

AVAILABLE 3-PHASE FAULT CURRENT AT THE TRANSFORMER SECONDARY TERMINALS IS ESTIMATED BY FPL TO BE RMS SYMMETRICAL AMPS AND DOES NOT INCLUDE CONSIDERATION FOR ANY MOTOR CONTRIBUTION AND/OR FAULT CURRENT ASYMMETRY

2- H.P. SEWAGE PUMPS \_\_\_\_\_ AMPS.  
 MISCELLANEOUS BASE LOAD \_\_\_\_\_ AMPS.  
 25% OF LARGEST MOTOR \_\_\_\_\_ AMPS.  
 TOTAL \_\_\_\_\_ AMPS.  
 PROVIDE SERVICE SIZE: "\_\_\_\_" AMP. "\_\_\_\_" VOLT, 3Ø, 4W

**LOAD CALCULATION**

CALCULATIONS BASED ON FORMULAS OF NFPA 70E / IEEE 1584, AS FOLLOWS:

**ARCING FAULT CURRENT I<sub>a</sub> CALCULATION**

K	I <sub>b</sub> f	V(kV)	GAP (mm)	log (I <sub>a</sub> )	I <sub>a</sub>
-0.097			25		

log (I<sub>a</sub>) = K + 0.662 LOG (I<sub>b</sub>f) + 0.0966 x V + 0.000526 x G + 0.5588 x V x LOG (I<sub>b</sub>f) - 0.00304 G x LOG (I<sub>b</sub>f)  
 K = -0.153 FOR OPEN CONFIGURATION AND -0.097 FOR BOX CONFIGURATIONS AS IN PANELS AND MCCS  
 I<sub>b</sub>f = BOLTED FAULT CURRENT FOR 3-PHASE FAULTS AT APPLICABLE ELECTRICAL EQUIPMENT IN KA  
 V = SYSTEM VOLTAGE IN KV  
 G = BUS BAR GAP BETWEEN CONDUCTORS:  
 15KV SWGR: 152mm  
 5KV SWGR: 104mm  
 LV SWGR: 32mm  
 PANEL/MCC: 25mm  
 CABLE: 13mm

**NORMALIZED INCIDENT ENERGY (E<sub>n</sub>) CALCULATION**

K1	K2	I <sub>a</sub>	GAP (mm)	log (E <sub>n</sub> )	E <sub>n</sub>
-0.555	-0.113		25		

log E<sub>n</sub> = K1 + K2 + 1.081 LOG I<sub>a</sub> + 0.0011 x G  
 E<sub>n</sub> = INCIDENT ENERGY IN J/cm<sup>2</sup> NORMALIZED FOR 0.2s ARCING DURATION AND 610mm WORKING DISTANCE  
 G = GAP BETWEEN BUS BAR CONDUCTORS 25mm \*TABLE D.8.2 ASSUMPTIONS  
 K1 = -0.792 FOR OPEN CONFIGURATIONS AND -0.555 FOR BOX CONFIGURATIONS  
 K2 = 0 FOR UNGROUNDED AND HIGH RESISTANCE GROUNDED SYSTEMS; -0.113 FOR GROUNDED SYSTEMS  
 I<sub>a</sub> = ARCING FAULT CURRENT

**INCIDENT ENERGY (E) CALCULATION**

Cf	E <sub>n</sub>	t	D (mm)	X	E (J/cm <sup>2</sup> )	E (cal/cm <sup>2</sup> )
1.5			455	1.641		

E = (4.184) (Cf) (E<sub>n</sub>) (t/0.2) (610<sup>X</sup>/D<sup>X</sup>)  
 Cf = 1.5 FOR VOLTAGES AT OR BELOW 1KV AND 1.0 FOR VOLTAGES ABOVE 1KV  
 t = ARCING DURATION IN SECONDS  
 X = DISTANCE EXPONENT, 1.473 FOR SWGR <=1KV, 0.973 FOR SWGR >1KV AND 1.641 FOR PANELS <=1KV  
 D = WORKING DISTANCE 455mm = 18 IN PER NFPA 70E

**FLASH BOUNDARY IN MM AT INCIDENT ENERGY OF 5.0 J/cm<sup>2</sup>**

Cf	E <sub>n</sub>	t	X	E <sub>b</sub>	D <sub>b</sub> (mm)	D <sub>b</sub> (inches)
1.5			1.641	5.0		

D<sub>b</sub> = [(4.184) (Cf) (E<sub>n</sub>) (t/0.2) (610<sup>X</sup>/E<sub>b</sub>)]<sup>1/2</sup> \*D.8.5 EMPIRICALLY DERIVED  
 E<sub>b</sub> = INCIDENT ENERGY SET AT 5.0 J/cm<sup>2</sup>  
 Cf = 1.5 FOR VOLTAGES AT OR BELOW 1KV AND 1.0 FOR VOLTAGES ABOVE 1KV  
 t = ARCING DURATION IN SECONDS  
 X = DISTANCE EXPONENT, 1.473 FOR SWGR <=1KV, 0.973 FOR SWGR >1KV AND 1.641 FOR PANELS <=1KV

**ARC FLASH HAZARD ANALYSIS**

THE LABELS FOR EACH APPLICABLE EQUIPMENT ON THIS PLAN ARE FROM A PRELIMINARY STUDY PERFORMED BY THE ENGINEER OR RECORD. CONTRACTOR SHALL PROVIDE FINAL LABELS ACCORDING TO SECTION 26 05 73.19

**DANGER**

Arc - Flash Hazard and Shock Hazard

\_\_\_\_\_ in Arc Flash Protection Boundary  
 \_\_\_\_\_ cal/cm<sup>2</sup> - Incident Energy Flash Hazard at 18 inches

CLASS \_\_\_\_\_

Appropriate PPE Required for both Arc-Flash and Shock Hazards:  
 Safety Glasses/Goggles, Hard Hat, Flash Suit Hood, Leather Gloves, Leather Work Shoes, Hearing Protection, FR clothing system with an ATPV rating >= X cal/cm<sup>2</sup>, Class 00 Voltage Rated Gloves, Voltage Rated Tools

Shock Hazard

480 VAC -- Shock Hazard with covers/doors open  
 3' - 6" -- Limited Approach Boundary  
 1' - 0" -- Restricted Approach Boundary  
 0' - 1' -- Prohibited Approach Boundary

LOCATION : PS-0000      PROTECTIVE DEVICE: XXXXXX  
 MAX FAULT CURRENT BY FPL: \_\_\_\_\_  
 STUDY DONE BY: XXXXXX      DATE: XXXXXX      FILE NAME: XXXXXX

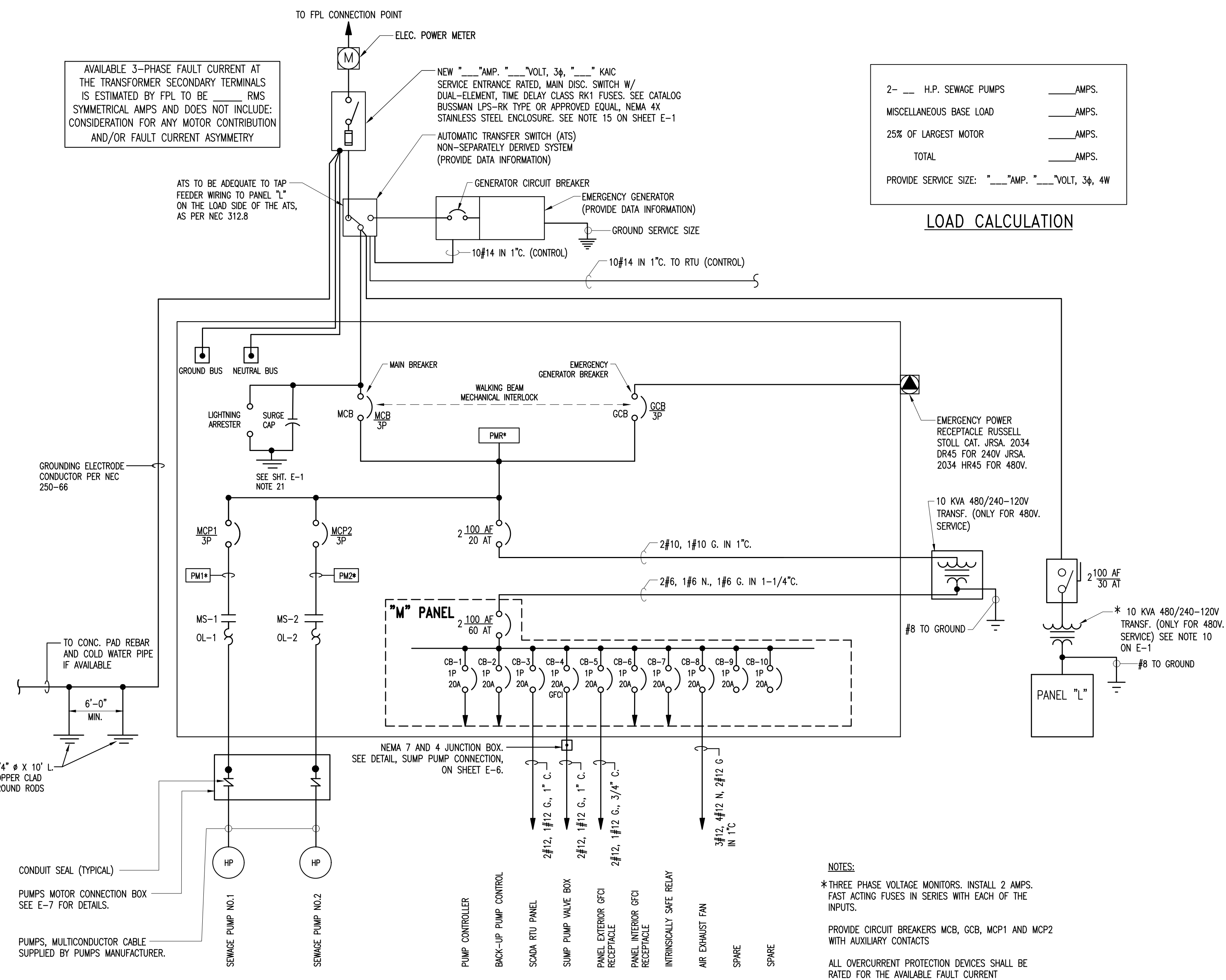
**NOTES:**  
 1- LABEL BACKGROUND SHALL BE WHITE COLOR.  
 2- LABEL LETTERING SHALL BE BLACK COLOR.  
 3- 'DANGER' WORD SHALL BE WHITE COLOR WITH RED BACKGROUND.  
 4- LABEL SIZE SHALL BE 4 X 6 INCHES.  
 5- INFORMATION PRINTED ON LABEL SHALL CONFORM TO THE REQUIREMENTS OF SECTION 26 05 73.19, SUB SECTIONS 3.04 AND 3.07 AND SHALL BE VERIFIED AND PROVED BY CONTRACTOR.  
 6- THE LABEL FOR EACH OF THE APPLICABLE EQUIPMENT SHALL BE LOCATED SO AS TO BE CLEARLY VISIBLE TO QUALIFIED PERSONS BEFORE EXAMINATION, ADJUSTMENT, SERVICING, OR MAINTENANCE OF THE EQUIPMENT NEC 110.16.  
 7- SEE NOTE #24, ELECTRICAL GENERAL NOTES SHEET E-1.

**ARC FLASH LABEL**

**ABBREVIATIONS:**

- MCB MAIN CIRCUIT BREAKER
- MPC MOTOR CIRCUIT PROTECTION
- GCB GENERATOR CIRCUIT BREAKER
- RTU REMOTE TERMINAL UNIT

THESE ARE NOT CONSTRUCTION DRAWINGS. THE INFORMATION HEREIN CONTAINED SHALL ONLY BE USED AS GENERAL GUIDELINE OF THE INTENDED OPERATION AND FUNCTIONS AND SHALL NOT BE CONSTRUED AS ALL INCLUSIVE. ENGINEERS OF RECORD AND CONSULTANTS USING THESE GUIDELINES SHALL VERIFY AND MODIFY ANY REQUIREMENT NOT NECESSARILY SHOWN AS MAY BE REQUIRED BY ANY AND ALL APPLICABLE CODES AND STANDARDS.



**ONE LINE DIAGRAM**  
N.T.S.

**SERVICE: 1-PH, 2Ø, 1Ø6(N) & 1Ø6(G) VOLTAGE: 240/120V**

**MAIN: 2P-60A M.C.B. LOCATION: CONTROL PANEL**

VA	POLE	TRIP	COND.	WIRE	REMARKS	1	2	3	4	5	6	7	8	9	10	11	12	13	VA	
540	1	20	3/4"	2#12 & (G)	PUMP CONTROL	1	2	2#12 & (G)	3/4"	20	1	180								
750	1	20	1"	2#12 & (G)	SCADA RTU PANEL	3	4	2#12 & (G)	1"	20	1	1200								
180	1	20	3/4"	2#12 & (G)	PANEL EXT. GFCI RECEPTACLE	5	6	2#12 & (G)	3/4"	20	1	180								
180	1	20	3/4"	2#12 & (G)	PANEL INT. GFCI RECEPTACLE	5	6	2#12 & (G)	3/4"	20	1	180								
180	1	20	3/4"	2#12 & (G)	INTRINSICALLY SAFE RELAY	7	8	2#12 & (G)	1"	20	1	1000								
1000	1	20	-	-	SPARE	9	10	-	-	20	1	1000								
2650	TOTAL				TOTAL CONNECTED LOAD: 6210 VA @ 240/120 VOLTS							3560								

**SERVICE: 1-PH, 2Ø, 1Ø6(N) & 1Ø6(G) VOLTAGE: 240/120V**

**MAIN: 2P-60A M.C.B. LOCATION: CONTROL PANEL**

VA	POLE	TRIP	COND.	WIRE	REMARKS	1	2	3	4	5	6	7	8	9	10	11	12	VA		
400	1	20	3/4"	2#12 & (G)	INSIDE LIGHTS	1	2	2#12 & (G)	3/4"	20	1	1500								
720	1	20	3/4"	2#12 & (G)	RECEPTACLES	3	4	2#12 & (G)	3/4"	20	1	720								
1200	1	20	3/4"	2#12 & (G)	EXHAUST FAN	5	6	2#12 & (G)	3/4"	20	1	400								
960	1	20	3/4"	2#12 & (G)	DAY TANK PUMP	7	8	2#12 & (G)	3/4"	20	1	800								
100	1	20	-	-	SPARE	9	10	-	-	20	1	100								
100	1	20	-	-	SPARE	11	12	-	-	20	1	100								
3480	TOTAL				TOTAL CONNECTED LOAD: 7100 VA @ 240/120 VOLTS							3620								

**BREAKERS, WIRING AND CONDUIT SCHEDULE**

VOLTS & PHASE	MOTOR HP	MOTOR AMP CODE	START SIZE	MOTOR CIRCUIT PROTECT. AMPS	MOTOR WIRE THWN CU. NOTE 13 ON E-5	SIZED FOR TWO PUMP STATIONS	
						MAIN & STAND-BY BREAKERS	SERVICE
240-1Ø	5	28	2	60	3#8 IN 1 1/2" C	100	#6 3#2, IN 1-1/2" C
240-1Ø	7.5	40	2	80	2#6 & 1#8G. IN 1-1/2" C	150	#6 3#1/0, IN 2" C
240-3Ø	5	15.2	1	30	4#10 IN 1 1/2" C	100	#6 4#2, IN 1-1/2" C
240-3Ø	7.5	22	2	50	4#8 IN 1 1/2" C	100	#6 4#2, IN 1-1/2" C
240-3Ø	10	28	2	50	3#6 & 1#8G. IN 1-1/2" C	100	#6 4#2, IN 1-1/2" C
240-3Ø	15	42	3	100	3#4 & 1#8G. IN 2" C	150	#6 4#1/0, IN 2" C
480-3Ø	5	7.6	1	15	4#12 IN 1 1/2" C	70	#6 4#3, IN 1-1/2" C
480-3Ø	7.5	11	1	30	4#12 IN 1 1/2" C	70	#6 4#3, IN 1-1/2" C
480-3Ø	10	14	2	30	4#10 IN 1 1/2" C	70	#6 4#3, IN 1-1/2" C
480-3Ø	15	21	2	50	4#10 IN 1 1/2" C	70	#6 4#3, IN 1-1/2" C
480-3Ø	20	27	2	50	4#8 IN 2" C	125	#6 4#1, IN 2" C
480-3Ø	25	34	3	50	3#6 & 1#8G. IN 2" C	150	#6 4#1/0, IN 2" C
480-3Ø	30	40	3	100	3#6 & 1#8G. IN 2" C	200	#4 4#3/0, IN 2" C
480-3Ø	40	52	3	100	3#4 & 1#6G. IN 2" C	200	#4 4#3/0, IN 2" C
480-3Ø	50	65	4	100	3#3 & 1#6(G) IN 2" C	200	#4 4#3/0, IN 2" C
480-3Ø	60	77	4	150	3#2 & 1#6(G) IN 2" C	225	#2 4#4/0, IN 2 1/2" C

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 MIAMI, FL 33133  
 786-552-4440

**PCTS 0000/CONTRACT X-000 or RPQ/ERX00000**  
**PUMPING STATION No. 0000 (STD. UPDATE 2021)**  
**SUBMERSIBLE PUMPING STATION WITH GENERATOR**  
 PROJECT OFFICIAL ADDRESS  
**ELECTRICAL ONE-LINE DIAGRAM**

**DRAWING HISTORY**

NO.	REVISION	DATE	BY
X	RELEASED FOR PERMIT	00/00/00	XXX
	PERMIT		
	BID		
	AS-BUILT		

**REVISIONS**

No.	DESCRIPTION	DATE	BY
Δ	XXXXXXXX	XX/XX/XX	XXX
	XXXXXXXX		

**APPROVALS**

DESIGNED: X.X.X.      DRAWN: X.X.X.  
 UNIT HEAD: X.X.X.  
 PROJECT MGR.: X.X.X.

Xxxx Xxxxx, P.E.  
 Xxxxx Engineer  
 State of Florida—License No.00000  
 Date: \_\_\_\_\_

FILE NAME: XXXXXE03.DWG  
 DATE: XX/XX/20XX      SCALE: AS NOTED  
**SHEET E-3**  
 DWG. No. S-00000-D