MOST SIGNIFICANT GROUND-WATER RECHARGE AREAS OF GEORGIA

by

Kenneth R. Davis, John C. Donahue, Robert H. Hutcheson, and Deborah L. Waldrop

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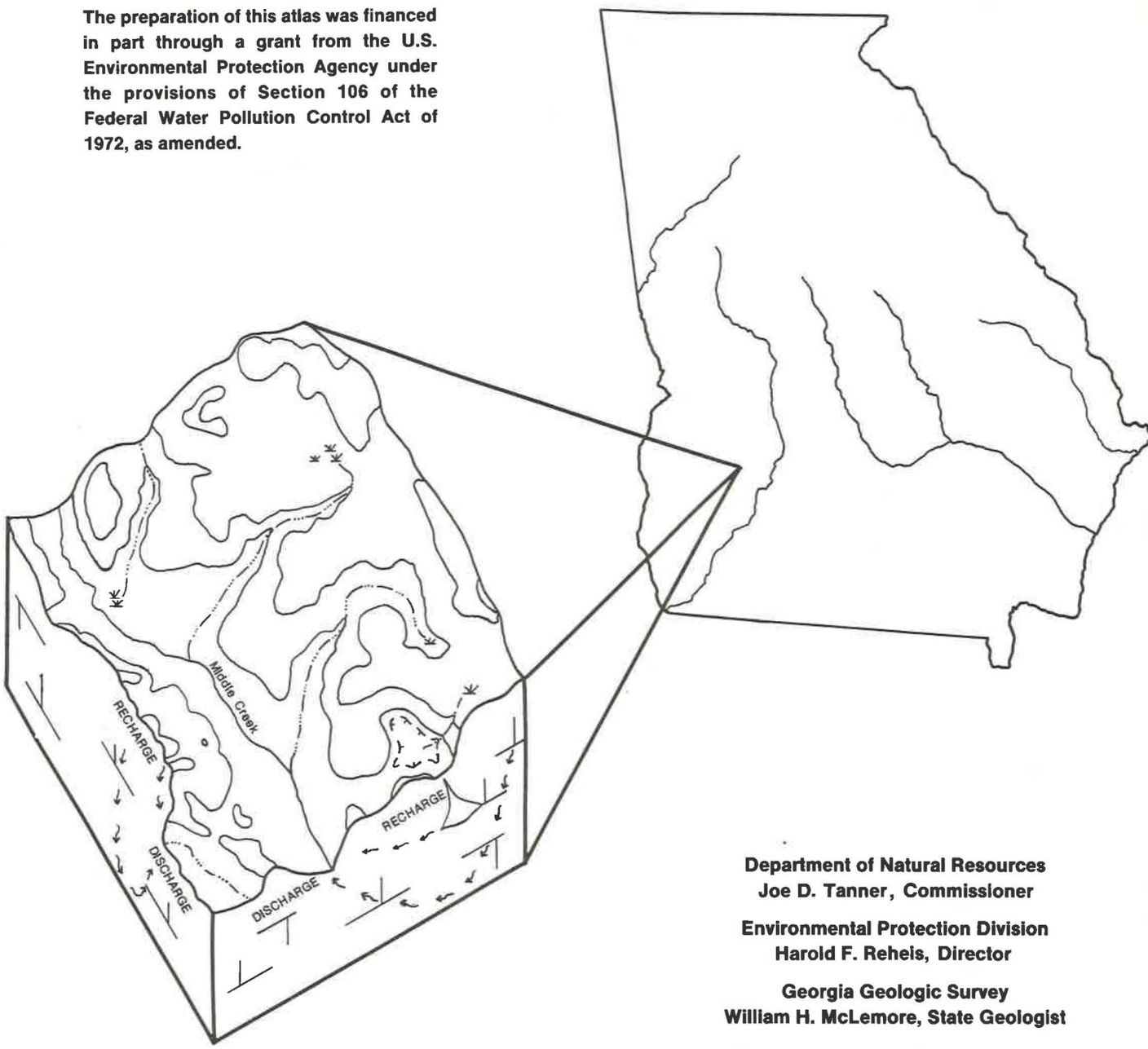

Department of Natural Resources
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RECHARGE AREAS FOR:

COASTAL PLAIN PROVINCE

- MIOCENE/PLIOCENE-RECENT UNCONFINED AQUIFERS
- FLORIDAN/JACKSONIAN AQUIFER SYSTEM
- CLAIBORNE AQUIFER SYSTEM
- CLAYTON AQUIFER SYSTEM
- CRETACEOUS-TERTIARY AQUIFER SYSTEM

RIDGE AND VALLEY PROVINCE

- UNCONFINED AQUIFERS

PIEDMONT PROVINCE

- PROBABLE AREAS OF THICK SOILS (may be significant recharge areas)

Scale 1:500,000
1 inch represents approximately 8 miles

10 0 10 20 30 40 Miles
10 0 10 20 30 40 50 Kilometers

Base Map Data

Source: U.S. Dept of the Interior-Geologic Survey topographic maps
U.S. Dept of the Army-Corps of Engineers topographic maps

Compiled, edited, and published by the U.S. Geologic Survey
Compiled in 1963
Edition of 1970

Datum is mean sea level
1927 North American datum
Lambert conformal conic projection based on standard parallels 33° and 45°

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INTRODUCTION

This map shows the most significant natural ground-water recharge areas in Georgia. Mapping of recharge areas is based on outcrop area, lithology, soil type and thickness, slope, density of lithologic contacts, geologic structure, the presence of karst, and potentiometric surfaces.

WHAT ARE RECHARGE AREAS?

Precipitation is the ultimate source of Georgia's fresh ground water. Recharge is the process by which precipitation infiltrates soil and rock to add to the volume of water stored in pores and other openings within them. Aquifers are soils or rocks that will yield water to wells. While recharge takes place throughout practically all of Georgia's land area, the rate or amount of recharge reaching underground aquifers varies from place to place depending on geologic conditions. Major ground- water resources may develop where permeable aquifers underlie or are connected to extensive areas favorable for recharge.

This map identifies approximately 13,000 square miles (23 percent) of Georgia's land surface through which the most significant recharge to aquifers occurs. Areas of recharge that may be induced by pumpage and leakage into aquifers, while potentially important, are not indicated on this map. The recharge areas mapped are those regions likely to have the greatest vulnerability to pollution of ground water from the surface and near surface activities of man. Therefore, this map is a qualitative assessment of the ground-water pollution susceptibility of Georgia.

Because ground-water systems and the factors controlling recharge vary with geology, the different geologic provinces of Georgia require different approaches to identify the most significant recharge areas. These are outlined by area as follows.

VALLEY AND RIDGE GEOLOGIC PROVINCE

Parts of ten counties in northwest Georgia are underlain by folded and faulted sedimentary formations of the Valley and Ridge Province. Steep slopes on highlands divert runoff to recharge areas in lowlands. Many lowlands in the Valley and Ridge Province are underlain by limestones and dolostones. The most significant recharge areas shown on the map are those outcrop areas of carbonate rock units where low slope conditions prevail. Some of these recharge areas are characterized by karst topography (caves and sinkholes). Extensive karst aquifer systems have developed in places in the carbonate rocks. Ground-water flow in these aquifers is at least partly controlled by solution channels. Thick soils and cherty residum overlie the carbonates and allow slow infiltration of water. The aquifers often discharge at springs in the area, several of which are used for public water supplies. Wells drilled into the carbonate aquifers can yield large amounts of water.

Ground-water flow rates in carbonate aquifers are often high and the susceptibility of these aquifers to pollution is also high. The lesser slope of the most significant recharge areas is also conducive to residential, commercial and industrial growth and development, which may impact ground-water quality.

PIEDMONT AND BLUE RIDGE GEOLOGIC PROVINCES

Most of northern Georgia, north of the Fall Line, is underlain by crystalline rocks with complex geologic character and with little or no porosity within the rocks themselves. While the overall porosity tends to be low, the rocks do contain joints and fractures along which ground water can move. The crystalline rocks are overlain by a weathered zone called saprolite which is relatively porous. Precipitation infiltrates downward into the soil and saprolite and fills fractures and joints in the rock where they occur. Wells can obtain water either from the saprolite or from the fractures in the rock; however, the most reliable sources of ground-water are from zones where the bedrock has been intensely fractured.

Precipitation falling on bare rock or on areas of thin soil generally runs off to surface streams before it infiltrates the limited fracture openings. Therefore, significant recharge areas in the crystalline rock terrane of northern Georgia are characterized by thick soils or saprolite coupled with low (less than 8 percent) slope and a relatively greater density of mapped geologic contacts. Coincidence of these conditions allows the soil/saprolite to serve as a reservoir for ground water for the underlying bedrock fracture system.

The relatively flat areas of thick soil are favored sites for commercial and industrial development as well as for siting sanitary landfills. This means that many significant recharge areas in the Piedmont and Blue Ridge Provinces also are the areas most likely to have present or future sources of pollution located in them.

The most significant recharge areas in the Blue Ridge and Piedmont Provinces are areas of thick soil/saprolite characterized by low slope. Since the Blue Ridge Province contains higher elevations and steeper slopes than does the Piedmont Province, significant recharge areas large enough to be shown at the scale of this map are much less common there than in the Piedmont.

COASTAL PLAIN PROVINCE

The southern six-tenths of Georgia, south of the Fall Line, is underlain by a wedge of Cretaceous and younger sediments that dip gently towards the Gulf of Mexico and Atlantic Ocean. Some of the sediments that underlie the Coastal Plain are very permeable whereas others are not. Where the permeable sediments are present near the surface, they are easily recharged by precipitation. Impermeable confining layers separate the permeable layers forming discrete and relatively hydraulically isolated aquifer systems. Ground water enters the aquifers through sometimes narrow recharge zones and then may flow long distances down the hydraulic gradient towards the ocean. Water may be obtained by wells at any point along the flow path.

The most significant recharge areas shown for the Floridan, Clayton, Claiborne, and Cretaceous-Tertiary Aquifers are the outcrop areas of limestone and sand hydraulically connected to the aquifers. Some areas of outcrop are excluded or incorporated into the recharge area of an adjacent aquifer system where surface drainage has isolated an outcrop area from the main body of the aquifer. Factors considered in defining the most significant recharge areas of the aforementioned aquifers include the area of outcrop of the aquifers, the potentiometric surfaces, the location of major discharge features (creeks and rivers), and the occurrences of permeable soils.

Pollution from sources located in the recharge areas has the potential not only of polluting ground water in the immediate vicinity of the site but of eventually affecting a substantial portion of the aquifer down gradient. Because flow rates are relatively slow in most of these aquifers, the effects of pollution may not appear for years in wells distant from the recharge zone.

Miocene and younger sediments of variable permeability occur at the surface over one half of the Coastal Plain. The Miocene/Pliocene-Recent aquifer systems are widely used for domestic supplies in the southern Coastal Plain as well as being increasingly utilized for public water supplies and industrial use in areas where the Floridan aquifer is heavily used. Although recharge to the Miocene/Pliocene-Recent aquifer systems takes place almost everywhere in the outcrop area, significant recharge areas were mapped by identifying the locations of the more permeable soils which enhance infiltration and storage of rainfall.

USE OF THIS MAP

This map was intended to delimit those recharge areas where the State of Georgia should direct ground-water protection efforts. Potential users of this map are advised of the following specific cautions.

1. Mapping at the 1:500,000 scale means that only the larger recharge areas could be included. Important smaller recharge areas, such as those in the Blue Ridge Province, cannot be shown at this scale.

2. Since about nine-tenths of the land surface of Georgia is a recharge area, the limit of 23 percent on the most significant recharge areas is arbitrary. Areas not mapped may be locally or regionally significant.

3. Areas mapped as recharge areas may include small areas of impermeable soils that limit recharge.

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