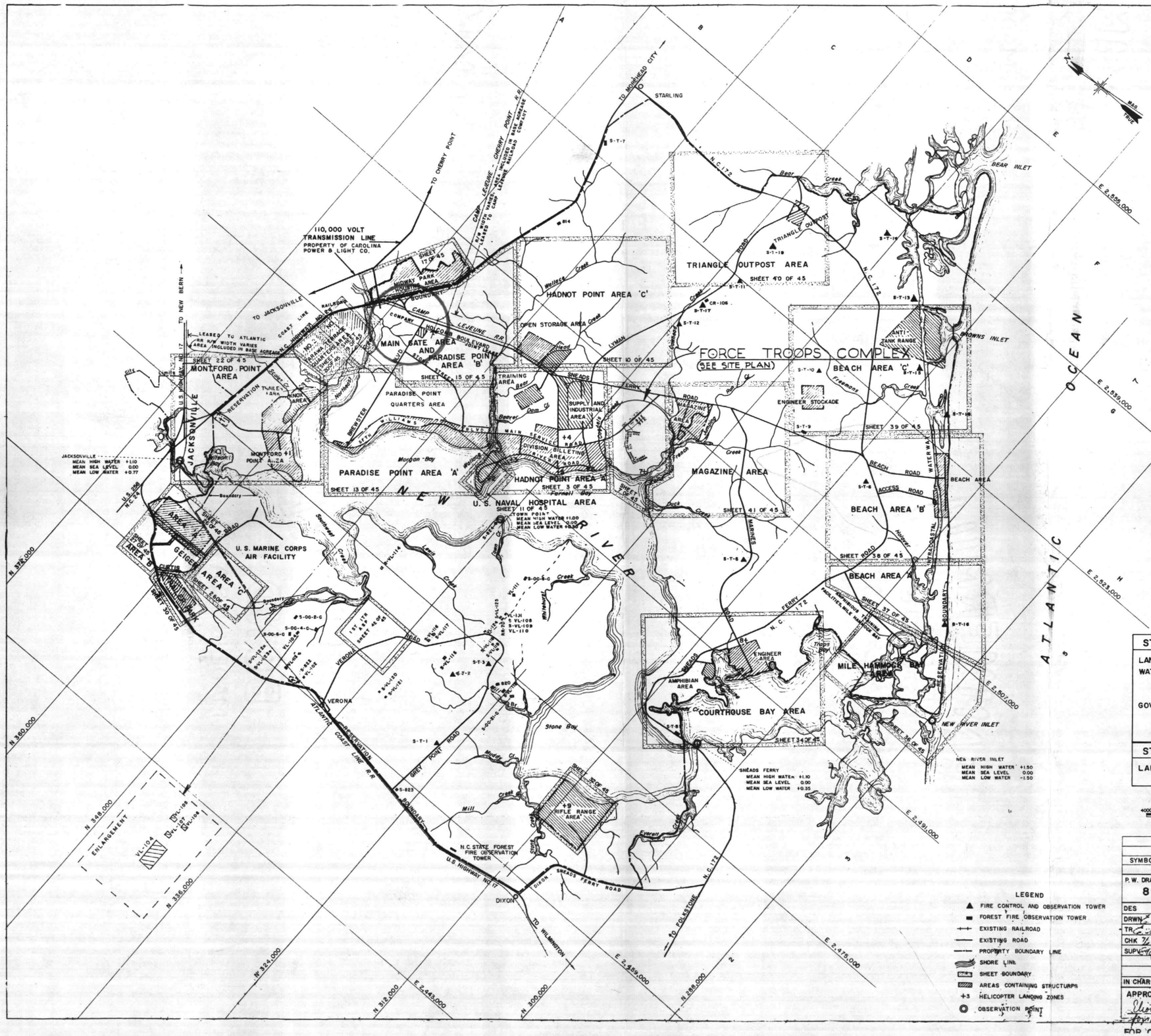
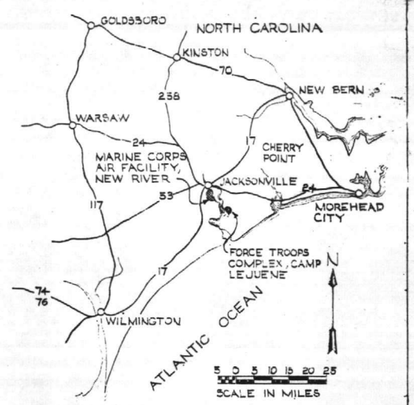
L G NORRIS





LOCATION MAP 1/16" = 1 MILE

STATION AREA MARINE CORPS BASE	ACRES
LAND, GOVERNMENT OWNED	83,046.38
WATER (WITHIN RESERVATION)	26,000.28
TOTAL	109,046.66
GOVERNMENT IN-LEASED · MOREHEAD CITY NOm-72944	1.125

STATION AREA U.S. NAVAL HOSPITAL	ACRES
LAND	144.6

4000 0 4000 8000 12,000 16,000 20,000
SCALE IN FEET

LEGEND
- FIRE CONTROL AND OBSERVATION TOWER
- FOREST FIRE OBSERVATION TOWER
- EXISTING RAILROAD
- EXISTING ROAD
- PROPERTY BOUNDARY LINE
- SHORE LINE
- SHEET BOUNDARY
- AREAS CONTAINING STRUCTURPS
- +3 HELICOPTER LANDING ZONES
- OBSERVATION POINT

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

P.W. DRAWING NO. 8902

DEPARTMENT OF THE NAVY BUREAU OF YARDS & DOCKS

MARINE CORPS BASE CAMP LEJEUNE, N.C.

MASTER SHORE STATION DEVELOPMENT PLAN

GENERAL DEVELOPMENT PLAN

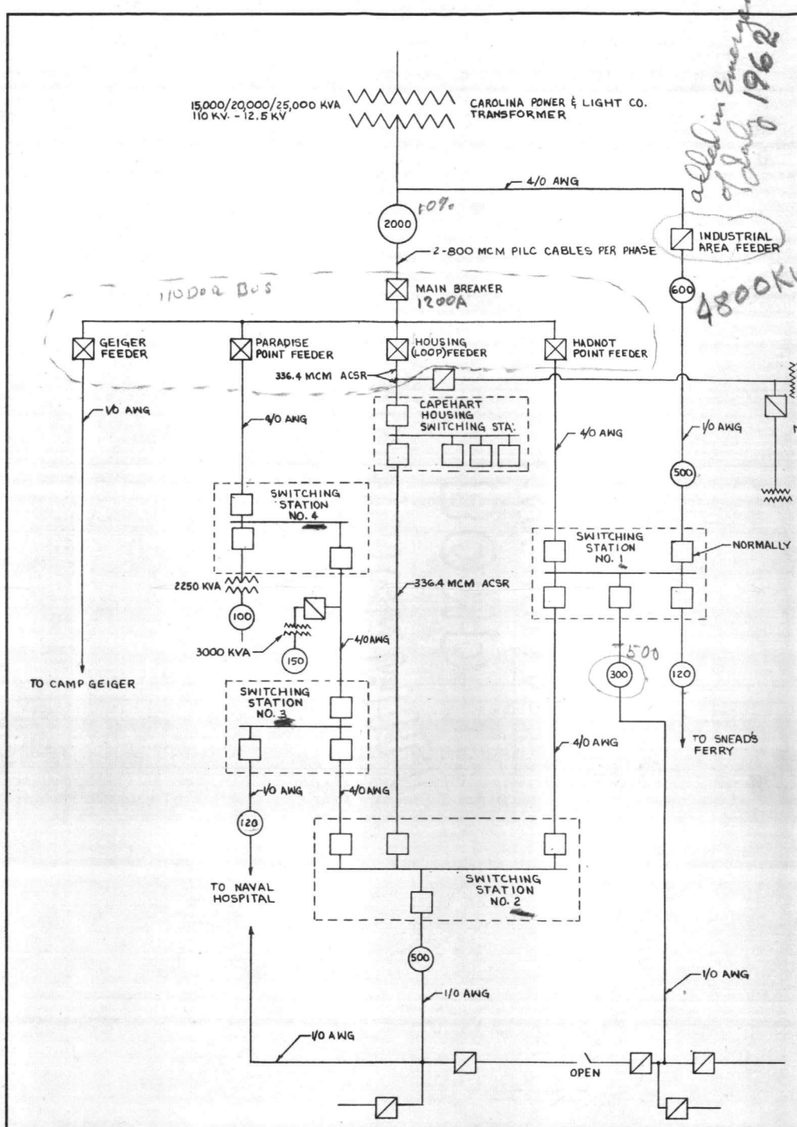
INDEX SHEET

DES
DRWN
TR
CHK
SUPV
IN CHARGE

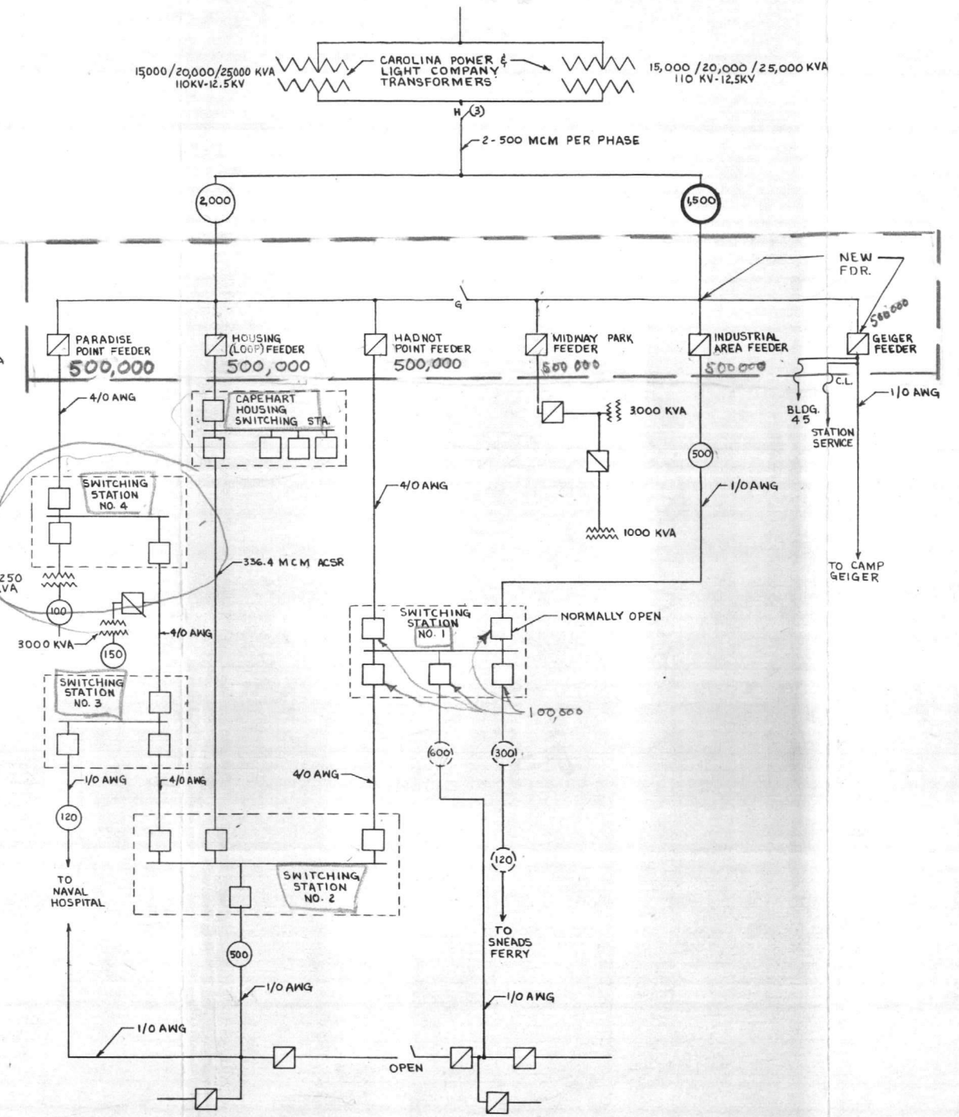
APPROVED 27 JULY 1964
DATE
Elliott B. Robertson
for COMMANDING GENERAL

SCALE GRAPHIC
SHEET 1 OF 45
Y&D DWG. NO. 56700z

FOR OFFICIAL USE ONLY



EXISTING SYSTEM
NOT TO SCALE



PROPOSED SYSTEM
NOT TO SCALE

LEGEND

- (500) VOLTAGE REGULATOR, KVA RATING AS SHOWN (EXISTING)
- (600) VOLTAGE REGULATOR, KVA RATING AS SHOWN (RELOCATED)
- (300) VOLTAGE REGULATOR, KVA RATING AS SHOWN (NEW)
- OIL CIRCUIT BREAKER - 150,000 KVA I/C
- OIL CIRCUIT BREAKER - 100,000 KVA I/C
- OIL CIRCUIT BREAKER - 250,000 KVA I/C
- OIL CIRCUIT BREAKER - 500,000 KVA I/C
- POWER TRANSFORMER - KVA RATING AS SHOWN
- G - THREE-POLE, GANG-OPERATED AIR BREAK SWITCH RATED 14.4 KV, 2,000 AMP
- H - SINGLE POLE, HOOK OPERATED DISCONNECTING SWITCH RATED 14.4 KV, 2,000 AMP
- C.L. - CURRENT LIMITING FUSE

SOUTHEASTERN
CONSULTING ENGINEERS, INC.
CHARLOTTE, NORTH CAROLINA

J. N. PEASE AND COMPANY
ARCHITECTS • ENGINEERS
CHARLOTTE, NORTH CAROLINA

DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS
ATLANTIC DIVISION
NORFOLK 11, VIRGINIA

MARINE CORPS BASE-CAMP LEJEUNE, NORTH CAROLINA
PRELIMINARY ENGINEERING REPORT FY 66
MODIFICATION OF ELECTRICAL DISTRIBUTION SYSTEM

CODE IDENT NO. 80091 | SIZE F | Y&D DRAWING NO. 1036749
SCALE | SPEC. NO. | SHEET 3 OF 3
LANTDIVDOCS DWG. NO. 68749

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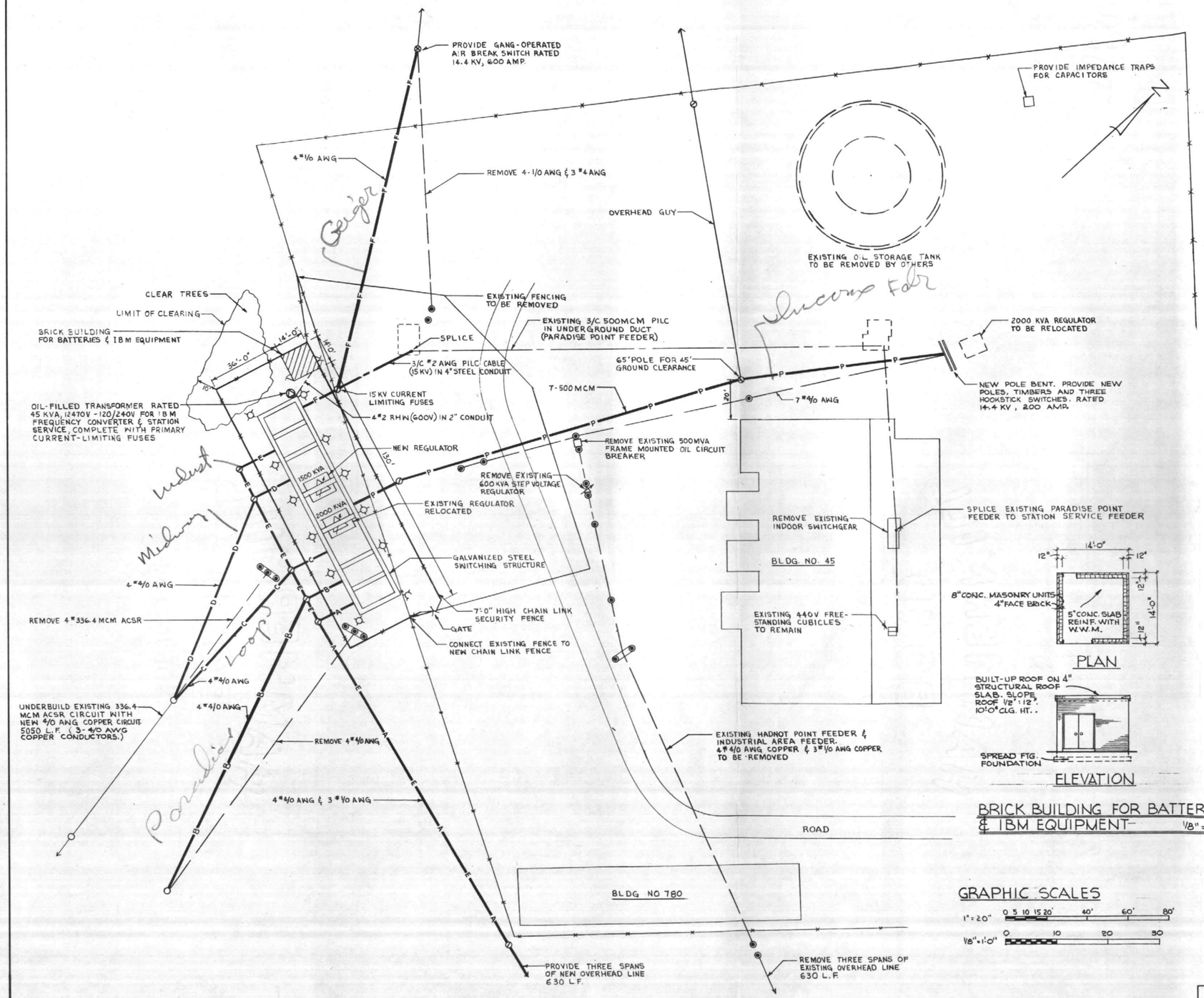


LEGEND

- EXISTING POLE TO BE RE-USED
- EXISTING POLE TO BE REMOVED
- EXISTING POLE TO BE REPLACED
- NEW POLE TO BE PROVIDED
- NEW POWER CIRCUIT BKR. RATING AS INDICATED
- NEW STEP VOLTAGE REG. RATING AS INDICATED
- NEW LUMINAIRE
- EXISTING OVERHEAD PRIMARY LINE
- EXISTING OVERHEAD PRIMARY LINE TO BE REMOVED
- UNDERGROUND LINE IN DUCT OR CONDUIT
- A HADNOT POINT FEEDER (NEW)
- B PARADISE POINT FEEDER (NEW)
- C HOUSING (LOOP) FEEDER (NEW)
- D MIDWAY PARK FEEDER (NEW)
- E INDUSTRIAL AREA FEEDER (NEW)
- F GEIGER FEEDER (NEW)
- P INCOMING FEEDER (NEW)

PLAN

ELEVATION

BRICK BUILDING FOR BATTERIES & IBM EQUIPMENT— 1/8" = 1'-0"

NOTES-

1. CONDUCTORS ARE COPPER UNLESS DESIGNATED OTHERWISE
2. EXISTING INDUSTRIAL FEEDER O.C.B. IS TO BE RELOCATED TO CAMP GEIGER SUBSTATION
3. EXISTING INDUSTRIAL FEEDER REGULATOR IS TO BE RELOCATED TO INDUSTRIAL AREA

GRAPHIC SCALES

1" = 20' 0 5 10 15 20' 40' 60' 80'

1/8" = 1'-0" 0 10 20 30

SOUTHEASTERN CONSULTING ENGINEERS, INC. CHARLOTTE, NORTH CAROLINA

NORTH CAROLINA REGISTERED 2167 ENGINEER BRUCE PARKERSON

J. N. PEASE AND COMPANY ARCHITECTS • ENGINEERS CHARLOTTE, NORTH CAROLINA	DEPARTMENT OF THE NAVY BUREAU OF YARDS & DOCKS ATLANTIC DIVISION NORFOLK 11, VIRGINIA
DES. RT DR. W.J.C. CHK. RT	MARINE CORPS BASE - CAMP LEJEUNE, NORTH CAROLINA
PROJ. MGR. D.M. MACKINTOSH, A.I.A., P.E.	PRELIMINARY ENGINEERING REPORT FY-66
SUBMITTED BY: DATE: 8/12/66 FIRM MEMBER PRINCIPAL	MODIFICATION OF ELECTRICAL DISTRIBUTION SYSTEM
DIRLANTDOCKS REVD. BR. MGR. Lupton ENG. DIR. Osborn	
SATISFACTORY TO: DATE: Chief B. Robertson 8/24/66 COMMANDANT 6 GENERAL	CODE IDENT. NO. 80091 SIZE F Y&D DRAWING NO. 1036748
APPROVED: DATE: 8-13-66 FOR DIRLANTDOCKS FOR CH. BUDOCKS	SCALE SPEC. NBy SHEET 2 OF 3
	LANTDOCKS DWG. NO. 68748

Modification of Electrical Distribution System

Prelim Engr. Repod (1966) by Pease & Asc.

1 25,000KVA, 110KV-12.47KV XMFR.

2 16,000KW in July 1961

3 20,736 KW peak Demand in July 1962

4 this emergency Demand caused a mesasary change drop load from Camp Knox & Monford P & feed CK & MP from Camp G. (under emergency conditions - Added a 600KVA regulator was connected to line side of existing 2000KVA

ELECTRIC POWER SYSTEM PLANNING REPORT

FOR

MARINE CORPS BASE, CAMP LEJEUNE

JACKSONVILLE, NORTH CAROLINA

UTILITIES DIVISION

ATLANTIC DIVISION, BUREAU OF YARDS AND DOCKS

FEBRUARY 1963

PREPARED BY:

Revel D. Crowson

REVEL D. CROWSON
Electrical Engineer

SECTION 1

GENERAL DISCUSSION

INTRODUCTION

In accordance with BUDOCKSINST 11310.15A of 6 October 1960, an analysis of the electrical distribution system at Marine Corps Base, Camp Lejeune, North Carolina, has been completed. The following report contains a discussion of the results of the analysis.

SCOPE

The purposes of this analysis are to determine the behavior of the distribution system under present operating conditions, the behavior of the system under expected future conditions, and the modifications necessary to enable the system to adequately meet those future conditions.

The analysis included a study of the system short-circuit characteristics to determine the adequacy of existing protective devices for interrupting present and expected faults and a load flow study to determine the adequacy of various system components for passing existing and future loads. The BUDOCKS Network Analyzers were employed in both phases of this study.

SUMMARY OF RECOMMENDATIONS

The following corrective measures are recommended to eliminate the defiencies disclosed by the analysis.

1. Replacement of underrated oil circuit breakers at Camp Geiger substation with new switchgear of 150 MVA interrupting capacity.

2. Replacement of marginally rated indoor circuit breakers at Camp Lejeune substation with a new outdoor switching station containing 500 MVA frame-mounted oil circuit breakers.

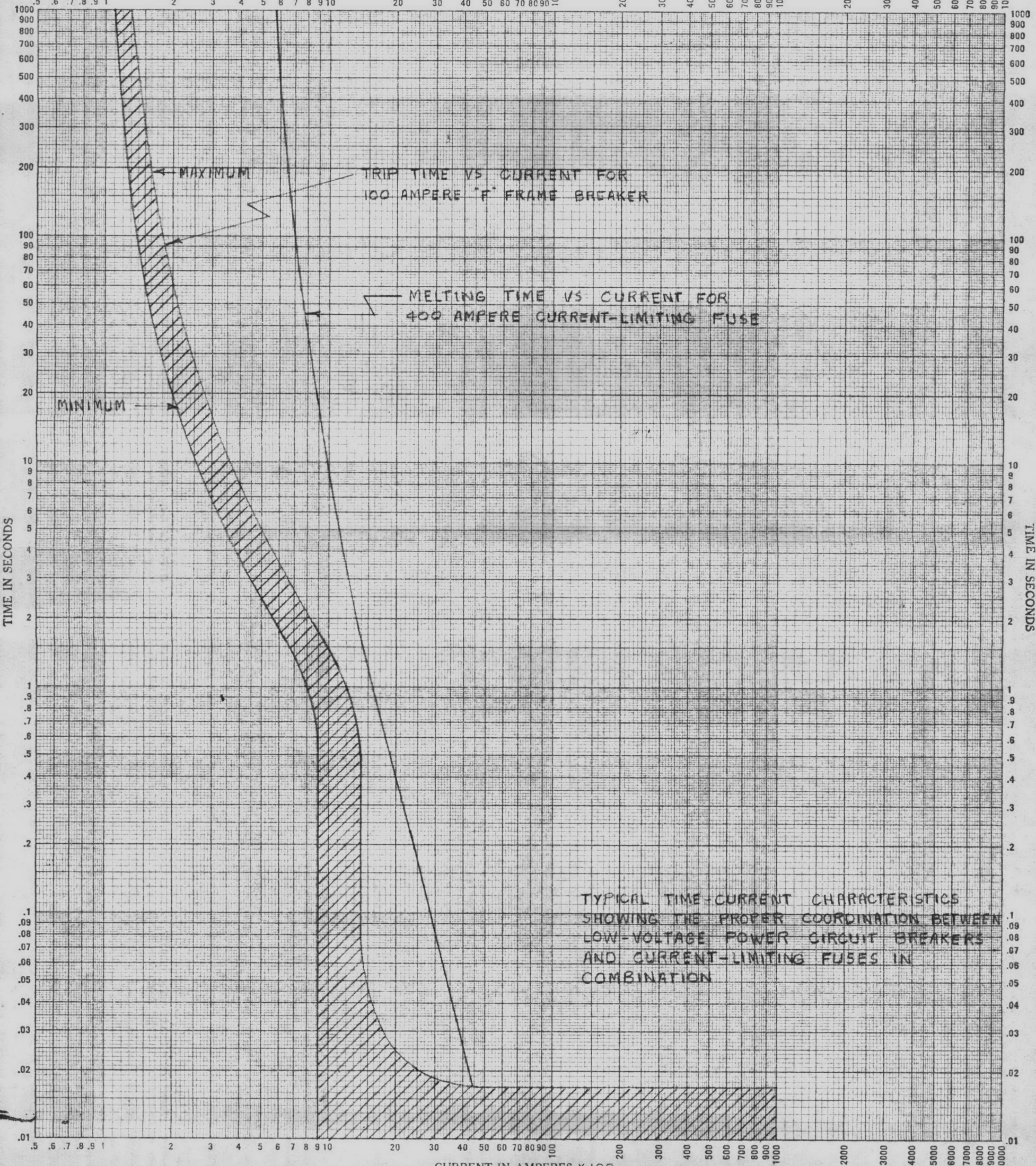
3. Purchase of a new 1500 KVA $\pm$ 10% step voltage regulator to supplement the existing 2000 KVA unit at the Camp Lejeune substation.

4. Reconnection of three radial feeders to the new 1500 KVA regulator to relieve the load on the 2000 KVA unit.

DESCRIPTION OF DISTRIBUTION SYSTEM

The MCB, Camp Lejeune complex receives electric power from the Carolina Power and Light Company through a company-owned 25,000 KVA 110 KV-12.47 KV transformer. This transformer replaced a 12/16/20,000 KVA unit which was disconnected and left in place. All of this power passes through a 2000 KVA $\pm$ 10% step voltage regulator. Two 800 MCM underground circuits with a combined capacity of approximately 1060 amps. serve the 12.47 KV indoor bus through a 1200 amp. main circuit breaker.

CURRENT IN AMPERES



TIME IN SECONDS

TIME IN SECONDS

TYPICAL TIME-CURRENT CHARACTERISTICS SHOWING THE PROPER COORDINATION BETWEEN LOW-VOLTAGE POWER CIRCUIT BREAKERS AND CURRENT-LIMITING FUSES IN COMBINATION

CURRENT IN AMPERES X 100

In July 1962 the peak demand for the station reached 20,736 KW (22,762 KVA) making it apparent that some emergency measures must be taken to divert some of the load from the voltage regulator and the 800 MCM incoming circuits. The following immediate steps were taken and are still in effect.

(1) The Montford Point feeder was opened between Camp Knox and the power plant and closed between Montford Point and Camp Geiger, thereby shifting approximately 1395 KVA to the Geiger substation.

(2) An additional 600 KVA voltage regulator, obtained on a loan basis from Carolina Power and Light Company, was connected on the line side of the 2000 KVA regulator at Camp Lejeune substation, and the Industrial feeder was connected to this new regulator.(See Section 2, Sheet 1). This diverted an additional 4800 KVA from the main regulator. An outdoor oil circuit breaker was moved from a lightly loaded feeder in the Regimental Area to protect this feeder. Subsequent to that time the borrowed regulator was returned to the utility company and was replaced by a rehabilitated 600 KVA regulator owned by the activity.

Although the above changes have eliminated the emergency condition for the present, this situation can be expected to repeat itself by the summer of 1966 if the present rate of load growth continues.

SHORT CIRCUIT STUDIES

The first portion of the study was an analysis of the short-circuit characteristics of the system. Both three-phase and line-to-ground faults were determined for various operating conditions. (See Section 3, Sheets 2 thru 6).

Under present normal operating conditions the circuit breakers at the Camp Lejeune main substation have marginally adequate interrupting capacity. These breakers are rated at 150 MVA at 13.8 KV and slightly less at the operating voltage. The worst condition occurs on line-to-ground faults which could reach as high as 95 per cent of the rated interrupting capacity. This condition should become worse as the utility company continues to expand its system. At the time of this study no information was available on future short-circuit characteristics of the utility system.

Under present and forseeable future conditions all other 12.47 KV circuit breakers on the Camp Lejeune distribution system have adequate interrupting capacity.

At the Camp Geiger substation both 12.47 KV circuit breakers have inadequate interrupting capacity. These breakers are rated at 50 MVA and could be subjected to line-to-ground faults as high as 38 per cent above this value.

One study was performed with the spare 12/16/ 20,000 KVA transformer connected to serve a portion of the system. This was done

in anticipation of the time when the 25,000 KVA unit now in service becomes inadequate to serve the entire load. No significant changes in fault values occurred except in the case where the two transformers are paralleled. During parallel operation faults in excess of 200 MVA could occur at the power plant bus. Faults occurring at any point greater than approximately one mile from the power plant would be within the interrupting rating of the circuit breakers.

LOAD FLOW STUDIES

The load flow portion of this study is divided into two sections. (See Section 3, Sheets 7 thru 10). The first is based on loads metered during the summer of 1962 and shows the division of these loads on the various feeders and the effect of the loads on bus voltages for various operating conditions. The second section shows load division and bus voltage regulation under expected future summer load conditions.

Under existing load conditions all feeders have adequate capacity for the loads they are carrying. However, two voltage regulators, in addition to the main regulator, are passing loads in excess of their ratings. The 120 KVA regulator on the Courthouse Bay radial carries a 1310 KVA load, while the 300 KVA on the Industrial feeder carries a peak load of 4300 KVA.

Bus voltages at most locations were within tolerable limits, although the 12.12 KV at the Capehart Housing switching station and the 11.57 KV at the Old Trailer Park tap might cause some trouble if transformer taps in these areas cannot provide an adequate boost. The bus voltage in the Rifle Range Area was 11.42 KV; however, it should be noted that this value occurs with the feeder voltage regulator operating at only 5 per cent boost. All of these voltage values are based on a power plant bus voltage of 12.8 KV.

CONCLUSIONS

At the present rate of load growth the entire station demand will climb to approximately 25,850 KVA by late 1965 or the summer of 1966. (See Section 2, Sheet 4). This value includes the Camp Knox and Montford Point loads which are presently being fed from Camp Geiger substation. Assuming no major system alterations during the interim, the following conditions will prevail at that time.

(1) The 2000 KVA main regulator will be loaded approximately 2 per cent in excess of its capacity.

(2) The 600 KVA regulator serving the Industrial Feeder will be operating at 91 per cent of capacity.

(3) The load on the 800 MCM main service cables will be 89 per cent of the conductor capacity.

From the preceding discussion the following conclusions can be drawn:

(1) Switchgear of higher interrupting capacity should be installed at the Camp Geiger Substation to meet present requirements.

(2) By 1966 additional transformer and voltage regulator capacity and switchgear of higher interrupting capacity will be required at the Camp Lejeune main substation.

RECOMMENDATIONS

A number of proposals for increasing the system capacity suggest themselves; these will be described here with comments on the advantages and disadvantages of each.

Camp Geiger

Proposal 1. Install a new 13.8 KV, 600A, 150 MVA outdoor oil circuit breaker to replace the existing 50 MVA unit serving the Camp Geiger Area. Cost of this project will be approximately $4200.

Proposal 2. Exchange the existing 50 MVA breaker with a unit of higher interrupting capacity from the Regimental Area. The only cost would be that involved in making the transfer.

Although Proposal 2 has immediate economic advantages, the 50 MVA breaker in the Regimental Area would become underrated in the event the utility company parallels two transformers at the Camp Lejeune Substation. Proposal 1 is recommended as best suiting the long range needs of the activity.

Camp Lejeune

Proposal 1. Purchase a new 1500 KVA regulator to replace the 600 KVA unit now at the main substation. Construct a new outdoor substation to replace the existing main substation. This proposal is diagrammed in section 2, sheet 2. The new station would be of the unit type with 1200 amp 500 MVA air circuit breakers. The bus tie breaker would remain open except in the event of loss of service from one of the regulators. The construction of a new section of overhead line to serve Midway Park would be required. The most direct route for this line would be along North Carolina Highway No. 24, a distance of 3300 feet; however, the most economical construction would be to underbuild the Housing Loop feeder to the point where the present Midway Park feeder begins.

This proposal provides breakers with sufficient interrupting capacity to meet any foreseeable needs and regulator capacity adequate for the next ten to fifteen years. The cost of this project would be approximately $270,000.

Proposal 2. This proposal differs from proposal 1 in that it employs an outdoor switching station with frame-mounted bank type oil circuit breakers in lieu of the unit substation construction. Although this

construction requires additional space, it can be built for approximately $50,000 less than the unit type and is easier to maintain and modify.

Proposal 3. This is identical to Proposal 2 except that it calls for relocating six 600 AMP 500 MVA circuits breakers from the Regimental Area to the new substation for use as feeder breakers. The relocated breakers would be replaced in the Regimental Area by new 600 AMP 150 MVA units. Three new 1200 AMP 500 MVA breakers would be purchased for use as the main secondaries and the bus tie. Although 1200 AMP feeder breakers would allow more room for system growth, the 600 AMP units are 13 per cent above the thermal capacity of the largest circuit conductor. The cost of this proposal would be approximately $200,000.

Proposal 4. This calls for the use of a single voltage regulator instead of the two specified previously. On the basis of the present rate of load growth it is felt that the smallest practical single regulator would be a 3500 KVA unit.

The substation could be similar to either of the other proposals except that one main secondary breaker and the bus tie breaker would be eliminated, and the other main secondary would increase to 2000 AMP capacity.

The existing 2000 KVA regulator could be salvaged, held in storage for some future need, or placed in service at some other location in the system.

Assuming a substation as described in Proposal 2, this project would cost approximately $250,000.

Besides its high cost, this proposal has the disadvantage of making the entire activity dependent upon the proper operation of a single regulator and circuit breaker. Failure of either of these units could result in loss of service to the entire station over an extended period.

Proposal 5. This is identical to Proposal 4 except that instead of installing a new 3500 KVA regulator the existing 2000 KVA unit would be reconnected for 4000 KVA and ± 5% regulation.

Although this project is less costly (total cost, $160,000) than the others, it offers the same disadvantage as described for Proposal 4. In addition, the loss of the services of the regulator during the time required for reconnecting could create voltage problems throughout the system. The work on the regulator could be best accomplished in a large service shop and would require about two months. If the work took place during the winter when the regulator normally is required to lower the incoming voltage, extensive damage to lighting equipment could result. If the regulator was out of service during the summer when the incoming voltage normally must be raised, the resultant low voltage might do considerable damage to rotating machinery.

Either of the above substation types could be tied into the utility company service with little difficulty. The open switching station offers one added advantage in this respect in that it eliminates the necessity for an overhead to underground transition which is costly to install.

It is anticipated that additional transformer capacity will have been connected at the Camp Lejeune main substation by the summer of 1966. Although the type of service to be provided has not been discussed with Carolina Power and Light Company by this office, it is felt that the 20,000 KVA transformer in reserve at Lejeune substation will be connected in some manner. (See Section 2, Sheet 3).

From the standpoint of the operation of the activity system it is more desirable to connect the second transformer as a separate unit to serve the 1500 KVA regulator, since this would limit fault currents to values similar to present levels. (See Section 3, Sheet 5). However, this connection might be construed as a separate point of service and would require negotiation with the utility company in an attempt to obtain conjunctive billing. With the concurrence of the activity this office will initiate any necessary negotiations with the utility company.

The other and less desirable method would be with the two transformers in parallel. This would increase fault values at the main substation above 200 MVA. The possibility of paralleling the transformer was the governing factor in the selection of 500 MVA switchgear for the new substation. Assurances of independent connection of the transformers would reduce the interrupting duty requirement to 250 MVA with a resultant reduction in the cost of the project.

On the basis of the preceding discussions Proposal 2 for the Camp Lejeune substation is recommended as best fitting the economic and operational needs of the activity. The proposed substation will provide adequate fault protection and load carrying capacity for the next several years, and at the same time provides a flexible system which can be easily expanded to meet any foreseeable demands.

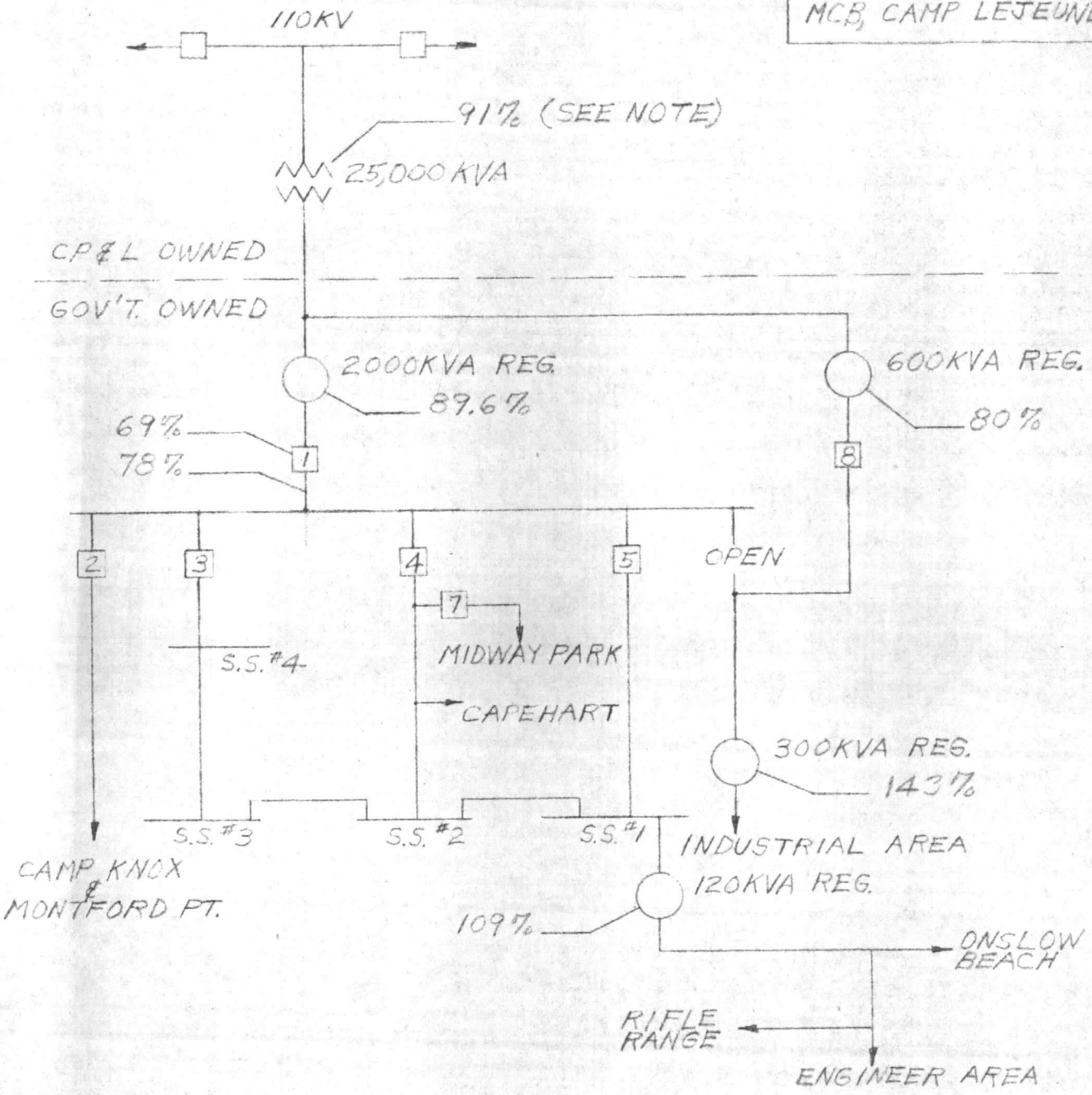
SECTION 2

CIRCUIT DIAGRAMS

AND

LOAD CURVES

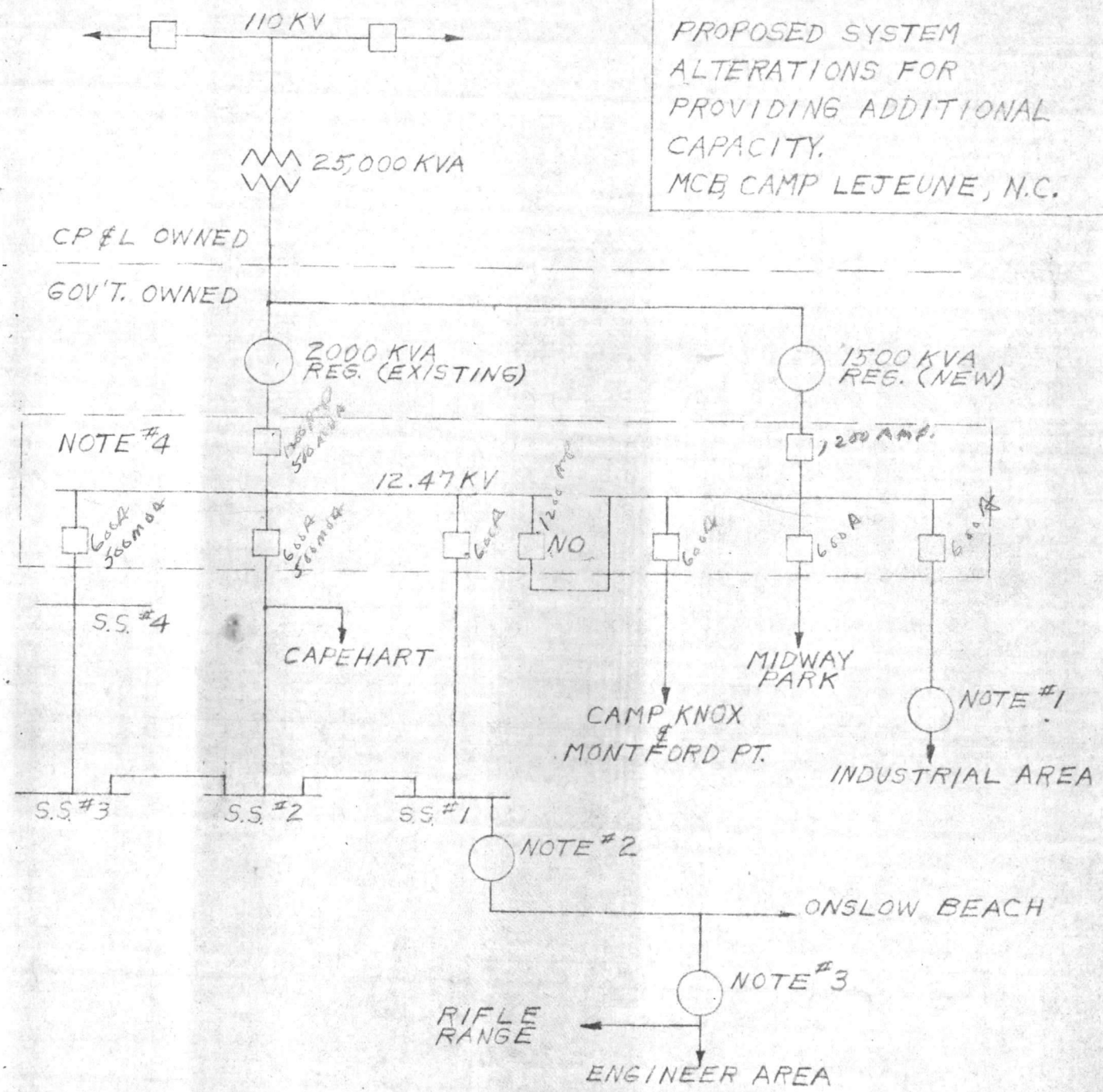
EXISTING SYSTEM
CONNECTIONS, 1-63
MCB, CAMP LEJEUNE, N.C.



NOTE: INDICATES LOADING IN PER CENT OF RATED CAPACITY DURING JULY, 1962.

1-25-63 RDC
SHEET 1

PROPOSED SYSTEM
ALTERATIONS FOR
PROVIDING ADDITIONAL
CAPACITY.
MCB, CAMP LEJEUNE, N.C.

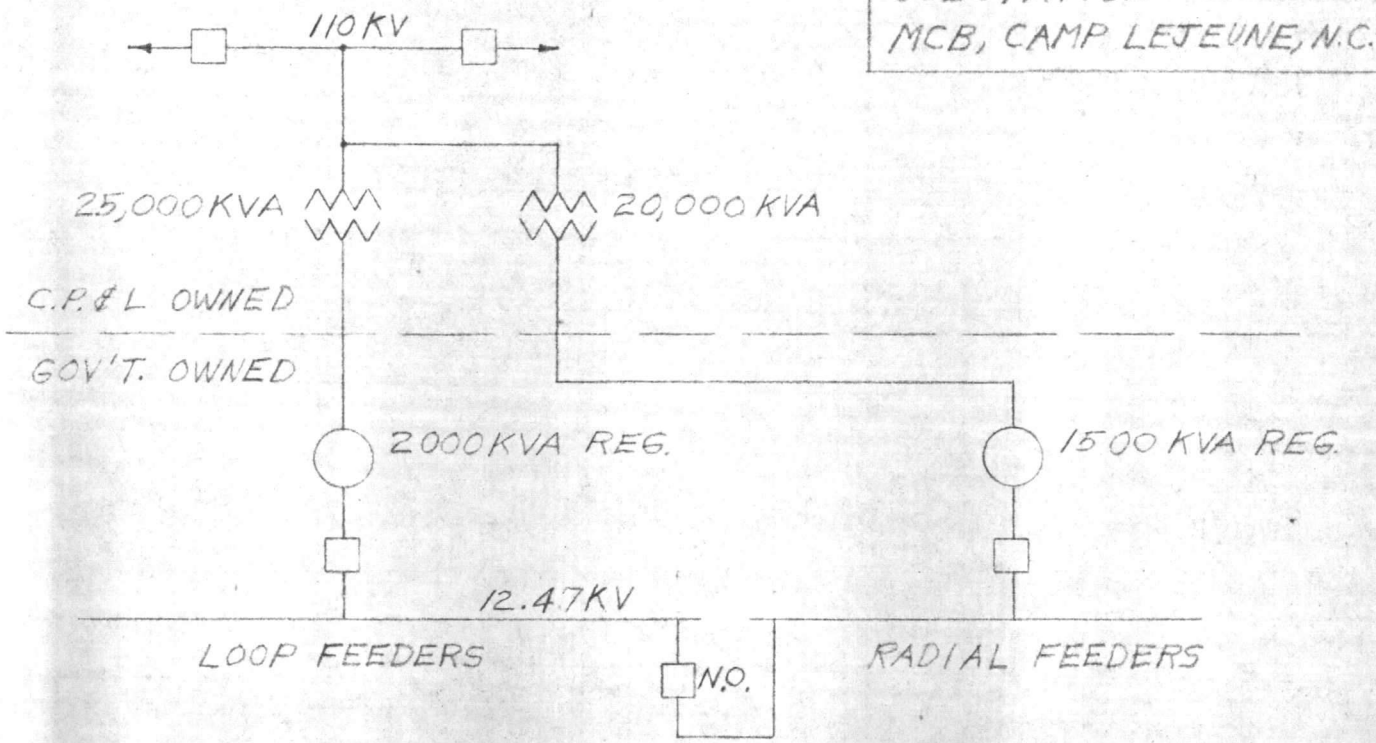


NOTES:

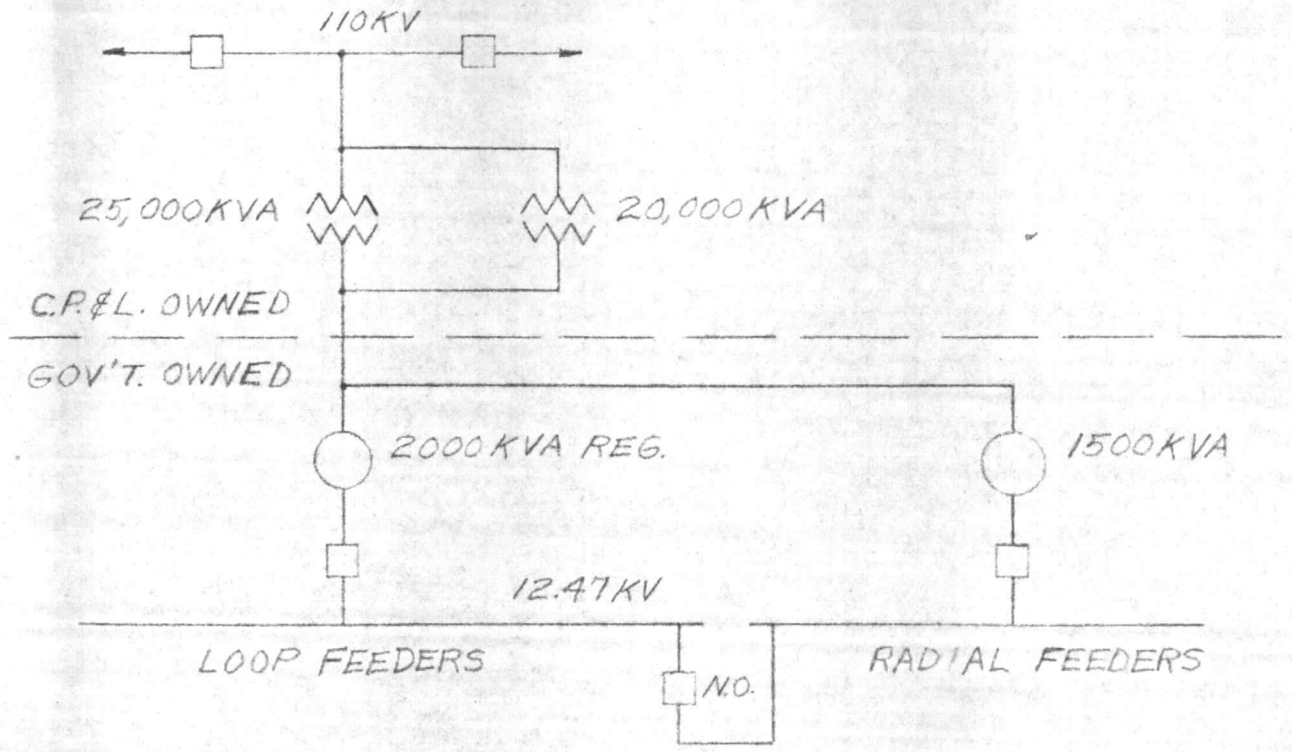
1. 600KVA REGULATOR RELOCATED FROM MAIN SUBSTATION. REPLACES EXISTING 300KVA UNIT.
2. 300KVA REGULATOR RELOCATED FROM INDUSTRIAL AREA. REPLACES EXISTING 120KVA UNIT.
3. RELOCATED 120KVA REGULATOR.
4. NEW OUTDOOR SUBSTATION. MAIN BREAKERS ARE 1200AMP 500MVA. FEEDER BREAKERS ARE 600AMP 500MVA.
5. PROPOSED CHANGES SHOULD BE ACCOMPLISHED PRIOR TO TIME ADDITIONAL MAIN TRANSFORMER CAPACITY IS REQUIRED.

1-25-63: RDC

CONNECTION OF SPARE TRANSFORMER AT MAIN SUBSTATION
MCB, CAMP LEJEUNE, N.C.

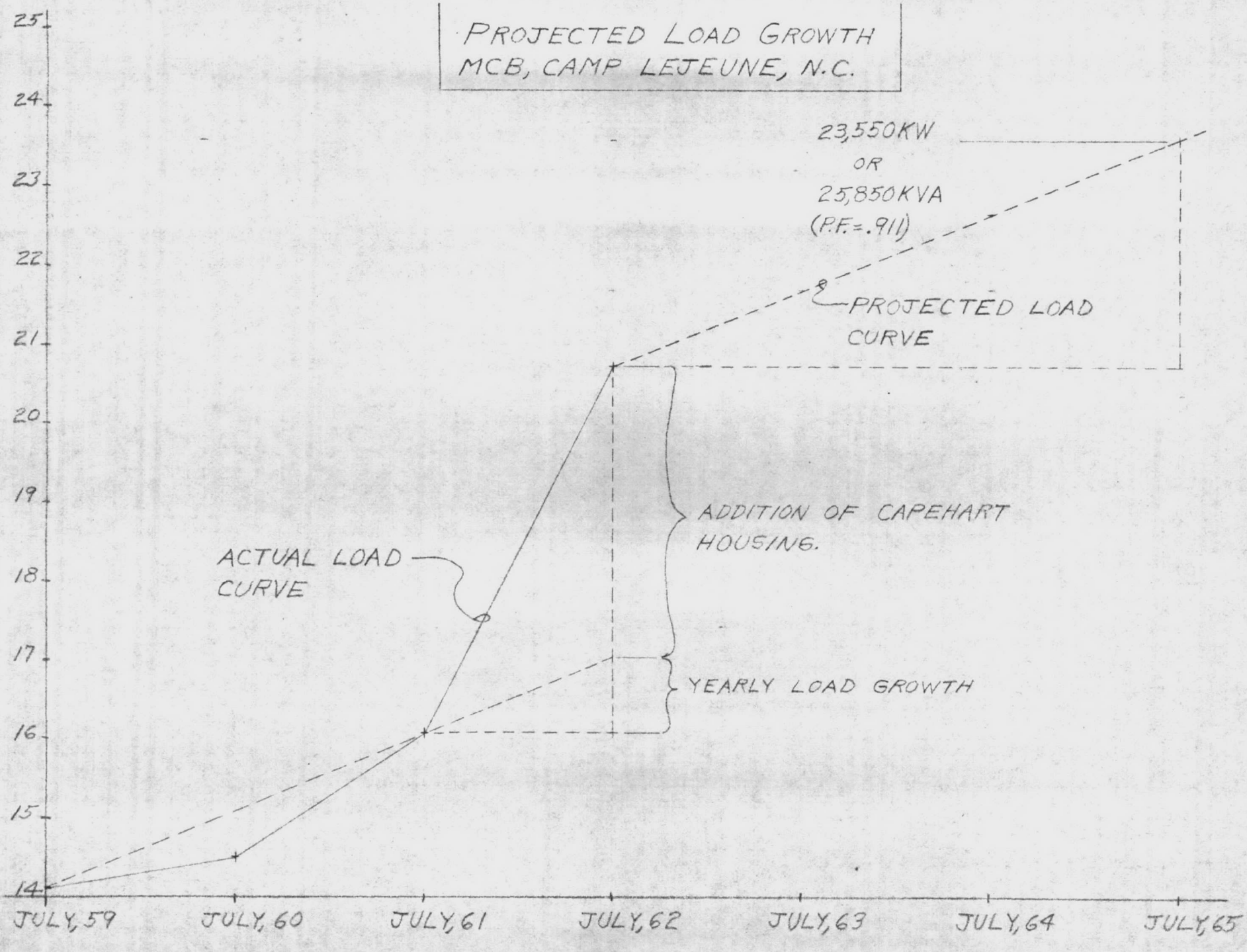


PREFERRED CONNECTION



1-25-63: RDC
SHEET 3.

PROJECTED LOAD GROWTH
MCB, CAMP LEJEUNE, N.C.



1-25-63: RDC
SHEET 4.

SHEET 5

KW DEMAND X 10^3

12 13 14 15 16 17 18 19 20 21

JUL. 59
AUG.
SEPT.
OCT.
NOV.
DEC.
JAN. 60
FEB.
MAR.
APR.
MAY
JUN.
JUL.
AUG.
SEPT.
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NOV
DEC.
JAN. 61
FEB
MAR.
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JUN.
JUL.
AUG.
SEPT.
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DEC.
JAN. 62
FEB
MAR
APR.
MAY
JUN.
JUL.
AUG.

OCT, 59-61

APR, 60-62

JAN, 60-62

JULY, 59-62

ELECTRIC DEMAND CURVE
MCB, CAMP LEJEUNE, N.C.

SECTION 3

SHORT-CIRCUIT

AND

LOAD FLOW STUDIES

$Z_1 = 0.00292 + j\,0.01464$
$Z_0 = 0.00624 + j\,0.02923$ } AUG. 1962

TO JACKSONVILLE

110 KV BUS

15,000/20,000/25,000 KVA
$Z = 0.06$

2,000 KVA

12,470 BUS

SEE NOTE 1

LEGEND

(500 KVA) — VOLTAGE REGULATOR, SIZE INDICATED

□ — OIL CIRCUIT BREAKER

NOTE 1. U.G. CABLE TO MIDWAY PARK, NOT IN USE; 3250 FT., 3-500 MCM.

NOTE 2. ALL IMPEDANCES ARE PER UNIT ON A 10 MVA BASE.

14,525' 3-#4/0 O.H.
$Z_1 = 0.0538 + J\,0.1233$
$Z_0 = 0.1045 + J\,0.5300$

12,100' 4-#1/0 O.H.
$Z_1 = 0.0895 + J\,0.1150$
$Z_0 = 0.1633 + J\,0.2960$

5,000' 4-336.4 ASCR O.H.
$Z_1 = 0.0187 + J\,0.0394$
$Z_0 = 0.0390 + J\,0.1000$

4,640' 4-336.4 ASCR O.H.
$Z_1 = 0.0173 + J\,0.0366$
$Z_0 = 0.0362 + J\,0.0930$

MIDWAY PARK

7,925' 3-#1/0 & 1-#4 O.H.
$Z_1 = 0.0585 + J\,0.0753$
$Z_0 = 0.1300 + J\,0.2440$

3-1,000 KVA, Δ-Y
12,470-4160/2400 V
$Z_1 = Z_0 = 0.1485$

1-999 KVA, Δ-Y
12,470-4160/2400 V
$Z_1 = Z_0 = 0.53$

5,000' 3#1/0 O.H.
$Z_1 = 0.0370 + J\,0.0475$
$Z_0 = 0.0545 + J\,0.1850$

CAPE HART HOUSING

3,170' 3-#1/0 O.H.
$Z_1 = 0.0234 + J\,0.0301$
$Z_0 = 0.0365 + J\,0.0672$

13,850' 4-336.4 ASCR O.H.
$Z_1 = 0.0518 + J\,0.1095$
$Z_0 = 0.1074 + J\,0.2655$

SW. STA. NO. 4

7,500' 3-#4/0 & 1-#4 O.H.
$Z_1 = 0.0278 + J\,0.0638$
$Z_0 = 0.0955 + J\,0.2080$

3-1,000 KVA
$Z_1 = Z_0 = 0.1749$

3-750 KVA, Δ-Δ
12,470-2400 V
$Z_1 = Z_0 = 0.205$

PARADISE POINT

6,875' 4-#1/0 O.H.
$Z_1 = 0.0508 + J\,0.0653$
$Z_0 = 0.0928 + J\,0.1685$

5,000' 4-#4 O.H.
$Z_1 = 0.0930 + J\,0.0485$
$Z_0 = 0.1380 + J\,0.1445$

CAMP KNOX

2,000' 4-#4 O.H.

MONTFORD POINT

2,125' 4-#1/0 O.H.
$Z_1 = 0.0157 + J\,0.0202$
$Z_0 = 0.0287 + J\,0.0521$

4,200' 4-#4 O.H.
$Z_1 = 0.0780 + J\,0.0407$
$Z_0 = 0.1160 + J\,0.1213$

8,675' 3-#4/0 & 1-#4 O.H.
$Z_1 = 0.0320 + J\,0.0735$
$Z_0 = 0.1106 + J\,0.2400$

SW. STA. NO. 3

2,450' 4-#4/0 O.H.
$Z_1 = 0.0091 + J\,0.0208$
$Z_0 = 0.0186 + J\,0.0517$

370' 3-#4/0 O.H.
$Z_1 = 0.0014 + J\,0.0032$
$Z_0 = 0.0027 + J\,0.0085$

370' 4-#4/0 O.H.
$Z_1 = 0.0014 + J\,0.0032$
$Z_0 = 0.0027 + J\,0.0091$

SW. STA. NO. 2

1,995' 4-#4/0 O.H.
$Z_1 = 0.0074 + J\,0.0170$
$Z_0 = 0.0152 + J\,0.0420$

800' 4-#4/0 O.H.
$Z_1 = 0.0030 + J\,0.0067$
$Z_0 = 0.0058 + J\,0.0197$

SW. STA. NO. 1

22,550' 4-#4/0 O.H.
$Z_1 = 0.0796 + J\,0.1830$
$Z_0 = 0.1550 + J\,0.4970$

5800' 3#1/0 O.H.
$Z_1 = 0.043 + J\,0.055$
$Z_0 = 0.0632 + J\,0.215$

SCHOOL

900' 3-#4 O.H.
$Z_1 = 0.0177 + J\,0.0092$
$Z_0 = 0.0209 + J\,0.0359$

12,250' 3-#1/0 O.H.
$Z_1 = 0.0906 + J\,0.1162$
$Z_0 = 0.1385 + J\,0.2660$

3,300' 4-#4/0 O.H.
$Z_1 = 0.0122 + J\,0.0280$
$Z_0 = 0.0238 + J\,0.1205$

3050' 3-#4 O.H.
$Z_1 = 0.0566 + J\,0.0296$
$Z_0 = 0.0670 + J\,0.1155$

OLD TRAILER PARK

1,575' 3-#1/0 O.H.
$Z_1 = 0.0117 + J\,0.0149$
$Z_0 = 0.0178 + J\,0.0342$

2,900' 3-#1/0 O.H.
$Z_1 = 0.0214 + J\,0.0275$
$Z_0 = 0.0328 + J\,0.0630$

INDUSTRIAL AREA

3800' 3-#4 O.H.
$Z_1 = 0.0707 + J\,0.0368$
$Z_0 = 0.0837 + J\,0.1440$

SNEADS FERRY ROAD

300 KVA

5,500' 3-#1/0 O.H.
$Z_1 = 0.0407 + J\,0.0523$
$Z_0 = 0.0600 + J\,0.2030$

400' 3-#1/0 O.H.
$Z_1 = 0.0030 + J\,0.0038$
$Z_0 = 0.0044 + J\,0.0148$

19,75' 4-#1/0 O.H.
$Z_1 = 0.1420 + J\,0.1820$
$Z_0 = 0.2590 + J\,0.4700$

250' 4-#1/0 O.H.
$Z_1 = 0.00185 + J\,0.0024$
$Z_0 = 0.0034 + J\,0.0061$

150 KVA

3900' 4-#1/0 O.H.
$Z_1 = 0.0289 + J\,0.0370$
$Z_0 = 0.0527 + J\,0.0955$

NO

500 KVA

370' 3-#1/0 O.H.
$Z_1 = 0.0027 + J\,0.0035$
$Z_0 = 0.0042 + J\,0.0080$

2,450' 4-#1/0 O.H.
$Z_1 = 0.0181 + J\,0.0232$
$Z_0 = 0.0331 + J\,0.0600$

800' 3-#1/0 O.H.
$Z_1 = 0.0059 + J\,0.0076$
$Z_0 = 0.0090 + J\,0.0174$

500 KVA

120 KVA

2,900' 3-#1/0 O.H.
$Z_1 = 0.0214 + J\,0.0276$
$Z_0 = 0.0316 + J\,0.1072$

1,200' 4-#1/0 O.H.
$Z_1 = 0.0089 + J\,0.0114$
$Z_0 = 0.0162 + J\,0.0294$

1,400' 4-#1/0 O.H.
$Z_1 = 0.0104 + J\,0.0132$
$Z_0 = 0.0189 + J\,0.0342$

37,175' 3-#1/0 O.H.
$Z_1 = 0.2750 + J\,0.3530$
$Z_0 = 0.4050 + J\,1.3700$

39,585' 3-#4 O.H.
$Z_1 = 0.7360 + J\,0.3840$
$Z_0 = 0.8700 + J\,1.4970$

5,300' 4-#1/0 O.H.
$Z_1 = 0.0392 + J\,0.0503$
$Z_0 = 0.0715 + J\,0.1300$

CAMP GEIGER

5,000' 3-#1/0 O.H.
$Z_1 = 0.0370 + J\,0.0475$
$Z_0 = 0.0545 + J\,0.1850$

2,900' 3-#4/0 & 1-#1/0 O.H.
$Z_1 = 0.0172 + J\,0.0248$
$Z_0 = 0.0280 + J\,0.0685$

2,800 4-#1/0 O.H.
$Z_1 = 0.0208 + J\,0.0266$
$Z_0 = 0.0378 + J\,0.0687$

TRIANGLE OUTPOST & "C" RANGE

1,495' 3-#1/0 O.H.
$Z_1 = 0.0111 + J\,0.0142$
$Z_0 = 0.0163 + J\,0.0552$

3-150 KVA, Δ-Δ
12,470-2400 V
$Z_1 = Z_0 = 0.644$

2,050' 3-#4 O.H.
$Z_1 = 1.0300 + J\,0.5370$
$Z_0 = 1.2180 + J\,2.1000$

ONSLOW BEACH

MCAF

NO

NAVHOSP

REGIMENTAL AREA

1,400' 3-#1/0 O.H.
$Z_1 = 0.0104 + J\,0.0133$
$Z_0 = 0.0186 + J\,0.0338$

350' 4-#1/0 O.H.
$Z_1 = 0.0026 + J\,0.0033$
$Z_0 = 0.0047 + J\,0.0086$

175' 4-#1/0 O.H.
$Z_1 = 0.0013 + J\,0.0017$
$Z_0 = 0.0024 + J\,0.0043$

27,930' 3-#1/0 O.H.
$Z_1 = 0.2070 + J\,0.2650$
$Z_0 = 0.3050 + J\,1.0330$

6,600' 3-#4 O.H.
$Z_1 = 0.1230 + J\,0.0640$
$Z_0 = 0.1455 + J\,0.2500$

750 KVA

7,500 KVA
110 KV-12,470/7200 V
$Z = 0.1347$

TO JACKSONVILLE

$Z_1 = 0.00299 + j\,0.01338$
$Z_0 = 0.00533 + j\,0.02714$ } AUG. 1962

250' 3-#4 O.H.
$Z_1 = 0.0047 + J\,0.0024$
$Z_0 = 0.0055 + J\,0.0095$

40,350' 3-#1/0 O.H.
$Z_1 = 0.2990 + J\,0.3840$
$Z_0 = 0.4400 + J\,1.4900$

5,275' 3-#4 O.H.
$Z_1 = 0.0982 + J\,0.0512$
$Z_0 = 0.1160 + J\,0.1995$

3-250 KVA Δ-Δ
12,470-2400 V
$Z_1 = Z_0 = 0.68$

RIFLE RANGE

COURTHOUSE BAY

LANTDOCKS DWG. NO.	
WORK REQ. NO.	
DES.	
DRWN. JDV	
TR.	
CHK.	
BR. MGR.	
ENG. DIR.	
SATISFACTORY TO / DATE	
APPROVED / DATE	
DIR LANTDOCKS FOR CH. BUDOCKS	

DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS
ATLANTIC DIVISION
NORFOLK 11, VIRGINIA

MARINE CORPS BASE
CAMP LEJEUNE, N.C.
IMPEDANCE DIAGRAM

CODE IDENT. NO.	SIZE	Y&D DRAWING NO
80091	F	

SCALE — SPEC — NBy — SHEET 1 OF 10

1-10-63 RDC

LEGEND

(500 KVA) — VOLTAGE REGULATOR, SIZE INDICATED

□ — OIL CIRCUIT BREAKER

NOTE 1. U.G. CABLE TO MIDWAY PARK, NOT IN USE; 3250 FT., 3-500 MCM.
2. FAULT VALUES IN MVA.

TO JACKSONVILLE

110 KV BUS

680

15,000/20,000/25,000 KVA

2,000 KVA

1

12,470 BUS

130

2

3

4 — SEE NOTE 1

5

6

(4) 73.5

45.5

27

(4) 85.5

7 — MIDWAY PARK

9 — 3-1,000 KVA, Δ-Y, 12,470-4160/2400 V

36

1-999 KVA, Δ-Y, 12,470-4160/2400 V

11.5

10.5 (4)

13

51.5 (6)

15

(6) 69

16

17 (6)

17

CAPE HART HOUSING

14

SCHOOL — 67

10 — 38.5 (1)

57.5 (1)

SW. STA. NO. 4

11 — 18 (1)

12

27 (2)

18

53 (2)

3-1,000 KVA

3-750 KVA, Δ-Δ, 12,470-2400 V

25 (2)

PARADISE 28

POINT 26.5

44 — CAMP KNOX

31

32

MONTFORD POINT

29

SW. STA. NO. 3

19 — 18 (3)

38 (3)

20

57 (3)

21

150 KVA

15.5 (5)

24 (5)

SW. STA. NO. 2

22

23

24 — 20 (5)

61 (5)

25

500 KVA

34 (7)

26

SW. STA. NO. 1

23.5 (7)

27

59 (7)

28

29

30 — NO

INDUSTRIAL AREA

28 — 300 KVA

OLD TRAILER PARK

34

SNEADS FERRY ROAD

32

NO

CAMP GEIGER

41

500 KVA

120 KVA

TRIANGLE OUTPOST & "C" RANGE

3-150 KVA, Δ-Δ, 12,470-2400 V

ONSLOW BEACH

33

8

55

34

35

44

37

36

15

14

38

NO

REGIMENTAL AREA

NAVHOSP 44

MCAF

32

65

750 KVA

7,500 KVA
110 KV-12,470/7200 V

TO JACKSONVILLE

INDICATES OPEN CIRCUIT

40

6.5

RIFLE RANGE

9.7

59

3-250 KVA Δ-Δ
12,470-2400 V

COURTHOUSE BAY

LANTDOCKS DWG. NO.	
WORK REQ. NO.	
DES.	
DRWN. JDV	
TR.	
CHK.	
BR. MGR.	
ENG. DIR.	
SATISFACTORY TO DATE	
APPROVED DATE	
DIRLANTDOCKS FOR CH. BUDOCKS	

DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS

ATLANTIC DIVISION

NORFOLK 11, VIRGINIA

MARINE CORPS BASE
CAMP LEJEUNE, N. C.
3 PHASE FAULT DISTRIBUTION
NORMAL OPERATION, 1963

CODE IDENT. NO.	SIZE	Y&D DRAWING NO
80091	F	

SCALE — SPEC — NBy — SHEET 2 OF 10

1-10-63 RDC

LEGEND

500 KVA — VOLTAGE REGULATOR, SIZE INDICATED

□ — OIL CIRCUIT BREAKER

NOTE 1. U.G. CABLE TO MIDWAY PARK, NOT IN USE; 3250 FT., 3-500 MCM.

CASE [A] SW 1 CLOSED, B 2 OPEN, SW 2 OPEN, SW 3 CLOSED, SW 4 OPEN B 30 CLOSED.

CASE [B] SAME AS [A] EXCEPT B 20 OPEN.

CASE [C] SAME AS [A] EXCEPT B 24 OPEN.

CASE [D] SAME AS [B] + [C]

CASE [E] SAME AS [A] EXCEPT B 3 OPEN.

CASE [F] SAME AS [A] EXCEPT B 4 OPEN.

TO JACKSONVILLE

110 KV BUS

15,000/20,000/25,000 KVA

2000 KVA

1

12,470 BUS

SEE NOTE 1

2 — 23 [A] — CAMP KNOX

3

4

5

6

7 — MIDWAY PARK

9 — 3-1,000 KVA, Δ-Y, 12,470-4160/2400 V

1-999 KVA, Δ-Y, 12,470-4160/2400 V

13

15 — CAPEHART HOUSING

16

17

14

10

SW. STA. NO. 4 — 26 [E]

11 — 12

18 — 32 [E]

3-1,000 KVA — 3-750 KVA, Δ-Δ, 12,470-2400 V

PARADISE POINT

31 — 28.5 [A] — MONTFORD POINT

31 [A]

SCHOOL

OLD TRAILER PARK

25.5 [C](1) / 22 [F](3)

18 [C](2) / 19 [F](1)

27 [E](1) / 27 [B](1)

23 [E](1) / 28 [C](2) / 23 [B](1) / 24 [F](1)

25 [B](2) / 24 [E](2) / 27 [F](2)

26 [B](2) / 25 [E](2) / 27 [F](2)

SW. STA. NO. 3

19 — 20 [E](1) / 21 [F](3)

20

22

23

SW. STA. NO. 2

24

SW. STA. NO. 1

26

27

26.5 [B] / 46 [C](1) / 26 [D] / 44 [E] / 43 [F](3)

21

150 KVA

25

500 KVA

50.5 [B](1) / 46.5 [C](2) / 33 [D] / 50 [E](1) / 43.5 [F](1)

28

500 KVA

29

50 [B](2) / 31 [C] / 31.5 [D] / 49.5 [E](2) / 44.5 [F](2)

30 — NO — INDUSTRIAL AREA

Sw. 5 — 300 KVA — 41 [A] / 26.5 [D]

Sw. 4

SNEADS FERRY ROAD

Sw. 6

120 KVA

NO Sw. 1

CAMP GEIGER

MCAF

32 — G5 [A]

750 KVA

7,500 KVA, 110 KV-12,470/7200 V

TO JACKSONVILLE

8

33 — 34 — 31 [D]

Sw. 2 — NO — Sw. 3

REGIMENTAL AREA

40 [A] / 26 [D]

NAVHOSP

35 — 36 — 37 — 27 [D]

TRIANGLE OUTPOST & "C" RANGE

12.5 [D]

38 — 3-150 KVA, Δ-Δ, 12,470-2400 V — ONSLOW BEACH

40 — RIFLE RANGE

39 — 3-250 KVA Δ-Δ, 12,470-2400 V — COURTHOUSE BAY

LANTDOCKS DWG. NO.	
WORK REQ. NO.	
DES.	
DRWN. JDV	
TR.	
CHK.	
BR. MGR.	
ENG. DIR.	
SATISFACTORY TO	DATE
APPROVED	DATE
DIRLANTDOCKS FOR CH. BUDOCKS	

DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS

ATLANTIC DIVISION

NORFOLK 11, VIRGINIA

MARINE CORPS BASE

CAMP LEJEUNE, N. C.

THREE PHASE FAULT DISTRIBUTION, 1963

CODE IDENT. NO.	SIZE	Y&D DRAWING NO
80091	F	
SCALE	SPEC NBy	SHEET 3 OF 10

1-10-63 RDC

LEGEND

500 KVA — VOLTAGE REGULATOR, SIZE INDICATED

□ — OIL CIRCUIT BREAKER

NOTE 1. U.G. CABLE TO MIDWAY PARK, NOT IN USE; 3250 FT., 3-500 MCM.

TO JACKSONVILLE

110 KV BUS

15,000/20,000/25,000 KVA

2,000 KVA

1

135

12,470 BUS

SEE NOTE 1

I_1+I_2: 42.5 (4)
I_0: 21.5 (4)

74.5 (4)

7 MIDWAY PARK

9 3-1,000 KVA, Δ-Y
12,470 - 4160/2400 V

29.5
1-999 KVA, Δ-Y
12,470 - 4160/2400 V

I_1+I_2: 6 (9)
I_0: 2.8 (9)

13

15

I_1+I_2: 27.5 (6)
I_0: 14.25 (6)

57 (6)

14

I_1+I_2: 9.1 (6)
I_0: 4.15 (6)

17 CAPEHART HOUSING

14

2

3

I_1+I_2: 8.1 (1)
I_0: 5 (1)

10

I_1+I_2: 17 (1)
I_0: 7.5 (1)

39 (1)

SW. STA. NO. 4

11

12

35

MONTFORD POINT CAMP KNOX

I_1+I_2: 12 (2)
I_0: 5 (2)

37 (2)

18

I_1+I_2: 11 (2)
I_0: 6.5 (2)

3-1,000 KVA

3-750 KVA, Δ-Δ
12,470 - 2400 V

24.5

3

PARADISE POINT

22.5

I_1+I_2: 19 (3)
I_0: 10.5 (3)

SW. STA. NO. 3

19

I_1+I_2: 9.1 (3)
I_0: 3.65 (3)

20

43 (3)

21

150 KVA

NO

CAMP GEIGER

MCAF

32

750 KVA

7,500 KVA
110 KV - 12,470/7200 V

TO JACKSONVILLE

NO

NAVHOSP 32.5

REGIMENTAL AREA

I_1+I_2: 8.1 (5)
I_0: 3.25 (5)

22

23

SW. STA. NO. 2

24

I_1+I_2: 12 (5)
I_0: 6.5 (5)

I_1+I_2: 10 (5)
I_0: 5 (5)

47 (5)

25

500 KVA

41

8

33

31

41.5

I_1+I_2: 17 (7)
I_0: 8.5 (7)

SW. STA. NO. 1

26

(7) 45

28

29

500 KVA

120 KVA

35

36

37

33

27

I_1+I_2: 11.5 (7)
I_0: 5.75 (7)

30 NO INDUSTRIAL AREA

300 KVA

21

TRIANGLE OUTPOST & "C" RANGE

9.8

9.6

38

3-150 KVA, Δ-Δ
12,470 - 2400 V.

ONSLOW BEACH

6

SCHOOL

51

OLD TRAILER PARK

26

SNEADS FERRY ROAD

24

I_1+I_2 – POSITIVE & NEGATIVE SEQUENCE COMPONENTS OF FAULT IN MVA.

I_0 – ZERO SEQUENCE COMPONENT OF FAULT IN MVA.

40

4.3

RIFLE RANGE

8

39

3-250 KVA Δ-Δ
12,470 - 2400 V

COURTHOUSE BAY

LANTDOCKS DWG. NO.	
WORK REQ. NO.	
DES.	
DRWN. JDV	
TR.	
CHK.	
BR. MGR.	
ENG. DIR.	
SATISFACTORY TO	DATE
APPROVED	DATE
DIR LANTDOCKS FOR CH. BUDOCKS	

DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS

ATLANTIC DIVISION
NORFOLK 11, VIRGINIA

MARINE CORPS BASE
CAMP LEJEUNE, N. C.

LINE TO GROUND FAULT DISTRIBUTION
NORMAL OPERATION, 1963

CODE IDENT. NO.	SIZE	Y&D DRAWING NO
80091	F	
SCALE	SPEC NBy	SHEET 4 OF 10

1-10-63 RDC

LEGEND

500 KVA — VOLTAGE REGULATOR, SIZE INDICATED

□ — OIL CIRCUIT BREAKER

NOTE 1. U.G. CABLE TO MIDWAY PARK, NOT IN USE; 3250 FT., 3-500 MCM.

CASE A: PARALLEL
25,000 KVA & 20,000 KVA
TRANSFORMERS

TO JACKSONVILLE

110 KV BUS

15,000/20,000/25,000 KVA

2000 KVA

12,000/16,000/20,000

REG. PROPOSED 1000 KVA

12,4 KV BUS

SEE NOTE 1

120

130
205 [A]

MIDWAY PARK

41

48 [A]

26

3-1,000 KVA, Δ-Y
12,470-4160/2400 V

33

1-999 KVA, Δ-Y
12,470-4160/2400 V

11.5

SCHOOL

OLD TRAILER PARK

63.5 [A]

SW. STA. NO. 4

CAMP KNOX

MONTFORD POINT

3-1,000 KVA

3-750 KVA, Δ-Δ
12,470-2400 V

PARADISE POINT

CAPEHART HOUSING

SW. STA. NO. 3

SW. STA. NO. 2

SW. STA. NO. 1

69 [A]

75 [A]

71 [A]

NO

INDUSTRIAL AREA

300 KVA

31 [A]

SNEADS FERRY ROAD

150 KVA

500 KVA

500 KVA

120 KVA

NO

CAMP GEIGER

MCAF

REGIMENTAL AREA

NO

NAVHOSP

TRIANGLE OUTPOST & "C" RANGE

3-150 KVA, Δ-Δ
12,470-2400 V

ONSLOW BEACH

750 KVA

7,500 KVA
110 KV-12,470/7200 V

TO JACKSONVILLE

— DENOTES OPEN CIRCUIT

3-250 KVA Δ-Δ
12,470-2400 V

RIFLE RANGE

COURTHOUSE BAY

LANTDOCKS DWG. NO.	DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS
WORK REQ. NO.	ATLANTIC DIVISION
DES.	NORFOLK 11, VIRGINIA
DRWN. JDV	MARINE CORPS BASE
TR.	CAMP LEJEUNE, N. C.
CHK.	3 Ø FAULT DISTRIBUTION
BR. MGR.	POSSIBLE 1970 OPERATION
ENG. DIR.	
SATISFACTORY TO — DATE	CODE IDENT. NO. 80091 — SIZE F — Y&D DRAWING NO
APPROVED — DATE	
DIR LANTDOCKS FOR CH. BUDOCKS	SCALE — SPEC — NBy — SHEET 5 OF 10

1-10-63

LEGEND

500 KVA — VOLTAGE REGULATOR, SIZE INDICATED

□ — OIL CIRCUIT BREAKER

NOTE 1. U.G. CABLE TO MIDWAY PARK, NOT IN USE; 3250 FT., 3-500 MCM.

CASE A. PARALLEL 25,000 & 20,000 KVA TRANSFORMERS.

TO JACKSONVILLE

110 KV BUS

15,000/20,000/25,000 KVA

2000 KVA

12,000/16,000/20,000

REG — PROPOSED 1000KVA

1

12,470 BUS

125

190 [A]

115

SEE NOTE 1

2 3 4 5 6 7 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41

MIDWAY PARK

3-1,000 KVA, Δ-Y
12,470 - 4160/2400 V

0.45
0.4 [A]

1 - 999 KVA, Δ-Y
12,470 - 4160/2400 V

SCHOOL

OLD TRAILER PARK

SNEADS FERRY ROAD

44 [A]

SW. STA. NO. 4

CAPEHART HOUSING

CAMP KNOX

MONTFORD POINT

3-1000 KVA

3-750 KVA, Δ-Δ
12,470 - 2400 V

PARADISE POINT

SW. STA. NO. 3

49 [A]

150 KVA

SW. STA. NO. 2

54 [A]

500 KVA

SW. STA. NO. 1

51 [A]

500 KVA

120 KVA

NO

INDUSTRIAL AREA

300 KVA

22 [A]

CAMP GEIGER

MCAF

NO

REGIMENTAL AREA

NAVHOSP

TRIANGLE OUTPOST & "C" RANGE

3-150 KVA, Δ-Δ
12,470 - 2400 V

ONSLOW BEACH

750 KVA

7,500 KVA
110 KV - 12,470/7200 V

TO JACKSONVILLE

—||— DENOTES OPEN CIRCUIT

3-250 KVA Δ-Δ
12,470 - 2400 V

RIFLE RANGE

COURTHOUSE BAY

LANTDOCKS DWG. NO.	
WORK REQ. NO.	
DES.	
DRWN. JDV	
TR.	
CHK.	
BR. MGR.	
ENG. DIR.	
SATISFACTORY TO	DATE
APPROVED	DATE
DIR LANTDOCKS FOR CH. BUDOCKS	

DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS

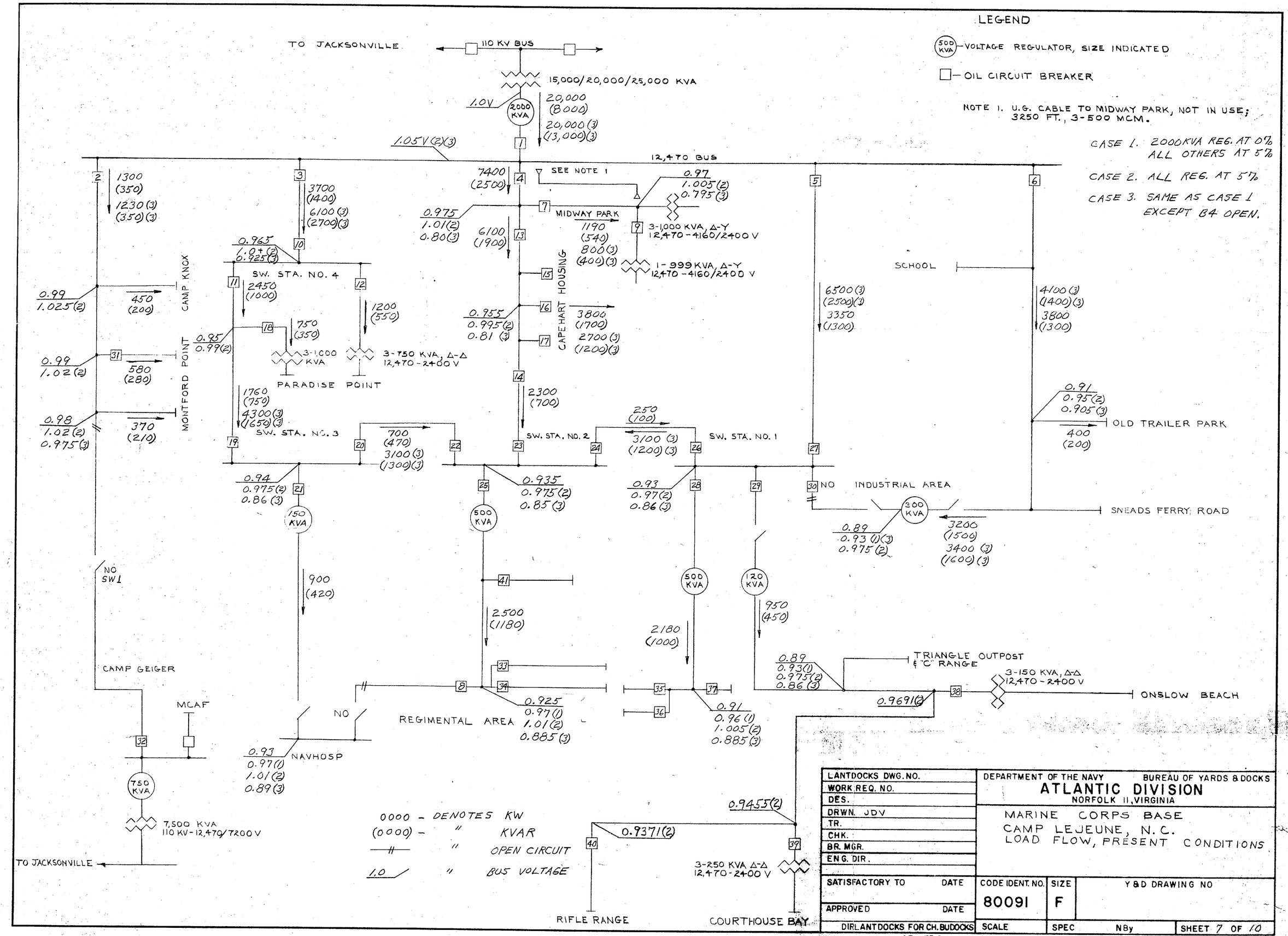
ATLANTIC DIVISION
NORFOLK 11, VIRGINIA

MARINE CORPS BASE
CAMP LEJEUNE, N. C.
LINE TO GND. FAULT DISTRIBUTION
POSSIBLE 1970 OPERATION

CODE IDENT. NO.	SIZE	Y&D DRAWING NO
80091	F	

SCALE | SPEC NBy | SHEET 6 OF 10

1-10-63 RDC



LANTDOCKS DWG. NO.	DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS		
WORK REQ. NO.	ATLANTIC DIVISION, NORFOLK 11, VIRGINIA		
DES.			
DRWN. JDV	MARINE CORPS BASE		
TR.	CAMP LEJEUNE, N.C.		
CHK.	LOAD FLOW, PRESENT CONDITIONS		
BR. MGR.			
ENG. DIR.			
SATISFACTORY TO — DATE	CODE IDENT. NO. 80091	SIZE F	Y&D DRAWING NO
APPROVED — DATE			
DIR LANTDOCKS FOR CH. BUDOCKS	SCALE	SPEC NBy	SHEET 7 OF 10

1-10-63 RDC

LEGEND

500 KVA — VOLTAGE REGULATOR, SIZE INDICATED

□ — OIL CIRCUIT BREAKER

NOTE 1. U.G. CABLE TO MIDWAY PARK, NOT IN USE; 3250 FT., 3-500 MCM.

CASE 1. ALL REG EXCEPT 2000 KVA AT 5%

TO JACKSONVILLE

110 KV BUS

15,000/20,000/25,000 KVA

2000 KVA

1 — 23,500 (1) (10,500)(1)

12,470 BUS

1.00 (1) = 12.8KV

SEE NOTE 1

8300 (1) (2,700)(1)

1160 (1) (430)(1)

0.96 (1)

7 — MIDWAY PARK

0.955 (1)

9 — 3-1,000 KVA, Δ-Y 12,470-4160/2400 V

1-999 KVA, Δ-Y 12,470-4160/2400 V

SCHOOL

2 — 1400 (1) (250)(1)

0.99 (1)

460 (1) (200)(1)

CAMP KNOX

3 — 4400 (1) (1450)(1) 0.955 (1)

10 — SW. STA. NO. 4

11 — 2950 (1) (900)(1)

12 — 1400 (1) (550)(1)

0.93 (1)

10 — 900 (1) (600)(1)

3-1,000 KVA

3-750 KVA, Δ-Δ 12,470-2400 V

PARADISE POINT

15 — 7050 (1) (2350)(1)

16 — 4400 (1) (1900)(1)

0.935 (1)

17 — CAPEHART HOUSING

14

5

6

4800 (1) (1300)(1)

0.9 (1)

500 (1) (200)(1)

OLD TRAILER PARK

0.885 (1)

SNEADS FERRY ROAD

860 (1)

0.985 (1)

31 — 530 (1) (200)(1)

0.985 (1)

420 (1) (150)(1)

MONTFORD POINT

950 (1) (450)(1)

19 — SW. STA. NO. 3 2300 (1) (800)(1)

20

22

0.915 (1)

21

1130 KVA

2600 (1) (620)(1)

850 (1) (450)(1)

23 — SW. STA. NO. 2

24

SW. STA. NO. 1

26

4250 (1) (1500)(1)

27

0.915 (1)

25

500 KVA

0.91 (1)

28

29

30 — NO — INDUSTRIAL AREA

300 KVA

0.925 (1)

4300 (1) (1500)(1)

500 KVA

120 KVA

NO

41

CAMP GEIGER

2900 (1) (1150)(1)

3,600 (1) (1,600)(1)

33

34

35

37

36

8 — 0.955 (1)

0.935 (1)

1120 (1) (470)(1)

0.91 (1)

TRIANGLE OUTPOST & "C" RANGE

3-150 KVA, Δ-Δ 12,470-2400 V.

38

ONSLOW BEACH

MCAF

32

(1) 1200 (1) (450)

NO

REGIMENTAL AREA

0.955 (1)

NAVHOSP

750 KVA

7,500 KVA 110 KV-12,470/7200 V

TO JACKSONVILLE

0000 — DENOTES KW

(0000) — " KVAR

40

RIFLE RANGE

39

3-250 KVA Δ-Δ 12,470-2400 V

COURTHOUSE BAY

LANTDOCKS DWG. NO.	DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS		
WORK REQ. NO.	ATLANTIC DIVISION, NORFOLK 11, VIRGINIA		
DES.			
DRWN. JDV	MARINE CORPS BASE, CAMP LEJEUNE, N. C., LOAD FLOW, 1965 LOADS		
TR.			
CHK.			
BR. MGR.			
ENG. DIR.			
SATISFACTORY TO DATE	CODE IDENT. NO. 80091	SIZE F	Y&D DRAWING NO
APPROVED DATE			
DIR LANTDOCKS FOR CH. BUDOCKS	SCALE	SPEC NBy	SHEET 8 OF 10

1-10-63 RDC

LEGEND

(500 KVA) — VOLTAGE REGULATOR, SIZE INDICATED

□ — OIL CIRCUIT BREAKER

NOTE 1. U.G. CABLE TO MIDWAY PARK, NOT IN USE; 3250 FT., 3-500 MCM.

CASE 1. B4 OPEN

CASE 2. CAP AT CAPEHART B4 OPEN
CAP @ 0.5

CASE 3 SAME AS CASE 2 EXCEPT B4 CLOSED, B14 OPEN

TO JACKSONVILLE

110 KV BUS

25,000 (13,000)

15,000/20,000/25,000 KVA

1.00

2000 KVA 3% UP

17,400 (10,000)

7800 (2750)

3% UP

12,4 TO BUS

12.8KV = 1.02

SEE NOTE 1

1.02 = 12.8KV

1400 (440)

MIDWAY PARK

1.005

3-1,000 KVA, Δ-Y
12,470 - 4160/2400 V

1-999 KVA, Δ-Y
12,470 - 4160/2400 V

SCHOOL

4550 (1550)

0.984

SW. STA. NO. 4

1450 (250)

1.01

460 (150)

CAMP KNOX

1000 (100)

1.007

550

MONTFORD POINT

1.005

360

1450 (570)

3100 (1100)

0.965

830 (350)

3-1,000 KVA

3-750 KVA, Δ-Δ
12,470 - 2400 V

PARADISE POINT

7600 (2600)

0.97

0.84 (1)
0.95 (2)
0.99 (3)

4200 (1700)

CAPEHART HOUSING

11 (CASE 3) @ 0.2

1100 (500)

1200 (300)

3300 (900)

SW. STA. NO. 2

SW. STA. NO. 1

3960 (1500)

SW. STA. NO. 3

2350 (870)

0.946

0.947

0.955 (1)

0.945

NO

INDUSTRIAL AREA

0.96

300 KVA 5%

4500 (1400)

4800
1400

(200)
470

0.935

OLD TRAILER PARK
0.93

SNEADS FERRY ROAD

150 KVA 5%

500 KVA 5%

500 KVA 5%

120 KVA 5%

NO

CAMP GEIGER

MCAF

1240 (450)

NO

0.99

NAVHOSP

3100 (1150)

0.99

REGIMENTAL AREA

3800 (1600)

0.97

1,300 (480)

0.937

TRIANGLE OUTPOST & "C" RANGE

3-150 KVA, Δ-Δ
12,470 - 2400 V.

ONSLOW BEACH

7.50 KVA

7,500 KVA
110 KV - 12,470/7200 V

TO JACKSONVILLE

0000 - DENOTES KW
(0000) - " KVAR
// " OPEN CIRCUIT

RIFLE RANGE

3-250 KVA Δ-Δ
12,470 - 2400 V

COURTHOUSE BAY

LANTDOCKS DWG. NO.	
WORK REQ. NO.	
DES.	
DRWN. JDV	
TR.	
CHK.	
BR. MGR.	
ENG. DIR.	
SATISFACTORY TO	DATE
APPROVED	DATE
DIRLANTDOCKS FOR CH. BUDOCKS	

DEPARTMENT OF THE NAVY BUREAU OF YARDS & DOCKS
ATLANTIC DIVISION
NORFOLK 11, VIRGINIA

MARINE CORPS BASE
CAMP LEJEUNE, N. C.
1965 LOADS AND CONNECTIONS

CODE IDENT. NO.	SIZE	Y&D DRAWING NO
80091	F	
SCALE	SPEC	NBy

SHEET 9 OF 10

1-10-63 RDC

LEGEND

500 KVA — VOLTAGE REGULATOR, SIZE INDICATED

□ — OIL CIRCUIT BREAKER

NOTE 1. U.G. CABLE TO MIDWAY PARK, NOT IN USE; 3250 FT., 3-500 MCM.

CASE 1. CAPACITORS AT OLD TRAILER PARK TAP & CAPEHART TAP

CASE 2. B14 OPEN

TO JACKSONVILLE

110 KV BUS

26,000 (10,500)

15,000/20,000/25,000 KVA

1.00

2,000 KVA 3%

20,500 (7500)

5500 (2100)

3%

12,470 BUS

12.8 KV = 1.02 / 1.02 (1)

SEE NOTE 1

1400 (450)

8700 (2700)

0.993 / 1.01 (1)

MIDWAY PARK

0.99

3-1,000 KVA, Δ-Y 12,470 - 4160/2400 V

1-999 KVA, Δ-Y 12,470 - 4160/2400 V

1.02 = 12.8 KV / 1.02 (1)

SCHOOL

5900 (2) (2,000) (2)

4700 (1600) 0.975

SW. STA. NO. 4

1370 (600)

1420 (250)

1.01

500 (150)

CAMP KNOX

3300 (1100)

0.96

830 (340)

3-1,000 KVA

3-750 KVA, Δ-Δ 12,470 - 2400 V

PARADISE POINT

920 (100)

1.008

550 (50)

MONTFORD POINT

1.008

400 (50)

7300 (2100)

0.968 / 1.023 (1) / 0.995 (2)

CAP @ 0.4

4300 (1750)

CAPEHART HOUSING

1160 (600)

3000 (900)

SW. STA. NO. 3

2470 (900)

SW. STA. NO. 2

850 (370)

SW. STA. NO. 1

5900 (2) (1900) (2)

4650 (1500)

5000 (1500)

470 (200)

OLD TRAILER PARK

0.93 / CAP @ .3 - 0.99 (1)

0.93 / 0.986 (1)

0.945 / 0.915 (2)

0.94 / 0.955 (1) / 0.914 (2)

0.935 / 0.915 (2)

NO

INDUSTRIAL AREA

300 KVA 5%

0.955 / 1.007 (1)

4600 (1450)

SNEADS FERRY ROAD

150 KVA 5%

500 KVA 5%

500 KVA 5%

120 KVA 5%

NO

CAMP GEIGER

MCAF

750 KVA

7,500 KVA 110 KV - 12,470/7200 V

TO JACKSONVILLE

1200 (470)

NO

0.99

NAVHOSP

3100 (1200)

0.985

REGIMENTAL AREA

3800 (1450)

0.97

1300 (470)

0.934

TRIANGLE OUTPOST & "C" RANGE

3-150 KVA, Δ-Δ 12,470 - 2400 V

ONSLOW BEACH

3-250 KVA Δ-Δ 12,470 - 2400 V

RIFLE RANGE

COURTHOUSE BAY

LANTDOCKS DWG. NO.	DEPARTMENT OF THE NAVY — BUREAU OF YARDS & DOCKS
WORK REQ. NO.	ATLANTIC DIVISION
DES.	NORFOLK 11, VIRGINIA
DRWN. JDV	MARINE CORPS BASE
TR.	CAMP LEJEUNE, N. C.
CHK.	1965 LOADS, PRESENT CONNECTIONS
BR. MGR.	
ENG. DIR.	
SATISFACTORY TO — DATE	CODE IDENT. NO. 80091 — SIZE F — Y&D DRAWING NO
APPROVED — DATE	
DIRLANTDOCKS FOR CH. BUDOCKS	SCALE — SPEC — NBy — SHEET 10 OF 10

1-10-63 RDC

L G NORRIS

FOR OFFICIAL USE ONLY

MARINE CORPS BASE

CAMP LEJEUNE, NORTH CAROLINA

PRELIMINARY ENGINEERING REPORT
(Fiscal Year 1966)

FOR

MODIFICATION OF ELECTRICAL DISTRIBUTION SYSTEM

J. N. PEASE ASSOCIATES

ARCHITECTS — ENGINEERS

CHARLOTTE, NORTH CAROLINA

DEPARTMENT OF THE NAVY

ATLANTIC DIVISION, BUREAU OF YARDS AND DOCKS

NORFOLK, VIRGINIA 23511

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R. A. BOTSFORD, AIA • F. C. HOBSON, PE • J. V. WARD, AIA

August 18, 1964

Director
Atlantic Division
Bureau of Yards and Docks
Norfolk, Virginia 23511

Re: Contract NBy-54456
A & E Services for Preliminary Engineering Report
Covering Modification of Electrical Distribution System
Camp Lejeune, North Carolina

Dear Sir:

We are submitting herewith a Preliminary Engineering Report covering Modification of Electrical Distribution System, Marine Corps Base, Camp Lejeune, North Carolina.

This report has been prepared in accordance with BUDOCKS Instructions 11010.14E.

We call your particular attention to the following:

A. The report prepared by Atlantic Division, Bureau of Yards and Docks in February, 1963 entitled "Electric Power System Planning Report for Marine Corps Base, Camp Lejeune, Jacksonville, North Carolina" was based upon a projected load of 25,850 KVA to occur in late 1965 or summer of 1966. Our study also indicates this projection as being realistic and accurate. The system as designed is adequate for that load. It should be noted that at a load level of 25,850 KVA the Housing (Loop) Feeder is loaded to 77 percent of thermal capacity and that the loss of the Paradise Point Feeder or Hadnot Point Feeder would result in the loading of the Housing Loop Feeder to 100 percent of thermal capacity.

BY MR CROWSAN

In view of this heavy loading on the loop feeders, we recommend that consideration be given to the future construction of an extension of the Midway Park feeder to the Capehart Housing Switching Station and the transfer of the Capehart Housing Switching Station

C. E. ASHLEY, JR., AIA • T. L. CORDLE, PE • C. S. HALFHILL, PE • A. W. ROTH, PE • F. F. SADRI, AIA • T. S. SIMPSON, PE

from the Housing Feeder to the new Midway Park Feeder. Construction of the proposed future feeder would be a logical expansion of the facilities proposed under this Preliminary Engineering Report.

B. It should be noted that the impedance traps proposed for installation in order to correct deficiencies in the IBM carrier current system are appropriate only for system parameters as presently conceived. The manufacturer of the traps has stated that any major changes in electrical system such as addition of power factor correction capacitors, reactors, ignitrons or large scale additions of 1 and 3 ampere fluorescent fixtures would require alterations or additions to the traps.

C. Carolina Power & Light Company has indicated that plans provide for paralleling a second transformer with the existing unit in 1965. In view of the estimate of 15 months from the initiation of preparation of plans and specifications to the completion of construction; coordination with the power supplier is essential to avoid exposure of the existing circuit breakers to faults in excess of interrupting capacity.

One loose copy of a colored "Witness Data Sketch" is attached to the original copy of this report.

Very truly yours,

J. N. PEASE ASSOCIATES

R. A. Botsford

R. A. Botsford

RAB:ks

INDEX

MODIFICATION OF ELECTRICAL DISTRIBUTION SYSTEM

MARINE CORPS BASE

CAMP LEJEUNE, NORTH CAROLINA

SECTION I. BASIS OF REQUIREMENT

Modification of the electrical distribution system of the Marine Corps Base prior to 1966 is necessary to provide uninterrupted service.

The Base complex receives electric power from Carolina Power and Light Company through a company-owned 25,000-KVA 110-KV - 12.47-KV transformer which replaced a 12/16/20,000-KVA unit. The latter unit was disconnected and left in place. This power passes through a 2,000-KVA ± 10 per cent step voltage regulator. Two 800 MCM underground circuits with a combined capacity of approximately 1060 amps serve the 12.47-KV indoor bus through a 1200 amp main circuit breaker. Under present normal operating conditions, the circuit breakers at the main sub-station (rated at 150 MVA at 13.8 KV and marginally less at operating voltage) have marginally adequate interrupting capacity. This condition may be expected to become worse as CP&L Company continues to expand.

The addition of 800 Capehart housing units and normal annual growth raised the electric demand load from about 16,000 KW in July 1961 to a peak demand of 20,736 KW (22,762 KVA) in July 1962. This demand increase of approximately 28 per cent resulted in the necessity to take emergency measures to divert some of the load from the voltage regulator and the 800 MCM incoming circuits. The Montford Point feeder was opened between Camp Knox and the CP&L Station and closed between Montford Point and Camp Geiger, thereby shifting approximately 1395 KVA to the Geiger Sub-Station. An additional 600-KVA voltage regulator (obtained on loan basis from CP&L Company) was connected on the line side of the 2000-KVA regulator at the Camp Lejeune Sub-Station and the Industrial Area feeder was connected to this regulator, thereby diverting an additional 4800 KVA from the main regulator. This borrowed regulator was later returned to CP&L Company and replaced by a 600-KVA regulator owned by the Base.

The above action disposed of the previous emergency. However, at the present rate of load growth (including Camp Knox and Montford Point, which are

presently being fed from the Camp Geiger Sub-Station under emergency conditions), the station demand will amount to approximately 25, 850 KVA by late 1965 or mid-1966, and the load on equipment will be approximately as follows:

Item	Load
2000-KVA main regulator	2% above capacity
600-KVA regulator	91% capacity
800 MCM main service cables	89% capacity

At that time switchgear of higher interrupting capacity will also be required at the main sub-station.

This project proposes necessary corrected action prior to this expected emergency condition. Provision of a 1500-KVA voltage regulator and oil circuit breakers of 500 MVA interrupting capacity is required with necessary protective fencing and lighting. Failure to provide additional electrical capacity prior to serious overloading of the system may result in serious damage to equipment and an interruption to service which could affect the entire Base for several weeks, or in the necessity of rationing electrical usage.

The project proposed herein conforms to recommendations contained in ELECTRIC POWER PLANNING REPORT, FEBRUARY 1963, which was prepared by the Atlantic Division, Bureau of Yards and Docks on the basis of an investigation of the distribution system conducted on an electronic circuit analyzer.

II. DESCRIPTION OF ITEM

This item consists of the following:

(a) A new galvanized steel structure consisting of seven structural steel bays complete with six frame-mounted tank type oil circuit breakers rated 14.4 KV, 1200 amperes, 500,000 KVA interrupting capacity. Structure is to include necessary switches for isolating and by-passing oil circuit breakers and for sectionalizing station bus. Structure is to be complete with luminaires for illumination of the area and with control power transformer.

(b) A new step voltage regulator rated 1500 KVA, 13.8 KV, three phase complete with regulator by-pass switches.

(c) Relocation of one existing step voltage regulator rated 2000 KVA, 13.8 KV, three phase. Regulator is to be relocated from an existing installation northwest of Building No. 45.

(d) A new 200 sq. ft. one story building for housing the existing IBM two-frequency carrier current equipment now located in Bldg. 45. The building will be constructed of the following materials: concrete slab on grade, walls of brick faced concrete masonry units and roof of a structural concrete slab insulated and roofed with a 4-ply built-up roofing.

(e) A new chain link fence and new routings of feeders in vicinity of switching station as required.

(f) Relocation of existing step voltage regulators in accordance with the following schedule:

(1) 600 KVA from Building 45 to Industrial Area.

(2) 500 KVA from Industrial Area to Regimental Area.

(3) 300 KVA from Regimental Area to Snead's Ferry Road.

(4) 120 KVA from Snead's Ferry Road to Rifle Range.

(g) A new 12.5 KV primary feeder to provide service to the Midway Park Area. Feeder is to consist of 5050 linear feet of three phase 4/0 AWG copper underbuilt on existing poles from Building No. 45 to Brewster Boulevard.

(h) Impedance traps to prevent short circuiting effect of Carolina Power & Light Company's power-factor correction capacitors on IBM carrier current equipment.

(i) Removal of existing indoor oil circuit breakers. These breakers are to be turned over to the Government.

(j) Relocation of existing Industrial feeder oil circuit breaker to Area 1 near Building 41. Circuit breaker is rated 500,000 KVA interrupting capacity.

SECTION III. PROJECT ANALYSIS

a. Operating and Maintenance Costs. (Not pertinent to this analysis.)

b. Incremental Funding. Incremental funding will not satisfy the requirement of this project.

c. Life of Requirement. The economical usable life of the proposed facilities is consistent with the duration of the requirement.

d. Contract Award Time. Schedule of estimated time required to complete the project.

Preparation of plans and specifications	120 Days
Advertising and receiving bids	45 Days
Construction	285 Days
Total Time Required	450 Days

e. Real Estate. Development of this project requires neither real estate nor easement requisitions.

f. Access Roads. This project will not require any changes to existing public roads and will not affect off-station traffic.

g. Fallout Shelter Construction. Not pertinent to this analysis.

h. Commercial and Industrial Facilities. No available commercial or industrial facilities can meet the requirement of this project.

i. Existing Station Facilities. The existing electrical distribution system is inadequate for the station demand anticipated in the summer of 1966. Energy is supplied to the Base by Carolina Power and Light Company at a location approximately 3300 feet northwest of the Main Gate on North Carolina Highway No. 24. The Government-owned facilities include the following major items of equipment. Loadings are based on measurements made in June, 1964.

1. 2000 KVA step voltage regulator loaded to 87 percent of thermal capacity.

2. 600 KVA step voltage regulator loaded to 63 percent of thermal capacity.

3. Underground 800 MCM PILC cables to lineup of indoor oil circuit breakers. Cables loaded to 80 percent of thermal capacity.

4. Lineup of indoor oil circuit breakers with exposure of breakers to faults as high as 96 percent of rated interrupting capacity.

5. 120 KVA step voltage regulator on Courthouse Bay feeder loaded to 109 percent thermal capacity.

6. 300 KVA step voltage regulator in Industrial area loaded to 97 percent thermal capacity.

It is estimated that the station demand will climb to approximately 25,900 KVA by the summer of 1966. Carolina Power & Light Company indicated in a letter dated June 23, 1964 that "Plans for 1965 call for paralleling a second transformer with the existing unit, the ratings and impedances to be essentially the same".

On the basis of changes proposed by the power supplier and on reasonable estimates of load growth, the anticipated loading on existing equipment in 1966 is as follows:

A. 2000 KVA step voltage regulator will be loaded to 107 percent of thermal capacity.

B. 600 KVA step voltage regulator will be loaded to 77 percent of thermal capacity.

C. Underground 800 MCM PILC cables will be loaded to 100 percent of thermal capacity.

D. Lineup of indoor oil circuit breakers will be subjected to faults as high as 171 percent of rated interrupting capacity.

E. 120 KVA step voltage regulator on Courthouse Bay feeder will be loaded to 134 percent of thermal capacity.

F. 300 KVA step voltage regulator in Industrial area will be loaded to 119 percent of thermal capacity.

j. Community Facilities. There are no community facilities considered adequate or desirable to offer service to the requirement of this project.

k. Types of Materials. Construction materials and methods were selected to provide minimum maintenance requirements without additional cost. The selected design and materials best meet the requirements ,and are the most economical to meet the anticipated requirements of the Station.

l. (Paragraph 1. omitted).

m. Aids to Navigation. Not applicable.

n. Siting. The site for this project is in conformance with the General Development Map of the Station.

o. Alternate Solutions. One alternate solution which has been considered is the substitution of a lineup of metalclad switchgear with air circuit breakers, rated 13.8 KV, 1200 amperes, 500,000 KVA interrupting capacity for the frame mounted oil circuit breakers which are recommended. This alternate solution was investigated in detail in the report prepared by Atlantic Division, Bureau of Yards and Docks in February, 1963. The alternate solution was eliminated from further consideration because of the additional cost (approximately $50,000) over the recommended scheme. It should also be noted that the installation of metcalclad switchgear would present additional long-range problems because of the difficulty in routing new distribution feeders from the area.

SECTION IV. CONSTRUCTION CRITERIA

A. Building for housing IBM equipment.

1. General Design Criteria:

Structural frame designed for 20 lb. L. L. on roof and 105 mph. wind loads on projected vertical area.

2. Foundations:

Concrete wall footings.

j. Community Facilities. There are no community facilities considered adequate or desirable to offer service to the requirement of this project.

k. Types of Materials. Construction materials and methods were selected to provide minimum maintenance requirements without additional cost. The selected design and materials best meet the requirements and are the most economical to meet the anticipated requirements of the Station.

l. (Paragraph L, omitted).

m. Aids to Navigation. Not applicable.

n. Siting. The site for this project is in conformance with the General Development Map of the Station.

o. Alternate Solutions. One alternate solution which has been considered is the substitution of a lineup of metalclad switchgear with air circuit breakers, rated 13.8 KV, 1200 amperes, 500,000 KVA interrupting capacity for the frame mounted oil circuit breakers which are recommended. This alternate solution was investigated in detail in the report prepared by Atlantic Division, Bureau of Yards and Docks in February, 1964. The alternate solution was eliminated from further consideration because of the additional cost (approximately $50,000) over the recommended scheme. It should also be noted that the installation of metalclad switchgear would present additional long-range problems because of the difficulty in routing new distribution feeders from the area.

SECTION IV. CONSTRUCTION CRITERIA

A. Building for housing IBM equipment.

1. General Design Criteria:

Structural frame designed for 20 lb. L. L. on roof and 105 mph. wind loads on projected vertical area.

2. Foundations:

Concrete wall footings.

3. Walls:

Brick faced concrete masonry units.

4. Floors:

6 inch concrete slab on grade.

5. Interior Finish:

Exposed masonry units.

6. Roof:

Structure of concrete slab - insulated - 4 ply built-up roofing.

7. Electrical for Building:

One 45 KVA, 12470 V Delta - 120/240 V Delta 4 W, 3 phase transformer for station lighting, battery charger and IBM equipment; 120-240 V, 4 wire, 3 phase underground system from outdoor switching station; illumination - 35 foot candles in building using Type RLM steel enamel shade fixtures. Telephone - one in building housing IBM equipment.

8. Plumbing:

None

9. Heating:

Portable electric heaters.

10. Ventilation:

Exhaust fan.

11. Collateral Equipment:

None

B. Outdoor Switching Station

1. One galvanized steel structure supported on concrete piers with connectors, bus work, insulators, mounting supports, fastening bolts and anchor bolts, lighting equipment, conduit and wiring, grounding equipment and deadend assemblies for terminating external conductors.

2. Six feeder oil circuit breakers rated 14.4 KV, 1200 ampere, 500,000 KVA interrupting capacity, D.C. close and D.C. trip.

3. One new step voltage regulator rated 1500 KVA, 13.8 KV, three phase, installed on reinforced concrete slab.

4. One existing step voltage regulator rated 2000 KVA, 13.8 KV, relocated from existing installation and installed on reinforced concrete slab.

5. Hookstick operated switches for by-passing and disconnecting circuit breakers and regulators.

6. Gang-operated disconnecting switch for sectionalizing switching station bus.

C. Additional related Substation Criteria

1. 7' high chain link fence, 3 strands barbed wire.

2. Current limiting fuses for underground feeder to Building No. 45.

3. Crushed stone for substation yard.

SECTION V. COST ESTIMATES

The engineering cost estimates are included hereinafter on NAVDOCKS Cost Estimate Forms 2493 and 2493A for the principal and supporting features of the line items. The Budget Estimate is computed by the following formula:

$$\text{Budget Estimate} = \frac{E\,(1.00 + C)}{0.93} \quad \text{where}$$

E is the engineering estimate
C is the contingency factor
0.93 provides for 7% Bureau administrative costs.
Contingency factor used = 10%
Budget Estimate = Engineering Estimate x 1.183

PRELIMINARY ENGINEERING COST ESTIMATE
PRINCIPAL CONSTRUCTION FEATURE(S)
NAVDOCKS 2493 (5-58)

STATION: Marine Corps Base, Camp Lejeune, North Carolina

DATE: 12 Aug. 1964

SUMMARY LINE ITEM DATA

CODE	LINE ITEM TITLE	EST. COST
812.10	Modification of Electric Distribution System	216,000
1000	ESTIMATED ARCHITECT AND ENGINEER FEE	11,000
	TOTAL	227,000

PRINCIPAL CONSTRUCTION FEATURE(S)

CODE	A C F	DESCRIPTION	UNIT	QUANTITIES	ENGINEERING ESTIMATES UNIT COST	ENGINEERING ESTIMATES COST	BUDGET ESTIMATES UNIT COST	BUDGET ESTIMATES COST	FEATURE BUDGET UNIT COST	FEATURE BUDGET COST
812.10		Substation								
		Outdoor steel structure bay	EA	7	8,614.28	60,300	10,190.00	71,300		
		Primary service to substation	LF	330	13.64	4,500	16.14	5,300		
		Voltage Regulator, 3-phase, 13.8 KV	KVA	1500	29.60	44,400	35.00	52,500		
		Voltage Regulator, 3-phase, 13.8 KV, relocated	KVA	2000	.35	700	.41	800		
		Oil circuit breakers, 15 KV, 1200 A, 500 MVA	EA	6	4,183.33	25,100	4,949.00	29,700		
		Relocate existing outgoing circuits	EA	5	1,360.00	6,800	1,609.00	8,000		
		Relocate service to Bldg. 45	EA	1	1,300.00	1,300	1,500.00	1,500		
	C	NON-TECHNICAL COLLATERAL	LS	LS	LS		LS		LS	
	T	TECHNICAL COLLATERAL	LS	LS	LS		LS		LS	
2000		SUPPORTING CONSTRUCTION FEATURES	LS	LS	LS		LS		LS	

Contingency Factor = 10%

Budget Estimate = Engineering Estimate x 1.183

LINE ITEM TOTAL

Continued Sheet 2

D-58495

PRELIMINARY ENGINEERING COST ESTIMATE
PRINCIPAL CONSTRUCTION FEATURE(S)
NAVDOCKS 2493 (5-58)

STATION: Marine Corps Base, Camp Lejeune, North Carolina

DATE: 12 Aug. 1964

SUMMARY LINE ITEM DATA

CODE	LINE ITEM TITLE	EST. COST
812.10	Modification of Electric Distribution System	See Sheet 1
1000	ESTIMATED ARCHITECT AND ENGINEER FEE	
	TOTAL	

PRINCIPAL CONSTRUCTION FEATURE(S)

CODE	ACF	DESCRIPTION	UNIT	QUANTITIES	ENGINEERING ESTIMATES UNIT COST	ENGINEERING ESTIMATES COST	BUDGET ESTIMATES UNIT COST	BUDGET ESTIMATES COST	FEATURE BUDGET UNIT COST	FEATURE BUDGET COST
812.10		Substation - Cont'd.								
		Relocate IBM equip't.	EA	1	1,500.00	1,500	1,800.00	1,800		
		Impedance traps for IBM Equip't.	EA	1	13,700.00	13,700	16,200.00	16,200		
		Relocate pilot wire equipment	Lot	1	1,600.00	1,600	1,900.00	1,900		
		Relocate Industrial Fdr. OCB to Camp Geiger Substation	EA	1	500.00	500	600.00	600		
		Building for IBM Equipment	SF	196	18.37	3,600	21.73	4,300		
		Remove indoor switch-gear cubicles	EA	9	244.44	2,200	289.17	2,600		
		Coordinate and calibrate protective relays	Lot	1	3,000.00	3,000	3,500.00	3,500		
		Sub-total				169,200		200,000		200,000
	C	NON-TECHNICAL COLLATERAL	LS	LS	LS		LS		LS	
	T	TECHNICAL COLLATERAL	LS	LS	LS		LS		LS	
2000		SUPPORTING CONSTRUCTION FEATURES	LS	LS	LS		LS		LS	16,000
								LINE ITEM TOTAL		216,000

D-55495

PRELIMINARY ENGINEERING COST ESTIMATE
SUPPORTING CONSTRUCTION FEATURE(S)
NAVDOCKS 2493A (5-58)

STATION: Marine Corps Base, Camp Lejeune, North Carolina

DATE: 12 Aug. 1964

LINE ITEM TITLE

Modification of Electric Distribution System

SUPPORTING CONSTRUCTION FEATURE(S)

CODE	ACF	DESCRIPTION	UNIT	QUANTITIES	ENGINEERING ESTIMATE		BUDGET ESTIMATE		FEATURE BUDGET ESTIMATE	
					UNIT COST	COST	UNIT COST	COST	UNIT COST	COST
812.30		Primary distribution lines	LF	5050	2.16	10,900	2.56	12,900		
872.10		Security fencing	LF	388	5.41	2,100	6.40	2,500		
		Clearing & grubbing	AC	1	500.00	500	600.00	600		
2000		TOTAL SUPPORTING FEATURES	LS	LS	LS	13,500	LS	16,000	LS	

GPO 869000

SAFE AMPERE CAPACITY FOR BARE COPPER	
SIZE	AMPERE CAPACITY
4/0	480
1/0	310
4	180
NOTE:	THE ABOVE VALUES TAKEN FROM A.E KNOWLTON ENGR. HANDBOOK

NOW SERVED BY C.P. & L. CO.

FEEDER CUT

750 KVA REGULATOR

600 AMP. BREAKERS
4 NO. 1/0

MCAF NEW RIVER

CAMP GEIGER

MONTFORD POINT

CAMP GEIGER TRAILER PARK

3-750 KVA

2-50 KVA REGULATORS

PARADISE POINT

3-50 KVA REGULATORS

3-1000 KVA

SWITCHING STA. NO. 4

CAMP KNOX
3 NO. 4/0

PARADISE PT.

25,000 KVA BANK (C.P. & L. CO.)

2,000 KVA REGULATOR

1200 AMP BREAKER

POWER PLANT 12.5KV / 7.2KV.

HADNOT PT.

IND. AREA

MIDWAY PARK

3 NO. 1/0

3 NO. 4

4 NO. 4/0

3 NO. 4

PINE GROVE TRAILER PARK

300 KVA REGULATOR
INDUSTRIAL AREA

4 NO. 1/0

4 No 4

4 NO. 4

4 NO. 4

4 NO. 336.4 MCM AL. COND.

120 KVA REGULATOR

3 NO 1/0

SWITCHING STA. NO. 2

SWITCHING STA. NO. 1

SWITCHING STA. NO. 3

500 KVA REGULATOR

4 NO. 4

3 NO. 4/0

4 NO. 1/0

120 KVA REGULATOR

3 NO. 1/0

4 NO. 1/0

NAVAL HOSPITAL

COURTHOUSE BAY - RIFLE RANGE SUB FEEDER

3 NO. 1/0

156 KVA REGULATOR

570 MAN BRIG

2ND DIV. SHOP AREA

4 NO. 1/0

4 NO. 1/0

FRENCH CREEK AREA

4 NO. 4

4 NO. 4

4 NO. 4

4 NO. 4

4 NO. 4

4 NO. 4

4 NO. 1/0

4 NO. 4

4 NO. 1/0

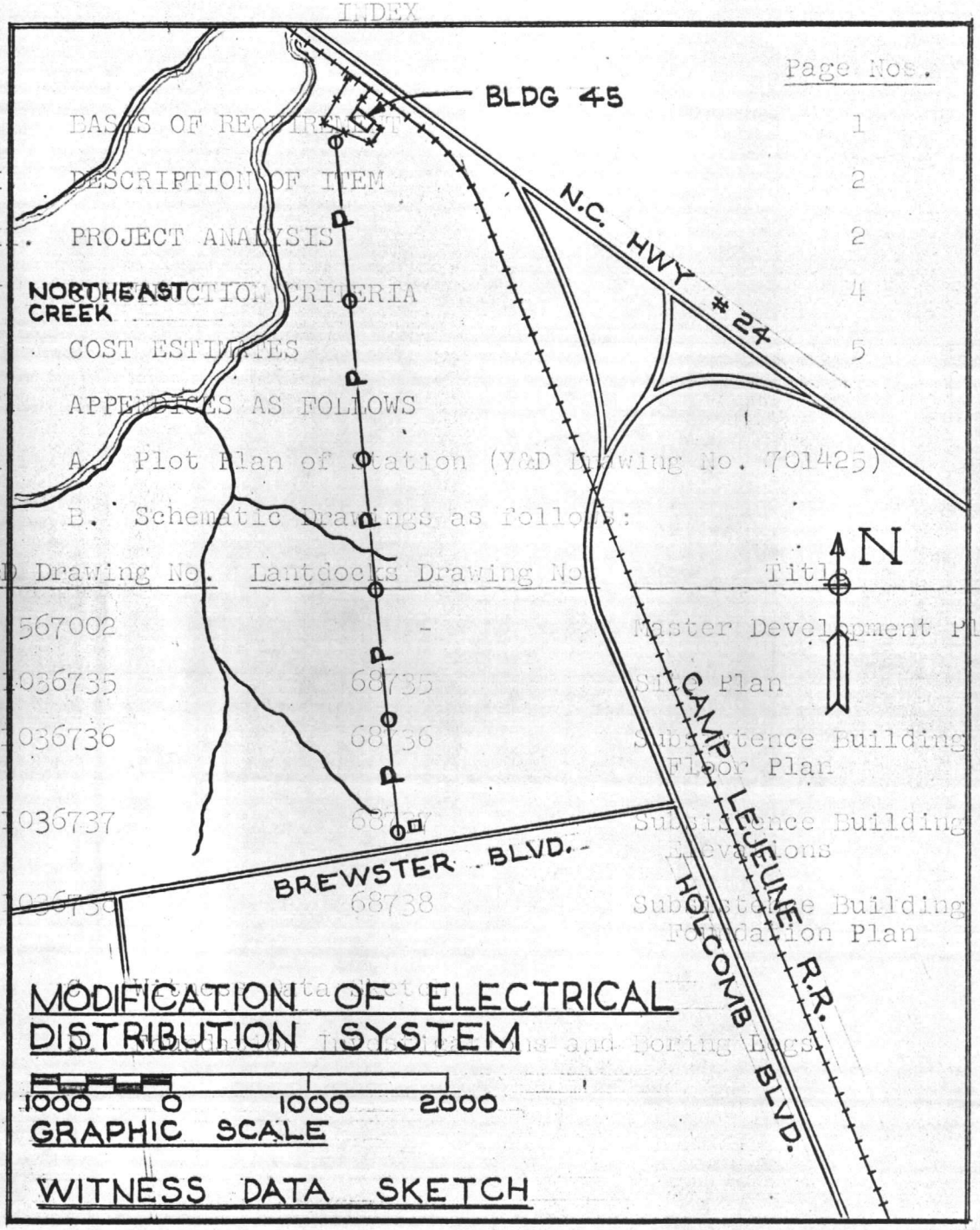
REGIMENTAL AREAS

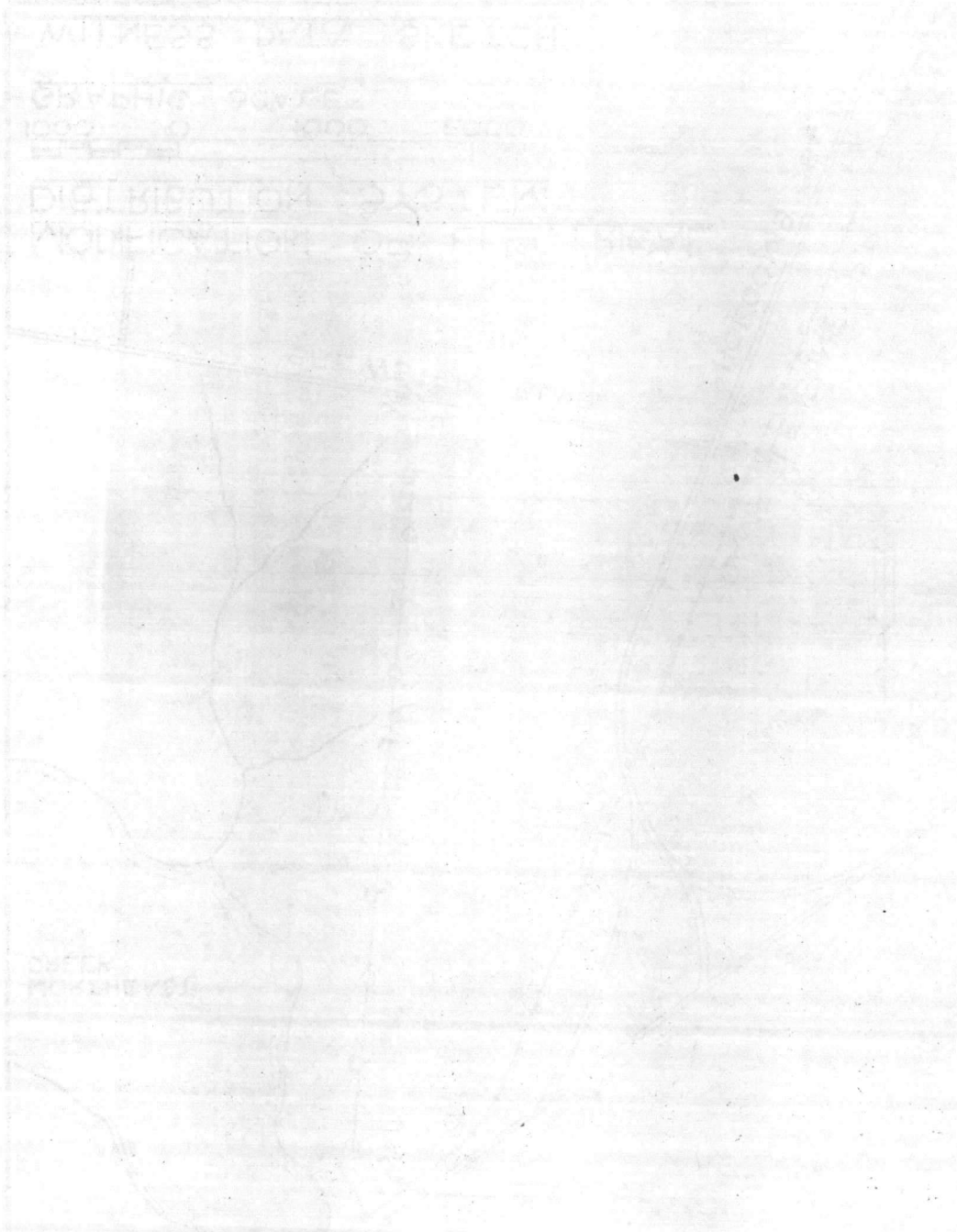
REVISIONS			PUBLIC WORKS DEPARTMENT
NO	DATE	APP.	CAMP LEJEUNE, NORTH CAROLINA
SCALE: NO SCALE	DRAWN By		
	TRACED By		
P.W. DWG. NO. 5531			
SHEET OF	APPROVED PUBLIC WORKS OFFICER		

INDEX

C. Miscellaneous Details

D. Heating and Ventilating Diagrams and Boring Logs





FILE FOLDER

DESCRIPTION ON TAB:

Preliminary Engr Report

1966 - Crowson

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Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

No. 409954-A

ON

WELDED LID

(2) LIFTING HOOKS (H-170-6)

(2) 4.25" DIA HOLES

8"

9"

(2) 15-KV 600A BUSHINGS (LAPP CAT # 21226)

1" DIA STUD 2" LONG

13.75"

13"

39"

32"

.5 GROUND PAD (H-170-3)

.5 DRAIN PLG (H-170-12)

6.25"

4"

7"

2"

15"

19"

(4) 2"X2"X4" MTG. FEET

1" RECESSED BOTTOM

(4) MTG SLOTS .5 X 1"

19"

21"

23"

ATLANTIC DIVISION, BUREAU OF YARDS & DOCKS
NORFOLK 11, VA.

APPROVED:

SUBJECT TO THE REQUIREMENTS OF

CONTRACT NBy 69355 SPEC 69355/65

APPROVAL OF MATERIALS AND/OR EQUIPMENT INDICATES COMPLIANCE WITH SPECIFICATION REQUIREMENTS ONLY — THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING PROPER PHYSICAL DIMENSIONS & WEIGHTS, COORDINATION OF TRADES, ETC., AS REQUIRED.

N. J. DRUSTRUP
RADM, CEC, USN
DIRLANTDOCKS

Date 12/5/66 DDM

SOUTHEASTERN CONSULTING ENGINEERS, INC.
P. O. Box 8028, Charlotte, N. C. 28208

Checked by BC Date 12/5/66

File cy.

1Ø-12,470V-700A-.1225MH, - TUNE TO 3218 ~ WITH 20 uf CAP-NWL 17456
1Ø-12,470V-700A-.115MH, - TUNE TO 2340 ~ WITH 40 uf CAP-NWL 17387

Part No. 409954-A	Item of Assembly No.	No. Req.	DR'N by WWF 4-12-66	NAME SIMPLEX OIL TRAPS
Scale: NONE	Material		C'K'D by	F6 4296
Heat Treatment:	Tolerances: Unless specified Fractional ±.010 Decimal ±.003		TR'C'D by	FOR CAMP LEJEUNE N.C. BASE
			REDR'N by	

Simplex TIME RECORDER CO., GARDNER, MASS., U.S.A.
STR J-563-6

REF. NOTHELFER DWG # D66-700

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DESCRIPTION:

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Confidential Records Management, Inc.
New Bern, NC
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9/08

DEPARTMENT OF THE NAVY
OFFICER IN CHARGE OF CONSTRUCTION
BUREAU OF YARDS AND DOCKS CONTRACTS
MARINE CORPS BASE, CAMP LEJEUNE, N. C.
28542

NAVAL FACILITIES ENGINEERING COMMAND CONTRACTS
MARINE CORPS BASE, CAMP LEJEUNE, N. C. 28542

IN REPLY REFER TO:
23-510:HH:mgj
NBy- 69355
13 May 1966

20

Ocean Electric Corporation
P. O. Box 12270
Norfolk, Virginia 23502

Re: Contract NBy- 69355, Electrical Distribution System, Marine Corps Base, Camp Lejeune, North Carolina

Gentlemen:

We are returning ~~___~~ herewith, _____ under separate cover, the following shop drawings or data sheets with action indicated:

No. of Dwgs.	Dwg. No.	Description	Action
1	409954-A	1 Phase Tuned Trap - FG 4296 - SIMPLEX TIME RECORDER COMPANY	Approved, subject to contract requirements. SEE NOTE BELOW

NOTE: We approved SIMPLEX Drawing No. 409932E in our letter of 7 March 1966 pertaining to the same equipment. Is 409932E superseded?

Sincerely yours,

P. P. MADDEN
ENS, CEC, USN
Assistant Resident Officer
in Charge of Construction

Copy to:
COMLANTDIVNAVFAC (w/cy encl)
✓File (w/cy encl)
Field (w/cy encl)
Records (w/2cys encl)
Board

SHOP DRAWING TRANSMITTAL

Department of the Navy
Resident Officer in Charge
Bureau of Yards and Docks Contracts
Jacksonville, North Carolina Area
Building 1005, Camp Lejeune, N. C.

Date 12 May 1966

Job No. 229

Subject: NBy - 69355

Attention: 23-510:HH:mgj

Electrical Distribution System

MCB, Camp Lejeune, N. C.

We transmit herewith the following shop drawings:

Copies Each	Drawing No.	Drawing Prepared By	Description or Title
7	409954-A	Simplex	1 Phase Tuned Trap
	Note: On 28 February 1966 we approved Simplex Drawing No. 409932E pertaining to same equipment. Is 409932E superseded?		
	Suggest these documents be forwarded to CP&L also, since equipment will be installed on CP&L lines by CP&L personnel.		

The above are:

[X] 1. Approved

[ ] 2. Approved with corrections noted.

[ ] 3. Returned for correction and re-submission.

[ ] 4. Not approved.

[X] 5. See attached remarks.

ROUTING

ORDE.	INT
1 11	BM
2 510	
3	
4	
5	
ORIG	INT

SOUTHEASTERN CONSULTING ENGINEERS, INC.
915 West Morehead Street (P. O. Box 8028)
Charlotte, North Carolina 28208

By Brice Tarleton
Brice Tarleton, P.E.

OCEAN ELECTRIC CORPORATION

"SERVING TIDEWATER ELECTRICALLY"

3460 TRANT AVENUE P. O. BOX 12270 NORFOLK, VIRGINIA 23502

PHONE: 855-1041

LETTER OF TRANSMITTAL

To: Resident Officer in Charge of Construction
Jacksonville, North Carolina Area
Building 1005
U. S. Marine Corps Base
Camp Lejeune, North Carolina

Date: 18 April 1966

Re: Contract NBy 69355-Electrical Distribution System, U. S. Marine Corps Base, Camp Lejeune, North Carolina
Our Job No. 2350

Gentlemen:

We are sending to you the following:

☐ Prints, ☐ Specifications, ☒ Shop Drawings, ☐ Samples,
☐ Cuts, ☐ Catalogues, ☐ Payroll, ☐ Tests,

No. of Copies	Drawing No.	Date	Latest Revision	Description
8	Simplex Dwg. #409954-A	4/12/66		Simplex Oil Traps

ROUTING ORDER

	ORIG	INT
1	JJ	HW
2	S-10	
3		
4		
5		

As submitted by us for APRROVAL

☒ These are for your approval.
☐ These are approved.
☐ These are disapproved.
☐ These are approved as noted.
☐ Note
☐ These are for final distribution.
☐ Please correct and furnish_____copies to resubmit for approval.
☐ Please send_____additional copies for final distribution.
☐ For your use or file.

OCEAN ELECTRIC CORPORATION

By R. A. Geary

R. A. Geary, Vice President

Copy to:

☐ Architect ☐ Subcontractor
☐ Job ☐ File


RECEIVED
21 APR 1966
Officer in Charge Const.
Public Works Dept.
Camp Lejeune,
N. C.

Shop Drawing Folder

NAVAL FACILITIES ENGINEERING COMMAND CONTRACTS
MARINE CORPS BASE, CAMP LEJEUNE, N. C. 28542

23-11:PPM:mgj
NBy-69355
13 May 1966

Mr. W. Paul Lyman
Carolina Power and Light Company
Raleigh, North Carolina

Re: Contract NBy-69355, Electrical Distribution System, Marine Corps Base, Camp Lejeune, North Carolina

Dear Sir:

This office is forwarding a copy of SIMPLEX Drawing No. 409954-A, Phase Tuned Trap, since this equipment will be installed on CP&L lines by your personnel.

Sincerely yours,

P. P. MADDEN
ENS, CEC, USN
Assistant Resident Officer
in Charge of Construction

Encl:
(1) SIMPLEX Oil Traps Dwg.

18 May 66

Mr Madden —

Shall we let the A+E

know about this ? (or just send them

a cy of the contractor's letter)

and a copy to A/E M.

OCEAN ELECTRIC CORPORATION

"SERVING TIDEWATER ELECTRICALLY"

3460 TRANT AVENUE P. O. BOX 12270 NORFOLK, VIRGINIA 23502

AREA CODE 703 - PHONE: 855-1041

16 May 1966

Resident Officer in Charge of Construction
Jacksonville, North Carolina Area
Building 1005
U. S. Marine Corps Base
Camp Lejeune, North Carolina

SUBJECT: Contract NBY 69355-Electrical Distribution System,
U. S. Marine Corps Base, Camp Lejeune, North Carolina
Our Job No. 2350

Gentlemen:

In reply to your transmittal dated May 13, 1966 with two (2) Simplex Tuned Trap Drawings, we wish to refer to your note. The original submittal did not contain enough data for our office, and did not indicate all information we desired, hence this resubmittal.

Yours very truly,

OCEAN ELECTRIC CORPORATION

R. A. Geary,
Vice President

RAG/ahs

18 May 66
Sent copy of this letter to A+E.

ROUTING ORDER	INT
1 11	RM
2 510	
3 20	Hc
4	
5	
ORIG	INT