
<td>Dec. – 1,463</td>
<td>9.75%</td>
<td>79.71%</td>
</tr>
<tr>
<td>2011</td>
<td>1,664</td>
<td>11.09%</td>
<td>Jul. – 2,163</td>
<td>14.42%</td>
<td>Nov. – 1,322</td>
<td>8.81%</td>
<td>38.88%</td>
</tr>
<tr>
<td>2012</td>
<td>2,235</td>
<td>14.90%</td>
<td>Jul. – 2,652</td>
<td>17.68%</td>
<td>Feb. – 1,658</td>
<td>11.05%</td>
<td>37.48%</td>
</tr>
<tr>
<td>2013</td>
<td>2,413</td>
<td>16.09%</td>
<td>Jul. – 3,126</td>
<td>20.84%</td>
<td>Apr. – 1,803</td>
<td>12.02%</td>
<td>42.32%</td>
</tr>
<tr>
<td>2014</td>
<td>1,885</td>
<td>12.57%</td>
<td>Jun. – 2,267</td>
<td>15.11%</td>
<td>Feb. – 1,501</td>
<td>10.01%</td>
<td>33.79%</td>
</tr>
<tr>
<td>2015</td>
<td>2,669</td>
<td>17.79%</td>
<td>Aug. – 3,303</td>
<td>22.02%</td>
<td>Mar. – 1,952</td>
<td>13.01%</td>
<td>40.90%</td>
</tr>
<tr>
<td>2016</td>
<td>2,726</td>
<td>18.18%</td>
<td>Jul. – 3,542</td>
<td>23.61%</td>
<td>Apr. – 2,068</td>
<td>13.79%</td>
<td>41.60%</td>
</tr>
<tr>
<td>2017</td>
<td>3,232</td>
<td>21.55%</td>
<td>Feb. – 5,556</td>
<td>37.04%</td>
<td>Nov. – 2,360</td>
<td>15.73%</td>
<td>57.52%</td>
</tr>
</tbody>
</table>

* 15,000 gallon capacity, limited to 12,500 gallons by U.S. Forest Service

4.0 REHABILITATION WORK PERFORMED

This treatment system had been in continuous operation since its construction in 1984, and the aeration tank and chlorine contact basin had not been emptied in approximately 34 years.

RWRD’s Capital Improvement and sub-regional facility staff planned and prepared a shut-down of the treatment plant. It was unknown what the condition of the facility would be once drained, since it had not been drained in 34 years. When the shutdown was in the initial planning stages in the fall of 2017, it was determined that a “worst case” scenario should be anticipated and planned for. Planned by SRF O&M staff and performed by KE&G Contractors (Job No. 180177), the oxidation ditch, clarifier, sludge holding tank and effluent disinfection tank were drained, power-washed, and inspected. The contents of the facility were vacuumed.
out and pumped in to sludge hauling trucks; loads were then transported to a manhole at the bottom of Mt. Lemmon and dumped into the conveyance system to be delivered to the Tres Rios WRF. Tanker trucks remained at the plant to vault and haul any flow during the rehabilitation.

The rehabilitation project and shutdown lasted from April 30, 2018 to May 4, 2018, with waste from the storage tank and existing sewer flows being diverted to tankers for transportation down the mountain and eventual discharge into Pima County’s conveyance system via manholes located at the base of the mountain. Overall, the facilities were in much better condition than originally anticipated, and rehabilitation/repairs were able to be conducted in an optimal time frame.

4.1 Recoating of the WRF
After the oxidation ditch, clarifier, and effluent storage tanks were drained and cleaned, there were several tests conducted immediately, including a visual examination of the tanks, steel thickness measurements, and weld inspections. Although the original coating appeared in relatively decent condition for its time in service, a complete recoating of these tanks were needed to extend their lifespan. There were portions of the wall where the coating had completely delaminated, leaving the steel exposed. Additionally, the tank walls also showed signs of dilapidation and the presence of fluid-filled black bubbles. It was clear that a recoating of the tank wall would help restore any efficiency that was lost due to these imperfections.

S-301 Epoxy Spray System, a fast drying coating developed by Warren Environmental, was chosen for its quick full-curing time (about 8 hours) and resistance to harsh weather conditions. This coating is a one hundred percent epoxy coating, applied by a specialty contractor with patented equipment. The coating application process began with a thorough brush-blasting to white metal and vacuuming of the tanks, including minor grinding to smooth any worn surfaces. The coating was then applied at a 120 mil thickness to both the primary mixed liquor tank, clarifier, and chlorine contact basin. The new coating was white, whereas the old coating was black. This change in color was well accepted by the operators who can now see through the mixed liquors and effluent better.

Future inspections to the visible portions of the tank coating should be conducted on an annual basis from this time onward. Detailed tank inspections of the entire system should be completed every ten years.

4.2 Equipment Protection Splash Guard
A rotor splash guard was installed by plant staff many years ago between the 12 and 3 o’clock position of the tank to prevent mixed liquor from splashing out of the oxidation ditch aeration tank near the compressors. The splash guard was made of welded steel and truck mud flaps. The condition of this modification was rusted and falling apart. The mud flaps and corroded steel were replaced by rubber neoprene sheeting and a new steel frame to help keep liquid solids from exiting the tank just after the aerating rotor.
4.3  Aeration Rotor Splash Guard
A neoprene sheet was affixed just after the aeration rotor to further reduce splashing of mixed liquors and help direct more air into the tank.

4.4  Splash Guard for Effluent
To avoid contamination of clarified final effluent by aerated solids, a Plexiglas acrylic sheet and metal frame shield was installed between the 4 and 5 o’ clock position of the oxidation ditch aeration tank and chlorine contact basin in the southeast position. This shield will prevent any splashing or spraying of solids into the already treated effluent.
4.5 **New Air Compressor to Match Existing Electrical**

Replacement of the older air compressor was also needed as it was at the end of its service life. The replacement compressor had to be special ordered in order to be compatible with the electrical requirements of the old one. The new compressor was also upsized for added capacity and an air drier was added to eliminate condensate in the air system.

4.6 **Replacement of Aerator in Sludge Holding Tank**

When the sludge holding tank was drained, it was discovered that one of the two coarse bubble aeration diffusers located inside the tank for mixing and aerobic sludge treatment had broken off and was missing. It was replaced with a similar style diffuser to recommission the tank to its original operation.
5.0 FUTURE MOUNT LEMMON WRF PROJECTS TO CONSIDER

There is potential for a number of projects to be completed at the Mount Lemmon WRF to increase efficiency, ease operation, create a safer working environment, create more beneficial use for the reclaimed water produced, and help monitor operations during roadway and weather restricted access to the plant.

5.1 Project 1 - Upgrade the Electrical System

Mt. Lemmon WRF is still presently operating using the original 208V system, while all of the other facilities under Pima County are using the upgraded 480V based system. The electrical equipment is located within a small control room, so operations personnel are often within arc flash boundaries. When originally constructed, NFPA 820 classification issues were not identified for the treatment facilities building. The treatment facility area is currently shown to be a Class 1 Division 1 hazardous classification area per NFPA 820 “Standard for Fire Protection in Wastewater Treatment and Collection Facilities” Table 5.2. Existing construction and lack of ventilation constitute a potential hazard to personnel safety. The existing control room is not sufficiently isolated from the oxidation ditch room, so that room is also a Class 1 Division 1 hazardous classification area.

Per the Standard, the potential exists for explosive gases in the entire treatment facility building. Any modifications to the MCC or electrical system will require the electrical system and control room to be brought up to code compliance per NFPA and NEC. It is recommended that investigation and mitigation to NFPA and NEC standards and electrical equipment at this location be relocated, repaired, or substituted for newer models to ultimately ensure compliance with today’s safety codes, minimize loss of utility power, and enable easier market accessibility when parts are in need of replacement.

Presently, electrical panels and breaker cabinets are situated in the main work area of human occupancy. The emergency generator is also located inside of the main plant building, which is constructed out of wood. All panels, cabinets, and generators must be replaced and relocated to a specifically designated electrical enclosure in order to comply with today’s safety codes.

The emergency electrical generator, engine, and power automatic transfer switch must be replaced with newer models to both ensure access to relevant repair parts and minimize loss of power in the event of an emergency. While the original equipment has been reliable over the years, unit parts are becoming more difficult to come by when conducting reparations on the generator, engine, and automatic transfer switch. Immediate replacement of the transfer switch is also recommended as power will not automatically switch to the emergency generator on loss of utility power if this switch were to fail. After this new equipment is properly set up, all associated switch gears and panels are to be installed in a newly constructed building separate from the process building and within all safety codes.

A small generator and panel must also be installed at the Booster Station of the spray field to power this location on a loss of power, as this site is not picked up by the Trico or plant generator in the event of an emergency.
For the upgrade at the treatment facility, the power pole that supplies the treatment building would be upgraded to 480V; a new generator would be purchased to provide power to a new automatic transfer switch; the new automatic transfer switch would feed a new transformer; a new MCC control panel would be located in a small prefabricated building with HVAC outside of the treatment building; new wiring would be pulled from the new MCC to the treatment building and to equipment; motors would need to be rewired, or replaced if wiring cannot be performed. For the power generator at the spray field, a new small 208V generator with an all-weather sound reducing enclosure would be installed and connected to a new automatic transfer switch.

5.2  Project 2 - Supervisory Control and Data Acquisition System Installation
Currently, the Mt. Lemmon WRF does not have any outside remote control capabilities besides a simplified remote auto-dialer system scheduled to trigger a couple of alarms. The installation of a supervisory control and data acquisition system (i.e. SCADA) would introduce options to remotely monitor levels and pump functions, assess indications of generator operations and plant alarms. The SCADA system would also remotely maximize operational ability of the lift station and process equipment at the main plant and help capture operational data to improve treatment performance. All of RWRD’s treatment facilities have been or are in the process of being ungraded with SCADA to improve monitoring, operations, and tracking performance. These SCADA systems are also linked to the RWRD Operations Control Center which is monitored 24-7 at the Tres Rios WRF. Improving the alarm call-out notification system is of the upmost priority, but installing remote operating capabilities plant-wide will also be imperative in the effort to maintain a constant channel of communication between the plant and the Booster station. A direct buried phone line, with most of its twisted pairs no longer functional, is currently the only avenue of contact from the booster station to the plant site.

5.3  Project 3 - Influent Equalization Basin
Due to the high transient population from visitors to the area, flow is received at the facility in large spikes during the day, leaving the oxidation aeration basin susceptible to high loading rates during these surges and nearly non-existent rates at night. This inconsistent and uneven flow starves the biology of the plant at night, resulting in denitrification of the sludge and floating solids in the clarifier; overloading the plant during the day proves to be a major concern as well as this can cause washout of solids and possible short circuiting of wastewater through the treatment process. An influent equalization basin allows a place for wastewater to be stored so that the facility can be fed wastewater in a more even, consistent matter. The equalization tank could be coupled with an aerated grit removal system to help remove harmful erosive material such as sand and egg shells, while helping to maintain fresher wastewater through constant aeration. The positive effects of an aerated grit removal equalization basin would ultimately make the exploration of other reclaimed use options more feasible in the future.
5.4 Project 4 - Aeration and Mixing of the Oxidation Ditch
While a spare gearbox and motor are in place to support the original rotor and accessories still intact at the plant site, air entrainment with a rotor, which uses paddles to splash air into the water, is not the most efficient form of aeration and mixing. More sustainable, energy-efficient options for aeration, movement, and treatment of ditch contents could be considered. The conversion of organics, such as ammonia, into inorganics (nitrification) requires air/oxygen, while the removal or nitrogen (denitrification) is performed under anoxic (low air/oxygen) conditions. Distinctly separating these two phases with better controlled equipment would help provide a healthier plant and better treated effluent.

Some of the upgrade strategies to control air include: A variable frequency drive (VFD) controlled by a dissolved oxygen (DO) probe added to the rotor motor to control the rotor speed; blowers with coarse bubble air entrainment through jet aeration with motive pumps to add large bubbles to the ditch and keep solids in suspension; or blower motors with fine bubble diffusers to add air effervescently into the wastewater with mixers to keep solids in suspension. These upgrades to the plant could be implemented to help reduce energy costs, increase reactor efficiency, increase unpermitted capacity, and lead to a cleaner effluent which would also make the exploration of other reclaimed use options more feasible in the future. A separate engineering evaluation would be performed to evaluate which option would most appropriately suit the facility.

5.5 Project 5 - Effluent Tertiary Treatment
Tertiary treatment involves the filtration of effluent to remove any solids that may have floated over the weirs of the clarifier. This filtration could include reverse osmosis, microfiltration, fabric cloth, diatomaceous earth, or even compressible synthetic fiber spheres. Currently, the treatment plant produces Class B reclaimed water (A.A.C. R-18-11-306) effluent for disposal. For a facility of this size, tertiary treatment is required by ADEQ to produce A or A+ quality reclaimed water (A.A.C. R-18-11-304 and 303, respectively) effluent. Reverse osmosis would clean the water to greater than drinking water standards and the membranes can be very maintenance intensive. Microfiltration may also remove more than is needed to meet Class A or A+ reclaimed water effluent standards. It is recommended that RWRD perform a separate engineering evaluation for effluent tertiary treatment to increase the quality of the effluent and help provide more viable options for disposal or reuse. The tertiary treatment system would be small in size because of the size of the treatment plant. The addition of tertiary treatment may require RWRD to apply for an ADEQ individual APP permit instead of operating under the current General Permit. Although, if placed near the disposal site, it may not be considered part of the treatment plant.

5.6 Project 6 - North Rock-Wall Stabilization
Some work has been done on the cliff face on the North side of the facility to help protect it from the slope that has been cut-out, but a much more inclusive and permanent fix needs to be done to stop the north face erosion into the plant site. This will stabilize the trees, boulders, and debris in this area and protect the parking area and building. RWRD should also consider
extending this rock-wall to the West to allow for installation of other facilities or areas for operations equipment and storage.

Figure 6 – Project Placement

6.0 PROJECT COSTS
6.1 Cost Estimates and Construction
Opinions of probable costs have been generated for the six projects best suited for the wastewater collection and/or treatment system upgrades for the Mount Lemmon WRF. Total estimated construction costs are presented in Table 5-2. The cost estimates were generated using historical information from the Treatment Capital Improvement Group.

Table 4 - Estimated Construction Costs

<table>
<thead>
<tr>
<th>Project</th>
<th>Construction Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1 — Upgrade the Electrical System</td>
<td>$ 632,816</td>
</tr>
<tr>
<td>Project 2 — SCADA System Installation</td>
<td>$ 270,000</td>
</tr>
<tr>
<td>Project 3 — Influent Equalization Basin</td>
<td>$ 850,000</td>
</tr>
<tr>
<td>Project 4 — Aeration and Mixing of Oxidation Ditch</td>
<td>$ 350,000</td>
</tr>
<tr>
<td>Project 5 — Effluent Tertiary Treatment</td>
<td>$ 150,000</td>
</tr>
<tr>
<td>Project 6 — North Rock-Wall Stabilization</td>
<td>$ 80,000</td>
</tr>
</tbody>
</table>
6.2 Non-Construction costs explained

Some non-construction cost estimates were not included in the costs above. Many of these items would occur in-house. These items are described as follows:

1. **Meetings and permitting** to discuss the necessary permitting with other agencies, such as ADEQ for APP or AZPDES permit and fees, USFS for discussion of land use, alteration of the effluent use permit, and alterations to the use of the land the plant sits on. This includes plan review, correspondence and meeting new requirements.

2. **Engineering design** includes site review, preparation of plans, design review meetings with RWRD staff, correspondence and meetings with utility companies, preparation of final engineer’s opinion of probable costs, specifications, advertisement and contract documents.

3. **Geotechnical services** shall include the mobilization of drilling and testing equipment to the project site, providing the appropriate number of test holes and borings to assess the existing geological site conditions, including advice on dewatering requirements (if any) and their impact on design. The geotechnical engineer will conduct tests on the soils to determine bearing capacity, corrosiveness of soils and any additional tests determined necessary. Any necessary adjustments to the specifications and project design shall be included based on the results of the geotechnical report.

4. **Survey services** shall include the mobilization of survey crew and equipment to the project site, provide appropriate number of shots to clearly define vertical and horizontal control for the site. The survey will provide an improvement survey indicating all existing structures and utilities, a topographic survey with vertical and horizontal control, and control points for construction.

5. **Potholing of existing utilities** should mitigate potential conflicts and assist in the final design and vertical layout of the improvements. The need to pothole existing utilities will be assessed during the design of the proposed improvements. Upon completion of the layout of the horizontal alignment of the proposed improvements, crossing between existing utilities and the proposed improvements will be assessed and recommendations will be made if the crossing should be potholed.

6. **Bidding services** include advertising the project, coordinating with contractors, providing project clarification, issuing plans and specifications to contractors, maintaining a bidders list, attending pre-bid conferences, preparing addenda, opening bids, tabulating bids, reviewing bids, and recommending award.

7. **Construction administration** services include engineering services to answer request for information submittals (RFIs) from the Contractor, review pay application, prepare work directives and change orders, perform periodic visits to the site, attend construction progress meetings, and attend a walk-thru for both substantial and final completion. Other services will include materials field testing and full-time construction inspection with an on-site representative.

8. **Reports** include pre-design efforts before design and construction of the project. They include studies such as Environmental Information Documents, Environmental Assessments, and Preliminary Engineering Reports.
9. **Legal fees** include fees for the Owner’s Attorney and Owner’s Bond Counsel for litigation purposes for any unknowns or unanticipated items that may come up during construction.

### 7.0 SELECTION OF A PROJECT

**Matrix Rating**

To facilitate the decision making process on an objective basis, the six projects were evaluated based on key attributes including:

1. **Capital Cost**—this attribute accounts for the construction cost estimates of the project. The more costly the project, the lower the project will score.
2. **Constructability**—this attribute accounts for the difficulty of construction and accounts for depth of construction, available work area and other difficulties during construction. The United States Fish and Wildlife Service designated that the Mexican Spotted Owl breeding season begins February 1st and ends August 31st. Any construction with motorized equipment must occur outside of this season.
3. **Site Availability/Land Acquisition**—this attribute accounts for all land acquisition and easements that will be needed for each project. The fewer acquisitions and easements required for the project, the higher the score.
4. **Operation and Maintenance (O&M)**—this attribute accounts for O&M costs associated with the project. The more costly the O&M costs are for the project, the lower the project will score.
5. **Permitting and Risk of Noncompliance/Fines**—this attribute accounts for the costs and required timeline associated with project permitting as well as risk of fines and corrective actions associated with permit noncompliance.
6. **Environmental Impacts**—this attribute accounts for how the installed project will affect the environment once installed. The more favorable the impact on the environment once the project is installed, the higher the project will score.
7. **System Reliability**—this attribute accounts for system reliability and accounts for the lifespan of the system project installed. The more heavily the project relies on mechanical systems, the lower the score will be.

Each attribute was given a weight of 1 to 3 based on the importance of the attribute in selecting the system, 1 being of lesser importance and 3 being of greatest importance. Each attribute was then assigned a score ranging from 1 to 6 for the respective project, with 1 being the least desirable and 6 being the most desirable. The score and the product of its weight provided the weighted score for each of the projects. Table 4, below, displays the matrix ranking for Projects 1 - 6. The project with the highest weighted score received the top rank.

### 7.1 Project 1 - Upgrade the Electrical System

Project 1 received the second highest score when compared to the other five projects and should be the one of the most desirable projects. The electrical system upgrades fared well in the permitting and risk of noncompliance category, operation and maintenance category as well as the system reliability category, because the upgrade of the electrical system will bring the facility into compliance with NFPA/NEC standards and make the electrical system more reliable. The electrical system is like the nervous system in the body; if it is not running
optimally, the plant will not be running optimally. The electrical upgrades will require some real estate to the West of the plant. The capital cost of the project did hurt the score because it is the 2nd most expensive project of the six proposed. It was assumed that most of the work required with the electrical upgrade could be planned so that there is a good maintenance of plant operations (MOPO) plan, requiring very little time for a shut-down. Other upgrades to the facility, requiring new electrical equipment, cannot be performed until the electrical system is brought into compliance.

7.2  Project 2 - Supervisory Control and Data Acquisition System Installation
Project 2 received the highest score because it is one of the most cost-effective projects being performed, does not require real estate, improves system reliability, and constructs a basis for remote data collection to keep better track of plant operations and make collection and submittal of compliance data easier. If installed with the electrical upgrades, the combined costs between the two projects may be greatly reduced.

Table 5 - Matrix Rating of Projects

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Weight</th>
<th>Upgrade Electric</th>
<th>SCADA Upgrade</th>
<th>Influent Equalization</th>
<th>Aeration &amp; Mixing</th>
<th>Tertiary Treatment</th>
<th>Rockwall Stabilization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Score Wt x Score</td>
<td>Score Wt x Score</td>
<td>Score Wt x Score</td>
<td>Score Wt x Score</td>
<td>Score Wt x Score</td>
<td>Score Wt x Score</td>
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<td>Site Availability &amp; Land Acquisition</td>
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<tr>
<td>Permitting &amp; Risk of Noncompliance</td>
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<td>10</td>
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<td>6</td>
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<td>Enviro Impacts</td>
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<td>4</td>
<td>4</td>
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<tr>
<td>System Reliability</td>
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<td>1</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.3  Project 3 - Influent Equalization Basin
Project 3 came in fifth, because the costs to perform the installation of an equalization basin were high. In addition, the proposed site took up a large space of land on the East side of the facility. The equalization basin may require RWRD to submit an Individual APP application to ADEQ, which would open up the facility to many recent requirements that were not included in the historic General Permits which are no longer issued. The equalization basin did do very well with environmental impacts as the facility would operate better if the large spikes in flows could be slowly fed to the plant; this could help prevent solids from being washed out of the oxidation ditch and reduce starvation of the treatment biology during low flow periods. It would be recommended to make this the third project, but perform a preliminary engineering evaluation to determine what items, such as grit removal or odor control would really be needed. If the plant could utilize the equalization basin only during the high usage days and not consistently, the costs may be drastically reduced. Consider just having a tank that gravity feeds back to the treatment facility, and making it part of the collection system to avoid having to apply for an Individual APP.

7.4  Project 4 - Aeration and Mixing of the Oxidation Ditch
Project 4 was tied for third. This project does not require any real-estate, had average project costs, but may require RWRD to apply for an ADEQ Individual APP Permit. The VFD with DO control, to operate the existing rotor, may not require alteration to the existing general permit. The treatment facility was designed for 15,000 GPD, so there would have to be a good business case made for the installation of a different aeration system. Fine bubble diffusion would require routine replacement and increase operation, maintenance and plant shut-down, due to lack of redundancy at the plant, compared to rotor operation alterations. OVIVO does have membranes that do not require maintenance for 20 years, but it is doubtful that energy savings will offset the costs of this upgrade and extra capacity is not needed at this time.

A engineering evaluation should be performed to select which alternative will be most suitable for the plant. Some of the alternatives would suit very well and could be performed at the same time as other projects to reduce costs and increase treatment capabilities. For example, performing rotor upgrades (VFD with DO control) or blower/jet aeration during the electrical upgrades may greatly reduce installation costs. Also, coupling the aeration and mixing upgrades with the influent equalization basin and/or tertiary treatment could produce reclaimed water effluent quality comparable to RWRD’s larger facilities, which could greatly increase regulatory and public acceptance for other uses of the reclaimed water.

7.5  Project 5 - Effluent Tertiary Treatment
Project 5 came in sixth, because more information is needed and an engineering analysis would need to be performed. Tertiary treatment will require an ADEQ Individual APP permit, unless it could somehow be performed near the effluent disposal field and not be deemed part of the treatment process. The treatment facility building appears to be somewhat congested, so the filtration of effluent may need to occur outside, unless the electrical and generator upgrades are performed, which would move this equipment into a building outside. With the small amount of flow that the plant is permitted for, the tertiary treatment would require a small
footprint. Adding tertiary filtration could help the facility achieve A+ reclaimed water standards and change public perception of discharging effluent into Sabino Creek. Although this filter would require extra maintenance, it may reduce chlorine/dechlorination demand and open up discharge options that could reduce electrical pumping and disposal costs to the current disposal field. RWRD may want to consider further evaluation of a tertiary treatment system to determine the type of system would best suit the needs of the facility.

7.6 Project 6 - North Rock-Wall Stabilization
Project 6 received a score which tied it for third place because of the low installation costs. The project does not appear to have environmental impacts, outside of the Mexican Spotted owl breeding season, or O and M impacts when compared to the other 5 projects. Because of the low cost, the project may be incorporated with the electrical upgrades or equalization basin, so that the rock stabilization could be constructed while other site improvements are being performed.

8.0 CONCLUSION AND RECOMMENDATIONS
The Mount Lemmon Water Reclamation Facility has a permitted capacity of 15,000 gallons of which approximately 25 percent is being utilized. In the past, RWRD was concerned with the condition of this 34 year old facility, but during a recent evaluation and rehabilitation project, the facility was found to be in extremely great condition which should allow the facility to operate for another 20-30 years.

The facility has an outdated electrical system and generator. Because of issues with weather, road conditions and/or fire closing off the road, it is recommended that electrical and SCADA upgrades be performed. These upgrades will help bring the facility into compliance with current codes/standards and greatly increase the reliability of the plant. SCADA improvements will allow the system to be remotely monitored 24 hours a day so that any issues that arise when operators are not present can be identified quickly. RWRD should consider stabilizing the rock wall during the next construction project to protect the facility on the North side and reduce costs by incorporating combining projects. Upgrading the aeration system to include a variable frequency drive on the rotor’s motor controlled by a dissolved oxygen meter should be evaluated and considered in the electrical upgrades; this in turn could help improve treatment and reduce electrical costs during times of low flow. This construction must occur outside the Mexican Spotted Owl breeding season which begins February 1st and ends August 31st. After the electrical, SCADA, and rock wall upgrades are performed, plans for an equalization basin, to be used when high flows are expected, should be considered. If the facility plans on discharging to Sabino Creek in the future to save costs on effluent disposal, it is recommended that tertiary treatment be further evaluated and possibly installed with the equalization basin. This would require an application for a new individual APP amendment, but could help the facility achieve A+ effluent requirements, which could help with public perception of secondary effluent discharges into the Sabino Creek through the use of a revised AZPDES permit.
Mount Lemmon Tank Rehabilitation
Summerhaven Sewer Facility
Maintenance Project Report

April to May 2018

KE&G Job No. 180177

Prepared for:
Pima County Regional Wastewater Reclamation Department
c/o KE&G Construction, Inc.

Prepared By:
Cascade Engineering and Drainage, Inc.
May 16, 2018
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APPENDICES

Appendix A – Project Team List
Appendix B – Project Photos
Appendix C – KE&G Project Schedule
Appendix D – Tank Thickness and Weld Inspection Reports
Appendix E – Coating Product Data Sheets
Executive Summary

The following report documents the maintenance activities and related quality assurance efforts for a coating rehabilitation (recoating) project for the sewer mix tank at the Summerhaven Sewer Treatment Facility. The coating rehabilitation project was completed from April 30, 2018 through May 4, 2018 by KE&G Construction, Inc.

The primary area of the rehabilitation or recoating was the interior of the tank and also the chlorine contact basin. Additional items also completed included replacement of steel plating along one part of the tank, new splash guards for the rotor as well as a spray shield for the chlorine contact basin.

Because the tank had not been emptied in 34 years, and due to the limited time for shut down, the project was approached with a specific coating schedule. The tank was inspected essentially as soon as it was emptied. The tank was determined to be in decent condition with no major damage. The tank was coated with a quick cure, one hundred percent epoxy coating by a specialty contractor utilizing patented equipment.

It is recommended that maintenance inspections of the upper or exposed areas of the tank where the coating is visible be conducted on an annual basis. A detailed inspection of the entire tank should be completed in ten years.
1.0 Introduction

This report has been prepared to document maintenance activities performed on the sewer mix tank at the Mount Lemmon Sewer Facility located at 12633 North Sabino Canyon Park in Summerhaven, Pima County, Arizona. In the fall 2017, Pima County Wastewater Reclamation staff determined the need for detailed maintenance of the tank. The tank had not been emptied in approximately 34 years. The project was scheduled to be completed by KE&G Contractors during the spring to avoid winter conditions. Prior to the project, extensive planning and research was completed to determine the best methods to address the condition of the tank. The project also required coordination of delivering continual sewer flows from the town of Summerhaven to the sewer facility. In addition, the tank was evaluated. The evaluation included a visual examination, steel thickness measurements, and weld inspections.

The project was completed on schedule during the first week of May. KE&G also completed other maintenance items at the facility including changing out a compressor and replacing a steel shield at the mix tank.

2.0 Background

The Summerhaven Sewer Treatment Facility was constructed in 1982/83 to serve the community of Summerhaven. The facility has been in continuous operation and is maintained on an ongoing basis, however the central mix tank as well as other portions of the main treatment system, including the chlorine and sludge overflow tanks, have never been emptied for maintenance. Being located on top of Mount Lemon, the diversion of ongoing sewer flows for maintenance presented certain challenges including how and where to deliver the existing sewage waste as well as how long of a shut down would be required.

3.0 Project Approach

Prior to the project start, a great deal of research and discussion took place to determine the best approach or strategy for this project. The goal was to be prepared for a “worse case” scenario depending on the condition of the tank. Therefore, the approach for the tank inspection and maintenance was to clean out the tank and conduct the inspection immediately to determine the tank’s condition. The tank was to be brush blasted and then coated with a quick cure one hundred percent epoxy.

The approach to this project was to intercept the existing sewer flows, as well as collect the waste within the existing tank and place the waste material into tankers for delivery down the mountain. Once at the bottom of Mount Lemmon, the waste would be discharged into Pima County’s sewer system at a manhole or manholes near the base of Mount Lemon.
4.0 Coating Rehabilitation Project

4.1 Description - This project focused on the need for rehabilitation or recoating of the interior of the mixing tank. There was also the possibility of repairs to the tank or tank support structure as well. It had been determined to utilize a coating system that provided a fast cure time (roughly 8 hours) and that also would withstand the harsh conditions of the tank’s environment and sewer waste contents. The tank was found to be in adequate condition to continue service without any structural repairs.

4.2 Existing Conditions

4.2.1 - Existing Coatings: Examination of the existing coatings took place on April 30 shortly after the tank was emptied and cleaned. The condition of the tank was found to be in decent condition. The existing coating was essentially past its serviceable or useful life. The tank walls show consistent dilapidation consisting of corroded mounds as well as black bubbles full of fluid varying in size from roughly one-half inch to two inches in size. There were also miscellaneous spots where the coating had delaminated leaving exposed steel wall. The wear on the existing coating was generally uniform throughout the tank.

4.2.2 - Existing Tank Condition: The tank walls were found to be in decent but worn condition. There were no areas that were excessively damaged leaving the walls thin. Pitting was noted in certain areas of the tank and on the effluent pipe.

The thickness of the tank walls was measured at roughly one-foot intervals at four different locations within the tank, approximately at 1:00, 3:00, 6:00, and 9:00 O’clock prior to coating removal. Note, a “Tank Layout Exhibit” is provided in Appendix B. The results for the wall thicknesses ranged from 0.256 to 0.30 inches thick. It is concluded that the tank has experienced minimal steel loss within its walls. See Appendix D for the tank wall measurement report.

There was modest pitting also noted on the tank walls. The majority of the pitting occurred on the clarifier exterior walls. The depth of the pitting was measured and ranged between roughly 1.0 up to 4.3 millimeters or 0.04 to 0.17 inches. Pitting was also noted on the horizontal effluent pipe with depths of 2.0 to 3.9 millimeters or 0.08 to 0.15 inches. See the photos of the pitting areas with depth measurements shown in the Appendix B. Note, the measurements noted within the photos are in millimeters.

The steel connection at the base of the tank walls with the upper side of the C-channel were found to be in decent condition. Minor rust was noted in two areas along the floor perimeter of the tank but no substantial steel loss. The welds were visually examined with no significant steel loss or damage noted. See the Welding Inspection Report within Appendix D.

The floor of the tank consists of concrete. It was found to be in generally good or decent condition as well. There was evidence of a loss of concrete, slightly exposing the aggregate in some areas. At the base of the 4-inch drain valve, more concrete loss on its surface was noted, most likely due to friction caused with flows at the valve attachments.
4.3 - Coating Removal: The existing coating was removed by A&O Painting who performed a brush off blast with #36 garnet blast material to remove the existing coating. They obtained an SSPC SP7 roughness condition.

4.4 Coating Application

4.4.1 – Final Tank Preparation: Because the tank was found to be in decent condition, no specific tank preparation was required other than brush off blasting and thoroughly cleaning the steel surface. The tank did receive minor grinding to smooth out any places with protruding or rough surface. The entire tank was vacuumed to assure full removal of any dust and particulate matter.

4.4.2 – Coating Description: The coating for this project, Warren Environmental, Inc.’s product 301-14 – 100% Solids Epoxy System, is a specialty coating that is made to withstand extremely harsh environments as well as achieve a full cure within 8 hours. This product is currently used by Pima County for the rehabilitation of sewer manholes. The coating system will adhere to different substrates, wet or dry, and is used with a single layer. The coating design was to be applied at 80 mils thickness, however, per the applicator, a more realistic actual thickness is about 120 mils or roughly 1/8 of an inch thick. See Appendix E for the coating data sheets.

4.4.3 – Coating Inspection: A visual inspection of the coating application was conducted on May 2, 2018. At the time of the inspection, the coating had cured roughly two hours and was “tacky” to the touch. The depth of the coating applied was verified to be well over 80 mils and closer to 120 mils. The coating appeared to be evenly distributed throughout the tank walls as well as effluent pipe. The coating was also applied at the weir inlet structure (at roughly 10:00) and generally extended up the underside of the angle iron bracing for the walk area above.

Along with the primary mix tank, the coating was applied to the chlorine contact basin as well. The application within the tank appeared to be consistent and of adequate thickness.

5.0 Project Time Line

The following provides a summary of the time line of the project specific to the mix tank recoating. Note, see Appendix A – Project Team List, for a list of each contractor/inspector with contact information.

- Mid fall 2017, Pima County decides the project will occur in the Spring after snow melts on Mount Lemmon.
- January through April 2018, KEG works with Pima County to determine best approach to the project as well as potential problems to anticipate.
- April 20, 2018, Preconstruction Meeting
- April 30, Tanker trucks set up to intercept existing sewage from Summerhaven, tankers with vac truck empty mix tank. Tank cleaned out. CED does inspection of tank including wall thickness measurements.
- May 1, A&O Painting brush off blasts tank as initial prep work for tank coating. CED conducts inspection including pitting depth measurements.
• May 2, Olson Precast Company applies coating to tank. CED conducts final inspection.
• May 3, KEG observes final cure of tank and completes other items at facility. Begin refilling the tank to return it to service by Friday.
• May 4, Tank returned to regular service.

6.0 Conclusions and Recommendations

From April 30 to May 4, 2018 a construction project to rehabilitate the existing coating of the sewer mix tank at the Summerhaven Sewer Treatment facility was completed. Detailed prior planning took place to anticipate different scenarios for the condition of the tank, and a specific plan of action was followed. The tank was brush off blasted and evaluated prior to coating application. Visual weld inspections and steel thickness measurements were performed to assure that the tank is in adequate condition. A specialty quick cure 100 percent epoxy coating was applied for the rehabilitation. The sewer tank was returned to service by May 4 as planned.

The recoating of the mix tank appears to have been completed in accordance with the coating manufacturer recommendations that included a specialty coating applicator utilizing the manufacturer’s patented coating spray equipment. The coating manufacturer indicates that the coating has a life expectancy of anywhere from 10 or 15 to 20 years.

A general inspection that focuses on the exposed newly coated areas of the tank should be performed annually. A detailed inspection of the tank should be conducted in ten years. Additionally, if any unusual conditions or wear are noted on the tanks exterior, additional inspections would be warranted.
APPENDIX A

Project Team List
Project Team:

KE&G Construction, Inc.  
5100 S Alvernon Way  
Tucson AZ, 85706  
Thomas Mansfield  
520 748-0188  

KEG General Contractor

A & O Painting  
3237 East President Street  
Tucson, AZ 85714  
Alex “Bruiser” Ortega  
520-573-0051

A&O Coating Contractor (Prep work)

Cascade Engineering & Drainage, Inc.  
PO Box 68197  
Tucson, AZ 85737  
Ross Lamberson, P.E.  
520-425-1937

CED Quality Assurance

Olson Precast Company  
2810 North Nellis Boulevard, Suite 100  
Las Vegas, NV 89115  
Andy Michalsky, P.E.  
702-643-4371

OPC Coating Contractor

Canyon State Inspections, Inc.  
3625 East Ajo Way  
Tucson, AZ 85713  
Chris Dolan  
520-745-3672

CSI Weld Inspections & Steel Thickness Measurement

Warren Environmental, Inc.  
137 Pine Street  
Middleborrough, MA 02346  
508-947-8539

WEI Coating Product Provider
APPENDIX B

Project Photos

Tank Layout Exhibit

Part 1 – Existing Tank Coating
Part 2 – Tank After Blasting Prep
Part 3 – Pitting Measurements
Part 4 – Other Appurtenances
Part 5 – Completed Coating Rehabilitation
Part 1 – Existing Tank Coating
Part 2 – Tank After Blasting Prep
Part 3 – Pitting Measurements (in millimeters)
Part 4 – Other Appurtenances
Part 5 – Completed Coating Rehabilitation
APPENDIX C

KE&G Project Schedule
Mt Lemmon Tank Assessment and Coating

Ancon scheduled with vac truck and tanker services. 2 vac truck and 4 tankers (5000Gal/each). They plan on turning 1st truck around and back up the mountain. Overtime in their proposal to KE&G to ensure tank is drained and cleaned on first day. Tank will have to be pumped to tanker trucks. Spill prevention to include poly wraps at all hose joints and a catch basin/containment at the tanker connection. Ancon scheduled to be on site at Mt Lemmon at 7am. Expect tank to be empty at ~ noon with cleaning taking and additional 2-4 hours.

AO scheduled with prepping tank surfaces for inspection and repair. Their cost proposal to KE&G has overtime allotted to ensure the tank is prepped and clean for coating. AO scheduled to be on site at 7am at Mt Lemmon. Cascade Engineering will also be on site at 7am to enter tank as AO is setting up for surface prep. Expect surface prep to take 6 hours with tank cleanup taking an additional 2-4 hours.

Cascade Engineering is scheduled to perform inspection when tank is drained and cleaned (7am on day 2). This inspection is to look for obvious signs of damage or degradation of the tank walls and to ensure that tank prep will not cause any further damage to the tank. Cascade will then inspect tank following surface prep to take wall thickness measurements and assessment (7am day 3). Cascade will then inspect the tank post coating.

Jenco to coat the tank with a Warren Environmental product. It is a 100% solids Epoxy Lining System for structural rehabilitation in harsh environments. (See provided sheet). They are scheduled to arrive 7am on site at Mt Lemmon. They will set up coating equipment while Cascade Engineering is performing post surface prep inspection and assessment.

Time line
Day 1 (4/30). Pump/Drain and Clean tank: Ancon and KE&G

Day 2 (5/1). Inspect and surface prep tank: Cascade Engineering, AO and KE&G

Day 3-5 (5/2-5/4). Engineering Evaluation and Repairs: Cascade Engineering, Jenco and KE&G

Other work to be performed: Install supplied Air Compressor and Dryer and replace bubbler/spray heads. Work to be performed by KE&G and Sabino Electric.
APPENDIX D

Tank Thickness and Weld Inspection Reports
PURCHASE ORDER: Mt. Lemmon Sewage
CSI JOB NUMBER: GT18-207
Date: 04-30-18
Report: 01
Page: 02 of 02

Client: Cascade engineering
Address:

ULTRASONIC THICKNESS CHECK IAW CUSTOMER REQUEST

In accordance with your request, Canyon State Inspection performed an ultrasonic thickness on the Mt. Lemmon Sewage Tank. Listed below are the results of our testing: West to East

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<th>B</th>
<th>C</th>
<th>D</th>
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Reviewed By: [Signature] Chris Dolan
**VISUAL WELD INSPECTION PER AWS D1.1**

In accordance with your request, Canyon State Inspection/Tucson performed visual weld testing at the Mt. Lemmon Sewage Tank, located in Tucson, AZ. Listed below are the results of our testing:

**FINAL REPORT**

<table>
<thead>
<tr>
<th>Area</th>
<th>Level</th>
<th>Quantity</th>
<th>Accept</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>Inside of tank @ welded areas</td>
<td>All</td>
<td>All</td>
<td>100%</td>
<td>Minimal corrosion pitting noted throughout.</td>
</tr>
<tr>
<td>Inside tank on wall</td>
<td></td>
<td></td>
<td></td>
<td>Need coating Removed to get depth measurement on pitting</td>
</tr>
</tbody>
</table>

**NONCONFORMANCES**

<table>
<thead>
<tr>
<th>Area</th>
<th>Level</th>
<th>Quantity</th>
<th>Accept</th>
<th>Remarks</th>
</tr>
</thead>
</table>

**Abbreviations:****
- it = insufficient throat
- il = insufficient leg
- if = insufficient fusion
- uc = under cut
- cl = coldlap
- por = porosity
- mw = missing weld
- len = insufficient length
- cra = crack
- slg = slag

We certify that all articles delivered under the PO above conform to all applicable blue print and MOT specifications. Evidence of this is on file and subject to examination. CSI warrants that it has, on file, data that all of the materials used do comply with the required instructions.

Reviewed by: [Signature]

Chris Dolan
APPENDIX E

Coating Product Data Sheets
**DESCRIPTION:** A two part, highly thixotropic epoxy system formulated for spraying with Warren Environmental, Inc.’s patented meter/mix spray equipment.

**CHARACTERISTICS:** Formulated with special additives and modifiers to enhance the water resistance, chemical resistance, and bond strength to a variety of substrates as well as its own internal strength. The high thixotropic index allows for up to a ¼” build-up on vertical surfaces without sag.

**APPLICATION:** Designed for use with Warren Environmental’s patented meter, mix and spray equipment. The epoxy component utilizes a 2 parts base to 1 part activator mix ratio by volume. This product is sold and installed only by technicians specifically trained and licensed in our patented techniques.

**ADVANTAGES:**
- % Long Open time for Efficient Topcoating
- % Excellent Cure at Low Temperature
- % Excellent Cure at High Humidity
- % Zero Induction Time
- % 0% VOC’s
- % 100% Solids
- % Long Working Time Relative to Cure Time
- % Ready-to-Use (No Thinning Required)
- % Excellent Water and Chemical resistance with ambient cure
- % Achieve high-build thicknesses without sag

**CERTIFICATION:** None

**SPECIAL SAFETY AND HANDLING:** There are no special safety or handling procedures beyond those published on the reverse and the Material Safety Data Sheets.

---

**Typical Properties**

### Liquid Properties (Systems)
- Viscosity: 90,000-120,000 cps
- Thixotropic Index: 5.0-6.0
- Specific Gravity: 1.162
- Flash Point (Closed Cup): >235°F
- Color: Varies
- Gelttime (200g@77°F): 27 minutes
- Thin Film Set (@ 77°F): 2 hours
- Thin Film Set (@ 40°F): 8 hours

### Physical Properties (1/8” Casting)
- Tensile Strength (ASTM D638-86): 7000 psi
- Flexural Strength (ASTM D790-86): 11,000 psi
- Flexural Modulus @ 0.100” (ASTM D790-86): 500,000 psi
- Compressive Strength (ASTM D995-85): 12,000 psi
- Glass Transition Temperature (ASTM D3418-82): 151°F
- Tensile Elongation @ Break: 4.8%
- Thin Film Set (@77°F): 2 hours
- Shore D Hardness: 83-85

### Chemical Resistance
(28 Day Immersion)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Weight Gain (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toluene</td>
<td>0.99</td>
</tr>
<tr>
<td>Ethanol</td>
<td>4.68</td>
</tr>
<tr>
<td>10% Acetic Acid</td>
<td>3.85</td>
</tr>
<tr>
<td>70% Sulfuric Acid</td>
<td>0.13</td>
</tr>
<tr>
<td>50% Sodium Hydroxide</td>
<td>0.09</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>1.11</td>
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<tr>
<td>Methanol</td>
<td>9.55</td>
</tr>
<tr>
<td>Xylene</td>
<td>0.69</td>
</tr>
<tr>
<td>Butyl Cellosolve</td>
<td>1.18</td>
</tr>
<tr>
<td>Methyl Ethyl Ketone</td>
<td>11.19</td>
</tr>
<tr>
<td>10% Lactic Acid</td>
<td>3.24</td>
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<tr>
<td>Bleach</td>
<td>0.93</td>
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<tr>
<td>1,1,1 Trichloroethane</td>
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<tr>
<td>10% Nitric Acid</td>
<td>2.05</td>
</tr>
<tr>
<td>30% Nitric Acid</td>
<td>4.17</td>
</tr>
</tbody>
</table>

Contact us at:
PO Box 1206, Carver, MA 02330
Tel. (508) 947-8539
Fax (508) 947-3220
www.warrenenviro.com
E-mail: info@warrenenviro.com

All values reported above are typical values, and are reported as a means of reference. Individual testing should be done to determine actual results, tested at specific conditions.
**100% Solids Epoxy Lining System for Structural Rehabilitation in Harsh Environments**

**Overview**

**DESCRIPTION:**
A two part, highly thixotropic epoxy system formulated for spraying with Warren Environmental, Inc.'s patented meter/mix spray equipment.

**CHARACTERISTICS:**
Formulated with special additives and modifiers to enhance the water resistance, chemical resistance, and bond strength to a variety of substrates as well as its own internal strength. The high thixotropic index allows for up to a 1/4" build-up on vertical surfaces without sag.

**APPLICATION:**
Designed for use with Warren Environmental's patented meter, mix and spray equipment. The epoxy component utilizes a 2 parts base to 1 part activator mix ratio by volume. This product is sold and installed only by technicians specifically trained and licensed in our patented techniques.

**SPECIAL SAFETY AND HANDLING:**
There are no special safety or handling procedures beyond those published on the reverse and the Material Safety Data Sheets.

**Key Points**

- Adheres to a variety of substrates
- Adheres well to dry or wet substrate
- Excellent cure in high humidity
- Excellent cure at low temperature
- Long open time for efficient topcoating
- 100% solids
- 0% VOC's
- Ready-to-use (DO NOT THIN)
- Two component
- Spray/mix with Warren Environmental patented system ONLY
- For use with/in corrosive or harsh environments
- Safe for aquatic life (ASTM E729)
- Tested for use with or without structural glass and/or carbon fiber
- Long working time relative to cure time
- Excellent water and chemical resistance with ambient cure
- Achieve high-build thicknesses without sag
- Single coat system

**Typical Properties**

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<tr>
<th>Liquid Properties</th>
<th>Viscosity</th>
<th>90,000-120,000 cps</th>
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<tr>
<td>Thixotropic Index</td>
<td>5.0-6.0</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.162</td>
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<tr>
<td>Flash Point (Closed cup)</td>
<td>&gt;235°F</td>
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<tr>
<td>Color</td>
<td>Varies</td>
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<tr>
<td>Get time (200g@77°F)</td>
<td>2 Minutes</td>
<td></td>
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<tr>
<td>Thin Film Set (@77°F)</td>
<td>2 Hours</td>
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</tr>
<tr>
<td>Thin Film Set (@40°F)</td>
<td>8 Hours</td>
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<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>(1/8&quot; Casting)</th>
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<tbody>
<tr>
<td>Tensile Strength</td>
<td>7000 psi</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>11,000 psi</td>
</tr>
<tr>
<td>Flexural Modulus @0-100' (ASTM D790-85)</td>
<td>5000 psi</td>
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<tr>
<td>Compressive Strength (ASTM D885-85)</td>
<td>12,000 psi</td>
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<tr>
<td>Glass Transition Temperature (ASTM D218-82)</td>
<td>151°F</td>
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<tr>
<td>Tensile Elongation @ Break</td>
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<tr>
<td>Shore D Hardness</td>
<td>83-85</td>
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</table>

**Chemical Resistance**

<table>
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Contact us at: PO Box 1206, Carver, MA 02330
Tel. (508) 947-8539 Fax (508) 947-3220
www.warrenenviro.com

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**Mission Statement**

Warren Environmental, Inc. will provide cost-effective coatings and methodologies that lead to permanent time-sensitive solutions meeting the structural rehabilitation needs of their customers. To this end, we pledge to use environmentally friendly materials, train and certify the people installing our products, and provide our customers a worry free experience.

**Storage and Use**

**EPOXY COATINGS:**

Are supplied in 50 gallon steel drums. The unmixed shelf life is one (1) year from date of purchase when stored indoors in their sealed original containers at a room temperature between 60°F and 80°F. When using this material, it is important to prevent cross contamination of the unused components. To assure proper performance, it is mandatory that the components be correctly identified and the mix ratio cited on the front of this bulletin be strictly followed.

**CURED IN-PLACE PIPLING SYSTEMS:** this patented system may be provided in several different methodologies depending upon the application and field conditions. Warren Environmental, Inc. requires that these materials be installed by our licensed applicators only. These people are trained by us to address the issues unique to each situation. For more information please contact us.

**General Surface Preparation Guidelines**

Surfaces to be coated or adhered to should be cleaned of oil, grease, rust, scale, loose dirt and other contaminants that may hinder the adhesion of the epoxy coating to the substrate. In many instances cleaning the area to be coated of tuberculation and debris via scarifiers, sand blasting, or water will be sufficient. In rare instances such as oil covered metal, it may be necessary to treat the area with a solvent based cleaner. It is important to remove all traces of the solvent including fumes prior to applying the epoxy coating to ensure that no pinhole defects develop as the product cures. Concrete should be cured a minimum of 30 days prior to applying coating materials. Please contact us with specific questions regarding your application.

**Warranty**

Warren Environmental, Inc. warrants only that the product meets that quality and technical standards published in its current literature. Warren Environmental, Inc. cannot be held responsible for circumstances outside of its control including, but not limited to: product application, product handling, product storage, or any other conditions outside of our control. If within one (1) year from date of purchase, any product is proven by accepted industry standard test methods to be defective Warren Environmental, Inc. will, at its sole option, either replace or refund the purchase price of the product. These remedies shall constitute the sole and exclusive remedy for any claim under this warranty. This warranty is in lieu of any other warranties, expressed, implied, or statutory and is strictly limited to its terms.

If you witness any unethical or incorrect practices related to the application of any Warren Environmental product please contact us immediately at 508 947 8539

**ALWAYS READ SDS SHEETS BEFORE WORKING WITH ANY PRODUCT!**

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