# *Natural Groundwater Aquifer Recharge*
# FOUNDATION DOCUMENT

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# *Natural Groundwater Aquifer Recharge*

## 10-1 INTRODUCTION

Aquifers can generally be defined as underground reservoirs of water. Santa Rosa County is underlain by two (2) aquifers that produce potable water for consumption. These are the Sand-and-Gravel Aquifer, or shallow, aquifer and the Floridan, or deep, aquifer. Together, they comprise the primary water supply sources for the County.

This sub-element addresses the unique characteristics of each of the aquifers, including: the groundwater that each contains, the recharging of the aquifer, the quality of the water, and the primary consumers of groundwater from each aquifer. Additionally, the document identifies the federal, state, regional, and local agencies which regulate the use of the aquifers and their applicable regulations. The quantity of groundwater is influenced by both natural and human causes. Since excessive withdrawal of water can affect an aquifer, the Natural Groundwater Aquifer Recharge Sub-element is closely related to both the Future Land Use Element and the Conservation Element of the Comprehensive Plan.

### A. Organization of the Element

This element is divided into four sections: the Introduction, Terms and Concepts, Existing Regulatory Framework, and Data and Analysis. Terms and Concepts define the terms used throughout most of this document. The Existing Regulatory Framework describes the current federal, state, regional and County regulations. The Data and Analysis section describes the current federal, state, regional and county regulations, identifies the water quality and quantity of the Floridan and Sand-and-Gravel Aquifers used to serve the water demands in Santa Rosa County, and describes the potential problems that could impact natural groundwater aquifer recharge areas within Santa Rosa County.

### B. Relationship to other Elements of the Comprehensive Plan

There are several key linkages between the Natural Groundwater Aquifer Recharge Sub-Element and other Elements of the Comprehensive Plan which include the following:

The *Future Land Use Element,* as an overall blueprint for managing growth in the County, defines the direction and intensity of future growth and development. This element will strongly influence the analysis of future Aquifer Recharge in different portions of the County.

The *Conservation/Coastal Management Elements* identifies all of the County's natural resources (i.e., geology, topography, minerals, soils, surface water quality and groundwater quality and quantity; floodplains, natural vegetative communities, wildlife habitats, fisheries, air quality, hazardous waste in addition; to coastal management issues beach and dune preservation, beach access, archaeological and historic sites, natural disaster planning, coastal high hazard areas and evacuation planning) and discusses various preservation techniques (i.e., preservation ordinances, conservation easements, financial incentives and land acquisition) as well as various land management techniques which will help to eliminate various land use conflicts.

The *Intergovernmental Coordination Element* provides opportunities to improve County collaboration and coordination with other agencies, such as the Environmental Protection Agency, Florida Department of Environmental Protection and the Northwest Florida Water Management District in exchanging important information related to environmentally sensitive areas located within Santa Rosa County.

The *Capital Improvements Element* will reflect the County's strategy for the delivery of infrastructure and other public services, which will serve a primary role in growth management. In addition, the Capital Improvements Element will reflect the five-year budget plan for capital outlay, which should support the Goals, Objectives, and Policies of this Element.

The *Infrastructure Element* consists of the Sanitary Sewer, Potable Water, Natural Groundwater Aquifer Recharge, Solid Waste and Stormwater Sub-Elements. From a growth management perspective, these Sub-Elements will help shape development trends into the next planning horizon, in addition to protecting both the surface and groundwater resources of the County throughout the next planning horizon.

## 10-2 TERMS AND CONCEPTS

Terms included in Appendix B of the Foundation Document are applicable to this element and are identified and described by the Florida Department of Community Affairs, in Rule 9J-5 of the Florida Administrative Code (F.A.C.) and in Section 163.3164, Florida Statutes (F.S.). All other terms and concepts used in this element are consistent with the intent of Rule 9J-5 and Chapter 163, F.S.

*Aquifer:* A geological formation having at least one horizontal impervious (confining) layer, which is capable of yielding a useful amount of water to a well or spring.

*Aquifer Recharge Area:* A specific area having soils which will permit the percolation of rainfall and other liquids.

*Aquifer System:* A heterogeneous body consisting of interspersed permeable and less permeable material that acts as a water-yielding hydraulic unit of regional extent.

*Cone of Depression:* A depression in the potentiometric surface of a body of ground water that has the shape of an inverted cone and develops around a pumped well.

*Confining Bed:* A body of relatively impermeable material stratigraphically adjacent to one or more aquifers.

*Consumptive Use:* Any use of water that reduces the supply from which it is being withdrawn or diverted.

*Discharge Area:* An area of land beneath which there is a net annual transfer of water from the saturated zone to a surface-water body, the land surface or the root zone. The net discharge is physically manifested by an increase of hydraulic heads with depth (i.e., upward ground-water flow to the water table). These zones may be associated with natural areas of discharge such as seeps, springs, caves, wetlands, streams, or bays.

*Floridan Aquifer:* A thick limestone aquifer that underlies all of Florida, as well as portions of southeastern Alabama, South Georgia and southern South Carolina. This aquifer is the primary source of drinking water to all but the southern peninsular and extreme westernmost panhandle of Florida.

*Groundwater Recharge Areas:* Areas contributing to or providing volumes of water which make a contribution to the storage or regional flow of an aquifer.

*Irrigation:* The process of artificially applying water to plant growth media or directly to living plant material.

*Percolation:* The downward movement through a permeable layer of earth.

*Prime Recharge Area:* An area so designated by the appropriate water management district governing board. High recharge and prime recharge areas shall receive a level of protection commensurate with their significance to natural systems or their status as current or future sources of potable water.

*Potentiometric Surface:* A surface which represents the static head in an aquifer. The potentiometric surface is determined by the levels to which water will rise in wells which are tightly cased into the aquifer. The water table and the artesian pressure surface are examples of potentiometric surfaces.

*Reclaimed Water:* Water that meets or exceeds FDEP standards for reuse and that is reused for a beneficial purpose after flowing out of any wastewater treatment facility.

*Surficial "shallow" Aquifer*: The uppermost unconfined permeable hydrogeologic unit contiguous with the land surface. The Surficial Aquifer System includes the Sand-and-Gravel Aquifer.

*Transmissivity:* The ability of a pervious surface to transmit water. Higher transmissivity means more water is penetrating into the aquifer.

### *Concepts*

*Water Supply:* Potable water is either produced from surface water obtained from lakes, rivers, man-made surface impoundments, etc., or groundwater. The selection of the source of the potable water supply must consider the type and quality of the water resources available, the cost of developing the source for use, and the manner and cost of providing protection of the resource to ensure its long term availability. In Santa Rosa County, as is the case in most of Florida, groundwater is the source of potable water. The water withdrawn from the source is commonly referred to as raw water. This raw water typically requires treatment before being used for public consumption. Treatment removes impurities from the raw water in order to improve its quality for either public health or aesthetic reasons, or both. The treatment process adds to the cost of supplying water, but it also expands the range of raw water sources that can be used.

*Wellfield Areas of Influence*

Land use activities can reduce the quality and quantity of water infiltrating into the aquifer and directly effect the County's potable water supplies. In the case of the well field areas of influence, rain which infiltrates into the soil within the area of influence may be drawn down into the wellfield cone of depression and thus into the County's wells. Any activity on the land surface that reduces the quantity of water infiltrating into the aquifer can directly effect the water supply. For this reason, the area of influence is the most important of the areas having significant water resource potential. Activities within the area of influence that can directly influence the water supply are listed below:

- Paving or covering soils of excellent to good recharge potential;
- Overdrainage of water table by use of deep ditches;
- Over pumping of private wells for irrigation of lawns;
- Excavation and recontouring of soils of excellent to good recharge potential;
- Development of wetlands;
- Seepage of contaminants such as hazardous or toxic substances into the soil.

The majority of water that infiltrates into the local aquifer comes through soils having excellent to good recharge potential. These soils are essential to the continuous recharge of the County's water supply. Development in areas where such soils are located can result in paving and covering of these soils so that less recharge reaches the local aquifer. Limiting impervious cover of these soils and making provision for no reduction of recharge are ways to mitigate the effects of development in highly pervious soils.

Ditches that are excavated below the water table have the potential to lower the historic water table in the vicinity of the ditch. Ditches which are below the water table and which are perpendicular to the flow of groundwater have very high potential for lowering the water table. The lowering of the water table has a two-fold effect: a lower water table reduces the volume of water available for public supply and increases the potential for saltwater intrusion. Designing ditches or swales which are higher than the water table, diversion of discharge to retention facilities for subsequent percolation into the groundwater system, minimizing ditches which are perpendicular to groundwater flow and piping of surface runoff will help reduce the adverse impacts of drainage facilities on the water table. Lakes, retention ponds and detention ponds have the same effect as ditches if they are excavated below the water table. Where possible, such drainage facilities should be designed as dry facilities except during operation.

## 10-3 EXISTING REGULATORY FRAMEWORK

### A. Federal

In 1986, the Federal Safe Drinking Water Act (PL 93-523) was amended to strengthen protection of public water system wellfields and aquifer that are the sole source of drinking water in the community. The amendments for wellfield protection requires states to work with local governments to map wellhead areas and develop land use controls that will provide long-term protection from contamination for these areas. The aquifer protection amendment requires the U.S. Environmental Protection Agency (EPA) to develop criteria for selecting critical aquifer protection areas. The program calls for state and local governments to map these areas and develop protection plans subject to EPA review and approval. Once a plan is approved, EPA may enter into an agreement with the local government to implement the plan. In summary, the law required the EPA to develop criteria for selecting critical aquifer protection areas.

Other measures were enacted to protect these areas include the Water Pollution Control Act and the Clean Water Act of 1972. The Federal Water Pollution Control Act (PL 92-500) amended by the Water Quality Act of 1987, regulates sanitary sewer service at the Federal level. This Act is directed towards maintaining the integrity of the nation's water bodies by restoring and/or maintaining the chemical, physical and biological integrity. The Act, which is implemented by the U.S. Environmental Protection Agency (EPA), established a national policy of implementing area-wide waste treatment and management programs to ensure adequate control of sources of pollutants.

The Clean Water Act of 1972 called for EPA to develop national pretreatment standards to control industrial discharges into sewage systems. All publicly-owned treatment works (POTWs) must enforce the Federal standards. The National Pretreatment Program is a cooperative effort of Federal, State and local officials for reducing undesirable industrial wastewaters into municipal sewers. The overall framework for the National Pretreatment Program is contained in the General Pretreatment Regulations that EPA published in 1978 and modified in 1981. These regulations require that all large POTWs – more than 5 million gallons, and smaller POTWs with significant industrial discharge, to establish local pretreatment programs.

## B. State

The Department of Environmental Protection (DEP) developed rules classifying aquifers and regulating their use as per Chapter 62-550 F.A.C. in accordance with the Florida Safe Drinking Water Act (Chapter 403, F.S.). Under this regulation, the state has set primary, as well as secondary, standards for the maximum contaminant levels allowed. Enforcement of the aforementioned regulations is the responsibility of the Florida Department of Environmental Protection (FDEP). The State of Florida generally enforces the Federal government's requirements for most contaminants. The following contaminants, however, are subject to more stringent FDEP standards:

- The FDEP regulates Ethylene dibromide (EBD) at 0.00002mg/L while the EPA standard is 0.00005 mg/L.
- The FDEP regulates sodium at 160 mg/L. Sodium is not regulated by the EPA.
- The FDEP regulates the following volatile organic compounds (VOCs) at levels more stringent than EPA standards: trichloroethane, carbon tetrachloride, 1, 2-dichloroethane, and benzene.

The MCL for Total Coliform (TC) bacteria in groundwater is 4 per 100 milliliters (mL). The following secondary MCLs are also regulated as enforceable standards: color is 15 color units; foaming agents is 0.5 mg/L, odor is 3 (odor threshold number). The secondary MCL for total dissolved solids (TDS) is 500 mg/L. This standard may be exceeded if no other MCL is exceeded.

The Florida Department of Environmental Protection also regulates domestic wastewater facilities and their discharge to the nations water bodies under Chapter 62-600, F.A.C., which was implemented under the provisions and requirements of the Florida Air and Water Pollution Control Act under Section 403, F.S. This Act established that no wastes are to be discharged to any waters of the state without first receiving the degree of treatment necessary to protect the beneficial uses of such water. However, the two exceptions to this rule are:

1.) Any domestic wastewater facility of design less than or equal to 2,000 gallons per day average daily flow serving a single establishment; and
2.) Septic tank drain fields or on-site systems with design capacity less than or equal to 5,000 gallons per day average daily flow serving a single establishment, with the exception of restaurant facilities generating less than 3,000 gallons per day; average daily flow or industrial facilities and all commercial laundry facilities.

It is the requirement of the State of Florida to require that all buildings served by on-site sewage disposal systems, except approved on-site gray-water systems, connect to a publicly owned or investor-owned permitted sewage system within 365 days after notification that such a system is available. For sewage flows of 600 gallons per day or less, a sewage system is considered available if a sewer line exists in a public easement or right-of-way which abuts the property and if gravity flow can be maintained from the building drain to the sewer line. For flows exceeding 600 gallons per day, a sewage system shall be considered available if a sewer line, force main, or lift station exists in a public easement or right-of-way which abuts the property or is within 10 feet of the property.

In relation to protection of the groundwater resources of the County, the Department of Environmental Protection regulates underground storage tanks under Chapter 62-761, F.A.C. This regulation covers the underground storage of pollutants such as gasoline, pesticides and fertilizers and establishes performance standards for the entire industry. Inspection and enforcement remains the responsibility of DEP. However, available financial and human resources limit the inspection and enforcement activities that are carried out.

In addition, DEP has also established regulatory requirements for facilities which discharge to groundwater (Section 62-4. 245, F.A.C.) and which inject materials directly underground (Chapter 62-28, F.A.C.). The Northwest Florida Water Management District (NWFWMD) was given the responsibility of preparing and making available to local governments an inventory study of the available groundwater resources to be used by the local governments to plan for future development in a manner which reflects the limits of available resources.

As directed by the Governor's Executive Order 96-297 and Subparagraph 373.036(2)(b)4, F.S., the findings of the District are illustrated in Technical Publication SJ98-2, Water Supply Assessment 1998. The Florida Legislature has also directed local governments to include topographic maps of areas designated by the Water Management Districts as Prime Recharge Areas for the Florida or Biscayne Aquifers in local comprehensive plans (section 163.3177 (6)(c), F.S.). The NWFWMD regulates water-related activities through the issuance of permits for water use, water well construction, surface water management systems, and stormwater management.

## C. Regional

The *Northwest Florida Water Management District* manages the water resources of the northwest Florida area to ensure the continued availability while maximizing both environmental and economic benefits. To regulate the use of groundwater supplies, the NWFWMD issues consumptive use permits (CUP) for irrigation wells or for any use of water withdrawals which reduces the supply. CUPs allocate water for beneficial uses such as agriculture, industry and public supply. The NWFWMD has established criteria for determining these uses: (1) the well exceeds 100,000 gallons per day on an annual basis, (2) a facility which has the capacity of withdrawing one million gallons per day or more and (3) a well six inches or larger in diameter.

In relation to water conservation, the NWFWMD requires water conservation practices in applications for Consumptive Use Permits (CUPs). Permits are reviewed for practices which meet the reasonable, beneficial criteria. Agricultural users, for example, are required to minimize or eliminate off-site discharge. Discharges during the hours from 9 a.m. to 5 p.m. are limited to .5 inch over a weir and no discharge is permitted after 5 p.m. Many farmers now employ a closed loop ditch system to irrigate their fields instead of letting water run off-site. The WMD is also investigating other methods for agricultural water reuse.

The *West Florida Regional Planning Council* (WFRPC) adopted the Strategic Regional Policy Plan (SRPP) in 1996. This document provides a long-range guide for the economic, physical, and social development of Northwest Florida. The following themes from within the Natural Resources of Regional Significance (NRRS) section that pertain to the Natural Groundwater Aquifer Recharge Sub-Element are as follows:

- Manage the Regional water supply to provide for all recognized needs on a sustainable basis and protect water recharge areas and existing and future well sites.
- Identify and protect water recharge areas and existing and future well sites through comprehensive land use planning and land development regulations.
- Investigate the development and use of alternative sources of water in areas where currently used sources are steadily declining and develop and implement strategies for use of alternative water supplies.
- Protect groundwater supply identified in groundwater basin resource inventories prepared by the Northwest Florida Water Management District.

- Prevent all development activities that would structurally impair the function of high volume recharge areas, or reduce the availability and flow of good quality water to those recharge areas.
- Prohibit any activities that would introduce wastes or other by-products into the groundwater system via recharge areas.
- Prohibit the mining of water, where use exceeds historical recharge.

## D. Local

Article 4 of the Santa Rosa County Land Development Code regulates stormwater management in the County. The regulations require all new development to retain the first 1-inch of runoff for a ~~one-hundred (100)~~ twenty-five (25) year, 24-hour storm event. This is twice the requirement of the Water Management District for stormwater retention. In addition, these regulations seek to preserve existing natural drainage collection, storage and conveyance systems.

# 10-4 DATA AND ANALYSIS

By definition, an aquifer is a geologic unit that can store and transmit significant quantities of water. The two primary sources of groundwater for beneficial uses in Santa Rosa County are the Sand-and-Gravel and Floridan Aquifers. The aquifers in Santa Rosa County are primarily composed of sand, gravel, shell, and limestone. Aquifers are separated by confining layers of materials which are less permeable to water. As discussed in the Potable Water Sub-Element, the Sand-and-Gravel Aquifer is the principal source of water supply for potable purposes throughout the County. The Floridan Aquifer provides the major source of water for the southern part of the County. The Floridan Aquifer is the principal source of water supply for potable purposes throughout most of Northwest Florida.

## A. Characteristics of the Natural Groundwater Aquifer

### A.1 Geology

Santa Rosa County is underlain by a veneer of Pleistocene terrace deposits overlying Tertiary beds of sand, silt, and limestone which dip southwestward at 30 to 40 feet per mile (Marsh, 1966). Stratigraphically, these sediments are referred to as undifferentiated alluvium and terrace deposits underlain by the Citronelle Formation. The uppermost part of this sequence forms the Sand-and-Gravel Aquifer. Major tributaries of the system are incised into the Sand-and-Gravel Aquifer. Groundwater flow from this aquifer discharges to these tributaries and to the bays.

Marsh (1966) also suggests that three marine surfaces of Pleistocene age can be recognized in the area; the Pamlico terrace at 30 feet, the Penholoway terrace at 70 feet, and a seaward sloping upland surface whose altitude ranges from about 60 to 200 feet. Remnants of these terraces are preserved as upland plateaus, flat-topped hills, and low coastal plains.

Santa Rosa Island is considered a classic example of bay barrier bar with a straight seaward margin. The island is about half a mile wide and has sand dunes as high as 50 feet above sea level. Two backshore terraces can be observed, one slightly above the other. Martens (1931) considered them to have been generated by storms.

A recharge area is comprised of land where water infiltrates into the land surface and moves downward into aquifer systems. A recharge area may be located in an area miles away from where an aquifer is utilized. The areas of highest recharge potential are called prime recharge areas. Prime recharge areas percolate water into the aquifer quickly resulting in high recharge of the aquifer.

As water moves through the surficial aquifer and Florida aquifer from areas of high hydraulic head to areas of low hydraulic head, the groundwater exerts pressure on the confining units. When a tightly cased well penetrates the aquifer system, the groundwater will rise in the well to a level that equates to the pressure exerted on the confining unit. This water level is referred to as the potentiometric surface. The elevation of the potentiometric surface fluctuates seasonally and yearly. Map 11-5 (Appendix A) illustrates the elevation of the potentiometric surface of the Floridan Aquifer in Santa Rosa County.

## A.2 Floridan Aquifer

The Floridan Aquifer System is the most productive water-bearing unit in Northwest Florida (District Water Management Plan, 17). The aquifer supplies 90 percent of the water needs in the area and it is utilized in all counties except Escambia and most of Santa Rosa (Ibid., 17). Limestone is the primary component of the aquifer. The layers range in thickness of 100 to 1,000 feet within northwest Florida (Ibid., 17). The Intermediate and Sub-Floridan Aquifer Systems function as groups of sediment that hamper the vertical movement of ground water. The Intermediate System limits the exchange of water between the Surficial Aquifer System and the Floridan Aquifer System. The Sub-Floridan System forms the base of the Floridan Aquifer groundwater flows (District Water Management Plan, 19).

Prior to development, ground water in the Floridan Aquifer flowed in a generally north to south direction. Pre-development aquifer water levels were highest in the northernmost parts of Region II. In northern Walton County, water levels were about 200 feet above MSL. In northern Santa Rosa water levels were lower, on the order of 130 feet above MSL. Floridan Aquifer water flowed down the hydraulic gradient and discharged naturally into the Choctawhatchee River, Choctawhatchee Bay and Gulf of Mexico. Along the coastline, pre-development heads ranged from about 20 feet above MSL in Walton County, to 50 feet above MSL in Okaloosa County and to 70 feet above MSL in Santa Rosa County.

Water levels have steadily declined since water production began. Since pre-development times, water levels in the Floridan Aquifer have been lowered throughout all of Santa Rosa and Okaloosa counties and about half of Walton County. Heads are presently below MSL throughout much of coastal Santa Rosa, Okaloosa and Walton counties. At its lowest, the potentiometric surface is depressed as much as 150 feet below MSL. This head reversal reflects a maximum loss of about 200 feet. The net result of water level declines is a regionally significant cone of depression.

Within the three counties, the cone of depression has grown in an asymmetrical fashion. Head declines are greatest (both areally and vertically) in the western half of the Region. The asymmetrical growth is driven by the relatively higher recharge in Walton County, as compared to Santa Rosa and Okaloosa counties. Heads in northern Walton County are virtually unaffected by current pumping elsewhere in the region.

A “cone of influence” is defined as a depression in the potentiometric surface of the groundwater that has the shape of an inverted cone. Cones develop around wells and wellfields when water is being withdrawn and define the area of influence of the well or wellfield. Cones of influence are studies by the water management districts on a site-specific basis according to the CUP. Chapter 62-40, Florida Administrative Code (F.A.C.) establishes criteria for review of CUPs.

One of the criteria established by Chapter 62-40, F.A.C., is “whether the impact of withdrawal extends to land not legally controlled by the user.” For groundwater withdrawals, the impact would be determined by the decrease in the water table. The NWFWMD requires the applicant to perform a standard aquifer test prior to CUP approval.

The recharge of aquifers happens either directly or indirectly. The direct process occurs where the sediments comprising the aquifer lie at or near the land surface or where overlying sediments are breached by karstic features that allow rainfall to move directly to the aquifer. The indirect process occurs when rainfall infiltrates the aquifer from overlying sediments as leakage. Both processes are important because they replenish the ground water resources, though at very different rates. Defined sections with lower recharge rates to the Floridan Aquifer are important areas from the perspective of water supply and demand. Typically, aquifer recharge in these delineated areas occurs indirectly, via leakage from "source" beds (i.e., Surficial Aquifer System), which overlie the aquifer. Due to the confinement of the Floridan Aquifer, the leakage is quite low, which translates into limited replenishment of the ground water resources in these areas (District Water Management Plan, 24).

The Floridan Aquifer is recharged by the Surficial Aquifer System in areas where the water in the Surficial Aquifer System is higher than the potentiometric surface of the Floridan Aquifer. There are no Floridan Aquifer recharge areas in Santa Rosa County. Discharge from the Floridan Aquifer occurs where the potentiometric surface of the aquifer is higher than the elevation of the water table in the Surficial Aquifer System.

The areas of higher recharge of the Floridan Aquifer are in Washington County, the northern part of Bay County, ¾ of Holmes County, and the northeast quarter of Walton County. These areas coincide where the aquifer is at or near land surface and where karst processes have breached the overlying confining unit. The high recharge characteristics allow for an abundant ground water resource. However, these characteristics also potentially limit the use of this resource, due to the relative ease of ground water contamination. Therefore, the delineated areas are important in terms of managing the integrity of the ground water quality (District Water Management Plan, 24).

### A.3 Surficial Aquifer

The thickness of the Surficial Aquifer System is variable. Its thickness ranges from a few feet to as much as 300 feet in the western part of the Region. In most of Santa Rosa County and in all of Escambia County, the Surficial Aquifer System is the primary source of potable water and is commonly called the Sand-and-Gravel Aquifer. In Santa Rosa County, the Sand-and-Gravel Aquifer provides about 75 percent of the ground water used with the remaining 25 percent coming from the Floridan Aquifer. In Okaloosa and Walton counties the situation is reversed, with the Floridan Aquifer providing the bulk of the ground water demand. The primary components of this aquifer are sand, clays, and gravel, with sands being the primary component. East of the Choctawhatchee River the aquifer is thin and is a minor water-bearing layer.

Groundwater in the Region is influenced largely by local recharge with minimal out of state contributions. The Surficial Aquifer has the most localized characteristics. For example, rain falling on a hill top recharges the Surficial Aquifer and the groundwater flows down-gradient to discharge at the foot of the hill into a stream that dissects the aquifer. The entire area overlying the Sand-and-Gravel Aquifer is a recharge area and discharge areas are usually close to areas being recharged (District Water Management Plan, 19).

## B. Water Use

Santa Rosa County falls into the Northwest Florida Water Management District's Water Supply Planning Region II. Region II is made up of Walton, Okaloosa and Santa Rosa Counties. Public supply is the largest water use category in Region II, accounting for an average of approximately ~~37.0~~44.97 mgd or ~~63~~70% of the total regional water use in ~~1995~~2000. Okaloosa County Water and Sewer is the Region's single largest public water supplier, with an average withdrawal of 6.8 mgd in 1995. The majority of public supply water use is within the Region's coastal area, which is a popular tourist destination and is more heavily populated than the Region's northern, inland areas.

Domestic self-supply and small public supply systems water use accounts for only a small percentage (~~5~~3.5% or ~~3.1~~2.25 mgd) of total water use within Region II. In 1995, an average of approximately 2.3 mgd was used in the Region II ASC and another 0.9 mgd was used in the remainder of the Region.

In ~~1995~~2000, the commercial/industrial self-supplied water use category accounted for an average of approximately ~~11.8~~10.65 mgd or about ~~20~~16.6% of the Region's total water use. The majority of this water was used within the non-ASC in Santa Rosa County. Major commercial/industrial users in Region II include Eglin Air Force Base in Okaloosa County (predominately the Floridan Aquifer), Air Products and Sterling Fibers in Santa Rosa County (Sand and Gravel Aquifer), and Perdue Farms in Walton County (Floridan Aquifer).

Recreational irrigation water use accounted for approximately ~~5.43~~5.79 mgd or ~~9~~% of the Region's total water use in ~~1995~~2000. The majority of water used for recreational irrigation, an average of approximately 4.56 mgd in 1995, was used by golf courses located in the southern portion of the Region. Some of the golf courses use treated wastewater effluent (reuse) for all or part of their irrigation demands.

Agriculture irrigation in ~~1995~~2000 used approximately ~~1.5~~0.59 mgd, accounting for approximately ~~3~~0.9% of the Region's total average water use. The vast majority of water use in this category took place in ~~Okaloosa~~Santa Rosa County (~~1.2~~0.34 mgd). Nurseries and corn crops were the Region's primary users of water for agricultural irrigation. A summary of water use by category is provided in *Table 10-1*.

Table 10-1
Freshwater Withdrawals (MGD) By Category
Santa Rosa County, ~~1995~~2000

| | Ground | Surface | Totals |
|---|---|---|---|
| Public Supply | ~~11.5~~14.62 | 0.0 | ~~11.5~~14.62 |
| Domestic/Small Public | ~~0.8~~0.81 | 0.0 | ~~0.8~~0.81 |
| Com./Industrial | ~~6.2~~5.58 | 0.0 | ~~6.2~~5.58 |
| Agricultural Irrigation | ~~0.2~~0.34 | 0.0 | ~~0.2~~0.34 |
| Recreational Irrigation | ~~1.5~~1.45 | 0.0 | ~~1.5~~1.45 |
| Total | ~~20.2~~22.80 | 0.0 | ~~20.2~~22.80 |

SOURCE: Northwest Florida Water Management District, ~~1995~~*Regional Water Supply Plan for Santa Rosa,*

The NWFWMD projects by the year ~~2020~~2025 water use categories are anticipated to increase throughout Santa Rosa County. Public supply is anticipated to increase to ~~21.1~~26.85 mgd; domestic/small public supply is anticipated to increase to ~~0.9~~1.39 mgd; commercial/industrial supply is anticipated to increase to ~~8.2~~8.7 mgd; agricultural irrigation is anticipated to ~~increase~~remain at ~~to~~ 0.5 mgd; and recreational irrigation is anticipated to ~~increase~~decrease to ~~2.6~~2.44 mgd.

In response to existing and anticipated water supply problems, the WMD has designated the coastal area of Santa Rosa, Okaloosa and Walton counties as a Water Resource Caution Area (WRCA). Map 11-6 (Appendix A) illustrates the location of this Water Resource Caution Area.

The WRCA designation subjects all non-exempt withdrawals to more rigorous scrutiny to ensure that the proposed withdrawal does not result in unacceptable impacts to the resource. Permittees within a WRCA also have increased water use reporting requirements, must implement water conservation measures, and must improve water use efficiencies. They are also required to perform an evaluation of the technical, environmental, and economic feasibility of providing reclaimed water for reuse. In Santa Rosa, Okaloosa, and Walton counties, use of the Floridan Aquifer for non-potable purposes is prohibited within the WRCA (Ryan et al. 1998).

### B.1 Wells

Currently, there are ~~12~~15 water systems in Santa Rosa County regulated by the Department of Environmental Protection (DEP). Each water system has its own public supply wells. In most areas of the County, these systems draw water from the surficial aquifer for potable uses. These include ~~56~~51 Sand-and-Gravel Aquifer wells and ~~5~~10 Floridan Aquifer wells.

In ~~2001~~2008, the Northwest Florida Water Management District issued permits for ~~996~~511 private wells. These wells were for potable water, irrigation and other uses. The potential yield of these wells is variable throughout the County.

## C. Water Quality

The substantial depression of the potentiometric surface puts wells in coastal parts of the Region at risk for saltwater intrusion. Along the coastline, areas exist with naturally occurring ground waters that exceed drinking water standards. These areas include much of coastal Santa Rosa and Walton counties. For example, along Santa Rosa Island, sodium exceeds its standard from the vicinity of the Santa Rosa/Okaloosa county line west to Gulf Breeze and beyond. On the mainland, at Navarre, sodium is near its standard. In the Tiger Point area, both sodium and chloride have concentrations around 500 mg/L. In a large area of Walton County south of Choctawhatchee Bay, both sodium and chloride are at or above their respective water quality standards. In addition, at some unknown distance south of the Gulf shoreline, Floridan Aquifer ground water everywhere south of Okaloosa County exceeds sodium and chloride standards. As a result, the 250 mg/L isochlor may be conceptualized as a broad, shallow arc, onshore in coastal Santa Rosa County, offshore south of Okaloosa County, and onshore again in coastal Walton County.

All of these areas with poor quality water are hydraulically up-gradient of the center of the cone of depression. Ground water from these areas is presently flowing toward the cone of depression. To date, water produced from the Floridan Aquifer in coastal Region II has been little affected by the deterioration of water quality. Prior to the cessation of their use, water from Navarre Beach wells was regularly exceeding the sodium standard (160 mg/L) and experiencing increasing chloride concentrations. In coastal Walton

County, selected wells owned by Florida Community Services Corp. have experienced increases in both sodium and chloride concentrations. Elsewhere, temporal concentration trends are relatively stable.

Continuation of the cone will eventually result in more widespread deterioration of water quality in supply wells and is, therefore, unsustainable. These factors lead to the current level of concern about the Region's ground water resources. As a consequence, long-term alternatives and options for new sources of water are needed to alleviate or prevent future problems anticipated with the continued use of the Floridan Aquifer in coastal areas. However, systems located in the transition zone very near to the non-potable portions of the Floridan Aquifer have already been impacted.

### C.1 Floridan and Surficial Aquifer Recharge Network

The Floridan Aquifer is recharged by the surficial aquifer system in areas where the water in the surficial aquifer system is higher that the potentiometric surface of the Floridan Aquifer. There are no Floridan Aquifer recharge areas in Santa Rosa County. Discharge from the Floridan Aquifer occurs where the potentiometric surface of the aquifer is higher than the elevation of the water table in the Surficial Aquifer System. Springs occur where the overlying confining layer is thin or absent and the potentiometric surface is higher than land surface.

Lakes, streams and wetlands provide recharge for the surficial aquifer. These areas need to be protected from pollution sources. Pollution of groundwater is a serious problem and clean-up procedures can be costly and take many years before the water is potable.

In addition, the increase in development within the County reduces the recharge area of the aquifer as well as affects the quality of available groundwater. The impacts upon groundwater quantity and quality should be addressed to protect the residents of the County and the region. The County and the region need to identify those areas with groundwater recharge potential so as to limit the type and density of development in those areas.

## D. Aquifer Recharge Needs And Assessments

There are several problems Santa Rosa County must face relevant to aquifer recharge. In summary, there are four potential problems that could impact natural groundwater aquifer recharge in Santa Rosa County. They include saltwater intrusion, contamination of the surficial aquifer, impacts of increased development, and the lack of a County wellfield protection ordinance.

### D.1 Saltwater Intrusion

Saltwater intrusion from the Gulf of Mexico and Santa Rosa Sound is one of the major threats to groundwater resources in southern Santa Rosa County. Saltwater intrusion, primarily caused by the over pumping of wells, can have a significant impact upon the adequate supply of suitable water to meet the needs of County residents. Saltwater intrusion occurs slowly (on the order of tens to hundreds of years) in response to declines in the potentiometric surface of the Floridan Aquifer. As fresh water is depleted, it is replaced with saltwater through the upward movement of water. The proposed amendments to the Natural Groundwater Aquifer Recharge Sub-element's objective and policies will enable the County to address the issue of water quality – specifically the potential impacts of saltwater intrusion.

## D.2 Contamination of the Surficial Aquifer

The adopted Comprehensive Plan indicated that the surficial aquifer is susceptible to contamination from human activities. Such activities include the dredging of canals, which may create an avenue for saltwater to enter the surficial aquifer, or the spilling or leaking of chemicals into the ground.

Another potential location of groundwater contamination is around the County's landfill. The Santa Rosa County Central Landfill is located on Da-Lisa Road. At the current time, the County has an Interlocal Agreement with the City of Milton for leachate treatment for the landfill. Therefore, no contamination has occurred to date. However, this area needs to be closely monitored for any future groundwater contamination.

As a result, the County is establishing wellhead protection areas around each public water supply well. Activities such as landfills and dumps, underground storage tanks and pipelines, septic tanks, direct industrial/municipal discharges, pesticides and chemicals, stormwater runoff, land application, and leaks from sewer lines shall be prohibited to prevent future groundwater contamination problems.

## D.3 Impact of Increased Development on the Recharge Area of the Aquifer

Increased development reduces the recharge area of the aquifer. This impact can be reduced by preserving natural drainage features and by using drainage retention structures to maximize aquifer recharge. The County's stormwater regulations prohibit the alteration, restriction, or removal of existing natural drainage systems without prior approval through the Santa Rosa County Development Review Process. To further ensure the County adequately addresses the impacts of increased development on the recharge area of the aquifer, actions should be taken to contain development to those areas that will not adversely impact the recharge areas. Proposed amendments to this Sub-element's objective and policies will also assist the County in identifying recharge and environmentally sensitive areas to limit the impact of increased development within the County.

## D.4 Lack of a County Wellfield Protection Ordinance

The Potable Water Element's goals, objective and policies require the adoption of Wellfield Protection Regulations within the Land Development Code. These regulations are necessary to help the County identify and protect those areas surrounding public potable water supply wells so as to prevent contamination of public water resources.