July 30, 2019
BOARD OF COUNTY COMMISSIONERS
ORANGE COUNTY, FLORIDA
ADDENDUM NO. 1 / RFP Y20-802
ENGINEERING SERVICES FOR SOUTH WATER RECLAMATION FACILITY (SWRF) PHASE 6A IMPROVEMENTS

RFP OPENING DATE: August 27, 2019

This Addendum is hereby incorporated into the bid documents of the project referenced above. The following items are clarifications, corrections, additions, deletions and/or revisions to and shall take precedence over the original documents.

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A. The following Attachments are hereby incorporated into RFP Y20-802:

- Standby Power Generation Technical Memorandum
- SWRF New Scada Control Room Project Memorandum
- SWRF New Central Receiving Building Project Memorandum
- SWRF Maintenance Building Renovation Project Memorandum
- SWRF South Service Area Pump Station Expansion Project Memorandum

B. The Proposer shall acknowledge receipt of this addendum by completing the applicable section in the solicitation or by completion of the acknowledgement information on the addendum. Either form of acknowledgement must be completed and returned not later than the date and time for receipt of proposal.

All other terms, conditions and specifications remain the same.

Receipt acknowledged by:

______________________________________ ____________________
Authorized Signature **Date Signed**

____
Title

Orange County Utilities

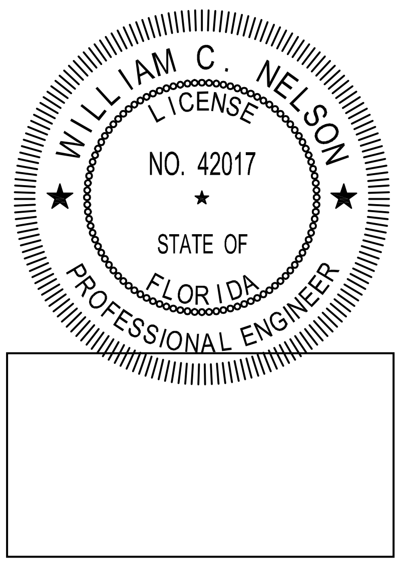
South Water Reclamation Facility

STANDBY POWER GENERATION TECHNICAL MEMORANDUM

FINAL | August 2018

Orange County Utilities

TECHNICAL MEMORANDUM
SWRF STANDBY POWER GENERATION



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Section 1

INTRODUCTION

1.1 Executive Summary

At the completion of the current Phase V construction project, SRWF will have (4) four emergency generators totaling 9250 KW, able to provide 535 amperes at 12,470 volts. Orlando Utility Commission (OUC) bills show that the peak demand load of the facility has averaged 412 amperes at 12,470 volts from 2014 through 2017 with a monthly peak of 638 amperes during Hurricane Irma in September 2017. Projected maximum demand amperes at the completion of Phase V construction is 660 amperes at 12,470 volts and 742 amperes at the completion of the replacement Influent Pump Station project. **The existing emergency generation system is insufficient for current and future electrical demands, significant load shedding operations must be done while impacting operations.**

Construction of a new electrical/generator building similar in size to the existing building would allow the electrical system and associated emergency generation system to be upgraded with minimal impact to the existing facility operations. The location of this new building is suggested to be adjacent to the existing electrical/generator building, in the area where the existing odor control biofilter for the Solids Building is located. **It is recommended that Orange County add a new electrical/generator building with a minimum of (2) two 2500 KW generators to the existing emergency generation system. A third 2500 KW generator would provide redundancy if any of the generators were unavailable due to repair and/or maintenance.**

It is recommended that Orange County update the existing load shed procedures in the SCADA system to accommodate the significant added loads from the Phase V expansion and new Influent Pump Station project. **This work is currently being reviewed as a potential change order to Phase V.**

It is recommended that Orange County add at least (2) two 12,000-gallon diesel tanks to provide at least 5 days (120 hours) of fuel storage associated with the four existing units and improve the controls/operation of the existing fuel system associated with the existing four generators. Additional tanks or larger tanks would be required to provide for 7 days (168 hours) of fuel storage.

We discussed that Orange County enter into a contract for the provision of temporary generators to provide additional standby power at the Influent Pump Station and Effluent Pump Station until the new generators are installed. The potential rental costs are included, and we also found that a number of large semi-trailer units are available for purchase. **It is recommended that Orange County consider purchasing a large unit that would not only fill the immediate need at SWRF but be available at EWRF and NWRF.**

It is important that Orange County improve record keeping for emergency generation operations, as EPA requires that maintenance records be kept along with fully documented operational records. Non-emergency operations are limited by mandate for generations systems not meeting current EPA requirements to 100 hours per year, and documentation of non-emergency operations is required. **It is recommended that Orange County review EPA record keeping requirements and put in place an easily accessed record keeping system for the emergency generators, Carollo will provide this under the Operations Support project.**

Based on the projections primarily due to the new Influent Pump Station project, it is critical that discussions begin with OUC on the service for this facility. The potential will eventually exist that if one OUC service is down that standby power is required to maintain normal operations. Since this will change to the utility service will impact available fault current, preliminary engineering will be needed to determine any impact to the fault values, equipment withstand ratings and potentially increase in arc flash energy for the facility. During this work, further investigation could be done with respect to standardizing the protective relays and DC power for the 15KV Switchgear. **Loads have now exceeded the 600 amperes limit of a single OUC service if one service (A or B) was out of service. It is recommended that Orange County begin coordination with OUC, investigate the potential OUC impacts for the facility and the requested standardization for the 15KV Switchgear.**

Table 1.1 Executive Summary Projects

Project Description	Budgetary Costs	Urgency Timing
1. New Electrical/Generator Building	$10,985,000	0-1 Year
2. SCADA System Load Shed Improvements	(Existing Contract)	0-1 Year
3. EPA Record Keeping	$0	0-1 Year
4. OUC Service and 15KV Switchgear Improvements	$1,154,000	0-1 Year
5. Additional Diesel Fuel Storage	$429,000	0-1 Year
6. Generator Rentals	$89,500/month	0-1 Year
7. Used 2000KW Trailer Unit	$415,500	0-1 Year

1.2 Background

The South Water Reclamation Facility (SWRF) has redundant OUC Utility feeds to the facilities main electrical switchgear. These two Utility Feeders originate at two separate substations. Facilities depend upon reliable utility sources to maintain plant operations. If both Utility services are lost, the facility will have four emergency generators which provide primary service voltage to the facility distribution system to maintain plant operations.

The SWRF facility is undergoing significant expansion of the plant and process systems. As part of these plant expansion, significant motor loads are being added to the existing electrical system.

Orange County is aware that emergency generator systems at the facility need to be reviewed to determine what current or future modification of the emergency generator systems may be required to maintain reliable operations. These systems are critical to maintaining plant process operations and additionally to meet current and future regulatory requirements.

Orange County made some preliminary decisions and requests associated with the work as follows:

1. We are not considering alternative fuels and the approach is based on diesel fuel for the standby engines.
2. Maintenance is done on the generators via a county wide maintenance contract.
3. Currently, there is no service contract for 15KV maintenance. OCU is evaluating options for one.
4. OUC does not offer a rate to provide credit for use of standby power as Duke Energy offers for EWRF.
5. Request was made by OCU to have the existing Generator Bus split from the current single bus arrangement.
6. Request was made by OCU to have the DC Systems be the same voltage allowing for standard components and operations between plants.
7. Request was made by OCU to have the protective relays also consistent allowing for standard components and operations between plants. OCU RPR/Field Services to verify that for Phase V that the new relays are setup and tested.
8. The previous plans to split the plant distribution into a north electrical distribution and a south electrical distribution are no longer being considered. OCU now desires to have OUC make revisions to their distribution (off the plant site) to eliminate the common mode failure at the single common power pole and upgrade capacity for each service to 1200A.

1.3 Objective

This report provides an evaluation of the existing electrical distribution system with respect to providing adequate on-site standby generation system to maintain existing and near future operations.

Estimated budgetary cost for determining funding requirements for inclusion into future Capital Improvement Projects (CIP) are also included in this report.

This evaluation will consider existing conditions of the facilities as they apply to current conditions and provide a plan for standby requirements for these facilities addressing the current projects planned for each.

This report addresses the standby power needs and projections based on current project scheduling. Included in this report are basic design criteria, single line diagrams, load projections, operating strategies, fuel supply and/or layouts as necessary to define the features and characteristics of the recommended options.

1.4 Approach

The redundancy of dual utility feeds has in recent years come under scrutiny due to the potential of having localized, state wide or multiple state power grid failures and outages under severe weather conditions such as hurricanes or strong tropical storms, potential terrorist attacks, etc. even though the redundant sources of power may come from two separate directions or different substations. Designs in which owners can maintain direct control of their power systems with on-site generators is considered necessary to maintaining operation of critical facilities such as water reclamation facilities and their respective pumping stations.

Maintaining operations is critical at these facilities and this report incorporates this philosophy. The approach must also consider the existing site conditions, available building and structure areas, existing electrical distribution equipment condition and ability to connect into existing electrical equipment as modifications are made to emergency and distribution systems. This report focuses on the interconnection at the main switchgear level and interface with either existing or proposed emergency generator systems.

In this report, we are utilizing Utility demand data as an indicator of the power requirements for the standby system. This demand data when defined as peak demand is typically set over a 15-minute window for the purpose of the rate schedule in effect. Therefore, it is not the actual peak KW that the plant demanded from the utility as some peaks may not have been picked up in the 15-minute window. These KW numbers also do not translate directly to the required size of the standby generators as there are other considerations to be considered with respect to starting of motors which have much higher current draw designated as starting KVA (SKVA). Another important factor is the way the loads are added to the standby generators. For example, block loading has much more impact on the voltage and frequency variations that the loads will see compared to the loads being added in many steps. The order that loads are added are also important as large loads which require more power should be added earlier in the steps as adding them at the end may result in adverse voltage and frequency variations. This report includes proposed locations for any additional emergency standby generators and distribution equipment that may be required to maintain plant process operations. These locations have been selected to minimize operational impacts as well as optimizing the available open property while also minimizing costs.

Section 2

ELECTRICAL UTILITY SERVICE REVIEW

2.1 Existing Electrical Distribution

2.1.1 Utility Supply

Power distribution at SWRF is provided by Orlando Utilities Commission (OUC) and is delivered to the facility at 12,470 volts via two separate 600Aservices. Service “A” from the west property line to a switch located adjacent to the Solids Building. Service “B” is fed from Sand Lake Road to a utility switch located adjacent to the Admin Building. Both service A and B terminate within the Generator/Electrical Building at a 12,470-volt main-tie-main switchgear which distributes power to numerous switches/pad mount transformers which reduce the voltage to either 4160 volts or 480 volts as required by service requirements of local buildings and utilization equipment.

Figure 2.1 OUC Service Drop "A" West Property Line

Figure 2.2 OUC 600A Switch "A" Solids Building

Figure 2.3 OUC Service Drop "B" North Property Line

Figure 2.4 OUC 600A Switch "B" Admin Building

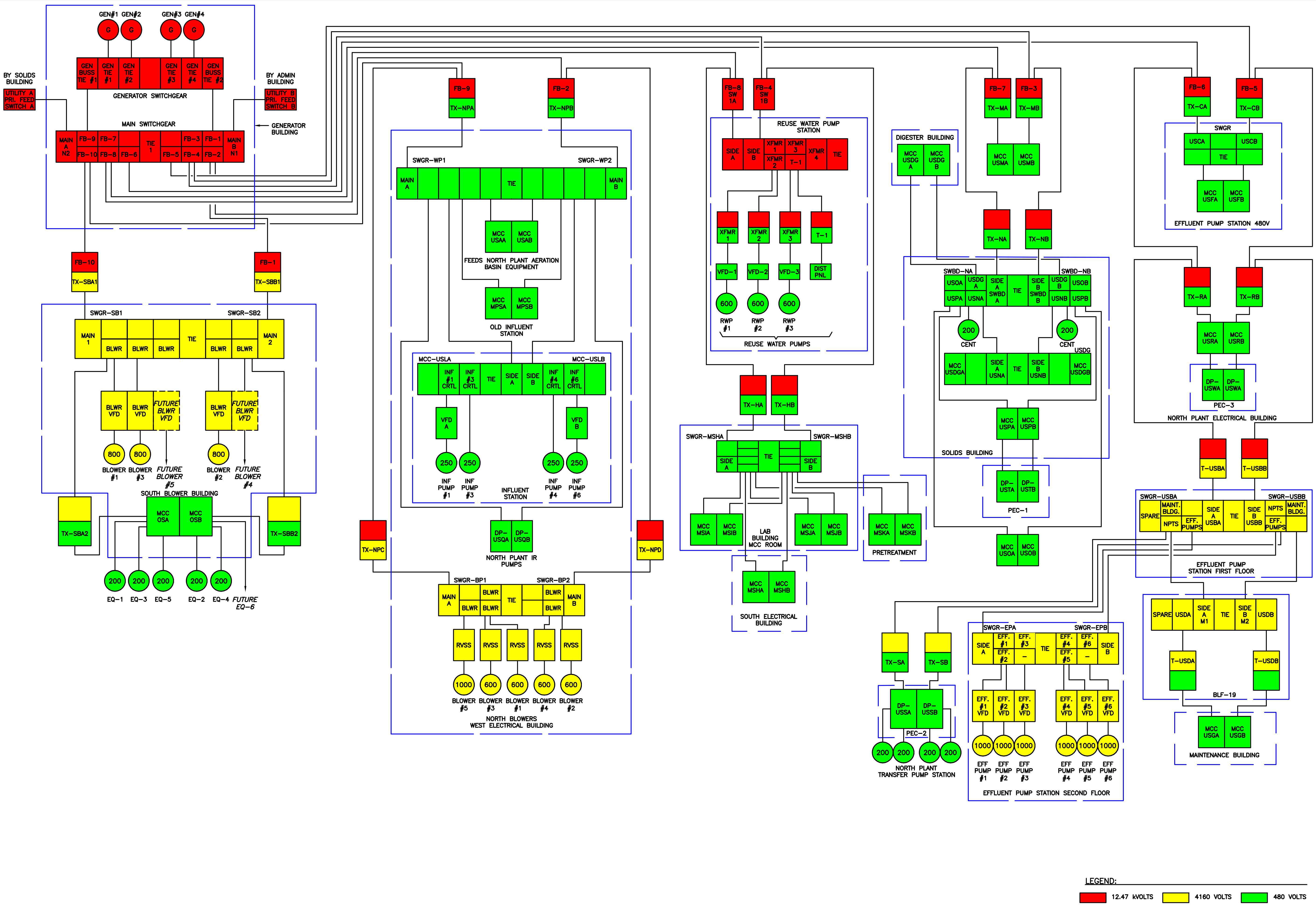
Billing for SWRF is via primary metering on each feeder. These meters are combined or totalized for billing purposes.

It appears that both service "A" and service "B" pass through utility switching on a single OUC power pole located at the north-west corner of the facility adjacent to Sand Lake Road. This configuration provides a single point of failure to the OUC Utility Electrical Distribution System serving this facility. It is recommended that OCU immediately begin discussion to request that OUC make revisions to their distribution (off the plant site) to eliminate the common mode failure at the single common power pole and upgrade capacity for each service to 1200A.

Figure 2.5 Common OUC Utility Pole for Service "A" & "B"

2.1.2 Distribution Overview

The main medium voltage Switchgear A and B side feed various switches/pad mount transformers distributed within the facility is shown below (refer to Figure E-1). The overall distribution including projects Post Phase V is shown in Figure E-2. In some cases, transformers are tapped from the primary side of the distribution switches to additional transformers on the same feeder. The transformers provide either 480-volt 3-phase, or 4160-volt, 3-phase as required by the local utilization equipment. Each transformer feeds either switchgear or Motor Control Centers (MCCs) to the respective A or B sides of the main-tie-main utilization equipment. This allows any of the utilization equipment to be powered either from the "A" side or "B" side of the facility by opening the respective main breaker and closing the tie breaker.



LEGEND:

12.47 KVOLTS | 4160 VOLTS | 480 VOLTS

REV.	DATE	DRAWN	CHK'D.	DESCRIPTION

REVISIONS

Electrical Design Associates
6965 PIAZZA GRANDE AVE., STE. 412
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WILLIAM C. NELSON, P.E.
Florida P.E. No. 42017

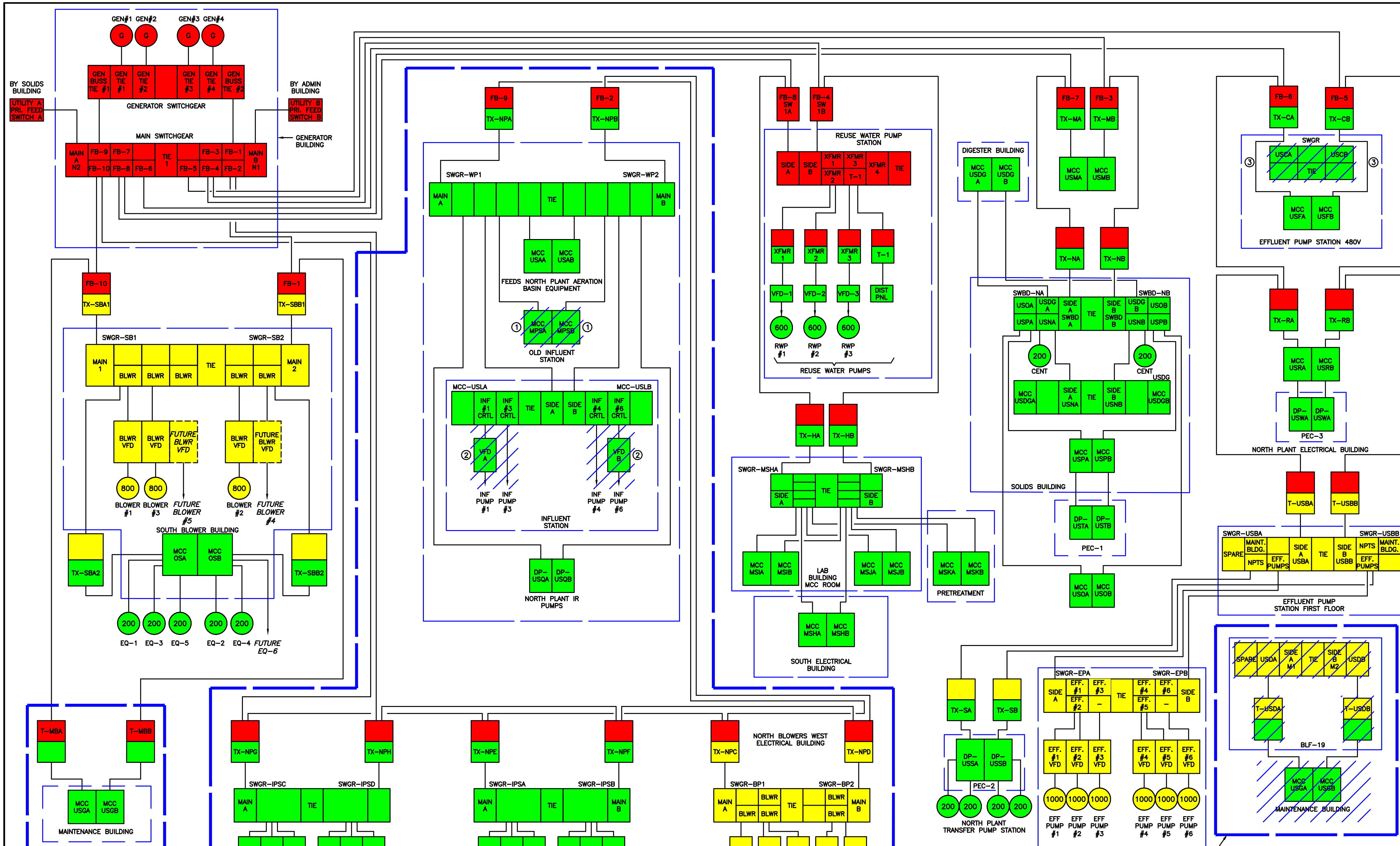
ORANGE COUNTY SOUTH WATER RECLAMATION FACILITY

OVERALL SINGLE LINE DIAGRAM THROUGH PHASE V

Designed by: WCN
Drawn by: SDV
Checked by: RTM
Approved by: WCN
Date: August 2018

PROJECT NO.

SHEET NO.
E-1



SPECIFIC NOTES:

1. MCC-MPSA & MCC-MPSB TO BE REMOVED DURING INFLUENT PUMP STATION PROJECT.
2. EXISTING INFLUENT PUMPS TO BE DEMOLISHED.
3. EXISTING MCC TO BE REMOVED.

LEGEND:

12.47 KVOLTS | 4160 VOLTS | 480 VOLTS

REV.	DATE	DRAWN	CHK'D.
DESCRIPTION			
REVISIONS			

EDA Electrical Design Associates

ORANGE COUNTY SOUTH WATER RECLAMATION FACILITY

OVERALL SINGLE LINE DIAGRAM POST PHASE V

Designed by: WCN
Drawn by: SDV
Checked by: RTM
Approved by: WCN
Date: August 2018

PROJECT NO.

SHEET NO.
E-2

Figure 2.6 Typical A & B Service Transformers/Switch

Section 3

STANDBY GENERATOR SYSTEMS

3.1 Existing Standby Generator System

The existing medium voltage switchgear and generator system was installed as part of the South Water Reclamation Facility Generator and 12.47KV Improvements project which was completed late 2008.

The existing generator system consists of three (3) Caterpillar model 3516 generators which were built January 2007 and delivered to Orange County on April 11, 2008.

Figure 3.1 Existing Dual Fuel 2250 KW Generator System

At the completion of Phase V construction at SWRF, the standby generation system will be comprised of four 12,470-volt Caterpillar generators. Three (3) rated at 2,250 KW and one (1) rated at 2,500 KW for a total of 9,250 KW.

Figure 3.2 New 2500 KW Generator (Installed During Phase V Construction)

These generators are connected to a Caterpillar custom switchboard using a single generator bus via 1200 ampere frame circuit breakers per generator with each circuit breaker having a 200 ampere trip.

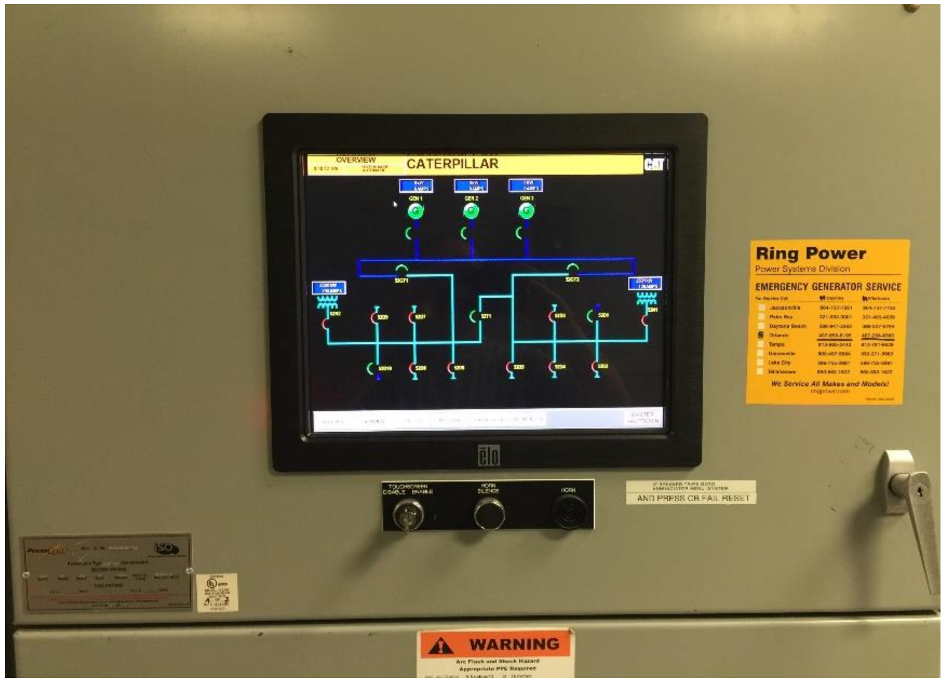


Figure 3.3 SWRF Generator Control Screen

Figure 3.4 Existing 12,470 Volt Generator Switchgear

DC power for generator/switchgear controls are provided by a 125 Volt DC battery system.

The current generator system is provided with a dual fuel system, which mixes natural gas with diesel fuel, up to approximately 70% natural gas and 30% diesel fuel. This system, if operating properly, allows the standby generation system to start using 100% diesel fuel and as the existing plant load stabilizes, to mix natural gas and diesel fuel to lower exhaust emissions for the system.

At start up and when adding large block loads to the generator system, the dual fuel control system switches to 100% diesel fuel until plant load stabilizes. The large block loads or starting of equipment under normal plant operations is not predictable.

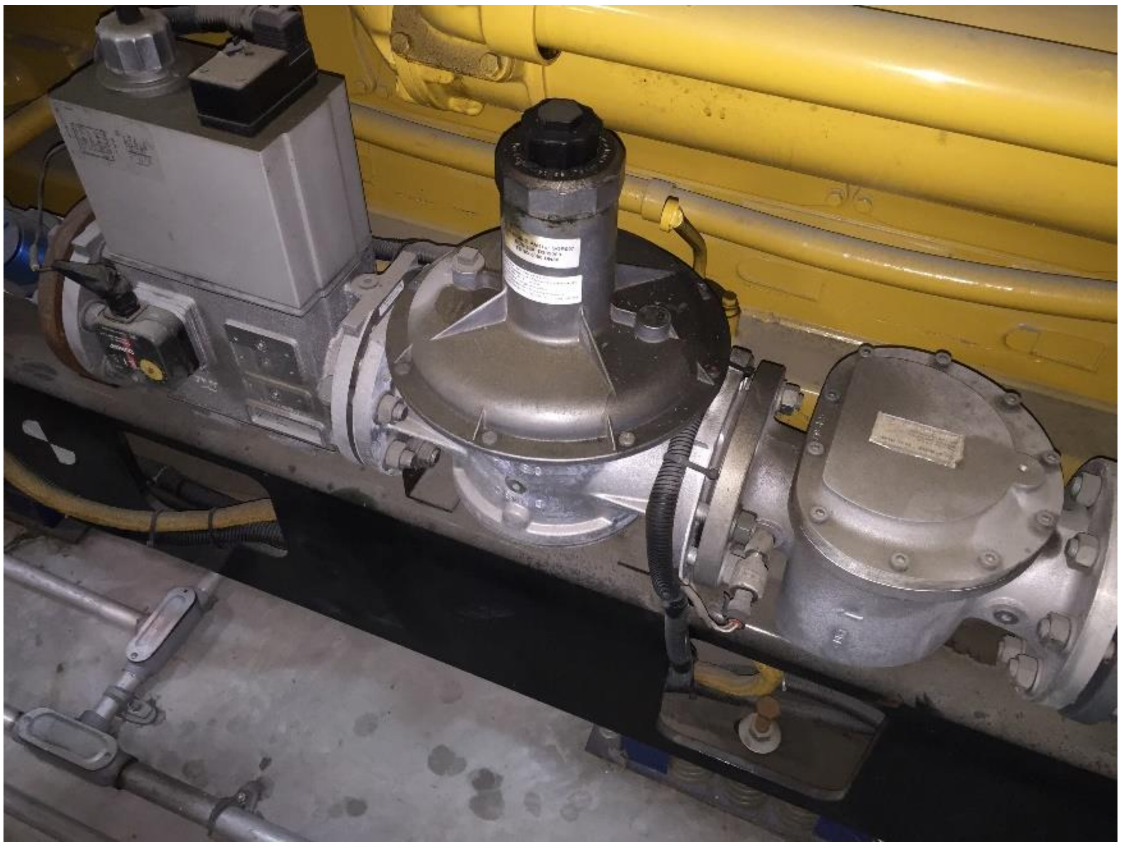


Figure 3.5 Generator Dual Fuel Natural Gas Trane at Generator

Figure 3.6 Dual Fuel Regulator and Generator Piping

At this point in time, the dual fuel system is not fully functional and OCU continues to incur additional operation costs for the natural gas service. Natural gas is not stored onsite and could not be relied upon in an emergency as the fuel source. Plant personnel report that there is an issue with low pressure from the natural gas utility which does not allow the dual fuel system to operate as designed.

There has been much discussion during the report preparation and workshops on the appropriate selection of fuel for the generators going forward. We make reference to the SWRF Biogas to Energy Alternatives Study by Carollo Engineers, Inc. dated May 2013, which recommend that existing standby generators not be modified for alternative fuel systems. The recommendation was that new smaller generator(s) would be provided for biogas use. The workshop discussions further clarified that due to the challenges with equipment/operations and cost of mixing natural gas that diesel fuel would be the fuel selected for future generators.

Figure 3.7 Generator Dual Fuel Control Panel

OUC does not currently offer any commercial or industrial standby generation programs which would provide credits for removing load from the electrical grid at the request of the utility or provide financial incentives.

Since OUC does not offer any industrial standby generation programs, and SWRF does not operate under load shed or peak shave operations (operating the generators when OUC power is available), installation of required RICE/NESHAP equipment is not necessary. It would be required if SWRF decided to operate the generators at time other than an emergency when power from OUC is lost. The current units meet EPA requirements for use as standby machines (emergency operation). The added cost to operate under load shed or peak shave (non-emergency operation) has an estimated installation cost of between $120,000 to $180,000 for the existing three generators to meet current non-emergency EPA standards. Equipment required includes:

- Stainless Steel catalyst
- Catalyst monitor
- Miscellaneous Power for monitoring system

3.2 Fuel Storage

The existing facility has diesel storage capacity comprised of (3) three 12,000- gallon fuel tanks for a maximum total of 36,000 gallons when the fuel tanks are full. These tanks are combined into a fuel piping scheme using a common header for all three generators. This system should be further investigated to determine if modifications are necessary to avoid a single point of failure to the fuel system.

Figure 3.8 Existing (3) 12,000 Gallon Fuel Tanks

At the end of Phase V construction, the facility will have (3) three 2250 KW generators and (1) 2500 KW generator which use approximately 656 gallons of diesel fuel per hour at full load and approximately 478.5 gallons per hour of fuel at ¾ average load with all generators running.

Table 3.1 Estimated Fuel Usage (SWRF Generators)

% Loading	Gallons per Hour	Operations Hours Full Tanks	Operations Hours 3/4 Full Tanks
100	656	54.9	41.2
75	478.5	75.2	56.4
50	333.4	108.0	81.0

Notes:
(1) Estimated fuel tanks maximum storage = 36,000 gallons
(2) Generator fuel usage typical for (3)-2250 KW generators and (1)-2500 KW generator

If two additional 12,000-gallon fuel tank were added, then the hours of operation would increase as shown below:

Table 3.2 Estimated Fuel Usage (SWRF Generators), (5) Five 12,000 Gallon Fuel Tank

% Loading	Gallons per Hour	Operations Hours Full Tanks	Operations Hours 3/4 Full Tanks
100	656	91.5	68.6
75	478.5	125.4	94.0
50	333.4	180.0	135.0

Notes:
(1) Estimated fuel tanks maximum storage = 60,000 gallons
(2) Generator fuel usage typical for (3)-2250 KW generators and (1)-2500 KW generator

Orange County Utilities guideline for this report is to have a minimum of 5 days (120 hours) of fuel reserve for operation of the emergency generation system. We also discussed the sizing if 7 days (168 hours) were required. The existing fuel supply meets 63% of this requirement for 5 days and 45% of this requirement for 7 days under the assumption that average % loading for the emergency system is 75%, typical for treatment facilities over a 24 hour period. In order to fully meet this criteria, under five days (2) two 12,000-gallon tanks would be required and under seven days (3) three 15,000-gallon tanks would be required for the existing four units. The existing fuel system should also be reviewed for common mode failures, removal of the non-functional natural gas blend system and simplifying the controls/operation of the fuel systems to allow for better understanding and control to manage fuel condition.

When additional similar sized generators are added to the facility, the addition of (1) one 16,000-gallon fuel tank for 5 days or the addition of (1) one 22,000-gallon fuel tank for 7 days per generator will maintain the emergency operation hours shown on the previous fuel usage chart.

3.3 EPA Requirements for Standby Generation Systems

On May 3, 2010, the U.S. Environmental Protection Agency (EPA) made effective the final rule for a set of national emission standards for hazardous air pollutants, known as RICE/NESHAP (Reciprocating Internal Combustion Engine/National Emission Standards for Hazardous Air Pollutants.)

The new regulations apply to existing stationary standby generators. Compliance to the new standards for all new equipment was required by 2013.

This complicated set of rules strikes a challenge for owners and operators of existing stationary generator sets as extensive applicability criteria (e.g. engine horsepower, build date, location, etc.) determines the emission standard, recordkeeping and maintenance for any stationary generator set.

For compression ignition (CI) or diesel engine generators greater than 500 HP, which were manufactured after April 1, 2006, EPA RICE/NESHAP regulations apply. All the generators located at SWRF & EWRF fall under these EPA requirements based upon build dates of January 2007 and October 2009 respectively.

It is imperative that a clear understanding of the EPA rules and applicable emergency or non-emergency operation of equipment is observed. Emergency Operation is defined as providing electrical power or mechanical work during an emergency. Examples include stationary generation equipment used to produce power for critical equipment when electric power from the local utility is interrupted. Non-Emergency use would include "Peak Shaving', "Standby Power Operation", and Voluntary Standby Power Operation at the request of the serving Utility.

EPA regulations limit the non-emergency hours for generators not meeting the RICE/NESHAP standards to a maximum of 100 hours per year. In a typical industrial facility, normal testing and maintenance operation of generators will normally consume the entire 100 hours allotted for non-emergency use. This allows for about an average of 1.9 hours per week or 8.3 hours per month. Realistically, maintenance operation of generators would be limited to a monthly or bi-weekly test to meet these EPA requirements.

There is no limitation of hours for generator operation under emergency conditions, when normal power is not available for critical equipment.

EPA regulations require record keeping for each generator. It is imperative that the owner maintain accurate records. General requirements are:

1. Each Generator is to have a non-resettable run time hour meter.
2. Owner to maintain copy of original manufacturer emissions compliance report for each generator.
3. Owner to record each generator hours of operation and the reason for operation, including whether it emergency or nonemergency service. This must be recorded each time an emergency generator is operated. Ideally, this information would be compiled automatically, via the facility SCADA system. This would provide easy access to the data if requested by regulatory authorities.
4. Owner to maintain maintenance Records, including oil test results, and records of any corrective maintenance activities.
5. Owner to record generator fuel usage, both during Emergency Run Hours and Non-Emergency Run Hours.
6. Typically, records are to be kept a minimum of three years.

3.4 General Recommendations

3.4.1 Generator Recommendations

NOTE: All load and supply currents (amperes) noted are shown at their equivalent values at 12,470 volts, the supply voltage of the SWRF emergency generator system.

Load Analysis:

1. The current pre-Phase V connected load for the facility (totaled from existing drawings) is 817 amperes at 12,470 volts. The average demand amperes, taken from OUC Utility bills from 2014 through 2017 is 417 amperes. This gives an average demand factor (DF) of 50.4%. This is lower than a more typical value of 60% for a facility of this type. It also tends to mean that there is more load that could run for consideration when sizing the generators.
2. It should be noted that this average demand from OUC Utility bills includes September and October in 2017 where peak demand was 637.7 amperes and 592.6 amperes which was significantly higher than any other month from 2014 through 2017. This period co-insides with the effects from Hurricane Irma and the recovery period post hurricane.

3. Phase V construction will add 493.5 connected amperes to the facility for a total of 1310.5 connected amperes at 12,470 volts.
4. Using the average demand factor of 50.4%, the future estimated demand load at the completion of Phase V is 660.5 amperes at 12,470 volts.
5. Currently, there are three (3) 2,250 KW standby generators installed for a total of 6,750 KW which can provide approximately 390 amps at 12,470 volts. As a part of the Phase V expansion, an additional 2,500 KW standby generator will be added bringing the total to 9,250 KW which can provide approximately 535 amps at 12,470 volts.
6. The peak average demand at the completion of Phase V of 660.5 amperes at 12,470 volts show that the existing (3) three generators plus the (1) one new Phase V generator do not have the capacity to serve the peak demands projected. It should be noted that at the time of design for Phase V, the demand factor used was closer to 40% based on the data available at that time. These units can serve the demands for the plant when the loads are less than the peak and when loads at the facility are operated under "load-shed" conditions during normal peak demand operating hours. This shortfall could also be managed when the peak process demands occur that solids treatment be shifted to the time periods outside the peak process demands. For example, the solid treatment could be done at night when the plant flows are at their lowest points to address the shortfall of standby power until the issue is addressed.
7. Looking at future projects, the most significant one is the replacement of the Influent Pump Station (IPS). This will remove (4) four-250 HP vertical pumps and initially replace them with (6) six-500 HP submersible pumps, with space for (2) two additional 500 HP submersible pumps in the future. This will add 82 demand amperes at 12,470 volts to the facility electrical system, for a total of 742.5 demand amperes at 12,470 volts.
8. The shortfall for meeting plant maximum demand loading when on generator power will be approximately 125.5 amperes at 12,470 volts at the completion of Phase V, and approximately 207.5 amperes at 12,470 volts at the completion of the Influent Pump Station.
9. Phase V construction is scheduled to be complete in mid-2019 and the Influent Pump Station is scheduled to be complete in mid to late 2021.
10. Electrical loading while on generator power is summarized in the charts below:

Table 3.3 Electrical Loading on Generator Power

SWRF Estimated Added Load Through Phase V	
Total Pre-Phase V Connected Amps @ 12,470V (From Load Sheets)	817
Utility Bills Pre-Phase V Average Demand Amps @ 12,470V (2016-2018)	412
Demand Factor Pre-Phase V from Spreadsheet & Utility Demand	50.4%
Additional Phase V Connected Load Amps @ 12,470V (From Load Sheets)	494
Total Phase V Connected Amps @ 12,470V	1311
Estimated Additional Phase V Amps @ 12,470V	50
Total Phase V Demand Amps 12,470V @ 50.4% DF	660.5
Existing Available Amps from 4 Generators @ 12,470V	535
Generator Overage/Shortfall Amps @ 12,470V	-125.5
SWRF Estimated Added Load Through IPS Project	
IPS Station - Remove 4-250 HP Pumps (N-1 Amps @ 12,470 V)	35
New IPS Station -Add 6-500 HP Pumps (N-1 Amps @ 12,470V)	116
Net Additional Amps from IPS Project	82
New Total Demand Amps @ 12,470V (Phase V + IPS Net Amps)	742.5
Existing Available Amps from 4 Generators @ 12,470V	535
Generator Overage/Shortfall Amps @ 12,470V	-207.5

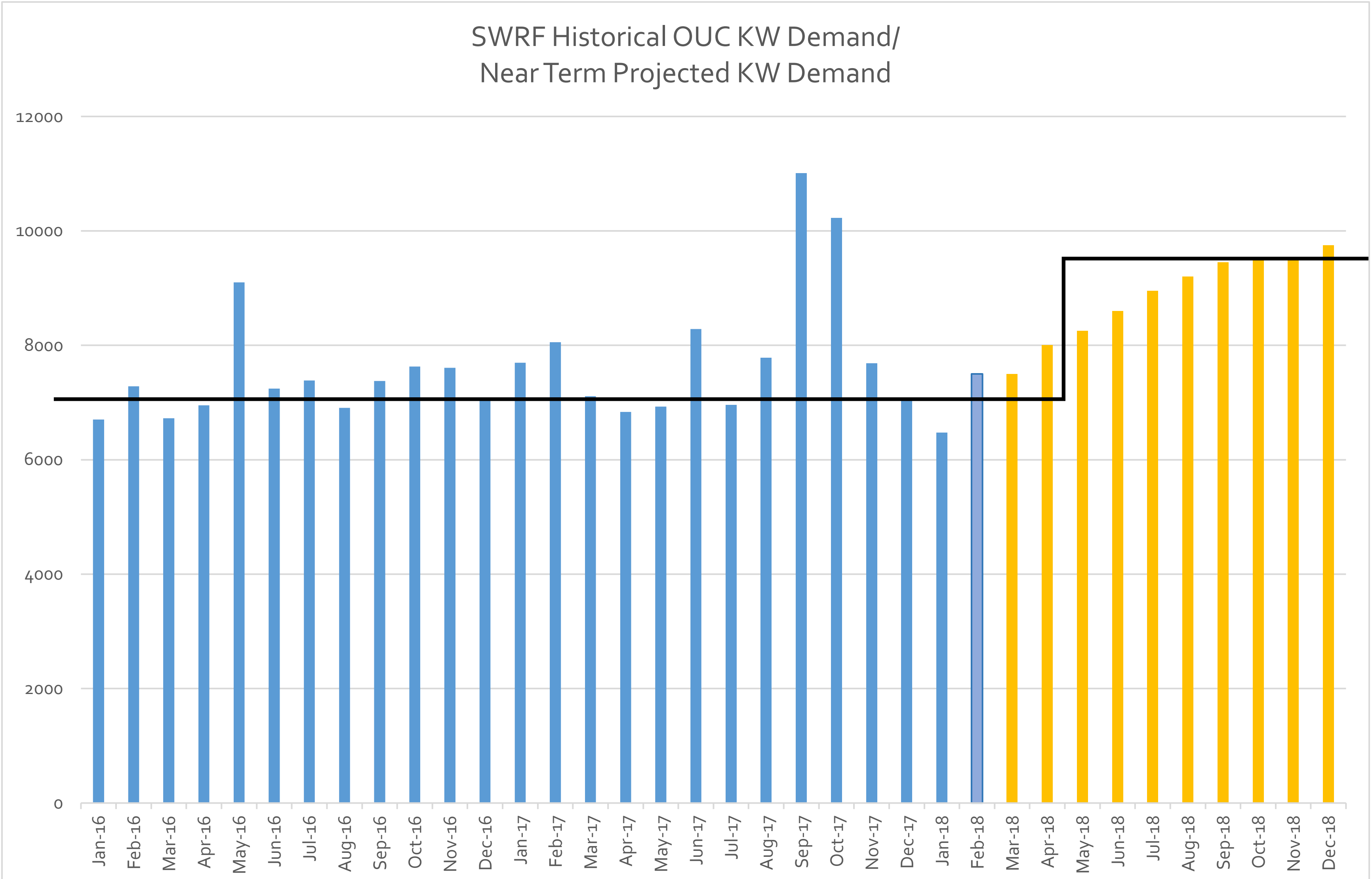


Figure 3.9 SWRF Historical OUC KW Demand/Near Term Projected KW Demand

11. Note that while OUC historical demand and projected near term demand loads generally are within or close to current (post Phase V) generator capacity, the OUC demand loads which occurred during the Hurricane Irma event (September 2017) and post event demand, significantly exceeded the capacity of the projected Phase V emergency generator system of 535 amperes at 12,470 volts. The hurricane event effectively provided a stress test of the current SWRF electrical distribution system. The blue bars represent OUC demand data and the orange bars are the projected values. The black line represents the standby generator capacity in KW available.
12. Maximum demand amperes for September 2017 was 637 amperes at 12,470 volts and October 2017 was 593 amperes at 12,470 volts. These high demand loads do not reflect the additional loads added as part of the Phase V construction, and future influent pump station projects. The demand loads which occurred during Hurricane Irma clearly indicate that additional generator capacity is needed for the facility if it is to function under generator power during emergency conditions without resorting to significant load shed operations.
13. It is recommended that Orange County update the procedures for load shed operations when on generator power. Significant new electrical loads have been added as part of the Phase V expansion and these loads need to be prioritized as part of the overall plant emergency operations procedures. This will be critical for any future plant operations when only generator power is available, such as severe weather events, where the loss of utility power would be a high probability. This criticality was demonstrated during the Hurricane Irma event in September 2017.
14. Supervisory staff stated that they focus on pumping and blowers in the emergency type operations where solids and other non-essential loads are reduced. They also stated that the blowers require staff to restart them manually and locally as they are not controlled via SCADA. From a standpoint of occupational safety, this situation needs to be addressed to avoid requiring staff to go out "into the storm" to get these loads back on.
15. The existing Main Distribution Switchgear and Generator Switchgear are rated at a maximum 1,200 amps at 12.47 KV. 1,200 amps at 12.47 KV can carry approximately 26,000 HP of running load. The existing Main Switchgear primary bus has the capacity to serve this facility and future loads.
16. It is our understanding that the OUC services currently are limited to 600 amps at 12.47 KV each and are served from two separate OUC substations. This limitation is the rating of the OUC primary switches on the "A" and "B" feeder to the facility. Since OUC is currently typically seeing less than 600 amps total at 12,470 volts for the facility, and that electrical load is normally split between the "A" side and "B" side of the electrical distribution system, the 600-ampere limitation of each service has not been a problem to date.
17. As additional loads are added to the facility, and the total demand amps reach or exceed the 600-ampere level, as predicted due to current and future plant expansions, Orange County will need to coordinate with OUC to address the future capacity for the two services. If the facility is required to be solely fed from either "A" or "B" service, particularly during a storm event, it is not unreasonable to conclude that the 600-ampere rated OUC Utility switches would not be adequate. This 600-ampere demand load has already been exceeded during the Hurricane Irma event in September 2017. Discussions with OUC should begin now to plan for future emergency operations.

3.4.2 Generator Sizing

Based on the load analysis, addition standby power is critically needed at this facility. During the time it will take to design and construct the recommended improvements, the following suggestions have been confirmed.

Prior to the installation of additional permanent installed generators, the New Influent Pump Station design has the ability to include four 1600A, 480V connections to the switchgear being furnished under that project so that large portable rented generators (approximately 1000 KW each) could be temporarily connected. For the existing Effluent Pump Station, the existing 5KV switchgear has a 1200A, 4,160V circuit breaker capable of connecting large portable rented generators (approximately 2000 KW each to a total 3 units) could be temporarily connected. These connections for temporary units can be utilized in the short term. This approach will significantly increase operational costs for rental and additional operations effort to run these units in a temporary arrangement. Below are the costs we received for rental units for consideration and we have based the total monthly estimate on (1) 2000KW at the Effluent Pump Station, (2) 1000KW at the Influent Pump Station, (4) Fuel Cells and Accessories at each unit:

Table 3.4 Rental Generator Costs

Generator Rentals	Monthly Cost
2000 KW Unit	$26,000
1000 KW Unit	$18,000
2500 Gallon Fuel Cell	$5,000
Cables and Accessories	$2,500
Total for 4MW (as noted above)	**$89,500**

There was some discussion on the potential for acquisition of smaller generators (capital cost) located around the site in lieu of large rental units (operation cost). The plant distribution does not currently have the ability to add generators at smaller low voltage points and the costs to make these connections would add extensive costs. This approach also adds complexity to the power distribution where staff are not always certain of the power connections and the need to maintain a larger number of units with respect to operational resources to manage fuel, safety, load shedding, etc. Since SWRF, EWRF, NWRF and the new SWWRF, all have large 15KV generators, OCU could purchase a large semi-trailer portable unit that could be utilized at each of the facilities in case a unit is out of service. New units are more difficult to come by with the latest emissions requirements but used units with low hours are available. For example, a used 2000KW unit with 1625 hours, 1250 gallon tank, on a triple axle semi-trailer is offered at $416,500.

Overall, we recommend that at least two additional 2500 KW generators each be provided in addition to the existing four generators to operate the facility at the current projected demand. These new units would be located adjacent to the existing four units. This would provide approximately 825 amperes at 12,470 volts and 0.8 power factor versus the estimated demand of 743 amperes at 12,470 volts. This takes into consideration the other effects in sizing mentioned earlier to address loading with voltage and frequency variations. Consideration could also be given that having 6 units still does not allow for one unit being out of service for maintenance and/or repair and adding a third unit would allow for this condition.

3.4.3 Fuel Storage Considerations

The existing generator fuel system is comprised of three (3) 12,000-gallon diesel fuel tanks. This along with an operational dual fuel system will provide the minimum desired 72-hour generator run time. Since the dual fuel system has not been operational, the existing diesel fuel system needs additional storage as noted earlier.

Since the dual fuel system does not have the capacity to support the demand of the existing generators, (reported as due to low system pressures from the gas utility) or is unable to be modified to provide this support, then (2) two 12,000-gallon fuel tanks should be added to provide the desired minimum run time of 120 hours for the existing four generators that will be available at the end of Phase V construction. It is further recommended that the gas components of the duel fuel system be removed from the generator building. Removal of the component parts of the natural gas portion of the dual fuel system would reduce maintenance costs, natural gas service costs, simplify the existing generator fuel system, and eliminate a non-working system from the facility. We also recommend that the fuel system be reviewed to avoid any common mode failures.

Space should be allocated for additional new fuel tanks to support any new generators. These should be installed adjacent to the suggested new building. Fuel tanks of 16,000- gallons per generator, will maintain the desired minimum 120-hour generator backup for a 2500 KW generator. It would be prudent to reserve and pre-wire future space for a total of four 16,000-gallon fuel tanks adjacent to any new Electrical/Generator Building. Providing accommodations for future fuel piping and electrical connections during initial construction of the fuel storage area will save money in the long run for relatively minor up-front cost.

3.4.4 Other Considerations

The SWRF facility has an extensive amount of medium voltage (15KV and 5KV) equipment throughout the electrical distribution. We would recommendation that arrangements via a term contract be made in advance of an emergency or for the basic routine/preventative maintenance required for the 15KV and 5KV portions of the SWRF electrical distribution. Presently there is no medium voltage (greater than 600V) electrician on staff for the County and consideration should be given for the 15KV and 5KV that the County has at other facilities to obtaining this expertise within OCU.

As noted earlier, OCU has an existing Generator Maintenance term contract which expired on July 14, 2018 unless extended. The contract covers limited annual inspection/maintenance, fuel recycling, antifreeze recycling, and load testing.

3.4.5 Electrical/Generator Building Considerations

The existing Electrical/Generator building was constructed in 2000 during Phase IV-A improvements. The building was designed for four generators, but the three existing generators were not installed until 2009. The building and generator gear are in good condition. The battery banks used for controls and starting of the generators likely need maintenance and load testing. The generators have minor oil leakage, but not to a significant degree.

Figure 3.10 Existing Generator/Electrical Building

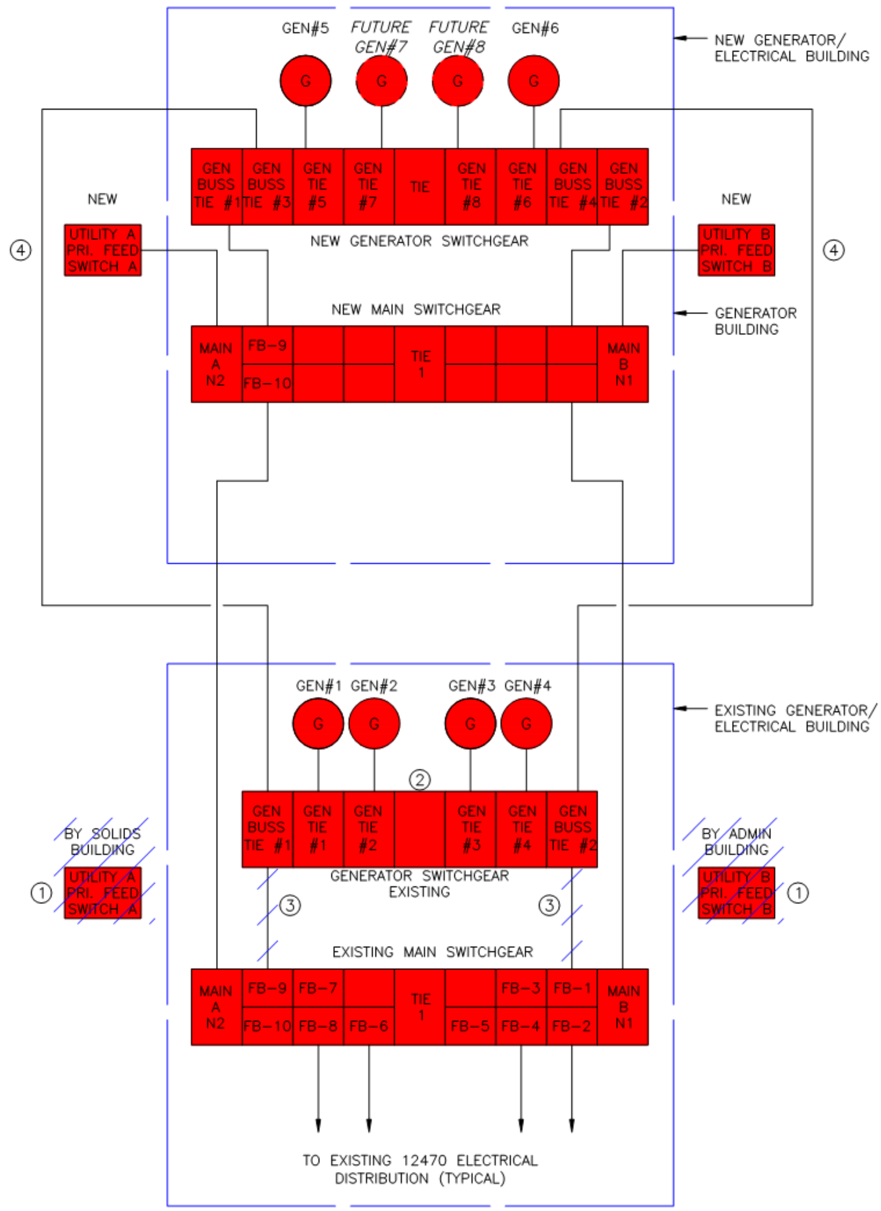
The existing Electrical/Generator Building does not readily have room to add additional feeder circuit breakers, or additional generators beyond what is being installed as part of the Phase V construction.

Our recommended approach is to consider the addition of another set of standby generators to increase the capacity of the emergency system along with the addition of a new 12.47 KV Switchgear lineup that could be configured to provide additional breakers for future plant expansion. This set of generators would be connected to the existing generator bus with a tie breaker to provide multiple options for distribution of generator power. Each set would be configured for parallel operation or all generators could be configured to parallel on the common generator bus. Since space is quickly being allocated on site with numerous projects, planning is needed to reserve space for the new standby generators and switchgear.

1. Electrical Generator Building Design
    a. It is recommended that the new Generator/Electrical Building be of similar size and configuration as the existing Generator/Electrical Building. This would provide room for up to four (4) additional 2500 KW generators as future plant loads are added to the distribution system.
    b. New 12.47 KV distribution switchgear is suggested to be provided, which would be fed from new utility drops located on the west side of the property. The existing

12.47 KV distribution switchgear would be sub-fed from the new gear using the existing main A and B circuit breakers. This would provide minimum impact on the existing 12.47 KV distribution system during construction.

c. Two new generators of similar size (2500 KW) to the existing are recommended to be installed in the new building with space allocated for two additional generators for future growth. The generators should be provided with a new generator switchgear lineup sized for ultimate build out of four additional generators.
d. The new generator switchgear lineup will be main-tie-main construction to provide maximum options for routing generator power distribution. One new generator would be connected to the A side and one new generator would be connected to the B side.
e. The existing generator switchgear line up should be modified by splitting the main bus and connecting the resulting two buses to the new generator switchgear A & B side. This would place three generators on the A and B side with space for a fourth generator on the A and B side in the future. This would provide improved options for providing generator power to the facility.
f. Provisions should also be made to allow connection of load banks to the generator system for testing making for a safer environment than the temporary cables laying on the ground during this activity.
g. Any medium voltage conduit installed within the facility should be 6" at a minimum. This will allow any existing medium voltage circuit to be increased in capacity with a corresponding increase in wire size and modifications to the medium voltage circuit breaker trip coil. Existing medium voltage conduits are typically 4" and are limited with respect to the wire size allowed. In order to upgrade the medium voltage circuit sizes, the existing conduits would need to be replaced, or additional conduits would need to be installed. As many areas around the facility have significant conduits and duct banks in place, particularly the corridor running from the existing generator building to the old generator/electrical distribution building, location and sizing of any new conduit corridors is critical for future projects and plant expansions. Planning for future plant expansions and/or upgrades, will reduce cost, construction time, and provide more options for power distribution.
h. The plenum air flow design will also be added to the Existing Generator/Electrical Building to prevent the intrusion of wind driven rain into the building and improvements in the reduction of noise.



PROPOSED SWRF ELECTRICAL MODIFICATIONS

NOTES:

1. EXISTING UTILITY SWITCHES (600A) TO BE REMOVED.
2. EXISTING GENERATOR BUS TO BE SPLIT.
3. EXISTING TO BE REMOVED.
4. NEW UTILITY SWITCHES (1200A).

Figure 3.11 Proposed SWRF Electrical Modifications

2. Electrical/Generator Building Location
   a. It is suggested that the new Electrical/Generator Building be located to the west of the existing Electrical/Generator Building. The location which currently has the biofilter (mulch bed) for the odor control system and digester flare system. This location provides ease of access to OUC Utility feeds and would also be close to the existing electrical distribution/generator building to minimize conduit and wiring required to interface the new generator building with the old generator building. The conceptual plans are shown in Figures E-3 and E-4.

Figure 3.12 Existing Biofilter - Proposed Location of New Electrical/Generator Building

Figure 3.13 Existing Biofilter - View from West

Section 4

ESTIMATED BUDGETARY CAPITAL IMPROVEMENTS COSTS

4.1 Opinion of Probable Construction Cost

Table 4.1 Opinion of Probable Construction Cost

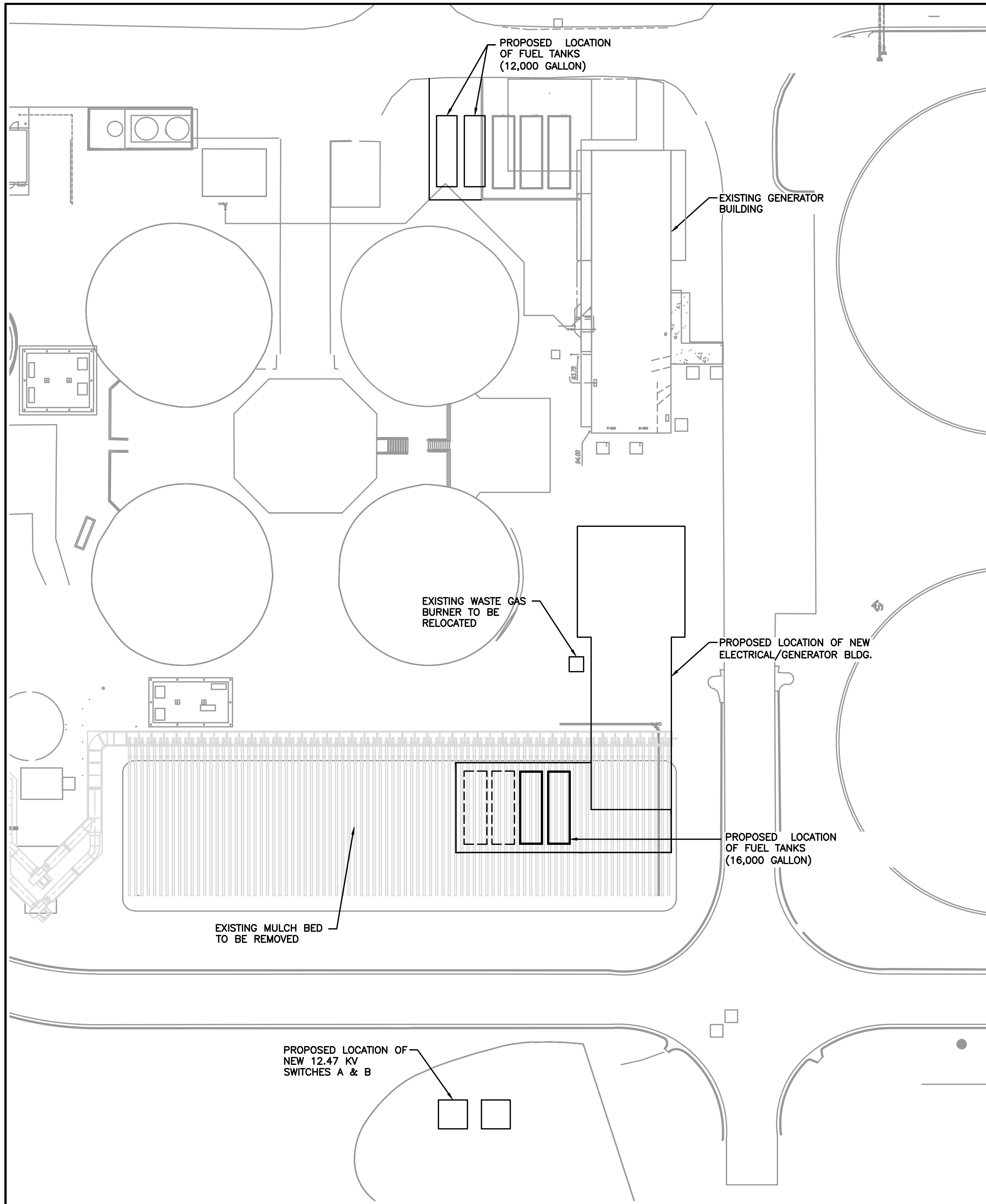
Upgrades/Improvements		Cost
New Electrical/Generator Building		
(2) 2500 KW Generator - 12.47 KV		$2,400,000
Generator Switchgear		$600,000
Main 15KV Distribution Switchgear		$775,000
(2) 16,000 Gallon Fuel Tank w/acc.		$280,000
Generator Building Cost (8400 SF)		$2,520,000
Misc. Equipment		$1,000,000
	Subtotal	**$7,575,000**
Contingency - 30%		$2,273,000
Contractor OH & Profit - 15%		$1,137,000
	Total	**$10,985,000**
OUC & 15KV Switchgear Improvements		
Switchgear Modifications		$315,000
Pad Mounted Equipment		$195,000
Misc. Equipment including UG Service Feeders		$285,000
Subtotal		**$795,000**
Contingency - 30%		$239,000
Contractor OH & Profit - 15%		$120,000
Total		**$1,154,000**

Table 4.1 Opinion of Probable Construction Cost (continued)

Upgrades/Improvements	Cost
Additional Diesel Fuel Storage	
(2) 12,000 Gallon Fuel Tank w/acc.	$160,000
Misc. Equipment	$135,000
Subtotal	**$295,000**
Contingency - 30%	$89,000
Contractor OH & Profit - 15%	$45,000
Total	**$429,000**

Notes:

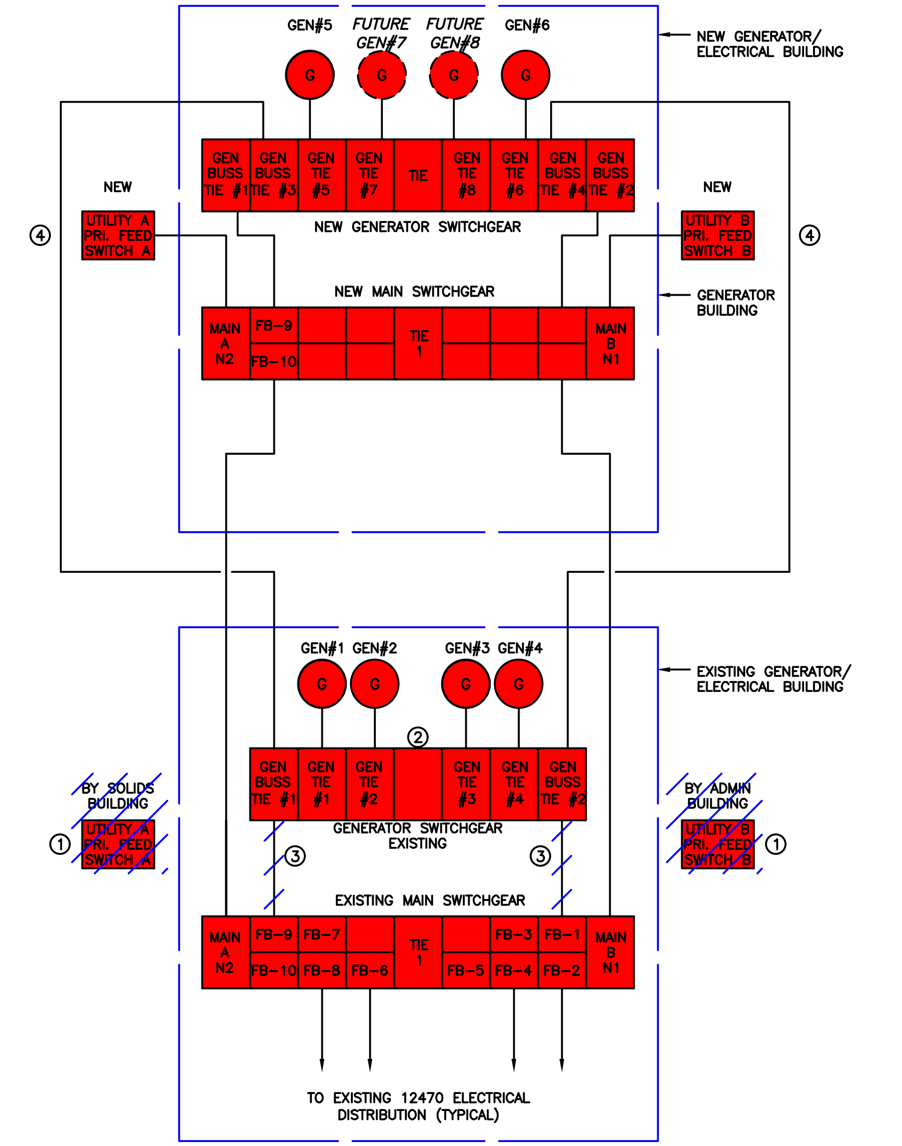
(1) Per AACE International, the anticipated accuracy of a Class IV OPCC is between -30% (below) to +50% (above) the cost of construction



PARTIAL SITE PLAN

SCALE: 1"=30'-0"

30 15 0 30'



PROPOSED SINGLE LINE

NOTES:

1. EXISTING UTILITY SWITCHES (600A) TO BE REMOVED.
2. EXISTING GENERATOR BUS TO BE SPLIT.
3. EXISTING TO BE REMOVED.
4. NEW UTILITY SWITCHES (1200A).

LEGEND:

12.47 KVOLTS | 4160 VOLTS | 480 VOLTS

REV.	DATE	DRAWN	CHK'D.	DESCRIPTION
				REVISIONS

EDA
Electrical Design Associates
6965 PIAZZA GRANDE AVE., STE. 412
ORLANDO, FLORIDA 32835
PHONE: (407) 745-5604
FAX: (407) 745-5603
C.O.A. No. 8079
WILLIAM C. NELSON, P.E.
Florida P.E. No. 42017

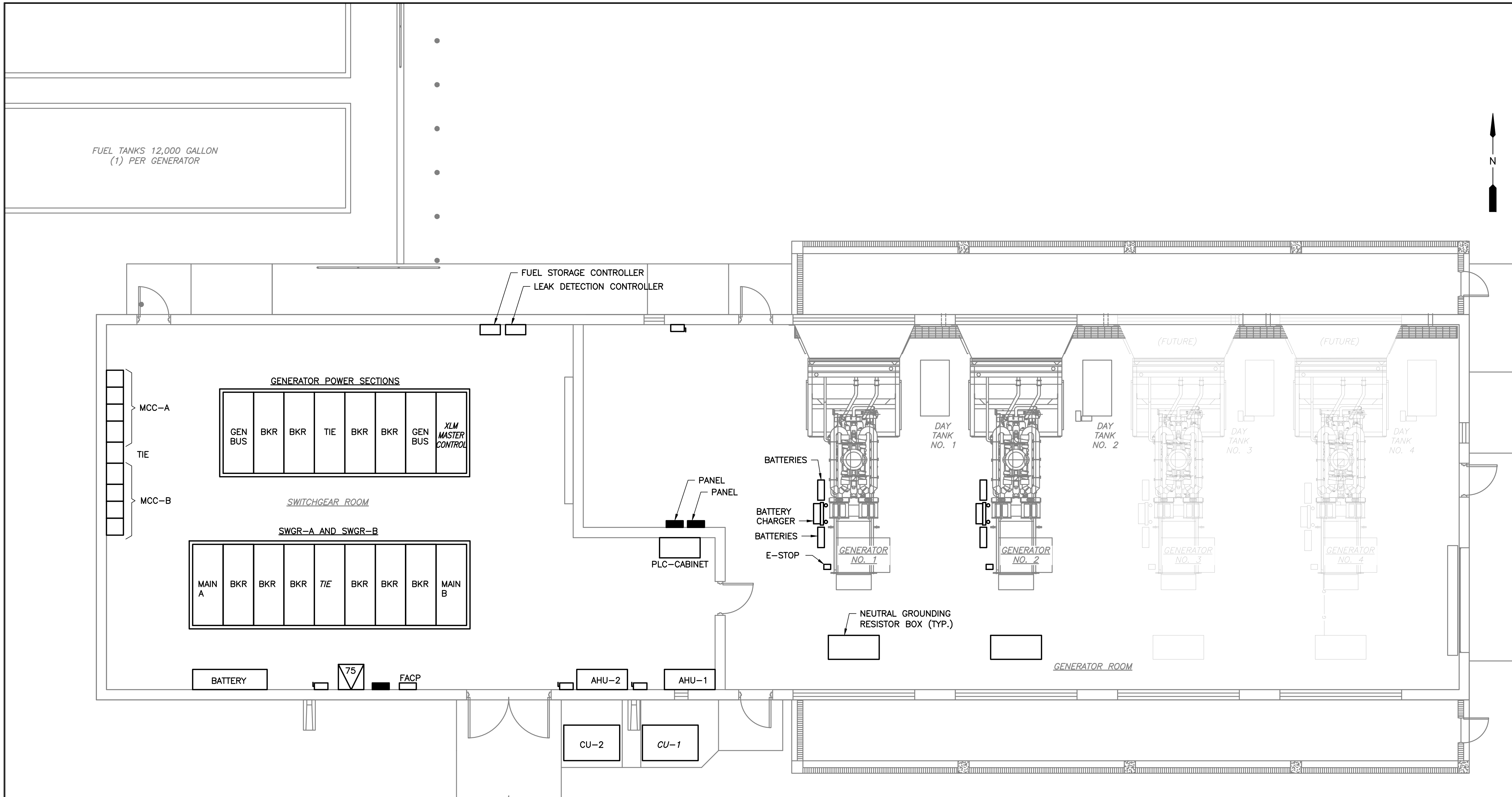
ORANGE COUNTY SOUTH WATER RECLAMATION FACILITY

SITE PLAN AND PROPOSED SINGLE LINE

Designed by: WCN
Drawn by: SDV
Checked by: RTM
Approved by: WCN
Date: August 2018

PROJECT NO.

SHEET NO.
E-3



PROPOSED ELECTRICAL/GENERATOR BUILDING

SCALE: 3/16"=1'-0"

6 4 2 0 5'

REV.	DATE	DRAWN	CHK'D.	DESCRIPTION REVISIONS

EDA
Electrical Design Associates
6965 PIAZZA GRANDE AVE., STE. 412
ORLANDO, FLORIDA 32835
PHONE: (407) 745-5604
FAX: (407) 745-5603
C.O.A. No. 8079
WILLIAM C. NELSON, P.E.
Florida P.E. No. 42017

ORANGE COUNTY
SOUTH WATER RECLAMATION FACILITY

PROPOSED ELECTRICAL/GENERATOR BUILDING

Designed by: WCN
Drawn by: SDV
Checked by: RTM
Approved by: WCN
Date: August 2018

PROJECT NO.

SHEET NO.

E-4

PROJECT MEMORANDUM

SWRF NEW SCADA CONTROL ROOM

Orange County Utilities

Date:	June 17, 2019
Project No.:	10698T.00

Prepared By:	Brent White, P.E. & Bill Nelson, P.E.
Reviewed By:	Erica Stone, Ph. D., P.E.
Subject:	CIP TM 2.3 South Water Reclamation Facility (SWRF) – New SCADA Control Room

Explanation of Project Need

The existing SCADA control room at SWRF is situated in the existing maintenance building which is located in the southeast portion of the SWRF property. The existing control room equipment has been in operation for some time and require replacement to upgrade outdated equipment and generally provide SWRF Operations staff with a more reliable and functional system to monitor and control SWRF and other OCU facilities.

This project proposes to demolish the existing equipment within the existing SCADA Control Room and rebuild a new SCADA control room in the same location.

Outline of Project Scope

- New SCADA control system furniture and SCADA control desk.
- Secure Server Room (add card readers thru ISS and remove access switch to exit server room)
- Connections to both non-business network (SCADA) and business network (admin) via separate machines in the control room
- Ability to monitor security cameras (not through ISS) and open gates at all three (future four) WRFs
- Multiple Large monitors (65 inch) for display of plant wide HMI screens (SWRF, EWRF, & NWRF) from the ceiling
- Smaller monitors for display of individual process troubleshooting, alarms, etc. on the desk
- Ability to back up SWRF servers to offsite facility at the President's Drive facility via fiber connection (currently backup servers are in the same rack and vulnerable to a single failure potential)
- Existing 120/208V UPS panelboard will be relocated to the server room.

Opinion of Probable Construction Cost Assumptions

- The ongoing Influent Pump Station Project will be providing new SCADA servers therefore it is assumed that new SCADA servers will not be part of the proposed SCADA control room project.
- OCU is currently planning on the HMI upgrade to be accomplish via another project due to current operational challenges with the old HMI system.

- It is assumed that demolition of the existing SCADA room furniture and equipment within the existing room will be performed during the Maintenance Building Renovation project prior to the buildout of the new SCADA room.
- New raised floor to be constructed under maintenance building renovation project to accommodate wiring throughout the room. The majority of the room will include a raised floor with a portion of the room matching the existing finished floor elevation to allow ease of ingress and egress through the doorways.
- It is assumed that the SCADA Control Room Project will be part of a larger SWRF Building Upgrades project which will include the Maintenance Building Renovation, New Central Receiving Building, and other SWRF building improvements.
- It is assumed that existing SCADA operations can be maintained during the construction of the new SCADA control room via the creation of a temporary room to locate the workstations and monitors to function as the SCADA Control Room within the existing Maintenance Building.
-

Opinion of Probable Construction Cost

Below is the Opinion of Probable Construction Cost (OPCC) for the SWRF SCADA Control Room Project. The total construction cost is estimated to be $118,019.00. The OPCC is a Class IV estimate, as defined by AACE International guidelines. The anticipated range of accuracy of a Class IV estimate is from -30% to +50% of the actual cost of construction. Due to the preliminary nature of the design maturation, a 30% contingency has been used for the purposes of this estimate. It is anticipated that the OPCC is revised during final design engineering, and as the scope of the project evolves.

New SWRF SCADA Control Room					
Opinion of Probable Construction Cost - Class IV Estimate					
Pay Item Number	Item	Estimated Quantity	Unit	Unit Price	Cost
1	Control Room System Furniture	1	LS	$20,000.00	$20,000.00
2	Security Camera NVRs	1	LS	$4,500.00	$4,500.00
3	Server Room Security	1	LS	$2,000.00	$2,000.00
4	65" UHD 4K Monitor	5	LS	$1,250.00	$6,250.00
5	24" Desktop Monitor	4	LS	$400.00	$1,600.00
6	Electrical Improvements	1	LS	$32,000.00	$32,000.00
7	Network, Video, Etc. Improvements	1	LS	$3,200.00	$3,200.00
8	Miscellaneous patching, painting, door, etc.	1	LS	$2,500.00	$2,500.00
	Subtotal				**$72,050.00**
	Contingency (30%)				$21,615.00
	Total				**$93,665.00**
	Contractor - General Conditions at 7% of Total				$6,557.00
	Contractor - Mobilization/Demobilization at 3% of Total				$2,810.00
	Contractor - Overhead and Profit at 15% of Total				$14,050.00
	Bonds at 1% of Total				$937.00
	Total				**$118,019.00**

Notes: The OPCC is a Class IV estimate, as defined by AACE International guidelines. The anticipated range of accuracy of a Class IV estimate is from -30% to +50% the actual cost of construction.

PROJECT MEMORANDUM

SWRF NEW CENTRAL RECEIVING BUILDING

Orange County Utilities

Date:	April 10, 2019
Project No.:	10698T.00

Prepared By:	Doug Sangster, RA, CGC
Reviewed By:	Brent White, P.E.
Subject:	Final CIP TM 2.2 South Water Reclamation Facility (SWRF) – New Central Receiving Building

Explanation of Project Need

The SWRF Central Receiving Building will be a successor project to the SWRF Maintenance Building Renovation. As part of the maintenance building project existing storage and shop areas are being repurposed with several areas changing use/occupancy. As a result of this change in the maintenance building use additional space is needed to accommodate delivery receiving and storage of equipment and materials. The proposed Central Receiving Building is proposed to serve as a single location for delivery, cataloging, storage, and distribution of all SWRF equipment and material deliveries.

Outline of Project Scope

The Central Receiving Building is proposed to be constructed directly south of the existing maintenance building. **Figure 1** shows the location of the proposed building. The new building will require the demolition of existing asphalt parking & curbs.

The building is assumed to be a fully sprinkled, 15,000 SF, 100′ x 150′ free-span metal building with 16′ minimum eve height. The envelope will consist of an insulated metal panel roof system with metal gutters and downspouts and painted CMU side walls with elastomeric paint. The exterior envelope will be designed to meet all hurricane and environmental code requirements. Building access will be via two 18′ wide by 16′ tall and one 16′ by 16′ power operated roll up doors along with Galvanized hollow metal man doors as required for emergency egress. A loading dock will be provided at the West side of the building with a hydraulic lift gate. Concrete floor construction will be specially engineered for warehouse use. **Figure 2** shows the preliminary building layout for the new central receiving building.

Approximately 2,600 SF will be air-conditioned with ground mounted direct expansion (DX) units. The remainder of the building will be served by exhaust fans to provide the required air changes. Radiant space heaters will protect stored items from freezing. Roof penetrations will be kept to a minimum. A 36′ x 36′ air-conditioned storage area with a power operated rollup door will be provided for electrical items. An air-conditioned office area will consist of three 12′ x 12′ and one 12′ x 20′ private offices as well as men's and women's ADA compliant restrooms. Exterior windows will be fixed, impact rated, insulated units in aluminum frames. There will be a pick-up counter adjacent to the office area and the loading dock. All conditioned spaces will be separated from non-conditioned areas with insulated CMU partitions. Exterior walls at conditioned areas will be insulated per code requirements.

Interior finishes in the offices will be carpet tile flooring in office areas and luxury vinyl tile (LVT) in corridors, painted gypsum board on metal stud walls and acoustical tile lay-in ceilings with LED lighting and acoustic control to improve staff efficiency. Restrooms will have ceramic tile flooring and walls with moisture/mold resistant gypsum board ceilings, painted.

The storage areas will be provided with heavy duty metal storage racks with aisles to allow access by fork lift. Lighting will be by high bay LED fixtures. An electric fork lift will be provided in the contract with a designated charging area. A 16' x 24' tool crib will be provided with secured access.

Site work will consist of clearing the area for the new building including demolition of exist parking spaces, asphalt drive areas, and curbing. There is also a recently constructed 42" ductile iron reclaimed water main which runs under the parking lot which may need to be relocated further north to avoid the new building construction. It is preferable that the newly installed piping not be relocated. The building may be able to be shifted further south and elongated east/west to avoid the existing piping. It is assumed that alternative building configurations to eliminate the relocation of the existing piping can be presented to OCU for their input in the final design effort phase of the project. Modifications will be made to the existing driveways to facilitate truck traffic and maneuvering and the addition of new parking areas to replace those displaced by the new building. The new parking areas will be located along the north entrance road to the existing maintenance building near the existing stormwater pond areas. The existing stormwater ponds may need to be expanded to the north to accommodate the slight increase of impervious area due to the removal of the pervious median in the existing parking lot. There will also be alterations to the existing site lighting, landscaping and irrigation systems.

Opinion of Probable Construction Cost Assumptions

Building construction costs were estimated based largely on a per square foot basis for the type of construction within the building. It is assumed that the existing 42 inch reclaimed water main will be relocated to the north of the building prior to construction of the building so as not to interfere with foundation construction. It is assumed that the Central Receiving Building project will be grouped with the Maintenance Building Renovation and other building improvements and bid as larger SWRF building Improvements project. It is assumed that the pre-engineered metal building will be of a standard design by a reputable metal building manufacturer who will supply the necessary structural calculations based on a design criteria outlined by the design architect/engineer.

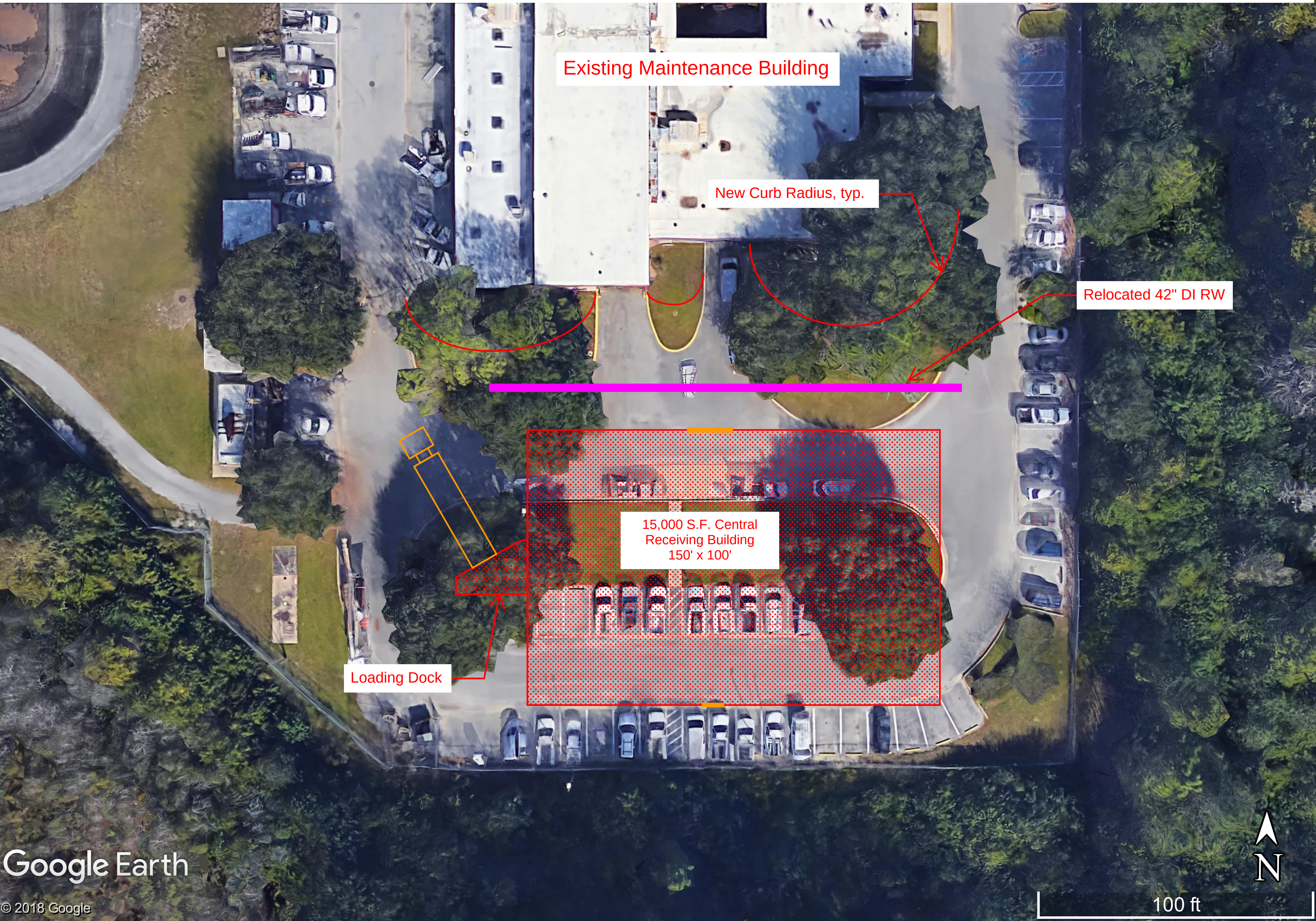
Opinion of Probable Construction Cost

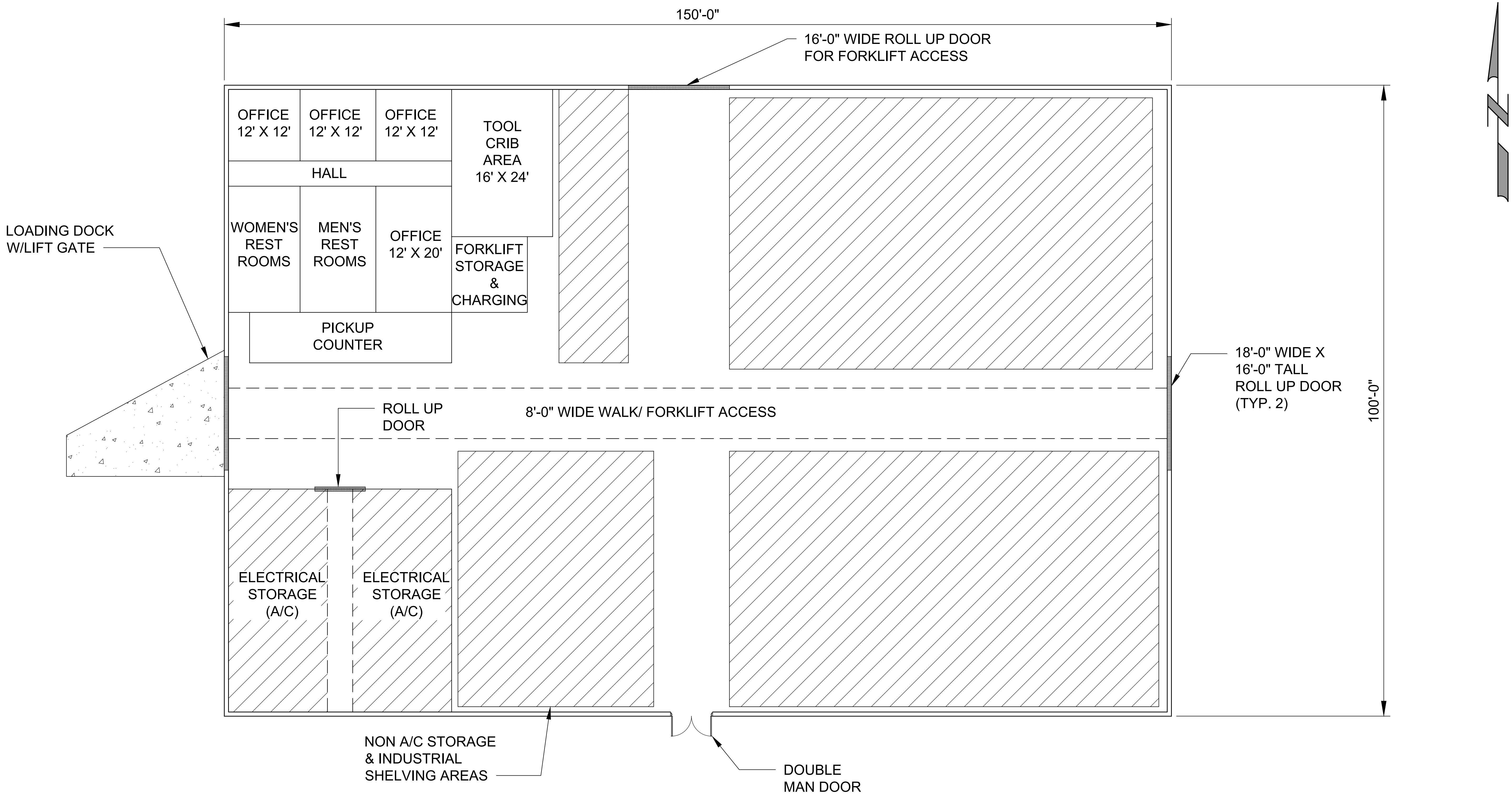
Below is the Opinion of Probable Construction Cost (OPCC) for the SWRF Central Receiving Building. The total construction cost is estimated to be $4,259,128.00. The OPCC is a Class IV estimate, as defined by AACE International guidelines. The anticipated range of accuracy of a Class IV estimate is from -30% to +50% of the actual cost of construction. Due to the preliminary nature of the design maturation, a 30% contingency has been used for the purposes of this estimate. It is anticipated that the OPCC is revised during final design engineering, and as the scope of the project evolves.

SWRF Central Receiving Building					
Opinion of Probable Construction Cost - Class IV Estimate					
Pay Item Number	Item	Estimated Quantity	Unit	Unit Price	Cost
1	Site work & RW Piping Relocation	1	LS	$275,000.00	$275,000.00
2	Substructure: CIP Concrete, 5" Engineered	15000	SF	$15.00	$225,000.00
3	Superstructure: PEMB steel frame, insulated metal panel roof	15000	SF	$112.00	$1,680,000.00
4	Exterior Envelope: CMU, OH Rollup Doors, Aluminum Windows	8000	SF	$13.50	$108,000.00
5	Life Safety: Fire Sprinklers, Alarm System	15000	SF	$7.30	$109,500.00
6	Plumbing: Water Closets, Lavatories, Eyewash Stations	5	EA	$4,000.00	$20,000.00
7	HVAC: Direct Expansion System	2600	SF	$12.00	$31,200.00
8	Electrical: Main Service & Distribution, Power, LED Lighting, Emergency Lighting	15000	SF	$6.60	$99,000.00
9	Miscellaneous: Office Area, Shelving, Fork Lift, Etc.	15000	SF	$3.50	$52,500.00
	Subtotal				**$2,600,200.00**
	Contingency (30%)				$780,060.00
	Total				**$3,380,260.00**
	Contractor - General Conditions at 7% of Total				$236,618.00
	Contractor - Mobilization/Demobilization at 3% of Total				$101,408.00
	Contractor - Overhead and Profit at 15% of Total				$507,039.00
	Bonds at 1% of Total				$33,803.00
	Total				**$4,259,128.00**

Notes: The OPCC is a Class IV estimate, as defined by AACE International guidelines. The anticipated range of accuracy of a Class IV estimate is from -30% to +50% the actual cost of construction.

FIGURE 1
SWRF CENTRAL RECEIVING BUILDING SITE PLAN





- 15,000 FT² (150' X 100') METAL BUILDING
- 2,600 FT² A/C SPACE
- 16 FT BUILDING WALL HEIGHT
- NON-A/C AREAS WILL HAVE EXHAUST FANS FOR REQUIRED AIR CHANGES

Figure No. 2
SWRF CENTRAL
RECEIVING BUILDING LAYOUT
ORANGE COUNTY UTILITIES

carollo
Engineers...Working Wonders With Water ™

PROJECT MEMORANDUM

SWRF MAINTENANCE BUILDING RENOVATION

Date:	April 25, 2019
Project No.:	10698T.00

Orange County Utilities

Prepared By:	Doug Sangster, RA, CGC
Reviewed By:	Brent White, P.E.
Subject:	Final CIP TM 2.5 South Water Reclamation Facility (SWRF) – Maintenance Building Renovation

Explanation of Project Need

The existing SWRF Maintenance Building was constructed in 1989 to consist of equipment and vehicle fleet maintenance, a general shop, equipment & parts storage, office space, a courtyard, locker rooms & restrooms, a training room, and a kitchen. The building is now 30 years old and as a result needs renovation and refurbishment to provide adequate service to SWRF personnel. In addition some of the original building uses are no longer needed (e.g. vehicle fleet maintenance) therefore refurbishment will allow the building to be modified to better suit the current needs of operations and maintenance staff.

Outline of Project Scope

The proposed project is a building renovation project within the existing Maintenance Building. This project is intended to be a successor project to the new Central Receiving Building. The project will include the repurposing and renovation of the existing space within the existing Maintenance Building as existing functions are relocated to the new Central Receiving Building.

The existing building has been segregated into multiple areas based on the proposed building use. The revised building use and occupancy types were developed with input from SWRF Operations staff based on their operational and maintenance needs. These proposed building areas (designated with area letters) can be seen on the attached **Figure SK-1**. The following descriptions provide the scope of renovation and approximate square footage for each proposed building use area under the Maintenance Building Renovation project.

Shops Area, A) 4,300 SF: This scope involves minor upgrades and alterations to improve the efficiency of operations and accommodate the maintenance requirements of technical systems that have changed over the years. Improvements will consist of reallocation of space between functional areas, painting, and more efficient LED lighting and new storage systems. Where required, existing spaces are to be sub-divided with non-bearing CMU partitions on new foundations. Storage areas will utilize off the shelf metal rack systems such as are available from Home Depot retailers. Contractor shall provide storage for shops area contents during construction and set up temporary work spaces. Construction will be phased to minimize the interruption of essential OCU operations. Assuring worker safety, accessibility, and code compliance will be included in this scope.

SCADA, B) 2,380 SF: Modifications to the SCADA area will include updated and relocated monitors and their mounting arrangement to make the facility's system status more readily apparent to the operators. The objective will be to improve plant efficiency of operation and reduce operator fatigue. A raised floor design will improve accessibility to cabling and reduce downtime when repairs or upgrades are required. Redundant systems will be incorporated wherever possible to eliminate single points of failure. Improvements will include entrance security, acoustical separation, task-oriented lighting, window treatments and access to facility security cameras will be included in this scope.

High Bay Area, C) 6,650 SF: Modifications to this area will include minor renovations to improve the efficient movement of people and materials and improve staff safety. This scope will include painting, signage, and efficient lighting along with replacement/renovation of existing equipment. Portions of this area may be used as temporary shops during construction. Construction will be phased to maintain continuous OCU operation.

Infill, D) 2,050 SF: The existing open courtyard area would be better utilized for a large training area. This scope will include new concrete foundations and slab on grade, steel columns, and roof structure. The interface with the existing roof system will be designed to maintain existing warranties. HVAC will be provided by a rooftop package unit. The contractor shall provide protection for the existing roof during construction.

Electrical power, LED lighting, data, and plumbing systems will be served from existing sources with increased capacity as required. Interior finishes will be carpet tiles, painted gypsum board walls and acoustical tile lay-in ceilings. Underfloor ducts will serve floor outlets for training computers. Accessories will include marker and tack boards along with CCTV monitors. Attention will be paid to the effect of the additional space on existing life safety systems such as egress requirements as well as increased parking.

Restrooms and Showers, E) 1,840 SF: The existing facilities will be brought up to current ADA standards and modernized for more efficient staff utilization and reduced maintenance requirements. The scope will include demolition of existing finishes and fixtures including floor trenching for new piping and rough in. Existing stacked lockers will be replaced with new full height units. Interior finishes will be ceramic tile flooring and walls with moisture/mold resistant gypsum board ceilings, painted. New male and female ADA compliant restroom facilities will be located nearer to work areas with access from the central high bay area to increase efficiency.

Office Area – Major Alterations, F) 3,960 SF: Portions of the office area will be gutted and new space arrangements created to accommodate changed functions and staff requirements. Space allocations will be based on a Needs Assessment jointly created by OCU management and the design team. An improved reception area will incorporate windows and an information counter to provide better control of visitors. Interior finishes will be carpet tile flooring, painted gypsum board walls with sound control batt insulation and acoustical tile lay-in ceilings.

Office Area – Minor Alterations, G) 5,650 SF: Portions of the existing office area will be upgraded with new carpet tile flooring in office areas and luxury vinyl tile (LVT) in break areas, painted gypsum board walls and acoustical tile lay-in ceilings with LED lighting and acoustic control to improve staff efficiency. Some minor space alterations are anticipated.

Opinion of Probable Construction Cost Assumptions

Construction costs were estimated based on per square foot costs for the type of renovation to be performed. The cost of the SCADA Control Room includes the building and architectural scope of work as described herein. SCADA equipment (SCADA racks, servers, monitoring televisions/screens, programming, and other SCADA network equipment will be included in a separate Opinion of Probable Construction Cost (OPCC) for the SCADA Control Room project.

It is assumed that this Maintenance Building Renovation project will be completed following the construction of the new Central Receiving Building so that the Central Receiving Building can be used to accommodate storage, maintenance, and office functions during the renovation of the Maintenance Building.

It is assumed that the Maintenance Building Renovation project will be grouped with the Central Receiving Building and other building improvements and bid as larger SWRF building Improvements project.

The following items are not included in the attached OPCC:

- New or modified fire protection/suppression systems.
- SCADA equipment within modified SCADA Control Room.
- Major structural modifications.
- HVAC, fire suppression, plumbing, and other MEP type work for existing building areas which are not specifically listed in the building area descriptions above.
- Site/Civil improvements surrounding the existing maintenance building.
- Energy efficiency improvements which are not related to renovation of the existing building to suit the new building use. For example energy efficient windows and air conditioning are not assumed to be replaced assuming they are in working order and can serve the revised building occupancies.

Opinion of Probable Construction Cost

Below is the Opinion of Probable Construction Cost (OPCC) for the SWRF Maintenance Building Renovation. The total construction cost is estimated to be $4,508,676.00. The OPCC is a Class IV estimate, as defined by AACE International guidelines. The anticipated range of accuracy of a Class IV estimate is from -30% to +50% of the actual cost of construction. Due to the preliminary nature of the design maturation, a 30% contingency has been used for the purposes of this estimate. It is anticipated that the OPCC is revised during final design engineering, and as the scope of the project evolves.

SWRF Maintenance Building Renovation					
Opinion of Probable Construction Cost - Class IV Estimate					
Building Area	Item	Estimated Quantity	Unit	Unit Price	Cost
A	Shops Area: minor renovation/alteration, paint, LED lighting, storage racks etc.	4360	SF	$50.00	$218,000.00
B	SCADA: computer floor, special lighting and controls, security, window treatment	2380	SF	$250.00	$595,000.00
C	High Bay Area: minor renovation, paint, LED lighting	6650	SF	$65.00	$432,250.00
D	Infill: roof, foundations, slab, mechanical, plumbing, electrical	2050	SF	$300.00	$615,000.00
E	Restrooms & Showers: major renovation/alteration, ADA requirements	1840	SF	$170.00	$312,800.00
F	Office Area: major alterations	3960	SF	$75.00	$297,000.00
G	Office Area: minor renovation	5650	SF	$50.00	$282,500.00
	Subtotal				**$2,752,550.00**
	Contingency (30%)				$825,765.00
	Total				**$3,578,315.00**
	Contractor - General Conditions at 7% of Total				$250,482.00
	Contractor - Mobilization/Demobilization at 3% of Total				$107,349.00
	Contractor - Overhead and Profit at 15% of Total				$536,747.00
	Bonds at 1% of Total				$35,783.00
	Total				**$4,508,676.00**

Notes: The OPCC is a Class IV estimate, as defined by AACE International guidelines. The anticipated range of accuracy of a Class IV estimate is from -30% to +50% the actual cost of construction.

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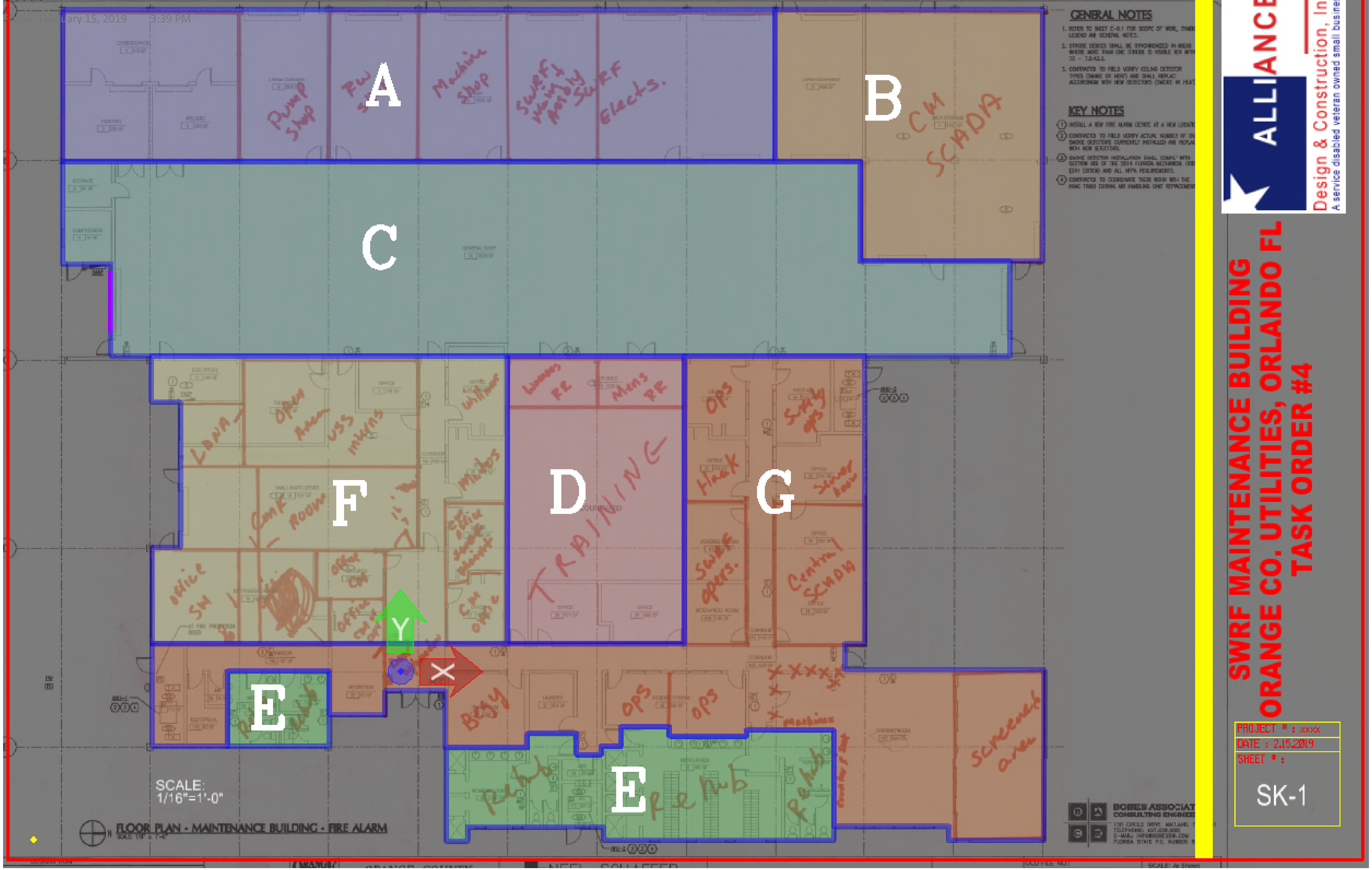

PROJECT MEMORANDUM

SWRF SOUTH SERVICE AREA PUMP STATION EXPANSION

Orange County Utilities

Date:	January 3, 2019
Project No.:	10698T.00

Prepared By:	Brent White, P.E. & William Nelson, P.E.
Reviewed By:	William Marshall, P.E.
Subject:	CIP TM 2.4 South Water Reclamation Facility (SWRF) – South Service Area (SSA) Pump Station Expansion

Explanation of Project Need

The South Water Reclamation Facility (SWRF) provides reclaimed water to the County's South Service Area (SSA) reclaimed water distribution system. This existing SSA system serves public, residential, and commercial irrigation as well as golf course irrigation needs and was constructed in 1995 and originally designed by Boyle Engineering Corporation. The SSA system is fed from the existing SWRF South Service Area Pump Station (SSAPS). This existing pump station consists of three (3) 600 HP Layne Bowler (now Layne/Verti-Line) vertical turbine pumps installed in cans. Each of the three existing pumps has an original design point of 6,500 gpm at 283 feet TDH. Based on this design point the existing pump station has a total capacity of 28.08 MGD and a firm capacity of 18.72 MGD. Historical flow data and discussion with SWRF Operations staff indicate that existing SSA demands are approximately 10.07 MGD ADF. Reclaimed water flow projections for the SSA have been performed by WSP as part of the upcoming SWRF Facilities Plan Report. These flow projections indicated that the average SSA demand will rise to approximately 13.1 MGD ADF with a recommended design peaking factor of 6.0. SWRF Operations staff has indicated that all three existing SSA pumps are regularly necessary to meet peak flow demands. Based on the increased reclaimed water projections and the current lack of pump redundancy at peak flows additional reclaimed water pumping is necessary to serve the South Service Area peak demands. A photo of the existing pump station and surge tank is shown below.

Electrical improvements for increased reliability are recommended in addition to the pump station capacity improvements. The existing 12,470V-480V transformers are dedicated to each pump with an additional transformer dedicated to the 480V loads. Based on the location of the existing tie breaker and bus split, the existing 12,470V switchgear will not be able to provide Class I reliability. Based on the age of the existing switchgear and lack of Class I reliability for the new loads, new 480V switchgear and a new dual transformer arrangement (similar to other recent OCU installations) is recommended.

Project Scope

The intent of this project is to provide additional pumping capacity at the existing SSA Pump Station to serve the increased reclaimed water demand projections. The existing pump station includes existing pump cans for three additional reclaimed water pumps of identical capacity to the existing 6,500 gpm pumps. The proposed project will install three (3) additional 600 HP vertical turbine pumps (6,500 gpm at 283 feet TDH), variable frequency drives, surge tank air compressors, and associated electrical and instrumentation. In addition to the equipment for the new pump capacity the project will also include replacement of existing aging electrical equipment (existing pump VFDs, existing switchgear, replacement of existing transformers). The anticipated scope of work for this project is as follows:

- Three (3) new VFD driven vertical turbine reclaimed water pumps installed in existing cans. New pumps design point will match existing pump design point of 6,500 gpm at 283 feet TDH
    - Motors will be 600 HP inverter duty rated
- 20" slanted disc check valves, 20" discharge butterfly valve, and air release valve for each new pump
- 20" discharge piping, extension of 42" discharge header, and associated fittings and piping appurtenances
- Three (3) new 480V 18-pulse variable frequency drives with soft start bypass
- Two (2) new 12,470V-480V pad mounted transformers (3750 KVA minimum each)
- New 4,000 Amp 480V Draw-out Switchgear (Main-Tie- Main) and feeder breakers for VFDs and dual 480V loads
- Demolition of existing 12,470V switchgear and pad mounted transformers
- New 480V Power Panel to provide redundancy and split of 480V loads.
- Check valve limit switch and high and low pressure switches for each pump, i.e. existing pump instrumentation
- Replacement of existing surge tank air compressors with a new air compressor system (dual 5 HP compressors mounted on one (1) new 80 gallon receiver tank)
- New 36" venturi flow meter to be installed on pump station discharge. Reconfiguration of the existing flow meter piping to provide sufficient upstream and downstream diameters to provide increased accuracy.
- New electrical and instrumentation wiring pulled through existing conduit (where applicable)
- Replacement of three (3) existing reclaimed water pump VFDs with new VFDs (with soft start bypass)
- PLC/SCADA programming to integrate new pumps (New PLC provided under separate contract)
- New HVAC split systems with full redundancy and demolition of existing HVAC system
- Startup, testing, and commissioning

Opinion of Probable Construction Cost Assumptions

- Construction costs shown in the OPCC are given in 2018 dollars.
- New pumps will be the same capacity as the existing pumps (6,500 gpm at 283 TDH)
- It is assumed that no concrete demolition or replacement will be necessary because the existing 30" suction piping is constructed from suction header to existing future pump cans.
- Existing conduit is constructed between SSA Pump Station MCC building and pump station
- Demolition of 12,470V switchgear to be sequenced with the installation of new 480V switchgear

- New SSA Pump Station PLC will be constructed and commissioned prior to taking the existing PLC out of service
- Existing PLC will be replaced under separate project. New pumps will be programmed and integrated into the new PLC as part of this project.
- Existing surge tank capacity was sized for buildout of the pump station therefore additional surge tank capacity is not needed as part of this project.
- Flow meter reconfiguration assumes that the existing valves can be utilized in conjunction with temporary piping to sequence the construction of the new flow meter configuration.

Opinion of Probable Construction Cost

Below is the Opinion of Probable Construction Cost (OPCC) for the SWRF South Service Area Pump Station Expansion. The total construction cost is estimated to be $5,004,090.00. The OPCC is a Class IV estimate, as defined by AACE International guidelines. The anticipated range of accuracy of a Class IV estimate is from -30% to +50% of the actual cost of construction. Due to the preliminary nature of the design, 5%-10% design maturation, a 30% contingency has been used for the purposes of this estimate. It is anticipated that the OPCC is revised during final design engineering, and as the scope of the project evolves.

Opinion of Probable Construction Cost

Class IV Estimate

SWRF South Service Area Pump Station Expansion					
Opinion of Probable Construction Cost - Class IV Estimate					
Pay Item Number	Item	Estimated Quantity	Unit	Unit Price	Cost
1	600 HP Vertical Turbine Pumps & Motors - Installed in Existing Pump Cans	3	EA	$250,000.00	$750,000.00
2	Piping Modifications (20" slanted disk check valves, 20" butterfly valves, discharge piping, air release valves, 42" discharge header modification)	1	LS	$150,000.00	$150,000.00
3	Pump Instrumentation (Check valve limit switch and high and low pressure switches)	1	LS	$60,000.00	$60,000.00
4	New Air Compressor & 80 gal. Receiving Tank (Dual 5 HP compressors)	1	EA	$15,000.00	$15,000.00
5	36" Flanged Venturi Flow Meter	1	EA	$50,000.00	$50,000.00
6	Piping and Valves Associated with Flow Meter Reconfiguration	1	EA	$70,000.00	$70,000.00
7	Variable Frequency Drives with RVSS Bypass (New Pumps)	3	EA	$115,000.00	$345,000.00
8	Replacement of existing reclaimed water pump VFDs with new VFDs (with RVSS bypass)	3	EA	$115,000.00	$345,000.00
9	12,470V-480V Pad Mounted Transformer	2	EA	$105,000.00	$210,000.00
10	New 4000A, 480V Switchgear	1	LS	$575,000.00	$575,000.00
11	Demolition of Existing 12,470V Switchgear and Transformers	1	LS	$45,000.00	$45,000.00
12	Electrical & Instrumentation Wiring	1	LS	$250,000.00	$250,000.00
13	Low Voltage Improvements	1	LS	$70,000.00	$70,000.00
14	PLC/SCADA programming to integrate existing and new pumps	1	LS	$40,000.00	$40,000.00
15	HVAC Improvements (new redundant split system)	1	LS	$100,000.00	$100,000.00
16	Startup, testing, and commissioning	1	LS	$50,000.00	$50,000.00
	Subtotal				**$3,125,000.00**
	Contingency (30%)				$937,500.00
	Total				**$4,062,500.00**
	Contractor - General Conditions at 7% of Total				$284,375.00
	Contractor - Mobilization/Demobilization at 3% of Total				$121,875.00
	Contractor - Overhead and Profit at 15% of Total				$609,375.00
	Bonds at 1% of Total				$40,625.00
	Total				**$5,118,750.00**

Notes: The OPCC is a Class IV estimate, as defined by AACE International guidelines. The anticipated rage of accuracy of a Class IV estimate is from -30% to +50% of the actual cost of construction.