City of Leesburg

GROWTH MANAGEMENT PLAN
AQUIFER RECHARGE ELEMENT

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Exhibit A
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CHAPTER VIII
AQUIFER RECHARGE ELEMENT

A. INTRODUCTION

The protection of recharge areas is critical in locations that rely on aquifers as the sole source of drinking water. Well-drained areas are often subject to alteration by development since these areas are typically prime land for development. The development of impervious surfaces such as roads, roofs, and parking areas reduces the area available for percolation, which, in turn, reduces the quantity of natural recharge to the aquifer. The quality of the water that is recharged into the aquifer is also a critical factor since impacts of development can compromise the quality of the groundwater. Groundwater can absorb contaminants from development and transmit them to the aquifer. This element is intended to protect the quantity and quality of natural groundwater that is recharged back into the aquifer.

1. Terms and Concepts

The following terms and concepts will be used in this element to help define the groundwater resource and its requirements for protection.

Aquifer— a water-bearing geologic formation.

Confining Unit—a geologic formation consisting of densely packed materials which generally precludes or reduces the penetration of water.

Potentiometric surface—the elevation that water would reach in a well penetrating into the aquifer.

Recharge—renewal of the groundwater resource.

Water Recharge Area—land or water areas through which groundwater is replenished.

Water Table—a level below which the ground is saturated with water.

B. AQUIFER RECHARGE DATA

The City of Leesburg falls near the western edge of the Middle St. Johns (MSJ) groundwater basin. A groundwater basin is a particular groundwater flow system that encompasses recharge areas, as well as the associated discharge areas. Three aquifer systems have been identified in the MSJ groundwater basin. These are the surficial (unconfined), the intermediate, and the Floridan (confined) aquifer systems. Map VIII-1 provides a generalized hydrogeologic cross section of the groundwater basin.

1. Hydrogeology

a. Surficial Aquifer

The surficial aquifer is composed of sand, shells, and some clays, and ranges in thickness from 20 feet near the St. Johns River to approximately 60 feet in the central part of the MSJ basin. The top of the aquifer is defined by the water table, which marks the line below which all soil voids are filled with water. The water table rises and falls in response to atmospheric pressure, amount of rainfall, permeability of soil and other factors. Flow in the surficial aquifer usually follows the topography

of the land and is an important source of water for individual domestic wells and small-scale irrigation systems. Since there is no overlying confining unit, groundwater recharge to the surficial aquifer system is controlled by local rainfall, land use, vegetation, topography, and local soils. Areas characterized by highly permeable, sandy soils that transmit fluids easily and yield significant quantities of water, are typically good recharge areas for the surficial aquifer system. This aquifer system can discharge into surface streams, lakes, and rivers, or deeper aquifers.

b. Intermediate Aquifer

The intermediate aquifer generally lies below the surficial aquifer and above the Floridan aquifer and occurs randomly throughout the MSJ groundwater basin. It is composed of clays and thin, water–bearing zones of sand, shell, and limestone. The intermediate aquifer can sometimes be found within the confining unit of the Floridan aquifer occurring at 60 to 150 feet below land surface and supplies water to some parts of the basin. The intermediate aquifer is a potential source of potable water in areas where the Floridan aquifer contains water of marginal quality. However, the intermediate aquifer does not provide a large water supply due to the fact that the water is found in relatively small isolated lenses.

c. Floridan Aquifer

The Floridan aquifer is the principal source of water for consumptive use in the MSJ groundwater basin and is the aquifer from which the City of Leesburg draws its public water supply. The Floridan aquifer is an artesian-confined aquifer composed primarily of limestone and dolomite. Characteristically, artesian aquifers contain groundwater that is under pressure that is greater than the atmospheric pressure. This pressure is demonstrated by the potentiometric surface level, which is the level to which water will rise in tightly enclosed wells that penetrate the aquifer.

The Floridan aquifer usually has two permeable zones containing potable water in the MSJ groundwater basin. The upper permeable zone consists of cavernous Ocala and Avon Park limestone and extends from approximately 100 to 500 feet below land surface. Withdrawals from the upper permeable zone are generally limited to small public supply and domestic wells. The lower permeable zone consists of cavernous Lake City limestone and extends from about 1,000 to 1,300 feet below land surface. A transition zones lies between these two permeable zones containing scattered areas of both types of permeable formations. The City of Leesburg draws most of the raw water used for the City water supply from the upper permeable zone of the Floridan aquifer and the remainder of its water from the transition area.

C. AQUIFER RECHARGE ANALYSIS

1. Groundwater Quality of the Floridan Aquifer

The natural quality of groundwater in MSJ groundwater basin varies greatly depending on the location and the depth from which water is obtained. A major concern in the MSJ basin is saltwater intrusion in areas of Seminole County. Although the MSJ groundwater basin is inland from the sea, and bordered on the west by the peninsular divide, there are some patches of connate saltwater intrusion existing in the Floridan aquifer. The potential exists for this saline water to migrate

upward within the aquifer system in response to: declines in the potentiometric surface, the magnitude of groundwater withdrawals, and climatic changes. However, saltwater interface is not a concern for the potable water supply in the Leesburg region due to the approximately elevation of –2,000 feet National Geodetic Vertical Datum (NGVD) of the saltwater interface. The chloride concentration is estimated at approximately 5,000 mg/l. Leesburg is located well outside the areas east of Lake County that have associated chloride and sulfate concentrations of equal or greater than 250 mg/l, the recommended limit of chloride and sulfate for public water supplies set by the Florida Department of Environmental Protection (FDEP). In addition, data taken from wells located in Lake County that penetrate the Floridan aquifer indicate that none of the 16 physical or chemical constituents monitored for groundwater exceed the maximum contaminant levels established in the National Interim Primary Drinking Water Regulations. Therefore, the Floridan aquifer underlying Leesburg is of good water quality and as such only chlorine disinfection is required to provide the City with potable water for distribution. Additional information regarding potable water quality is contained in the Potable Water Element, Chapter V.

2. Recharge to the Floridan Aquifer

Groundwater recharge is vital for providing adequate groundwater supplies for future uses and for preserving the quality of groundwater resources. Recharge to the Floridan aquifer occurs in areas where the elevation of the water table within the surficial aquifer is higher than the elevation of the potentiometric surface elevation of the Floridan aquifer. The elevation of the potentiometric surface is between fifty-five (55) and seventy (70) feet above mean sea level (MSL) within the Leesburg service area and fluctuates in response to rainfall amounts within the recharge areas. Normally, the potentiometric surface level fluctuates about five (5) feet, with the highest levels being recorded in September, just after the rainy season. The lowest levels are normally in May, at the end of the dry season.

In areas where the elevation of the water table is higher than the potentiometric surface level, groundwater moves from the surficial aquifer in a downward direction through the upper confining unit to the Floridan aquifer. Recharge rates are highest in areas where the hydraulic pressure difference and permeability are greatest. The recharge rates are directly proportional to the hydraulic pressure difference and the hydraulic conductivity of the upper confining unit and inversely proportional to the thickness of the upper confining unit.

Recharge also occurs directly from infiltrating rainfall where limestones of the Floridan aquifer are at or near land surface. The amount of water available as recharge to the Floridan aquifer is that part of rainfall, after losses to runoff and evapotranspiration, that infiltrates to the water table and continues to move downward to the Floridan aquifer. Generally, when rainfall exceeds evaporation by approximately two inches (2") per year, and the difference between water table elevation and the potentiometric surface is about ten (10) feet, conditions which are conducive to recharge exist, and recharge to the Floridan aquifer occurs. Soils having high infiltration potential with little or no runoff due to the lack of surface

drainage features are most conducive to recharging groundwater systems. Precipitation in the Leesburg area averaged 49.2 inches/year from 1958 to 1997 as recorded at the nearby Lisbon monitoring station. Maximum precipitation during this period was 67.7 inches as recorded in 1959 and the minimum was 31.85 inches in 1961. Areas of groundwater recharge to the upper Floridan aquifer in Leesburg are depicted in Map VIII-2**.**

There are two areas within the Leesburg City limits that have a high potential for groundwater recharge (greater than 12 inches per year). The larger of these two areas is located in the eastern portion of the City between Lake Griffin and Lake Harris, in the Tomato Hill area. The other area of high aquifer recharge is located in the northwestern portion of the City, along the western side of Highway 27 just north of C.R. 44C and extends north and west into Lake County.

3. Regulatory Framework

Regulations have been enacted to prevent negative impacts of excessive water consumption. Extreme lowering of aquifer levels and surface water flows can adversely impact ecosystems by lowering lake levels, degrading wetlands and other natural systems and habitats. Other related negative impacts can include increased sinkhole frequency and saltwater intrusion in coastal areas.

a. State Regulation

Groundwater within the State of Florida has been classified into four categories in Section 62, Florida Administrative Code. These classifications and their designated uses are as follows:

CLASS G-I Potable water use, groundwater in single-source aquifers which have a total dissolved solids content of less than 3,000 mg/l.

CLASS G-II Potable water use, groundwater in aquifers which have a total dissolved solids content of less than 10,000 mg/l, unless otherwise classified by the Environmental Regulation Commission.

CLASS G-III Non-potable water use, groundwater in unconfined aquifers which has a total dissolved solids content of 10,000 mg/l or greater, or which has total dissolved solids of 3,000-10,000 mg/l and either has been reclassified by the Commission as having no reasonable potential as a future source of drinking water, or has been designated by the Department as an exempted aquifer pursuant to Section 62-28.13(3), F.A.C.

CLASS G-IV Non-potable water use, groundwater in confined aquifers which has a total dissolved solids content of 10,000 mg/l or greater.

The State delegates powers to agencies to regulate well construction and ensure that wells are contaminant free. The potable water provided by the public wells within Leesburg is of a good quality requiring minimal treatment.

The Water Management Districts within the state of Florida designate areas that are Priority Water Resource Caution Areas (PWRCA) and/or Restricted Allocation

Areas (RAA). **The City lies completely within a PWRCA**. ~~Leesburg has not been classified as a high priority area in terms of water use or aquifer recharge protection priorities. In fact, only a small portion of the City is classified as having high recharge characteristics.~~ The St. Johns River Water Management District (SJRWMD) has produced a series of GIS maps regarding aquifer recharge, water use, and related natural resource protection. Map VIII-2 indicates the location of high recharge areas within the City of Leesburg as identified by the SJRWMD.

SJRWMD has the authority to regulate consumptive use permitting within its district, under Section 373.216 of the Florida Statutes. A consumptive use permit allocates a

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maximum allowable withdraw from the aquifer. The basic principles of the consumptive use permit review is as follows:

1) The use must be beneficial.

2) The use must not interfere with a pre-existing legal use.

3) The use must be in the public interest.

SJRWMD has issued consumptive use permit number 94 to the City of Leesburg, which is valid through 2004. This permit allows for an annual withdrawal for the Floridan aquifer of 2722.9 MG in 2001, 2897.9 MG in 2002, 3061.4 MG in 2003, and 3333.4 MG in 2004.

b. Local Regulations

The City of Leesburg has adopted wellhead and aquifer protection criteria, which is detailed in Chapter 27 of the Code of Ordinance. The ordinance adopts minimum setbacks from public water supply wells for specific land uses that could have an effect on the quality of the groundwater. In addition, the ordinance adopts standards restricting activities known to adversely affect the quality of surface and groundwater within the City of Leesburg. The criteria established within this ordinance are in accordance with the criteria set forth by the FDEP.

Table VIII-1: Projected 15-Year (2020) Reclaimed Water Usage Impact on Aquifer Recharge

Row	Column	1995 Recharge (In/year)	Leesburg's Total **Additional Recharge from Reuse Activities (In/yr)	Updated Recharge (2020 Projection) (in/yr)
41	25	18.151	0.020	18.171
41	26	16.482	1.140	17.622
41	27	14.388	1.140	15.528
41	28	16.482	0.020	16.502
41	29	20.201	3.140	23.341
42	24	14.388	0.020	14.408
42	25	14.388	0.020	14.408
42	29	20.201	0.020	20.221
42	30	14.388	0.020	14.408
42	31	20.201	0.590	20.791
42	32	14.388	0.020	14.408
43	17	14.388	0.540	14.928
43	19	16.482	0.020	16.502
43	20	20.201	0.020	20.221
43	21	23.858	0.020	23.878

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Row	Column	1995 Recharge (in/year)	Leesburg's Total **Additional Recharge from Reuse Activities (in/yr)	Updated Recharge (2020 Projection) (in/yr)
43	22	20.201	0.020	20.221
43	23	21.471	0.020	21.491
44	17	20.201	5.070	25.271
44	18	18.151	0.090	18.241
44	19	14.388	11.960	26.348
44	20	20.201	0.890	21.091
44	21	14.388	2.410	16.798
45	16	20.201	2.240	22.441
52	10	23.140	2.721	25.861
52	11	24.769	1.633	26.402
52	20	18.059	0.123	18.182
52	21	20.582	0.490	21.072
52	22	11.690	0.613	12.303
53	9	15.790	1.633	17.423
53	10	23.140	4.354	27.494
53	11	15.790	4.354	20.144
53	12	26.530	1.633	28.163
53	18	22.421	1.158	23.579
53	19	20.582	1.158	21.740
53	20	19.570	1.225	20.795
53	21	22.758	3.063	25.821
53	22	22.758	1.225	23.983
54	9	6.018	4.354	10.372
54	10	6.018	4.354	10.372
54	11	15.790	4.354	20.144
54	12	23.140	4.354	27.494
54	13	20.582	1.633	22.215
54	17	23.039	1.158	24.197
54	18	23.161	2.316	25.477
54	19	22.758	3.474	26.232
54	20	19.570	2.451	22.021
54	21	23.341	2.451	25.792
54	22	23.341	0.613	23.954
55	9	6.018	4.354	10.372
55	10	15.790	4.354	20.144

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55	11	6.018	4.354	10.372
55	12	26.530	4.354	30.884
55	13	19.570	4.354	23.924
55	14	20.582	0.544	21.126
55	16	22.421	0.695	23.116
55	17	22.758	4.631	27.389
55	18	20.582	4.631	25.533
55	21	23.341	0.404	23.745
Row	**Column**	**1995 Recharge (in/year)**	**Leesburg's Total **Additional Recharge from Reuse Activities (in/yr)**	**Updated Recharge (2020 Projection) (in/yr)**
56	9	15.790	4.354	20.144
56	10	6.018	4.354	10.372
56	11	6.018	4.354	10.372
56	12	20.498	4.354	24.852
56	13	11.690	1.089	12.779
56	16	22.618	0.463	23.081
56	17	22.758	2.316	25.606
56	18	19.570	1.158	21.952
56	21	23.341	2.706	26.047
57	9	6.018	4.354	10.372
57	10	15.790	4.354	20.144
57	11	6.018	4.354	10.372
57	12	24.769	2.721	27.490
58	9	27.690	4.354	32.044
58	10	20.498	4.354	24.852
58	11	25.842	4.354	30.196
58	12	23.140	0.544	23.684
59	10	15.790	1.089	16.879
59	11	25.842	2.177	28.019
Total Recharge From Reuse in 2020:			**176.82**	
Average Recharge		**18.512**	**2.296**	**20.835**

Above recharge values were calculated by Andreyev Engineering Inc. (AEI) using SJRWMD 1995 ECF Groundwater Model and reuse data obtained from Boyle Engineering, Inc. for City Center and East service area, and from AEI's 2003 City of Leesburg Reuse Master Plan, South service area reuse estimates.

Map VIII- 1: Generalized Hydrologic Cross Section

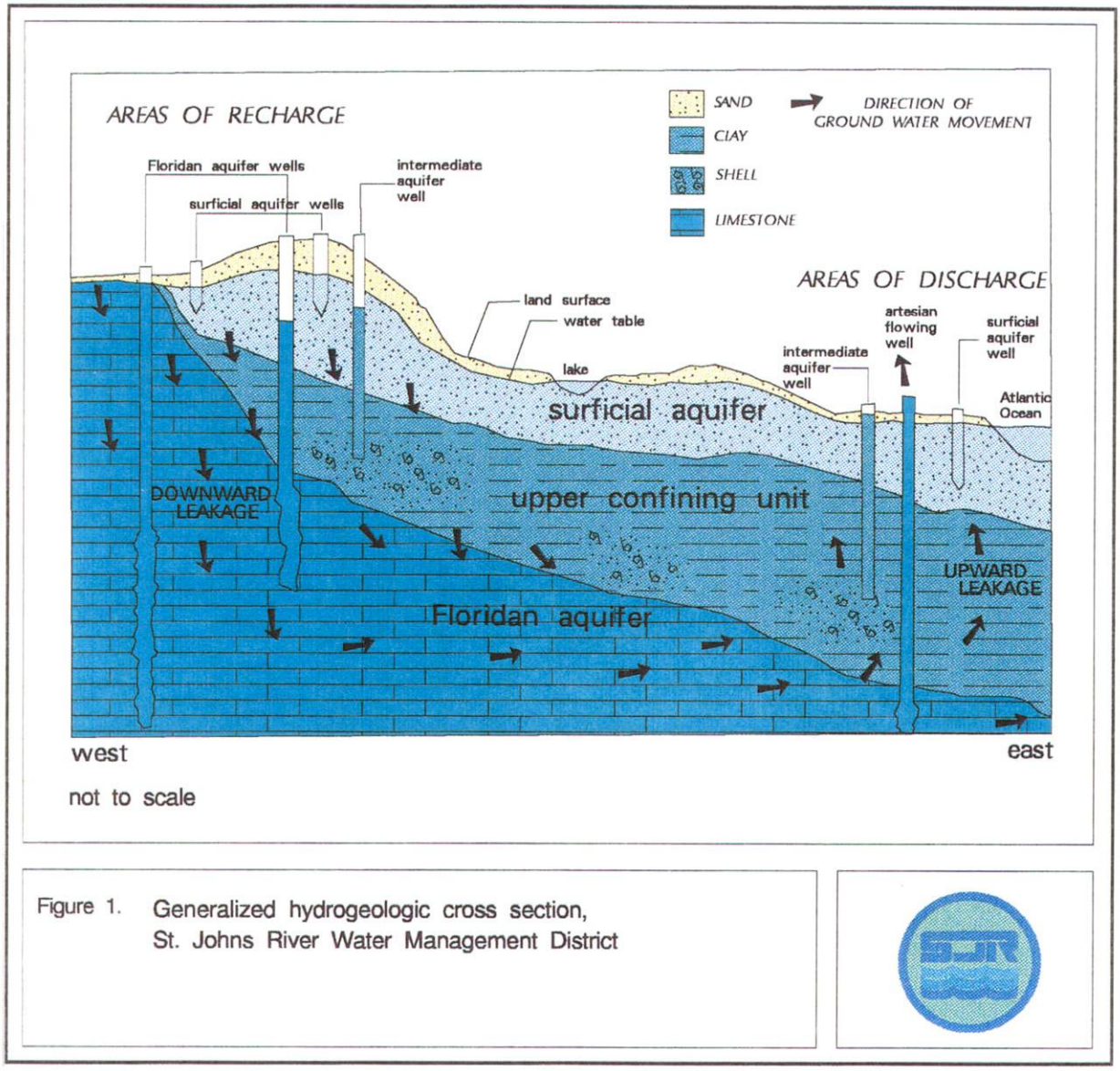
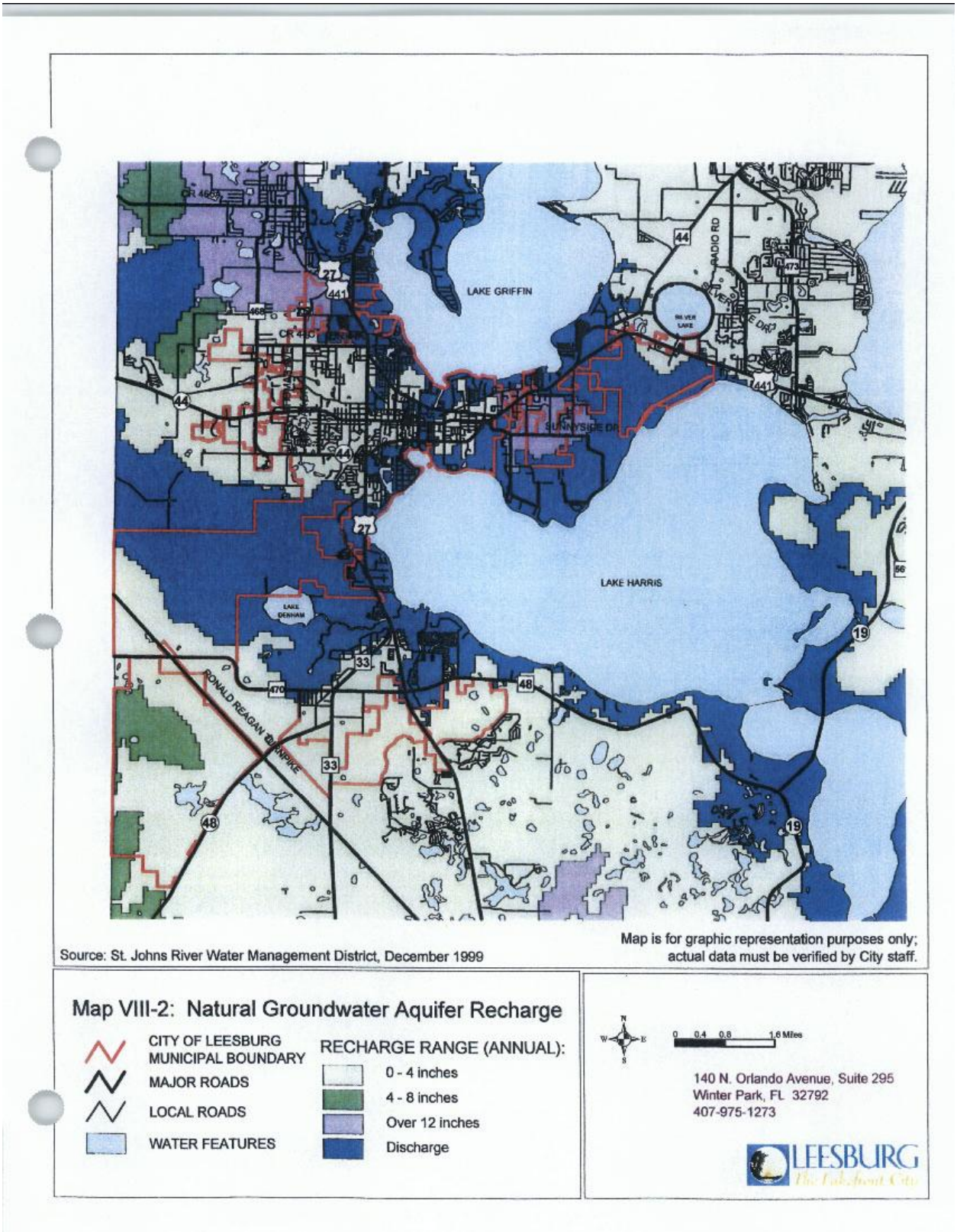


Figure 1. Generalized hydrogeologic cross section, St. Johns River Water Management District

Map VIII-2: Natural Groundwater Aquifer Recharge



D. GOALS, OBJECTIVES, AND POLICIES

GOAL 1:

To maximize the rechargeability of developed land and ensure a safe, plentiful supply of potable water.

Objective 1.1: ***Recharge Area Protection***. The City of Leesburg shall coordinate with other agencies and continue to enforce measures in the Code of Ordinances ensuring protection of the City's natural recharge areas from potential pollution sources.

Policy 1.1.1: In an effort to eliminate potential sources of groundwater pollution, the City in cooperation with the FDEP, will require abandoned or leaking tanks containing substances harmful to the environment (petroleum, pesticides, etc.) to be removed, repaired, or otherwise neutralized by the landowner.

Policy 1.1.2: The City shall continue to prohibit land uses within specific distances from public water supply wells that could have negative impacts on groundwater quality.

Policy 1.1.3: The City shall prohibit generators of large quantities of hazardous waste, as designated by the U.S. Environmental Protection Agency (EPA) and the FDEP, from within those areas designated as High Aquifer Recharge areas (greater than 12 inches of recharge per year), see Map VIII-2.

Objective 1.2: ***Groundwater Recharge***. The City of Leesburg shall enforce measures in the Code of Ordinances for the purpose of maximizing recharge to the underlying aquifer.

Policy 1.2.1: The stormwater management section in the Code of Ordinances shall require retention and recovery by infiltration of stormwater runoff in areas of high groundwater recharge potential in order to maximize groundwater recharge.

Policy 1.2.2: The City shall continue to enforce the following maximum impervious surface ratios within high recharge areas:

- 80% maximum coverage for commercial uses outside the CBD core
- 100% for commercial uses within the CBD core
- 80% for industrial uses
- 50% for residential uses

Policy 1.2.3: The City shall continue to coordinate with Lake County, St. Johns River Water Management District, and state and federal agencies to achieve regional aquifer recharge protection objectives.

Objective 1.3: ***Groundwater Conservation.*** The City will recognize the underlying aquifer as a finite and delicate resource thereby necessitating the best management practices to promote groundwater conservation.

Policy 1.3.1: The City shall adopt a local Florida Friendly Landscape ordinance, prepared with consideration to the St. John's River Water Management District's "Standards for Landscape Irrigation in Florida" document, which is based on the District's model landscape ordinance and shall promote, through educational programs and publications, the use of Florida friendly landscaping practices, which include low or no water landscaping, native plants, the use of solid waste composts, efficient irrigation systems, and the prohibition of exotic plant species, which will result in the conservation of water..

Policy 1.3.2: By 2003, the City will initiate and maintain a leak detection and repair program for its potable water utilities.

Policy 1.3.3: The City shall continue to cooperate with the St. Johns River Water Management District to monitor groundwater supply conditions and review of consumptive use quantities.

Policy 1.3.4: The City shall continue to educate residents on the benefits of water conservation and shall expand water conservation efforts, in accordance with the City's Water Conservation Plan. The City will continue to promote the following programs:

- Landscape and irrigation seminars
- Water audit program
- Irrigation timer assistance
- High water user program
- Website information
- Public Service Announcements
- Landscape demonstration
- Employee Training
- Lake County Water Alliance Initiative
- Requiring the use of EPA Water Sense plumbing fixtures and where applicable, appliances, in new developments
- Require Homeowners Associations Boards in new developments to include a water conservation coordinator.
- Coordination with the SJRWMD's Watershed Action Volunteer (WAV) program to provide water conservation speakers to local schools and community organizations and promote community volunteer activities.
- Display and distribute water conservation information at community functions.

- Participation in education programs with the Lake County Water Authority and University of Florida/IFAS Florida Yards & Neighborhoods
- Work with developers, civic organizations, home owners associations, community clubs, etc. to promote the importance of water conservation
- Participate in educational programs with University of Florida/IFAS Florida Yards & Neighborhoods.
- Informative Billing
- Billing Inserts to promote water conservation

Policy 1.3.5 The City shall require installation of dual line distribution systems in new developments and encourage individual connection to its reclaimed water system for irrigation purposes.

Policy 1.3.6 The City shall evaluate the need for restricted irrigation hours ordinance that is in compliance with State and local regulations. The City shall also require working automatic rain sensor shut-offs on all automatic irrigation systems.

Policy 1.3.7 The City will continue to expand its reclaimed water system to increase availability of reuse water and to decrease potable water demand, in support of the City's 10-Year Water Facilities Work Plan