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WORK PLAN FOR PHASE 1  
(April 1, 1986 - April 1, 1987)

Work items to be accomplished during Phase 1 will be based almost entirely on existing data.

WORK TASK I Compile all available ground-water data from USGS, State, and Camp Lejeune files for the area, including water-level, water-quality, water-use, and well-log data. Construct a computer data set of this data that will facilitate future statistical analysis.

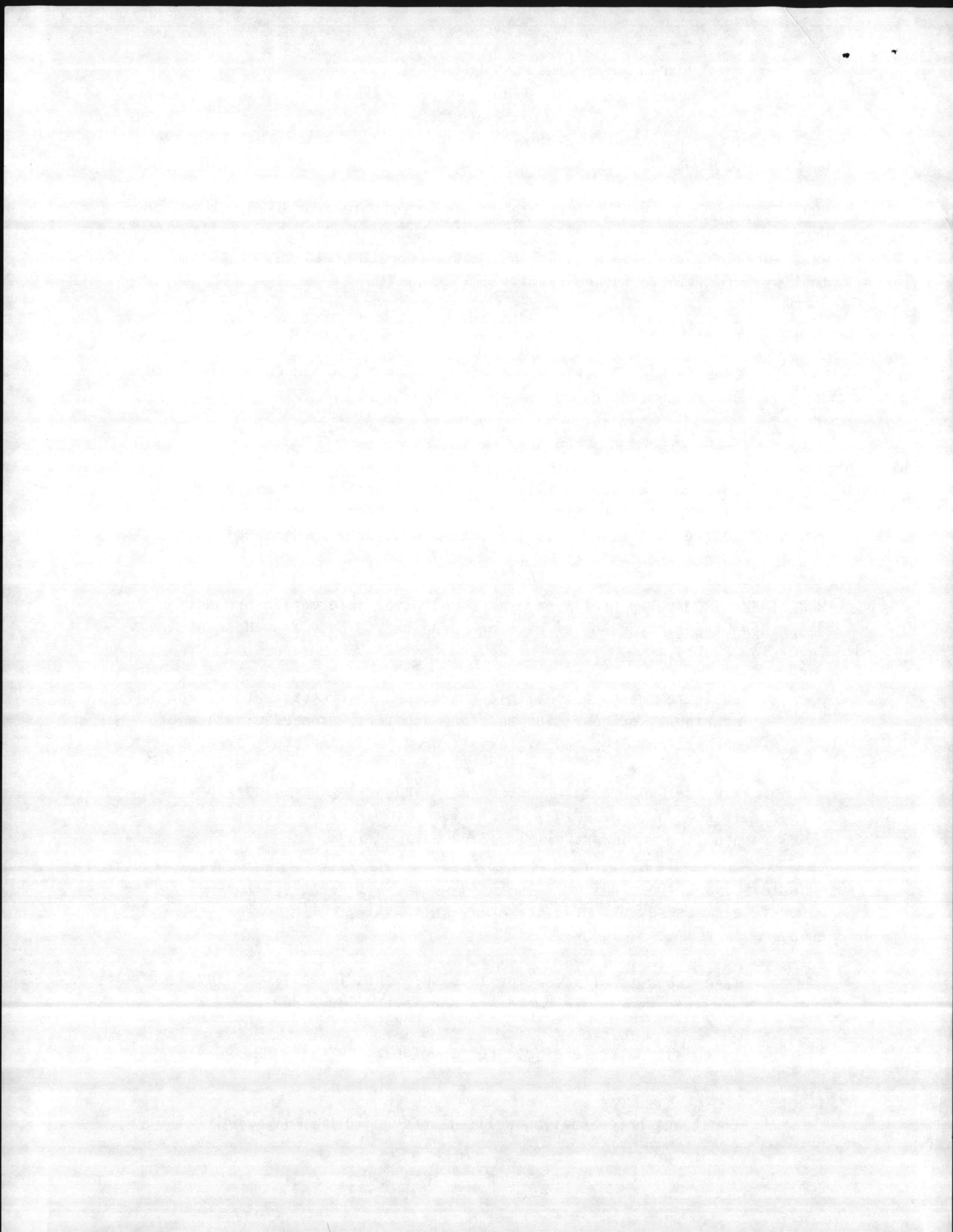
- a. Compile USGS data sources.
- b. Compile N.C. Department of Natural Resources and Community Development data sources.
- c. Compile Camp Lejeune data resources.
- d. Inventory existing wells, take water-quality samples, and evaluate field parameters including chloride concentration, bromide concentration, pH, temperature, dissolved oxygen, specific conductance.

WORK TASK II Develop preliminary maps and other information products describing the geohydrologic framework beneath the base and adjacent areas in Onslow County.

- a. Evaluate the general lithic character, thickness, extent, and continuity of confining beds and aquifers, from examination of geophysical logs made in existing wells in the study area.
- b. Run new geophysical logs for existing wells where additional data is needed. These logs may include gamma-ray, neutron, bulk density, sonic gravel-time, and caliper logs.

WORK TASK III Map potentiometric surfaces of the water-supply aquifer from water-level measurements made primarily in existing wells in the Camp Lejeune 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.
- c. Construct a few shallow wells if needed to prepare a water-table map.



The information from WORK TASKS I, II, and III will be used to make a preliminary assessment of the hydrogeologic framework beneath Camp Lejeune. This assessment will be reviewed in Phase 2a (WORK TASK I) to determine the location and number of test wells to be drilled.

WORK TASK IV Prepare report on the results of the Phase 1 investigations with appropriate illustrations and data tables. The proposed title of the Phase 1 report is "A preliminary geohydrologic framework of the Camp Lejeune Marine Corps Base area, N.C."

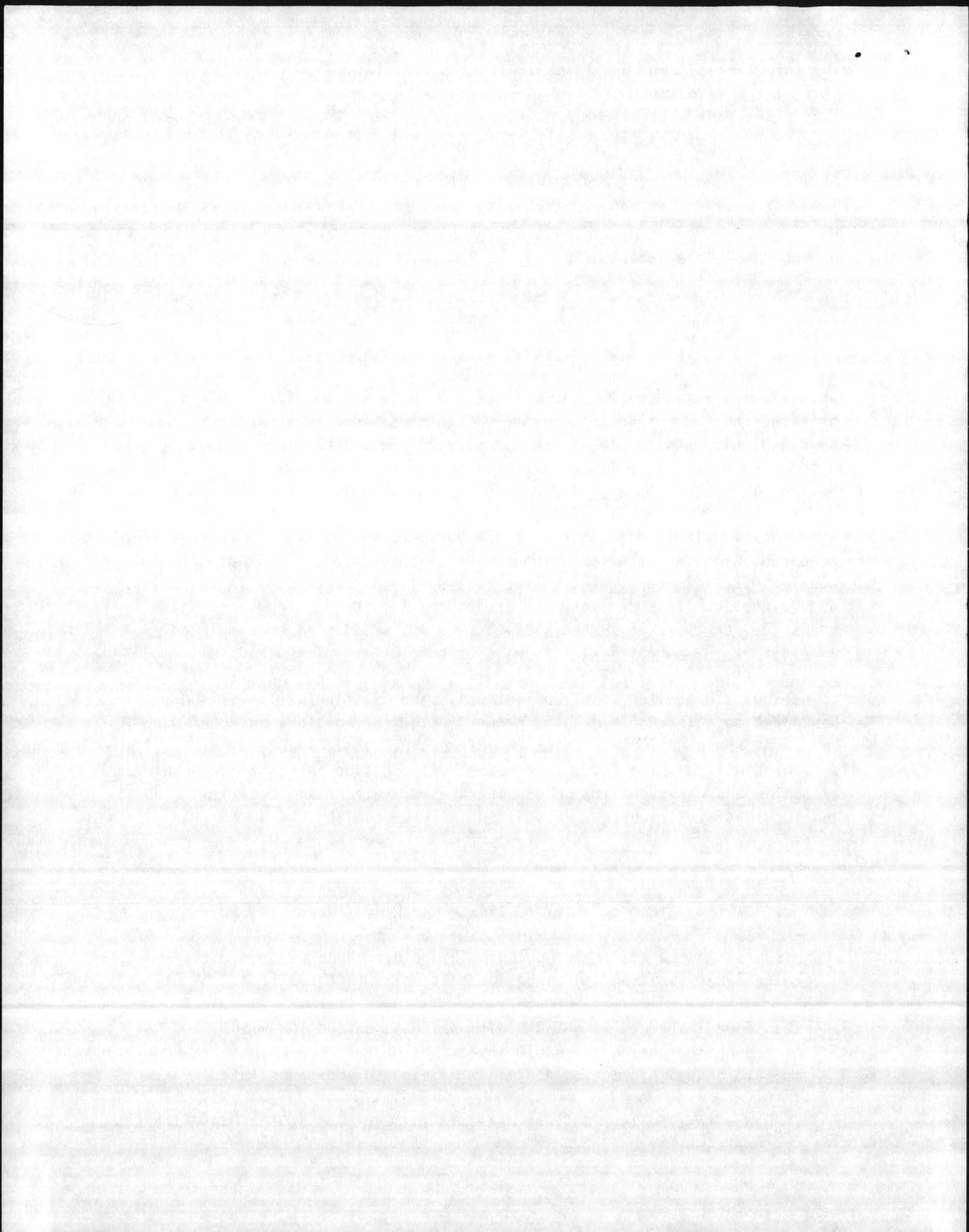
WORK PLAN FOR PHASE 2  
(Years 2 and 3 (April 1, 1987 - March 30, 1989))

Phase 2 will extend over a two-year period and will be devoted to test drilling and the collection and analysis of additional water quality, hydrogeologic, and aquifer hydraulic-parameter data. The work tasks associated with the drilling, testing, and analysis of new well data will be divided into two subphases, 2a and 2b. Phase 2a will be a drilling phase and Phase 2b will be a testing and data-analysis phase. At the end of Phase 2a, a data report describing the hydrogeology of the new wells will be prepared. The report will include information on geologic formations and aquifer materials penetrated by the test wells, water quality in the wells, and geophysical logs completed by the end of 2a. During the third year of the study, or Phase 2b, geophysical logging of wells will be completed, analysis of the geophysical logs will be completed, editing and refinement of the preliminary hydrologic framework developed during Phase 1 will be completed, and aquifer tests on test wells and existing wells will be conducted to determine hydraulic properties of the aquifers and confining beds. At the end of Phase 2b, a report on the revised hydrogeologic framework will be prepared. This report will include information on the hydraulic and water-quality properties of the aquifers and confining beds and the spatial variability of these properties beneath the base.

PHASE 2a  
Year 2 (April 1, 1987 - March 30, 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 Camp Lejeune in order to share information and minimize expense where possible.
- b. New test wells (200 feet deep) to fill in gaps in the Phase I cross sections are proposed:



- 1) One well south of HP-632 on Section A-A'
- 2) One well on Paradise Point east of NW-3 on Section B-B'
- 3) One well on the shore of the New River on the M.C. Air Station side on Section B-B'
- 4) One or two wells along the Camp Lejeune--Cherry Point Railroad
- 5) Two wells along a proposed new dip Cross Section paralleling Wallace Creek

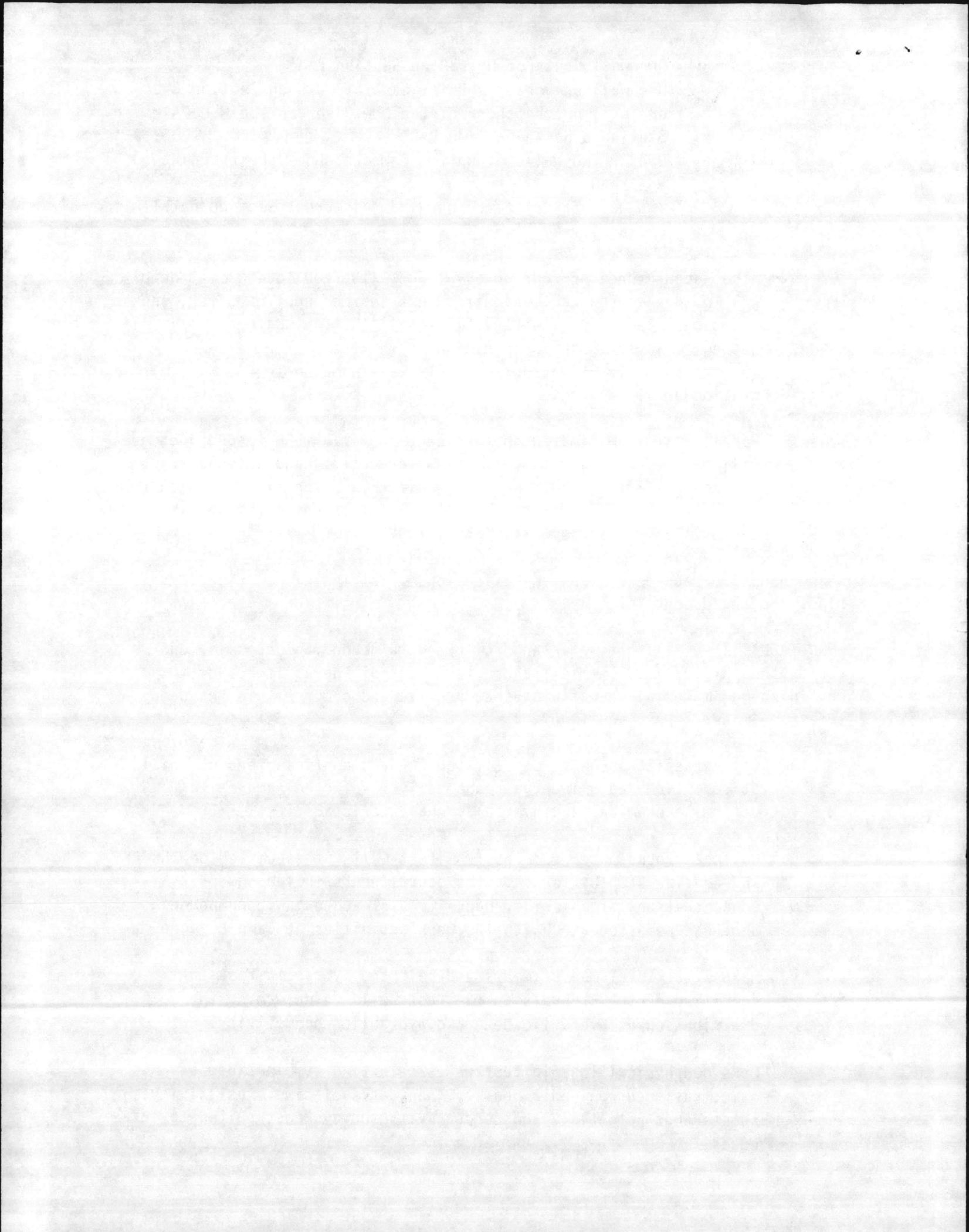
Also, about three or four observation wells (200 to 400 feet deep) will be needed to make an aquifer test in the supply aquifer, and an additional four to six observation wells (50 to 100 feet deep) will be needed to investigate the position of the freshwater-saltwater interface and its relation to supply-well pumping in the M.C. Air Station area.

Finally, it is estimated that three test wells (500 to 600 feet deep) will be needed to investigate the water-quality and water-bearing characteristics of the deep sand aquifers and the limestone aquifer in the base area, however, project funding is not sufficient to allow the drilling of these wells (April 1987).

WORK TASK II Prepare drilling specifications, distribute specifications for bids, and award contract.

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, and organic compounds that can be associated with the work activities at Camp Lejeune.
- 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.



- e. Make surficial geophysical surveys over the New River and elsewhere as feasible to supplement data obtained from the test wells.

WORK TASK IV Prepare report on the results of Phase 2a investigations with appropriate illustrations and data tables. This will be a data report that describes test- and observation-well construction and the new hydrogeologic data from the test wells. The proposed title of the Phase 2a report is "Well logs and hydrologic data from test wells at Camp Lejeune Marine Corps Base, North Carolina." The well logs will include both geophysical and lithologic logs.

#### PHASE 2b

Year 3 (April 1, 1988 - March 30, 1989)

WORK TASK I Complete drilling, sampling, and hydraulic tests of test wells. (This is first priority work item if drilling and testing of test wells was not completed during Phase 2a or if the drilling of additional wells became necessary.)

WORK TASK II Complete geophysical logging of new and existing wells. Analyze logs.

- a. Analyze the geophysical and lithologic logs to identify depths to aquifer units and confining beds.
- b. Construct fence diagrams to determine the lateral extent of aquifer units and confining beds.

WORK TASK III Conduct aquifer tests on new and existing wells to determine hydraulic properties of aquifer unit(s) and confining beds.

WORK TASK IV Based on new findings, refine and edit the preliminary assessment of the hydrogeologic framework that was developed during Phase 1.

WORK TASK V Prepare a report that describes the refined hydrogeologic framework. The proposed title of the phase 2b report is "Hydrogeologic framework beneath Camp Lejeune Marine Corps Base, North Carolina."

#### WORK PLAN FOR PHASE 3

Year 4 (April 1, 1989 - March 30, 1990)

WORK TASK I Construct a finite-difference ground-water flow model of the hydrogeologic system in and around Camp Lejeune based on 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 (optimization analysis).

The ground-water flow model will be a management aid that can be used (1) to guide site selection for new wells through prediction of water-level drawdowns that will occur in response to planned pumping rates at potential well sites, and (2) to evaluate water-level drawdowns at existing production wells through prediction of drawdowns that would occur in response to alternative pumping schedules. The potential benefits to be gained from model studies are less well interference, lower pumping costs, and reduced chance for contamination of the water supply.

WORK TASK II Prepare report on the results of Phase 3 investigations with appropriate illustrations and data tables. The proposed title of the Phase 3 report is "Ground-water supply and potential for contamination--Camp Lejeune Marine Corps Base, North Carolina."

