TRI-COUNTY AIRPORT AUTHORITY

AIRFIELD LIGHTING SYSTEM, SIGNAGE AND AIRPORT EQUIPMENT ASSESSMENT

TRI-COUNTY AIRPORT (1J0)

Bonifay, Florida

FINAL REPORT

DECEMBER 2019

Prepared For
TRI-COUNTY AIRPORT AUTHORITY

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EXECUTIVE SUMMARY

INTRODUCTION

The Tri-County Airport Authority (TCAA) retained **AVCON, Inc.** (**AVCON**) to complete an airport-wide lighting system, signage and other airport equipment assessment, including a condition assessment of the electrical vault at Tri-County Airport (1JO). This Assessment shall also evaluate conformance with FAA Engineering Brief EB-79 for all Airport-owned equipment.

The project included the following major elements:

- Completion of an operational and code assessment of the existing airfield lighting vault;
- Visual review of the existing airfield lighting, guidance signs and other NAVAID systems;
- Development of a CIP Implementation Plan (2020-2026) to complete the recommended options.

FINDINGS & RECOMMENDATIONS

During the spring of 2019, a site visit with the 1JO maintenance contractor was conducted to evaluate the existing facilities and prepare recommendations for TCAA to address and implement repairs, rehabilitation, and/or replacement. This Report documents the assessment of the physical characteristics and the electrical condition of the existing airfield lighting and its associated power distribution system. This includes the power system as it originates from the utility service point (normal power), through the vault enclosure distribution system, to the constant current regulators (CCR) and ultimately out to the airfield lighting fixtures.

In summary, the following have been evaluated:

- Airfield Lighting Vault Distribution – The Airfield Lighting Vault is a steel enclosure set next to the beacon and does not have conditioned inner space for the electronic equipment. The Airfield Lighting Enclosure is powered from a West Florida Electrical Cooperative underground utility from a 25Kva Pad Mounted Transformer. A 150-ampere main breaker is internal to the service meter enclosure. Power to the Airfield Lighting Enclosure is a 240volt, 3wire, 1 phase, 60hertz service. There are several electrical and electronic components contained within this enclosure for the airfield lighting which are detailed in the body of this report.
- Interior working space around the electrical equipment has several issues that must be addressed, including compliance with working space conditions, grounding repairs and additional lightning protection installation. The distribution panel and ancillary components housed inside the metal enclosure are not environmentally sealed nor is there ample working space requirements per the NFPA 70 National Electrical code.
- Airfield Lighting Enclosure - The existing steel enclosure is an aging and out-of-date structure, and the footprint is not conducive to further expansion. The existing regulators are also older, making replacement parts difficult to obtain. Multiple near and long-term solutions are addressed in the report, with the ultimate recommendation being a complete replacement of the steel enclosure with a weatherproof structural

concrete vault with conditioned interior and all associated electrical and airfield equipment

- Stand by Generator: Currently the airport lighting enclosure is not supported by a standby generator.
- Airfield Lighting Equipment:
  - Home Runs – In the short term, the airfield lighting home run cabling can be replaced in the existing conduit system. Long term, the home run duct bank and cables will need to be replaced or extended to accommodate the new airfield lighting vault.
  - Lighting and Signage – The existing quartz/halogen incandescent lighting and signage systems should be replaced with energy efficient LED fixtures and signs. To gain the most efficiency, the L-830 isolation transformers will also be replaced to best match the fixture/sign power rating. Additionally, the L-824 cables and L-823 connectors, within the circuit should also be replaced.
  - Airport Rotating Beacon – Similar to other electrical components on the airfield, the Airport's rotating beacon needs to be replaced and the tower updated as described further in this report. Multiple near-term repair efforts are also recommended in the interim while funding for the beacon replacement is procured.
  - NAVAIDs (PAPIs, and Wind Cones) – Replacement is recommended for each of the Airport-owned PAPIs. The location requires adjustment in order to comply with Federal Aviation Administration ("FAA") Engineering Brief 79. The existing wind cone is a L-807 externally lighted incandescent unit.

CIP IMPLEMENTATION PLAN

The final component of this Airport facility assessment was to prepare a Capital Improvement Program (CIP), which compiles a listing of associated costs for all of the recommended improvements identified above and within the report. The cost estimates were developed for TCAA in order to create projects of different timeframes/priorities for funding and budgeting purposes (between 2020-2026). **Table 7** summarizes the various cost estimates, including prescribed percentages of the construction costs for Detailed Pricing Allowance (contingency to accomplish detailed design including elements yet to be defined), Contractor Mobilization, Construction Maintenance of Traffic (MOT), Professional Fees, and Contingencies.

1 BACKGROUND

Pursuant to an agreement between the Tri-County Airport Authority (TCAA) and **AVCON, Inc.** (**AVCON**), a Task Order was issued to **AVCON** on May 13, 2019, authorizing the completion of an Airport-wide Lighting System, Signage and Other Airport Equipment Assessment, including a Condition Assessment of the electrical vault at Tri-County Airport (1JO). As the development and implementation of the future airfield enhancements move forward, it will be prudent that the lighting and signage systems be evaluated and updated.

The work was performed on behalf of TCAA, who is responsible for the operation, maintenance and development of the Tri-County Airport.

The project provides for the following major elements:

- Completion of an operational and code assessment of the airfield lighting vault;
- Visual review of the existing airfield lighting and guidance signs;

The project criteria shall evaluate the existing airfield lighting enclosure, airfield lighting and signs, and address the requirements for upgrades or enhancements to the airfield lighting and NAVAIDS systems. The evaluation is documented in this Report for review by TCAA.

Figure 1: Aerial Photo of Tri-County Airport (1JO)

Tri-County Airport (1JO) is a General Aviation Airport operated by the Tri-County Airport Authority (TCAA) located six (6) miles northeast of the City of Bonifay in Holmes County Florida serving both northeast Florida and southeast Alabama. The airport covers an area of 304 acres at an elevation of 85 feet above mean sea level. The airfield consists of a single runway 01-19 measuring 5,398 feet long by 75 feet wide with an asphalt surface. The runway is lighted with Medium Intensity Runway Lighting (MIRL). Each runway end has a Precision Approach Path Indicator (PAPI) system. There are five (5) taxiway connectors leading from the runway to a parallel taxiway "A". All taxiways are lighted with in turf Medium Intensity Taxiway Lighting (MIRL). The runway and taxiways have signage in accordance with FAA A/C 150/5340-18. The signage is powered from the adjacent runway or taxiway circuit. Additionally, there is a lighted general aviation helipad, airport windcone, and segmented circle in close proximity to the helipad.

Based on a review of record documents, it appears the last substantial upgrade to the Airport's airfield lighting systems was completed in 2015. Record documents also reflect that the last substantial upgrades to the Airport's signage system appears to have been completed within the same time frame.

Since the time of these last major rehabilitation projects, the aviation industry has been replacing and upgrading existing incandescent airfield lighting systems using energy-efficient Light Emitting Diode (LED) light source technology. Generally, LED light sources have a 50% or greater energy efficiency over incandescent (halogen quartz) light sources. LED technology has allowed for substantially more efficient and low-energy lighting fixtures and signs. In Florida, the sun's ultraviolet (UV) rays cause the airfield sign panel colors to fade at an accelerated rate. The signs with panels directly facing the sun will typically fade to the point of needing replacement within approximately five (5) years. Panels not directly facing the sun may last up to seven (7) years. As noted above, four (4) years have passed since the last major signage upgrade at 1JO.

It is understood that TCAA's intention is to replace the existing incandescent airfield lighting and signage systems with new LED light sources to improve visibility of the airfield, reduce energy and maintenance costs, and reduce the life-cycle cost.

2 SITE VISIT SUMMARY

AVCON's electrical staff assigned to the project, Mark Goodacre and Carl Johnson, toured the Tri-County Airport (1JO) airfield lighting enclosure, airfield taxiways and runway on May 26, 2019.

The purpose of this site visit was to review the current status of the airfield lighting systems with James Motley. At the time of the inspection, Mr. Motley was the Tri-County Airport Authority (TCAA) maintenance electrician responsible for the electrical systems at 1JO. Due to his hands-on knowledge of 1JO's systems, **AVCON** sought Mr. Motley's expertise to determine if any known concerns exist regarding the systems discussed in this Report.

AVCON discussed the existing conditions of the Airport electrical systems with Mr. Motley. A summary follows:

- Runway 1-19 L-824 cable and L-830 isolation transformers have an extremely low insulation resistance value and need replacement;
- Runway 1-19 Medium Intensity Runway Light (MIRL) fixtures are 4 years old and incandescent; replacement with MIRL LED fixtures should be considered;
- Overall, the airfield lighting home run cables generally have a low insulation resistance value and need replacement;
- Runway 1, and Runway 19 Precision Approach Path Indicators (PAPIs) need replacement;
- The Runway 1-19 threshold light configuration does not conform with current Federal Aviation Administration (FAA) standards and must be addressed;
- The Airfield signage is generally in poor condition;
- Taxiways on the airfield utilize incandescent fixtures, which are generally in poor condition; replacement with LED fixtures should be considered;
- Taxiway lighting spacing and configuration does not comply with FAA criteria.

During the morning of May 26, 2019, **AVCON**'s electrical staff met Mr. Motley at the airfield lighting enclosure. The purpose of this visit was to document the equipment with a photographic inventory and to visually evaluate the airfield lighting enclosure equipment.

Following the airfield lighting enclosure review, Mr. Motley escorted the **AVCON** Team throughout the AOA to examine various aspects of the airfield being included in this Report.

3 AIRFIELD LIGHTING ENCLOSURE ASSESSMENT

A. GENERAL

The Tri-County Airport(1JO) airfield lighting (AFL) enclosure, is located on the north side of the Airport Administration Building. See **Figure 2** for photos of Airfield Lighting Enclosure.

Figure 2: Airfield Lighting Enclosure (AFL Vault)

B. ELECTRICAL SERVICE AND DISTRIBUTION

The AFL enclosure is equipped with a 150 ampere, 120/240-volt, single-phase, three-wire electrical distribution system. The normal (utility power is provided by West Florida Electrical Coop (WFEC. Normal power is connected via a WFEC 25 kVA oil-filled transformer located approximately 35 feet east of the enclosure. The WFEC electrical service meter number is #16507948. The AFL enclosure normal power main disconnecting means (utility main circuit breaker is located on the utility pole just east of the enclosure with the WFEC meter.

A standby diesel generator set is not available for backup power, should the normal power fail.

The normal (utility power source provides power to the airfield lighting systems and airfield lighting enclosure through Distribution Panel "A". Verification of the circuit breaker trip settings or calibration of the trip units was not included within the scope of this report.

Distribution Panel A is a main lug only, 225-ampere, 120/240-volt, single phase, three-wire panel. Panel A provides power to the Runway 1-19 constant current regulator (CCR), and the Taxiway system CCR.

The airfield lighting enclosure electrical distribution Panel "A" is a Square D model QOC30US NEMA 1 enclosure and is in fair condition. Panel "A" has 8 circuit breakers installed for the airfield lighting system. The circuit breakers are a mixture of "Classified Product" and "Square-D" components. The Square-D breakers interrupting current is rated at 10,000 amperes for 120/240Volts. The Classified Product did not have visible interrupting current ratings displayed on the breakers.

Breakers included in Panel "A" are as follows:

Breaker Location 1,3 = 2 Pole, 60 Amp, Breaker - Taxiway Light Constant Current Regulator

Breaker Location 5,7 = 2 Pole, 70 Amp Breaker - Runway Lighting Constant Current Regulator

Breaker Location 9,11 = 2 Single Pole, 20 Amp, Breakers with Breaker tie - PAPI Power, Voltage Driven

Breaker Location 13 = 1 Pole, 20 Amp Breaker - Beacon Power

Breaker Location 15 = 1 Pole, 20 Amp Breaker – Wind Cone power

Breaker Location 17 = 1 Pole, 20 Amp Breaker - Receptacle

Breaker Location 2 = 1 Pole, 20 Amp Breaker - Radio Control

It is important that nameplates adequately describe the function of the particular equipment involved. Nameplates for panelboards and other equipment should include the panel/equipment designation, panel name, source(s) of power & voltage, and phase of the supply. For example, "Equip YY, Panel A, fed from Panel XYZ, 480/277V, 3-phase, four-wire." Consistency is key to the effectiveness of nameplates. The unique name, number, power source(s)/phase number, voltage level, and any additional pertinent information about each piece of equipment should be included on the nameplate that is referencing the respective equipment.

For example, in **Figure 3**, the nameplate calls out “MAIN DISCONNECT.” It is unclear if this is indicating the “normal power” or “standby power”, etc. Similarly, the CCR nameplate does not indicate the source of CCR control power. See **Figure 4** for an example of a nameplate providing the proper information.

Figure 3: Typical Phenolic Nameplates on Main Disconnect and Regulator

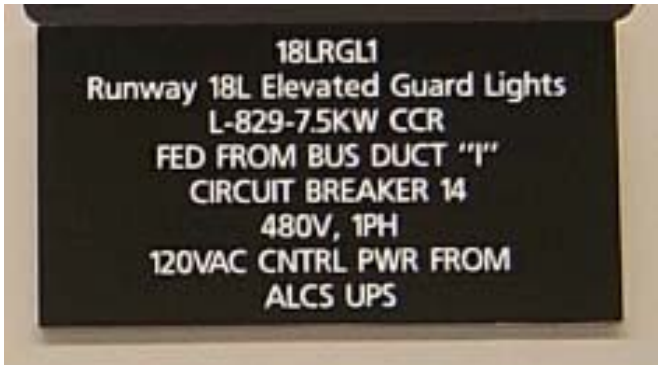

Figure 4: Sample Phenolic Nameplate on the Front of a CCR

An arc-flash hazard assessment is an effective means of identifying electrical hazards in the workplace. More specifically, the Occupational Safety and Health Administration (OSHA) requires that an assessment be performed to: "determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE)." There are no records of an Arc-Flash Hazard Assessment being performed in the past at 1JO. A Short Circuit/ Coordination/Arc-Flash Study is highly recommended for the AFL vault electrical system. See **Figure 5** for a generic Arc-Flash label.

An effective electrical safety program is best developed when employees understand and abide by OSHA and the National Fire Protection Association (NFPA) requirements, as identified below.

NFPA® 70E, Standard for Electrical Safety in the Workplace – 2015 is a national consensus standard recognized by OSHA as an effective means to provide safe working conditions for electrical workers.

NFPA 70E defines a Risk Assessment as "*An overall process that identifies hazards, estimates the potential severity of injury or damage to health, estimates the likelihood of occurrence of injury or damage to health, and determines if protective measures are required.*" Article 110 requires the electrical safety program to have a risk assessment procedure. (6) Appendix F

NFPA 70E is not an OSHA standard but is used by OSHA as a means to determine if an employer has made a good faith effort to conform with OSHA's General Duty Clause:

OSHA General Duty Clause

"SEC. 5. Duties (5)
(a) Each employer

(1) shall furnish to each of his employees employment and a workplace of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;

(2) shall comply with occupational safety and health standards promulgated under this Act.

(b) Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this Act which are applicable to his own actions and conduct."

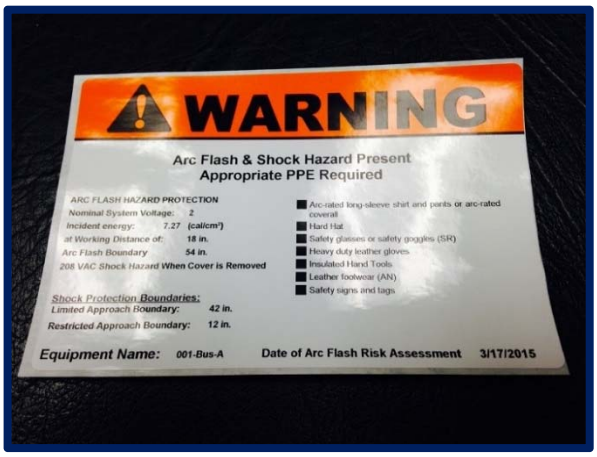

Figure 5: Generic Arc-Flash label

Also, please reference* NFPA® 70, National Electrical Code, 2014 *(NEC) Articles 110.21 and 110.24. ***(7) Appendix F***

C. CONSTANT CURRENT REGULATORS (CCR)

Table 1: Existing CCR Summary

EXISTING CCR SUMMARY						
Circuit Name	**Circuit Description**	**CCR Size/ Step**	**Manuf.**	**CCR Tech.**	**CCR FAA Type**	**CCR Age**
R/W 1-19	Runway 1-19 Edge, MIRL 1-19	7.5/3	Crouse-Hinds	Ferro	L-828	Est.12 yr.
T/W	Taxiway Circuit	15/3	Siemens	Ferro	L-828	Est.12 yr.

Both CCRs are of the ferro-resonant design. Ferro-resonant CCRs are typically more efficient and generate less electrical noise than other technologies. Ferro-resonant CCRs, across the spectrum, are typically the most efficient CCR technology throughout their entire load range. Having said that, loading a CCR below 50% is the least efficient segment of a CCR load profile. While the CCRs are capable of 100% loading, typical loading for taxiway CCRs is between 65% and 80% and typical loading for runway CCRs is in the 80% to 90% range. These values are used as a rule of thumb on new designs to allow for expansion. Measurements of the existing CCR loads are presented in Appendix A of this Report.

If the phased conversion of incandescent lamps to LED light sources is implemented throughout the airfield, existing CCRs loads will be decreasing. It is recommended in the future for 1JO to replace the aging CCRs to match the load of each circuit during the conversion to LED technology.

FAA Advisory Circular (AC) 150/5345-10, *Specification for Constant Current Regulators and Regulator Monitors*, is the contemporary version of the AC that specifies the types, sizes, output current, steps, and monitoring points for CCRs.

A service life of twenty years or more can typically be expected from these types of CCRs. However, lightning and other environmental events out of the Airport's control can severely shorten a CCR's life expectancy.

Based upon the CCR serial numbers, both of the CCRs appear to be approximately 12 years old.

Parts for these older CCRs are expected to become more and more difficult to obtain. Lack of spare parts will shorten the useful life of these older CCRs. Therefore, it is recommended to replace the CCRs. A single wholesale replacement is ideal, resulting in a commonality of units and parts; however, if funding restraints are of concern, a phased approach may be considered, replacing units in sequence.

Both of the CCRs have a 6.6-ampere output and are sizes 7.5 kW and 15 kW. Both CCRs have three (3) brightness steps (**see Figure 6**).

Figure 6: Existing Constant Current Regulators and Vault Enclosure

The current FAA Advisory Circular 150/5340-30J, *Design and Installation Details for Airport Visual Aids* require High Intensity Runway Lighting (HIRL) systems to be five brightness steps while the Medium Intensity Runway Lighting (MIRL) and Medium Intensity Taxiway Lighting (MITL) are required to be three brightness steps.

The existing enclosure is not equipped with heating and air conditioning equipment to maintain the internal temperature within acceptable limits.

The branch circuits providing electrical power to the CCRs appear to be in fair condition. The electrical equipment and CCRs are properly maintained. The CCRs are enclosed within the AVL enclosure. The CCRs are fed from the panel listed in **Table 2** below:

Table 2: Existing CCR Power Circuit Data

EXISTING CCR POWER CIRCUIT DATA				
Circuit Name	**Circuit Description**	**CCR Size/ Step**	**Panel Circuit**	**Input Voltage**
RWY	Runway Circuit	7.5/3	PANEL A 5,7	240V, 1PH
TWY	Taxiway Circuit	15/3	PANEL A 1,3	240V, 1PH

The CCR output currents should be maintained within the limits specified in FAA AC 150/5345-10, *Specification for Constant Current Regulators and Regulator Monitors*.

FAA AC 150/5345-10 Table 1, reprinted in **Table 3**, denotes the proper CCR output current with the allowable current ranges. Electric current has a significant effect on the lamp brightness and lamp life as demonstrated by the information following this table.

Table 3: Table 1 CCR Output Current from FAA AC 150/5345-10

TABLE 1 CCR OUTPUT CURRENT FROM FAA AC 150/5345-10				
CLASS	**STYLE**	**STEP**	**NOMINAL OUTPUT**	**ALLOWABLE RANGE**
1	1	3	6.6 A	6.50 A – 6.70 A
		2	5.5 A	5.40 A – 5.60 A
		1	4.8 A	4.70 A – 4.90 A

If CCR output current is higher than required, it can significantly reduce lamp life. Whereas a lower than required output current results in inadequate lighting for the pilot while maneuvering on the airfield. Small changes in CCR output current result in large changes in light output. Variations within the allowable current limits can significantly impact the lighting system, as listed below in **Table 4**.

Table 4: Step B5/B100 Light Output and Life as Related to Current Tolerances

STEP B5/B100 LIGHT OUTPUT AND LIFE AS RELATED TO CURRENT TOLERANCES (5) Appendix F				
UPPER CURRENT LIMIT	**NOMINAL CURRENT**	**LOWER CURRENT LIMIT**	**% OF LAMP LIFE**	**% OF LUMEN OUTPUT**
6.7 A			79%	110%
	6.6 A		100%	100%
		6.5 A	145%	90%

Source: Data extrapolated from Visual Aids Digest and ADB Airfield Solutions.

Low lumen output could result in substandard lighting to meet FAA illumination requirements. **Table 5** compares CCR current output to light output and lamp life. In addition to the level of operating current, many other factors affect lamp life such as vibration, heat sources, and mechanical connections. The data in the table only considers operating current and should not be construed as a guarantee of lamp life in an active airfield lighting fixture. (8) Appendix F

Table 5: CCR Output Current as a Percentage of Light Output and Lamp Life

CCR OUTPUT CURRENT AS A PERCENTAGE OF LIGHT OUTPUT AND LAMP LIFE (5) Appendix F				
CCR Step	**CCR Output Current**	**Percent of Max Current**	**Percent of Max Light Output**	**Percent of Lamp Life**
	7.26 amps	110%	181%	10%
	6.93 amps	105%	135%	31%
	6.73 amps	102%	113%	62%
	6.67 amps	101%	106%	79%
B5/B100	6.6 amps	100%	100%	100%
	6.53 amps	99%	94%	127%
	6.4 amps	97%	83%	207%
	6.34 amps	96%	78%	266%
	6.2 amps	94%	68%	440%
B30	5.5 amps	83%	31%	Note 1
B4	5.2 amps	79%	23%	Note 1
B10	4.8 amps	73%	14%	Note 1
B3	4.1 amps	62%	5.2%	Note 1
B2	3.4 amps	52%	1.7%	Note 1
B1	2.8 amps	42%	0.5%	Note 1

Source: Data provided by Visual Aids Digest and ADB Airfield Solutions
Note 1: >440% the lamp will probably fail in some other mode prior to reaching this lamp life.

Both 1JO CCRs are the “DRY” type. “DRY” type indicates the CCRs are air cooled. Generally, many of the older technology CCRs were the “WET” type, oil cooled. The dry type CCRs perform well and typically require less maintenance since there is no insulating oil requiring regular dielectric testing.

The CCRs are currently sitting directly on the concrete floor of the airfield lighting steel enclosure. The respective CCR supply conductors are routed from the respective panel through conduit and wire-way to the CCR. Each CCR is bonded to the system ground bus using a copper conductor.

The output (5 kV series circuits) of the CCRs are routed through a conduit to the output wire-way. The output wire-way is connected to the airfield lighting underground duct bank and manhole system via conduit. The CCR outputs presently exit the enclosure and are routed through a series of junction cans immediately east of the vault enclosure and then on to the airfield.

The interface with the field circuits occurs on the east wall of the enclosure through two LB fittings penetrating the enclosure wall as in **Figure 7**. L-823 connector kits are located in the wire-way to allow disconnecting and shorting of the CCR/airfield lighting circuits for troubleshooting purposes as in **Figure 8**. No SCO-1 cut outs are installed to safely disconnect the circuit from the airfield or short the regulator for testing as in **Figure 9**.

Figure 7: LB fittings

Figure 8: L-824 CCR Wireway

Figure 9: SCO Cutout Example

D. MIXING CABLES OF VARIOUS VOLTAGE SYSTEMS

The wire-way and manhole/duct system used for the 5 kV (5000 volts) airfield lighting series circuit cables are also currently being used for the 480-volt feeders to the PAPIs and other circuits operating at less than 1000 volts.

The 2017 National Electric Code (NEC) Section 300.3(C)(2) (excerpt following) identifies two categories of circuits: a.) above 1000 volts (ex. 5 kV airfield lighting series circuit unshielded cables); and b.) 1000 volts or less (ex. PAPIs and other NAVAIDs) and prohibits mixing of the two. Therefore, an additional raceway/manhole separate from the 5 kV airfield lighting series circuit cables is needed to house the 1000 volt and less cables.

NEC Section 300.3(C)(2)

300.3 Conductors.
(C) Conductors of Different Systems.

(1) 1000 Volts, Nominal, or Less. *Conductors of ac and dc circuits, rated 1000 volts, nominal, or less, shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway. All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway.*

Secondary wiring to electric-discharge lamps of 1000 volts or less, if insulated for the secondary voltage involved, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.

Informational Note No. 1: See 725.136(A) for Class 2 and Class 3 circuit conductors.
Informational Note No. 2: See 690.4(B) for photovoltaic source and output circuits.

(2) Over 1000 Volts, Nominal. *Conductors of circuits rated over 1000 volts, nominal, shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 1000 volts, nominal, or less unless otherwise permitted in C(300.3)(2)(a) through (C)(2)(d).*

(a) Primary leads of electric-discharge lamp ballasts insulated for the primary voltage of the ballast, where contained within the individual wiring enclosure, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.

(b) Excitation, control, relay, and ammeter conductors used in connection with any individual motor or starter shall be permitted to occupy the same enclosure as the motor-circuit conductors.

(c) In motors, transformers, switchgear, switchboards, control assemblies, and similar equipment, conductors of different voltage ratings shall be permitted.

(d) In manholes, if the conductors of each system are permanently and effectively separated from the conductors of the other systems and securely fastened to racks, insulators, or other approved supports, conductors of different voltage ratings shall be permitted.

Conductors having non-shielded insulation and operating at different voltage levels shall not occupy the same enclosure, cable, or raceway.

E. LIGHTNING PROTECTION AND GROUNDING

The airfield lighting enclosure is not equipped with a lightning protection system. Florida is one of the highest density lightning flash areas in North America. It is recommended that the airfield lighting vault be equipped with a NFPA 780 and UL 96 compliant lightning protection system.

Grounding of the constant current regulators (CCR) appears adequate and in good condition. However, the CCR ground bus does not make a complete loop around the vault interior, allowing for a single point of failure. It is recommended that the ground bus be arranged in a loop configuration.

The Airfield Beacon bonding and grounding is in poor condition. AVCON suggests installing a ground loop around the structure, installing a bonding conductor from the beacon to the ground loop and replacing the lightning protection down conductor between the beacon tower and the ground loop.

Most of the signs have a ground conductor attached to the sign and going under the leg of the sign. This ground conductor should connect to a ground rod. At the time of the visit this could not be determined. The grounding of each sign should be inspected and replaced as required with the ground conductor terminating at a ground rod.

The PAPI systems should have a ground loop installed around each unit and each loop should be tied together with a common bonding conductor. Ground conductors should be installed from each PAPI unit and the PCU to the ground loop.

The counterpoise between each light fixture should have a detailed examination to determine if the counterpoise conductor is viable and bonds all light fixtures together. All lighting and signage should be bonded to the counterpoise conductor and the counterpoise should be terminated at the vault to provide an equipotential grounding system for all airfield lighting.

AVCON suggests installing lighting arrestors throughout the airfield lighting system within the primary L-824 airfield conductor. The lighting arrestors are installed at intervals of approximately 2000 feet along the L-824 conductor within a light base and bonded to the light base and counterpoise. This provides lighting protection for the L-824 conductor and light fixtures to mitigate the propagation of the lighting strike throughout the lighting conductor.

F. WORKING SPACE ABOUT EQUIPMENT (8) Appendix F

The subsequent paragraphs are an abbreviated summary of *NFPA® 70, National Electrical Code, 2014* (NEC) requirements focusing on working space around electrical equipment since the output voltage of a fully loaded 30 kW, 6.6 ampere CCR is 4,545 volts; Article 110, Part III "*Over 600 Volts, Nominal"* is also applicable to this discussion. (Note: A 4 kW CCR has an output of 606 volts. A 20 kW CCR has an output of 3,030 volts.)

Below is a summary of NEC workspace **depth** requirements. The dimensional data is cited from NEC Table 110.26(A)(1) and Table 110.34(A).

Table 6: NFPA® 70 NEC 2014 - Working Spaces

NFPA® 70 NEC 2014 - WORKING SPACES			
NOMINAL VOLTAGE TO GROUND	MINIMUM CLEAR DISTANCE		
	CONDITION 1	CONDITION 2	CONDITION 3
0–150 V	3 FT	3 FT	3 FT
151–600 V	3 FT	3 FT 6 IN.	4 FT
601-2500 V	3 FT	4 FT	5 FT
2501–9000 V	4 FT	5 FT	6 FT

Note: Where the conditions are as follows:

***Condition 1** — Exposed live parts on one side of the working space and no live or grounded parts on the other side of the working space, or exposed live parts on both sides of the working space that are effectively guarded by insulating materials.*

***Condition 2** — Exposed live parts on one side of the working space and grounded parts on the other side of the working space. Concrete, brick, or tile walls shall be considered as grounded.*

***Condition 3** — Exposed live parts on both sides of the working space.*

Condensing NEC Sections 110.26(A)(2) and 110.32 provides the following criteria for the **width** of workspace in front of electrical equipment:

- Equipment operating over 600 volts - 36 inches.
- Equipment operating at 600 volts and less - width of the equipment or 30 inches, whichever is greater.

NEC Section 110.26(A)(3) states: ***"Height of Working Space.** The workspace shall be clear and extend from the grade, floor, or platform to a height of 2.0 m (6½ ft.) or the height of the equipment, whichever is greater. Within the height requirements of this section, other equipment*

that is associated with the electrical installation and is located above or below the electrical equipment shall be permitted to extend not more than 150 mm (6 in.) beyond the front of the electrical equipment."

It should also be noted that NEC required working space is not permitted to be used for storage. Some typical "Working Space about Equipment" discrepancies are discussed below:

G. SAFETY BOARD

The existing airfield lighting enclosure is not equipped with a FAA AC 150/5340-26C Safety Board. The components and make-up of a Safety Board is described in FAA AC 150/5340-26C, Chapter 2 Part 2.6. When an Airfield Lighting Vault is constructed, AVCON recommends installing a Safety Board that meets FAA Criteria.

H. AIRFIELD LIGHTING VAULT STRUCTURE

The existing AFL enclosure structure is showing various signs of deterioration. For example, there is indication of water intrusion in at least two locations and the exterior doors do not seal well. There are open vents in the top and bottom of the enclosure. The enclosure rests on a concrete pad. The enclosure should have a ground ring installed around the perimeter of the pad and have all components bonded and grounded to the ground ring. In addition to the above, the "DANGER – HIGH VOLTAGE" signs are missing on the double doors entering the electric enclosure.

A new vault should be constructed. This new structure can be a concrete pre-cast structure which would house all airfield electrical components and controls. The structure would have a ground ring installed around the structure, a ground bus installed around the inside of the structure to bond all components to a common ground and air terminals for lightning protection. The homerun duct bank will need to be coordinated with the new vault location. A new home run duct bank should be constructed. The new home run duct bank route will be dependent upon the location selected for the new vault.

I. AIRFIELD LIGHTING HOME RUN DUCT BANK

The existing airfield lighting home run duct bank was constructed with the original vault. Limited work has been performed on the airfield lighting duct bank. Mainly cable replacement when required or adding new circuits to the airfield.

The duct bank system is the vehicle that connects the airfield lighting power source to the airfield lighting. It is imperative to have a functional airfield lighting duct bank network.

J. AIRFIELD LIGHTING CONTROL Pilot Controlled Lighting (PCL) System

The existing airfield lighting control is provided via an Air-to-Ground Radio Decoder Manufactured by Rural Electric. The unit is a L-854, Type 1, Style A, radio decoder serial number 00454, manufactured in 2008, set to the frequency 122.800.

The system has one major component:

- Vault L-854 Radio Controller (Pilot Controlled Lighting – PCL)

See **Figure 10** for photos of the PCL enclosure and the PCL unit.

The L-854 Pilot Radio controls the airfield lighting. The airfield lighting is activated by the aircraft radio, via the PCL. It is intended that three clicks on the microphone turn the lights on to the B10 step; five clicks turn the airfield lighting on to the B30 step; and seven clicks turn the airfield lighting on to the B100 step (full intensity). The PCL was tested during the sight visit and was malfunctioning while stepping through the 3,5, and 7 mike clicks.

Figure 10: Pilot Control Lighting L-854 Radio Decoder

4 AIRFIELD LIGHTING EQUIPMENT

A. RUNWAY 1-19 Lighting

Runway 1-19 is 5,398 feet long by 75 feet wide and is the sole runway of the Tri-County Airport(1JO).

The runway is equipped with the following lighting and NAVAID systems:

- Medium Intensity Runway Edge (MIRL), Edge lighting, 6.6-amp, FAA L-861 fixtures.
- MIRL, Threshold/End lights, 6.6-amp, FAA L-861E fixtures
- Airport-owned Runway 1 L-881 (2-box) Precision Approach Path Indicator (PAPI).
- Airport-owned Runway 19 L-881 (2-box) PAPI.

The existing Medium Intensity Runway Lighting (MIRL) L-861 runway edge and L-861E Runway Threshold/End lights are approximately 4 years old and are quartz incandescent type (see **Figure 11**).

The existing Runway 1-19 MIRL circuit has a low insulation resistance value. FAA AC 150/5340-26C, *Maintenance of Airport Visual Aid Facilities*, states any circuit measuring less than 1 megohm "is destined for rapid failure." It is recommended that the quartz incandescent L-861 runway edge lights, L-861E runway threshold/end lights, L-824 cables, L-823 connectors, and L-830 isolation transformers are replaced, and that light emitting diode (LED) fixtures be considered for replacement of the quartz runway edge lights. LED MIRLs are listed for use by the FAA and are eligible for federal funding participation.

When replacing home run cables, all cabling within the common conduit/duct should be replaced at the same time. It is recommended that design for all future lighting system projects include requirements for field lightning arrestor assemblies, which help protect the fixtures, cables and transformers from the adverse effects of lightning.

The cost of LED runway light fixtures has decreased considerably in the last few years. Currently, the cost of a new LED and a new quartz fixture are virtually the same. **AVCON** recommends replacing the fixtures with new LED models. The longer life of the LED units, resulting in lower maintenance costs and reduced energy usage, makes the LED fixtures a desirable and economical choice.

For comparison, an existing L-861 fixture is illuminated by a 45 watt / 6.6-amp type 48A0083 halogen bulb in each fixture and requires a 30/45-watt L-830-1 isolation transformer. The load at the CCR for this single fixture with the transformer of would be 47.4VA.

Using the same manufacturer, ADB, compared to the existing fixture a L-861T(L) LED fixture with the same criteria would have a long-lasting LED light engine and require a 10/15-watt L-830-16 transformer. The total CCR load for this unit with the transformer would be 21.5VA or a 54% Energy Savings for this fixture when compared with the halogen fixture.

Figure 11: Runway Threshold Lighting

B. AIRFIELD SIGNAGE

Airfield signage units are Size 2, Style 2&3 units and are generally in fair condition with some signs requiring faded or damaged panels to be replaced. The signs on the airfield are older, ADB incandescent L-858 Signature Series as shown in the photos below (see **Figure 12**). The existing signs were manufactured and installed in the 2015 time period. The ADB signs can be recognized by the tapered lamp housing screw tops.

When replacing faded panels FAA AC 150/5340-30 requires that the entire message be replaced to avoid color variation within the panels for the message.

The grounding of each sign could not be determined if the ground wire was attached to an individual ground rod. The existing bonding conductor is fastened to the sign and runs under the sign frangible power leg. (see **Figure 13**).

The distance from grade to the frangible point of the fixture needs to be 3" or less per FAA Engineering Brief 79. Grading around these fixtures and sodding to restore the grade can correct this condition (see **Figure 14**).

L-858 signs may have a 10 to 20-year life span depending upon severity of weather exposure and level of maintenance. According to the nameplate data the existing signs were manufactured in 2015. Typically, 15 years can be an expected life span for a sign unit and panel changes for faded panels can be expected every 5-7 years.

The cost of light-emitting diode (LED) signs has decreased considerably in the last few years. Currently, the cost of a new LED sign and a new quartz incandescent sign are virtually the same per module. **AVCON** recommends replacing the signs with new LED models. The longer life of the LED units, resulting in lower maintenance costs and reduced energy usage, makes the LED signs a desirable and economical choice.

For comparison, the existing 3 Module, Size 2, Taxiway Guidance sign shown in **Figure 20** is illuminated by six (6) halogen incandescent lamps that are 48 watts / 6.6-amp type MR-16 in each sign and each sign unit requires a 500-watt L-830 isolation transformer. The max VA Load at the CCR for this existing sign is listed on the nameplate as 350VA.

Using the same manufacturer, ADB, compared to the existing sign a LED sign with the same criteria, 3 Modules and size 2, would have a long-lasting LED light bar and would and require a 100-watt transformer. The total CCR load for this unit would be 100VA or a 71% Energy Savings for this one sign.

Figure 12: Taxiway Directional Sign and Mandatory Hold Sign

Figure 13: Sign Bonding to Ground Rod

Figure 14: Sign Grade not in accordance with FAA EB 79

C. TAXIWAY LIGHTING

The taxiways west of Runway 1-19 utilize incandescent fixtures and are generally in fair to poor condition. The quartz incandescent L-861T taxiway edge lights, L-824 cables, L-823 connectors and L-830 isolation transformers are all recommended for replacement with LED fixtures.

There are several areas of the airfield having inconsistent lighting patterns that are not in accordance with FAA criteria for taxiway edge lighting per FAA AC 150/5340-30. These areas are mainly at the "T" intersections of Taxiway A and the connectors to the runway. The far side of these connectors, on the single edge of the taxiway, do not have adequate lighting along the edge. This condition can be corrected by installing additional lighting along the edge of pavement in these areas. In addition, the edge lighting in some areas exceed the maximum height above the surrounding grade. The distance from grade to the frangible point of the fixture needs to be 3" or less per FAA Engineering Brief 79. Grading around these fixtures and sodding to retain the grade can correct this condition (see **Figure 15**).

The cost of LED taxiway light fixtures has decreased considerably in the last few years. Currently, the cost of a new LED and a new quartz fixture are virtually the same. **AVCON** recommends replacing the fixtures with new LED models. The longer life of the LED units, resulting in lower maintenance costs and reduced energy usage, makes the LED fixtures a desirable and economical choice.

For comparison, the existing L-861T fixture shown in **Figure 20** is illuminated by a 30 watt / 6.6-amp type 48A0085 quartz bulb in each fixture and requires a 30/45-watt L-830-1 isolation transformer. The load at the CCR for this single fixture with the transformer of would be 31.6VA.

Using the same manufacturer, ADB, compared to the existing fixture a L-861T(L) LED fixture with the same criteria would have a long-lasting LED light engine and require a 10/15-watt L-830-16 transformer. The total CCR load for this unit with the transformer would be 15VA or a 52% Energy Savings for this fixture when compared with the quartz fixture.

Figure 15: Taxiway Edge Lighting

D. PRECISION APPROACH PATH INDICATOR (PAPI)

Panel A provides power to the two (2) PAPI systems on the airfield. The PAPI power is turned on/off at the vault enclosure by a circuit breaker in panel "A." The power can also be turned (on/off) locally at each set of PAPI's via an external disconnect switch. The intensity of the PAPI lighting is controlled by Photocell at each set of PAPI's and the L-854 radio. The line voltage to the PAPI is 240 volts from Panel A, routed in conduit to the external disconnect switch attached to the Power Control unit at each PAPI location. See **Figure 16**.

The existing Runway PAPI's are voltage powered units with a local Power Control Unit (PCU) and photosensor for lighting control. FAA Engineering Brief No. 79 (EB-79), *Determining RSA NAVAID Frangibility and Fixed-By-Function Requirements* currently mandates the PAPI Power and Control Unit (PCU) and electrical distribution equipment be located outside the runway object free area (ROFA). The external disconnect switch and the PCU are mounted on frangible legs but the component location does not comply with FAA EB 79.

FAA AC 150/5345-28G, Precision Approach Path Indicator (PAPI) Systems, 9/29/2011 states that the maximum allowable distance between the nearest light housing assembly and the PCU is 100 feet. The 100-foot requirement limits the ability to move the PCU out of the ROFA. For this reason, current driven FAA Style B PAPIs should be considered. Another reason to consider using a current driven PAPI is the routing of power cables to the PAPI units in the field. The existing voltage-powered circuits are in the same duct bank and manhole system as the 5 kV airfield lighting series circuit cables. As previously discussed in Chapter 5, NEC Section 300.3(C) prohibits mixing the 5 kV airfield lighting series circuit unshielded cables with the 1000 volt and less voltage powered PAPI cables in the same raceway or enclosure.

Construction of a new vault to add additional constant current regulators (CCRs) for the addition of a TCAA-owned and maintained PAPIs on Runways 1 and 19 would create space for new dedicated PAPI CCRs. Refer to Chapter 5, Section G for details concerning NEC required working space in the vicinity of airfield lighting equipment. Per recommendations made in Chapter 5, a new airfield lighting vault should be considered and included in the Airport's capital improvement plan.

Figure 16: Runway 19 PAPI

E. AIRPORT ROTATING BEACON

Airport rotating beacons typically have an expected life of up to 20 years depending upon the impacts of environmental conditions, as well as the quality and frequency of the maintenance performed over the life of the equipment. The Airport's existing L-802A high intensity rotating beacon is estimated to be in excess of 10 years old, has been impacted by the environmental conditions, and beyond its useful life due to unavailability of spare parts. (see **Figure 17)**. It is ultimately recommended to include a complete airport rotating beacon replacement at the end of the capital improvement budget.

Short-term basic service/repair efforts may be completed to keep the existing beacon in working order until funding is available for a complete replacement. These recommended efforts include replacing the existing bulb with a longer-life, metal halide lamp; inspection/repair of the existing fall protection system; re-painting the existing beacon and pole; and various grounding improvements. Currently, the existing beacon pole has a strike termination device installed, but no visible grounding electrode. It is recommended to have a local grounding electrode installed and bonded to the beacon pole and the circuit equipment grounding conductor. It is further recommended that the lightning protection system on the beacon be inspected for compliance with NFPA 780.

Figure 17: Airport Rotating Beacon and Tower

F. WIND CONES

The Airport's centerfield wind cone is shown in **Figure 18**. This wind cone is an L-807 halogen, externally lighted wind cone with a 12-foot sock and Segmented Circle with landing pattern indicators. The wind cone is in close proximity to the Fuel Farm and Helipad. AVCON recommends replacement of the existing windcone with an internally lighted L-807 primary windcone. The electrical load from an LED unit will be significantly lower and the unit would require fewer bulb changes as the average life of a LED fixture is approximately 50,000 hours.

The airfield does not have Supplemental windcones, L-806 frangible units, at either runway end.

Figure 18: Existing L-807 Main Wind Cone with Segmented Circle (Centerfield)

5 SUMMARY

A. AIRFIELD LIGHTING VAULT DISTRIBUTION

The airfield lighting enclosure electrical distribution is in acceptable condition. Interior working space around the electrical equipment has several issues that must be addressed. The existing working space does not comply with NFPA or OSHA requirements. A short circuit/coordination/arc-flash study should be performed. The vault grounding system needs some repairs, the vault ground bus should be bonded to a ground loop configured with the airfield counterpoise also connected to this loop. This would provide an equipotential grounding system for the vault enclosure. In addition, a NFPA 780 lightning protection system should be installed to protect the vault equipment.

The enclosure structure is showing its age and the footprint is not conducive to further expansion.

It is recommended that TCAA consider constructing a new airfield lighting vault. The new vault would address all of the issues associated with the existing facilities and would ensure a functional electrical distribution system for the next twenty plus years. The new facility would have space to allow for future airfield lighting expansion, conditioned space for airfield control systems, and spare parts storage.

The new airfield lighting vault could be located adjunct to the beacon location on the west side of the airport. The new facility should allow for ample power capacity and floor space for twenty years or more of growth. A siting study will need to be performed to confirm an acceptable location.

B. AIRFIELD LIGHTING HOME RUN DUCT BANK AND L-824 CABLE

The airfield lighting vault home run electrical duct bank will need to be reworked/replaced to accommodate the new airfield lighting vault.

The existing airfield lighting home run circuit L-824 cables are in poor condition. It is recommended to replace these L-824 cables in the near future.

C. AIRFIELD LIGHTING AND SIGNAGE

The quartz incandescent lighting systems need to be replaced with energy efficient light emitting diode (LED) fixtures and signs. To gain the most efficiency, the L-830 isolation transformer needs to be matched to the fixture/sign power rating. The airfield signs, lighting fixtures (all incandescent), L-824 cables, L-823 connectors, and L-830 isolation transformers should all be replaced. LED signs/fixtures will be specified for the replacement items. It is recommended that sign replacement is initiated with the oldest units first, but all incandescent airfield signs should ultimately be replaced with LED airfield signs.

Support for some constant current regulator (CCR) spare parts will continue to become more challenging. The best solution for the TCAA is to replace the CCRs. This could be a phased operation, replacing the older unit first. However, a single wholesale replacement would result in a commonality of parts. New energy-efficient ferro-resonant CCRs should be considered. Obtaining parts for the older CCRs is problematic.

D. AIRPORT ROTATING BEACON

A new rotating beacon is recommended for the Airport, as the existing beacon is beyond its useful life. In the interim, various minor repairs can be completed to keep the beacon operational until the new beacon is constructed. The lighting protection system of air terminals and down conductor should be replaced and bonded to a ground loop. The beacon equipment ground(s) should be replaced and bonded to the ground loop

E. MISCELLANEOUS NAVAIDS

The airport owned PAPIs should have the grounding improved and modified to comply with FAA Engineering Brief 79.

The existing main wind cone should be replaced with an LED unit.

6 CAPITAL IMPROVEMENT PROGRAM (CIP)/ IMPLEMENTATION PLAN

A. METHODOLOGY

Preliminary project cost estimates for improvements recommended within this report are included in **Table 7,** comprising the Tri-County Airport(1JO) Capital Improvement Program (CIP) for the period between 2020 and 2026. Per Tri-County Airport Authority (TCAA) request, the CIP was developed with the following assumptions considered in preparation of the project cost estimates:

- All dollars are stated in CY 2019 costs (no escalation incorporated);
- Individual project costs are rounded to the nearest $1,000;
- Markups:
  - 10 percent Detailed Pricing Allowance included in Construction Cost;
  - 10 percent Mobilization included in Construction Cost;
  - 3 percent Maintenance of Traffic included in Construction Cost;
  - 20 percent Professional Fees (design and RPR services) included in Total Project Cost;
  - 15 percent construction contingency included in Total Project Cost.

The above criteria were incorporated into each of the individual project cost estimates

B. APPROACH

Given the age, remaining service life, and condition of much of the airfield electrical equipment evaluated within this report, it is recommended to ultimately replace a majority of the components. For several items, specifically the Airfield Lighting Vault building and its related infrastructure and equipment (including emergency generator), as well as the rotating airport beacon, it is understood that replacement of such items at one time may not be feasible from a budgetary perspective. Therefore, both interim solutions and long-term capital improvements will be required. Interim solutions include less expensive, maintenance-type measures, while long term recommendations consider complete major rehabilitation/replacement or new construction. Notwithstanding the localized interim repair requirements, this report has provided a tentative prioritization of the capital improvements based on serviceability and ultimate improvements for the flying community. The priority considerations may be altered based on operational priorities of the airport and potential failures among the project listing. Obviously, the priority of this Report as well as the overall well-being of the airport is maintaining a safe and functional airfield within the availability of project funding and governmental grants.

C. PROJECT PRIORITIZATION

Each of the project cost estimates generated are presented as standalone project costs to rehabilitate the various elements of the airport's runway & taxiway lighting, signage system, beacon and vault construction. As future upgrades of the airfield pavement surfaces are

contemplated, it is typically convenient to incorporate upgrades to the airfield lighting and signage systems at that same time while the adjacent pavements are out of service if funding is available.

To determine the priority of the work, typically one should consider the companion airfield improvement project as one of the first elements of the electrical priority. For example, when funding becomes available for rehabilitation of Runway 1-19, the runway lighting could be accomplished during that same project, perhaps under a concurrent closure. However, in the case of 1JO, it appears the pavements are relatively new, and it may be anticipated that the electrical systems will need to be replaced in advance of any companion paving assignments.

Inasmuch as the entirety of the electrical system needs repair and restoration, one recommended approach is to orchestrate the work based on the highest priority of project from a funding perspective, which indicates the runway as the highest priority. The current project breakdown illustrates the runway as the highest priority as it includes the conduit system for the remainder of the airfield lighting and signage improvements.

An alternate funding priority would be to address the requirements as failures or obsolescence finally puts the systems out of service. Lighting facilities are important to the overall well-being of the airport, including routine nighttime access. Based on the requirements for continuity of service among each of the elements described in this report, it is important to consider completing the entirety of each task element to provide a complete and sound installation from the regulators to the last lighting fixtures or signs.

As another program element, it may be advisable to address the priority of the work from a safety perspective. In this case, due to substandard electrical compliance and regulatory features of the existing vault, it may be advisable to address the safe operations and maintenance access to the airfield lighting vault making that the first priority of the program. Although the airfield lighting circuitry is still in service, the core system vault is ready for attention and replacement.

Further to the above, it is AVCON's understanding that the airport currently has approximately $40,000 in remaining grant funds available for the current fiscal year. Although the overall budget costs for each of the identified tasks exceeds this value, it is possible that the TCAA consider using the funds to provide design services for the first element of work based on need. This would initiate the program going forward and provide "shovel-ready" plans and specifications in anticipation of follow-on construction funding from the new fiscal year funding. A reasonable grant for the first project could include the initial construction work and design of the next task.

While pushing forward to construct some element of the electrical improvements at the airport, the funding is so small that the cost effectiveness of trying to accomplish such a limited element of construction under this budget would be disappointing. Clearly certain costs such as mobilizing the contractor to the site would occupy a disproportionate amount of the funding. As such, we recommend that the engineering element of work be pursued with the state funding staff. There are no practical $40,000 construction projects worth undertaking at the airport. Maintenance costs are specifically not eligible.

D. SUMMARY

Table 7 follows which summarizes the required work at the airport. Although the specific priority of work is undefined, for illustrative purposes, we have used the priority ranking based on funding priorities for FDOT and other funding agencies. Runways compete at the highest levels of the projects listed and may represent the best option for moving forward with the funding scenarios for TCAA. This table presents the overall funding plan to assist TCAA staff in moving forward with their budgeting and other coordination for these recommended future 1JO Airport capital improvement projects. We recommend that the project listing be discussed in depth and continuously with State and Federal funding agencies. See Appendix B for complete breakdown of Program Costs and CIP budgets.

Table 7: Summary of Recommended Capital Improvements

Tri-County Airport Authority
CIP Program Budget
12/9/2019

Item Number	Description	Cost Estimate
CIP-001	Runway Lighting	$695,000
CIP-002	Taxiway Lighting	$647,000
CIP-003	Sign Replacement	$273,000
CIP-004	Vault Building	$673,000
CIP-005	Generator Installation (Outside Vault)	$278,000
CIP-006	Runway 1 PAPI	$ 95,000
CIP-007	Runway 19 PAPI	$ 95,000
CIP-008	Beacon	$ 70,000

Appendix A

Constant Current Regulator (CCR) Load Test Sheets

Tri-County Airport Authority
AIRFIELD LIGHTING CIRCUIT DATA SHEET
Airfield Lighting Utility Enclosure

Circuit Designation:	**Runway Edge Circuit**	Date:	**5/17/2019**
Circuit Description:	**Runway 1-19 Edge Light Circuit (MIRL)**	Ph. Wire Size/Type:	**N/A**
Source Panel/Ckt	**Panel "A", CB 1,3,**	GND. Wire Size/Type:	**N/A**
Panel ∅; CB Size:	**60 Amp, 2P, 1 Ph**	Conduit Size/Type:	**Flex**
CCR Size:	**7.5 Kw, 3 Step**	CCR Output Amps:	**6.6**
CCR Manufacturer:	**Crouse Hinds**	Yr. Manufactured:	
CCR Type No.:	**L-828**	Part No.:	**82860-D-07-4-66-03**
Output Amp Steps:	**/ / 4.8 / 5.5 / 6.6**		
Input Volts:	**240** Ph.: **1ph** Hz.: **60**	Input Amps:	**34**
Control Voltage:	**120**	Serial Number:	**1107**
Oil Capacity:	**N/A Gal.** Oil Test Date:	Weight:	**lbs.**
CCR Insp./Calib.:	**N/A** Date:	Circuit Age:	**Years**
Insul. Resist. at 1 min.:	**1.6m Ω @ 1000 V**	Weather:	
Lamps in Ckt.:	Lamp Watts:	Lamps Out:	N/A

	Calibration	LOAD TEST							
Step	Output Amps	Output Amps	Output Voltage	Output KVA	Output PF	Input Amps	Input Volts	Input KVA	Input PF
B1/B10	**+.05**	**4.85**	**607.2**	**2.960**	**.64**				
B2/B30	**+.06**	**5.56**	**672**	**3.760**	**.68**				
B3/B100	**+.05**	**6.65**	**772.4**	**5.160**	**.76**				
B4									
B5									

Comments:

Tri-County Airport Authority
AIRFIELD LIGHTING CIRCUIT DATA SHEET
Airfield Lighting Utility Enclosure

Circuit Designation:	**Taxiway Edge Circuit**	Date:	**5/17/2019**
Circuit Description:	**Taxiway Edge Light Circuit (MITL)**	Ph. Wire Size/Type:	**N/A**
Source Panel/Ckt	**Panel "A", CB 1,3,**	GND. Wire Size/Type:	**N/A**
Panel ∅; CB Size:	**60 Amp, 2P, 1 Ph, 10 kA**	Conduit Size/Type:	**Flex**
CCR Size:	**15 Kw, 3 Step**	CCR Output Amps:	**6.6**
CCR Manufacturer:	**Siemens**	Yr. Manufactured:	**2007**
CCR Type No.:	**L-829, ACE2**	Assembly No.:	**CCF6615/323A**
Output Amp Steps:	**/ / 4.8 / 5.5 / 6.6**		
Input Volts:	**240** Ph.: **1ph** Hz.: **60**	Input Amps:	**84**
Control Voltage:	**120**	Serial Number:	**20071204000035**
Oil Capacity:	**N/A Gal.** Oil Test Date:	Weight:	**lbs.**
CCR Insp./Calib.:	**N/A** Date:	Circuit Age:	**Years**
Insul. Resist. at 1 min.:	**2200 Ω @ 1000 V**	Weather:	
Lamps in Ckt.:	Lamp Watts:	Lamps Out:	N/A

	Calibration	LOAD TEST							
Step	Output Amps	Output Amps	Output Voltage	Output KVA	Output PF	Input Amps	Input Volts	Input KVA	Input PF
B1/B10	-.02	4.78	1352	6.440	.81				
B2/B30	-.03	5.47	1544	8.440	.83				
B3/B100	+.06	6.56	1872	12.200	.87				
B4									
B5									

Comments:

Appendix B

Cost Estimate and CIP Budget

TRI-COUNTY AIRPORT AUTHORITY
CIP COST ESTIMATE
FINAL SUBMITTAL
12/10/2019

CIP ITEM	ITEM DESCRIPTION	UNIT	QUANTITY	EXTENSION	PRICING ALLOWANCE	CONTRACTOR MOBILIZATION	MAINTENCE OF TRAFFIC	PROFESSIONAL FEES DESIGN AND CONSTRUCTION	OVERALL CONSTRUCTION CONTINGENCY	TOTAL PROJECT BUDGET	ROUNDED PROJECT BUDGET
CIP-001	**Runway Lighting**	**LS**	1	$ 437,000	$ 43,700	$ 43,700	$ 13,110	$ 87,400	$ 65,550	$ 690,460	**$ 690,000**
CIP-002	**Taxiway Lighting**	**LS**	1	$ 407,000	$ 61,050	$ 40,700	$ 12,210	$ 81,400	$ 61,050	$ 663,410	**$ 663,000**
CIP-003	**Signs**	**LS**	1	$ 172,000	$ 25,800	$ 17,200	$ 5,160	$ 34,400	$ 25,800	$ 280,360	**$ 280,000**
CIP-004	**Runway 1 PAPI System**	**LS**	1	$ 60,000	$ 9,000	$ 6,000	$ 1,800	$ 12,000	$ 9,000	$ 97,800	**$ 98,000**
CIP-005	**Runway 19 PAPI System**	**LS**	1	$ 60,000	$ 9,000	$ 6,000	$ 1,800	$ 12,000	$ 9,000	$ 97,800	**$ 98,000**
CIP-006	**Vault Building**	**LS**	1	$ 423,000	$ 63,450	$ 42,300	$ 12,690	$ 84,600	$ 63,450	$ 689,490	**$ 689,000**
CIP-007	**Beacon**	**LS**	1	$ 44,000	$ 6,600	$ 4,400	$ 1,320	$ 8,800	$ 6,600	$ 71,720	**$ 72,000**
CIP-008	**Generator (OUTSIDE VAULT)**	**LS**	1	$ 175,000	$ 26,250	$ 17,500	$ 5,250	$ 35,000	$ 26,250	$ 285,250	**$ 285,000**
				$ 1,778,000	**$ 244,850**	**$ 177,800**	**$ 53,340**	**$ 355,600**	**$ 266,700**	**$ 2,876,290**	**$ 2,875,000**

TRI-COUNTY AIRPORT AUTHORITY
CIP COST ESTIMATE

12/2/2019

BID ITEM	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	EXTENSION
CIP-001	***Runway Lighting***	***LS***			$ 437,000.00
	TEMPORARY POWER AND TEMPORARY AIRFIELD LIGHTING/SIGNAGE/NAVIGATIONAL FACILITIES	LS	1	$ 21,000.00	$ 21,000.00
	ELECTRICAL DEMOLITION	LS	1	$ 11,000.00	$ 11,000.00
	PORTABLE LIGHTED RUNWAY CLOSURE MARKERS, "LIGHTED X'S"	LS	1	$ 20,000.00	$ 20,000.00
	L-861(L) MEDIUM INTENSITY RUNWAY EDGE LIGHT LED - CLEAR/CLEAR	EA	50	$ 1,500.00	$ 75,000.00
	L-861E(L) MEDIUM INTENSITY RUNWAY THRESHOLD LIGHT LED - GREEN/RED	EA	16	$ 1,500.00	$ 24,000.00
	1/C L-824 TYPE C - UNSHIELDED #8 AWG 5KV STRANDED COPPER CABLE - INSTALLED IN DUCT OR CONDUIT	LF	50,000	$ 1.00	$ 50,000.00
	1/C #2 AWG SOLID COPPER COUNTERPOISE CABLE - INSTALLED OVER DUCT OR CONDUIT	LF	50,000	$ 1.60	$ 80,000.00
	0.75" DIA. BY 10.00' LONG COPPER CLAD STEEL SECTIONAL GROUND ROD	EA	200	$ 80.00	$ 16,000.00
	1 WAY 2" SCHEDULE 40 PVC DIRECT EARTH BURIED DUCT	LF	2,000	$ 5.50	$ 11,000.00
	2 WAY 2" SCHEDULE 40 PVC DIRECT EARTH BURIED DUCT	LF	1,000	$ 12.00	$ 12,000.00
	4 WAY 2" SCHEDULE 40 PVC DIRECT EARTH BURIED DUCT	LF	50	$ 16.00	$ 800.00
	6 WAY 2" SCHEDULE 40 PVC DIRECT EARTH BURIED DUCT	LF	200	$ 16.00	$ 3,200.00
	1 WAY 2" SCHEDULE 40 PVC CONCRETE ENCASED DUCT OR DIRECTIONAL BORED DUCT	LF	1,500	$ 14.00	$ 21,000.00
	2 WAY 2" SCHEDULE 40 PVC CONCRETE ENCASED DUCT OR DIRECTIONAL BORED DUCT	LF	1,000	$ 20.00	$ 20,000.00
	4 WAY 2" SCHEDULE 40 PVC CONCRETE ENCASED DUCT OR DIRECTIONAL BORED DUCT	LF	1,000	$ 30.00	$ 30,000.00
	6 WAY 2" SCHEDULE 40 PVC CONCRETE ENCASED DUCT OR DIRECTIONAL BORED DUCT	LF	1,000	$ 42.00	$ 42,000.00
CIP-002	***Taxiway Lighting***	***LS***	1		$ 407,000.00
	L-861T(L) OMNIDIRECTIONAL, BLUE, LED, TAXIWAY EDGE LIGHT (T)	EA	260	$ 800.00	$ 208,000.00
	L-852T(L) OMNIDIRECTIONAL, GREEN, LED, HELIPORT PERIMETER LIGHT	ES	28	$ 1,500.00	$ 42,000.00
	1/C L-824 TYPE C - UNSHIELDED #8 AWG 5KV STRANDED COPPER CABLE - INSTALLED IN DUCT OR CONDUIT	LF	50,000	$ 1.00	$ 50,000.00
	1/C #2 AWG SOLID COPPER COUNTERPOISE CABLE - INSTALLED OVER DUCT OR CONDUIT	LF	50,000	$ 1.60	$ 80,000.00
	0.75" DIA. BY 10.00' LONG COPPER CLAD STEEL SECTIONAL GROUND ROD	EA	200	$ 80.00	$ 16,000.00
	1 WAY 2" SCHEDULE 40 PVC DIRECT EARTH BURIED DUCT	LF	2,000	$ 5.50	$ 11,000.00
CIP-003	***Signs***	***LS***			$ 172,000.00
	L-858(L) SIGN – SINGLE/DOUBLE FACE, LED, SIZE 2 - 1 MODULE	EA	1	$ 3,000.00	$ 3,000.00
	L-858(L) SIGN – SINGLE/DOUBLE FACE, LED, SIZE 2 - 2 MODULE	EA	1	$ 4,200.00	$ 4,200.00
	L-858(L) SIGN – SINGLE/DOUBLE FACE, LED, SIZE 2 - 3 MODULE	EA	1	$ 5,300.00	$ 5,300.00
	1/C L-824 TYPE C - UNSHIELDED #8 AWG 5KV STRANDED COPPER CABLE - INSTALLED IN DUCT OR CONDUIT	LF	50,000	$ 1.00	$ 50,000.00
	1/C #2 AWG SOLID COPPER COUNTERPOISE CABLE - INSTALLED OVER DUCT OR CONDUIT	LF	50,000	$ 1.65	$ 82,500.00
	0.75" DIA. BY 10.00' LONG COPPER CLAD STEEL SECTIONAL GROUND ROD	EA	200	$ 80.00	$ 16,000.00
	1 WAY 2" SCHEDULE 40 PVC DIRECT EARTH BURIED DUCT	LF	2,000	$ 5.50	$ 11,000.00
CIP-004	***Runway 1 PAPI System***	***LS***			$ 60,000.00
	RUNWAY 1 PAPI SYSTEM	LS	1		$ -
	GRADING AND PREPERATION OF SITE,	LS	1		$ -
	CONSTRUCTION OF PAPI FOUNDATIONS	LS	1		$ -
	INSTALLATION OF PAPI LIGHT HOUSING ASSEMBLIES	LS	1		$ -
	INSTALLATION OF 2"PVC CONDUIT TO CONNECT TO HOME RUN CONDUIT	LS	1		$ -
	INSTALLATION OF #2 AWG BARE SOLID COPPER COUNTERPOISE ABOVE CONDUIT	LS	1		$ -
	INSTALLATION OF #2 AWG BARE SOLID COPPER GROUND RING WITH GROUND RODS AROUND PAPI FOUNDATIONS	LS	1		$ -
	INSTALLATION OF BONDING AND GROUNDING CONDUCTORS FROM PAPI UNIT TO GROUND RING	LS	1		$ -
	INSTALLATION OF L-824 CONDUCTORS INCLUDING HOME RUN TO VAULT AND CONNECT TO CCR PROVIDED BY OTHERS	LS	1		$ -
	AIMING AND ADJUSTMENT OF INDIVIDUAL PAPI LIGHT HOUSING ASSEMBLIES	LS	1		$ -
	FAA FLIGHT CHECK OF PAPI AND COMMISIONING	LS	1		$ -
	FINAL GRADING AND CLEAN UP OF FACILITY SITE.	LS	1		$ -
CIP-005	***Runway 19 PAPI System***	***LS***	1		$ 60,000.00
	RUNWAY 19 PAPI SYSTEM	LS	1		$ -
	GRADING AND PREPERATION OF SITE,	LS	1		$ -
	CONSTRUCTION OF PAPI FOUNDATIONS	LS	1		$ -
	INSTALLATION OF PAPI LIGHT HOUSING ASSEMBLIES	LS	1		$ -
	INSTALLATION OF 2"PVC CONDUIT TO CONNECT TO HOME RUN CONDUIT	LS	1		$ -
	INSTALLATION OF #2 AWG BARE SOLID COPPER COUNTERPOISE ABOVE CONDUIT	LS	1		$ -
	INSTALLATION OF #2 AWG BARE SOLID COPPER GROUND RING WITH GROUND RODS AROUND PAPI FOUNDATIONS	LS	1		$ -
	INSTALLATION OF BONDING AND GROUNDING CONDUCTORS FROM PAPI UNIT TO GROUND RING	LS	1		$ -
	INSTALLATION OF L-824 CONDUCTORS INCLUDING HOME RUN TO VAULT AND CONNECT TO CCR PROVIDED BY OTHERS	LS	1		$ -
	AIMING AND ADJUSTMENT OF INDIVIDUAL PAPI LIGHT HOUSING ASSEMBLIES	LS	1		$ -
	FAA FLIGHT CHECK OF PAPI AND COMMISIONING	LS	1		$ -
	FINAL GRADING AND CLEAN UP OF FACILITY SITE.	LS	1		$ -
					$ -
CIP-006	***VAULT BUILDING***	***LS***			$ 423,000.00
	AIRFIELD ELECTRICAL VAULT - SITE PREPARATION, NEW COMPLETE				$ 27,000.00
	SURVEY	LS	1	$ 15,000.00	$ 15,000.00
	CLEAR, GRADE, AND SOD THE AREA AROUND THE VAULT FOR A MINIMUM DISTANCE OF 15 FEET (4.57 M) ON ALL SIDES.	LS	1	$ 5,000.00	$ 5,000.00
	GROUND GRID	LS	1	$ 3,000.00	$ 3,000.00
	VAULT SHALL BE A MINIMUM 6" ABOVE SURROUNDING GRADE	LS	1	$ 1,000.00	$ 1,000.00
	CONCRETE SIDEWALK ACCESS TO VAULT BUILDING	LS	1	$ 3,000.00	$ 3,000.00
	AIRFIELD ELECTRICAL VAULT - PRE-ENGINEERED, PRECAST CONCRETE VAULT BUILDING, NEW COMPLETE				$ 151,000.00
	VAULT BUILDING SHALL BE A PRE-ENGINEERED CONCRETE STRUCTURE, 42'X16'X9'2" (INTERIOR DIM.)	LS	1	$ 100,000.00	$ 100,000.00
	PRECAST FLOOR/FOUNDATION	LS	1	$ 45,000.00	$ 45,000.00

	FLOOR SHALL BE PRIMED AND PAINTED WITH A DURABLE EPOXY TYPE FLOOR COATING AND SHALL BE SEALED WITH A GLOSS FINISH SEALANT.	LS	1	$ 1,000.00	$ 1,000.00
	VAULT BUILDING ENTRANCE SHALL BE COVERED 6" BEYOND PERIMETER OF DOOR OPENING PADS	LS	1	$ 2,000.00	$ 2,000.00
	HEAVY DUTY 60" WIDE COMMERCIAL POLYURETHANE CORE, FLUSH STEEL PANEL DOUBLE DOOR WITH; STAINLESS STEEL HINGES AND HARDWARE DOOR CLOSER MECHANISM PANIC BAR EXIT HARDWARE	EA	2	$ 500.00	$ 1,000.00
	HEAVY DUTY 30" WIDE COMMERCIAL POLYURETHANE CORE, FLUSH STEEL PANEL SINGLE DOOR WITH; STAINLESS STEEL HINGES AND HARDWARE DOOR CLOSER MECHANISM PANIC BAR EXIT HARDWARE	EA	1	$ 1,000.00	$ 1,000.00
	CONCRETE STOOP FOR DOOR OPENING	LS	1	$ 1,000.00	$ 1,000.00
	AIRFIELD ELECTRICAL VAULT - ELECTRICAL SERVICE, NEW COMPLETE				$ 47,000.00
	POWER COMPANY	LS	1	$ 1,000.00	$ 1,000.00
	METER	LS	1	$ 1,000.00	$ 1,000.00
	PRIMARY CONDUIT	LS	1	$ 1,000.00	$ 1,000.00
	TRANSFORMER	LS	1	$ 2,000.00	$ 2,000.00
	TRANSFORMER PAD	LS	1	$ 2,000.00	$ 2,000.00
	CONTRACTOR	LS	1	$ 40,000.00	$ 40,000.00
	AIRFIELD ELECTRICAL VAULT - POWER DISTRIBUTION, COMMUNICATIONS, LIGHTING, HVAC, GROUNDING AND LIGHTING PROTECTION, NEW COMPLETE				$ 83,000.00
	AFLCS AIR TO GROUND ANTENNA	LS	1	$ 1,000.00	$ 1,000.00
	HVAC	LS	1	$ 2,500.00	$ 2,500.00
	SECONDARY CONDUIT	LS	1	$ 1,000.00	$ 1,000.00
	SECONDARY CONDUCTORS	LS	1	$ 1,000.00	$ 1,000.00
	AUTOMATIC TRANSFER SWITCH	LS	1	$ 2,000.00	$ 2,000.00
	MDP - MAIN DISTRIBUTION SWITCH	LS	1	$ 2,000.00	$ 2,000.00
	SUB PANEL	LS	1	$ 500.00	$ 500.00
	STEPDOWN TRANSFORMER	LS	1	$ 1,500.00	$ 1,500.00
	120V LIGHTING PANEL	LS	1	$ 500.00	$ 500.00
	PILOT CONTROLLED RADIO L-154	LS	1	$ 500.00	$ 500.00
	DISCONNECT CCRS	LS	1	$ 2,000.00	$ 2,000.00
	6X6 OR 8X8 WIREWAY/RACEWAY	LS	1	$ 1,000.00	$ 1,000.00
	GROUND BUS BAR	LS	1	$ 500.00	$ 500.00
	GPS EQUIPMENT, TELEPHONE BOARD AND UPC	LS	1	$ 500.00	$ 500.00
	CABLE TRAY	LS	1	$ 500.00	$ 500.00
	INTERIOR LIGHTING	LS	1	$ 1,000.00	$ 1,000.00
	EXTERIOR LIGHTING	LS	1	$ 1,000.00	$ 1,000.00
	SAFETY BOARD	LS	1	$ 1,000.00	$ 1,000.00
	RECEPTACLE	LS	1	$ 1,000.00	$ 1,000.00
	GFI RECEPTACLE	LS	1	$ 1,000.00	$ 1,000.00
	CCR'S	EA	3	$ 20,000.00	$ 60,000.00
	SHUNT TRIP	LS	1	$ 1,000.00	$ 1,000.00
	AIRFIELD ELECTRICAL VAULT – AIRFIELD LIGHTING CONTROL SYSTEM MODIFICATIONS: VENDOR, NEW COMPLETE				$ 65,000.00
		LS	1	$ 65,000.00	$ 65,000.00
	AIRFIELD ELECTRICAL VAULT – AIRFIELD LIGHTING CONTROL SYSTEM MODIFICATIONS: CONTRACTOR, NEW COMPLETE				$ 50,000.00
		LS	1	$ 50,000.00	$ 50,000.00
CIP-007	***BEACON***	***LS***			$ 44,000.00
	L-801A, CLASS 1, STYLE 2	LS	1	$ 4,500.00	$ 4,500.00
	AIRPORT BEACON TIP-DOWN POLE, 55'	LS	1	$ 30,000.00	$ 30,000.00
	COPPER CLAD LIGHTNING ROD 8'-0" (Set of 3)	LS	1	$ 300.00	$ 300.00
	L-810 OBSTRUCTION LIGHT, SINGLE, LED, IR, 120/240VAC, Dialight RTO-CR07-001	EA	2	$ 500.00	$ 1,000.00
	SHIPPING & HANDLING	LS	1	$ 5,200.00	$ 5,200.00
	GROUND GRID	LS	1	$ 3,000.00	$ 3,000.00
CIP-008	***GENERATOR (OUTSIDE VAULT)***	***LS***			$ 175,000.00
	AIRFIELD ELECTRICAL GENERATOR - SITE PREPARATION, NEW COMPLETE				$ 175,000.00
	GENERATOR	LS	1	$ 150,000.00	$ 150,000.00
	FUEL TANK WITH PUMP AND SYSTEM	LS	1	$ 2,000.00	$ 2,000.00
	BATTERY CHARGING STATION	LS	1	$ 3,000.00	$ 3,000.00
	12" STABILIZED SUBBASE SET 20" BELOW GROUND	LS	1	$ 1,000.00	$ 1,000.00
	6" CRUSHED CONCRETE OR SHELL PLACED ABOVE SUBBASE	LS	1	$ 700.00	$ 700.00
	2" GRAVEL PLACED ABOVE 6" CRUSHED CONCRETE OR SHELL	LS	1	$ 700.00	$ 700.00
	CONCRETE BASE FOR MOUNTING GENERATOR SET. FOUNDATION SHALL EXTEND 3' BEYOND GENERATOR ENCLOSURE EDGE ON ALL SIDES	LS	1	$ 15,000.00	$ 15,000.00
	6" BOLLARDS SET IN FOUNDATION	EA	4	$ 400.00	$ 1,600.00
	SHUNT TRIP	EA	1	$ 1,000.00	$ 1,000.00