WATER SYSTEM MASTER PLAN

Prepared for:

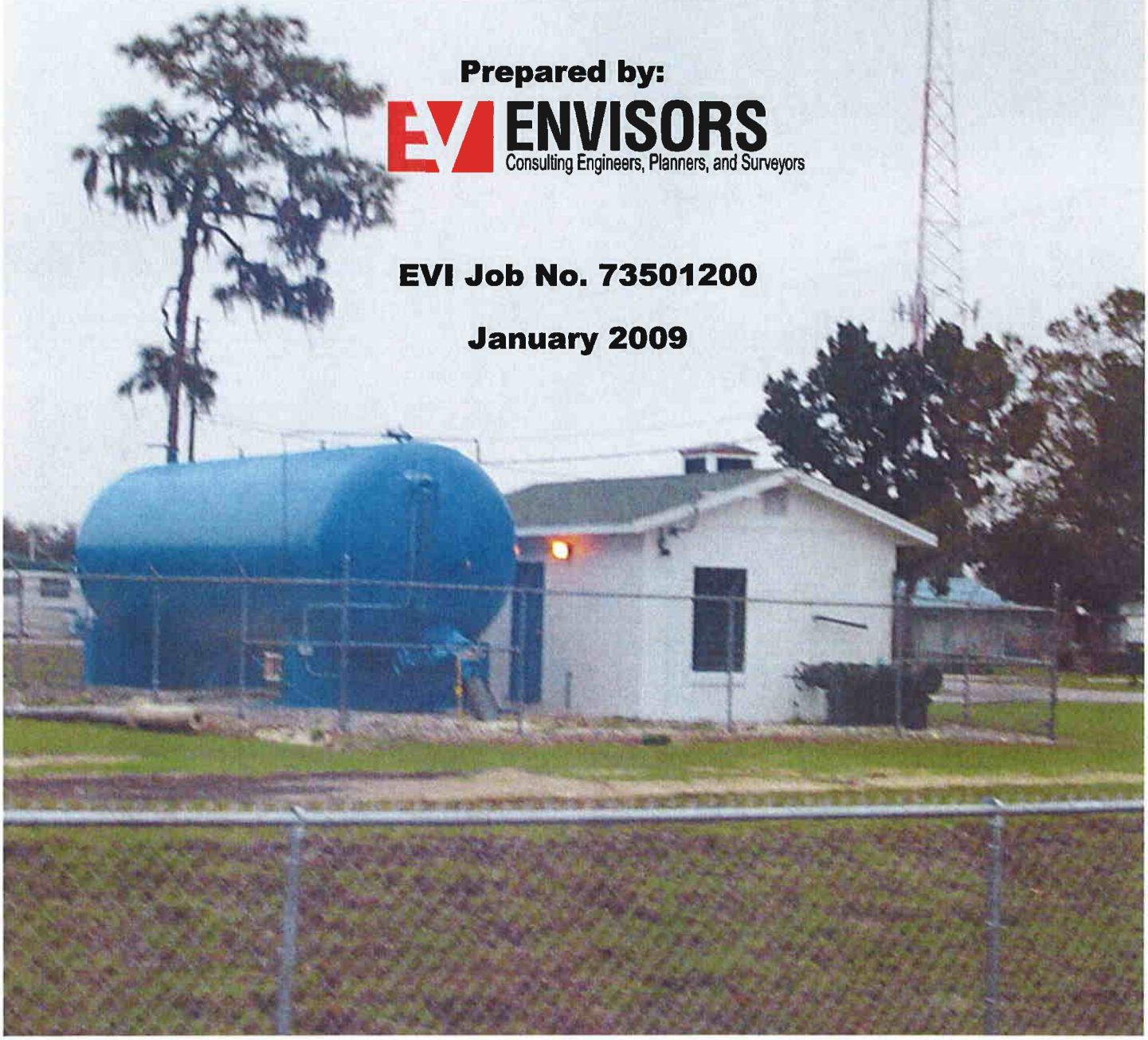
CITY OF POLK CITY

Prepared by:

ENVISORS
Consulting Engineers, Planners, and Surveyors

EVI Job No. 73501200

January 2009



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CITY OF POLK CITY
WATER SYSTEM MASTER PLAN

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EXECUTIVE SUMMARY

The City of Polk City (City) anticipates future potable water customer growth and desires to prepare a Water System Master Plan to determine water system improvements that will be necessary to provide adequate service to future water customers. Accordingly, Envisors was contracted to prepare this Water System Master Plan. The findings of this Report are based on staff direction, available data, and conditions present in May 2007.

Population Projections:

Based on information provided by City planning staff, population projections were made for 10-year and ultimate build-out planning periods. Population projections were based on developments currently in the City's development review process and 23 additional areas identified as either potential development areas or existing developed areas not currently connected to the City's potable water distribution system. The City anticipates its potable water service population to increase from approximately 4,677 persons currently to a service population of approximately 17,750 persons in 2019. The total population following ultimate build-out of the City's water service area is projected to be approximately 43,130 persons.

Demand Projections:

Future water system demands, which are directly proportional to the City's anticipated population growth, were also projected. It is generally prudent to make conservative demand projections for master planning purposes to identify the full range of potential level of service needs and ensure adequate infrastructure is planned to meet these potential needs. Based on the City's anticipated population growth, Average Daily Demand (ADD) for water service is projected to increase from approximately 486,543 gpd to approximately 2.9 MGD in 2019 and to approximately 6.3 MGD at ultimate build-out.

Recommended Water System Improvements:

Based on Envisors' analysis of the existing water system in consideration of current and projected water system demands, the following water system improvements are recommended to meet level of service requirements:

<u>Immediate Water System Improvements (See Figure 4):</u>

- (Project 1) Construction of 6-inch PVC water line (~64 LF) to create looping within Arnwine property along Mt. Olive Road;
- (Project 2) Replacement of existing 6" dead-end waterline throughout existing distribution system with 8" PVC pipe (~ 13,405 LF) and 10" PVC pipe (~ 4,000 LF);
- (Project 3) Interconnection of Polk City and Mt. Olive water distribution systems within Mt. Olive Shores North;

- (Project 4) Interconnection of existing stub out along Waterview Dr. to Mt. Olive Shores North;

- (Project 5) Construction of new 10-inch PVC water line (~4,600 LF) south of Mt. Olive Shores North and south of Mud Lake to provide looping with Mt. Olive Shores distribution system;

- (Project 6) Conversion of existing City Backup Water Production Facility (WPF #2) on Commonwealth Avenue to a well field including construction of a 12-inch PVC raw water line (~3,870 LF) from WPF #2 to the City's Primary WPF (WPF #1) located on N. Bougainvillea;

- (Project 7) Construction of improvements to WPF #1 to meet FDEP Chapter 62-555 F.A.C. performance and capacity requirements for water production facilities;

- (Project 8) Replacement of selected 2-inch water line with 6-inch PVC water line (~6,230 LF) throughout the City's distribution system; and

- (Project 9) Transfer of existing diesel generator from the WPF #1 to Mt. Olive WPF (following refurbishment of the WPF #1) to add emergency power at this location.

Year 2019 Water System Improvements (See Figure 6):

- (Project 10) Construction of a proposed new WPF #3 in the southern area of the City's projected service area south of I-4;

- (Project 11) Construction of 12-inch PVC raw water line (~7,600 LF) from the Mt. Olive WPF to the proposed WPF #3;

- (Project 12) Interconnect and improvements to existing Polk County Correctional Facility WPF;

- (Project 13) Construction of a new 16-inch PVC water line (~4,170 LF) from the proposed WPF #3 to interconnect with existing distribution system along Mt. Olive Road;

- (Project 14) Replacement of existing 6-inch and 8-inch water line along Mt. Olive Road with 12-inch PVC water line (~5,600 LF);

- (Project 15) Construction of 12-inch PVC water line (~1,770 LF) on SR 33 for emergency interconnection with City of Lakeland;

- (Project 16) Construction and replacement of existing 6-inch and 8-inch water line with 12-inch PVC water line (~11,120 LF) from proposed WPF #3 along Mount Olive Road and SR 655 to intersection of SR 655 and SR 33;

- (Project 17) Replacement of 10-inch water line with 12-inch PVC water line (~4,380 LF) from WPF #1 to intersection of SR 33 and Clearwater Ave;

- (Project 18) Replacement of 10-inch water line with 16-inch PVC water line (~400 LF) along Bougainvillea Ave.;

- (Project 19) Construction of 16-inch (~ 1,210 LF), 12-inch (~13,070 LF), and 10-inch (~2,180 LF) PVC water line from Polk County Correctional WPF to proposed 10-inch water line at the intersection of SR 557 and Hwy 559;

- (Project 20) Construction of 12-inch PVC water line (~12,260 LF) along Barfield Road;

- (Project 21) Construction of 6-inch PVC water line (~1,050 LF) along Orange Blvd.;

- (Project 22) Construction of new and replacement of existing waterline with 6-inch (~2,645 LF), 8-inch (~8,400 LF), and 10-inch (~7,180 LF) PVC water line connecting existing developed regions within the City's service area; and

- (Project 23) Construction of 6-inch (~23,340 LF), 8-inch (~20,840 LF), and 10-inch (~20,620 LF) PVC water line to provide service to projected development regions.

Ultimate Water System Improvements (See Figure 8):

- (Project 24) Construction of a proposed WPF #4 near Voyles Loop Road;

- (Project 25) Replacement of 10-inch water line along SR 33 with 12-inch PVC water line (~2,260 LF) from Clearwater Ave. to Lake Margaret Blvd.;

- (Project 26) Replacement of 10-inch water line along SR 557 with 12-inch PVC water line (~1,890 LF) from Bougainvilla Ave. to Bridges Rd.;

- (Project 27) Replacement of 8-inch water line along SR 557 with 10-inch PVC water line (~5,795 LF) from near Lakeshore Dr. to Hwy 559;

- (Project 28) Construction of 6-inch PVC water line (~7,020 LF) connecting existing developed regions within the City's service area; and

- (Project 29) Construction of 6-inch (~20,236 LF), 8-inch (~28,360 LF), 10-inch (~38,665 LF), and 12-inch (~20,700 LF) PVC water line to provide service to projected development regions.

Recommended Studies:

In addition to the above recommended capital improvement projects, it is recommended that the City perform the following studies/additional work to better define the proposed projects and better position itself for potential grant and loan funding assistance:

- Conduct a detailed water audit to identify and quantify the sources of water losses;

- Complete feasibility and/or preliminary engineering studies for all new water production facility projects to identify the appropriate project scope to be concurrent with future conditions;
- Prepare a water supply plan to ensure future water sources are identified and available for the City's water service area;
- Complete land purchase evaluation(s) as necessary for future facilities and lines;
- Maintain and regularly update existing water maps and associated hydraulic models for future development review;
- Conduct security vulnerability assessment(s) for all treatment plants and off-site infrastructure; and
- Prepare a Water System Master Plan update every five years.

Opinion of Probable Costs:

An opinion of probable costs for the recommended water system capital improvement projects was prepared to aid the City in developing a Capital Improvements Plan (CIP). The following is a summary of Envisors' opinion of probable costs (in 2008 dollars) for the needed water system capital improvement projects:

Water System Needs:

• Immediate	$ 5,207,216
• Year 2019	$ 17,236,410
• Ultimate	$ 10,809,971
Total:	$ 33,253,597

Potential Funding Sources:

Some of these improvements (such as off-site water line extensions) will likely be partially or completely funded by developers, assuming the City requires the improvements as a condition of development approval. Other potential funding sources for the needed water system improvements include the following:

- Development impact fees;
- United States Department of Agriculture (USDA) grant/loan program;
- Florida Department of Environmental Protection (FDEP) State Revolving Fund (SRF) loan program;
- Southwest Florida Water Management District (SWFWMD) Cooperative Funding Program (up to 75% grant funding w/ REDI designation); and
- Community Development Block Grant (CDBG) Program.

It is recommended that the City investigate and apply for funding assistance to construct the necessary utility system improvements. Water rate and impact fee studies should be performed and periodically updated to ensure that City's rates and impact fees are adequate to complement these grants/loans and adequately fund these improvements.

Implementation Schedule:

The water system capital improvement implementation schedules that are provided in this Water System Master Plan (immediate, year 2019, and ultimate) are believed to be based on the best available planning information currently available as provided to Envisors by City staff. Although the City is projecting very rapid growth in the near future based on current conditions, the precise implementation schedule for the recommended water system capital improvement projects should be reviewed annually and dependent upon the rate of development actually observed over the planning period. The predictability of where and when development will occur is difficult and projections of growth beyond 10 years are especially difficult. To accomplish this, City staff should develop a program to monitor actual water usage volumes and track known land development plans to develop a specific year-to-year implementation schedule and ensure that water system infrastructure capacity remains adequate over time and that funding for needed improvements is secured.

1.0 INTRODUCTION

1.1 Overview

The City of Polk City (City) anticipates future water system customer growth and desires to prepare a Water System Master Plan to serve as a guide in the future expansion and extension of its water system to provide adequate service to its water service area customers. Therefore, the City has contracted Envisors to prepare a Water System Master Plan. This document identifies needed improvements to the water system to meet current demands and projected demands for 10-year and ultimate service area build-out planning horizons.

1.2 Background

The City of Polk City is located in north central Polk County, Florida, generally centered around the intersection of State Road 33 (Commonwealth Boulevard) and State Road 655 (Berkley Road). The City's utility service area generally borders the utility service areas of the City of Lakeland to the west, the City of Auburndale to the south, and the City of Lake Alfred to the southeast. The Green Swamp is located directly north of the City of Polk City's water service area. The City is located approximately 40 miles southwest of the City of Orlando and approximately 40 miles east northeast of the City of Tampa. A location map is included as **Figure 1**. Polk City has a current population of approximately 4,700 persons and is one of 17 incorporated municipalities in Polk County.

The City operates a water utility system that services the majority of its residents within the City Limits. The City has recently acquired the Mt. Olive water production facility (WPF) from Polk County Utilities that services the Mt. Olive residential neighborhood located southeast of the City's existing service area.

2.0 SCOPE OF WORK

Based on discussions with City staff and the scope of work defined in Envisors' Contract, the City desires the specific issues/items listed below to be addressed in this Water System Master Plan Report.

(A) City's level of service requirements summary (fire flow, normal operating pressures, per capita use) as defined by the City;
(B) Approximate boundaries of the City's existing and future utility service area, as defined by the City;
(C) Population/customer evaluation and projections;
(D) Land use/customer classification evaluation;
(E) Review of utility system renewal and replacement program;
(F) Overview of present and anticipated future regulatory issues (compliance and permitting).
(G) Water distribution system mapping, based on existing water distribution system maps and other data provided by the City;

(H) Cursory evaluation of the physical condition of current water system infrastructure (plants, lines, tanks) that is visible, or based on specific information provided by the City;
(I) Water system flow demand estimates based on billing and plant data provided by the City;
(J) Future water system flow demand estimates;
(K) Water losses (cursory review);
(L) Overview of water metering issues;
(M) Available fire flow level of service;
(N) Raw water supply quantity adequacy exclusive of hydrogeological modeling;
(O) Water production facility capacity and water quality evaluation;
(P) Hydraulic analysis of the City's water distribution system to verify level of service adequacy including, but not limited to, pressure, average day flow, peak flow, and fire flow;
(Q) Water system improvement needs and options;
(R) Security requirements (overview);
(S) Auxiliary power requirements; and
(T) Cost estimate of water system capital improvements.

3.0 UTILITY CUSTOMERS

3.1 Current Customer Base

3.1.1 Current Land Use/Utility Service Area

The City Limits currently encompass approximately 2.3 square miles. The City's projected ultimate Utility Service Area, which extends beyond the City Limits, encompasses approximately 19.3 square miles. This service area boundary is based on ultimate growth projections provided by City staff and presents potential conflicts with the Southwest Water Management District Water Use Permit service areas of the City of Auburndale to the south, and the City of Lake Alfred to the east. The City has a small central business district centered generally around the intersection of State Road 33 (Commonwealth Avenue) and State Road 655 (Broadway Boulevard) which is comprised of commercial, industrial, and governmental buildings.

The majority of areas within the City Limits include water mains within a reasonable distance. The majority of the utility service area outside of the City Limits is currently without water service.

3.1.2 Current Customers

Information regarding the number of current utility customers was obtained from the City's utility billing department. The City currently has approximately 1,670 water customers inclusive of the recently acquired Mt. Olive water system.

3.2 Projected Customer Base

3.2.1 Future Utility Service Area

The Utility Service Area of Polk City is surrounded on all sides by other Utility Service Areas and the Green Swamp as described in **Section 1.2**. Bordering service areas include the City of Lakeland, the City of Auburndale, and the City of Lake Alfred. The Utility Service Area is ultimately expected to expand significantly beyond its current limits. Major factors that will drive future service area and demand growth for the City include, but are not limited to the USF Polytech Facility that is being constructed just south of the City's service area, general demographic trends for Florida, and the advantageous location of the City along I-4 between Tampa and Orlando.

3.2.2 Growth Projection Methodology

The development of accurate growth projections is critical to the master planning process. Growth projections for this Water System Master Plan were based upon development information provided by City planning staff including the locations of known named developments and more generalized future land use areas. For the purpose of presenting the growth projections, the defined areas of projected population growth were assigned reference numbers that are used on **Table 1** and illustrated on **Figure 2**. The growth projections were subdivided into growth areas anticipated to occur within the next 10 years (by year 2019) and ultimate (beyond 2019). The following is a generalized summary of the anticipated growth:

- Residential Growth: There are a total of 20 residential growth areas projected to occur within the next 10 years. The majority of the 10-year residential growth areas are named developments that are already in some phase of development review by the City. Also included in the 10-year growth projections is expansion of water lines to service several neighborhoods currently supplied water via private shallow wells. There are six additional residential growth areas anticipated to ultimately occur beyond the year 2019. The ultimate residential growth areas include two large primarily undeveloped land areas to the east and west of the City's current utility service area.

- Industrial Commercial Growth: There are a total of nine commercial growth areas projected to occur within the next 10 years. The majority of the 10-year commercial growth areas are specific commercial development projects that City staff has knowledge of. There are three commercial growth areas anticipated to ultimately occur beyond the year 2019.

3.2.3 Year 2019 Projected Population

Population growth estimation based upon the above-described City provided development information is summarized on **Table 1**. A total of 4,669 new equivalent dwelling units (EDUs) were projected to be provided service by year 2019. Multiplying this number of EDUs by 2.8 persons per household in Polk City (based on year 2000 U.S. Census data) yields an additional 13,074 persons. The total projected service population for year 2019 including the current serviced population is 17,750 persons. This 10 year growth represents a 380% total (14.3% annual) increase over the current serviced population of 4,677 persons.

Although the population for the City of Polk City has remained relatively constant in years past, the projected large population increases in the near future are believed to be reasonable in consideration of the following:

- Most of the growth areas include developments which are already being constructed or are in the City's development review process. These developments alone will result in over 3,995 new homes (approximately 11,186 residents).
- Several other municipalities within Polk County have experienced or are projecting similar rapid growth rates including Auburndale, Dundee, Haines City, and Lakeland.
- It is prudent to utilize conservative growth estimates for master planning efforts.

3.2.4 Ultimate Projected Population

The projection of the ultimate population for the City's service area is provided on **Table 1**. The ultimate projected population was estimated by assuming complete build-out of all City staff identified development areas and complete build-out of the remainder of the City's utility service area outlined on **Figure 2**. Based on discussions with City staff these extremely large areas are projected to contain 2.5 EDUs per acre. This value is used because large amounts of these regions will be dedicated to storm water management ponds, roadways, utility rights-of-way, and other uses which do not have utility demands.

Including the year 2019 projected development, a total of 13,733 new EDUs are projected following complete build-out of the City's utility service area. Multiplying this value by 2.8 persons per household in Polk City based on year 2000 U.S. Census data yields 38,453 persons. The total ultimate projected service population including the current population is 43,130 persons. This growth represents a 922% total increase over the current population of 4,677 persons. If the 10 year projected growth rate of 14.3% remains constant, this ultimate population growth will occur in approximately 16.6 years. Assuming a more conservative 10% growth rate, the ultimate population would occur in approximately 23.3 years.

4.0 WATER SYSTEM

4.1 Water System Level of Service Standards

For the purpose of this Water System Master Plan, appropriate level of service standards were established to provide an evaluation basis for the adequacy of water service for current and projected future demands. The following general level of service standards are based on FDEP Chapter 62-555 F.A.C., Recommended Standards for Water Works (10 State Standards), and other City-provided level of service standards:

- Minimum raw water supply as required under FDEP Chapter 62-555 F.A.C.;
- Minimum water storage as required under FDEP Chapter 62-555 F.A.C. and 10 State Standards;
- Minimum backup reliability as provided in FDEP Chapter 62-555 F.A.C.;
- Minimum high service pumping capacity as provided in FDEP Chapter 62-555 F.A.C.;
- Emergency power requirements as provided in FDEP Chapter 62-555 F.A.C. and 10 State Standards;
- Security requirements as provided in FDEP Chapter 62-555 F.A.C. and 10 State Standards; and
- Minimum fire flow planning requirements of 500 gpm at 20 psi residual pressure for residential areas and 1,000 gpm at 20 psi residual pressure for industrial/commercial areas as established by City staff.

4.2 Water System Demands

4.2.1 Current Water System Demands

Current water system demand data was obtained from the Southwest Florida Water Management District (SWFWMD) Water Information System (WMIS) average of the year 2007 average daily pumping. The current water system has an average day demand of approximately 486,543 gpd. The water demand has remained relatively constant with some gradual increases over recent years.

Water use quantity data for the 25 largest users was provided by City Staff based on Year 2007 data. The largest user was Lelynn RV Resort (8,3312 gpd), which is less than the significant user classification (25,000 gpd) as defined by the SWFWMD.

4.2.2 Projected Water System Demands

Population projections and future land use information provided by the City were utilized to project water system demands for year 2019 and the ultimate utility service area build-out. The methodology used for projecting future water demand increases for the established growth areas was to multiply the projected population increases by a per capita water consumption of 132 gallons per capita per day (gpcd). The per capita consumption rate of 132 gpcd is a conservative value used for this Water System Master Plan that is higher than the per capita consumption rate stated in the City's current Water Use Permit (128 gpcd). Although future water system conservation measures could lower the per capita consumption somewhat, this higher value was used in order to remain conservative.

Year 2019 and ultimate demand projections are included on **Table 1**. The projected average daily demand (ADD) increase in water use by year 2019 over current demands is approximately 2.4 MGD. This represents an increase of 488% over the current water system demand (486,543 gpd). The projected ultimate increase in water use over current demands is approximately 5.8 MGD. This represents an increase of 220% over the year 2019 projected water system demands.

Based on information provided by City staff, no significant users (> 25,000 gpd) are anticipated to connect to the water system in the near future.

4.2.3 Water Loss Evaluation

Comparison of City WPF pumping records versus City water billing records allows for a rough evaluation of unaccounted water. Data from the months of January 2007 through December 2007 shows pumping record quantities totaled approximately 102.5 million gallons. City billing records for the months of January 2007 through December 2007 indicate approximately 92.1 million gallons of water usage. This indicates water losses of approximately 10.1%. This amount of unaccounted for water is below the current SWFWMD guidelines for water use permitting, which state water losses above 12% require remedial actions to be taken.

A formal water loss study has not been performed by the City in recent years. A water loss study should be performed by the City to determine the sources of water loss. Possible sources of water losses could include line leaks, under-reporting customer flow meters, and unrecorded water main flushing events.

4.3 Water System Infrastructure

4.3.1 Water Production Facilities

The City owns and operates two water production facilities (WPFs), WPF #1 and WPF #2 and has recently acquired the Mount Olive WPF from Polk County Utilities. The location of each WPF is illustrated on **Figure 2**. **Table 2** summarizes the various design components and capacities of WPF #1, WPF #2, and Mt. Olive WPFs. Photographs of the WPFs are included in **Appendix A**.

4.3.1.1 Water Production Facility #1

The Primary WPF (WPF #1) for the City of Polk City is located behind Polk City's recently completed City Hall facility on N. Bougainvillea Boulevard in the north-central region of the City's existing service area (**Figure 2**) and includes one water production well, a sodium hypochlorite disinfection system, and one 20,000 gallon hydro-pneumatic tank.

The on-site production well providing raw water is equipped with a well pump that has a capacity of approximately 650 gpm. The well pump delivers water to the 20,000 gallon hydro-pneumatic tank via a 12-inch diameter pipe. A sodium hypochlorite system provides disinfection to the raw groundwater prior to entry into the hydro-pneumatic tank. The hydro-pneumatic tank provides a pressure range used to manage flow to the water distribution system. A diesel-powered generator is included to provide emergency power.

The hydro-pneumatic tank currently operates at a pressure range between 51 and 71 psi according to City utility staff.

WPF #1 has reportedly recently undergone renovations including the installation of the emergency generator. At this time WPF #1 is working properly and there are no complaints from operators regarding individual pieces of equipment.

4.3.1.2 Water Production Facility #2

WPF #2 includes one water production well, a sodium hypochlorite disinfection system, and a chlorine contact tank. WPF #2 is located adjacent to the intersection of SR 33 and Berkley Road (SR 655). There is currently no backup power at this WPF.

According to City utility staff, problems exist running WPF #2 when WPF #1 is also in operation. WPF #2 includes a chlorine contact tank used ensure proper contact time for disinfection, but the well pump on/off controls are based on the operating levels of the hydro-pneumatic tank located at WPF #1. Due to the difficulty in

operating both plants, WPF #2 is not operated under normal conditions. However the City's existing SWFWMD water use permit (WUP) requires the projected year 2013 groundwater withdrawal to be split approximately equally between WPF #1 and WPF #2 wells.

The well pump at WPF #2 has a rating of approximately 400 gpm. A field test is necessary and recommended to determine the actual capacity of the well pump.

If the City desires to operate WPF #2 more frequently and in conjunction with WPF #1, system modifications will be necessary.

4.3.1.3 Mount Olive Water Production Facility

The Mt. Olive WPF and service area was recently acquired from Polk County Utilities and is located in the southern portion of the City's utility service area north of Mt. Olive Road. The WPF includes two water production wells, a sodium hypochlorite disinfection system, and two 10,000 gal hydro-pneumatic tanks.

The on-site production wells providing raw water have well pump capacities of approximately 650 gpm and 1,000 gpm, respectively. Each well pump delivers water via a manifold piping system to the 10,000 gallon hydro-pneumatic tanks, which operate in parallel. A sodium hypochlorite system provides disinfection to the raw groundwater prior to entry into the hydro-pneumatic tanks. The hydro-pneumatic tanks provide a pressure range between 50 and 60 psi to manage flow to the water distribution system. Currently there is no backup power at the Mt. Olive WPF.

4.3.2 Water Distribution System

Available as-built drawings of completed water line projects were provided by the City and utilized to construct a map of the existing Polk City water distribution system. In addition, City utility staff reviewed the water distribution system map, and some revisions were made to water line locations/sizes based on their personal knowledge.

The water system was mapped with the best available resources and knowledge of the system without excavation of water lines. It is believed to be reasonably accurate for the purpose of this Water System Master Plan. However, it should not be considered an exact representation of the water distribution system, as some historical records of water line improvements and repairs may have not been maintained. No as-built drawings were available for the existing Mt. Olive system recently acquired from Polk County Utilities, and, as such, assumptions regarding water line sizes and locations were required for this area.

The map of the current water distribution system is included (**Figure 3**). Exact pipe materials for the entire water distribution system are not known and, as such, are not represented on the map. However, it is likely that many of the older water lines in the central portion of the City are constructed of cast iron or galvanized steel pipe. Newer water lines are constructed of PVC pipe.

4.4 Water Production Facilities Analysis

4.4.1 Raw Water Production Capacity

Raw water production for the City of Polk City is accomplished via pumping of one water supply well serving WPF #1 with a reported capacity of approximately 650 gpm, one water supply well serving WPF #2 with pumping capacity of approximately 400 gpm, and two water supply wells serving the Mt. Olive WPF with a combined pumping capacity of approximately 1,650 gpm. Therefore, the total combined raw water production capacity for the City of Polk City water supply system is approximately 2,700 gpm. WPF #2 is not currently operated under normal conditions according to City staff.

The design criteria for raw water production capacity in accordance with Chapter 62-555 F.A.C. for water supply systems serving 350 or more persons utilizing only groundwater for water supply is summarized as follows:

- A minimum of two wells shall be connected to each water supply system.
- The total well capacity shall equal at least the system's design maximum-day water demand including design fire flow.
- The total well capacity with the largest producing well out of operation shall equal at least the design average day water demand and preferably the design maximum day water demand for the system.

The City's Water Use Permit (WUP) was issued in April of 2007 and expires in December of 2013. The WUP allows for an annual average pumpage quantity of 967,200 gpd and a peak month pumpage quantity of 1,238,000 gpd. Due to the unpredictability of future WUP requirements, water use permit planning is outside the scope of this Water System Master Plan. However, this document does provide consideration for current trends in SWFWMD water use permitting, which generally favor spreading out of water supply wells to minimize localized impacts. Additionally, the requirements set forth in current SWFWMD Central Florida Coordination Area rules are considered in locating future WPFs.

4.4.1.1 Current Conditions

An analysis was performed to determine if the currently available raw water production capacity is adequate to serve current demands. A summary of this analysis is included in **Table 3**. Although WPF #2 is not normally operational, raw water supply from this facility was considered in the analysis. With these assumptions, the analysis indicates the current raw water supply of 2,700 gpm meets the established design criteria.

4.4.1.2 Future Conditions

An analysis was performed to determine if the raw water production capacity is adequate to serve projected demands for year 2019 and the ultimate build-out. A summary of this analysis is included in **Tables 4 and 5**. The analysis indicates the currently available raw water supply (2,700 gpm) does not fully meet design requirements for projected year 2019 (4,975 gpm) or ultimate (9,760 gpm) demands. Additional raw water supply will need to be added to satisfy projected future water system demands.

4.4.1.3 Needed Improvements

New water supply wells/well pumps will be needed to meet projected year 2019 water use demands. A minimum of 2,275 gpm of new total raw water supply capacity will be required between all water production facilities (**Table 4**). Actual well yields and locations for new wells will need to be determined via aquifer performance testing and groundwater modeling in conjunction with SWFWMD water use permitting.

In order to meet projected ultimate build-out demands, a minimum of 8,000 gpm of new total raw water supply capacity will be required between all water production facilities (**Table 5**). Actual well yields and locations for new wells will need to be determined via aquifer performance testing and groundwater modeling in conjunction with SWFWMD water use permitting.

4.4.2 Water Storage

Current City water system storage consists of three hydro-pneumatic tanks, one located at WPF #1 and two at the Mt. Olive WPF. The hydro-pneumatic tanks include a 20,000 gallon tank at WPF #1, and two 10,000 gallon tanks at the Mt. Olive WPF. WPF #2 also has a steel tank to ensure adequate chlorine contact time for disinfection but is not operated as a hydro-pneumatic tank and, therefore, was not included in the analysis of existing storage.

Without considering the City's WPF #2, the City's water system is currently limited to 20,000 gallons of operational storage (estimated to be 50% of tank volume) provided by the three hydro-pneumatic tanks.

The design criteria for water storage in accordance with Chapter 62-555 F.A.C. is summarized as follows:

- The total finished water storage capacity (excluding any storage capacity for fire protection) connected to a water system shall at least equal 25 percent of the water system's maximum-day water demand, or

- The water system's total useful finished water storage capacity (excluding any storage capacity for fire protection) must be sufficient to meet the water system's peak hour water demand for at least four consecutive hours.

For small systems utilizing hydro-pneumatic tanks:

- In conjunction with the capacity of the water system's source, treatment, and finished-water pumping facilities, the water system's total useful finished-water storage capacity (i.e., the water system's total effective hydro-pneumatic tank volume) is sufficient to meet the water system's peak instantaneous water demand for at least 20 consecutive minutes.

- 10 State Standards states that water systems serving more than 150 customers shall have ground or elevated storage.

4.4.2.1 Current Conditions

Since the City of Polk City serves over 1,800 customer connections with its hydro-pneumatic tank system, the threshold value for number of customers that may be serviced via a hydro-pneumatic tank system (150) is greatly exceeded in accordance with Ten State Standards.

An analysis was performed to determine the required storage capacity to serve current demands (**Table 6**). The analysis performed was based on construction of ground storage reservoirs since hydro-pneumatic tanks are only recommended for small water systems and would not be appropriate for the expansion of the Polk City water system. The analysis indicates a total of approximately 120,362 gallons of new storage will be required to meet the design criteria for current demands.

4.4.2.2 Future Conditions

An analysis was performed to determine what storage capacity will be required to serve projected year 2019 and ultimate demands (**Tables 7 and 8**). The analysis performed was based on construction of ground storage reservoirs since hydro-pneumatic tanks are only recommended for small water systems and would not be sufficient for the expansion of the Polk City water distribution system. The analysis indicates a total of 1,550,960 gallons of new storage will be required to meet the design criteria for year 2019 projected demands. To meet the design criteria for ultimate demands, a total of 3,161,000 gallons of new storage will be required.

4.4.2.3 Needed Improvements

In order to meet FDEP finished water storage requirements for current demands, replacing the existing hydro-pneumatic tank at the WPF #1 with a 500,000 gal GSR and high service pumping would be sufficient to meet existing storage requirements with some additional storage for projected growth. Sufficient space exists on the City-owned WPF #1 property to construct the new GSR.

In order to fully meet design criteria for projected year 2019 and ultimate water system demands, it is recommended that a feasibility study be performed to determine the location that additional storage capacity should be constructed. The location where the additional storage is to be constructed will be affected to some extent by future water supply permitting requirements. A total of 3,161,000 gallons of new finished water storage will ultimately be required between all facilities based on projected ultimate demands (**Table 8**).

4.4.3 High Service Pumping

High service pumping for the City of Polk City water supply system is accomplished via the well pumps located at each of the City's WPFs. The City's combined total high service pumping capacity is 2,700 gpm.

The design criteria for water systems in accordance with Chapter 62-555 F.A.C. is summarized as follows:

- The total high service pumping capacity shall at least meet the water system's peak hour water demand.

- The total high service pumping capacity shall at least meet the water system's maximum day demand plus fire flow demand.

- The system must maintain a minimum pressure of 20 psi throughout the water system's service area.

- A standby high service pump (either installed or uninstalled) must be provided that is of sufficient capacity to replace the largest high service pump at each WPF, and only one standby high service pump is required if the pump may be used to replace pumps at multiple WPF locations.

4.4.3.1 Current Conditions

An analysis was performed to determine if the high service pumping capacity is adequate to meet current demands. A summary of this analysis is included in **Table 9**. Although back-up WPF #2 is functional but not normally run (400 gpm), the analysis indicates currently available high service pumping capacity does meet the design requirements for current demands and design criteria with the capacity of WPF #2 included.

4.4.3.2 Future Conditions

An analysis was performed to determine what high service pumping capacity is needed to meet projected year 2019 and ultimate demands. A summary of this analysis is included in **Tables 10 and 11**. In order to meet the design criteria for year 2019 demands, an additional 7,000 gpm over the existing available high service pumping capacity will be required. In order to meet design criteria for the ultimate demands, an additional 15,400 gpm over the existing available high service pumping capacity will be required.

4.4.3.3 Needed Improvements

High service pumping improvements are immediately needed in order to meet design criteria for current demands. As it is recommended in Ten State Standards that only small systems be served by hydro-pneumatic tanks, it is recommended that WPF #1 be modified with the addition of a GSR and high service pumps with a dedicated raw water transmission line from the well located at WPF #2. A new motor control center will be required with the new high service pumps. It is recommended that the high service pumps include VFD motor controls in order to provide operators increased control of the distribution system. Adequate space exists on the existing City-owned WPF #1 property to install a new GSR and a building to house new high service pumps and motor control center.

In order to fully and cost effectively meet design criteria for projected year 2019 and ultimate water system demands, it is recommended that a feasibility study be performed to determine the

location(s) of construction and additional capacities of high service pumping facilities. This feasibility study should include an economic and operational analysis that includes the alternative of constructing elevated storage facilities to reduce the quantity of additional high service pumping needed based on detailed future system operational data (diurnal demand/pressure curves) once such operational data is available. The location where the additional high service/elevated storage is to be constructed will be affected to some extent by future water supply permitting requirements. A total of 15,400 gpm of high service pumping capacity will ultimately be needed between all facilities (not considering the possible construction of elevated storage) based on projected ultimate demands (**Table 11**).

4.5 Water Distribution System Analysis

4.5.1 Water Line Condition

Many of the City's water distribution lines are greater than 20 years old. The City's water lines are reportedly constructed of a combination of ductile iron, galvanized steel, and PVC.

The potential for future water line breaks should be reduced by the construction of new VFD high service pumps at WPF #1 and future WPFs. Utilization of VFD pumps will reduce pressure surges through constant pressure discharge of the pumps.

4.5.2 Water Distribution System Hydraulic Modeling

A generalized hydraulic model of the City's water distribution system was prepared in order to aid in the evaluation of the following:

- Operating conditions of the water distribution system under the current system configuration using current system demands;
- The effect of additional demands on the City water system from projected growth for year 2019 and ultimate build-out;
- The capability of the water system to deliver fire flows; and
- The effects of various water production facilities and water distribution system improvements on current and projected system demands.

4.5.2.1 Water Distribution System Model Development

The WaterCAD Version 8.0 software package (WaterCAD) was utilized to model the water distribution system. WaterCAD uses the Hazen-Williams formula as a basis for calculating head loss through system pipes.

The model piping network was set up using the best available water system maps developed through interaction with City utility staff as described in **Section 4.3.2**. Elevations for the piping distribution network were approximated in the model based on SWFWMD-supplied topographic shapefiles that use elevation data derived from USGS quadrangle maps. Aerial photography was used to increase the legibility of the model maps.

The pipe friction coefficient "C" input value utilized in the Hazen-Williams empirical equation for pipe flow is an index of pipe hydraulic capacity with lower "C" values representing higher pipe friction losses. The "C" value is dependent upon a number of factors including pipe material, pipe age, cross-sectional area, and amount of pipe tuberculation. As pipe materials, pipe age, and amount of pipe tuberculation are unknown for most of the water distribution piping system, a "C" value of 120 was selected for all model pipes. For comparison, PVC has a "C" value of 150 and concrete has a "C" value of 110.

Water production facility design information including tank sizes and pump characteristics was provided by City utility staff and used to develop the model. Water production facilities were simulated simplified as elevated reservoirs in the model.

Overall water system demands based on historical well pumping data obtained from the SWFWMD for year 2007 was input into the model. Demands for the largest 25 users were inserted at the appropriate geographic locations within the model. The remaining user demands were divided equally among the remaining model nodes.

Water system demand peaking factors were based on the following published and commonly accepted values:

- Average day demand (ADD): 1.0 peaking factor;
- Maximum day demand (MDD): 2.0 peaking factor; and
- Peak hour demand (PHD): 3.0 to 4.0 peaking factor

These peaking factors were utilized for various modeling simulations as described in following sections. The PHD peaking factor typically decreases as population increases. It was assumed that a PHD peaking factor of 4.0 was appropriate for the existing conditions model. A 3.5 PHD peaking factor was used for year 2019 and ultimate modeling simulations.

4.5.2.2 Water Distribution System Hydraulic Model Limitations

The hydraulic model developed for the City of Polk City has a number of limitations that may affect the accuracy of the model including the following:

- Model setup is based on the best available water distribution system maps and WPF infrastructure information provided to Envisors by City utility staff.

- Field calibration efforts to help maximize model accuracy were not included under Envisors' contract for this work and, therefore, have not been completed;

- "Current" model demands are representative of the year 2007, based on well pumping data obtained by Envisors from the SWFWMD; and

- Model output is representative of simulated system demands for year 2007 and for future projected system demands.

4.5.2.3 Modeling Simulations using Current Demands

Multiple hydraulic modeling simulations were performed to determine the current operating characteristics of the City's water distribution system. The purpose of the current system modeling simulations was to identify possible current deficiencies in the water distribution system network under ADD, PHD, and MDD with fire flow conditions.

The City and Mt. Olive water systems were modeled as separate systems for the current demand modeling simulations. Flow control valves set to the well pump capacities for each of the two existing WPFs were used for simulations of the current system, because flow capacities from both of the existing hydro-pneumatic tank WPFs are limited by well pump flows, especially for fire flow simulations.

The fire flow modeling simulations were set up to simulate fire flow throughout all model node locations while maintaining a 20 psi residual pressure at all node locations.

Plots of water system modeling simulation results are included in **Appendix B** as follows:

- **Figure B-1**: Existing ADD Simulation;
- **Figure B-2**: Existing PHD Simulation; and
- **Figure B-3**: Existing MDD Fire Flow Simulation.

Appendix B **Figures B-1 and B-2** illustrate pressures via color coding at model node locations as well as line sizes. Appendix B **Figure B-3** illustrates the available fire flow under MDD conditions via color coding at model node locations as well as line sizes.

The results of the current system hydraulic modeling simulations are summarized in **Table 12**. The following are major conclusions based on the modeling simulations that were performed:

- System pressures range from greater than 40 psi to less than 80 psi throughout the City's service area under ADD conditions and from greater than 30 psi to less than 80 psi under PHD conditions.

- The capacity of the current system to supply 500 gpm fire flows under MDD conditions is generally adequate in the Polk City service area, but is limited throughout the Mt. Olive WPF service area.

- The capacity of the current system to supply 1,000 gpm of industrial/commercial fire flows under MDD conditions was simulated to be inadequate and only available within a small portion of residential area surrounding the Mt. Olive WPF.

It is assumed that the City will be interconnecting the existing Polk City distribution system and the Mt. Olive WPF distribution system in the near future. A MDD fire flow simulation was performed to determine the affect of the interconnection on the modeled distribution system. The capacity of the interconnected system to provide fire flow of > 1,000 gpm in commercial areas greatly increased and was generally adequate. Fire flows in excess of 1,000 gpm were modeled to be available along SR 33 and along SR 55 from intersection with SR 33 to the intersection with Lakeshore Dr.

Additional modeling runs were performed following the addition of various potential system improvements to the current water distribution model. The system improvement modeling simulations were performed under ADD, PHD, and MDD with fire flow conditions. The potential system improvements that were simulated included improvements that were observed to be needed based on results of the current system modeling. The following are the system improvements that were simulated:

- Interconnection of Polk City and Mt. Olive water distribution systems;

- Construction of 6-inch water line to create looping within Arnwine property along Mt. Olive Rd;

- Replacement of existing 6-inch dead-end water lines throughout the existing distribution service area with 8-inch and 10-inch water line;

- Interconnection of existing stubout along Waterview Drive to Mt. Olive Shores North;

- Construction of 10-inch water line south of Mt. Olive Shores North and south of Mud Lake to provide looping with Mt. Olive distribution system;

- Conversion of existing WPF #2 to a well field including construction of 12-inch raw water line from WPF #2 to WPF #1;

- Refurbishment of WPF #1 to meet FDEP Chapter 62-555 F.A.C. requirements for water production facilities;

- Replacement of selected 2-inch water lines with 6-inch water lines at various locations throughout the City's distribution system; and

- Transfer of existing backup generator from WPF #1 to Mt. Olive WPF following refurbishment of WPF #1 (includes new generator at WPF #1).

Figure 4 illustrates the locations of the immediate system improvements (color-coded by pipe diameter) along with existing water lines (shown colored grey). **Figure 5** shows the improvements with both existing and immediate system improvement water lines color-coded based on pipe diameter. Plots of water system modeling simulation results are included in **Appendix B** as follows:

- **Figure B-4**: Existing ADD Simulation with Immediate Improvements; and

- **Figure B-5**: Existing PHD Simulation with Immediate Improvements; and

- **Figure B-6**: Existing MDD Fire Flow Simulation with Immediate Improvements.

Appendix B **Figures B-4 and B-5** illustrate pressures via color coding at model node locations as well as line sizes. Appendix B **Figure B-6** illustrates via color coding the available fire flow under MDD conditions at model node locations and line sizes.

The results of the existing system hydraulic modeling simulations with improvements are summarized in **Table 13**. The following are conclusions based on the modeling simulations that were performed:

- Interconnecting of the Polk City and Mt. Olive distribution systems with additional system looping improves system pressures throughout both service areas;

- Conversion of WPF #2 to serve as a wellfield for WPF #1 enhances groundwater withdrawal management for compliance with existing Southwest Florida Water Management District (SWFWMD) Water Use Permit;

- Modifications to WPF #1 allow storage and high service pumping requirements set forth in FDEP Chapter 62-555 F.A.C. to be met; and

- Replacement of small diameter water lines in residential areas with 6-inch lines allows minimum fire flow level of service requirements (500 gpm) to be reasonably met for residential areas.

4.5.2.4 Year 2019 Modeling Simulations

Modeling simulations for year 2019 were based on the model with immediate system improvements. WPF #2 was included as a well field contributing to WPF #1 in the Year 2019 modeling simulations. The following additional improvements were then added:

- New WPF #3 located south of Interstate 4;

- Construction of raw water line from Mt. Olive WPF to a proposed new WPF #3, which would convert the Mt. Olive WPF wells into a wellfield supplying WPF #3.

- Interconnection of modified Polk County Correctional Facility WPF with City's distribution system; and

- Various new and upsized water system trunk lines to meet projected Year 2019 development demand and fire flow.

Multiple hydraulic modeling simulations were performed using projected year 2019 demands to determine the year 2019 operating characteristics of the Polk City water distribution system. The purpose of the year 2019 system modeling simulations was to identify possible future deficiencies in the water distribution system network under projected ADD, PHD and MDD plus fire flows.

Figure 6 illustrates the locations of the year 2019 system improvements (color-coded by pipe diameter) with existing water lines including immediate improvements (shown colored grey). **Figure 7** shows both existing and year 2019 system improvement water lines color-coded based on pipe diameter. The results of the year 2019 system hydraulic modeling simulations are summarized in **Table 14**. Plots of water system modeling simulation results are included in **Appendix B** as follows:

- **Figure B-7**: Year 2019 ADD Simulation;
- **Figure B-8**: Year 2019 PHD Simulation; and
- **Figure B-9**: Year 2019 MDD Fire Flow Simulation.

The following are major conclusions based on the modeling simulations that were performed:

- The year 2019 improvements provide adequate service under ADD and PHD demand conditions;
- The residential fire flow criteria (500 gpm under MDD conditions) and industrial/commercial fire flow criteria (1,000 gpm under MDD conditions) were met with the proposed year 2019 improvements; and
- The sizes of the representative trunk lines that were added for the growth areas (**Figure 6**) were shown to be adequate to provide flow for projected year 2019 demands.

4.5.2.5 Ultimate Modeling Simulations

Modeling simulations for ultimate build-out were based on the year 2019 model with all proposed previous improvements as a starting point. Major trunk lines to reach projected growth areas and projected ultimate demands were then added to the model. Based on the initial Ultimate distribution system modeling analysis, an additional WPF in the northwest area of the projected ultimate utility service area was determined necessary to meet projected ultimate demands. These improvements were also included in the ultimate modeling simulations.

Multiple hydraulic modeling simulations were performed to determine the operating characteristics of the Polk City water distribution system under projected ultimate demand conditions. The purpose of the ultimate system modeling simulations was to identify possible future deficiencies in the water distribution system network under projected ADD, PHD, and MDD plus fire flow.

Figure 8 illustrates the locations of ultimate system improvements (color-coded by pipe diameter) along with existing water lines including year 2019 improvements (shown colored grey). **Figure 9** shows both existing and ultimate system improvement water lines color-coded based on pipe diameter. The results of the ultimate system hydraulic modeling simulations are summarized in **Table 15**. Plots of water system modeling simulation results are included in **Appendix B** as follows:

- **Figure B-10**: Ultimate ADD Simulation;
- **Figure B-11**: Ultimate PHD Simulation; and
- **Figure B-12**: Ultimate MDD Fire Flow Simulation.

The following are major conclusions based on the modeling simulations performed:

- The proposed ultimate improvements provide adequate service for projected ultimate ADD and PHD conditions.
- The residential fire flow criteria (500 gpm under MDD conditions) and industrial/commercial fire flow criteria (1,000 gpm under MDD conditions) were met with the ultimate system improvements.
- Sizes of the representative trunk lines for the growth areas (**Figure 8**) were shown to be adequate to provide flow for projected ultimate demands.

4.5.3 Summary of Needed Water Distribution System Improvements

Based on the hydraulic modeling simulations performed, **Table 16** summarizes immediate, year 2019, and ultimate needed water distribution system capital improvements. **Figures 4, 6, and 8** illustrate needed water distribution system improvements for immediate, year 2019, and ultimate projected demands, respectively.

Trunk line improvements are proposed with the future in mind. It is believed that the improvements described herein will require minimal up sizing in the future. Upgrading of trunk lines is always a possibility if system demands differ either in quantity or spatially from projections, but the goal of this Water System Master Plan is to minimize the likelihood that this will occur.

4.6 Additional Water System Review Topics

4.6.1 Water Supply Planning

Due to the unpredictability of future water use permitting requirements, water supply planning is outside the scope of this Water System Master Plan. The City of Polk City is within the boundaries of the established Central Florida Coordination Area (CFCA). The current CFCA rules that apply to the City stipulate that no additional groundwater withdrawals may be permitted beyond the year 2013. Current CFCA rules for the Southern Water Use Caution Area (SWUCA), which has Interstate 4 for a northern boundary, are different in that additional groundwater withdrawals beyond the year 2013 would be allowed. Envisors has had general discussions with SWFWMD staff regarding this issue. In general, SWFWMD staff seemed to understand the relative inequity of the current CFCA rules as they apply to the City of Polk City. SWFWMD staff stated that the CFCA rules are scheduled to sunset in 2013 and that the new rules that will need to be drafted may very well allow additional groundwater withdrawals north of Interstate 4.

This Water System Master Plan does provide consideration for current trends in SWFWMD water use permitting, which generally favor spreading out of water supply wells to minimize localized impacts. Additionally, the requirements set forth in the current SWFWMD CFCA rules are considered in locating future WPFs. Specifically, the proposed new WPF #3 is located within the SWUCA in a location where additional groundwater withdrawals would be allowed beyond the year 2013 under current CFCA rules, should the current rules mandating no further groundwater withdrawals for areas outside of the SWUCA be carried over following rule revisions that will take place in 2013.

4.6.2 Security Review

FDEP Chapter 62-555.315(1) F.A.C. requires that all wellheads must be properly secured from tampering or vandalism by fences with lockable access gates or lockable buildings. City wells currently meet these minimum requirements. City staff should, however, consider additional security in the form of alarm systems and closed-circuit television monitoring at all current and future WPFs.

The U.S. Bioterrorism Act requires that drinking water utilities serving more than 3,300 persons must conduct a vulnerability assessment, certify that the assessment has been completed, and submit a copy of the assessment to the EPA. In addition, an emergency response plan that outlines response measures to be taken should an incident occur must also be completed and submitted to the EPA. The required vulnerability assessments help water utilities evaluate their susceptibility to potential threats and identify corrective actions to reduce or mitigate the risk of serious consequences from vandalism, insider sabotage, or terrorist

attack. With the acquisition of the Mt. Olive WPF, the City has surpassed serving the minimum 3,300 persons and should be aware of this requirement.

If the City has not done so already, it is recommended that the vulnerability assessment and emergency response plan be submitted to EPA as soon as possible. The plan should be appropriately updated as system improvements are made.

4.6.3 Backup Power

Per FDEP Chapter 62-555.320(14) F.A.C. by no later than December 31, 2005, each community water system serving, or designed to serve, 350 or more persons or 150 connections shall provide standby power for operation of that portion of the system's water source, treatment, and pumping facilities necessary to deliver drinking water meeting all applicable primary or secondary standards at a rate at least equal to the average daily water demand for the system.

WPF #1 currently has a backup generator with automatic transfer switch installed. The generator is sized to provide backup power to the existing well pump and sodium hypochlorite disinfection system.

Functional backup power is not available at WPF #2 or Mt. Olive WPF. WPF #2 is not run under normal circumstances and backup power is unnecessary at this time. A diesel-powered emergency generator should, however, be installed at the Mt. Olive WPF to meet reliability requirements.

In order to comply with FDEP emergency power requirements, diesel-powered generators with automatic transfer switches will be required at new WPFs for ultimate demands. It is recommended that these generators be sized to provide simultaneous power for all WPF pumps and components for each respective water plant. This will allow the WPFs to remain in full operation during power outages.

4.6.4 Repair and Replacement Program

The City does not currently have an established formal water system repair and replacement program. Consideration should be given by City staff to develop such a program. A water system repair and replacement program would allow for improved fiscal planning and would help reduce the frequency of water line breaks and other water system failures through preventative maintenance of the City's aging water system.

4.6.5 Interlocal Agreements

The City of Polk City utility service area is located east of the City of Lakeland Utility Service Area and north of the Auburndale Service Area.

An interlocal agreement between the City of Polk City and these municipalities for sharing of water in emergency situations does not currently exist. It would be extremely beneficial for the City of Polk City to engage in such an agreement and to make the necessary water line interconnections needed to allow further system backup reliability. This alternative could be rapidly accomplished and could possibly allow the City to alleviate some of the strain of increased water use if the increased water demands occur prior to the recommended improvements. This improvement is suggested only to provide a large quantity of water in emergency situations. This improvement is listed as a Year 2019 improvement on **Table 16**.

4.7 Water System Capital Projects

4.7.1 Implementation Schedule

The water system capital improvement implementation schedules that are provided in this Water System Master Plan (immediate, year 2019, and ultimate) are believed to be based on the best available planning information currently available provided to Envisors by City staff. Although the City is projecting very rapid growth in the near future, the precise implementation schedule for the recommended water system capital improvement projects should be dependent upon the rate of development actually observed over the planning period. The predictability of where and when development will occur is difficult and projections of growth beyond 10 years are especially speculative. To accomplish this, City staff should develop a program to monitor actual water volumes and track known land development plans to develop a specific year-to-year implementation schedule and ensure that water system infrastructure capacity remains adequate over time and that funding for needed improvements is secured.

A schedule of water system capital improvement projects is included (**Table 16**). Needed water system capital improvement projects are divided into the following three implementation schedule categories:

- Immediate Needs: Projects that are deemed immediate needs are those that should be completed as soon as possible to satisfy level of service and regulatory requirements that are not currently being met.

- Year 2019 Needs: Projects that are deemed year 2019 needs are those that, based on best available current growth information, will need to be completed within 10 years to help ensure level of service requirements are met within this time frame. Several of the Year 2019 needs may need to be completed early in the 10-year planning horizon.

- Ultimate Needs: Projects that are deemed ultimate needs are those that, based on best available current growth information, will need to

be completed prior to complete build-out of the existing established utility service area to help ensure level of service requirements are met within this time frame.

It is important to recognize that several improvements listed are intended to be designed and constructed by developers and not by the City. Most water lines should be constructed by developers. In some cases, the City may elect to pay for over-sizing of water lines to provide capacity for future growth.

It is recommended that this Water System Master Plan be revised in three to five years. Growth projections indicate that a significant amount of growth will occur within this time-frame, and it will be important to observe the affects of this growth on the system and generate an updated plan for the future after observing this growth.

4.7.2 Project Cost Summary

A preliminary opinion of costs in 2008 dollars for the needed water system capital improvement projects is included (**Table 16**). The opinion of probable costs provided is based on current conditions and on Envisors' best judgment as experienced and qualified professional engineers familiar with the construction industry. Because the exact scope of work for the needed projects will not be known until final engineering design work has been completed, the opinion of probable costs provided should be considered preliminary in nature. Envisors has no control over the cost of labor, materials, equipment, or services furnished by contractors; methods of determining prices; competitive bidding; nor future economic conditions. These factors may greatly affect the actual costs of needed capital improvement projects.

The costs presented in **Table 16** are representative of total construction costs for the recommended improvements. However, all costs may not be incurred directly by the City, as developers will need to construct the improvements necessary to serve their developments. It is recommended that the City develop a Capital Improvement Plan (CIP) based on current and future utility infrastructure priorities. The CIP should be updated regularly.

5.0 POTENTIAL FUNDING SOURCES

Potential funding sources for the needed water system improvements include the following:

- Development impact fees: The City should establish impact fees that are adequate to fund infrastructure necessary to service planned development areas. Impact fee assessments should be performed periodically by the City to determine if water impact fees are substantial enough to fund needed utility system improvements.

- United States Department of Agriculture (USDA) grant/loan program: The City is eligible for USDA grant/loan programs, which currently provide grant funding for up to 75 percent of project costs and low interest loans for the remaining project costs.

- FDEP State Revolving Fund (SRF) loan programs: The City is eligible to apply for FDEP SRF low interest loans for water and wastewater improvements. The City may be eligible for a discounted loan interest rate due to its socioeconomic conditions.

- SWFWMD Cooperative Funding: SWFWMD provides funding for various eligible water conservation related projects including reclaimed water and deep aquifer supply wells. The City may be eligible for up to 75% grand funding with REDI designation.

- Community Development Block Grant (CDBG) Program: It is Envisors' understanding that the City has opted out of receiving relatively small CDBG grants annually from the funding program with Polk County and is now eligible to receive larger grants via the CDBG Small Cities Program.

It is recommended that the City investigate and apply for funding assistance to construct the necessary utility system improvements. Water rate and impact fee studies should then be conducted to ensure that City's rates and impact fees are adequate to complement these grants/loans and adequately fund these improvements.

6.0 RECOMMENDATIONS SUMMARY

6.1 Water System Recommendations

The following is a summary of all Water System Master Plan recommendations for the City's water system:

Immediate Water System Improvements:

The recommended immediate water system improvements are shown on **Figure 4** and are summarized as follows:

- (Project 1) Construction of 6-inch PVC water line (~64 LF) to create looping within Arnwine property along Mt. Olive Road;

- (Project 2) Replacement of existing 6-inch dead-end water lines throughout existing distribution system with new 8-inch PVC (~2,635 LF) and 10-inch PVC (~4,000 LF) water line;

- (Project 3) Interconnection of Polk City and Mt. Olive water distribution systems within Mt. Olive Shores North;

- (Project 4) Interconnection of existing stub out along Waterview Dr. to Mt. Olive Shores North;

- (Project 5) Construction of new 10-inch PVC water line (~4,600 LF) south of Mt. Olive Shores North and south of Mud Lake to provide looping with Mt. Olive Shores distribution system;

- (Project 6) Conversion of existing WPF #2 on Commonwealth Avenue to a well field including construction of a 12-inch PVC raw water line (~3,870 LF) from WPF #2 to WPF #1 located on N. Bougainvillea;

- (Project 7) Construction of improvements to WPF #1 to meet FDEP Chapter 62-555 F.A.C. performance and capacity requirements for water production facilities;

- (Project 8) Replacement of selected 2-inch water line with 6-inch PVC water line (~6,230 LF) throughout the City's distribution system; and

- (Project 9) Transfer of existing diesel generator from WPF #1 to Mt. Olive WPF (following refurbishment of WPF #1) to add emergency power at this location.

Year 2019 Water System Improvements (in addition to Immediate Improvements):

The recommended year 2019 water system improvements are shown on **Figure 6** and are summarized as follows:

- (Project 10) Construction of a proposed new WPF #3 in the southern area of the City's projected service area south of I-4;

- (Project 11) Construction of 12-inch PVC raw water line (~7,600 LF) from the Mt. Olive WPF to the proposed WPF #3;

- (Project 12) Interconnect and improvements to existing Polk County Correctional Facility WPF;

- (Project 13) Construction of a new 16-inch PVC water line (~4,170 LF) from the proposed WPF #3 to interconnect with existing distribution system along Mt. Olive Road;

- (Project 14) Replacement of existing 6-inch and 8-inch water line along Mt. Olive Road with 12-inch PVC water line (~5,600 LF);

- (Project 15) Construction of 12-inch PVC water line (~1,770 LF) on SR 33 for emergency interconnection with City of Lakeland;

- (Project 16) Construction and replacement of existing 6-inch and 8-inch water line with 12-inch PVC water line (~11,120 LF) from proposed WPF #3 along Mount Olive Road and SR 655 to intersection of SR 655 and SR 33;

- (Project 17) Replacement of 10-inch water line with 12-inch PVC water line (~4,380 LF) from WPF #1 to intersection of SR 33 and Clearwater Ave;

- (Project 18) Replacement of 10-inch water line with 16-inch PVC water line (~400 LF) along Bougainvilla Ave.;

- (Project 19) Construction of 16-inch (~ 1,210 LF), 12-inch (~13,070 LF), and 10-inch (~2,180 LF) PVC water line from Polk County Correctional WPF to proposed 10-inch water line at the intersection of SR 557 and Hwy 559;

- (Project 20) Construction of 12-inch PVC water line (~12,260 LF) along Barfield Road;

- (Project 21) Construction of 6-inch PVC water line (~1,260 LF) along Orange Blvd.;

- (Project 22) Construction of new and replacement of existing water lines with 6-inch (~2,645 LF), 8-inch (~8,400 LF), and 10-inch (~7,180 LF) PVC water line connecting existing developed regions within the City's service area; and

- (Project 23) Construction of 6-inch (~23,340 LF), 8-inch (~20,840 LF), and 10-inch (~20,620 LF) PVC water line to provide service to projected development regions.

Ultimate Water System Improvements (in addition to Immediate and Year 2019 Improvements):

The recommended ultimate water system improvements are shown on **Figure 8** and are summarized as follows:

- (Project 24) Construction of a proposed new northwest WPF (WPF #4) near Voyles Loop Road;

- (Project 25) Replacement of 10-inch water line along SR 33 with 12-inch PVC water line (~2,260 LF) from Clearwater Ave. to Lake Margaret Blvd.;

- (Project 26) Replacement of 10-inch water line along SR 557 with 12-inch PVC water line (~1,890 LF) from Bougainvilla Ave to Bridges Rd.;

- (Project 27) Replacement of 8-inch water line along SR 557 with 10-inch PVC water line (~5,795 LF) from near Lakeshore Dr. to Hwy 559;

- (Project 28) Construction of 6-inch PVC water line (~7,020 LF) connecting existing developed regions within the City's service area; and

- (Project 29) Construction of 6-inch (~20,236 LF), 8-inch (~28,360 LF), 10-inch (~38,665 LF), and 12-inch (~20,700 LF) PVC water line to provide service to projected development regions.

6.2 Additional Recommended Studies

In addition to the above recommended projects, it is recommended that the City perform the following studies/additional work:

- Conduct a detailed water audit to identify and quantify the sources of water losses;
- Complete feasibility and/or preliminary engineering studies for all new water production facility projects to identify the appropriate project scope to be concurrent with future conditions;
- Water supply planning to ensure future water sources are identified and available;
- Complete land purchase evaluation(s) as necessary for future facilities and lines;
- Maintain existing water maps and associated hydraulic models for future development review;
- Conduct security vulnerability assessment(s) for all treatment plants and off-site infrastructure; and
- Prepare a Water System Master Plan update every five years.

7.0 REFERENCES

American Water Works Association, Manual of Water Supply Practices, AWWA M32, Distribution Network Analysis for Water Utilities, 1989.

Florida Department of Environmental Protection, Chapter 62-555 Florida Administrative Code.

Florida Department of Environmental Protection, Chapter 62-604 Florida Administrative Code.

Florida Department of Environmental Protection, Chapter 62-610 Florida Administrative Code.

Haestad Methods, Water Distribution Design and Modeling Featuring WaterCAD, 2000.

Recommended Standards for Water Works, 2003 Edition, Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.

U.S. Census Bureau Data for Polk City, Florida, 2000.

TABLES

Table 1
Water Use Projections

Current Mount Olive Water Customers:	851	Data Source: FDEP 2007 Basic Facility Reports
Current Polk City Water Customers:	1,002	Data Source: FDEP 2007 Basic Facility Reports
Current Polk City Residential Water Customers:	819	City Water Billing Records
Current Mount Olive Residential Water Customers:	851	(Assumed same as Total Water Customers)
Persons Per Household:	2.8	Data Source: U.S. Census 2000
Current Polk City Population Served:	2,294	Estimate based on City Water Billing Records
Current Mount Olive Population Served:	2,383	Estimate based on assumed # of residential customers
Total Population Served:	4,677	
Current AAD Water Use MT Olive WTP (gpd):	203,066	Data Source: SWFWMD Pumpage Records (01/07 - 12/07)
Current AAD Water Use Polk City WTP(gpd):	283,477	Data Source: SWFWMD Pumpage Records (01/07 - 12/07)
Total Current AAD water Use (gpd):	486,543	
Future Development Per Capita Use (gpd/person):	132	
Equivalent Dwelling Unit Use (gpd/EDU):	369.6	(Persons per Household * Future Development Per Capita Use)

Growth Area	Type	Year 2019 Projected Acreage Increase	Year 2019 Projected EDU	Year 2019 Projected Population Increase	Year 2019 Projected AAD Water Use Increase (gpd)
1	Residential (Arnwine)	142	388	1,086	143,405
2	Residential (Holly Cove)	115	426	1,193	157,450
3	Residential (MTO Shore North)	189	600	1,680	221,760
4	Residential (Gill Property)	733	751	2,103	277,570
5	Residential (Sandy Pointe)	15	41	115	15,154
6	Residential (Barfield)	240	600	1,680	221,760
7	Residential (King et al)	330	825	2,310	304,920
8	Residential (MTO Shores)	100	250	700	92,400
9	Commercial	4	46	--	17,068
10	Residential	7	28	78	10,349
11	Residential (Tuscany)	10	60	168	22,176
12	Residential (Antigua Pointe)	8	26	73	9,610
13	Commercial	5	16	--	5,830
14	Residential	280	200	560	73,920
15	Residential	93	240	672	88,704
16	Commercial (Harper Dev)	170	714	1,100,000 sq. ft.	264,000
17	Commercial	40	39	60,000 sq. ft.	14,400
18	Residential	18	21	59	7,762

Table 1
Water Use Projections (Continued)

Growth Area	Type	Year 2019 Projected Acreage Increase	Year 2019 Projected EDU	Year 2019 Projected Population Increase	Year 2019 Projected AAD Water Use Increase (gpd)
19	Commercial	9	28	--	10,230
20	Residential	32	80	225	29,660
21	Residential	75	20	56	7,392
22	Commercial	73	218	--	80,410
24	Commercial/Residential (Jail)	156	463	--	171,270
26	Residential	28	69	193	25,502
27	Industrial	64	191	--	70,620
30	Commercial (Lake Shore)	6	50	--	9,900
31	Residential	11	32	90	11,827
37	Residential (Rubin Apts)	2	12	34	4,435
38	Residential (Fred Apts)	2	16	45	5,914
	Projected Year 2019 Additional:	**2,957**	**6,384**	**13,074**	**2,375,396**
	Projected Year 2019 Totals:			**17,750**	**2,861,939**

Growth Area	Type	Ultimate Projected Acreage Increase	Ultimate Projected EDU	Ultimate Projected Population Increase	Ultimate Projected AAD Water Use Increase (gpd)
23	Residential	246	616	1,724	227,581
25	Residential	291	728	2,038	269,069
28	Commercial	3	9	--	3,410
29	Commercial	23	69	--	25,630
32	Commercial	60	179	--	66,000
33	Residential	187	468	1,310	172,880
34	Residential	1,131	2,828	7,917	1,045,044
35	Residential	1,610	4,025	11,270	1,487,640
36	Residential	160	400	1,120	147,840
	Projected Ultimate Additional:	**6,669**	**15,705**	**38,453**	**5,820,491**
	Projected Ultimate Totals:			**43,130**	**6,307,034**

Table 2
Water Production Facilities Summary

WPF #1

Water Supply Well	Well Pump	Hydro-pneumatic Tanks	High Service Pumps	Elevated Storage Tank
#3: 12-in dia., 168 ft casing, 700 ft total depth	650 gpm	20,000		

WPF #2

Water Supply Wells	Well Pumps	Hydro-pneumatic Tanks	High Service Pumps	Elevated Storage Tank
#2: 10-in dia., 156 ft casing, 600 ft total depth	400 gpm			

Mount Olive WPF

Water Supply Well	Well Pumps	Hydro-pneumatic Tanks	High Service Pumps	Elevated Storage Tank
#1: 12-in dia., N/A casing, 583 ft total depth	650 gpm	#1: 10,000 gal		
#2: 12-in dia., 126 ft casing, 800 ft total depth	1000 gpm	#2: 10,000 gal		

Table 3
Current Raw Water Production Capacity Analysis

Current Well Capacities:

Well	Pump Capacity (gpm)	Pump Capacity (gpd)	
WPF #1	650	936,000	As provided by City staff during
WPF #2	400	576,000	site visit.
Mount Olive WPF			
MTO1	650	936,000	As provided by County staff
MTO2	1,000	1,440,000	during site visit.
Totals:	**2,700**	**3,312,000**	

Total Raw Water Production Capacity with Largest Well Pump Out of Operation:	1,700	1,872,000

Current System Demands:

Average Day Water System Demand:	338	gpm
Maximum Day Water System Demand:	676	gpm
Peak Hour Water System Demand:	1,352	gpm
Fire Flow Demand (required for 2 hours total):	1,000	gpm
Total Maximum Day Demand + Fire Flow:	1,676	gpm

Comparison to Design Criteria:

Design Criteria: The total well capacity shall equal at least the system's design maximum day water demand including fire flow.

Current maximum day + fire flow demand:	1,676	gpm	
Current well capacity:	2,700	gpm	Criteria Satisfied

Design Criteria: The total well capacity with the largest producing well out of operation shall equal at least the design average day water demand and preferably the design maximum day water demand for the system.

Current maximum day water demand:	676	gpm	
Well capacity with largest well out of operation:	1,700	gpm	Criteria Satisfied

Design Criteria: Total well capacity shall be designed to meet peak capacity utilizing pumping capacity and finished-drinking-water storage.

Current peak hour water demand	1,352	gpm	
Finished-drinking-water storage:	0	gpm	
Current well capacity:	2,700	gpm	Criteria Satisfied

Table 4
Year 2019 Raw Water Production Capacity Analysis

Well Capacities:	Existing		
Well	Pump Capacity (gpm)	Pump Capacity (gpd)	
WPF #1	650	936,000	As provided by City staff
WPF #2	400	576,000	during site visit.
Mount Olive WPF			
MTO1	650	936,000	As provided by County staff
MTO2	1,000	1,440,000	during site visit.
Totals:	2,700	3,888,000	
Total Raw Water Production Capacity with Largest Well Pump Out of Operation:	1,700	2,448,000	

Projected System Demands: **System Demands**

Projected Average Day Water System Demand: 1,987 gpm

Projected Maximum Day Water System Demand: 3,975 gpm
(Estimated to be 2x Average Day Demand)

Fire Flow Demand (required for 2 hours total): 1,000 gpm

Total Projected Maximum Day Demand + Fire Flow: 4,975 gpm

Comparison to Design Criteria:

Design Criteria: The total well capacity shall equal at least the system's design maximum day water demand including fire flow.

Projected maximum day + fire flow demand:	4,975 gpm	
Current well capacity:	2,700 gpm	Criteria NOT Satisfied
Needed well capacity improvements:	2,275 gpm	

Design Criteria: The total well capacity with the largest producing well out of operation shall equal at least the design average day water demand and preferably the design maximum day water demand for the system.

Projected maximum day water demand:	3,975 gpm	
Current well capacity with largest well out of operation:	1,700 gpm	Criteria NOT Satisfied
Needed well capacity improvements:	2,275 gpm	

Needed year 2019 well capacity improvements: **2,275 gpm**
3,276,000 gpd

Table 5
Ultimate Raw Water Production Capacity Analysis

Well Capacities:	Existing		
Well	Pump Capacity (gpm)	Pump Capacity (gpd)	
WPF #1	650	936,000	As provided by City staff
WPF #2	400	576,000	during site visit.
Mount Olive WPF			
MTO1	650	936,000	As provided by County staff
MTO2	1,000	1,440,000	during site visit.
Totals:	2,700	3,888,000	
Total Raw Water Production Capacity with Largest Well Pump Out of Operation:	1,700	2,448,000	

Projected System Demands: **System Demands**

Projected Average Day Water System Demand: 4,380 gpm

Projected Maximum Day Water System Demand: 8,760 gpm
(Estimated to be 2x Average Day Demand)

Fire Flow Demand (required for 2 hours total): 1,000 gpm

Total Projected Maximum Day Demand + Fire Flow: 9,760 gpm

Comparison to Design Criteria:

Design Criteria: The total well capacity shall equal at least the system's design maximum day water demand including fire flow.

Projected maximum day + fire flow demand:	9,760 gpm	
Current well capacity:	2,700 gpm	Criteria NOT Satisfied
Needed well capacity improvements:	8,000 gpm	

Design Criteria: The total well capacity with the largest producing well out of operation shall equal at least the design average day water demand and preferably the design maximum day water demand for the system.

Projected maximum day water demand:	8,760 gpm	
Current well capacity with largest well out of operation:	1,700 gpm	Criteria NOT Satisfied
Needed well capacity improvements:	8,000 gpm	

Needed ultimate well capacity improvements: **8,000 gpm**
11,520,000 gpd

Table 6
Current Water Storage Capacity Analysis

Existing Water Storage Capacities:

Water Production Facility	Storage Capacity (gal)[1]
WPF #1	0
WPF #2	0
Mount Olive WPF	0

Notes:

[1] 10 State Standards states systems serving more than 150 living units should have ground or elevated storage and hydro-pneumatic tank storage is not to be considered for fire protection purposes. Additional storage will need to be added to meet existing system demands (Table 6). The existing hydro-pneumatic tanks should be taken out of service and replaced with ground or elevated storage.

Current System Demands Analysis:

Average Day Water System Demand:	486,543 gpd	
	338 gpm	
Maximum Day Water System Demand:	973,086 gpd	
(Estimated to be 2x Average Day Demand)	676 gpm	
Peak Hour Water System Demand:	1,352 gpm	
(Estimated to be 4x Average Demand)		
Fire Flow Demand (required for 2 hours total):	1,000 gpm	

Required Fire Flow Storage:

SSR = NFF + MDC - PC - ES - SS - FDS

+ NFF (needed fire flow)	1,000 gpm	
+ MDC (maximum daily consumption)	676 gpm	
- PC (production capacity)	2,700 gpm	
- ES (emergency supply)	0 gpm	(no emergency interconnects)
- SS (suction supply)	0 gpm	(assuming no fire flow from suction supply)
- FDS (fire department supply)	0 gpm	(assuming no fire dept. supplied water)
SSR (fire flow storage supply required)	-1,024 gpm	
* (Assumed 2 hour fire flow event)	120 min	
Required Fire Flow Storage:	-122,910 gal	(negative value due to excess amount of raw water supply available)

Comparison to Design Criteria:

One of the following two design criteria must be met:

Design Criteria: The total finished water storage capacity (excluding any storage capacity for fire protection) connected to a water system shall at least equal 25 percent of the water system's maximum-day water demand.

25% of maximum day demand:	243,272 gal	
Required Fire Flow Storage:	-122,910 gal	
Current water storage:	0 gal	Criteria NOT Satisfied
Storage needed:	120,362 gal	

Design Criteria: The water system's total useful finished water storage capacity (excluding any storage capacity for fire protection) is sufficient to meet the water system's peak hour water demand for at least four consecutive hours.

4 hours of peak hour flow:	324,480 gal	
Required Fire Flow Storage:	-122,910 gal	
Current water storage:	0 gal	Criteria NOT Satisfied
Storage needed:	201,571 gal	

Minimum Additional Storage Required: 120,362 gal

Table 7
Year 2019 Water Storage Capacity Analysis

Existing Water Storage Capacities:

Water Production Facility	Storage Capacity (gal)[1]
WPF #1	0
WPF #2	0
Mount Olive WPF	0

Notes:

[1] 10 State Standards states systems serving more than 150 living units should have ground or elevated storage and hydropneumatic tank storage is not to be considered for fire protection purposes. Additional storage will need to be added to meet existing system demands (Table 6). The existing hydro-pneumatic tanks should be taken out of service and replaced with ground or elevated storage.

Current System Demands Analysis:

Average Day Water System Demand:	2,861,939 gpd	
Maximum Day Water System Demand:	5,723,879 gpd	
(Estimated to be 2x Average Day Demand)	3,975 gpm	
Peak Hour Water System Demand:	417,366 gph	
(Estimated to be 3.5x Average Demand)	6,956 gpm	
Fire Flow Demand	1,000 gpm	

Required Fire Flow Storage:

SSR = NFF + MDC - PC - ES - SS - FDS

+ NFF (needed fire flow)	1,000 gpm	
+ MDC (maximum daily consumption)	3,975 gpm	
- PC (production capacity)	3,975 gpm	(incl minimum 2019 well improvements)
- ES (emergency supply)	0 gpm	(no emergency interconnects)
- SS (suction supply)	0 gpm	(assuming no fire flow from suction supply)
- FDS (fire department supply)	0 gpm	(assuming no fire dept. supplied water)
SSR (fire flow storage supply required)	1,000 gpm	
* (Assumed 2 hour fire flow event)	120 min	
Required Fire Flow Storage:	119,990 gal	

Comparison to Design Criteria:

One of the following two design criteria must be met:

Design Criteria: The total finished water storage capacity (excluding any storage capacity for fire protection) connected to a water system shall at least equal 25 percent of the water system's maximum-day water demand.

25% of maximum day demand:	1,430,970 gal	
Required Fire Flow Storage:	119,990 gal	
Current water storage:	0 gal	Criteria NOT Satisfied
Storage needed:	1,550,960 gal	

Design Criteria: The water system's total useful finished water storage capacity (excluding any storage capacity for fire protection) is sufficient to meet the water system's peak hour water demand for at least four consecutive hours.

4 hours of peak hour flow:	1,669,465 gal	
Required Fire Flow Storage:	119,990 gal	
Current water storage:	0 gal	Criteria NOT Satisfied
Storage needed:	1,789,455 gal	

Minimum Year 2019 Storage Required: 1,550,960 gal

Table 8
Ultimate Water Storage Capacity Analysis

Existing Water Storage Capacities:

Water Production Facility	Storage Capacity (gal)[1]
WPF #1	0
WPF #2	0
Mount Olive WPF	0

Notes:

[1] 10 State Standards states systems serving more than 150 living units should have ground or elevated storage and hydropneumatic tank storage is not to be permitted for fire protection purposes. Additional storage will need to be added to meet existing system demands (Table 6). The existing hydropneumatic tanks should be taken out of service and replaced with ground or elevated storage.

Current System Demands Analysis:

Average Day Water System Demand:	6,307,034 gpd	
Maximum Day Water System Demand:	12,614,068 gpd	
(Estimated to be 2x Average Day Demand)	8,760 gpm	
Peak Hour Water System Demand:	919,776 gph	
(Estimated to be 3.5x Average Demand)	15,330 gpm	
Fire Flow Demand:	1,000 gpm	

Required Fire Flow Storage:

SSR = NFF + MDC - PC - ES - SS - FDS

+ NFF (needed fire flow)	1,000 gpm	
+ MDC (maximum daily consumption)	8,760 gpm	
- PC (production capacity)	9,700 gpm	(incl minimum ultimate well improvements)
- ES (emergency supply)	0 gpm	(no emergency interconnects)
- SS (suction supply)	0 gpm	(assuming no fire flow from suction supply)
- FDS (fire department supply)	0 gpm	(assuming no fire dept. supplied water)
SSR (fire flow storage supply required)	60 gpm	
* (Assumed 2 hour fire flow event)	120 min	
Required Fire Flow Storage:	7,172 gal	

Comparison to Design Criteria:

One of the following two design criteria must be met:

Design Criteria: The total finished water storage capacity (excluding any storage capacity for fire protection) connected to a water system shall at least equal 25 percent of the water system's maximum-day water demand.

25% of maximum day demand:	3,153,517 gal	
Required Fire Flow Storage:	7,172 gal	
Current water storage:	0 gal	Criteria NOT Satisfied
Storage needed:	3,160,689 gal	

Design Criteria: The water system's total useful finished water storage capacity (excluding any storage capacity for fire protection) is sufficient to meet the water system's peak hour water demand for at least four consecutive hours.

4 hours of peak hour flow:	3,679,103 gal	
Required Fire Flow Storage:	7,172 gal	
Current water storage:	0 gal	Criteria NOT Satisfied
Storage needed:	3,686,275 gal	

Minimum Ultimate Storage Required: 3,161,000 gal

Table 9
Current High Service Pumping Capacity Analysis

Existing High Service Pump Capacities:

Water Production Facility	High Service Pumping Capacity[1] (gpm)
WPF #1	650
WPF #2	400
Mount Olive WPF	
Well #1	650
Well #2	1,000
Total HSP:	2,700 gpm

Notes:

[1]Well pumps act as high service pumps (hydro-pneumatic tank water systems)

Current System Demands Analysis:

Average Day Water System Demand: 338 gpm

Maximum Day Water System Demand: 676 gpm
(Estimated to be 2x Average Day Demand)

Peak Hour Water System Demand: 1,183 gpm
(Estimated to be 3.5x Average Day Demand)

Fire Flow Demand: 1,000 gpm

Comparison to Design Criteria:

Design Criteria: The total high service pumping capacity shall at least meet at least the water system's or the booster station service area's peak-hour water demand (assuming standby pump criteria is satisfied).

Peak hour demand:	1,183 gpm	
Current HSP:	2,700 gpm	Criteria Satisfied

Design Criteria: The total high service pumping capacity shall at least meet the water system's maximum day demand plus fire flow demand for the fire flow design period (assuming standby pump criteria is satisfied).

Maximum day demand + fire flow:	1,676 gpm	
Current HSP:	2,700 gpm	Criteria Satisfied

Design Criteria: A standby high service pump (either installed or uninstalled) must be provided that is of sufficient capacity to replace the largest high service pump at each WPF and only one standby high service pump is required if the pump may be used to replace pumps at multiple WPF locations.

Peak hour demand	1,183 gpm	
Maximum day demand + fire flow:	1,676 gpm	(Worse case)
Current HSP (with largest HSP off line):	1,700 gpm	Criteria Satisfied
Needed Additional HSP:	0 gpm	

Needed Immediate HSP improvements: 0 gpm

Table 10
Year 2019 High Service Pumping Capacity Analysis

Existing High Service Pump Capacities:

Water Production Facility	High Service Pumping Capacity (gpm)
WPF #1	0
WPF #2	0
Mount Olive WPF	0
Total HSP:	0 gpm[1]

Notes:

[1]Replacement of hydro-pneumatic tanks (Table 7) results in well pumps no longer utilized as high service pumps.

Current System Demands Analysis:

Average Day Water System Demand: 1,987 gpm

Maximum Day Water System Demand: 3,975 gpm
(Estimated to be 2x Average Day Demand)

Peak Hour Water System Demand: 6,956 gpm
(Estimated to be 3.5x Average Day Demand)

Fire Flow Demand: 1,000 gpm

Comparison to Design Criteria:

Design Criteria: The total high service pumping capacity shall at least meet at least the water system's, or the booster station service area's, peak-hour water demand.

Peak hour demand:	6,956 gpm	
Current HSP:	0 gpm	Criteria NOT Satisfied
Needed Addiotional HSP:	7,000 gpm	

Design Criteria: The total high service pumping capacity shall at least meet the water system's maximum day demand plus fire flow demand for the fire flow design period.

Maximum day demand + fire flow:	4,975 gpm	
Current HSP:	0 gpm	Criteria NOT Satisfied
Needed Addiotional HSP:	5,000 gpm	

Design Criteria: A standby high service pump (either installed or uninstalled) must be provided that is of sufficient capacity to replace the largest high service pump at each WPF and only one standby high service pump is required if the pump may be used to replace pumps at multiple WPF locations.

Maximum day demand + fire flow:	4,975 gpm	
Current HSP (with large HSP off line):	0 gpm	Criteria NOT Satisfied
Needed Addiotional HSP:	5,000 gpm	

Needed Year 2019 HSP improvements: 7,000 gpm

Table 11
Ultimate High Service Pumping Capacity Analysis

Existing High Service Pump Capacities:

Water Production Facility	High Service Pumping Capacity (gpm)
WPF #1	0
WPF #2	0
Mount Olive WPF	0
Total HSP:	0 gpm[1]

Notes:

[1]Replacement of hydro-pneumatic tanks (Table 7) results in well pumps no longer utilized as high service pumps.

Current System Demands Analysis:

Average Day Water System Demand: 4,380 gpm

Maximum Day Water System Demand: 8,760 gpm
(Estimated to be 2x Average Day Demand)

Peak Hour Water System Demand: 15,330 gpm
(Estimated to be 3.5x Average Day Demand)

Fire Flow Demand: 1,000 gpm

Comparison to Design Criteria:

Design Criteria: The total high service pumping capacity shall at least meet at least the water system's, or the booster station service area's, peak-hour water demand.

Peak hour demand:	15,330 gpm	
Current HSP:	0 gpm	Criteria NOT Satisfied
Needed Additional HSP:	15,400 gpm	

Design Criteria: The total high service pumping capacity shall at least meet the water system's maximum day demand plus fire flow demand for the fire flow design period.

Maximum day demand + fire flow:	9,760 gpm	
Current HSP:	0 gpm	Criteria NOT Satisfied
Needed Additional HSP:	9,800 gpm	

Design Criteria: A standby high service pump (either installed or uninstalled) must be provided that is of sufficient capacity to replace the largest high service pump at each WPF and only one standby high service pump is required if the pump may be used to replace pumps at multiple WPF locations.

Maximum day demand + fire flow:	9,760 gpm	
Current HSP (with large HSP off line):	0 gpm	Criteria NOT Satisfied
Needed Additional HSP:	9,800 gpm	

Needed Ultimate HSP improvements: 15,400 gpm

Table 12
Summary of Hydraulic Modeling Results for Current Water System

Modeling Simulation Description	Flow Delivered to System (gpm)			Summary of Results
	WPF #1	WPF #2	Mt. Olive WPF	
ADD simulation with all WPFs in operation	89	88	160	All system pressures >42psi, most system pressures >52 psi.
PHD simulation with all WPFs in operation	357	354	639	Some system pressures as low as 34 psi, most system pressures >45 psi.
MDD fire flow simulation with all WPFs in operation	Depends on location of needed fire flow	Depends on location of needed fire flow	Depends on location of needed fire flow	Fire flows <500 gpm in areas with 6-in water lines without looping, >1,000 gpm available fire flow only within Mt. Olive shores near the Mt. Olive WTP

Table 13
Summary of Hydraulic Modeling Results for Existing Demands with System Improvements

Modeling Simulation Description	Flow Delivered to System (gpm)			Summary of Results
	WPF #1	WPF #2	Mt. Olive WPF	
ADD simulation with all WPFs in operation	192	Operated as wellfield	146	All system pressures ≥49 psi.
PHD simulation with all WPFs in operation	774	Operated as wellfield	576	All system pressures >46 psi.
MDD fire flow simulation with all WPFs in operation	Depends on location of needed fire flow	Operated as wellfield	Depends on location of needed fire flow	Modeled fire flows >500 gpm in all areas, >1,000 gpm available fire flow for most commercial areas.

Summary of Improvements:

1) Installation of ~ 64 LF of 6" water line to create looping within Arnwine property along Mt. Olive Road.
2) Upsize ~ 17,407 LF of existing dead-end 6" waterline throughout existing distribution system with 8" and 10" waterline.
3) Interconnection of Polk City and Mt. Olive water distribution system within Mt. Olive Shores North.
4) Interconnection of existing stubout along Waterview Dr. to Mt. Olive Shores North.
5) Installation of ~ 4,600 LF of new 10" waterline south of Mt. Olive Shores North and south of Mud Lake to provide looping with Mt. Olive Shores distribution system.
6) Conversion of WPF #2 to well field including installation of ~3,870 LF of 12" raw water line from WPF #2 to WPF #1.
7) Needed modifications to WPF #1 to meet 62-555 requirements for water production facilities.
8) Replacement of ~ 6,230 LF of 2" pipe with 6" pipe throughout the City's distribution system.
9) Transfer of existing backup generator from WPF #1 to Mt. Olive WPF.

Table 14
Summary of Hydraulic Modeling Results
for Year 2019 Demands with System Improvements

Modeling Simulation Description	Flow Delivered to System (gpm)					Summary of Results
	WPF #1	WPF #2	Mt. Olive WPF	WPF #3	Polk Co. Correctional WPF	
ADD simulation with all WPFs in operation	841	Operated as wellfield	Operated as wellfield	843	292	All system pressures >43 psi, most system pressures >50 psi.
PHD simulation with all WPFs in operation	2,000	Operated as wellfield	Operated as wellfield	3,602	1,317	All system pressures >30 psi, most system pressures >40 psi.
MDD fire flow simulation with all WPFs in operation	Depends on location of needed fire flow	Operated as wellfield	Operated as wellfield	Depends on location of needed fire flow	Depends on location of needed fire flow	Modeled fire flows >500 gpm in all residential areas and >1,000 gpm for commercial areas.

Summary of Improvements:

10) Construction of a proposed WPF #3 in the southern area of the City's projected service area south of I-4.
11) Construction of 12" raw water line from Mt. Olive WPF to proposed WPF #3 (~ 7,600 LF as modeled, dependent upon final location of proposed WPF #3)
12) Interconnect and modify existing Polk County Correctional Facility WPF.
13) Extend 16" water line from proposed WPF #3 to interconnect with existing distribution system along Mt. Olive Road (~ 4,170 LF) as modeled, dependent upon final location of proposed WPF #3).
14) Replacement of existing 6" and 8" water line along Mt. Olive Road with 12" (~ 5,600 LF).
15) Extension of ~ 1,770 LF of 12" water line on SR 33 for emergency interconnect with City of Lakeland
16) Installation and replacement of existing 6" and 8" water line with 12" water line from proposed WPF #3 along Mt. Olive Road and SR 655 to intersection of SR 655 and SR 33 (~ 11,120 LF as modeled, dependent upon final location of proposed WPF #3).
17) Replacement of ~ 4,380 LF of 10" water line with 12" water line from WPF #1 to intersection of SR 33 and Clearwater Ave.
18) Replacement of ~ 400 LF of 10" water line with 16" water line along Bougainvillea Ave.
19) Construction of ~ 1,210 LF of 16", ~ 13,070 LF of 12", and ~ 2,180 LF of 10" water line from Polk County Correctional WPF to existing 10" water line at the intersection of SR 557 and Hwy 559.
20) Construction of ~ 12,260 LF of 12" water line along Barfield Road.
21) Construction of ~ 1,050 LF of 6" water line along Orange Blvd.
22) Construction of new and replacement of existing water line with ~ 2,645 LF 6", ~ 8,400 LF 8", and ~ 7,180 LF 10" water line connecting existing developed regions within the City's service area.
23) Construction of ~ 23,340 LF 6", ~ 20,840 LF 8", and ~ 20,620 LF 10" water line to provide service to projected development regions.

Table 15
Summary of Hydraulic Modeling Results for Ultimate Demands with System Improvements

Modeling Simulation Description	Flow Delivered to System (gpm)						Summary of Results
	WPF #1	WPF #2	Mt. Olive WPF	WPF #3	Polk Co. Correctional WPF	WPF #4	
ADD simulation with all WPFs in operation	930	Operated as wellfield	Operated as wellfield	1,549	620	1,269	All system pressures >45 psi, most system pressures >55 psi.
PHD simulation with all WPFs in operation	4,394	Operated as wellfield	Operated as wellfield	2,879	3,422	4,597	All system pressures >32 psi, most system pressures >45 psi.
MDD fire flow simulation with all WPFs in operation	Depends on location of needed fire flow	Operated as wellfield	Operated as wellfield	Depends on location of needed fire flow	Depends on location of needed fire flow	Depends on location of needed fire flow	Modeled fire flows >500 gpm in all residential areas and >1,000 gpm in all commercial areas.

Summary of Improvements:

24) Construction of a proposed WPF #4 near Voyles Loop Road.
25) Replacement of ~ 2,260 LF of 10" water line along SR 33 with 12" water line from Clearwater Ave. to Lake Margaret Blvd.
26) Replacement of ~ 1,890 LF of 10" water line along SR 557 with 12" water line from Bougainvillea Ave to Bridges Rd.
27) Replacement of ~ 5,795 LF of 8" water line along SR 557 with 10" water line from near Lakeshore Dr. to Hwy 559.
28) Construction of ~ 7,020 LF 6" water line connecting existing developed regions within the City's service area.
29) Construction of ~ 20,236 LF 6", ~ 28,360 LF 8", ~ 38,665 LF 10", and ~ 20,700 LF 12" water line to provide service to projected development regions.

Table 16
Water System Capital Improvement Projects Cost Summary

IMMEDIATE NEEDS:

Proj. No.	Project Description	Need for Project	Opinion of Probable Cost*
1	Installation of 6" PVC water line tie-ins (~ 64 LF) to create looping within Arnwine property along Mt. Olive Road.	Needed to allow fire flow level of service standards to be met	$ 5,000
2	Replacement of existing 6" dead-end waterline throughout existing distribution system with 8" PVC pipe (~ 13,405 LF) and 10" PVC pipe (~ 4,000 LF).	Needed to allow fire flow level of service standards to be met.	$ 696,200
3	Interconnection of Polk City and Mt. Olive water distribution system within Mt. Olive Shores North.	Needed to allow fire flow level of service standards and enhanced service throughout existing Polk City and Mt. Olive distribution systems.	$ 12,000
4	Interconnection of existing stub out along Waterview Dr. to Mt. Olive Shores North.	Needed to allow fire flow level of service standards to be met.	$ 5,000
5	Installation of new 10" (~ 4,600 LF) waterline south of Mt. Olive Shores North and south of Mud Lake to provide looping with Mt. Olive Shores distribution system.	Needed to allow fire flow level of service standards to be met, and provides system backbone line for future growth areas.	$ 230,000
6	Conversion of WPF #2 to well field, including installation of 12" (~3,870 LF) raw water line from WPF #2 to WPF #1.	Needed to allow enhanced well field pumping control and needed modifications at WPF #1.	$ 242,200
7	Modifications to WPF #1.	Needed to meet Ch 62-555 F.A.C. requirements for water production facilities.	$2,410,000
8	Replacement of existing 2" water line with 6" pipe (~ 6,230 LF) throughout the City's distribution system.	Needed to allow fire flow level of service standards to be met.	$ 186,900
9	Transfer of existing backup generator and transfer switch from WPF #1 to Mt. Olive WPF and install new generator at WTP #2.	Needed to provide backup power to Mt. Olive WPF per Ch 62-555 F.A.C. requirements.	$ 50,000
		Total:	**$ 3,837,300**
		Planning, Design, Misc. Engineering/Surveying, Construction (18%):	$ 690,714
		Contingency (15%):	$ 679,202
		Grand Total:	**$ 5,207,216**

10-YEAR NEEDS:

Proj. No.	Project Description	Need for Project	Opinion of Probable Cost*
10	Construction of a proposed WPF #3 in the southern area of the City's projected service area south of I-4.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$3,085,000
11	Construction of 12" raw water line from Mt. Olive WPF to proposed WPF #3 (~ 7,600 LF as modeled, dependent upon final location of proposed WPF #3).	Conversion of Mt. Olive WPF to a wellfield for proposed WPF #3 for enhanced control of well field pumping in support of projected growth.	$ 586,000
12	Interconnect and modify existing Polk County Correctional Facility WPF.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$2,055,000
13	Extend 16" water line from proposed WPF #3 to interconnect with existing distribution system along Mt. Olive Road (~ 4,170 LF as modeled, dependent upon final location of proposed WPF #3).	Needed to allow fire flow level of service and demand requirements to be met within projected future growth regions.	$ 473,600
14	Replacement of existing 6" and 8" water line along Mt. Olive Road with 12" (~ 5,600 LF).	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 336,000
15	Extension of 12" (~ 1,770 LF) water line on SR 33 for emergency interconnect with City of Lakeland.	Provides an emergency potable water source and increases the City's ability to take advantage of alternative water supply partnering with other municipalities in the future.	$ 120,000

Table 16
Water System Capital Improvement Projects Cost Summary (Continued)

10-YEAR NEEDS (Continued):

Proj. No.	Project Description	Need for Project	Opinion of Probable Cost*
16	Installation and replacement of existing 6" and 8" water line with 12" water line from proposed WPF #3 along Mount Olive Road and SR 655 to intersection of SR 655 and SR 33 (~ 11,120 LF as modeled, dependent upon final location of proposed WPF #3).	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 667,200
17	Replacement of 10" water line with 12" (~ 4,380 LF) water line from WPF #1 to intersection of SR 33 and Clearwater Ave.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 262,800
18	Replacement of 10" (~ 400 LF) water line with 16" water line along Bougainvillea Ave.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 20,000
19	Construction of 16" (~ 1,210 LF), 12" (~ 13,070 LF), and 10" (~ 2,180 LF) water line from Polk County Correctional WPF to proposed 10" water line at the intersection of SR 557 and Hwy 559.	Needed to interconnect WPFs, and allow fire flow level of service and demand requirements to be met for projected future growth	$ 990,000
20	Construction of 12" (~ 12,260 LF) water line along Barfield Road.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 735,600
21	Construction of 6" (~ 1,050 LF) water line along Orange Blvd.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 31,500
22	Construction of new and replacement of existing water line with 6" (~ 2,645 LF), 8" (~ 8,400 LF), and 10" (~ 7,180 LF) water line connecting existing developed regions within the City's service area.	Needed to allow fire flow level of service and demand requirements to be met for projected future water service connections	$ 774,350
23	Construction of 6" (~ 23,340 LF), 8" (~ 20,840 LF), and 10" (~ 20,620 LF) water line to provide service to projected development regions.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 2,564,800
		Total:	**$12,701,850**
		Planning, Design, Misc. Engineering/Surveying, Construction (18%):	$ 2,286,333
		Contingency (15%):	$ 2,248,227
		Grand Total:	**$ 17,236,410**

ULTIMATE NEEDS:

Proj. No.	Project Description	Need for Project	Opinion of Probable Cost*
24	Construction of a proposed WPF #4 near Voyles Loop Road.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$2,300,000
25	Replacement of 10" water line along SR 33 with 12" (~ 2,260 LF) water line from Clearwater Ave. to Lake Margaret Blvd.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 135,600
26	Replacement of 10" water line along SR 557 with 12" (~ 1,890 LF) water line from Bougainvillea Ave to Bridges Rd.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 113,400
27	Replacement of 8" water line along SR 557 with 10" (~ 5,795 LF) water line from near Lakeshore Dr. to Hwy 559.	Needed to allow fire flow level of service and demand requirements to be met for projected future growth	$ 289,750

Table 16
Water System Capital Improvement Projects Cost Summary (Continued)

ULTIMATE NEEDS (Continued):

Proj. No.	Project Description	Need for Project	Opinion of Probable Cost*
28	Construction of 6" (~ 7,020 LF) water line connecting existing developed regions within the City's service area.	Needed to allow fire flow level of service and demand requirements to be met for projected future water service connections	$ 210,600
29	Construction of 6" (~ 20,236 LF), 8" (~ 28,360 LF), 10" (~ 38,665 LF), and 12" (~ 20,700 LF) water line to provide service to projected development regions.	Needed to allow fire flow level of service and demand requirements to be met for projected future water service connections	$ 4,916,730
		Total:	**$7,966,080**
		Planning, Design, Misc. Engineering/Surveying, Construction (18%):	$ 1,433,894
		Contingency (15%):	$ 1,409,996
		Grand Total:	**$ 10,809,971**

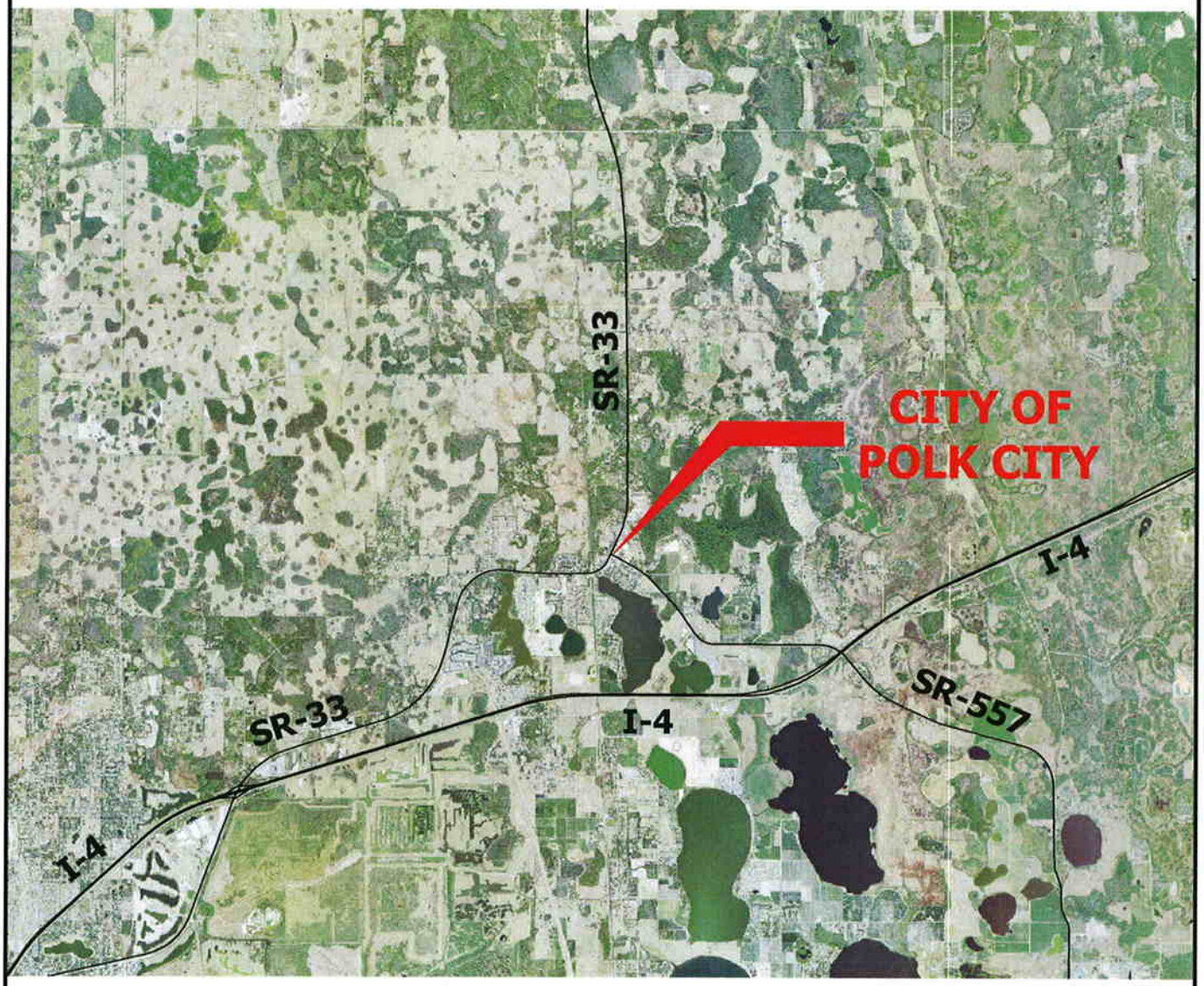
NOTES:

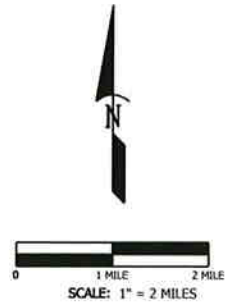
1) Opinion of probable costs for all proposed projects are based on 2008 conditions and are in 2008 dollars.

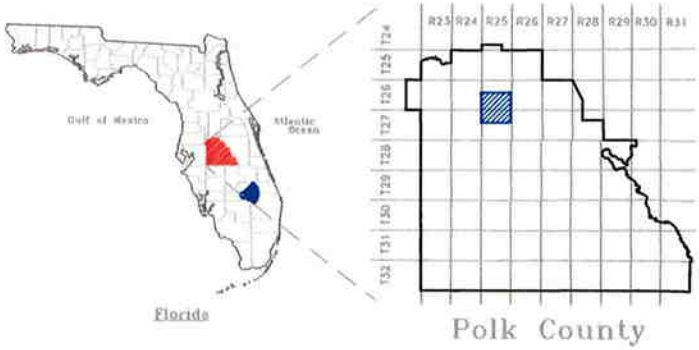
2) Because EVI has no control over the cost of labor, materials, equipment, or services furnished by contractors; methods of determining prices; competitive bidding; nor economic market conditions, any opinions of construction and material costs are made on the basis of past experience and represent EVI's best judgment as experienced and qualified professional engineers familiar with the construction industry. Envisors cannot guarantee that proposals, bids, or actual costs will not vary from our opinion of probable costs. If at any time the Town of Lake Placid desires greater assurance as to the probable costs, an independent cost estimator can be retained to develop a detailed cost estimate.

FIGURES

FIGURE 1
CITY OF POLK CITY LOCATION MAP



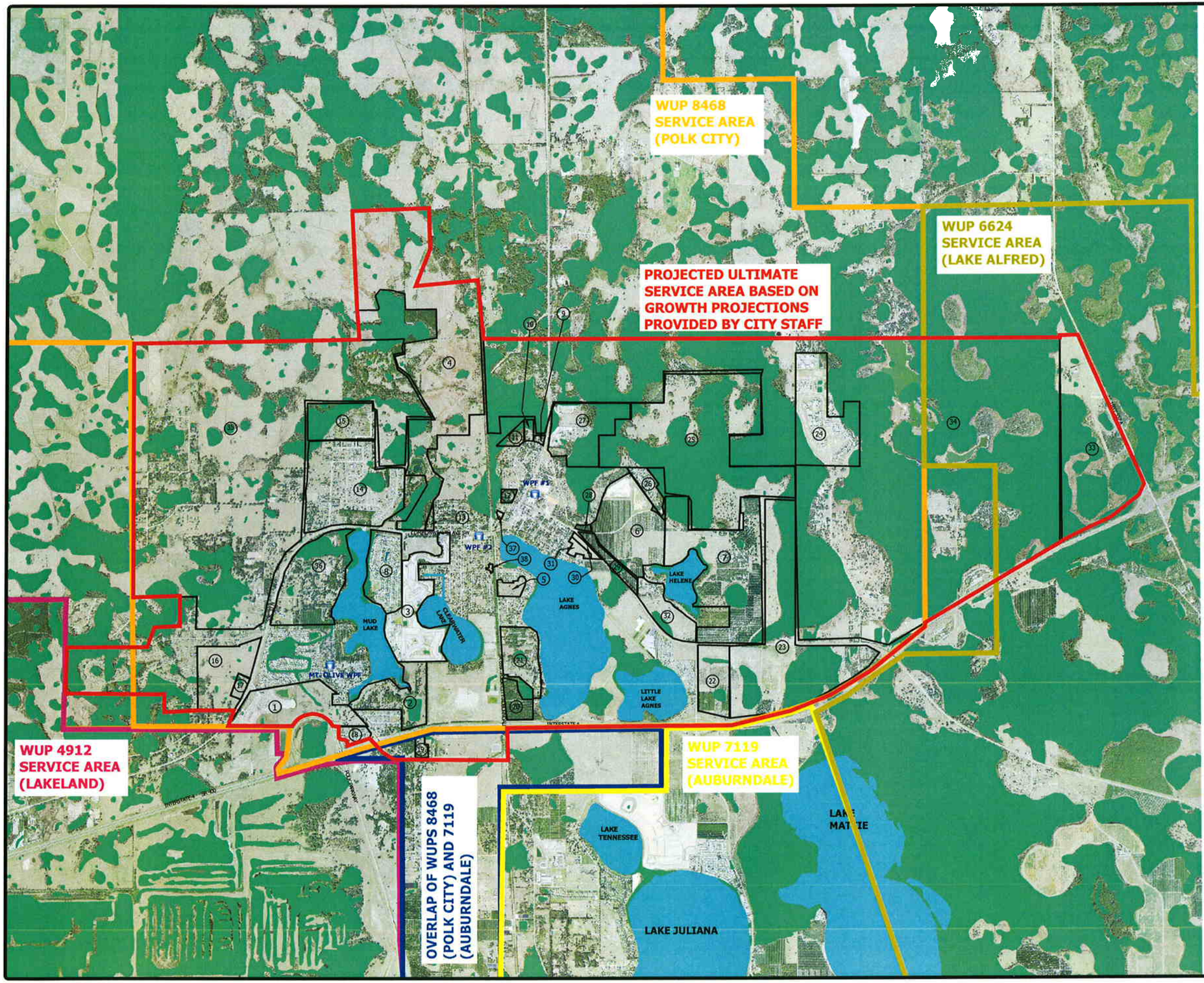




WATER MASTER PLAN
CITY OF POLK CITY

ENVISORS
CONSULTING CIVIL & ENVIRONMENTAL ENGINEERS, PLANNERS & SURVEYORS

FIGURE 2
PROJECTED DEVELOPMENT AREAS



LEGEND

- Projected Development Borders
- 99 — Projected Development Table ID Numbers
- Approximate Wetland Location - National Wetland Inventory

PROJECTED GROWTH
(As Provided by City Planning Staff)

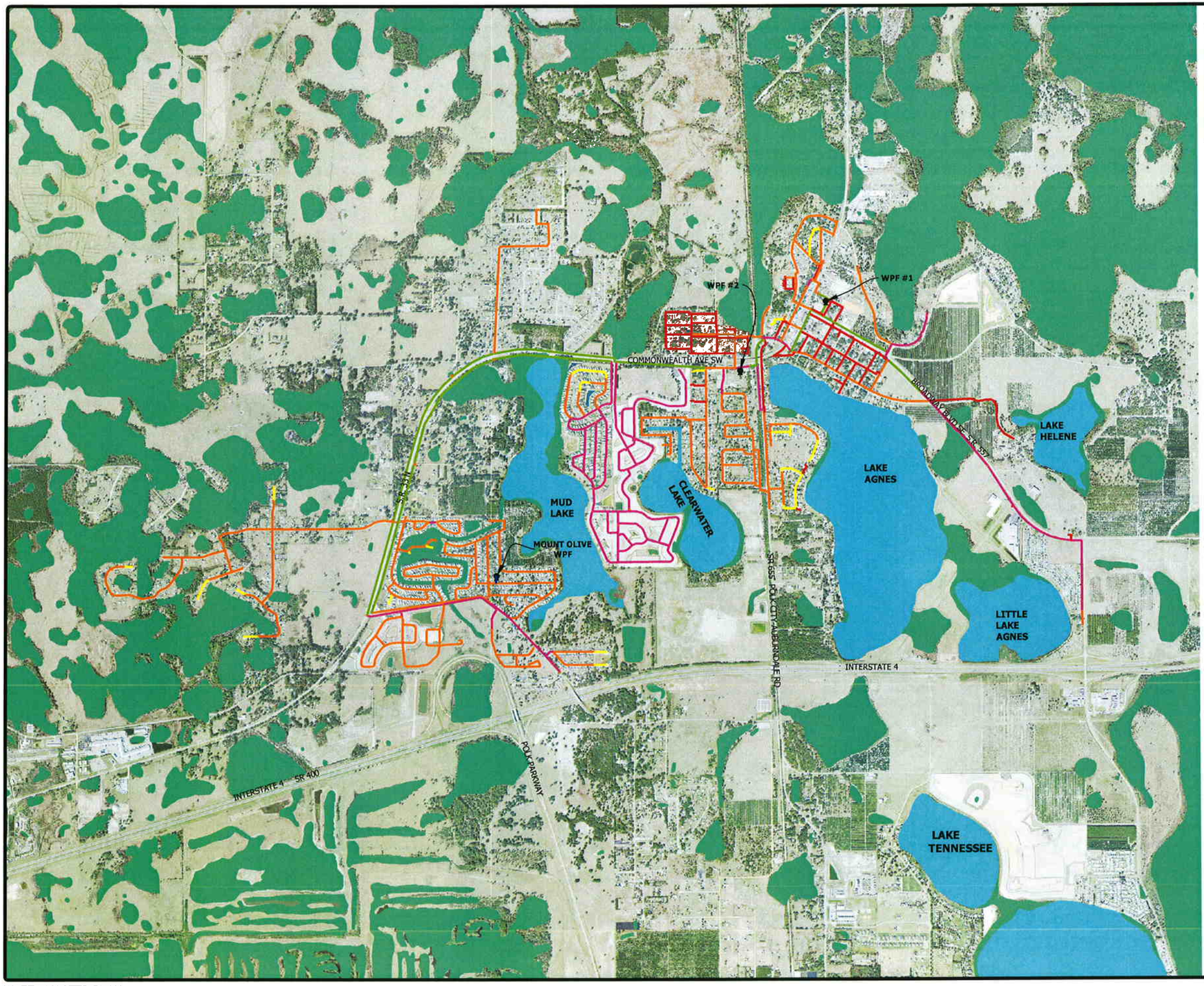
Year 2019:

Growth Area	Type	Acres	EDUs
1	Residential (Arnwine)	142	388
2	Residential (Holly Cove)	115	426
3	Residential (MTO Shore North)	189	600
4	Residential (Gill Property)	733	751
5	Residential (Sandy Pointe)	15	41
6	Residential (Barfield)	240	600
7	Residential (King et al)	330	825
8	Residential (MTO Shores)	100	250
9	Commercial	4	46
10	Residential	7	28
11	Residential (Tuscany)	10	60
12	Residential (Antigua Pointe)	8	26
13	Commercial	5	16
14	Residential	280	200
15	Residential	93	240
16	Commercial (Harper Dev)	170	714
17	Commercial	40	39
18	Residential	18	21
19	Commercial	9	28
20	Residential	32	80
21	Residential	75	20
22	Commercial	73	218
24	Commercial/Residential (Jail)	156	463
26	Residential	28	69
27	Industrial	64	191
30	Commercial (Lake Shore)	6	50
31	Residential	11	32
37	Residential (Rubin Apts)	2	12
38	Residential (Fred Apts)	2	16

Ultimate:

Growth Area	Type	Acres	EDUs
23	Residential	246	616
25	Residential	291	728
28	Commercial	3	9
29	Commercial	23	69
32	Commercial	60	179
33	Residential	187	468
34	Residential	1,131	2,828
35	Residential	1,610	4,025
36	Residential	160	400

FIGURE 3
EXISTING WATER SYSTEM INFRASTRUCTURE MAP



N

0 1,250' 2,500'

SCALE: 1" = 2,500'

POLK COUNTY

Approximate Wetland Location - National Wetland Inventory

Pipe Diameter (in) Legend

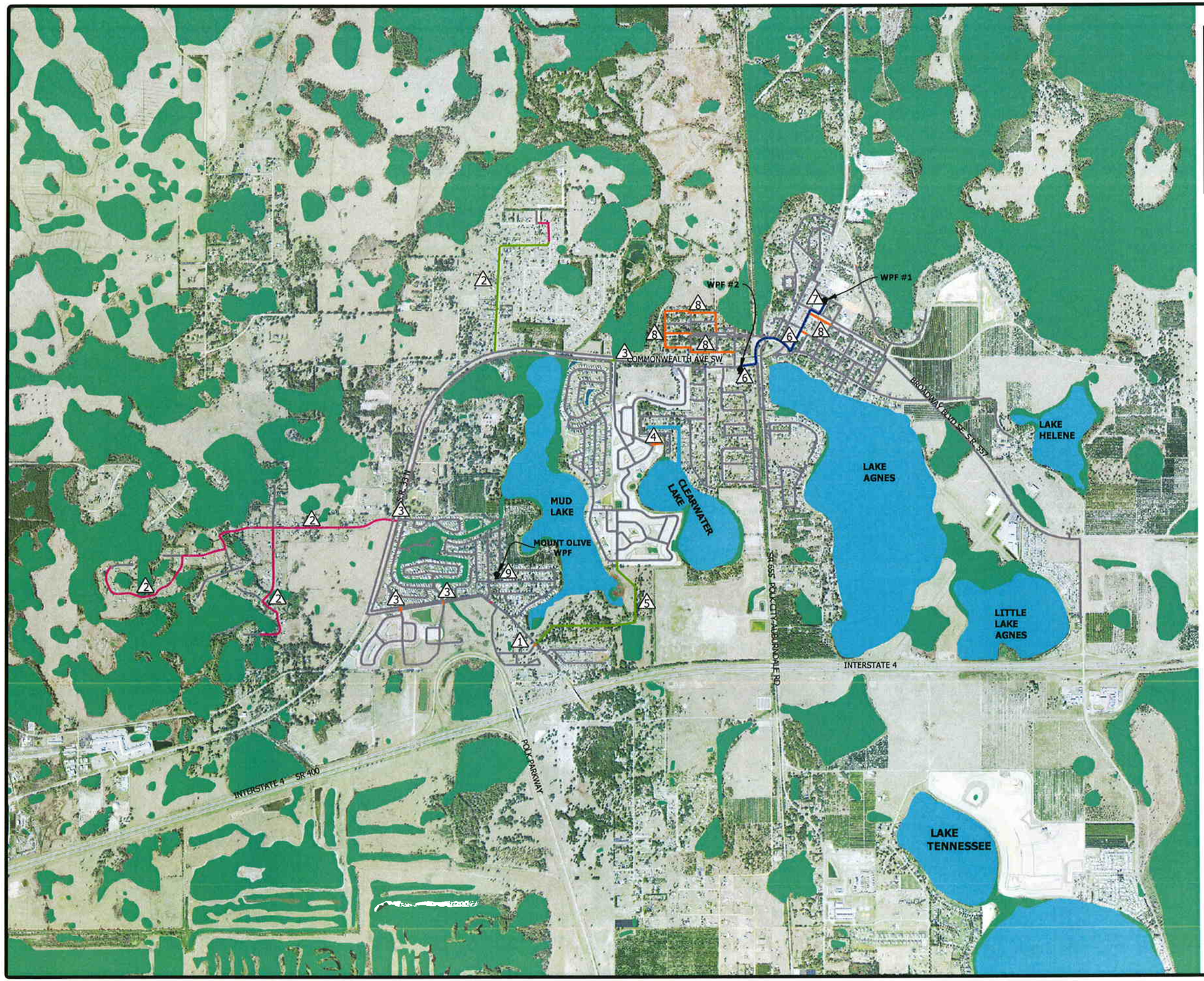
	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE 4

WATER SYSTEM INFRASTRUCTURE MAP HIGHLIGHTING IMMEDIATE IMPROVEMENTS



N

SCALE: 1" = 2,500'

MAP EXCERPT

POLK COUNTY

Approximate Wetland Location - National Wetland Inventory

Pipe Diameter (in) Legend

<=	2
<=	4
<=	6
<=	8
<=	10
<=	12
>	12

Immediate Water System Improvements

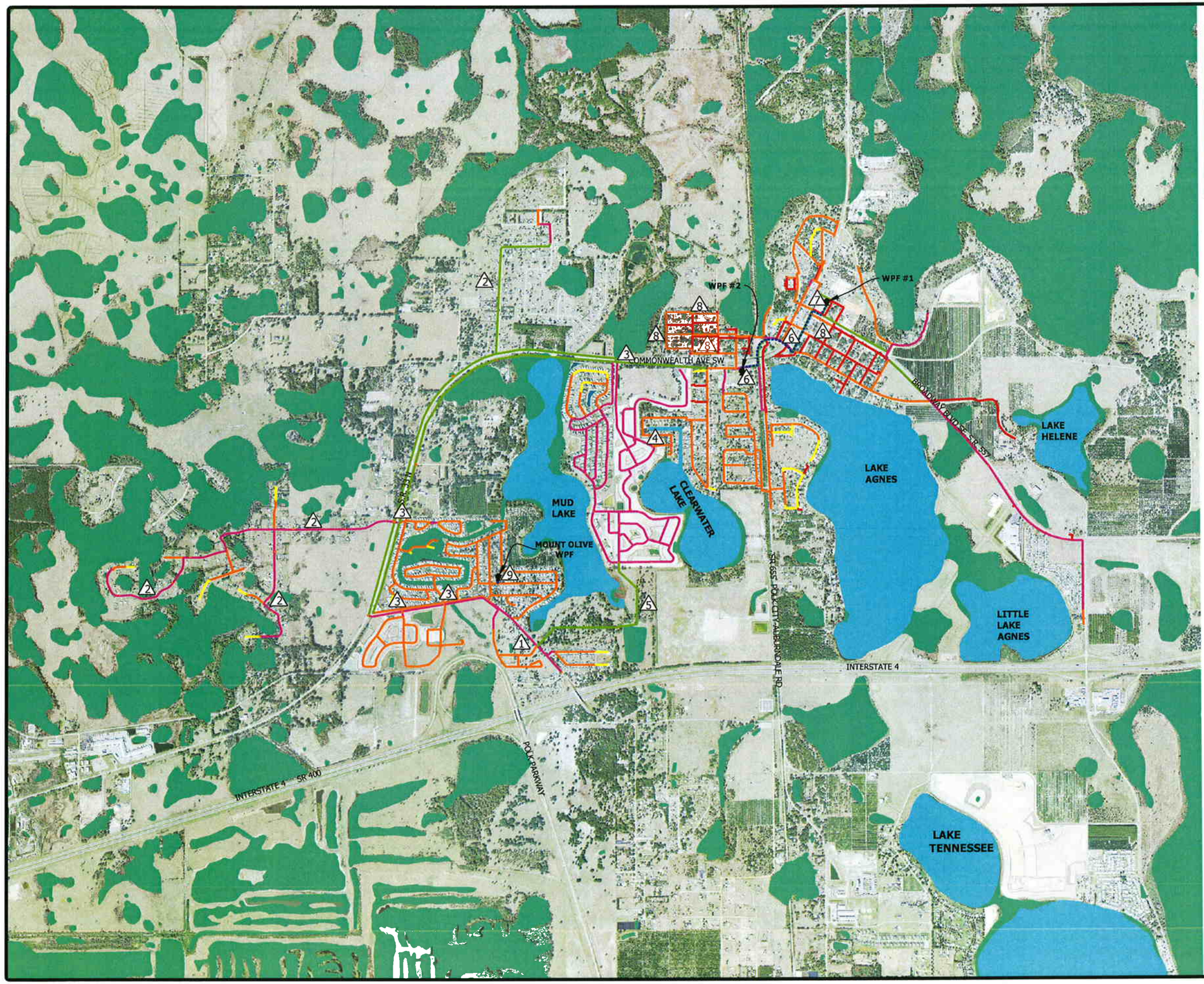
1. Installation of 6-inch water line tie-ins to create looping within Arwine property along Mt. Olive Rd;
2. Replacement of existing dead-end 6-inch waterline (2 locations) throughout existing distribution system with 8-inch and 10-inch waterline;
3. Interconnection of Polk City and Mt. Olive water distribution systems;
4. Interconnection of existing stubout along Waterview Dr. to Mt. Olive Shores North;
5. Installation of 10-inch waterline south of Mt. Olive Shores North and south of Mud Lake to provide looping with Mt. Olive distribution system;
6. Conversion of WPF #2 to well field including installation of 12-inch raw water line from WPF #2 to WPF #1;
7. Modification of WPF #1 to meet 62-555 requirements for water production facilities;
8. Replacement of selected 2-inch waterlines with 6-inch waterlines at various locations throughout the City's distribution system; and
9. Transfer of existing backup generator from WPF #1 to Mt. Olive WPF to provide backup reliability.

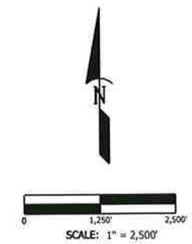
Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE 5

WATER SYSTEM INFRASTRUCTURE MAP WITH IMMEDIATE IMPROVEMENTS





Approximate Wetland Location - National Wetland Inventory

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

Immediate Water System Improvements

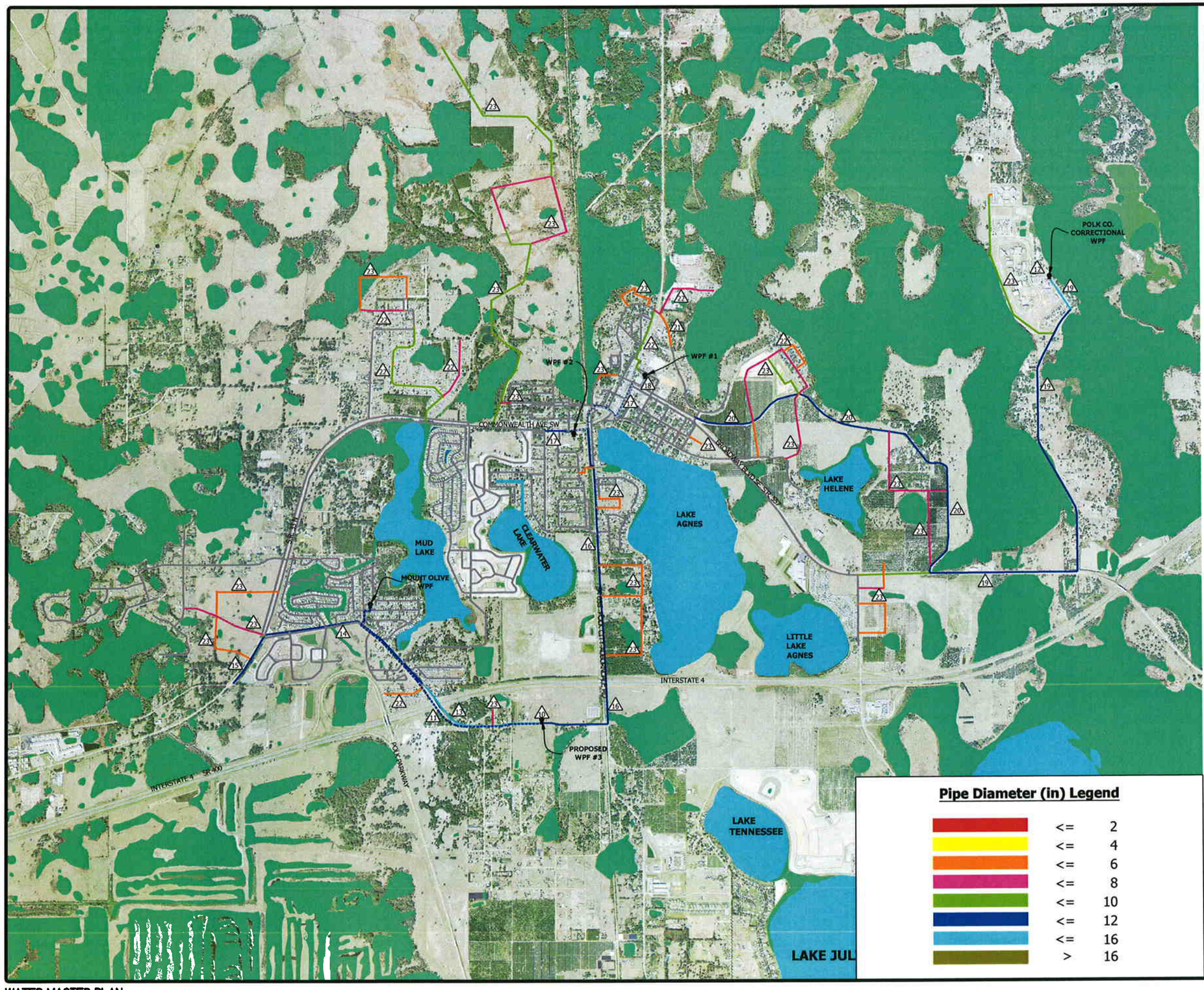
1. Installation of 6-inch water line tie-ins to create looping within Arwine property along Mt. Olive Rd;
2. Replacement of existing dead-end 6-inch waterline (2 locations) throughout existing distribution system with 8-inch and 10-inch waterline;
3. Interconnection of Polk City and Mt. Olive water distribution systems;
4. Interconnection of existing stubout along Waterview Dr. to Mt. Olive Shores North;
5. Installation of 10-inch waterline south of Mt. Olive Shores North and south of Mud Lake to provide looping with Mt. Olive distribution system;
6. Conversion of WPF #2 to well field including installation of 12-inch raw water line from WPF #2 to WPF #1;
7. Modification of WPF #1 to meet 62-555 requirements for water production facilities;
8. Replacement of selected 2-inch waterlines with 6-inch waterlines at various locations throughout the City's distribution system; and
9. Transfer of existing backup generator from WPF #1 to Mt. Olive WPF to provide backup reliability.

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE 6

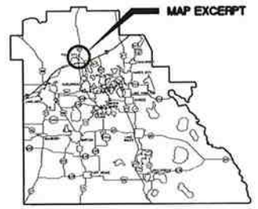
WATER SYSTEM INFRASTRUCTURE MAP HIGHLIGHTING YEAR 2019 IMPROVEMENTS



N

0 1,500' 3,000'

SCALE: 1" = 3,000'



POLK COUNTY

Approximate Wetland Location - National Wetland Inventory

Year 2019 Water System Improvements

10. Construction of a proposed WPF #3 in the southern area of the City's projected service area south of I-4;
11. Construction of 12" raw water line from Mt. Olive WPF to proposed WPF #3 (~7,600 LF as modeled, dependent upon final location of proposed WPF #3);
12. Interconnect and modify existing Polk County Correctional Facility WPF;
13. Extend 16" water line from proposed WPF #3 to interconnect with existing distribution system along Mt. Olive Road (~4,170 LF as modeled, dependent upon final location of proposed WPF #3);
14. Replacement of existing 6" and 8" water line along Mt. Olive Road with 12" (~5,600 LF);
15. Extension of 12" (~1,770 LF) water line on SR 33 for emergency interconnect with City of Lakeland;
16. Installation and replacement of existing 6" and 8" water line with 12" water line from proposed WPF #3 along Mount Olive Road and SR 655 to intersection of SR 655 and SR 33 (~11,120 LF as modeled, dependent upon final location of proposed WPF #3);
17. Replacement of 10" water line with 12" (~4,380 LF) water line from WPF #1 to intersection of SR 33 and Clearwater Ave.;
18. Replacement of 10" (~400 LF) water line with 16" water line along Bougainvilla Ave.,
19. Construction of 16" (~1,210 LF), 12" (~13,070 LF), and 10" (~2,180 LF) water line from Polk County Correctional WPF to proposed 10" water line at the intersection of SR 557 and Hwy 559;
20. Construction of 12" (~12,260 LF) water line along Barfield Road;
21. Construction of 6" (~1,050 LF) water line along Orange Blvd.;
22. Construction of new and replacement of existing water line with 6" (~2,645 LF), 8" (~8,400 LF), and 10" (~7,180 LF) water line connecting existing developed regions within the City's service area; and
23. Construction of 6" (~23,340 LF), 8" (~20,840 LF), and 10" (~20,620 LF) water line to provide service to projected development regions.

Pipe Diameter (in) Legend

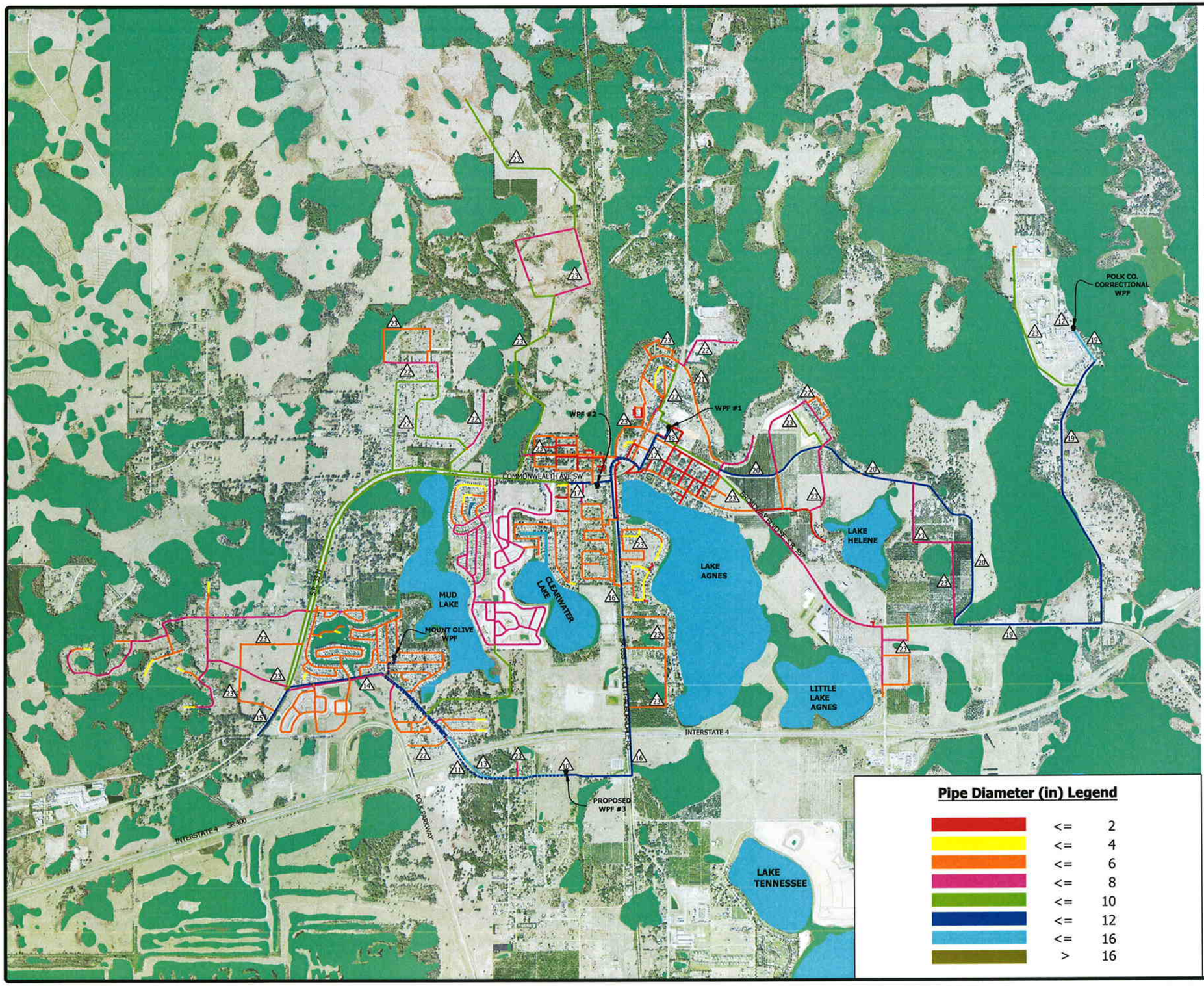
<=	2
<=	4
<=	6
<=	8
<=	10
<=	12
<=	16
>	16

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE 7

WATER SYSTEM INFRASTRUCTURE MAP WITH YEAR 2019 IMPROVEMENTS



N

0 1,500' 3,000'

SCALE: 1" = 3,000'

MAP EXCERPT

POLK COUNTY

Approximate Wetland Location - National Wetland Inventory

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	<=	16
	>	16

Year 2019 Water System Improvements

10 Construction of a proposed WPF #3 in the southern area of the City's projected service area south of I-4;

11 Construction of 12" raw water line from Mt. Olive WPF to proposed WPF #3 (~7,600 LF as modeled, dependent upon final location of proposed WPF #3);

12 Interconnect and modify existing Polk County Correctional Facility WPF;

13 Extend 16" water line from proposed WPF #3 to interconnect with existing distribution system along Mt. Olive Road (~4,170 LF as modeled, dependent upon final location of proposed WPF #3);

14 Replacement of existing 6" and 8" water line along Mt. Olive Road with 12" (~5,600 LF);

15 Extension of 12" (~1,770 LF) water line on SR 33 for emergency interconnect with City of Lakeland;

16 Installation and replacement of existing 6" and 8" water line with 12" water line from proposed WPF #3 along Mount Olive Road and SR 655 to intersection of SR 655 and SR 33 (~11,120 LF as modeled, dependent upon final location of proposed WPF #3);

17 Replacement of 10" water line with 12" (~4,380 LF) water line from WPF #1 to intersection of SR 33 and Clearwater Ave.;

18 Replacement of 10" (~400 LF) water line with 16" water line along Bougainvilla Ave.;

19 Construction of 16" (~1,210 LF), 12" (~13,070 LF), and 10" (~2,180 LF) water line from Polk County Correctional WPF to proposed 10" water line at the intersection of SR 557 and Hwy 559;

20 Construction of 12" (~12,260 LF) water line along Barfield Road;

21 Construction of 6" (~1,050 LF) water line along Orange Blvd.;

22 Construction of new and replacement of existing water line with 6" (~2,645 LF), 8" (~8,400 LF), and 10" (~7,180 LF) water line connecting existing developed regions within the City's service area; and

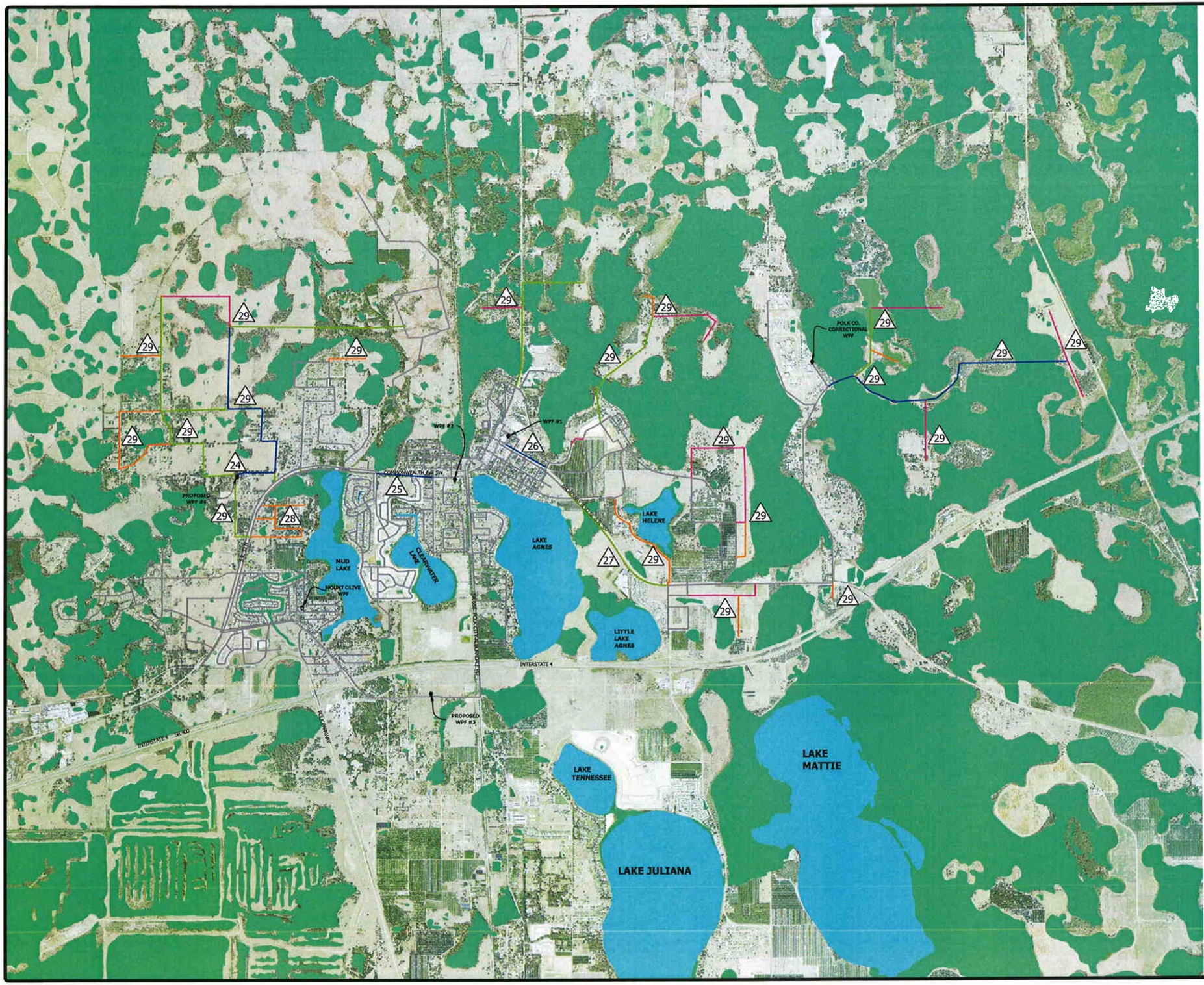
23 Construction of 6" (~23,340 LF), 8" (~20,840 LF), and 10" (~20,620 LF) water line to provide service to projected development regions.

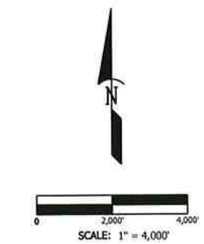
Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE 8

WATER SYSTEM INFRASTRUCTURE MAP HIGHLIGHTING ULTIMATE IMPROVEMENTS





Approximate Wetland Location - National Wetland Inventory

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	<=	16
	>	16

Ultimate Water System Improvements

24 Construction of a proposed WPF #4 near Voyles Loop Road;

25 Replacement of 10" water line along SR 33 with 12" (~ 2,260 LF) water line from Clearwater Ave. to Lake Margaret Blvd.;

26 Replacement of 10" water line along SR 557 with 12" (~ 1,890 LF) water line from Bougainvilla Ave to Bridges Rd.;

27 Replacement of 8" water line along SR 557 with 10" (~ 5,795 LF) water line from near Lakeshore Dr. to Hwy 559;

28 Construction of 6" (~ 7,020 LF) water line connecting exisiting developed regions within the City's service area; and

29 Construction of 6" (~ 19,065 LF), 8" (~ 28,360 LF), 10" (~ 38,665 LF), and 12" (~ 20,700 LF) water line to provide service to projected development regions.

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

WATER MASTER PLAN
CITY OF POLK CITY

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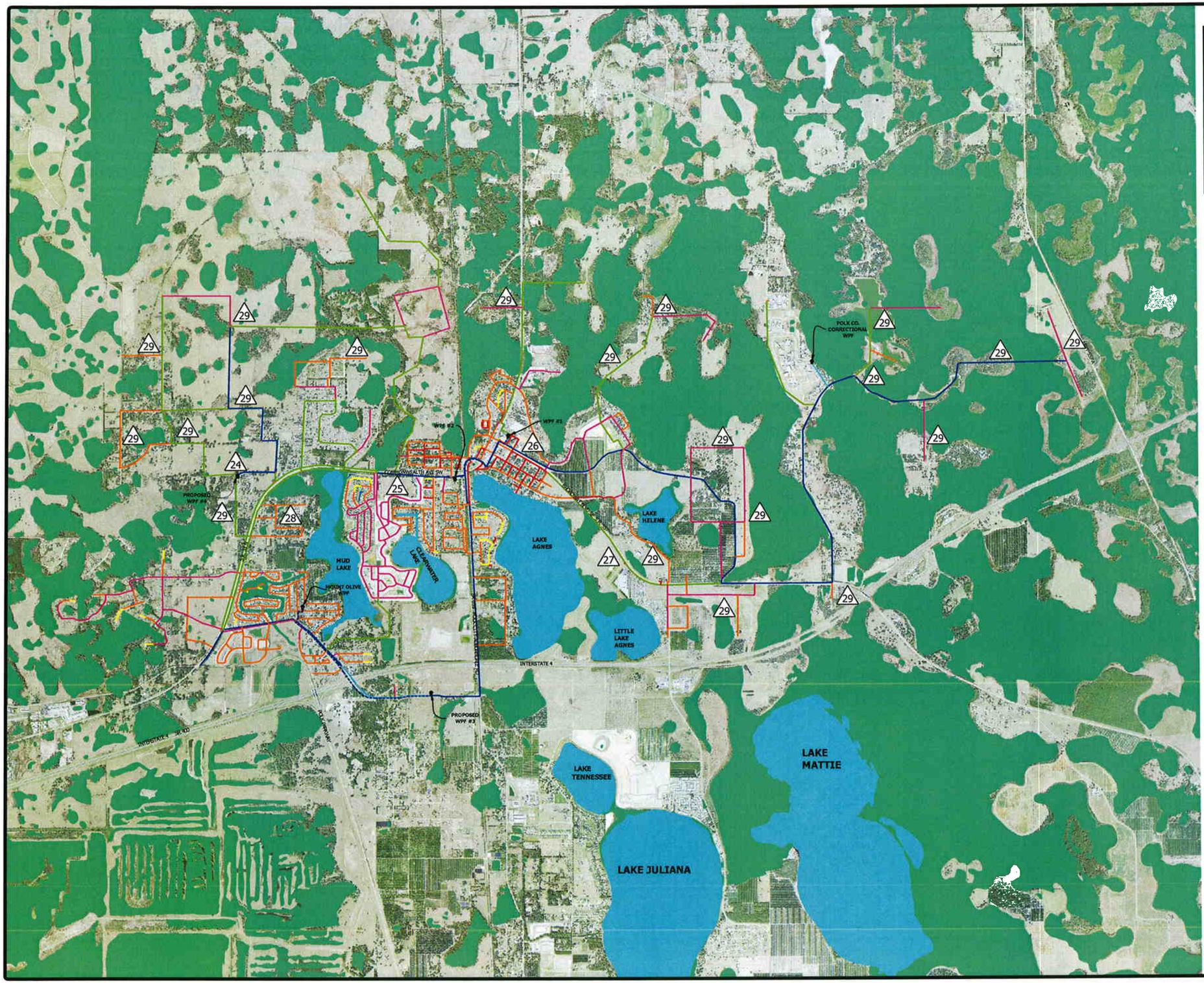
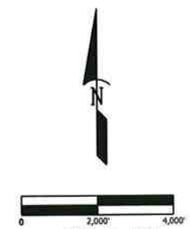
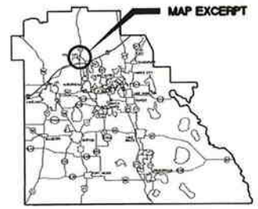
FIGURE 9

WATER SYSTEM INFRASTRUCTURE MAP WITH ULTIMATE IMPROVEMENTS







Approximate Wetland Location - National Wetland Inventory

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	<=	16
	>	16

Ultimate Water System Improvements

24 Construction of a proposed WPF #4 near Voyles Loop Road;

25 Replacement of 10" water line along SR 33 with 12" (~ 2,260 LF) water line from Clearwater Ave. to Lake Margaret Blvd.;

26 Replacement of 10" water line along SR 557 with 12" (~ 1,890 LF) water line from Bougainvilla Ave to Bridges Rd.;

27 Replacement of 8" water line along SR 557 with 10" (~ 5,795 LF) water line from near Lakeshore Dr. to Hwy 559;

28 Construction of 6" (~ 7,020 LF) water line connecting exisiting developed regions within the City's service area; and

29 Construction of 6" (~ 20,236 LF), 8" (~ 28,360 LF), 10" (~ 38,665 LF), and 12" (~ 20,700 LF) water line to provide service to projected development regions.

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

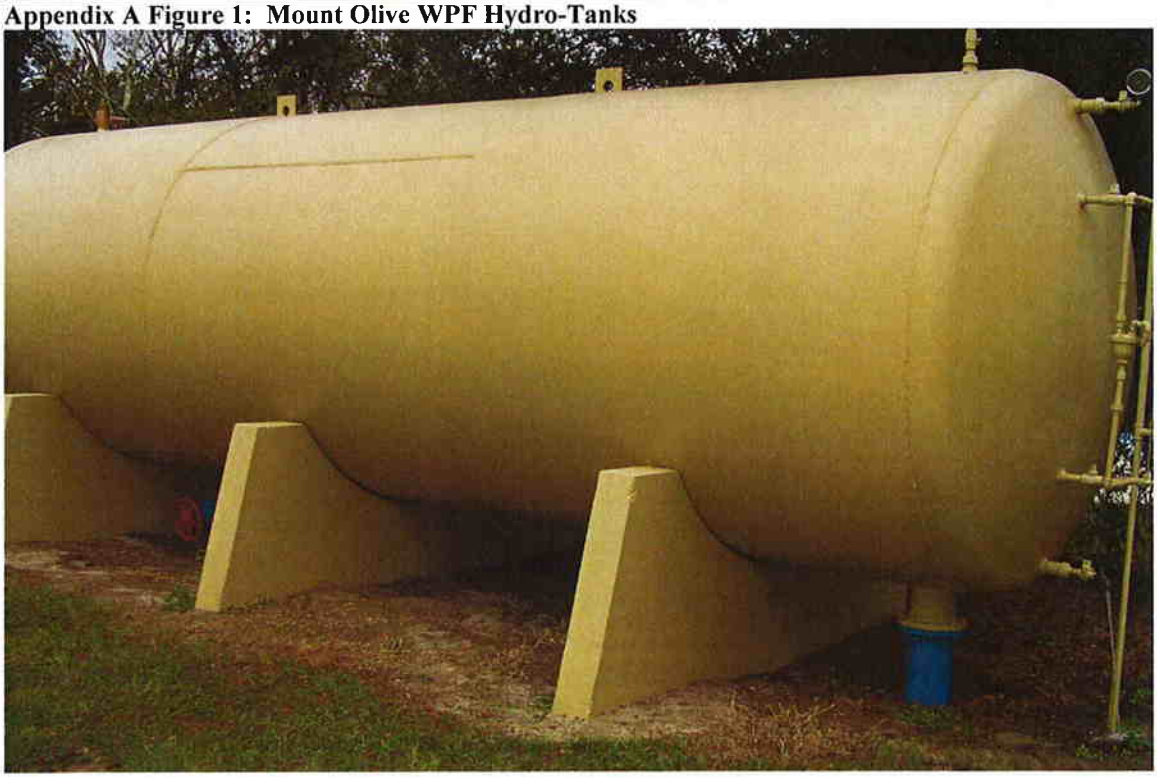
Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

APPENDIX A

PHOTOGRAPHS OF EXISTING WATER PRODUCTION FACILITIES

MOUNT OLIVE WPF

Appendix A Figure 1: Mount Olive WPF Hydro-Tanks

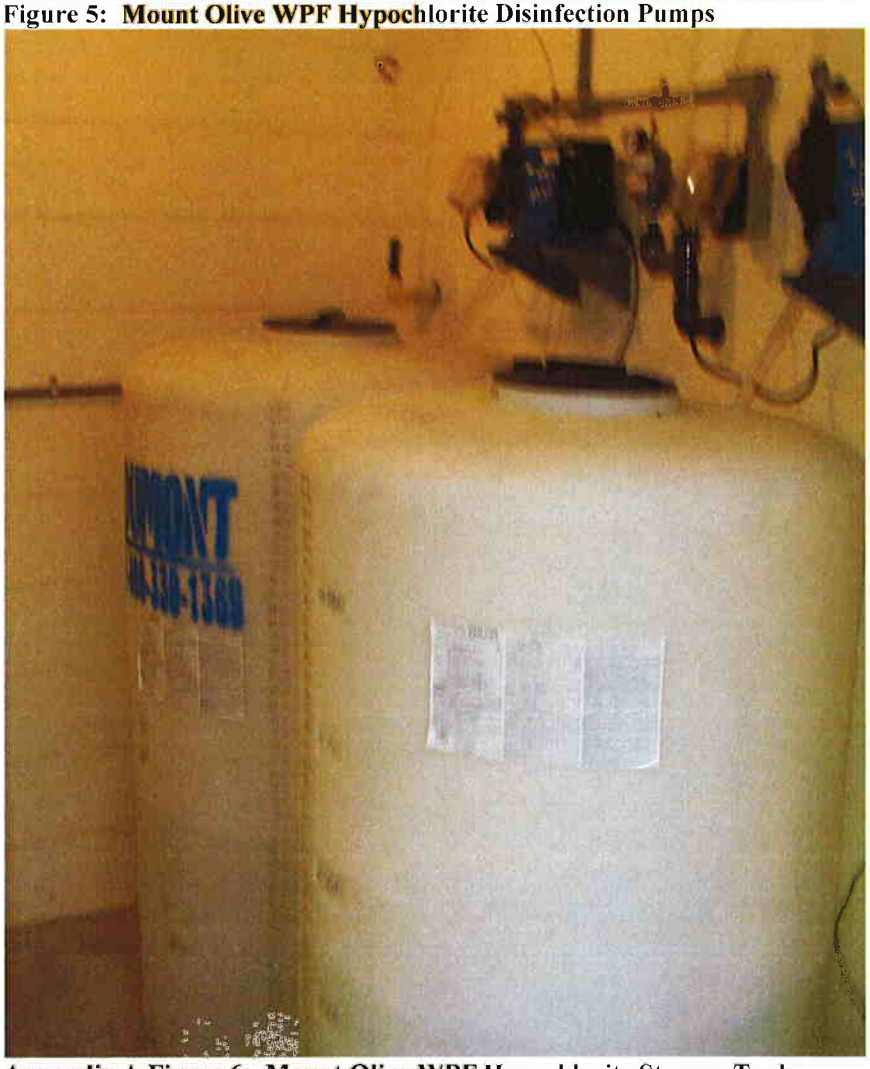


Appendix A Figure 2: Mount Olive WPF 20,000 gal Hydro-Tank

Appendix A Figure 3: Mount Olive WPF Well Pump (1 of 2)

Appendix A Figure 4: Mount Olive WPF Well Pump (2 of 2)

Appendix A Figure 5: **Mount Olive WPF Hypochlorite Disinfection Pumps**



Appendix A Figure 6: Mount Olive WPF Hypochlorite Storage Tanks

Appendix A Figure 7: Mount Olive WPF Flow Meters

Appendix A Figure 8: Mount Olive WPF Panel

WPF #1

Appendix A Figure 9: WPF #1

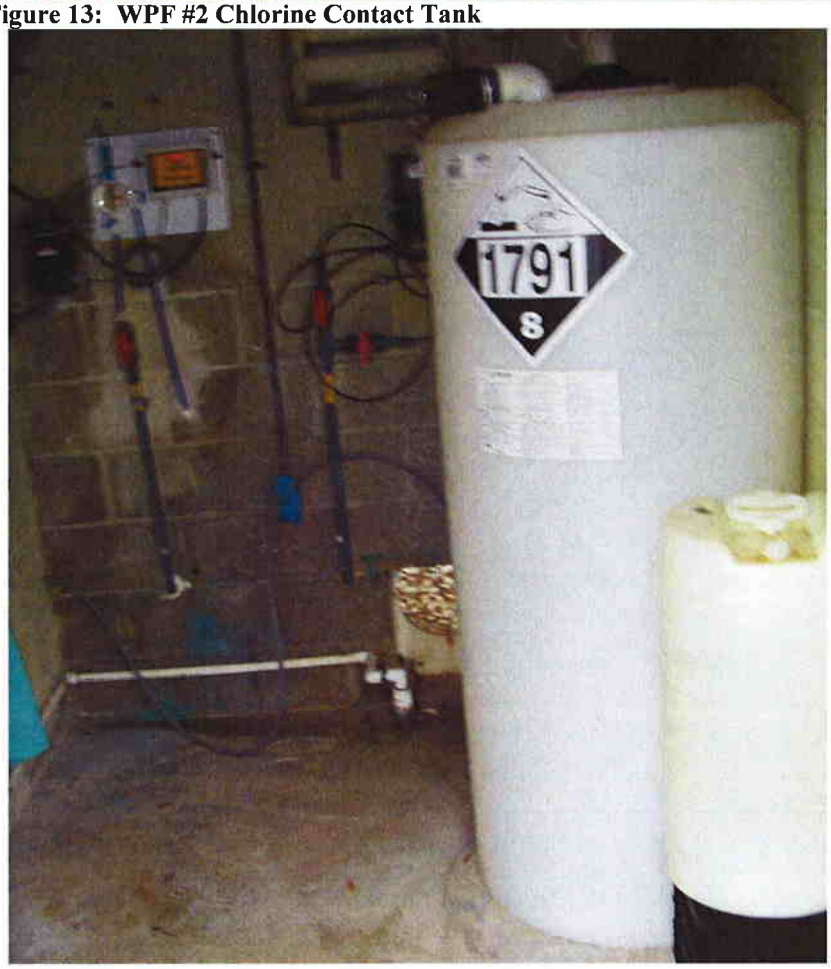
Appendix A Figure 10: WPF #1 Hydro-Tank

Appendix A Figure 11: WPF#1 Backup Emergency Generator

Appendix A Figure 12: WPF #1 Well Pump (1 of 1)

WPF #2

Appendix A Figure 13: WPF #2 Chlorine Contact Tank

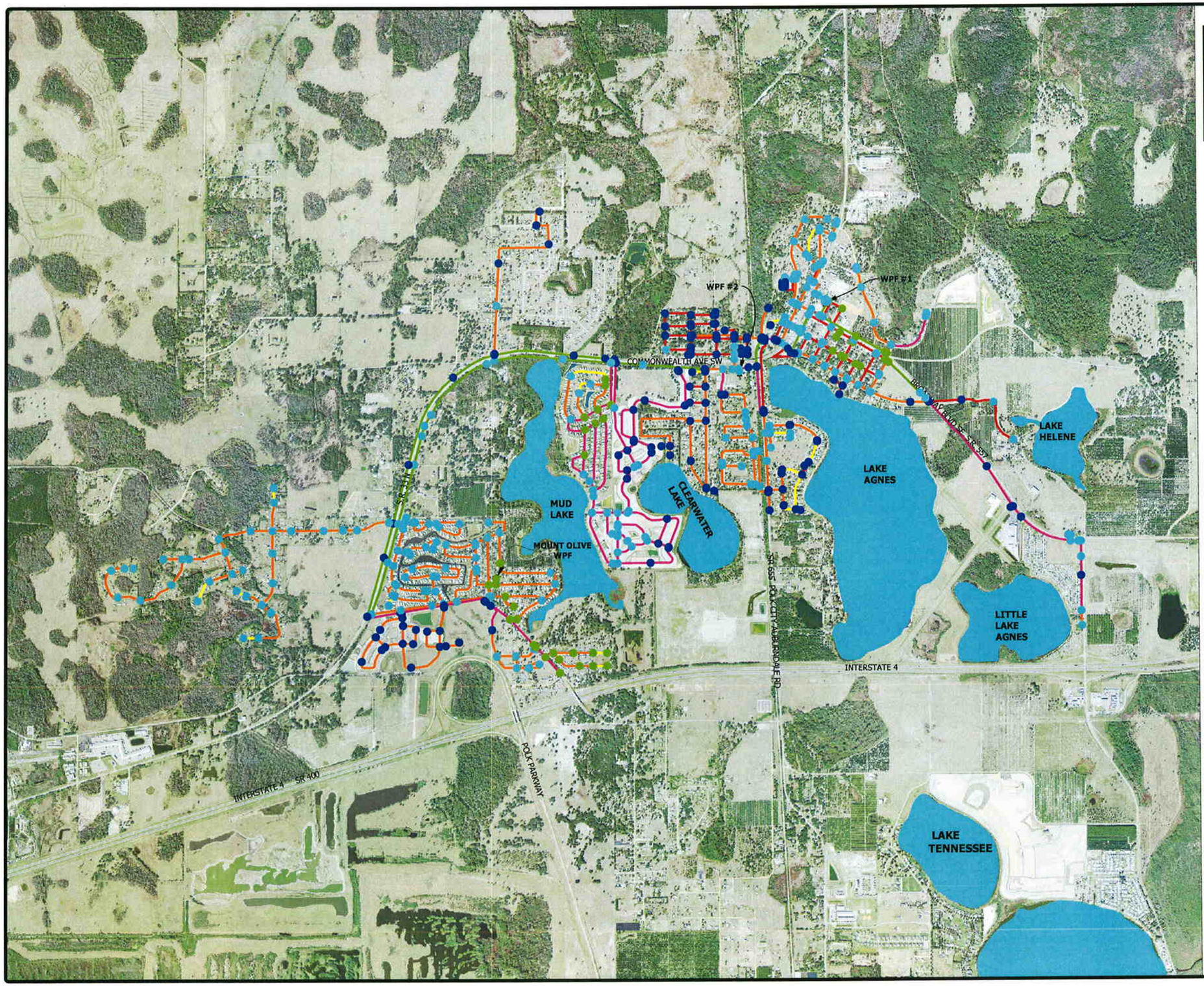


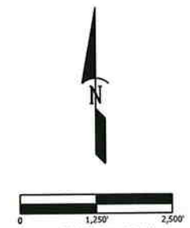
Appendix A Figure 14: WPF #2 Hypochlorite Storage Tank and Chlorine Analyzer

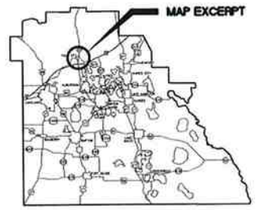
APPENDIX B

WATER SYSTEM MODELING SIMULATION RESULTS

FIGURE B-1
EXISTING ADD SIMULATION







Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

Pressure (psi) Legend

	<=	20.0
	<=	30.0
	<=	40.0
	<=	50.0
	<=	60.0
	<=	80.0
	>	80.0

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

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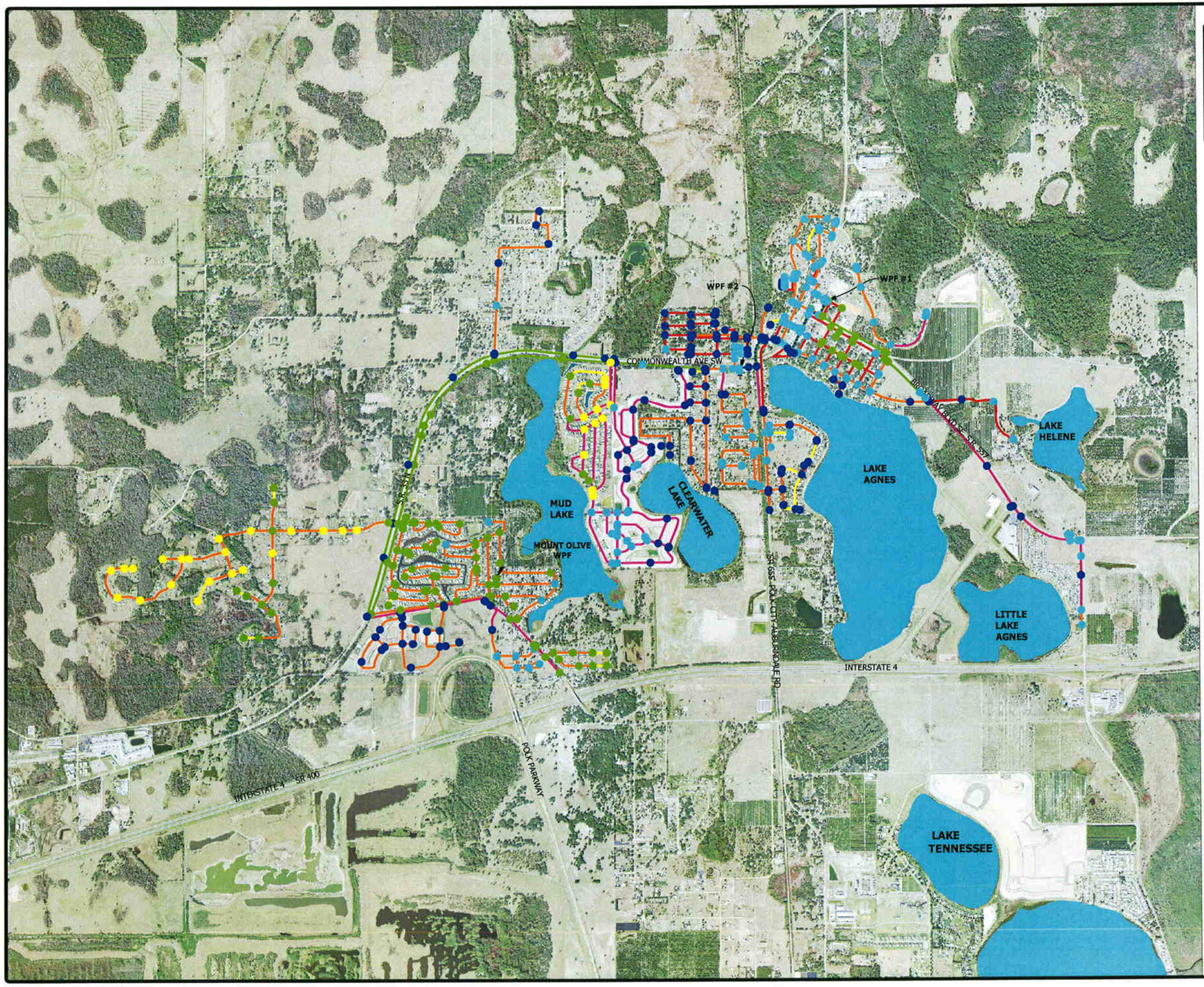
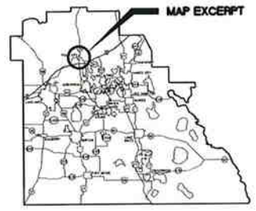
FIGURE B-2
EXISTING PHD SIMULATION



N

0 1,250' 2,500'

SCALE: 1" = 2,500'



POLK COUNTY

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

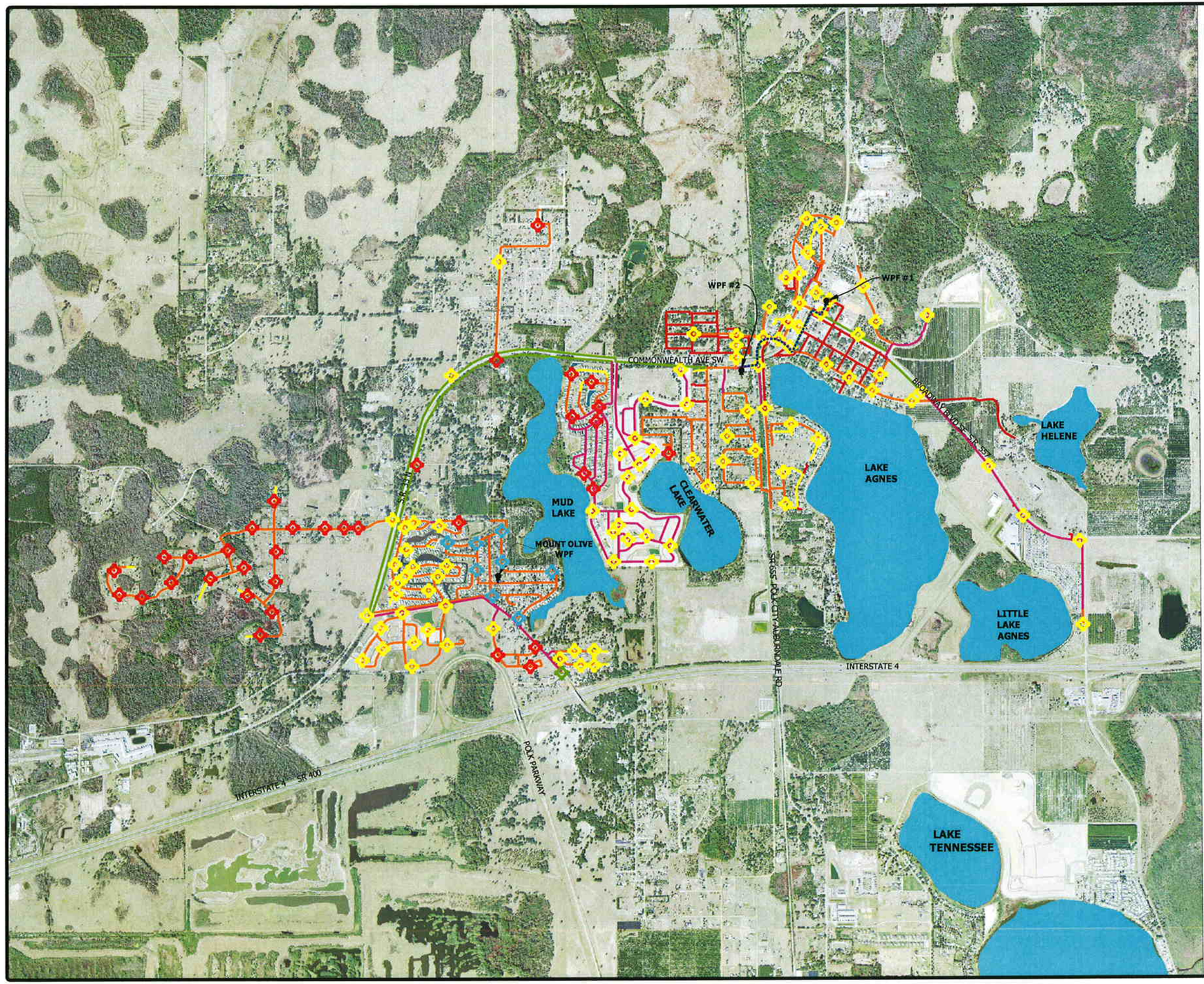
Pressure (psi) Legend

	<=	20.0
	<=	30.0
	<=	40.0
	<=	50.0
	<=	60.0
	<=	80.0
	>	80.0

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE B-3
EXISTING MDD FIRE FLOW SIMULATION



N

0 1,250' 2,500'

SCALE: 1" = 2,500'

POLK COUNTY

Pipe Diameter (in) Legend

<=	2
<=	4
<=	6
<=	8
<=	10
<=	12
>	12

Available Fire Flow (gpm) Legend

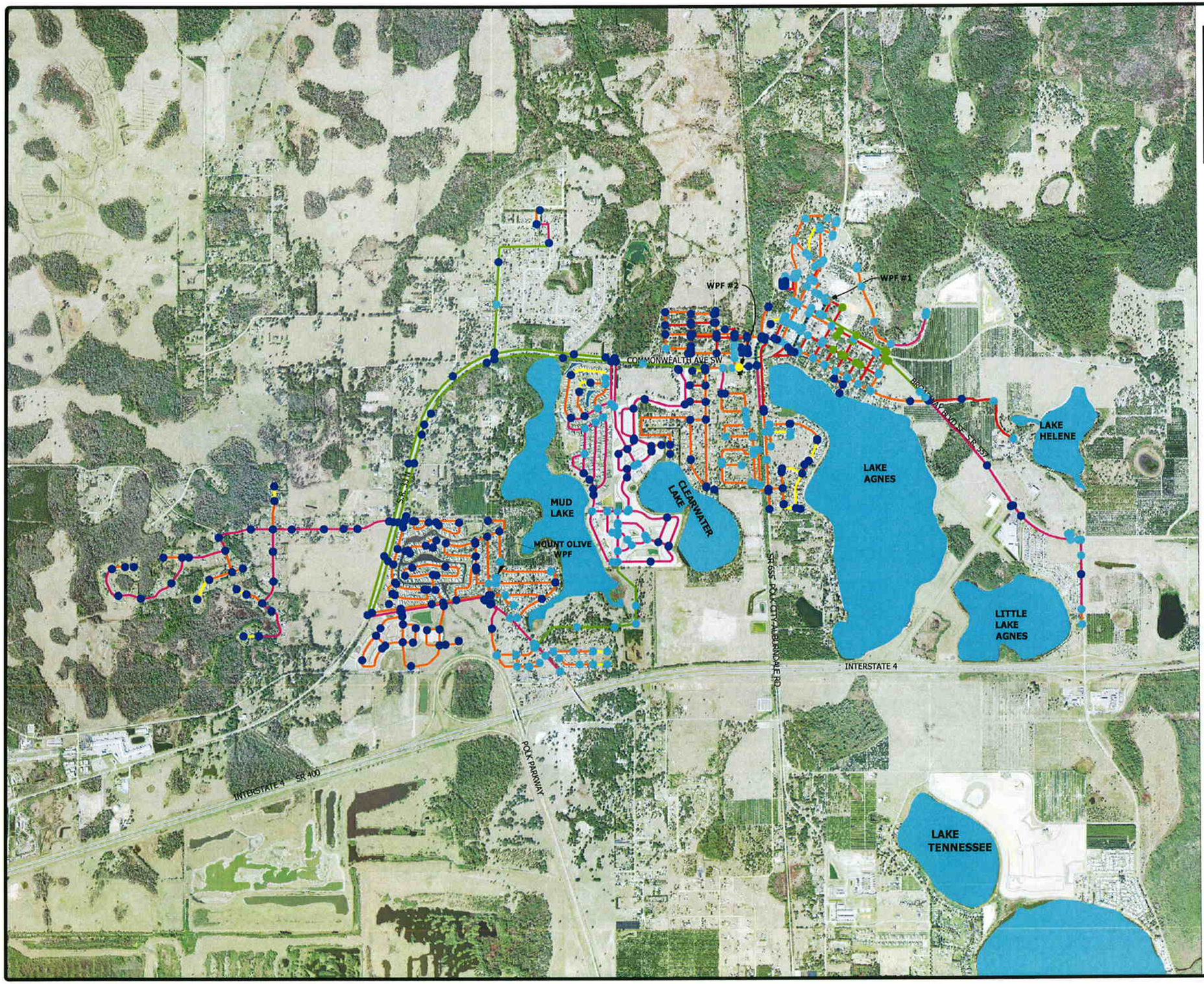
<	500
<=	750
<=	1,000
<=	1,500
<=	3,000

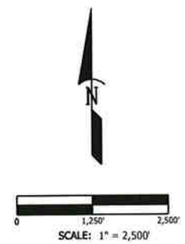
Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

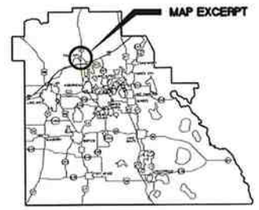
Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE B-4

EXISTING ADD SIMULATION WITH IMMEDIATE IMPROVEMENTS







Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

Pressure (psi) Legend

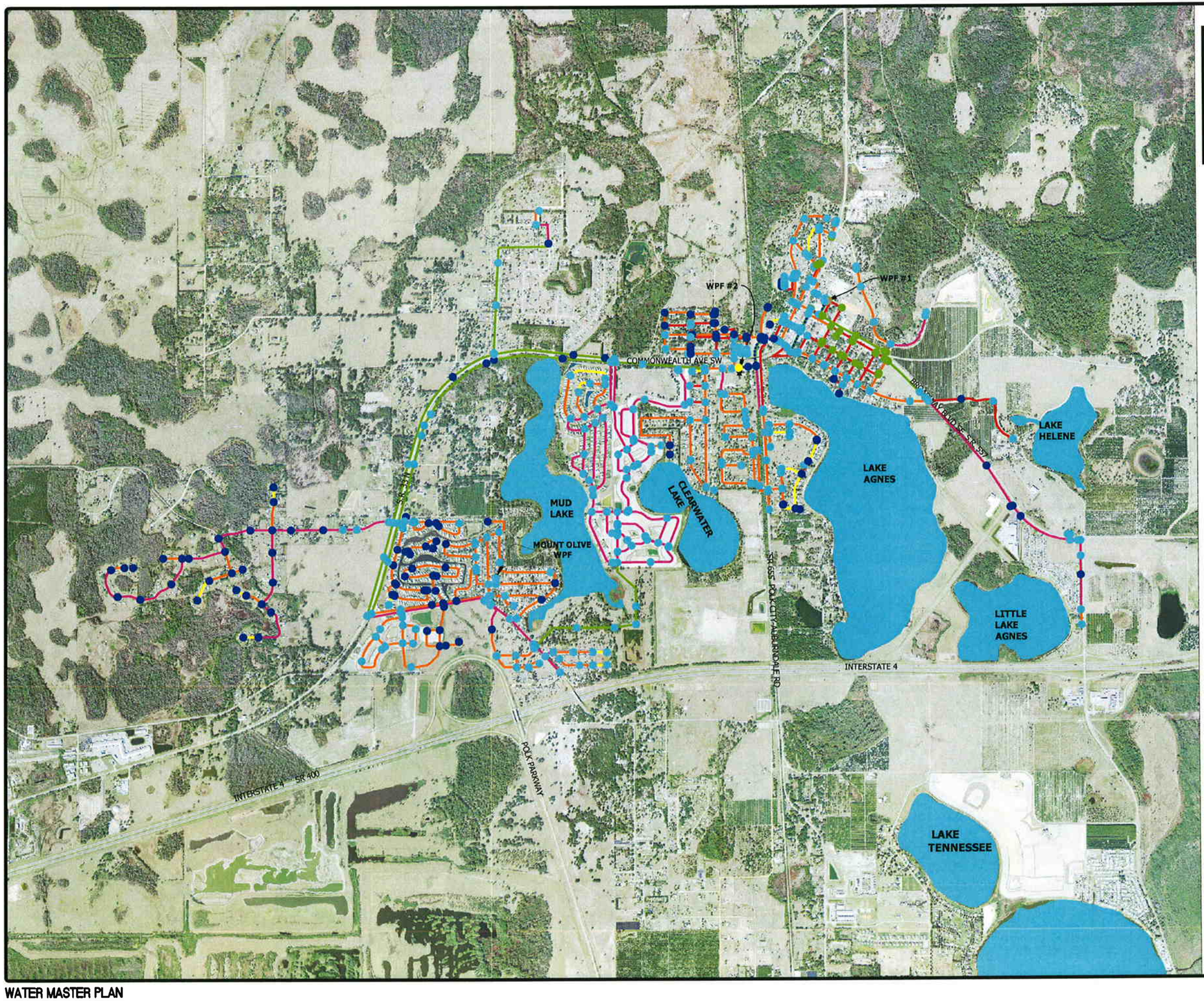
	<=	20.0
	<=	30.0
	<=	40.0
	<=	50.0
	<=	60.0
	<=	80.0
	>	80.0

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE B-5

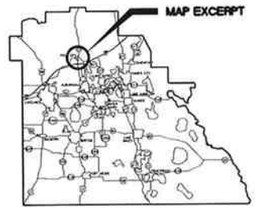
EXISTING PHD SIMULATION WITH IMMEDIATE IMPROVEMENTS



N

0 1,250' 2,500'

SCALE: 1" = 2,500'



POLK COUNTY

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

Pressure (psi) Legend

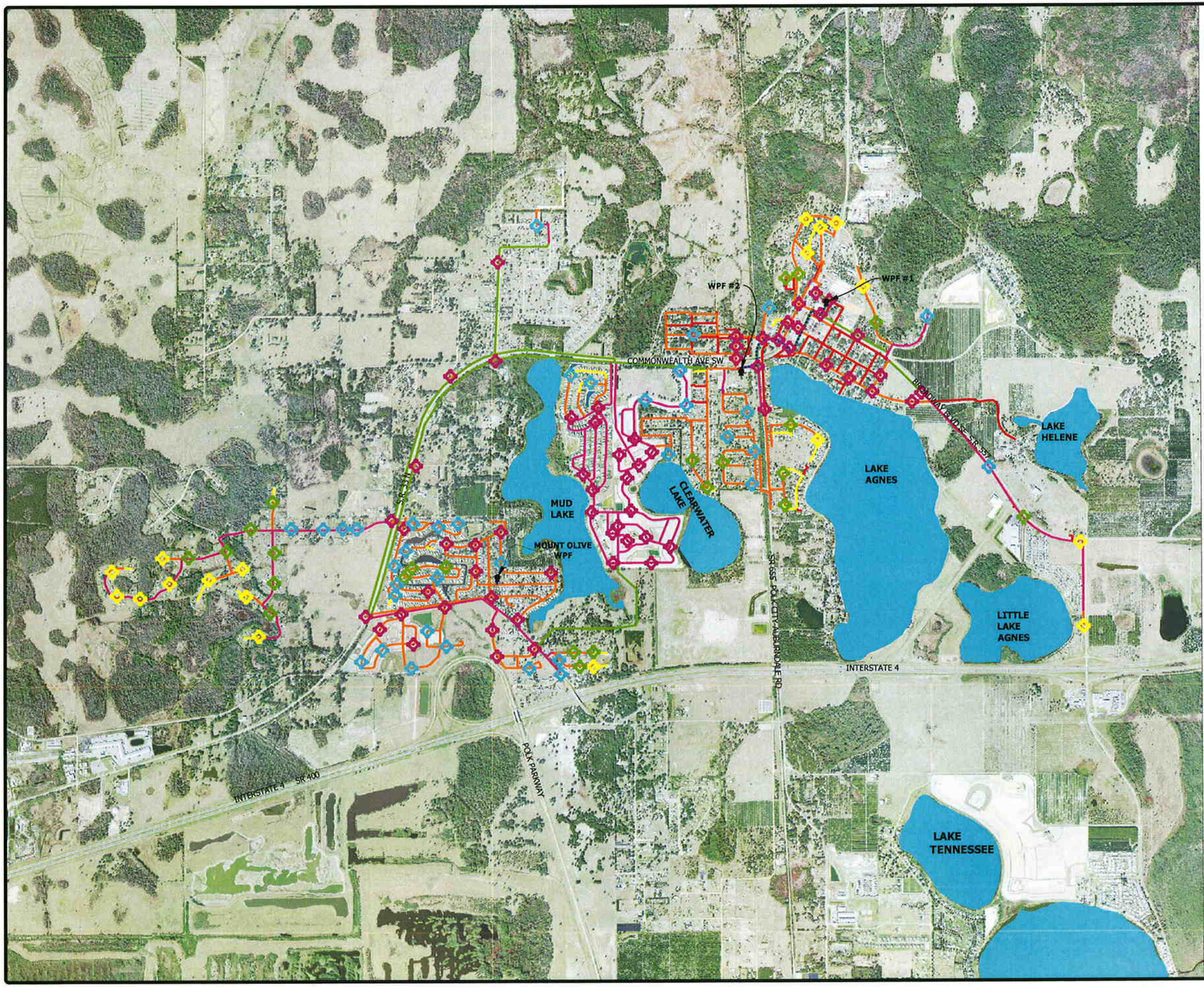
	<=	20.0
	<=	30.0
	<=	40.0
	<=	50.0
	<=	60.0
	<=	80.0
	>	80.0

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE B-6

EXISTING MDD FIRE FLOW SIMULATION WITH IMMEDIATE IMPROVEMENTS



N

0 1,250' 2,500'

SCALE: 1" = 2,500'

MAP EXCERPT

POLK COUNTY

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

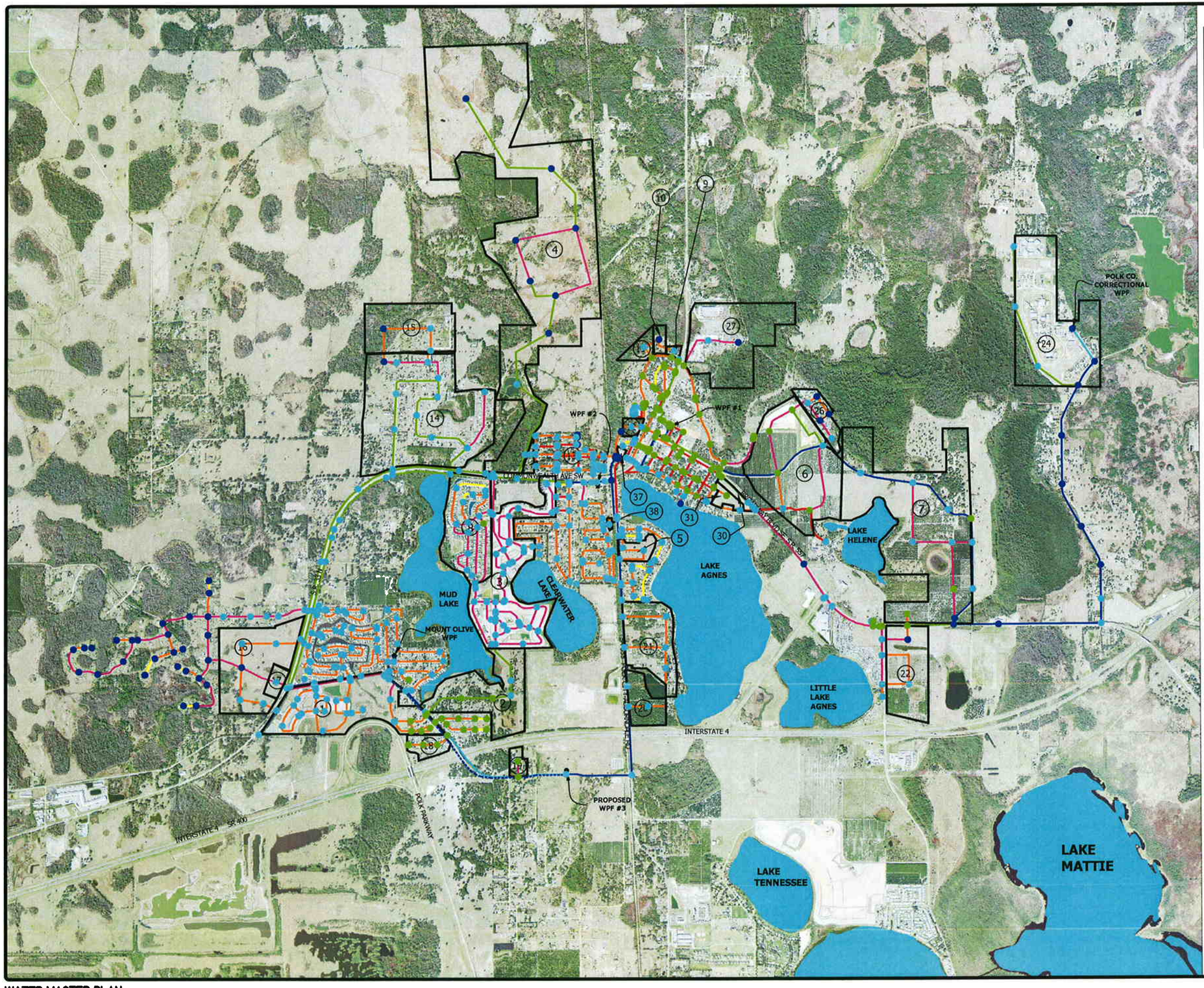
Available Fire Flow (gpm) Legend

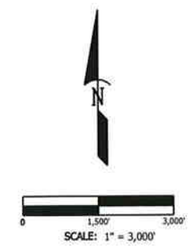
	<	500
	<=	750
	<=	1,000
	<=	1,500
	<=	3,000

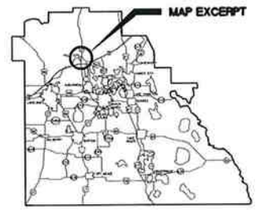
Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE B-7
YEAR 2019 ADD SIMULATION







Projected Development Borders

99 Projected Development Table ID Numbers

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

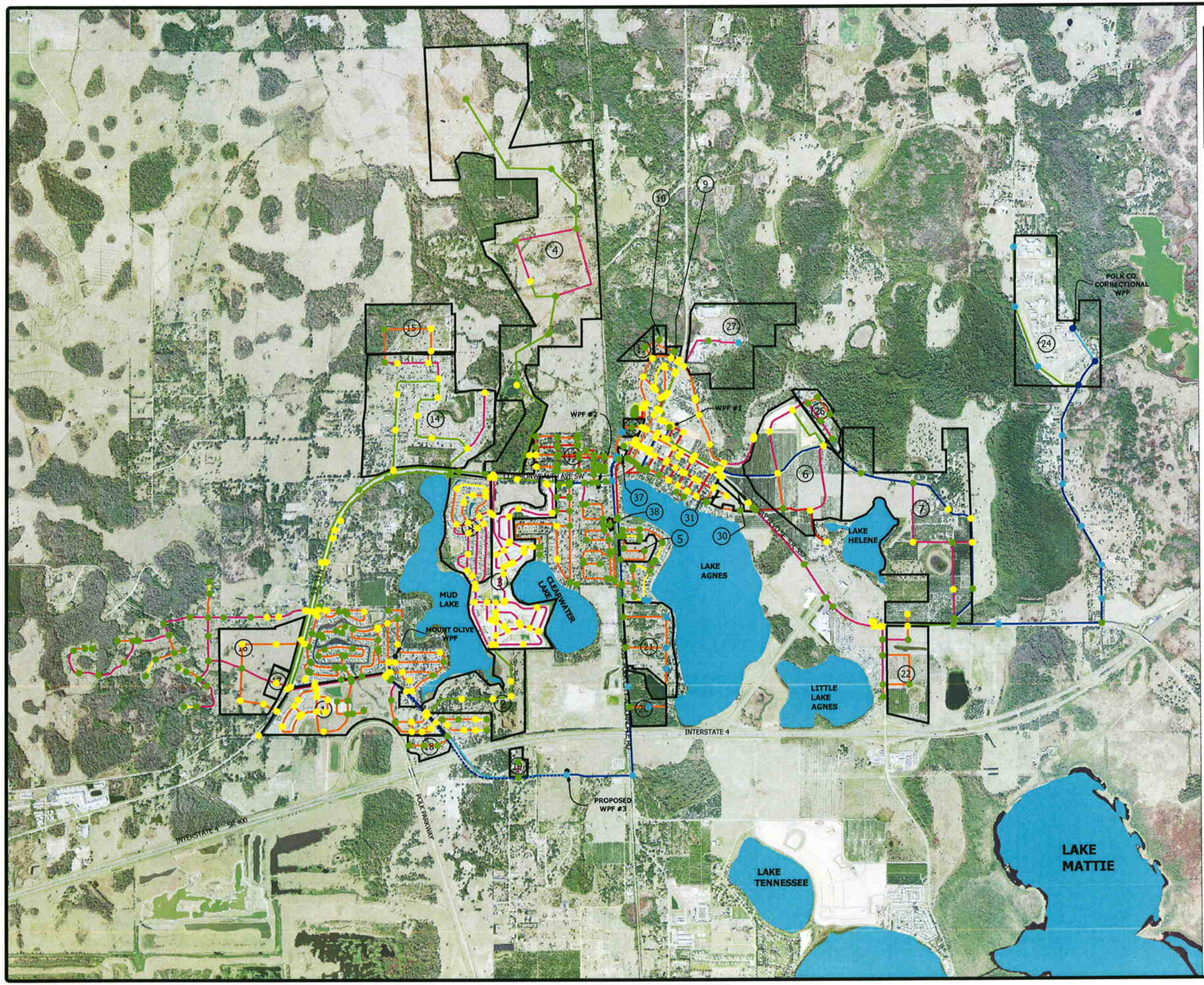
Pressure (psi) Legend

	<=	20.0
	<=	30.0
	<=	40.0
	<=	50.0
	<=	60.0
	<=	80.0
	>	80.0

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE B-8
YEAR 2019 PHD SIMULATION



N

0 1,500' 3,000'
SCALE: 1" = 3,000'

MAP EXCERPT

POLK COUNTY

Projected Development Borders

99 Projected Development Table ID Numbers

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

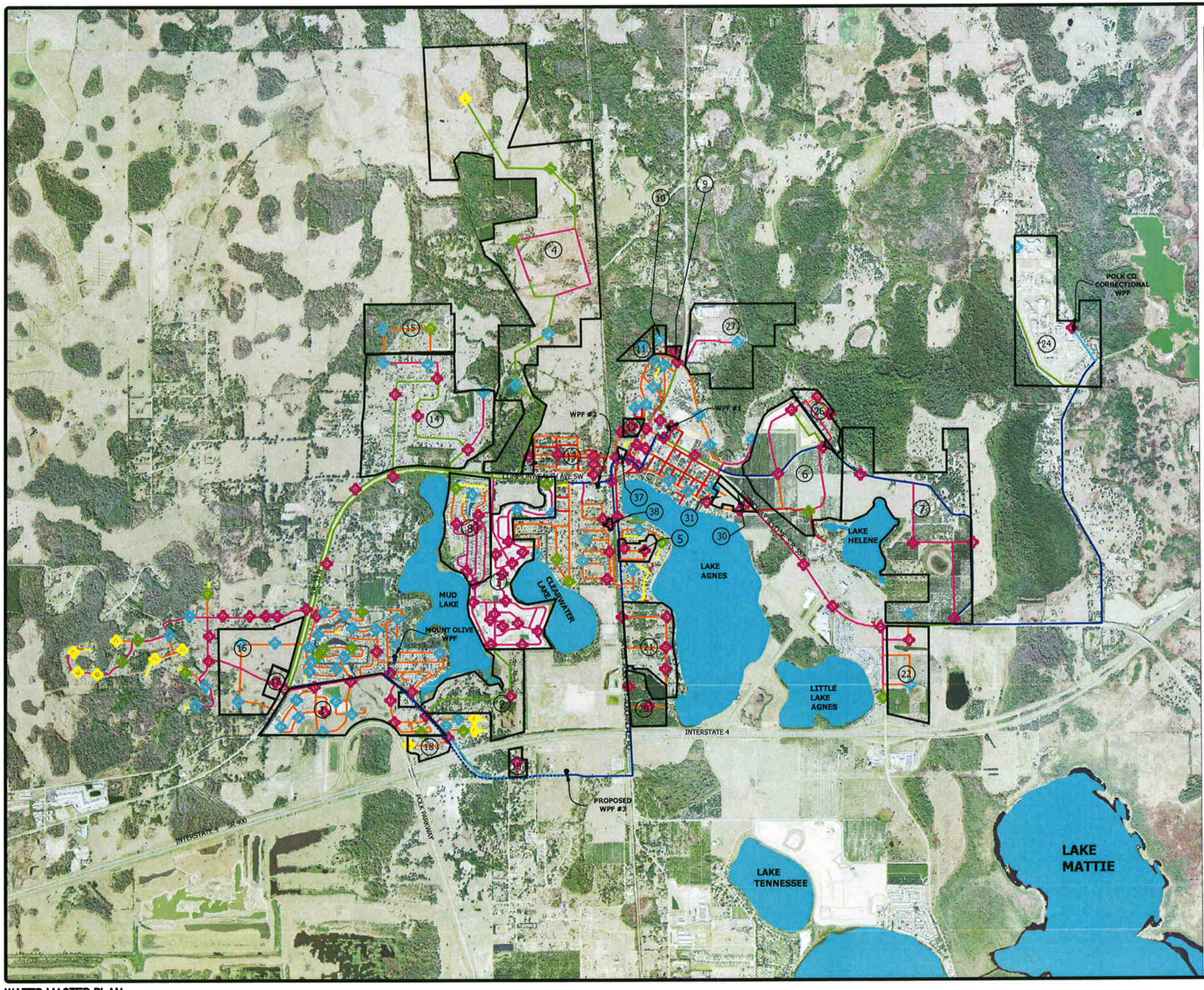
Pressure (psi) Legend

	<=	20.0
	<=	30.0
	<=	40.0
	<=	50.0
	<=	60.0
	<=	80.0
	>	80.0

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

FIGURE B-9
YEAR 2019 MDD FIRE FLOW SIMULATION



N

0 1,500' 3,000'

SCALE: 1" = 3,000'

MAP EXCERPT

POLK COUNTY

Projected Development Borders

99 Projected Development Table ID Numbers

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

Available Fire Flow (gpm) Legend

	<	500
	<=	750
	<=	1,000
	<=	1,500
	<=	3,000

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

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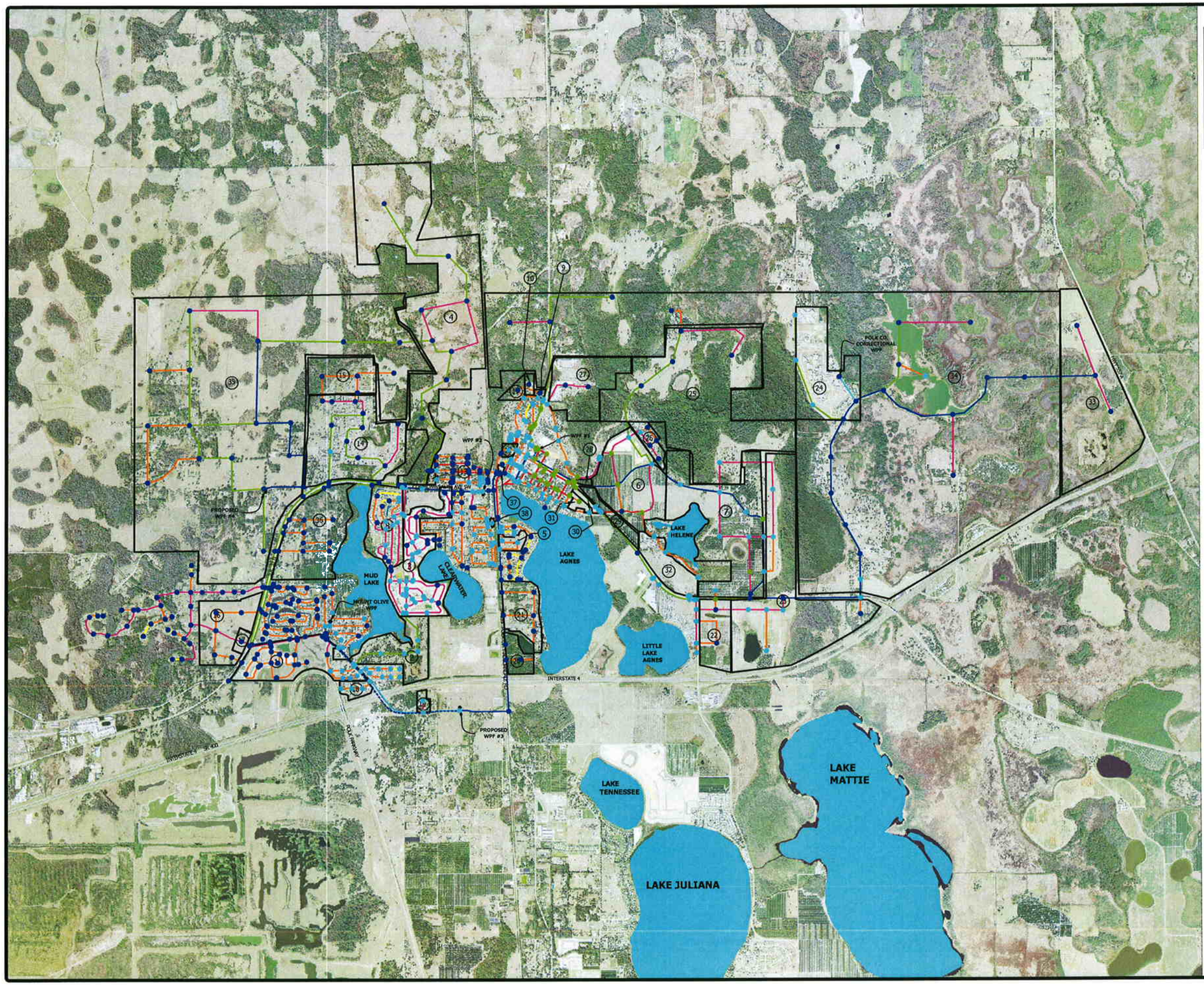
FIGURE B-10
ULTIMATE ADD SIMULATION



N

0 2,000' 4,000'

SCALE: 1" = 4,000'

POLK COUNTY

Projected Development Borders

99 Projected Development Table ID Numbers

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

Pressure (psi) Legend

	<=	20.0
	<=	30.0
	<=	40.0
	<=	50.0
	<=	60.0
	<=	80.0
	>	80.0

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

ENVISORS
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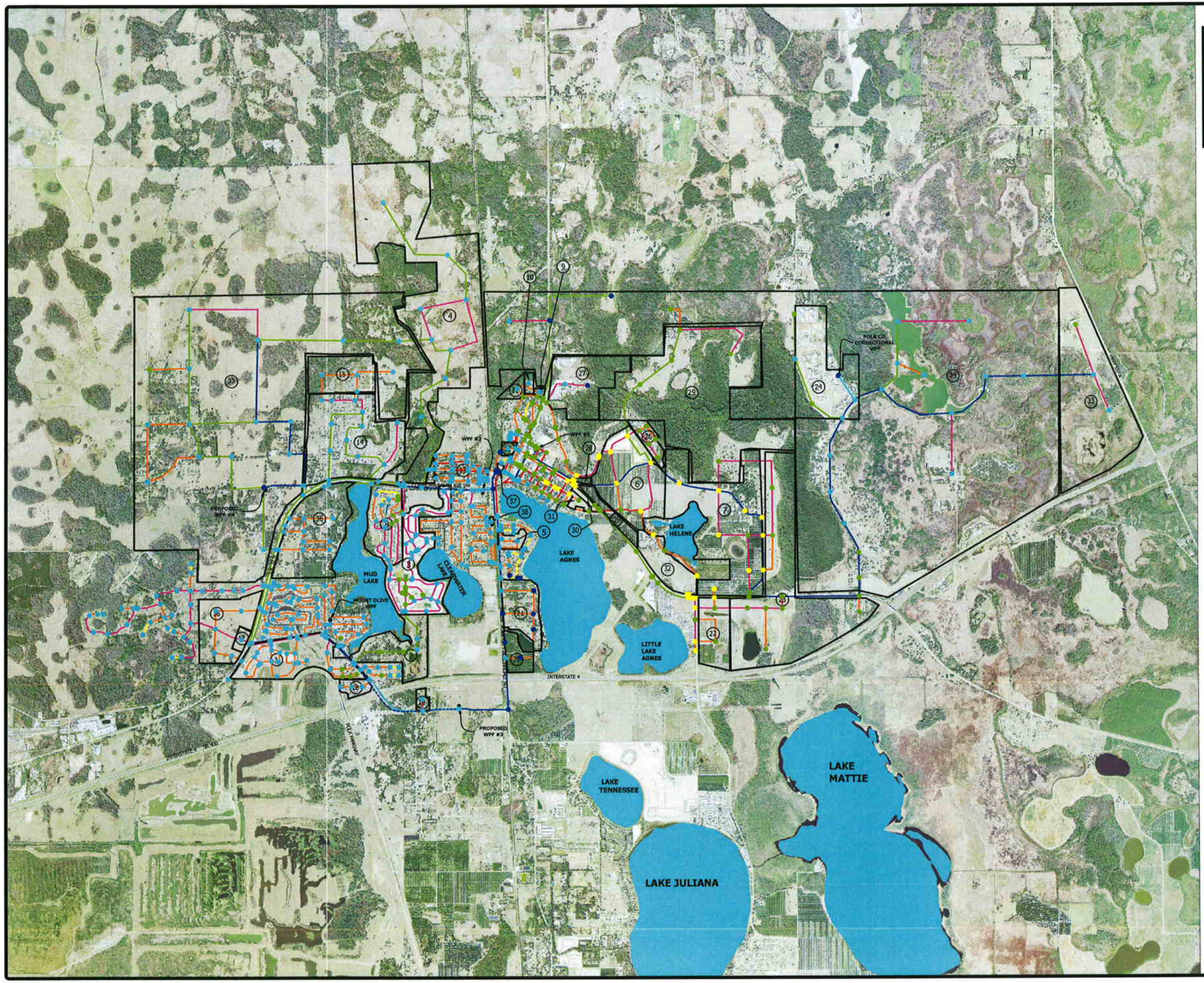
FIGURE B-11
ULTIMATE PHD SIMULATION



Projected Development Borders

99 Projected Development Table ID Numbers

Pipe Diameter (in) Legend

<=	2
<=	4
<=	6
<=	8
<=	10
<=	12
>	12

Pressure (psi) Legend

<=	20.0
<=	30.0
<=	40.0
<=	50.0
<=	60.0
<=	80.0
>	80.0

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

ENVISORS
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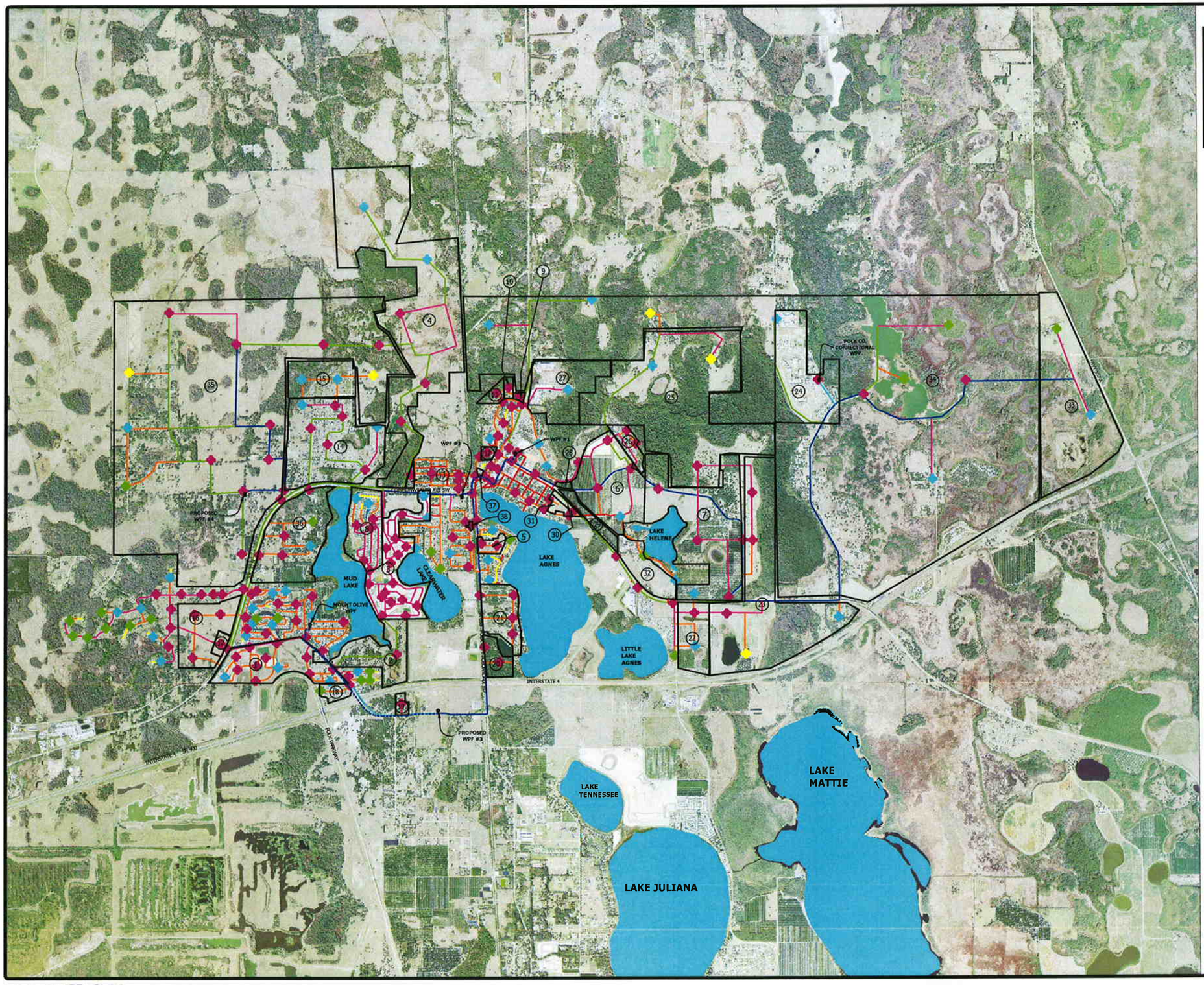
FIGURE B-12
ULTIMATE MDD FIRE FLOW SIMULATION



N

0 2,000' 4,000'

SCALE: 1" = 4,000'

MAP EXCERPT

POLK COUNTY

Projected Development Borders

99 Projected Development Table ID Numbers

Pipe Diameter (in) Legend

	<=	2
	<=	4
	<=	6
	<=	8
	<=	10
	<=	12
	>	12

Available Fire Flow (gpm) Legend

	<	500
	<=	750
	<=	1,000
	<=	1,500
	<=	3,000

Map displays the general locations of existing and proposed utility infrastructure based upon best available information provided by the City of Polk City

Aerial photography (updated 2007) provided by the Polk County Property Appraisers Office.

ENVISORS
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