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United States Department of the Interior

GEOLOGICAL SURVEY

P. O. Box 2857
Raleigh, North Carolina
27602

May 28, 1985

Mr. Douglas Nelson, Director
Natural Resources and Environmental
Affairs Division
Building 198, Stop 1
Marine Corps Air Station
Cherry Point, North Carolina 28533

Dear Mr. Nelson:

Per your request during our telephone conversation on May 10, 1985, we have made changes in the proposed study of ground-water supply at the Air Station to reduce costs. We will delete the five to seven shallow (60 to 75 feet deep) wells we had planned to construct for the purposes of sampling and analyzing soil and aquifer materials, and for monitoring ground-water quality and water-table fluctuations. This is done with the proviso that five to seven replacement wells are constructed according to the attached location map and specifications. The wells are numbered according to priority on the map, from highest priority (1) to lowest (7).

We checked with Mr. Ray Whitaker of Froehling and Robertson, Inc., and he told us they didn't have the equipment needed to construct the kind of wells we want for the study. So, we have scaled down the specifications for the shallow replacement wells to suit their equipment. These shallow wells are very important to the aquisition of data needed for the proposed study, and we are giving up our control on the amount and kind of samples that will be collected and the quality of the well construction. Consequently, the amount of the resulting data will be reduced and the quality of the data will have to be taken at face value.

The estimated drilling costs have been reduced to $110,000, and geophysical-logging and laboratory-service costs for PHASE 2 of the study have been reduced to $10,000 and $20,000, respectively.

Mr. Turner (District Chief) and I went to Reston, Virginia, to discuss the proposed study with USGS personnel at our National Headquaters on May 15 and 16, 1985. We requested that more USGS research personnel become involved in the planning and implementation of the project, particularly the research drilling and sampling team from Denver, Colorado. If the drilling and sampling team can work with us we can probably further reduce the drilling costs for the project. However, if they become involved we will have to be able to publish some reports on the results of the study, particularly on the drilling and sampling techniques used.

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At present we had better plan on an estimated minimum amount of $110,000 as the cost of drilling, well construction, sampling and well testing. I'll let you know when we receive further information on the research people and their involvement.

I have revised the proposal and the preliminary work plans to reflect these new cost estimates and have enclosed copies of the documents for your information. Please call (919-755-4510) if you have any commments or questions about any of the enclosures.

Sincerely,

Orville B. Lloyd, Jr.

Orville B. Lloyd, Jr.
Hydrologist

Enclosures

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Procedure for constructing shallow observation wells, 3-inch diameter

1. 60' split-spoon sampling (about one sample every 5 feet).

2. 60' x 6" borehole.

3. 37' x 3" screw-joint (no glue), schedule 40 PVC casing and

4. 25' x 3" screw-joint schedule 40 PVC casing (no glue) slotted

5. Swab and clean inside of schedule 40 PVC casing (slotted and unslotted) with strong detergent (Liqui-Nox for example) and rinse with clean water.

6. Place casing in 6" borehole centered from top to botton and

7. Place clean, washed, medium-grained, quartz sand in annular space between 6" borehole and 2" casing to a depth of about 32 feet below land.

8. Place 2 feet of bentonite pellets above sand filter pack and fill remainder of the annular space with grout back to land surface.

9. Pump well until water clears.

10. Clean rig plumbing and pumping system by pumping detergent and rinse water through the rig with its own pumps, and steam clean split-spoon equipment and drill stem and rods inside and out before moving rig and/or drilling another hole.

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PRELIMINARY WORK PLAN FOR PHASE 1
(Fiscal Year 1986)

WORK TASK I. Determine the present quality of water from existing supply wells that tap the deep, limestone, water-supply aquifer in the Air Station area.

a. Collect water samples from existing supply wells in conjunction with the NACIP water-sampling program
b. Analyze samples with emphasis on determining the presence or absence of the hazardous and toxic wastes that have been disposed or spilled at the Air Station

WORK TASK II. Evaluate the general lithic character, thickness, extent and continuity of any confining beds and aquifers overlying the deep, limestone, water-supply aquifer from geophysical logs made in existing wells in the Air Station area.

a. Pull pumps from existing water-supply wells and make gamma-ray, neutron, bulk density and sonic travel-time logs in these and other available wells
b. Analyze logs to determine aquifer and confining bed lithology and porosity type and distribution

WORK TASK III. Map potentiometric surfaces of the shallow water-table aquifer and the deep, limestone, water-supply aquifer from water-level measurements made primarily in existing wells in the Air Station area.

a. Make two sets of water-level measurements in wells and local creeks and streams, one in "wet" and one in the "dry" season
b. Establish water-level recorders on selected existing and available wells that may occur in the shallow water-table aquifer and the deep water-supply aquifer
c. Construct a few shallow wells if needed to prepare a water-table map

WORK TASK IV. Prepare report on the results of the Phase 1 investigations with appropriate illustrations and data tables.

ESTIMATED COSTS FOR PHASE 1

Geophysical logging	$ 25,000
Laboratory services	43,000
Data collection, analysis, interpretation, and report preparation	50,000
Total estimated costs for Phase 1	$ 118,000

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PRELIMINARY WORK PLAN FOR PHASE 2
(Fiscal Years 1987 and 1988)

WORK TASK I. Review available geologic, hydrologic and chemical data and determine exact location and number of test wells to be drilled.

a. Coordinate drilling and additional data collection with the data compiled during the NACIP investigations at the Air Station in order to share information and minimize expense where possible
b. At present, it is estimated that about four wells will be needed (one about 450 or 500 feet, and three about 120 feet in depth)

WORK TASK II. Prepare drilling specifications, distribute specifications for bids and award contract to a qualified drilling contractor.

NOTE: Because of the hazardous and toxic nature of some of the wastes disposed at the Air Station, the drilling specifications will include special and expensive well-construction procedures and personal-safety precautions that must be taken during this phase of the investigation to protect on-site workers, the general public, the environment and the water-supply aquifer. These procedures and precautions are listed in the appendix to the project proposal.

WORK TASK III. Drill test wells and collect data needed to determine and verify the physical and chemical characteristics of the aquifer and confining-bed materials and fluids that overlie and occur within the deep, limestone, water-supply aquifer.

a. Collect split-spoon samples of aquifer and confining-bed materials at specified depth intervals and analyze selected samples to determine chemical and hydraulic characteristics
b. Collect ground-water samples from test wells at specified depths and analyze samples for selected constituents including concentrations of chloride, heavy metals, cyanides, and organic compounds that can be associated with the work activities at the Air Station
c. Make water-level measurements and selected hydraulic tests at specified depth intervals in the test wells to determine the distribution of hydraulic head and hydraulic conductivity
d. Make geophysical logs in test wells selecting combinations of gamma-ray, neutron, bulk density, sonic travel-time, resistivity, spontaneous potential, and conductivity surveys best suited to data needs

WORK TASK IV. Prepare report on the results of Phase 2 investigations with appropriate illustrations and data tables.

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ESTIMATED COSTS FOR PHASE 2

Construction and equipment	
Well drilling, construction, sampling and testing	$110,000
Safety equipment	
Air monitoring instruments	9,500
Personal protection respirators and clothing	7,500
Water-sampling equipment	3,000
Geophysical logging	10,000
Laboratory analytical services	20,000
Data collection, analysis, interpretation, and report preparation	114,000
Total estimated costs for Phase 2	$ 274,000 a/

a/ - This sum is to be divided over two fiscal years as follows:
Fiscal Year 1987 funds: $ 137,000
Fiscal Year 1988 funds: $ 137,000

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PRELIMINARY WORK PLAN FOR PHASE 3
(Fiscal Year 1989)

WORK TASK I. Construct a finite-difference ground-water flow model of the hydrogeologic system in and around the Air Station from the data and interpretations that resulted from investigations during Phases 1 and 2.

a. Determine grid system for area and discretize appropriate maps of aquifer and confining-bed characteristics (such as structure tops, thicknesses, hydraulic conductivity, potentiometric surfaces, etc.)
b. Determine boundary conditions
c. Develop a steady-state digital model for unstressed (pre-pumping) conditions in the area
d. Evaluate different ground-water pumpage and development schemes to determine which alternatives will reduce the chances for contamination of the water-supply aquifer

WORK TASK II. Prepare report on the results of Phase 3 investigations with appropriate illustrations and data tables.

ESTIMATED COSTS FOR PHASE 3

Computer time and computer-support personnel.....	$ 29,000
Data preparation, analysis, interpretation and report preparation.....	79,000
Total estimated costs for Phase 3.....	$ 108,000

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PROJECT PROPOSAL

NC 84F GROUND-WATER SUPPLY AND POTENTIAL FOR CONTAMINATION -- CHERRY POINT MARINE CORPS AIR STATION, NORTH CAROLINA

U.S. Geological Survey
Raleigh, N.C.

June 16, 1983
Revised 8-9-83
Revised 4-1-85
Revised 5-24-85

PREFACE

This proposal was prepared by the U.S. Geological Survey at the request of the U.S. Marine Corps. Years of accumulated hazardous and toxic wastes at the Marine Corps Air Station have created actual and potential water contamination problems for both the area ground-water and surface-water systems. This study deals with the ground-water problems and is divided into three phases. Phase 1 addresses the immediate need of the Air Station to evaluate the quality of the present ground-water supply regarding actual and potential contamination by the disposed wastes. The possibility of these hazardous and toxic substances being in the water-supply aquifer is of critical concern because of the relative location of supply wells to the disposal and spill areas. Phase 2 addresses the anticipated need for additional chemical, geologic and hydrologic data by proposed test-well drilling at selected locations to determine and verify the characteristics of the aquifers, confining beds and fluids that occur in the Air Station area. The data and interpretations obtained from Phases 1 and 2 will be needed for Phase 3, which will consist of constructing a finite-difference, ground-water flow model to determine alternative ground-water use and management practices that will help reduce the chances for contamination of the water-supply aquifer. The three phases are necessary because the water-supply contamination situation appears to be critical and this study approach allows the most pressing and important questions to be answered first and as quickly as the process of obtaining reliable answers will allow.

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PROJECT PROPOSAL

TITLE AND LOCATION: NC 84F Ground-water supply and potential for contamination -- Cherry Point Marine Corps Air Station, North Carolina

The Marine Corps Air Station, an area of about 18 square miles, is located in southeastern Craven County, North Carolina. The station is bounded on the north by the Neuse River, the east by Hancock Creek, the south by NC Highway 101 and the west by an irregular north-south line located about 0.75 miles west of Slocum Creek (see fig. 1 and 2).

PROBLEM AND NEEDS: Since the Air Station opened in 1942, water supply has been derived from a thick artesian-limestone aquifer, the top of which underlies the station at a depth of about 120 feet below sea level (fig. 3). Considerable amounts and various kinds of hazardous and toxic liquid wastes have been spilled or disposed of at numerous different landfill sites on the Air Station (fig. 2). These predominately sandy landfill sites, in use for over 40 years, lack natural or synthetic seepage barriers as required by today's standards.

The heaviest concentration of disposed wastes and spills is very near the line of production wells that supply most of the water for the Air Station. Supply wells partially penetrate the artesian-limestone aquifer and, in places, the potentiometric surface is below the water table thereby enhancing downward movement of contaminants from the water-table into the artesian aquifer. This potential for downward movement is greatest around the pumping supply wells (fig. 3). Potential contamination of the water supply aquifer is increased by the possibility of direct connection between the aquifers through deep wells via improper construction, incomplete plugging, or corroded or breached casing. In addition, the lower part of the water-supply aquifer contains saline water, which has the potential to encroach on the freshwater supply. The potential for movement of hazardous and toxic wastes and saline water into the area ground-water system, and the ground-water use and management practices that will reduce the chances of contamination, need to be evaluated.

PURPOSE OF PROJECT: The purpose of the proposed study is to evaluate (1) the quality of ground-water being pumped from the Air Station wells that tap the artesian-limestone aquifer (water-supply aquifer), (2) the potential for contamination of the water-supply aquifer by hazardous and toxic wastes that occur at various surface disposal sites at the Air Station, and by saline-water encroachment, and (3) alternative ground-water use and management practices that will help reduce the chances for contamination of the water-supply aquifer.

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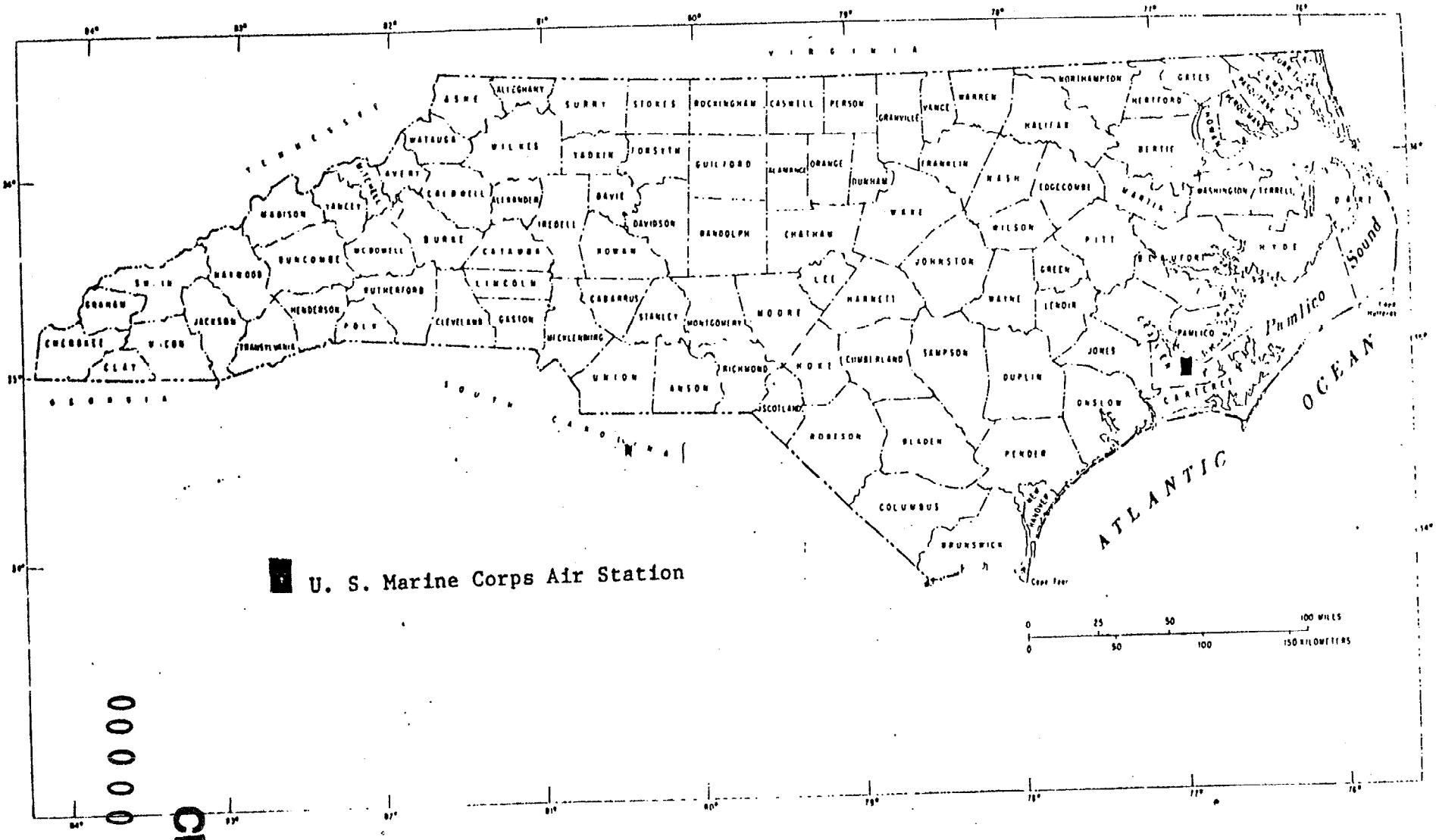

U. S. Marine Corps Air Station

Figure 1.--Location of Cherry Point Marine Corps Air Station, Havelock, North Carolina.

SCOPE OF PROJECT: The study area includes the Air Station and environs, but particular emphasis will be placed on the western half of the Air Station where the present water-supply wells and the greatest concentration of waste sites occur (fig. 2). Study elements will include determining the present quality (with appropriate emphasis on the hazardous and toxic wastes) of the ground water from wells that tap the artesian-limestone (water-supply) aquifer, the water-table aquifer, and the intermediate-sandy aquifer (fig. 3). Potential contamination of the water-supply aquifer by toxic and hazardous waste will be evaluated by determining the hydraulic potential for downward movement of contaminated water from the water-table to the artesian-limestone aquifer and estimating the amount and rate of movement. In addition, the depth of the freshwater/saline-water interface will be determined and the potential for upward movement of the saline water will be evaluated.

Water-level and water-quality data obtained from more than 50 wells that were drilled during the second phase of the Navy Assessment and Control of Installation Pollutants (NACIP) program at the Air Station, will be used in conjunction with the data to be collected during the proposed USGS study to help define the hydrology and any potential and existing water-quality problems. The wells drilled for the NACIP program range from 25 to 75 feet in depth, and were located adjacent to 14 disposal sites at the Air Station to confirm whether or not the shallow ground water has been contaminated by hazardous and toxic wastes.

Because of the hazardous and toxic wastes disposed at the Air Station, special and expensive well construction procedures and personal safety precautions must be taken during the course of the investigation to protect the on-site workers, the general public, the environment and the water-supply aquifer. These precautions are listed and discussed in the appendix to this proposal.

PROJECT PLANS:

1. Quality of ground water - Water samples will be collected from the individual water-supply wells and other selected wells that may tap the artesian-limestone aquifer; from three temporary observation wells that will be constructed in the intermediate sandy aquifer at locations between the hazardous-waste sites and the existing water-supply wells; from a temporary test well that will be drilled in the artesian-limestone aquifer (possibly in the vicinity of the golf course at the Air Station); and from existing water supply wells. Chemical analyses of the water samples will include determining the concentrations of chloride, heavy metals, cyanides and organic compounds that can be associated with work at the Air Station. The water quality determinations will be made primarily to identify, quantify, and determine the source of chemical constituents in the raw-water supply.

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2. Hydraulic potential for ground-water movement - Water level data will be collected on the deep artesian-limestone aquifer, the intermediate artesian-sand aquifer and the water-table aquifer (fig. 3) from existing wells and from the proposed temporary test well and observation wells. Estimates of the water transmitting and storage capabilities of the artesian-limestone aquifer will be used to calculate water-level drawdowns in the limestone aquifer beneath the waste sites. Maps and cross sections of the water-table and potentiometric surfaces will be constructed from the water-level data, and the amount and spacial distribution of the head differences within and between the water-table and artesian aquifers will be determined.

3. Amount and rate of ground-water movement - Geophysical logs of open and available observation wells will be used to estimate the thickness and areal extent of the confining beds that separate the aquifers. From and in conjunction with this data, about three core holes will be located and drilled through the confining bed materials and the core samples will be tested in the laboratory for vertical hydraulic conductivity. Careful siting and special construction methods will be used to nullify the possible spread of contamination during the coring operations. In addition, these holes will be plugged with cement when sample collection and observations have been completed. The vertical conductivity data and the other hydrologic and geologic data collected will be used to construct a finite-difference digital model of the hydrologic system that in turn will be used to compute estimates of the amount and rate of water moving into the artesian water-supply aquifer. This model will be used to evaluate alternative ground-water use and management practices that will help reduce the chances for contamination of the water-supply aquifer.

RELATION TO LONG-RANGE PLAN: This study relates directly to the North Carolina District's long-range plan (dated May 12, 1980) involving deterioration of ground-water quality due to waste-disposal and land-use practices.

RELATION TO STATE AND WRD PROGRAMS: Several State agencies are involved in study or regulating waste-disposal and land-use practices. The Division of Environmental Management is looking at the Air Station's waste sites to determine the degree to which Slocum Creek may be contaminated by waste leachate. The Department of Human Resources, having adopted EPA Hazardous Waste-Site Regulations, is interested in the ground-water contamination and monitor-well programs everywhere in the State.

Ground-water contamination studies, including those involving waste disposal, are of high national priority FY 85 for the Geological Survey.

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STUDY BENEFITS: Results of this study will provide information for operating and protecting the water-supply system and to help insure safe drinking water at the Air Station. In addition, the results should provide data that will lead to a better understanding of the movement of various types of contaminants in Coastal Plain sediments in humid regions.

REPORTS: A report will be written for the USMC describing the results of each completed phase of the investigation (see TIME FRAME for phase descriptions). The completion of all three phases of the study will result in an interpretive report entitled, "Ground-water supply and potential for contamination - Cherry Point Marine Corps Air Station, North Carolina." Additional reports may be written on various technical aspects of the investigation. Written progress reports on the study will be prepared and submitted quarterly.

TIME FRAME: The study is divided into three phases and is proposed to begin October 1, 1985 and end September 30, 1989. Because of the large expense of special well-drilling procedures and personal safety precautions, the middle phase has been extended over a two-year period. A brief discussion of the work tasks and the time frame for each of the phases follows:

Phase 1 (Fiscal Year 1986) - Appraise the quality of water in the deep, limestone, water-supply aquifer, and the hydrogeology, distribution of hydraulic head and configuration of the potentiometric surface in the deep, water-supply aquifer, and the shallow water-table aquifer, primarily with EXISTING WELLS.

Phase 2 (Fiscal Years 1987 and 1988) - Collect additional hydrogeologic and chemical data needed to determine and verify the hydraulic and chemical characteristics of aquifer and confining-bed materials and the fluids, respectively, that overlie and occur within the deep, limestone, water-supply aquifer, primarily with NEW TEST-WELL DRILLING.

Phase 3 (Fiscal Year 1989) - Construct a finite-difference model of ground-water flow through the aquifer and confining-bed materials in the Air Station area to determine alternative grond-water use and management practices that will reduce the chances for contamination of the water-supply aquifer in the Air Station area, primarily with DATA FROM PHASES 1 and 2.

MANPOWER: Manpower required to complete the study are summarized below, as follows:

Project chief:	Hydrologist,	GS-1315-12/13	Full time
Project staff:	Hydrologist,	GS-1315-7/9	Part time
	Hydrologic technician,	GS-1315-7/9	Part time

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APPENDIX
(Safety Precautions and Drilling Procedures)

Special considerations:

These wells will be drilled on a military installation and, to the best of our knowledge, near but not in old hazardous-waste dump sites. Nevertheless, precautions will be taken to protect the contractor and USGS personnel working at the borehole sites and the general public and environment in the event that the drill should accidently unearth some hazardous waste material. These precautions are listed as follows:

1. The air around the drilling rig will be monitored to help maintain proper protection measures. The monitoring will be done by USGS personnel.

2. Some self-contained breathing apparatus (30 minute and 5 minute escape type) and air-purifying respirators (full faced, canister equipped) provided by the USGS will be available at the site. However, a proper fit cannot be assured unless the contractor provides respirator masks that have been approved by the National Institute for Occupational Safety and Health (NIOSH) and fitted to their own pesonnel.

3. Protective clothing--it will be necessary for the contractor to provide protective clothing for their personnel. The following items will be needed for each worker to insure personal protection and safety:

   a. Chemical splash suit (2 piece) made of neoprene (best design includes jacket with nondetachable hood, without fabric-lined neck, and flap covering front buttons or zipper; bib overalls without fly).

   b. Boots, steel toe and shank, made of neoprene or nitrile (also referred to as Bunar-N, milled nitrile, nitrile laytex, NBR, and acrylonitrile) 12 to 14 inches high.

   c. Gloves (2 pair worn at once) inner glove of natural rubber (surgical type) and outer glove made of nitrile, gauntlet about 14 inches long.

   d. Hard hat, and face shield or safety glasses or goggles to protect face and eyes from splashes when full face-mask respirator is not worn.

4. If large amounts of water are to be discharged at the bore hole sites, arrangements will be made to discharge the water into a railroad tank car and run it through the industrial waste treatment plant at the installation. The Hazardous Waste Coordinator at the installation will help determine the necessity for such action, and will arrange for implementation if such action is necessary.

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Procedure for construction of deep observation wells

1. 60' split-spoon sampling (about one sample every 5 feet).
2. 60' x 12" borehole.
3. 62' x 8" schedule 40, screw-joint (no glue) PVC casing.
4. Place grout between 12" borehole and 8" casing (centered).
5. Change mud, clean rig plumbing and puming system by pumping detergent and rinse water through rig with its own mud pumps, and steam clean split spoon and drilling stem and rods inside and out.
6. 1 Shelby-tube sample from about 60 to 62 feet.
7. 60' split-spoon sampling from about 62 to 122 feet (once about every 5 feet).
8. 60' x 7 5/8" borehole.
9. 1 Shelby-tube sample from about 122 to 124 feet.
10. Swab and clean inside of schedule 40 PVC casing (slotted and unslotted) with strong detergent (Liqui-Nox for example) and rinse with clean water.
11. 15' x 4", schedule 40, screw-joint (no glue) slotted PVC casing.
12. Place slotted and unslotted casing in 7 5/8" borehole and center from bottom to top.
13. Stand by 1 hour for USGS personnel to make gamma-ray log.
14. Set screen (slottted casing) and place clean, washed, medium-grained, quartz sand around screen in annular space between 7 5/8" borehole and 4" casing and pump well until water is clear. Then fill the rest of the annular space with the sand to a depth of about 80 feet below land.
15. Place 2 feet of bentonite pellets above sand filter pack and fill the remainder of the annular space with grout back to land surface.
16. Pump well until water clears.
17. Repeat step 5 above before moving to and/or drililng another well.

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DEPARTMENT OF THE NAVY SELF-DUPLICATING NOTE

Use only for an informal, preferably hand-written note. Make duplicate only when required for follow-up or work file. See correspondence manual for formal, official memoranda.

TO: → MAIN (Attn: UTIL)

NREAD

☐ ACTION	☐ COORDINATE	☐ PREPARE FOR SIGNATURE
☐ AS DISCUSSED	☐ CORRECTION	☐ REPORT BACK
☐ CALL/SEE ME	☒ INFORMATION	☐ RETURN
☐ COMMENT/CLEAR	☐ PREPARE DRAFT	☐

SUBJ: GROUNDWATER RESOURCE STUDY

Encl: USGS ltr dtd 28 May

- This shows (Cherry Point efforts) mostly in the NACIP work
- USGS, Raleigh called yesterday + wants to ~~set~~ up a discussion of our needs: 23 July 85 (I'll send them a letter)
- Your input is needed on:
  - scope of work
  - questions to be answered
  - source of funds
  - etc.
- call if ?'s.

FROM: [signature]

DATE 6/19

EXT. 3034

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