WATER RESOURCES MANAGEMENT PLAN, JACKSON COUNTY, MISSISSIPPI

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PREAMBLE

The development of an area-wide water resources management plan is a dynamic process involving consideration of many complex issues. The initial step in formulation of the Water Resources Management Plan for Jackson County involved preparation of a Water Resources Evaluation. The following paper is a narrative summary of the Water Resources Evaluation report and related efforts spanning the years 1985 through 1987, and represents a compilation of the conclusions reached at that time. Due to the dynamic nature of the planning process and ever-changing socioeconomic conditions, the findings and recommendations noted herein may not reflect the current status of the various program elements.

INTRODUCTION

With the advent of the space age, the earth has been referred to by many astronomers and earth scientists as the blue planet, due to the color induced by the vast oceans which cover over two-thirds of its surface. The apparent abundance of water revealed by the expanse of oceans, lakes and rivers is deceptive in that less than one percent of the total amount of water on the surface of the earth is considered fresh water, suitable for consumption by man, when excluding consideration of the water trapped in the polar ice caps and glaciers [1]. As the world-wide population and industrial society continues to expand at an exponential rate, the demand for water for survival and economic development is also expected to proceed at a similar pace.

Since human existence is largely dependent upon the availability of drinking water of adequate quality and quantity, the careful control and management of water resources to meet the current and future needs of mankind is essential. The need for such planning and management is evidenced by the increase in total daily water withdrawal for all purposes in the United States from practically zero in ancient times to approximately 2,000 gallons per capita at present [2]. By comparison, the total average daily water demand in Jackson County presently approximates 55 MGD or 430 gallons per capita while the total average daily water demand is projected to exceed to 125 MGD or 900 gallons per capita per day by the year 2005, including a requirement for approximately 30 MGD or 200 gallons per capita of potable water for public and industrial usage [3].

PURPOSE AND SCOPE

To meet these needs, a long range water resources management planning effort has recently been undertaken by the Jackson County Board of Supervisors to provide technical guidance to the infrastructure enhancements needed to meet the public and industrial water supply needs of the County for the next 50 years. The effort included preparation of a technical report completed in December 1986 entitled the Water Resources Evaluation (WRE), which involved the issuance of three reports [3,4,5] summarizing the findings of the investigations and detailing the recommended structural improvements, financial requirements and organizational concepts. The WRE for Jackson County included (1) the development of population/water use projections, (2) an assessment of short-term water resources needs and facilities requirements and (3) development of a comprehensive long-term water resources management plan to serve the future public and industrial water needs of the County, including consideration of a multipurpose reservoir facility.

PHASE I

The initial element of the WRE involved development of population/water demand projections for the County. To facilitate development of these estimates, the County was subdivided into planning districts reflecting consideration of existing certificated water service areas and census blocks as shown on Exhibit 1. This analysis indicated an approximate one percent annual growth in the County population over the next 25 years resulting in an anticipated increase in total population from 118,015 as recorded by the 1980 Census to approximately 153,000 by the year 2005, and 159,000 by 2010.

Similarly, water demand projections were made for each district which indicated that total water usage in the County would increase from approximately 54 MGD at present to approximately 126 MGD by the year 2005-10. Detailed water usage inventories performed in the course of the work indicated a present requirement for supplies of potable water of approximately 19 MGD consisting of 12 MGD for public needs and 7 MGD for industrial needs. In addition, industrial process water demands were found to approximate 35 MGD. Projections indicated that the demand for potable water supplies will increase to approximately 28 MGD, by the year 2005-10, including 19 MGD for public and 11 MGD for industry, while industrial

process water demands will approach 98 MGD. A summary of the population and water demand projections is reflected in Exhibit 2.

PHASE II

Following development of population and water demand projections for the County, efforts focused on the assessment of the short-term water supply capabilities of the groundwater aquifer systems which are currently serving all the public drinking water and high quality industrial water supply requirements of Jackson County. Of the fourteen major groundwater aquifer systems in Mississippi [6], three are available in Jackson County for production of drinking water including the Citronelle, Graham Ferry and Pascagoula formations, all of which are considered part of the Miocene system. The primary production layers from which water suppliers are drawn in Jackson County include the Graham Ferry formation at a depth of approximately 350-450 feet in the Pascagoula area and 600 feet in the Ocean Springs area, and the upper Pascagoula formation at a depth of approximately 600 feet in the Pascagoula area and 900 feet in the Ocean Springs area.

Groundwater usage for public and industrial purposes along the Gulf Coast dates to 1884 when the first successful wells were installed in the area [7] which produced flowing water at artesian heads ranging from 20 feet to 40 feet above land surface in Jackson County. Since that date, records indicate that more than 5,000 public, private and industrial water supply wells have been constructed along the Gulf Coast within six miles of the shore-line [8].

Evaluations of the groundwater aquifer systems in the County were performed as a component of the WRE which indicated that usage for public and industrial purposes had significantly impacted the aquifer systems, resulting in a general decline in the water table, or potentiometric surface, in the Graham Ferry and Pascagoula formations of approximately 85 feet in Jackson County since the year 1900 as shown on Exhibits 3 and 4. Further, the evaluation indicated that approximately three-fourths of this decline occurred from 1940 to the present, reflecting the dramatic increase in withdrawals that accompanied the strong urban and industrial growth in Jackson County during the period following World War II. The dramatic declines in the potentiometric surface have resulted in a deterioration in water quality as well as reduced quantity production capabilities in the highly urban/industrial centers of the County. According to investigations as early as 1944, this degradation in water quality is a result of either salt-water encroachment from the Gulf or from the migration of connate salt-waters trapped in the lower reaches of the formation [7].

Computer modeling of the groundwater aquifer systems indicated that continued declines in the water table surface would occur in the future with increased groundwater usage, thereby compounding the water quality and quantity limitations in the area. Evaluation of numerous case studies indicated that even with elimination of groundwater usage in the Pascagoula/Moss Point area, the potentiometric surface would continue to decline in much of the remainder of the County, possibly resulting in further contamination of the aquifer in other areas. To provide for the continued residential growth and economic development of the County, the transition to an alternate or supplemental source of supply outside the presently urban/industrial zones in Jackson County will apparently be necessary. By such an action, the existing aquifer systems could be stabilized over time, and an improvement in the water quality in the groundwater aquifer systems should result from reversal of the land-ward gradient, as currently existing in the aquifer. The State Bureau of Land and Water Resources has indicated that reductions in groundwater dependency may be necessary as early as 1995 in some areas of Jackson County to arrest the deterioration of water quality in the aquifer systems, if steps are not being taken to secure alternate sources of supply by that time.

Given the quality and quantity limitations associated with the continued usage of groundwater as the primary source of potable water supply in Jackson County and impending regulatory constraints, investigations were completed to evaluate the potential alternate supply sources to replace or supplement the declining groundwater supplies in the urban/industrial districts. In development of the water resources management plan, numerous supply sources were considered including remote groundwater well fields, surface water supply streams, water supply reservoirs and desalinization. After preliminary screening, three primary alternatives for water management were identified, two of which involved the conjunctive use of groundwater and surface water, and a third that involved the use of surface water only. The source of surface water supply considered was the Pascagoula River and the source of groundwater supply considered was a remote well field in the west-central portion of the County.

Evaluation of these water management alternatives indicated that the most cost-effective, functionally dependable, institutionally implementable concept involved the transition of all currently groundwater dependent public and industrial water demands to a new area-wide water supply system drawing its source from the Pascagoula River as shown on Exhibit 5. The concept being considered involves (1) installation of a raw water intake structure on the Pascagoula River near Cumbest Bluff, (2) construction of a potable water treatment facility near the intake, (3) installation of large diameter treated water transmission pipelines to the urban centers throughout the County and (4) construction of ground storage tanks at strategic delivery points throughout

the County from which the treated water will be metered and pumped into the local utility distribution systems. The concept, if implemented as a county-wide effort, would provide an initial treatment capacity of 30 MGD to meet the projected year 2005-10 average daily public and industrial potable water demand, and provide transmission capacity to meet the anticipated maximum daily requirement of 56 MGD. Phasing concepts have also been evaluated to allow implementation of the water management plan in segments to ease financial impacts. Under this plan the initial phase of construction would be completed by 1995, and subsequent phases completed as regulatory or water supply requirements dictate.

PHASE III

Following development of the short-term water management concepts for Jackson County, the final phase of the effort to evaluate the long-term needs was initiated. This analysis involved the identification and evaluation of the facilities necessary to meet the long-term water demands of the County including potable supplies of 60 MGD and industrial process supplies of up to 190 MGD. A critical factor impacting the use of surface water, as proposed, involves dealing with the issue of low-flow on the Pascagoula River, a consideration which must be addressed as a part of the management plan. State law requires that consumptive withdrawals be reduced or ceased when the base flow in the river falls below the minimum flow level required to maintain water quality standards or protect downstream fish and wildlife habitats. To allow continued use of the river as a source during drought, an alternate source must be available to augment or replace the river supply. Low-flow augmentation alternatives which were considered included multipurpose reservoir facilities, storage ponds and well fields. Since a reservoir is not an option which is implementable in the short-term, the low-flow augmentation concept will likely involve the use of a storage pond or remote well field, depending on the results of test drilling program recommended for undeveloped areas of the County.

Another major element of the WRE involved an analysis of the potential for development of a multipurpose fresh water reservoir facility. As with many coastal areas, shoreline development is an important feature that can have a major impact on the economic prosperity of the region. Because much of the shoreline in Jackson County is presently developed and most abuts the Gulf or a brackish water estuary, the potential attraction of fresh water shoreline for development is considered great. The preliminary reservoir analysis involved consideration of 18 sites, many of which had been evaluated previously by others [9, 10]. The evaluation included design considerations for spillway capacity to pass the probable maximum flood, an assessment of sedimentation and evaluation of shoreline/recreational development potential. None of the alternatives considered could provide adequate daily flows on an annual basis to serve as the primary supply source while maintaining a recreation pool. Due to this factor, the pumped-storage, low-flow augmentation concept was recommended for operation of the reservoir, if implemented.

After preliminary screening of the alternatives, two reservoir concepts were identified and evaluated in detail, including sites on Bluff and Moungers Creek in the central portion of the County. Based on preliminary land purchase requirements and shoreline development plans, cost analyses indicated the two sites to be roughly equivalent with project requirements of approximately $60 million. Analysis of preliminary development plans indicated that ad valorem revenue and recreation fees collected during the initial 20 years of operation would fall significantly short of debt service and operation costs, but that the facility would generate significant annual income after that period. Due to the significant cost of the reservoir facility and the initial revenue drain that it would represent, implementation is being deferred until a later date or until economic conditions justify implementation. It was noted that either reservoir, if implemented, would provide approximately 55 miles of shoreline and 4500 acres of freshwater recreation in waters up to 40 feet in depth, providing significant freshwater recreation opportunities for the Gulf Coastal region of the State. A conceptual layout of the Moungers Creek Reservoir shoreline development plan is shown on Exhibit 6.

The true test of feasibility for any major infrastructure program involves the realization of the project through implementation. To facilitate implementation of the proposed program, the final element of the WRE effort involved development of detailed financial analyses and recommended management concepts. The financial analysis involved development of various project funding alternatives using combinations of user fees, projected ad valorem revenue and special sales tax receipts, in addition to sinking fund concepts, to underwrite the anticipated project cost of $67 million to serve the public sector only and $95 million to serve both the public and industrial sector needs for potable water. The financial analysis indicated that the unit wholesale cost for treated water to the user communities throughout the County could vary from $.40-1.20/1000 gallons, depending upon the level of industrial water demand, use of a sinking fund, or use of a special sales tax option.

The ultimate management concept considered to afford implementation involved the formation of a new water utility, referred to as a water management district (WMD). Under this concept, the WMD would be responsible for the construction, operation and maintenance of the regional water supply facilities,

once the facilities design and site acquisition is completed by the County. The concept also involved the sale of treated water to user communities at a uniform wholesale rate based on contractual commitments between the WMD and local water utility. Under this scenario, treated water meeting all State and Federal requirements would be delivered to the user communities by the WMD at specific service points, from which the water would be metered into the local water distribution systems and sold to the local utility company based on contractual agreements. Under this concept, the local utility companies would remain responsible for distribution and billing for water supplied to individual customers within their service areas as they presently function.

Realization of the water resources management plan under consideration, as with any large public works program, must involve development of a sound organizational concept which informs the public and generates the public support necessary for implementation. As noted previously, it was anticipated that the water supply system would be constructed, operated and maintained by a new water utility entity in the long term. While the permanent agency responsible for construction of the needed improvements could take any one of several forms, creation of the new agency would likely require new legislation. It appears, however, that adequate statutory authority currently exists for formation of a WMD under House Bill 149, as passed by the Mississippi Legislature in 1985. The concept would involve formation of a WMD with a governing board made up of representatives of each of the contracting user communities.

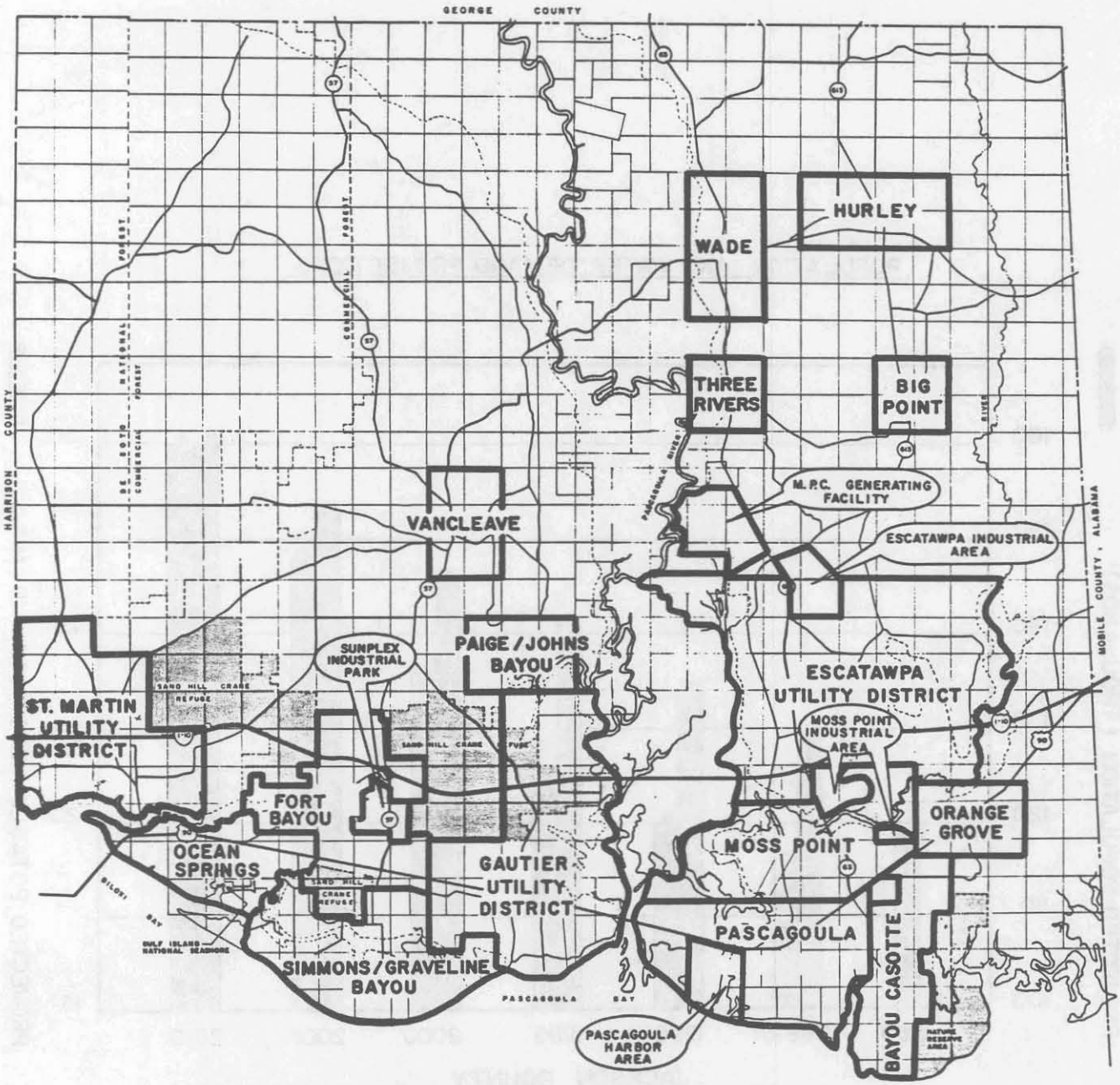
Due to the level of effort necessary to formalize the WMD and the time required to complete the detailed legislative and financial planning, an Interim Management Committee (IMC) was established by the County to function as the arm of County government in furthering the water resources management planning to completion, or until establishment of the permanent WMD body. The IMC included representatives of the public sector, business, industry and labor. The IMC functioned to provide for the transition of water management responsibility from the County Government, where it now rests, to the WMD at a future date upon formulation. Further, the role of the IMC in development of a comprehensive water resources management plan for the County, was specifically defined by the Board of Supervisors to include responsibility to (1) evaluate the technical, organizational and financial aspects of the WRE report, (2) function as the agent of the County to inform the residents of the findings of the WRE report and (3) function to communicate the IMC recommendations and ultimate program objectives established by the County to the residents.

SUMMARY AND CONCLUSIONS

A comprehensive water resources evaluation and management plan has been prepared for Jackson County. The evaluation indicated that existing groundwater supplies are not adequate to meet the economic development needs of the County. Analyses found the Pascagoula River to be the best long-term alternate source of supply for serving the public and industrial water supply needs of the County. Evaluation of several alternatives found that installation of a county-wide potable water supply system would be the most cost-effective and implementable water management option. Estimates indicated that the program cost would range from $67-95 million, depending on the level of industrial water usage on the system. Financial analyses indicated a probable unit wholesale cost to the user communities in the range of $.40-1.20/1000 gallons, depending on the level of industrial usage, special sales tax income and sinking fund development. The management concept considered involved formation of a water management district to construct, operate and maintain the proposed facilities, and to provide water to the user communities based on contractual agreements.

REFERENCES

1. Gehm, H. W., et. al., Handbook of Water Resources and Pollution Control, Van Nostrand Reinhold Company, 1976.
2. Liptak, B.G., Environmental Engineers Handbook, Volume 1, Ilton Book Company, Randon, Pennsylvania, 1974.
3. Waggoner Engineering, Inc., Jackson County Water Resources Evaluation, Phase I Interim Report, Population/Water Demand Projections, January 1986.
4. Waggoner Engineering, Inc., Jackson County Water Resources Evaluation, Phase II Interim Report, Short-Term Water Resources Assessment, April, 1986.
5. Waggoner Engineering, Inc., Jackson County Water Resources Evaluation, Phase III Final Report, Long-Term Water Resources Assessment, December, 1986.
6. Characterization of Aquifers Designated as Potential Drinking Water Sources in Mississippi, U.S. Geological Survey, Report #81-550, 1982.
7. Geology and Ground-Water Resources of the Coastal Area in Mississippi, Mississippi State Geological Survey, Bulletin #60, 1944.
8. Water Resources Overview of the Mississippi Gulf Coast Area, U.S. Geological Survey, Report #85-94, 1985.
9. Water Supply Study for Jackson County, Mississippi, Mobile District, Corps of Engineers, February 1981.
10. Bluff Creek Reservoir, Preliminary Engineering Study, Pat Harrison Waterway District, 1975.



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SCALE IN MILES

JACKSON COUNTY
WATER RESOURCE EVALUATION

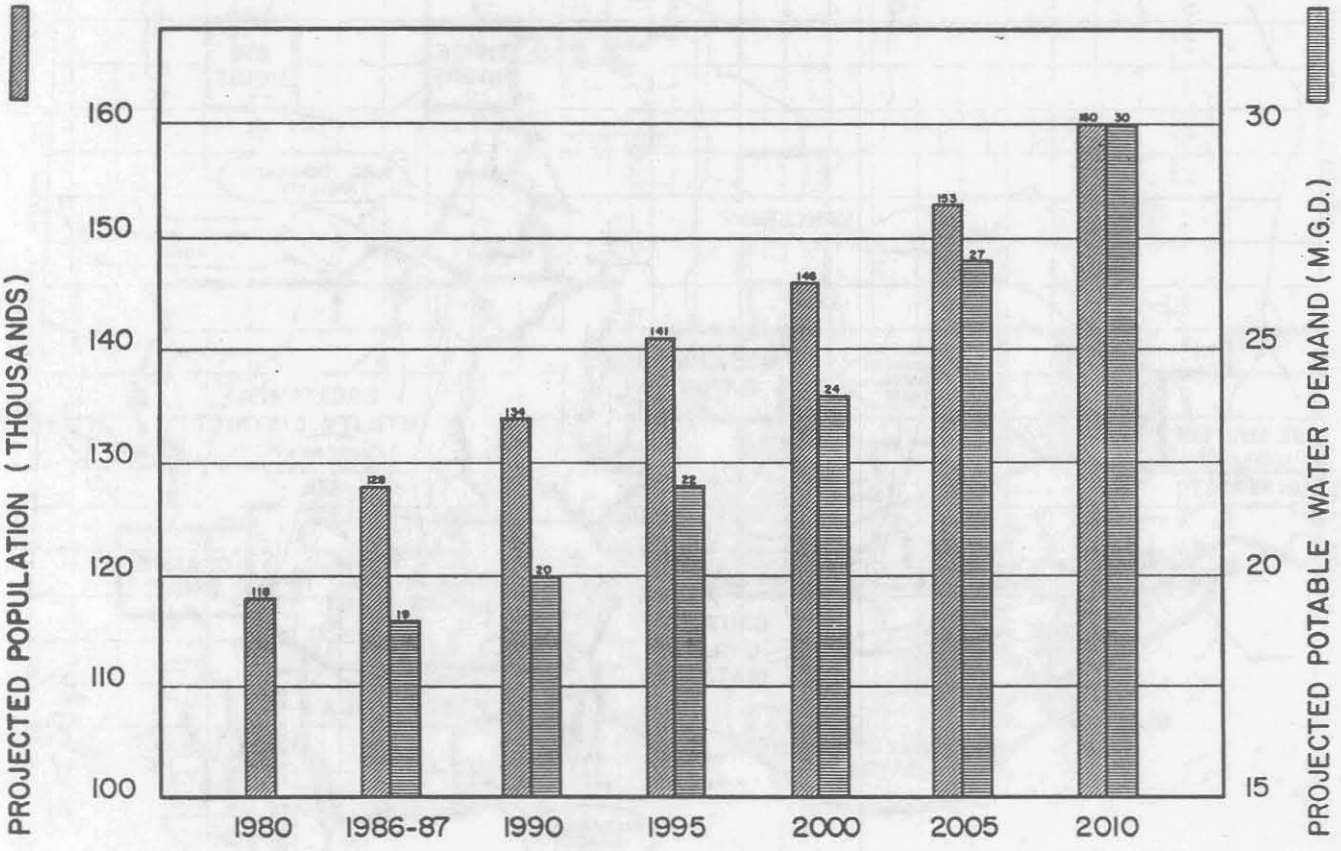
EXHIBIT - 1
PLANNING DISTRICTS

PREPARED BY

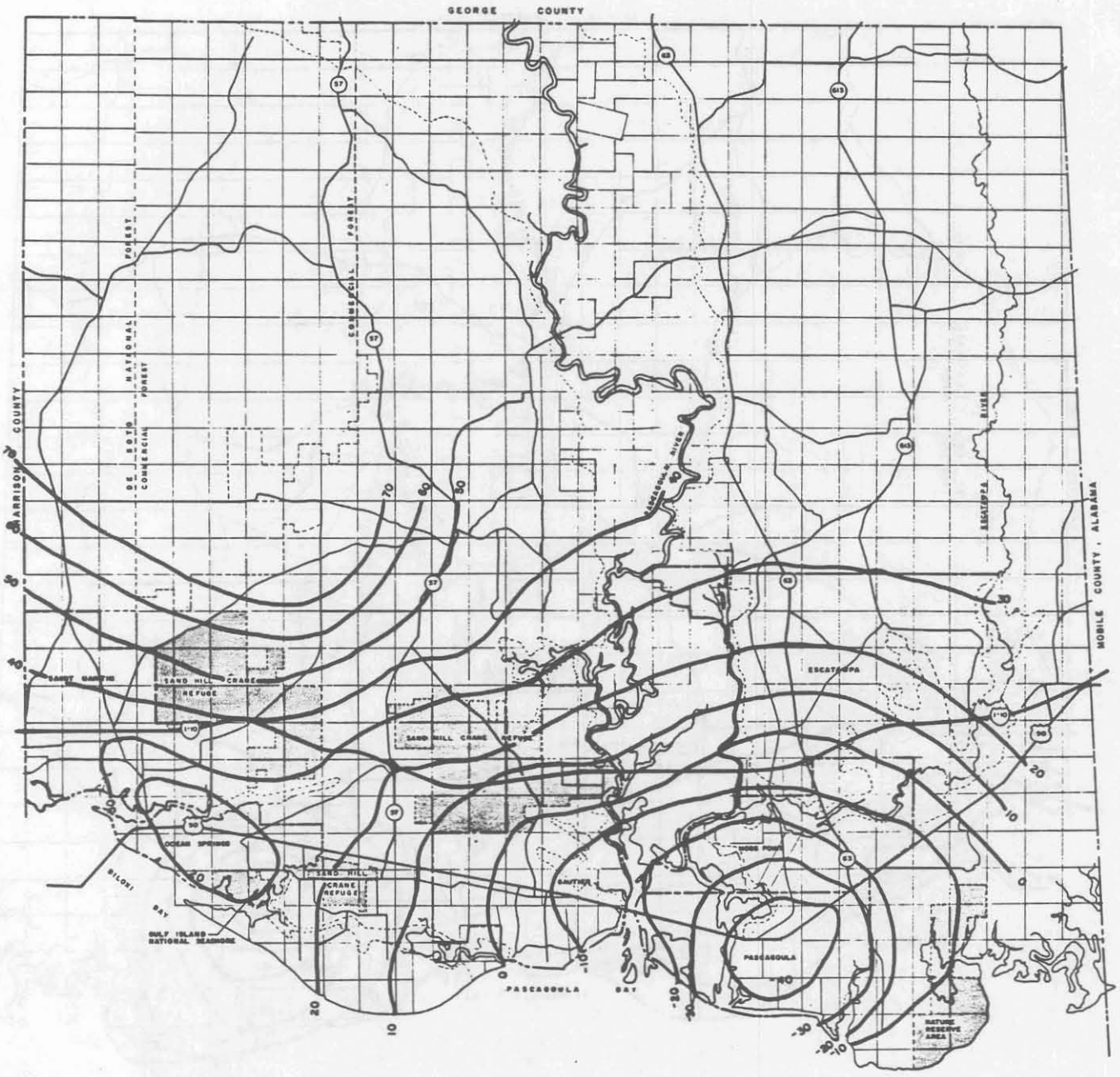
WAGGONER ENGINEERING CO. INC.

JACKSON / BRANDON, MISSISSIPPI

POPULATION AND WATER DEMAND PROJECTIONS



JACKSON COUNTY
WATER RESOURCE EVALUATION
EXHIBIT-2
PREPARED BY
WAGGONER ENGINEERING CO. INC.
JACKSON / BRANDON, MISSISSIPPI



SCALE : 1" = 2 MILES

JACKSON COUNTY
WATER RESOURCE EVALUATION

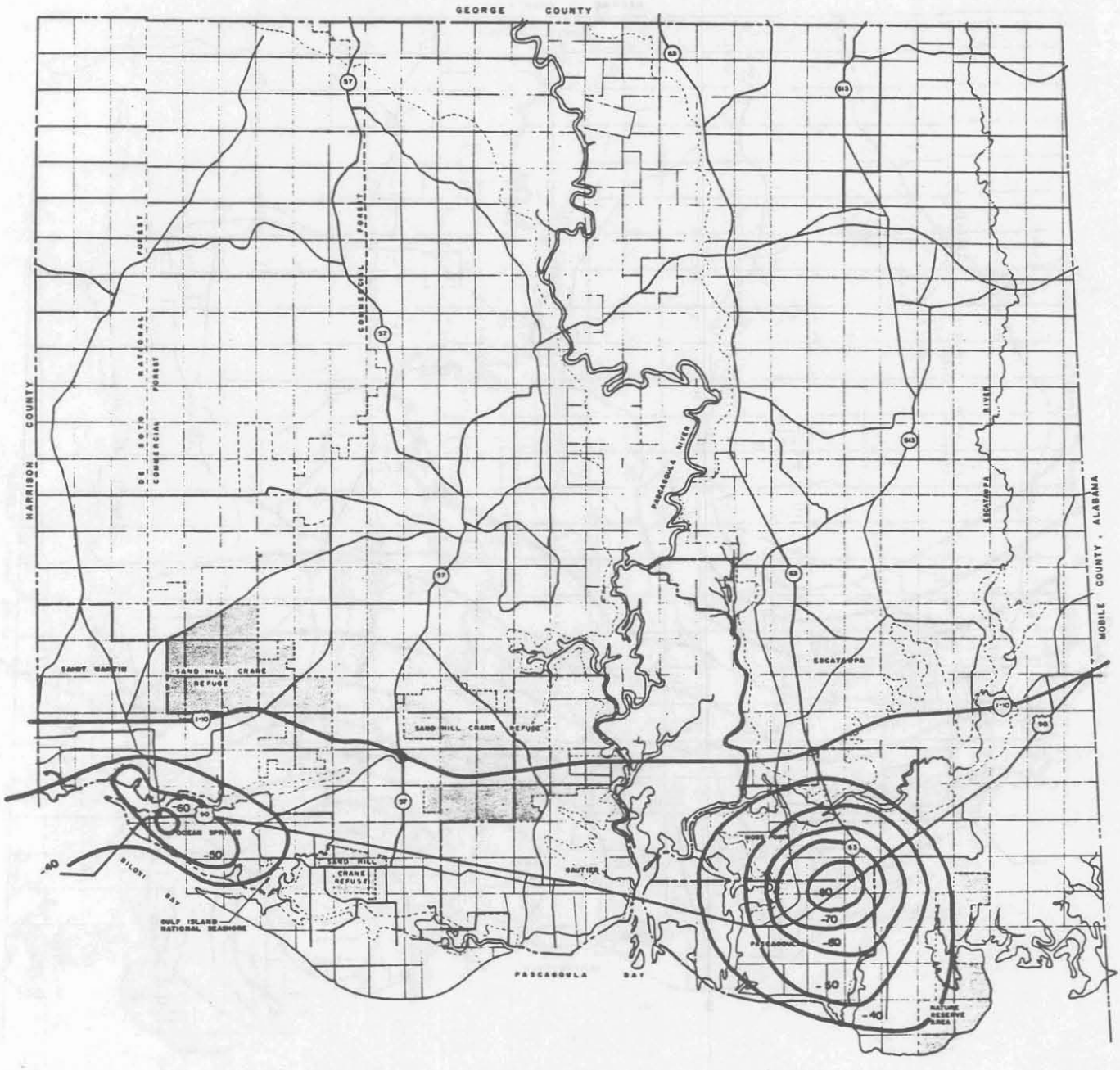
EXHIBIT - 3

1940 WATER LEVELS IN GRAHAM FERRY FORMATION

PREPARED BY

WAGGONER ENGINEERING CO. INC.

JACKSON / BRANDON, MISSISSIPPI



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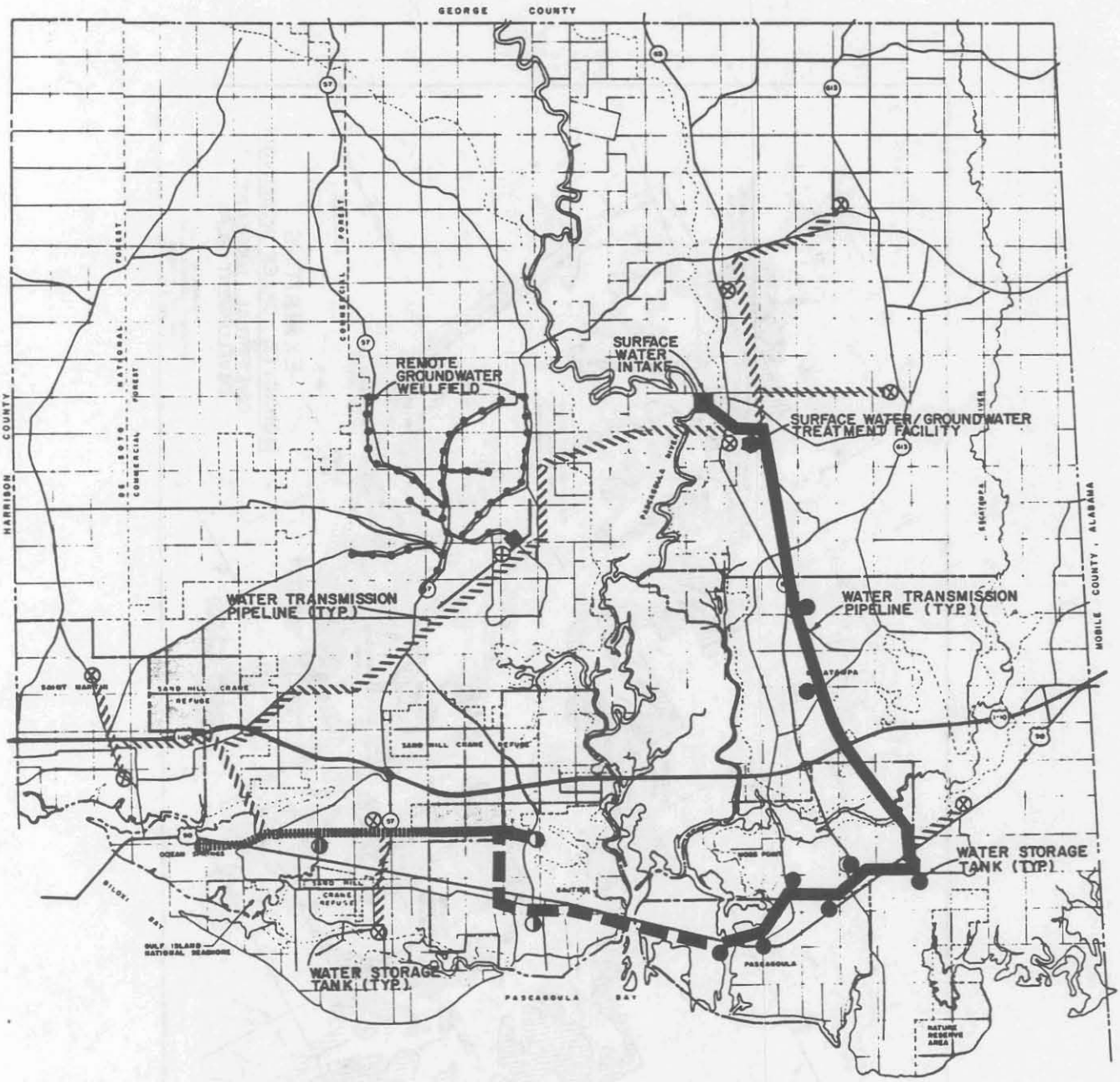
SCALE : 1" = 2 MILES

JACKSON COUNTY
WATER RESOURCE EVALUATION
EXHIBIT - 4
1985 WATER LEVELS IN GRAHAM FERRY FORMATION

PREPARED BY

WAGGONER ENGINEERING CO. INC.

JACKSON / BRANDON, MISSISSIPPI



PHASE - 1
PHASE - 2
PHASE - 3a
PHASE - 3b

SCALE : 1" = 2 MILES

JACKSON COUNTY
WATER RESOURCE EVALUATION
EXHIBIT - 5
AREA-WIDE WATER SUPPLY SYSTEM

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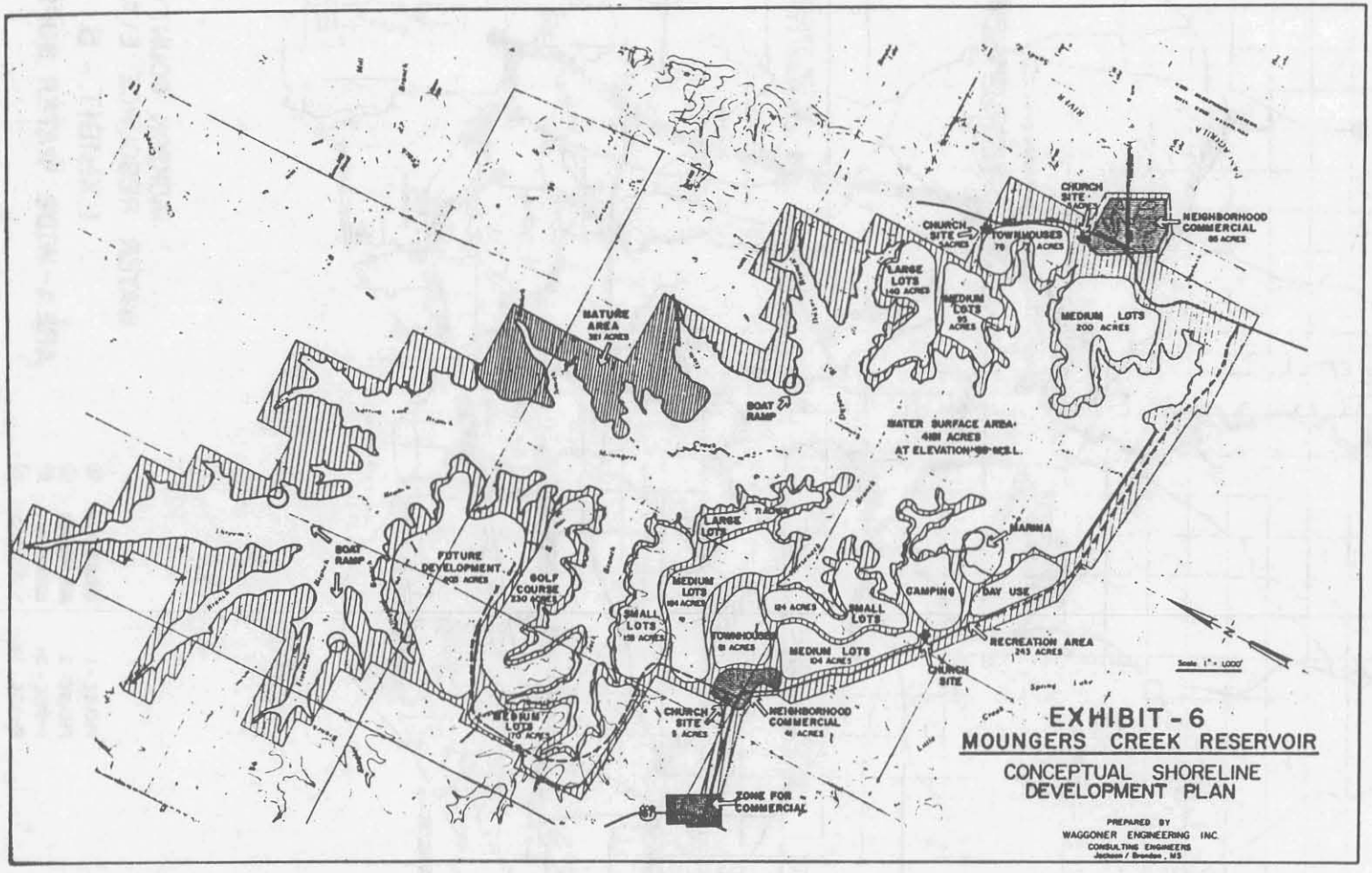
CHURCH SITE - 5 ACRES
NEIGHBORHOOD COMMERCIAL 88 ACRES
CHURCH SITE - 5 ACRES
TOWNHOUSES 70 ACRES
LARGE LOTS 140 ACRES
MEDIUM LOTS 95 ACRES
MEDIUM LOTS 200 ACRES
NATURE AREA 381 ACRES
BOAT RAMP
WATER SURFACE AREA- 4481 ACRES AT ELEVATION +99' MSL
LARGE LOTS 71 ACRES
MARINA
BOAT RAMP
FUTURE DEVELOPMENT 420 ACRES
GOLF COURSE 230 ACRES
MEDIUM LOTS 184 ACRES
SMALL LOTS 158 ACRES
124 ACRES
SMALL LOTS
CAMPING
DAY USE
TOWNHOUSES 18 ACRES
MEDIUM LOTS 104 ACRES
RECREATION AREA 243 ACRES
CHURCH SITE
Scale 1" = 1000'
MEDIUM LOTS 170 ACRES
CHURCH SITE 5 ACRES
NEIGHBORHOOD COMMERCIAL 46 ACRES
ZONE FOR COMMERCIAL
EXHIBIT - 6
MOUNGERS CREEK RESERVOIR
CONCEPTUAL SHORELINE DEVELOPMENT PLAN
PREPARED BY
WAGGONER ENGINEERING INC.
CONSULTING ENGINEERS
Jackson / Brandon, MS