Item #160267

Sept 1, 2016

Excerpt from 2008 Facilities Assessment and Expansion Technical Memorandum

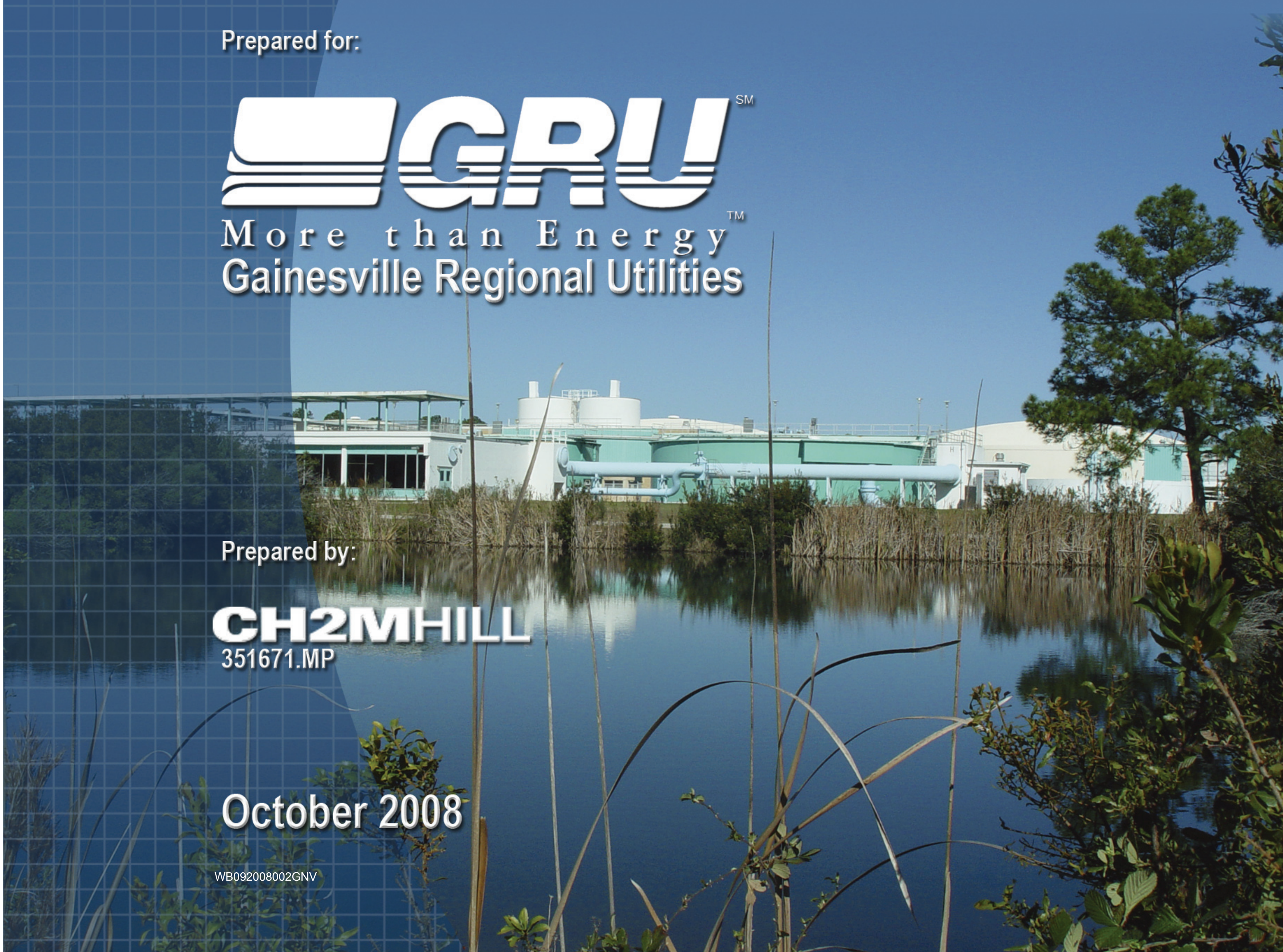
Pages 17-22

FINAL

Murphree WTP Expansion Technical Memorandum

Prepared for:

GRU
More than Energy
Gainesville Regional Utilities



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Electrical Evaluation

The electrical evaluation consists of a summary of the existing conditions, recommended improvements, and a phasing plan. The recommended improvements include preliminary provisions for the RTUs that are proposed to be a part of the Murphree WTP Contingency Plan. Since the contingency plan is not yet completed, assumptions for the electrical loads of the RTUs were made. Two RTUs are included in the electrical evaluation, specifically RTU Northwest and RTU Southeast. These two RTUs are assumed for the purposes of the electrical evaluation to provide granular activated carbon treatment for a portion of the raw water and repumping the treated raw water to the reactor clarifiers.

Existing Conditions

Murphree WTP is powered by two separate electrical systems: a 4,160-volt system that powers the high service pumps exclusively and a 480-volt system that powers all other plant loads, excluding the raw water well pumps. The well pumps are powered at 480 volts through separate electrical services for each pump and are not connected to the plant 480-volt system. Power systems for the raw water wells are not considered in this document. The existing 480-volt and 4,160-volt systems receive power from separate GRU electrical service transformers and are shown in the Existing Single Line Diagram in Attachment B, Drawing E-1.

There is no transformer at the Murphree WTP that converts 4,160-volt power to 480-volt power. None of the instrumentation, control, lighting or auxiliary loads in the High Service Pump Building can receive power from the 4,160-volt system. There is a diesel generator that provides back-up power for the 480-volt loads, but the 4,160-volt loads cannot receive power from this diesel-generator.

4,160-Volt System. The 4,160 volt system consists of a pair of 12,470 to 4,160 volt utility service transformers located north of the High Service Pump Building, a 4,160 volt motor control center designated motor control center A (MCC-A) located in the building, underground conductors between the transformers and MCC-A, and under-slab branch circuit conductors to the 700 hp high service pump motors.

The MCC-A includes a switch to select one of the two 4,160 volt service transformers to power its single bus. There is no connection to the plant emergency generator. High service pumps Nos. 1 and 6 provide back-up service and are powered by diesel engines that are used during outages of the 4,160 volt power system.

480-Volt System. The 480-volt system receives power from of a single 12,470 to 480-volt utility service transformer located north of the High Service Pump Building and a 900 KW diesel-generator set located inside the building. These two sources of power are connected to a service-rated automatic transfer switch, **ATS-1**, which in turn feeds a single bus 1,200 ampere switchboard designated DSGR-1. Both ATS-1 and DSGR-1 are located outdoors, north of the High Service Pump Building and adjacent to the service transformer.

A second 480-volt GRU electrical service transformer connected to DSGR-2A located adjacent to the Chemical Building is available for connection to the system but is normally not used since a new full-capacity feeder was installed to provide generator backed-up power from DSGR-1A at the High Service Pump Station. DSGR-2A contains two main circuit breakers, one to connect the switchgear to DSGR-1A, and the second to connect the switchgear to the adjacent GRU electrical service transformer. These two circuit breakers are Kirk-key interlocked to prevent simultaneous closure.

This second GRU electrical service transformer was installed in a dedicated space between 480-volt switchgear DSGR-2 and a GRU electrical primary switch. This space had sufficient width to accommodate the original transformer. The original transformer developed oil leaks and was replaced by GRU several years ago. The replacement transformer is wider than the original and does not fit in the space properly. It bears against DSGR-2 to the north and the primary switch to the south. As a result, its doors cannot be opened without sufficient force being applied to deflect the enclosures of DSGR-2 and the primary switch. This does not comply with the requirement of National Electrical Safety Code ANSI C-2 Article 125 for ***Working Space about Electrical Equipment***.

Recommended Improvements

New Electrical Building

Six components of the electrical distribution system that are required for operation of the plant, MCC-A, DSGR-1, DSGR-2, MCC-B, MCC-C, and MCC-D, are past the end of their expected service lives. Construction of an Electrical Building sized and located as shown on Site Plan Drawing C-3 will enable installation of replacements for DSGR-1, MCC-A, MCC-B, and MCC-D while the existing equipment remains in-service. It will also provide a climate-controlled environment for this equipment and power for the AFDs.

MCC-A

Existing High Service Pump MCC-A is more than 30 years old and is being maintained with parts and service from a third-party maintenance organization specializing in equipment of this type and age. The manufacturer no longer services this equipment. MCC-A is past its expected service life and may suffer an irreparable failure at any time.

Although there are two service transformers available to power MCC-A, the MCC itself and its built-in 4,160 volt selector switch are single points of failure which can prevent 4,160 volt power from reaching the high service pumps until repairs are made. Extended operation of the two diesel powered pumps (HSP Nos. 1 and 6) will be required under these circumstances.

Where redundant process equipment is available, such as the high service pumps, greater reliability can be obtained by separating the process equipment into two groups and powering each group from a separate power bus. This prevents a single bus fault from disabling all process equipment. Powering each bus from a separate service transformer provides two separate, independent, redundant sources of power for the connected process equipment.

Where a third source of power is available, such as a generator, a third bus connected to the third power source and to each of the equipment buses through isolation switches provides additional reliability. With such an arrangement either utility source or the generator can power all process equipment, and no single bus fault can shut down all process equipment.

The 4,160-volt section of the Proposed Single Line Diagram on Drawing E-2 shows the recommended arrangement. Each of the two existing 4,160-volt service transformers will be connected to separate buses in new MCC-A so that 4,160-volt power could also be obtained from the 480-volt plant generator through a new 4,160 to 480 volt step-up transformer. This will provide the ability to reduce the number of diesel engines running during utility outages.

DSGR-1

Both existing ATS-1 and existing DSGR-1 are single points of failure which can prevent 480-volt power from reaching the plant from either the service transformer or from the diesel generator. If either of these fails, the high service pump room, Administration and Filter Building, reactor clarifiers 1 and 2, and the west recarbonation facility will be without 480- and 120-volt power until repairs are made. ATS-1 is new but DSGR-1 is more than 30 years old and its manufacturer is no longer in business. It is recommended that both ATS-1 and DSGR-1 be replaced with new DSGR-1A as shown in the 480-volt section of the Proposed Single Line Diagram on Drawing E-2.

DSGR-1A is proposed as a three bus switchboard similar to MCC-A described above for the 4,160-volt system. A second 480-volt service transformer will be installed and either the existing or a new diesel generator can be used for emergency power. Redundant feeders will be extended from the two distribution buses of DSGR-1A to loads, including new MCC-B serving the High Service Pump Building, DSGR-2A for loads in the Chemical and Vacuum Filter Buildings, the two new RTUs discussed earlier in this technical memorandum and existing MCC-F in the East Recarbonation Building.

With this arrangement, no single failure of either transformer, the generator or any one of the three buses in DSGR-1A will prevent 480-volt power from reaching the connected loads from an alternate source.

MCC-B and MCC-D

Both existing MCC-B in the High Service Pump Building and MCC-D in the West Recarbonation Building are more than 30 years old and their manufacturer is no longer in business. Both have single bus designs and represent single points of failure where a single fault can prevent power from reaching any of their loads until repairs are made.

Replacement of both MCC-B and MCC-D with a new MCC-B configured in a two bus design is shown in the Proposed Single Line Diagram on Drawing E-2. Because of their proximity to the proposed location of the new Electrical Building shown on Site Plan Drawing C-1, the loads now powered from both existing MCC-B and existing MCC-D can be powered from a new MCC-B located in the new Electrical Building.

MCC-C

Existing **MCC-C** in the Chemical Building is also more than 30 years old and beyond its service life. Its replacement with a new MCC-C is also recommended, as shown on Proposed Single Line Diagram E-2 and included in the Phasing Plan below.

As shown in the Existing Single Line Diagram on Drawing E-1, MCC-C is used primarily as distribution switchgear and acts as a controller for only five small motors, none of which drive process equipment. A new distribution panelboard, DP-C, was provided adjacent to MCC-C under a previous project. It is recommended that the distribution loads now connected to MCC-C, some of which are process loads, be reconnected to DP-C. MCC-C can then be removed and its replacement installed in the same location. If necessary, temporary starters can be provided for the motors which would otherwise be out-of-service during the changeover.

DSGR-2

DSGR-2 is more than 30 years old and past its expected useful service life. As shown in the Existing Single Line Diagram on Drawing E-1, its only use is providing power to the Vacuum Filter Building. New switchgear DSWG-2A was installed adjacent to DSGR-2 in a previous project and all loads except the Vacuum Filter Building were removed from DSGR-2 at that time. It is recommended that connection of the Vacuum Filter Building feeder be changed from DSGR-2 to DSGR-2A and that DSGR-2 be removed along with the GRU electrical service transformer and primary switch at this location.

Diesel Generator

Emergency electrical power is provided to the plant at 480 volts by a Caterpillar D399 diesel engine generator set located in the High Service Pump Room. This unit has over 1100 hours on it and pre-dates the Caterpillar Service Information System. Caterpillar estimates it is at least 30 years old.

The 900 KW rating of the generator is less than the plant 480 volt load. Load management is required during emergency operation to ensure that the load connected to the generator remains within its rating.

During a load bank test run 2-20-2007 it was found that the unit could not sustain operation at 100% of rated load due to diesel engine overheating. The test was completed successfully at 75% of rated load.

The cost estimate for the project includes replacement of this unit with two 1000 KW diesel engine generators. With MCC-A and MCC-B both removed from the High Service Pump Room, space will be available to locate both generators there. Alternatively, space is available in the yard to locate the generators outside the building in weatherproof enclosures. The cost estimate includes the cost for weatherproof (non-sound attenuating) enclosures

Phasing Plan

The work proposed can be completed with minimum interruption of plant operations, sequenced as follows:

1. Construct the new Electrical Building shown on Drawing E-3 in the location shown on the site plan Drawing C-1 with new electrical equipment as described above and shown on Drawing E-3. It will be constructed on top of two existing underground 4,160 volt feeders powering the high service pumps through MCC-A, but they can be protected during construction and will be abandoned in place after completion of the work.

2. Install new sections of existing DSGR-1A within the new Electrical Building to expand it to the west. Note that the new Electrical Building will be constructed around existing switchgear DSGR-1A to facilitate its incorporation into the new system. Install the bus link connecting the new sections of DSGR-1A to the existing sections of DSGR-1A until all loads have been removed from DSGR-1 and it can be de-energized.

3. Coordinate installation of two new GRU electrical 12,470 to 480-volt service transformers north of the new Electrical Building and route service conductors from the west transformer to the west main CB of new DSGR-1A. Construct conduits for service conductors from the

east transformer to the east main CB of existing DSGR-1A but delay installation of the service conductors until DSGR-1 can be de-energized.

4. Coordinate construction of two new 4,160-volt feeders from the existing GRU electrical 12,470 to 4,160-volt transformers shown on site plan Drawing C-3 to the cable compartments of new MCC-A shown on Drawing E-3. Construction will require shutdown of the existing transformers, but this can be accomplished without loss of power to existing MCC-A since the transformers and existing feeder cables are redundant and can be shut down one at a time.

5. Construct four new runs of cable tray from the new Electrical Building to the existing High Service Pump Building at an elevation of 14 feet above finish grade (AFG). The High Service Pump Building roof is located 29 feet AFG, so the cable trays will connect to the north wall slightly more than half way up the wall. Installation of the cable trays and their structural supports can be completed without interfering with plant operation.

6. Route 4,160-volt cables to power HSP #2, 3, 4, 5, 7, and 8 from new MCC-A and AFDs in the new Electrical Building overhead through the new cable trays in 5 above to the interior of the High Service Pump Building on the north wall. Turn these cables vertically in conduit and rise behind the bridge crane rails into the ceiling space above the bridge crane. Route the cables across the building to the south wall and down to the level of the mezzanine in the high service pump bay. From there, route the cables overhead at 10 feet AFF to the high service pumps.

7. After the last existing high service pump has been disconnected from existing MCC-A, remove MCC-A and its service cables, remove housekeeping pad, cut off the conduits flush with the slab, and grout level with finished floor.

8. Construct one run of cable tray from new Electrical Building as shown on site plan Drawing C-1 and E-3 eastward to the east end of Filter No. 4. Turn the cable tray south and route along the east wall to the south wall of the filter pipe gallery.

9. Route new 480-volt power cables from new DSGR-1A to Transfer Pumps Nos. 1, 2, and 3, Backwash Fill Pumps Nos. 1 and 2, existing panelboards, Reactor Clarifiers Nos. 1 and 3, pivot and rake drives, sludge pumps, recarbonation blowers, exhaust fans, and other loads shown connected to MCC-B1 and MCC-B2 on Drawing E-2.

10. When all loads have been disconnected from existing MCC-B in the High Service Pump Building and reconnected to new MCC-B in the new Electrical Building, remove existing MCC-B, remove the housekeeping pad, cut off conduits flush with slab, and grout level with finished floor.

11. When all loads have been disconnected from MCC-D in the west recarbonation Electrical Building, remove existing MCC-D; remove its housekeeping pad, cut off conduits flush with slab, and grout level with finished floor.

12. Construct cable tray overhead to existing DGSR-2A and route new feeder cables to it from the new bus of DSGR-1A.

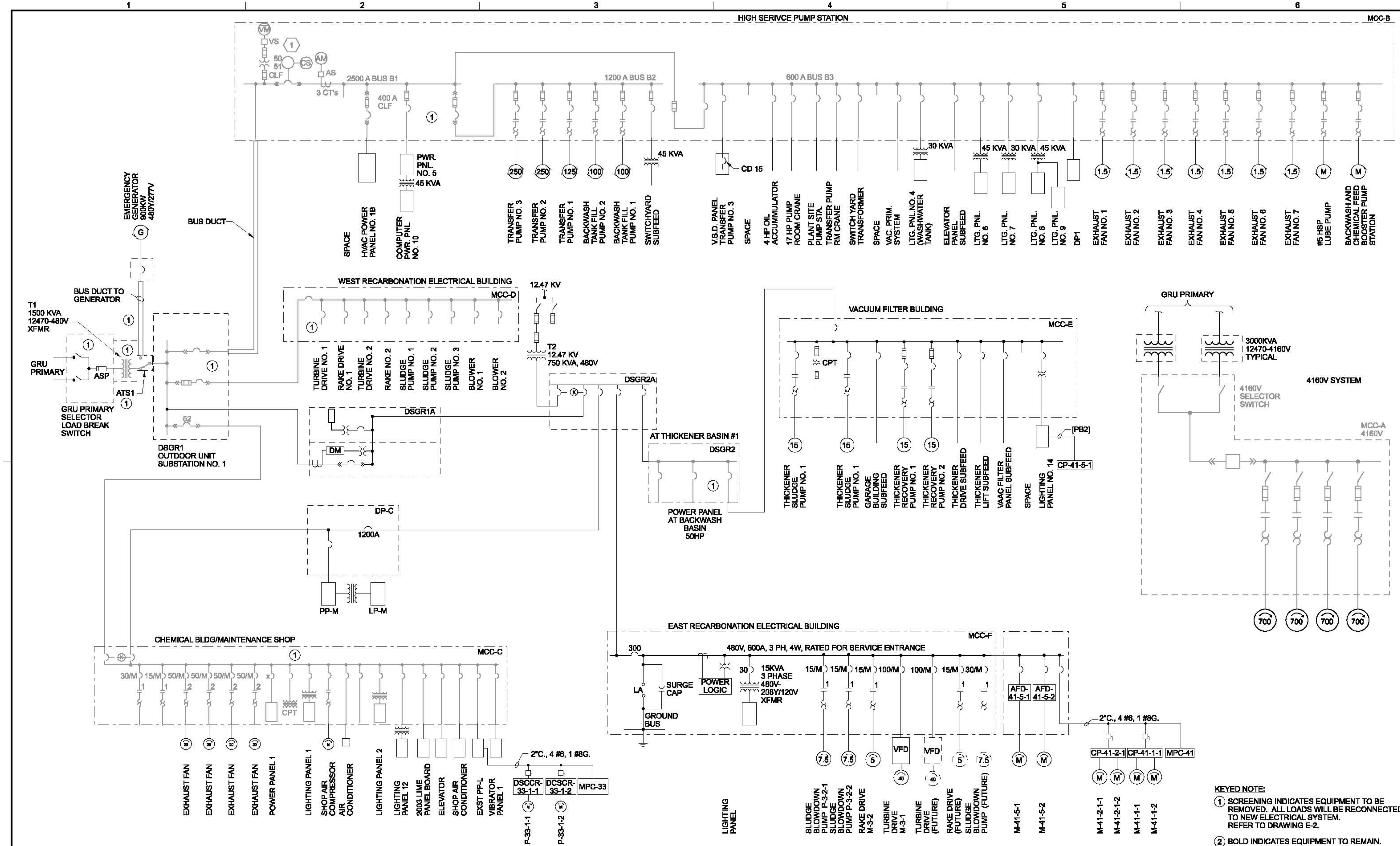
13. Connect existing or new generator(s) to new center bus of DSGR-1A with cables in new cable tray.

14. With all loads operating from new MCC-A and DSGR-1A, coordinate with GRU electrical to remove existing 480-volt service transformer. Remove existing ATS-1 and DSGR-1. Remove feeder cables to DSGR-1A, cab conduits at DSGR-1. Remove overhead buses to generator and existing MCC-B.

15. Coordinate with plant personnel to shutdown all power to new DSGR-1A and install bus link between existing and new sections of DSGR-1A.

16. Construct feeder to East RTU.

17. Construct future feeder to existing MCC-F in East Recarbonation Building if additional load capacity is required at DSGR-2A.



KEYED NOTE:
1. SCREENING INDICATES EQUIPMENT TO BE REMOVED. ALL LOADS WILL BE RECONNECTED TO NEW ELECTRICAL SYSTEM. REFER TO DRAWING E-2.
2. BOLD INDICATES EQUIPMENT TO REMAIN.

DSGN MJ WAYNE					
DR PK OAKES					
CHK MJ WAYNE					
APVD MJ WAYNE	NO.	DATE	REVISION	BY	APVD

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL
3011 S.W. WILLISTON ROAD
GAINESVILLE, FLORIDA 32608
EB0000072 AAC001992

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GAINESVILLE, FLORIDA
GAINESVILLE REGIONAL UTILITIES
GAINESVILLE, FLORIDA

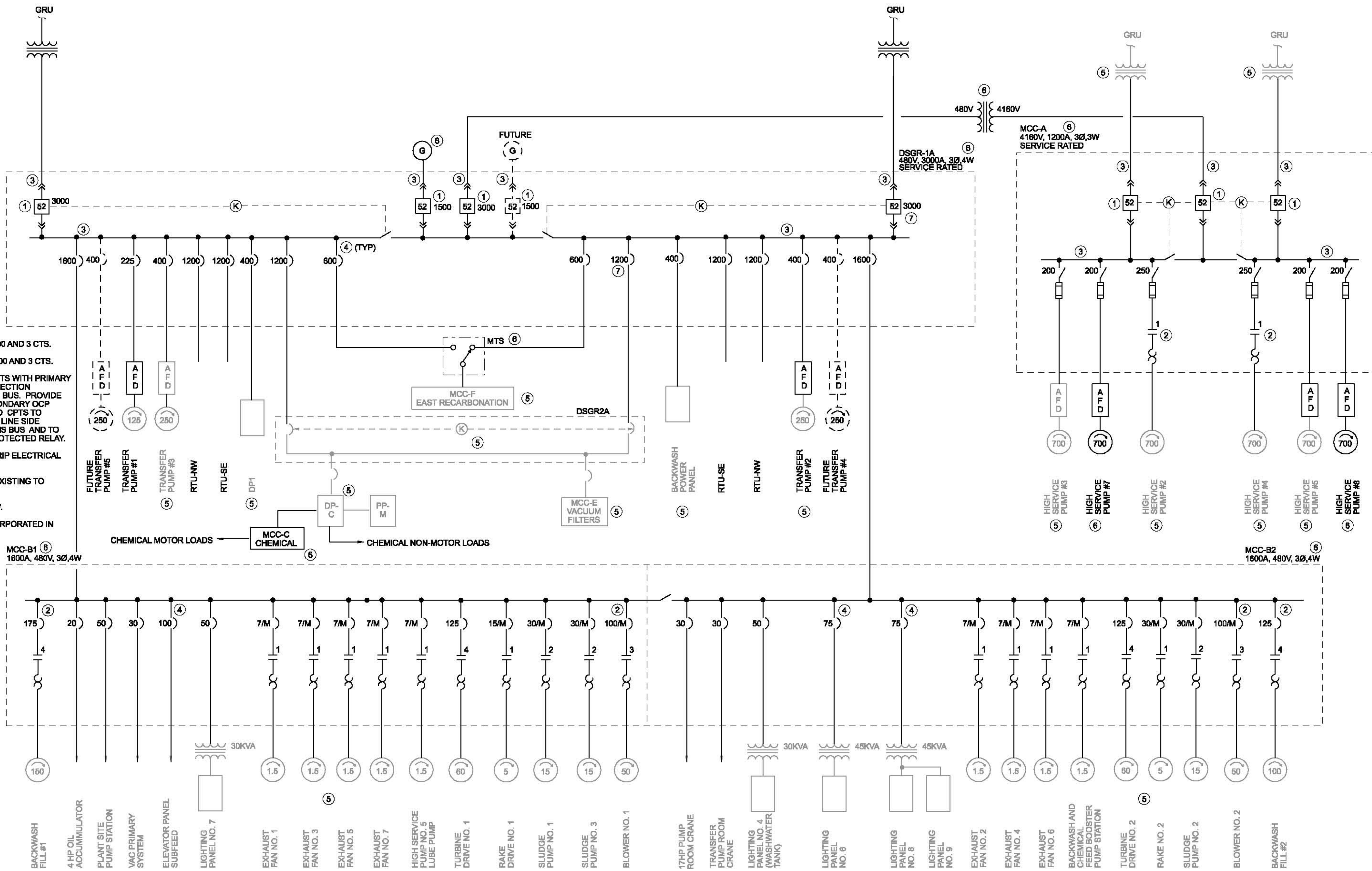
ELECTRICAL
DEMOLITION AND EXISTING
SINGLE LINE DIAGRAM

SHEET	
DWG	E-1
DATE	OCT 2008
PROJ	351671

FILENAME: dn 00e602_351671.dgn PLOT DATE: 10/24/2008 PLOT TIME: 11:38:55 AM

KEYED NOTES:

1. PROVIDE WITH FP-5000 AND 3 CTS.
2. PROVIDE WITH MP-4000 AND 3 CTS.
3. PROVIDE PTS AND CPTS WITH PRIMARY OVERCURRENT PROTECTION CONNECTED TO THIS BUS. PROVIDE 120V THROUGH SECONDARY OCP FROM THESE PTS AND CPTS TO INTERRUPTERS WITH LINE SIDE CONNECTIONS TO THIS BUS AND TO THE ASSOCIATED PROTECTED RELAY.
4. PROVIDE WITH DIGITRIP ELECTRICAL TRIP UNIT.
5. SCREEN INDICATES EXISTING TO REMAIN.
6. BOLD INDICATES NEW.
7. EXISTING TO BE INCORPORATED IN DSGR-1A.



DSGN	MJ WAYNE
DR	PK OAKES
CHK	MJ WAYNE
APVD	MJ WAYNE

NO.	DATE	REVISION	BY	APVD

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ELECTRICAL
PROPOSED SINGLE LINE DIAGRAM

SHEET	
DWG	E-2
DATE	OCT 2008
PROJ	351671

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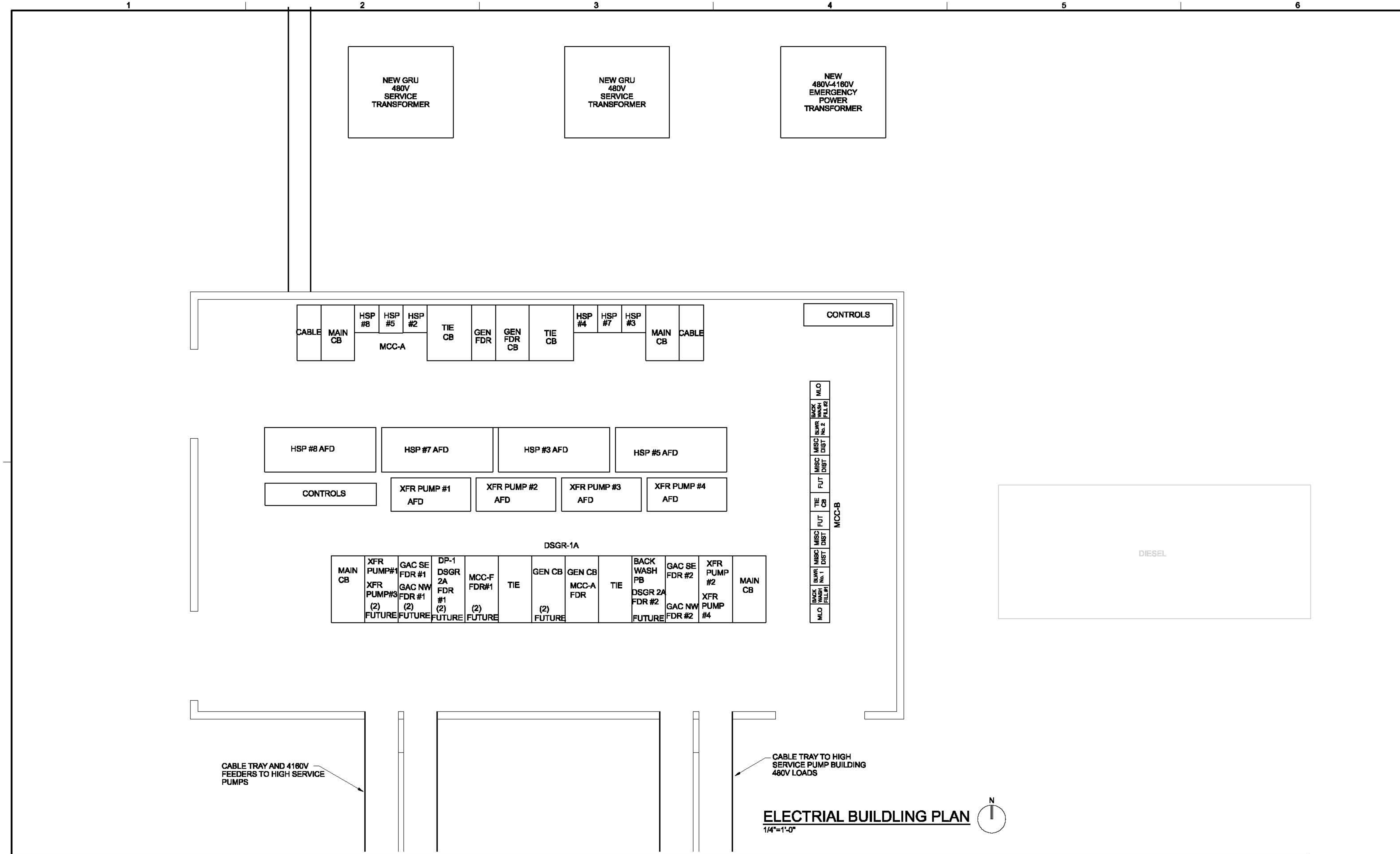

ELECTRIAL BUILDLING PLAN

1/4"=1'-0"

DSGN MJ WAYNE					
DR PK OAKES					
CHK MJ WAYNE					
APVD MJ WAYNE	NO.	DATE	REVISION	BY	APVD

VERIFY SCALE
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ELECTRICAL

ELECTRICAL BUILDING PLAN

SHEET	
DWG	E-3
DATE	OCT 2008
PROJ	351671

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