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INTERIM STRATEGY

FOR MANAGING

SALT WATER INTRUSION

IN THE UPPER FLORIDAN AQUIFER

OF SOUTHEAST GEORGIA

April 23, 1997

INTERIM STRATEGY FOR MANAGING SALT WATER INTRUSION IN THE UPPER FLORIDAN AQUIFER OF SOUTHEAST GEORGIA

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Executive Summary

The Georgia Environmental Protection Division's objective is to STOP THE INTRUSION OF SALT WATER before municipal water supply wells on Hilton Head Island, South Carolina and Savannah, Georgia are contaminated, and to prevent an existing salt-water problem at Brunswick, Georgia from worsening. Salt water intrusion into the Upper Floridan Aquifer threatens ground water supplies in the Hilton Head-Savannah and Brunswick areas. Intrusion rates, however, are quite slow, being more than a hundred years to reach Savannah. To accomplish this objective, EPD will to do the following:

(1) Conduct expanded scientific and feasibility studies to determine with certainty how to permanently stop the salt water intrusion moving towards Hilton Head Island, South Carolina and Savannah, Georgia and how to prevent the existing salt water intrusion at Brunswick, Georgia from worsening.

(2) Require the development of comprehensive local water supply plans in a 24 county area of southeast Georgia.

(3) Create one or more advisory committees. With their input, the additional scientific information and the local water supply plans, develop a long term ground water management plan for southeast Georgia by the end of the year 2005, which will protect the Upper Floridan aquifer from further salt water intrusion.

(4) Impose caps on ground water use in Glynn County, Chatham County, and portions of Bryan and Effingham counties, to avoid worsening the rate of salt water intrusion at Hilton Head - Savannah and at Brunswick.

(5) Reduce ground water use in Chatham County by at least 10 million gallons per day by December 31, 2005 through conservation and substitution of surface water for ground water. Union Camp will provide at least 6.5 Mgd of the total 10 Mgd of ground water reduction in Chatham County. This will be affirmed through reductions in ground water use permits.

(6) Allow on an interim basis increases in ground water withdrawals in the areas of southeast Georgia that have little impact on salt water intrusion problems.

(7) Encourage and promote water conservation and reduced ground water usage wherever feasible, throughout southeast Georgia.

Introduction

The Upper Floridan Aquifer of southeast Georgia is susceptible to salt water intrusion. The aquifer is a primary source of drinking and industrial process water throughout 24 counties of the region. The United States Geological Survey (USGS) estimates 1995 ground water use in the area to be about 359 million gallons per day (Mgd).

EPD believes only a small portion of the aquifer is susceptible to salt water intrusion. There is one confirmed source of salt water and two additional suspected sources of salt water threatening Savannah. A salt water wedge exists on the northern end of Hilton Head Island; this wedge is slowly moving beneath the Island toward Savannah. Further south near the eastern end of Bull Island in South Carolina, geologic conditions favorable for ocean water to enter the aquifer also exist. Some wells in this area have higher than expected salinity. Based on ground water modeling, the United States Geological Survey (USGS) reports that salt water may be entering the aquifer offshore from Tybee Island. Salt water, originating from deeply buried brines currently is intruding the aquifer at Brunswick. Further south in the St. Marys-Fernandina Beach area, the USGS reports that salt water intrusion conditions are similar to those at Brunswick; some wells in northern Florida have been abandoned because of salt water problems.

In February of 1996, EPD proposed a draft Interim Strategy to protect the Upper Floridan Aquifer in twenty-four southeast Georgia counties from salt water intrusion. In the draft Interim Strategy, EPD subdivided southeast Georgia into three subareas (i.e., northern, central, and southern), which were separated because of geological information (Figure 1). The proposed Interim Strategy could be carried out within the confines of EPD's existing statutory authority. Minimal regulations were proposed for the northern and southern subareas. For the central subarea, EPD proposed that permittee meet certain standards of water-use efficiency, use alternate sources of water, or trade ground water allocations. If the proposed Interim Strategy were carried out as it was originally presented, the net result would be equivalent to a 12-Mgd reduction in ground water withdrawals in Chatham County. The bulk of the actual reductions, however, would have been in counties other than Chatham.

Between early March and mid-April 1996, EPD held nine public meetings to solicit comments, and received over four hundred written and oral responses. One of the primary comments was that

the impacts (costs vs. benefits) of the proposed Interim Strategy needed clarification. There was the perception that the proposed Interim Strategy could create adverse economic impacts on some categories of users. The remaining comments generally fell into six categories; as follows (in no particular order):

(1) There was a need for comprehensive water supply planning in southeast Georgia.

(2) The level of scientific knowledge needed to be expanded, particularly with respect to locations where salt water is entering the aquifer, and where and when salt water would reach Georgia users. Moreover, there were considerable misconceptions about the geological nature of the salt water intrusion problem.

(3) Sources of water that are alternate to the Upper Floridan Aquifer need to be identified, described, and tested.

(4) There was the perception that the proposed Interim Strategy was unfair to some categories of users, particularly those that are not close to the aquifer drawdown areas in Chatham and Glynn counties.

(5) The relationship between Georgia, Florida, and South Carolina needed clarification. Clarification was particularly needed with respect to each state's expectation of the others.

(6) The information base on agricultural water use was too poor to be used for meaningful ground water management purposes.

After receiving the comments, it was clear to EPD that the draft proposed Interim Strategy required considerable rethinking; and that a non-regulatory perspective should be one of the avenues investigated. To achieve this, EPD contracted with the School of Policy Studies of Georgia State University (GSU). The GSU principal investigators had backgrounds in environmental economics and interstate water negotiations. GSU completed its analysis on October 1, 1996, and recommended that EPD's Interim Strategy pursue a policy of Rational (or expanded) Use.

The primary thrust of GSU's proposal was that a policy of Rational Use would be conducive to economic development. GSU pointed out that salt water intrusion velocities were very low. Therefore, a nominal user fee could be instituted to replace those wells in Chatham and Glynn counties, when such wells became salty in the future. The user fees would be placed in a fund and allowed to grow by accruing interest. By the time salt water actually began to contaminate wells in either Chatham or Glynn counties, the fund would be more than adequate to construct surface water treatment plants, construct engineered barriers to salt water intrusion, or to develop other aquifers.

A number of stakeholders expressed concerns that such a policy would deplete the aquifer. Some of those expressing this viewpoint requested that EPD pursue a policy of "sustainable use" (i.e., a policy that when implemented would result in withdrawal reductions of sufficient magnitude to ensure that continued use of the Upper Floridan Aquifer at such reduced use levels would not result in any further movement of the salt water wedge). Some stakeholders commented that EPD should expand upon the economic analysis that GSU had attempted. Many stakeholders were supportive of using fees to expand the level of scientific knowledge. Based on public comments, EPD decided not to pursue a policy which would allow the aquifer to become salty at Chatham County, or which would allow any further salting of the aquifer in Glynn County.

After considering all of the oral and written comments received, EPD released a proposed Revised Interim Strategy on December 20, 1996. Three public meetings were held on the proposal in January 1997 and approximately 90 oral and written comments were received. Many comments contradicted one another; for example, some stakeholders advocated pumpage reductions whereas other stakeholders advocated no pumpage reductions. Nevertheless, there were several consistent themes; among them:

- Scientific studies should be colleague reviewed.
- EPD should aggressively promote water conservation.
- The requirement of comprehensive water supply planning should be expanded to all of southeast Georgia on an accelerated schedule.
- EPD should solicit ideas from technical advisory committees.
- 1995 or 1996 pumping levels might not be hydrologically appropriate for establishing permit caps.
- Water conservation or reductions in pumpage could be more readily achieved via incentives.
- EPD should allow flexibility in permits in those areas where pumpage is capped, if total withdrawals do not exceed the cap.

New Geological Information

Since first proposing the Interim Strategy in February, 1996, EPD has embarked on a $1,500,000 five-year study. The purpose of this study is to better define the mechanics of salt water intrusion and to identify those areas that would be most susceptible to intrusion. At the time of this writing deep wells have been constructed on Tybee Island, and are in progress at St. Marys. Several shallow wells also have been drilled at Hilton Head Island. During the summer and fall of 1996, about two dozen separate ground water modeling runs were performed. Some newly developed information includes:

(1) Under 1985 pumping conditions (the date to which the USGS models are calibrated), the salt water wedge could reach the center of the cone of depression at Savannah in about 120-270

years from now (from the vicinity of Bull Island or from northern Hilton Head Island, respectively). At Brunswick, the plume occupies about 2.8 square miles and may be growing.

(2) Under expanded pumping scenarios, where withdrawals are consistent with population increases, only two areas within the central subarea are susceptible to salt water intrusion; namely Hilton Head-Chatham County and eastern Glynn County. Increasing pumping would result in salt water reaching these areas more rapidly. All other parts of the central subarea should continue to have fresh ground water.

(3) The Upper Floridan Aquifer is not susceptible to depletion because ground water withdrawn by pumping is replaced by lateral and vertical inflow. After more than 100 years of pumping, the Aquifer remains completely full. Continued pumping at reasonable growth rates would result in salt water slowly reaching currently unaffected fresh water supply wells in these two areas.

(4) Based on USGS modeling, there would have to be about a 60-65 Mgd reduction in pumpage in Chatham County and about a 100% reduction in Glynn County and all remaining central subarea counties maintaining constant pumpage (i.e., no increases) to halt salt water intrusion. As long as there is significant pumping in southeast Georgia, salt water intrusion is irreversible.

(5) Other than accelerated salt water intrusion, there are no known or expected environmental impacts associated with increased pumpage. No surface water bodies or habitat would be affected.

(6) Within the central subarea, the further pumpage is away from Chatham and Glynn counties, the less would be the impact on the potentiometric surface and salt water intrusion. For example, ground water models performed by the USGS at EPD's request suggest that one gallon of ground water pumped at Savannah has about the same impact on salt water intrusion at the northern end of Hilton Head Island as about 100 gallons pumped at Sylvania or about 25 gallons pumped at Brunswick.

Impacts of the Strategies Proposed To Date

There have been several salt water intrusion mitigation strategies proposed to date. For each strategy, EPD had the USGS perform a modeling run, using either the EPD Coastal Model, the RASA Model, the Brunswick Vicinity Model or the Savannah Vicinity Model. All models were developed by the USGS and follow USGS modeling protocols; all are interrelated and information can be cross-compared. Using the USGS models, EPD estimated the impact of each of the proposed

strategies on salt water intrusion; that is, how much would intrusion be quickened or slowed if that strategy were employed. The results are presented in Table 1.

EPD has authorized and provided funding to the USGS to publish these model runs with accompanying assumptions. This publication will conform to USGS colleague-review procedures.

INTERIM STRATEGY

General

This Interim Strategy is intended to continue the process of protecting the Upper Floridan Aquifer of southeast Georgia from salt water intrusion. Once implemented, the Interim Strategy will continue until December 31, 2005. During the time that the Interim Strategy is in effect, EPD will work with a broad-based stakeholder advisory committee on information exchange, and will encourage and accept input from the committee on matters related to both the implementation of the Interim Strategy and development of a final strategy. EPD also would cooperate with other public and private entities to develop comprehensive water supply plans, and to gather water use, engineering, and geologic information. The outcome will be the development of a final strategy (by December 31, 2005) which is a broadly understood and supported, and which will stop salt water intrusion at Hilton Head, Savannah, and Brunswick and also allow additional ground water withdrawals in the 24 counties of southeast Georgia.

When fully implemented the Interim Strategy will:

(1) Develop the information needed to assist Georgia's stakeholders with the development and implementation of a final strategy that will acceptably address salt water intrusion and encroachment problems along Georgia's coast.

(2) Recognize the importance of all users throughout southeast Georgia.

(3) Promote conservation of ground water throughout southeast Georgia.

(4) Develop comprehensive water supply plans throughout southeast Georgia.

(5) Develop feasibility studies (with economic analysis) of engineered barriers, redistributed pumpage, and alternate sources of water in the central subarea.

(6) Develop expanded scientific studies throughout southeast Georgia.

(7) Minimize restrictions on those users that have minimal impact on salt water intrusion.

(8) Allow reasonable expanded use of the Upper Floridan Aquifer in those areas of southeast Georgia where such use has been found, based on sound science, to not have a significant influence on salt water encroachment in Chatham County or salt water intrusion in Glynn County.

(9) Utilize input from stakeholder advisory committees to develop planning, science, and feasibility scopes of work.

For the purposes of managing the Upper Floridan Aquifer, EPD will continue to subdivide southeast Georgia into three separate subareas as shown in Figure 1. Based on information provided in USGS Professional Paper 1403-D, ground water pumping in the northern subarea has little or no impact on salt water intrusion; the impact of pumpage in the southern subarea on salt water intrusion is not known; ground water pumpage in the central subarea impacts salt water intrusion.

Based on currently available scientific information and EPD's interpretation of the results of recent USGS modeling runs, EPD cannot demonstrate that pumping from the Upper Floridan Aquifer in the northern and southern subareas will significantly affect the movement of the salt water intrusion towards Chatham County or the upward movement of salt water in Glynn County. EPD will therefore not cap withdrawals in these subareas at any specific level, but will allow reasonable additional pumping from the aquifer until such time as it can be shown that such withdrawals exercise unacceptable adverse influence on the two problem areas.

For the central subarea, exclusive of Chatham and Glynn counties and defined portions of Bryan and Effingham counties, the Interim Strategy would permit some limited increases in withdrawals for those counties that have comprehensive water supply plans. [Note: EPD estimates that through 2005, total new ground water withdrawals in the central subarea would be about 15 Mgd, an increase of about 6 percent over current use. This would include issuing permits for those applications currently in review as well as new permit applications.] For Chatham and Glynn counties and defined portions of Bryan and Effingham counties (see Figure 2), the Interim Strategy would be based on the principle of "No Impact of Salt Water Intrusion on Existing Users". Ground water withdrawals in this area would be capped at some defined levels, and withdrawals from the Upper Floridan Aquifer in Chatham County would be reduced by at least 10 Mgd by December 31, 2005. The effect of this capping will be that at the end of the interim period, Chatham, Bryan and Effingham counties will still have a reliable source of fresh water for at least 100 years. On the other hand, salt water is already impinging on some existing Glynn County water supply wells; therefore capping of ground water use in Glynn County will better protect the existing users and should provide them with access to the aquifer for at least 50 years or more.

Depending on the scientific information gathered during the period that the Interim Strategy is in effect, it may be appropriate in the Final Strategy to limit or restrict ground water withdrawals in the northern and southern subareas. The decision to do this, however, would not be made until 2005 as the Final Strategy is being developed.

Scientific studies and comprehensive water supply planning cost money. Such money could be obtained through direct appropriations or through user fees. EPD believes that user fees are most appropriate as the users receive the direct benefit of having a reliable long-term water supply.

However, the final decision regarding the best mechanism to fund studies and to conduct planning, rests with the General Assembly and the Governor. This matter should be dealt with by the General Assembly in the 1998 legislative session.

Assuming the General Assembly and the Governor support a fee based system during the 1998 legislative session, it is likely that EPD will recommend a nominal and equitable user fee be assessed on all permitted users in all three subareas. It is also likely that EPD will recommend that the proceeds from the fees be used, (1) to provide for comprehensive water supply planning, (2) to perform scientific studies to monitor and predict salt water intrusion, and (3) to perform feasibility studies of redistributing pumpage, of obtaining water from sources other than the Upper Floridan Aquifer, and of creating engineered barriers to salt water intrusion.

Finally, EPD will likely recommend that until the Final Strategy is developed, fee money only be used for the development of comprehensive water-supply plans, the gathering of scientific studies, and the performing of such feasibility studies. Some or all of these thoughts may be modified prior to the General Assembly's consideration of the matter next year.

Implementation of this strategy, however, will require some changes in State laws and EPD's Rules. Interested legislators have introduced a resolution to the 1997 Session of the General Assembly to create a Study Committee. The purpose of the Study Committee is to hold hearings, to receive recommendations on legislation to protect southeast Georgia from salt water intrusion, and to identify a mechanism for funding further studies and planning. Based upon the strategy and the Study Committee findings, implementing legislation may be introduced in the 1998 session of the General Assembly. If the General Assembly and the Governor concur, then EPD would begin collecting fees and using them to carry out the Interim Strategy.

EPD would conduct regular (at least yearly) progress meetings to update stakeholders on new monitoring information, technological advances, and so forth. EPD would continue to coordinate with the St. Johns River Water Management District in Florida and the South Carolina Department of Health and Environmental Control to establish consistent salt water intrusion protection measures across state boundaries.

Water-Supply Planning

EPD recognizes that local comprehensive water-supply planning is critical to prudent management of the Upper Floridan Aquifer in southeast Georgia. Such plans should be prepared utilizing public participation and should, at a minimum, address the following issues for each county:

- Historical water use perspective.
- Review of existing water supply needs and options studies.

- Current water management practices.
- Identification of possible sources of water other than the Upper Floridan Aquifer.
- Quantification of existing ground and surface water usage.
- Conservation efforts.
- Population, land use projections, and water demand projections to 2050.
- Development of water-supply management options.
- Implementation schedules.

To ensure that the plans are consistent in content, format, and methods, EPD will distribute a detailed water supply plan outline by May 30, 1997.

New withdrawal permit applications from the Upper Floridan Aquifer will be reviewed by EPD for all southeast Georgia counties, except in Chatham, Glynn, and the southern portions of Bryan and Effingham counties, effective January 1, 1997. However, comprehensive water supply planning is extremely important for southeast Georgia. Therefore, EPD will not issue new municipal, industrial, and agricultural Upper Floridan Aquifer ground water permits, after December 31, 2000, to applicants in any county of the 24 county area which has not developed a comprehensive water supply plan and had it approved by EPD.

Agricultural water use information is lacking. This is particularly significant as agriculture is a rapidly expanding user group in southeast Georgia (an estimated 200% increase in permitted usage between 1985 and 1995). To expand the level of knowledge of this important user group, EPD will work with agricultural interests to develop a statistically valid yearly estimate of agricultural water uses for each southeast Georgia county, and a program to educate agricultural water users on best management practices to conserve irrigation water.

EPD would contract to develop an general educational program on irrigation best management practices and irrigation-water conservation.

Conservation

EPD will regulate Upper Floridan Aquifer ground water withdrawals in Chatham County so that at least 10 Mgd of the 14.59 Mgd reductions identified by the Savannah/Chatham County Metropolitan Planning Commission's (MPC) Comprehensive Water Supply will be achieved by December 31, 2005.

EPD expects the pulp and paper industry to carry out those ground water conservation measures identified in the 1995 Institute of Paper Science and Technology Study.

After January 1, 2001, EPD will only issue any new or expanded permits for municipal ground water supply, where the local government has developed water-conservation ordinances, including ultra-low flow plumbing requirements, audits to find out transmission losses, and so forth. This would apply to users in all three subareas.

After January 1, 2001, EPD will only allow new or expanded agricultural use of ground water for those owners who have taken a course on irrigation best management practices and irrigation water conservation. This would apply to users in all three subareas.

After January 1, 2001, EPD will only allow new or expanded industrial use of ground water for those owners who have developed a water conservation plan. This would apply to users in all three subareas.

EPD encourages Chatham and Glynn counties, along with those portions of Bryan and Effingham counties where ground water is fully capped, to use surface water or shallow aquifers for future water supply. In these areas EPD will also require water users, wherever feasible, to substitute surface water, treated wastewater, or water from shallow aquifers for golf course irrigation and non-contact cooling water currently being withdrawn from the Upper Floridan Aquifer.

EPD recognizes that incentives can be conducive to conservation, especially for those users that would have to make capital improvements.

Permitting (Upper Floridan Aquifer, only)

- During the period in which the Interim Strategy is in effect, EPD, in consultation with the affected permittees, will reasonably adjust some existing municipal and industrial ground water withdrawal permits to a yet to be determined level. A review of EPD's permits shows that some permits are for rates that greatly exceed actual usage.

- Inactive ground water use permits will be canceled. This would apply to all three subareas.

- A significant amount of the 10 Mgd of reduced Upper Floridan Aquifer ground water use will come from voluntary reductions by Union Camp. Union Camp has agreed to reduce its permitted withdrawal by 6.5 Mgd, which is the equivalent of its prorata share of industrial ground water pumping in Chatham County. In conjunction with that, EPD will also reduce Union Camp's ground water withdrawal permit by 1.9 Mgd (from 28.5 Mgd to 26.6 Mgd) in order to eliminate unused capacity made available by increased water use efficiencies achieved by Union Camp. Union Camp's permit thus will be further reduced from 26.6 Mgd to 20.1 Mgd by December 31, 2005.

Union Camp has made a further commitment to transfer 2.5 Mgd in ground water capacity if it is needed by other permittees for domestic growth. Union Camp will make this capacity available for transfer (assuming surface water treatment plant capacity is available to replace this quantity of water) after EPD develops suitable guidance governing such transfers.

- EPD believes that certain water use practices are no longer wise for the Upper Floridan Aquifer. These include golf course irrigation and non-contact cooling water. EPD will not issue any new permits for golf-course irrigation or non-contact cooling water, where alternate sources of water exist. This would apply to users in all three subareas.

- EPD will not issue any new ground water withdrawal permits in Chatham or Glynn counties without associated reductions in water usage elsewhere within the county. If consistent with EPD approved, comprehensive local water supply plans, EPD would consider allowing the transfer of some or all of a permitted ground water withdrawal from one user to others, provided such transfer shifts pumpage away from the deepest portions of the potentiometric cone of depression. (See "Reallocation of Water" for further details.)

- On the basis of ground water modeling that has been performed, EPD will cap future withdrawals from the Upper Floridan Aquifer in those portions of Bryan and Effingham counties that have the same hydrodynamic impact on salt water intrusion as Chatham County withdrawals. The affected areas generally are those portions of Bryan County southeast of Fort Stewart and those portions of Effingham County south of Georgia Highway #119. EPD, however, will consider public water supply applications in these areas which have been submitted to EPD before April 23, 1997 or for which project applications have been submitted to the local zoning board before April 23, 1997.

- EPD will establish the permit limit for each individual Upper Floridan Aquifer permit holder in Chatham, Glynn and those capped portions of Bryan and Effingham counties. The modified annual permitted withdrawal limit will be based upon an evaluation of annual reported ground water withdrawals over the interval from 1990 to 1996. In most instances, caps are expected to be based upon the highest annual reported ground water withdrawal during that period.

- EPD will not issue water withdrawal permits or safe drinking water permits for the development or construction of new public water systems in the Chatham County or Glynn County cap areas after April 23, 1997, if the source of water supply is the Upper Floridan Aquifer, with the possible exception of transfers which shift pumpage away from the cone of depression. This also applies to the Bryan County and Effingham County cap areas except as provided for in the preceding paragraphs. EPD will continue to evaluate the issuance, modification and renewal requests for permits to operate a public water system for existing

systems and for new systems that had initiated the permitting process prior to the implementation of this strategy.

- For public water systems using less than 0.10 Mgd in Chatham and Glynn counties and in the capped portions of Bryan and Effingham counties, EPD will modify existing Safe Drinking Water permits to require the permittee to begin metering and reporting their water use by December 31, 1998.

- For all 24 counties covered by this strategy, any request for the expansion of a public water system would require the submittal, approval and implementation of a water conservation plan. Also, metering of the water system and water use monitoring will be required (all sources, treatment facilities and service connections). After December 31, 2000, EPD would not approve or permit any new project for development or construction within the counties which have not developed comprehensive water supply plans and had them approved by EPD.

- EPD will not necessarily permit all new additional withdrawals within the central subarea. For applications received after April 23, 1997, new ground water withdrawal permits within the central subarea, outside the capped areas, will only be issued after EPD has assessed the impact on salt water intrusion on other users. EPD would perform similar assessments on withdrawal permit applications that average 1 Mgd or more in the northern and southern subareas.

- With the exception of Glynn and Chatham counties and capped portions of Bryan and Effingham counties, EPD will limit total new permitted withdrawals in the counties covered by this strategy to 10% above the USGS's estimate of 1995 ground water use for the entire 24 counties. This limit is equivalent to 36 Mgd, and would apply to all three subareas. This value will be periodically reassessed as new scientific information is developed.

Reallocation of Water

Reductions in Upper Floridan Aquifer ground water use will occur as a result of conservation, source substitution, and other means. As such reductions opportunities are identified, EPD will modify permits (in consultation with permittees) to reduce permit limits to agreed upon levels over agreed upon periods of time. In consultation with the permittee and other Upper Floridan Aquifer stakeholders in the affected area, EPD will consider reallocating this unused capacity in one or more of the following ways:

- Permanently remand the reclaimed water to the Upper Floridan Aquifer unencumbered so that it contributes to the maintenance of the potentiometric surface.

- Temporarily remand the reclaimed water to the Upper Floridan Aquifer until such time as municipal water needs (as identified in the EPD approved regional/local water supply plan) is such that this reclaimed water can be allocated to municipal water users in "the affected area." Again priority will be given to reallocations that have the effect of redistributing pumpage to points further away from the centers of established cones of depression, and to reallocations to areas where surface water is not economically available.

- Distribute to municipal water supply system(s) within the previously described area in a fashion outlined in EPD approved regional (or local) water supply plan. Priority will be given to such reallocations that have the effect of redistributing pumpage to points further away from the centers of established cones of depression, and to reallocations to areas where surface water is not economically available. However, EPD will not reallocate ground water in such amounts that would prevent the attainment of a total 10 Mgd reduction in use in Chatham County by December 31, 2005.

Sound Science

EPD currently is in the second year of a five-year program to expand knowledge of ground water and geology in the 24 county area. The USGS is participating in these studies as a cooperator. In addition, using state appropriations, EPD personnel are drilling approximately two dozen additional monitoring wells in Southeast Georgia, EPD is also financing the construction of some monitoring wells in the Hilton Head and Bull Island area of South Carolina. The five-year program is designed to establish an early warning system of salt water monitoring wells, evaluate alternate sources of water to the Upper Floridan Aquifer, and expand EPD's version of the USGS ground water models into South Carolina and Florida. EPD will continue to pursue these scientific investigations.

During the public meetings that were held on the draft Interim Strategy, a number of stakeholders requested an expansion of scientific studies to more precisely locate the position of fresh water-salt water interface, to more precisely identify the locations where salt water is entering the aquifer, to more precisely predict the velocity and route of salt water movement, to perform feasibility studies of possible engineered barriers to salt water intrusion or pumpage redistribution, and to more precisely assess the impact of withdrawals in the northern and southern subarea on salt water intrusion in the central subarea and vice versa.

Doing this would require expanded geological studies, possibly including offshore drilling, land and marine seismic surveys, and development of new salt water transport models. To achieve this and assuming funds are available for scientific studies, EPD also would perform additional geological and engineering studies, as recommended by a Technical Advisory Committee. The primary objective of these studies would be to obtain a more precise estimate of the time that salt

water will begin to contaminate currently fresh water wells and to establish the feasibility of methods that can be employed to prevent or slow such contamination.

Wherever possible, EPD will use the services of the USGS to take advantage of the USGS's ability to match offerings on a dollar for dollar basis.

Conclusions

EPD's objective is to STOP THE INTRUSION OF SALT WATER before municipal water supply wells on Hilton Head Island and Savannah are contaminated, and to prevent an existing salt water problem at Brunswick from worsening. Salt water intrusion into the Upper Floridan Aquifer threatens ground water supplies in the Hilton Head-Savannah and Brunswick areas. The implementation of the recommendations included in this interim Strategy will set the stage for the development of the final strategy by December 31, 2005.

SUB-AREA DIVISIONS

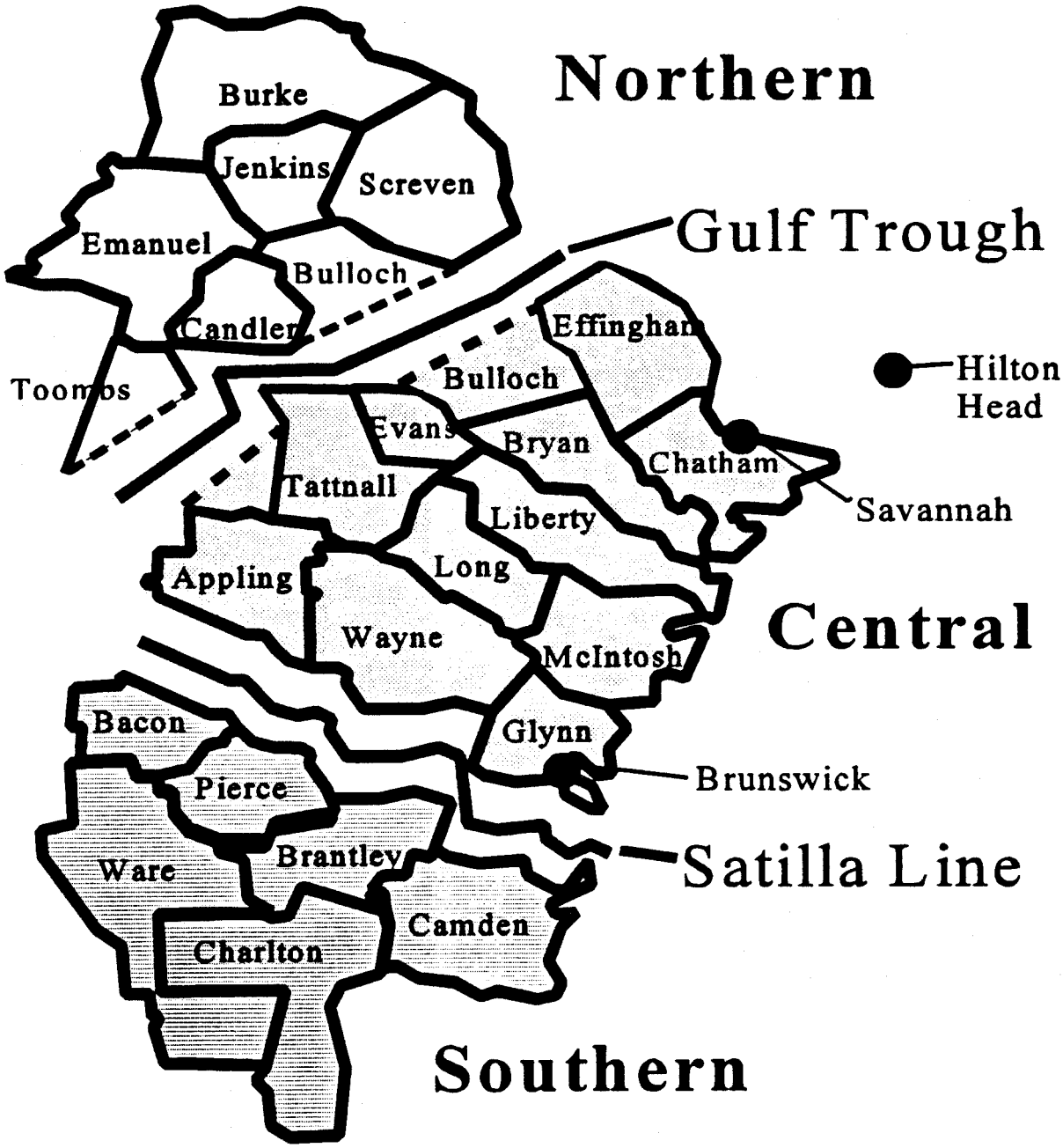

Figure 1

CAPPED AREA

All of Chatham and Glynn counties
Effingham County-South of Hwy 119
Bryan County-South of Fort Stewart

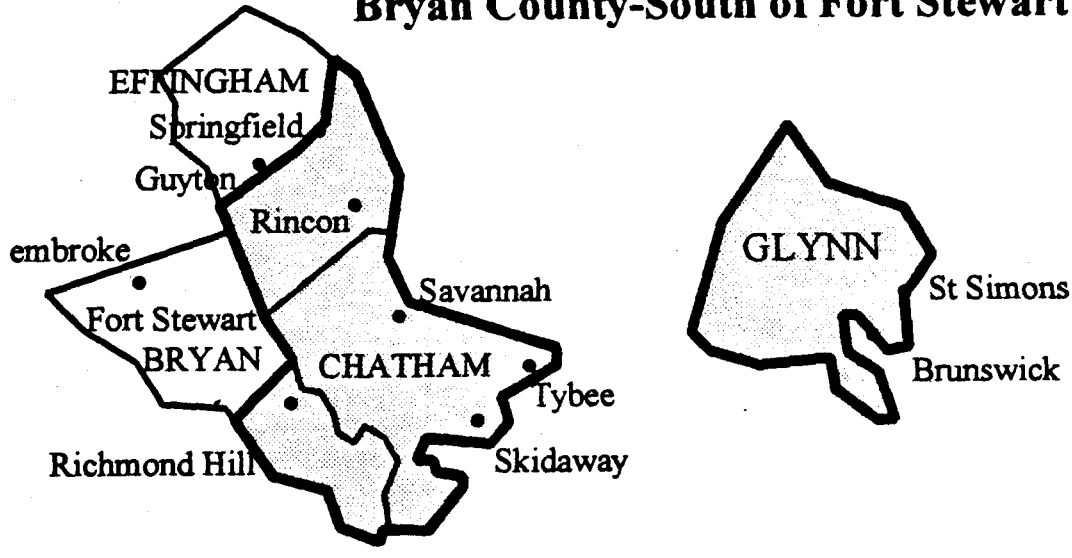

TABLE 1

RESULTS OF MODELING OF VARIOUS STRATEGIES

SITUATION / PLAN	ASSUMPTIONS	TRAVEL TIME FROM EAST END OF BULL ISLAND, S.C.; Years FROM 2005	TRAVEL TIME FROM N. END OF HILTON HEAD ISLAND, S.C.; Years FROM 2005	SIZE OF SALT WATER PLUME AT BRUNSWICK
1985 Conditions	Assume that 1985 pumping conditions continue until 2005.	≈110 years	≈260 years	About 41.5 Mgd of upward flux flow into Lower Floridan Aquifer; about 2.8 square miles currently contaminated.
SC DHEC Plan Applies to Chatham County only	20 Mgd reduction in Chatham County from 1995 pumping rates. Other counties not considered.	≈150 years Pumpage from other counties not considered.	≈370 years Pumpage from other counties not considered.	Not applicable.
EPD Interim Strategy (Initial Version) Applies to Central Subarea	145 gpd per person; Chatham County implements some of MPC Plan; pulp and paper industry implements IPST recommendations; golf course and cooling water use curtailed; water offsets implemented.	≈120 years	≈300 years	Upward flux flow into Lower Floridan Aquifer reduced by about 5.5 Mgd. Contaminated area of about 2.4 sq. mi.
MPC Plan Applies to all of Southeast Georgia	14.59 Mgd reduction in Chatham County from 1995 pumping rates. All other counties held at 1985 pumpage.	≈130 yrs.	≈360 yrs.	Upward flux flow into Lower Floridan Aquifer reduced by about 0.1 Mgd. Size of contaminated area essentially unchanged.
1985 x 110% Applies to all of Southeast Georgia	10% increase across the board for 1985 users.	≈80 yrs	≈240 yrs.	Upward flux flow into Lower Floridan Aquifer increases by about 2.7 Mgd. Contaminated area of about 3.0 sq. mi.
1985 x 90% Applies to all of Southeast Georgia	10% decrease across the board for 1985 users.	≈140 yrs	≈350 yrs	Upward flux flow into Lower Floridan Aquifer decreases by about 2.4 Mgd. Contaminated area of about 2.6 sq. mi.

EPD Interim Strategy (second version) Applies to Central Subarea	Pumpage in Chatham and Glynn Counties capped at current levels; 15 Mgd in rest of Central Subarea to account for existing applications and reasonable growth in other counties (GSU growth rate projections).	≈ 110 yrs.	≈ 290 yrs. See note # 5.	Upward flux flow into Lower Floridan Aquifer decreases by 1.9 Mgd. Contaminated area of 2.7 sq. Mi.
Sustainable Use Applies to Central Subarea	Reduce pumpage in Chatham County to reverse gradient from Port Royal Sound. Reduce pumpage in Glynn County to reduce flux from Fernandina Permeable Zone into Lower Floridan Aquifer to 0 Mgd or to pre-development conditions, whichever is less.	To achieve permanent elimination of the salt-water threat, pumpage in Chatham County will have to be reduced about 60-65 Mgd from current pumping rates.	To achieve permanent elimination of the salt-water threat, pumpage in Chatham County will have to be reduced about 55-60 Mgd from current pumping rates.	Model indicates that there was upward flux flow from the Fernandina Permeable Zone into the Lower Floridan Aquifer prior to development. This suggest that there may have been salt-water intrusion in the Brunswick area prior to pumping. To return to pre-development conditions will require a 100% reduction in pumpage in Glynn County.
50 Mgd increase in Chatham County from current pumping rates.	Chatham County specifically requested an assessment of the impact of replacing surface water from the I&D plant with ground water from the northwestern part of the County.	≈60 yrs.	≈180 yrs.	Not applicable