



HENRY VON OESEN AND ASSOCIATES  
CONSULTING ENGINEERS  
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March 6, 1979

Atlantic Division  
Naval Facilities Engineering Command  
Norfolk, Virginia 23511

Attn: Mr. M. L. Bryant, P. E. Re: Contract N62470-78-B-4600

Gentlemen:

We have studied the well water quality at Tarrawa Terrace and Montford Point at Camp Lejeune. Recent analyses of the water from each well presently in use were obtained from the Base Utility Division. These analyses were compared to the applicable requirements of the Safe Drinking Water Act, Bureau of Medicine and Surgery, and the State of North Carolina.

Although complete analyses of all wells were not available, there is sufficient overlapping and data from other sources to give indications of water quality in the area. Copies of the available analyses are attached.

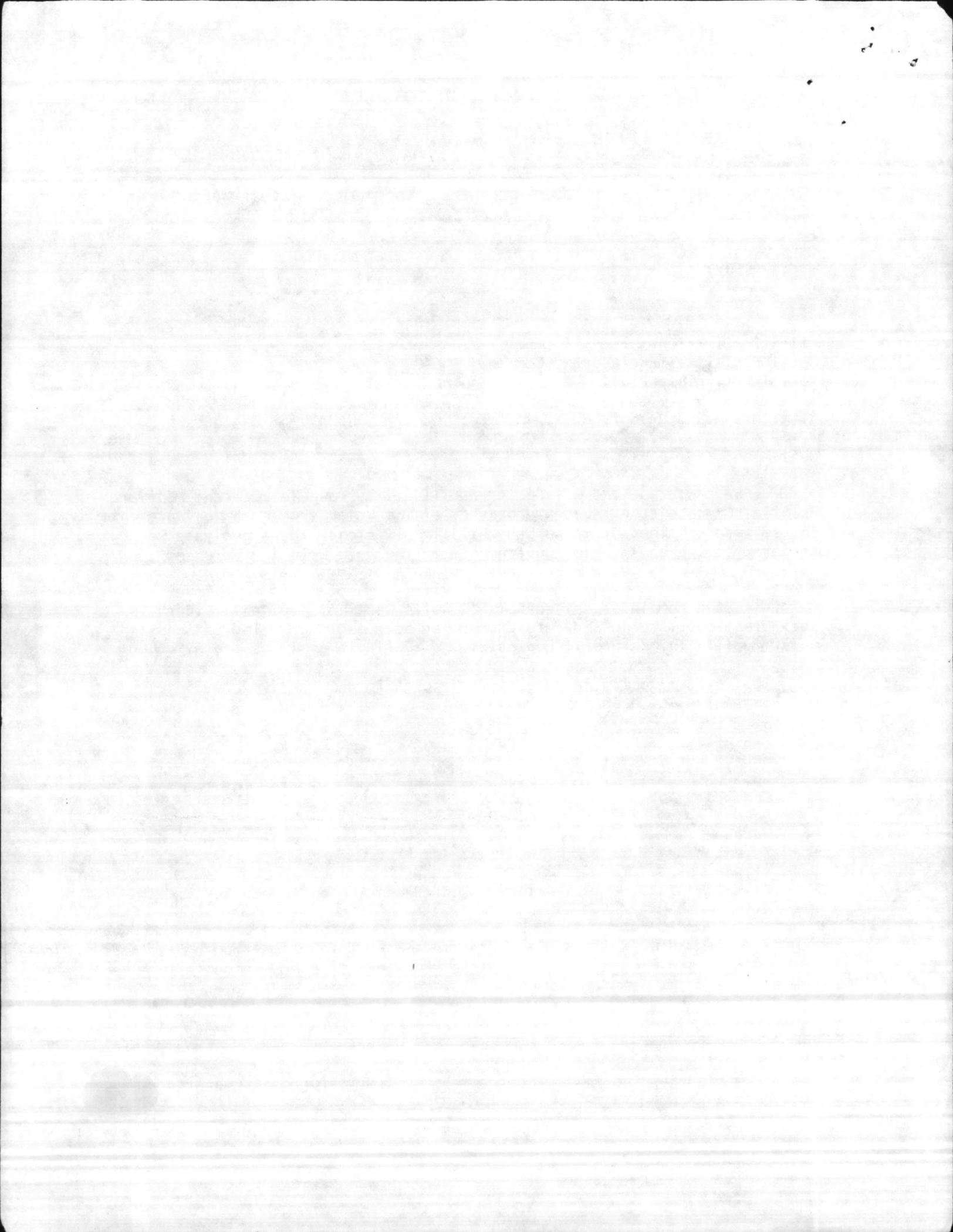
The maximum contaminant level for inorganic chemicals of the Safe Drinking Water Act are as follows:

Arsenic	0.05 mg/l
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Selenium	0.01
Silver	0.05
Fluoride	1.4 to 2.4 (depending on temperature)
Nitrate	10.0

The State of North Carolina has the following additional maximum contaminant levels for other chemicals and requires treatment to remove amounts in excess:

Iron	0.3
Manganese	0.05

The State also has the following recommended limits for other chemical substances:



Chloride	250
Copper	1.0
Phenols	0.001
Sulfate	250
Total dissolved solids	500
Zinc	5

All of the wells presently in use meet the Safe Drinking Water Act requirements. They also meet the state recommended limits for other chemical substances. However, the iron content in every well is significantly in excess of the state maximum. Manganese is also slightly high in three wells. Although there are no state or federal limits for hardness, DM-5 recommends treatment of water with hardness in excess of 150. Hardness of the present wells ranges from 164 to 320, and it is the present practice at Camp Lejeune to soften the water. The hardness is virtually all calcium bicarbonate.

Therefore, the water needs treatment for removal of significant amounts of iron and calcium bicarbonate hardness. There are two basic types of treatment that we would recommend for this service, as indicated on the attached sketches.

1. Aeration - filtration - ion exchange

The aerator oxidizes the dissolved ferrous state iron (and manganese) to the ferric state, forming a floc which is settled and filtered out. About 75% of the water will pass through zeolite softeners, and about 25% bypassed to provide a residual hardness of 75 mg/l. There will be the usual applications of chlorine, fluoride, and possibly chemical feeds for flocculation and pH adjustment.

2. Cold lime process

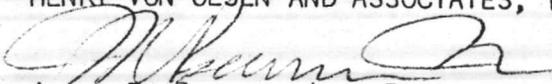
Lime is injected into the raw water as it enters the lime contact tank. Through a catalytic precipitation process, the hardness and iron are precipitated and partially removed by coating on a sand media in the contact tank. The remaining hardness and iron floc are removed in the filter. The rate of lime feed is set to provide a residual hardness of 75 mg/l. Recarbonation may be required if the leaving pH is above 9. The usual applications of chlorine and fluoride will be made.

The final report will discuss the merits and economics of each treatment method.

If you have any questions regarding this information, please let us know.

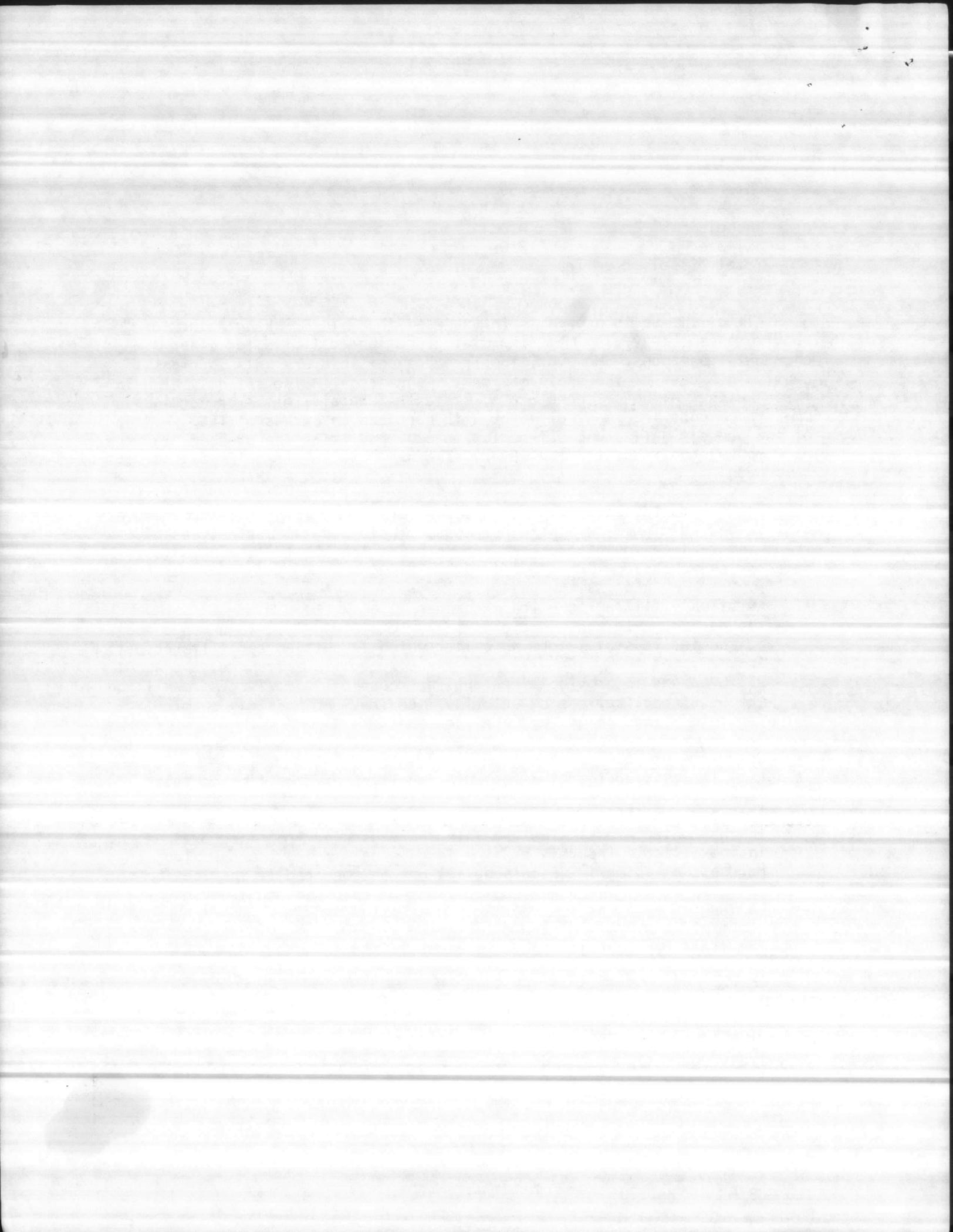
Very truly yours,

HENRY VON OESSEN AND ASSOCIATES, INC.



James R. Benson, Jr., P. E.

JRB/GGB  
Enc.



CHEMICAL ANALYSIS - WATER  
 MCBCL 11330/3 (REV 8-74)

MONTFORD POINT

Date 2-7-79

142  
~~M-167~~

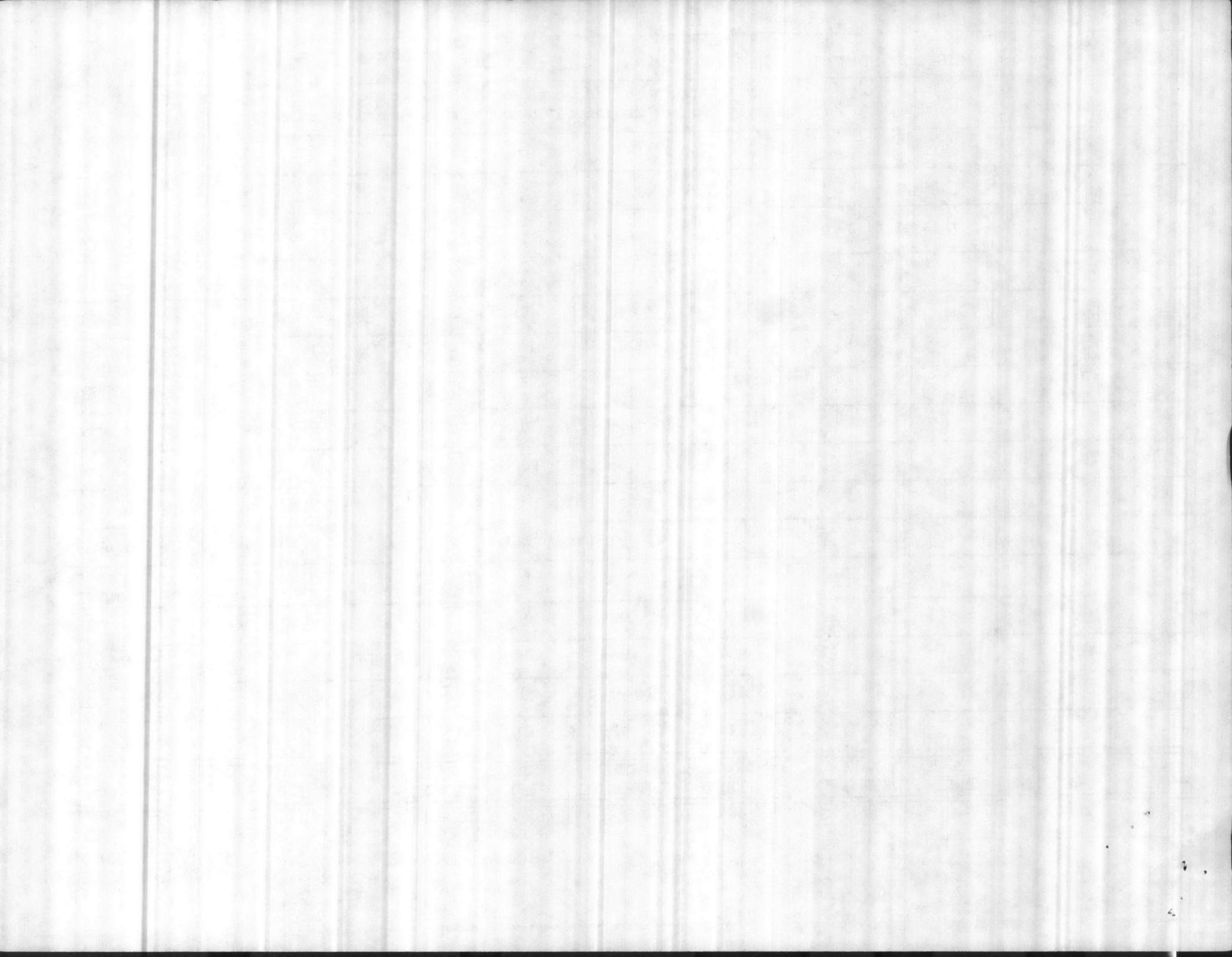
Parameter	<del>M-167</del>	M-168	M-197	M-628	M-629	M-630	RIFLE RANGE	HOLCOMB BLVD	NEW RIVER
PH	7.4	7.3	7.3	7.4	7.3	7.4			
PHENOLTHALEIN ALKALINITY	0	0	0	0	0	0			
METHYL ORANGE ALKALINITY	204	230	250	228	178	212			
HARDNESS CARBONATES AS CaCO <sub>3</sub>	190	220	320	220	180	308			
BICARBONATES AS CaCO <sub>3</sub>									
CHLORIDES AS Cl	8	14	162	10	12	108			
HARDNESS AS CaCO <sub>3</sub>									
IRON AS Fe	.83	.95	2.05	.85	4.50	1.16			
MANGANESE	.03	.03	.04	.03	.06	.03			
CALCIUM	85	87	125	88	65	115			
MAGNESIUM	1.22	2.31	4.16	1.92	1.68	2.35			
FLUORIDE									
CHLORINE RESIDUAL									

REMARKS:

NOTE: All results reported in parts per million unless otherwise noted except for pH, temperature, and specific conductance. One liter of potable water is assumed to weigh one kilogram.

LABORATORY ANALYSIS BY:

DATE OF ANALYSIS:



CHEMICAL ANALYSIS - WATER  
 MCBCL 11330/3 (REV 8-74)

TARAWA TERRACE

Date 2-7-79

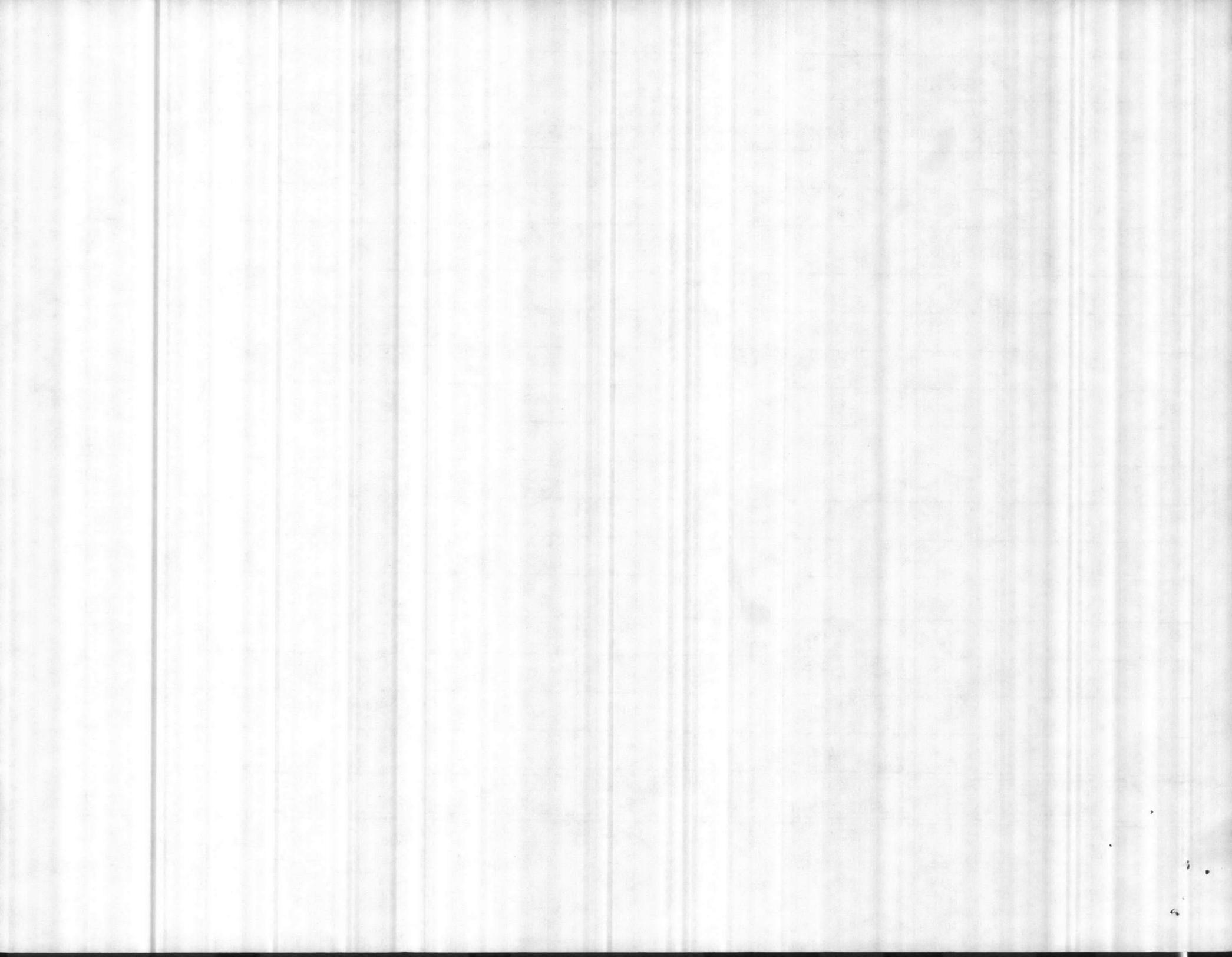
	TT-26	TT-30	TT-52	TT-53	TT-54	TT-67			
Parameter	<del>WADSWORTH POINT</del>	<del>MONTFORD POINT</del>	<del>WAMP GARDNER</del>	<del>TARAWA TERRACE</del>	<del>ONSLOW BAY</del>	<del>COOKHOUSE BAY</del>	<del>REFLEX RANGE</del>	<del>XXXXXXXXXX</del>	<del>NEW KIRK</del>
PH	7.4	7.3	7.2	7.4	7.5	7.7			
PHENOLTHALEIN ALKALINITY	0	0	0	0	0	0			
METHYL ORANGE ALKALINITY	228	224	204	198	180	172			
HARDNESS CARBONATES AS CaCO <sub>3</sub>	220	220	256	216	200	164			
BICARBONATES AS CaCO <sub>3</sub>									
CHLORIDES AS Cl	14	16	12	8	12	2			
HARDNESS AS CaCO <sub>3</sub>									
IRON AS Fe	.93	12.0	5.20	1.0	.53	1.25			
MANGANESE IRON BICARBONATE	.02	.10	.06	.03	.01	.03			
CALCIUM IRON BICARBONATE	103	85	106	80	81	67			
MAGNESIUM IRON BICARBONATE	2.26	2.2	2.72	1.82	1.40	1.79			
FLUORIDE									
CHLORINE RESIDUAL									

REMARKS:

NOTE: All results reported in parts per million unless otherwise noted except for pH, temperature, and specific conductance. One liter of potable water is assumed to weigh one kilogram.

LABORATORY ANALYSIS BY:

DATE OF ANALYSIS:



NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES  
 CHEMICAL ANALYSIS OF WATER  
 Division of Health Services, Laboratory Section  
 P. O. Box 25047, Raleigh, North Carolina 27611

Complete all items above Heavy Line  
 (see instructions on reverse side)

Name of Owner or Supplier: CAMP LEJEUNE  
 Address: JACKSONVILLE, N.C.  
MONTFORD POINT Well No. M - 630  
 County: ONSLAW  
 Report to: WORTH F. PICKARD  
BOX 1085  
SANFORD, N.C. 27330  
 Collected by: RALPH W. HARRISON  
 Date Collected: 10/15/75 Time: 5:30 p.m.  
 Remarks: EAST COAST CONSTRUCTION CO. INC.  
P. O. BOX 5004  
JACKSONVILLE, N. C. 28540  
Contract N62470-75-C-5109  
Addition to Water Wells  
Camp Lejeune, N. C.

Type of Supplier:  
 1-Municipal  
 2-Sanitary District  
 3-Mobile Home Park  
 4-Community  
 5-Association  
 6-Industrial  
 7-Institution  
 8-Private  
 9-Other

Source of Water:  
 1-Ground  
 2-Surface  
 3-Both  
 4-Purchases

Source of Sample:  
 1-Well tap  
 2-House Tap  
 3-Distribution Tap

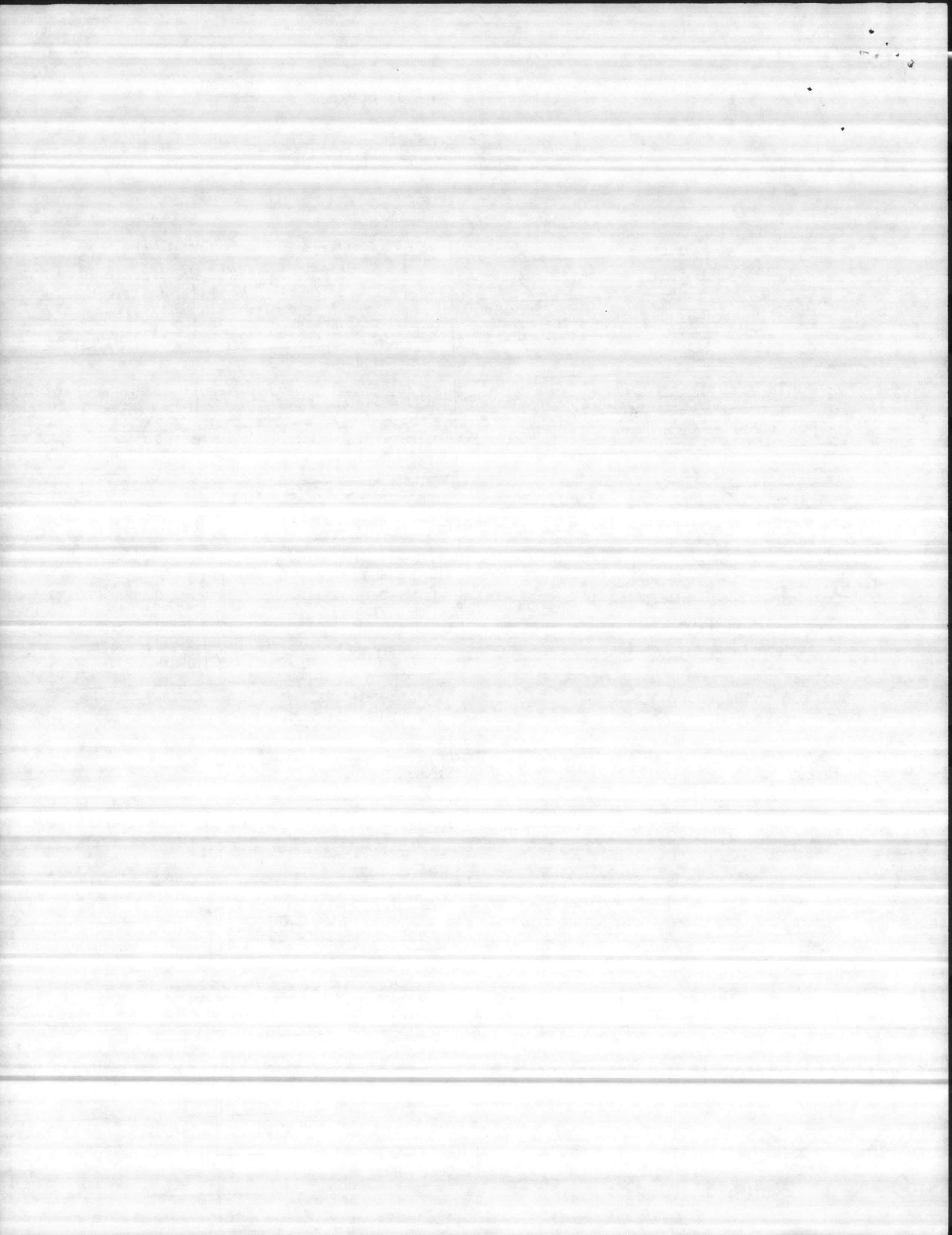
Type of Sample:  
 1-Raw  
 2-Treated

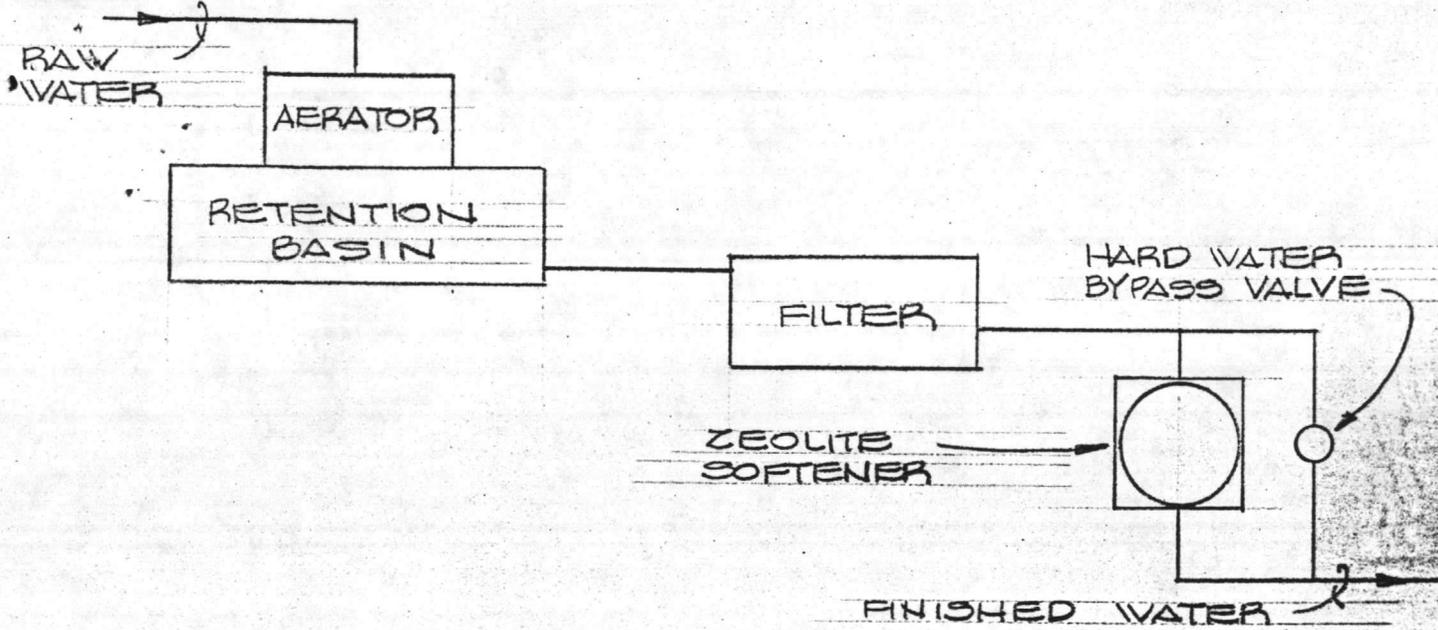
Type of Treatment:  
 0-None  
 1-Chlorinated  
 2-Fluoridated  
 3-Filtered  
 4-Alum  
 5-Lime  
 6-Soda Ash  
 7-Polyphosphate  
 8-Water Softener  
 9-Other

Analysis Desired:  
 1-Complete analysis (18 tests)  
 2-Partial analysis (9 tests)

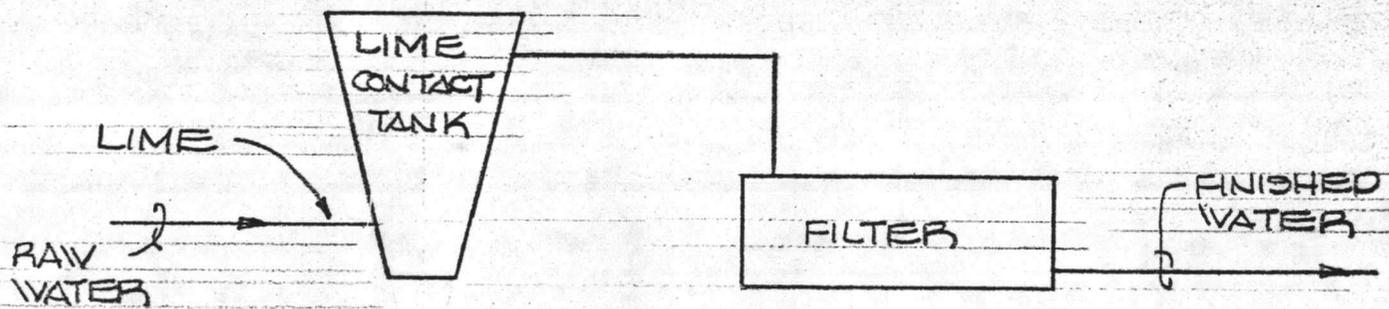
ANALYSIS

Color	(000)	0	units	Ph	(00.0)	7.2
Results in Parts per Million						
Alkalinity CaCO <sub>3</sub>	(000)	217		Fluoride	(0.00)	0.13
Total Hardness	(000)	282		Arsenic	(*0.00)	< 0.01
Iron	(*00.00)	0.23		Cadmium	(*0.00)	< 0.01
Manganese	(*00.00)	< 0.03		Chromium <sup>VI</sup>	(*0.00)	< 0.05
Chloride SiO <sub>2</sub>	(000)	2.5		Copper	(*00.00)	< 0.05
Hardness CaCO <sub>3</sub>	(000)	7		Lead	(*0.00)	< 0.05
Chloride	(000)	49		Zinc	(*00.00)	< 0.05
Sulfate	(000)	10		Calcium		109.0
Chloride	(00.0)	1.7		Magnesium		2.4





AERATION-FILTRATION-ION EXCHANGE



COLD LIME PROCESS

TREATMENT PROCESSES  
 TARAWA TERRACE-MONTFORD POINT  
 CAMP LEJEUNE, N.C.

NG2470-78-B-4600

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