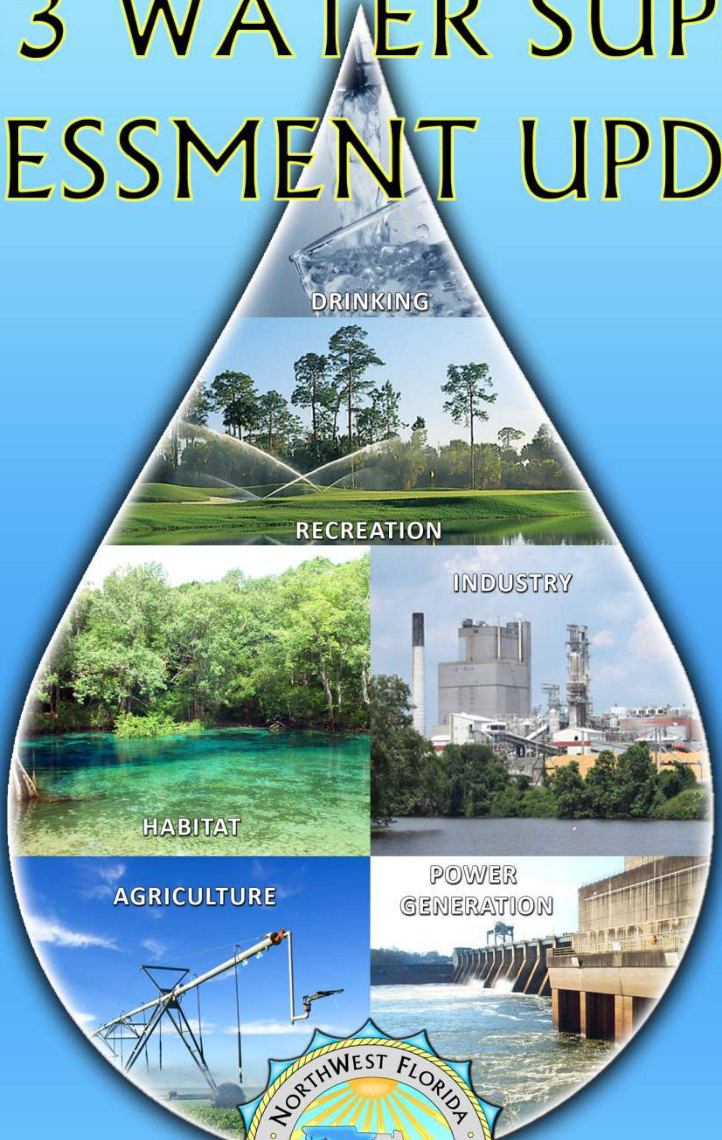
2013 WATER SUPPLY ASSESSMENT UPDATE



NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Water Resources Assessment 14-01

January 2014

For additional information, write or call:

Northwest Florida Water Management District
81 Water Management Drive
Havana, Florida 32333-4712
(850) 539-5999

DISTRICT OFFICES

Headquarters
81 Water Management Drive
Havana, FL 32333-4712
Telephone (850) 539-5999
Fax (850) 539-2777

Crestview
180 E. Redstone Avenue
Crestview, Florida 32539
Telephone (850) 683-5044
Fax (850) 683-5050

Tallahassee (Environmental Resource Permitting Only)
Carr Building, Suite 225
3800 Commonwealth Boulevard, MS LS225
Tallahassee, FL 32399
Telephone (850) 921-2986
Fax (850) 921-3082

Econfina (Land Management and Forestry Operations)
6418 E. Highway 20
Youngstown, FL 32466-3808
Telephone (850) 722-9919
Fax (850) 722-8982

Milton (Land Management Operations Only)
5453 Davisson Road
Milton, FL 32583
Telephone (850) 626-3101
Fax (850) 626-3110

Marianna (Land Management Operations Only)
4765 Pelt Street
Marianna, FL 32446
Telephone (850) 482-9522
Fax (850) 482-1376

Acknowledgements

Numerous individuals at the District and elsewhere provided invaluable assistance, information, and guidance throughout the development of this report. The contributions of the following staff are gratefully acknowledged: Angela Chelette, Bureau Chief, Division of Resource Regulation; Duncan Cairns, Chief, Bureau of Environmental and Resource Planning; and Nick Wooten, Chief, Bureau of Surface and Groundwater Management. This Water Supply Assessment update was prepared under the supervision and oversight of Guy Gowens, Director, Division of Resource Management.

We appreciate the review and comment of public supply use by many water utilities, as well as, county and local planners throughout the District. We also appreciate data provided by industrial/commercial/institutional and power generation water users who generously provided information on their current and future demands. In addition, we thank staff from the U.S. Geological Survey, Florida Department of Agriculture and Consumer Services, U.S. Department of Agriculture and the University of Florida - Institute of Food and Agricultural Sciences county extension offices for providing data and/or reviewing projections of agricultural water use.

Primary Authors: Tony Countryman, Kathleen Coates, Leigh Brooks, Paul Thorpe, Ken Busen, Ed Chelette, and Fran Flores.

Cover and Geographical Information Systems: John Crowe, Philip Griffith, Brittany Wood.

Editorial and Contributory Assistance: Tom Brown, Duncan Cairns, Angela Chelette, Lauren Connell, Brett Cyphers, Lauren Engel, Yesenia Escribano, Craig Freeman, Guy Gowens, Elaine McKinnon, Selina Potter, and Nick Wooten.

Cover photo credits:
Drinking: http://www.momgoesgreen.com
Recreation: http://www.rainbird.fr
Habitat: John B. Crowe, Associate Hydrologist, NWFWMD
Industry: http://media.hamptonroads.com
Agriculture: http://www.southernstates.com
Power Generation: John B. Crowe, Associate Hydrologist, NWFWMD

EXECUTIVE SUMMARY

This update to the district-wide Water Supply Assessment (WSA) for northwest Florida evaluates whether existing and reasonably anticipated water sources and conservation efforts in each of the District's seven water supply planning regions are adequate to meet projected future water demands through 2035 while sustaining water resources and related natural systems. Section 373.709, Florida Statutes (F.S.), requires the District to conduct detailed water supply planning for any region where existing and reasonably anticipated water sources are not sufficient to meet future water supply needs. The district-wide WSA was first completed in 1998 (Ryan et al. 1998), and was updated in 2003 (Bonekemper 2003) and again in 2008 (Coates et al. 2009).

This assessment is organized around seven water supply planning regions (Figure 1.1), which were delineated based on consideration of county boundaries, as well as water supply sources and water resource conditions. Based on the earlier assessments and subsequent actions by the Governing Board, regional water supply plans (RWSPs) have thus far been developed in northwest Florida to address water resource and supply challenges in three regions: Region II (Santa Rosa, Okaloosa, and Walton counties), Region III (Bay County), and Region V (Gulf and Franklin counties).

For the 2013 WSA, the availability of existing and reasonably anticipated future water supply sources to meet projected demands through 2035 was re-evaluated for each water supply planning region using the best available information and analyses. On a regional basis, existing water supply sources were determined to be sufficient to meet projected future water needs while sustaining water resources and associated natural systems throughout much of northwest Florida. However, it is recommended that RWSPs continue to be implemented and updated as necessary for Region II and Region III to accommodate the continued development of alternative water supply sources and needed facilities for source reliability.

In Region V, surface water source development has been completed, per the 2007 Region V RWSP. Additionally, population growth and water demand trends in the region have not occurred to the extent previously anticipated. A re-evaluation of Region V indicates that current and anticipated water sources are considered sufficient at the regional level to meet water needs while sustaining water resources and natural systems through year 2035, and that the continued implementation of the RWSP is not necessary at this time. This determination will be re-evaluated in future WSAs. No additional RWSPs are currently recommended.

For the 2013 WSA, water use was estimated for 2010 and future water needs were projected for 2015 through 2035 at five year intervals for the following use categories: public supply; domestic self-supply; agriculture self-supply; recreation self-supply; industrial, commercial, and institutional (I/C/I) self-supply; and thermoelectric power generation. Annual average water demands were projected and, as in the past, water demands associated with a 1-in-10 year drought event were also projected.

In 2010, water use within the District's jurisdictional boundaries totaled approximately 357.22 million gallons per day (mgd) (Table ES.1). The largest use category in 2010 was public supply, which accounted for 159.57 mgd or 45 percent of all water use in the District. The second largest use category was I/C/I self-supply, which accounted for 66.44 mgd, or 19 percent, of the total water use. Agricultural water use was the third largest category and accounted for 47.22 mgd, or 13 percent, of the total water use. The county with the largest water use was Escambia County (95.38 mgd), followed by Bay County (72.34 mgd), Leon County (41.77 mgd), and Okaloosa County (33.14 mgd) (Table ES.2).

Total water use is projected to increase by 17 percent during the 2010-2035 planning horizon to approximately 417.26 mgd by 2035 (Table ES.1). An additional 60.04 million gallons per day will be required to meet the future needs in the District through 2035. Most of the increase is attributable to a 21 percent increase in population that is projected to occur, from approximately 1.36 million people in 2010 to an estimated 1.65 million people by 2035 (Table ES.2) (University of Florida 2013).

Water needs for public supply are estimated to increase by 34.06 mgd, or 21 percent, from 159.57 mgd in 2010 to 193.63 mgd in 2035, and will continue to be the largest use category. Increases in water demands for the remaining use categories are each less than 10 mgd. Power generation use is estimated to decrease by 0.17 mgd, or 0.5 percent, from 34.82 mgd in 2010 to 34.65 mgd in 2035 (Table ES.1).

Table ES.3 summarizes, by region, the total wastewater flow, total reuse flow, and the amount of potable water replaced by reclaimed water in 2010. An estimated 95.56 mgd of domestic wastewater was generated district-wide in 2010, and approximately 49.01 mgd, or 51 percent, was reused. Approximately 12.17 mgd were reused to replace potable-quality water for irrigation of golf courses, residential lawns, public areas, nurseries, and industrial uses. Region II generated the largest quantity of wastewater (27.34 mgd) and had the largest reuse flow (23.42 mgd) followed by Region VII, where nearly all wastewater generated (18.89 mgd) was reused, primarily at the City of Tallahassee's Southeast Farm sprayfield facility. The District encourages reuse and has provided financial support for reuse system development from the Water Protection and Sustainability Program Trust Fund. The District is also currently offering grant funding through its Water Supply Development Community Assistance Initiative.

Savings possible through conservation were estimated by calculating the water savings that could result if public water supply utilities were able to achieve a gross per capita water use of 150 gallons per capita per day (gpcd) or less. Using this approach, it is estimated that approximately 19.59 mgd or 25 percent savings could potentially be achieved for the 44 utilities whose per capita use in 2010 exceeded this amount (Table ES.4). Overall, this would reduce 2035 public supply water demand by approximately 10 percent district-wide. Additional water conservation savings can be achieved by other use sectors including industrial, agriculture, and recreation.

Table ES.1 Estimated and Projected Change in Total Water Use by Category, 2010-2035

Water Use Category	Water Use 2010 (mgd)	% of Total	Water Use 2035 (mgd)	% of Total	Increase 2010-2035	% Increase 2010-2035
Public supply	159.57	45%	193.63	46%	34.06	21%
Domestic self-supply	23.27	7%	28.82	7%	5.55	24%
Ind./Comm./Inst. (I/C/I)	66.44	19%	72.66	17%	6.22	9%
Recreational self-supply	25.91	7%	31.95	8%	6.05	23%
Agricultural use	47.22	13%	55.55	13%	8.33	18%
Power generation	34.82	10%	34.65	8%	-0.17	-0.5%
District Total	**357.22**	**100%**	**417.26**	**100%**	**60.04**	**17%**

Table ES.2 Estimated Water Use and Population for 2010 and 2035 in NWFWMD

		Population		Total Average Water Use (mgd)		Primary Water Sources
Region	County	2010	2035	2010	2035	
I	Escambia	297,619	319,300	95.38	95.99	sand-and-gravel aquifer
	Total	**297,619**	**319,300**	**95.38**	**95.99**	
II	Santa Rosa	151,372	218,800	24.76	38.45	Floridan aquifer/ sand-and-gravel aquifer
	Okaloosa	180,822	216,400	33.14	35.33	
	Walton	55,043	87,200	15.69	26.98	
	Total	**387,237**	**522,400**	**73.59**	**100.76**	
III	Bay	168,852	209,100	72.34	88.42	Deer Point Lake reservoir
	Total	**168,852**	**209,100**	**72.34**	**88.42**	
IV	Calhoun	14,625	16,900	4.23	4.46	Floridan aquifer
	Holmes	19,927	21,600	4.96	5.45	
	Jackson	49,746	50,700	25.36	30.83	
	Liberty	8,365	11,300	1.80	2.05	
	Washington	24,896	29,700	4.06	5.37	
	Total	**117,559**	**130,200**	**40.41**	**48.16**	
V	Gulf	15,863	16,400	2.78	2.88	Floridan aquifer/ sand-and-gravel aquifer/ Gulf County canal
	Franklin	11,549	12,000	4.09	2.47	
	Total	**27,412**	**28,400**	**6.88**	**5.35**	
VI	Gadsden	46,389	50,500	18.38	19.26	Floridan aquifer/ surface water
	Total	**46,389**	**50,500**	**18.38**	**19.26**	
VII	Jefferson	10,417	11,433	3.14	3.29	Floridan aquifer
	Leon	275,487	332,700	41.77	49.81	
	Wakulla	30,776	41,900	5.34	6.23	
	Total	**316,680**	**386,033**	**50.25**	**59.33**	
	District Total	**1,361,748**	**1,645,933**	**357.22**	**417.26**	

Table ES.3 Reuse of Domestic Wastewater in 2010 (mgd)
(Facilities with a permitted treatment plant capacity of 0.1 mgd or greater.)

Region	Total Wastewater Flow	Reuse Flow	Reuse Flow that Replaces Potable-Quality Water*
I	24.37	1.18	0.00
II	27.34	23.42	8.82
III	15.37	2.70	2.60
IV	5.91	2.91	0.00
V	1.66	0.75	0.10
VI	2.03	0.49	0.00
VII	18.89	17.56	0.65
District Total	**95.56**	**49.01**	**12.17**

*Reuse Flow That Replaces Potable-Quality Water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses. Not included in this flow calculation are agriculture irrigation of other crops, absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant (FDEP 2011).

Table ES.4 Potential Savings in Public Supply Water Demand by 2035, Based on 150 gpcd*

Region	County	Potential Water Savings 2035 (mgd)	Percent Savings for Applicable Utilities
I	Escambia	0.22	16%
	Total	**0.22**	**16%**
II	Okaloosa	2.08	37%
	Santa Rosa	0.44	34%
	Walton	3.96	41%
	Total	**6.48**	**39%**
III	Bay	9.50	43%
	Total	**9.50**	**43%**
IV	Calhoun	0.05	8%
	Holmes	0.23	23%
	Jackson	0.22	18%
	Liberty	0.11	21%
	Washington	0.05	5%
	Total	**0.67**	**15%**
V	Franklin	0.71	44%
	Gulf		
	Total	**0.71**	**44%**
VI	Gadsden	0.23	26%
	Total	**0.23**	**26%**
VII	Jefferson	0.13	23%
	Leon	1.65	5%
	Wakulla	0.01	5%
	Total	**1.79**	**6%**
	District Total	**19.59**	**25%**

*Gallons per capita per day

TABLE OF CONTENTS

1 INTRODUCTION 1-1

1.1 WATER USE PERMITTING 1-2
1.2 MINIMUM FLOWS AND LEVELS 1-3
1.3 HISTORY AND ACCOMPLISHMENTS 1-4
1.4 RECENT WATER SUPPLY PLANNING LEGISLATION 1-6
1.5 REPORT ORGANIZATION 1-6

2 METHODOLOGIES 2-1

2.1 WATER USE ESTIMATES AND PROJECTIONS 2-1
2.1.1 Public Supply 2-2
2.1.2 Domestic Self-Supply and Small Public Supply Water Systems 2-6
2.1.3 Industrial, Commercial, and Institutional (I/C/I) Self-Supply 2-6
2.1.4 Agricultural Water Use 2-7
2.1.5 Recreation Self-Supply 2-10
2.1.6 Power Generation 2-12
2.2 WATER RESOURCE ASSESSMENTS 2-12
2.2.1 Reuse 2-13
2.2.2 Conservation 2-14

3 SOURCE ASSESSMENTS BY REGION 3-1

3.1 REGION I: ESCAMBIA COUNTY 3-3
3.1.1 Water Use Estimates and Projections 3-4
3.1.2 Assessment of Water Resources 3-6
3.1.3 Determination of the Need for a Regional Water Supply Plan 3-16
3.2 REGION II: OKALOOSA, SANTA ROSA AND WALTON COUNTIES 3-17
3.2.1 Water Use Estimates and Projections 3-18
3.2.2 Assessment of Water Resources 3-23
3.2.3 Determination of the Need for a Regional Water Supply Plan 3-40
3.3 REGION III: BAY COUNTY 3-41
3.3.1 Water Use Estimates and Projections 3-42
3.3.2 Assessment of Water Resources 3-46
3.3.3 Determination of the Need for a Regional Water Supply Plan 3-55
3.4 REGION IV: CALHOUN, HOLMES, JACKSON, LIBERTY AND WASHINGTON COUNTIES 3-57
3.4.1 Water Use Estimates and Projections 3-58
3.4.2 Assessment of Water Resources 3-61
3.4.3 Determination of the Need for a Regional Water Supply Plan 3-70
3.5 REGION V: FRANKLIN AND GULF COUNTIES 3-71
3.5.1 Water Use Estimates and Projections 3-72
3.5.2 Assessment of Water Resources 3-74
3.5.3 Determination of the Need for a Regional Water Supply Plan 3-82
3.6 REGION VI: GADSDEN COUNTY 3-83
3.6.1 Water Use Estimates and Projections 3-83
3.6.2 Assessment of Water Resources 3-86
3.6.3 Determination of the Need for a Regional Water Supply Plan 3-96
3.7 REGION VII: JEFFERSON, LEON AND WAKULLA COUNTIES 3-97
3.7.1 Water Use Estimates and Projections 3-98
3.7.2 Assessment of Water Resources 3-102
3.7.3 Determination of the Need for a Regional Water Supply Plan 3-111

4 SUMMARY AND CONCLUSIONS 4-1

5 REFERENCES ... 5-1

6 APPENDICES ... 6-1

APPENDIX A ... 6-1
APPENDIX B ... 6-5
APPENDIX C ... 6-6
APPENDIX D ... 6-7
APPENDIX E ... 6-13

LIST OF FIGURES

Figure 1.1 NWFWMD Water Supply Planning Regions....1-2
Figure 1.2 NWFWMD Water Resource Caution Areas....1-3
Figure 1.3 Selected Waterbodies on the Minimum Flows and Levels Priority List....1-4
Figure 3.1 Map of Region I, Escambia County....3-3
Figure 3.2 Region I Water Use by Category, 2010....3-5
Figure 3.3 Observed Potentiometric Surface of the Main-Producing Zone of the Sand-and-Gravel Aquifer, Escambia County, Florida, May 2007....3-8
Figure 3.4 Hydrographs of Sand-and-Gravel Wells near Oak Grove (Northern Escambia County) and along Nine Mile Road (Southern Escambia County) in the A) Surficial Zone, B) Main Producing Zone, and C) Deep Main Producing Zone....3-9
Figure 3.5 Hydrographs of Sand-and-Gravel Wells: A) USGS TH2 and B) USGS 032-7241A....3-10
Figure 3.6 Hydrograph of Sand-and-Gravel Well USGS 031-716-1....3-10
Figure 3.7 Peoples #4 Water Quality A) Sodium (Na^+), Chloride (Cl^-), and C) TDS....3-11
Figure 3.8 Region I Sand-and-Gravel Aquifer Steady-State Ground Water Budget....3-12
Figure 3.9 Map of Region II....3-17
Figure 3.10 Region II Water Use by Category, 2010....3-22
Figure 3.11 Potentiometric Surface of the Upper Floridan Aquifer in Region II for A) Estimated Conditions Prior to 1940 (Predevelopment) and B) June 2010....3-25
Figure 3.12 Water Levels in Sand-and-Gravel Aquifer Wells P3A (Blue) and P5A (Green) vs. Monthly Pumpage from Nearby Public Supply Wells (Red)....3-27
Figure 3.13 Withdrawals from the Floridan Aquifer in Region II....3-28
Figure 3.14 Hydrographs of the A) Navarre Cement Plant and B) Midway #1 Floridan Aquifer Wells in Southern Santa Rosa County....3-29
Figure 3.15 Hydrographs of the A) Mary Esther #2, B) Wright Upper Floridan Aquifer, C) EAFB Field #5/Well #2, and D) Crestview #4 in Southern and Central Okaloosa County....3-30
Figure 3.16 Hydrographs of the A) West Hewett Street, B) S.L. Matthews, C) USGS Freeport 17, and D) FAF #47 Floridan Aquifer Wells in Southern Walton County....3-31
Figure 3.17 Hydrographs of the A) Paxton and B) Camp Henderson Floridan Aquifer Wells....3-32
Figure 3.18 Coastal Cross-Section of Floridan Aquifer System Chloride and Sodium Concentration Data3-33
Figure 3.19 Region II Floridan Aquifer Groundwater Budget....3-34
Figure 3.20 Map of Region III, Bay County....3-41
Figure 3.21 Region III Water Use by Category, 2010....3-44
Figure 3.22 Cumulative Departure from Normal Rainfall along Bear Creek at US 231....3-46
Figure 3.23 Flow Duration Curve for Econfina Creek at Highway 388....3-46
Figure 3.24 Potentiometric Surface of the Floridan Aquifer System in Bay County, June 2010....3-51
Figure 3.25 Hydrographs of the A) Fannin Airport, B) Tyndall #10, C) Argonaut Street, and D) Eddie Barnes Floridan Aquifer Wells....3-52
Figure 3.26 Region III Floridan Aquifer Steady-State Groundwater Budget....3-53
Figure 3.27 Map of Region IV....3-57
Figure 3.28 Region IV Water Use by Category, 2010....3-60
Figure 3.29 Potentiometric Surface of the Floridan Aquifer in Region IV, June 2010....3-63
Figure 3.30 Hydrographs of Wells Located in the Dougherty Karst Area at A) International Paper Company Well, Jackson County, and B) USGS-422A Well, Washington County.....3-64
Figure 3.31 Hydrograph of St. Joe Tower Well Located in the Apalachicola Embayment Area....3-65
Figure 3.32 Region IV Floridan Aquifer Steady-State Groundwater Budget....3-65
Figure 3.33 Map of Region V....3-71
Figure 3.34 Region V Water Use by Category, 2010....3-73
Figure 3.35 Potentiometric Surface of the Floridan Aquifer System in Region V, June 2010....3-76
Figure 3.36 Hydrogeologic Cross-Section of Coastal Franklin County....3-77

Figure 3.37 Hydrographs of the A) Port St. Joe and the B) Ice Plant Wells 3-78
Figure 3.38 Chloride Concentration Data for the Pavilion Well, Apalachicola 3-78
Figure 3.39 Region V Floridan Aquifer Steady-State Groundwater Budget 3-79
Figure 3.40 Map of Region VI....3-83
Figure 3.41 Region VI Water Use by Category, 2010 3-85
Figure 3.42 Potentiometric Surface of the Floridan Aquifer System in Gadsden County, June 2010....3-88
Figure 3.43 Hydraulic Head Variations among Hydrostratigraphic Units in Region VI....3-89
Figure 3.44 Variations of Floridan Aquifer Water Quality with Increasing Depth 3-89
Figure 3.45 Hydrographs of Wells in A) Quincy, B) Greensboro, C) Chattahoochee, and D) Midway 3-90
Figure 3.46 Region VI Floridan Aquifer Steady-State Groundwater Budget....3-91
Figure 3.47 Telogia Creek Average Daily Discharge (cfs)....3-93
Figure 3.48 Map of Region VII 3-97
Figure 3.49 Region VII Water Use by Category, 2010 3-101
Figure 3.50 Land Elevation in Region VII, based on LiDAR Data 3-103
Figure 3.51 Potentiometric Surface of the Floridan Aquifer System in Region VII, June 2010....3-104
Figure 3.52 Hydrographs of the A) Olson Road and B) Newport Recreation Wells 3-105
Figure 3.53 Region VII Floridan Aquifer Stead-State Groundwater Budget 3-106
Figure 4.1 Total Water use by Category for the NWFWMD, 2010 - 2035 4-2

LIST OF TABLES

Table ES.1 Estimated and Projected Change in Total Water Use by Category, 2010-2035.......................... ii
Table ES.2 Estimated Water Use and Population for 2010 and 2035 in NWFWMD iii
Table ES.3 Reuse of Domestic Wastewater in 2010 (mgd) iii
Table ES.4 Potential Savings in Public Supply Water Demand by 2035, Based on 150 gpcd*........................iv
Table 3.1 Escambia County Public Supply Water Demand Projections, 2010 - 2035 (mgd) 3-4
Table 3.2 Region I Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)......................... 3-6
Table 3.3 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd) 3-6
Table 3.4 Region I Reuse of Domestic Wastewater, 2010 (mgd).. 3-15
Table 3.5 Region I Domestic Wastewater Flow Projections 2015 - 2035 (mgd).. 3-15
Table 3.6 Region I Available Reclaimed Water Projections 2015 - 2035* (mgd).. 3-15
Table 3.7 Okaloosa County Public Supply Water Demand Projections, 2010 - 2035 (mgd)....................... 3-19
Table 3.8 Okaloosa County Public Supply Water Production Projections, 2010 - 2035 (mgd) 3-19
Table 3.9 Santa Rosa County Public Supply Water Demand Projections, 2010 - 2035 (mgd)..................... 3-20
Table 3.10 Santa Rosa County Public Supply Water Production Projections, 2010 - 2035 (mgd)............. 3-20
Table 3.11 Walton County Public Supply Water Demand Projections, 2010 - 2035 (mgd) 3-21
Table 3.12 Walton County Public Supply Water Production Projections, 2010 - 2035 (mgd).................... 3-21
Table 3.13 Region II Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)..................... 3-23
Table 3.14 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015-2035 (mgd) 3-23
Table 3.15 Region II Reuse of Domestic Wastewater, 2010 (mgd) 3-37
Table 3.16 Region II Domestic Wastewater Flow Projections 2015 - 2035 (mgd)....................................... 3-38
Table 3.17 Region II Available Reclaimed Water Projections 2015 - 2035* (mgd)..................................... 3-39
Table 3.18 Region III Public Supply Water Demand Projections, 2010 - 2035... 3-43
Table 3.19 Region III Public Supply Water Production Projections, 2010 - 2035 3-43
Table 3.20 Region III Water Use Estimates and Projections by Category, 2010 - 2035 (mgd).................. 3-45
Table 3.21 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd) 3-45
Table 3.22 Region III Reuse of Domestic Wastewater, 2010 (mgd).. 3-54
Table 3.23 Region III Domestic Wastewater Flow Projections 2015 - 2035 (mgd) 3-55
Table 3.24 Regional III Available Reclaimed Water Projections 2015 - 2035* (mgd)................................ 3-55
Table 3.25 Calhoun County Public Supply Water Demand Projections, 2010 - 2035 (mgd) 3-58
Table 3.26 Holmes County Public Supply Water Demand Projections, 2010 - 2035 (mgd)........................ 3-58
Table 3.27 Jackson County Public Supply Water Demand Projections, 2010 - 2035 (mgd)....................... 3-58
Table 3.28 Liberty County Public Supply Water Demand Projections, 2010 - 2035 (mgd)........................ 3-59
Table 3.29 Washington County Public Supply Water Demand Projections, 2010 - 2035 (mgd) 3-59
Table 3.30 Region IV Water Use Estimates and Projections by Category, 2010 - 2035 (mgd) 3-61
Table 3.31 Demand Projections for a 1-in-10 Year Drought Event, Region IV, 2015 - 2035 (mgd)........... 3-61
Table 3.32 Region IV Reuse of Domestic Wastewater, 2010 (mgd).. 3-68
Table 3.33 Region IV Domestic Wastewater Flow Projections 2015 - 2035 (mgd)...................................... 3-69
Table 3.34 Region IV Available Reclaimed Water Projections 2015 - 2035* (mgd) 3-70
Table 3.35 Franklin County Public Supply Water Use Projections, 2010 - 2035 (mgd).............................. 3-72
Table 3.36 Gulf County Public Supply Water Use Projections, 2010 - 2035 (mgd) 3-72
Table 3.37 Region V Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)..................... 3-74
Table 3.38 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd) 3-74
Table 3.39 Region V Reuse of Domestic Wastewater, 2010 (mgd).. 3-81
Table 3.40 Region V Domestic Wastewater Flow Projections 2015 - 2035 (mgd) 3-81
Table 3.41 Region V Available Reclaimed Water Projections 2015 -2035* (mgd)...................................... 3-82
Table 3.42 Region VI Public Supply Water Demand Projections, 2010 - 2035 (mgd) 3-84
Table 3.43 Region VI Water Use Estimates and Projections by Category, 2010 - 2035 (mgd) 3-85
Table 3.44 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd) 3-86
Table 3.45 Flow Statistics for Quincy Creek and Telogia Creek 3-94
Table 3.46 Region VI Reuse of Domestic Wastewater, 2010 (mgd) 3-95
Table 3.47 Region VI Domestic Wastewater Flow Projections 2015 -2035 (mgd)....................................... 3-95

Table 3.48 Region VI Available Reclaimed Water Projections 2015 - 2035* (mgd) 3-96
Table 3.49 Jefferson County Public Supply Water Demand Projections, 2010 - 2035 (mgd) 3-98
Table 3.50 Leon County Public Supply Water Demand Projections, 2010 - 2035 (mgd) 3-98
Table 3.51 Leon County Public Supply Water Production Projections, 2010 - 2035 (mgd)........................ 3-99
Table 3.52 Wakulla County Public Supply Water Demand Projections, 2010 - 2035 (mgd) 3-99
Table 3.53 Wakulla County Public Supply Water Production Projections, 2010 - 2035 (mgd).................. 3-99
Table 3.54 Region VII Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)................ 3-101
Table 3.55 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd) 3-102
Table 3.56 Region VII: Reuse of Domestic Wastewater, 2010 (mgd) 3-109
Table 3.57 Region VII Domestic Wastewater Flow Projections 2015 - 2035 (mgd) 3-110
Table 3.58 Region VII Available Reclaimed Water Projections 2015 - 2035* (mgd)................................. 3-110
Table 4.1 Estimated and Projected Change in Total Water Use by Category, 2010 - 2035........................... 4-1
Table 4.2 Reuse of Domestic Wastewater in 2010 (mgd) 4-3
Table 4.3 Summary of Water Supply Assessment Update Conclusions.. 4-4
Table 6A.1 Okaloosa County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd) 6-1
Table 6A.2 Santa Rosa County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)..... 6-1
Table 6A.3 Walton County Water Use Estimates and Projections by Category, 2010-2035 (mgd) 6-1
Table 6A.4 Calhoun County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd) 6-2
Table 6A.5 Holmes County Water use Estimates and Projections by Category, 2010 - 2035 (mgd)........... 6-2
Table 6A.6 Jackson County Water use Estimates and Projections by Category, 2010 - 2035 (mgd)........... 6-2
Table 6A.7 Liberty County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd) 6-2
Table 6A.8 Washington County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd) ... 6-3
Table 6A.9 Franklin County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)......... 6-3
Table 6A.10 Gulf County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd) 6-3
Table 6A.11 Jefferson County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd) 6-4
Table 6A.12 Leon County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd) 6-4
Table 6A.13 Wakulla County Water use Estimates and Projections by Category 2010 - 2035 (mgd)......... 6-4
Table 6B.14 Water Use Estimates and Projections by Region and Source type (mgd) 6-5
Table 6C.15 Public Supply Population and Per Capita Water Use.. 6-6
Table 6D.16 Public Supply Utility Projected 5-Year Growth Rates... 6-7

ACRONYMS AND ABBREVIATIONS

ADR	Average Daily Rate
AFB	Air Force Base
AFSIRS	Agricultural Field Scale Irrigation Requirements Simulation (Model)
AWT	Advanced Wastewater Treatment
BEBR	Bureau of Economic and Business Research, University of Florida
District	Northwest Florida Water Management District
EISA	Energy Independence and Security Act
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FRUS	Fairpoint Regional Utility System
F.S.	Florida Statutes
ft^2/day	Feet Squared Per Day
gpcd	Gallons Per Capita Per Day
gpm	Gallons Per Minute
gpm/ft	Gallons Per Minute per Foot
GWUP	General Water Use Permit
I/C/I	Industrial, Commercial, and Institutional Self Supply
IFAS	Institute of Food and Agricultural Studies, University of Florida
in/yr	Inches per Year
IWUP	Individual Water Use Permit
MCL	Maximum Contaminant Level
MFL	Minimum Flows and Levels
mgd	Millions Gallons per Day
mg/L	Milligrams per Liter
NWFWMD	Northwest Florida Water Management District
PWS	Public Water Supply
RWSP	Regional Water Supply Plan
SWIM	Surface Water Improvement and Management
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WHPA	Wellhead Protection Area
WRCA	Water Resource Caution Area
WRF	Water Reclamation Facility
WSA	Water Supply Assessment
WPSPTF	Water Protection and Sustainability Program Trust Fund
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

This page intentionally left blank.

1 INTRODUCTION

In 1997, the Florida Legislature established requirements for the State of Florida's five water management districts to conduct district-wide water supply assessments and, where appropriate, to subsequently develop regional water supply plans (RWSPs). Specifically, water management districts were required to delineate one or more water supply planning regions within their respective jurisdictions and to conduct a water supply assessment to examine, by region, future water supply demands for a 20-year planning horizon and the ability of existing and reasonably anticipated sources to meet the projected demands. If the Governing Board determines that a RWSP is needed for a particular region, it shall be prepared pursuant to Chapter 97-160, Laws of Florida, and 373.036, Florida Statutes (F.S.). RWSPs are prepared to analyze and present various alternatives for meeting the anticipated future water needs (section 373.709(1), F.S.).

The Northwest Florida Water Management District (District) completed its first Water Supply Assessment (WSA) in 1998 (Ryan et al. 1998). At that time, the District delineated seven water supply planning regions (Figure 1.1). The primary factors considered in delineation of the regions were county boundaries and the similarity of water supply conditions. County boundaries were used, because population data needed for estimating and projecting water use is typically available at the county level. The seven water supply planning regions are:

I. Escambia County
II. Okaloosa, Santa Rosa, and Walton counties
III. Bay County
IV. Calhoun, Holmes, Jackson, Liberty, and Washington counties
V. Franklin and Gulf counties
VI. Gadsden County
VII. Jefferson, Leon, and Wakulla counties

The District updates the WSA every five years. These updates help water managers identify potential problems far enough in advance to enable the development and implementation of strategies to prevent water shortages and harm to water resources and associated natural systems. The District first updated the WSA in 2003 and extended water demand projections through year 2025 (Bonekemper 2003). The second WSA update was completed in 2008 (Coates et al 2009) and included an evaluation of the ability of existing and reasonably anticipated sources to meet the projected demands through year 2030. This third WSA update extends the demand projections through year 2035 and provides updated evaluations of the ability of existing and reasonably anticipated sources to meet these projected demands. This report meets the requirements of section 373.709, F. S.

Water supply planning is one of the District's programs aimed at ensuring the protection and sustainability of water resources. Other District activities include public education and outreach, hydrologic data collection and monitoring, water resources investigations, preservation of critical lands and habitats, ecological restoration, Surface Water Improvement and Management (SWIM), Minimum Flows and Levels (MFLs), regulatory programs, and local funding assistance such as the Water Protection and Sustainability Program Trust Fund, and the Water Supply Development Community Assistance Initiative.

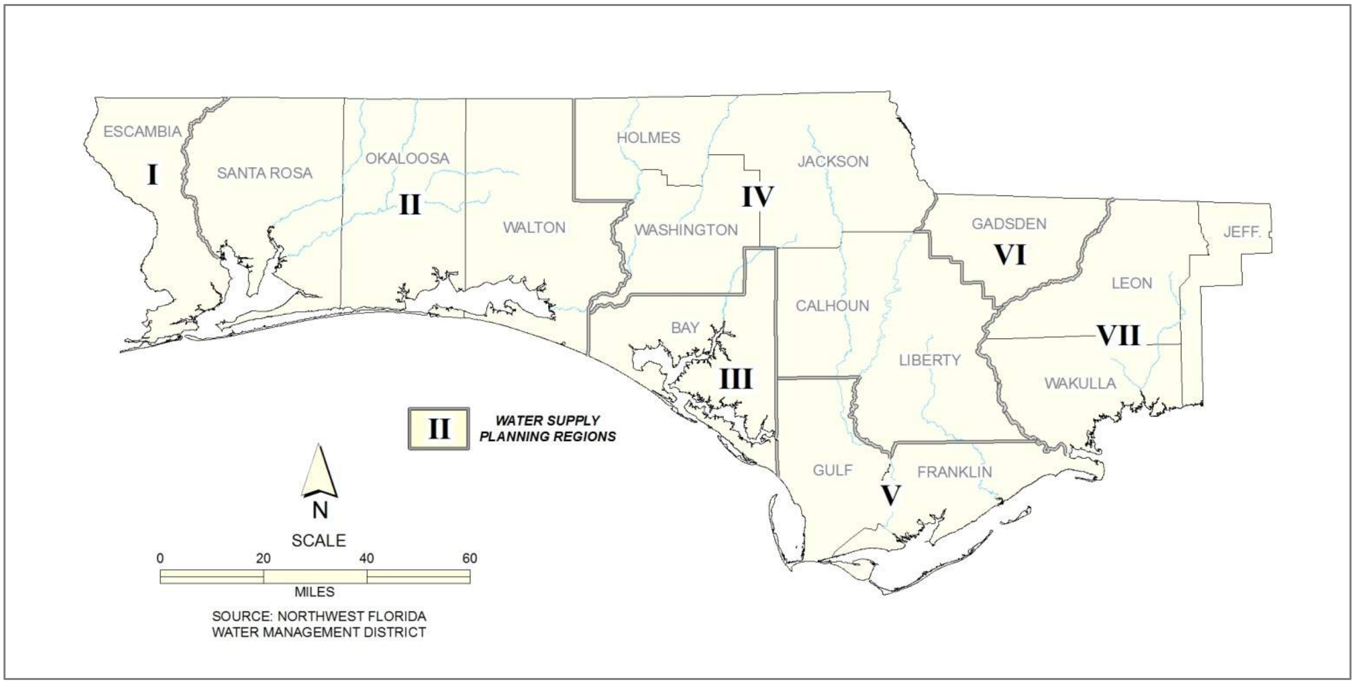


Figure 1.1 NWFWMD Water Supply Planning Regions

1.1 Water Use Permitting

Water Use Permitting Program

The Water Use Permitting program (Chapter 40A-2, F.A.C.) allocates water supplies in a manner that is reasonable and beneficial, that is in the public interest, and that does not harm existing legal users or natural resources. The permitting thresholds and type of water use permit required vary based on the type of water use and the magnitude, location, and duration of the withdrawal. The current permitting thresholds can be found in Chapter 40A-2, F.A.C.

The Water Use Permitting program is one of the tools that the District uses to manage water resources and ensure sustainability. In addition to ensuring water withdrawals do not cause harm to existing legal users or water resources, water use permits require that water be used efficiently. Permits issued to public supply utilities generally require the implementation of water conservation measures such as public education, water-conserving rate structures, and monitoring of water losses in the distribution system. Permits for large industrial uses and golf courses also contain water conservation requirements. Additional requirements may be applicable in Water Resource Caution Areas, as discussed below.

Water Resource Caution Areas

In response to existing and anticipated water supply issues, the District's Governing Board has designated two Water Resource Caution Areas (WRCAs) and set more stringent water use permitting criteria in these areas. The two designated WRCAs include the coastal area of Santa Rosa, Okaloosa and Walton counties, and the Upper Telogia Creek drainage basin in Gadsden County (Figure 1.2). The WRCA designation subjects all non-exempt withdrawals to more rigorous scrutiny to ensure that the proposed withdrawal does not cause harm to the resource. Permittees within a WRCA have additional water use reporting requirements, must implement water conservation measures, and must maximize water use efficiency. They are also required to evaluate the availability and, if available, the technical, environmental, and economic feasibility of utilizing reclaimed water. The WRCA designation in the coastal areas of Santa Rosa, Okaloosa, and Walton counties also prohibits new or expanded use of the Floridan aquifer for non-potable purposes such as landscape and golf course irrigation.

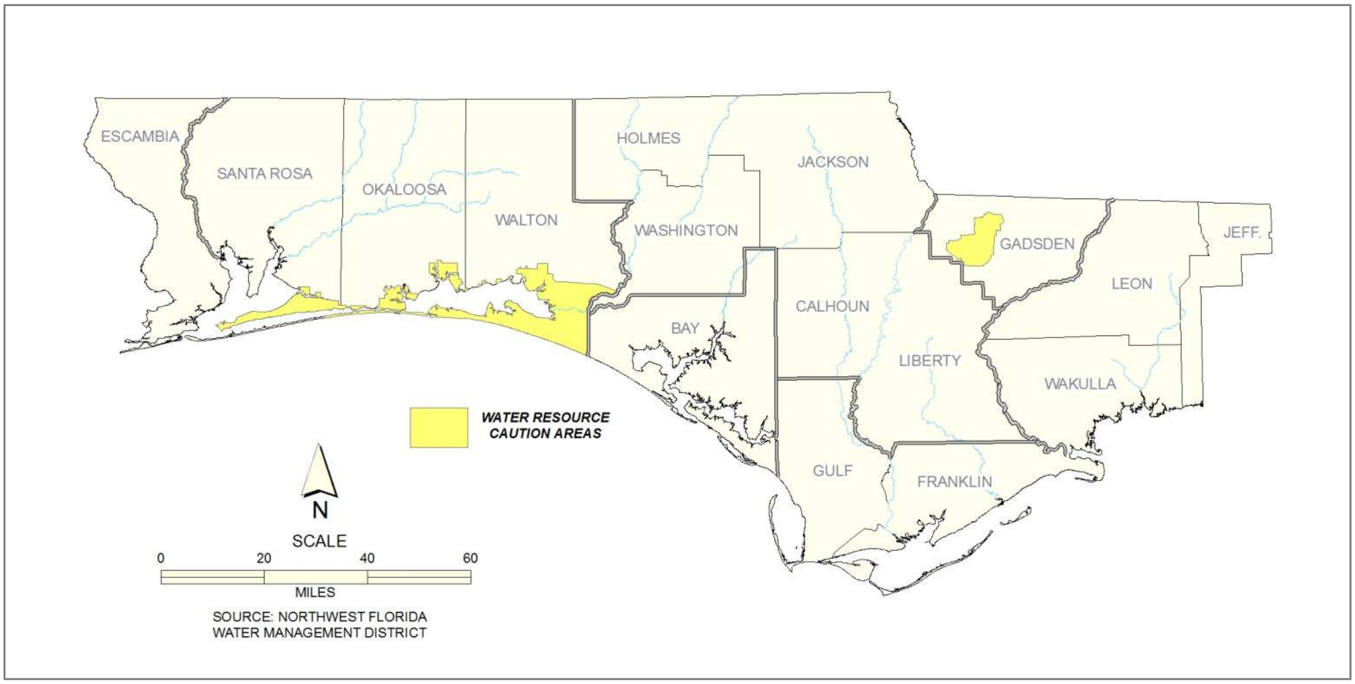


Figure 1.2 NWFWMD Water Resource Caution Areas

1.2 Minimum Flows and Levels

Section 373.042(1), F.S., requires each water management district to develop minimum flows and levels (MFLs) for specific surface and groundwater bodies within their jurisdiction. The minimum flow or level for a given water body is the limit at which further withdrawals will be significantly harmful to the water resources or ecology of the area. MFLs are calculated using the best available information and consider natural seasonal fluctuations, non-consumptive uses, and a variety of environmental values associated with coastal, estuarine, riverine, spring, aquatic, and wetlands ecology as specified in section 62-40.473, F.A.C. In areas where consumptive water uses are currently or anticipated to result in flows and levels being below an adopted MFL, a recovery or prevention strategy for the water body must also be developed.

The process of establishing an MFL involves a series of steps including identification of priority waterbodies, technical assessments of hydrologic regimes necessary to sustain water resources and related natural systems, and adoption of District rules codifying each proposed MFL. Adopted MFLs are considered when reviewing consumptive use permit applications. A proposed withdrawal may not cause flows or water levels to fall below an adopted MFL.

The District's Fiscal Year 2012-2013 MFL priority list and schedule were approved by the Florida Department of Environmental Protection in March 2013. The priority list is updated annually and may be found on the District's website: http://www.nwfwmd.state.fl.us/. The current priority list includes the St. Mark's River Rise, Wakulla and Sally Ward Springs, coastal Franklin County, Jackson Blue Spring, and Coastal Region II Floridan aquifer, as well as other rivers, springs, lakes, and aquifers throughout the District (Figure 1.3). The District established Water Reservations for the Apalachicola and Chipola rivers in 2006 (Section 40A-2.223, F.A.C.), reserving the magnitude, duration, and frequency of observed flows for the protection of the fish and wildlife of the rivers, floodplains, and Apalachicola Bay.

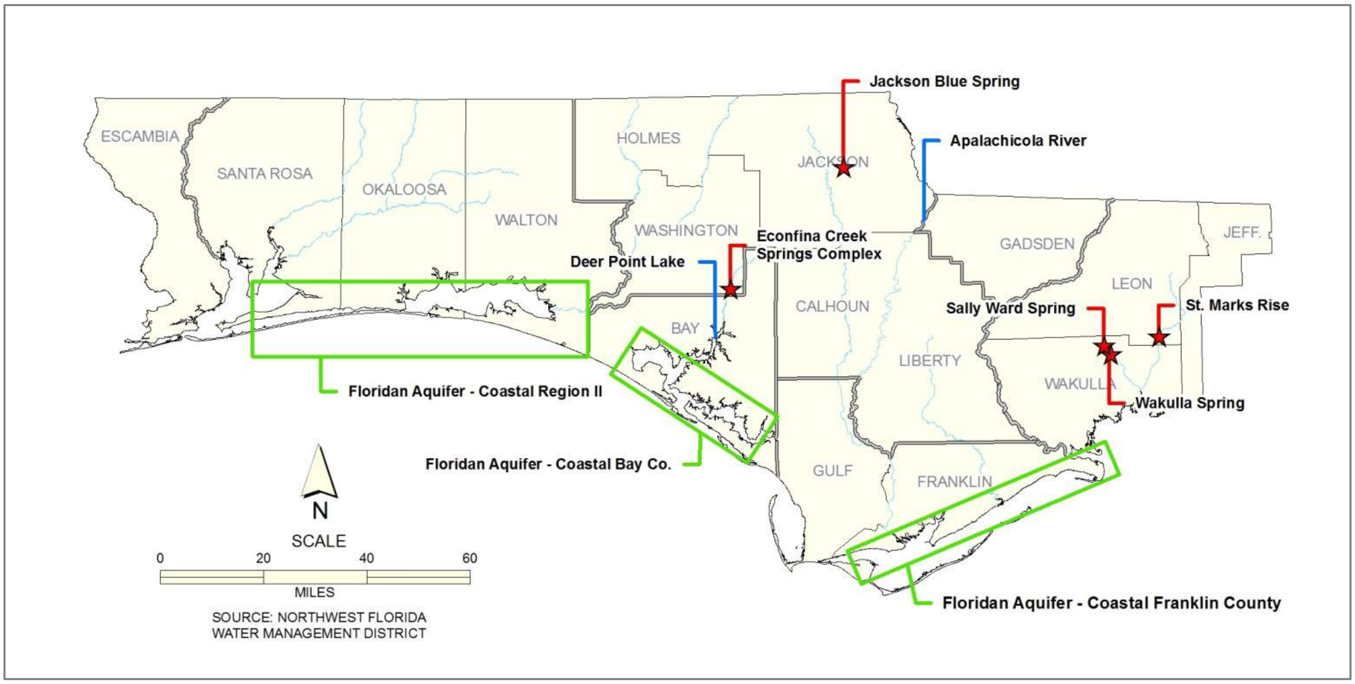


Figure 1.3 Selected Waterbodies on the Minimum Flows and Levels Priority List

1.3 History and Accomplishments

The District supported local and regional water supply activities through planning, water resource investigations, cooperatively funded projects and public education. Prior to 1997, the District concentrated on coastal areas facing acute water resource challenges, with emphasis on what is now Region II. The District released the Regional Water Supply Development Plan in 1982, focusing on Bay, Escambia, Okaloosa, Santa Rosa, and Walton Counties (Barrett, Daffin & Carlan, Inc. 1982). The District has also performed numerous groundwater and surface water evaluations in other areas, many of which were performed in support of local water supply planning efforts.

The District completed its first WSA in 1998 (Ryan et al. 1998). The District identified the coastal areas of Region II, which includes Okaloosa, Santa Rosa and Walton counties, as the highest priorities for water supply planning and the development of alternative supplies. The District's Governing Board approved the first RWSP for Region II in 2001 and it was updated in October 2006 and February 2012 (Bartel et al. 2000; NWFWMD 2006; Busen and Bartel 2012). The District updated the water demand projections component of the WSA in June 2003 (Bonekemper 2003) and December 2008 (Coates et al 2009).

In 2005, the Florida Legislature amended Chapters 163 and 373, F.S., to enhance the coordination between regional water supply planning and local comprehensive planning. The legislation requires local governments in areas subject to RWSPs to cooperate with the District in the development of alternative water supplies. It also emphasizes the need for local governments to implement water conservation and reuse programs. Each local government located in a RWSP area must now prepare a water supply facilities work plan for a minimum 10-year period that describes the public, private and regional water supply facilities that will be developed to address future water needs, including alternative water supply projects, and water reuse and conservation.

In June 2006, the Governing Board determined, based on a staff recommendation, that projected future water demands combined with the potential for saltwater intrusion to the Floridan aquifer in the coastal areas of Franklin and Gulf counties substantiated the need for a RWSP in Region V. This plan was approved by the District Governing Board in January 2007 (NWFWMD 2007).

In February 2008, the Board directed staff to develop a RWSP for Region III (Bay County). The Region III RWSP was approved by the Governing Board in August 2008 and is currently being updated. The second WSA update was completed in December 2008 and approved by the District's Governing Board in May 2009. Based on the conclusions of this update, the Governing Board approved the staff recommendation to continue implementation of RWSPs for regions II, III, and V, and that regional water supply planning was not required for other regions of the District.

The Water Protection and Sustainability Program Trust Fund (WPSPTF) established by the 2005 Florida Legislature provided a dedicated source of revenue that enabled the District to provide cost-share funding for alternative water supply development and water resource development projects. The District allocated over $21 million in funding to local governments and utilities while leveraging over $58 million in cost-sharing contributions. No funding has been appropriated by the Legislature for this program since FY 2009-2010.

The District has also provided water supply development assistance to local governments and utilities outside of the WPSPTF. Such assistance included facilitation of a $3.1 million federal grant for the development of an inland wellfield and nearly $12 million in funding assistance from the District's General Fund and other state funding sources to help local governments and utilities develop and upgrade water supply infrastructure throughout northwest Florida. Additionally, the District has acquired over 41,000 acres within the Econfina Recharge Area of Bay and Washington counties. Acquisition, management, and restoration of these lands by the District has provided an important contribution toward ensuring protection of both quantity of groundwater and spring recharge and water quality for Deer Point Lake Reservoir in Bay County.

In 2013, the District announced the availability of grant funding for the purpose of helping local governments and utilities meet local water supply challenges while addressing water resource protection and management needs. The funds will be made available, on a competitive basis, for water supply development assistance projects to include traditional and alternative water supply development, reuse of reclaimed water, and conservation activities that result in quantifiable water savings.

The District continues to promote water conservation and the reuse of reclaimed water, especially in those regions with RWSPs. In addition to providing grant funding to local governments and utilities, the District distributes brochures on water conservation and drought-tolerant landscaping techniques, and participates in the Water Conservation Hotel and Motel Program (Water CHAMP). District staff also encourage water reuse and conservation through water use permitting activities and when reviewing proposed comprehensive plan amendments and developments of regional impact. In response to regulatory, grant funding, and cooperative planning efforts, significant investments in water reuse system infrastructure have been made, particularly in coastal Region II.

For annual updates to the District's water supply-related activities, please refer to the Consolidated Annual Report, which can be found on the District's website.

1.4 Recent Water Supply Planning Legislation

During 2013, Section 570.085, F.S., was modified to provide for increased participation and assistance from the Florida Department of Agriculture and Consumer Services (FDACS) in regional water supply planning activities. Under the new legislation, the FDACS will establish an agricultural water supply planning program that includes the development of data indicative of future agricultural water demands. The data shall be based on a 20-year planning horizon and will include projections of irrigated acreage for each crop or use category, crop, or water use coefficient for average year and 1-in-10 drought year conditions, and an evaluation of the uncertainties affecting agricultural production. The data and projections developed by FDACS will be provided to the water management districts.

1.5 Report Organization

Section 2 presents the approach and methods used in this WSA update. Section 3 provides the resource assessments for each water supply planning region, including water demand projections, descriptions of the water resources, and an evaluation of the ability of the water resources to meet future needs through 2035. Section 4 presents the summary and conclusions.

2 METHODOLOGIES

This section describes the methods used to estimate 2010 water use and to project future annual average water demands for the 2015-2035 planning period. Also described are the methods used to estimate water needs during a 1-in-10 year drought event. It is important to note that water demand projections do not account for future opportunities to reduce demands by implementing additional water reuse or water conservation measures.

An overview of the approach used to assess the availability of water sources to meet future needs while sustaining water resources and related natural systems is also provided.

2.1 Water Use Estimates and Projections

For the purposes of water supply planning, water use is divided into six categories:

- Public Supply
- Domestic Self-Supply, including Small Public Water Systems
- Industrial, Commercial, and Institutional Self-Supply
- Agricultural Use
- Recreation Self-Supply
- Thermoelectric Power Generation Self-Supply

Attempts were made to improve upon the methods used in the original 1998 WSA and subsequent updates to estimate and project water use. Drought-year projections are included to address the level-of-certainty planning goal outlined in Chapter 373, F.S.:

> "*The level-of-certainty planning goal associated with identifying the water supply needs of existing and future reasonable-beneficial uses must be based upon meeting those needs for a 1-in-10 year drought event*." (Section 373.709(2)(a) 1, F. S.)

During drought events, multiple factors come into play that can affect determinations made regarding the availability of water to meet the needs of both permitted users and the natural systems. Under drought conditions water demands will increase for certain uses such as recreational irrigation and outdoor water use (landscape irrigation). Drought conditions also can reduce the amount of water available for withdrawal from a given source without causing harm to natural systems. This condition tends to be most applicable to surface water sources (rivers, lakes, reservoirs) and aquifers that, because of their geologic characteristics, tend to fluctuate widely in response to short duration climatic events.

Specific methodologies for estimating and projecting average year and 1-in-10 year drought water demands are described below. For all methodologies, 2010 was used as a base year. When this WSA update was initiated, 2010 was the most recent year for which water use data were available. It is anticipated that future water demands will vary somewhat from current projections due to uncertainties and changes in patterns of development and population growth, market conditions, and changes in technology that affect water use. Rainfall variability, including long-term multidecadal oscillations, short-term variability, and spatial patterns will also have significant but difficult to predict effects on future water demands.

2.1.1 *Public Supply*

The methodology for the category of public supply differs from the methodology used in previous WSAs, with the intention of refining the data and enhancing water use projections. With the 2013 WSA update, demand estimates, and projections for public water supply (PWS) utilities consider both end-user (or retail) demand and wholesale production, which can be located some distance from retail customers in the case of water transfers. In prior WSAs, water demand projections were based on historical trends in wholesale water withdrawals. For the current assessment, water demand projections for a utility were calculated as the projected population served multiplied by the base year 2010 gross per capita water use. The method used for PWS utility population estimates and projections has also been updated to use the most reasonable numbers from either a geospatial analysis or reported information. In prior years, population projections were reported only at the county level.

The population served and amounts of water used by PWS utilities were assessed using base year 2010 estimates and projected in five year increments through the 2035 planning horizon. Systems considered for this assessment are those retail utilities providing public water supply that meet the threshold equal to or greater than 0.1 mgd average daily rate of actual or permitted use. Systems below the threshold were also included if water use may meet the threshold during the planning period or if multiple small systems within a county collectively met the threshold and together account for a major portion of the county's water usage. Where public suppliers report large industrial or other use separately, that use is shown in the appropriate water use category and not included in the public supply withdrawal amounts. Most, but not all, retail utilities have an Individual Water Use Permit (IWUP). Those that do not are considered secondary users which purchase or import water from another PWS utility that does have an IWUP.

<u>Population Served by Public Utilities in 2010</u>

District staff estimated permanent residential population within PWS utility areas using one of two methods. For the first method, District staff developed a geospatial database with the assistance of PWS utilities that delineates areas currently served by the water distribution systems. To those mapped areas, 2010 U.S. Census blocks were assigned based on centroid location of the blocks. Where blocks crossed distribution area boundaries, blocks were assigned as in or out based on a visual review of aerial photography for preponderance of development. The populations of blocks within PWS served areas were summed to derive the 2010 population estimate. Census block populations represent permanent population. The second method for estimating population was to multiply the number of active meter connections reported by the utility, or if available the number of residential dwelling units served, by the 2010 U.S. Census persons per household estimate for the respective county. In many cases the District lacked adequate data from PWS utilities on the number of residential connections. The population estimate selected from the results of these two methods was based on professional judgment, considering confidence in the mapped distribution area boundaries, abundance of private domestic wells located therein, and the reasonableness of resulting per capita water use rates.

Population projections carried 2010 estimates forward through 2035 generally applying county-wide growth rates derived from the University of Florida's Bureau of Economic and Business Research (BEBR) population projections (University of Florida 2013). The growth rates, derived from BEBR's low, medium, or high growth scenario projections, that best corresponded to a concordant city's historical growth rate were assigned to PWS service areas. City growth rates were calculated as an average of linear and growth trends based on eight years of historical data (2005 to 2012) obtained from BEBR. For unincorporated areas, the county-wide BEBR medium growth rate was applied, making adjustments where appropriate based on professional judgment. Growth rates were adjusted as appropriate for mitigating factors, as in areas that are built out and have limited growth potential or where proximate historical trends were flat or negative. Preliminary estimates and projections were distributed to PWS utilities and local government planners for review and comment. In addition, six public workshops were held that provided opportunity for utility and local government officials, as well as the public, to provide feedback on population estimates, projections and growth rates. Comments were received from several utilities and local governments, and adjustments were made as appropriate.

The total county population represents the sum of the populations served by PWS utilities and the domestic self-supplied population. County populations for the 2015–2035 planning horizon were maintained at the BEBR medium projections.

The growth rates reflected here represent a significant departure from trends projected in previous WSAs. The recent economic downturn dramatically slowed development in the panhandle. The most recent BEBR county population projections (University of Florida 2013) make a substantial downward adjustment in future population growth rates, and a number of municipalities have experienced negative population growth during the past several years.

2010 Water Demand Estimates and Projections

To determine retail water demand, 2010 estimates and gross per capita water use rates for each PWS utility were derived from District reports, primarily pumping audits and customer use reports. Additional sources of data were used if necessary, including District permitting files, Florida Department of Environmental Protection (FDEP) monthly operating reports, and FDEP basic facilities reports. The data included water source; amount pumped, imported, and exported; water system losses; and water delivered to customers. All wholesale and retail losses were allocated to secondary users proportionally based on water exports to determine the gross per capita withdrawals associated with the demand. Total average daily water use, or average daily rate (ADR) in mgd, was calculated for each PWS utility and summarized for each county and for each region. The formula is:

$$\text{Utility Water Use} = \text{Withdrawals} + \text{Imports} - \text{Exports}$$

Withdrawals are permitted by the District and may be from ground or surface water sources. Imports are water purchased or transferred into the utility from another utility. Exports are water sold or transferred outside of the utility distribution area.

For utilities that serve more than one county, the percent of population served in each county was calculated and water use apportioned to the appropriate counties by the same percentages. Tables will show a utility listed under more than one county to account for water transfers and differing county growth rates. This applies to the City of Tallahassee, South Walton Utility Company, Inc., and the Town of Caryville.

The gross per capita water use rate apportions all types of customer uses including residential, commercial, institutional, industrial, recreation, aesthetic, agricultural, and fire protection and utility water losses to each permanent resident in the utility's distribution area. This rate is used for planning purposes only to project future demand. The formula is:

$$\text{Gross per capita water use} = \frac{\text{Utility water use}}{\text{Utility residential population}}$$

Population estimates are intended to represent permanent residential population and do not account for seasonal or short-term population fluctuations due to tourism, short- and long-term vacation rentals, second-home dwellers, large conferences and special events, and so forth. However, utility water use does include water demand associated with those population fluctuations. Therefore, in areas that serve transient and tourism demand, particularly along the Gulf coast, gross per capita rates can be very high. This District is working with utilities to obtain better data regarding the residential population served, residential water use, and domestic self-supplied water use within each distribution area to facilitate improved estimates of residential per capita use. Residential per capita rates exclude large industrial, commercial, institutional, recreational, and other non-residential customers. Improving estimates of residential per capita water use would allow more equal comparisons among utilities and aid in setting conservation goals and evaluating progress.

For some utilities, a three-year average of water demand (2009 through 2011) was used as the baseline rather than the 2010 value where staff determined that 2010 water withdrawals may not adequately reflect average demand due to metering problems, drought, high water losses, or where 2015 projections were inconsistent with reported 2012 water use. This approach was used for Berrydale Water System, City of Bristol, City of Graceville, City of Marianna, City of Niceville, City of Port St. Joe, City of Valparaiso, Emerald Coast Utilities Authority, Mossy Head Water Works, Inc., Point Baker Water System, Inc., Talquin Electric Cooperative, Inc. East Regional Water System, Talquin Electric Cooperative, Inc. Meadows at Woodrun, and Water Management Services, Inc.

Water demand projections are the product of population projections and gross per-capita water use rates. For planning purposes, it was assumed that per capita usage will remain constant over the 2015 - 2035 planning horizon. This is a conservative assumption as per capita rates may decrease if conservation and water use efficiency measures are implemented. Estimates and projections were summarized for each county and for each water supply planning region. These projections were compared with projections that certain utilities provided in planning documents or water use permit applications. Most of these projections had been developed prior to the economic downturn and overestimated future needs as compared with current projections.

In some cases, the base year (2010) population served and water use estimates vary from those reported by U.S. Geological Survey (USGS), because USGS population served estimates were not developed using the geospatial approach employed here. In addition, USGS water use estimates excluded water suppliers providing less than 0.1 mgd and include a large industrial use in Bay County supplied by a public supply utility and an institutional use that is a substantial portion of Graceville's public supply demand.

<u>2010 Water Production Estimates and Projections</u>

Wholesale estimates and projections of raw water withdrawals by water source were developed to evaluate the adequacy of sources to meet retail demands. The base year for water production estimates was 2010. Projections generally apply the population growth rate for each utility to base year raw water withdrawals by source in five year increments.

For some utilities, it was necessary to consider additional factors such as water obtained from multiple sources or transferred between systems. For example, some utilities withdraw water locally from the Floridan aquifer and also receive water from a remote sand-and-gravel aquifer wellfield. In the case of water transfers, projections for raw water withdrawals were made by separating amounts used by each retail utility customer in 2010 and applying the respective growth rate of the retail utility to that amount, or by assigning the water demand for the retail utility to the wholesale utility.

In Region II, projections of withdrawals from the coastal Floridan aquifer were capped at each utility's currently permitted average daily rate. Any additional demand was assigned to an alternate water source.

<u>1-in-10 Year Drought Projections</u>

The 1-in-10 year drought projections indicate the estimated increase in water used during a drought year based on the demand during an average year. Water demand increases during a drought year are largely the result of short-term increases in irrigation.

A 1-in-10 year drought event is an event that results in an increase in water demand of a magnitude that would have a 10 percent probability of occurring during any given year. The level of certainty water supply planning goal is to assure at least a 90 percent probability during any given year that all the needs of reasonable-beneficial water uses will be met, while also sustaining water resources and related natural systems. FDEP guidance calls for using information from PWS utilities to estimate seasonal and climatic variations in demand, or lacking local information to use other studies or apply a 6 to 10 percent increase in average demand to represent the 1-in-10 year condition (FDEP 2001).

In past WSAs and water supply plans, increases in projected average year demands of 2 to 7 percent have been used to project 1-in-10 year drought conditions. For the 2013 WSA update, total water demand by PWS utilities within the District was compared for a drought year, 2006, and an average rainfall year, 2008. The increase in water usage for the drought year was 7.3 percent. Therefore, a multiplier of 1.07 was used to project the drought condition demand.

<u>Sources of Uncertainty in Demand Projections</u>

a. Population estimates for distribution areas are approximations based on best available data. For utilities where GIS was used to determine 2010 population served, the approach of assigning U.S. Census blocks to public supply distribution areas results in approximations of population in the distribution areas. Populations within blocks cannot be split. Thus, depending on how blocks are assigned along boundaries, there may be some localized over and underestimation. On the whole, this approach is expected to even out and result in a reasonable population estimate for the service area. Also, public supply distribution areas may include properties served by domestic self-supply wells that are impractical to exclude from distribution area maps. This could result in higher population estimates and lower gross per capita rates than actual.
b. Actual population changes may differ spatially or numerically from what is projected, particularly at the sub-county level.
c. Gross per capita water use is assumed to remain constant throughout the planning period. Actual per capita use may vary from year to year and may change over time due to changes in economic conditions, climatic conditions, demographics, or water conservation and efficiency measures.
d. Growth rates used for projecting water use and production were developed for regional planning purposes and should not be relied upon for facilities design planning.

Transient and seasonal populations are not accounted for in demand estimates or projections. This results in some coastal communities with significant tourism having very high calculated per capita use rates.

2.1.2 *Domestic Self-Supply and Small Public Supply Water Systems*

The domestic self-supply category includes individual residences supplied by private wells and small public water systems with an annual average water withdrawal of less than 0.1 mgd. This water use is aggregated and reported at the county level.

The population using domestic self-supply systems for each county was estimated by subtracting the population served by the public water supply (PWS) systems in the county from the 2010 Census population for the county. Projecting future domestic self-supply population follows the same logic. County PWS population projections were subtracted from the BEBR medium population projections for each county in five year intervals, resulting in the projected domestic self-supply population.

Water use estimates and projections for domestic self-supply were calculated for each county by multiplying the domestic self-supply population by a county-specific domestic self-supply per capita water use rate. County domestic per capita use rates were estimated by USGS, which exclude commercial and industrial usage (both self-supply and public supply) to derive residential usage (Marella 2013). This represents a refinement over the previous WSA, which applied a standard per capita rate of 106 mgd for domestic self-supply.

For projecting the 1-in-10 year drought demand, it is assumed that the same factors that increase public water supply demand in a 1-in-10 year drought event will also affect domestic self-supply water demand. Therefore, the drought year projections for domestic self-supply will use the same multiplier of 1.07 as that used in PWS drought year projections.

<u>Sources of Uncertainty in Demand Projections</u>

a. Public supply distribution areas may include pockets of domestic self-supply. This could result in lower than actual estimates of domestic self-supply use.
b. Population changes may differ spatially or numerically from what is projected.

2.1.3 *Industrial, Commercial, and Institutional (I/C/I) Self-Supply*

Industrial/commercial/institutional (I/C/I) self-supplied water users include manufacturing plants, chemical processing plants, water bottling plants, office buildings, hospitals, correctional facilities, military bases, schools and universities, and other facilities with an IWUP. The IWUP thresholds for I/C/I water users vary among regions and counties. The I/C/I water users included in this assessment are consumptive use permit holders with a permitted or average daily rate usage of 0.1 mgd or greater.

<u>2010 Water Use Estimates</u>

The 2010 I/C/I water use estimates are the annual average daily withdrawal rates reported by each permittee contained in the District's Water Use Permit (WUP) files.

<u>Projections for 2015-2035</u>

Predicting future I/C/I water use is difficult because of changes in economic conditions, facility operations, and unanticipated facility closures, expansions, or relocations. Therefore, water demand projections for the 2015 to 2035 planning period were requested and received directly from the IWUP holders.

1-in-10 Year Drought Projections

Drought-year water demand projections for I/C/I water users are not anticipated to differ from water demands during an average rainfall year.

Sources of Uncertainty in Demand Projections

a. Water use for self-supplied industrial and commercial users may differ from projections due to economic and market conditions, facility expansion or closings and other variables that influence production.
b. Water use for institutional facilities (e.g., schools, military installations) may differ from projections due to unanticipated changes in the population served.

2.1.4 *Agricultural Water Use*

Agricultural water use consists of water withdrawn for the irrigation of crops and non-irrigation uses associated with farming operations. This includes water withdrawn for irrigating field, fruit and vegetable crops, nursery and greenhouse plants, and grasses or pasture. Non-irrigation uses include water withdrawn for livestock, fish farming, and other uses associated with agricultural operations.

Agricultural water use is permitted under either a General Water Use Permit (GWUP) by rule or an Individual Water Use Permit (IWUP). Small water users that fall below defined IWUP thresholds may operate under a GWUP, which means that they do not have to file an application or obtain a permit document from the District. Thresholds for GWUPs and IWUPs are set forth in Chapter 40A-2, F.A.C., and vary depending on location within the District. The vast majority (generally more than 85 percent) of the agricultural water use is accounted for by water users holding an IWUP. Permittees with an average daily rate of 0.1 mgd or greater are generally required to estimate and report water use. Permittees operating under a GWUP and IWUP holders who use less than 0.1 mgd are not typically required to report water use.

As not all agricultural water users are required to report pumpage, using only reported water use data could underestimate agricultural water use. As an alternative, District staff estimated agricultural irrigation water use indirectly by multiplying the number of irrigated acres (for each crop type) by the supplemental irrigation need (also referred to as the irrigation application rate). In the past, the District has used irrigated acreage estimates provided by the USGS as the basis for estimated use and projected demand. The USGS acreage estimates are compiled using the U.S. Department of Agriculture (USDA) Census of Agriculture and the USDA National Agricultural Statistics Service county-level data for selected crops. Estimates of planted acreage were made for various types of vegetables, fruit crops and orchards, field crops, and ornamentals and grasses. The USGS also estimated the percent of crop acreage that is irrigated and the method of irrigation (low volume or sprinkler) based on input from District staff. The District reviewed and revised the USGS acreage estimates as described below.

2010 Water Use Estimates

District staff estimated the 2010 self-supplied agricultural water use by adding the estimated irrigation use, as described above, to the available, reported non-irrigation use. Acreage estimates provided by the USGS were reviewed and, in many cases, revised based on information from various sources. These sources included:

a. Water use, irrigated acreage, and crop type data required to be reported for compliance with IWUPs.
b. IWUP database files such as correspondence, staff reports, pumping reports and audits, and other documents that might list water use, crop type, or irrigated acres, if not required to be reported under the permit.
c. GIS analysis to estimate, from 2010 summer and winter aerial photographs, the number of irrigated acres associated with 6- to 8-inch diameter agricultural wells not required to have an IWUP.
d. GIS analysis to estimate, from 2010 summer and winter aerial photographs, the number of irrigated acres associated with observable, center-pivot irrigation systems not already accounted for by other sources.
e. Comments on the draft USGS irrigated acreage estimates provided by the University of Florida, Institute of Food and Agricultural Sciences (IFAS) county extension agents and USDA personnel for each county.

The data review resulted in modified estimates of crop type and associated irrigated acreage for each county. These estimates were provided to and accepted by the USGS. District staff subsequently used the Agricultural Field-Scale Irrigation Requirement Simulation (AFSIRS) program (Smajstrla 1990) to generate irrigation application rates for each crop type based on climatological data, irrigation method and efficiency, and soil type. Climatic conditions in Jackson County (where the majority of agricultural water use in the District occurs) combined with fine loamy soils were used as the basis for generating the irrigation application rates district-wide. The use of Jackson County climatic conditions is anticipated to result in conservatively high estimates of irrigation water use, as the Jackson County area often exhibits lower annual rainfall than other areas of the District. The climatological data included spatially interpolated values of rainfall and evapotranspiration rates for the years 1975 through 1999. These are the most recent interpolated values available. A review of the Jackson County 2010 rainfall patterns relative to long-term average conditions indicate that the growing season was drier than average. District staff used the AFSIRS irrigation rates associated with a 2-in-10 year return interval, which corresponds to drier than average conditions, to estimate the 2010 agricultural irrigation water use. The agricultural irrigation water use estimates were added to the reported non-irrigation agricultural water use to estimate the total 2010 agricultural water use.

<u>Projections for 2015-2035</u>

District staff developed projections of agricultural water use for the 2015 to 2035 planning period for each county and region. As agricultural production is affected by market, economic, climatic, regulatory, and political factors, the future is difficult to predict. Consequently, projections were based on measureable historical and recent trends in reported water use, irrigated acreage, crop types, and numbers of agricultural well construction and water use permits. District staff examined data for the following trends:

- USGS irrigated acreage and estimated water use, 1995 through 2010;
- USDA irrigated acreage, 1982 through 2007;
- Total District agriculture IWUPs and summed ADRs, 1990 through 2012;
- New Agricultural IWUP issued, 2000 through 2012; and
- New Agricultural IWUP issued, 2000 through 2012 using a 4-year moving average.

In some counties and regions, the analyses indicated highly variable water use, and a lack of identifiable trends. Where the analyses reflected a slight decrease or no clear trend in recent historical water use and/or irrigated land, projections were held at the values estimated for the 2010 baseline year. Where significant trends were identified, the 2015 projection reflected continuation of the trend. Values for subsequent years were then kept constant given the uncertainties inherent in agricultural water use discussed above. In most regions, staff based agricultural water use projections on trends in irrigated acreage and total county-wide permitted ADRs between 2009 and 2012.

In addition to market and weather conditions, legislative actions may have significant effects on future agricultural production and thus irrigation demand. Significant legislative initiatives and associated regulatory actions considered include:

- The Energy Independence and Security Act (EISA) of 2007, which established a Renewable Fuels Standard that increases the volume of renewable fuel (biofuel) in gasoline from 9 billion gallons in 2008 to 36 billion gallons by 2022;
- Subsequent U.S. Environmental Protection Agency regulations to implement the EISA of 2007 and set annual biofuel standards; and
- Preliminary proposals for the Agricultural Reform, Food and Jobs Act (commonly called the Farm Bill) would expand the Biomass Crop Assistance Program to promote advanced bioenergy production. As of the time of this writing, a final Farm Bill has yet to be enacted into law.

Due to inherent uncertainties in commodity values, weather, future state and federal legislation, and other factors, District staff projected agricultural water use only to the year 2015, and then held values constant through 2035. Projections will be updated for the next WSA, conducted every five years, based on observed change. Agricultural water use estimates and projections were provided to the Florida Department of Agriculture and Consumer Services (FDACS) for review and comment.

<u>1-in-10 Year Drought Projections</u>

For the 2010 base year, District staff, along with county agricultural extension agents familiar with agricultural operations, reviewed rainfall data in the District and determined that the 80th percentile non-exceedance probability (2-in-10 return interval) irrigation application rates provided by the AFSIRS program best represented the 2010 agricultural irrigation water use.

To project water demands for a 1-in-10 drought year condition, the AFSIRS irrigation rates for a 1-in-10 year return interval (e.g., 90th percentile) were multiplied by the 2010 irrigated acreage. The projections were developed by crop type within each county. The difference between the 2-in-10 year irrigation rates used to estimate water use for year 2010 and the 1-in-10 drought year rates were calculated and applied as a percent increase to the 2015 projected irrigation water use. Non-irrigation water use not affected by drought was projected without change to 2015. These amounts were combined to get the total projected agricultural water use for the 1-in-10 year drought condition. As with the 2010 base year projections, the drought year projections were held constant from 2015 to 2035.

<u>Sources of Uncertainty in Demand Projections</u>

a. The future irrigated acreage for any particular crop may differ from what we have projected due to a variety of factors including economic and market conditions, regulatory and political factors, and other variables that influence decision-making by agricultural producers.
b. Irrigation application rates may differ from those used in projections due to variations in climatic conditions and changes in irrigation system efficiency.

c. For IWUPs not required to report pumpage, it is unknown how closely actual water use matches the permitted allocation.

2.1.5 *Recreation Self-Supply*

Recreation self-supply includes golf course and landscape irrigation, water-based recreation, and aesthetic use. The recreation water use reported in the 2008 WSA included only IWUPs having an ADR of 0.1 mgd or greater. For this 2013 WSA update, District staff estimated recreation water use for all IWUPs and GWUPs. GWUPs are held by non-exempt water users that fall below the threshold for an IWUP. A GWUP is issued by rule and no formal application process is required other than obtaining a well construction permit for groundwater sources. Examples of water uses that have a GWUP are homeowners with small diameter landscape irrigation wells, homeowner organizations that pump water to maintain aesthetic features such as a fountain or lake, and small golf courses that fall below the IWUP thresholds. Because water use associated with GWUPs has been estimated for this assessment, the recreation water use estimates presented in this report will be larger than the estimates provided in the 2008 WSA. Due to this change in methodology, it is not appropriate to infer historical trends in recreation water use from values reported in the WSAs.

<u>Water Use Estimates for 2010</u>

District staff calculated the 2010 recreation water use for each county as the sum of the water use associated with IWUPs and GWUPs. For IWUPs, the average daily recreation water use reported by each permittee for 2010 was tabulated and summed. For smaller IWUPs where reporting was not required, the permitted average daily rate was used as an estimate of the 2010 water use.

GWUPs were identified within each county using the District's well construction permit records. The analysis included all wells with recreation use types (recreational irrigation, landscape irrigation, aesthetic use, or water-based recreation) that were constructed or repaired since the initiation of the District's well construction permitting program in 1976. Abandoned wells, duplicate wells, and wells associated with an IWUP were excluded from the analysis. The number of permitted recreation wells versus those actually in operation in year 2010 is unknown and, therefore, the recreation water use associated with GWUPs is a best estimate given the available data. The water use associated with GWUPs was subdivided into the following categories for estimation purposes: (1) landscape and recreation irrigation uses associated with wells less than 8 inches in diameter, (2) landscape and recreation irrigation uses associated with wells 8 inches and larger in diameter, (3) golf course irrigation operating under a GWUP, (4) aesthetic use operating under a GWUP, and (5) water-based recreation operating under a GWUP. The methodology used to estimate each of these components is detailed below. The District does not have information on GWUPs that use surface water for landscape irrigation; however, this use is anticipated to be negligible, as groundwater is the predominant water source throughout most of the District.

GWUP Landscape and Recreation Irrigation - Well Diameter Less Than 8 Inches

For each county, District staff estimated the water use associated with small diameter landscape and recreation irrigation wells as the product of the number of permitted irrigation wells, the irrigation application rate, an average parcel size, and the fraction of the parcel irrigated. Most landscape irrigation associated with wells less than 8 inches in diameter is likely associated with residential lawns. Based on a GIS review of parcels sizes for single-family residences, an average parcel size of 0.25 acres was selected for use in Regions IV, V, VI, and VII and an average parcel size of 0.5 acres was selected for use in Regions I, II, and III. The fraction of each parcel irrigated was estimated to be 40 percent

(Friedman et al. 2013). Application rates for landscape irrigation were determined for each county using the AFSIRS model. Inputs to the AFSIRS model included the predominant soil type found within each county, the nearest climatological data, and an irrigation system efficiency of 75 percent.

GWUP Landscape and Recreation Irrigation – Well Diameter Equal to or Greater Than 8 Inches

Landscape and recreation irrigation use associated with wells having a diameter of 8 inches or greater was generally associated with schools and ball fields. The analysis was identical to that described above for wells less than 8 inches in diameter except that the irrigated area was estimated using aerial photography rather than being based on average single family residence parcel sizes.

GWUP Golf Course Irrigation

For golf courses without an IWUP, staff estimated the 2010 water use by multiplying a turf grass irrigation rate by the number of irrigated acres. Irrigated acreage was estimated as the number of golf course holes multiplied by five irrigated acres per hole (Marella, personal communication 2008). The average of five irrigated acres per hole is consistent with data in the District's permit database. The turf grass irrigation rate applied was 25 inches per acre based on AFSIRS.

GWUP Aesthetic Use

There were 23 well construction permits associated with aesthetic use that were not included under an IWUP. Aerial photography was reviewed for each facility to determine if ponds were present that were potentially augmented for aesthetic purposes. If ponds were present, District staff estimated the 2010 water use as the product of the pond surface area and a pond supplementation rate of 30 inches per year, which is consistent with recreational pond allocations associated with IWUPs. If no ponds were present, the water use was estimated as 50 gallons per day, which was estimated, using average annual pan evaporation, to represent the water demand associated with a swimming pool having 450 square feet of surface area.

GWUP Water-based Recreation

Well construction permit records indicated that there are two GWUPs associated with water-based recreation. For each facility, the 2010 water use was estimated as the product of the pond surface area and a pond supplementation rate of 30 inches per year. District staff estimated the pond area from aerial photography. The rate of 30 inches per year is based on existing District IWUP calculations for maintaining recreational ponds.

<u>Projections for 2015-2035</u>

Water demands for recreation water use were assumed to be proportional to population growth. For each county, District staff projected demands for 2015 through 2035 at five-year intervals by multiplying the total 2010 estimated recreation water use by the BEBR medium population projection growth rates.

<u>1-in-10 Year Drought Projections</u>

Recreational irrigation demands for a 1-in-10 year drought were estimated using the AFSIRS model. The ratio of the 1-in-10 drought year demand to the 2-in-10 year irrigation demand (which was used as the basis for the 2010 water use estimates) was calculated for each county. The projections for 2015 through 2035 were then multiplied by the appropriate county-specific ratio to obtain the 1-in-10 drought year projections.

Sources of Uncertainty in Demand Projections

a. For IWUPs not required to report pumpage, it is unknown how closely actual water use matches the permitted allocation.
b. For estimates of water use associated with GWUPs, uncertainties exist regarding the number of wells in operation, the irrigated area associated with each well, and the irrigation rates applied.

2.1.6 *Power Generation*

Water use estimates and projections for power generation reflect the amount of water that is consumptively used. Fresh water and brackish water withdrawn for power generation is frequently used for once-through cooling and most of this water is returned to its source. The amount of water consumptively used (i.e., not returned to the source; also known as net use) was estimated for 2010 and projected for 2015 through 2035. All permitted IWUPs are reported in this assessment.

District staff estimates differ greatly from those of the USGS, as USGS reports gross pumpage or total withdrawals, whereas the District reports net consumptive use.

2010 Water Use Estimates

Water use estimates for the 2010 baseline reflect the annual average withdrawals reported by each permittee multiplied by the fraction that was consumptively used through evaporation or water loss. For example, if a power generation facility withdrew 10 mgd of surface water and 90 percent was returned to the surface water source, then only 10 percent of the water was consumptively used. Therefore, the net water use value would be 1 mgd. Generally, all groundwater is considered to be consumptively used.

Projections for 2015-2035

In past WSAs, water use projections for power generating facilities were provided by direct communication with the permittees. For this WSA, District staff reviewed electric utility ten-year site plans posted online with the Public Service Commission. District staff also contacted permit holders directly to ascertain their future plans. Projections for each facility include demands for both fresh and brackish water; however, only the water demands that are anticipated to be consumptively used (i.e., not returned to their original water source) were included in the projection tables.

1-in-10 Year Drought Projections

Drought-year water demand projections for power generation are not anticipated to differ significantly from water demands during an average rainfall year.

2.2 Water Resource Assessments

The approach used to assess the ability of reasonably anticipated water sources to meet future water needs varies by region and source type. For groundwater resources, the assessment criteria generally included the evaluation of long-term changes in the potentiometric surface and impacts to groundwater quality. Where appropriate, the potential for groundwater pumpage to reduce groundwater discharge to surface water features (springs, rivers, bays) was evaluated qualitatively by comparing the relative magnitudes of withdrawals to surface water flows. To further assess the magnitude of groundwater withdrawals, the regional scale groundwater budgets that were developed in support of the 1998 WSA were re-evaluated. The water budgets were based on output from calibrated steady-state groundwater flow models and provide an approximation of average groundwater conditions. Although steady-state models do not account for seasonal or annual variation in flow, they do provide a means to estimate the relative magnitude of the various inflows to and outflows from an aquifer.

For surface water resources, the assessment criteria involved evaluating the sustainability of surface water resources and associated natural systems. The assessments were typically made by comparing the relative magnitudes of withdrawals and surface water flows.

2.2.1 *Reuse*

As part of the resource assessment, District staff summarized the amount of reclaimed water used during 2010 and then estimated the amount that may be available to meet future water demands for each planning region. The source of data for the reuse portion of this assessment was FDEP's 2010 Reuse Inventory (FDEP 2011). Operators of domestic wastewater facilities with a permitted capacity of 0.1 mgd or greater that provide reclaimed water for reuse are required to submit an annual reuse report to FDEP. Information reported for these facilities is compiled into FDEP's annual reuse report. Utility reuse reports and wastewater permits were also reviewed. There were some discrepancies between FDEP's reuse inventory data, utility reuse reports, and permits. In such cases, clarification was provided by FDEP staff and District staff adjusted the numbers accordingly.

Wastewater treatment facilities that were inactive in 2010 were not included in the estimates or projections. Some facilities were active in 2010 but have since closed. Flow numbers were included in the 2010 estimates for those facilities. For wastewater projections, flows are counted with the facility that is now processing that wastewater. This is the case with these facilities: Pensacola ECUA-Main Street has closed, with wastewater going to the ECUA-Central WRF facility; Ft. Walton Beach Wastewater Treatment Plant (WWTP) has closed, with wastewater going to Okaloosa County's Arbennie Pritchett Water Reclamation Facility; and Lake Bradford Road WWTP had closed, with flows now going to the T. P. Smith Water Reclamation Facility in Tallahassee.

To develop wastewater projections for years 2015 through 2035, District staff assumed that increases in wastewater generation would correspond to increases in public supply water use. Projected population growth rates for concordant potable water utility distribution areas were used to develop wastewater projections. If there was no concordant public water supply utility, the BEBR medium growth rate for the county was used.

District staff also projected the amount of reclaimed water potentially available for reuse. This was determined by subtracting from projected wastewater flows the reuse flows in 2010 that replaced potable-quality water multiplied by a peaking factor of 1.5 that ensures adequate reclaimed water will be available to meet reuse needs. The peaking factor accounts for seasonal impacts on demands or increased irrigation and other outdoor water usage during drought. As stated in the reuse inventory, reuse flow that replaces potable-quality water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses (FDEP 2011). Not included in this flow calculation are agriculture irrigation of other crops (sprayfields), absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant. The resulting gallons are estimated to be available to meet future water demands for non-potable water.

2.2.2 *Conservation*

For planning purposes, a simple method was used to estimate the potential savings that could be achieved through conservation measures and reductions in water losses within public supply distribution systems. It was assumed that if all public supply utilities and domestic self-supply users could achieve a gross per capita water use of 150 gallons per capita per day (gpcd) or less, significant conservation could be realized. Public supply utilities whose 2010 gross per capita rates were greater than 150.5 gpcd were included in the analysis. Utilities were estimated to achieve 150 gpcd by 2035 and water demand projections were recalculated for the lower per capita rate. The difference between the 2035 water use projections based on estimated 2010 gross per capita rates and the rate of 150 gpcd represents the potential water savings from conservation. It is understood that, for some public supply utilities, achieving a gross per capita rate of 150 gpcd might not be feasible or cost-effective. This may be the case, for example, for utilities that serve large and varying seasonal and tourist populations, as well as for utilities that serve substantial nonresidential uses.

3 SOURCE ASSESSMENTS BY REGION

This page intentionally left blank

3.1 Region I: Escambia County

Region I lies within the Pensacola Bay and Perdido Bay watersheds and is comprised solely of Escambia County, including the municipalities of Century and Pensacola (Figure 3.1). The largest water use categories are public supply and industrial, commercial and institutional (I/C/I) water use. Historically, Pensacola has had a large military and industrial economy. In recent years the area has worked to revitalize and diversify this economy, such as with the Escambia County Mid-West Sector Plan covering approximately 16,000 acres along the I-10 corridor. Approximately 82 percent of the population resides outside of incorporated areas. The sand-and-gravel aquifer is the primary water source for this region.

Region I Snapshot		
	2010	2035
Population	297,619	319,300
Water Use (mgd)	~ 95	~ 96
Primary Source	Sand-and-Gravel Aquifer	
RWSP Status	No RWSP Recommended	

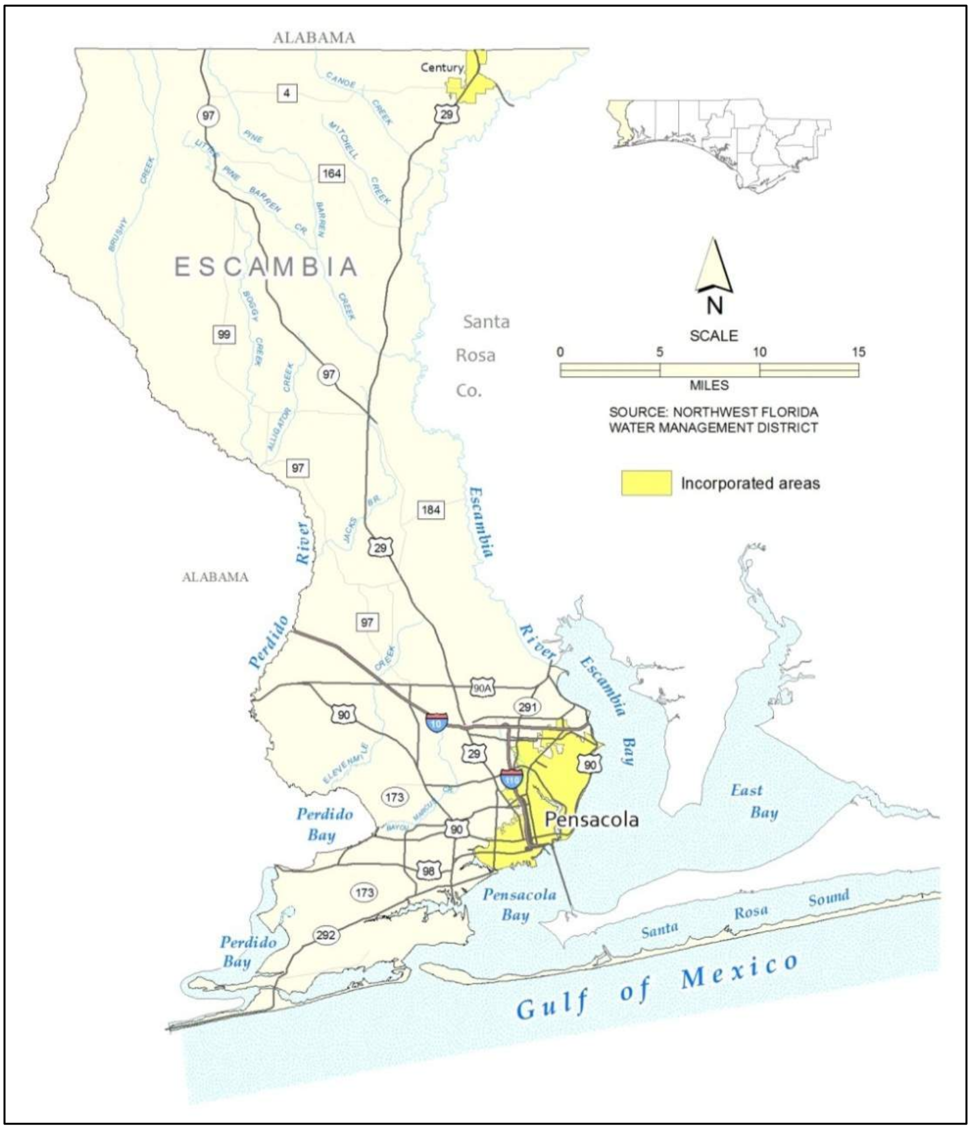


Figure 3.1 Map of Region I, Escambia County

3.1.1 *Water Use Estimates and Projections*

Public Supply

Ten utilities providing public water supply in Escambia County were included in this assessment. Together they provide water to 94 percent of the total county population. The county population estimated by BEBR has declined slightly since 2005. The slowdown in growth is reflected in reduced BEBR growth projections, resulting in a 2035 projection that is 12 mgd less than what the District previously projected for 2030 in the 2008 WSA update.

The Emerald Coast Utilities Authority (ECUA) is the largest of these systems (Table 3.1), serving nearly 80 percent of Escambia County residents. Service is provided to the City of Pensacola and surrounding areas. The utility has over 30 active wells that withdraw water from the sand-and-gravel aquifer. The ECUA withdrew 33.53 mgd in 2010, which is less than the amount withdrawn in 2005. ECUA's water demand is anticipated to increase by approximately 2.44 mgd to 35.97 mgd by 2035, reflecting a much more moderate rate of growth than was anticipated in the prior WSA.

Peoples Water Service Company serves customers in southwestern Escambia County and is the region's second largest public supply utility. The utility withdrew 2.39 mgd from the sand-and-gravel aquifer in 2010 (Table 3.1). Demand is projected to increase to approximately 2.57 mgd by 2035. This is also a decrease in projected demand compared to the 2008 WSA.

The remaining eight public water systems serve central and northern Escambia County. These utilities collectively used 3.63 mgd in 2010. Future water demands for these utilities are projected to increase to a total of 3.96 mgd by 2035.

Table 3.1 Escambia County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Bratt-Davisville Water System, Inc.	0.21	0.21	0.21	0.22	0.22	0.22
Central Water Works, Inc.	0.34	0.35	0.35	0.36	0.36	0.37
Century, Town of	0.51	0.51	0.51	0.51	0.51	0.51
Cottage Hill Water Works, Inc.	0.36	0.36	0.37	0.37	0.38	0.38
Emerald Coast Utilities Authority	33.53	34.00	34.60	35.13	35.59	35.97
Farm Hill Utilities, Inc.	0.57	0.62	0.65	0.67	0.70	0.73
Gonzalez Utilities Association, Inc.	0.59	0.60	0.61	0.62	0.63	0.63
Molino Utilities, Inc.	0.80	0.81	0.82	0.83	0.85	0.85
Peoples Water Service Company of Florida	2.39	2.43	2.47	2.51	2.54	2.57
Walnut Hill Water Works	0.25	0.25	0.26	0.26	0.26	0.27
Total	**39.55**	**40.13**	**40.85**	**41.48**	**42.04**	**42.51**

Domestic Self-Supply and Small Public Water Systems

The population served by domestic wells and small public water systems was estimated at 16,606 persons in 2010, which was approximately 6 percent of the total county population. This population used an estimated 1.46 mgd of water in 2010, and future needs are anticipated to increase only slightly by 2035 (Table 3.2).

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

In 2010, I/C/I consumptive water use in Region I totaled 32.20 mgd (Table 3.2). Sources for I/C/I water include the Escambia River and the sand-and-gravel aquifer. The largest water users were International Paper (21.89 mgd in 2010) and Ascend Performance Materials, LLC (7.90 mgd in 2010). The volume of water used for Ascend Performance Materials was less than their ADR because 98 percent of their surface water pumpage was returned to the Escambia River. Future I/C/I water demands are projected to decrease to 27.10 mgd by 2035, a reduction of 5.10 mgd or 15.8 percent.

Recreation Self-Supply

The 2010 estimated water use for self-supplied landscape, residential and golf course irrigation, and aesthetic use totaled 3.69 mgd in Region I (Table 3.2). Sources of water for recreation uses include the sand-and-gravel aquifer, streams, bayous, and golf course ponds. Region I recreation water demands are anticipated to increase to 3.96 mgd by 2035 and future demands will continue to be met by a combination of reclaimed, surface, and groundwater sources.

Agricultural Use

The estimated agricultural water use in Region I was 2.57 mgd in 2010 (Table 3.2). Agriculture in Escambia County consists largely of cotton, peanuts, soybeans, and corn in the northern and central portions of the county. There is also some irrigation of fruit crops, sod and ornamentals. Agricultural production is affected by market, economic, climatic, regulatory, and political factors; therefore, the future is difficult to predict. Because of the uncertainty of many of these factors, the agricultural water use projections were assessed until the year 2015, followed by a period of no change until 2035. Future agricultural water demands are projected to increase by 0.75 mgd to 3.32 mgd, or 29 percent, by 2015.

Power Generation

Gulf Power Company's Crist Electrical Generating Plant (Crist Plant) currently relies on groundwater from the sand-and-gravel aquifer and surface water from the Escambia River and Governor's Bayou. Consumptive water use at the Crist Plant totaled 15.91 mgd in 2010 (Table 3.2). Due to various changes in operations and plant processes, water use at the Crist Plant will remain the same until 2015 and then will increase 1.68 mgd, or 11 percent, to 17.59 mgd by the year 2020 and remain constant through 2035.

Total Water Use and Population

Average annual water use in Escambia County totaled 95.38 mgd in 2010 (Table 3.2). The largest use categories were public supply (41 percent of total) and I/C/I (34 percent). Power generation accounted for 17 percent of the 2010 total use. Domestic self-supply, agriculture, and recreation collectively accounted for the remaining 8 percent (Figure 3.2).

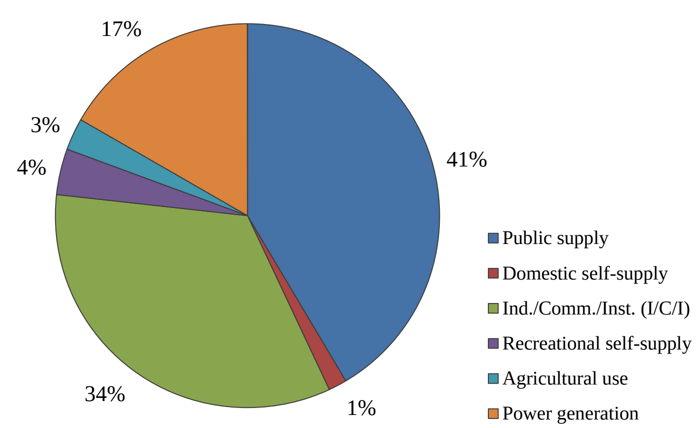


Figure 3.2 Region I Water Use by Category, 2010

The population in Escambia County was 297,619, according to the Census Bureau in 2010 (BEBR 2013). Population and public supply water use are both projected to increase over the planning period. The medium-range population projection for Escambia County in 2035 is 319,300 persons and represents a 7 percent increase from 2010 (BEBR 2013).

The total water demand in Region I is projected to increase by less than 1 percent, or approximately 0.61 mgd, between 2010 and 2035 (Table 3.2). The total 2035 water demand is projected to reach approximately 95.99 mgd. Decreases in I/C/I water demands are projected at 5.10 mgd by 2035. Public supply water demand is projected to reach 42.51 mgd for an increase of 2.96 mgd or 7.5 percent. Water demand increases or decreases for the remaining use categories are relatively small.

Table 3.2 Region I Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	39.55	40.13	40.85	41.48	42.04	42.51
Domestic self-supply	1.46	1.46	1.48	1.50	1.51	1.52
Ind./Comm./Inst. (I/C/I)	32.20	28.91	28.07	27.08	27.09	27.10
Recreational self-supply	3.69	3.74	3.81	3.86	3.91	3.96
Agricultural use	2.57	3.32	3.32	3.32	3.32	3.32
Power generation	15.91	15.91	17.59	17.59	17.59	17.59
Total	**95.38**	**93.48**	**95.11**	**94.83**	**95.46**	**95.99**

1-in-10 Year Drought Projections

Projected water demands for a 1-in-10 year drought event are shown in Table 3.3. The 2035 total water demand for a 1-in-10 year drought is about 4 percent higher than the 2035 total average year water demand.

Table 3.3 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd)

	Projected				
Water Use Category	2015	2020	2025	2030	2035
Public supply	42.94	43.71	44.39	44.98	45.48
Domestic self-supply	1.57	1.59	1.60	1.61	1.62
Ind./Comm./Inst. (I/C/I)	28.91	28.07	27.08	27.09	27.10
Recreational self-supply	4.16	4.23	4.30	4.35	4.40
Agricultural use	3.71	3.71	3.71	3.71	3.71
Power generation	15.91	17.59	17.59	17.59	17.59
Total	**97.20**	**98.90**	**98.67**	**99.34**	**99.90**

3.1.2 *Assessment of Water Resources*

Escambia County depends on both surface and groundwater, with groundwater supplying the vast majority of all fresh water used in the region. Due to highly mineralized water in the Floridan aquifer system, the sand-and-gravel aquifer is the principal source of groundwater for Escambia County. Given the high availability of good quality water, it is anticipated that this use pattern will continue through the year 2035. Local rivers and bays in the region are part of large watersheds that extend into Alabama and other areas of northwest Florida. The estuaries in the region depend substantially upon surface water inflows, with only minor groundwater contributions.

Groundwater Resources

In order of depth, the hydrogeologic units which describe the groundwater flow system are the surficial aquifer system, the intermediate confining unit, the Floridan aquifer system, and the sub-Floridan system.

In Region I, the surficial aquifer system is referred to as the sand-and-gravel aquifer. It ranges in thickness from 350 to 530 feet. In southern Escambia County, the sand-and-gravel aquifer includes a surficial zone, low-permeability zone, and main-producing zone. The surficial zone consists of fine to medium-grained sand, with gravel beds and lenses (Randazzo and Jones 1997). The low-permeability zone is 20 to 100 feet thick. The relatively leaky nature of the low permeability zone enables water from the surficial zone to readily recharge the underlying main-producing zone to varying degrees. This leakiness ranges from excessively leaky where the zone is thinner and contains more sand to non-leaky where the zone is thicker and consists almost entirely of clay. The low permeability zone is typically much leakier in the southern half of the county. The main-producing zone is comprised of highly productive sand and gravel layers interbedded with clayey layers. Well yields often exceed 1,000 gallons per minute (gpm) and may reach 2,500 gpm. Where the land surface elevations increase and the relief is high, particularly in northern Escambia County, the main producing zone is divided by multiple low permeability zones. Also, discontinuous clay layers in the unsaturated zone may locally cause perched water table conditions which might support surface water features during wetter periods.

The intermediate confining unit is an effective, regional confining unit, which significantly restricts groundwater flow between the sand-and-gravel aquifer and the underlying Floridan aquifer system. The intermediate confining unit does contain a minor aquifer, the Escambia Sand. However, poor water quality, limited thickness, and depths of 600 to 900 feet to the top of the unit make the Escambia Sand an unviable groundwater source.

Below the intermediate confining unit is the Floridan aquifer system. The Bucatunna clay, a highly effective middle confining unit, separates the upper and lower carbonate units of the Floridan aquifer system in this region. Both the upper and lower Floridan aquifer contain highly mineralized water. The top of the upper Floridan aquifer unit ranges from approximately 350 feet below sea level in northeast Escambia County to approximately 1,450 feet below sea level in the southwest. The lower Floridan aquifer is hydraulically isolated from the potable water flow system and is used for injection of acidic industrial waste. Due to the depth of the upper Floridan aquifer and the poor quality of water, the sand-and-gravel aquifer, with its high availability of water in wells less than 300 feet deep, is a much-preferred source of water.

The sub-Floridan system underlies and confines the Floridan aquifer system. The hydraulic conductivity of this unit is considerably lower than that of the overlying Floridan aquifer. The sub-Floridan system forms the base of the Floridan aquifer system.

<u>Groundwater Flow in the Sand-and-Gravel Aquifer</u>

The potentiometric surface of the main-producing zone as interpreted for May 2007 is shown in Figure 3.3. During this time, the potentiometric surface reaches a height of approximately 220 feet above sea level in the northern Escambia County. From this high point, water levels decline to the east, west, and south. The Escambia and Perdido rivers, along with some wells, are major discharge points for the aquifer in the northern half of the region. South of Cantonment, water levels in the main-producing zone increase, reaching an elevation of about 60 feet above sea level near the intersection of Interstate 10 and Highway 29. From here, groundwater elevations decline in all directions.

Groundwater moves to points of discharge, including wells, the Perdido and Escambia rivers, small streams, Perdido Bay, and the Pensacola Bay System. The locations of wells used in subsequent discussions are also shown in Figure 3.3.

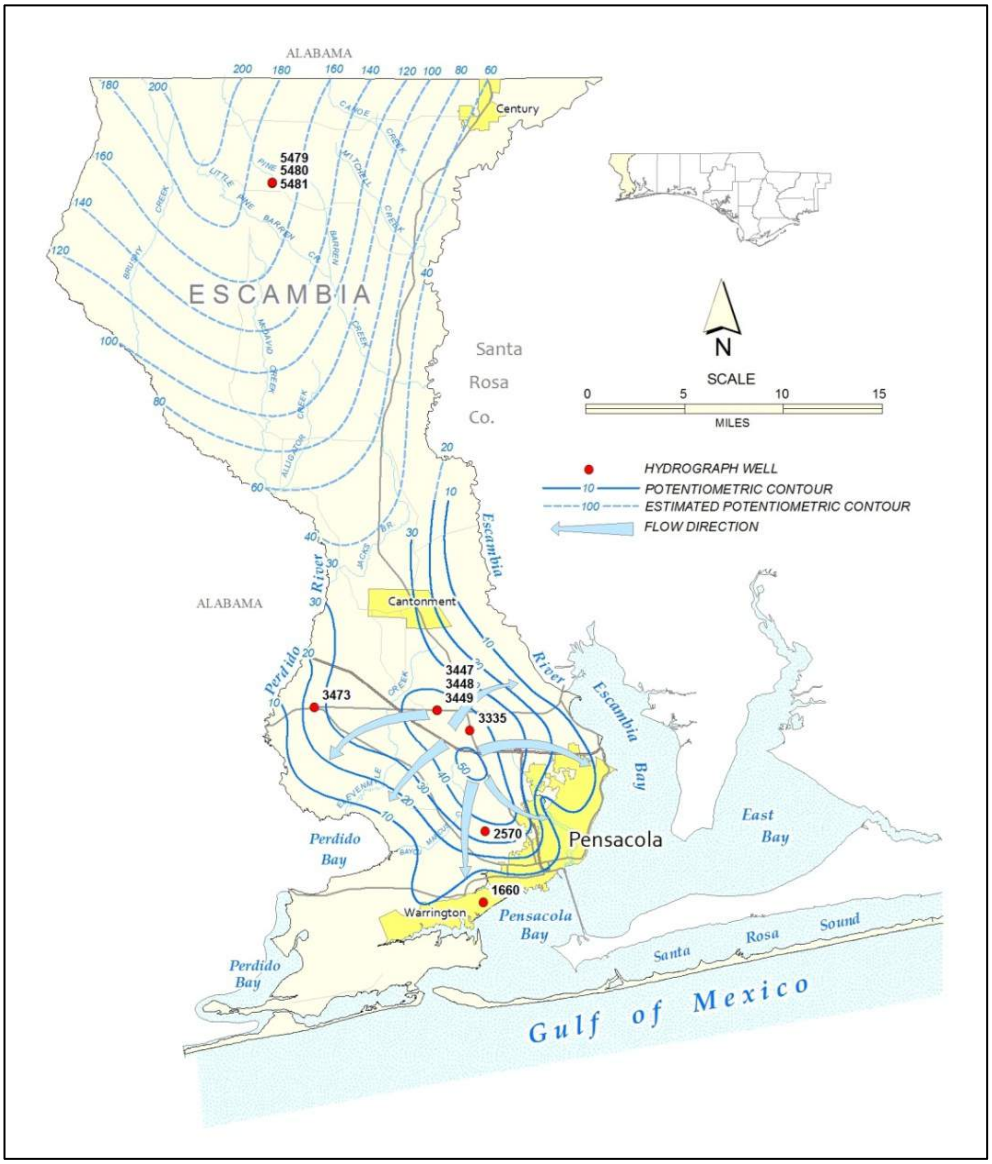


Figure 3.3 Observed Potentiometric Surface of the Main-Producing Zone of the Sand-and-Gravel Aquifer, Escambia County, Florida, May 2007

<u>Assessment Criteria</u>

The criteria used to assess the impacts of groundwater withdrawals on water resources and associated natural systems include long-term depression of the potentiometric surface of the main-producing zone of the sand-and-gravel aquifer and attendant alteration of groundwater quality and reductions in regional groundwater discharge to streams (e.g., reductions in base flow). A regional groundwater budget was also used to evaluate the relative magnitude of groundwater withdrawals. Because the majority of the regional population and water use occur in the southern half of Region I, this assessment focuses primarily on that area.

<u>Impacts to Groundwater Resources and Related Natural Systems</u>

The sand-and-gravel aquifer is recharged primarily by local rainfall. The duration and magnitude of rainfall directly affects water level trends. Hydrographs for two well clusters show water level trends and the difference in low permeability zone leakiness between northern and southern Escambia County (Figure 3.4). The well clusters consist of wells at the same site in the surficial zone, the underlying shallow main producing zone, and the deeper main producing zone. Data are presented for a well cluster near Oak Grove (NWFIDs 5479, 5480, 5481) in northern Escambia County and along Nine Mile Road (NWFIDs 3447, 3448, 3449) in southern Escambia County. The locations of all wells are shown on Figure 3.3.

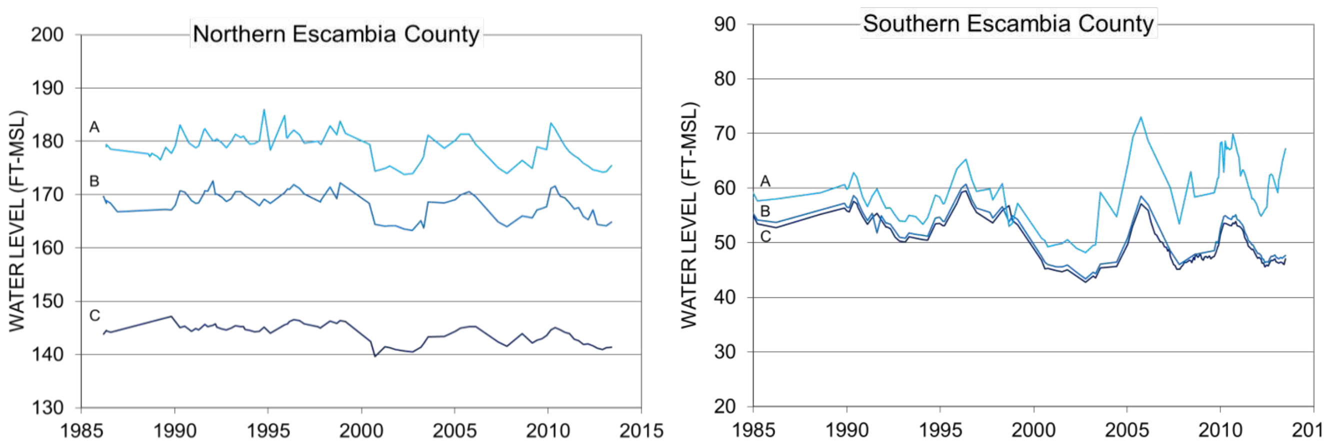


Figure 3.4 Hydrographs of Sand-and-Gravel Wells near Oak Grove (Northern Escambia County) and along Nine Mile Road (Southern Escambia County) in the A) Surficial Zone, B) Main Producing Zone, and C) Deep Main Producing Zone

In northern Escambia County, where low permeability zones in the sand-and-gravel aquifer are not as leaky, there is greater difference in measured water levels between the surficial zone and the underlying main producing zone. The water levels in the deeper part of the main producing zone are a subdued reflection of the surficial zone. Recharge from the surficial zone is reduced in this part of the county relative to the southern portion of the county. In southern Escambia County, the main producing zone is less confined by the leakier low permeability zone creating a smaller head gradient between aquifer zones and allowing more recharge to the main producing zone. However, the divergence of the Nine Mile Road hydrographs between the surficial zone and main producing zone may indicate that the increased development of groundwater in southern Escambia County is depressing the potentiometric surface of the main producing zone. This condition should be closely monitored and re-evaluated at the time of the next WSA update. Both hydrographs show the dips in water levels associated with drought conditions during 1999-2001, 2006-2007, and 2010-2012. It is expected that southern Escambia County will continue to provide the majority of groundwater used in this region during the 2015 to 2035 planning period. There is currently much less groundwater development in northern Escambia County. Full exploration of the groundwater potential of northern Escambia County will likely be necessary to meet growing demands.

Additional long-term trends can be seen in the hydrographs below for a well in Pensacola (Figure 3.5A) and a well near Beulah (Figure 3.5B). The locations of these wells are shown on Figure 3.3 and indicated on the map by the NWFID number shown in the upper right hand corner of the associated graph.

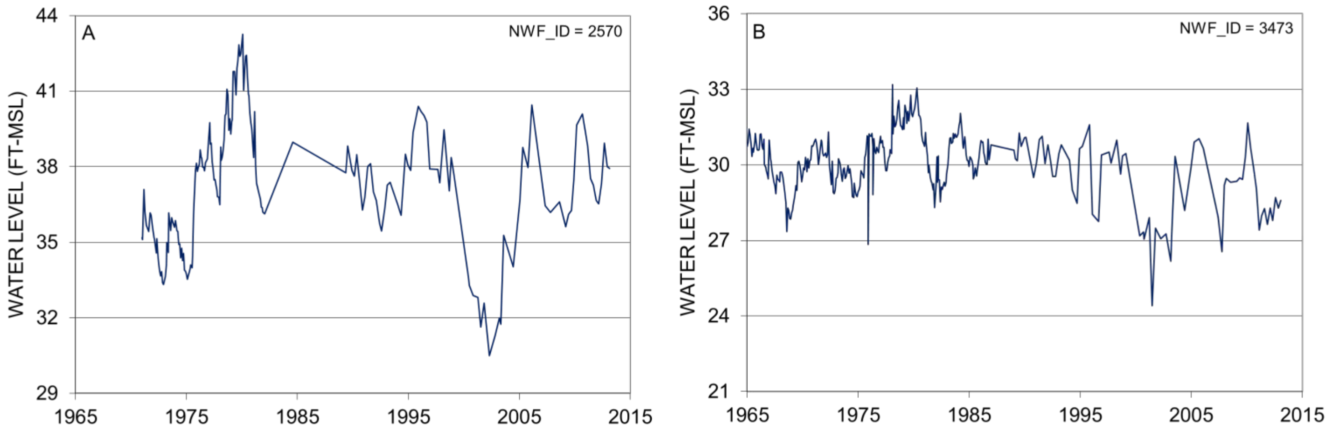


Figure 3.5 Hydrographs of Sand-and-Gravel Wells: A) USGS TH2 and B) USGS 032-7241A

Overall, the long-term fluctuation of water levels in these two wells appears to be primarily related to, and coincide with, rainfall variations. Both hydrographs show seasonal water level variations. The Beulah well (Figure 3.5B) exhibits a negative water level trend between 1959 and 1967. Both hydrographs depict a positive trend between 1975 and 1980. A regional drought between 1980 and 1983 caused groundwater levels to drop between 5 and 7 feet. The hydrographs show recovering water levels throughout the rest of the decade as above normal rainfall occurred. Through most of the 1990s, alternating wet and dry years resulted in modest variations in annual water levels, with a slight negative trend.

Northwest Florida experienced an extended drought starting in 1999 and continuing through the spring of 2001. Between March 2000 and February 2001, drought conditions within Region I varied from moderate to exceptional, according to the National Drought Mitigation Center. During this time water levels in the main producing zone declined, as can be seen in the hydrographs (Figure 3.5). Although normal rainfall returned in mid-2001, groundwater levels continued to drop to historic levels as infiltrating groundwater had yet to reach the water table in areas of higher elevation. By late 2002, groundwater levels had dropped about 7 feet from 1999 levels. Water levels recovered over the next three years as Region I experienced above average rainfall. In 2006, rainfall was again below normal and groundwater levels again began to steadily fall. By late 2007, water levels had declined 4 to 5 feet from 2006 levels. The magnitude of the water level response to rainfall variations and the expression of long-term trends are due, in part, to each well's location relative to recharge/discharge areas; larger responses are observed in wells located near the center of recharge areas and away from discharge areas.

Another example of water level trends in southern Escambia County is shown in the hydrograph for USGS 031-716-1 (Detroit Blvd, 3335) (Figure 3.6). This well is also open to the main-producing zone. Large fluctuations in water level are observed in this well due to its location near the groundwater high in the center of the recharge area and its proximity to several major supply wells. Seasonal variations and a long-term negative trend exist throughout the period of record. Water levels experienced a maximum decline of approximately 35 feet. This decline, although notable, is exaggerated by extreme climatic

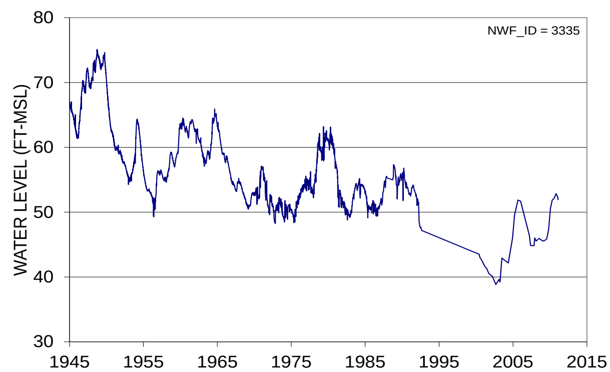


Figure 3.6 Hydrograph of Sand-and-Gravel Well USGS 031-716-1

conditions that existed at the beginning and end of the record period. The 1940s were an extremely wet period, elevating water levels to historic highs. By contrast, drought conditions during the last 15 years have reduced water levels to historic lows. Extended and more frequent dry periods combined with increased groundwater development appear to be the primary cause of long-term water level declines. Continued water level monitoring in Region I is needed to evaluate future water resource sustainability.

In 2010, withdrawals from the sand-and-gravel aquifer were estimated at approximately 80.46 mgd. Even at this pumping level, most impacts to the potentiometric surface of the main producing zone are limited due to well spacing and the substantial aquifer recharge rate. More significant impacts are limited to areas of concentrated withdrawals in the southern half of Region I. These areas include Cantonment, areas adjacent to the Escambia River southeast of Cantonment, and areas adjacent to Pensacola Bay in Warrington. Pumpage effects on water levels in the northern half of the region are significantly less due to limited pumpage in that area. Localized depression of the potentiometric surface due to pumping can potentially reduce the groundwater contribution to surface water features and induce intrusion of saltwater along the coast and bay areas.

Impacts to groundwater levels due to pumping, although limited, are persistent. The impact of localized, concentrated pumping has resulted in the periodic measurement of water levels below sea level within the main-producing zone. Water levels below sea level have been measured adjacent to the Escambia River in the vicinity of the Crist Plant and Solutia, Inc., and along Pensacola Bay in Warrington. Depressed water levels have been observed in these areas since the 1970s. These drawdowns are of concern to water quality due to their close proximity to the saltwater interface, as discussed below. Water level and water quality monitoring are typically required of permitted users in these areas.

Hydraulic heads in the sand-and-gravel aquifer in south/central Escambia County are currently 50 to 60 feet above sea level (Figure 3.3). This positive head gradient holds the saltwater interface just beyond the coastline beneath the bay system. Careful placement of major supply wells has prevented the salt water from migrating inland. However, the fresh water within the sand-and-gravel aquifer is in close hydraulic connection with salt water beneath the coastal bays and estuaries. Since excessive pumping would result in saltwater intrusion problems, continued careful planning in the coastal fringe is necessary.

Evidence of this potential problem can be seen in water quality data from a public supply well located approximately 2,000 feet from Pensacola Bay in Warrington. Water levels in the well between July 2003 and July 2009 averaged between 6 and 14 feet below sea level. Water levels currently average 3 feet below sea level. Water quality data for the same time period indicate that sodium, chloride, and total dissolved solids concentrations have more than doubled and continue to increase (Figure 3.7). If these water quality trends continue sodium concentration may exceed the 160 mg/L guidance concentration by 2030. Chloride concentrations may exceed the 250 mg/L maximum contaminant level (MCL) by the end of 2019 and total dissolved solids concentrations may exceed the 500 mg/L MCL by early 2018.

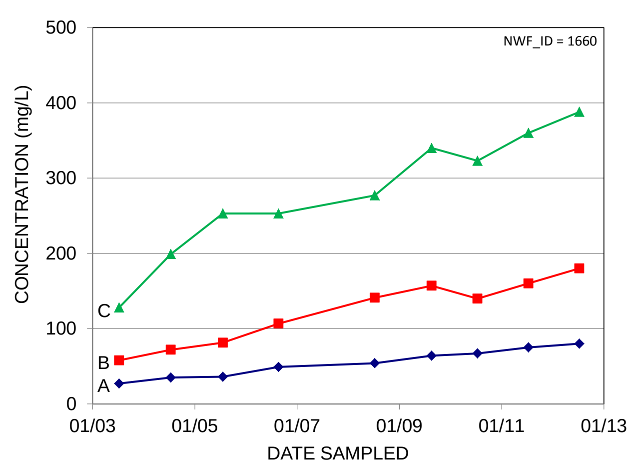


Figure 3.7 Peoples #4 Water Quality A) Sodium (Na^+), Chloride (Cl^-), and C) TDS

The sand-and-gravel aquifer is highly susceptible to contamination from surface spills and waste disposal practices. Anthropogenic impacts have historically polluted the surficial zone of the sand-and-gravel aquifer in the southern half of the region. Because the main-producing zone is readily recharged by leakage from the surficial zone, contamination has spread to the main-producing zone (Roaza et al. 1991). Numerous public supply wells in the region have documented the presence of chlorinated solvent, petroleum hydrocarbon, and pesticide contamination (Ma et al. 1999). Water from these wells is treated to remove these contaminants before being introduced into the water distribution systems.

The District, ECUA, and other local utilities have worked together to limit future contamination of public supply wells (Richards et al. 1997). Wellhead protection areas (WHPA) have been incorporated into the Escambia County Land Development Code. The regional groundwater flow model (Roaza et al. 1993) on which the existing WHPAs are based is currently being updated by ECUA and will allow for the delineation of WHPAs for recent and future public supply wells, as well as for the evaluation of potential saltwater intrusion and wetland impacts due to pumping. Much of this ongoing effort is supported with new and existing data provided by the District.

Groundwater Budget

The water budget developed in support of the 1998 WSA (Ryan et al. 1998) presents an order-of-magnitude approximation of the major sources and discharges to the main-producing zone of the sand-and-gravel aquifer in Region I (Figure 3.8). The recharge rate to the main-producing zone (166 mgd) equates to approximately 5.3 in/yr over the region (Ryan et al. 1998). Major discharges from the main producing zone include discharge to surface water features and groundwater withdrawal via wells. The simulated discharges to the Escambia and Perdido rivers were 38.1 mgd and 10.0 mgd, respectively.

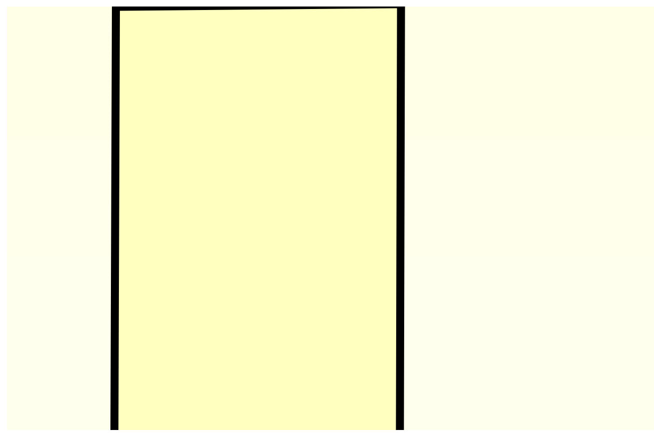


Figure 3.8 Region I Sand-and-Gravel Aquifer Steady-State Ground Water Budget

Although not explicitly simulated, the 2010 groundwater use of 80.46 mgd represents 48 percent of the water budget of the main-producing zone. The projected 2035 groundwater demand (79.64 mgd) represents 48 percent of the water budget of the main producing zone in Region I. The groundwater demand for a 1-in-10 year drought event (83.45 mgd) represents 50 percent of the water budget of the main producing zone. Although the projected groundwater demands appear to represent a large percentage of the water budget, the groundwater budget does not account for flow within the surficial zone or additional recharge to the main producing zone induced by the increase in pumpage.

Because this simulated water budget is only for the main-producing zone, the projected water demand was also compared to the estimated inflow for the entire sand-and-gravel aquifer in Region I. Vecchioli et al. (1990) calculated the average total recharge to the sand-and-gravel aquifer (including the surficial zone) for select sites in nearby Okaloosa County and portions of Santa Rosa and Walton counties to be approximately 20 in/yr. This recharge rate can generally be applied to Region I, based on the similarity of topography and the sand-and-gravel aquifer between regions. Given an estimated recharge rate of 20 in/yr to the entire aquifer within Escambia County, the 2010 groundwater withdrawals of 80.46 mgd represent approximately 13 percent of the total sand-and-gravel aquifer water budget (629.4 mgd). The projected 2035 groundwater demand (79.64 mgd) represents approximately 13 percent of the total sand-and-gravel aquifer water budget. The 2035 demand for a 1-in-10 year drought event (83.45 mgd) also represents approximately 13 percent of the total groundwater budget. Given the close hydraulic connection between the sand-and-gravel aquifer and surface waters, groundwater withdrawals are expected to reduce discharge to surface waters on a regional scale by an amount equal to or somewhat less than the amount withdrawn.

The Escambia and Perdido rivers have significant total flows and are not likely to be adversely impacted by relatively small changes in baseflow even under low flow (Q_{90}) conditions. The Q_{90} flow is the flow exceeded 90 percent of the time for the period of record. The median flow and the Q_{90} flow in the Escambia River at Molino are estimated to be 2,608 mgd (4,035 cfs) and 1,015 mgd (1,570 cfs), respectively, for the 1983-2013 period of record. The median flow and the Q_{90} flow in the Perdido River at Barrineau Park are estimated to be 322 mgd (498 cfs) and 184 mgd (284 cfs), respectively, for the 1941-2013 period of record. Relatively small changes in bay discharge are also not likely to have an adverse impact. There is, however, a potential for localized impacts to small streams and wetlands. Such impacts are evaluated and addressed through the District's consumptive use permitting process.

Given the relative magnitude of projected 2035 demands compared to the groundwater budget for the entire sand-and-gravel aquifer in Region I, significant regional impacts to water resources and related natural systems as a result of groundwater withdrawals are not anticipated. However, localized impacts may be of concern and continued monitoring of water levels and water quality is necessary to support future evaluations of resource sustainability.

<u>Water Quality Constraints on Availability</u>

Groundwater from the sand-and-gravel aquifer has a low mineral content and is suitable for all uses. However, water quality constrains the availability of water from the sand-and-gravel aquifer in localized areas. The high permeability of the sand-and-gravel aquifer, which contributes to the high groundwater availability, also facilitates the movement of contaminants.

The major water quality constraint is surface contamination, which migrates into the aquifer and contaminates wells. Nearly half of the major supply wells located in southern Escambia County have been impacted by contaminants. Although treatment facilities successfully remove the contaminants prior to distribution, the cost of treatment is driving consideration of developing new groundwater sources in northern Escambia County. The potential for saltwater intrusion also constrains pumping near saline surface waterbodies. Excessive withdrawals in the coastal fringe will induce the movement of salt water towards these wells.

<u>Adequacy of Groundwater Resources</u>

In Region I, the existing and reasonably anticipated groundwater sources are currently considered adequate to meet the projected 2035 average and 1-in-10 year drought event demands, while sustaining water resources and related natural systems. Observed water level impacts and water quality issues are currently localized. Data indicates that the sand-and-gravel aquifer is capable of sustaining projected withdrawals; however, expanded water level and water quality monitoring are needed to confirm sustainability. To ensure groundwater resource sustainability, increases in groundwater supply development in the coastal fringe areas should not be expected (Roaza et al. 1996).

Surface Water Resources

Surface water in Region I is used primarily for industrial use and as cooling water for power production. The primary sources used are the Escambia River and Governor's Bayou.

The Escambia River is 240 miles long and has its headwaters in Alabama. The watershed area is 4,233 mi^2 (Fernald and Purdum 1998). Near the Town of Century, the median stream flow is 2,327 mgd (3,600 cfs), based on 79 years of data from the USGS. The low flow (Q_{90}) for the same period is 827 mgd (1,280 cfs). As discussed previously, the USGS gauging station further south near Molino has data from 1983 through 2013. The median and Q_{90} flows estimated for this site are 2,608 mgd (4,035 cfs) and 1,015 mgd (1,570 cfs), respectively. Thus, the median flow for the Escambia River increases 281 mgd between these two sites. The median flow at the Molino gauging station has decreased approximately 12 percent since 2008 due to prolonged drought conditions starting at the end of 2010 and ending in mid-2012.

Governor's Bayou, a source of water for power generation, is located just north of the Crist Plant, approximately 7 miles south of the Molino gage site. The bayou is formed by a diversion from the Escambia River that rejoins the main channel further downstream.

Assessment Criteria

The primary assessment criterion for surface water availability is the sustainability of surface water resources and associated natural systems.

Impacts to Surface Water Resources and Related Natural Systems

Although approximately 296 mgd of surface water was withdrawn from the Escambia River and Governor's Bayou for industrial use and power production in 2010, only about 14.92 mgd was consumptively used. The remainder was returned to its source. This consumption represents only 1 percent of the Q_{90} flow at the Molino gage for the 1983 through 2013 period. By 2035, consumptive surface water withdrawals from the Escambia River area are projected to remain about the same or even decrease slightly.

Water Quality Constraints on Availability

Surface water quality is suitable for all intended uses and there are no current water quality constraints.

Adequacy of Surface Water Resources

In Region I, the existing and reasonably anticipated surface water sources are considered adequate to meet the projected 2035 demands, while sustaining water resources and related natural systems.

Reclaimed Water

In 2010, approximately 1.18 mgd or 5 percent of the wastewater generated in Escambia County was reused at wastewater treatment facilities (Table 3.4). ECUA's Central Water Reclamation Facility wastewater treatment plant came online in 2010 to replace the Main Street facility. The new wastewater plant may provide up to 31.85 mgd of reclaimed water, including 20 mgd for power generation and industrial uses at the Gulf Power Crist Facility and 8 mgd for industrial uses at International Paper. Additional opportunities exist for local governments and utilities to further develop reuse systems to meet industrial and irrigation water needs.

Table 3.4 Region I Reuse of Domestic Wastewater, 2010 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Reuse Flow that Replaces Potable-Quality Water*
Bayou Marcus WRF	8.20	6.51	0.00	0.00	0.00
ECUA-Main Street	20.00	16.45	7.00	1.13	0.00
Pensacola Beach WWTP	2.40	0.96	0.43	0.05	0.00
Town of Century WWTF	0.45	0.46	0.00	0.00	0.00
Escambia County Total	**31.05**	**24.37**	**7.43**	**1.18**	**0.00**

*Reuse Flow That Replaces Potable-Quality Water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses. Not included in this flow calculation are agriculture irrigation of other crops, absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant (Source: DEP reuse inventories).

Table 3.5 Region I Domestic Wastewater Flow Projections 2015 - 2035 (mgd)

Facility Name	2015	2020	2025	2030	2035
Bayou Marcus WRF	6.60	6.72	6.82	6.90	6.98
ECUA-Central WRF	14.30	14.55	14.77	14.97	15.13
Pensacola Beach WWTP	0.97	0.99	1.00	1.01	1.03
Town of Century WWTF	0.46	0.46	0.46	0.46	0.46
Escambia County Total	**22.32**	**22.72**	**23.05**	**23.34**	**23.59**

Table 3.6 Region I Available Reclaimed Water Projections 2015 - 2035* (mgd)

Facility Name	2015	2020	2025	2030	2035
Bayou Marcus WRF	6.60	6.71	6.82	6.90	6.98
ECUA-Central WRF	0.00	0.00	0.00	0.00	0.00
Pensacola Beach WWTP	0.88	0.90	0.91	0.92	0.93
Town of Century WWTF	0.46	0.46	0.46	0.46	0.46
Escambia County Total	**7.93**	**8.07**	**8.19**	**8.29**	**8.37**

*Projections are for potentially available reclaimed water and do not take into account planned expansions of reuse systems.

Conservation

Conservation measures ECUA has taken to address water loss include a computerized system to monitor pressure and flow changes, electronic meter reading and monitoring, distribution system maintenance, and on-demand leak repair. ECUA's demand management measures include public education through flyers, billing, website, news media, presentations to schools and civic organizations, door hangers for hotels, and watering restrictions during drought. Peoples Water Service alerts customers of suspected leaks and has an acoustic leak detector. As of 2010, the company has replaced all meters with radio read meters. A public education program conveys water conservation information in an annual report, website, and billing messages.

Implementation of additional conservation measures in Escambia County could reduce future demands on ground and surface water sources. The Conserve Florida EZ Guide tool can help utilities evaluate cost-effective conservation measures for their situation. It is estimated that 0.22 mgd could be saved by the year 2035 by reducing gross per capita use to 150 gpcd. This would be a 16 percent savings for the two utilities whose per capita rate exceeds this level; the Town of Century and Molino Utilities. Per capita rates could be reducing through measures aimed at improving water system efficiency (e.g., reducing water losses in the distribution system) and water conservation measures.

3.1.3 *Determination of the Need for a Regional Water Supply Plan*

The ground and surface water resources in Region I are anticipated to be adequate to meet the projected average water demands and demands for a 1-in-10 year drought event through 2035 without causing adverse impacts to water resources and related natural systems. Therefore, no RWSP is recommended at this time.

3.2 Region II: Okaloosa, Santa Rosa and Walton Counties

Region II is within the Pensacola Bay System and the Choctawhatchee River and Bay watersheds. The three-county region contains 15 municipalities and several large public supply utilities, including two regional water supply providers (Figure 3.9). The population is concentrated in the coastal area, which also has had the highest growth rate in the region. The coastal area experiences seasonal fluctuations in water demand associated with tourism and part-time residents. Large public landholdings include Eglin Air Force Base (AFB), which covers approximately 464,000 acres in the center of the region, and the Blackwater State Forest, which covers approximately 206,000 acres in northern Okaloosa and Santa Rosa counties. The State of Florida also owns 19,931 acres in southern Walton County, including Point Washington State Forest, several state parks and recreation areas, and a state preserve. Additionally, the District owns and manages 71,281 acres in the Blackwater River, Escambia River, Choctawhatchee River, Garcon Point, and Yellow River water management areas.

Region II Snapshot		
	2010	2035
Population	387,237	522,400
Water Use (mgd)	~ 74	~ 101
Primary Sources	Floridan Aquifer/ Sand-and-Gravel Aquifer	
RWSP Status	Implementation	

Figure 3.9 Map of Region II

All three counties rely primarily upon groundwater from the sand-and-gravel and Floridan aquifers. In the coastal area, the historical landward movement of the saltwater interface limits groundwater withdrawals from the Floridan aquifer. During the past 10 years, initiatives on the part of the District and coastal utilities have successfully reduced Floridan aquifer withdrawals along the coast, enabling water level recovery in coastal areas. Surface water is not currently used to any significant degree in the region.

3.2.1 *Water Use Estimates and Projections*

Public Supply

Public supply water use in Region II totaled 45.72 mgd in 2010 (Table 3.7 through Table 3.12), the highest use of all seven planning regions. Within Region II, there are 40 public supply utilities, some of which are involved in sizeable water transfers between utilities or systems to bring inland groundwater to the coast. In addition, there are inter-county water supply transfers. To better understand these transfers and the disjunction of local water demands and regional water supplies anticipated to meet those demands, separate tables have been provided on retail demand (end use) and production (withdrawals). Two permitted systems are solely wholesale producers of water (Fairpoint Regional Utility System and South Walton Utility Company's Rockhill Inland Well Field), two utilities rely solely on purchased water (Gulf Breeze Water Department and South Santa Rosa Utilities) and are therefore not required to have a consumptive use permit; other utilities produce their own water and some participate in water purchases and/or sales.

Fairpoint Regional Utility System provides water from the inland sand-and-gravel aquifer to meet the needs of the City of Gulf Breeze and South Santa Rosa Utility System. It also supplies 86 percent of Midway's water and about 50 percent of water used by the Holley-Navarre and Navarre Beach water systems. South Walton Utility Company, Inc., withdrawing from the inland Floridan aquifer, provides water to its coastal customers in Walton and Okaloosa counties and to Destin Water Users in Okaloosa County. Okaloosa County Water and Sewer transfers water from its mid-county system to its Garniers system on the coast. Florida Community Services Corporation of Walton County (dba Regional Utilities) withdraws groundwater from inland Floridan aquifer wells, purchases water from the City of Freeport, and supplies about 20 percent of Inlet Beach's water.

The largest water demand in 2010 was from Okaloosa County Water and Sewer, Main service area (aka Garniers) (4.98 mgd), Pace Water System, Inc. (3.67 mgd), and Destin Water Users (3.51 mgd). The largest 2010 raw water withdrawals were from Fairpoint Regional Utility System (4.06 mgd), Pace Water System, Inc. (3.67 mgd), South Walton Utility Company, (3.58 mgd), and Okaloosa County Water and Sewer, Main (Garniers) (3.48 mgd).

Public supply water demands are anticipated to increase 14.28 mgd to approximately 60.0 mgd by 2035. This is a reduction of over 10 mgd from the 2030 projection in the 2008 WSA and appears to reflect the global economic slowdown.

Within the WRCA, there has been a steep increase in the number of permits issued to construct private irrigation wells in the surficial aquifer over the last four years. This is due to the prohibition on new or expanded use of the Floridan aquifer for non-potable purposes such as landscape and golf course irrigation in this area. This serves to keep utility gross per capita rates down and reduces reliance on the Floridan aquifer.

Table 3.7 Okaloosa County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated			Projected		
Utility	2010	2015	2020	2025	2030	2035
Auburn Water System	1.47	1.64	1.75	1.86	1.97	2.08
Baker Water System	0.25	0.26	0.27	0.28	0.29	0.30
Blackman Community Water System, Inc.	0.00	0.03	0.03	0.03	0.03	0.03
Crestview, City of	2.63	2.94	3.14	3.33	3.53	3.72
Destin Water Users	3.51	3.57	3.63	3.70	3.76	3.83
Fort Walton Beach, City of	2.67	2.67	2.67	2.67	2.67	2.67
Holt Water Works, Inc.	0.15	0.16	0.17	0.17	0.18	0.18
Laurel Hill, City of	0.16	0.16	0.16	0.16	0.16	0.16
Mary Esther, Town of	0.46	0.46	0.46	0.46	0.46	0.46
Milligan Water System	0.15	0.16	0.16	0.17	0.17	0.18
Niceville, City of	2.62	2.79	2.96	3.15	3.35	3.56
Okaloosa County Water & Sewer, Bluewater	1.41	1.44	1.48	1.52	1.55	1.59
Okaloosa County Water & Sewer, Main (Garniers)	4.98	4.98	4.98	4.98	4.98	4.98
Okaloosa County Water & Sewer, Mid-County	0.94	1.05	1.12	1.19	1.26	1.32
South Walton Utility Co., Coastal Well Field (Okaloosa County demand)	0.62	0.66	0.68	0.70	0.73	0.75
Valparaiso, City of	0.49	0.50	0.51	0.52	0.53	0.54
Total	**22.51**	**23.47**	**24.17**	**24.88**	**25.61**	**26.33**

Table 3.8 Okaloosa County Public Supply Water Production Projections, 2010 - 2035 (mgd)

	Estimated			Projected		
Utility	2010	2015	2020	2025	2030	2035
Auburn Water System	1.47	1.64	1.75	1.86	1.97	2.08
Baker Water System	0.25	0.26	0.27	0.28	0.29	0.30
Blackman Community Water System, Inc.	0.00	0.03	0.03	0.03	0.03	0.03
Crestview, City of	2.63	2.94	3.14	3.33	3.53	3.72
Destin Water Users	1.78	1.82	1.77	1.77	1.77	1.77
Fort Walton Beach, City of	2.67	2.67	2.67	2.67	2.67	2.67
Holt Water Works, Inc.	0.15	0.16	0.17	0.17	0.18	0.18
Laurel Hill, City of	0.16	0.16	0.16	0.16	0.16	0.16
Mary Esther, Town of	0.46	0.46	0.46	0.46	0.46	0.46
Milligan Water System	0.15	0.16	0.16	0.17	0.17	0.18
Niceville, City of	2.62	2.79	2.96	3.00	3.00	3.00
Okaloosa County Water & Sewer, Bluewater	1.41	1.44	1.48	1.50	1.50	1.50
Okaloosa County Water & Sewer, Main (Garniers)	3.48	3.48	3.48	3.48	3.48	3.48
Okaloosa County Water & Sewer, Mid-County	2.44	2.55	2.62	2.70	2.81	2.92
Valparaiso, City of	0.49	0.50	0.51	0.52	0.53	0.54
Total	**20.16**	**21.06**	**21.63**	**22.10**	**22.54**	**22.97**

Table 3.9 Santa Rosa County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

Utility	Estimated 2010	Projected 2015	2020	2025	2030	2035
Bagdad-Garcon Point Water System	0.49	0.53	0.59	0.63	0.68	0.72
Berrydale Water System	0.23	0.23	0.25	0.25	0.26	0.26
Chumuckla Water System	0.35	0.38	0.41	0.45	0.48	0.50
East Milton Water System	1.29	1.38	1.52	1.65	1.76	1.86
Fairpoint Regional Utility System	-	-	-	-	-	-
Gulf Breeze Water Department	0.96	0.96	0.96	0.96	0.96	0.96
Holley-Navarre Water System, Inc.	2.64	2.92	3.27	3.61	3.93	4.21
Jay, City of	0.19	0.19	0.19	0.19	0.19	0.19
Midway Water System	1.21	1.30	1.43	1.55	1.65	1.75
Milton, City of	1.81	1.95	2.14	2.32	2.48	2.62
Moore Creek-Mt. Carmel Utilities, Inc.	0.28	0.28	0.30	0.31	0.32	0.32
Pace Water System, Inc.	3.67	4.07	4.64	5.21	5.77	6.29
Point Baker Water System, Inc.	0.79	0.85	0.94	1.02	1.09	1.15
Santa Rosa Board of County Commissioners,	0.28	0.28	0.30	0.31	0.31	0.31
South Santa Rosa Utilities	0.84	0.85	0.89	0.93	0.94	0.95
Total	**15.03**	**16.18**	**17.82**	**19.39**	**20.81**	**22.08**

Table 3.10 Santa Rosa County Public Supply Water Production Projections, 2010 - 2035 (mgd)

Utility	Estimated 2010	Projected 2015	2020	2025	2030	2035
Bagdad-Garcon Point Water System	0.49	0.53	0.59	0.63	0.68	0.72
Berrydale Water System	0.23	0.23	0.25	0.25	0.26	0.26
Chumuckla Water System	0.35	0.38	0.41	0.45	0.48	0.50
East Milton Water System	1.29	1.38	1.52	1.65	1.76	1.86
Fairpoint Regional Utility System	4.06	4.31	4.69	5.03	5.33	5.58
Gulf Breeze Water Department	0.00	0.00	0.00	0.00	0.00	0.00
Holley-Navarre Water System, Inc.	1.23	1.36	1.52	1.68	1.83	1.96
Jay, City of	0.19	0.19	0.19	0.19	0.19	0.19
Midway Water System	0.60	0.60	0.60	0.60	0.60	0.60
Milton, City of	1.81	1.95	2.14	2.32	2.48	2.62
Moore Creek-Mt. Carmel Utilities, Inc.	0.28	0.28	0.30	0.31	0.32	0.32
Pace Water System, Inc.	3.67	4.07	4.64	5.21	5.77	6.29
Point Baker Water System, Inc.	0.79	0.85	0.94	1.02	1.09	1.15
Santa Rosa Board of County Commissioners, Navarre Beach Water System	0.04	0.04	0.04	0.04	0.04	0.04
South Santa Rosa Utilities	0.00	0.00	0.00	0.00	0.00	0.00
Total	**15.03**	**16.18**	**17.82**	**19.39**	**20.81**	**22.08**

Table 3.11 Walton County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Argyle Water System	0.07	0.08	0.09	0.10	0.11	0.11
DeFuniak Springs, City of	1.53	1.53	1.53	1.53	1.53	1.53
FCSC of Walton Co. / Regional Utilities	2.84	3.13	3.52	3.89	4.21	4.50
Freeport, City of	0.70	0.78	0.87	0.96	1.05	1.12
Freeport, North Bay Water System	0.13	0.15	0.17	0.20	0.22	0.24
Inlet Beach	0.09	0.10	0.11	0.13	0.14	0.14
Mossy Head Water Works, Inc.	0.28	0.29	0.31	0.33	0.34	0.35
Paxton, City of	0.21	0.21	0.21	0.21	0.21	0.21
South Walton Utility Co., Rockhill Inland Well Field	-	-	-	-	-	-
South Walton Utility Co., Coastal Well Field (Walton County demand)	2.35	2.58	2.91	3.21	3.48	3.72
Total	**8.19**	**8.83**	**9.73**	**10.55**	**11.28**	**11.91**

Table 3.12 Walton County Public Supply Water Production Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Argyle Water System	0.07	0.08	0.09	0.10	0.11	0.11
DeFuniak Springs, City of	1.53	1.53	1.53	1.53	1.53	1.53
FCSC of Walton Co. / Regional Utilities	1.79	1.99	2.26	2.52	2.76	2.97
Freeport, City of	1.77	1.95	2.20	2.43	2.63	1.12
Freeport, North Bay Water System	0.13	1.45	1.63	1.78	1.92	2.04
Inlet Beach	0.07	0.08	0.09	0.10	0.11	0.12
Mossy Head Water Works, Inc.	0.28	0.29	0.31	0.33	0.34	0.35
Paxton, City of	0.21	0.21	0.21	0.21	0.21	0.21
South Walton Utility Co., Rockhill Inland Well Field	3.58	3.77	4.33	4.72	5.07	5.39
South Walton Utility Co., Coastal Well Field	1.11	1.22	1.13	1.13	1.13	1.13
Total	**10.54**	**12.57**	**13.77**	**14.84**	**15.80**	**14.95**

Domestic Self-Supply and Small Public Water Systems

The estimated population served by domestic self-supply and small public water systems was 38,987 in 2010. This population used an estimated 4.04 mgd of water in 2010. Demands are anticipated to increase to 6.62 mgd by 2035 (Table 3.13). The domestic self-supply population, calculated as the BEBR total county population minus the populations served by public supply utilities, is projected to grow from 10 to 11 percent of the regional population.

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

The I/C/I water use in Region II totaled 3.68 mgd in 2010 (Table 3.13). The sand-and-gravel aquifer and the coastal Floridan aquifer are the primary water sources for this use category. Large I/C/I water users include Eglin AFB, Hurlburt Field AFB, Taminco Methylamines, Inc., Santa Rosa Energy Center, Okaloosa Correctional Facility and Sterling Fibers. Projected I/C/I water demands for these users are anticipated to increase to 9.74 mgd, or by approximately 165 percent, by 2035. This dramatic increase is primarily due to projected demands for industrial use.

Recreation Self-Supply

The 2010 estimated water use for self-supplied landscape, residential and golf course irrigation, and aesthetic uses totaled 13.65 mgd in Region II (Table 3.13). Recreation water use continues to be the second largest use category in Region II. About two thirds of recreation use water in Region II was withdrawn from the main producing zone of the sand-and-gravel aquifer. The remaining third was split between other groundwater sources and surface water sources. Region II recreation water demands are anticipated to remain the second largest use in Region II, increasing to 17.78 mgd by 2035. Future demands will continue to be met by a combination of reclaimed water, surface water, and groundwater sources.

Agricultural Use

The estimated water used for agriculture was 6.54 mgd in 2010 (Table 3.13). Agriculture in Region II consists largely of container ornamentals, field crops, and pasture/hay. Some corn, vegetables, and fruit crops are also grown. Agricultural production is affected by market, economic, climatic, regulatory, and political factors; therefore, the future is difficult to predict. In determining the projected water use, District staff examined economic and regulatory factors along with various linear trends using annual numbers of agricultural well permits, permitted average daily rates, and new IWUPs. Due to the uncertainty of many of these factors, agricultural water use was projected for the year 2015 and then held constant through 2035. No changes in the agricultural water demands are anticipated between 2010 and 2015; therefore, water demand projections will remain constant at 6.54 mgd from 2010 through 2035.

Power Generation

There are no power generation facilities in Region II and District staff are not aware of any plans to develop power generation facilities in this region.

Total Water Use and Population

In 2010, average annual water use in Region II totaled 73.63 mgd (Table 3.13). The largest use categories were public supply (62 percent) and recreation self-supply (19 percent). The remaining use categories collectively accounted for the remaining 19 percent (Figure 3.10).

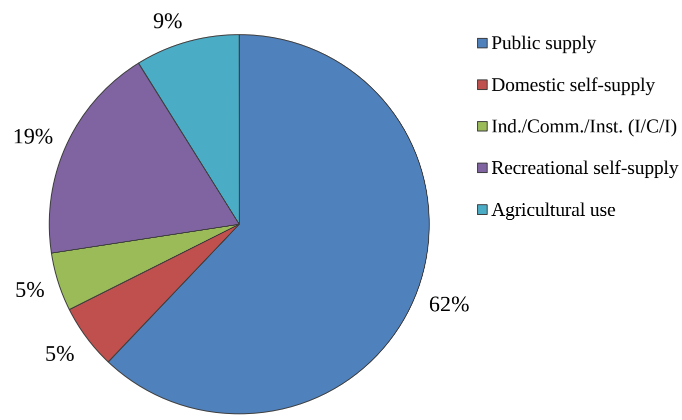


Figure 3.10 Region II Water Use by Category, 2010

The population in Region II was 387,237, according to the Census Bureau in 2010 (BEBR 2013). Population and public supply water use are both projected to increase over the planning period. The medium-range population projection for Region II in 2035 is 522,400 persons and represents a 35 percent increase from 2010 (BEBR 2013). It should be recognized that the actual population served in coastal Region II is heavily affected by tourism and seasonal populations. The population estimates and projections here, as calculated by the U.S. Census and BEBR, solely reflect permanent populations.

The total water demand in Region II is projected to increase by 37 percent, or by 27.17 mgd, between 2010 and 2035 (Table 3.13). The projected total 2035 water demand is approximately 100.76 mgd. Public supply water demands are estimated to grow by 14.55 mgd and account for the majority of the increase. Water demand will also increase for domestic self-supply, recreation self-supply, and I/C/I. The remaining use categories have no changes or are relatively small.

Table 3.13 Region II Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	45.72	49.81	53.21	56.33	59.15	60.00
Domestic self-supply	4.00	4.63	5.32	5.90	6.36	6.70
Ind./Comm./Inst. (I/C/I)	3.68	5.88	7.83	8.96	9.58	9.74
Recreational self-supply	13.65	14.42	15.36	16.25	17.06	17.78
Agricultural use	6.54	6.54	6.54	6.54	6.54	6.54
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**73.59**	**81.29**	**88.26**	**93.98**	**98.70**	**100.76**

1-in-10 Year Drought Projections

Projected water demands for a 1-in-10 year drought event are shown in Table 3.14. The total 2035 water demand for a 1-in-10 year drought is approximately 7 percent higher than the 2035 total average year water demand.

Table 3.14 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015-2035 (mgd)

	Projected				
Water Use Category	2015	2020	2025	2030	2035
Public supply	53.29	56.94	60.28	63.29	64.20
Domestic self-supply	4.99	5.69	6.27	6.71	7.01
Ind./Comm./Inst. (I/C/I)	5.88	7.83	8.96	9.58	9.74
Recreational self-supply	15.76	16.79	17.76	18.66	19.44
Agricultural use	6.96	6.96	6.96	6.96	6.96
Power generation	0.00	0.00	0.00	0.00	0.00
Total	**86.89**	**94.21**	**100.23**	**105.20**	**107.35**

3.2.2 *Assessment of Water Resources*

The hydrogeologic system, especially in the coastal area in Region II, has been heavily affected by groundwater withdrawals. Historical groundwater development along the coast has resulted in the depression of the Floridan aquifer potentiometric surface and has induced saltwater intrusion. Based on the results of the 1998 WSA, the District developed a RWSP for Region II (Bartel et al. 2000) and it was subsequently updated in 2006 (NWFWMD 2006) and 2012 (Busen and Bartel 2012). Although surface water was evaluated as an alternative water supply, it is reasonable to anticipate that significant reliance on groundwater will continue through the year 2035. Accordingly, the water resources evaluation presented here summarizes the results of the RWSP implementation and presents an updated evaluation of groundwater sustainability.

Groundwater Resources

In order of depth, the hydrogeologic units that describe the groundwater flow system are the surficial aquifer system, the intermediate system, the Floridan aquifer system and the sub-Floridan system. In Region II, the surficial aquifer system is specifically referred to as the sand-and-gravel aquifer. The sand-and-gravel aquifer is the primary water source for Santa Rosa County, while the Floridan aquifer is the primary source for Okaloosa and Walton counties. In 2010, groundwater from the sand-and-gravel aquifer system provided about 41 percent of the water used in the region, the Coastal Floridan aquifer provided about 26 percent, and the Inland Floridan aquifer provided about 30 percent. The remaining 3 percent consisted of surface water and water from the surficial and intermediate aquifers.

The sand-and-gravel aquifer consists of unconsolidated quartz sand, gravel, silt and clay ranging in thickness from less than 50 feet in Walton County to more than 400 feet in Santa Rosa County. Considerable local variation in the thickness of the sand-and-gravel aquifer occurs due to local topography and the somewhat irregular surface of the intermediate system. The sand-and-gravel aquifer exists under unconfined to semi-confined conditions. Discontinuous layers of silt and clay provide for semi-confined conditions in the lower portions of the aquifer. Recharge originates as rainfall. Based on hydrograph separation techniques applied to nine streams with at least 10 years of continuous flow records, recharge in and around Okaloosa County averages approximately 20 in/yr (Vecchioli et al. 1990). Because the intermediate system acts as a confining unit, most recharge to the sand-and-gravel aquifer discharges to local streams forming the stream baseflow component. Stream baseflow in this region is substantial and generally exceeds 1 cfs/mi^2 (Vecchioli et al. 1990). Sand-and-gravel aquifer wells in Santa Rosa County yield as much as 1,440 gpm. East of Santa Rosa County, the sand-and-gravel aquifer is less productive and is generally used for non-potable purposes. In coastal Okaloosa County, the sand-and-gravel aquifer has been evaluated as an alternative water supply. As much as 2.4 mgd may be available within the Ft. Walton Beach area (DeFosset 2004).

The intermediate system forms an effective confining unit, restricting the vertical flow of water between the overlying sand-and-gravel aquifer and the underlying Floridan aquifer. The intermediate system consists of fine-grained clastic sediments along with clayey limestone and shells, ranging in thickness from about 50 feet in northeast Walton County to over 1,000 feet in southwestern Santa Rosa County. Withdrawals from the intermediate system are mostly limited to the coastal area of southeastern Walton County and well yields are quite low.

Underlying the intermediate system, the Floridan aquifer system consists of a thick sequence of carbonate sediments of varying permeability and a regionally extensive clay confining unit. The top of the Floridan aquifer system dips from the northeast to the southwest, with the elevation of the top of the system ranging from approximately 100 feet above sea level to more than 1,200 feet below sea level. In Santa Rosa County and the western and coastal portions of Okaloosa County, the Floridan aquifer system is split into the upper and lower Floridan aquifer by the Bucatunna Clay. The Bucatunna Clay is a highly effective confining unit. To the east, where the Bucatunna Clay is not present, the Floridan aquifer is one hydraulic unit (Figure 3.18). Where the Bucatunna is present, the upper Floridan aquifer thickness varies from about 50 feet in northern Santa Rosa County to more than 400 feet in southern Okaloosa and Walton counties. Where the Bucatunna is absent, the Floridan aquifer reaches a total thickness of over 700 feet. Well yields for the Floridan aquifer are highly variable; the most productive areas are the central portions of Okaloosa and Walton counties, the Midway area, and the Destin area while poor well yields occur in the coastal fringe of Okaloosa and Walton counties.

The sub-Floridan system underlies and confines the Floridan aquifer system. The sub-Floridan system forms the base of the Floridan aquifer. Little is known of the hydraulic character of this unit in the region, but it is believed to be considerably lower than that of the overlying Floridan aquifer.

<u>Groundwater Flow in the Floridan Aquifer</u>

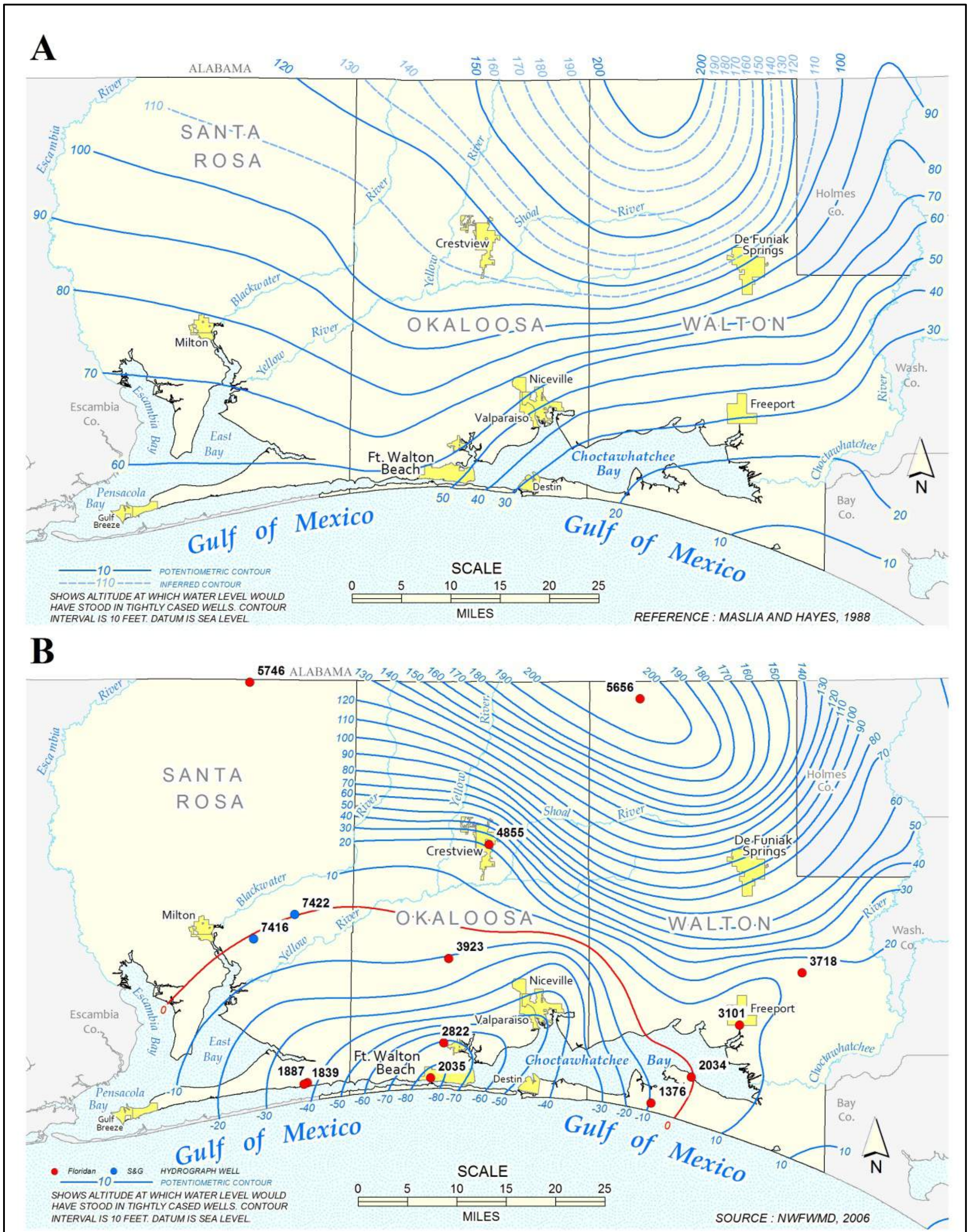


Figure 3.11 Potentiometric Surface of the Upper Floridan Aquifer in Region II for A) Estimated Conditions Prior to 1940 (Predevelopment) and B) June 2010

Figure 3.11 shows the estimated Floridan aquifer potentiometric surface under pre-development and June 2010 conditions. In northwest Walton County, the potentiometric surface reaches an elevation of over 200 feet above sea level. From this point, water levels decline in all directions. Under non-pumping, pre-development conditions, groundwater flow was downgradient to discharge areas in southern Okaloosa and Walton counties, as well as to the Choctawhatchee River. Floridan aquifer water levels in the Fort Walton Beach area were historically about 50 feet above sea level. A steady decline in water levels between the early 1940s and 2000 resulted in a loss of as much as 185 feet of head pressure in the Floridan aquifer along the coast. This changed the coast from an area of natural discharge for the Floridan aquifer to an area of induced recharge. This has created the potential for saltwater intrusion along coastal region II. Over the last 13 years, regulatory limits on the use of the Floridan aquifer in coastal Region II have succeeded in recovering approximately 55 feet of head. Figure 3.11 shows water levels in the Ft. Walton Beach area were at approximately 80 feet below sea level under 2010 pumping conditions.

<u>Assessment Criteria</u>

Two criteria were used to assess impacts to the sand-and-gravel aquifer and the Floridan aquifer system: long-term depression of the potentiometric surface and impacts to groundwater quality.

<u>Impacts to Groundwater Resources and Related Systems</u>

The 1998 WSA describes the history of water supply development in Region II and the resulting impacts to water resources (Ryan et al. 1998). Significant groundwater development along the coast began in the early 1940s and has resulted in the depression of the Floridan aquifer potentiometric surface and movement of the saltwater interface towards these coastal wells. Since 1998, major water supply initiatives implemented and led by the District have successfully stabilized the coastal Floridan aquifer water levels and reduced the saltwater intrusion threat to coastal Floridan aquifer wells. These initiatives have included the development of an inland sand-and-gravel aquifer wellfield in Santa Rosa County and the development of inland Floridan aquifer wells in Okaloosa and Walton counties. These inland facilities have provided an alternative source of water to meet the increasing demand in coastal areas, while also enabling a reduction in coastal withdrawals. This updated assessment focuses on the results of these initiatives and ongoing activities to manage and enhance the sustainability of the groundwater resources.

Sand-and-Gravel Aquifer

The sand-and-gravel aquifer provided over 90 percent of the groundwater used in Santa Rosa County in 2010. In 2004, Fairpoint Regional Utility System (FRUS) began operating an inland sand-and-gravel aquifer wellfield in Santa Rosa County as an alternative water source for coastal Santa Rosa County. In 2010, public supply withdrawals from the inland sand-and-gravel wellfield averaged approximately 4.06 mgd. Of this total, 3.4 mgd was provided to coastal utilities, thus reducing coastal Floridan aquifer withdrawals. For all water use categories, a total of approximately 23 mgd was withdrawn from the sand-and-gravel aquifer in Santa Rosa County in 2010. These withdrawals take place with little impact to the water resources due to high sand-and-gravel aquifer recharge rates and adequate well spacing. No significant regional water level declines have occurred in Santa Rosa County. Hydrographs show that drawdown impacts are generally limited to the immediate vicinity of individual pumping wells and water levels are influenced more by recharge rates.

Recent studies have been conducted to evaluate the inland sand-and-gravel aquifer wellfield in the region between the Blackwater and Yellow rivers in Santa Rosa and Okaloosa counties to evaluate the amount of water that can be withdrawn from the wellfield. A three-dimensional transient groundwater flow model was developed to evaluate cumulative impacts of additional pumping. Modeling results indicate that, properly managed, an additional 12 mgd of groundwater above 2010 estimates can be drawn from this area for a groundwater production total of approximately 18 mgd.

The highly productive nature of the sand-and-gravel aquifer is illustrated in Figure 3.12. Hydrographs are presented for monitoring wells P3A (NWFID 7416) and P5A (NWFID 7422). The locations of these monitor wells are shown in blue on Figure 3.11 and indicated on the map by their NWFID numbers. Nine public supply wells that are part of the East Milton Water System and the FRUS wellfield and are within 2.5 miles of well P3A. Monitoring well P5A is located approximately 5 miles northeast of well P3A (more than three miles from the nearest supply well) and is not influenced by pumping.

A comparison of the hydrographs for P3A, which is within the wellfield zone of influence, and P5A, removed from the influence of pumping, indicates water levels in the sand-and-gravel aquifer are more strongly affected by variations in recharge than current pumping levels. Between 2000 and 2004, the East Milton Water System pumped approximately 0.8 mgd. During this time, the region was experiencing a drought and groundwater levels declined until late summer 2002. The water levels rose during 2003 in response to increased recharge from above average rainfall. In February 2004, the FRUS wellfield came online and by June 2004 their withdrawals increased to 3.8 mgd. Declining water levels during 2006 through 2008 are associated with another low rainfall period. More recently, drought conditions continued from 2010 through 2012 and pumping in the area increased to between 5 and 6 mgd. Despite the increased pumping, water levels in well P3A reacted to the drought periods and rebounded in periods with above normal rainfall. Water levels in both P3A and P5A follow very similar trends in response to recharge and show no significant water level response to the increased pumping.

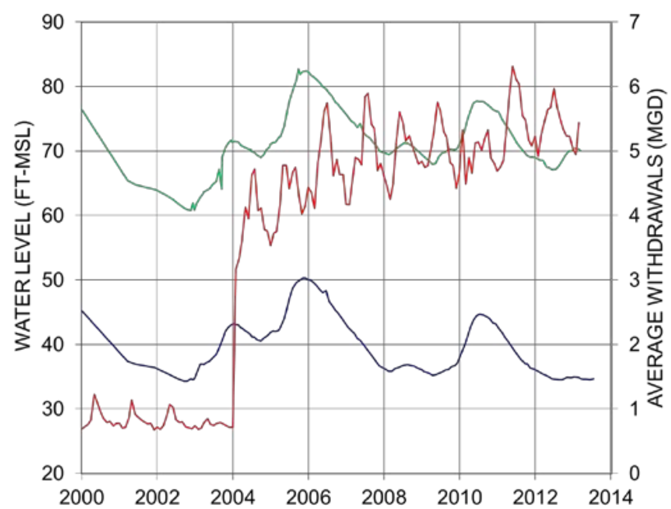


Figure 3.12 Water Levels in Sand-and-Gravel Aquifer Wells P3A (Blue) and P5A (Green) vs. Monthly Pumpage from Nearby Public Supply Wells (Red)

Floridan Aquifer System

Increased Floridan aquifer groundwater withdrawals since the early 1940s have resulted in the formation of a significant cone of depression in the Floridan aquifer (Figure 3.11). The withdrawals were concentrated in the coastal area with about half of the withdrawals occurring in coastal Okaloosa County. Water levels within the cone of depression were drawn down as much as 130 feet below sea level in 2000. This feature developed over the previous 60 years as water demands and Floridan aquifer withdrawals increased.

Water level trends over the past two decades have been positively affected by District initiatives to limit Floridan aquifer withdrawals along the coast and stabilize the cone of depression. Initiatives include the 1989 designation of coastal Santa Rosa, Okaloosa, and Walton counties as a Water Resource Caution Area. This designation, in part, prohibits new and expanded uses of the Floridan aquifer for non-potable purposes, mandates water conservation measures, and requires permittees to evaluate the feasibility of using reclaimed water. In the early 1990s, public supply withdrawals on Santa Rosa Island were eliminated. Other water supply initiatives included development of the inland sand-and-gravel aquifer, shifting Floridan aquifer groundwater pumping away from the coastline, and implementing reuse and conservation measures. The major water supply initiatives implemented since 1998 were designed to reduce coastal withdrawals and provide for some water level recovery in coastal areas while also providing for increased water demands.

Figure 3.13 shows the effect of these initiatives on coastal withdrawals. In 1998, coastal withdrawals averaged 28 mgd and accounted for 78 percent of the Floridan aquifer pumping in the region. By 2007, coastal withdrawals were reduced by 20 percent to approximately 22 mgd. By 2010, coastal withdrawals had been reduced even further to approximately 17 mgd. The reduction was enabled by the development of the inland sand-and-gravel aquifer wellfield in Santa Rosa County in 2004 and the development of inland Floridan aquifer wells in both Okaloosa County (2006) and Walton County (2001). By 2010, inland withdrawals had increased to approximately 24 mgd and accounted for 58 percent of the Floridan aquifer withdrawals in the region.

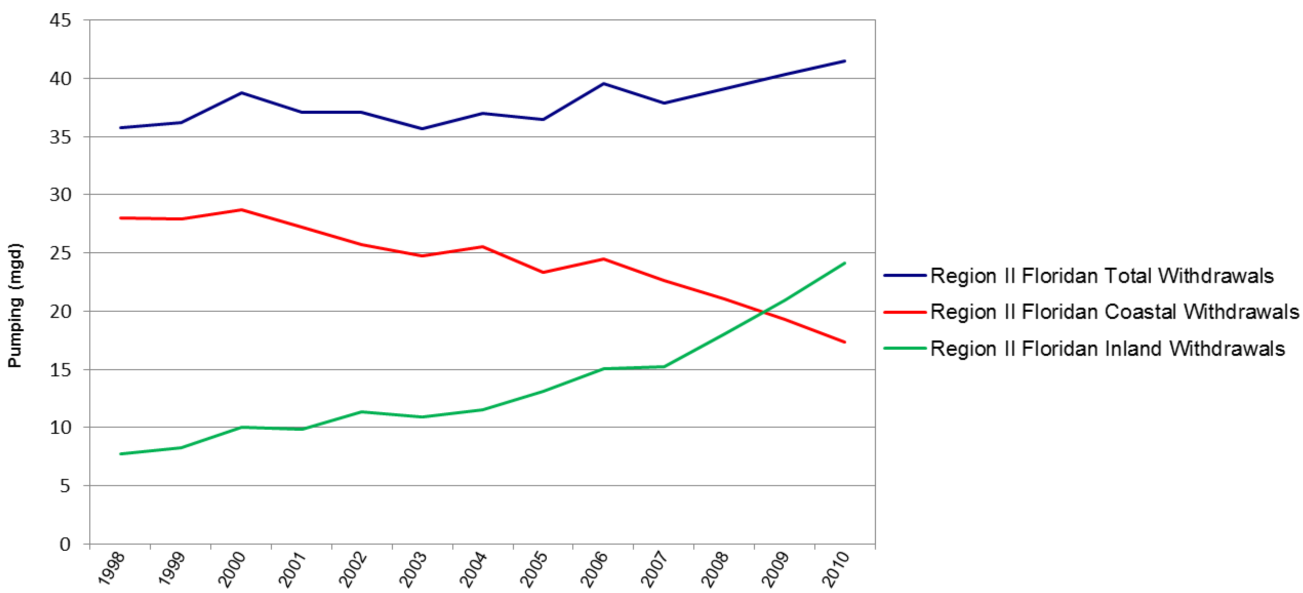


Figure 3.13 Withdrawals from the Floridan Aquifer in Region II

Floridan Aquifer Water Levels

Hydrographs from Region II show the history of development of the cone of depression and the beneficial effect of reducing the coastal withdrawals. Well locations for the following hydrograph discussion are shown on Figure 3.11. The wells are identified on the figure by their NWFID numbers located in the upper right-hand corner of the associated graph.

Water level trends along coastal Santa Rosa County are represented by the hydrograph for the Navarre Cement Plant well (Figure 3.14A), which shows a significant water level decline over 30 years of groundwater development. This well was located just north of Santa Rosa Sound and was abandoned in the early 1990s. However, the negative trend continues through 2002 in the hydrograph for the nearby Midway #1 well (Figure 3.14B). The additional utilization of the sand-and-gravel aquifer in coastal Santa Rosa County and the inland wellfield eliminated some of the coastal Floridan pumping in the area and reversed the trend. As of 2013, water levels in coastal Santa Rosa County have recovered almost 50 feet.

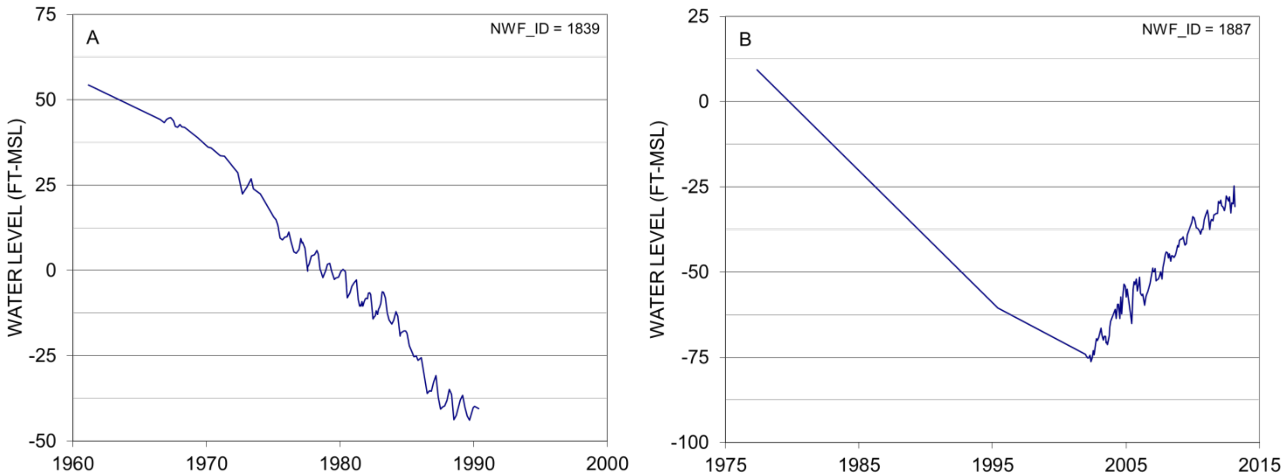


Figure 3.14 Hydrographs of the A) Navarre Cement Plant and B) Midway #1 Floridan Aquifer Wells in Southern Santa Rosa County

In Okaloosa County, hydrographs also show the mitigating effect of reduced withdrawals along the coast as Floridan aquifer pumping is moved inland. Hydrographs are presented for wells along a south to north transect from the coast to the mid-county area (Figure 3.15). The Mary Esther #2 well is located just west of Ft. Walton Beach, near the center of the potentiometric surface cone of depression. Water levels have been observed in this well as low as 140 feet below sea level (Figure 3.15A). However, remediating measures have increased water levels approximately 70 feet from 1998 to 2013. Water levels in the Wright Upper Floridan well (Figure 3.15B), located approximately 2 miles north of Ft. Walton Beach have increased about 50 feet over the same period. The recovery of water levels in these coastal areas has reduced the threat of saltwater intrusion.

Further north, the mitigating effect of reductions in coastal pumping is lessened by the effects of increased pumping further inland. Well #2 at Field #5 on Eglin AFB (Figure 3.15C) is located about halfway between the reduced pumping along the coast and the increased pumping in the mid-county region. Water level declines have stabilized in this well and are slowly starting to recover. As anticipated, the hydrograph for the Crestview #4 well shows the continued slow decline in Floridan aquifer water levels in the Crestview area (Figure 3.15D). From 1998 to 2013, Crestview #4 water levels have declined an additional 10 feet in response to increased inland withdrawals used to reduce coastal pumping as well as increased withdrawals by central Okaloosa County utilities.

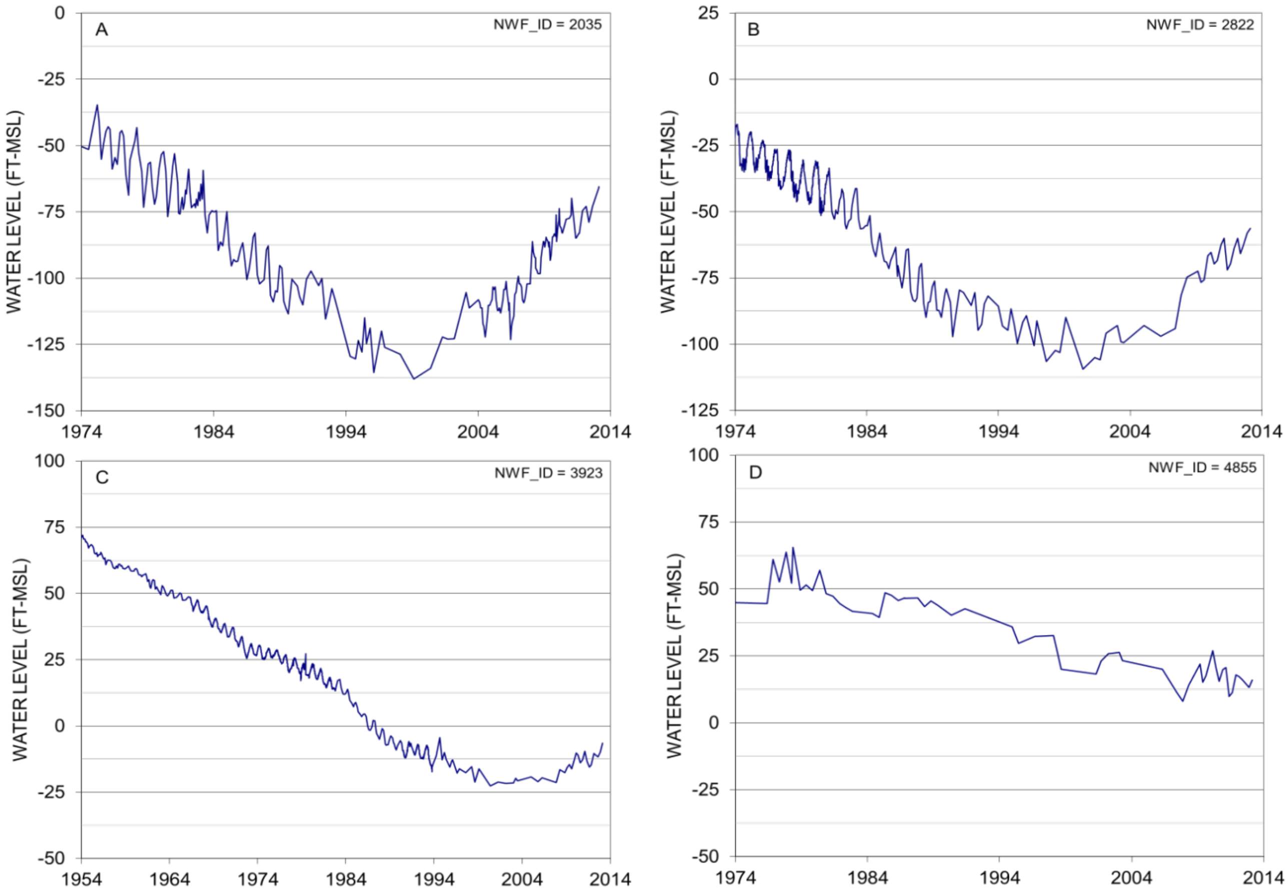


Figure 3.15 Hydrographs of the A) Mary Esther #2, B) Wright Upper Floridan Aquifer, C) EAFB Field #5/Well #2, and D) Crestview #4 in Southern and Central Okaloosa County

A similar shifting of impacts from coastal to inland areas is observed in Walton County. Regional Utilities has abandoned all of their coastal Floridan aquifer wells and moved their pumping north of Freeport. Destin Water Users and South Walton Utilities are also obtaining some of their supply from inland wells and are committed to further reducing their coastal withdrawals. Hydrographs are presented for a well located less than two miles east of South Walton Utility's coastal wells (West Hewett Street), a well approximately 5 miles to the northeast along the south side of Choctawhatchee Bay (S.L. Matthews), a well north of Choctawhatchee Bay in Freeport (USGS Freeport #17), and a monitor well at the former First American Farms (FAF #47) site north of Freeport (Figure 3.16).

A loss in potentiometric head is historically evident in the coastal West Hewett Street (Figure 3.16A) and S.L. Matthews wells (Figure 3.16B). These drawdowns are not as great as observed in the western part of Region II due to the thinner, leakier intermediate system along the eastern end of Choctawhatchee Bay. However, since coastal pumping has been reduced, water levels in the West Hewett Street well have recovered almost 10 feet and water levels in the S.L. Mathews well have recovered about 3 feet to mean sea level.

Water levels in the USGS Freeport #17 (Figure 3.16C) well show seasonal fluctuations in the 1960s and 1970s due to the large-scale agricultural irrigation at First American Farms, located approximately five miles to the north. The long-term decline in water levels, due to the pumpage concentrated in coastal Okaloosa County, is evident in the Freeport area. Since 1948, about 30 feet of head has been lost in the Floridan aquifer at this well location. Declines in the potentiometric surface in the Freeport area have increased over the last 10 years due to increased withdrawals by Freeport and the development of the inland Floridan aquifer wellfield about 6 miles north of Freeport (at the location of the former First American Farms). The drawdown in the potentiometric surface around Freeport is also evident in Figure 3.11.

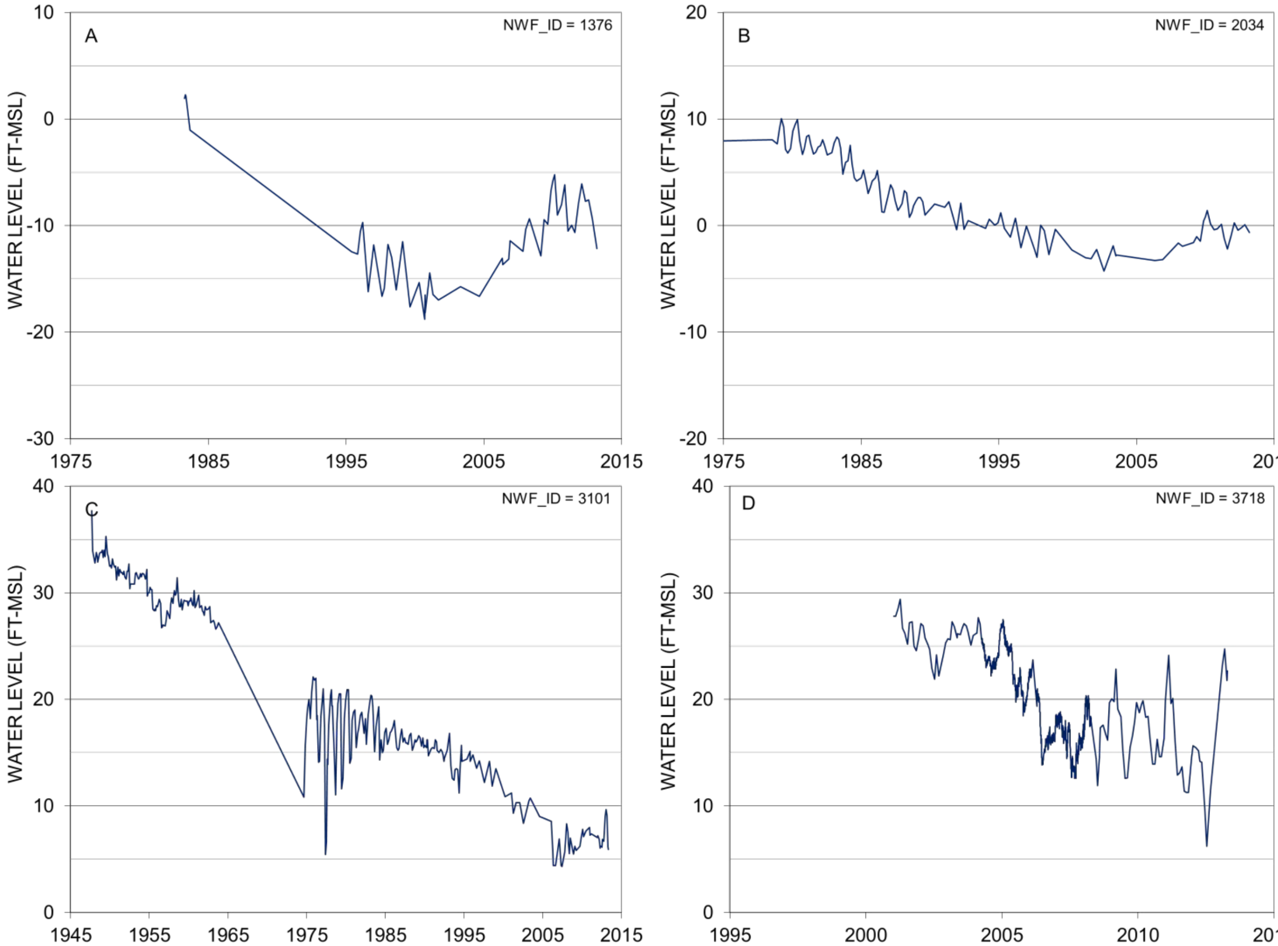


Figure 3.16 Hydrographs of the A) West Hewett Street, B) S.L. Matthews, C) USGS Freeport 17, and D) FAF #47 Floridan Aquifer Wells in Southern Walton County

The FAF #47 well (Figure 3.16D) is located north of Freeport, about one mile east of the inland wellfield. This hydrograph shows the effect of the inland wellfield withdrawals which began in 2001. Water levels in the immediate vicinity of the wellfield have declined between 10 and 15 feet. Although additional water level declines have occurred in inland areas where pumpage has increased, these areas are not threatened by saltwater intrusion and water level declines are currently manageable.

Along the northern boundary of Region II, far from the coast, two separate responses to historical pumping are evident in the hydrographs for the Paxton and Camp Henderson wells (Figure 3.17). The Paxton well (Figure 3.17A) is located in northernmost Walton County on the region's potentiometric high. This well shows no observable long-term water level decline, rather short term effects as a result of the persistent drought from 2003 to 2013; it is not affected by the coastal pumpage occurring approximately 40 miles to the south. In this area, recharge rates are expected to be somewhat greater than elsewhere in the region due to the intermediate system being relatively thin.

By contrast, the Camp Henderson well (Figure 3.17B), located approximately 40 miles due west in Santa Rosa County and slightly further from the coastal pumping center, lost more than 20 feet of head between 1968 and 2013. As is the case with the Paxton well, essentially no pumping from the Floridan aquifer occurs in this area. Effects of coastal pumping have spread out nearly 40 miles to the state line, due to the presence of a thick, effective confining unit, low rate of Floridan aquifer recharge and lower Floridan aquifer transmissivities in Santa Rosa County.

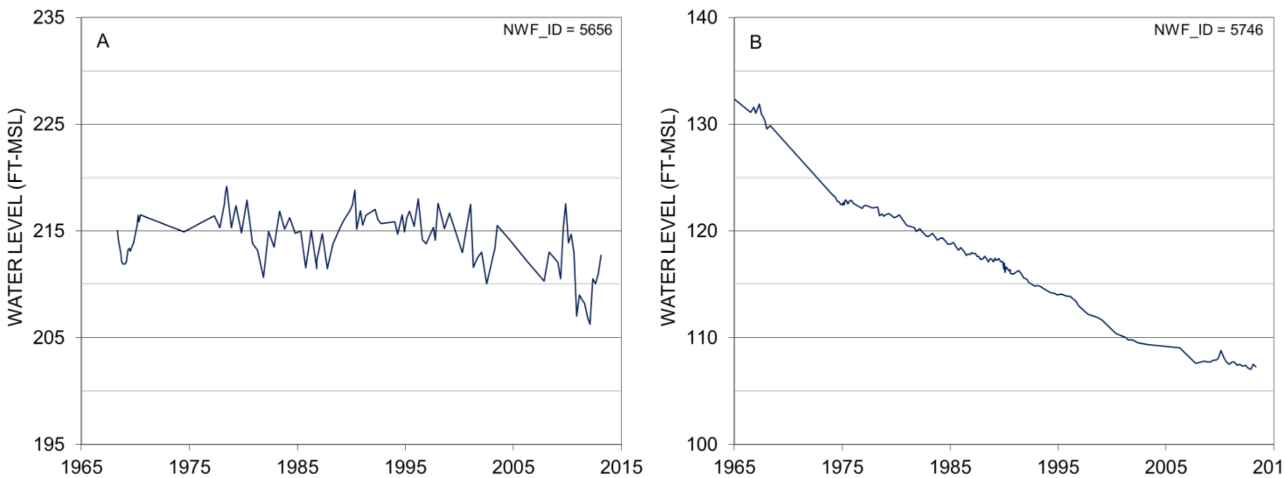


Figure 3.17 Hydrographs of the A) Paxton and B) Camp Henderson Floridan Aquifer Wells

Coupled with concerns about the potentiometric surface decline are continued concerns about the quality of Floridan aquifer water withdrawn in the coastal area. The water level declines illustrated in the above hydrographs also extend over an unknown area offshore beneath the Gulf of Mexico. Water quality data shows poor quality, non-potable water present in the Floridan aquifer in southern Santa Rosa County and in south Walton County near the eastern extent of Choctawhatchee Bay (Pratt 2001). Non-potable, saline water also occurs offshore beneath the Gulf of Mexico. Figure 3.18 shows sodium and chloride concentrations in the Floridan aquifer along the coast from southeast Santa Rosa County to Bay County. The figure presents average chloride and sodium concentration data collected during the 1990s.

Floridan aquifer water becomes increasingly more mineralized to the west. Sodium and chloride concentrations exceed the drinking water standard just west of the Midway area and in the vicinity of Navarre Beach. As you move east across the Santa Rosa-Okaloosa County line, the quality of water in the Floridan aquifer improves. Further east (in the Destin area), water quality continues to be good. The best water quality in the Floridan aquifer, along the coastal fringe, is found east of Destin in the South Walton Utility Company service area. However, immediately east of this area, the Floridan aquifer water quality deteriorates. This area of naturally-occurring poor quality water is extensive, covering much of coastal Walton County near the eastern extent of Choctawhatchee Bay. The average concentrations for the 1990s are also representative of conditions prior to development of the groundwater resource. Throughout most of the coastal area, the quality of water withdrawn has remained stable over time. Data, beginning in the 1950s and 1960s, shows no significant change in water quality in most areas. Data indicates increasing concentrations of sodium and chloride in Floridan aquifer groundwater is generally limited to wells located in or very near the saltwater interface. These areas include southeast Santa Rosa County and the eastern extent of Choctawhatchee Bay. As of 2012, monitoring data indicates conditions in the coastal area of the Floridan aquifer have not changed since the 2006 RWSP Update (NWFWMD 2006).

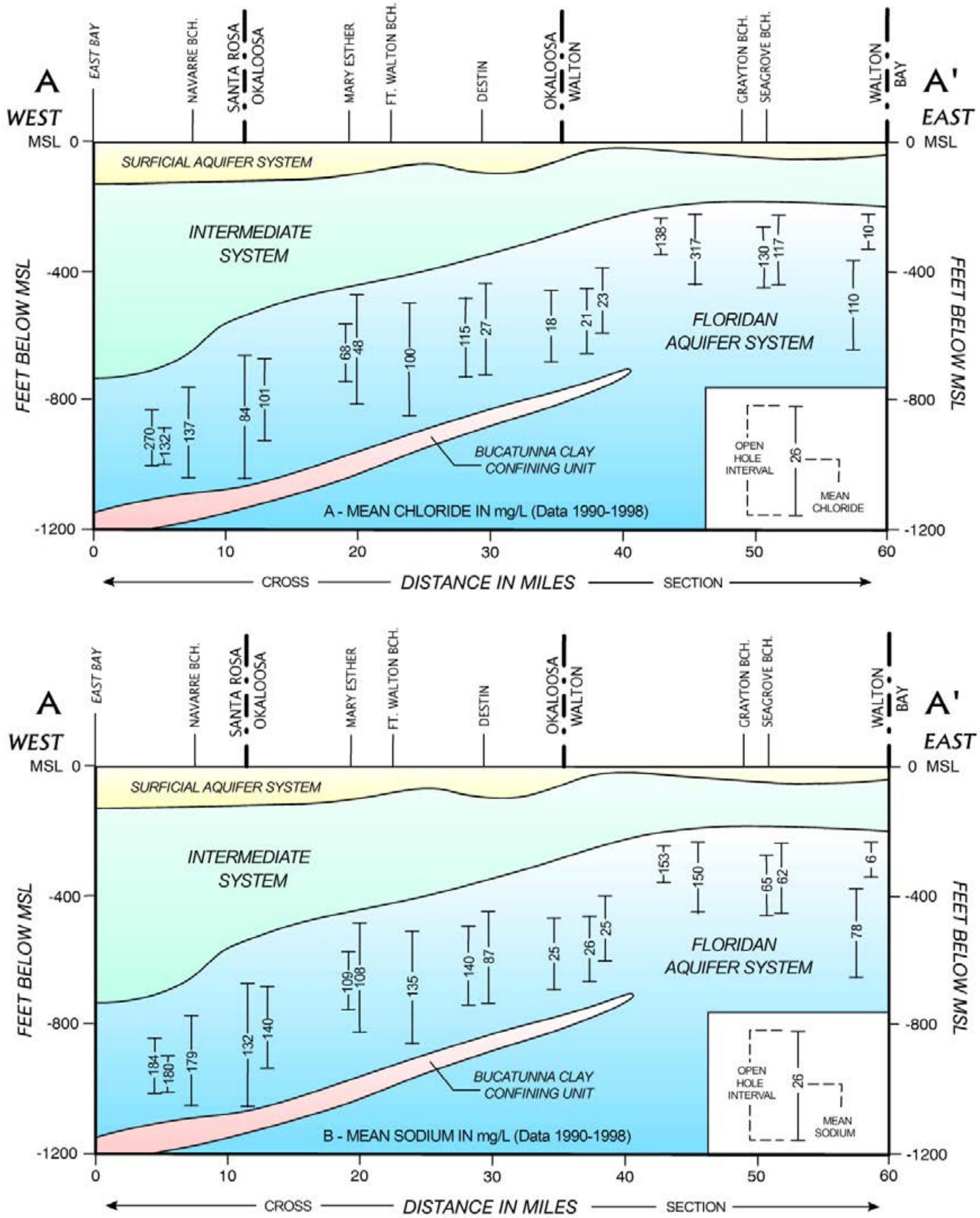


Figure 3.18 Coastal Cross-Section of Floridan Aquifer System Chloride and Sodium Concentration Data

Lower Floridan Aquifer Water Quality

In July 1997, a lower Floridan aquifer monitoring well was constructed in Destin to determine the feasibility of reverse osmosis treatment of water from the lower Floridan for potable use. The well was drilled to a total depth of 1,460 feet, and water quality samples were taken from the lower Floridan at 11 intervals between 928 feet to 1,422 feet. Just below the Bucatunna Clay, a sodium concentration of 690 mg/L and a chloride concentration of 1,200 mg/L yielded a sodium/chloride ratio of 0.58, approximately that of sea water (0.55). Water in this well became progressively more mineralized with depth, but the sodium/chloride ratio remained between 0.50 and 0.71. The results of this study concluded that the quality of groundwater in the Lower Floridan aquifer below the Bucatunna Clay is non-potable.

Groundwater Budget

To further assess withdrawals from the Floridan aquifer, a groundwater budget was prepared using output from an updated calibrated steady-state regional groundwater flow model (HydroGeoLogic 2000) and the 2010 regional Floridan aquifer pumping. The updated model included: 1) expansion of the model domain to the entire Region II area, 2) conversion to a fully 3-dimensional flow model with active layers representing the principal hydrogeologic units down to the sub-Floridan, and 3) modified calibration and hydraulic property fields. The water budget presents an order-of-magnitude approximation of the major inputs to and discharges from the Floridan aquifer system in Santa Rosa, Okaloosa, and Walton counties by which to compare the 2010 regional withdrawals.

Figure 3.19 Region II Floridan Aquifer Groundwater Budget

The updated model water budget, which covers a larger area than the previous model (Ryan et al. 1998), indicates that the Region II Floridan aquifer withdrawals of 41.5 mgd would represent approximately 46 percent of the groundwater flowing into the Floridan aquifer in Region II (Figure 3.19). As previously discussed, both the magnitude and the spatial distribution of Floridan aquifer withdrawals are important within this region. Although pumpage accounts for a relatively large fraction of the water budget, District initiatives have successfully shifted Floridan aquifer withdrawals away from the coast and lessened the threat of saltwater intrusion. Efforts to manage groundwater withdrawals and develop alternative water sources in Region II will continue.

Inflow to the Floridan aquifer from beneath the Gulf of Mexico remains a concern. Although the exact distribution of saltwater in the Floridan aquifer beneath the Gulf of Mexico is uncertain, saltwater is certainly present. The simulated inflow of 7.9 mgd from the Gulf of Mexico can potentially have a significant effect on the quality of groundwater withdrawn from the Floridan aquifer (HydroGeoLogic 2000). This is a continued concern, as raised in the initial WSA, regarding the sustainability of current withdrawal practices.

Model results indicate that approximately 1 mgd of the approximately 59.4 mgd leakage into the Floridan aquifer through the intermediate system may represent induced saltwater recharge. This induced recharge is due to the aquifer drawdown beneath Choctawhatchee Bay. Although the induced recharge is only a small fraction of the total leakage into the aquifer, it has the potential to degrade the quality of water being withdrawn. This issue is of greatest concern in the Choctawhatchee Bay area of Walton County where the intermediate system is leakier.

Recharge to the sand-and-gravel aquifer is estimated to average about 20 in/yr (Vecchioli et al. 1990). Local streams and rivers are the primary discharge areas for the sand-and-gravel aquifer. Other discharge components include leakage (recharge) to the underlying Floridan aquifer, pumpage, and outflow to surrounding areas such as the Choctawhatchee Bay. Pumpage from the sand-and-gravel aquifer in Region II totaled approximately 30 mgd in 2010, with 15 mgd of this pumpage occurring in the northern two-thirds of Santa Rosa County. Withdrawals in this sub-region account for nearly all of the public supply and I/C/I water use and most of the domestic self-supply and agricultural water use of the sand-and-gravel aquifer in Region II. Based on a model-simulated recharge of 584 mgd in this sub-region, the pumpage (15 mgd) represents approximately 3 percent of the sand-and-gravel aquifer water budget.

<u>Water Quality Constraints on Availability</u>

High recharge rates and the leaky nature of the sand-and-gravel aquifer make it susceptible to anthropogenic contamination that may constrain use locally or necessitate treatment. Deterioration of Floridan aquifer water quality within the cone of depression constrains water availability along the coast. Water quality has very slowly degraded where the saltwater interface has been identified as a transition zone from freshwater to salt water: near Navarre Beach and Midway to the west; in the coastal area to the south of the easternmost Choctawhatchee Bay to the east; and the lower Floridan aquifer near north Ft. Walton Beach where the underlying Bucatunna Clay confining unit tapers.

As part of the RWSP for Region II, saltwater intrusion modeling was performed to analyze the effect of Floridan aquifer pumping on the movement of the saltwater interface and water quality (HydroGeoLogic 2005 and 2007a). Regional projections of groundwater use estimated 2025 public supply demand at approximately 62 mgd. Forecast simulations were performed which included increasing Floridan aquifer withdrawals to approximately 62 mgd by the year 2025 with slightly more than half of the projected pumping (32 mgd) assigned to inland areas. Pumping was held constant at that rate from 2025 to 2100, thus assuming the development of surface water sources to provide for additional demands beyond the simulated 2025 withdrawals of 62 mgd (HydroGeoLogic 2007b and 2007c). These model forecasts show the withdrawals to be sustainable through the simulation period.

<u>Adequacy of Groundwater Resources</u>

The sand-and-gravel aquifer in Santa Rosa County is an extremely productive aquifer system and, due to its high rate of recharge, is capable of providing regionally-significant quantities of water. In southern Okaloosa and Walton counties, the sand-and-gravel aquifer is capable of meeting a portion of the growing local non-potable demand. The potential for a hydraulic connection between the sand-and-gravel aquifer and the local streams and wetlands requires careful planning and analysis of proposed withdrawals to avoid significant local impacts to natural systems located near production wells. However, rainfall and/or direct recharge to surficial wetlands tend to have a much greater regional influence on these systems than pumping.

District-led water supply initiatives have successfully reduced coastal pumping in the Floridan aquifer along the coast. This reduction in pumpage has enabled water levels to recover over much of the area and has slowed, but not eliminated, the threat of saltwater intrusion. A significant cone of depression is still present and concerns related to saltwater intrusion and water quality degradation remain. Continued utilization of Floridan aquifer groundwater will need to continue to be closely monitored if current levels of use are to be maintained at sustainable levels into the future.

District efforts to stabilize or reduce coastal withdrawals and develop alternative water sources will continue along with efforts to better understand the uncertainty regarding movement of the saltwater interface. Thus, the initiatives outlined in the RWSP should continue to be implemented in Region II.

Surface Water Resources

Historically, surface water has not played a major water supply role in Region II. Surface water withdrawals totaled approximately 1.6 mgd in 2010 and largely reflect water withdrawn from streams and ponds for golf course and agricultural use. However, with the implementation of the RWSP, surface water is being evaluated as an alternative source to future increased use of the Floridan aquifer.

The potential fresh surface water sources in Region II for regional water supply purposes are the Blackwater River, Yellow River, Shoal River, Choctawhatchee River and Escambia River. Feasibility analysis of surface water alternatives in Okaloosa County was conducted by the District in 2006 (PBS&J 2006). Analyses of the flow and water quality of the rivers in Okaloosa County indicate these waterbodies have the greatest potential to meet this county's future demands. The adequacy of using such alternatives as direct withdrawals, direct withdrawals in conjunction with small offline surface water supply reservoirs, or river bank filtration showed the greatest promise (PBS&J 2006). Potential impacts of proposed surface water withdrawals will continue to be evaluated under the RWSP for Region II.

Reclaimed Water

In 2010, of the 27.3 mgd of the wastewater generated in Region II, 86 percent (23.4 mgd) was of reuse quality. Of the 27.3 mgd total wastewater flows, 8.8 mgd, or 32 percent, was used to replace potable-quality water (Table 3.15). Public access reuse included irrigation of golf courses (4.9 mgd), residential lawns (2.0 mgd), and landscapes (1.9 mgd). Minor industrial uses occurred at wastewater treatment facilities (0.2 mgd). The majority of reclaimed water (14.3 mgd) was discharged to spray fields, infiltration basins, and absorption fields. The remainder of the wastewater (3.9 mgd) was disposed to surface waters and used for wetland augmentation.

Destin Water Users, Holley-Navarre and South Santa Rosa Utility System reclaim nearly 100 percent of their wastewater and use it to replace potable quality water. Destin has developed an aquifer storage and recovery system to store excess reclaimed water for later use. Ft. Walton Beach is expanding its reuse capacity and utilization through the Arbennie Pritchett Water Reclamation Facility and Hurlburt Reclaimed Water Line.

The District has provided technical assistance and funding for several reclaimed water projects. Among them, the City of Freeport constructed a wastewater reuse system to provide approximately 0.47 mgd of reclaimed water to irrigate a future residential subdivision and golf course. Construction to expand Okaloosa County's Bob Sikes Water Reclamation Facility has also been completed. Approximately 1.0 mgd of reclaimed water is available from this facility for public access irrigation in the vicinity of Crestview.

While significant progress has been made developing water reuse infrastructure, there are still opportunities to expand the wastewater and reuse customer bases and further develop reuse infrastructure with the goal of replacing potable-quality water. It is projected that by 2035 there will be 33.21 mgd of wastewater generated, 20.48 mgd of which may potentially be available for reuse (Tables 3.16 and 3.17).

Table 3.15 Region II Reuse of Domestic Wastewater, 2010 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Reuse Flow that Replaces Potable-Quality Water*
Arbennie Pritchett Water Reclamation Facility	12.00	6.00	12.00	6.11	0.65
Bob Sikes WRF	1.00	0.08	1.12	0.08	
Crestview WWTP	4.13	1.23	2.86	1.23	
Destin Water Users WRF	6.00	2.91	8.63	2.91	2.24
Eglin AFB - Auxiliary Field 3 WWTP	0.13	0.01	0.13	0.01	
Eglin AFB – Plew Heights WWTP	1.50	0.33	1.50	0.72	
Eglin Main Base WWTP	1.00	0.40	1.00		
Ft. Walton Beach WWTP	4.65	1.18	4.65		
Hurlburt Field AWTP	1.00	0.56	1.63		
Mary Esther WWTP	1.10	0.58	1.10	0.58	
Niceville - Valparaiso - Okaloosa County (NVOC) Regional WWTF	3.35	2.43	8.09	2.64	0.64
Okaloosa Correctional Institute WWTP	0.18	0.20	0.18	0.20	
Russell F.W. Stephenson WWTF	1.00	0.41	1.00	0.41	
Okaloosa County Total	**37.03**	**16.31**	**43.87**	**14.90**	**3.53**
Holley Wastewater Reclamation Facility	0.25	0.00	0.08		
Holley-Navare Wastewater Treatment Facility	2.99	1.36	4.41	1.36	1.36
Milton WWTF	2.50	1.52	0.05	0.00	
Navarre Beach WWTP	0.93	0.24	0.03	0.01	
Pace Water System, Inc. WWTP	5.00	1.13	5.00	0.67	0.67
South Santa Rosa Utility System (SSRUS) WWTF	2.00	1.63	3.50	1.44	1.44
Sundial Utilities WWTP	0.25	0.07	0.15	0.07	
Town of Jay WWTP	0.12	0.06	0.12	0.06	
Santa Rosa County Total	**14.04**	**5.99**	**13.34**	**3.59**	**3.46**
City of Defuniak Springs WWTP	1.50	0.65	1.50	0.65	
City of Freeport WWTP	0.60	0.15	0.47	0.15	
Point Washington WWTF	2.00	1.05	4.00	2.04	0.64
Sandestin WWTP	4.00	1.30	4.00	0.55	0.55
Seacrest WWTF	2.00	0.35			
South Walton Utility Company Inc., WWTP	2.75	1.37	6.61	1.37	0.63
Walton Correctional Institution WWTP	0.23	0.17	0.23	0.17	
Walton County Total	**13.08**	**5.04**	**16.80**	**4.93**	**1.83**
Region II Total	**64.15**	**27.34**	**74.01**	**23.42**	**8.82**

*Reuse Flow That Replaces Potable-Quality Water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses. Not included in this flow calculation are agriculture irrigation of other crops, absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant (Source: DEP reuse inventories).

Table 3.16 Region II Domestic Wastewater Flow Projections 2015 - 2035 (mgd)

Facility Name	2015	2020	2025	2030	2035
Arbennie Pritchett Water Reclamation Facility	6.00	6.00	6.00	6.00	6.00
Bob Sikes WRF	0.09	0.10	0.11	0.11	0.12
Crestview WWTP	1.38	1.47	1.56	1.65	1.74
Destin Water Users WRF	2.96	3.02	3.07	3.13	3.18
Eglin AFB - Auxiliary Field 3 WWTP	0.01	0.01	0.01	0.01	0.01
Eglin AFB – Plew Heights WWTP	0.33	0.33	0.33	0.33	0.33
Eglin Main Base WWTP	0.42	0.43	0.45	0.46	0.47
Hurlburt Field AWTP	0.59	0.61	0.63	0.65	0.67
Mary Esther WWTP	0.58	0.58	0.58	0.58	0.58
Niceville - Valparaiso - Okaloosa County (NVOC) Regional WWTF	2.58	2.74	2.92	3.10	3.30
Okaloosa Correctional Institute WWTP	0.21	0.22	0.23	0.23	0.24
Russell F.W. Stephenson WWTF	0.41	0.41	0.41	0.41	0.41
Okaloosa County Total	**15.56**	**15.92**	**16.29**	**16.66**	**17.04**
Holley Wastewater Reclamation Facility	0.01	0.01	0.01	0.01	0.01
Holley-Navare Wastewater Treatment Facility	1.51	1.69	1.86	2.02	2.17
Milton WWTF	1.64	1.80	1.95	2.08	2.20
Navarre Beach WWTP	0.24	0.25	0.26	0.27	0.27
Pace Water System, Inc. WWTP	1.25	1.43	1.60	1.77	1.93
South Santa Rosa Utility System (SSRUS)	1.65	1.73	1.80	1.83	1.84
Sundial Utilities WWTP	0.07	0.08	0.08	0.09	0.09
Town of Jay WWTP	0.06	0.06	0.06	0.06	0.06
Santa Rosa County Total	**6.41**	**7.03**	**7.62**	**8.13**	**8.57**
City of Defuniak Springs WWTP	0.65	0.65	0.65	0.65	0.65
City of Freeport WWTP	0.16	0.18	0.20	0.22	0.23
Point Washington WWTF	1.15	1.30	1.43	1.56	1.66
Sandestin WWTP	1.43	1.61	1.78	1.93	2.06
Seacrest WWTF	0.39	0.44	0.48	0.52	0.56
South Walton Utility Company Inc., WWTP	1.50	1.69	1.87	2.03	2.16
Walton Correctional Institution WWTP	0.19	0.21	0.24	0.26	0.27
Walton County Total	**5.48**	**6.09**	**6.66**	**7.16**	**7.60**
Region II Total Wastewater Projections	**27.45**	**29.04**	**30.56**	**31.95**	**33.21**

Table 3.17 Region II Available Reclaimed Water Projections 2015 - 2035* (mgd)

Facility Name	2015	2020	2025	2030	2035
Arbennie Pritchett Water Reclamation Facility	5.03	5.03	5.03	5.03	5.03
Bob Sikes WRF	0.09	0.10	0.11	0.11	0.12
Crestview WWTP	1.38	1.47	1.56	1.65	1.74
Destin Water Users WRF	0.00	0.00	0.00	0.00	0.00
Eglin AFB - Auxiliary Field 3 WWTP	0.01	0.01	0.01	0.01	0.01
Eglin AFB – Plew Heights WWTP	0.33	0.33	0.33	0.33	0.33
Eglin Main Base WWTP	0.42	0.43	0.45	0.46	0.47
Hurlburt Field AWTP	0.59	0.61	0.63	0.65	0.67
Mary Esther WWTP	0.58	0.58	0.58	0.58	0.58
Niceville - Valparaiso - Okaloosa County (NVOC) Regional WWTF	1.62	1.79	1.96	2.14	2.34
Okaloosa Correctional Institute WWTP	0.21	0.22	0.23	0.23	0.24
Russell F.W. Stephenson WWTF	0.41	0.41	0.41	0.41	0.41
Okaloosa County Total	**10.67**	**10.97**	**11.29**	**11.61**	**11.93**
Holley Wastewater Reclamation Facility	0.01	0.01	0.01	0.01	0.01
Holley-Navare Wastewater Treatment Facility	0.00	0.00	0.00	0.00	0.13
Milton WWTF	1.64	1.80	1.95	2.08	2.20
Navarre Beach WWTP	0.24	0.25	0.26	0.27	0.27
Pace Water System, Inc. WWTP	0.25	0.43	0.61	0.78	0.94
South Santa Rosa Utility System (SSRUS)	0.00	0.00	0.00	0.00	0.00
Sundial Utilities WWTP	0.07	0.08	0.08	0.09	0.09
Town of Jay WWTP	0.06	0.06	0.06	0.06	0.06
Santa Rosa County Total	**2.26**	**2.62**	**2.96**	**3.28**	**3.69**
City of Defuniak Springs WWTP	0.65	0.65	0.65	0.65	0.65
City of Freeport WWTP	0.16	0.18	0.20	0.22	0.23
Point Washington WWTF	0.19	0.33	0.47	0.59	0.69
Sandestin WWTP	0.60	0.78	0.95	1.10	1.23
Seacrest WWTF	0.39	0.44	0.48	0.52	0.56
South Walton Utility Company Inc., WWTP	0.55	0.74	0.92	1.08	1.21
Walton Correctional Institution WWTP	0.19	0.21	0.24	0.26	0.27
Walton County Total	**2.73**	**3.35**	**3.91**	**4.42**	**4.85**
Region II Total Avail. Reclaimed Water	**15.66**	**16.93**	**18.16**	**19.30**	**20.48**

*Projections are for potentially available reclaimed water and do not take into account planned expansions of reuse systems.

Conservation

Substantial conservation actions have been undertaken in Region II due to resource regulation and designation of the coastal WRCA. Conservation measures are required of utilities located in the WRCA as a condition of their water use permits. All utilities have implemented public education programs aimed at promoting and enhancing water conservation and nearly all coastal utilities have implemented water conserving rate structures. Many utilities have implemented additional activities to enhance conservation and water use efficiency. Destin Water Users (DWU), for example, has a customer leak detection program and telemetered monitoring to inform staff of changes in distribution system pressure conditions and possible leaks. Water efficiency is promoted by DWU among commercial and residential establishments such as providing water conservation kits to lodging facilities and homes constructed before 1992. Home water audits are available. Regional Utilities offers plumbing fixture retrofits. A local ordinance provides irrigation efficiency and drought-tolerant landscaping requirements for the service area. Fort Walton Beach offers water conservation kits to customers. Holley Navarre Water System prohibits yard meters and the use of potable water for irrigation and other non-potable uses and offers plumbing fixture retrofits. Niceville has a plumbing fixtures retrofit kit, leak detection in the field, and has removed most municipal irrigation sites from Floridan aquifer usage. South Walton Utility Company uses a telemetry system to monitor for large leaks and offers plumbing retrofits for showerheads and faucets. Most utilities have active meter replacement programs to improve efficiency and accounting. Crestview, while outside of the WRCA, has a water conservation and efficiency plan under their water use permit. Their meter replacement program is 80 percent complete.

As permitted withdrawal amounts from coastal Floridan aquifer wells were reduced and new and expanded uses of the Floridan aquifer for non-potable uses were prohibited, more expensive alternative water supplies were being developed that have likely resulted in property owners increasingly using private shallow wells for landscape irrigation. Use of Florida Friendly landscaping practices, selection of plants adapted to coastal conditions, conversion of grass lawns to drought-tolerant ground covers, and installation of rain barrels could further alleviate landscape irrigation demand.

By reducing gross per capita water use to 150 gpcd (reflective of permanent populations only) utilities within Region II could potentially save approximately 6.5 mgd by 2035; however, further evaluation is needed to identify cost-effective conservation measures and potential funding sources. The Conserve Florida EZ Guide tool may be useful for evaluating potential future conservation programs.

3.2.3 *Determination of the Need for a Regional Water Supply Plan*

Regulatory action and RWSP implementation over the last 15 years have successfully mitigated impacts to coastal groundwater resources. Strategies have included shifting Floridan aquifer pumping away from the coast and implementing expanded reuse programs and conservation measures. Given ongoing concerns regarding the sustainability of Floridan aquifer groundwater production along the coast, future demands may be met through development of alternative inland groundwater or surface water sources. Alternative sources that will continue to be evaluated under the RWSP include surface water, expanded use of the sand-and-gravel aquifer, conservation, and reuse. Continued implementation of the RWSP pursuant to section 373.709, F. S., is recommended for Region II.

3.3 Region III: Bay County

Region III is primarily within the St. Andrew Bay watershed and is comprised of Bay County, including the municipalities of Callaway, Lynn Haven, Mexico Beach, Panama City, Panama City Beach, Parker, and Springfield (Figure 3.20). All of these municipalities purchase potable water from Bay County Utilities Department, which holds a permit to withdraw water from the Deer Point Lake Reservoir. The reservoir is the source of water for nearly 90 percent of the county's population. The City of Lynn Haven is the only municipality not entirely served by the county's utility. To protect the recharge area for Econfina Creek, which supplies the Deer Point Lake Reservoir, the District has acquired over 40,000 acres in Bay, Washington, and Jackson Counties as the Econfina Creek Water Management Area. The region has two wetland mitigation banks, two state parks, a state forest, and a large conservation park owned by Panama City Beach.

Region III Snapshot		
	2010	2035
Population	168,852	209,100
Water Use (mgd)	~ 72	~ 88
Primary Source	Deer Point Lake Reservoir	
RWSP Status	Implementation	

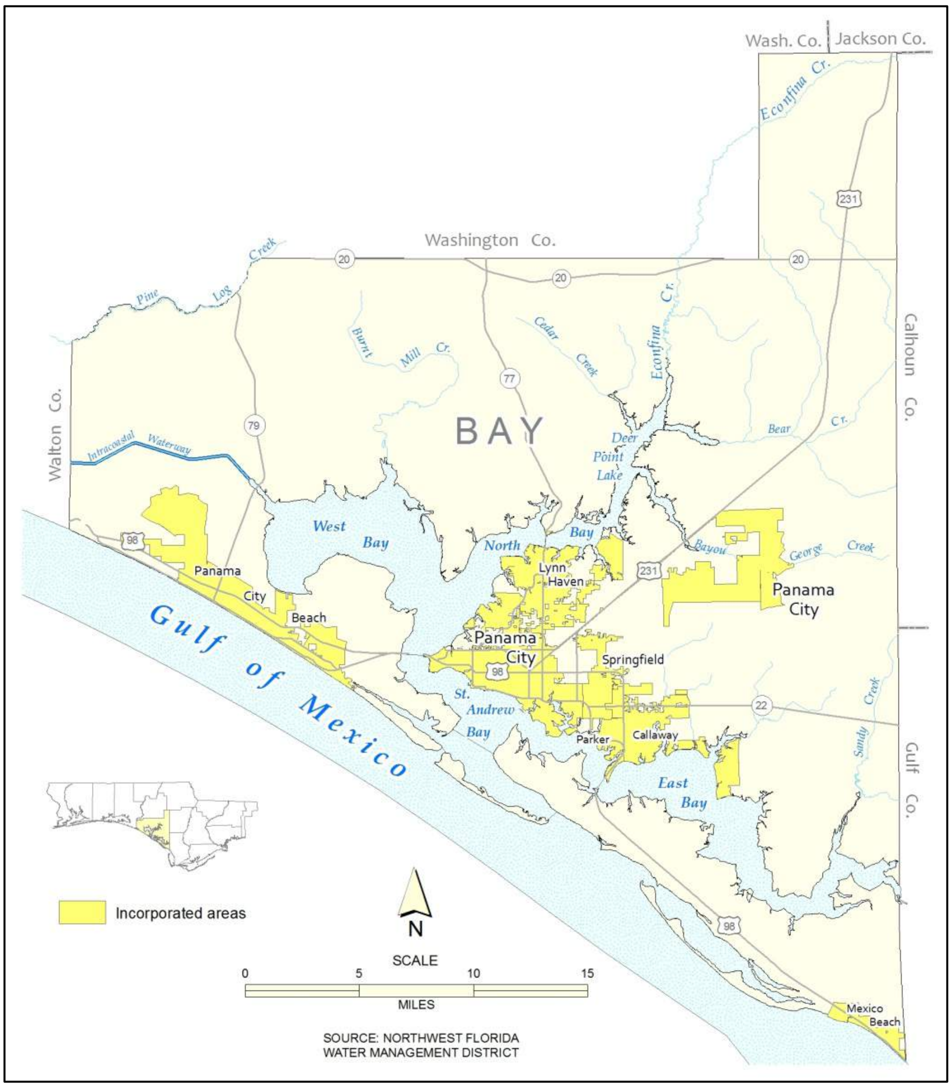


Figure 3.20 Map of Region III, Bay County

3.3.1 *Water Use Estimates and Projections*

Public Supply

Only two public supply utilities in the county, Bay County Utility Services and the City of Lynn Haven, produce their own water and together they provide water for 89 percent of county residents. Bay County Utility Services under the authority of the Bay County Board of County Commissioners (BOCC) provides surface water from the Deer Point Lake Reservoir to seven municipal utilities located within the county (Callaway, Lynn Haven, Mexico Beach, Panama City, Panama City Beach, Parker, and Springfield) as well as to customers it serves in unincorporated areas (listed below as Bay County BOCC, Cedar Grove, and Gulf Coast Electric Cooperative (GCEC)). Callaway now serves water to the community of Sandy Creek. These systems are listed separately in the tables below because they have different growth and per capita rates, and for county-managed systems different billing rates that could affect per capita usage.

Bay County Utility Services withdrew 25.21 mgd of surface water for public supply use in 2010 (Table 3.19). The utility also provides water to large industrial and institutional users, as indicated in the I/C/I water use section. Public supply withdrawals for Bay County Utility Services are projected to increase by approximately 6.49 mgd to 31.70 mgd in 2035. This is about 40 percent less than the 2030 projection in the 2008 WSA, which assumed a high growth scenario. For 2010, the average gross per capita water use rate for public supply utilities in Bay County was 180 gpcd, with rates in public supply service areas ranging from 58 to 348 gpcd. It should be recognized that the actual population served in Region III is heavily affected by tourism and seasonal populations. This is particularly the case in Panama City Beach. The population estimates and projections here, as calculated by the U.S. Census and BEBR, solely reflect permanent populations.

Lynn Haven and Panama City Beach have experienced the highest population growth rates in recent years and therefore have the largest projected growth rates for water demand. In 2010, the City of Lynn Haven purchased 26 percent of its water from Bay County Utility Services. Lynn Haven plans to continue to meet some of its future needs using its own Floridan aquifer wells. Projections assumed a groundwater source for the entire projected demand of 4.82 mgd in 2035, an increase of 2.15 mgd over 2010 usage. However, due to concerns about saltwater intrusion, it is expected that Lynn Haven will need to continue water quality monitoring and perform additional groundwater flow and solute transport modeling to demonstrate that proposed groundwater withdrawals are sustainable without causing harm to existing legal uses or water resources.

Table 3.18 Region III Public Supply Water Demand Projections, 2010 - 2035

	Estimated			Projected		
Utility	2010	2015	2020	2025	2030	2035
Bay County BOCC	0.96	0.99	1.05	1.10	1.14	1.18
Callaway	1.61	1.61	1.61	1.61	1.61	1.61
Cedar Grove	0.48	0.50	0.53	0.56	0.58	0.60
GCEC (North Bay, Lake Merial)	0.53	0.55	0.58	0.61	0.64	0.66
Lynn Haven, City of	2.67	2.96	3.37	3.81	4.29	4.82
Mexico Beach	0.27	0.27	0.27	0.27	0.27	0.27
Panama City	6.49	6.65	6.82	6.99	7.16	7.34
Panama City Beach	12.65	13.82	15.06	16.26	17.40	18.47
Parker	0.48	0.48	0.48	0.48	0.48	0.48
Sandy Creek Utility Services, Inc.	0.06	0.07	0.07	0.07	0.08	0.08
Springfield	1.00	1.00	1.00	1.00	1.00	1.00
Total	**27.20**	**28.89**	**30.83**	**32.75**	**34.64**	**36.51**

Table 3.19 Region III Public Supply Water Production Projections, 2010 - 2035

	Estimated			Projected		
Utility	2010	2015	2020	2025	2030	2035
Bay County BOCC	25.21	25.93	27.46	28.94	30.35	31.70
Callaway	0.00	0.00	0.00	0.00	0.00	0.00
Cedar Grove	0.00	0.00	0.00	0.00	0.00	0.00
GCEC (North Bay, Lake Merial)	0.00	0.00	0.00	0.00	0.00	0.00
Lynn Haven, City of	1.93	2.96	3.37	3.81	4.29	4.82
Mexico Beach	0.00	0.00	0.00	0.00	0.00	0.00
Panama City	0.00	0.00	0.00	0.00	0.00	0.00
Panama City Beach	0.00	0.00	0.00	0.00	0.00	0.00
Parker	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Creek Utility Services, Inc.	0.06	0.00	0.00	0.00	0.00	0.00
Springfield	0.00	0.00	0.00	0.00	0.00	0.00
Total	**27.20**	**28.89**	**30.83**	**32.75**	**34.64**	**36.51**

Domestic Self-Supply and Small Public Water Systems

The estimated population served by domestic self-supply and small public water systems was 17,892 in 2010. This population used an estimated 1.75 mgd of water in 2010 and water demands are anticipated to decrease to 1.69 mgd by 2035 (Table 3.20).

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

I/C/I was the second largest use category in 2010 and accounted for 24.21 mgd or 33.8 percent of the water use in Bay County (Table 3.20). Large I/C/I water users include Rock Tenn (formerly known as Stone Container), Arizona Chemical Company and Tyndall Air Force Base. Although these three water users pump small quantities of groundwater, they obtain the majority of their water from Deer Point Lake Reservoir via Bay County Utilities. Projected I/C/I water demands are anticipated to increase by 25.4 percent to 30.15 mgd by 2035.

Recreation Self-Supply

The 2010 estimated water use for self-supplied landscape, residential, and golf course irrigation totaled 3.67 mgd in Region III (Table 3.20). Water for recreational uses in Region III was drawn mostly from the surficial aquifer. There were also withdrawals from the Floridan aquifer and surface water sources. A small portion was withdrawn from the intermediate aquifer. Region III recreation water demands are anticipated to increase to 4.55 mgd by 2035 and future demands will continue to be met by a combination of reclaimed water, surface water, and groundwater sources.

Agricultural Use

The estimated water use for agricultural use was approximately 2.25 mgd in 2010 (Table 3.20). Agriculture in Bay County consists largely of sod farming, and also includes some irrigation for hay and fruit crops. Due to the difficulties inherent in projecting the mix of future agricultural crops and acreages, the agricultural demands were projected to remain constant at 2010 quantities through the planning period.

Power Generation

Consumptive water use for power generation in Bay County totaled 13.24 mgd in 2010 (Table 3.20). The two power generation facilities are the Gulf Power Company Lansing Smith Electric Generating Plant (Lansing Smith Plant) and the Bay County Waste to Energy Facility. In 2010, the Lansing Smith facility consumptively used 0.86 mgd of groundwater from the Floridan aquifer and 12.3 mgd of surface water from Alligator Bayou. The Waste to Energy Facility relies solely on groundwater and consumptively used 0.08 mgd in 2010. Water saving programs at the Lansing Smith Plant are expected to maintain the 2010 consumptive water use rates for power generation through the planning period. The Bay County Waste to Energy Facility is anticipated to remain at a consumptive rate of approximately 0.1 mgd through 2035.

Total Water Use and Population

In 2010, the average annual water use in Bay County totaled 72.34 mgd (Table 3.20). The largest use categories were public supply (38 percent of total), I/C/I (34 percent) and power generation (18 percent). The other use sectors collectively accounted for the remaining 10 percent (Figure 3.21).

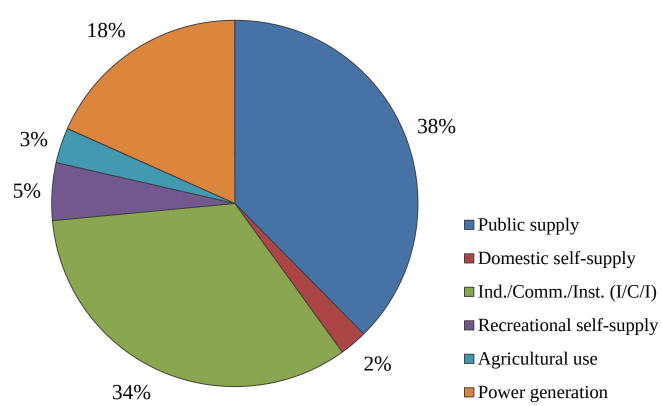


Figure 3.21 Region III Water Use by Category, 2010

The population of Bay County was 168,852 according to the U.S. Census Bureau in 2010 (BEBR 2013). Population and public supply water use are both projected to increase over the planning period. The medium-range population projection for Bay County in 2035 is 209,100 persons and represents a 24 percent increase from 2010 (BEBR 2013). As noted above, the actual population served in the region is heavily affected by tourism and seasonal populations. The population estimates and projections here, as calculated by the U.S. Census and BEBR, solely reflect permanent populations.

The total water demand in Region III is projected to increase by 22 percent, or by 16.08 mgd, between 2010 and 2035 (Table 3.20). Public supply and I/C/I water demands are projected to grow the most by 9.31 mgd and 5.94 mgd, respectively and account for the majority of this increase. Water consumptively used for domestic self-supply is anticipated to decrease by about 0.0.06 mgd. Water demand changes for the remaining use categories are relatively small.

Table 3.20 Region III Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	27.20	28.89	30.83	32.75	34.64	36.51
Domestic self-supply	1.75	1.59	1.77	1.86	1.83	1.69
Ind./Comm./Inst. (I/C/I)	24.21	29.76	29.83	29.90	30.11	30.15
Recreational self-supply	3.67	3.79	4.01	4.22	4.39	4.55
Agricultural use	2.25	2.25	2.25	2.25	2.25	2.25
Power generation	13.24	13.26	13.26	13.26	13.26	13.26
Total	**72.34**	**79.54**	**81.95**	**84.24**	**86.48**	**88.42**

1-in-10 Year Drought Projections

Projected demands for a 1-in-10 year drought are shown in Table 3.21. The 2035 total water demand for a 1-in-10 year drought is approximately 3.5 percent higher than the 2035 total average year water demand.

Table 3.21 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd)

	Projected				
Water Use Category	2015	2020	2025	2030	2035
Public supply	30.92	32.98	35.04	37.07	39.07
Domestic self-supply	1.70	1.90	1.99	1.95	1.81
Ind./Comm./Inst. (I/C/I)	29.76	29.83	29.90	30.11	30.15
Recreational self-supply	4.01	4.25	4.47	4.65	4.82
Agricultural use	2.42	2.42	2.42	2.42	2.42
Power generation	13.26	13.26	13.26	13.26	13.26
Total	**82.07**	**84.64**	**87.08**	**89.47**	**91.53**

3.3.2 *Assessment of Water Resources*

Prior to 1961, Bay County was dependent on groundwater for potable and industrial water supplies (Ryan et al. 1998). Following the construction of the Deer Point Lake Reservoir in 1961, many water users reduced groundwater pumpage and began using surface water. Surface water is now the principal source of supply and is anticipated to remain the principal source through 2035.

Surface Water Resources

From a water supply perspective, Deer Point Lake Reservoir and its tributaries comprise the principal surface water resources within Region III. Deer Point Lake Reservoir covers between 4,500 to 5,500 acres, depending on the lake stage. The four principal tributaries contributing to Deer Point Lake Reservoir are Econfina, Bear, Bayou George, and Big Cedar creeks. Between 1998 and 2008, these four tributaries contributed an average 423 mgd (654 cfs) to the lake, based on data collected by the NWFWMD. These data are representative of a low flow period. Since 1999, three distinct droughts occurred resulting in a rainfall deficit of approximately 110 inches. Normal rainfall for Region III is approximately 61.1 in/yr based on a 30-year average (1981-2010). Figure 3.22 shows the cumulative departure from normal rainfall for a station located along Bear Creek, approximately 7 miles east of Deer Point Lake Reservoir. The figure shows that the cumulative departure from normal rainfall is continuing into 2013 with a shortage of approximately 100 inches.

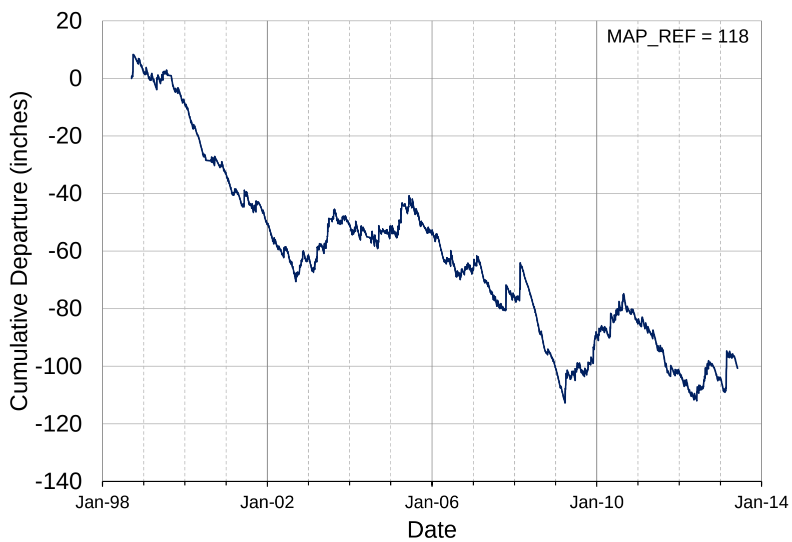


Figure 3.22 Cumulative Departure from Normal Rainfall along Bear Creek at US 231

Econfina Creek has a drainage area of 129 mi^2 and contributes approximately 60 percent of the average annual inflow into Deer Point Lake Reservoir. During low flow conditions, Econfina Creek contributes almost 80 percent of the inflow (Richards 1997). The large streamflow results, in part, from significant Floridan aquifer spring discharge along the middle Econfina Creek. The long-term average flow (1935 to 2012) for Econfina Creek at Highway 388 is 340 mgd (527 cfs). Because of the high percentage of spring inflow, discharge from Econfina Creek into Deer Point Lake Reservoir is

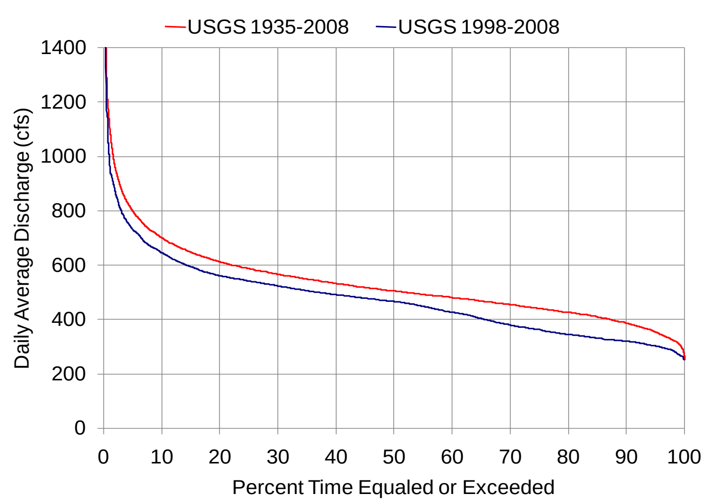


Figure 3.23 Flow Duration Curve for Econfina Creek at Highway 388

relatively stable over the year. The average flow for a 10-year period including several droughts (1998 to 2008) was 308 mgd (477 cfs), or 11 percent below the long-term average, reflecting the stable contribution of groundwater. Flow-duration curves for Econfina Creek for the 10-year drought period and the full period of record are shown in Figure 3.23. It is apparent that even under dry conditions, Econfina Creek contributes a significant quantity of fresh water to Deer Point Lake Reservoir. In addition, ground and surface waters from the Econfina watershed are presently of high quality. To protect the future use and quality of the reservoir, the District has purchased and manages more than 41,000 acres of land along the Econfina Creek and in the Econfina Recharge Area.

Bear Creek is the second largest tributary to Deer Point Lake. This creek drains a region to the east and northeast of the lake that has a large amount of poorly drained swampy areas. The watershed area is 128 mi^2. Based on continuous discharge records from 1962 to 1965, the creek has an average flow of 226 mgd and an estimated Q_{90} (flow exceeded during 90 percent of the period of record) of 103.4 mgd. This creek is typical of the blackwater streams common in northwest Florida. It has a number of organic-bottom tributary streams that come together to form the sand-bottomed main channel known as Bear Creek. These tributaries originate in swamps and bogs common in the Gulf Coastal Lowlands. The waters are slightly acidic and increases in color are typical following rainy periods due to flushing of organic materials from the adjacent swampy areas.

Bayou George Creek is located to the south of Bear Creek and directly east of Deer Point Lake. It has a drainage area of 51 mi^2. Based on periodic discharge measurements between 1962 and 1965, the creek has an average flow of 26 mgd (Musgrove et al. 1965). This creek, like Bear Creek, drains low-lying swampy areas within the Gulf Coastal Lowlands and may be characterized as a blackwater stream. The mouth of this creek was inundated when Deer Point Lake was formed and is now a drowned stream valley referred to as Bayou George.

Big Cedar Creek has the lowest flow of any of Deer Point Lake's tributaries. Based on periodic discharge measurements between 1962 and 1965, the creek has an average flow of 12 mgd (Musgrove et al. 1965). It is located to the west of Econfina Creek and northwest of the lake, draining an area of 62 mi^2 (Musgrove et al. 1965). This creek originates from Court Martial Lake within the well-drained sandhill region of southern Washington County and the western part of Bay County. This creek may also be characterized as a blackwater stream and has similar characteristics to Bear Creek and Bayou George Creek.

Deer Point Lake Reservoir is the largest contributor of fresh water to the St. Andrew Bay estuary system, although not the only one. Together with Deer Point Lake, five other streams contribute, on average, an estimated 818 mgd (1,266 cfs) of fresh water to the estuarine system (Musgrove et al. 1965). The system consists of four interconnecting waterbodies: West, North, East, and St. Andrew Bays. Based on a 1994-2004 water budget prepared by the District, an average of approximately 550 mgd (851 cfs) of fresh water flows over the Deer Point dam into North Bay (Crowe et al. 2008).

Wetappo Creek, with a drainage area of 77 mi^2, delivers an average flow of 80 mgd (124 cfs) to the eastern edge of East Bay (period of record 1936, and 1962 through 1964), with an instantaneous low flow of 6 mgd (9.3 cfs). The drainage basin can contribute 1.6 cfs/mi^2 during average flow conditions and 0.12 cfs/mi^2 during the instantaneous low flow condition.

Sandy Creek, west of Wetappo Creek, also discharges into East Bay. Its drainage basin is 60 mi^2, and it discharges 70 mgd (108 cfs) under average conditions, with an instantaneous low flow of ten mgd

(15.5 cfs) (period of record 1962 through 1965). The drainage basin can contribute 1.8 cfs/mi^2 during average flow conditions and 0.28 cfs/mi^2 during the instantaneous low flow condition.

Callaway Creek likewise discharges to East Bay, and with a drainage basin of 13 mi^2, discharges 9 mgd (14 cfs) to the estuary system during average conditions, with an instantaneous low flow of 0.6 mgd (0.93 cfs) (period of record 1962 through 1964). The drainage basin can contribute 1.1 cfs/mi^2 during average flow conditions and 0.07 cfs/mi^2 during the instantaneous low flow condition.

Burnt Mill Creek discharges an average of 23 mgd (36 cfs), (8 mgd, 12.4 cfs) instantaneous low flow) into West Bay from its 45 square mile drainage basin. The drainage basin can contribute 0.8 cfs/mi^2 during average flow conditions and 0.27 cfs/mi^2 during the instantaneous low flow condition (period of record 1962 through 1964).

Crooked Creek also discharges into West Bay, contributing an average flow of 17 mgd (26 cfs), with an instantaneous low flow condition of 6 mgd (9.3 cfs) from a watershed area of 22 mi^2. The drainage basin can contribute 1.2 cfs/mi^2 during average flow conditions and 0.42 cfs/mi^2 during the instantaneous low flow period (period of record 1962 through 1964).

Assessment Criteria

The primary assessment criterion for surface water availability is the sustainability of surface water resources and associated natural systems. Reductions in surface water flows relative to discharges needed to sustain the downstream estuarine and bay environments have recently been assessed (Crowe et al. 2008). For water supply purposes, reduced surface water inflows to the reservoir during droughts or the increased probability of such were also considered.

Impacts to Surface Water Resources and Related Natural Systems

Drought conditions may cause potential impacts to water resources as a result of increased demand and reduced supply. The ability of the natural system to sustain surface water demands during periods of drought can be assessed, in part, by comparing current use and drought year water demands to Q_{90} flows into Deer Point Lake Reservoir and the St. Andrew Bay system. Hydrologic and hydrodynamic modeling also was performed to assess the impact of reservoir withdrawals on the North Bay estuary of the St. Andrew Bay System.

Surface water withdrawals from Deer Point Lake Reservoir were approximately 52 mgd in 2010. Between 1998 and 2008, the Q_{90} inflow from the four principal tributary streams is estimated to be 244 mgd. The 2010 surface water demands were equivalent to about 21 percent of the reservoir inflow for the low rainfall period. The 2010 surface water demands equate to approximately 16 percent of the total inflow to the St. Andrew Bay system under low flow conditions (316 mgd, Musgrove et al. 1965). Bay County Utilities' allocation of 69.5 mgd was initially permitted through 2010. An extension of the allocation agreement through 2040 allows for increased withdrawals, not to exceed 98 mgd. If existing use trends continue, surface water demands for the region are projected to reach approximately 76 mgd by 2035. Projected 2035 surface water demands for a 1-in-10 year drought event (78 mgd) are equivalent to 32 percent of the Q_{90} inflow to Deer Point Lake Reservoir under low rainfall conditions and 25 percent of the estimated freshwater low-flows to St. Andrew Bay. These flows are further buffered by groundwater seepage into the bay and the storage effect of Deer Point Lake.

The construction of Deer Point Lake Reservoir in 1961 altered the natural estuarine system of North Bay. A new salinity regime was established in North Bay as the system adapted to the regulated fresh water flows from Deer Point Lake Reservoir. As discussed above, the District performed an assessment of fresh water inflows into Deer Point Lake Reservoir and potential impacts of additional water supply withdrawals from the reservoir on the salinity of North Bay (Crowe et al. 2008). The assessment included a characterization of the Deer Point Lake watershed and North Bay system, a hydrologic model of the Deer Point Lake Reservoir, and a hydrodynamic model of North Bay. The results of the study concluded that the permitted increases in withdrawals from the reservoir up to 98 mgd and periodic drawdowns of lake levels will not adversely affect the salinity of the North Bay estuarine system. Proper management, monitoring, and protection of fresh water flows ensure that the North Bay estuary continues to be a healthy, productive, and diverse ecosystem. Deer Point Lake Reservoir is included on the District's Minimum Flows and Levels (MFL) priority list. The schedule for MFL development is updated annually and may be found on the District's website.

<u>Water Quality Constraints on Availability</u>

Deer Point Lake Reservoir and its tributary creeks are classified as Class I Waters of the State due to their designation as the major potable water supply for Bay County. Water quality within the system has thus far been adequate for the designated uses; however, there have been indications of less than ideal water quality.

Consumption advisories have been issued for Deer Point Lake Reservoir due to elevated concentrations of mercury in largemouth bass (FDEP 2006a). There also has been a history of problematic aquatic plants within the lake (Hardin 1980, Kobylinski et al. 1980). These problems may be a result of nutrients within the system prior to the impoundment of fresh water and/or the addition of nutrients associated with development within the watershed. As a relatively shallow impounded system, Deer Point Lake Reservoir is highly susceptible to sedimentation, to the point that too much accumulation could reduce the storage capacity needed for water supply. Areas of oxygen depletion and reduction in biological diversity have been noted within the impoundment, which contribute to concern for the overall health of the system (Young 1987, Wolfe et al. 1988). Water clarity reductions and turbidity increases have been documented throughout the lake, but particularly within the Bayou George area (Hardin 1980).

Growth in Bay County not only increases the demand for water but also creates the potential for land use activities that could impact water quality. Of particular concern is residential development plumbed to individual septic systems near the reservoir or its tributaries. To help prevent water quality degradation, Bay County enacted the Deer Point Lake Protection Zone Ordinance in 1994. The ordinance expanded the protection zone boundary established by the State in 1967 and requires low-density development, a 75-ft natural vegetation setback, stringent stormwater runoff requirements, and prohibits certain incompatible land uses. Presently, the quality of ground and surface water in the Deer Point Lake watershed is sufficiently high that the water can be used with minimal treatment. To safeguard the present condition of the lake, future land uses in the watershed should continue to be carefully managed.

In addition to anthropogenic concerns, the hurricane seasons within the first decade of the millennium emphasized existing concerns over the susceptibility of the reservoir to storm surge. Based on the National Hurricane Center's Tropical Cyclone Reports, the Gulf Coast experienced a 10 to 15 foot storm surge from Hurricane Ivan (2004) and a 24 to 28 foot storm surge from Hurricane Katrina (2005). These two storms were Category 3 hurricanes when they made landfall. Storm surge predictions were made for the Deer Point Lake Dam using the SLOSH model (USACE 1998). The elevation of the dam spillway is 4.5 feet above mean sea level. The predicted surge heights ranged from 11.3 feet (Category 3) to 17.5 feet (Category 5) above sea level. Storm surge from hurricanes of these magnitudes could inundate the lake with moderately to highly saline water. Under average inflow conditions (723 cfs), it has been estimated it would take about 22 days to replace the reservoir volume (Toler 1964). During the initial filling of the reservoir, it took several months to reduce chloride levels to drinking water standards. The salinity of the lake at the time the dam was completed was about 39 percent that of seawater. As a worst-case scenario, lake flushing time could be extended if it became more saline than previous estimates. As a result, the availability of water from the Deer Point Lake Reservoir is constrained by the possibility of a storm surge event or anthropogenic impact that temporarily degrades water quality.

Adequacy of Surface Water Resources

In Region III, the existing and reasonably anticipated surface water sources are adequate to meet the requirements of existing and reasonably anticipated future average water demands and demands for a 1-in-10 year drought through 2035, while sustaining water resources and related natural systems. However, the Deer Point Lake Reservoir is vulnerable to being impacted by salt water from a hurricane storm surge associated with a Category 3 or higher storm. Bay County has proposed to construct a water intake structure further upstream from the dam in the Econfina Creek basin, slightly north of Bear Creek. This station would provide an alternative raw surface water intake that would be unaffected or minimally affected in the event of dam failure or breach leading to intrusion of salt water due to storm surge (Hatch Mott MacDonald 2013).

Groundwater Resources

Groundwater is significant in Region III from two perspectives. First, a significant fraction of the surface water discharged into the Deer Point Lake Reservoir originates as discharge from the Floridan aquifer both within and outside of Region III. This discharge is conveyed to Deer Point Lake Reservoir via Econfina Creek. Second, expanded use of the Floridan aquifer is being proposed by the City of Lynn Haven as an alternative to purchasing treated surface water from Bay County Utilities.

In order of depth, the hydrogeologic units which describe the groundwater flow system are the surficial aquifer system, the intermediate system, the Floridan aquifer system and the sub-Floridan system.

The surficial aquifer typically consists of unconsolidated quartz sand. Groundwater generally exists under unconfined conditions. The thickness of the surficial aquifer ranges between 40 feet and 80 feet in coastal Bay County and is typically 40 feet or less in inland areas. In low-lying areas along Econfina Creek, the surficial aquifer is absent. Along the coastal fringe, the saturated thickness and permeability are sufficient to form a locally important source of groundwater that is used to meet some water needs, particularly for non-potable uses such as landscape irrigation. Well yields range from 200 to 500 gpm.

The intermediate system consists of fine-grained low permeability sediments and functions primarily as a confining or leaky confining unit. In central and northern Bay County, the thickness of the intermediate system is typically 100 feet or less. Along Econfina Creek, this unit is very thin to absent. In coastal Bay County, this unit reaches a thickness of 200 to 300 feet and includes a locally significant aquifer. Well yields are on the order of 200 to 300 gpm and although not as productive as the surficial aquifer, the intermediate system in coastal Bay County is capable of yielding significant quantities of water.

The Floridan aquifer system is the source of most of the groundwater pumped in Region III. It consists of a sequence of carbonate sediments ranging in thickness from about 600 feet in northeast Bay County to more than 1,400 feet in the extreme southeast part of the county. The hydraulic conductivity is quite variable. In northwest Bay County, results of aquifer performance testing were on the order of 45,000 ft^2/day and specific capacity values averaged 120 gpm/ft. This is an area of active recharge, flow and dissolution of the Floridan aquifer system.

The Floridan aquifer system's zone of contribution for Region III extends into southern Washington and eastern Calhoun and Gulf counties (Richards 1997). On the east side of Econfina Creek in the Bay County panhandle, the potentiometric surface reaches a maximum elevation of approximately 100 feet above sea level (Figure 3.24). From this high point, water levels decline in all directions. Along the Bay-Washington County line, the potentiometric surface is lower; reaching an average elevation of just over 40 feet above sea level. From here, water levels decline toward Econfina Creek and the Gulf of Mexico. Significant spring discharge occurs along the Econfina Creek in northern Bay and southern Washington Counties.

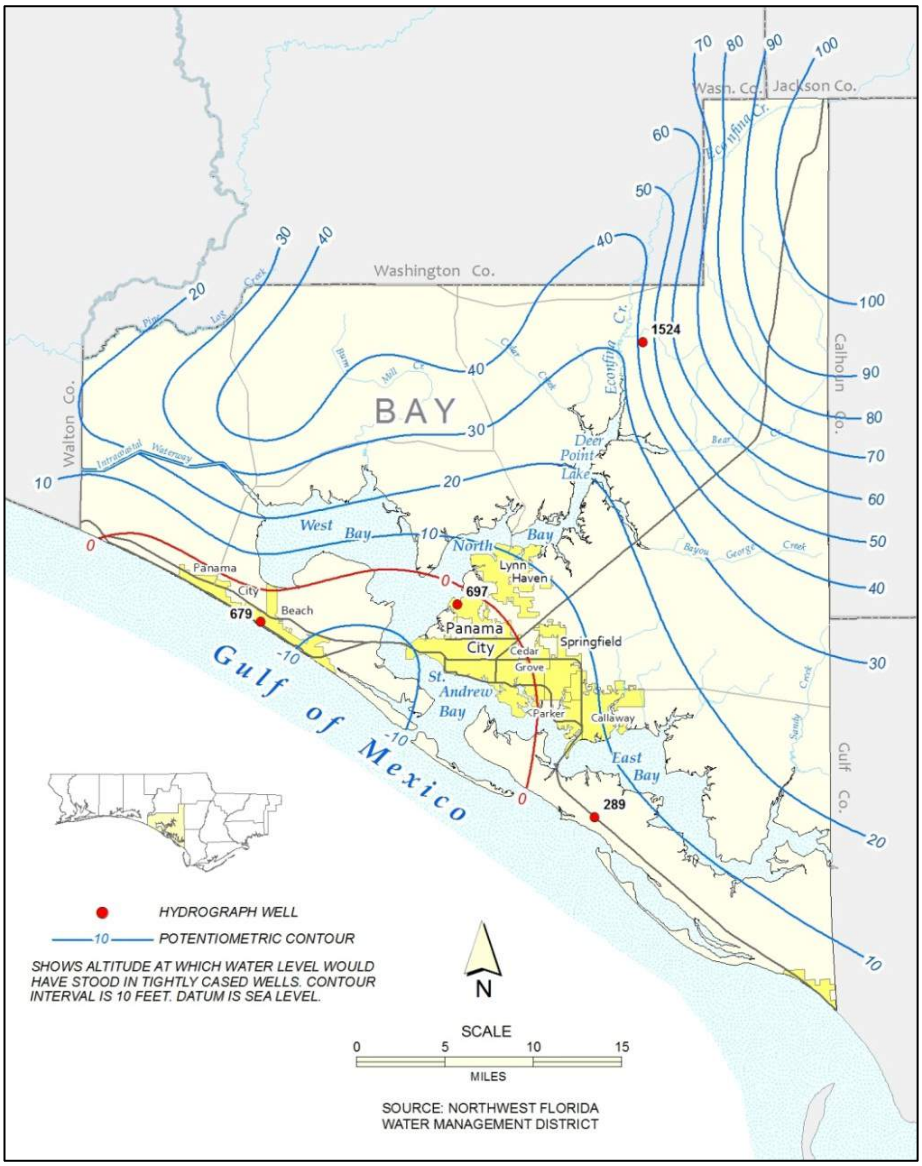


Figure 3.24 Potentiometric Surface of the Floridan Aquifer System in Bay County, June 2010

The sub-Floridan system underlies and confines the Floridan aquifer system. The sub-Floridan system forms the base of the Floridan aquifer. Little is known of the hydraulic character of this unit in the region, but it is believed to be considerably lower than that of the overlying Floridan aquifer.

Assessment Criteria

The long-term depression of the potentiometric surface of the Floridan aquifer system and attendant alteration of groundwater quality were the primary criteria used to assess groundwater availability. A regional groundwater budget was also used to examine the relative magnitude of groundwater withdrawals.

Impacts to Groundwater Resources and Related Natural Systems

Data presented in Figure 3.25 shows historical Florida aquifer water levels near the coast. Hydrographs include a well near the Panama City Airport (Fannin Airport well), a well at Tyndall AFB (Tyndall #10), and a well in Panama City Beach (Argonaut Street well). A fourth well (Eddie Barnes well) is located north of Deer Point Lake Reservoir, away from the historical pumping centers. The locations of these monitor wells are shown on Figure 3.24 and identified by their NWFID numbers.

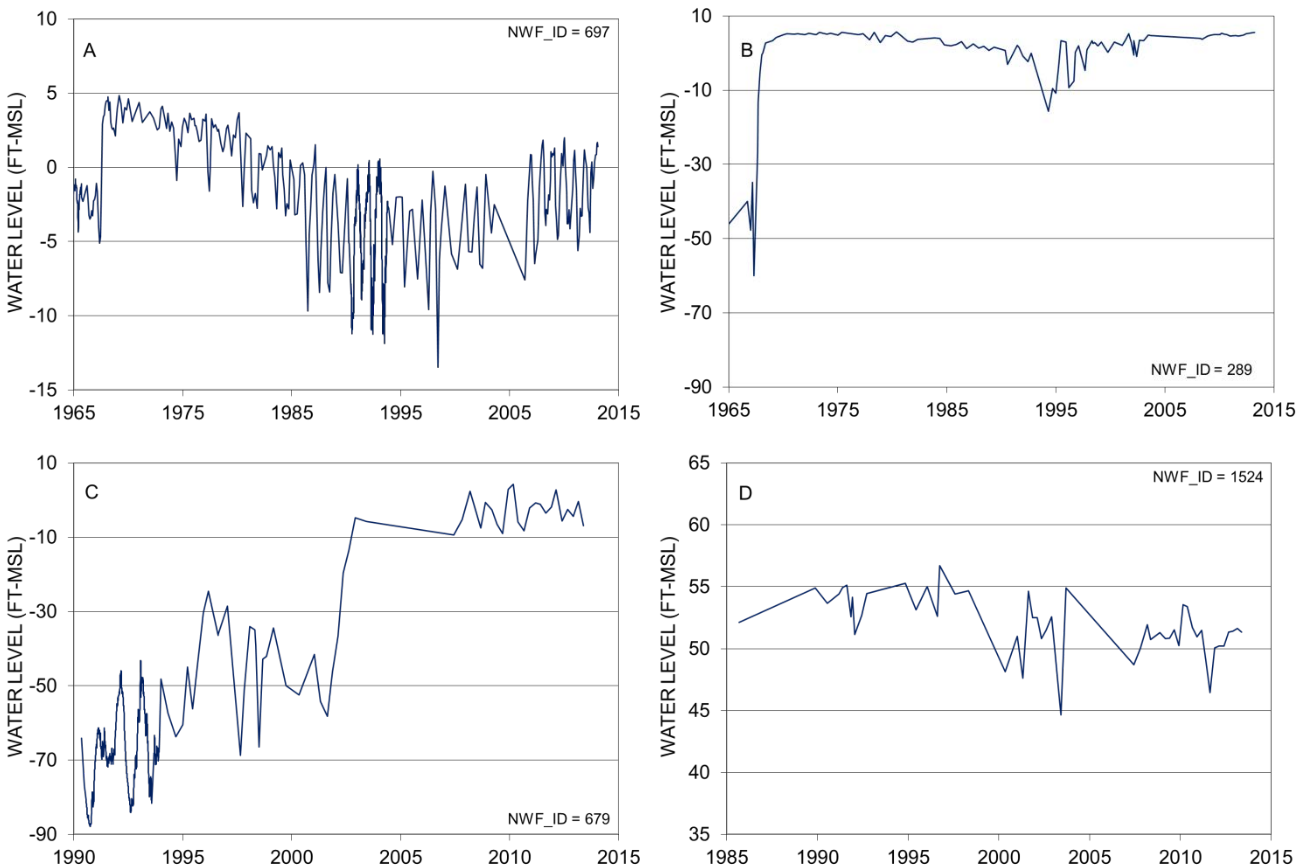


Figure 3.25 Hydrographs of the A) Fannin Airport, B) Tyndall #10, C) Argonaut Street, and D) Eddie Barnes Floridan Aquifer Wells

The Fannin Airport (Figure 3.25A) and Tyndall (Figure 3.25B) wells depict water level declines that persisted from the late 1930s to late 1960s, largely due to industrial withdrawals. Larger declines are evident in the Tyndall well, which was closer to and downgradient from the former wellfields used prior to the industrial supply switch to surface water. With the reduction in Floridan aquifer pumping, water levels in both wells rebounded in 1967. Subsequent to this recovery, water levels began to drift down again. This downward trend largely represents increased withdrawals in the Panama City Beach area. As a result, a significant cone of depression again formed in the Floridan aquifer.

The Argonaut Street hydrograph (Figure 3.25C) indicates that the Panama City Beach cone of depression has existed since at least 1990. Water levels in the Argonaut Street well ranged between 90 and 30 feet below sea level during the 1990s. Water levels have recovered to less than 10 feet below sea level in 2010 (Figure 3.24).

In 2002, deteriorating water quality associated with the local cone of depression prompted Panama City Beach to abandon their supply wells and begin purchasing all of their water from Bay County Utilities. Following the cessation of pumping, water levels in the Floridan aquifer recovered approximately 50 feet, as shown in the Argonaut Street well. At 2013, water levels are just below sea level in the Panama City Beach area (Argonaut well) due to the continued limited use (approximately 8 mgd) of the Floridan aquifer for public supply, industrial, irrigation, and domestic self-supply water use.

By contrast, the Eddie Barnes well, located in northeast Bay County just east of Econfina Creek, appears to have been unaffected by withdrawals (Figure 3.25D). Based on results from a calibrated, steady-state groundwater flow model (Richards 1997), the simulated potentiometric surface of the Floridan aquifer at this location differed by approximately 0.01 feet between pumping and non-pumping conditions. Water levels have fluctuated approximately 10 feet between 1985 and 2013. The lowest water levels are associated with the three droughts experienced over the last 15 years. This well indicates that the groundwater levels that control stream baseflow are relatively stable and only moderately affected by drought.

Groundwater Budget

The water budget presents an order-of-magnitude approximation of the major Floridan aquifer system sources and discharges for Bay County (Ryan et al. 1998) (Figure 3.26). It was prepared using output from a calibrated flow mode. Although a calibrated steady-state model does not account for seasonal or annual variation in flow, the model does provide a means to estimate the relative magnitude of the various inflows to and outflows from the aquifer. At the northern part of the region along the Bay-Washington County line a new groundwater supply source was proposed for development in the 2008 Region III RWSP. The project was to provide 5 mgd of groundwater or approximately 2 percent of the groundwater budget to the region. This proposed alternative groundwater supply source development did not occur.

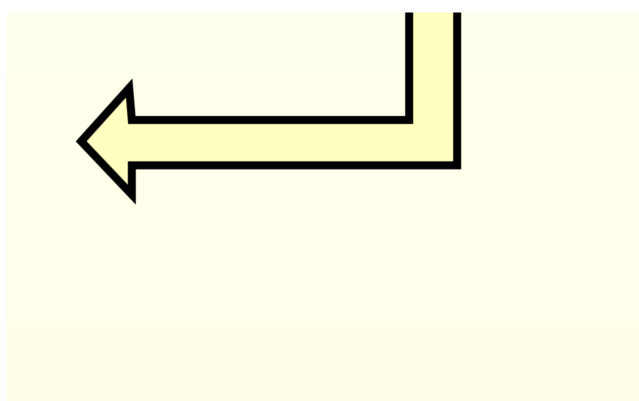


Figure 3.26 Region III Floridan Aquifer Steady-State Groundwater Budget

When analyzing the groundwater budget, it is important to realize that the most active portion of the flow system is located in the northern part of the region, away from the coastline. This is the part of Region III lying on the southernmost edge of the Dougherty Karst region. It includes the extensive karst terrain found west of Econfina Creek in northern Bay and southern Washington counties. The Dougherty Karst region is significant for being both a recharge and a discharge area for the Floridan aquifer. Recharge occurs within the karst terrain and discharge occurs into Econfina and Holmes Creeks. As a result, much of the inflow to and outflow from the Floridan aquifer (as quantified in the above water budget) occurs in the northern half of Region III.

The southern half of the region, where the majority of groundwater usage occurs, is relatively removed from the active part of the flow system. This has a negative implication regarding the vulnerability of the Floridan aquifer to saltwater intrusion and upconing impacts from pumping. Being in a relatively sluggish, low-velocity, slowly flushed part of the flow system, with a natural background of elevated sodium, chloride and TDS concentrations, the coastal area is susceptible to both lateral saltwater intrusion and vertical upconing of saline water.

Water Quality Constraints on Availability

Concerns regarding water quality and potentiometric surface declines constrain the availability of the Floridan aquifer in coastal Bay County. However, over most of Region III, the quality of groundwater in all three aquifer systems is suitable for most uses.

Adequacy of Groundwater Resources

The 2035 projected groundwater demand is small, approximately 6 percent, of the regional water budget and regional groundwater resources are adequate to provide for the projected average annual withdrawals and the 1-in-10 year drought event withdrawals of 14.27 mgd and 15.15 mgd, respectively.

Reclaimed Water

Approximately 2.7 mgd or 18 percent of the 15.4 mgd of wastewater generated in Bay County in 2010 was of reuse quality, and almost the same amount was used to replace potable-quality water (Table 3.22). Reclaimed water was reused to irrigate public access areas such as golf courses, sports parks, and residential lawns, as well as being reused for industrial purposes at wastewater treatment plants. Local governments and utilities are exploring opportunities to meet future water use needs with reclaimed water. The Millville and St. Andrews WWTFs present opportunities for reclaiming water that is being disposed of in St. Andrew Bay (Tables 3.23 and 3.24).

Table 3.22 Region III Reuse of Domestic Wastewater, 2010 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Reuse Flow that Replaces Potable-Quality Water*
Lynn Haven Wastewater Treatment Facility	2.50	1.49	1.00	0.11	0.11
Military Point Regional AWT Facility	7.00	4.40	1.11	0.60	0.50
Millville AWT Facility	5.00	2.30			
Panama City Beach WWTP #1	10.00	4.28	14.00	1.99	1.99
St. Andrews WWTF	5.00	2.90			
Bay County Total	**29.50**	**15.37**	**16.11**	**2.70**	**2.60**

*Reuse Flow That Replaces Potable-Quality Water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses. Not included in this flow calculation are agriculture irrigation of other crops, absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant (Source: DEP reuse inventories).

Table 3.23 Region III Domestic Wastewater Flow Projections 2015 - 2035 (mgd)

Facility Name	2015	2020	2025	2030	2035
Lynn Haven Wastewater Treatment Facility	1.64	1.87	2.11	2.38	2.68
Military Point Regional AWT Facility	4.54	4.81	5.05	5.27	5.45
Millville AWT Facility	2.30	2.30	2.30	2.30	2.30
North Bay WWTF	0.00	0.00	0.00	0.00	0.00
Panama City Beach WWTP #1	4.68	5.09	5.50	5.89	6.25
St. Andrews WWTF	2.90	2.90	2.90	2.90	2.90
Bay County Total	**16.06**	**16.97**	**17.87**	**18.74**	**19.58**

Table 3.24 Regional III Available Reclaimed Water Projections 2015 - 2035* (mgd)

Facility Name	2015	2020	2025	2030	2035
Lynn Haven Wastewater Treatment Facility	1.48	1.71	1.95	2.22	2.51
Military Point Regional AWT Facility	3.79	4.06	4.30	4.52	4.70
Millville AWT Facility	2.30	2.30	2.30	2.30	2.30
North Bay WWTF	0.00	0.00	0.00	0.00	0.00
Panama City Beach WWTP #1	1.70	2.11	2.52	2.91	3.27
St. Andrews WWTF	2.90	2.90	2.90	2.90	2.90
Bay County Total	**12.17**	**13.08**	**13.98**	**14.84**	**15.68**

*Projections are for potentially available reclaimed water and do not take into account planned expansions of reuse systems.

Conservation

Modest conservation efforts are being pursued in Region III. Lynn Haven has a welcome kit on water conservation for new residents and an ongoing meter replacement program. Bay County Utility Services has established a conservation-oriented rate structure and has information about detecting and locating water leaks on their website. A variety of further conservation opportunities exist. For example, if the cities of Lynn Haven and Panama City Beach could reduce their gross per capita water use to 150 gpcd (reflecting permanent populations only), it is estimated that those two utilities combined could save 9.5 mgd by 2035, or 41 percent of their water use. Further evaluation is needed to determine the cost effectiveness of additional water conservation. Water utilities are encouraged to use the Conserve Florida EZ Guide tool to identify those options most cost effective for their customer base.

3.3.3 *Determination of the Need for a Regional Water Supply Plan*

Currently surface water resources are anticipated to be sufficient to meet the projected demands through 2035 while sustaining water resources and associated natural systems. However, the current principal source of supply is vulnerable to coastal storm surge and dam failure. The District's Governing Board determined in March 2008 that a RWSP was needed for Region III and the plan was subsequently adopted in August 2008. Continuance of regional water supply planning can focus on developing a water supply alternative that will address vulnerabilities associated with potential hurricane impacts. The District, therefore, will be updating the RWSP, which is anticipated to be available in March 2014.

This page intentionally left blank.

3.4 Region IV: Calhoun, Holmes, Jackson, Liberty and Washington Counties

Region IV consists of five rural counties and 24 municipalities, with 75 percent of the population residing in unincorporated areas (Figure 3.27). Government, retail trade, service and manufacturing are the region's major employment sectors. A significant portion of land in the region is devoted to forestry, agriculture, and conservation. The District manages over 95,000 acres within Region IV, including tracts in the Holmes Creek, Econfina Creek, Choctawhatchee River, Upper Chipola River, and Apalachicola River water management areas. The majority of Liberty County lies within the Apalachicola National Forest. Water demands in Region IV are primarily met with groundwater from the Floridan aquifer.

Region IV Snapshot		
	2010	2035
Population	117,559	130,200
Water Use (mgd)	~ 40	~ 48
Primary Source	Floridan Aquifer	
RWSP Status	No RWSP Recommended	

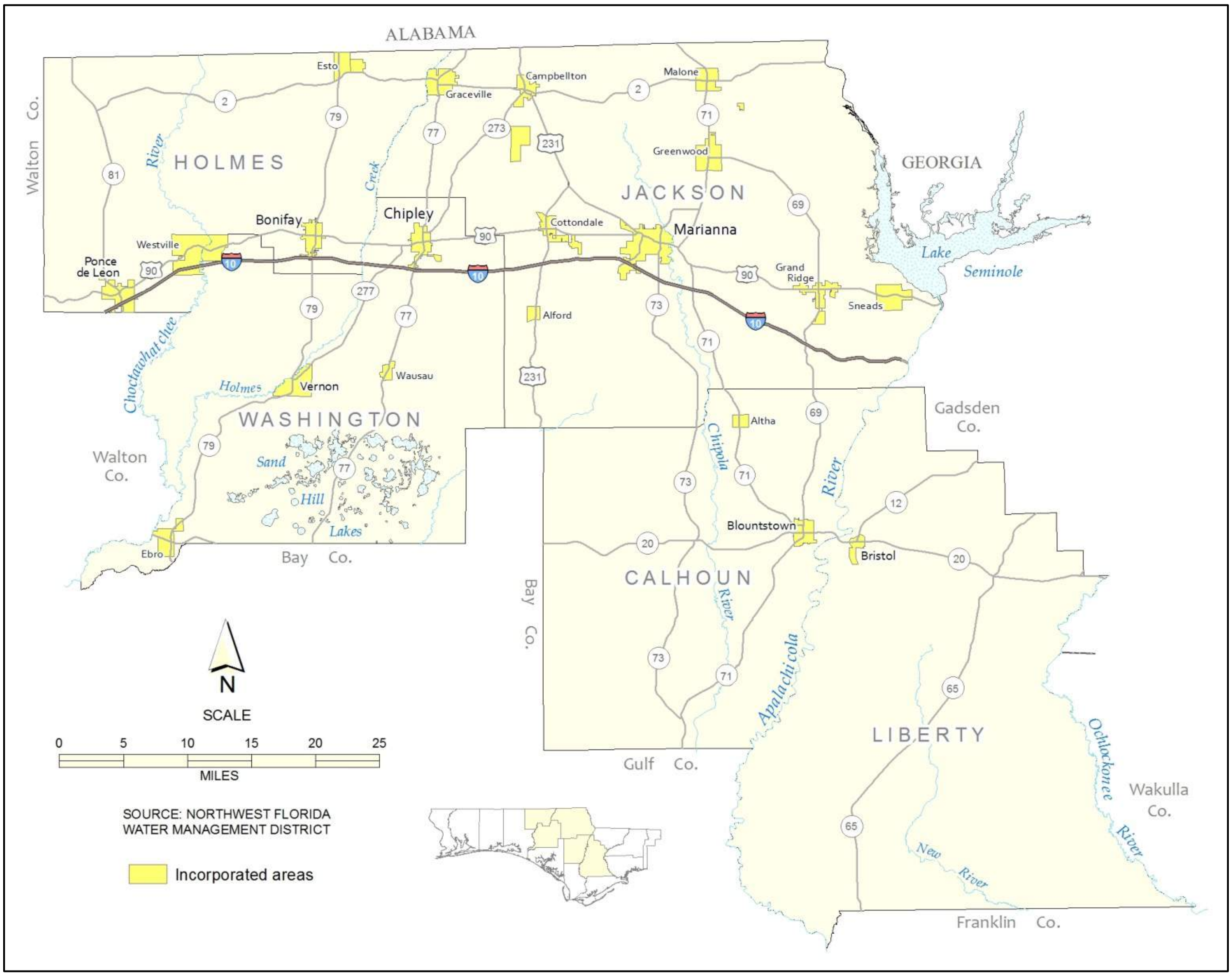


Figure 3.27 Map of Region IV

3.4.1 *Water Use Estimates and Projections*

Public Supply

Thirty public water systems collectively withdrew approximately 5.71 mgd of groundwater in 2010 (Table 3.25 through Table 3.29) and supplied approximately 33 percent of the population. Most of these are small water systems that have an average daily use of less than 1 million gallons per day. The largest withdrawals were by the City of Marianna (1.1 mgd), the City of Bonifay (0.8 mgd), the City of Chipley (0.6 mgd), and the City of Blountstown (0.6 mgd). All of the remaining utilities used less than 0.5 mgd. The Town of Caryville in Washington County provides approximately 30,000 gpd to residents in nearby Holmes County. This small amount did not merit including separate tables for demand and production; only demand is shown. Caryville's water production estimates and projections represent the sum for both counties. Total withdrawals for public supply use are anticipated to increase only 0.4 mgd by 2035 reflecting slow growth projected for the region.

Table 3.25 Calhoun County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Altha, Town of	0.08	0.08	0.08	0.08	0.08	0.08
Blountstown, City of	0.58	0.59	0.60	0.61	0.62	0.63
Total	**0.67**	**0.67**	**0.68**	**0.69**	**0.70**	**0.71**

Table 3.26 Holmes County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Bonifay, City of	0.81	0.81	0.81	0.81	0.81	0.81
Caryville, Town of (Holmes County demand)	0.03	0.03	0.03	0.03	0.03	0.03
Esto Water Works	0.03	0.03	0.03	0.03	0.03	0.03
Joyce E. Snare Waterworks (Dogwood)	0.04	0.05	0.05	0.05	0.05	0.05
Noma, Town of	0.07	0.07	0.07	0.07	0.07	0.07
Ponce de Leon, Town of	0.10	0.11	0.12	0.14	0.16	0.18
Westville, Town of	0.05	0.06	0.06	0.06	0.06	0.06
Total	**1.13**	**1.15**	**1.17**	**1.19**	**1.21**	**1.24**

Table 3.27 Jackson County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Alford, Town of	0.06	0.06	0.06	0.06	0.06	0.06
Campbellton, Town of	0.03	0.03	0.03	0.04	0.04	0.04
Cottondale, City of	0.13	0.13	0.13	0.13	0.13	0.13
Graceville, Town of	0.40	0.40	0.40	0.40	0.40	0.40
Grand Ridge, Town of	0.12	0.13	0.13	0.13	0.14	0.14
Greenwood, City of	0.11	0.11	0.11	0.11	0.11	0.11
Jacob, City of	0.02	0.02	0.02	0.02	0.02	0.02
Malone, Town of	0.08	0.08	0.08	0.08	0.08	0.08
Marianna, City of	1.11	1.11	1.12	1.12	1.12	1.13
Sneads, Town of	0.24	0.24	0.24	0.24	0.24	0.24
Total	**2.30**	**2.32**	**2.33**	**2.33**	**2.34**	**2.35**

Table 3.28 Liberty County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

Utility	Estimated 2010	Projected 2015	2020	2025	2030	2035
Bristol, City of	0.27	0.28	0.29	0.30	0.32	0.33
Liberty Co. BOCC, Hosford-Telogia	0.12	0.14	0.14	0.15	0.16	0.17
Liberty Co. BOCC, Lake Mystic Water System	0.04	0.05	0.05	0.06	0.06	0.06
Liberty Co. BOCC, Rock Bluff Water System	0.03	0.03	0.03	0.03	0.04	0.04
Liberty Co. BOCC, Estiffanulga Water System	0.03	0.03	0.03	0.03	0.03	0.04
Sumatra Water System	0.02	0.02	0.02	0.02	0.02	0.02
Talquin Electric Coop., Sweetwater System	0.01	0.01	0.01	0.01	0.01	0.01
Total	**0.52**	**0.55**	**0.58**	**0.61**	**0.64**	**0.67**

Table 3.29 Washington County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

Utility	Estimated 2010	Projected 2015	2020	2025	2030	2035
Sunny Hills Utilities (Fr. Aqua Utilities Florida, Inc.)	0.20	0.21	0.22	0.23	0.24	0.24
Caryville, Town of (Washington County demand)	0.07	0.07	0.07	0.07	0.07	0.07
Chipley, City of	0.65	0.65	0.65	0.65	0.65	0.65
Vernon, City of	0.12	0.12	0.12	0.12	0.12	0.12
Wausau, Town of	0.05	0.05	0.05	0.05	0.05	0.05
Total	**1.10**	**1.10**	**1.11**	**1.12**	**1.13**	**1.14**

Domestic Self-Supply and Small Public Water Systems

The majority of the population (78,887 persons) was served by small public water systems or domestic self-supply in 2010. The estimated domestic self-supply water use was 6.73 mgd in 2010 and demands are anticipated to increase to 7.53 mgd in 2035 (Table 3.30).

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

I/C/I users accounted for 2.68 mgd or about 7 percent of the Region IV water use in 2010 (Table 3.30). Water users in this category include several correctional facilities, a school facility, and several county government complexes. The projected water demands for existing I/C/I users are anticipated to increase to 3.34 mgd by 2035.

Recreation Self-Supply

The 2010 estimated water use for self-supplied recreation totaled approximately 1 mgd in Region IV (Table 3.30). Recreation water use is the smallest use category for Region IV. Almost all of the recreation water used in Region IV was withdrawn from the Floridan aquifer. A small portion was taken from surface water ponds. Region IV recreation use demands are expected to remain steady through 2035. Future demands are anticipated to be met primarily from the Floridan aquifer.

Agricultural Use

Agriculture was the largest water use category in 2010. Agriculture accounted for approximately 21.91 mgd or 54 percent of the total estimated water use in Region IV (Table 3.30). Agricultural crops include peanuts, corn, cotton, hay, sod and other field crops, vegetables, and fruit crops. Seasonality plays a major role in agricultural water usage in Region IV. In Jackson County, approximately 84 percent of the total yearly irrigation water is used during the five month period of May through September (the growing season). In Calhoun County, 63 percent of the irrigation water is used during this period. Non-crop agricultural water usage (livestock watering and aquaculture) was 2.14 mgd or less than 10 percent of the total agricultural water usage in 2010. Future agricultural water use for the region is projected to increase to 29.59 mgd by 2015. Projections are then held constant through the planning period to year 2035 due to the uncertainty in forecasting. Future agricultural water use may differ from projected values due to changes in economic conditions, climate, or other factors that affect agricultural production and agricultural water use needs.

Power Generation

The two power generation facilities that have consumptive water use permits are the Telogia Power facility in Liberty County and Gulf Power Company's Scholz Electric Generating Plant in Jackson County. Sources of water for power plant uses include the Floridan aquifer system, the Apalachicola River, and a tributary of Telogia Creek. Most of the surface water and some of the groundwater is used for once-through cooling and discharged to surface waters. Consumptive water use for power generation totaled 2.35 mgd in 2010 and is anticipated to increase to 2.39 mgd by 2015 (Table 3.30). Gulf Power has reported their intent to close the Scholz power plant in Jackson County in 2015. This would reduce power generation use to 0.48 mgd after 2015.

The Jim Woodruff hydroelectric plant, located 0.2 miles from the confluence of the Chattahoochee and Flint rivers on the border between Gadsden and Jackson counties, generates electricity by passing water through turbines; it requires no consumptive use of water to operate the turbines.

Total Water Use and Population

Average annual water use in Region IV totaled approximately 40.41 mgd in 2010 (Table 3.30). The largest use categories were agriculture (54 percent of total) and domestic self-supply (17 percent) (Figure 3.28). Among the five counties in Region IV, Jackson County used the largest amount of water (Appendix A). The total water use for Jackson County was approximately 25.36 mgd in 2010 and agriculture accounted for the majority of this amount (16.24 mgd in 2010).

According to the 2010 Census the total population in Region IV was 117,559 persons (BEBR 2013). Population and public supply water use are both projected to increase over the planning period. The medium-range projections indicate that the total Region IV population will increase by 11 percent to 130,200 in 2035 (BEBR 2013).

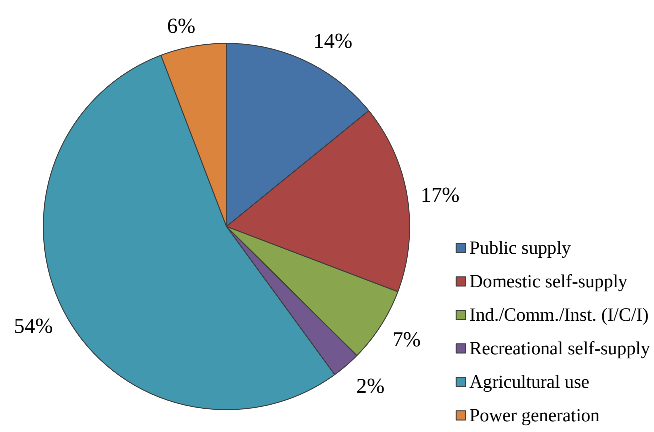


Figure 3.28 Region IV Water Use by Category, 2010

The total water demand in Region IV is projected to increase by approximately 19 percent, or 7.75 mgd, between 2010 and 2035 (Table 3.30). By 2035, total water demand for the five-county region is projected to be 48.16 mgd. Public supply water demands are estimated to grow by 0.39 mgd and demands for domestic self-supplied water are projected to grow by 0.80 mgd. Water consumptively used for power generation is anticipated to decrease to 0.48 mgd and water demands for I/C/I uses are projected to increase by 0.66 mgd.

Table 3.30 Region IV Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

Water Use Category	Estimated 2010	Projected 2015	2020	2025	2030	2035
Public supply	5.71	5.80	5.87	5.95	6.03	6.10
Domestic self-supply	6.73	6.87	7.08	7.26	7.40	7.53
Ind./Comm./Inst. (I/C/I)	2.68	3.09	3.15	3.21	3.28	3.34
Recreational self-supply	1.02	1.04	1.07	1.09	1.11	1.12
Agricultural use	21.91	29.59	29.59	29.59	29.59	29.59
Power generation	2.35	2.39	0.48	0.48	0.48	0.48
Total	**40.41**	**48.77**	**47.24**	**47.57**	**47.88**	**48.16**

1-in-10 Year Drought Event Projections

Projected demands for a 1-in-10 year drought event are shown in Table 3.31. The 2035 total demand for a 1-in-10 year drought is 54.70 mgd and is approximately 14 percent higher than the 2035 total average year water demand.

Table 3.31 Demand Projections for a 1-in-10 Year Drought Event, Region IV, 2015 - 2035 (mgd)

Water Use Category	Projected 2015	2020	2025	2030	2035
Public supply	6.20	6.28	6.36	6.45	6.53
Domestic self-supply	7.35	7.58	7.77	7.92	8.05
Ind./Comm./Inst. (I/C/I)	3.09	3.15	3.21	3.28	3.34
Recreational self-supply	1.12	1.15	1.18	1.20	1.21
Agricultural use	35.09	35.09	35.09	35.09	35.09
Power generation	2.39	0.48	0.48	0.48	0.48
Total	**55.24**	**53.73**	**54.08**	**54.41**	**54.70**

3.4.2 *Assessment of Water Resources*

The vast majority of groundwater in Region IV is obtained from the Floridan aquifer system. Given the high availability of groundwater from the Floridan aquifer and good water quality, it is reasonable to anticipate that this use pattern will continue through the year 2035. Accordingly, the water source evaluation presented here emphasizes groundwater resources.

Groundwater Resources

Region IV includes two distinct hydrogeologic settings, the Dougherty Karst region and the Apalachicola Embayment (Pratt et al. 1996a). Holmes, Washington, Jackson and northern Calhoun counties lie within the Dougherty Karst region, while southern Calhoun and Liberty counties lie within the Apalachicola Embayment (Figure 3.29). The Dougherty Karst region has a very dynamic groundwater flow system characterized by a strong hydraulic connection between ground and surface waters, high aquifer recharge rates, and karst features. Compared to the Dougherty Karst region, the Apalachicola Embayment is characterized by a poor connection between ground and surface waters, low recharge rates, and groundwater quality that deteriorates with depth. In both regions, the groundwater flow system consists of four hydrogeologic units: the surficial aquifer system, the intermediate system, the Floridan aquifer system, and the sub-Floridan system.

The surficial aquifer is negligible as a source of water supply within Region IV. Its significance to the region derives from its role as a source of recharge water for the underlying aquifers. The surficial aquifer is absent in portions of all five counties in this region.

The intermediate system is between 50 and 100 feet thick in most of the Dougherty Karst region, is breached by recent and relic sinkholes, and functions as a semi-confining unit. In parts of the Dougherty Karst region, the intermediate system is effectively absent, placing the Floridan aquifer at or near the land surface. Within the Apalachicola Embayment of Region IV, the intermediate system is generally 100 to 200 feet thick and functions as an effective confining unit that significantly restricts recharge to the underlying Floridan aquifer.

Directly beneath the intermediate system (where it is present) or immediately beneath land surface (where it is absent) is the Floridan aquifer system. The Floridan aquifer system consists of a carbonate sequence that ranges in thickness from less than 100 feet in northern Jackson County to approximately 2,000 feet in southeastern Liberty County. In this region, the Floridan aquifer includes the Chattahoochee Formation, the Marianna and Suwannee limestones, and the Ocala Limestone. Typically, only the upper several hundred feet are utilized as a source of water. In the Dougherty Karst region, there is substantial recharge to the Floridan aquifer and a strong hydraulic connection between the ground and surface waters. The recharge has caused extensive dissolution and the development of a very active groundwater flow system, with wells yielding up to 1,500 gpm.

The potentiometric surface is strongly influenced by groundwater discharging to local springs, creeks and rivers (Figure 3.29). The potentiometric surface reaches a maximum elevation of approximately 150 feet above sea level in northern Holmes and Jackson counties. From here, groundwater flows south towards discharge areas. Major discharge features include the Chipola, Choctawhatchee and Apalachicola rivers and Holmes and Econfina creeks, one first magnitude spring (Jackson Blue), 17 second magnitude springs, and 12 third magnitude springs (Barrios 2005; Barrios and Chelette 2004). Groundwater quality is generally good throughout the Dougherty Karst region; however highly mineralized water occurs in a limited area where Holmes Creek joins the Choctawhatchee River.

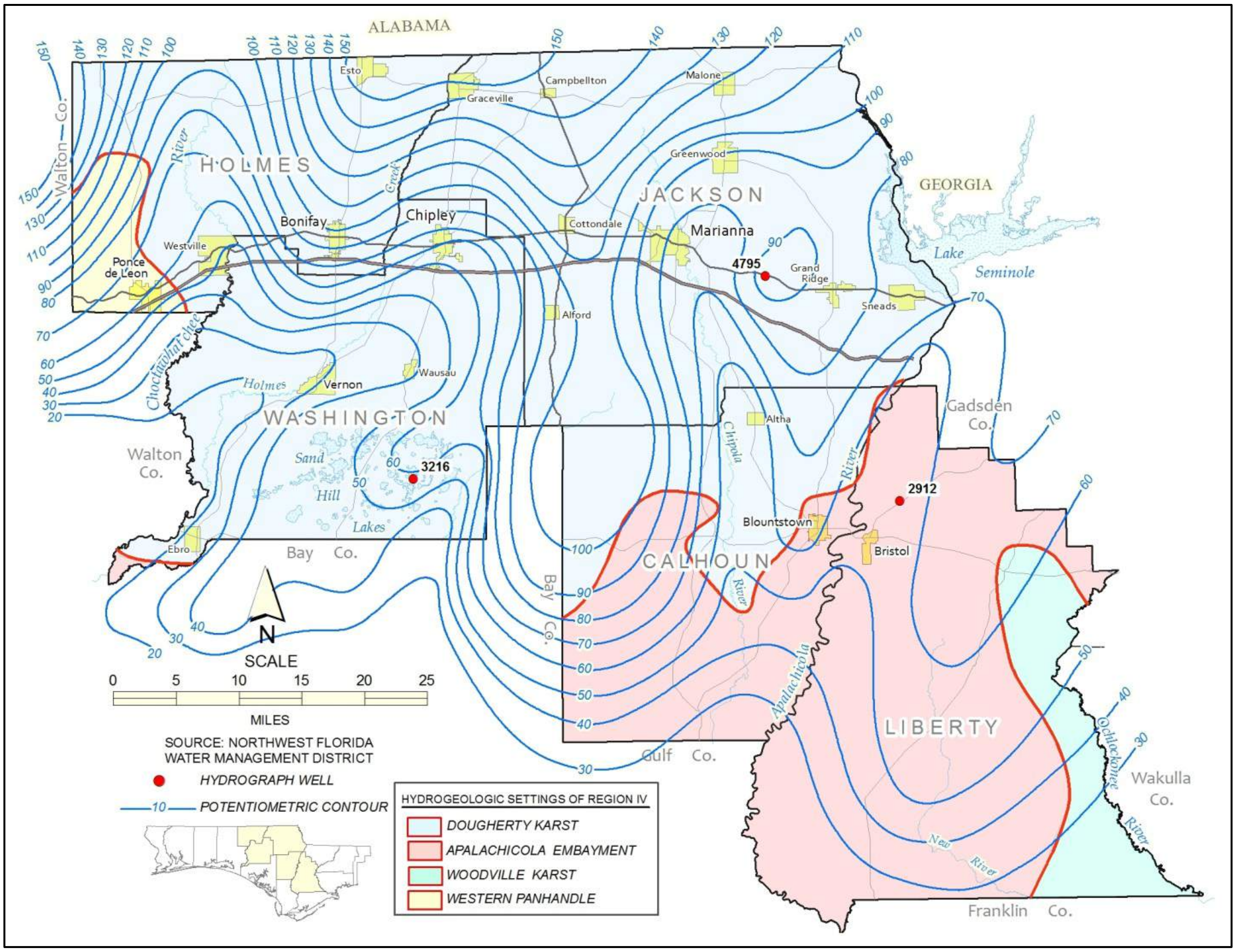


Figure 3.29 Potentiometric Surface of the Floridan Aquifer in Region IV, June 2010

Groundwater conditions in Liberty and southern Calhoun counties are typical of the Apalachicola Embayment. The intermediate system is relatively thick and forms an effective confining unit which restricts recharge to the Floridan aquifer. The low aquifer recharge has resulted in limited dissolution within the aquifer, lower transmissivities, and poor water quality at depth. Only the upper few hundred feet of the Floridan aquifer is utilized in Liberty County and well yields are generally less than 250 gpm. The potentiometric surface declines from about 65 feet above sea level in northern Liberty County to less than 30 feet above sea level in southern Calhoun and Liberty counties. Limited groundwater discharge occurs along the Apalachicola and lower Chipola rivers. Groundwater flow is generally southerly towards Gulf and Franklin counties.

The sub-Floridan system underlies and serves as a confining unit for the Floridan aquifer system. In the northern portion of Region IV, the sub-Floridan system includes the Claiborne Aquifer, which is used a source of water for some public supply and agricultural wells.

<u>Assessment Criteria</u>

Because of the significant differences between the groundwater flow system in the Dougherty Karst region and Apalachicola Embayment, different assessment criteria are used to assess the potential impacts of groundwater withdrawals. Within the Dougherty Karst region, the assessment criteria include the potential reduction of discharge to surface water features (streams and springs) and the long-term depression of the potentiometric surface of the Floridan aquifer. In the Apalachicola Embayment, the criteria include the long-term depression of the potentiometric surface and the attendant alteration of groundwater quality. A regional groundwater budget was also used to evaluate the relative magnitude of groundwater withdrawals in Region IV.

Impacts to Groundwater Resources and Related Natural Systems

Hydrographs for three wells are presented to illustrate fluctuations in the Floridan aquifer potentiometric surface. Data are presented for a well located near Marianna (International Paper well), a well located near Wausau (USGS 422A well), and a well located near Bristol (St. Joe Tower well) (Figures 3.30 and 3.31). The locations of these monitor wells are shown on Figure 3.29 and identified on the map by their NWFID numbers located in the upper right-hand corner of the associated graph.

The International Paper (Figure 3.30A) and USGS 422A (Figure 3.30B) wells are located in the Dougherty Karst region. From the 1960s through 2012, water levels have fluctuated considerably in these wells. The three severe droughts since 1999 are evident, with water levels exhibiting declines between 2000 and 2012 (Figure 3.30). Since the 1960s, water levels have risen and fallen through time in response to seasonal and annual variations in rainfall, pumpage, and aquifer recharge. Due to high recharge and high aquifer transmissivity in the Dougherty Karst region, groundwater withdrawals, which totaled 53 mgd in 2010, have not resulted in any discernible depressions in the potentiometric surface of the Floridan aquifer (Figure 3.29) compared to prior years.

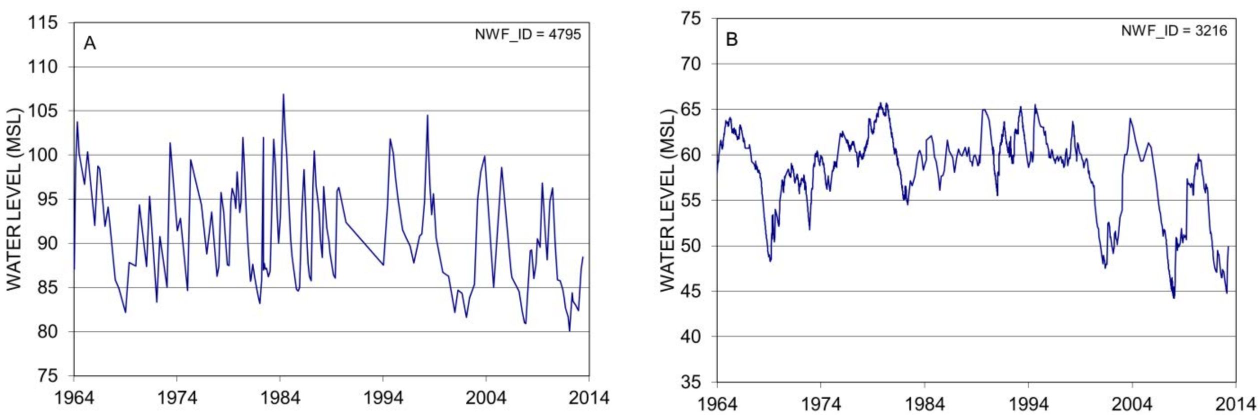


Figure 3.30 Hydrographs of Wells Located in the Dougherty Karst Area at A) International Paper Company Well, Jackson County, and B) USGS-422A Well, Washington County.

Given the strong hydraulic connection between ground and surface waters in the Dougherty Karst region, groundwater withdrawals may reduce discharge to surface waters by an amount equal to or somewhat less than the amount withdrawn. Some of the factors which may mitigate the effect of withdrawals on groundwater discharge include aquifer recharge generated by inefficient irrigation practices, land application of treated wastewater, recharge induced by withdrawals, and a change in the zone of contribution caused by the withdrawals.

The potentially affected surface water features include the Chipola, Choctawhatchee and Apalachicola rivers, Holmes Creek, and the upper Econfina creeks and the numerous springs. The flow of these rivers and creeks is substantial. The median flow of the Econfina Creek at Highway 388 in Bay County is 516 cfs. Flow of the other creeks and rivers is substantially greater. The range of spring flow is quite large. The discharge of Jackson Blue Spring, which is a first magnitude spring located in the Chipola River basin, averages 126 cfs (NWFWMD 2011). At least nine second magnitude springs and seven third magnitude springs also occur in the Chipola River basin.

The first magnitude Gainer Springs Group and some second magnitude springs along the Econfina Creek are located in northernmost Bay County, but the Econfina Recharge Area extends into and includes much of southeastern Washington County. Numerous other second and third magnitude springs occur along the Holmes Creek and the Choctawhatchee River. There are few groundwater withdrawals in these areas.

The St. Joe Tower Well is located within the Apalachicola Embayment in northern Liberty County. This well does show a gradual decline in water levels of approximately one foot per 15 years (Figure 3.31). This decline is largely attributable to the combined withdrawals by the City of Bristol (located 3.5 miles to the southwest) and by the Liberty Correctional Institute (located 4 miles to the east). Their combined withdrawals for 2010 averaged 0.6 mgd. This moderate withdrawal has resulted in observable drawdown due to the low recharge and low aquifer transmissivity characteristic of the embayment area.

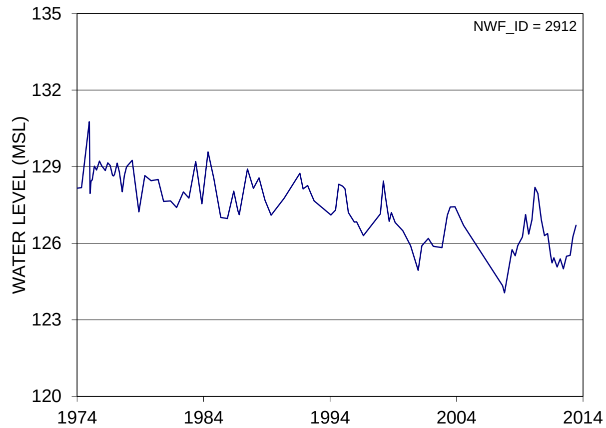


Figure 3.31 Hydrograph of St. Joe Tower Well Located in the Apalachicola Embayment Area

Groundwater Budget

A region-wide groundwater budget was prepared for the 1998 WSA to estimate the relative magnitude of the inflows to and outflows from the Floridan aquifer (Figure 3.32). The major inflow to the Floridan aquifer is recharge from the surficial aquifer (direct recharge - 209 mgd and leakage – 1,069 mgd), which equates to an annual rate of 7.9 in/yr. Major discharges from the Floridan aquifer are the discharges to rivers and springs (1,167 mgd).

Region IV groundwater withdrawals accounted for 38.35 mgd (59 cfs) of the total water use of 40.41 mgd in 2010. If there were no mitigating factors that offset withdrawals, such as additional recharge resulting from irrigation and sprayfields, withdrawals would be expected to reduce discharge to rivers and springs on average by about 59 cfs region-wide. Based on the groundwater budget, the 2010 withdrawals of 38.35 mgd would represent 3 percent of the average groundwater discharge to rivers and springs.

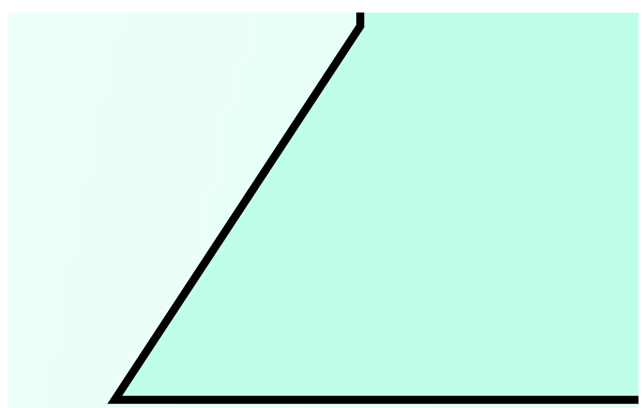


Figure 3.32 Region IV Floridan Aquifer Steady-State Groundwater Budget

The projected 2035 total demand of approximately 48 mgd in Region IV represents 3.5 percent of the regional groundwater budget for the Floridan aquifer. The projected 2035 demand of approximately 55 mgd for a 1-in-10 year drought condition represents about four percent of the regional groundwater budget for the Floridan aquifer.

Water Quality Constraints on Availability

Water quality issues constrain groundwater availability in Region IV in two ways. The first constraint is upconing of mineralized water associated with excessive drawdown or excessive depth of penetration of wells located in the Apalachicola Embayment region of Calhoun and Liberty counties. This problem can be avoided by using appropriate spacing between wells, limiting withdrawal rates, and restricting well depths.

The second potential water quality constraint exists in the Dougherty Karst region where the karst topography and high recharge rate makes the Floridan aquifer susceptible to contamination by land use practices. The groundwater in the area has been affected by agrichemical contamination, primarily ethylene dibromide. Contamination is generally of low constituent concentrations and is primarily limited to portions of northeast Jackson County (Roaza 1989). However, in some areas water treatment may be necessary for potable use. Additionally, agricultural practices in Jackson County have affected water quality by introducing nutrients that impact both wells and natural systems. Nitrate levels at Jackson Blue Spring have increased to the range of 3.2 to 3.5 mg/L (NWFWMD 2010; Barrios and DeFosset 2005).

Adequacy of Groundwater Resources

Within Region IV, groundwater resources are anticipated to be adequate to meet the projected 2035 Floridan aquifer demands for average conditions (48 mgd) and a 1-in-10 year drought event (54 mgd) without causing harm to regional water resources and related natural systems. The projected demands are not expected to result in long-term declines in the potentiometric surface of the Floridan aquifer. Groundwater withdrawals will, however, reduce groundwater discharge to the surface water features such as rivers and springs, but projected 2035 demands are small compared to the total regional groundwater discharge. Consequently, no significant regional impacts are expected. However, localized impacts are possible in the vicinity of concentrated pumping. For example, there is the potential for seasonal groundwater withdrawals within the Jackson Blue contribution area to affect the Jackson Blue Spring discharge, particularly during the summer months or drought periods. Jackson Blue Spring is included on the District's list of priority waterbodies for the development of minimum flows and levels (MFLs). Enhanced hydrologic data collection to support MFL development for Jackson Blue Spring is anticipated to begin in 2014. Technical assessments and modeling completed in support of the MFL will include further evaluation of the effects of seasonal groundwater pumpage on spring discharge. The District's MFL Priority List is updated annually and may be found on the District's website.

Within the Apalachicola Embayment, groundwater availability is limited due to low aquifer transmissivities and poor water quality at depth. Prudent well spacing and limited withdrawal rates and well depths will be required to ensure a sustainable supply of good quality water. Through careful planning and management, the resource is anticipated to be adequate to meet the projected 2035 demands.

Surface Water Resources

The surface water resources in Region IV are significant. As previously noted, major surface water features include the Apalachicola, Chipola and Choctawhatchee rivers, Econfina and Holmes creeks, one first magnitude spring (Jackson Blue) and 17 second magnitude springs. Each of the second magnitude springs discharge between 10 and 100 cfs.

In terms of annual flow, the Choctawhatchee and Apalachicola rivers are two of the five largest rivers in the state. The average flow of the Choctawhatchee River at Bruce is 4,630 cfs and the average flow of the Apalachicola River at Chattahoochee is 13,200 cfs. Their basins include significant areas of Alabama and Georgia. The average flows of Econfina Creek at Bennett, Holmes Creek at Vernon and the Chipola River at Altha are 534 cfs, 486 cfs, and 1,020 cfs respectively, and include large groundwater inflow components. The Apalachicola, Chipola and Choctawhatchee rivers are designated as SWIM priority waterbodies of the District and Outstanding Florida Waters by FDEP. The District established a Water Reservation for the Apalachicola River in 2006, whereby all surface water within the basin has been reserved for the river system.

<u>Assessment Criteria</u>

The criteria for assessing impacts of surface water withdrawals are the sustainability of the surface water flow regime and associated natural systems.

<u>Impacts to Surface Water Resources and Related Natural Systems</u>

Within Region IV, approximately 2 mgd of surface water was used for agricultural use and power generation uses in 2010. Power generation is the largest user of surface water in the region, with approximately 1.6 mgd withdrawn from the Apalachicola River and consumptively used at Plant Scholz in 2010. This withdrawal quantity represents less than one tenth of 1 percent of the average daily flow in the Apalachicola River at Chattahoochee. No impacts associated with these surface water withdrawals have been detected or reported.

Surface water resources are considered adequate to meet the projected 2035 surface water demands of approximately 1.5 to 2.5 mgd within Region IV. A surface water quality concern within Region IV is the high nutrient load of the groundwater discharging to Jackson Blue Spring. This issue is being addressed through FDEP's development of a Basin Management Action Plan for Jackson Blue Spring.

<u>Adequacy of Surface Water Resources</u>

Surface water resources are considered adequate to meet the projected 2035 surface water demands within Region IV while sustaining the water resources and associated natural systems.

Reclaimed Water

As shown in Table 3.32, approximately 2.9 mgd or 49 percent of the wastewater generated in 2010 in Region IV was of reuse quality. However, this water was discharged to sprayfields and infiltration ponds rather than being used to directly replace ground or surface water withdrawals. The City of Chipley developed a reuse system that began operating in 2011 to replace groundwater withdrawals and provide reclaimed water for irrigation at a golf course, industrial park, and agricultural lands. Although the feasibility of reuse system development may be limited by economic considerations, facility locations, storage options and other factors, there may be additional opportunities to meet future irrigation and industrial water needs with reclaimed water, particularly in Jackson County.

Table 3.32 Region IV Reuse of Domestic Wastewater, 2010 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Reuse Flow that Replaces Potable-Quality Water*
Blountstown WWTP	1.50	0.59			
Calhoun County Total	**1.50**	**0.59**	**0.00**	**0.00**	**0.00**
Bonifay WWTF	1.40	0.87			
Holmes County Total	**1.40**	**0.87**	**0.00**	**0.00**	**0.00**
City of Marianna WWTP	4.00	1.56	4.00	1.52	
Cottondale WWTP	0.30	0.07	0.25	0.07	
Graceville WWTF	1.10	0.89			
Grand Ridge WWTF	0.21		0.21	0.04	
Jackson Correctional Institution WWTP	0.24	0.18	0.24	0.18	
Town of Sneads WWTP	0.73	0.46	1.19	0.46	
Jackson County Total	**6.58**	**3.15**	**5.89**	**2.26**	**0.00**
Bristol Wastewater Treatment Facility	0.25	0.10	0.25	0.10	
Liberty Correctional Institution WWTP	0.28	0.16	0.28	0.16	
Liberty County Total	**0.53**	**0.26**	**0.53**	**0.26**	**0.00**
Chipley WWTP	1.20	0.65	1.20		
City of Vernon WWTF	0.21	0.12	0.21	0.12	
Washington Correctional Institution WWTP	0.47	0.27	0.47	0.27	
Washington County Total	**1.87**	**1.04**	**1.87**	**0.39**	**0.00**
Region IV Total	**11.88**	**5.91**	**8.29**	**2.91**	**0.00**

*Reuse Flow That Replaces Potable-Quality Water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses. Not included in this flow calculation are agriculture irrigation of other crops, absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant (Source: FDEP reuse inventories).

Table 3.33 Region IV Domestic Wastewater Flow Projections 2015 - 2035 (mgd)

Facility Name	2015	2020	2025	2030	2035
Blountstown WWTP	0.59	0.60	0.61	0.62	0.63
Calhoun County Total	**0.59**	**0.60**	**0.61**	**0.62**	**0.63**
Bonifay WWTF	0.87	0.87	0.87	0.87	0.87
Holmes County Total	**0.87**	**0.87**	**0.87**	**0.87**	**0.87**
City of Marianna WWTP	1.56	1.57	1.57	1.58	1.59
Cottondale WWTP	0.07	0.07	0.07	0.07	0.07
Graceville WWTF	0.89	0.89	0.89	0.89	0.89
Grand Ridge WWTF	0.05	0.05	0.06	0.06	0.06
Jackson Correctional Institution WWTP	0.18	0.18	0.18	0.18	0.18
Town of Sneads WWTP	0.46	0.46	0.46	0.46	0.46
Jackson County Total	**3.21**	**3.22**	**3.22**	**3.23**	**3.24**
Bristol Wastewater Treatment Facility	0.10	0.11	0.11	0.12	0.12
Liberty Correctional Institution WWTP	0.17	0.18	0.19	0.20	0.21
Liberty County Total	**0.28**	**0.29**	**0.30**	**0.32**	**0.33**
Chipley WWTP	0.65	0.65	0.65	0.65	0.65
City of Vernon WWTF	0.12	0.12	0.12	0.12	0.12
Washington Correctional Institution WWTP	0.28	0.29	0.31	0.32	0.33
Washington County Total	**1.05**	**1.06**	**1.08**	**1.09**	**1.10**
Region IV Total Wastewater Projections	**6.00**	**6.05**	**6.09**	**6.13**	**6.17**

Table 3.34 Region IV Available Reclaimed Water Projections 2015 - 2035* (mgd)

Facility Name	2015	2020	2025	2030	2035
Blountstown WWTP	0.59	0.60	0.61	0.62	0.63
Calhoun County Total	**0.59**	**0.60**	**0.61**	**0.62**	**0.63**
Bonifay WWTF	0.87	0.87	0.87	0.87	0.87
Holmes County Total	**0.87**	**0.87**	**0.87**	**0.87**	**0.87**
City of Marianna WWTP	1.56	1.57	1.57	1.58	1.59
Cottondale WWTP	0.07	0.07	0.07	0.07	0.07
Graceville WWTF	0.89	0.89	0.89	0.89	0.89
Grand Ridge WWTF	0.05	0.05	0.06	0.06	0.06
Jackson Correctional Institution WWTP	0.18	0.18	0.18	0.18	0.18
Town of Sneads WWTP	0.46	0.46	0.46	0.46	0.46
Jackson County Total	**3.21**	**3.22**	**3.22**	**3.23**	**3.24**
Bristol Wastewater Treatment Facility	0.10	0.11	0.11	0.12	0.12
Liberty Correctional Institution WWTP	0.17	0.18	0.19	0.20	0.21
Liberty County Total	**0.28**	**0.29**	**0.30**	**0.32**	**0.33**
Chipley WWTP	0.35	0.35	0.35	0.35	0.35
City of Vernon WWTF	0.12	0.12	0.12	0.12	0.12
Washington Correctional Institution WWTP	0.28	0.29	0.31	0.32	0.33
Washington County Total	**0.75**	**0.76**	**0.78**	**0.79**	**0.80**
Region IV Total Avail. Reclaimed Water	**5.70**	**5.75**	**5.79**	**5.83**	**5.87**

*Projections are for potentially available reclaimed water and do not take into account planned expansions of reuse systems.

Conservation

Region IV has generally not experienced the water demand and resource constraints for public supply as seen in other regions that would drive concerted conservation efforts. The City of Marianna has an active water loss reduction program and has been able to substantially reduce losses. Bonifay has improved its water accounting and has a customer meter replacement program to reduce water losses. Other utilities in Region IV should continue to monitor and where possible, further reduce water losses in their distribution systems. However, half of the public supply utilities have gross per capita usage greater than 150 gpcd, so there is potential for additional water system efficiency improvements and conservation savings at the utility scale. Achieving a gross per capita use of 150 gpcd or less could potentially save 0.67 mgd by 2035, which would be a 15 percent savings for the 15 utilities that fit this profile. The EZ Guide tool from Conserve Florida could be useful to water suppliers in determining the most cost-effective conservation options that are appropriate for a particular customer base.

3.4.3 *Determination of the Need for a Regional Water Supply Plan*

Existing and reasonably anticipated groundwater and surface water sources in Region IV are anticipated to be adequate to meet the projected demands through 2035, while sustaining the water resources and associated natural systems. Therefore, no RWSP is recommended.

3.5 Region V: Franklin and Gulf Counties

Region V is within the Apalachicola River and Bay and the St. Andrew Bay watersheds and is comprised of Gulf and Franklin counties, including the cities of Apalachicola, Carrabelle, Port St. Joe and Wewahitchka (Figure 3.33). The region is predominantly rural, with extensive conservation lands including Tate's Hell State Forest, Apalachicola National Forest, St. Vincent National Wildlife Refuge, two state wildlife management areas, and state parks located on St. Joseph Peninsula, St. George Island and Bald Point. Population and development are concentrated in the coastal areas. The economy is highly dependent upon tourism and natural resources, with leading activities being forestry, commercial and sport fishing, and seafood processing.

Region V Snapshot		
	2010	2035
Population	27,412	28,400
Water Use (mgd)	~ 7	~ 5
Primary Sources	Floridan Aquifer/Chipola River via St. Joe Canal	
RWSP Status	Continued Implementation of RWSP Not Recommended	

Figure 3.33 Map of Region V

Historically, most water consumption occurred in Gulf County with significant industrial use. With the closing of the Port St. Joe paper mill in 1998, public supply is now the largest use category. The region depends on groundwater and surface water sources. Both the Floridan and surficial aquifers are used in Gulf County. Franklin County depends primarily on the Floridan aquifer for potable supply and the surficial aquifer is used for domestic irrigation on the barrier islands. However, groundwater availability is limited due to poor water quality at depth and the potential for saltwater intrusion in coastal areas. Coastal Gulf and Franklin counties were designated as Areas of Special Concern in 1998 and a RWSP was developed for this area in 2007 (NWFWMD 2007).

3.5.1 *Water Use Estimates and Projections*

Public Supply

Public supply water use totaled approximately 3.67 mgd in 2010 (Tables 3.35 through 3.37). The largest public supply water systems in Region V are the City of Port St. Joe (1.18 mgd in 2010) and the City of Carrabelle, which now provides water to Lanark Village (combined 0.58 mgd). The City of Apalachicola and Water Management Services, which serves St. George Island, both withdrew about 0.5 mgd in 2010. St. James Island Utility Company was permitted in 2004 to serve the Summer Camp/St. James Island planned unit development. Population growth is projected to be slight in Franklin and Gulf counties. Reflecting this, public supply water demands in Region V are anticipated to increase by only 0.12 mgd to 3.79 mgd in 2035. It should be noted, however, that seasonal and tourist populations account for a relatively high proportion of the effective population served within the coastal reaches of Region V. The projections given assume that the relative importance of seasonal and tourist populations will remain consistent through the planning horizon

Table 3.35 Franklin County Public Supply Water Use Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Alligator Point Water Resources District	0.09	0.09	0.09	0.09	0.09	0.09
Apalachicola, City of	0.51	0.51	0.51	0.51	0.51	0.51
Carrabelle, City of	0.44	0.45	0.45	0.45	0.45	0.45
Carrabelle, City of (Lanark Village)	0.14	0.14	0.14	0.14	0.14	0.14
Eastpoint Water & Sewer District	0.26	0.27	0.27	0.27	0.27	0.27
St. James Island Utility Company	0.03	0.04	0.04	0.04	0.04	0.04
Water Management Services, Inc.	0.51	0.53	0.53	0.53	0.53	0.53
Total	**1.97**	**2.03**	**2.03**	**2.03**	**2.03**	**2.03**

Table 3.36 Gulf County Public Supply Water Use Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Lighthouse Utilities Company, Inc.	0.35	0.35	0.35	0.36	0.36	0.36
Port St. Joe, City of	1.18	1.19	1.20	1.21	1.21	1.22
Wewahitchka, City of	0.17	0.17	0.17	0.17	0.17	0.17
Total	**1.70**	**1.71**	**1.72**	**1.73**	**1.74**	**1.76**

Domestic Self-Supply and Small Public Water Systems

The population served by domestic self-supply and small public water systems was estimated at 4,272 persons in 2010. This represents approximately 16 percent of the total population in Gulf and Franklin counties. The estimated water use for domestic self-supply and small public water systems was 0.48 mgd in 2010 and water demands are anticipated to increase a negligible amount by 2035 (Table 3.37).

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

I/C/I water users accounted for 2.11 mgd or 31 percent of the 2010 water use in Region V (Table 3.37). Large I/C/I water users include two correctional institutions and General Chemical. General Chemical closed operations in June 2013. The I/C/I water users rely on groundwater from the Floridan aquifer system. Projected I/C/I water demands are anticipated to decrease to 0.42 mgd in 2015 and remain constant through 2035.

Recreation Self-Supply

The 2010 estimated water use for self-supplied landscape, residential and golf course irrigation and aesthetic uses totaled 0.47 mgd in Region V (Table 3.37). Water sources included the surficial, intermediate and Floridan aquifers, and golf course ponds. Region V recreation water demands are not expected to increase through 2035 and future demands are anticipated to be met by the same sources being utilized in 2010.

Agricultural Use

The estimated agricultural water use totaled 0.15 mgd in 2010 (Table 3.37). Agricultural water use reflects water used for livestock watering in Gulf County. Due to the difficulties inherent in projecting the mix of future agricultural commodities and acreages, water demands for agriculture are projected to remain constant at 2010 use quantities through the planning period.

Power Generation

There are currently no power generation facilities in Gulf or Franklin counties.

Total Water Use and Population

In 2010, the average annual water use in Region V totaled 6.88 mgd (Table 3.37). The largest use category was public supply (53 percent of total). Other significant use categories included I/C/I, domestic self-supply and recreation (Figure 3.34).

The 2010 Census population for Region V was 27,412 (BEBR 2013). Population and public supply water use are both projected to increase over the planning period. The medium-range projections for 2035 indicate a combined Gulf and Franklin county population of 28,400 persons. This represents a 4 percent increase from 2010 (BEBR 2013).

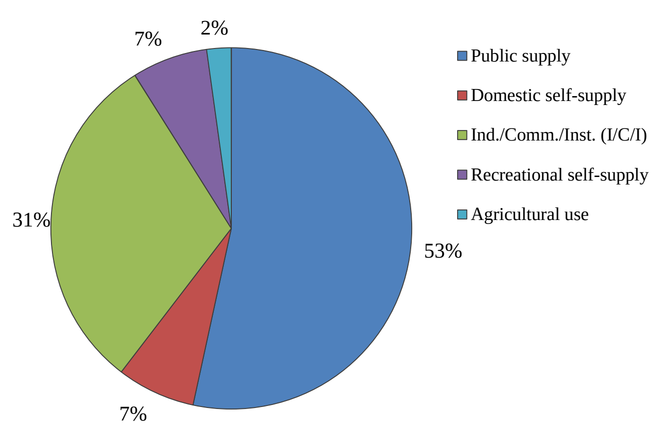


Figure 3.34 Region V Water Use by Category, 2010

Total water demands are projected to decrease by 22 percent, or 1.53 mgd, to approximately 5.35 mgd in 2035. Public supply, domestic self-supply, and recreation self-supply are expected to increase slightly. Water use for the remaining categories is anticipated to remain constant or decrease.

Table 3.37 Region V Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	3.67	3.74	3.76	3.77	3.78	3.79
Domestic self-supply	0.48	0.51	0.51	0.51	0.51	0.51
Ind./Comm./Inst. (I/C/I)	2.11	0.42	0.42	0.42	0.42	0.42
Recreational self-supply	0.47	0.47	0.48	0.48	0.48	0.48
Agricultural use	0.15	0.15	0.15	0.15	0.15	0.15
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**6.88**	**5.30**	**5.31**	**5.32**	**5.34**	**5.35**

1-in-10 Year Drought Projections

Projected demands for a 1-in-10 year drought event are shown in Table 3.38. The 2035 total Region V demand for a 1-in-10 year drought is approximately 6 percent higher than the 2035 total average year demand.

Table 3.38 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd)

	Projected				
Water Use Category	2015	2020	2025	2030	2035
Public supply	4.01	4.02	4.03	4.04	4.05
Domestic self-supply	0.54	0.54	0.55	0.55	0.55
Ind./Comm./Inst. (I/C/I)	0.42	0.42	0.42	0.42	0.42
Recreational self-supply	0.51	0.51	0.52	0.52	0.52
Agricultural use	0.15	0.15	0.15	0.15	0.15
Power generation	0.00	0.00	0.00	0.00	0.00
Total	**5.63**	**5.65**	**5.66**	**5.68**	**5.69**

3.5.2 *Assessment of Water Resources*

Historically, Gulf County depended upon groundwater for both public and industrial water supplies. Withdrawals began in the 1930s to supply water to the St. Joe Paper Company Mill and associated industries. By the early 1950s, groundwater was being withdrawn at an approximate rate of 9 mgd. Most of this water was pumped from the Floridan aquifer. As a result of this pumping, the potentiometric surface of the Floridan aquifer became substantially depressed in the vicinity of the City of Port St. Joe. Recognizing that sufficient groundwater was not available to meet the expanding needs of the paper mill, an 18.5 mile long canal was constructed in 1953 between the City of Port St. Joe and the Chipola River to provide a surface water supply. The surface water pumping capacity was 51.48 mgd before the mill closed in 1998. Prior to the mill closing, surface water provided an average of 28 mgd for industrial use. In June 2001, the District awarded a grant to the City of Port St. Joe to assist in the acquisition of the canal as a public water supply source. The City of Port St. Joe currently owns the canal and is using the surface water to meet public supply needs.

Franklin County has been historically dependent on water from the Floridan aquifer. In 2010, approximately 2 mgd of groundwater was withdrawn to meet public supply needs. Due to increases in population, water demand in the area has slowly increased over time and has heightened concerns about resource sustainability. Saltwater intrusion into the upper portion of Floridan aquifer is a threat to supply wells located along the coastline of Franklin County.

Based on these concerns, the District developed a RWSP for Region V (NWFWMD 2007). The RWSP identified surface water from the Gulf County Fresh Water Supply Canal (formerly referred to as the Port St. Joe Canal) as the preferred alternative water source for Gulf County. The primary water supply option identified for Franklin County was the development of an inland Floridan aquifer wellfield. Since development of the RWSP, the recommended surface water supply facility was completed for the City of Port St. Joe. Additionally, the previously anticipated population growth and development within the region has not materialized.

Groundwater Resources

Geographically, Region V lies primarily within the Apalachicola Embayment region of the Florida panhandle. Accordingly, water availability from the Floridan aquifer is constrained by factors that are typically associated with the embayment's hydrogeology, i.e., the presence of an effective confining unit overlying the Floridan aquifer, very low aquifer recharge, low aquifer transmissivities, and poor water quality at depth. However, the hydrogeologic setting on the eastern end of Franklin County transitions between the Apalachicola Embayment and the Woodville Karst regions. Within this transition zone the intermediate confining unit becomes thinner and leakier and the Floridan aquifer is more transmissive and not as deep. In order of depth, the hydrogeologic units that comprise the groundwater flow system are the surficial aquifer, the intermediate system, the Floridan aquifer system, and the sub-Floridan system.

The surficial aquifer consists of undifferentiated sands and clays. Groundwater typically exists under unconfined conditions, with some areas being semi-confined by local sandy clay layers. In Gulf County, the saturated thickness and permeability of the surficial aquifer are sufficient to form a locally important water source. Groundwater from the surficial aquifer tends to be less mineralized than water from the underlying Floridan aquifer. The City of Port St. Joe obtains approximately 25 percent of their groundwater from the surficial and intermediate aquifers. The average well yield is approximately 200 gpm. In Franklin County, the surficial aquifer is used on the barrier islands where wells yielding up to 50 gpm are utilized for domestic landscape irrigation. Over much of Franklin County, the surficial aquifer system intersects the ground surface in wetland areas.

This intermediate system functions largely as a confining unit and consists of soft, fossiliferous limestone overlain by a thin layer of sandy clay and clayey sand. The intermediate system is approximately 400 feet thick near Port St. Joe and thins toward the north and the east, reaching a thickness of less than 50 feet thick in eastern Franklin County. As the intermediate system thins, leakage across it increases and causes it to function as a semi-confining unit. The intermediate system has some capacity to serve as a water source. In eastern Bay County, the City of Mexico Beach previously used two intermediate system wells, each producing about 300 gpm. In southern Gulf County, the intermediate system is used as a source of water for some domestic landscape irrigation wells.

The Floridan aquifer is the main source for groundwater pumped in Region V. The aquifer is a sequence of carbonate sediments ranging in thickness from about 1,000 feet in the northwestern Gulf County to more than 2,800 feet in southern Franklin County. Aquifer transmissivity is variable and is highest in eastern Franklin County, which is the southernmost extension of the Woodville Karst Plain and an area of active recharge, flow, and dissolution. Test wells in Tate's Hell State Forest yielded transmissivities of 20,000 to 40,000 ft^2/d. In coastal Franklin County and in Gulf County, transmissivities and well yields are lower. Testing has yielded transmissivities of 6,000 ft^2/d in Apalachicola, 2,000 ft^2/d in coastal Gulf County (Wagner et al. 1980), and 6,500 ft^2/d 15 miles north of Port St. Joe (Barr and Pratt 1981).

Throughout the region, the Gulf of Mexico coastline is a discharge boundary for the Floridan aquifer system. In 2010, the potentiometric surface of the Floridan aquifer ranged from about 30 feet above sea level in northern Gulf County to less than 10 feet above sea level at Port St. Joe and along coastal Franklin County (Figure 3.35). Groundwater flows south towards the coast. Only in the northernmost part of Gulf County does the portion of the aquifer containing fresh water approximately equal the entire thickness of the aquifer. Approaching the coastline, the freshwater portion of the aquifer thins considerably, reflecting the loss of fresh water to the Gulf of Mexico discharge boundary.

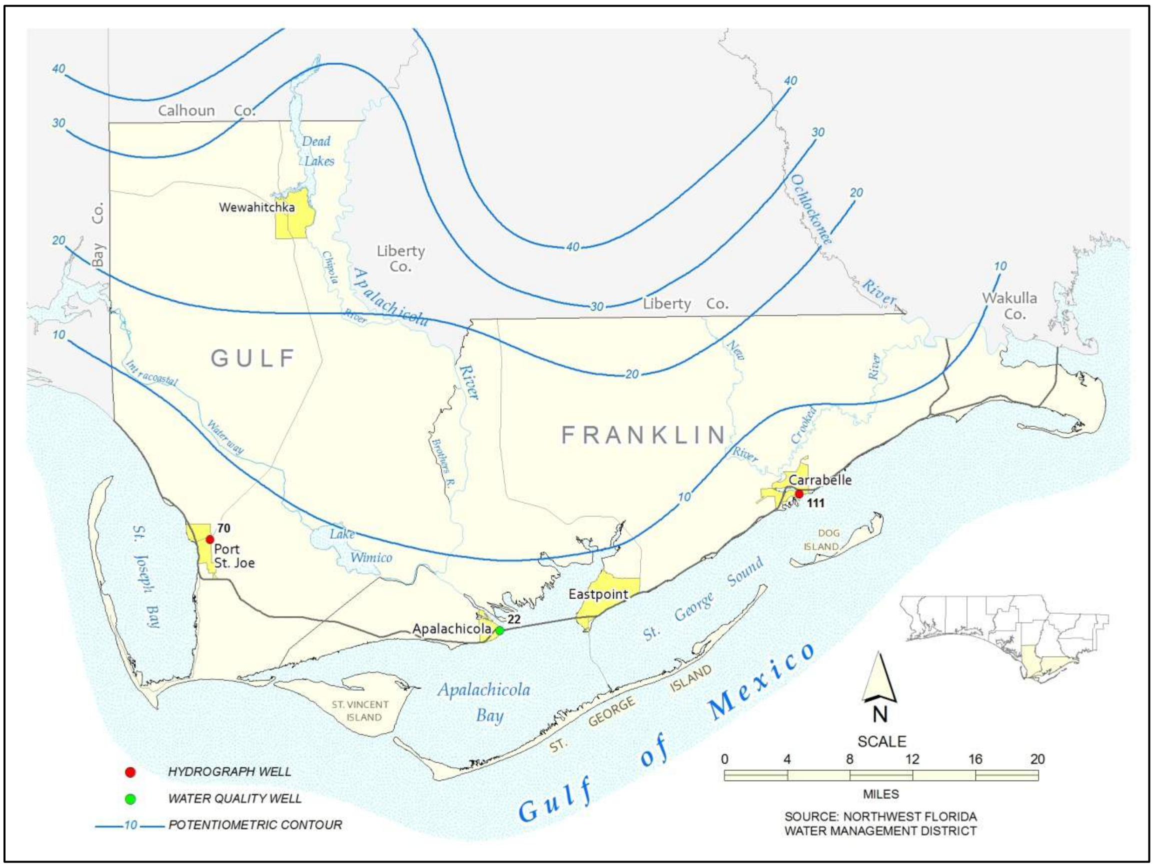


Figure 3.35 Potentiometric Surface of the Floridan Aquifer System in Region V, June 2010

Groundwater quality degrades with increasing depth and proximity to the coast. Only in the northernmost part of Gulf County does the portion of the aquifer containing potable water approximately equal the entire thickness of the aquifer. The fresh water portion of the Floridan aquifer thins towards the coast where the aquifer discharges to the Gulf of Mexico. This places a significant constraint on the long-term viability of water production from the Floridan aquifer in the immediate proximity of the coast. Total dissolved solids (TDS) concentrations from the upper portion of the Floridan aquifer range from 250 mg/L in northern Gulf County to over 400 mg/L in northern and central Franklin County

(Maddox et al. 1992). Along the coast, TDS concentrations range from 250 mg/L to 650 mg/L. The state drinking water standard for TDS is 500 mg/L.

Figure 3.36 shows the hydrogeologic units and the approximate thickness of the potable water interval of the Floridan aquifer along the coast of Franklin County. The thickness of the potable interval is based on chloride data. TDS and other analytes may further limit the thickness of the potable interval. Data show the thickness of the potable interval increases along the coast towards the west where the aquifer is better confined. Data suggest that the vertical transition zone between potable and saline water is a sharp interface. For example, at Alligator Point, chloride concentrations increase from 124 mg/L at a depth of 180 feet to 1,800 mg/L at a depth of 200 feet.

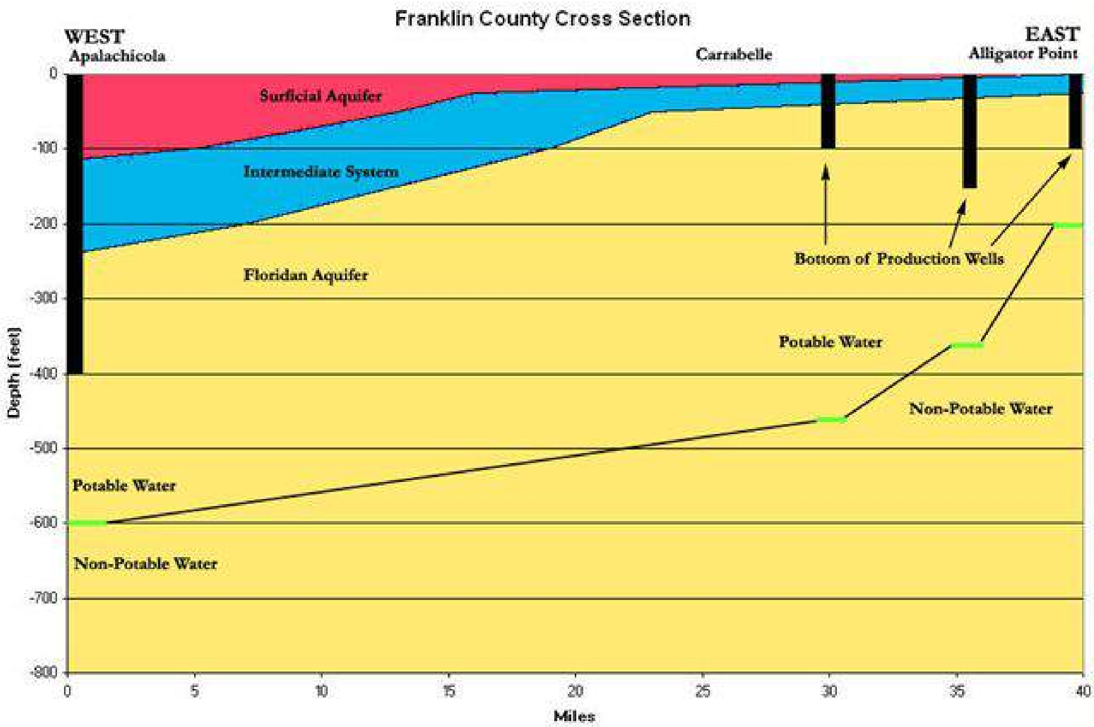


Figure 3.36 Hydrogeologic Cross-Section of Coastal Franklin County

Coastal Gulf County also has naturally-occurring, elevated levels of fluoride and iron in the Floridan aquifer. Drinking water standards require a fluoride concentration of less than 4 mg/L and an iron concentration of less than 0.3 mg/L. Floridan aquifer water in this area can have fluoride levels as high as 10 mg/L (Ryan et al. 1998) and iron levels between 1 and 7 mg/L.

<u>Assessment Criteria</u>

Two criteria were used to assess impacts on groundwater resources: long-term depression of the potentiometric surface of the Floridan aquifer and impacts on groundwater quality.

<u>Impacts to Groundwater Resources and Related Natural Systems</u>

Figure 3.37 presents hydrographs for two Floridan aquifer wells. Hydrographs are presented for a monitor well in Port St. Joe and the Ice Plant well in Carrabelle. The locations of these monitor wells are shown on Figure 3.35 and are identified on the map by their NWFID number located in the upper right-hand corner of the associated graph.

The Port St. Joe well (Figure 3.37A) is located about one mile from the historical center of pumping. Prior to the development of a surface water supply, water levels historically averaged 10 feet below sea level and reflected an estimated 15 to 20 feet of drawdown caused by withdrawals of about 1.5 mgd in this area of low transmissivity. Once pumping was reduced in 2009, water levels recovered by more than 20 feet and are now approximately 5 feet above sea level.

The Ice Plant well in Carrabelle (Figure 3.37B) shows a slight increasing water level trend during the period of record. Withdrawals in the vicinity of Carrabelle are relatively small and increased from about 0.2 mgd to 0.5 mgd between 1996 and 2010. Pumping has historically had a smaller effect on aquifer heads in the coastal area of Franklin County. This is likely due to lower pumping rates, more widely distributed pumping and greater leakiness of the intermediate system. The intermediate system is only half as thick in coastal Franklin County as it is in coastal Gulf County. Leakage from the surficial aquifer system likely plays a part in attenuating drawdowns in this area. However, localized saltwater intrusion is of concern in the vicinity of production wells.

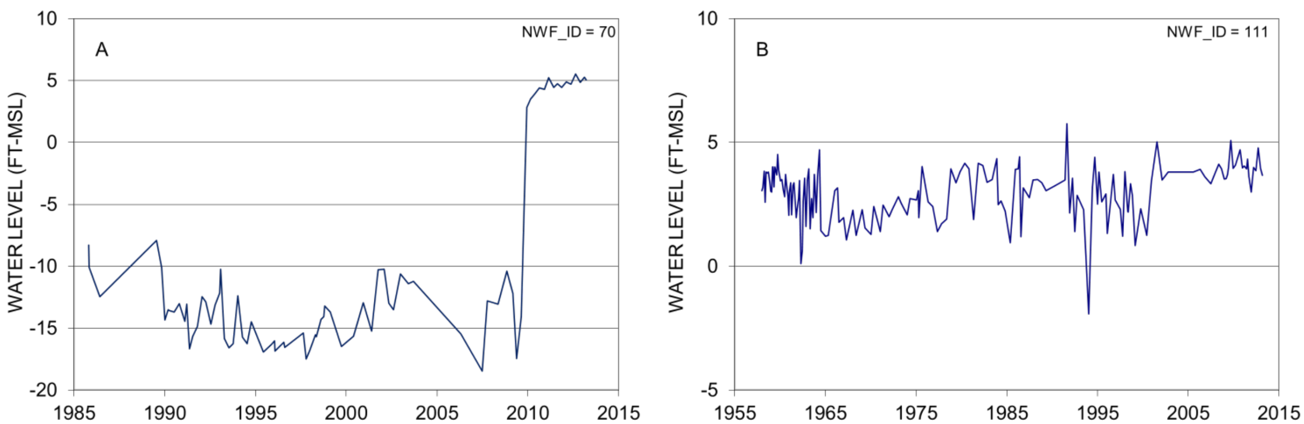


Figure 3.37 Hydrographs of the A) Port St. Joe and the B) Ice Plant Wells

The lateral intrusion or vertical upconing of saltwater associated with the depression of the potentiometric surface is a threat to groundwater quality and limits groundwater availability throughout the coastal portion of Region V. Figure 3.38 shows the Floridan aquifer chloride concentrations for the Pavilion well in Apalachicola (casing depth 422 feet, total depth 551 feet). The well was used for monitoring, but is no longer available for sampling. Between 1964 and 1991, water levels in the well declined about 2 feet while the chloride concentration rose from 630 mg/L to over 1,000 mg/L. This well is somewhat deeper than the City of Apalachicola production wells and is located closer to the coast (Figure 3.35). The Apalachicola public supply wells are located about 2.5 miles from the Pavilion well. The increase in chloride concentrations appears to be related to withdrawals in Apalachicola. The declining water quality in the Floridan aquifer raises concerns regarding the intrusion of salt water, the long-term sustainability of coastal withdrawals, and whether the shallower portions of the Floridan aquifer system may begin to see a corresponding decline in

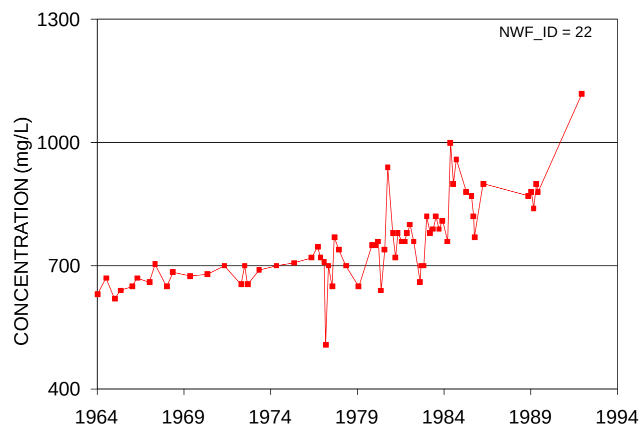


Figure 3.38 Chloride Concentration Data for the Pavilion Well, Apalachicola

groundwater quality. Alligator Point currently limits withdrawal rates and carefully manages water production from their wells due to the localized upconing of salt water.

Despite the previous long-term depression of the potentiometric surface at Port St. Joe, monitoring has indicated no significant change in groundwater quality at this location. The previously depressed potentiometric surface and the ongoing potential for saltwater intrusion do, however, pose a threat to the long-term sustainability of future groundwater withdrawals at this location.

Groundwater Budget

A regional groundwater budget was prepared for the 1998 WSA to estimate the relative magnitude of the various inflows to and outflows from the Floridan aquifer (Figure 3.39). The groundwater budget indicates low groundwater availability within the region. This limitation arises primarily from the low inflow to the Floridan aquifer (recharge and subsurface inflow). The recharge rate to the Floridan aquifer is very low and equates to less than 0.5 inches per year. The 2010 Floridan aquifer groundwater use of 5.92 mgd represents 31 percent of the estimated Floridan aquifer groundwater budget. The projected 2035 groundwater demand of 4.35 mgd represents 23 percent of the estimated Floridan aquifer groundwater budget.

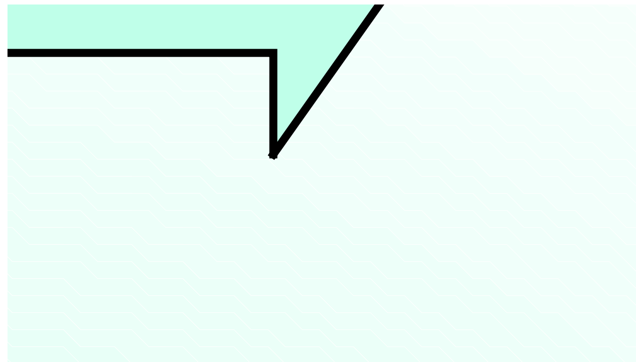


Figure 3.39 Region V Floridan Aquifer Steady-State Groundwater Budget

<u>Water Quality Constraints on Availability</u>

The major water quality constraints on increased withdrawals include upconing of poor quality water from deeper portions of the Floridan aquifer and lateral intrusion of salt water from offshore areas. High levels of fluoride may limit availability for potable use or necessitate costly treatment.

<u>Adequacy of Groundwater Resources</u>

With the dramatic decrease in industrial water demand in Region V over the past two years, the projected 2035 average water demands is less than the 2005 estimated water demand. The 2035 projected water demand of 5.71 mgd for a 1-in-10 year drought event is one percent less than the estimated water demand in 2005. Groundwater resources are considered adequate to meet the projected 2035 average water demands and water demands for a 1-in-10 year drought event. Because of the potential for water quality to degrade due to upconing and saltwater intrusion associated with current and projected withdrawals, water supply development will need to be carefully managed to ensure resource sustainability and reliability.

The Floridan aquifer in coastal Franklin County has been identified as a priority waterbody for the development of minimum flows and levels (MFLs). Hydrologic and water quality data collection to support MFL development are ongoing and may be further expanded in 2014. As part of the technical assessments needed to support MFLs, the potential for saltwater intrusion resulting from groundwater withdrawals and the sustainability of the Floridan aquifer will be further evaluated.

Surface Water Resources

Significant use of surface water is limited to diversions from the Chipola River and withdrawals from the canal. The diversion location is 2.5 miles above the confluence of the Chipola and Apalachicola rivers. The Chipola and Apalachicola rivers flow into the region from the north. Long-term records (1913 to 2013) from the USGS for a station near Altha in Calhoun County indicate that the mean flow in the Chipola River is 1,010 cfs, the median flow is 835 cfs, and the flow exceeds 695 cfs 75 percent of the time. The station at Altha includes about 65 percent of the basin, or 781 mi^2. Further downstream in Region V, the Chipola River flow increases as the contributing drainage area increases.

At Wewahitchka, about 12 miles above the confluence of the Chipola and Apalachicola rivers, a natural floodplain channel (the Chipola Cutoff) connects the two rivers and diverts flow from the Apalachicola River to the Chipola River. At the Chipola Cutoff, the flow of the Chipola River increases significantly due to the flow diverted from the Apalachicola River. The drainage basin for the Chipola River is approximately 1,200 mi^2.

The flow in the Apalachicola River at Sumatra, which is located seven miles below the confluence of the Apalachicola River and the Chipola River, is much higher due to its large contributing basin (19,200 mi^2) which extends into Alabama and northern Georgia. At Sumatra, the flow of the Apalachicola River includes the flow of the Chipola River. USGS records (1978 to 2013) indicate that the mean flow at Sumatra is 15,900 cfs, the median flow is 14,900 cfs, and the flow exceeds 8,660 cfs 75 percent of the time.

Assessment Criteria

The criteria for assessing impacts to surface water withdrawals are the sustainability of the surface water flow regime and associated natural systems.

Impacts to Surface Water Resources and Related Natural Systems

Prior to 1998, the average daily withdrawal from the Chipola River was 28 mgd or about 43 cfs. This is less than 1 percent of the 25th percentile flow in the Apalachicola River at Sumatra and no impacts were noted or reported as a result of this withdrawal. Surface water withdrawals from the Chipola River via the freshwater canal totaled 0.66 mgd in 2010. The projected 2035 surface water demands are approximately 0.66 mgd for average conditions and 0.71 mgd for a 1-in-10 year drought event. The current permitted maximum daily diversion from the river to the canal is 5.1 mgd. The 2035 projected surface water demands for a 1-in-10 year drought event is 14 percent of the currently permitted maximum daily diversion rate. The rate is much lower than historical withdrawal rates and is not anticipated to cause adverse impacts to surface waters or associated natural systems.

Adequacy of Surface Water Resources

With the exception of authorized water withdrawals from the City of Port St. Joe, the District's Governing Board has established water reservations for the Chipola and Apalachicola rivers that reserve that magnitude, duration, and frequency of flows for the protection of fish and wildlife. Thus, surface water resources are anticipated to be sufficient to meet demands through 2035.

Reclaimed Water

In 2010, approximately 0.8 mgd or 45 percent of Region V's wastewater was of reuse quality and 0.1 mgd or 6 percent was used to replace potable-quality water (Table 3.39). Most of the reclaimed water, 0.7 mgd, was applied to spray fields rather than being used in place of surface or groundwater withdrawals. The cities of Carrabelle and Apalachicola have implemented public access reuse with high-level disinfection. Modest amounts of reclaimed water, 0.1 mgd, were used for prison toilet flushing and subdivision irrigation in Carrabelle. Although the feasibility of reuse systems in Region V may be limited by financial feasibility, facility locations, storage options, and other factors, there may be opportunities for water users to meet some of their future water needs with reclaimed water.

Table 3.39 Region V Reuse of Domestic Wastewater, 2010 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Reuse Flow that Replaces Potable-Quality Water*
Apalachicola WWTF	1.00	0.21	0.92		
Eastpoint Wastewater Treatment Plant	0.30	0.14	0.30	0.14	
Kenneth B. Cope AWT Facility	1.20	0.34	1.18	0.34	0.10
SummerCamp WWTP	0.12	0.00	0.12		
Franklin County Total	**2.62**	**0.69**	**2.52**	**0.48**	**0.10**
City of Port St. Joe WWTF	3.10	0.59	3.23		
Gulf Correctional Institution WWTP	0.35	0.27	0.35	0.27	
Wewahitchka WWTP	0.50	0.11	0.50		
Gulf County Total	**3.95**	**0.97**	**4.08**	**0.27**	**0.00**
Region V Total	**6.57**	**1.66**	**6.60**	**0.75**	**0.10**

*Reuse Flow That Replaces Potable-Quality Water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses. Not included in this flow calculation are agriculture irrigation of other crops, absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant (Source: FDEP reuse inventories).

Table 3.40 Region V Domestic Wastewater Flow Projections 2015 - 2035 (mgd)

Facility Name	2015	2020	2025	2030	2035
Apalachicola WWTF	0.21	0.21	0.21	0.21	0.21
Eastpoint Wastewater Treatment Plant	0.15	0.15	0.15	0.15	0.15
Kenneth B. Cope AWT Facility	0.35	0.35	0.35	0.35	0.35
SummerCamp WWTP	0.00	0.00	0.00	0.00	0.00
Franklin County Total	**0.71**	**0.71**	**0.71**	**0.71**	**0.71**
City of Port St. Joe WWTF	0.59	0.60	0.60	0.60	0.61
Gulf Correctional Institution WWTP	0.27	0.27	0.28	0.28	0.28
Wewahitchka WWTP	0.11	0.11	0.11	0.11	0.11
Gulf County Total	**0.98**	**0.98**	**0.99**	**0.99**	**1.00**
Region V Total Wastewater Projections	**1.69**	**1.69**	**1.70**	**1.70**	**1.71**

Table 3.41 Region V Available Reclaimed Water Projections 2015 -2035* (mgd)

Facility Name	2015	2020	2025	2030	2035
Apalachicola WWTF	0.21	0.21	0.21	0.21	0.21
Eastpoint Wastewater Treatment Plant	0.15	0.15	0.15	0.15	0.15
Kenneth B. Cope AWT Facility	0.20	0.20	0.20	0.20	0.20
SummerCamp WWTP	0.00	0.00	0.00	0.00	0.00
Franklin County Total	**0.56**	**0.56**	**0.56**	**0.56**	**0.56**
City of Port St. Joe WWTF	0.59	0.60	0.60	0.60	0.61
Gulf Correctional Institution WWTP	0.27	0.27	0.28	0.28	0.28
Wewahitchka WWTP	0.11	0.11	0.11	0.11	0.11
Gulf County Total	**0.98**	**0.98**	**0.99**	**0.99**	**1.00**
Region V Total Available Reclaimed Water	**1.54**	**1.54**	**1.55**	**1.56**	**1.56**

*Projections are for potentially available reclaimed water and do not take into account planned expansions of reuse systems.

Conservation

Implementation of additional conservation measures in Region V could help constrain future demands on ground and surface water resources. Franklin County utilities together have the highest gross per capita usage of all 16 counties in the District, although this reflects tourism and seasonal populations that are not incorporated in the per capita use calculations. Five, or half, of the public supply utilities in Region V, all located in coastal Franklin County, have gross per capita usage exceeding 150 gpcd. A savings of 0.71 mgd by 2035, or 44 percent of their water usage, could be achieved if gross per capita water consumption could be reduced to 150 gpcd through reductions in water losses and the implementation of conservation measures. The EZ Guide tool from Conserve Florida can inform utilities of the conservation options most suitable for their situation at the least cost.

Water Management Services has active leak detection, meter replacement, public education, and toilet tank displacement kit programs. The City of Apalachicola has a water conservation and efficiency plan to comply with their consumptive use permit. The city is working to eliminate yard meters so that outdoor water use will be billed at the same rate as indoor use to encourage non-wasteful use of water.

3.5.3 *Determination of the Need for a Regional Water Supply Plan*

The major surface water supply facility recommended by the Region V RWSP (NWFWMD 2007) was completed in 2009. Additionally, population growth and water demand trends have not materialized as previously anticipated. Based on the updated demand projections and assessments of resources described above, the currently available and anticipated sources of water will be sufficient to meet regional water supply needs through 2035. The continued update and implementation of a RWSP for the region is not recommended. However, water supply development will need to be carefully managed to ensure resource sustainability and reliability, especially with respect to coastal groundwater resources. Water reuse and conservation should also be further developed. It may also be prudent for utilities and local governments to continue to evaluate interconnections as a strategy to enhance reliability and drought preparedness. The determination of the need for RWSP update and implementation will be reevaluated in future WSAs, supported by technical data collection and analysis completed pursuant to MFL development.

3.6 Region VI: Gadsden County

Region VI lies within the Apalachicola and Ochlockonee River watersheds and consists solely of Gadsden County, including the municipalities of Chattahoochee, Greensboro, Gretna, Havana, Midway and Quincy (Figure 3.40). The region is relatively rural, with over half of the population residing in unincorporated areas, and has slow population growth. Agriculture is the primary component of the region's economy and the largest water use category. Predominant crops include vegetables, nurseries, and sod. The largest employment sectors are government, agriculture, and retail trade. Although groundwater provided approximately 63 percent of all water used in 2010, availability is limited due to the low water yielding properties of the Floridan aquifer. The majority of surface water in the region, which also has limited availability, is used for agricultural production.

Region VI Snapshot		
	2010	2035
Population	46,389	50,500
Water Use (mgd)	~ 18	~ 19
Primary Sources	Floridan Aquifer and Surface Waters	
RWSP Status	No RWSP Recommended	

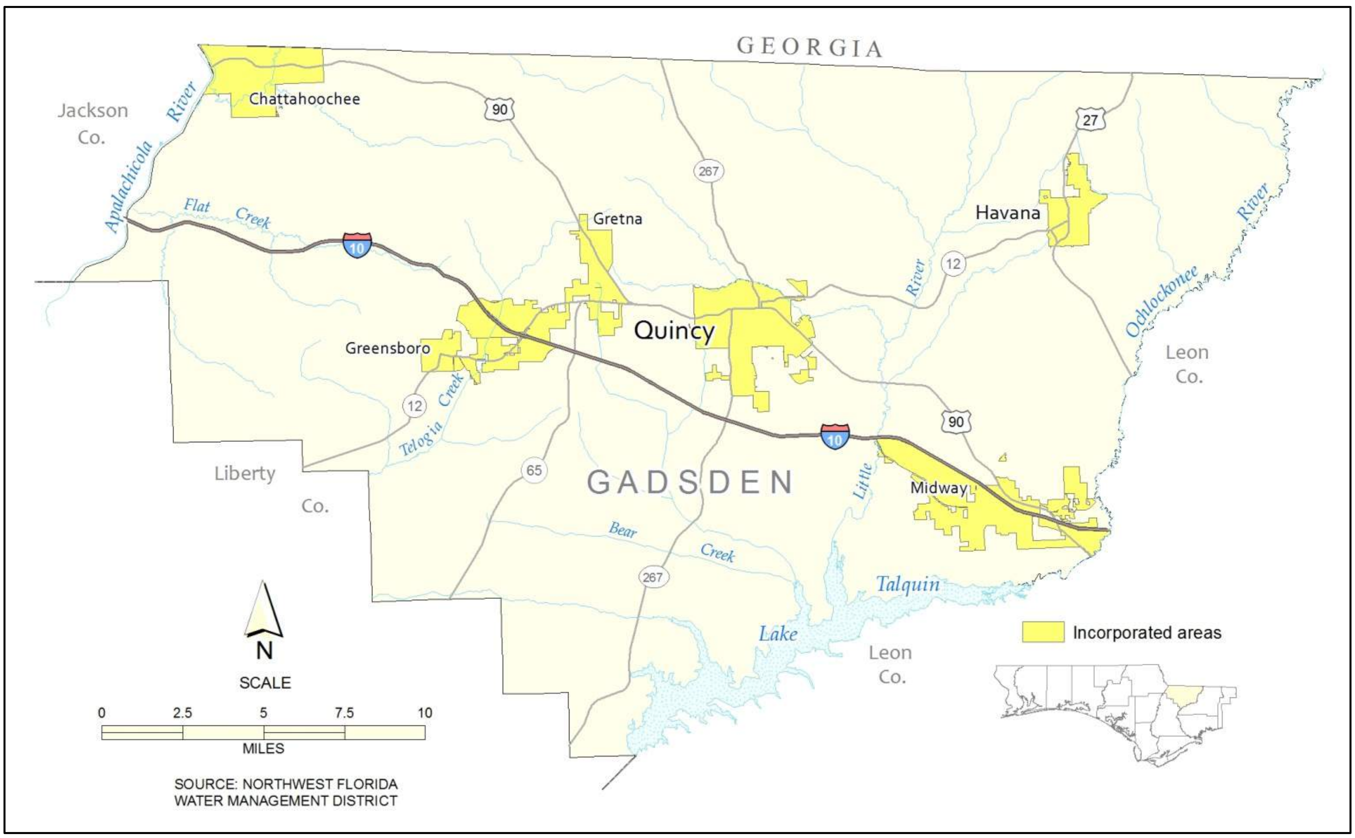


Figure 3.40 Map of Region VI

3.6.1 *Water Use Estimates and Projections*

Public Supply

The largest public supply utilities are Talquin Electric Cooperative (1.65 mgd in 2010) and the City of Quincy (1.41 mgd in 2010) and (Table 3.42). Water withdrawals for the remaining utilities were 0.5 mgd or less. The City of Chattahoochee supplies water and does billing for the Rosedale Water Association and anticipates taking over the water system when funding is secured. Chattahoochee's water production estimates and projections are the sum of demand for both systems. Public supply water use in Gadsden County totaled 4.46 mgd in 2010 and is the second largest use category next to agriculture (Table 3.43). All public supply utilities currently rely on groundwater from the Floridan aquifer. Public supply water demands for Gadsden County are projected to increase moderately to 5.02 mgd in 2035 (Table 3.42).

Table 3.42 Region VI Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated			Projected		
Utility	2010	2015	2020	2025	2030	2035
Chattahoochee, City of	0.38	0.38	0.38	0.38	0.38	0.38
Greensboro, Town of	0.07	0.07	0.07	0.08	0.08	0.08
Gretna, City of	0.40	0.40	0.40	0.40	0.40	0.40
Havana, Town of	0.51	0.51	0.51	0.51	0.51	0.51
Quincy, City of	1.41	1.54	1.61	1.68	1.75	1.82
Rosedale Water Association	0.04	0.04	0.04	0.04	0.04	0.04
Talquin Electric Cooperative, Inc.*	1.65	1.69	1.72	1.75	1.77	1.79
Total	**4.46**	**4.63**	**4.73**	**4.83**	**4.93**	**5.02**

**Includes Gadsden County Regional, Hammock Creek, Jamieson, and St. James Water Systems*

Domestic Self-Supply and Small Public Water Systems

The estimated population served by domestic self-supply and small public water systems was 15,173 persons in 2010 and represented about one-third of the total county population. The estimated 2010 water use for this population was 1.44 mgd and demands are anticipated to increase a negligible amount by 2035 (Table 3.43).

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

The 2010 I/C/I water use totaled 0.46 mgd (Table 3.43). The two 2010 I/C/I water users are the BASF Corporation and the Florida State Hospital. Quincy Creek is the primary water source for the BASF Corporation and the Floridan aquifer is the source of water for the Florida State Hospital. Water demands for these two users, along with SK Enterprises of Northwest Florida who was permitted in 2011, are projected to increase to 0.75 mgd by 2015 and stay at that level through 2035.

Recreation Self-Supply

The 2010 self-supplied recreation water use totaled 0.20 mgd in Region VI (Table 3.43). The Floridan aquifer is the primary source of water, water-based recreation and aesthetic use accounting for 68 percent of the total use. A small portion of the water used for recreation is withdrawn from the intermediate aquifer and surface water sources. Region VI recreation water demands are not expected to change significantly through 2035 and future demands are anticipated to be met by the same sources utilized in 2010.

Agricultural Use

Agricultural water use in Gadsden County totaled 11.82 mgd in 2010 (Table 3.43). The Upper Telogia Creek WRCA comprises a portion of the county. Most water withdrawals for agricultural use are metered. The primary crops in Gadsden County are container nurseries, tomatoes, vegetables, field crops and sod. Sources of irrigation water include several streams, the Floridan aquifer system, and reclaimed water. Although future demands for agricultural use are somewhat uncertain, trends show that they are expected to remain fairly constant.

Power Generation

The Jim Woodruff hydroelectric plant, located 0.2 miles from the confluence of the Chattahoochee and Flint rivers on the border between Gadsden and Jackson counties, generates electricity by passing water through turbines. It requires no consumptive use of water to operate.

Total Water Use and Population

Average annual water use in Gadsden County totaled approximately 18.38 mgd in 2010 (Table 3.43). The largest use categories were agriculture (64 percent of total) and public supply (24 percent). Domestic self-supply, I/C/I, and recreation uses collectively accounted for the remaining 12 percent (Figure 3.41).

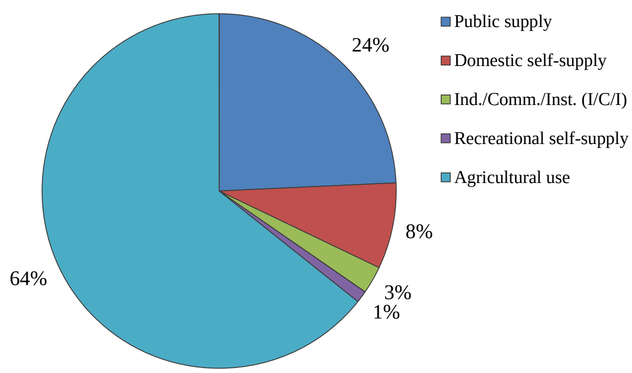


Figure 3.41 Region VI Water Use by Category, 2010

According to the U.S. Census, the total population in Gadsden County was 46,389 in 2010 (BEBR 2013). Population and public supply water use are both projected to increase over the planning period. The medium-range population projection for Gadsden County in 2035 is 50,500 persons. This represents a 9 percent increase from 2010 (BEBR 2013).

The total water demand in Region VI is projected to increase by 5 percent, or 0.88 mgd, between 2010 and 2035, reaching a total of 19.26 mgd by 2035 (Table 3.43). Public supply water needs are projected to increase by approximately 0.56 mgd and I/C/I by 0.29 mgd. Changes for the remaining water use categories are small.

Table 3.43 Region VI Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	4.46	4.63	4.73	4.83	4.93	5.02
Domestic self-supply	1.44	1.44	1.46	1.46	1.46	1.46
Ind./Comm./Inst. (I/C/I)	0.46	0.75	0.75	0.75	0.75	0.75
Recreational self-supply	0.20	0.20	0.21	0.21	0.21	0.21
Agricultural use	11.82	11.82	11.82	11.82	11.82	11.82
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**18.38**	**18.85**	**18.97**	**19.07**	**19.17**	**19.26**

1-in-10 Year Drought Projections

Projected demands for a 1-in-10 year drought event are shown in Table 3.44. The 2035 total water demand for a 1-in-10 year drought is about 5 percent higher than the 2035 total average year water demand.

Table 3.44 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd)

			Projected		
Water Use Category	2015	2020	2025	2030	2035
Public supply	4.95	5.07	5.17	5.27	5.37
Domestic self-supply	1.54	1.56	1.56	1.57	1.56
Ind./Comm./Inst. (I/C/I)	0.75	0.75	0.75	0.75	0.75
Recreational self-supply	0.22	0.23	0.23	0.23	0.24
Agricultural use	12.29	12.29	12.29	12.29	12.29
Power generation	0.00	0.00	0.00	0.00	0.00
Total	**19.76**	**19.90**	**20.00**	**20.11**	**20.21**

3.6.2 *Assessment of Water Resources*

Groundwater availability is very limited throughout most of the region due to the low water-yielding properties of the Floridan aquifer and poor water quality at depth. Groundwater accounted for approximately 11.8 mgd or 63 percent of the total water used in 2010. Since 2003, groundwater is the only source utilized for public supply. Prior to 2003, the City of Quincy relied on surface water withdrawn from Quincy Creek. Virtually all of the current surface water withdrawals in the region are used for agricultural or recreation self-supply use. Surface water currently provides approximately 58 percent of the agricultural demand in Gadsden County. Because of concerns regarding the availability of surface water and groundwater in the upper Telogia Creek Basin, the District designated this area as a Water Resource Caution Area (WRCA) (Figure 1.2).

Groundwater Resources

The groundwater hydrology of Region VI varies greatly. In the central portion of the county, low-permeability sediments found in the structural trough known as the Apalachicola Embayment dominate the hydrogeology. Along the western flanks of the county, the permeability of the Floridan aquifer significantly increases, resulting in increased groundwater availability. Within the region, four hydrostratigraphic systems are present: a moderately thick to absent surficial aquifer system, a thick to moderately thick intermediate system, a thick Floridan aquifer system, and a low-permeability, basal confining unit. In order of depth, the hydrogeologic units that comprise the groundwater flow system are the surficial aquifer system, the intermediate system, the Floridan aquifer system, and the sub-Floridan system.

The surficial aquifer consists primarily of interbedded layers of clayey sand and sandy clay and is negligible as a source of water supply in Region VI. Its significance to the regional water supply derives from its role as a source of recharge water for underlying systems and its discharge to steams throughout the region which sustains stream flow during periods of drought. Due to erosion, the surficial aquifer system is thin to absent in some of the deeper stream channels within the region.

The intermediate system consists of low permeability sediments, which form an effective confining unit that significantly restricts recharge to the underlying Floridan aquifer. The intermediate system is between 200 and 300 feet thick in central Gadsden County and thins to less than 150 feet in the extreme northwestern and eastern portions of the county. The intermediate system functions primarily as a confining unit, however, carbonates within the intermediate system form minor water-bearing zones that are occasionally utilized for domestic water supply. These units also supply some recharge to the underlying Floridan aquifer system.

The Floridan aquifer system consists of a thick sequence (600 to 1,200 feet) of carbonates across the region. The Apalachicola Embayment is a geological structural trough, which is deepest along the axis that runs through central Gadsden County from the northeast to southwest. Within the embayment, the Floridan aquifer is overlain by a thick intermediate system. Due to the overall low permeability of the intermediate system, recharge to the Floridan aquifer system is limited and very little secondary dissolution of the carbonates has taken place. As a result, Floridan aquifer transmissivities are very low (generally less than 1,000 ft^2/d) throughout the embayment. These are some of the lowest values in northwest Florida. Throughout the central portion of the region, including the upper Telogia Creek WRCA, wells typically exhibit specific capacities of less than 3 gpm/ft. Deeper wells (400 feet below sea level) may show specific capacities of up to 15 gpm/ft. Although maximum well yields range from 100 to 300 gpm, considerable drawdown is associated with these withdrawal rates. In addtition, the limited amount of leakage into the Floridan aquifer system has prevented flushing of naturally-occurring, poor quality water from within the deeper portions of the aquifer. The combination of low transmissivities and poor water quality at depth results in limited groundwater availability.

In northwestern and eastern Gadsden County, on the outer edges of the embayment, the intermediate system thins and the Floridan aquifer system is closer to the surface and much more permeable. These portions of the county are adjacent to and greatly resemble the active groundwater flow areas of the Woodville Karst region in Leon County and the Dougherty Karst region in western Jackson County. Transmissivities on the flanks of the embayment are, by Region VI standards, very high. Due to the significantly increased permeability of the Floridan aquifer in these areas, well yields are higher. Specific capacities increase sharply between the Mt. Pleasant community and Chattahoochee. Near Chattahoochee, transmissivities increase to about 100,000 ft^2/d. To the east near the Ochlockonee River, aquifer testing resulted in a transmissivity of 40,000 ft^2/d (Richards and Dalton 1987).

Typically, only the upper 60 percent of the Floridan aquifer system thickness is utilized for water supply, due to increasingly mineralized water in deeper portions of the aquifer. The upper third of the aquifer exhibits well yields generally less than 100 gpm. Somewhat greater yields of up to 300 gpm are possible in the middle portion of the aquifer. High pumping rates or long periods of pumping in the upper or middle portion of the Floridan aquifer system can cause upconing of highly mineralized water from below. Due to higher transmissivities, greater well yields occur in the northwestern and in the eastern portion of Gadsden County.

The Sub-Floridan System underlies and confines the Floridan aquifer flow system. Due to a lack of data, little is known of the hydraulic character of this unit within the region.

The Floridan aquifer system's zone of contribution for Region VI extends north into southwest Georgia (Davis 1996). The Georgia portion of the zone of contribution includes parts of Decatur and Grady counties. In north-central Gadsden County, the potentiometric surface is at an elevation of approximately 70 feet above sea level (Figure 3.42). From this potentiometric high, groundwater flow is primarily towards the Apalachicola River to the west and towards Leon County to the southeast. Principal discharge areas include the Apalachicola River, Wakulla Spring, and other springs in the Woodville Karst plain.

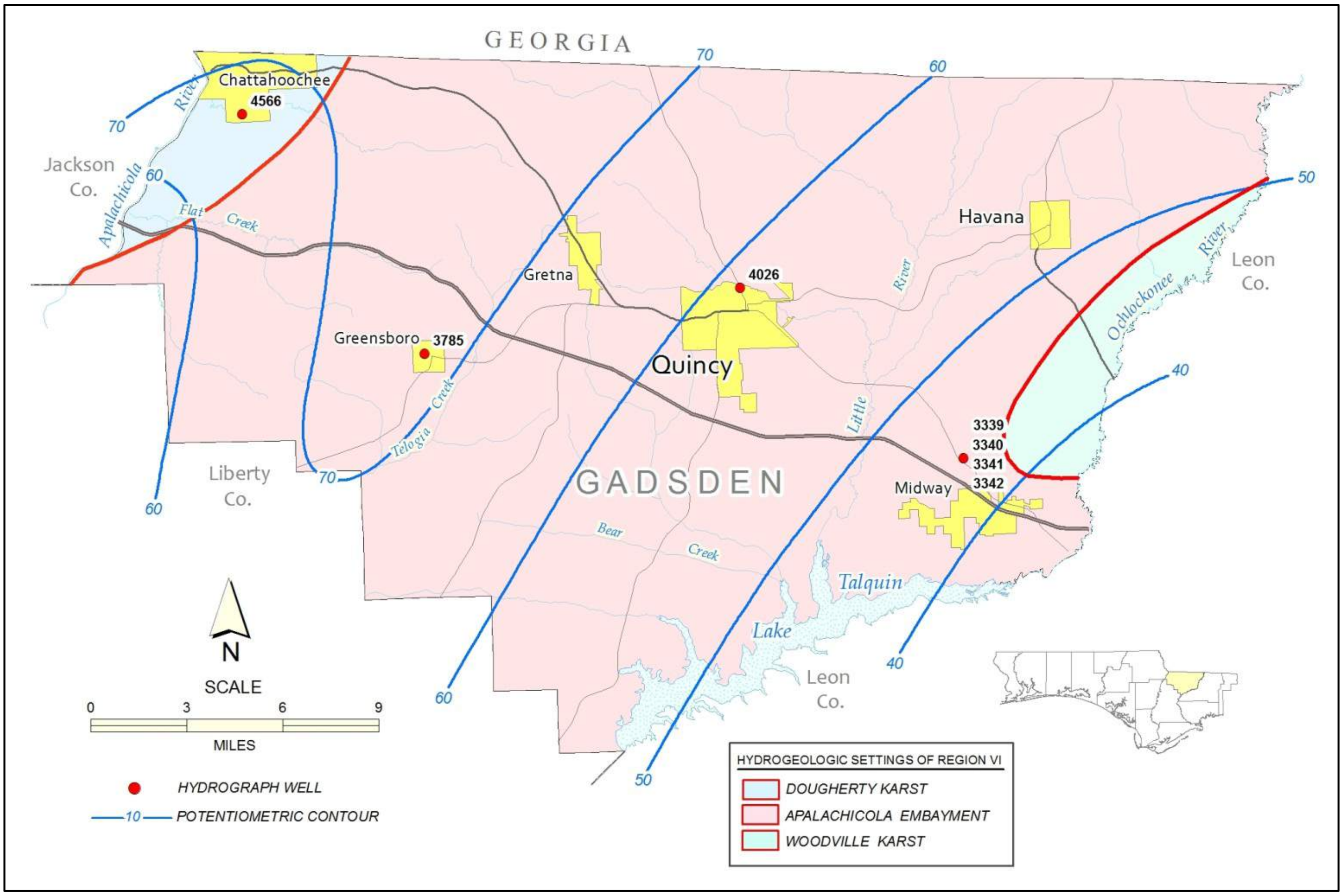


Figure 3.42 Potentiometric Surface of the Floridan Aquifer System in Gadsden County, June 2010

Throughout Gadsden County water levels within the upper third of the Floridan aquifer can be as much as 110 feet above sea level, or about 40 feet higher than the water levels in the middle and lower portions of the aquifer (Wagner 1982). This is due to the presence of marl and other low permeability sediments within the upper third of the Floridan aquifer. These low permeability sediments retard the downward movement of water within the Floridan aquifer and are the cause of the higher heads found in the upper portion of the aquifer. This upper portion of the Floridan aquifer is the interval tapped by most domestic supply wells in the county. The middle, higher yielding portion of the aquifer is primarily utilized by agriculture and public water supply utilities. Figure 3.43 shows the relative water levels for the various hydrostratigraphic units in the region.

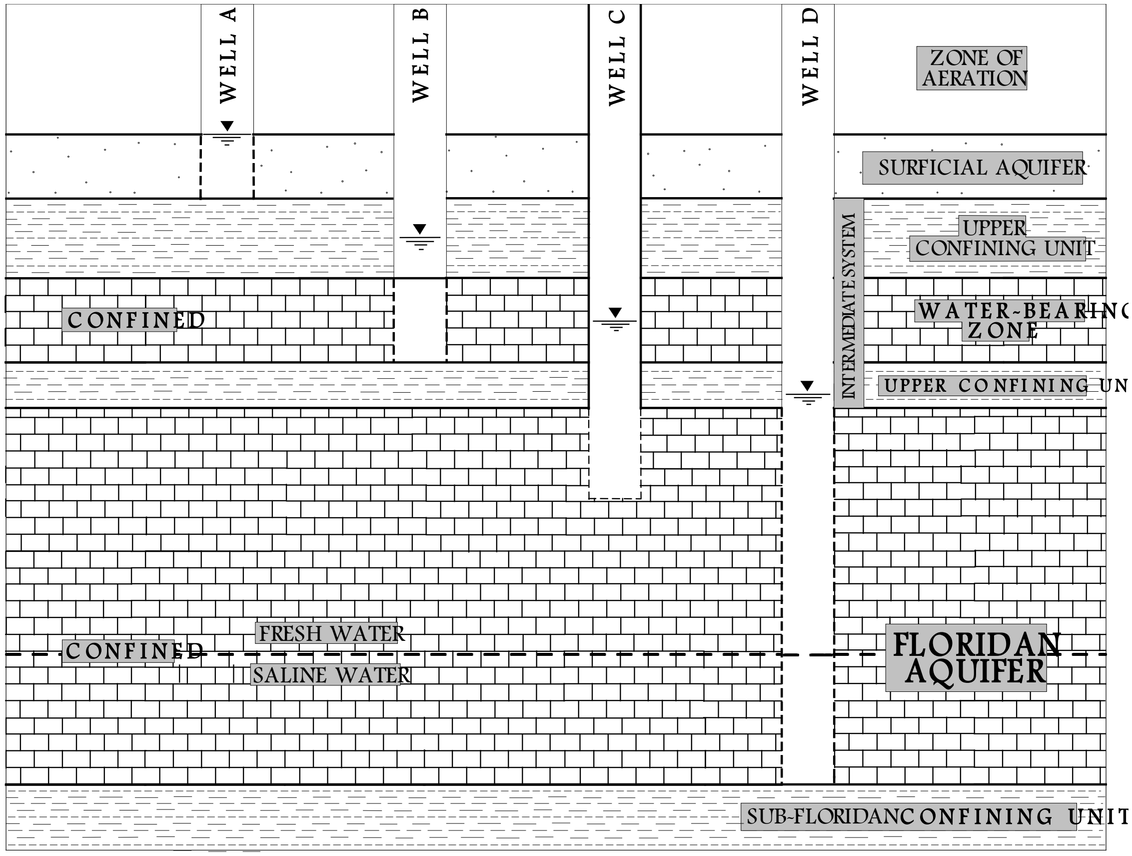


Figure 3.43 Hydraulic Head Variations among Hydrostratigraphic Units in Region VI

Throughout the region, water quality data from wells with total depths below approximately 400 feet below sea level show an increase in mineralization and total dissolved solids (TDS) and are more likely to induce upconing of poor quality water. Figure 3.44 presents data from the City of Quincy Well #2, which shows the deteriorating water quality with depth (Wagner 1982). At the Apalachicola River near Chattahoochee, saline water (chloride concentration>1,000 mg/L) has been encountered at an elevation of 200 feet below sea level.

<u>Assessment Criteria</u>

Two criteria were used to assess impacts on groundwater resources: long-term depression of the potentiometric surface of the Floridan aquifer, and attendant alteration of groundwater quality. A regional groundwater budget was also used to evaluate the relative magnitude of groundwater withdrawals.

Impacts to Groundwater Resources and Related Natural Systems

Hydrographs for four wells are presented to depict long-term trends in Floridan aquifer water levels (Figure 3.45): data are presented for wells located in Quincy (NWFID 4026), Greensboro (NWFID 3785), Chattahoochee (NWFID 4566), and Midway (NWFIDs 3339 through 3342). The locations of these monitor wells are shown on Figure 3.42 and indicated on the map by their NWFID numbers.

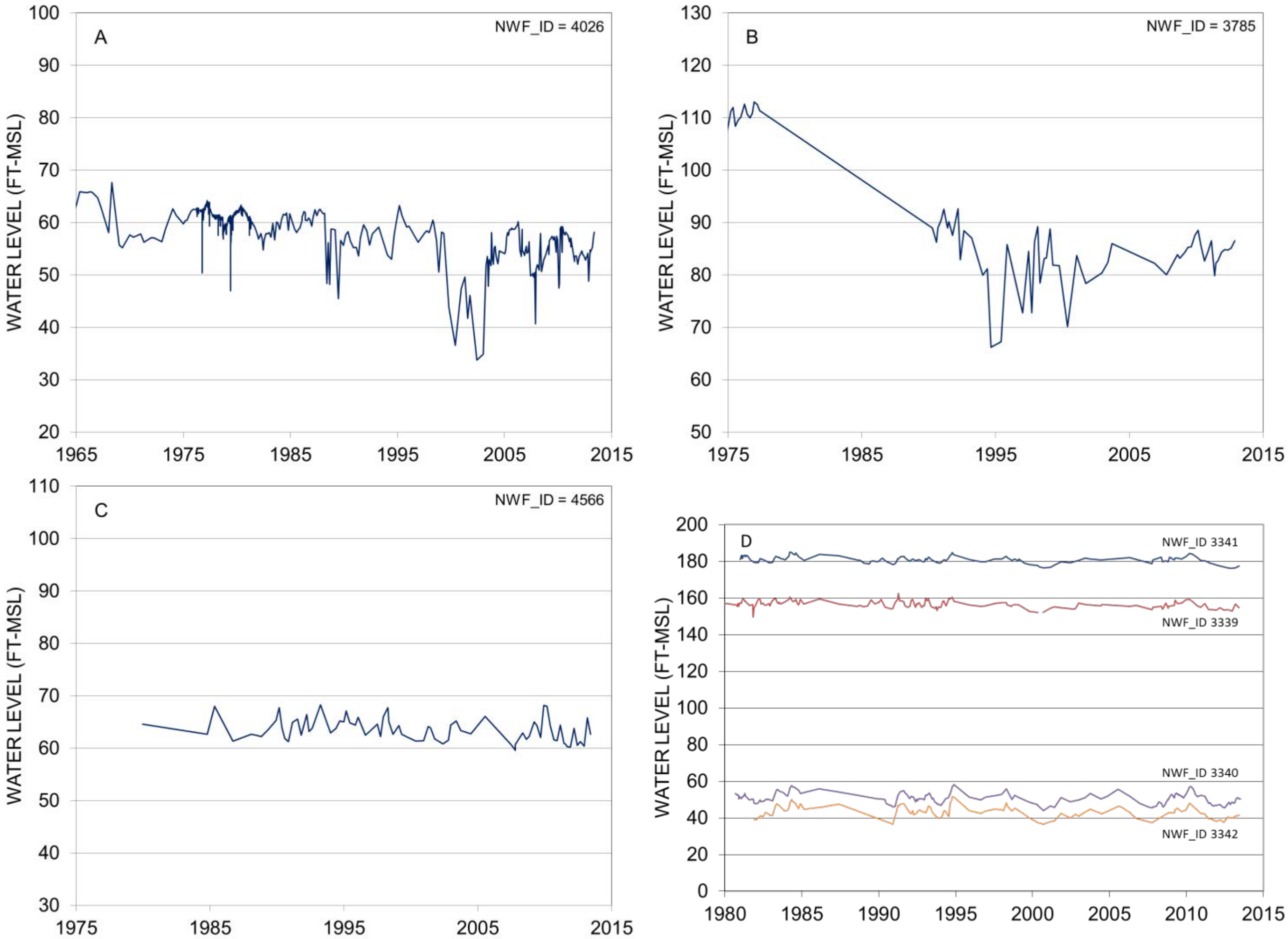


Figure 3.45 Hydrographs of Wells in A) Quincy, B) Greensboro, C) Chattahoochee, and D) Midway

The Quincy well (Figure 3.45A) is constructed in the more productive middle portion of the Floridan aquifer. The hydrograph is affected by a City of Quincy back-up supply well, which is located nearby. A decline in the water level of about 5 feet is noted since 1961. This decline can likely be attributed to use of the nearby well and recent droughts. Use of the middle portion of the Floridan aquifer is limited due to poor quality water at depth and the potential for upconing.

The Greensboro well (Figure 3.45B) is completed in the upper portion of the Floridan aquifer and is representative of the primary interval utilized in the vicinity of Greensboro. In the mid-1970s, water levels were about 110 feet above sea level. Between 1974 and the late 1980s, the hydrograph shows a decline of about 20 feet despite only a modest increase in groundwater use in the vicinity of Greensboro. Due to the very low transmissivities and low aquifer recharge, modest withdrawals can result in the propagation of significant aquifer drawdown. Similar water level decline is also noted elsewhere in the Telogia Creek basin. Somewhat larger water level declines have been recorded near sites of significant withdrawal. Since the early 1990s, water levels have stabilized due to monitoring, careful permitting of new withdrawal locations, optimizing water use efficiencies for both ground and surface water resources, and planning associated with the designation of the Upper Telogia Creek WRCA.

The Chattahoochee well (Figure 3.45C) is located in northwestern Gadsden County. The well is located at the edge of the embayment and lies in the Dougherty Karst region where the Floridan aquifer is closer to the surface, more permeable, and interconnects with the Apalachicola River. The hydrograph shows that the water levels in this area are relatively stable and less influenced by pumping.

The Midway wells (Figure 3.45D) are a cluster of water wells that show the hydraulic head variations among hydrostratigraphic units as shown in Figure 3.43. The upper well is located in the surficial aquifer and has a hydraulic head that is 20 feet greater than the second well, located in the intermediate aquifer. The lower two hydrographs represent wells in the upper and lower Floridan aquifer where there is a consistent 5 to 10 foot hydraulic head difference between these two units. The water levels in these wells are stable since there is little pumping in the area and the wells are located near the edge of the embayment.

Significant water level declines are generally limited to areas of greater groundwater withdrawals. In the northwest and eastern areas of higher aquifer transmissivities, little or no water level decline has occurred despite increased withdrawals. Although demand on the Floridan aquifer is limited in Region VI, it is apparent that modest withdrawals in the central portion of Gadsden County can result in significant water level declines. The management of withdrawals will continue to require appropriate spacing and the siting of new wells in areas of higher transmissivity and groundwater availability.

Groundwater Budget

A regional groundwater budget was estimated to present an order-of-magnitude approximation of the water flow into and out of the Floridan aquifer in Region VI (Figure 3.46) (Ryan et al. 1998). The budget was prepared from a calibrated steady-state groundwater flow model. Although a steady-state model does not account for seasonal or annual variations in flow, the model does provide a means to estimate the relative magnitude of the various inflows to and outflows from the aquifer. The flow system components for Region VI were estimated using output from a steady-state, three-dimensional groundwater flow model (Davis 1996). The model was calibrated to conditions as they occurred in October and November of 1991.

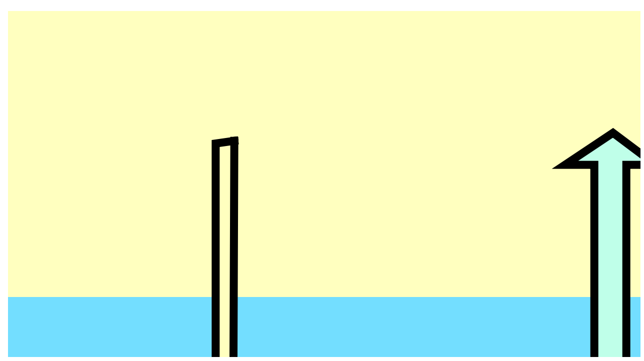


Figure 3.46 Region VI Floridan Aquifer Steady-State Groundwater Budget

To estimate water budget components for this region, District staff used the computer program ZONEBUDGET (Harbaugh 1990) to analyze model output obtained from the USGS (Davis 1997). ZONEBUDGET allows the user to define a subregion within a model domain and calculate the inflow and outflow to that subregion. Major regional groundwater inflows are subsurface inflow from areas hydraulically upgradient, leakage into the upper Floridan aquifer from the overlying intermediate system within the region, and surface infiltration and direct recharge to the upper Floridan aquifer within the region. The total Region VI steady-state groundwater inflow into the Floridan aquifer was estimated to be 53.7 mgd. Recharge to the Floridan aquifer (9.2 mgd) equates to an annual rate of less than 0.5

inches per year. The 2010 groundwater use of approximately 11.5 mgd is 21 percent of the estimated Floridan aquifer groundwater budget in Region VI. The projected 2035 groundwater demand of 12.4 mgd represents approximately 23 percent of the regional groundwater budget.

Water Quality Constraints on Availability

Naturally occurring highly mineralized water in the lower portion of the Floridan aquifer system does represent a constraint to the development of groundwater resources in the region. Long-term depression of the potentiometric surface of the Floridan aquifer may result in local upconing of this poor-quality water and affect the quality of groundwater withdrawn.

Adequacy of Groundwater Resources

Groundwater resources in Region VI are limited, particularly in the central part of the region. Through careful planning and permitting, the groundwater resources of the region are anticipated to be adequate to meet the projected 2035 demands for average conditions and a 1-in-10 year drought event. However, the management of groundwater withdrawals will require adequate well spacing and limited withdrawals in the central portion of the region. Higher capacity wells will need to be located in the more transmissive areas in northwest and eastern Gadsden County. Agricultural water use, the largest use sector, is not anticipated to increase in the near future. Additionally, most agricultural needs in Region VI are met using surface water sources.

Surface Water Resources

The surface water resources of Region VI consist of a well-developed network of streams, natural wetlands and manmade impoundments. The impoundments were constructed primarily for agricultural irrigation. No natural lakes occur in the region. The well-developed stream network is typical of areas with clayey sub-soils, which limit infiltration rates and aquifer recharge. The soil characteristics result in high runoff rates and relatively high average total stream flow compared to base flow. These characteristics limit the availability of surface water during periods of low rainfall or drought. The major surface water resources used for water supply in Region VI are the Telogia and Quincy creeks.

Telogia Creek

To assess surface water flow conditions in the Telogia Creek basin, the District maintains a gauging station on Telogia Creek at County Road 65D. This is the most upstream, long-term station in the watershed and it is located downstream from where most of the agricultural surface water withdrawals occur. Figure 3.47 shows the stream flow hydrograph for this station, which includes approximately 36.4 mi^2 of an intensely-farmed contributing watershed area. Flows at this location range from zero (no flow) to 1,815 cfs. The mean annual flow for the years 1990 through 2012 is 36.1 cfs (23.4 mgd) and is equivalent to a basin runoff of about 13.5 inches per year. The minimum annual flow during this period was 12.5 cfs (8.1 mgd - recorded during the drought year of 2011) and is equivalent to a basin runoff of about 4.7 inches per year.

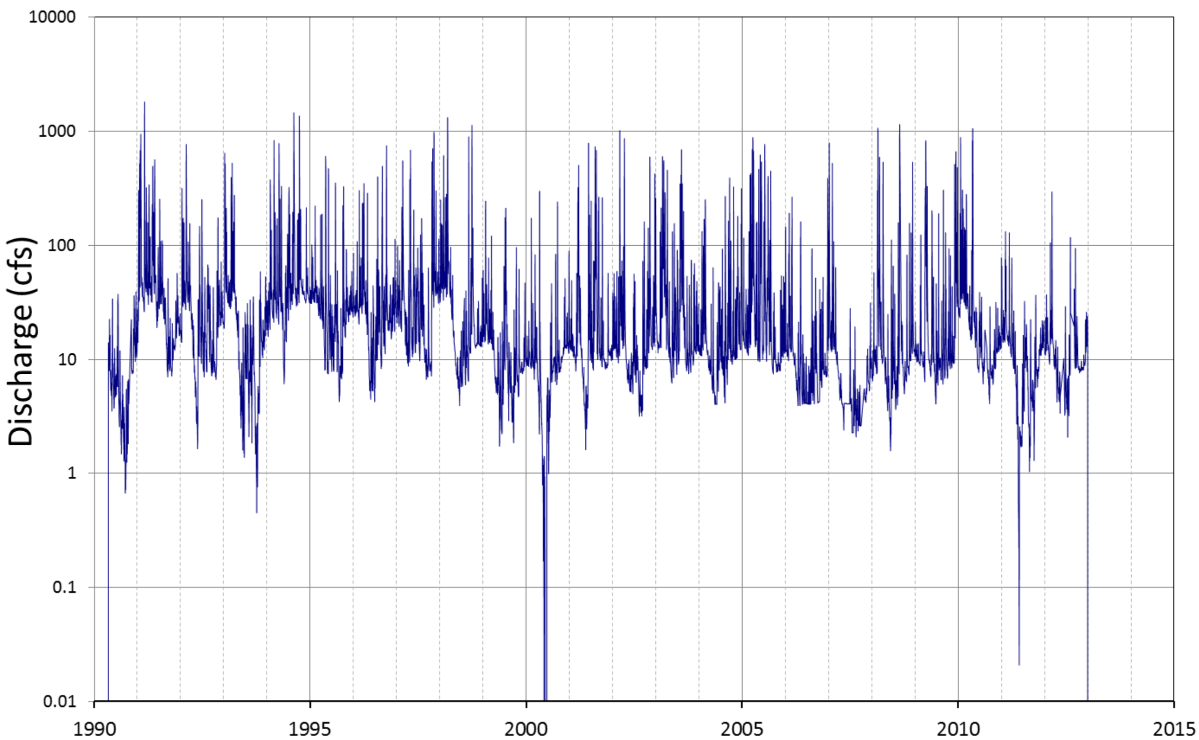


Figure 3.47 Telogia Creek Average Daily Discharge (cfs)

At the low Q_{90} flows, the wetted width of the Telogia Creek channel shrinks by an estimated one to 7 feet due to projected pumping rates. All of these changes in wetted area occur within-bank and affect only the alluvial part of the channel. Above the Q_{90} flows and further downstream from the District's gage, changes in wetted area due to pumping become much less perceptible. Historically, the flow regime in the upper reaches of the creek included a zero flow condition. This condition has occurred for at least 60 years, extending back to the region's tobacco farming era. There are also many farm ponds and in-stream impoundments constructed throughout the Telogia Creek watershed which have significantly altered the historical flow regime. In several instances, new wetlands and lake areas have been created by these impoundments. The irregular and infrequent drawdowns and refilling of the ponds for maintenance by agricultural producers have also altered the hydrologic regime. As a result, wetland systems have adapted to drought periods and dry streamflow conditions, as well as the backwater and storage effects of the ponds.

Quincy Creek

The USGS maintained a gauging station on Quincy Creek at SR 267 from 1974 to 1992. The drainage area for this station is 16.8 square miles. The Quincy Creek basin is similar to the Telogia Creek basin in that they are both relatively small basins with their headwaters located within the region. Approximately 20 years of nearly continuous stage and flow data are available for the upper portion of each of these basins. Table 3.45 provides summary flow statistics. All historical and current flow records for these stations are affected by withdrawals.

The period of record for the Telogia Creek includes the six record droughts experienced in 1999, 2000, 2006, 2007, 2011 and 2012, with the most severe drought occurring in 2011. Irrigation withdrawals in the Telogia Creek basin are more seasonal than the combined public supply, industrial and agricultural withdrawals from Quincy Creek during 1974 to 1992. The instantaneous low flow exhibited by these two creeks is quite low and is typical of streams in Region VI during periods of low rainfall and drought. The City of Quincy no longer obtains its water supply from Quincy Creek and now relies on groundwater.

Table 3.45 Flow Statistics for Quincy Creek and Telogia Creek

Summary Statistic	Quincy Creek (at SR 267: 16.8 mi^2) Oct 1974 to Sept 1992	Telogia Creek (at CR 65D: 36.4 mi^2) May 1990 to Dec 2012
Average Annual Runoff (in)	22.7	13.5
Annual Mean (cfs)	28.0	36.1
Q90 (cfs)	9.3	4.3
Highest Annual Mean (cfs)	47.2	76.1
Lowest Annual Mean (cfs)	17.3	12.5
Instantaneous Peak Flow (cfs)	2910.0	1815.0
Instantaneous Low Flow (cfs)	2.3	0.0

<u>Assessment Criteria</u>

The general assessment criterion for surface water availability is the sustainability of the surface water flow regime and associated natural systems. For Telogia Creek, the assessment is based upon a guiding principle that the historical flow regime should be maintained to the extent that the natural systems present today are sustainable. The flow regime and natural systems in the Telogia Creek basin have been highly altered by the construction of farm ponds, in-stream impoundments, and a long history of agricultural water withdrawals.

<u>Impacts to Surface Water Resources and Related Natural Systems</u>

During periods of drought, low stream flows typically occur in this region. Because of the natural variability of stream flows under drought conditions and the intensive historical use of the resource, no widespread impairment, relative to historic flows, has been identified. Since the declaration of the Upper Telogia Creek WRCA, no significant increase in surface withdrawals has been authorized and any impact on the frequency of low flows due to pumping activity has been stabilized.

<u>Water Quality Constraints on Availability</u>

Surface water quality is suitable for current uses and does not constrain availability; however, large amounts of runoff which result from high rainfall events can cause local increases in turbidity in the creeks. Turbidity levels usually returns to normal within several days.

<u>Adequacy of Surface Water Resources</u>

Because most surface water use in Region VI is for agriculture and agricultural water demand projections are based on allocated permit quantities, the projected 2035 surface water demands for average conditions (6.84 mgd) do not differ significantly from the projected water demands for a 1-in-10 year drought (7.0 mgd). Although surface water resources can be very limited during periods of drought, continued careful management of the resource should provide available quantities sufficient to meet future demands.

The adequacy of the surface water resources requires that permit thresholds on water withdrawals not be exceeded. In addition, practices to reduce demand and minimize withdrawals from streams during low flow and drought periods may be required. These include increasing the reuse of water for agricultural purposes, installing runoff recovery systems, and increasing the use of offline storage facilities. These practices combined with increasing water use efficiencies and the implementation of other water conservation measures should ensure adequate availability during times of drought and locally reduce the stress of withdrawals on the natural system.

Reclaimed Water

As shown in Table 3.46, 24 percent or 0.5 mgd of the wastewater generated in Gadsden County in 2010 was of reuse quality. All of this reuse was applied to percolation trenches or spray fields except for a small amount used at the wastewater treatment plant in Quincy. The City of Quincy desires to implement a reuse program if sufficient funding can be obtained. The City of Gretna is able to provide reclaimed water for nursery irrigation; however, no flow was reported for 2010. Conversion to high-level disinfection reuse systems and further reuse system development could enable the replacement of some potable-quality water used at nurseries with reclaimed water.

Table 3.46 Region VI Reuse of Domestic Wastewater, 2010 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Reuse Flow that Replaces Potable-Quality Water*
City of Chattahoochee WWTP	0.40	0.26			
City of Gretna WWTP	0.35	0.24		0.24	
Florida State Hospital WWTP	1.30	0.28			
Gadsden East WWTF	0.25	0.10	0.25	0.10	
Havana WWTF	0.40	0.21	0.40	0.14	
Quincy WWTP	1.50	0.95	0.00	0.02	
Gadsden County Total	**4.20**	**2.03**	**0.65**	**0.49**	**0.00**

*Reuse Flow That Replaces Potable-Quality Water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses. Not included in this flow calculation are agriculture irrigation of other crops, absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant (Source: DEP reuse inventories).

Table 3.47 Region VI Domestic Wastewater Flow Projections 2015 -2035 (mgd)

Facility Name	2015	2020	2025	2030	2035
City of Chattahoochee WWTP	0.26	0.26	0.26	0.26	0.26
City of Gretna WWTP	0.24	0.24	0.24	0.24	0.24
Florida State Hospital WWTP	0.28	0.28	0.28	0.28	0.28
Gadsden East WWTF	0.10	0.10	0.10	0.10	0.10
Havana WWTF	0.21	0.21	0.21	0.21	0.21
Quincy WWTP	1.03	1.08	1.13	1.18	1.22
Gadsden County Total	**2.12**	**2.17**	**2.22**	**2.27**	**2.31**

Table 3.48 Region VI Available Reclaimed Water Projections 2015 - 2035* (mgd)

Facility Name	2015	2020	2025	2030	2035
City of Chattahoochee WWTP	0.26	0.26	0.26	0.26	0.26
City of Gretna WWTP	0.24	0.24	0.24	0.24	0.24
Florida State Hospital WWTP	0.28	0.28	0.28	0.28	0.28
Gadsden East WWTF	0.10	0.10	0.10	0.10	0.10
Havana WWTF	0.21	0.21	0.21	0.21	0.21
Quincy WWTP	1.03	1.08	1.13	1.18	1.22
Gadsden County Total	**2.12**	**2.17**	**2.22**	**2.27**	**2.31**

*Projections are for potentially available reclaimed water and do not take into account planned expansions of reuse systems.

Conservation

Additional conservation measures could be implemented in Region V to lessen demands on ground and surface waters. Half of the ten public supply utilities in Region VI have gross per capita use that exceeds 150 gpcd. Savings of 0.23 mgd are potentially available to these utilities by 2035 by working to reduce this rate to 150 gpcd. The EZ Guide tool, developed by Conserve Florida, would be useful in guiding utilities to the most cost effective conservation options to match their specific circumstances.

Talquin Electric Cooperative experiences high water losses and is working to better identify unmetered usage. They are replacing meters with electronic ones that automatically upload to a database, which will assist in reducing water losses and identifying customer leaks. They are also replacing older service lines to the current standard material. Conservation tips are provided in their customer magazine. Quincy has implemented a meter replacement program with electronic meters, allowing real time monitoring to detect and repair leaks. They are making progress reducing water losses through remote sensors and timely leak identification and repairs. The city has also implemented a conservation rate structure. Customer bills include a comparison of usage from the previous year. The Town of Havana provides public education on water conservation through several methods.

3.6.3 *Determination of the Need for a Regional Water Supply Plan*

The groundwater and surface water resources in Region VI appear adequate to meet the projected average and 1-in-10 year drought event demands through 2035, while sustaining the water resources and associated natural systems. Therefore, no RWSP is recommended. However, continued careful management of the water resources is required. Additional development of groundwater resources will necessitate adequate well spacing and limiting withdrawals in the central portion of the region. Higher capacity wells will need to be located in the more transmissive areas found in the northwest and eastern portions of Gadsden County. The adequacy of the surface water resources, which are primarily used for agricultural use, may locally require measures to minimize withdrawals from streams during low flow and drought conditions. Practices such as increasing the reuse of wastewater for agricultural use, installing additional runoff recovery systems, and increasing the use of offline storage facilities should continue to be implemented in these areas.

3.7 Region VII: Jefferson, Leon and Wakulla Counties

Region VII consists of the three easternmost counties of the District, including the cities of Monticello, Tallahassee, Sopchoppy, and St. Marks (Figure 3.48). Note that only a portion of Jefferson County falls within the District's jurisdiction; the data and analyses reflect only the portion of the county.

Region VII Snapshot		
	2010	2035
Population	316,680	386,033
Water Use (mgd)	~ 50	~ 59
Primary Source	Floridan Aqufier	
RWSP Status	No RWSP Recommended	

Except for the Tallahassee metropolitan area, most of Region VII is relatively rural, a result of large public landholdings (St. Marks National Wildlife Refuge and the Apalachicola National Forest) and large private ownerships such as plantations and timber landholdings. The dominant employers within the planning region are government, retail trade and service sectors, with many residents of the region commuting to Tallahassee to work. The majority of water used in the region is withdrawn from the Floridan aquifer system, a relatively prolific source of good quality water. The water resources of this region sustain the St. Marks, Wakulla, and Ochlockonee rivers, Apalachee Bay, and the many lakes and freshwater springs.

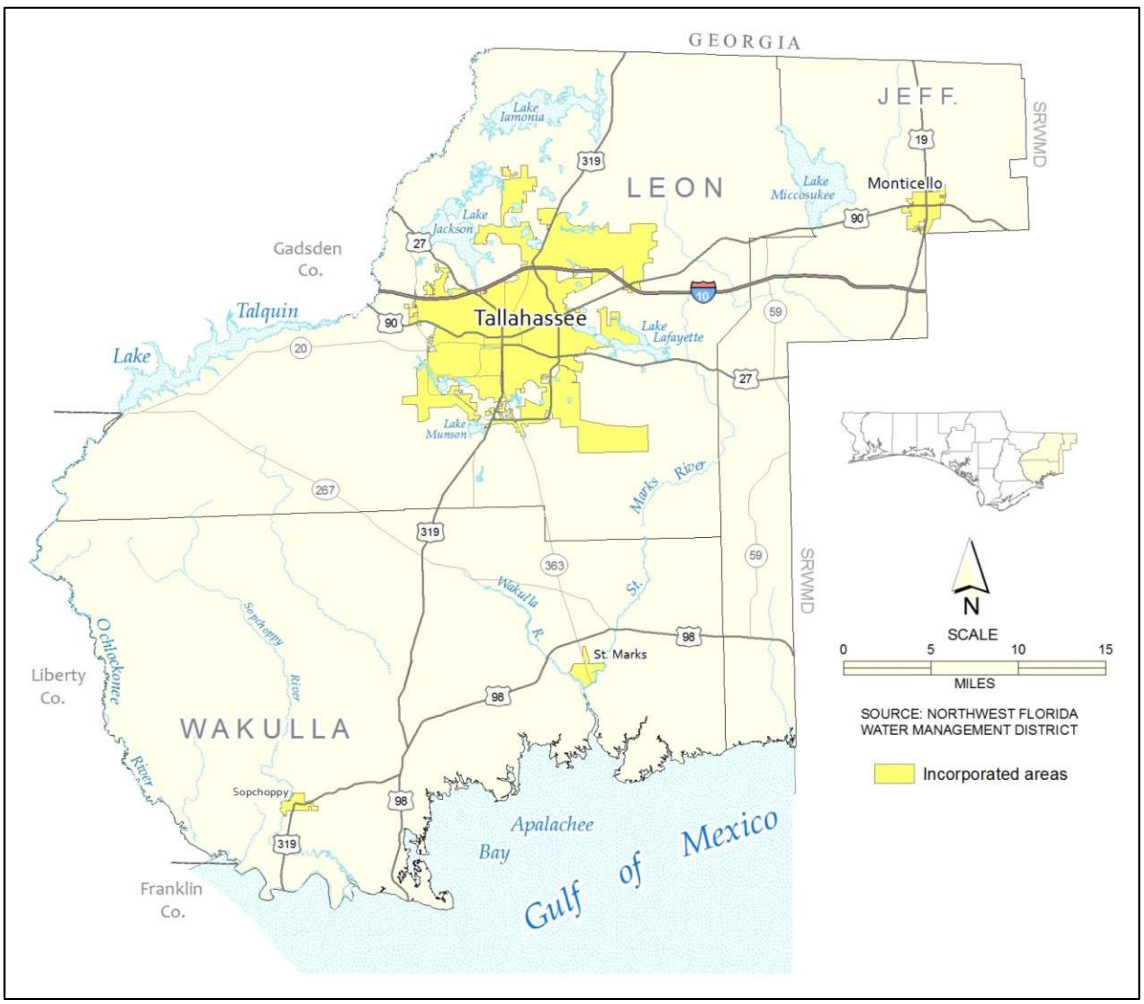


Figure 3.48 Map of Region VII

3.7.1 *Water Use Estimates and Projections*

Public Supply

Public supply water use in Region VII totaled 33.24 mgd in 2010 (Tables 3.49 through 3.53). Approximately 70 percent of the population is served by public supply utilities. By far the largest such utility is the City of Tallahassee, withdrawing about 26.90 mgd in 2010 to serve city residents and the Woodville community in southern Leon County and the adjoining community in Wakulla County proximate to Woodville Highway. The City of Tallahassee also exports water to serve the potable water needs of the City of St. Marks in Wakulla County. Water demand and production tables are provided below for Leon and Wakulla Counties to show these inter-county transfers. Talquin Electric Cooperative, Inc. operates several separate water systems, together using 4.17 mgd in 2010. Public supply withdrawals in Region VII are projected to increase by 6.46 mgd and reach 39.70 mgd by 2035. This is a substantial decline from 2008 WSA projections, in line with slowed growth projections due to the economic slowdown. The Floridan aquifer system is the primary source of potable water in Region VII.

Table 3.49 Jefferson County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Jefferson Communities Water System, Inc.	0.23	0.23	0.24	0.24	0.25	0.25
Monticello, City of	0.57	0.57	0.57	0.57	0.57	0.57
Total	**0.80**	**0.80**	**0.81**	**0.81**	**0.82**	**0.82**

Table 3.50 Leon County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Rowe Drilling Company, Inc.*	0.15	0.16	0.17	0.17	0.18	0.18
Tallahassee, City of (Leon County demand)	26.43	27.28	28.24	29.23	30.23	31.25
Talquin Electric Cooperative, Inc. (TEC)†	0.05	0.05	0.06	0.06	0.06	0.06
TEC Bradfordville Regional Utility System	1.35	1.40	1.47	1.53	1.59	1.63
TEC Lake Jackson Regional Water System	0.99	1.03	1.07	1.12	1.16	1.20
TEC Leon County East Regional Water System	0.24	0.25	0.26	0.27	0.28	0.29
TEC Leon County South Regional Water Syster	0.09	0.09	0.10	0.10	0.10	0.11
TEC Leon County West Regional Water Systen	0.24	0.25	0.26	0.27	0.28	0.29
TEC Meadows at Woodrun	0.40	0.41	0.43	0.45	0.47	0.48
Total	**29.95**	**30.92**	**32.06**	**33.20**	**34.35**	**35.50**

**Includes Brewster Estates, Bucklake Estates, Meadow Hills Subdivision, North Lake Meadows, Plantation Estates and Sedgefield Water Systems.*

†Includes Annawood, Meridian Hills and Stonegate Water Systems.

Table 3.51 Leon County Public Supply Water Production Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Rowe Drilling Company, Inc.*	0.15	0.16	0.17	0.17	0.18	0.18
Tallahassee, City of	26.90	27.77	28.77	29.78	30.81	31.85
Talquin Electric Cooperative, Inc. (TEC)†	0.05	0.05	0.06	0.06	0.06	0.06
TEC Bradfordville Regional Utility System	1.35	1.40	1.47	1.53	1.59	1.63
TEC Lake Jackson Regional Water System	0.99	1.03	1.07	1.12	1.16	1.20
TEC Leon County East Regional Water System	0.24	0.25	0.26	0.27	0.28	0.29
TEC Leon County South Regional Water Syster	0.09	0.09	0.10	0.10	0.10	0.11
TEC Leon County West Regional Water Systen	0.24	0.25	0.26	0.27	0.28	0.29
TEC Meadows at Woodrun	0.40	0.41	0.43	0.45	0.47	0.48
Total	**30.42**	**31.41**	**32.58**	**33.76**	**34.94**	**36.11**

**Includes Brewster Estates, Bucklake Estates, Meadow Hills Subdivision, North Lake Meadows, Plantation Estates and Sedgefield Water Systems.*

†Includes Annawood, Meridian Hills and Stonegate Water Systems.

Table 3.52 Wakulla County Public Supply Water Demand Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Panacea Area Water System, Inc.	0.24	0.25	0.27	0.29	0.31	0.33
Sopchoppy, Town of	0.88	0.91	0.98	1.06	1.13	1.21
St. Marks, City of, Water Sys.	0.10	0.10	0.10	0.10	0.10	0.10
Tallahassee, City of (Wakulla County demand)	0.37	0.39	0.42	0.45	0.48	0.51
Talquin Electric Coop., Inc./Wakulla Regional	0.86	0.89	0.97	1.04	1.11	1.17
Wakulla County, River Sink Subdivision	0.05	0.05	0.06	0.06	0.07	0.07
Total	**2.50**	**2.60**	**2.80**	**3.00**	**3.20**	**3.38**

Table 3.53 Wakulla County Public Supply Water Production Projections, 2010 - 2035 (mgd)

	Estimated	Projected				
Utility	2010	2015	2020	2025	2030	2035
Panacea Area Water System, Inc.	0.24	0.25	0.27	0.29	0.31	0.33
Sopchoppy, Town of	0.88	0.91	0.98	1.06	1.13	1.21
St. Marks, City of, Water Sys.	0.00	0.00	0.00	0.00	0.00	0.00
Talquin Electric Coop., Inc./Wakulla Regional	0.86	0.89	0.97	1.04	1.11	1.17
Wakulla County, River Sink Subdivision	0.05	0.05	0.06	0.06	0.07	0.07
Total	**2.03**	**2.11**	**2.28**	**2.45**	**2.62**	**2.77**

Domestic Self-Supply and Small Public Water Systems

Domestic self-supply is the second largest use category and accounted for 7.41 mgd or 15 percent of the total water use in Region VII in 2010 (Table 3.54). The population served by domestic self-supply and small public water systems was estimated at 93,774 persons in 2010, or 30 percent of the Region VII population. A large number of private domestic wells are located within the City of Tallahassee's water distribution area. Water demands are anticipated to increase to approximately 9.42 mgd in 2035.

Industrial, Commercial, and Institutional (I/C/I) Self-Supply

Current I/C/I water demands total 1.09 mgd and comprise only 2 percent of the water use in Region VII (Table 3.54). The two large I/C/I water users are St. Marks Powder and Winco Utilities. Winco Utilities provides water to Wakulla County Correctional Institution and a commercial park. Future Winco Utilities water users will include residential customers and that portion of the use will be accounted for in future public supply projections. Projected I/C/I water demands for St. Marks Powder and Winco Utilities are anticipated to increase from 1.09 mgd in 2010 to 1.16 mgd by 2035.

Recreation Self-Supply

The 2010 estimated water use for self-supplied landscape, golf course irrigation, water-based recreation and aesthetic use totaled 3.21 mgd in Region VII (Table 3.54). The largest use in 2010 was water-based recreation followed closely by golf course irrigation. Sources of water for recreation uses include limited withdrawals from the surficial and intermediate aquifers with the majority of water withdrawn from the Floridan aquifer. There were no reported uses of surface water or reclaimed water for recreation uses in Region VII during 2010. Some water used for golf course irrigation under a GWUP may have been obtained from on-site ponds. Region VII recreation water demands are expected to increase by 0.64 mgd to a total use of 3.85 mgd in 2035. Future demands are anticipated to be met by a combination of groundwater, surface water, and reclaimed water sources.

Agricultural Use

Agricultural water use in Region VII was estimated at 1.98 mgd in 2010 (Table 3.54). Agricultural commodities include ornamentals, hay, sod, peanuts, grapes and some vegetables. Due to the difficulties inherent in projecting the mix of future agricultural crops and acreages, and the loss of some agricultural land, water demands for agriculture are projected to decrease to 1.88 mgd by 2015 and to remain constant through the 2035 planning period.

Power Generation

The three power generation facilities in Region VII are the Sam O. Purdom Generating Station (Purdom Plant), the Arvah B. Hopkins Generating Station (Hopkins Plant), and the C. H. Corn Hydroelectric Plant, all of which are operated by the City of Tallahassee. The Purdom Plant uses surface water from the St. Marks River and reclaimed water obtained from the City of St. Marks and St. Marks Powder. The Hopkins Plant uses groundwater from the Floridan aquifer system. The Corn Hydro Plant operates at the Lake Talquin dam in western Leon County and generates electricity by passing water through turbines, requiring no consumptive use of water to operate. Consumptive water use for power generation totaled about 3.32 mgd in 2010 and is expected to remain constant through the planning period (Table 3.54).

Total Water Use and Population

In 2010, the average annual water use in Region VII totaled 50.25 mgd (Table 3.54). The largest use categories were public supply (66 percent of total) and domestic self-supply (15 percent). Agriculture, recreation, I/C/I, and power generation collectively accounted for the remaining 19 percent (Figure 3.49).

U.S. Census block data applied to a geographic information system analysis showed the population in Region VII, which covers about one half of Jefferson County, to be 316,680 in 2010 (BEBR 2011, U.S. Census Bureau). Population and public supply water use are both projected to increase over the planning period. The medium-range population projections for Leon and Wakulla Counties and a portion of Jefferson County total 386,033 persons in 2035. This represents a 22 percent increase from 2010 (BEBR 2013, U.S. Census Bureau).

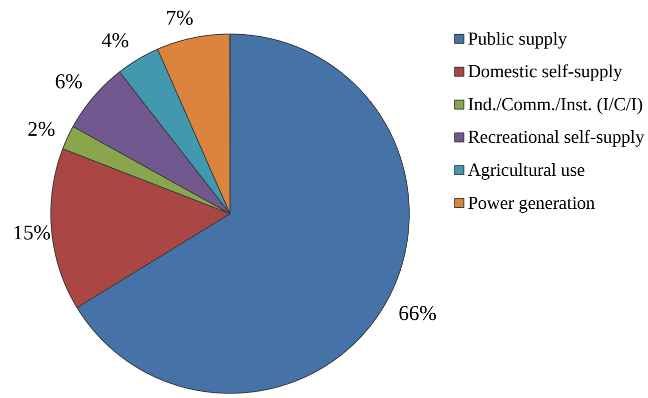


Figure 3.49 Region VII Water Use by Category, 2010

The total water demand in Region VII is projected to increase by 18 percent, or by 9.08 mgd, between 2010 and 2035, reaching 59.33 mgd in 2035 (Table 3.54). Public supply demands account for the majority of this increase (6.46 mgd). Water use by domestic self-supply and small public water systems is anticipated to increase by about 2 mgd. Projected water demand changes for the remaining use categories are small.

Table 3.54 Region VII Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	33.24	34.32	35.67	37.02	38.37	39.70
Domestic self-supply	7.41	7.67	8.26	8.76	9.17	9.42
Ind./Comm./Inst. (I/C/I)	1.09	1.16	1.16	1.16	1.16	1.16
Recreational self-supply	3.21	3.30	3.46	3.60	3.74	3.85
Agricultural use	1.98	1.88	1.88	1.88	1.88	1.88
Power generation	3.32	3.32	3.32	3.32	3.32	3.32
Total	**50.25**	**51.65**	**53.74**	**55.74**	**57.64**	**59.33**

1-in-10 Year Drought Projections

Projected water demands for a 1-in-10 year drought event are shown in Table 3.55. The 2035 total demand for a 1-in-10 year drought is about 6.6 percent higher than the 2035 average year total water demand.

Table 3.55 Demand Projections for a 1-in-10 Year Drought Event, by Category, 2015 - 2035 (mgd)

	Projected				
Water Use Category	2015	2020	2025	2030	2035
Public supply	36.72	38.16	39.61	41.06	42.48
Domestic self-supply	8.21	8.83	9.37	9.82	10.08
Ind./Comm./Inst. (I/C/I)	1.16	1.16	1.16	1.16	1.16
Recreational self-supply	3.59	3.76	3.92	4.07	4.19
Agricultural use	2.02	2.02	2.02	2.02	2.02
Power generation	3.32	3.32	3.32	3.32	3.32
Total	**55.02**	**57.26**	**59.40**	**61.44**	**63.25**

3.7.2 *Assessment of Water Resources*

Groundwater from the Floridan aquifer is the primary water source within Region VII. Given the high availability of groundwater and its excellent quality, it is reasonable to anticipate that this use pattern will continue through the year 2035. Consequently, the assessment presented here emphasizes the characterization of groundwater availability and quality.

Groundwater Resources

Region VII lies within the Woodville Karst region, which is one of the four major groundwater regions in the District (Pratt et al. 1996). Local groundwater recharge has resulted in dissolution within the Floridan aquifer and the widespread development of karst features such as sinkholes, springs, disappearing streams, and an extensive network of underground conduits in Wakulla and southern Leon counties. The region is characterized by a strong hydraulic connection between ground and surface waters, high aquifer recharge and high groundwater availability.

The Cody Scarp is a prominent topographic feature that runs east-west along southern Leon County. The Cody Scarp marks the northern encroachment of the sea in the Pleistocene epoch and is identified by a significant drop in elevation (Figure 3.50). North of the Cody Scarp, the Miocene and Pliocene age sediments thicken and act as a semi-confining unit for the Floridan aquifer. South of the Cody Scarp, the Miocene and Pliocene sediments are largely absent and the Floridan aquifer system is unconfined. The groundwater flow system in Region VII consists of four hydrogeologic units. In descending order from land surface, the units are: the surficial aquifer system (where present), the intermediate system (where present), the Floridan aquifer system, and the sub-Floridan system.

The surficial aquifer is absent in southeast Leon County, eastern Wakulla County and southern Jefferson County. Where present, the surficial aquifer is generally thin and comprised of undifferentiated sandy sediments. The surficial aquifer is negligible as a source of water supply within Region VII. Its significance to the regional water supply derives from its role as a source of recharge water for the underlying aquifers.

Beneath the surficial aquifer lies the intermediate system. It is generally comprised of the low permeability, clayey sediments of the Hawthorne Group and the Miccosukee Formation. Throughout most of Leon County and northern Jefferson County, the intermediate system is less than 100 feet thick, breached by sinkholes, and primarily functions as a semi-confining unit. In southwest Leon and western Wakulla counties, the intermediate system increases in thickness to 200 feet or more, is generally intact, and functions as a confining unit. In eastern Wakulla, southeastern Leon, and southern Jefferson counties, the intermediate system has been eroded away by geological processes, leaving the Floridan aquifer near land surface.

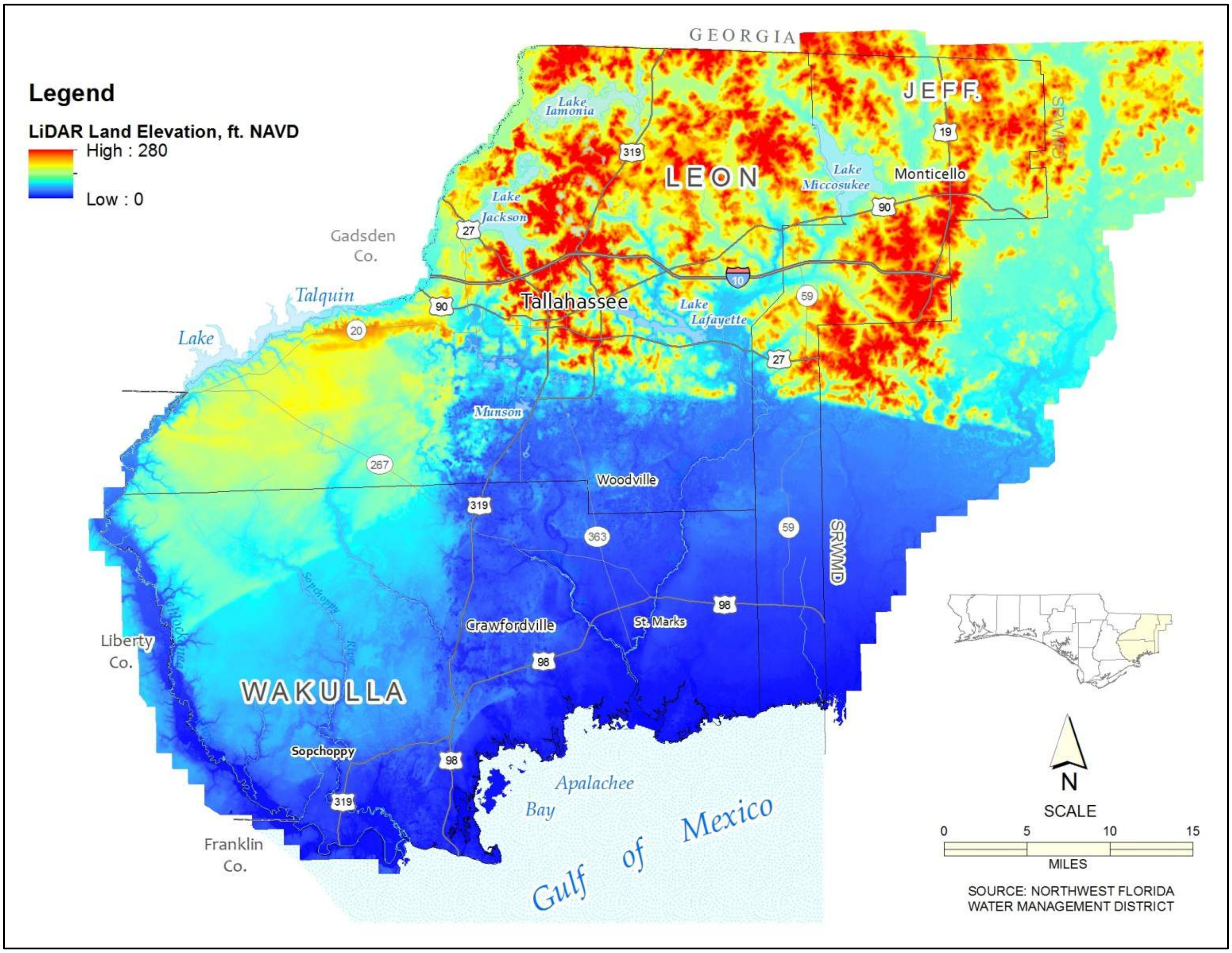


Figure 3.50 Land Elevation in Region VII, based on LiDAR Data

Beneath the intermediate system (where it is present) or immediately beneath land surface (where the intermediate system is absent) is the Floridan aquifer. The Floridan aquifer underlies the entire region and ranges from 1,000 feet thick in northwestern Leon County to over 2,000 feet thick in the southern part of the region. In order of increasing depth, the Floridan aquifer consists of the St. Marks / Chattahoochee Formations, Suwannee Limestone, Ocala Limestone, Avon Park Formation, and Oldsmar Formation. Although the Floridan aquifer system is relatively thick, only the upper several hundred feet are utilized for water supply mainly due to high groundwater availability in this interval. However, limited well data indicates lower hydraulic conductivity and increasing mineralization with depth.

Within the region, high groundwater recharge occurs where the intermediate system is thin, breached or not present. This has resulted in a very active groundwater flow system and the development of karst features including sinkholes, springs and an extensive network of conduits within the aquifer. The Floridan aquifer exhibits a high capacity for transmitting water. Transmissivities in this region are some of the highest in the panhandle ranging from 5,000 to greater than 1,000,000 ft^2/day.

The zone of groundwater contribution for Region VII extends into southwest Georgia (Lewis et al. 2009). In northernmost Leon and Jefferson counties, the Floridan aquifer potentiometric surface is approximately 60 feet above sea level. From here, water levels gradually decline as groundwater flows to the south and discharges to numerous springs and the Gulf of Mexico. South of the Cody Scarp, the potentiometric surface is relatively flat and aquifer water levels are generally within several feet of sea level (Figure 3.51). Regional discharge features include at least 51 springs (Barrios 2006), three of which are first magnitude springs: Wakulla Spring, St. Marks River Rise and Spring Creek.

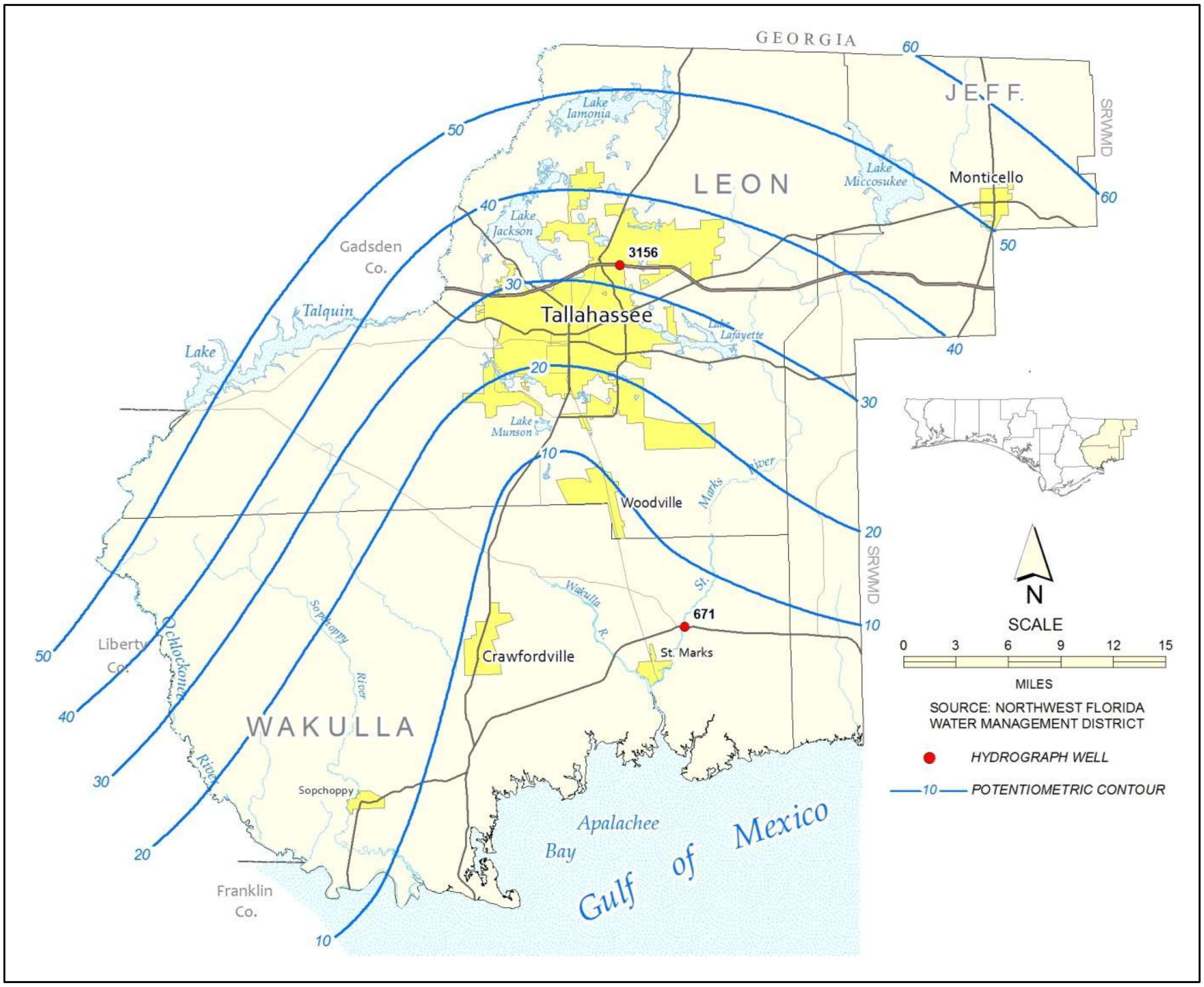


Figure 3.51 Potentiometric Surface of the Floridan Aquifer System in Region VII, June 2010

Water quality and well yield data is mostly limited to the upper several hundred feet of the aquifer. The bottom of the average well casing elevation is located approximately 60 feet below sea level and the average well depth elevation is approximately 220 feet below sea level. These wells typically exhibit specific capacities between 50 and 1,500 gpm/ft. Well yields generally range from several hundred to 2,500 gpm. Although there are exceptions, the water quality is generally good and suitable for all uses. Exceptions to good water quality include the presence of high total dissolved solids (TDS), saline water along the coastal fringe, and locally occurring iron and manganese.

Limited data suggest lower hydraulic conductivities and increasing mineralization of groundwater with depth in the Floridan aquifer. A well, constructed at Florida State University in 1994, was deeper than is typical for supply wells. The well (NWFID 2591) was cased to 265 feet below sea level with the open hole extending to 375 feet below sea level. The hydraulic performance of the well was less than anticipated, with a specific capacity of 54 gpm/ft. This value is about 20 times less than for nearby wells open to the uppermost interval of the Floridan aquifer. Water quality data (NWFWMD consumptive use permit files) showed a chloride concentration of 648 mg/L, a sulfate concentration of 1,330 mg/L, and a TDS value of 3,290 mg/L. No water quality analyses are available for the deeper portions of the Floridan aquifer. However, oil and gas test well logs indicate continually increasing mineralization with depth.

The sub-Floridan system underlies and confines the Floridan aquifer. Knowledge of the sub-Floridan system is limited to data obtained from the few oils and gas test wells drilled in the region.

<u>Assessment Criteria Used</u>

The criteria used to assess the sustainability of groundwater resources include the evaluation of long-term changes in the potentiometric surface of the Floridan aquifer, review of regional groundwater budgets, and the potential for reduced groundwater discharge to rivers and springs.

<u>Impacts to Groundwater Resources and Related Natural Systems</u>

Region VII groundwater withdrawals totaled approximately 50 mgd (77 cfs) in 2010. The largest consumptive use of water in Region VII is the City of Tallahassee. The City of Tallahassee withdrew approximately 27 mgd of groundwater from the Floridan aquifer in 2010. These withdrawals are concentrated in and around the city in the northern part of the region and represents 54 percent of the total 2010 estimated consumptive use for Region VII. Hydrographs for two wells are presented to depict examples of long-term trends in the Floridan aquifer potentiometric surface in Region VII (Figure 3.52). The locations of these monitor wells are shown on Figure 3.51 and indicated on the map by their NWFID number located in the upper right-hand corner of the associated graph.

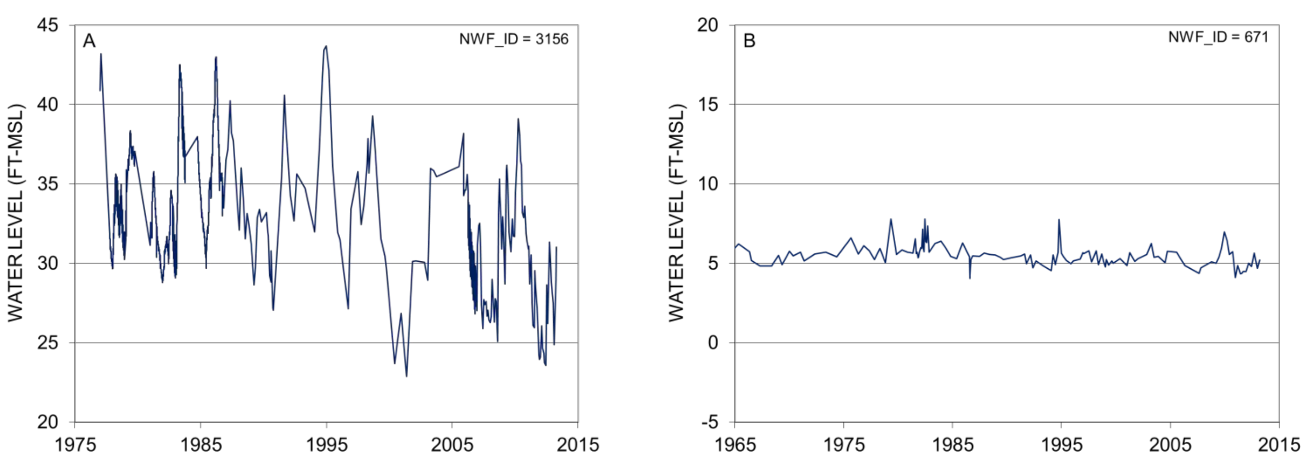


Figure 3.52 Hydrographs of the A) Olson Road and B) Newport Recreation Wells

Figure 3.52A shows the hydrograph for the Olson Road well, which is located near the significant pumping in Tallahassee, Florida. Between 1977 and 2012, water levels in the Olson Road well have varied between 23 feet and 44 feet above sea level. Between 1975 and 2010, total water use in Region VII increased from approximately 28 mgd to about 50 mgd. The Olson Road well is located within 2 miles of several major supply wells and indicates no significant downward water level trend attributable to the pumping increase. Aquifer levels have fluctuated over time in response to variations in climate and pumpage and exhibit a response to the significant droughts of 2000, 2007, and 2011.

Daily cycling of nearby public supply wells results in a drawdown of approximately 2.5 feet that quickly recovers once pumping has ceased. Due to the highly transmissive nature of the Floridan aquifer, the drawdowns in the potentiometric surface due to pumping are localized in nature and dissipate quickly with increasing distance from a well.

The second hydrograph is for the Newport Recreation well located in Wakulla County near Newport, Florida (Figure 3.52B). Wakulla is a relatively rural county with a 2010 total water use of 4.8 mgd. There are no significant groundwater withdrawals in the vicinity of the Newport Recreation well. During its period of record from 1961 to 2012, the Newport Recreation well showed a small fluctuation in water levels, ranging between 4 and 8 feet above sea level. Water level fluctuations in this well are moderated because of its proximity to the Gulf of Mexico discharge boundary. This well also shows no observable downward trend attributable to the considerable pumping to the north in Leon County. No significant decline in the potentiometric surface and no upconing of poor quality water have been observed as a result of regional groundwater withdrawals.

Given the strong hydraulic connection between ground and surface waters, groundwater withdrawals may be expected to reduce discharge to surface waters by an amount less than or equal to the amount withdrawn. Some of the factors which may mitigate the effect of withdrawals on groundwater discharge include aquifer recharge generated by land application of treated wastewater, recharge generated by irrigation practices, recharge induced by withdrawals, recharge generated by septic tanks, and changes in the groundwater contribution zone. The potentially affected discharge features include Wakulla River and springs, the St. Marks River Rise, and Spring Creek.

Groundwater Budget

A regional groundwater budget was prepared to assess the adequacy of the groundwater resources to meet future demands (Ryan et al. 1998). The water budget is intended to represent an order-of-magnitude approximation of the major inflows to and outflows from the Floridan aquifer within the region. The water budget components were estimated using output from a calibrated steady state three-dimensional groundwater flow model developed by the USGS (Davis 1996). The model was calibrated to conditions observed in October and November 1991. Region VII lies entirely within the model domain.

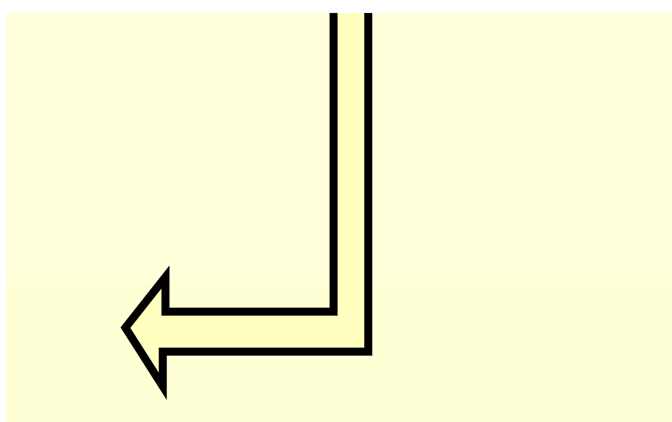


Figure 3.53 Region VII Floridan Aquifer Stead-State Groundwater Budget

Figure 3.53 shows the simulated inflows and outflows to the Floridan aquifer in Region VII. The major inflows are direct recharge to the Floridan aquifer, leakage into the upper Floridan aquifer through the overlying intermediate system and subsurface groundwater inflow from areas to the north (southwest Georgia and Gadsden County). For the 1991 groundwater model calibration period, the total groundwater inflow into the Floridan aquifer under steady-state conditions was estimated to be 1,080 mgd. Major regional groundwater discharges from the Floridan aquifer include discharge to rivers and springs, upward leakage into the intermediate system, subsurface outflow to areas hydraulically downgradient (Gulf of Mexico), and groundwater withdrawal via wells.

In Region VII, land application of treated wastewater returns a relatively large percentage of groundwater to the Floridan aquifer system as recharge. The Florida Department of Environmental Protection (FDEP) defines the recharge fraction as "the portion of reclaimed water used in a reuse system that recharges an underlying potable quality groundwater that is used for potable supply or augments a Class I surface water, expressed as a percentage of the total reclaimed water used (FDEP 2013)." Region VII wastewater flow for all permitted treatment plants with a capacity of more than 0.1 mgd totaled 18.89 mgd in 2010. Wastewater flow from the City of Tallahassee accounted for the majority of this amount. In 2010, the City of Tallahassee applied 16.48 mgd at their Southeast Farm Sprayfield. The high permeability of the local soils results in a significant local groundwater recharge, with rates at the Southeast Sprayfield estimated at 100 to 200 in/yr (Davis 2010). Therefore, the recharge fraction associated with the City of Tallahassee sprayfield is likely higher than the statewide values of 25 to 50 percent used by FDEP. If, for example, 50 percent to 75 percent of the reclaimed water applied (about 8.2 to 12.3 mgd) recharges the groundwater system, the net groundwater withdrawal in Region VII would be reduced from 50 mgd to approximately 38 to 42 mgd (58 to 65 cfs).

Based on a net groundwater use of 38 to 42 mgd in Region VII, the 2010 withdrawals could potentially reduce the discharge to rivers and springs by 58 to 65 cfs. This represents approximately 5 percent of the combined river and spring groundwater discharge in the Region VII water budget. The projected 2035 groundwater demand totals 59 mgd. Using the assumptions described above, the projected net groundwater use would likely be 51 mgd or less, depending on the actual recharge fraction and future sprayfield application rates. A net groundwater use of 51 mgd would represent 4.7 percent of the total water budget or 6 percent of the combined river and spring discharge (851 mgd). As part of the minimum flows and levels assessments for the St. Marks River Rise, Wakulla Spring, and Sally Ward spring, the District will continue hydrologic monitoring and will perform the technical assessments needed to develop a comprehensive understanding of the hydrologic regime necessary to sustain the Wakulla-St. Marks ecosystem.

<u>Water Quality Constraints on Availability</u>

Water quality constraints on groundwater availability include the intrusion of saline water in coastal areas, upconing of naturally occurring poor quality water from deeper within the Floridan aquifer, the presence of high iron or manganese concentrations, and local organic chemical contamination. None of these pose a significant constraint on availability.

The threat of intrusion or upconing of saline water is limited to wells located in the coastal area. Given the generally low demand in the immediate coastal area, this constraint is manageable. Management of the resource in this area will require locating wells as far inland as practical, limiting well depths and limiting pumping rates. Upconing of naturally occurring poor quality water is of little concern due to the high groundwater availability and good water quality in the uppermost portion of the Floridan aquifer. Due to their limited occurrence, high iron or manganese concentrations do not significantly constrain availability.

Local organic chemical contamination of the groundwater exists at some locations. However, given the constituents involved, their concentrations and the associated treatment options, this issue does not presently pose a significant constraint to water supply availability at the regional scale.

<u>Adequacy of Groundwater Resources</u>

The groundwater sources are anticipated to be adequate to meet the projected 2035 demands for Region VII while sustaining the water resource and related natural systems. Future technical assessments performed in support of minimum flows and levels for the Wakulla and St. Marks systems will quantify the hydrologic regime necessary to sustain the St. Marks/Wakulla ecosystem.

Surface Water Resources

Three first magnitude springs (discharge 100 cfs or greater), five second magnitude springs (discharge between 10 and 100 cfs), and numerous smaller springs occur within the St. Marks River and Wakulla River basins (Barrios 2006). The first magnitude springs are Wakulla Spring, St. Marks River Rise, and Spring Creek. The Wakulla Spring vent forms the Wakulla River and the St. Marks River Rise discharges to the lower St. Marks River. Spring Creek is comprised of a set of submarine vents that discharges into Apalachee Bay. Numerous smaller springs also contribute to aquifer discharge in Region VII.

The St. Marks River, Wakulla River, and Apalachee Bay have each been designated as Outstanding Florida Waters (OFW). A large portion (450,000 acres) of Apalachee Bay has been designated as the Big Bend Aquatic Preserve. The primary purpose of the Aquatic Preserve is to conserve biological resources within the preserve and in adjacent waters. The rivers and bay provide habitat for a number of endangered and threatened species such as the bald eagle, Atlantic Ridley turtle and West Indian manatee. The natural systems associated with the St. Marks and Wakulla Rivers and Apalachee Bay are highly adapted to and dependent upon freshwater flows from the spring systems. Additional information regarding the lower St. Marks, Wakulla, and Apalachee Bay systems can be found in the resource characterization completed by the District in 2009 (Lewis et a. 2009).

There is no direct consumptive use of these surface waters at this time. Currently, the most significant water resource concerns for these ecosystems are the increased nutrient load of the groundwater discharging to Wakulla Spring and the hydrologic regime water needed to sustain the St. Marks/ Wakulla ecosystem. The District has initiated data collection to support the development of minimum flows and levels for the Wakulla/St. Marks ecosystems. The nutrient issue is being addressed through FDEP's initiative to develop a Basin Management Action Plan for Wakulla Spring.

Reclaimed Water

In 2010, 93 percent of the 18.89 mgd of wastewater generated in Region VII was of reuse quality (Table 3.56). Only 0.65 mgd, or 3 percent, was used to replace potable-quality water. These uses included public access reuse in the Southwood community of Tallahassee, cooling at a power plant in St. Marks, and nursery irrigation just outside Monticello. All of Monticello's wastewater was reused at Simpson Nurseries, which is located outside of the District boundary in Jefferson County. The City of Tallahassee applied 16.48 mgd of reclaimed water at the Southeast Farm facility. The District helped fund the city's Tram Road Public Access Reuse Facility, which has potential to expand reuse to meet its 1.2 mgd capacity. The city is authorized by FDEP to direct up to 26.50 mgd of reclaimed water to a future general service area for public access reuse. The District has pledged support to Wakulla County which is seeking the remainder of funding for a reuse system to provide for golf course irrigation. It is anticipated that local governments and utilities in Region VII will continue to expand the use of reclaimed water to meet their future industrial and irrigation water needs, as well as other non-potable uses. The amount of wastewater projected to be available for reuse in 2035 is 21.69 mgd (Table 3.58).

Table 3.56 Region VII: Reuse of Domestic Wastewater, 2010 (mgd)

Facility Name	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Reuse Flow that Replaces Potable-Quality Water*
City of Monticello WWTP	0.80	0.53	0.10	0.53	0.53
Jefferson County Total	**0.80**	**0.53**	**0.10**	**0.53**	**0.53**
Killearn Lakes WWTP	0.70	0.81	0.70		
Lake Jackson WWTP	0.50	0.27	0.50	0.52	
Sandstone Ranch Subdivision WWTP	0.25	0.00	0.25		
T. P. Smith Water Reclamation Facility	26.50	16.48	32.56	16.48	0.08
Leon County Total	**27.95**	**17.56**	**34.01**	**16.99**	**0.08**
City of St. Marks WWTF	0.15	0.04	0.10	0.04	0.04
Wakulla County WWTF	0.60	0.42	0.60		
Winco Utilities, Inc. WWTP	0.50	0.34	0.50		
Wakulla County Total	**1.25**	**0.80**	**1.20**	**0.04**	**0.04**
Region VII Total	**30.00**	**18.89**	**35.31**	**17.56**	**0.65**

*Reuse Flow That Replaces Potable-Quality Water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses. Not included in this flow calculation are agriculture irrigation of other crops, absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant (Source: FDEP reuse inventories).

Table 3.57 Region VII Domestic Wastewater Flow Projections 2015 - 2035 (mgd)

Facility Name	2015	2020	2025	2030	2035
City of Monticello WWTP	0.53	0.53	0.53	0.53	0.53
Jefferson County Total	**0.53**	**0.53**	**0.53**	**0.53**	**0.53**
Killearn Lakes WWTP	0.84	0.88	0.92	0.95	0.98
Lake Jackson WWTP	0.28	0.29	0.31	0.32	0.33
Sandstone Ranch Subdivision WWTP	0.00	0.00	0.00	0.00	0.00
T. P. Smith Water Reclamation Facility	17.00	17.60	18.21	18.83	19.47
Leon County Total	**18.13**	**18.78**	**19.44**	**20.11**	**20.79**
City of St. Marks WWTF	0.04	0.04	0.04	0.04	0.04
Wakulla County WWTF	0.44	0.47	0.51	0.54	0.57
Winco Utilities, Inc. WWTP	0.35	0.38	0.41	0.44	0.46
Wakulla County Total	**0.83**	**0.90**	**0.96**	**1.02**	**1.07**
Region VII Total Wastewater Projections	**19.48**	**20.20**	**20.93**	**21.66**	**22.39**

Table 3.58 Region VII Available Reclaimed Water Projections 2015 - 2035* (mgd)

Facility Name	2015	2020	2025	2030	2035
City of Monticello WWTP	0.00	0.00	0.00	0.00	0.00
Jefferson County Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Killearn Lakes WWTP	0.84	0.88	0.92	0.95	0.98
Lake Jackson WWTP	0.28	0.29	0.31	0.32	0.33
Sandstone Ranch Subdivision WWTP	0.00	0.00	0.00	0.00	0.00
T. P. Smith Water Reclamation Facility	16.88	17.47	18.09	18.71	19.35
Leon County Total	**18.00**	**18.65**	**19.32**	**19.98**	**20.66**
City of St. Marks WWTF	0.00	0.00	0.00	0.00	0.00
Wakulla County WWTF	0.44	0.47	0.51	0.54	0.57
Winco Utilities, Inc. WWTP	0.35	0.38	0.41	0.44	0.46
Wakulla County Total	**0.79**	**0.86**	**0.92**	**0.98**	**1.03**
Region VII Total Avail. Reclaimed Water	**18.79**	**19.51**	**20.24**	**20.96**	**21.69**

*Projections are for potentially available reclaimed water and do not take into account planned expansions of reuse systems.

Conservation

Public supply utilities in Region VII have implemented water conservation programs that include public education, water conserving rate structures and leak detection and repair. The City of Tallahassee's public education program for water conservation includes radio announcements, bill inserts, promotion of rain barrel use, and home energy audits that provide free low-flow faucet aerators. Talquin Electric Cooperative has implemented a meter replacement program, water conserving rate structures, and includes water conservation ideas in its monthly newsletter, *The Current*. Although the public utilities in Region VII have implemented water conservation program, there are additional opportunities. Examples may include retrofitting of older homes and businesses with low flow toilets and showerheads, water conservation programs at hotels and motels, and the promotion of Florida-Friendly landscaping. The District will continue to work with utilities and other water users to identify and promote additional water conservation measures.

By reducing gross per capita use to 150 gpcd, seven utilities in Region VII could potentially save 1.79 mgd by 2035. Utilities can identify the most cost-effective conservation and water use efficiency measures specific to their budget and distribution area characteristics by using the Conserve Florida EZ Guide.

3.7.3 *Determination of the Need for a Regional Water Supply Plan*

The groundwater resources in Region VII are anticipated to be adequate to meet the projected demands through 2035 while sustaining the water resource and related natural systems. Therefore, no RWSP is recommended.

This page intentionally left blank

4 SUMMARY AND CONCLUSIONS

The District completed its first WSA in June 1998 for the 1995-2020 planning horizon (Ryan et al. 1998). The District subsequently updated the water use estimates and demand projections in 2003 (Bonekemper 2003) and again in 2008 (Coates et al. 2008). The water sources were also re-evaluated during the 2008 update. This WSA update provides revised water demand projections for the 2015-2035 planning horizon and re-evaluates the ability of existing and reasonably anticipated future water sources and conservation to meet projected future demands, while sustaining water resources and associated natural systems.

For each of the seven planning regions, District staff developed water use estimates for 2010. District staff also developed water demand projections at five year intervals for the 2015-2035 planning period. Water use estimates and projections were made at the county or user level for six use categories: public supply; domestic self-supply and small public water systems; agriculture self-supply; recreation self-supply; industrial, commercial, and institutional (I/C/I) self-supply; and thermoelectric power generation. For each use category, water demands were projected for average conditions and a 1-in-10 year drought event.

For the categories of public supply, I/C/I, and power generation, all water users with permitted ADRs of 0.1 mgd or greater were included in the analysis. For agriculture and recreation self-supply, the estimates and projections included both water users operating under an IWUP and users who operate under a GWUP. For public supply, water use estimates and projections include those utilities with a permitted capacity of 0.1 mgd and utilities whose use is anticipated to reach 0.1 mgd within the planning horizon.

In 2010, the estimated water use in the District totaled approximately 357.22 mgd (Table 4.1). Public supply was the largest use sector and accounted for 159.57 mgd, or 45 percent, of all water use. The district-wide average gross per capita water use in 2010 for public supply use was 146 gpcd. The second largest use category was I/C/I water use, which accounted for 66.44 mgd, or 19 percent, of the total. Agricultural irrigation accounted for 47.22 mgd, or 13 percent, of the total water use. The other three use categories accounted for the remaining 23 percent. The county with the largest total water use was Escambia County (95.38 mgd), followed by Bay County (72.34 mgd), Leon County (41.77 mgd), and Okaloosa County (33.14 mgd).

Table 4.1 Estimated and Projected Change in Total Water Use by Category, 2010 - 2035

Water Use Category	Water Use 2010 (mgd)	% of Total	Water Use 2035 (mgd)	% of Total	Increase 2010-2035	% Increase 2010-2035
Public supply	159.57	45%	193.63	46%	34.06	21%
Domestic self-supply	23.27	7%	28.82	7%	5.55	24%
Ind./Comm./Inst. (I/C/I)	66.44	19%	72.66	17%	6.22	9%
Recreational self-supply	25.91	7%	31.95	8%	6.05	23%
Agricultural use	47.22	13%	55.55	13%	8.33	18%
Power generation	34.82	10%	34.65	8%	-0.17	-0.5%
District Total	**357.22**	**100%**	**417.26**	**100%**	**60.04**	**17%**

Total water use in the District is projected to increase by 17 percent over the 2010-2035 planning period to approximately 417.26 mgd by 2035 (Figure 4.1). An additional 60.04 mgd will be required to meet the needs of the seven planning regions. Public supply will continue to be the largest use both in terms of the quantity of water (an additional 34.06 mgd by 2035) and the share of the total water use (increasing from 45 percent to 46 percent of total). Water used for I/C/I purposes will remain the second largest use category and is projected to increase by 9 percent to 72.66 mgd by 2035. Power generation is projected to decrease slightly from 34.82 mgd to 34.65 mgd over the planning period.

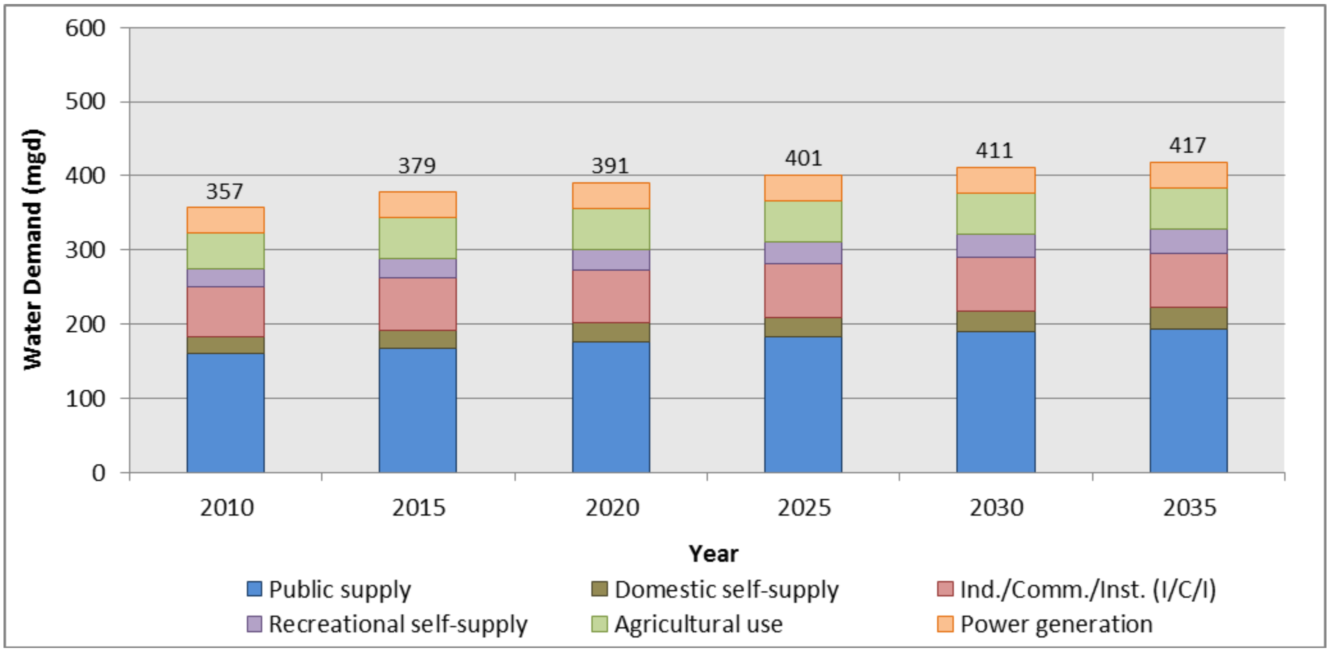


Figure 4.1 Total Water use by Category for the NWFWMD, 2010 - 2035

Table 4.2 summarizes the total wastewater treatment plant flows and reuse in 2010. A total of 95.56 mgd of domestic wastewater was generated district-wide in 2010. Of this amount, approximately 49.01 mgd, or 51 percent, was of reuse quality. Approximately 12.17 mgd, or 13 percent, replaced potable-quality water for golf course irrigation, residential lawn irrigation, irrigation of public areas and parks, nursery irrigation, and industrial uses. Region II generated the largest quantity of wastewater (27.34 mgd) and had the largest reuse flow (23.42 mgd), followed by Region VII where nearly all wastewater generated (18.89 mgd) was applied at the City of Tallahassee's Southeast Farm. Local governments and utilities throughout the District continue to explore the use of reclaimed water to meet future industrial and irrigation needs. The District encourages reuse that reduces demands on potable water supplies and has provided financial support for reuse system development from the Water Protection and Sustainability Program Trust Fund. To date, the District has granted $7.85 million in funding for reuse projects that will reclaim an estimated 8.40 mgd of wastewater in Regions II, IV, and VII.

Table 4.2 Reuse of Domestic Wastewater in 2010 (mgd)

Region	Plant Capacity	Total Wastewater Flow	Reuse Capacity	Reuse Flow	Reuse Flow that Replaces Potable-Quality Water*
I	31.05	24.37	7.43	1.18	0.00
II	64.15	27.34	74.01	23.42	8.82
III	29.50	15.37	16.11	2.70	2.60
IV	11.88	5.91	8.29	2.91	0.00
V	6.57	1.66	6.60	0.75	0.10
VI	4.20	2.03	0.65	0.49	0.00
VII	30.00	18.89	35.31	17.56	0.65
District Total	**177.34**	**95.56**	**148.40**	**49.01**	**12.17**

*Reuse Flow That Replaces Potable-Quality Water includes flows for public access irrigation, irrigation of edible crops, toilet flushing, fire protection, and industrial uses. Not included in this flow calculation are agriculture irrigation of other crops, absorption fields, rapid infiltration basins, wetlands, and industrial reuse at the treatment plant (Source: FDEP reuse inventories).

The availability of water from existing and anticipated water supply sources to meet projected demands and the sustainability of water resources and associated natural systems were evaluated for each planning region using the best available information. On a regional basis, existing and anticipated water supply sources are considered sufficient to meet projected future water needs while sustaining water resources and associated natural systems throughout most of northwest Florida. It is recommended that RWSPs continue to be implemented and updated as necessary for Region II and Region III to accommodate continued development of alternative water supply sources and needed facilities for source reliability. In Region V, the major alternative water supply development project recommended for coastal Gulf County has been completed, and growth and water demand trends have not developed as previously anticipated. Thus, continued implementation of a RWSP is not currently recommended for Region V. **No additional regions are recommended for the development of a RWSP at this time.**

Efforts to monitor, regulate, and coordinate with local and regional water users will continue. Any new assessments of the water resources within a RWSP area discussed in this document will also be incorporated in the next update of the respective RWSP. Table 4.3 summarizes the conclusions for each of the seven planning regions. This WSA will be updated again in 2018.

Table 4.3 Summary of Water Supply Assessment Update Conclusions

Region	Average and Drought Year Water Needs Met?	Water Resource Limitations and Concerns	2035 Alternative Water Sources
I	All	- Saltwater intrusion in coastal areas - Localized water quality problems in the sand-and-gravel aquifer	Reuse
II	All, with RWSP	- Potentiometric surface declines and saltwater intrusion in coastal areas	Inland groundwater, surface water and reuse
III	All, with RWSP	- Saltwater intrusion in the Floridan aquifer in coastal Bay County - Alternative sources are needed to increase supply reliability	Alternative surface water intake and reuse
IV	All	- Limited groundwater availability in the Apalachicola Embayment area - Localized groundwater contamination in northeast Jackson County - Jackson Blue Spring discharge potentially affected by seasonal groundwater use - Potential localized impacts to natural systems from concentrated pumping	Reuse
V	All	- Potentiometric surface declines and saltwater intrusion in the Floridan aquifer in coastal areas	Surface water, inland groundwater and reuse
VI	All	- Limited groundwater resources in central Gadsden County - Limited surface water resources for agriculture during drought periods	Reuse
VII	All	- Wakulla Spring and St. Marks River Ecosystem	Reuse

5 REFERENCES

Barr, D. E., and T. R. Pratt. 1981. *Results of Aquifer Test and Estimated Drawdowns in the Floridan Aquifer, Northern Gulf County, Northwest Florida*. Northwest Florida Water Management District. Water Resources Special Report 81-1. Havana, Florida.

Barrett, Daffin and Carlan, Inc. 1982. *Regional Water Supply Development Plan and Engineering and Financial Feasibility Study for Coastal Areas of Escambia, Santa Rosa, Okaloosa, Walton and Bay Counties, Florida*. Prepared for the Northwest Florida Water Management District. Havana, Florida.

Barrios, K., and A. R. Chelette. 2004. *Chipola River Spring Inventory Jackson and Calhoun Counties, Fl*. Northwest Florida Water Management District. Water Resources Special Report 04-01. Havana, Florida.

Barrios, K. 2005. Choctawhatchee River *Springs Inventory Holmes, Walton and Washington Counties, Fl*. Northwest Florida Water Management District. Water Resources Special Report 05-02. Havana, Florida.

Barrios, K. 2006. *St. Marks River and Wakulla River Springs Inventory. Leon and Wakulla Counties, FL*. Northwest Florida Water Management District. Water Resources Special Report 06-03. Havana, Florida.

Bartel, R. L., T. R. Pratt, T. L. Macmillan, R. R. Potts, C. J. Richards, R. D. Womble, J. A. Bonekemper, and R. A. Countryman. 2000. *Regional Water Supply Plan for Santa Rosa, Okaloosa, and Walton Counties*. Northwest Florida Water Management District. Water Resources Assessment 2000-1. Havana, Florida.

Bonekemper, J. 2003. *Northwest Florida Water Management District Water Supply Projections 2005-2025*. Northwest Florida Water Management District Water Resources Assessment 03-01. Havana, Florida.

Busen, K. and R. Bartel. 2012. *2012 Regional Water Supply Plan Update for Santa Rosa, Okaloosa, and Walton Counties, Water Supply Planning Region II*. Northwest Florida Water Management District Water Resources Assessment 2012-01. Havana, Florida.

Coates, K., C. Coger, R. A. Countryman, M. Pritzl, and C. J. Richards. 2009. *2008 Water Supply Assessment Update.* Northwest Florida Water Management District. Water Resources Assessment 08-02. Havana, Florida.

Crowe, J. B., W. Huang, and F. G. Lewis. 2008. *Assessment of Freshwater Inflows to North Bay from the Deer Point Watershed of the St. Andrew Bay System*. Northwest Florida Water Management District. Water Resources Assessment 08-1. Havana, Florida.

Davis, H. 1996. *Hydrologic Investigation and Simulation of Ground-Water Flow in the Upper Floridan Aquifer of North-Central Florida and Southwestern Georgia and Delineation of Contributing Areas for Selected City of Tallahassee*, Florida Water-Supply Wells. U.S. Geological Survey. Water-Resources Investigations Report 95-4296. 56 p.

Davis, H. 1997. Personal communication.

Davis, H., B. G. Katz, and D. W. Griffin. 2010. *Nitrate-N Movement in Groundwater from the Land Application of Treated Municipal Wastewater and Other Sources in the Wakulla Springs Springshed Leon and Wakulla Counties, Florida, 1966-2018.* U.S. Geological Survey. Scientific Investigations Report 2010-5099. 90 p.

DeFosset, K. L. 2004. *Availability of Groundwater from the Sand-and-Gravel Aquifer in Coastal Okaloosa County, Florida*. Northwest Florida Water Management District. Water Resources Technical File Report 04-01. Havana, Florida. 30 pp.

Fernald, E. A., and E. D. Purdum, eds. 1998. *Water Resources Atlas of Florida*. Florida State University, Institute of Science and Public Affairs. Tallahassee, Florida. 312 p.

Florida Department of Environmental Protection. 2001. Final Report: 1-in-10-year Drought Requirement *in* Florida's Water Supply Planning Process For the 2005 Water Supply Plan. 1-in-10-year Drought Subcommittee Of the Water Planning Coordination Group. Tallahassee, Florida.

Florida Department of Environmental Protection. 2006. *Water Quality Assessment Report Choctawhatchee–St. Andrew*. Division of Water Resource Management, Bureau of Watershed Management. Tallahassee, Florida.

Florida Department of Environmental Protection. 2011. *2010 Reuse Inventory*. Tallahassee, Florida.

Friedman, K., J. P. Heaney, M. Morales, and J. E. Palenchar. 2013. Predicting and managing residential potable irrigation using parcel-level databases. Journal of the American Water Works Association 105:372-386.

Hardin, S. 1980. *Movement and Ecological Effects of Grass Carp Introduced into an Open Reservoir System.* Florida Game and Fresh Water Fish Commission Final Report.

Hatch Mott McDonald. 2013. Memorandum to George Roberts from Bill Perry. RE: Bay County Alternative Water Supply Project. July 11, 2013.

HydroGeoLogic, Inc., 2000. Modeling of Groundwater Flow in Walton, Okaloosa and Santa Rosa Counties, Florida. Prepared for the Northwest Florida Water Management District, Havana, Florida.

______________________________________. 2006. *Saltwater Intrusion in the Floridan Aquifer in Walton, Okaloosa, Santa Rosa Counties: Western Model Domain*. Prepared for the Northwest Florida Water Management District, Havana, Florida.

____________________________________. 2007a. *Saltwater Intrusion in the Floridan Aquifer in Walton, Okaloosa, Santa Rosa Counties: Western Model Domain Forecast Simulations*. Prepared for the Northwest Florida Water Management District, Havana, Florida.

______________________________________. 2007b. *Saltwater Intrusion in the Floridan Aquifer in Walton, Okaloosa, Santa Rosa Counties: Eastern Domain Forecast Simulations*. Prepared for the Northwest Florida Water Management District, Havana, Florida.

______________________________________. 2007c. *Saltwater Intrusion in the Floridan Aquifer in Walton, Okaloosa, Santa Rosa Counties: Eastern Model Domain*. Prepared for the Northwest Florida Water Management District, Havana, Florida.

Kobylinski, G. 1980. Martin Bayou Intensive Survey Documentation, Bureau of Water Analysis, Water Quality Section.

Lewis, G., N. D. Wooten, and R. L. Bartel. 2009. *Lower St. Marks River / Wakulla River / Apalachee Bay Resource Characterization.* Northwest Florida Water Management District, Water Resources Special Report 2009-01. Havana, Florida.

Ma, T., T. R. Pratt, J. Dukes, R. A. Countryman, and G. Miller. 1999. *Susceptibility of Public Supply Wells to Groundwater Contamination in Southern Escambia County, Florida.* Northwest Florida Water Management District. Water Resources Special Report 99-1. Havana, Florida.

Maddox, G. L., J. M. Lloyd, T. M. Scott, S. B. Upchurch, and R. Copeland, eds. 1992. *Florida Groundwater Quality Monitoring Program—Background Hydrogeochemistry*. Florida Geological Survey Special Publication No. 34.

Marella, R. L. 2013. U.S. Geological Survey, Florida Water Science Center – Orlando, Florida. Personal communication.

Musgrove, R. H., J. B. Foster, and L. G. Toler. 1965. *Water Resources of the Econfina Creek Basin Area in Northwestern Florida*. Florida Geological Survey. Report of Investigations No. 41. 51 p.

National Drought Mitigation Center, University of Nebraska, Lincoln, Nebraska.

Northwest Florida Water Management District. 2006. *Regional Water Supply Plan for Santa Rosa, Okaloosa, and Walton Counties: Water Supply Planning Region II*. Water Resources Assessment 06-01. Havana, Florida.

_______________________________________. 2007. *Regional Water Supply Plan: Region V, Franklin and Gulf Counties*. Water Resources Assessment 07-01. Havana, Florida.

PBS&J. 2006. *Conceptual Alternative Water Supply Development Projects and Planning Level Cost Estimates: Water Supply Planning Region* II. Technical Services for Surface Water Supply Facilities Planning and Feasibility Analysis.

Pratt, T. R., C. J. Richards, K. A. Milla, J. R. Wagner, J. L. Johnson, and R. J. Curry. 1996. *Hydrogeology of the Northwest Florida Water Management District.* Northwest Florida Water Management District. Water Resources Special Report 96-4. Havana, Florida.

Randazzo, A. F. and D. S. Jones, eds. 1997. *The Geology of Florida*. University Press of Florida. 327 p.

Richards, C. J. and J. B. Dalton. 1987. *Availability of Groundwater at Selected Sites in Gadsden and Leon Counties, Northwest Florida*. Northwest Florida Water Management District. Water Resources Special Report 87-2. Havana, Florida.

Richards, C. J. 1993. *Preliminary Hydraulic Assessment of Walton/Okaloosa/Santa Rosa Regional Utility Authority's Western Sub-Regional Wellfield*. Northwest Florida Water Management District. Water Resources Special Report 93-1

Richards, C. J. 1997. *Delineation of the Floridan Aquifer Zone of Contribution for the Econfina Creek and Deer Point Lake, Bay and Washington Counties, Florida*. Northwest Florida Water Management District. Water Resources Special Report 97-2. Havana, Florida. 17 p.

Richards, C. J., T. R. Pratt, and K. A. Milla. 1997. *Wellhead Protection Area Delineation in Southern Escambia County, Florida*. Northwest Florida Water Management District. Water Resources Special Report 97-4. Havana, Florida. 52 p.

Roaza, H. P., T. R. Pratt, and W. B. Moore. 1989. *Hydrogeology and Non-point Source Contamination of Groundwater by Ethylene Dibromide in Northeast Jackson County, Florida*. Northwest Florida Water Management District. Water Resources Special Report 89-5. Havana, Florida.

Roaza, H. P., T. R. Pratt, C. J. Richards, J. L. Johnson, and J. R. Wagner. 1991. *Conceptual Model of the Sand and Gravel Aquifer, Escambia County, Florida.* Northwest Florida Water Management District. Water Resources Special Report 91-6. Havana, Florida.

Roaza, H. P., T. R. Pratt, and C. J. Richards. 1993. *Numerical Modeling of Groundwater Flow and Contaminant Transport in the Sand-and-Gravel Aquifer, Escambia County, Florida*. Northwest Florida Water Management District. Water Resources Special Report 93-4. Havana, Florida. 92 p.

Roaza, H. P., C. J. Richards, and T. R. Pratt. 1996. *Analysis of Groundwater Availability in the Cordova Park Area, Southeastern Escambia County, Florida.* Northwest Florida Water Management District. Technical File Report 96-2, prepared for Escambia County Utilities Authority. Havana, Florida.

Ryan, P. L., T. L. Macmillian, T. R. Pratt, A. R. Chelette, C. J. Richards, R. A. Countryman, and G. L. Marchman. 1998. *District Water Supply Assessment.* Northwest Florida Water Management District. Water Resources Assessment 98-2. Havana, Florida.

Smajstrla, A. G. 1990. *Agricultural Field Scale Irrigation Requirements Simulation Model: Technical Manual Version 5.5*. University of Florida Agricultural Engineering Department. Gainesville, Florida. 251 p.

Toler, L. G., R. H. Musgrove, and J. B. Foster. 1964. Freshening of Deer Point Lake, Bay County, Florida. *Journal of the American Water Works Association* 56(8):984 - 990.

University of Florida. 2013. Population Studies, March 2013, Volume 46, Bulletin 165. Bureau of Business and Economic Research.

Vecchioli, J., C. H. Tibbals, A. D. Duerr, and C. B. Hutchinson. 1990. *Ground-Water Recharge in Florida – A Pilot Study in Okaloosa, Pasco, and Volusia Counties*. U.S. Geological Survey. Water Resources Investigations Report 90-4195.

Wagner, J. R., E. A. Hodecker, and R. Murphy. 1980. *Evaluation of Industrial Water Availability for Selected Areas of the Northwest Florida Water Management District*. Northwest Florida Water Management District. Water Resources Assessment 80-1. Havana, Florida.

Wagner, J. R. 1982. *Groundwater Resources of the Little River Basin and Vicinity, Northwest Florida.* Northwest Florida Water Management District, Water Resources Special Report 82-2. Havana, Florida.

Water Planning Coordination Group. 2005. *Format and Guidelines for Regional Water Supply Plans.* Florida Department of Environmental Protection. Tallahassee, Florida.

Wolfe, S. H., J. A. Reidenaur, and D. B. Means. 1988. *An Ecological Characterization of the Florida Panhandle*. U.S. Fish and Wildlife Services, FWS Biol. Report 88(12).

Young, W.T. 1987. "Assessment of Discharge Impacts of the Bay County Wastewater Treatment Plant in St. Andrew Bay, June 14, 1983 and March 20, 1985," Department of Environmental Regulation, Northwest District. Tallahassee, Florida.

This page intentionally left blank

6 APPENDICES

Appendix A

Water Use Estimates and Projections by County

Appendix A (Tables A.1 through A.13) provides the total water use estimates and projections by category at the county level for Regions II, IV, V and VII. The counties in these regions include: Calhoun, Franklin, Gulf, Holmes, Jackson, Jefferson, Leon, Liberty, Okaloosa, Santa Rosa, Wakulla, Walton, and Washington. Water use data for Escambia, Bay and Gadsden Counties can be found in the appropriate sections of the text for Regions I, III, and VI, respectively.

Table 6A.1 Okaloosa County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	22.51	21.06	21.63	22.10	22.54	22.97
Domestic self-supply	1.09	1.37	1.49	1.57	1.62	1.60
Ind./Comm./Inst. (I/C/I)	2.26	1.64	1.71	1.82	1.93	2.04
Recreational self-supply	6.52	6.88	7.14	7.38	7.60	7.81
Agricultural use	0.76	0.76	0.76	0.76	0.76	0.76
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**33.14**	**31.71**	**32.73**	**33.63**	**34.45**	**35.18**

Table 6A.2 Santa Rosa County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	15.03	16.18	17.82	19.39	20.81	22.08
Domestic self-supply	1.10	1.13	1.16	1.15	1.11	1.04
Ind./Comm./Inst. (I/C/I)	1.27	3.42	5.22	6.19	6.55	6.55
Recreational self-supply	3.18	3.42	3.75	4.07	4.35	4.59
Agricultural use	4.19	4.19	4.19	4.19	4.19	4.19
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**24.76**	**28.34**	**32.14**	**34.99**	**37.02**	**38.45**

Table 6A.3 Walton County Water Use Estimates and Projections by Category, 2010-2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	8.19	12.57	13.77	14.84	15.80	14.95
Domestic self-supply	1.81	2.17	2.67	3.13	3.55	3.91
Ind./Comm./Inst. (I/C/I)	0.15	0.82	0.90	0.95	1.10	1.15
Recreational self-supply	3.95	4.12	4.47	4.80	5.11	5.38
Agricultural use	1.59	1.59	1.59	1.59	1.59	1.59
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**15.69**	**21.27**	**23.40**	**25.31**	**27.15**	**26.98**

Appendix A (continued)

Table 6A.4 Calhoun County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	0.67	0.67	0.68	0.69	0.70	0.71
Domestic self-supply	0.97	1.00	1.05	1.10	1.13	1.16
Ind./Comm./Inst. (I/C/I)	0.00	0.00	0.00	0.00	0.00	0.00
Recreational self-supply	0.02	0.02	0.02	0.02	0.02	0.02
Agricultural use	2.57	2.57	2.57	2.57	2.57	2.57
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**4.23**	**4.25**	**4.31**	**4.38**	**4.42**	**4.46**

Table 6A.5 Holmes County Water use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	1.10	1.12	1.14	1.16	1.18	1.21
Domestic self-supply	1.51	1.52	1.56	1.59	1.61	1.61
Ind./Comm./Inst. (I/C/I)	0.09	0.09	0.09	0.09	0.09	0.09
Recreational self-supply	0.21	0.21	0.22	0.22	0.22	0.23
Agricultural use	2.05	2.31	2.31	2.31	2.31	2.31
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**4.96**	**5.26**	**5.33**	**5.38**	**5.42**	**5.45**

Table 6A.6 Jackson County Water use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	2.30	2.32	2.33	2.33	2.34	2.35
Domestic self-supply	2.72	2.73	2.74	2.75	2.76	2.77
Ind./Comm./Inst. (I/C/I)	1.75	1.87	1.90	1.94	1.98	2.03
Recreational self-supply	0.44	0.44	0.44	0.44	0.44	0.45
Agricultural use	16.24	23.23	23.23	23.23	23.23	23.23
Power generation	1.91	1.91	0.00	0.00	0.00	0.00
Total	**25.36**	**32.50**	**30.64**	**30.69**	**30.76**	**30.83**

Table 6A.7 Liberty County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	0.52	0.55	0.58	0.61	0.64	0.67
Domestic self-supply	0.40	0.46	0.49	0.52	0.54	0.57
Ind./Comm./Inst. (I/C/I)	0.42	0.32	0.32	0.32	0.32	0.32
Recreational self-supply	0.01	0.01	0.01	0.01	0.01	0.01
Agricultural use	0.01	0.01	0.01	0.01	0.01	0.01
Power generation	0.44	0.48	0.48	0.48	0.48	0.48
Total	**1.80**	**1.84**	**1.89**	**1.95**	**2.00**	**2.05**

Appendix A (continued)

Table 6A.8 Washington County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	1.13	1.13	1.14	1.15	1.16	1.17
Domestic self-supply	1.12	1.16	1.24	1.31	1.37	1.42
Ind./Comm./Inst. (I/C/I)	0.42	0.80	0.83	0.85	0.88	0.89
Recreational self-supply	0.35	0.36	0.38	0.40	0.41	0.42
Agricultural use	1.04	1.47	1.47	1.47	1.47	1.47
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**4.06**	**4.92**	**5.06**	**5.17**	**5.29**	**5.37**

Table 6A.9 Franklin County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	1.97	2.03	2.03	2.03	2.03	2.03
Domestic self-supply	0.25	0.28	0.28	0.28	0.28	0.28
Ind./Comm./Inst. (I/C/I)	1.73	0.02	0.02	0.02	0.02	0.02
Recreational self-supply	0.14	0.14	0.14	0.14	0.14	0.14
Agricultural use	0.00	0.00	0.00	0.00	0.00	0.00
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**4.09**	**2.47**	**2.47**	**2.47**	**2.47**	**2.47**

Table 6A.10 Gulf County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	1.70	1.71	1.72	1.73	1.74	1.76
Domestic self-supply	0.23	0.23	0.23	0.24	0.24	0.24
Ind./Comm./Inst. (I/C/I)	0.38	0.40	0.40	0.40	0.40	0.40
Recreational self-supply	0.33	0.33	0.33	0.33	0.34	0.34
Agricultural use	0.15	0.15	0.15	0.15	0.15	0.15
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**2.78**	**2.83**	**2.84**	**2.85**	**2.87**	**2.88**

Appendix A (continued)

Table 6A.11 Jefferson County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	0.80	0.80	0.81	0.81	0.82	0.82
Domestic self-supply	0.51	0.51	0.54	0.56	0.58	0.59
Ind./Comm./Inst. (I/C/I)	0.00	0.00	0.00	0.00	0.00	0.00
Recreational self-supply	0.53	0.52	0.54	0.56	0.57	0.58
Agricultural use	1.30	1.30	1.30	1.30	1.30	1.30
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**3.14**	**3.13**	**3.18**	**3.23**	**3.27**	**3.29**

Note: Only reflects those water use within the within the NWFWMD.

Table 6A.12 Leon County Water Use Estimates and Projections by Category, 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	29.95	31.41	32.58	33.76	34.94	36.11
Domestic self-supply	5.64	5.85	6.28	6.65	6.95	7.12
Ind./Comm./Inst. (I/C/I)	0.00	0.00	0.00	0.00	0.00	0.00
Recreational self-supply	2.44	2.52	2.64	2.76	2.86	2.95
Agricultural use	0.42	0.32	0.32	0.32	0.32	0.32
Power generation	3.32	3.32	3.32	3.32	3.32	3.32
Total	**41.77**	**43.43**	**45.15**	**46.81**	**48.39**	**49.81**

Table 6A.13 Wakulla County Water use Estimates and Projections by Category 2010 - 2035 (mgd)

	Estimated	Projected				
Water Use Category	2010	2015	2020	2025	2030	2035
Public supply	2.50	2.11	2.28	2.45	2.62	2.77
Domestic self-supply	1.25	1.31	1.43	1.54	1.64	1.71
Ind./Comm./Inst. (I/C/I)	1.09	1.16	1.16	1.16	1.16	1.16
Recreational self-supply	0.24	0.25	0.27	0.29	0.31	0.33
Agricultural use	0.26	0.26	0.26	0.26	0.26	0.26
Power generation	0.00	0.00	0.00	0.00	0.00	0.00
Total	**5.34**	**5.09**	**5.41**	**5.71**	**5.98**	**6.23**

Appendix B

Appendix B provides water use estimates and demand projections by water source type, for both average demand conditions and water demands for a 1-in-10 year drought event.

Table 6B.14 Water Use Estimates and Projections by Region and Source type (mgd)

Water Supply Planning Area	2010	2035	
	Estimated Use	Projected Use	1-in-10
Region I	**95.38**	**95.99**	**99.89**
Ground Water	80.46	79.64	83.45
Surface Water	14.92	16.35	16.44
Region II	**73.59**	**100.76**	**107.49**
Ground Water	72.36	99.31	105.90
Surface Water	1.23	1.45	1.58
Region III	**72.34**	**88.42**	**91.53**
Ground Water	10.53	14.27	15.15
Surface Water	61.80	74.14	76.39
Region IV	**40.41**	**48.16**	**54.69**
Ground Water	38.35	47.68	54.16
Surface Water	2.06	0.48	0.55
Region V	**6.88**	**5.35**	**5.71**
Ground Water	5.92	4.35	4.64
Surface Water	0.97	1.00	1.07
Region VI	**18.38**	**19.26**	**20.20**
Ground Water	11.53	12.42	13.09
Surface Water	6.84	6.84	7.12
Region VII	**50.25**	**59.34**	**63.26**
Ground Water	50.22	59.31	63.22
Surface Water	0.04	0.03	0.04
Total	**357.22**	**417.26**	**442.78**

Note: Does not include reclaimed water used for golf course irrigation.
ADR = average daily rate
1-in-10 = 1-in-10 year drought event

Appendix C

Appendix C provides the estimated uniform gross per capita water use for public supply for each county during 2010.

Table 6C.15 Public Supply Population and Per Capita Water Use

County	2010 Total County Population [1]	2010 Population served by Large Public Supply Utilities [2]	2010 Public Supply Water Use (gpd)[3]	Average Uniform Gross Per Capita Water Use (gpcd) [4]
Bay	168,852	150,960	27,201,927	180
Calhoun	14,625	4,281	667,796	156
Escambia	297,619	281,013	39,550,563	141
Franklin	11,549	9,584	1,974,957	206
Gadsden	46,389	31,216	4,459,936	143
Gulf	15,863	13,556	1,697,764	125
Holmes	19,927	6,223	1,131,106	182
Jackson	49,746	15,708	2,299,358	146
Jefferson[5]	10,417	5,441	799,480	147
Leon	275,487	197,105	29,945,939	152
Liberty	8,365	4,803	515,592	107
Okaloosa	180,822	165,977	22,505,516	136
Santa Rosa	151,372	139,653	15,027,215	108
Wakulla	30,776	19,672	2,499,068	127
Walton	55,043	42,648	8,189,657	192
Washington	24,896	7,657	1,099,228	144
Total	**1,361,748**	**1,095,497**	**159,565,102**	
Average				**146**

[1] *Source: U.S. Census 2010 population reflects permanent population. Does not include seasonal residents.*
[2] *Estimate based on data reported by utilities or population of 2010 U.S. Census blocks with centroid in public supply distribution areas.*
[3] *Based on water demand.*
[4] *gpcd = gallons per capita per day*
[5] *Reflects the 2010 U.S. Census block population within the NWFWMD.*

Appendix D

Appendix D provides five year growth rates used to make future water use projections for each utility.

Table 6D.16 Public Supply Utility Projected 5-Year Growth Rates

Public Water Supply Utility	2015	2020	2025	2030	2035	Comments[(1),(2)]
BAY COUNTY						
Bay County BOCC	3.1%	6.0%	5.1%	4.2%	3.5%	BEBR Medium.
Callaway	0.0%	0.0%	0.0%	0.0%	0.0%	City trend for Callaway negative. Projected no growth. In 2012 Callaway took over distribution for Sandy Creek.
Cedar Grove	3.1%	6.0%	5.1%	4.2%	3.5%	BEBR Medium.
GCEC (North Bay, Lake Merial)	3.1%	6.0%	5.1%	4.2%	3.5%	BEBR Medium.
Lynn Haven, City of	10.7%	13.7%	13.1%	12.7%	12.3%	City trend.
Mexico Beach	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Panama City	2.5%	2.5%	2.5%	2.5%	2.5%	City trend negative. City planning director suggested 2 - 3% growth rate based on development plans. Agreed to 2.5%.
Panama City Beach	9.3%	8.9%	8.0%	7.0%	6.2%	City trend aggresively positive. Used BEBR High.
Parker	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Sandy Creek Utility Services, Inc.	3.1%	6.0%	5.1%	4.2%	3.5%	Distribution provided by Callaway.
Springfield	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
CALHOUN COUNTY						
Altha	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Blountstown	0.8%	1.6%	1.6%	1.6%	1.6%	City trend.
ESCAMBIA COUNTY						
Bratt-Davisville Water System, Inc.	1.4%	1.8%	1.5%	1.3%	1.1%	BEBR Medium.
Central Water Works, Inc.	1.4%	1.8%	1.5%	1.3%	1.1%	BEBR Medium.
Century, Town of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Cottage Hill Water Works, Inc.	1.4%	1.8%	1.5%	1.3%	1.1%	BEBR Medium.
Emerald Coast Utilities Authority	1.4%	1.8%	1.5%	1.3%	1.1%	City trend for Pensacola is negative. BEBR Low is also negative. Used BEBR Medium for slow growth.
Farm Hill Utilties, Inc.	7.5%	4.6%	4.4%	4.0%	3.7%	BEBR High. Most of the North Escambia Sector Plan is in the Farm Hill franchise area.
Gonzalez Utilities Association, Inc.	1.4%	1.8%	1.5%	1.3%	1.1%	BEBR Medium.
Molino Utilities, Inc	1.4%	1.8%	1.5%	1.3%	1.1%	BEBR Medium.
Peoples Water Service Company of Florida, Inc.	1.4%	1.8%	1.5%	1.3%	1.1%	BEBR Medium.
Walnut Hill Water Works	1.4%	1.8%	1.5%	1.3%	1.1%	BEBR Medium.

Appendix D (continued)

Public Water Supply Utility	2015	2020	2025	2030	2035	Comments[(1),(2)]
FRANKLIN COUNTY						
Alligator Point Water Resources District	3.9%	0.0%	0.0%	0.0%	0.0%	BEBR Medium.
Apalachicola, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Carrabelle, City of	3.9%	0.0%	0.0%	0.0%	0.0%	BEBR Medium. City population doubled in 2010 due to prison annexation, so trend not reliable.
Carrabelle, City of (Lanark Village)	3.9%	0.0%	0.0%	0.0%	0.0%	BEBR Medium.
Eastpoint Water and Sewer District	3.9%	0.0%	0.0%	0.0%	0.0%	BEBR Medium.
St. James Island Utility Company	3.9%	0.0%	0.0%	0.0%	0.0%	BEBR Medium.
Water Management Services, Inc.	3.9%	0.0%	0.0%	0.0%	0.0%	BEBR Medium.
GADSDEN COUNTY						
Chattahoochee	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Greensboro	2.6%	1.9%	1.4%	1.4%	1.2%	City trend negative. Town manager wanted to show growth of 2 to 3% to reflect desire to serve newly annexed land extending to Interstate 10, agreed on BEBR Medium.
Gretna	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Havana	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Quincy, City of	8.9%	4.6%	4.4%	4.2%	3.8%	City trend positive. Used BEBR High.
Rosedale Water Association	0.0%	0.0%	0.0%	0.0%	0.0%	Near and gets water from Chattahoochee. Projected no growth.
Talquin Electric Cooperative, Inc.[(3)]	2.6%	1.9%	1.4%	1.4%	1.2%	BEBR Medium.
GULF COUNTY						
Lighthouse Utilities Company, Inc.	0.9%	0.6%	0.6%	0.6%	0.6%	BEBR Medium.
Port St. Joe	0.9%	0.6%	0.6%	0.6%	0.6%	City trend negative. City engineer requested using growth rate in recent permit renewal, which was BEBR medium as projected at the time. Revised to current BEBR Medium.
Wewahitchka	0.9%	0.6%	0.6%	0.6%	0.6%	City trend positive. Used BEBR Medium.
HOLMES COUNTY						
Bonifay, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend slightly negative. Projected no growth.
Caryville, Town of (Holmes County portion)	0.0%	0.0%	0.0%	0.0%	0.0%	Projected no growth to reflect same rate as Town of Caryville.
Esto Water Works	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Joyce E. Snare Waterworks	13.6%	2.5%	1.9%	1.4%	0.9%	BEBR Medium.
Noma, Town of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Ponce de Leon, Town of	7.4%	15.3%	14.6%	14.1%	13.7%	City trend.
Westville, Town of	13.6%	2.5%	1.9%	1.4%	0.9%	City trend aggresively positive. Used BEBR Medium.

Appendix D (continued)

Public Water Supply Utility	2015	2020	2025	2030	2035	Comments[(1),(2)]
JACKSON COUNTY						
Alford, Town of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Campbellton, Town of	6.5%	3.2%	3.1%	3.0%	2.9%	City trend positive. Used BEBR High.
Cottondale	0.5%	0.4%	0.2%	0.4%	0.4%	City trend very slow growth. Used BEBR Medium.
Graceville	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Grand Ridge	6.5%	3.2%	3.1%	3.0%	2.9%	City trend positive. Used BEBR High.
Greenwood	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Jacob, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Malone	0.0%	0.0%	0.0%	0.0%	0.0%	Historic population has been erratic. Projected no growth.
Marianna	0.5%	0.4%	0.2%	0.4%	0.4%	City population has been erratic but trend positive. Used BEBR Medium.
Sneads	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
JEFFERSON COUNTY						
Jefferson Communities Water System, Inc.	-0.4%	3.4%	2.6%	2.6%	1.3%	BEBR Medium.
Monticello, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
LEON COUNTY						
Rowe Drilling Company, Inc.[(4)]	3.4%	4.8%	4.3%	3.8%	3.0%	General manager indicated most of their systems have no, or very limited, available property for future growth and will experience very little additional demand during the next twenty-five years.
Tallahassee, City of (Leon County portion)	3.2%	3.5%	3.5%	3.4%	3.4%	City trend.
Talquin Electric Cooperative, Inc.[(5)]	3.4%	4.8%	4.3%	3.8%	3.0%	BEBR Medium.
LIBERTY COUNTY						
Bristol, City of	3.7%	4.6%	4.5%	4.4%	4.3%	Used city trend, slightly slower growth than BEBR Medium.
Liberty Co. BOCC, Hosford-Telogia	11.2%	5.4%	5.1%	4.9%	4.6%	BEBR Medium.
Liberty Co. BOCC, Lake Mystic Water System	11.2%	5.4%	5.1%	4.9%	4.6%	BEBR Medium.
Liberty Co. BOCC, Rock Bluff Water System	11.2%	5.4%	5.1%	4.9%	4.6%	BEBR Medium.
Liberty Co. BOCC, Estiffanulga Water System	11.2%	5.4%	5.1%	4.9%	4.6%	BEBR Medium.
Sumatra Water System	11.2%	5.4%	5.1%	4.9%	4.6%	BEBR Medium.
Talquin Electric Cooperative Inc., Sweetwater System	11.2%	5.4%	5.1%	4.9%	4.6%	BEBR Medium.

Appendix D (continued)

Public Water Supply Utility	2015	2020	2025	2030	2035	Comments[(1),(2)]
OKALOOSA COUNTY						
Auburn Water System	11.9%	6.6%	6.2%	5.8%	5.4%	Number of active metered connections last five years showed 11.5% growth. Utility said they have most developable land in county with lower land costs. Utility concurred with BEBR high.
Baker Water System	5.5%	3.7%	3.3%	3.1%	2.7%	BEBR Medium.
Blackman Community Water System, Inc.	5.5%	3.7%	3.3%	3.1%	2.7%	BEBR Medium.
Crestview, City of	11.9%	6.6%	6.2%	5.8%	5.4%	City trend very high. Comment recevied at workshop that growth in Crestview area will be concentrated more in Okaloosa Mid-County and Auburn water system areas. Revised rates downward to BEBR High.
Destin Water Users	1.8%	1.8%	1.8%	1.8%	1.7%	City trend.
Fort Walton Beach, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend combining Cinco Bayou and Ft. Walton Beach populations is negative. Projected no growth.
Holt Water Works, Inc.	5.5%	3.7%	3.3%	3.1%	2.7%	BEBR Medium.
Laurel Hill, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Mary Esther, Town of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Milligan Water System	5.5%	3.7%	3.3%	3.1%	2.7%	BEBR Medium.
Niceville, City of	6.3%	6.3%	6.3%	6.3%	6.3%	City trend is slightly negative. City requested using 6.3% based on population analysis in their Water System Facilities Plan which is being updated. Consultant cited 1,100-acre development on east side, desirable schools, and new utility accounts.
Okaloosa Co. Water & Sewer, Bluewater	2.5%	2.5%	2.5%	2.5%	2.5%	GIS shows area built out and constrained by water and Eglin AFB. County provided growth rate. Development would be commercial and residential infill. Utility to provide water in 2013 to Navy EOD, which will abandon their self supply well.
Okaloosa Co. Water & Sewer, Main (Garniers)	0.0%	0.0%	0.0%	0.0%	0.0%	City trend for Shalimar is negative. Projected no growth.
Okaloosa Co. Water & Sewer, Mid-County	11.9%	6.6%	6.2%	5.8%	5.4%	Comment recevied at workshop that growth in Crestview area will be concentrated more in Okaloosa Mid-County and Auburn water system areas. Revised from BEBR Medium to BEBR High.
South Walton Utility Company, Coastal Well Field (Okaloosa County portion)	5.5%	3.7%	3.3%	3.1%	2.7%	BEBR Medium.
Valparaiso, City of	1.7%	1.7%	1.7%	1.7%	1.7%	City trend negative. City public works director provided report showing 0.34% annual growth, which equates to 1.71% growth over 5 year periods.

Appendix D (continued)

Public Water Supply Utility	2015	2020	2025	2030	2035	Comments [(1),(2)]
SANTA ROSA COUNTY						
Bagdad-Garcon Point Water System	7.6%	9.9%	8.4%	6.9%	5.5%	BEBR Medium. Utility concurred with growth rate.
Berrydale Water System	1.1%	5.2%	3.7%	1.9%	0.4%	BEBR Low. County build out analysis indicated limited growth potential.
Chumuckla Water System	7.6%	9.9%	8.4%	6.9%	5.5%	BEBR Medium.
East Milton Water System	7.6%	9.9%	8.4%	6.9%	5.5%	BEBR Medium.
Fairpoint Regional Utility System	-	-	-	-	-	Wholesale production only.
Gulf Breeze Water Department	0.0%	0.0%	0.0%	0.0%	0.0%	City trend is flat except for very low growth first period. County staff reported near build out, low to no growth. Projected no growth.
Holley-Navarre Water System, Inc.	10.9%	11.9%	10.4%	8.7%	7.3%	Used rate midway between BEBR Medium and BEBR High. County staff reported fast growth.
Jay, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend is continual negative growth at -1.2%. County build out analysis indicated very limited growth potential. Projected no growth.
Midway Water System	7.6%	9.9%	8.4%	6.9%	5.5%	BEBR Medium.
Milton, City of	7.6%	9.9%	8.4%	6.9%	5.5%	BEBR Medium. City has aggressive growth trend but county staff did not indicate high growth for this utility.
Moore Creek-Mt. Carmel Utilities, Inc.	1.1%	5.2%	3.7%	1.9%	0.4%	BEBR Low. County build out analysis indicated limited growth potential.
Pace Water System, Inc.	10.9%	14.0%	12.4%	10.6%	9.1%	Used rate midway between BEBR Medium and BEBR High. County staff reported fast growth.
Point Baker Water System, Inc.	7.6%	9.9%	8.4%	6.9%	5.5%	BEBR Medium.
Santa Rosa Board of County Commissioners, Navarre Beach Water System	1.1%	5.2%	3.7%	1.9%	0.4%	BEBR Low. County build out analysis indicated limited growth potential.
South Santa Rosa Utilities	1.1%	5.2%	3.7%	1.9%	0.4%	BEBR Low. County staff reported limited growth potential.
WAKULLA COUNTY						
Panacea Area Water System, Inc.	4.3%	8.4%	7.5%	6.4%	5.3%	BEBR Medium.
Sopchoppy, Town of	4.1%	7.6%	7.4%	7.2%	7.0%	City trend.
St. Marks, City of, Water Sys.	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Tallahassee, City of (Wakulla County portion)	4.3%	8.4%	7.5%	6.4%	5.3%	BEBR Medium.
Talquin Electric Cooperative, Inc./Wakulla Regional	4.3%	8.4%	7.5%	6.4%	5.3%	BEBR Medium.
Wakulla County, River Sink Subdivision	4.3%	8.4%	7.5%	6.4%	5.3%	BEBR Medium.

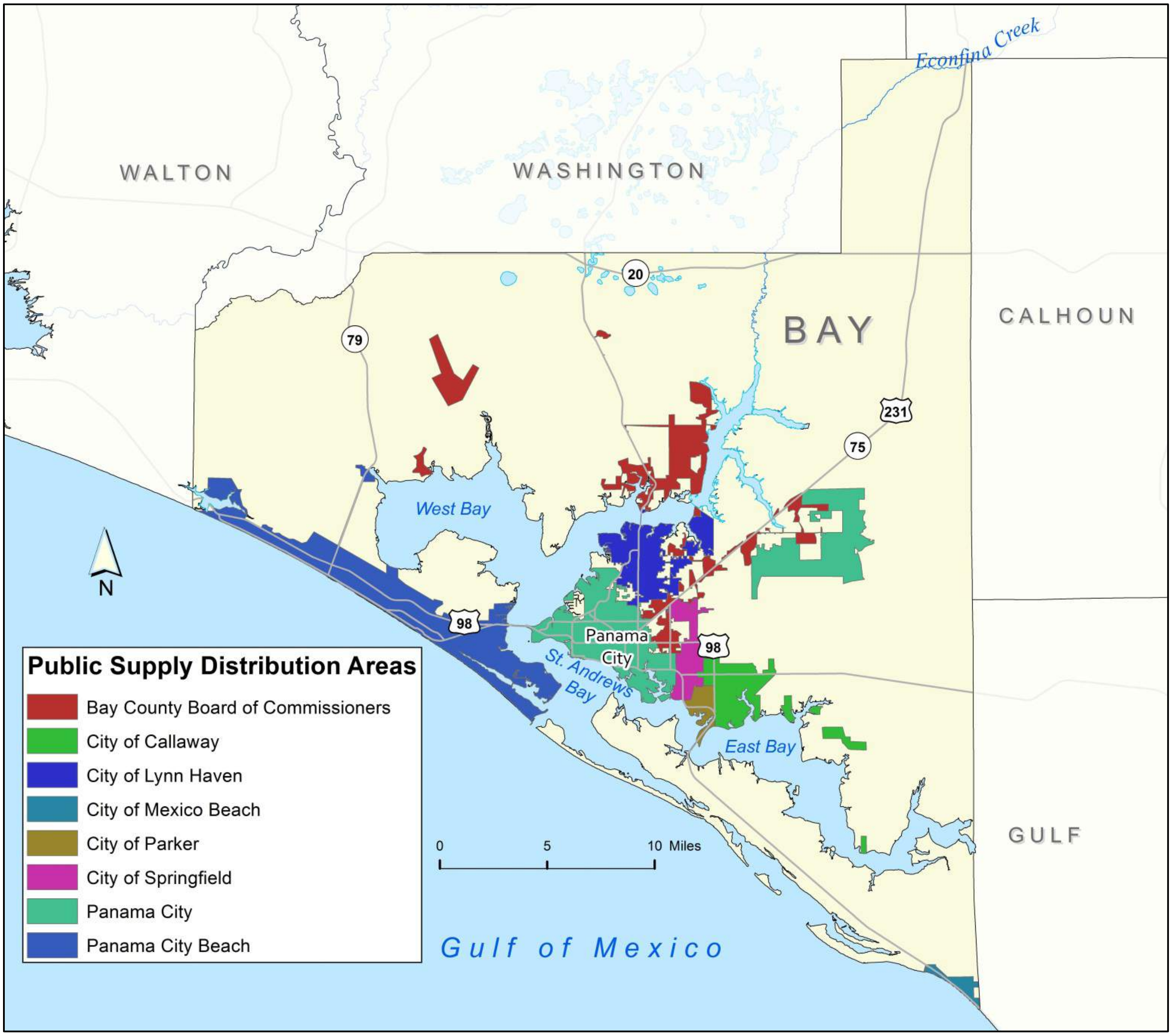
Appendix D (continued)

Public Water Supply Utility	2015	2020	2025	2030	2035	Comments[(1),(2)]
WALTON COUNTY						
Argyle Water System	10.1%	12.7%	10.4%	8.4%	6.7%	BEBR Medium.
DeFuniak Springs, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
FCSC of Walton Co. / Regional Utilities	10.1%	12.7%	10.4%	8.4%	6.7%	BEBR Medium.
Freeport, City of	10.1%	12.7%	10.4%	8.4%	6.7%	BEBR Medium.
Freeport, North Bay Water System	16.8%	16.8%	14.4%	12.2%	10.4%	City trend aggressively high. Used BEBR High.
Inlet Beach	10.1%	12.7%	10.4%	8.4%	6.7%	BEBR Medium.
Mossy Head Water Works, Inc.	3.6%	7.9%	5.4%	3.4%	1.5%	BEBR Low used to align better with recent projections for consumptive use permit.
Paxton, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
South Walton Utility Company, Rockhill Inland Well Field	-	-	-	-	-	Wholesale production only.
South Walton Utility Company, Coastal Well Field (Walton County portion)	10.1%	12.7%	10.4%	8.4%	6.7%	BEBR Medium.
WASHINGTON COUNTY						
Sunny Hills Utilities (formerly Aqua Utilities Florida, Inc.)	2.4%	5.1%	4.1%	3.6%	2.8%	BEBR Medium.
Caryville, Town of (Washington County portion)	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Chipley, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Vernon, City of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.
Wausau, Town of	0.0%	0.0%	0.0%	0.0%	0.0%	City trend negative. Projected no growth.

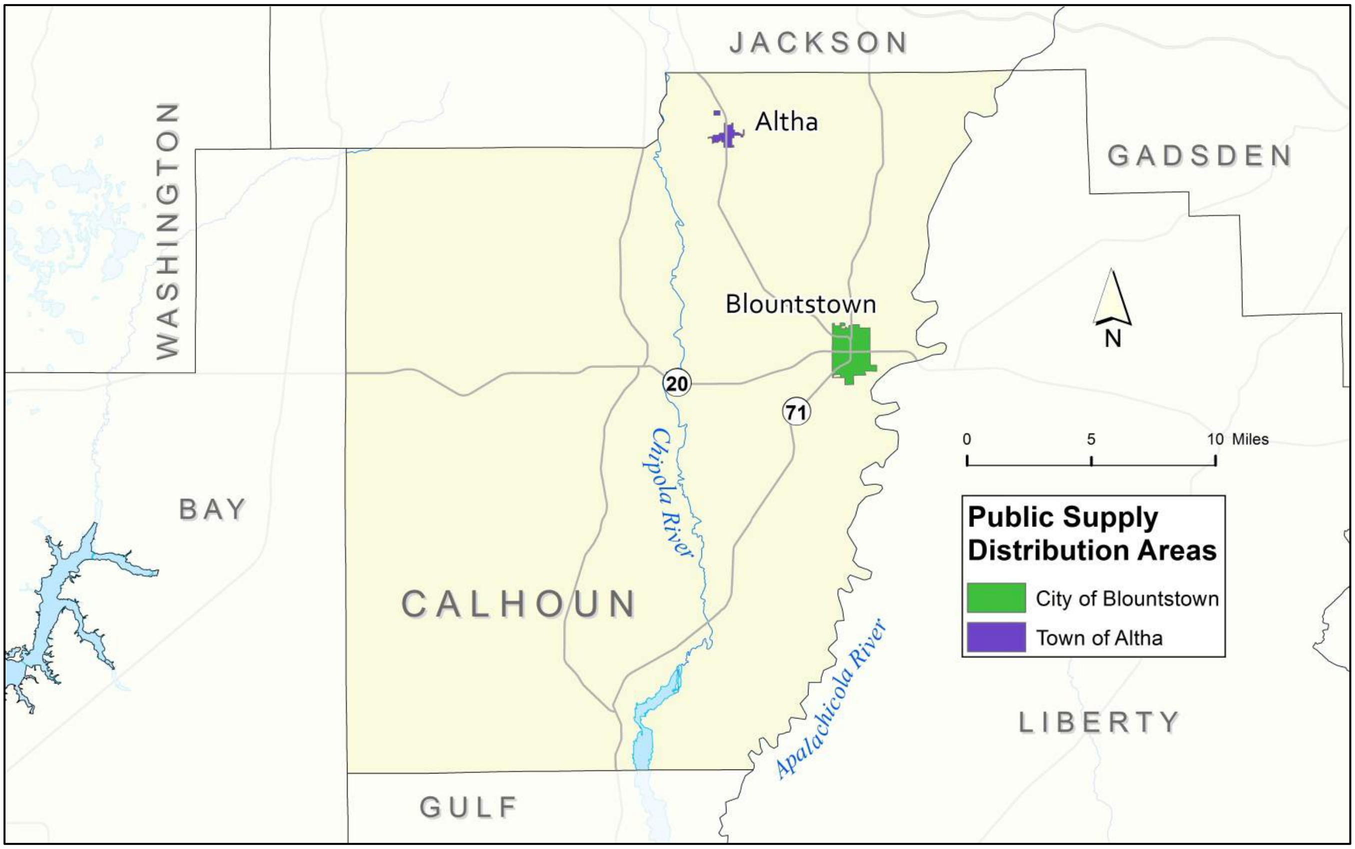
(1) BEBR refers to University of Florida, Bureau of Economic and Business Research, March 2013: BEBR Estimates of Population by County and City in Florida.
(2) BEBR Medium rate for county used unless stated otherwise. BEBR best fit scenario was used where there was concordant city population trend (average of linear and growth trends based on 8 years of historic data), or sometimes city trend itself. Some utilities provided growth rates.
(3) Includes Gadsden County Regional, Hammock Creek, Jamieson, and St. James Water Systems
(4) Includes Brewster Estates, Bucklake Estates, Meadow Hills Subdivision, North Lake Meadows, Plantation Estates and Sedgefield Water Systems.
(5) Includes Annawood, Bradfordville Regional, Lake Jackson Regional, Leon County East Regional, Leon County South Regional, Leon County West Regional, Meadows at Woodrun, Meridian Hills, and Stonegate Water Systems.

Appendix E

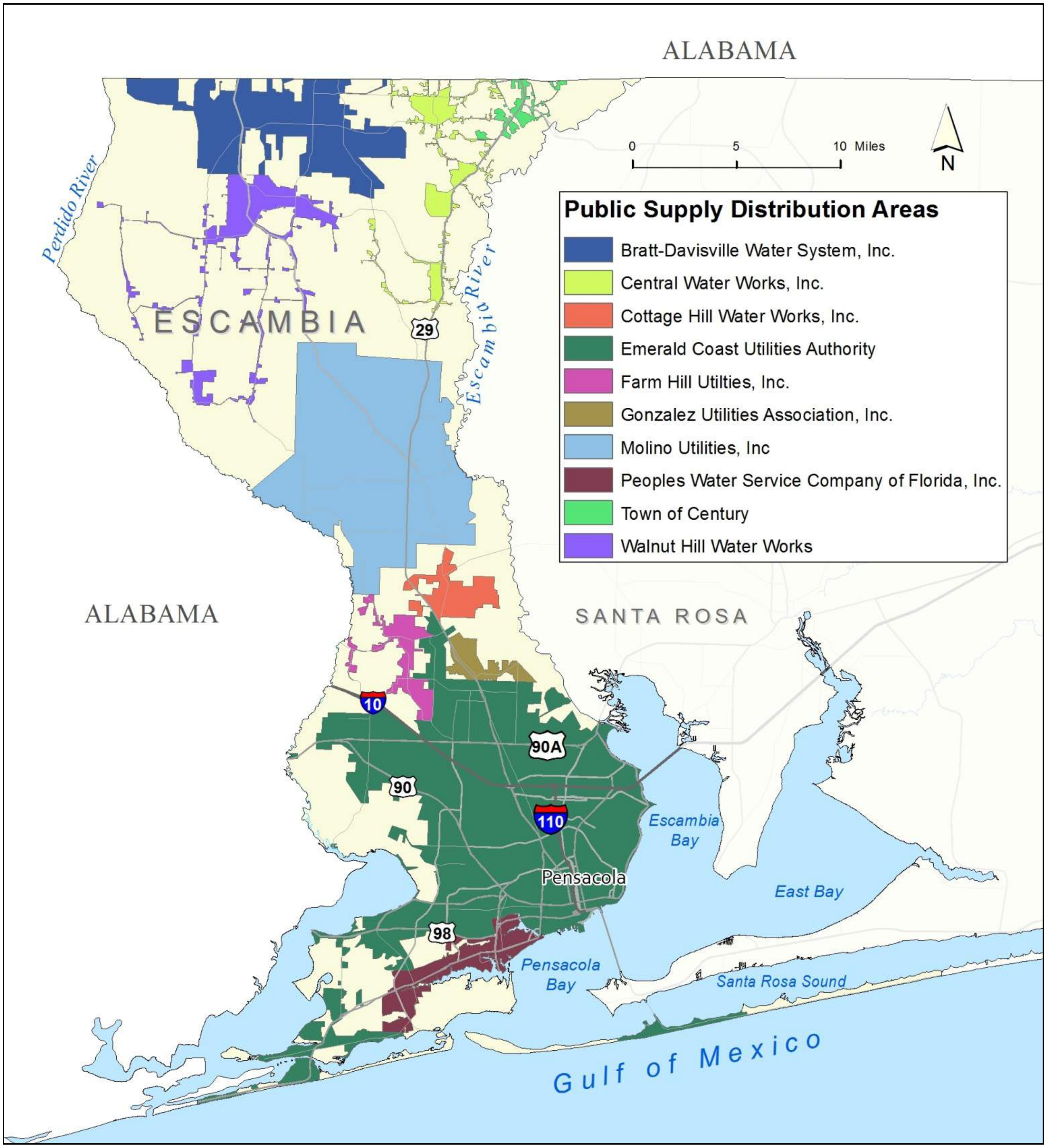
Appendix E shows public supply utility water distribution areas by county. See the Methodology section for an explanation of how these maps were developed.



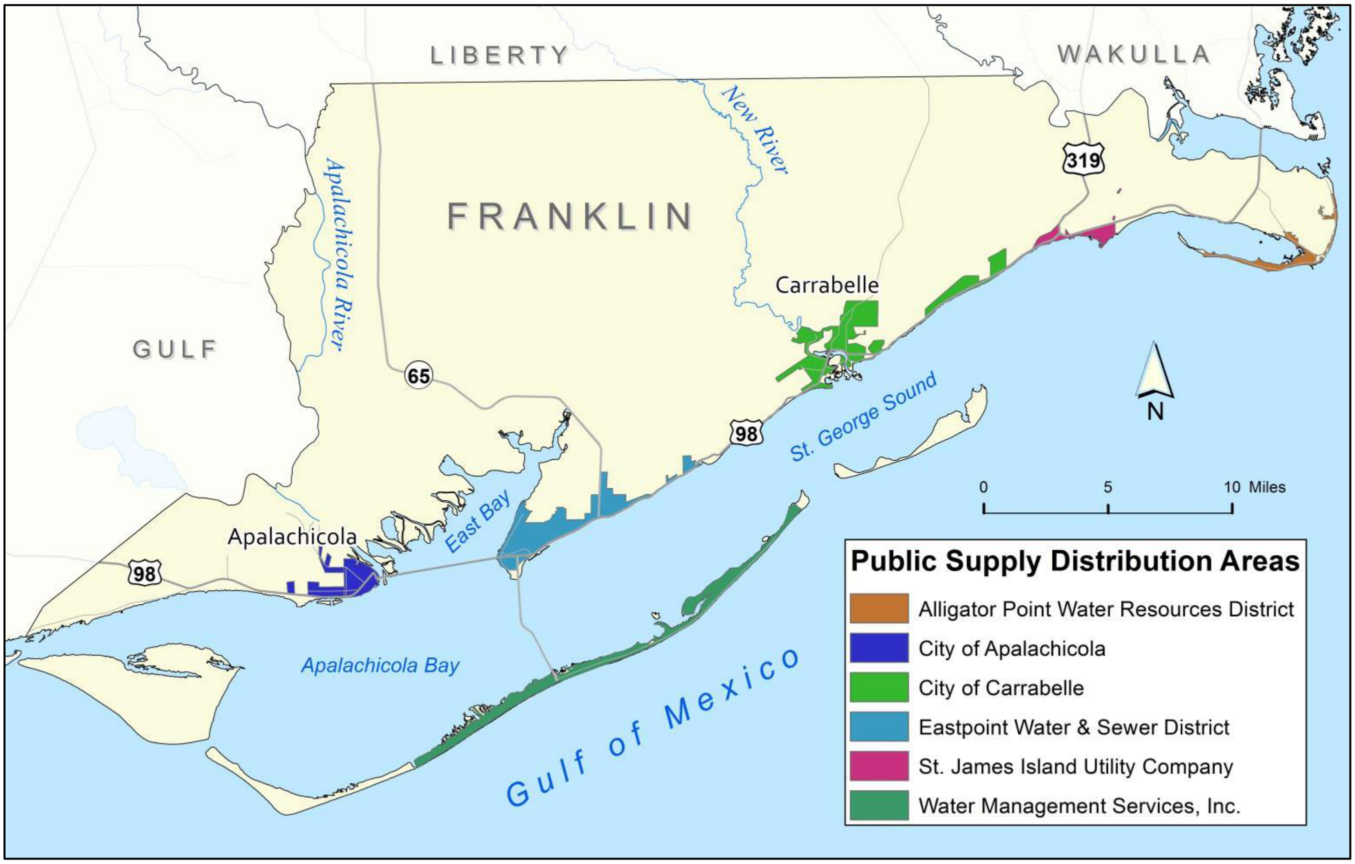
Appendix E (continued)

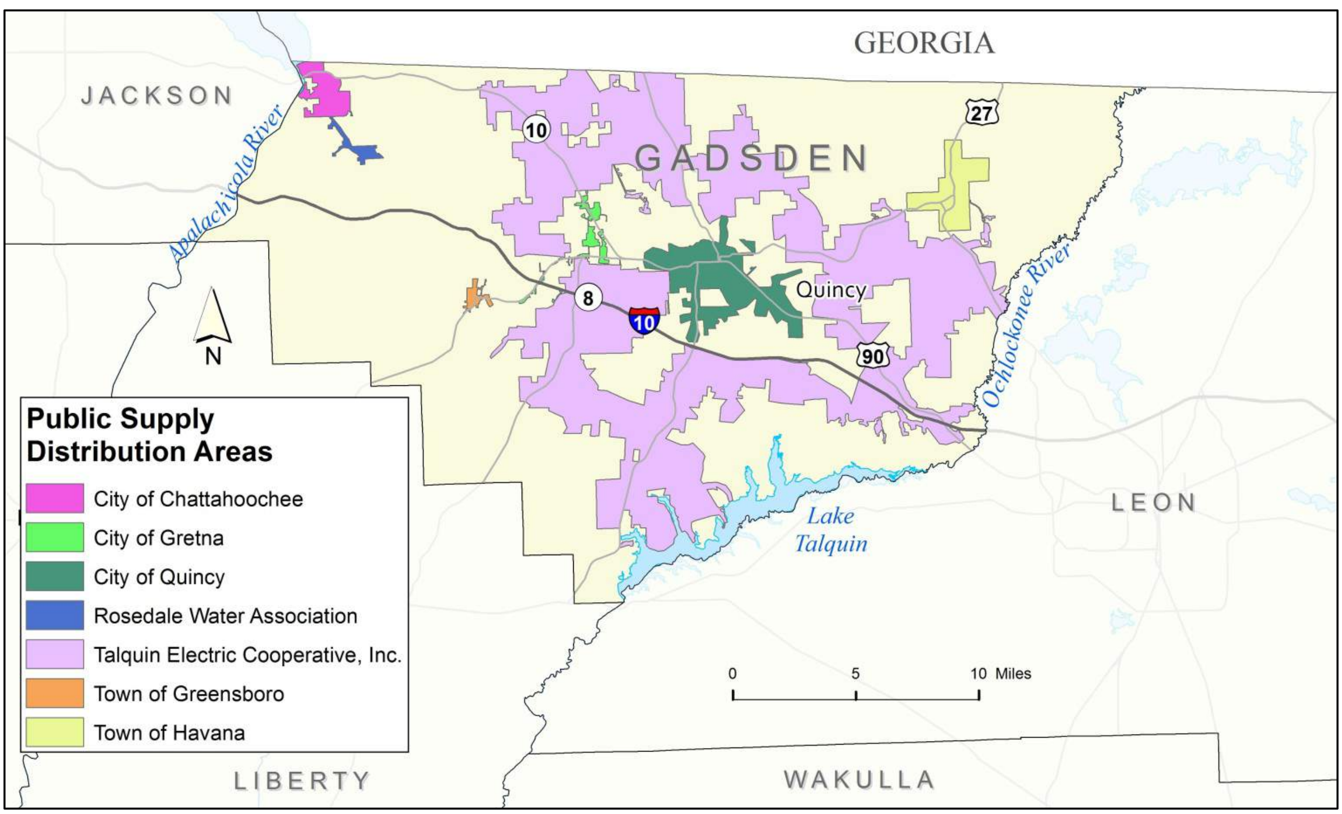


Appendix E (continued)

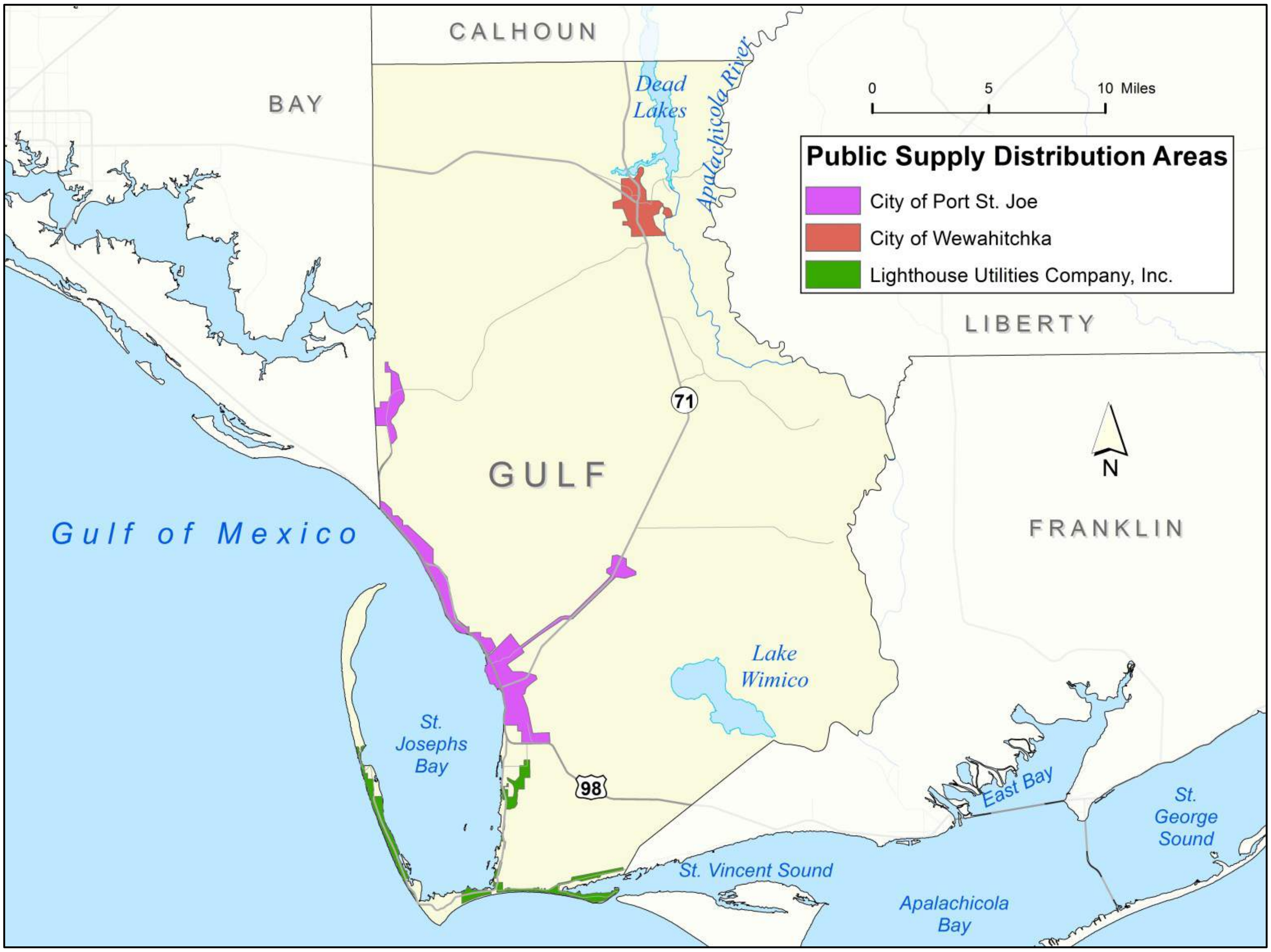


Appendix E (continued)

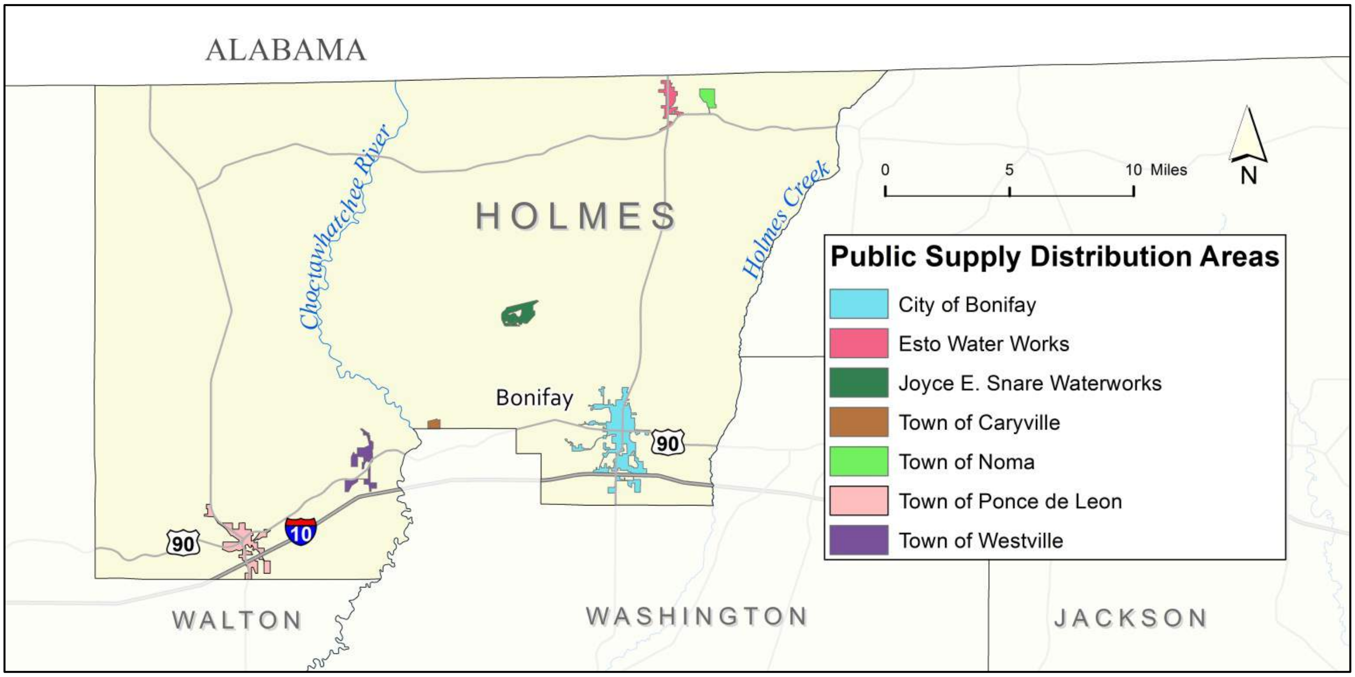




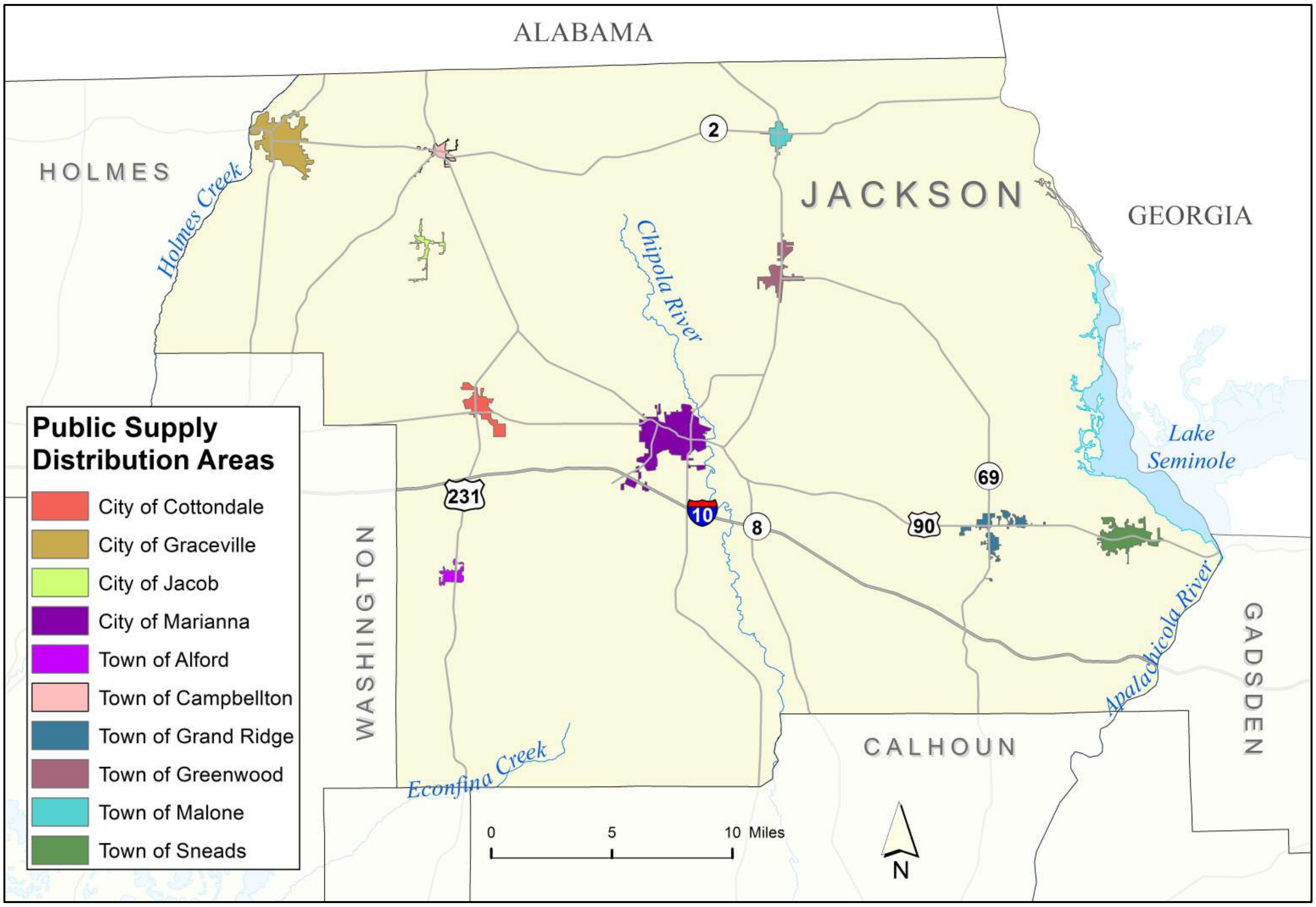
Appendix E (continued)



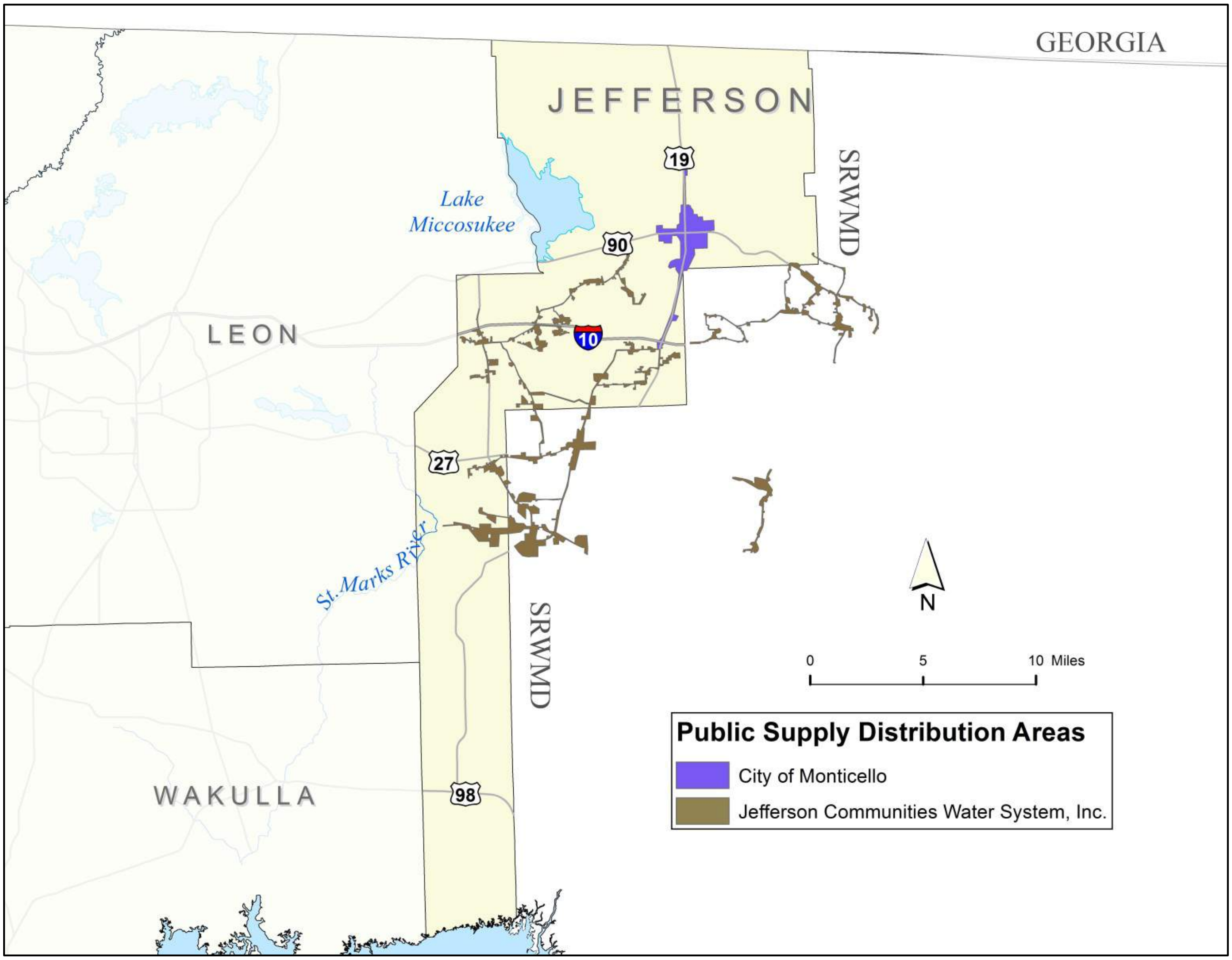
Appendix E (continued)



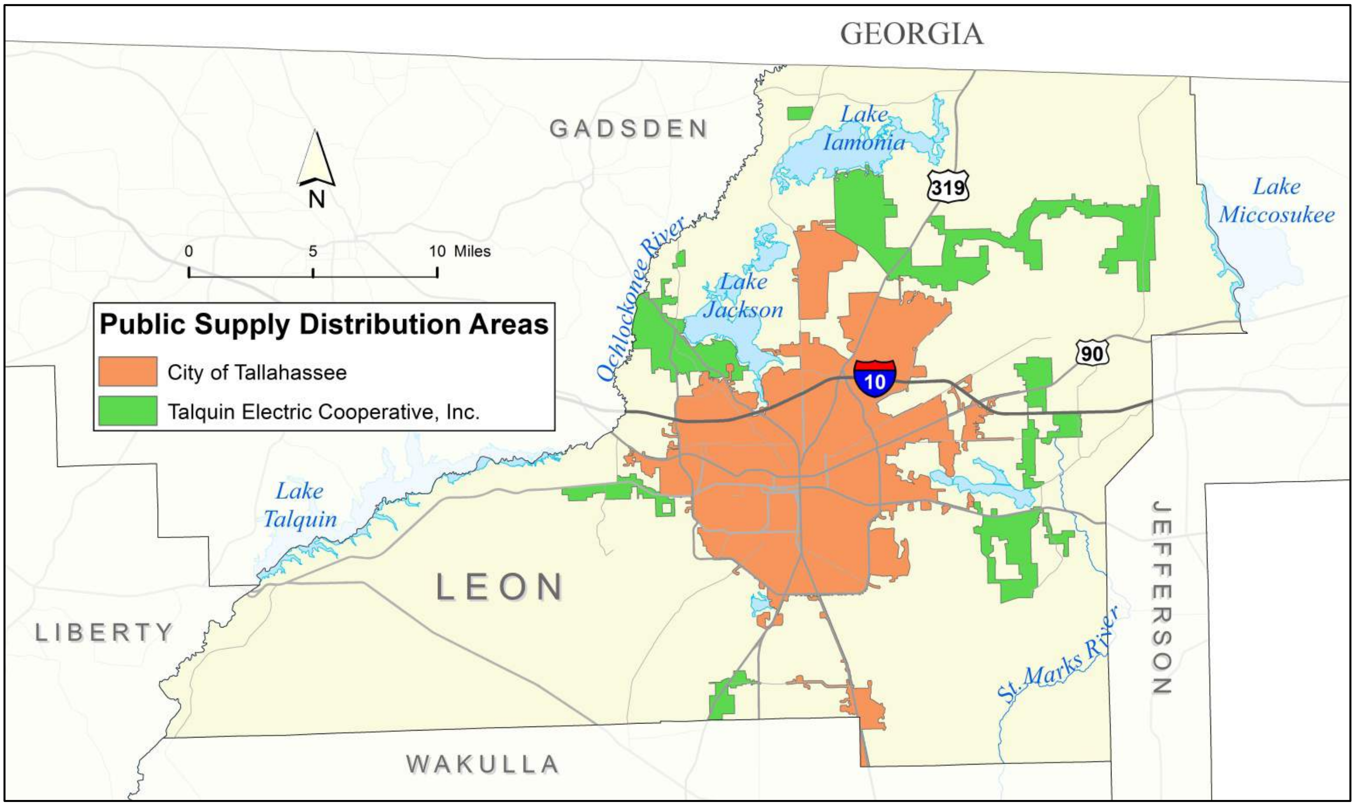
Appendix E (continued)



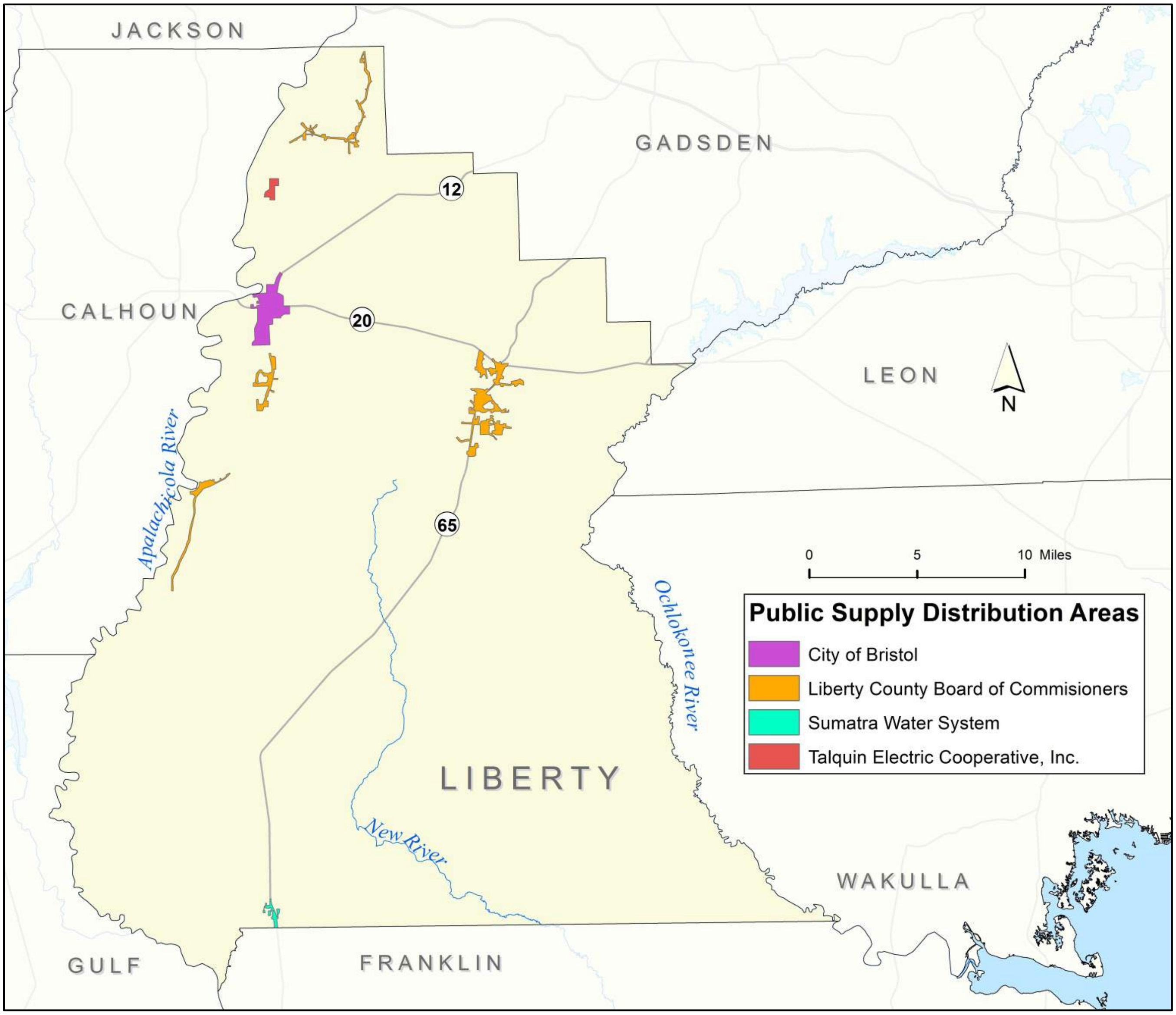
Appendix E (continued)



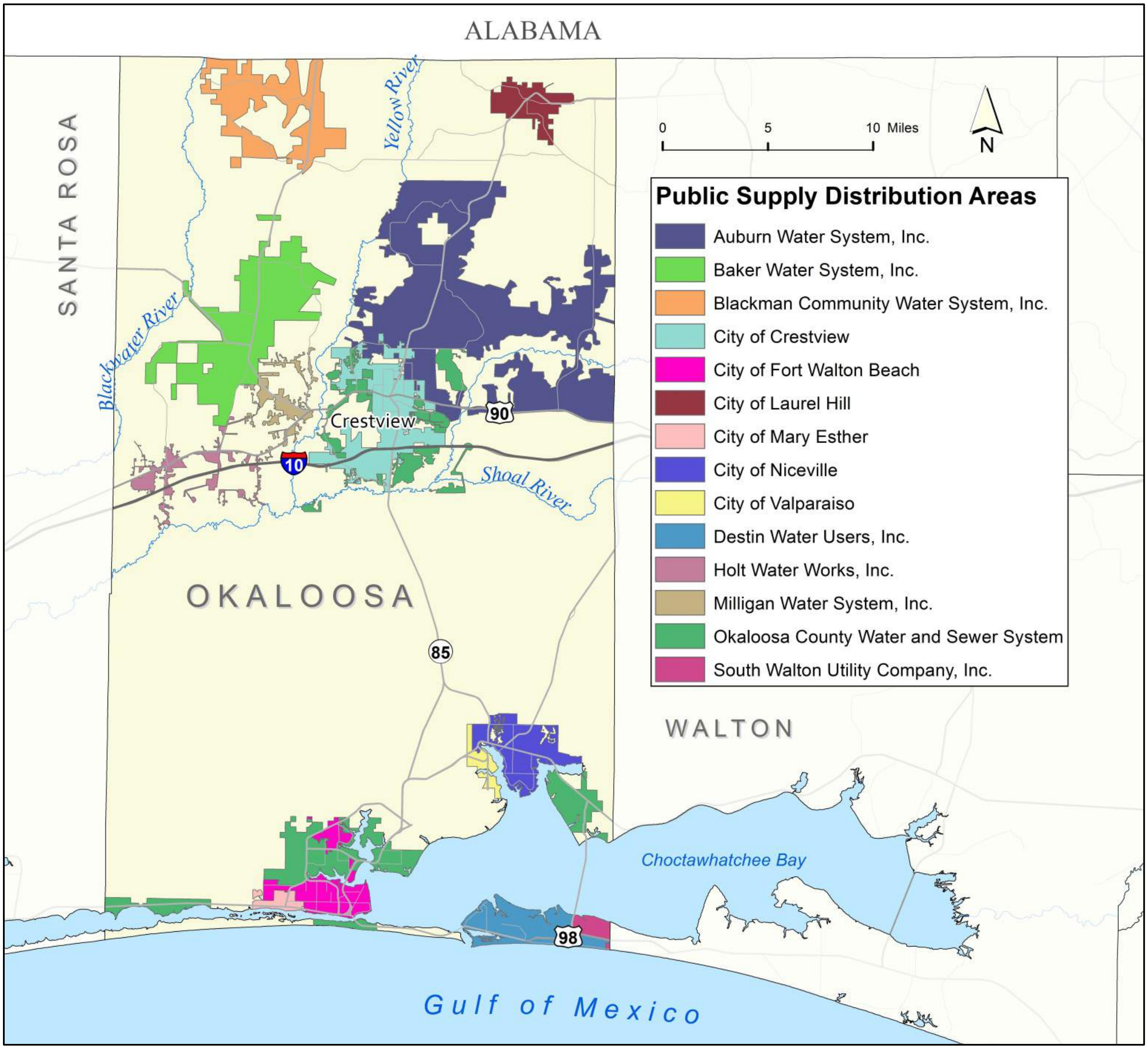
Appendix E (continued)



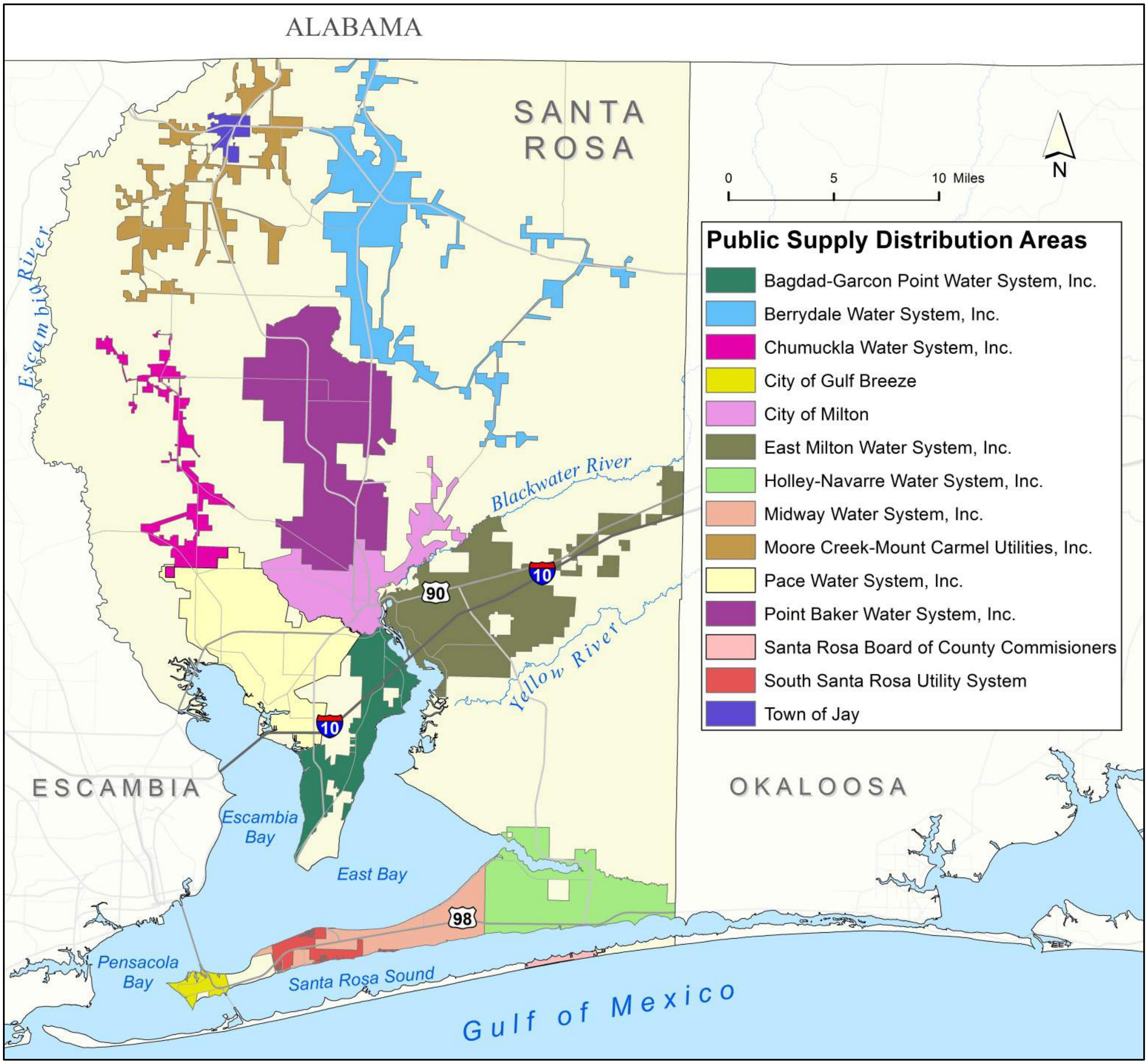
Appendix E (continued)



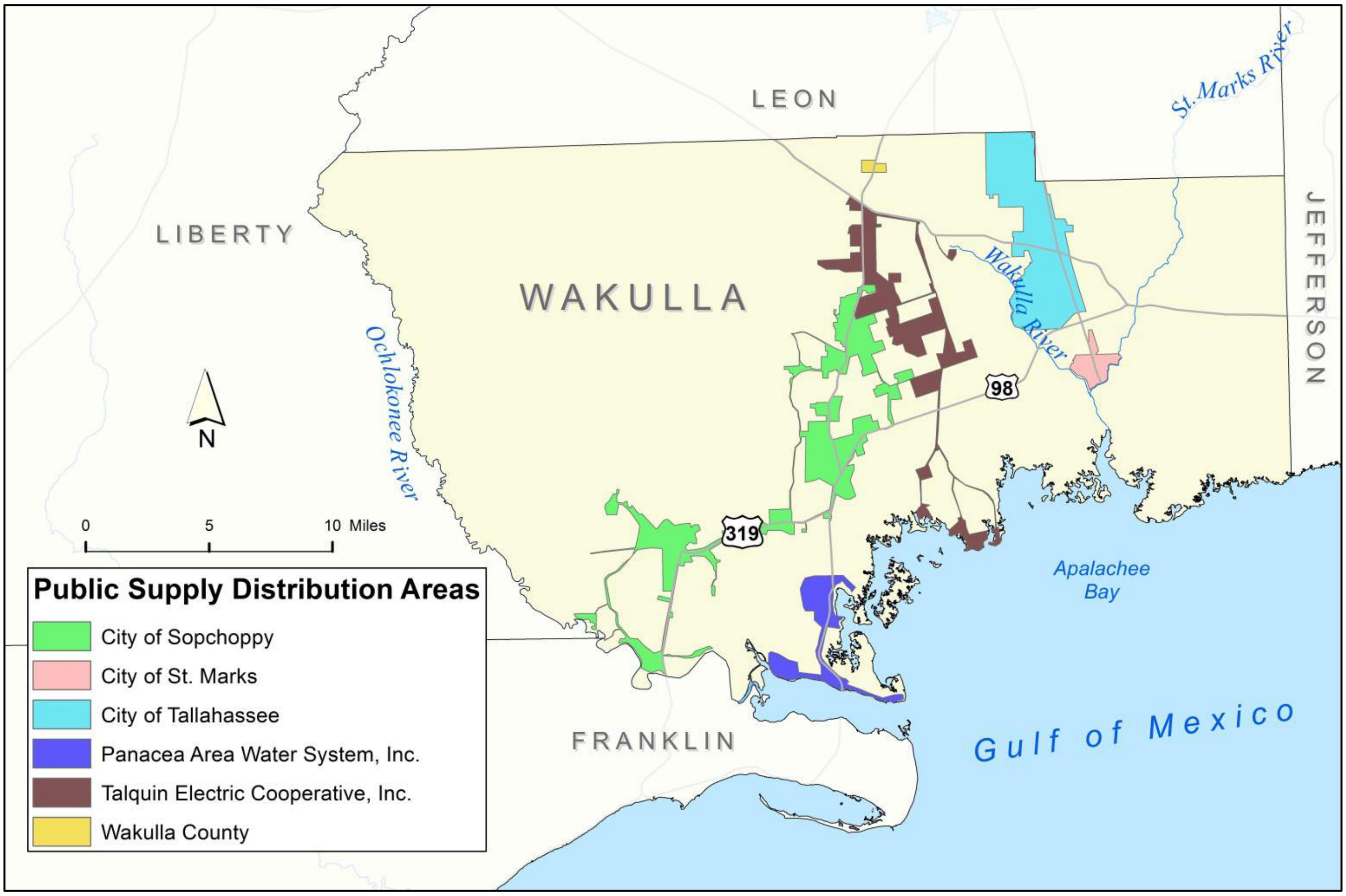
Appendix E (continued)



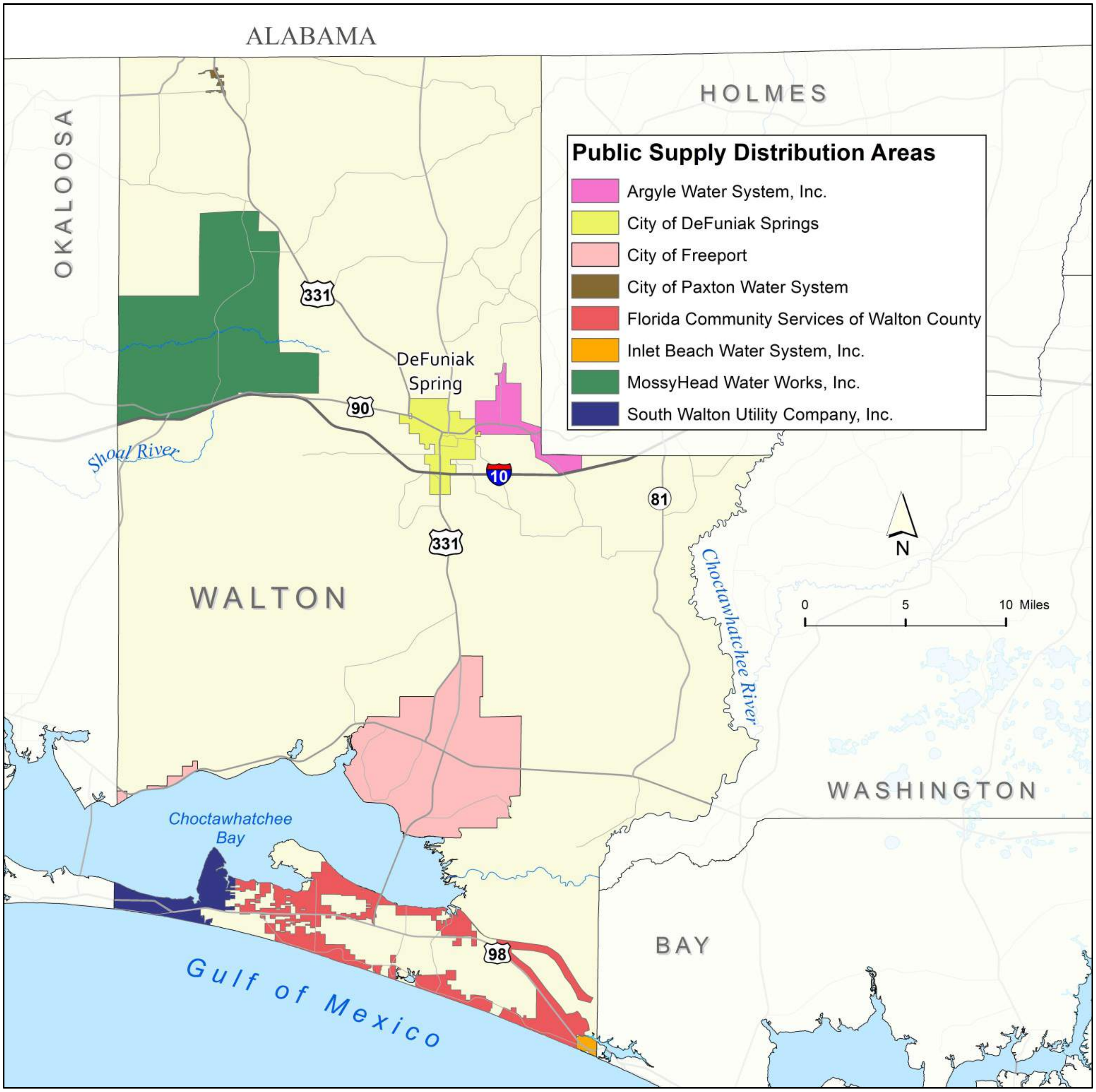
Appendix E (continued)



Appendix E (continued)



Appendix E (continued)



Appendix E (continued)