Delaware County Regional Sewer District

Sanitary Sewer Master Plan

Technical Memorandum #4 – Future Service Areas and Alternatives

November 17, 2016

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1.0 Executive Summary

Technical Memorandum #4 both investigates the capacity constraints within the sewer and treatment systems and the alternatives necessary to provide conveyance and treatment for anticipated development over the next ten years. It will also address existing safety initiatives and infrastructure components that are nearing their useful life or in need of operational or maintenance upgrades to protect the District's assets. The capacity alternatives are necessary to accommodate immediate development needs as well as short and long term needs. The safety and maintenance alternatives were derived from the comprehensive condition assessment. Growth projections for the overall service area anticipate approximately 700 new residential flow unit equivalents per year over the next five to ten years and the alternative recommendation schedule is based on this. Beyond the ten year planning horizon, there are necessary projects to sustain that growth with sanitary sewer capacity; however the exact timing of the improvements is less defined. This Technical Memorandum recommends projects organized into Early Action (immediate need), Short-Term (5-10 years), and Long-Term (beyond 10 years) to reflect the urgency of the improvements as well as the anticipated schedule. The timing of many of the Short and Long-Term improvements should mirror that of development trends and sewage flows actually realized in the various sub basins as development occurs, not necessarily the date projected in this document. As future development occurs, continuous updates to the hydraulic model are required to ensure that current conditions are being considered and dynamic solutions are available to accommodate new growth. DCRSD should re-evaluate the priority of the projects list on an annual basis and adjust the list based on the most current development trends and modeling results.

The anticipated sewage flows upon which the alternatives and recommendations are based, are calculated by the hydraulic model using a 25-Year Level of Service (a storm with a 4% chance of occurring annually). The application of a 25-Year Level of Service for the hydraulic sizing of all sewers and pump stations provides a conservative approach which should allow for some deviations from the anticipated plan and allow for delay in unnecessary improvements. This Level of Service as determined by the Delaware County Regional Sewer District (DCRSD) and the project team is recommended for a system that has rapid growth potential and will allow for future development while maintaining system capacity.

The projects listed below were identified by the project team and are recommended to be constructed in the “Early Action” 1 to 5 year timeframe. This will allow for development to proceed without delay due to capacity constraints in the existing sewage collection or treatment systems. In addition to these projects, there are a number of projects shown in Appendix A which were already in design or construction at the time of publication. These projects are included for the purposes of budgetary forecasting.

- Olentangy Environmental Control Center (OECC) Facilities Plan – This project is a prerequisite to any improvements at the OECC due to limited capacity to accommodate future development. These projects initially include a new headworks with expanded pumping capacity, grit removal, and screening. Also necessary in the short term is a more thorough evaluation of the requirements for bringing the OECC North plant back online which will be developed as part of the facility plan. The OECC North plant will be needed to treat the additional future flows identified by the modeling effort. Additional needs may be identified in the Facility Plan.

- Leatherlips Pump Station Inflow and Infiltration Reduction – This project is necessary to identify the locations of excess inflow and infiltration tributary to the Leatherlips Pump Station and repair these areas to reduce the inflow. The hydraulic model shows the capacity of Leatherlips PS is exceeded due to higher than expected level of Inflow and Infiltration for a system of the age and size of the tributary area. An investigation of the sources of this additional flow should be explored prior to upsizing both the forcemain and pump station at a potentially significantly higher cost.
- Peachblow Early Action Pump Station Upgrade – This project is necessary to allow for additional planned developments to proceed on the west side of Alum Creek Lake. The upgraded pump station would be required to handle approximately 3.5 MGD peak flow (current capacity is 0.864 MGD) and would also entail the upsizing of the 4,300 LF forcemain from 8” to 16” diameter. This project should be completed with the New Relief Pump Station discussed below to ensure that the downstream system can handle the additional flow.
- New Relief Pump Station (Lower Alum Creek Relief PS) on the Alum Creek Trunk Sewer – This relief pump station should be located on the Alum Creek Trunk Sewer downstream of the confluence with the Oak Creek Trunk Sewer. The pump station is necessary prior to the completion of an upgraded Peachblow Pump Station as the trunk sewer will surcharge significantly in larger wet weather events. This surcharge has the potential to flood basements in homes in the area below the Alum Creek Dam. This relief pump station will be required to be sized for approximately 11 MGD peak and will have need to include nearly 9,500 LF of new 24” forcemain which will convey flow directly to the headworks at the Alum Creek Water Reclamation Facility (ACWRF). This will open up additional capacity in the Alum Creek Trunk Sewer downstream of the proposed pump station.
- Cheshire Pump Station Upgrade – This upgrade of the Cheshire PS is necessary to provide capacity of additional development on the east side of Alum Creek Lake including growth in the vicinity of the 36/37 interchange with I-71. The proposed pump station would be upgraded to handle a peak flow of 3.5 MGD (from 1.116 MGD). This project will include the upsizing and construction of nearly 3 miles of forcemain from 10” to 14” to allow for flow from the upsized pump station to convey flow to a downstream 21” sewer with available capacity.
- System Arc Flash Study – The Arc Flash Study is a comprehensive review and mapping of the plant electrical systems in order to develop safety requirements for live maintenance. The outcome of this work is to determine the necessary level of Personal Protection Equipment needed to safely do maintenance. This study is to be performed every five years and is a code requirement.
- Dewatering and Cake Storage Improvements – These three projects are all related to the solids handling and disposal methods currently in use at the OECC and ACWRF. In the case of both facilities, an additional dewatering centrifuge is recommended to reduce the amount of time needed to fill a disposal truck as well as to reduce the net weight and

volume of sludge being landfilled. The new centrifuges along with the cake storage will provide additional flexibility to the plant operations staff as well.

The concept level estimated cost of these Early Action projects can be found in the table below:

Table 1.1 Early Action Projects

Project Name	Estimated Cost (Planning Level Estimate, 2016 Dollars)
OECC Facilities Study	$500,000
System Arc Flash Study	$300,000
ACWRF Mixer and Aeration Upgrade	$2,500,000
Peachblow Early Action PS Upgrade	$1,440,200
Cheshire PS Upgrade	$2,733,200
Lower Alum Creek Relief PS	$7,609,400
Leatherlips PS I/I Investigation	$300,000
ACWRF Dewatering Improvements	$1,710,000
OECC Dewatering Improvements	$1,570,000
OECC Cake Storage Improvements	$1,650,000
Total:	**$20,312,800**

The Short-Term projects are anticipated to be needed within the next 5-10 years due to the aging of existing infrastructure and increasing sanitary flow from projected development. The bulk of the projects are anticipated at the treatment plants to treat with increased efficiency and to address escalating maintenance issues. The majority of the collection system projects are needed to provide sewer access to new development areas or address sections of pipe which are shown in the model to not meet the Level of Service. These projects include significant upgrades at the OECC (specific sizing, layout, and technology to be identified by the Facility Plan), the gravity elimination of the Golf Village Pump Station, and capacity enhancements to the Olentangy Trunk Sewer, likely by parallel relief sewer. Finally, the evaluation of the existing growth projections for central Delaware County and consideration of downstream capacity constraints suggests that a new water reclamation facility located on the northern part of Alum Creek Lake will be necessary. This facility is projected as part of the set of recommendations made in technical memorandum #3. Slower than anticipated development in the proposed Central Alum Creek Water Reclamation Facility (CACWRF) Basin may delay the need for this facility, but will not eliminate the need for it. All of the recommendations for downstream infrastructure depend on flow from the northern parts of Berlin and Berkshire Townships being sent to this new facility for treatment once downstream pump stations and sewers around Peachblow and Cheshire Pump Stations can no longer handle the additional flow.

The projects in the table below were identified as necessary in the 5 to 10 year time frame:

Table 1.2 Short-Term Projects

Project Name	Estimated Cost (Planning Level Estimate, 2016 Dollars)
OECC Headworks Upgrade	$15,009,800
OECC North Plant Rehabilitation	$9,300,900
ACWRF Grit Improvements	$4,995,800
WRF Electrical and I&C Improvements	$3,000,000
West Alum Creek PS	$3,725,500
Central Alum Creek WRF	$22,000,000
East Alum Creek PS Upgrade	$3,422,200
Seldom Seen Forcemain Redirection	$268,800
Golf Village Relief Sewer	$9,390,500
Olentangy River Trunk Sewer Parallel Relief Sewer	$8,755,800
Total:	**$79,869,300**

The final group of projects are identified as Long-Term projects and are subject to additional evaluation prior to construction. These improvements were estimated at approximately $27 million dollars and include items that are not immediate requirements, but are anticipated to be necessary eventually. Projects include: secondary upgrades at Peachblow PS, sewer or pump station upsizing in areas that are anticipated to see longer term growth, and improvements at the OECC that will be dependent on future regulatory changes with stricter effluent limits. As most of these projects depend on conditions outside the control of the DCRSD, continuous monitoring of the flow in the collection system and at the OECC will be needed to ensure conditions do not change sooner than expected.

The total anticipated capital plan for all of the projects identified in this Technical Memorandum including development projects provided by DCRSD is approximately $157 million in 2016 dollars. The Early Action and Short-Term projects necessary to ensure the specified development areas have available capacity are expected to cost $20M and $80M within the first 5 and 10 years respectively. It is critical to note that these recommendations are based on a 25-Year Level of Service, existing growth and development patterns and rates as well as the desires of the individual Townships and municipalities as determined by their Comprehensive Plans and discussions with elected officials. The nature of development, particularly in areas with high growth rates is difficult to predict. The recommendations laid out in the memorandum below attempt to provide flexibility for unpredictable changes to development while keeping an eye on what the eventual build out will look like. All recommended improvements as well as their precursors, timing recommendations, and budgets are identified in the appendices.

2.0 Introduction and Overview

Technical Memorandum 4 was developed to identify current and future capacity constraints and required improvements necessary to provided sanitary sewer service and sewage treatment to predefined growth areas within Delaware County in addition to the existing system. It is also intended to confirm that all existing service areas meet a minimum hydraulic Level of Service as determined by the Delaware County Regional Sewer District (DCRSD). Finally, this memorandum will identify improvements necessary to meet possible future regulatory changes applied to the various treatment facilities while enhancing the overall efficiency and utilization of existing assets. This memorandum is a supplement to previous Technical Memoranda including Technical Memorandum #3 which identified condition and capacity constraints of the system under current conditions and Technical Memorandum #2 which identified critical assumptions upon which the hydraulic modeling effort is based. These Technical Memoranda are components of the final Sanitary Sewer Master Plan which will reference all technical memoranda.

The focus of this Technical Memorandum #4 is the impact of anticipated future growth on the capacity of the gravity sewers, force mains, and pump stations which make up the collection system. After discussions with – or review of documents from – numerous County stakeholders both public and private, areas of likely near term growth have been identified. These areas do not necessarily represent all possible growth in the County, but rather serve to identify the most likely locations of growth in areas that will impact the DCRSD.

The sewer system hydraulic model developed and calibrated as a part of this project was used to load projected wet and dry weather sewer flows from anticipated growth areas into the existing sewer system to determine available capacity. Capacity from the projected development areas is measured from the tie in point of the new area to the existing system all the way down to the wastewater reclamation facility. This includes all forcemains and pump stations encountered along the way and will take into account not only the dry weather flow but also the wet weather peaks encountered to ensure that the 25-Year Storm Level of Service determined by the DCRSD is not degraded.

This memorandum includes a review of the methodologies used to identify service areas and build out locations, assign dry weather and peak flows, and recognize capacity issues and develop alternatives for relief. It will also briefly define the growth areas and developments, DCRSD projects currently in design or construction, and the flow contributions of each area. Finally, this memorandum will identify the future infrastructure requirements necessary to handle the increased sanitary flow and assign planning level costs to each project. The cost estimates developed for the projects use metrics based on a number of similar sized projects as the specifics of each proposed improvement are not known. These proposed projects will include sewer, pump station, or treatment plant upgrades and will identify the primary driver for the anticipated timing. This will allow for projects to be timed for construction only when necessary as development plans can be fluid.

3.0 Methodology

The methodology for collecting data, creating and calibrating the hydraulic model, and identifying and justifying the critical parameters and assumptions are all discussed at greater length in the preceding Technical Memoranda 2 and 3. The focus of this Section is to specifically identify the outcomes of hydraulic modeling, alternatives to provide future service, and the merits of each alternative within the bounds of the overall system conditions and Level of Service as determined by the DCRSD.

3.1 Future Development Areas

To estimate the areas for future development, collaboration between the HDR team and the County staff identified areas that would likely begin to be developed or be fully developed within the next 10 years. This was based on current information on likely development planned for the County as well as discussions with individual townships and review of additional future plans, including long-term transportation planning. While these areas are not likely to be the only locations where development occurs over the next ten years, they are areas where the largest quantity of new sanitary flow is expected to be generated. Development that occurs within individual sub basins but outside of the specifically identified “growth areas” will impact the plan. However, because a large quantity of growth is anticipated in each sub basin as a baseline, there is flexibility as to where development occurs within each tributary area without the outcomes from this document being invalid. Individual development areas will be discussed in each of the specific basin sections.

3.2 Development Density

Though future development acreage was estimated across the system, the density or number of residential, commercial, and industrial units in each development area was determined based on the individual township. Table 3.1 shows the existing densities allowed in each of the townships per their unique zoning and comprehensive plans. These values were then applied to the future development area by township. More rural townships were assumed to have potential for increased densities in the future despite slightly lower current densities. If these higher densities are not permitted, then the eventual sizing of local sewers may turn out to be slightly conservative. For commercial/industrial areas, a flow of 3000 gallons per acre was utilized for planning purposes - this equates to an approximate 10.3 units/acre, assuming a 290 gallons/unit equivalency. Therefore for the purposes of this evaluation, for every acre of commercial/industrial, it was assumed to be approximately equivalent to 10.3 residential units.

Table 3.1 Proposed Future Density by Township

Existing Developed Ratio				Future Development Ratio (Estimated)			Maximum (u/acre) - Existing Density		Estimated Future Density (u/acre)		Estimated Future (u/acre)	Estimated Persons per Acre (Equivalent)
Township	% Multi	% Single	% Com/Ind	% Multi	% Single	% Com/Ind	R2	R3	SF	MF		
Berkshire	0.03	0.96	0.01	0.03	0.92	0.05	0.5	1.5	2.2	4.0	2.7	7.3
Berlin	0.11	0.88	0.01	0.1	0.85	0.05	1.5	2.2	2.2	4.0	2.8	7.7
Concord	0.11	0.88	0.01	0.1	0.85	0.05	1.5	1.5	2.2	4.0	2.8	7.7
Genoa	0.12	0.87	0.01	0.12	0.87	0.01	-	1.8	2.2	4.0	2.5	6.9
Harlem	0.18	0.82	0	0.11	0.82	0.01	-	-	2.2	4.0	2.3	6.5
Kingston	0.01	0.85	0.14	0.02	0.84	0.14	-	-	2.2	4.0	3.4	9.3
Liberty	0.18	0.73	0.09	0.18	0.72	0.1	2.2	6.0	2.2	6.0	3.7	10.2
Orange	0.15	0.62	0.23	0.15	0.7	0.15	3.0	4.0	3.0	4.0	4.2	11.7

3.3 Dry Weather Flow

For each unit, a value of 290 gallons per day was assumed based on the current Delaware County Design Standards. Given that the average water usage is typically between 60-80 gallons/person/day and a typical household would be between 2.5-3.0 people, which would equate to a range of 150-240 gallons/unit/day of sanitary flow, allowing for additional contributions for dry weather infiltration. The 290 gallons/unit/day was applied in the hydraulic model across the entire future development acreage, at the assigned density by township as noted in Table 3.1. The future dry weather flow contributions assumed in the model are consistent with the current Delaware County standards for development.

3.4 Wet Weather Flow

Wet Weather flow in the hydraulic model is estimated using the Unit Hydrograph (UH) method which estimates the Infiltration and Inflow (I/I) as a function of the rainfall entering the sanitary sewer system. The UH method uses three parameters know as R, T, and K to describe the short term, medium term, and long term hydrograph response to the rainfall. These parameters are defined below:

- R – The fraction of rainfall volume that enters the sewer system.
- T – The time frame from the onset of rainfall to the peak of the unit hydrograph.
- K – The ratio of time to recession of the UH.

With construction of the hydraulic model, the methodology for projecting future wet weather contributions from new development is required to be updated in order to be effectively simulated. The HDR team looked to develop a relationship between the proposed design standard methodology from the County and a way to represent these flows dynamically in the hydraulic model. In the hydraulic model, the wet weather response is a function of the simulated rainfall; for previous design standards, the County had assumed the following:

- Application of a peaking factor using the equation 5.0/(Q(avg, in MGD) x 10)^1/6
- Infiltration flow of 80 gallons per person per day

This wet weather peak flow is generated independent of any level of service designation (10-year, 25-year, etc.). For wet weather flow, an area of recent development was utilized to provide RTK parameters that would generate wet weather flow in addition to the estimated dry weather flow. In the targeted areas of recent development, the total R-factor based on observed rainfall and meter data (i.e. the % of rainfall that enters the sanitary system) is approximately 2.0%. Based on previous evaluations conducted by the project team for different utilities, typical values for new development are within 1-2%, so this is reasonable and represents a good starting point for accounting for wet weather response from future growth. For comparison, typical values of older development typically range from 2-5% and areas with high I/I response in separate sanitary systems can be higher than 5%. The parameters that were calibrated to the area of recent development are shown in Table 3.2

Table 3.2 New Development RDII Parameters

Parameter	R	T	K
Short – Term	0.9%	4	3
Medium – Term	0.7%	12	3
Long – Term	0.4%	30	4

As a pilot area, the project team utilized the proposed Evans Farm development in Berlin and Orange Township to compare the peak flow response from the proposed sites using various design events to those developed by the design standards in an attempt to benchmark the design flows against a level of service.

Table 3.3 Orange Township Flow Comparison

Phase	Design Standard Peak Flow (MGD)	10Yr Model Peak Flow (MGD)	25Yr Model Peak Flow (MGD)	50Yr Model Peak Flow (MGD)	100Yr Model Peak Flow (MGD)
A	1.24	1.17	1.26	1.33	1.40
B	0.28	0.25	0.27	0.29	0.31
C	0.58	0.41	0.44	0.46	0.48
D	0.16	0.15	0.16	0.18	0.19
E	0.09	0.05	0.06	0.06	0.07
Sum of A-E	**2.35**	**2.03**	**2.19**	**2.32**	**2.45**
Total (as one development)	**1.98**				

Table 3.3 Berlin Township Flow Comparison

Phase	Design Standard Peak Flow (MGD)	10Yr Model Peak Flow (MGD)	25Yr Model Peak Flow (MGD)	50Yr Model Peak Flow (MGD)	100Yr Model Peak Flow (MGD)
A	0.39	0.34	0.37	0.40	0.43
B	0.57	0.45	0.48	0.51	0.54
C	0.23	0.16	0.17	0.18	0.19
D	0.53	0.43	0.47	0.51	0.54
E	0.44	0.43	0.47	0.51	0.55
Sum of A-E	**2.16**	**1.81**	**1.97**	**2.10**	**2.23**
Total (as one development)	**1.73**				

For the overall areas, there is a difference in the results when examining the overall development as the sum of all the smaller areas or as the overall area. Assuming the sum of all of the smaller areas results in having the 50-year design event be the closest match to the current design standards. Using the overall larger area as a single development instead results in the 10-year design event matching closest to the current design standards. For Berlin Township, for example, the design standards range from 1.73 MGD to 2.16 MGD depending on how the methodology is applied (either as the sum of all the smaller areas or as one single area). The average of these two values is 1.95, which correlates closely with the 25-year model predicted peak flow.

To satisfy both conditions, it was determined that the 25-year design event provided a compromise between the two comparisons, offering an increased level of conservatism and a balance between the two methods. As a result, the 25-year design storm event was selected as the planning design event as it was felt that it did the best job of correlating to the current Delaware County design standards for flows from new development.

By utilizing the 25-year design event and the hydraulic model, the impact of multiple developments and various future infrastructure scenarios could be examined using the fully dynamic model.

3.5 Level of Service

For purposes of evaluating requirements for future improvements, an improvement was considered necessary if the proposed maximum HGL in the 25-year design event was found to be within 6-ft of the ground surface in locations where there was the potential for lateral connections to be present. This methodology allows for surcharge in areas with deep sewers or in locations where there are no lateral connections. Due to the size of the 25-year design event, a number of existing assets that are capable of handling dry weather flow and the more frequent smaller rain events will be modeled as under capacity based on the higher Level of Service. The project team in concurrence with the DCRSD has determined that this Level of Service is appropriate, however it should be recognized that higher Levels of Service correspond to larger infrastructure and higher costs. The project team has attempted to balance the competing objectives of high Level of Service while reducing costs and providing the necessary flexibility required by a fast growing County such as Delaware.

3.6 Cost Estimates

The cost estimates for the projects discussed in this document were developed based on the approximate sizing and siting requirements as defined in Technical Memoranda 3 and 4. While the basic size and location requirements of various improvements are known, additional work will be necessary to verify this prior to any construction. This is particularly critical with regard to improvements proposed to handle future growth as the timing and distribution of the growth is highly variable. The purpose of the cost estimates was to ensure that the needed improvements were given a viable and conservative estimate for budgeting purposes. These estimates include Administrative costs, Engineering, and a 30% design contingency on top of the mobilization, contractor overhead and profit, and estimated cost of the work to be performed. Assumptions for each estimate as well as the cost breakdowns can be found in Appendix A.

4.0 New Service Areas

New growth areas within each treatment plant tributary basin were identified by DCRSD and the project team. It was determined that no flow would move from one existing treatment facility tributary basin to another with the exception of the construction of new water reclamation facilities.

4.1 OECC Future Growth

Future development was determined for the OECC service area based on discussions with the County and incorporation of input from townships, planning documents and discussions with developers. Figure 1 in Appendix B shows the future development that was assumed in the OECC basin.

4.2 OECC Capacity Evaluation and New Infrastructure Requirements

The OECC tributary area was evaluated based on the location of potential bottlenecks that are expected to occur based on the planned future development. This is development that is anticipated in the near future that would be tributary to the OECC according to the current division of basins developed by DCRSD. Based on discussions with the County the following improvements were considered to be components of the future conditions:

- The Liberty Sawmill Extension Phase 1 is assumed to be constructed, which would result in the elimination of the Golf Village North PS.
- Verona PS is assumed to be online, transferring flow from Leather Lips PS tributary area to the Golf Village PS.

The overall evaluation of the OECC was completed based on the specific basins and pump stations that showed current and future hydraulic limitation given the planned future development.

The model was simulated using the 25 year design event and assuming the above conditions to examine locations that were identified as problem areas. The results of the model simulation are shown in Figure 2 in Appendix B. The following sections discuss the specific locations that were identified as part of the hydraulic evaluation.

4.2.1 Leatherlips Pump Station

Leatherlips PS under existing conditions was found to overflow within the 25-year design storm event. Though there is limited growth projected to occur in the tributary area, the current observed wet weather responses have indicated that the station is unable to handle wet weather flows during large events. Construction of the Verona PS and redirection of flows from the Leatherlips basin to the Golf Village basin will reduce wet and dry weather flows to the pump station, but to continue to mitigate the likelihood of flooding due to hydraulic limitations in wet weather, the following options were considered:

- Redirection of the Seldom Seen PS to the Golf Village system via either Seldom Seen PS or Verona PS.

- Private and Public Source I/I removal in the Leatherlips basin; this basin was found to have the worst I/I response (5%) in the County system and so offers opportunity for I/I reduction to reduce the peak flows and volumes tributary to the pump station.
- PS, forcemain, and downstream trunk sewer upgrade to handle increased conveyance capacity.

The alternatives were evaluated for likelihood of success and potential overall cost. Redirection of the Seldom Seen PS does not result in elimination of the Leatherlips hydraulic capacity limitations and would result in further overloading Golf Village PS. The downstream forcemain and sewer improvements would result in extensive replacement or parallel infrastructure from Leatherlips all the way to the Olentangy Trunk Sewer; the current Leatherlips discharge essentially causes the downstream sewer to be at max capacity in the 25-year design event, allowing for little additional increases in flow regardless of the capacity of Leatherlips Pump Station.

Due to the high levels of I/I observed in the basin (as described in TM #3), an Sanitary Sewer Evaluation Study (SSES) and I/I removal program is recommended for the areas that would remain tributary to Leatherlips PS. 50% I/I reduction greatly reduces the projected overflow at Leatherlips PS (and eliminates it completely if Seldom Seen can be redirected to Golf Village at some point in the future). It is recommended that Closed Circuit TV (CCTV) and some additional field investigation are performed to identify if remedial action can be taken in these areas to address the high wet weather response observed at the pump station. Upon completion of the Verona Pump Station and I/I evaluation, additional flow monitoring should be performed in this sub basin to determine the efficacy of the work done as well as the magnitude of any remaining capacity problem.

4.2.2 Golf Village Pump Station

Under existing conditions, the peak flow to the Golf Village pump station exceeds the maximum capacity, causing the influent line to surcharge. Under proposed conditions, the Golf Village North pump station will be redirected to the Liberty Sawmill sewer while the Verona PS will be directed to the Golf Village PS. This results in a slight increase in peak flows, exacerbating the current surcharge condition and pushing the maximum HGL within a few feet of the ground surface along Sawmill Road, requiring improvements at Golf Village. The 18-inch main gravity line upstream of Golf Village PS surcharges nearly to the surface under the proposed 25-year conditions and there is some flooding along some of the tributary sewers at low-lying manholes. Two alternatives to alleviate these issues were examined:

- Alternative 1 – Golf Village Pump Station Capacity Increase. This alternative utilizes the current flow routing with upsized pump stations and sewers to allow for the increased volumes.
    - To accommodate the peak modeled 25-year flow, the pump station capacity would be required to be 5 MGD; this would cause the peak velocity in the existing forcemain to be 7.2 fps, however given the length of the forcemain (19,400 feet), the headlosses with the high velocity could require a larger pumping station.

  - Additionally, gravity sewer downstream of the forcemain requires an increase in size to eliminate flooding:
    - Upsize 905 LF of 15-inch sewer to 24-inch sewer
    - Upsize 25 LF of 18-inch sewer to 24-inch sewer
    - Upsize 4,700 LF of 27-inch sewer to 36-inch
    - Upsize 1,630 LF of 18-inch sewer to 24-inch

- Alternative 2 – Golf Village Gravity Sewer. This alternative relies on the elimination of the existing Golf Village Pump Station with a gravity sewer which ultimately conveys flow to the OECC.
  - Remove Existing Pump Station and abandon forcemain.
  - 15,830 LF 21-inch new sewer would be installed from Golf Village PS north to Rutherford Rd and then along Carriage Road to SR315 where it would connect to the Olentangy Trunk Sewer.
  - As a result of this connection, this alternative would require upsizing 1,400 LF of 15-inch sewer to 24-inch sewer downstream of the connection to just south of Daventry Lane
  - Finally, this would require upsizing 370 LF of 8-inch sewer to 24-inch sewer between SR315 and the 42-inch north/south sewer along the Olentangy River
  - Downstream of the Golf Village connection, there is some capacity available in the existing Olentangy River trunk sewer prior to the addition of any future flows from the north. The 42-inch sewer is currently (assuming no growth) operating at 40% depth capacity, this will increase to 50% depth capacity. The 36-inch sewer is currently (no growth) operating at 70% depth capacity, this will increase to 90% depth capacity. The most downstream sections of 42-inch sewer are currently (no growth) operating at 70-90% depth capacity, this will increase to 90-100% depth capacity under this alternative.
  - This sewer in itself does not cause the Olentangy trunk sewer to require an upgrade, but it does utilize some of the remaining capacity, indicating that a parallel trunk sewer or replacement sewer will be necessary with the continued growth projected in the northern portions of the OECC basin.

In reviewing both options for the Golf Village Pump Station tributary area, the gravity sewer was selected as the recommended alternative for the following reasons:

- The proposed gravity sewer would offer opportunities to redirect flows from Seldom Seen PS to the Golf Village basin and potentially additional development that is currently planned be treated at Scioto Reserve WRF.
- Elimination of the Golf Village pump station and therefore its forcemain discharge from the current outlet could enable additional flow in the Powell area. This would eliminate a limitation on the flows in the existing trunk sewer serving the downtown Powell area enabling increased densities in the Powell area for redevelopment.
- There are some pockets of homes that are currently served by septic systems (along Carriage Road and Wren Lane) that could potentially be sewered with the installation of this gravity sewer.
- Downstream of the current Golf Village forcemain outlet, the increased conveyance option would require trenchless construction of the sewer in some locations that is over

40-ft deep, making this alternative more costly and less attractive. Figure 3 in Appendix B shows the recommended 21” gravity sewer alignment as well as the 24” sewer upsizing.

4.2.3 Additional Hydraulic Bottlenecks

Across the OECC system, there are some additional locations that showed potential capacity limitations following the addition of the baseline improvements (Verona PS, Liberty Sawmill Extension), future growth, and the 25-year design storm event. These locations were analyzed and evaluated to determine any potential improvements that may be necessary. Additional flow monitoring on the sub areas is recommended prior to any improvements.

Olentangy Crossing Trunk Sewer

A section of the Olentangy Crossing Trunk Sewer is a 10-inch diameter sewer between sections of 15-inch and 21-inch diameter sewer. With future growth projected to occur upstream, the 10-inch section of sewer is shown to be undersized and causes a backup to occur in the 25-year design storm. Figure 4 in Appendix B shows the location of the existing sewer as well as the surcharged segments. Though this location does not have any current issues, it would be recommended to upsize this segment of pipe to eliminate the bottleneck and accommodate the anticipated long-term growth. It is recommended that this improvement to install approximately 360-ft of 21-inch diameter sewer in the place of the existing 10 and 15-inch segments when additional upstream development warrants. This area was not anticipated to have significant near term growth by the District.

Trotters Gait Pump Station

In the 25-year design storm, the Trotters Gait Pump Station shows an upstream surcharge that could cause potential basement backup issues as the hydraulic grade line is within the range where basements are typically located. Figure 5 in Appendix B shows the plan view of the sewer upstream of the pump station illustrating the backup in the event; this area is not projected to have any future growth and the 10-year design storm does not show a significant surcharge. Prior to any improvements at this location, it is recommended to monitor the flows at the pump station to confirm the precise magnitude of the capacity limitations prior to recommending any projects; no improvements are recommended at this time.

Woodland Hall Sewer

In the 25-year design storm, the sewer along Woodland Hall Drive shows significant surcharge in both the 10-inch and 8-inch diameter sections. Figure 6 in Appendix B shows the plan view of the sewer in the 25-year design storm. It is recommended that this area be monitored more specifically moving forward to ensure that it is appropriately represented in the model. Upon completion of the more targeted flow monitoring, there may be expansions suggested by the model however no immediate improvements are recommended in the short term, though faster development of the Liberty Park could change this. This project is identified as a Long Term improvement.

Wingate Sewer

In the 25-year design storm, the sewer along Wingate Dr. is shown to surcharge along its entire length as shown in Figure 7 in Appendix B. This area had no local flow monitoring conducted and there is not likely to be much development tributary to this sewer. It is recommended that this area be monitored going forward to ensure that it is appropriately represented in the model. Upon completion of the additional monitoring and verification of the results, the project listed in as a Short Term project may be necessary. No improvements are recommended without additional investigation.

Sherborne Mews Pump Station

In the 25-year design storm, the Sherborne Mews Pump Station shows an upstream surcharge that could cause potential basement backup issues. Figure 8 in Appendix B shows the plan view of the sewer as well as the surcharge levels in the event. This area is not projected to have substantial future growth and the 10-year design storm does not show a significant surcharge. Prior to any action at this location, it would be recommended to monitor the pump station to confirm the potential for capacity limitations; no improvements are recommended at this time.

The Retreat Sewer

In the 25-year design storm, a portion of the Retreat Sewer is shown to surcharge along the length. Figure 9 in Appendix B shows the plan view of this sewer. This area did not have any local flow monitoring conducted and there is not likely to be much development tributary to this line. This area should be included in future flow monitoring to ensure that it is appropriately represented in the model. No improvements are recommended at this time without additional investigation.

Olentangy Trunk Sewer

Flows in the Olentangy Trunk sewer were reviewed to determine the potential need for any increased trunk sewer conveyance. It was determined that, under existing conditions, the main trunk sewer has capacity. With the addition of the Liberty Sawmill extension, available capacity remains. Under the future growth scenario that was modeled, it is likely improvements will be required to the trunk sewer; however, those may have to be evaluated under full build out conditions. It is recommended that the County track the flows in the main trunk sewer as new connections come online to identify the need and timing of potential upgrades. The preliminary investigation into the need to upsize this sewer or provide a parallel relief sewer is identified as a Short Term project.

4.3 OECC Project Prioritization and Implementation

For purposes of developing short-term and long-term CIP recommendations, the proposed projects identified across the system have been grouped into three categories: Early Action projects (0-5 years), Short-term projects (5-10 years) and Long-term projects (> 10 years)

The table below indicates the identified projects for the OECC basin as well as their proposed categorization and justification.

Table 4.1 Proposed Early Action and Short Term OECC Basin Improvements

Project Description	Justification	Category	Comments
Leatherlips PS SSES Evaluation and I/I Mitigation Plan	The existing pump station shows a capacity limitation but the tributary area is shown to have significant I/I, making this a candidate for upstream rehabilitation and I/I mitigation activities	Early Action (1-5 Years)	An assumed 50% reduction was included in proposed scenarios and was necessary to mitigate overflows in the 25-year event.
Golf Village Relief Sewer and Associated improvements 15,830 LF 21-inch sewer 1,740 LF of 24-inch sewer	The existing Golf Village PS is undersized in the 25-year event and is projected to get worse in the future	Short-Term (5-10 Years)	Installation of the Golf Village Sewer would require upsizing of the downstream sewer as well to a 24-inch sewer.
Olentangy River Trunk Sewer Parallel Relief Sewer	Given the long-term future growth, the Olentangy Trunk Sewer is required to have a capacity increase for significant portions of the sewer	Short-Term (5-10 Years)	Existing conditions do not show issues with the existing trunk sewer and it is capable of delivering more than the current OECC treatment capacity. Future upgrades to the OECC treatment facility should be coordinated with the trunk sewer to retain consistency with the delivery capacity of the system.

4.4 ACWRF Future Growth

Future development was determined for the Alum Creek Water Reclamation Facility service area based on discussions with the County and incorporation of input from townships, planning documents and discussions with developers. Figure 10 in Appendix B shows the future development that was assumed in the Alum Creek WRF basin.

4.5 ACWRF Capacity Evaluation and New Infrastructure Requirements

The Alum Creek Water Reclamation Facility and its tributary collection system was evaluated to identify the location of potential capacity deficiencies that are expected based on the planned future development. Based on discussions with the County, the following were considered to be components of the future conditions:

- The current Maxtown PS Upgrade project would be completed.
- A new Water Reclamation Facility, located on the north side of the Alum Creek Lake, south of Rt. 36/37 and referred to as the Central Alum Creek Water Reclamation Facility, was considered an integral component of future planning. This is due to the significant growth anticipated on the north side of the lake as well as significant capacity constraints of the existing conveyance assets all the way down to the ACWRF. Due to the anticipated need for additional conveyance or treatment capacity for both near and long-term growth in the Central Alum basin as well as additional growth along the Rt. 36/37 corridor, the location of a new regional WRF on the north side of the Alum Creek Lake is seen as a logical location for the construction of an additional regional water reclamation facility to service the growth. This alternative was seen as more viable over the long term than providing significant upgrades to nearly every segment of the collection system between the location of the new growth and the existing ACWRF located in central Orange Township. This project is further discussed in Section 5.1 – CACWRF.
- The long-term discharge of the East Alum Creek PS would be to the new Central Alum Creek WRF; the existing pump station site could be re-used and a new forcemain would be required that would pump under the lake to the new WRF. A new forcemain from an upsized East Alum Creek PS will be required to handle anticipated future growth regardless of the outlet location.
- A new pump station, referred to as West Alum Creek Pump Station, would be constructed on the west side of Alum Creek Lake, near the intersection of Cheshire Rd. and Old State Road. This pump station is intended to convey sewage generated from new and existing development north of Cheshire Road to the new Central Alum Creek WRF.
- A proposed “Berkshire” pump station located south of the Bent Tree Golf Course and within Berkshire Township that would address local flows, allow for the removal of the Bent Tree treatment facility and redirect flows into the East Alum Creek system.

The overall assessment of the Alum Creek basin was evaluated based on the specific basins and pump stations that showed current and future hydraulic limitation given the planned future development and utilizing the 25-year design event. Figure 11 in Appendix B shows capacity deficiencies within the ACWRF basin given existing infrastructure and future tributary areas.

4.5.1 Peachblow & New West Alum Creek Pump Station

The current capacity of the Peachblow Pump Station is approximately 3.0 MGD. Currently, the pump station is capable of pumping a maximum flow of 0.9 MGD, which is causing a backup upstream of the pump station under wet weather conditions. This backup results in the influent sewer experiencing significant surcharge, though it is not currently projected to overflow due to its depth and the length of upstream surcharge. In addition to the current capacity issues, there is a substantial area anticipated to be tributary to Peachblow Pump Station that is likely to grow significantly in the near term. The current tributary acreage for Peachblow Pump Station (See Figure 12 in Appendix B for an overview of the area) is approximately 500 acres with approximately 3,250 acres planned for possible future development, meaning that the long-term future flows are likely to create significant additional problems at Peachblow with peaks in excess of both the proposed pump station as well as a number of downstream sewers. To address all of the projected future flows, it is anticipated that some sanitary flows would need to be directed to the proposed Central Alum WRF while also upsizing the existing Peachblow PS to send part of the additional flows downstream. This plan endeavors to maximize the capacity of the Peachblow Pump Station and existing sewers in the near term while also maintaining flexibility for longer-term growth.

As part of a long-term plan for the area west of Alum Creek Lake, it is recommended to split the existing area tributary to Peachblow Pump Station and redirect flow from an area north of the Peachblow to the proposed Central Alum Creek WRF. This will be done through the construction of a new West Alum Creek Pump Station, located near the intersection of Cheshire and Old State Roads. Given the potential long-term build out of this area, the recommended maximum capacity of this new pump station would be approximately 3.9 MGD, which would handle the current and 25-year future growth flows in this area. The area that would be available for future growth tributary to this new pump station is approximately 1,240 acres. This project relieves the Peachblow Pump Station of these acres of tributary area preserving its capacity for anticipated development closer to the southern end of the lake. To direct flow from the new West Alum Creek Pump Station to the new Central Alum Creek WRF, a new forcemain would be required. The approximate length and size of the new forcemain is 12,200 L.F. and 16 inches, respectively. The size of the forcemain is based on the velocity in the forcemain being approximately 5 feet per second (fps) at the maximum planned flow. Some additional local sewer improvements in the vicinity of the new pump station may be required as well, but will be dependent on specific development locations.

Once the new West Alum Creek Pump Station is constructed, potential tributary area to the existing Peachblow Pump Station is reduced to a manageable quantity for downstream assets. With the construction of the West Alum Creek PS, the peak flow to Peachblow given future growth conditions and the 25-year design storm was determined to be 6.6 MGD, which is well above the existing design of the pump station. To handle this higher wet weather flow, both the pump station and forcemain will need to be upsized as well as some sections of gravity sewer.

Upsizing Peachblow pump station to handle the projected maximum wet weather capacity (6.6 MGD) would cause additional capacity problems downstream; in this case it would result in excessive velocities in the existing forcemain and flooding manholes in the 21-inch trunk sewer immediately downstream of the forcemain discharge. If the pump station were to be upgraded to 6.6 MGD capacity, then downstream upsizing of the sewer is necessary; this project would also require a relief sewer or upsized sewer approximately 11,500 feet from the forcemain discharge to the location of the larger diameter downstream trunk.

A solution to increase the local capacity of Peachblow PS while limiting the potential for downstream flooding in the 21-inch trunk sewer would be to upgrade the pump station to a larger maximum capacity that would not overload the downstream sewer. The maximum capacity for Peachblow PS without causing an issue in the 21-inch trunk sewer is approximately 3.5 MGD capacity. See Figure 13 in Appendix B for an overview of the area including the extents of the proposed improvement. At this capacity, the Peachblow pump station can meet current peak flows (approximately 3.0 MGD) and would allow for some additional connections upstream of Peachblow PS until the West Alum Creek PS and Central Alum Creek WRF were constructed. In the 21-inch sewer downstream of the forcemain discharge, there would be no flooding or surcharging due to local hydraulic restrictions. Ultimately, should development continue to occur, the pump station could be upgraded to the required 6.6 MGD.

Given the range of anticipated future capacities (3.5 MGD to 6.6 MGD), a new forcemain would be required to replace the existing 8-inch forcemain. The recommended forcemain size is 16 inches, which would be sufficient for both a 3.5 MGD and 6.6 MGD pump station (4 fps to 7 fps). With the larger diameter forcemain, if required, the future expansion of the Peachblow pump station to meet the 6.6 MGD capacity can be done without upsizing the forcemain.

With the pump station upgrade to 6.6 MGD, the downstream trunk sewer would need to be upsized from a 21-inch to a 30-inch sewer from the forcemain outlet to the 36-inch sewer downstream. The upgrade of Peachblow PS to 6.6 MGD along with the downstream sewer upgrades are both long term projects.

4.5.2 East Alum Creek Pump Station

Under existing conditions, the peak flow to the East Alum Creek pump station is approximately 0.5 MGD in the 25-year, 24-hour design event. The existing pump station has the capacity to handle current flows without significant upstream surcharging. Without considering the downstream limitations of Cheshire PS (which accepts all flow from the East Alum Creek tributary area via the East Alum Creek PS and forcemain), East Alum Creek would have the ability to accept approximately 600 more single family housing units before it would need to be upsized. Downstream capacity constraints of the Cheshire PS however, reduce the overall availability for near term development in the Cheshire/East Alum Creek tributary area to essentially zero. There is a substantial amount of future development that is projected to occur within the East Alum Creek PS tributary area. The future growth upstream of the East Alum Creek will eventually increase the maximum flow in the 25-year design event from 0.5 MGD to 5 MGD as the area builds out. Therefore, it is recommended to redirect the flow from its current discharge point in the trunk sewer tributary to the Cheshire PS to the proposed Central Alum Creek WRF, and upsize the pump station capacity to 5 MGD as flow increases in the system demand. To serve a 5 MGD pump station, a new forcemain would be constructed that would convey flow from the upgraded pump station to the Central Alum Creek WRF; the approximate length and size of forcemain from East Alum Creek to Central Alum WRF would be 8,500 L.F. and 16-inch diameter, respectively. Figure 14 in Appendix B summarizes the recommended changes to the East Alum Creek PS and forcemain.

4.5.3 Cheshire and Summerwood Pump Stations

After considering the existing and anticipated future flows for the areas upstream of both the Cheshire and Summerwood pump stations, it was determined that both pump stations need to be upgraded to meet existing and future flows. Figure 15 in Appendix B summarizes the recommended upgrades to the Cheshire and Summerwood pump station and forcemain.

The peak flow for Cheshire PS under existing conditions and the 24-hour 25 year design storm is 2.0 MGD, which is above the 1.1 MGD the pump station is currently able to pump. This currently causes a backup upstream of the pump station and surcharge along the influent sewers during large rainfall events. This matches what is observed by DCRSD staff when they set up additional pumping at this station during more extreme events. To help address anticipated flows associated with significant growth upstream of Cheshire PS, the proposed redirection of the East Alum Creek PS to the Central Alum Creek WRF is recommended and is discussed in the previous section. This would remove some existing upstream tributary area from the Cheshire basin while also eliminating a large area of future growth from Cheshire PS.

If the redirection of the East Alum Creek PS is completed, the peak flow in the 25-year design event under future conditions for the remaining area is 3.5 MGD. Therefore, it is recommended to upgrade the existing Cheshire pump station to 3.5 MGD capacity to meet capacity of both current and future flows. Unfortunately, the existing 10-inch forcemain and the 15-inch trunk sewer downstream of Cheshire PS are unable to handle the additional flow from the upgraded pump station.

The required forcemain diameter for the 3.5 MGD Pump Station would be 14-inches. It is also recommended that the forcemain outlet be changed from its current location at the 15-inch sewer to MH 11MH000003000129, which is the start of the 21-inch sewer. This would require that the new 14-inch forcemain extend approximately 15,800 feet south from the upgraded Cheshire Pump Station. The alternative to this longer forcemain would be the replacement of the approximately 6,500 feet of 15-inch sewer with a 21-inch sewer along Africa Road, portions of which are 15-20 feet deep while still upsizing the forcemain, however only over its existing length. A smaller diameter forcemain at shallower depths would provide for a cheaper alternative than upsizing the existing gravity line for the same distance with a larger pipe.

In addition to upgrading and upsizing the Cheshire pump station and forcemain, respectively, it is also recommended to upgrade and upsize the Summerwood pump station and forcemain to handle future growth. Currently, the pump station is pumping 0.6 MGD. The anticipated future growth flow contributions increase the peak flow in the 25-year design event to 1.0 MGD, which causes flooding to be modeled upstream of the pump station. It is recommended to increase the pump station capacity to 1.0 MGD and upsize the existing forcemain from 6 inches to 8 inches in diameter. This project is dependent on local connections upstream of Summerwood PS and could be coordinated with the timing of specific development with any upgrades to the station being contingent upon new units being added in the upstream tributary area. Based on current estimates, approximately 150 additional single family units could be constructed within the Summerwood basin prior to the upgrade being necessary.

4.5.4 Lower Alum Creek Relief Pump Station

One of the major hydraulic bottlenecks identified in the existing system is located along the Alum Creek Trunk Sewer, at the location where the Oak Creek trunk sewer meets the Alum Creek trunk sewer. Both the hydraulic model and the County have identified this site as a current bottleneck with the existing model showing surcharge at this location under various conditions. This can be seen in various figures in Appendix B. Both the 24-inch sewer and the 30-inch sewer in this area are shown to be out of capacity in major storm events and with any upsizing of the Peachblow PS. Any upstream improvements or future growth, including the upsizing of Peachblow PS (even without additional growth to go with it), would exacerbate this issue and result in local flooding and potential basement backups due to the short distance between the sewer and basements south of the Alum Creek dam. Figure 16 in Appendix B summarizes the recommended improvements for the Lower Alum Creek Relief PS and potential forcemain alignment.

To address this issue, two possible options were identified:

- Increase conveyance to the Alum Creek Pump Station through the construction of a parallel relief sewer or upsizing of the current trunk sewer. This would result in approximately 9000' of 30-inch to 36-inch new trunk sewer or upsizing the existing trunk sewer for approximately the same length.
- Construct a Relief Pump Station near the intersection of the 18-inch Oak Creek Trunk Sewer and the 24-inch Alum Creek Trunk Sewer that would direct flow directly to the Alum Creek WRF through a new forcemain.

The Relief Pump Station was selected due to the flexibility it provides as well as the easier construction versus a considerable length of gravity sewer though a developed area. This new pump station would enable sewage flows from the east side of Alum Creek Lake to continue to increase from additional development without requiring replacement of the existing Alum Creek Trunk Sewer or the Alum Creek Influent Pump Station as the new Lower Alum Creek Relief Pump Station would free up significant capacity.

Three locations for the new relief pump station were evaluated: north of the Oak Creek trunk sewer along the main Alum Creek Trunk Sewer, along the Oak Creek trunk sewer west of the Alum Creek Trunk Sewer, and south of the confluence of the Oak Creek trunk sewer and Alum Creek Trunk Sewer. In order to reflect the recommendations for the pump stations upstream of ACWRF, the recommended pump station upgrades and forcemain upsizing/redirection were included in the analysis – see Figure 16 in Appendix A. Under wet weather conditions (25 year design storm) and future growth flows on both sides of the lake, the location south of the Oak Creek trunk sewer is recommended so as not to cause flooding along the Alum Creek trunk line. The recommended capacity of the new relief pump station is 11 MGD. The recommended forcemain length to reach the Alum Creek WRF is approximately 9,500 L.F. which would keep the forcemain within existing Right of Way. The recommended diameter given the projected forcemain flow and velocities is 24-inch however this sizing would need to be confirmed during the design of the pump station and force main.

4.6 Project Prioritization and Implementation

For purposes of developing CIP recommendations, the proposed projects identified across the system have been grouped into three categories: Early Action projects (0-5 years), Short-term projects (5-10 years) and Long-term projects (> 10 years). The prioritization takes into account the likely timeframe of net development within a sub basin however there can be significant deviations from the assumptions over the short term.

The following table indicates the identified projects for the Alum Creek WRF basin as well as their proposed categorization and justification.

Table 4.2 Proposed Alum Creek Basin Improvements

Project Description	Justification	Category	Comments
New 11 MGD Lower Alum Creek Relief PS and associated 9,500 ft, 24-inch diameter forcemain to Alum Creek WRF	Existing 24-inch and 30-inch sewers show surcharge in the 25-year design event; additional growth upstream would cause local flooding	Early Action (1-5 Years)	This initial sizing is to handle existing and future planned development and a 3.5 MGD max capacity Peachblow PS. A future upgrade to Peachblow PS to a 6.6 MGD pump station would require an upgrade to 14 MGD to handle additional peak flows
Peachblow PS Early Action Upgrade to 3.5 MGD and associated 4,300 ft, 16-inch forcemain	Existing station is undersized and receives 3.0 MGD under current conditions	Early Action (1-5 Years)	The initial sizing is based on not overloading the downstream sewer. Ultimately, the maximum projected capacity for the pump station is 6.6 MGD at full build out of the tributary area and assuming the construction of a new pump station north of Peachblow that would send additional flow to Central Alum WRF
Cheshire PS Upgrade to 3.5 MGD and associated 15,800 ft, 14-inch forcemain	Existing station is undersized and upstream flooding occurs in the 25-year design event	Early Action (1-5 Years)	This sizing is based on the projected growth in the tributary area as well as not overloading the downstream 21-inch sewer
Central Alum Creek WRF	Prior to upgrades to the East Alum Creek PS or a construction of a new West Alum Creek PS, the WRF would have to be available to handle wastewater flows	Short-Term (5-10 Years)	This new WRF located in the Central Alum Basin would provide service to the Rt 36/37 corridor as well as the east and west portions of Alum Creek Lake
New 4 MGD West Alum Creek PS and associated 12,200 ft, 16-inch diameter forcemain to Central Alum Creek WRF	This station is based on full –build-out of the upstream tributary area and is heavily reliant on future growth. The timing and sizing of this facility will depend on the local growth patterns	Short-Term (5-10 Years)	A smaller pump station may be more applicable at start-up depending on the timing of future growth; the 4 MGD station represents a long-term condition that may take longer than 10 years to realize
East Alum Creek PS Upgrade to 5.0 MGD and associated 8,500 ft, 16-inch forcemain to Central Alum Creek WRF	This station is based on the full build out of this area along Rt 36-37 and is heavily reliant on future growth. The timing and sizing of this facility will depend on the local growth patterns	Short-Term (5-10 Years)	A smaller pump station may be more applicable at start-up depending on the timing of future growth; the 5 MGD station represents a long-term condition that may take longer than 10 years to realize
Summerwood PS Upgrade to 1.0 MGD and associated 3,600 ft, 8-inch forcemain	This station is based on local growth tributary to the Summerwood PS	Long-Term (10+ Years) – 150 units remaining capacity	Any improvements to Summerwood PS would be growth dependent and will be based on monitoring and tracking growth tributary to the pump station.

4.7 LSWRF: Growth Areas within the LSWRF Service Area

The LSWRF is located within Concord Township and was built to provide service to future development in southwestern Delaware County. The design capacity of the plant is 1.4 MGD (expandable to 2.8 MGD). Figure 17 in Appendix B identifies four future development areas that are proposed to discharge flow to the LSWRF over time. These four development areas total 2,160 acres (6,371 units). Based on the model assumptions detailed in Section 3, the proposed future development will generate an average DWF of 1.85 MGD and a peak wet weather flow (25-year, 24-hour design storm) of 8.25 MGD.

The table below includes a summary of the future growth for Lower Scioto Water Reclamation Facility.

Table 4.3 Lower Scioto Water Reclamation Facility Future Development

WRF	Sub-Basin	Units	Area (ac)	Avg Dry Weather Flow (mgd)	Peak Wet Weather Flow (mgd)
LSWRF	A	442	158	0.13	0.59
	B	276	99	0.08	0.37
	C	2170	785	0.63	2.90
	D	3483	1118	1.01	4.38
Total		6371	2160	1.85	8.25

Although the average dry weather flow from these development areas is larger than the current design capacity, minimal growth in the plant's tributary area has occurred and as such, it is not currently in danger of being under capacity in the near term. As growth occurs within the tributary area, flows should be tracked at the Water Reclamation Facility and should be monitored against the current design capacity.

To serve the future development areas, significant new infrastructure will be required including additional influent Pump Stations or gravity sewers. The exact location of these facilities will be determined as necessary as the development occurs. At this time, it is anticipated that any new infrastructure directing flow to LSWRF will be a part of, or in conjunction with, a significant new development in the vicinity of the treatment facility.

4.8 Other Facilities: Growth Areas within the Scioto Reserve, Scioto Hills, Tartan Fields, Northstar, and Bent Tree Service Areas

4.8.1 Scioto Reserve

The Scioto Reserve Water Reclamation Facility has a design capacity of 0.4 MGD. Figure 18 in Appendix B shows future development areas that are proposed to discharge to Scioto Reserve. These development areas total 349 acres (approximately 1,292 units); Figure 18 in Appendix B shows the future development area. Based on the model assumptions detailed in Section 3, the proposed future development tributary to SRWRF will generate an average DWF of 0.38 MGD and a peak wet weather flow (25-year, 24-hour design storm) of 1.48 MGD. This additional flow may be somewhat offset over time if part of the current Scioto Reserve tributary area is rerouted to the LSWRF via the O'Shaughnessy Pump Station and the Butts Road Trunk Sewer, though this will not likely be enough to offset the flow from the proposed future areas. The table below includes a summary of the future growth for Scioto Reserve Water Reclamation Facility.

Table 4.4 Scioto Reserve Water Reclamation Facility Future Development

WRF	Sub-Basin	Units	Area (ac)	Avg. Dry Weather Flow (mgd)	Peak Wet Weather Flow (mgd)
Scioto Reserve	A	887	240	0.26	1.02
	B	405	109	0.12	0.46
Total		1292	349	0.38	1.48

The average dry weather flow from these new development areas in addition to the current flow (estimated at about 0.3 MGD) is larger than the current design capacity; as growth occurs in these areas, flows should be tracked at the Water Reclamation Facility and should be monitored against the existing design capacity. The outcome of the ongoing study at SRWRF should also be considered upon its completion to determine the impact on both existing and future flows. This facility is a zero discharge facility which requires that the facility both treat the wastewater flow up to permit levels and provides treated effluent for use at the golf course associated with the facility. Discharged flow must be accommodated in the existing golf course impoundment ponds prior to land application.

4.8.2 Scioto Hills

The current design capacity of Scioto Hills Water Reclamation Facility is 0.084 MGD. The system is currently operating at capacity, however there are currently no future development plans proposed to be tributary to this facility.

4.8.3 Tartan Fields

The current design capacity of Tartan Fields Water Reclamation Facility is 0.25 MGD although in practice, the facility has been unable to achieve this thoughput. This is related to outlet pipes from the aeration tanks and transfer pipes between the tanks. Hydraulic issues related to this facility are being evaluated by a study separate from the Master Planning process. There is a considerable amount of nearby agricultural land as well as areas of consolidated numbers of Home Sewage Treatment Systems nearby that have the potential for development. This facility is a zero discharge facility which requires that the facility both treat the wastewater flow up to permit levels and provides treated effluent for use at the golf course associated with the facility. Both of these criteria must be met in order for changes in the volume of flow accepted by the Tartan Fields WRF.

4.8.4 Northstar

The Northstar Water Reclamation Facility is a zero discharge facility, with treated wastewater held on site and used as irrigation on the Northstar Golf Course and other common property.

The design capacity is 0.4 MGD. The facility was recently put online as homes in the tributary area are beginning to be occupied. Figure 19 in Appendix B shows two future development areas that are proposed to discharge flow to the Northstar WRF. These two development areas total 2,441 acres (approximately 7,185 residential unit equivalents at anticipated density, however due to the location near the 36/37 interchange with I-71, this could end up developing at higher than anticipated densities if accepted by the Township). Based on the model assumptions detailed in Section 3, the proposed future development will generate an average DWF of 2.09 MGD and a peak wet weather flow (25-year, 24-hour design storm) of 9.5 MGD. The table below includes a summary of the future growth for Northstar Water Reclamation Facility.

Table 4.5 Northstar Water Reclamation Facility Future Development

WRF	Sub-Basin	Units	Area (ac)	Avg Dry Weather Flow (mgd)	Peak Wet Weather Flow (mgd)
Northstar	A	1611	597	0.47	2.25
	B	5574	1844	1.62	7.25
Total		7185	2441	2.09	9.5

The average dry weather flow from these development areas in addition to the current flow (estimated at about 0.05 MGD) is larger than the current design capacity; as growth occurs in these areas, flows should be tracked at the Water Reclamation Facility and should be monitored against the existing design capacity. Growth in these areas could be redirected to the Alum Creek Central Basin at some point in the future if needed as well.

To serve these future development areas within the Northstar sub basin, new infrastructure will be required; however it is anticipated to be provided by the developer as growth within the Northstar development occurs.

4.8.5 Bent Tree

The current design capacity of Bent Tree Water Reclamation Facility is 0.01 MGD. There are currently no future development plans proposed to be tributary to this facility. The Berkshire Pump Station discussed in Section 3 is proposed to serve much of the surrounding area and could include the possible elimination of the Bent Tree WRF and conveyance of the flow to the Central Alum Creek Basin.

4.8.6 Sunbury

Portions of the current DCRSD service area are planned to be tributary to the Sunbury collection system while other areas annexed by Sunbury are proposed to be served by DCRSD. Figure 20 in Appendix B shows the proposed future development areas that are included in the future tributary areas to Sunbury. This includes a total of 381 acres (1029 units) and future design flows of 0.3 MGD average DWF and 1.43 MGD. As the potential for future annexations by Sunbury are uncertain, development and sewage flows generated east of I-71 in the vicinity of the 36/37 interchange should be closely monitored to ensure that new development does not negatively impact either the East Alum Creek or Cheshire Pump Stations in the short term.

5.0 Water Reclamation Facility Infrastructure Needs

Many of the infrastructure needs at the Water Reclamation Facilities are related to steady flow increases seen over time and to the gradual degradation or obsolescence of existing facilities. Over the last ten years, new development has slowed significantly from its previously high rate seen in the mid 2000's. The rate of development is now recovering but has yet to reach the levels seen in the middle of the last decade. This has led to the treatment facilities accepting less new flow than was anticipated in the 2005 Master Plan. As the development rate is again increasing within the DCRSD service area, an evaluation of the treatment facilities future capacity needs is warranted; however, with the OECC and ACWRF currently operating at around 75% and 55% of rated hydraulic capacity respectively, no major facility upgrades are required to handle the existing flow. The focus of Technical Memo #4 is about providing service for future area and accommodating that flow through the treatment facilities. The proposed treatment improvements as well as the conditions that necessitate them were previously discussed in Technical Memorandum #3; however the major conclusions as more specific upgrade sizing will be discussed in Technical Memorandum #4.

5.1 Capacity Changes

5.1.1 Olentangy Environmental Control Center

Capacity constraints are most clearly identified within the Olentangy Environmental Control Center (OECC) at the headworks. While large flows are regularly handled at OECC, the influent wet well frequently surcharges to varying degrees indicating that the influent pumping cannot keep up with the incoming flow. By allowing the additional flow to be stored in the influent gravity sewer upstream of the pump station, the existing system configuration acts as a damper on high but infrequent peak flows. Unfortunately in the more extreme cases, the disparity between incoming sewage flows and pumping capacity can lead to surcharging in the wet well more than what would be considered acceptable. Once influent flows have backed up in the wet well to the extent that they are able bypass the comminutors (which allows larger debris to reach the pumps and other downstream unit processes), it is no longer operating at an acceptable level.

In order to handle the flow generated by a 25-year design storm of approximately 26 MGD, the existing influent pumping station is proposed to be upsized. Due to the age and size of the existing pump station as well as the desire to remove more debris than can currently be captured prior to the influent pumps, a new influent pump station, sized at a firm capacity of 26 MGD is proposed. It will require new pumps capable of matching the existing dry weather and wet weather flows and should be expandable to accept increased flows as Liberty Township continues to develop along the new Sawmill Parkway. The new headworks will also replace the comminutors with grit removal and screening instead. This will lead to significantly less ragging in the pumps, downstream mixers, and solids handling equipment as well as reduce the wear from grit and its associated accumulation in the aeration tanks and channels. The type and specific sizing of the equipment will be determined upon the completion of the OECC Facility Plan project. The sanitary flows projected in the Master Plan and 25 Year Level of Service indicate that this project will be required within the 1-5 year short term window.

Aeration Upgrades for OECC South are proposed to maximize the ability of plant staff to utilize their existing tankage while also providing the capability to provide better control of their blower usage. This will also provide the ability to better react to changes in NPDES nutrient removal requirements moving forward as the over aeration can hamper Biological Nutrient Removal. Nutrient removal efficiencies will also be improved with the added control of sidestream flows originating from the solids handling processes. Proposed improvements include new turbo blowers, fine bubble diffusers, piping, and valving for more precise and efficient transfer of oxygen to the wastewater. This project will include new baffles and mixers for the tanks as well as VFDs on the RAS pumps, which will allow for better flow control to respond to varying conditions. As there have not yet been changes to NPDES permit requiring additional nutrient control, and because the existing system is capable of meeting the permit currently, this project is designated as a long-term project. Significant changes to the discharge permit during the next renewal cycle however may cause this project to be brought forward.

The OECC North Plant Rehabilitation project will include a thorough evaluation and the rehabilitation or renovation of the “original” northern train of OECC. This part of the facility was originally designed to treat an average flow of 1.5 MGD but has been offline for a number of years and will require restoration to the concrete tankage as well as new valves, pipes, air diffusers and piping, RAS pumps, mixers, and baffles. In addition, the clarifier equipment will also need to be replaced as well as various gates and sludge collection equipment. The new equipment will need to be connected to the existing SCADA system and will require integration of new equipment into recently updated MCCs and PLCs and replacement of wiring that has not yet been upgraded as part of recent electrical improvements. Due to the anticipated increases in flow to the OECC facility and the current utilization of the facility, this project is designated as a short-term project.

The final proposed OECC project is for the filter upgrades. At the OECC, the OEPA is currently allowing for partial filter bypass as long as effluent limits are still being met, sampling results demonstrate this, and the bypass is done to ensure efficient operation. During “automatic” bypass (v-notch weir inside the filter building) events, sampling at the outfall is required to ensure effluent limits are being met. Absent the current OEPA allowance, OECC can only route flow around the filter building, through a bypass pipe, during filter and UV maintenance and the bypass must be agreed upon in advance by the OEPA. Increases in flow, solids loading, or changes to the facility NPDES permit would require the Filter Upgrade project to be undertaken sooner than anticipated. At this time no specific replacement technology has been selected, as the filters would not need to be utilized if replaced in the short term (due to the current OEPA bypass allowance). This is subject to change in the future however, particularly as flow or loading increases. This has been designated as a long-term project.

5.1.2 Alum Creek Water Reclamation Facility

The Alum Creek Water Reclamation Facility (ACWRF) generally requires fewer improvements and upgrades compared to the OECC, which is in line with what should be expected from a newer facility. It was noted in Technical Memorandum #3 that the facility is overloaded biologically compared to the design conditions. Because the facility still has hydraulic capacity remaining available, the biological overload has not become a significant issue (current peaks are around 14 MGD with 26 MGD capacity), however as the flows to the plant increase toward the anticipated buildout conditions, it is anticipated that BOD and TSS removal will become a concern before the hydraulic limits are reached. The two major projects recommended are both related to existing reliability and flexibility of existing systems.

The first project is proposed to assist in maximizing the capabilities of the activated sludge system as indicated by a recent Filter Upgrade Memo commissioned by DCRSD. The recommended improvements include new turbo blowers, fine bubble diffusers, air piping, valves, and mixers.

The second major project is for the installation of a new grit removal system which the facility does not currently have. Grit accumulation was discussed in staff interviews and noted upon inspection in the aeration tanks and various channels within the plant. The grit removal improvements will bring the facility in line with most other major treatment works, will help maximize tank space, protect the diffusers, and prolong the life of mechanical equipment in the wet stream including pumps and mixers. This project has been identified as a short-term project.

5.1.3 Central Alum Creek Water Reclamation Facility

The Central Alum Creek Water Reclamation Facility (CACWRF) is a proposed new treatment plant to be constructed on the Alum Creek peninsula on the north side of Alum Creek Lake, south of 36/37 (See Figure 14 in Appendix B). The purpose of this facility is to accommodate the increased growth which is anticipated to occur in the areas designated as Delaware County Service Areas “Alum Creek B” and the northeastern sections of “Alum Creek C.” These areas are projected to develop in the near future due to their proximity to the outlet mall and other development recently constructed at the I-71/36/37 interchange, the possible interchange expansion, and the siting of a new high school on the northwest side of Alum Creek Lake. This development has increased interest in land development in the adjacent parcels of which nearly 2,250 acres have been identified as likely to see some type of improvement over time. While the timing of the new development is difficult to determine, it has become apparent that some type of development will occur in the 5-10 year time period which will stress the existing collection system both east and west of Alum Creek Lake as described in Section 4.0. Due to the defined Level of Service and the size of the existing gravity sewer currently conveying flow to the ACWRF, it was difficult to identify a cost effective alternative for sending significant quantities of additional sewage through the existing collection system for treatment. Furthermore, it was determined that possible future infill development in the northern sections of Genoa and Orange Townships as well as the southern segments of Berlin Township and the sanitary flow generated therein would be better situated to be conveyed to – and treated at – the existing ACWRF in a more cost effective manner.

The proposed CACWRF was sited to be easily accessible to the areas in the northern parts of Berlin and Berkshire Townships which have already seen significant interest in near term development. The location will require the purchase of property by the District for the construction of the new facility, which would discharge highly treated effluent to the Alum Creek Lake. Preliminary agreement with the City of Columbus allows for this facility to be sized at approximately 800,000 GPD which should serve the near term needs of the DCRSD. In order to convey flow from the east and west sides of the lake, one new pump station is proposed on the west side of the lake as well as the upgrade and rerouting of an existing one on the east side. Finally a new gravity sewer is proposed to accept flow from developments directly to the north along US36/SR37 and into southern Kilbourne Township. All three proposed conveyance lines as well as the two pump stations will be sized to accept flow from the proposed development area utilizing a 25-year Level of Service. Based on current projections of development, there could be upwards of 4,000 new residential units in the CACWRF tributary area developed over the next decade along with a number of commercial and possibly even industrial sites. The proposed West Alum Creek Pump Station is initially sized for a peak flow of 3.9 MGD while the existing East Alum Creek Pump Station will be rerouted and expanded to be capable of handling a peak flow of 5 MGD. Both of these facilities are discussed in greater detail in Section 4.5. The proposed CACWRF is expected to be sized for approximately 800,000 GPD in its initial phase but is likely to be expandable as agreement allows and development requires.

The CACWRF will need to be timed to fit with existing development needs as Peachblow, Cheshire, and East Alum Creek pump stations all are anticipated to reach their capacity over the next ten years. Both Peachblow and Cheshire pump stations are slated for near term upgrades to ensure capacity is available within both tributary areas but as growth continues, both of those facilities will approach their upgraded capacity as well as the capacity of the much longer downstream gravity sewers. East Alum Creek pump station has some remaining capacity as well (as long as Cheshire PS is upgraded) but in the next 5 to 10 years, even that facility is likely to be pushed to its limits. It is at that time, prior to any significant upgrade to East Alum Creek pump station, or the gravity sewers downstream of Peachblow or Cheshire pump stations that the CACWRF should be brought online. This timing will allow DCRSD to utilize existing assets for as long as possible prior to additional interim upgrades that will ultimately route sanitary flow away from its long term terminus, the CACWRF. The precise timing of this moment will be determined by carefully monitoring the flows at East Alum Creek, Cheshire, and Peachblow pump stations during wet weather events as well as the number of new sanitary sewer connections approved in the areas tributary to those pump stations. Ideally, this will provide enough time to complete the CACWRF in conjunction with the upgrade or construction of the asset (East or West Alum Creek PS) that triggered the requirement for treatment capacity in the area.

Table 5.1 Proposed Treatment Improvements

Project Description	Justification	Category	Comments
OECC Facility Plan	The project is necessary to ensure that all upgrades at the OECC are coordinated and are sized appropriately.	Early Action (1-5 Years)	The overall facility plan will provide a more detailed analysis of both the existing plant and the requirements necessary for future flows.
System Arc Flash Study	Required to ensure safe maintenance can be completed and meet code requirements.	Early Action (1-5 Years)	
ACWRF Mixer and Aeration Upgrades	Optimization of the Aeration system will allow for better pollutant removal and lower energy use.	Early Action (1-5 Years)	This project will require further investigation into the biological treatment processes at ACWRF prior to construction.
OECC North Plant Rehabilitation	Renovating and restarting the North Train at OECC will provide additional hydraulic and biological capacity for future flow.	Short-Term (5-10 Years)	This project will need to be coordinated with the Facility Plan and Headworks improvement projects.
ACWRF Grit Removal Improvements	Grit removal improvements at ACWRF which currently has no grit handling equipment will reduce maintenance costs as well as wear and tear on downstream pumps and mechanical equipment.	Short-Term (5-10 Years)	The source of the grit (from the collection system or filters) should be further investigated prior to construction.
OECC Headworks	Existing headworks is undersized for larger storms under current conditions. Under future conditions, the wetwell and pumping will be even more undersized.	Short-Term (5-10 Years)	The existing wet well floods and bypasses the comminutors in heavy rains. New screens will need to be installed to remove floatables and rags from the flow and larger pumps and a larger wet well are needed to handle future flows.
WRF Electrical and I&C Improvements	Overall Electrical and Control System integration is needed at both facilities to ensure smooth operation.	Short-Term (5-10 Years)	Various motors, transformers, soft starters, VFDs, and MCCs have reached the end of their projected useful life and will need to be replaced.
CACWRF	This project is needed to provide additional treatment capacity on the north side of the Alum Creek Lake. Expanding downstream conveyance capacity is not a viable long term solution.	Short-Term (5-10 Years)	Future development trends around the northern part of the Alum Creek Lake require additional treatment or conveyance capacity in this area.
OECC South Aeration Upgrades	Optimization of the South Plant Aeration system will allow for better pollutant removal and lower energy use.	Long-Term (10+ Years)	This project will be based in part on the outcomes of the OECC Facility plan which will involve a more in depth evaluation of the biological processes.
OECC Filter Upgrades	Current filters do not operate effectively.	Long-Term (10+ Years)	These filters are not currently needed to ensure that NPDES permit is met, though it is anticipated that they will be necessary over the long term with more flow or tighter permits.

6.0 Project Recommendations

The early action and short term alternatives identified, evaluated, and recommended in Section 4 and 5 are recommended for design or construction in the very near term. Also included are the estimated planning level costs of the recommended improvements as well as the timeline and suggested series in which they should be constructed. As the various improvements are interrelated in many cases, the following section lays out the order and critical prerequisites of each improvement. A summary table of the currently proposed projects as well as the planning level estimate of costs and project prerequisites can be found in Appendix A.

6.1 Future Service Areas: Early Action Recommendations

- Peachblow PS Early Action Upgrade – Upgrade of the Peachblow Pump Station will permit near term growth (prior to the construction of the Central Alum Creek WRF) with flow conveyed to the ACWRF. This project, in conjunction with the New Lower Alum Creek Relief Pump Station, forcemain upgrade, and the downstream gravity sewer upgrade will permit flow from both the near and long term upgrade sizing of the Peachblow PS to be conveyed to ACWRF. This project is necessary to enable any growth beyond the Evans Farm development to be served by sewers with available downstream capacity. As there are a number of development tracts west of the Alum Creek Lake in the tributary area for this pump station, the immediate planning for the upgrade of this facility is considered a high priority. The estimated cost of this project is $1,440,200.
- Cheshire PS Upgrade – The upgrade of the Cheshire Pump Station and forcemain is necessary to meet existing requirements under peak wet weather conditions however the proposed size will allow for some growth within the basin. Long term, the proposed forcemain can continue to be used as growth continues however an additional pump station upgrade will likely be necessary in the to accommodate this, depending on the speed of growth in the tributary area. The estimated cost of this project is $2,733,200.
- New Lower Alum Creek Relief PS – The Lower Alum Creek Relief Pump Station is a requirement prior to any improvements to the Peachblow PS or other development within the ACWRF tributary area along the west side of Alum Creek Lake. The estimated cost of this project is $7,609,400.
- Leatherlips Service Area I/I Study – This project is already ongoing per DCRSD however additional resources including flow monitors should be brought to bear as available to develop a more robust understanding of the tributary area. This project and the associated flow monitoring will not only yield a more accurate model of the sub basin but may also identify “low hanging fruit” type projects which can quickly address some of the larger sources of inflow and infiltration if they exist. The estimated cost of this project is $300,000.

6.2 WRF: Recommendations

- OECC Facility Plan – A Facility Plan for the OECC is needed to ensure that the large number of proposed improvements at this facility are coordinated. These improvements include a new headworks (pumps, grit removal, screening), aeration improvements, and the North Plant Rehabilitation. The estimated cost of this Facility Plan project is $500,000.

- ACWRF Mixer and Aeration Upgrades – This project will add new mixers, blowers, air diffusers, and air piping per the recommendations of the Hazen and Sawyer Filter Study. The purpose of this upgrade project is to optimize the biological system to ensure that energy use is minimized while pollutant removal is maximized. The estimated cost of this project is $2,500,000.
- System Wide Electrical and I&C Improvements and System Arc Flash Study– As there was no additional capacity component to these improvements, they were discussed at length in Technical Memorandum #3. These improvements are necessary to synchronize electrical and control systems at the water reclamation facilities and to ensure worker safety and code compliance. The estimated costs of these projects are $3,000,000 and $300,000 respectively.
- ACWRF and OECC Dewatering Improvements – The dewatering improvements at each facility were discussed at length in Technical Memorandum #3. The proposed improvements entail the installation of new sludge centrifuges at both ACWRF and OECC and the associated systems and appurtenances. The estimated costs of these projects are $1,710,000 and $1,570,000 respectively.
- OECC Cake Storage Improvements – The cake storage improvements are proposed to ensure that dewatered sludge can be safely stored at the OECC prior to ultimate disposal. This project, in conjunction with additional dewatering improvements at each major facility will increase the flexibility with regard to the removal of solids. The estimated cost of this project is $1,650,000.

6.3 Short Term Recommendations

The recommendations for the short term are not listed as Early Action projects in large part due to the need to complete a precursor project in advance or the need for additional flow monitoring. These projects can not be immediately constructed however the planning and preliminary design of these improvements should begin as soon as possible to ensure that the system is able to accommodate new growth and maintain the desired Level of Service.

- OECC Headworks – The precise sizing and requirements of the new headworks proposed for the OECC will be determined as part of the facility plan. For the purposes of this evaluation and cost estimating, the pump station was assumed to need to be capable of handling the modeled 25-year storm. This includes the ability to screen and pump up to a firm 26 MGD peak. The estimated cost of this project is $15,009,800.
- ACWRF Grit Removal Improvements – New grit removal tanks and equipment will need to be added to the existing preliminary treatment works. This will increase the long term life of downstream mechanical equipment as well as maintain maximum available tank space and reduce a persistent maintenance issue. This equipment will need to be sized to accommodate approximately 12-15 MGD peaks that area anticipated during reasonable recurrence intervals and expandable to the peak rated flow of the ACWRF of 30 MGD. The estimated cost of this project is $4,995,800.

- OECC North Plant Rehabilitation – The evaluation of the existing north plant facilities is the first step to getting the north train of OECC back online. Significant upgrades are needed to all mechanical and electrical equipment as well as to the degraded concrete, coatings, diffusers, and air piping. Existing valves, gates, and other equipment will need to be thoroughly inspected prior to any possible reuse. This train has the ability to add approximately 1.4 MGD in treatment capacity to the activated sludge system based on its original rating. The estimated cost of this project is $9,300,900.
- West Alum Creek PS – The West Alum Creek Pump Station will be needed as the area around the proposed new high school develops. This area encompasses the entire northwestern corner of the Alum Creek Lake. The speed with which this growth occurs will be the driver behind this improvement project. This project can not be completed until the CACWRF is online. The estimated cost of this project is $3,725,500.
- Central Alum Creek WRF – Begin preliminary siting, sizing, and possible land acquisition for the development of this new WRF over the next 2 to 3 years. Ultimate timing for the startup of this facility will be at such time as either the Peachblow or Cheshire pump stations or downstream conveyance options no longer have available capacity for new development at the 25 Year Level of Service. The estimated cost of this project is $22,000,000.
- East Alum Creek PS – This project is intended to replace the existing East Alum Creek Pump Station with a regional pump station that will supply flow from the northeastern edge of Alum Creek Lake and the 36/37/I71 interchange area to the new CACWRF. This facility will continue to convey flow via Cheshire Pump Station until this upgrade is complete at which point the upsized pump station and forcemain will be one of two major influent pump stations to the CACWRF. The estimated cost of this project is $3,422,200.
- Seldom Seen Forcemain Redirection – The Seldom Seen Forcemain redirection is a project that will either reduce the overall pump station count by consolidating flow at larger regional pump stations, in this case, Trotters Gait or reduce the length of forcemain needed to convey flow to the OECC. This project would remove flow from the Leatherlips tributary area which may impact the wet weather surcharging seen there. The Leatherlips I/I investigation and additional model calibration in that sub basin should be completed prior to the redirection of this forcemain or elimination of the Seldom Seen Pump Station. The estimated cost of this project is $268,800.
- Golf Village Relief Sewer – This project is intended to relieve the wet weather surcharging that already exists upstream of the Golf Village Pump Station while also opening up additional gravity sewer capacity in the Powell area. The construction of this relief sewer will reduce the risk of overflows by replacing a mechanical system with a gravity line and will allow for additional HSTS to be replaced with sewer if desired. This sewer will convey flow from a large tributary area which has some remaining available land for development. The estimated cost of this project is $9,390,500.
- Olentangy River Trunk Sewer Parallel Relief Sewer – The Olentangy River Trunk Sewer Parallel Relief Sewer is a project that is intended to supplement the gravity sewer capacity of the main trunk sewer which runs north from the OECC along the Olentangy River. Currently this trunk sewer conveys the bulk of the OECC tributary area but as it is extended north, it has begun to encounter capacity constraints. The construction of a

parallel relief sewer will provide additional capacity for development in the OECC basin along the Sawmill Parkway Extension at a lower cost than expanding the existing trunk sewer. It is anticipated that this relief sewer could be extended farther north as additional capacity is needed however at this time, only the southern phase is included. The estimated cost of this project is $8,755,800.

Appendix A – Project Cost Summary Sheets

DELAWARE COUNTY SANITARY SEWER MASTER PLAN - PROJECT COST SCHEDULE

Project Number	Project Type	Project Name	Cost (2016 Dollars)	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12+
				CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025	CY 2026	CY 2027	CY 2027+
1	O&M	OECC Facilities Study	$500,000	$ 250,000	$ 250,000										
2	O&M	System Arc Flash Study	$300,000	$ 300,000											
3	O&M	ACWRF Mixer and Aeration Upgrades	$2,500,000	$ 1,000,000	$ 1,500,000										
4	O&M	Tartan Fields Upgrades	$1,000,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000								
5	O&M	Scioto Reserve Upgrades	$1,500,000	$ 250,000	$ 500,000	$ 500,000	$ 250,000								
6	O&M	Lower Scioto WRF (LSWRF) Service Upgrades	$1,500,000	$ 500,000	$ 500,000	$ 500,000									
7	O&M	Leatherlips PS Service Area I&I Reduction	$300,000	$ 100,000	$ 100,000	$ 100,000									
8	O&M	Seldom Seen Forcemain Redirection	$268,800		$ 268,800										
9	O&M	ACWRF Dewatering Improvements	$1,710,000			$ 1,710,000									
10	O&M	OECC Dewatering Improvements	$1,570,000			$ 1,570,000									
11	O&M	OECC Cake Storage Improvements	$1,650,000				$ 1,650,000								
12	O&M	OECC Headworks	$15,009,800			$ 1,500,000	$ 3,000,000	$ 5,250,000	$ 5,259,800						
13	O&M	WRF Electrical and I&C Improvements	$3,000,000	$ 200,000		$ 500,000	$ 1,000,000	$ 1,300,000							
14	O&M	ACWRF Grit Removal Improvements	$4,995,800			$ 495,800	$ 2,000,000	$ 2,000,000	$ 500,000						
15	O&M	Olentangy/Wingate/White Oak Road Sewer Upsizing	$5,901,300												$ 5,901,300
16	O&M	OECC South Aeration Upgrades	$8,009,000												$ 8,009,000
17	O&M	OECC Filter Upgrades	$3,002,100												$ 3,002,100
18	O&M	Woodland Hall Road Sewer Upsizing	$3,001,100												$ 3,001,100
		O&M Subtotal:	$55,717,900	$2,850,000	$3,368,800	$7,125,800	$8,150,000	$8,550,000	$5,759,800	$0	$0	$0	$0	$0	$19,913,500
19	Development	Peachblow PS Early Action Upgrade	$1,440,200	$ 200,000	$ 620,100	$ 620,100									
20	Development	Clark-Shaw Sewer	$4,000,000	$ 4,000,000											
21	Development	Cheshire PS Upgrade	$2,733,200	$ 233,200	$ 1,250,000	$ 1,250,000									
22	Development	Lower Alum Creek Relief PS (LACR PS)	$7,609,400	$ 609,400	$ 3,500,000	$ 3,500,000									
23	Development	Liberty Sawmill Sewer Phase 1	$5,000,000	$ 2,500,000	$ 2,500,000										
24	Development	Liberty Sawmill Sewer Phase 2	$5,000,000				$ 500,000	$ 2,250,000	$ 2,250,000						
25	Development	OECC North Plant Rehab	$9,300,900					$ 500,000	$ 500,000	$ 1,750,000	$ 4,250,000	$ 2,300,900			
26	Development	West Alum Creek PS (WACPS)	$3,725,500						$ 1,500,000	$ 2,225,500					
27	Development	Central Alum Creek WRF (CACWRF)	$22,000,000	$ 500,000	$ 500,000	$ 1,000,000	$ 2,000,000	$ 3,000,000	$ 7,500,000	$ 7,500,000					
28	Development	Summerwood PS Upgrade	$1,023,100										$ 1,023,100		
29	Development	East Alum Creek PS (EAC PS) Upgrade	$3,422,200						$ 1,422,200	$ 2,000,000					
30	Development	Golf Village Relief Sewer	$9,390,500		$ 140,500	$ 250,000	$ 1,000,000	$ 1,100,000	$ 2,300,000	$ 2,300,000	$ 2,300,000				
31	Development	Olentangy River Trunk Sewer Parallel Relief Sewer	$8,755,800					$ 2,000,000	$ 3,377,900	$ 3,377,900					
32	Development	Berkshire Township PS	$2,500,000	$ 250,000	$ 250,000	$ 1,000,000	$ 1,000,000								
33	Development	US 23 Sewers	$3,866,000		$ 1,933,000	$ 1,933,000									
34	Development	Peachblow Gravity Sewer Upsizing	$3,929,900												$ 3,929,900
35	Development	Peachblow PS Long Term Upgrade	$2,987,000												$ 2,987,000
36	Development	Central Alum Creek WRF (CACWRF) Influent Gravity Sewer	$5,000,000						$ 2,000,000	$ 2,000,000	$ 1,000,000				
		Development Subtotal:	$101,683,700	$8,292,600	$10,693,600	$9,553,100	$4,500,000	$8,850,000	$20,850,100	$21,153,400	$7,550,000	$2,300,900	$1,023,100	$0	$6,916,900
		Total:	**$157,401,600**	**$11,142,600**	**$14,062,400**	**$16,678,900**	**$12,650,000**	**$17,400,000**	**$26,609,900**	**$21,153,400**	**$7,550,000**	**$2,300,900**	**$1,023,100**	**$0**	**$26,830,400**

All cost opinions and estimates provided by HDR are on the basis of experience and judgment; however since HDR has no control over market conditions or bidding procedures, HDR does not warrant that bids, ultimate construction cost, or project economics will not vary from such opinions or estimates

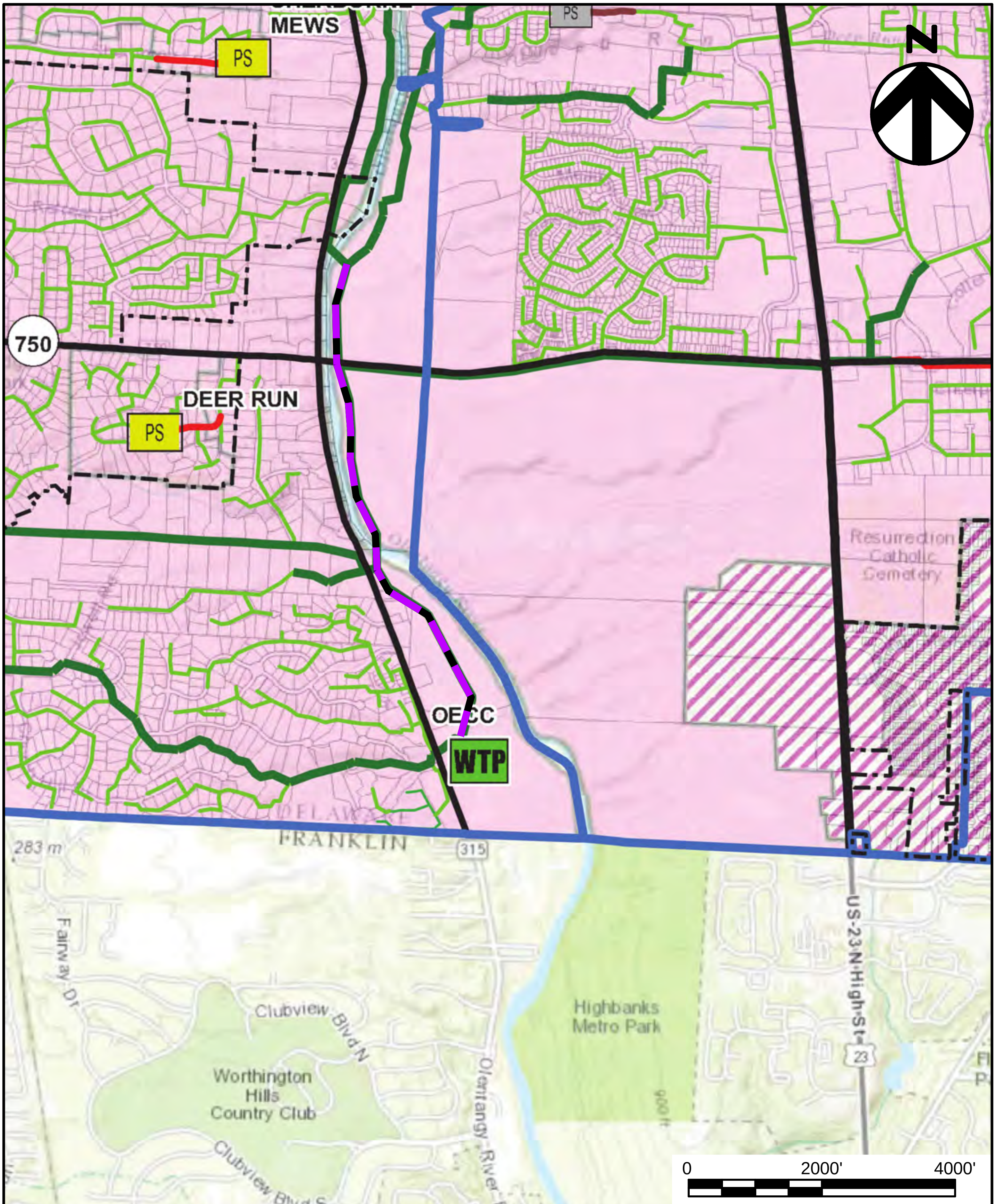
SELDOM SEEN FORCEMAIN REDIRECTION				
Project Description: Extend existing FM from manhole 09MH001271000004. Approximately 3,600 LF of new 6" FM.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	3600	LF	$40	$144,000
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	0	EA	$5,000	$0
Pump Station Upgrade	0	LS	$0	$0
			Materials & Labor Total	**$144,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$21,600	$21,600
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$17,300	$17,300
			CONSTRUCTION TOTAL	**$182,900**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$9,100	$9,100
Engineering (12% of Construction)	1	LS	$21,900	$21,900
Design Contingency (30% of Construction)	1	LS	$54,900	$54,900
			GENERAL REQUIREMENTS TOTAL	**$85,900**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$268,800**

WOODLAND HALL ROAD SEWER UPSIZING				
Project Description: Upsize approximately 6,700 LF of 10" gravity sewer to 12" gravity sewer from manhole 09MH001560000001 to 09MH001559000010.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	6700	LF	$225	$1,507,500
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
Manhole	20	EA	$5,000	$100,000
Pump Station Upgrade	0	LS	$0	$0
			Materials & Labor Total	**$1,607,500**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$241,100	$241,100
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$192,900	$192,900
			CONSTRUCTION TOTAL	**$2,041,500**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$102,100	$102,100
Engineering (12% of Construction)	1	LS	$245,000	$245,000
Design Contingency (30% of Construction)	1	LS	$612,500	$612,500
			GENERAL REQUIREMENTS TOTAL	**$959,600**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$3,001,100**

SUMMERWOOD PUMP STATION UPGRADE				
Project Description: Increase PS size to 1 MGD and replace 3,600 LF of 6" FM with 8" FM.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	0	LF	$54	$0
8-inch Forcemain	3600	LF	$55	$198,000
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	0	EA	$5,000	$0
Pump Station Upgrade	1	LS	$350,000	$350,000
			Materials & Labor Total	**$548,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$82,200	$82,200
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$65,800	$65,800
			CONSTRUCTION TOTAL	**$696,000**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$34,800	$34,800
Engineering (12% of Construction)	1	LS	$83,500	$83,500
Design Contingency (30% of Construction)	1	LS	$208,800	$208,800
			GENERAL REQUIREMENTS TOTAL	**$327,100**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$1,023,100**

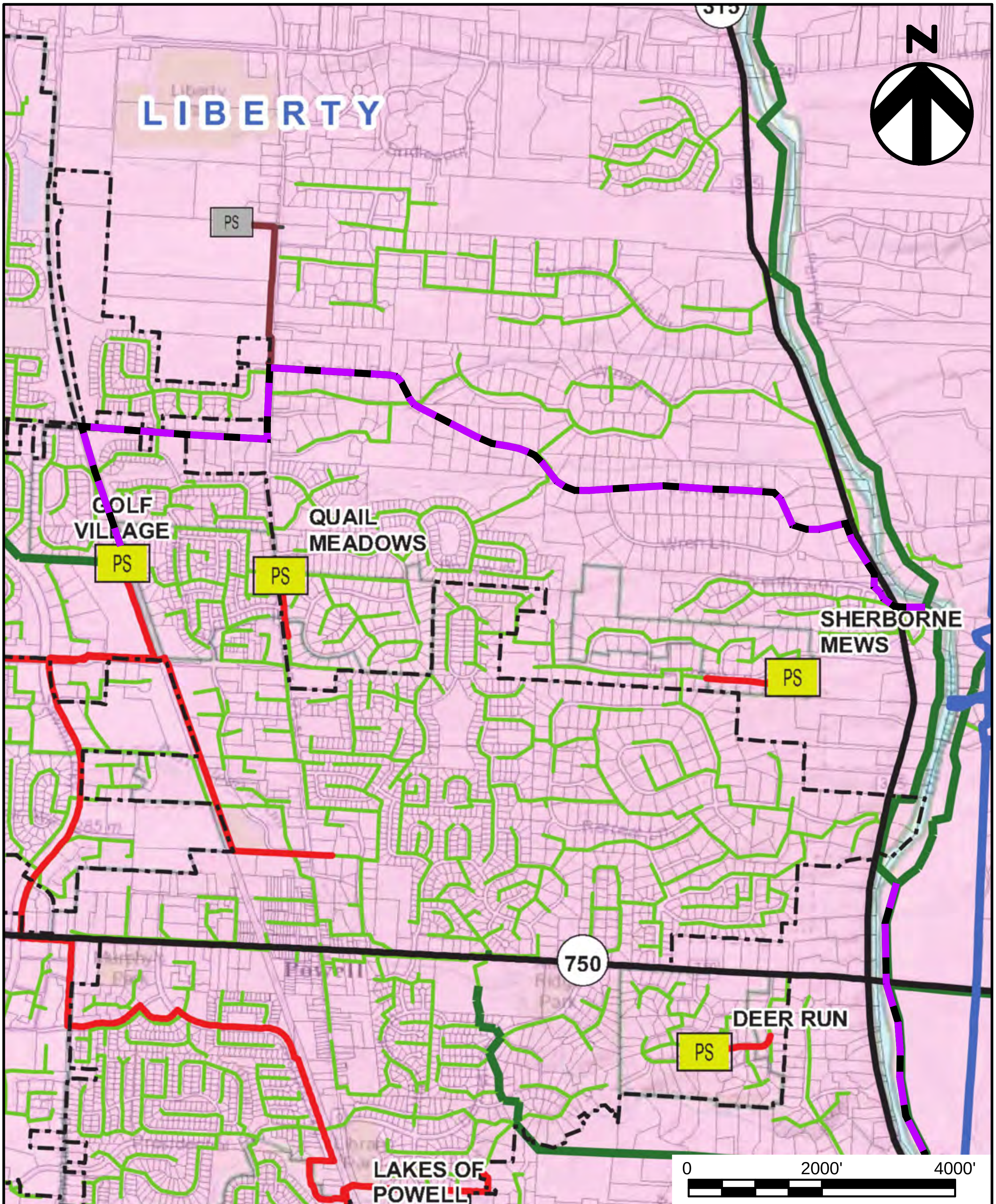
OLENTANGY/WINGATE/WHITE OAK ROAD SEWER				
Project Description: Upsize approximately 11,000 LF of pipe. 3,600 LF of pipe to 24" (from manhole 09MH001784000050 to 09MH001556000001) and another 7,400 LF to 21" (from manhole 09MH001556000001 to 09MH0012260000A1).				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	2300	LF	$221	$508,300
21-inch Pipe (Granular Backfill)	5100	LF	$277	$1,412,700
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	3600	LF	$300	$1,080,000
Manhole	32	EA	$5,000	$160,000
Pump Station Upgrade	0	LS	$0	$0
Materials & Labor Total				**$3,161,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$474,200	$474,200
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$379,300	$379,300
CONSTRUCTION TOTAL				**$4,014,500**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$200,700	$200,700
Engineering (12% of Construction)	1	LS	$481,700	$481,700
Design Contingency (30% of Construction)	1	LS	$1,204,400	$1,204,400
GENERAL REQUIREMENTS TOTAL				**$1,886,800**
PROBABLE ESTIMATE OF ENGINEERS PROJECT COST				**$5,901,300**

OLENTANGY RIVER TRUNK SEWER PARALLEL RELIEF SEWER				
Project Description: Construct approximately 13,500 LF of 36" parallel relief sewer to existing 42" and 36" Olentangy River trunk line.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	8254	LF	$325	$2,682,550
30-inch Pipe (Granular Backfill)	0	LF	$375	$0
36-inch Pipe	5250	LF	$350	$1,837,500
36-inch Pipe (Granular Backfill)	0	LF	$400	$0
Manhole	34	EA	$5,000	$170,000
Pump Station Upgrade	0	LS	$0	$0
			Materials & Labor Total	**$4,690,050**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$703,500	$703,500
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$562,800	$562,800
			CONSTRUCTION TOTAL	**$5,956,350**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$297,800	$297,800
Engineering (12% of Construction)	1	LS	$714,800	$714,800
Design Contingency (30% of Construction)	1	LS	$1,786,900	$1,786,900
			GENERAL REQUIREMENTS TOTAL	**$2,799,500**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$8,755,800**



OECC Headworks Upgrade and Olentangy River Trunk Sewer Parallel Relief

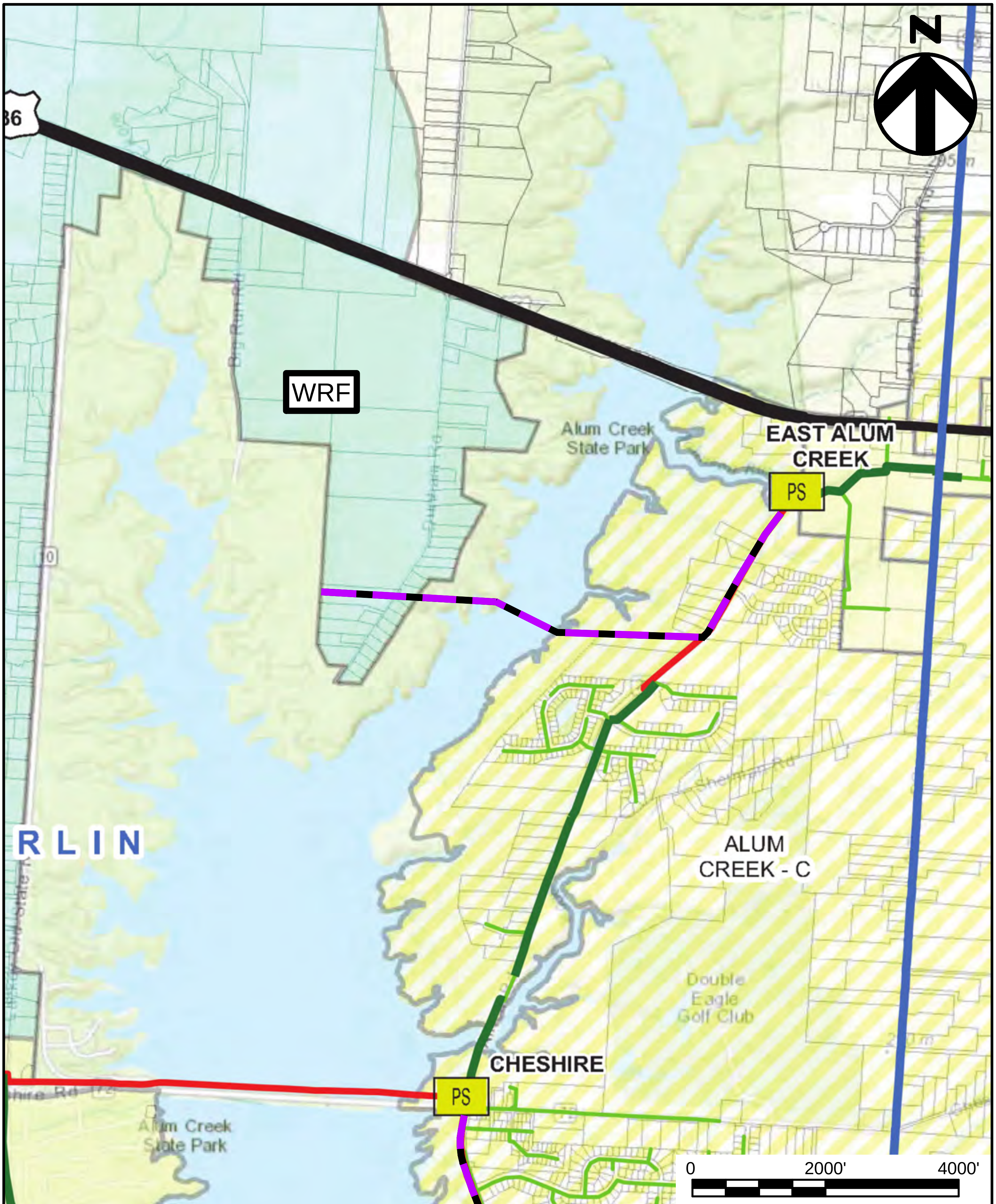
GOLF VILLAGE RELIEF SEWER				
Project Description: Remove PS from service with a gravity relief sewer. Approximately 16,000 LF of new 21" gravity sewer.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	16000	LF	$292	$4,672,000
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	54	EA	$5,000	$270,000
Pump Station Demolition	1	LS	$88,000	$88,000
			Materials & Labor Total	**$5,030,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$754,500	$754,500
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$603,600	$603,600
			CONSTRUCTION TOTAL	**$6,388,100**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$319,400	$319,400
Engineering (12% of Construction)	1	LS	$766,600	$766,600
Design Contingency (30% of Construction)	1	LS	$1,916,400	$1,916,400
			GENERAL REQUIREMENTS TOTAL	**$3,002,400**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$9,390,500**



HDR

Golf Village Relief Sewer

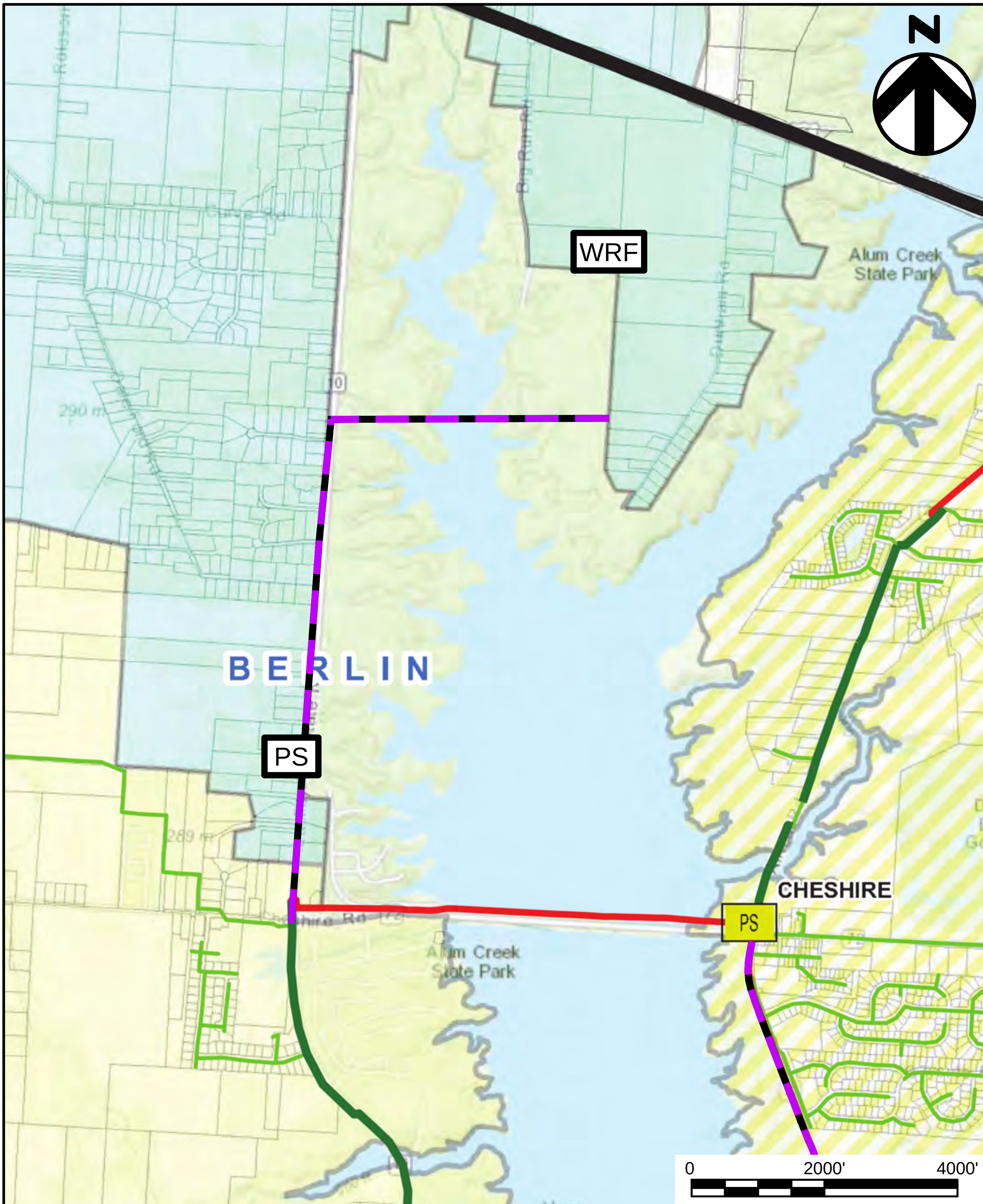
EAST ALUM CREEK PUMP STATION UPGRADE				
Project Description: Increase PS size to 5 MGD and replace 8,600 LF of 12" FM with 16" FM. The new FM will convey flow to the new CACWRF.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	0	LF	$54	$0
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	8600	LF	$130	$1,118,000
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	0	EA	$5,000	$0
Pump Station Upgrade	1	LS	$715,000	$715,000
			Materials & Labor Total	**$1,833,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$275,000	$275,000
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$220,000	$220,000
			CONSTRUCTION TOTAL	**$2,328,000**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$116,400	$116,400
Engineering (12% of Construction)	1	LS	$279,400	$279,400
Design Contingency (30% of Construction)	1	LS	$698,400	$698,400
			GENERAL REQUIREMENTS TOTAL	**$1,094,200**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$3,422,200**



HDR

East Alum Creek Pump Station Upgrade

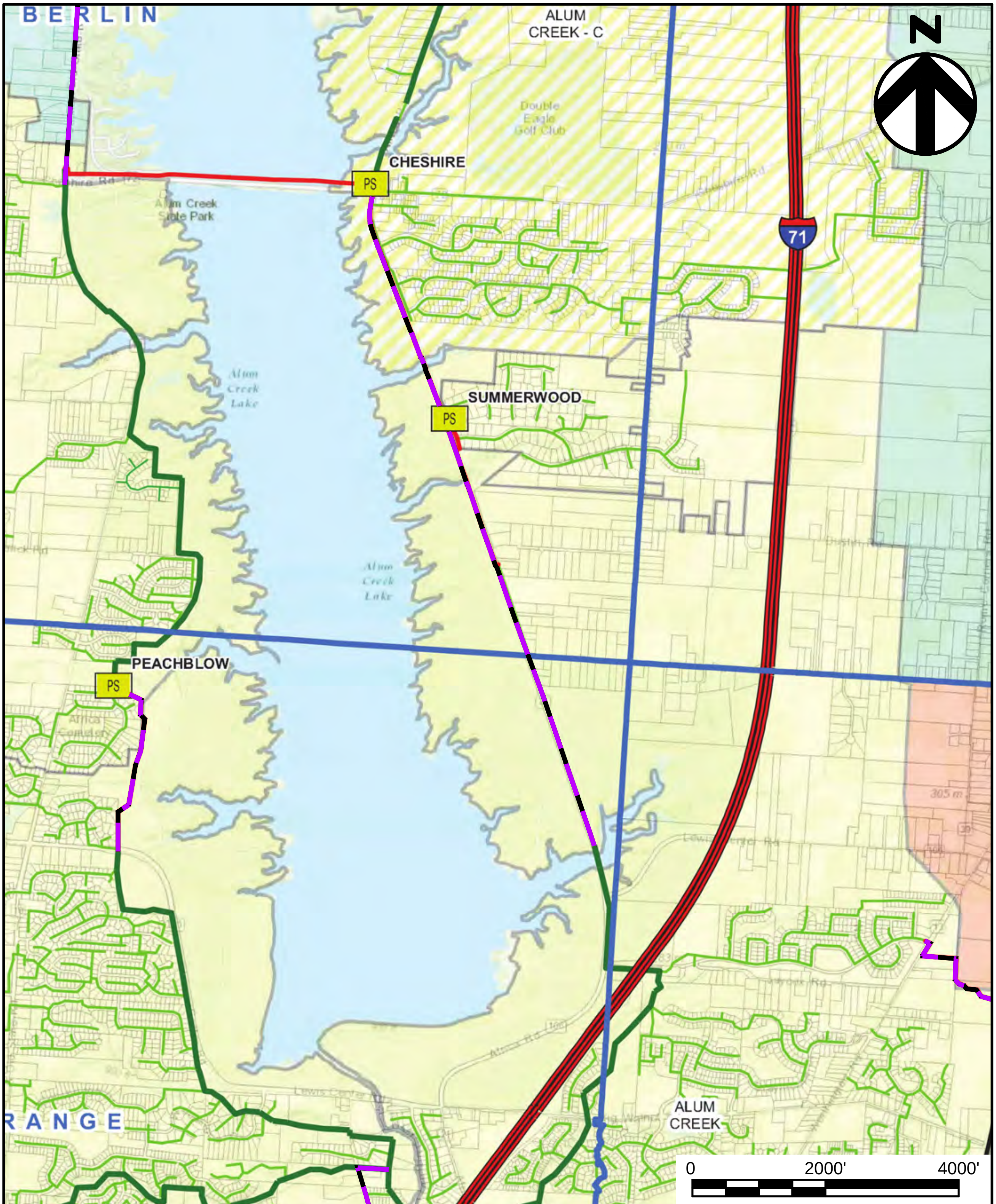
WEST ALUM CREEK PUMP STATION				
Project Description: New 3.9 MGD pump station on northwest side of Alum Creek Reservoir. This pump station is intended to remove flow from the Peachblow tributary area and convey it to a new Central Alum Creek WRF via a new 12,200 LF, 16" forcemain.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	0	LF	$54	$0
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	12200	LF	$123	$1,500,600
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	0	EA	$5,000	$0
Pump Station Upgrade (original by developer)	1	LS	$495,000	$495,000
			Materials & Labor Total	**$1,995,600**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$299,300	$299,300
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$239,500	$239,500
			CONSTRUCTION TOTAL	**$2,534,400**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$126,700	$126,700
Engineering (12% of Construction)	1	LS	$304,100	$304,100
Design Contingency (30% of Construction)	1	LS	$760,300	$760,300
			GENERAL REQUIREMENTS TOTAL	**$1,191,100**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$3,725,500**



HDR

West Alum Creek Pump Station

CHESHIRE PUMP STATION UPGRADE				
Project Description: Upgrade PS to 3.5 MGD and upsize 15,800 LF existing 10" FM to 14".				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	0	LF	$54	$0
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	15800	LF	$80	$1,264,000
16-inch Forcemain	0	LF	$98	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	0	EA	$5,000	$0
Pump Station Upgrade	1	LS	$200,000	$200,000
			Materials & Labor Total	**$1,464,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$219,600	$219,600
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$175,700	$175,700
			CONSTRUCTION TOTAL	**$1,859,300**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$93,000	$93,000
Engineering (12% of Construction)	1	LS	$223,100	$223,100
Design Contingency (30% of Construction)	1	LS	$557,800	$557,800
			GENERAL REQUIREMENTS TOTAL	**$873,900**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$2,733,200**



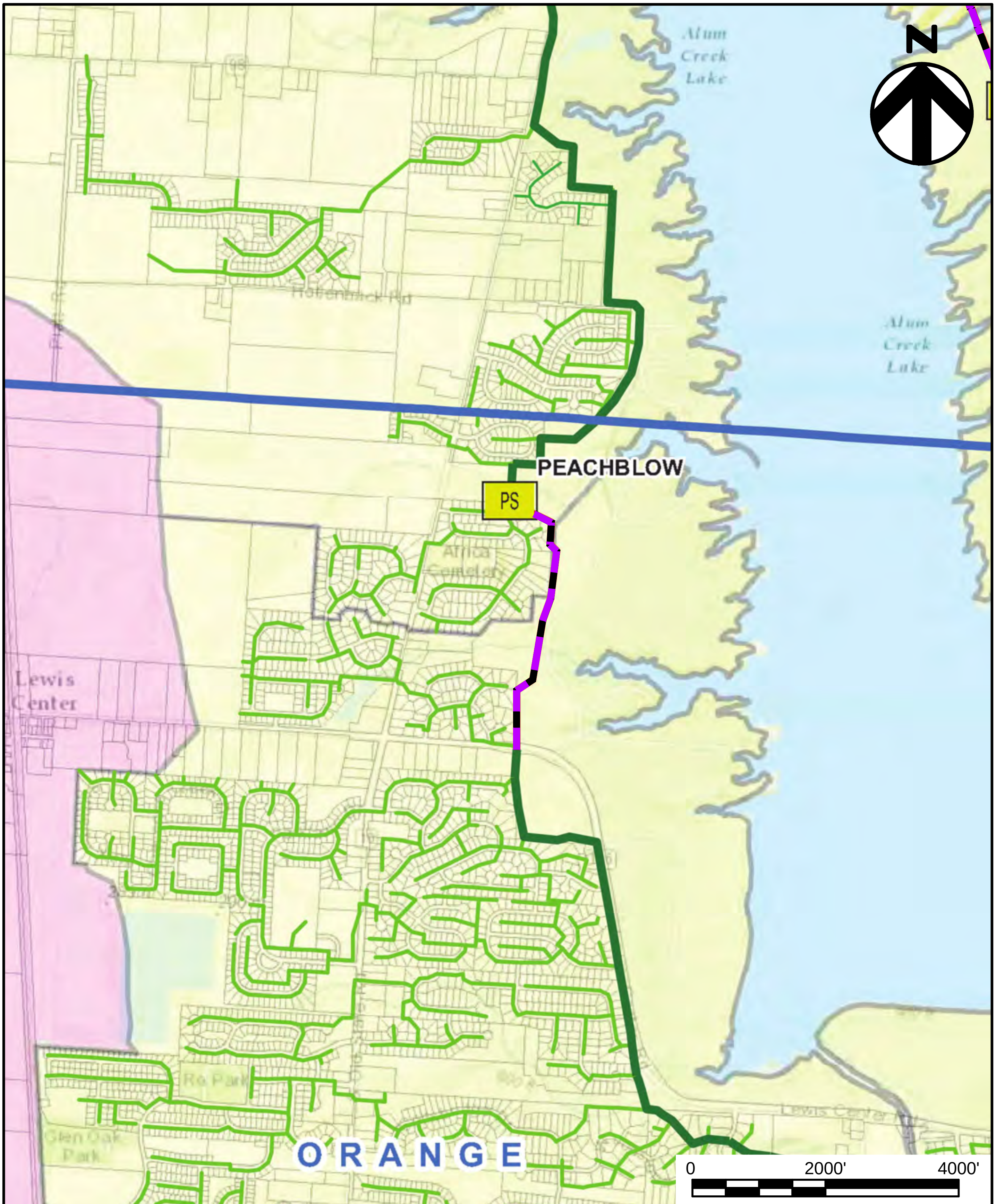
HDR

Cheshire Pump Station Upgrade

CENTRAL ALUM CREEK GRAVITY SEWER				
Project Description: New influent pump station at the Central Alum Creek Water Reclamation Facility. This project includes 8,500 LF of new 21" and 24" gravity sewer to collect from from future growth areas around the US36/SR37 corridor.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	0	LF	$54	$0
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
24-inch Forcemain	0	LF	$130	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	3500	LF	$225	$787,500
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	5000	LF	$250	$1,250,000
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	25	EA	$5,000	$125,000
Pump Station Upgrade	1	LS	$500,000	$500,000
			Materials & Labor Total	**$2,662,500**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$399,400	$399,400
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$319,500	$319,500
			CONSTRUCTION TOTAL	**$3,381,400**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$169,100	$169,100
Engineering (12% of Construction)	1	LS	$405,800	$405,800
Design Contingency (30% of Construction)	1	LS	$1,014,400	$1,014,400
			GENERAL REQUIREMENTS TOTAL	**$1,589,300**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$5,000,000**

PEACHBLOW GRAVITY SEWER UPSIZING				
Project Description: Upsize 21" sewer to 24" from 02MH000004000087 to Peachblow PS. Upsize 21" sewer to 30" sewer from manhole 11MH000004000058 to manhole 11MH001716000001.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	0	LF	$54	$0
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	800	LF	$250	$200,000
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	4200	LF	$450	$1,890,000
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	3	EA	$5,000	$15,000
Pump Station Upgrade	0	LS	$0	$0
			Materials & Labor Total	**$2,105,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$315,800	$315,800
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$252,600	$252,600
			CONSTRUCTION TOTAL	**$2,673,400**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$133,700	$133,700
Engineering (12% of Construction)	1	LS	$320,800	$320,800
Design Contingency (30% of Construction)	1	LS	$802,000	$802,000
			GENERAL REQUIREMENTS TOTAL	**$1,256,500**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$3,929,900**

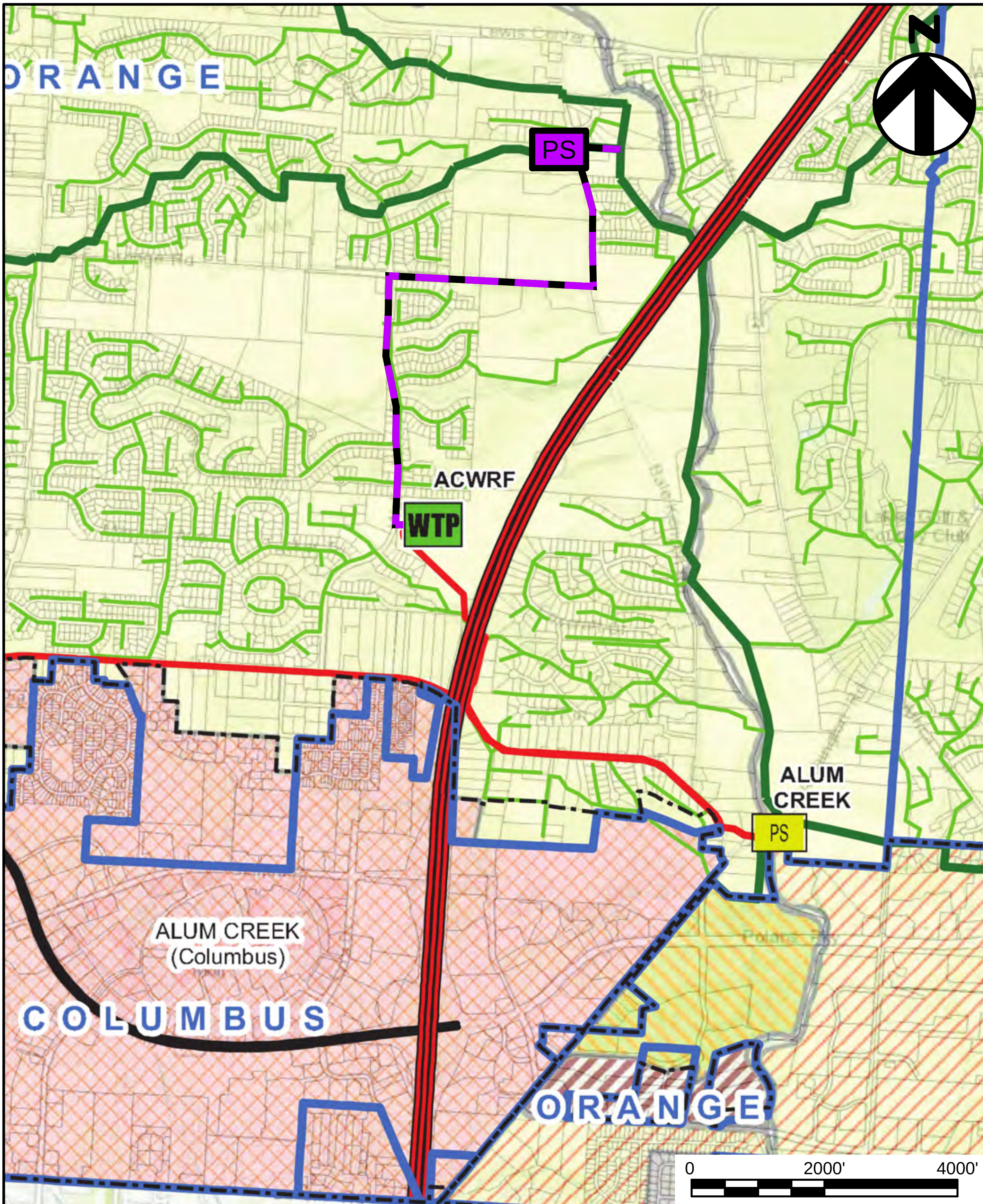
PEACHBLOW PUMP STATION - EARLY ACTION UPGRADE				
Project Description: Increase existing pump station capacity to a peak of 3.5 MGD and replace 4,300 LF of existing 8" forcemain with 16" forcemain.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	0	LF	$54	$0
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	4300	LF	$98	$421,400
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	0	EA	$5,000	$0
Pump Station Upgrade	1	LS	$350,000	$350,000
			Materials & Labor Total	**$771,400**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$115,700	$115,700
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$92,600	$92,600
			CONSTRUCTION TOTAL	**$979,700**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$49,000	$49,000
Engineering (12% of Construction)	1	LS	$117,600	$117,600
Design Contingency (30% of Construction)	1	LS	$293,900	$293,900
			GENERAL REQUIREMENTS TOTAL	**$460,500**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$1,440,200**



Peachblow Pump Station - Early Action Upgrade

PEACHBLOW PUMP STATION - LONG TERM UPGRADE				
Project Description: Upgrade pump station capacity to 6.6 MGD utilizing the 16" forcemain from the previous upgrade.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	0	LF	$54	$0
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	0	EA	$5,000	$0
Pump Station Upgrade	1	LS	$1,600,000	$1,600,000
			Materials & Labor Total	**$1,600,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$240,000	$240,000
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$192,000	$192,000
			CONSTRUCTION TOTAL	**$2,032,000**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$101,600	$101,600
Engineering (12% of Construction)	1	LS	$243,800	$243,800
Design Contingency (30% of Construction)	1	LS	$609,600	$609,600
			GENERAL REQUIREMENTS TOTAL	**$955,000**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$2,987,000**

LOWER ALUM CREEK RELIEF PUMP STATION				
Project Description: New 11 MGD relief pump station on the Alum Creek Trunk Sewer. This project includes 9,500 LF of new 24" forcemain to convey the flow directly to the ACWRF.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
6-inch Forcemain	0	LF	$54	$0
8-inch Forcemain	0	LF	$55	$0
10-inch Forcemain	0	LF	$63	$0
12-inch Forcemain	0	LF	$70	$0
14-inch Forcemain	0	LF	$82	$0
16-inch Forcemain	0	LF	$98	$0
24-inch Forcemain	9500	LF	$133	$1,263,500
8-inch Pipe	0	LF	$140	$0
8-inch Pipe (Granular Backfill)	0	LF	$190	$0
12-inch Pipe	0	LF	$160	$0
12-inch Pipe (Granular Backfill)	0	LF	$215	$0
15-inch Pipe	0	LF	$180	$0
15-inch Pipe (Granular Backfill)	0	LF	$230	$0
18-inch Pipe	0	LF	$200	$0
18-inch Pipe (Granular Backfill)	0	LF	$250	$0
21-inch Pipe	0	LF	$225	$0
21-inch Pipe (Granular Backfill)	0	LF	$275	$0
24-inch Pipe	0	LF	$250	$0
24-inch Pipe (Granular Backfill)	0	LF	$300	$0
30-inch Pipe	0	LF	$400	$0
30-inch Pipe (Granular Backfill)	0	LF	$450	$0
36-inch Pipe	0	LF	$500	$0
36-inch Pipe (Granular Backfill)	0	LF	$550	$0
Manhole	0	EA	$5,000	$0
Pump Station Upgrade	1	LS	$2,812,450	$2,812,450
			Materials & Labor Total	**$4,075,950**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$611,400	$611,400
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$489,100	$489,100
			CONSTRUCTION TOTAL	**$5,176,450**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$258,800	$258,800
Engineering (12% of Construction)	1	LS	$621,200	$621,200
Design Contingency (30% of Construction)	1	LS	$1,552,900	$1,552,900
			GENERAL REQUIREMENTS TOTAL	**$2,432,900**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$7,609,400**



Lower Alum Creek Relief Pump Station

OECC NORTH PLANT REHABILITATION				
Project Description: OECC North Plant Rehabilitation. Rehabilitation of 1.4 MGD (original rating) OECC North aeration, clarification, and associated pipe, diffusers, blowers, electrical requirements, etc.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
Demolition	1	LS	$81,700	$81,700
Aeration Tank Concrete/Drains/Railing Rehab	6	Tank	$100,000	$600,000
Clarifier Concrete/Drains/Railing Rehab	4	Tank	$100,000	$400,000
Air Valves and Piping	1	LS	$130,000	$130,000
Diffusers and Laterals	1	LS	$120,000	$120,000
Misc. Channels and Piping	1	LS	$100,000	$100,000
Pumping and Appurtenances	1	LS	$200,000	$200,000
Clarifier Equipment, baffles, weirs, etc	1	LS	$2,000,000	$2,000,000
RAS Pumps and Piping	1	LS	$220,000	$220,000
Flow Meters	1	LS	$100,000	$100,000
Post Air Hydraulic Improvements	1	LS	$200,000	$200,000
Electrical + I&C (20%)	1	LS	$830,340	$830,340
			Materials & Labor Total	**$4,982,040**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$747,300	$747,300
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$597,800	$597,800
			CONSTRUCTION TOTAL	**$6,327,140**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$316,400	$316,400
Engineering (12% of Construction)	1	LS	$759,300	$759,300
Design Contingency (30% of Construction)	1	LS	$1,898,100	$1,898,100
			GENERAL REQUIREMENTS TOTAL	**$2,973,800**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$9,300,900**

CENTRAL ALUM CREEK WATER RECLAMATION FACILITY				
Project Description: Central Alum Creek Water Reclamation Facility. New 800,000 GPD secondary wastewater reclamation facility constructed on greenfield. This facility will have influent pumped directly to the head of the plant from the East and Northwest Alum Creek Pump Stations.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
Land Acquisition	1	LS	$750,000	$750,000
Grit and Screening	1	LS	$1,200,000	$1,200,000
Channels and Piping	1	LS	$1,000,000	$1,000,000
Aeration Tanks	1	LS	$3,250,000	$3,250,000
Clarifiers and Splitter	1	LS	$2,250,000	$2,250,000
Disinfection	1	LS	$750,000	$750,000
Tertiary Treatment	1	LS	$750,000	$750,000
Electrical + I&C (20%)	1	LS	$1,840,000	$1,840,000
			Materials & Labor Total	**$11,790,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$1,768,500	$1,768,500
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$1,414,800	$1,414,800
			CONSTRUCTION TOTAL	**$14,973,300**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$748,700	$748,700
Engineering (12% of Construction)	1	LS	$1,796,800	$1,796,800
Design Contingency (30% of Construction)	1	LS	$4,492,000	$4,492,000
			GENERAL REQUIREMENTS TOTAL	**$7,037,500**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$22,000,000**

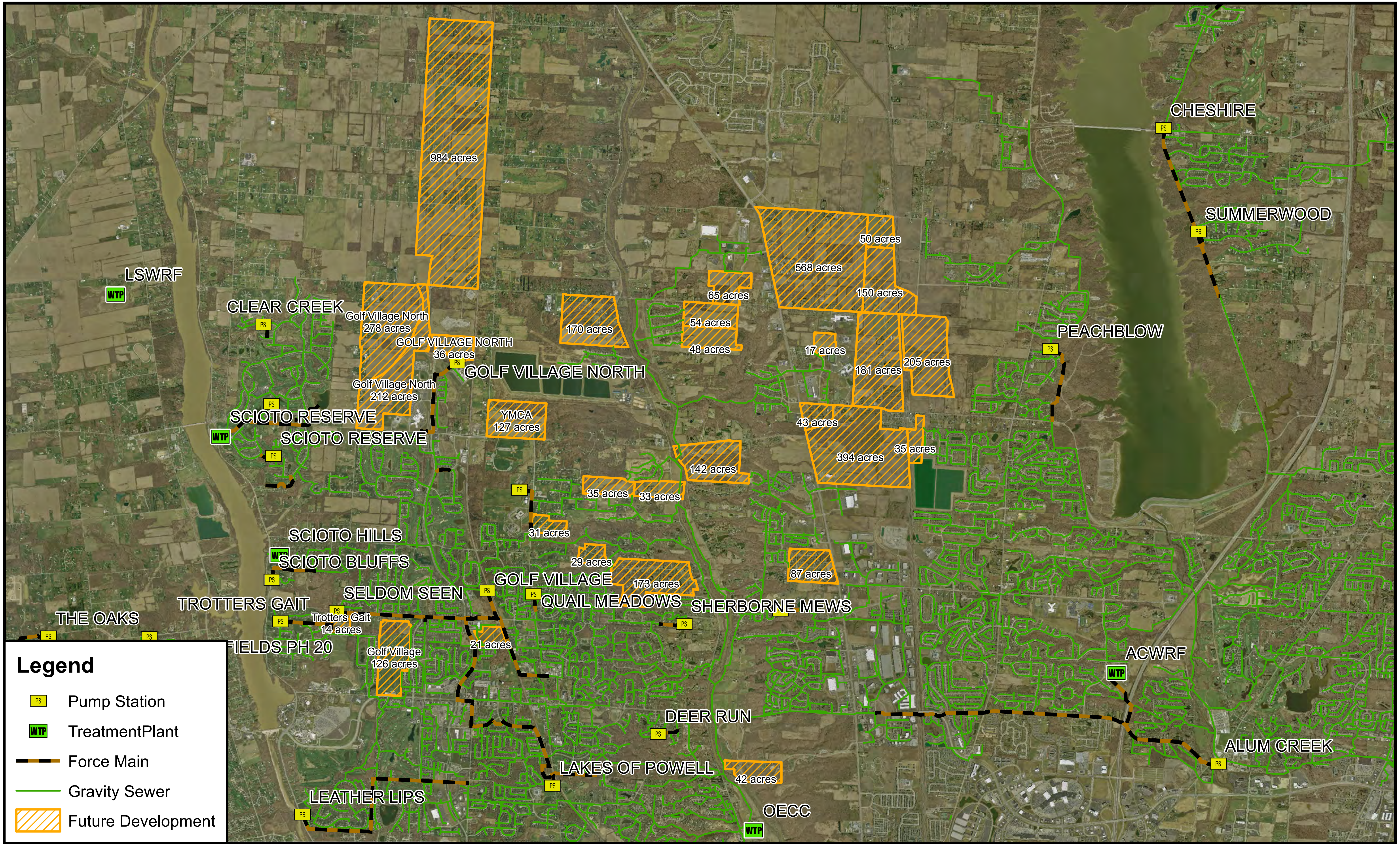
ACWRF GRIT REMOVAL IMPROVEMENTS				
Project Description: ACWRF Grit Removal Improvements. Construction of a Grit Removal system and new building to house the equipment and appurtenances prior to the activated sludge system at ACWRF.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
Site Work and Demolition	1	LS	$90,000.00	$90,000
Structural/Concrete Repair	1	LS	$100,000.00	$100,000
New Grit Equipment Building	1	LS	$100,000.00	$100,000
Grit Pumps	1	LS	$90,000.00	$90,000
Grit Washers	1	LS	$200,000.00	$200,000
Grit Vortex Units	1	LS	$800,000.00	$800,000
Gates, Channels, and Piping	1	LS	$850,000.00	$850,000
Electrical + I&C (20%)	1	LS	$446,000.00	$446,000
Materials & Labor Total				**$2,676,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$401,400	$401,400
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$321,100	$321,100
CONSTRUCTION TOTAL				**$3,398,500**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$169,900	$169,900
Engineering (12% of Construction)	1	LS	$407,800	$407,800
Design Contingency (30% of Construction)	1	LS	$1,019,600	$1,019,600
GENERAL REQUIREMENTS TOTAL				**$1,597,300**
PROBABLE ESTIMATE OF ENGINEERS PROJECT COST				**$4,995,800**

OECC FILTER UPGRADE				
Project Description: OECC Filter Upgrade. Replacement of existing filters with disc style filters.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
Site Work	1	LS	$50,000	$50,000
Demolition of Existing Filters and Appurtenances	1	LF	$50,000	$50,000
New Filters and Appurtenances	1	LF	$700,000	$700,000
Valves	1	LF	$100,000	$100,000
Pipes and Fittings	1	LF	$200,000	$200,000
Baffles and Channel Modification	1	LF	$240,000	$240,000
Electrical + I&C (20%)	1	LS	$268,000	$268,000
Materials & Labor Total				**$1,608,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$241,200	$241,200
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$193,000	$193,000
CONSTRUCTION TOTAL				**$2,042,200**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$102,100	$102,100
Engineering (12% of Construction)	1	LS	$245,100	$245,100
Design Contingency (30% of Construction)	1	LS	$612,700	$612,700
GENERAL REQUIREMENTS TOTAL				**$959,900**
PROBABLE ESTIMATE OF ENGINEERS PROJECT COST				**$3,002,100**

OECC SOUTH AERATION UPGRADES				
Project Description: OECC South Aeration Upgrades. New blowers, diffusers, piping, and valves.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
Concrete Tank Rehab	1	LS	$150,000	$150,000
Mixers	1	LS	$200,000	$200,000
Air Piping	1	LS	$250,000	$250,000
Valves	1	LS	$225,000	$225,000
Baffles	1	LS	$150,000	$150,000
Diffusers	1	LS	$600,000	$600,000
Blowers	1	LS	$2,000,000	$2,000,000
Electrical + I&C (20%)	1	LS	$715,000	$715,000
			Materials & Labor Total	**$4,290,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$643,500	$643,500
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$514,800	$514,800
			CONSTRUCTION TOTAL	**$5,448,300**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$272,400	$272,400
Engineering (12% of Construction)	1	LS	$653,800	$653,800
Design Contingency (30% of Construction)	1	LS	$1,634,500	$1,634,500
			GENERAL REQUIREMENTS TOTAL	**$2,560,700**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$8,009,000**

OECC HEADWORKS				
Project Description: OECC Headworks Upgrade. New facility including influent pumping up to 26 MGD (firm) with grit removal and screening.				
Item Description	Quantity	Unit	Unit Cost	Total Cost
CONSTRUCTION				
Materials & Labor				
Excavation	7500	CY	$20	$150,000
Site Work and Dewatering	1	LS	$300,000	$300,000
Concrete Work	1	LS	$2,400,000	$2,400,000
Piping	1	LS	$500,000	$500,000
Influent Pumps and Appurtenances	1	LS	$750,000	$750,000
Valves	1	LS	$270,000	$270,000
Flowmeter	1	LS	$80,000	$80,000
Demolition and Rerouting of Existing PS	1	LS	$750,000	$750,000
Grit Chamber Equipment	1	LS	$250,000	$250,000
Grit Washers and Pumps	1	LS	$250,000	$250,000
Automatic Screens	1	LS	$500,000	$500,000
Screw Press	1	LS	$200,000	$200,000
Gates	1	LS	$300,000	$300,000
Electrical + I&C (20%)	1	LS	$1,340,000	$1,340,000
			Materials & Labor Total	**$8,040,000**
Mobilization, Bonds & Insurance (15% of Materials & Labor)	1	LS	$1,206,000	$1,206,000
Contractor Overhead & Profit (12% of Materials & Labor)	1	LS	$964,800	$964,800
			CONSTRUCTION TOTAL	**$10,210,800**
GENERAL REQUIREMENTS				
Administrative and Easement Costs (5% of Construction)	1	LS	$510,500	$510,500
Engineering (12% of Construction)	1	LS	$1,225,300	$1,225,300
Design Contingency (30% of Construction)	1	LS	$3,063,200	$3,063,200
			GENERAL REQUIREMENTS TOTAL	**$4,799,000**
			PROBABLE ESTIMATE OF ENGINEERS PROJECT COST	**$15,009,800**

Appendix B – Figures



0 0.5 1 2 3 Miles

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Figure 1
Full Development- 25Yr
OECC Existing Service Area

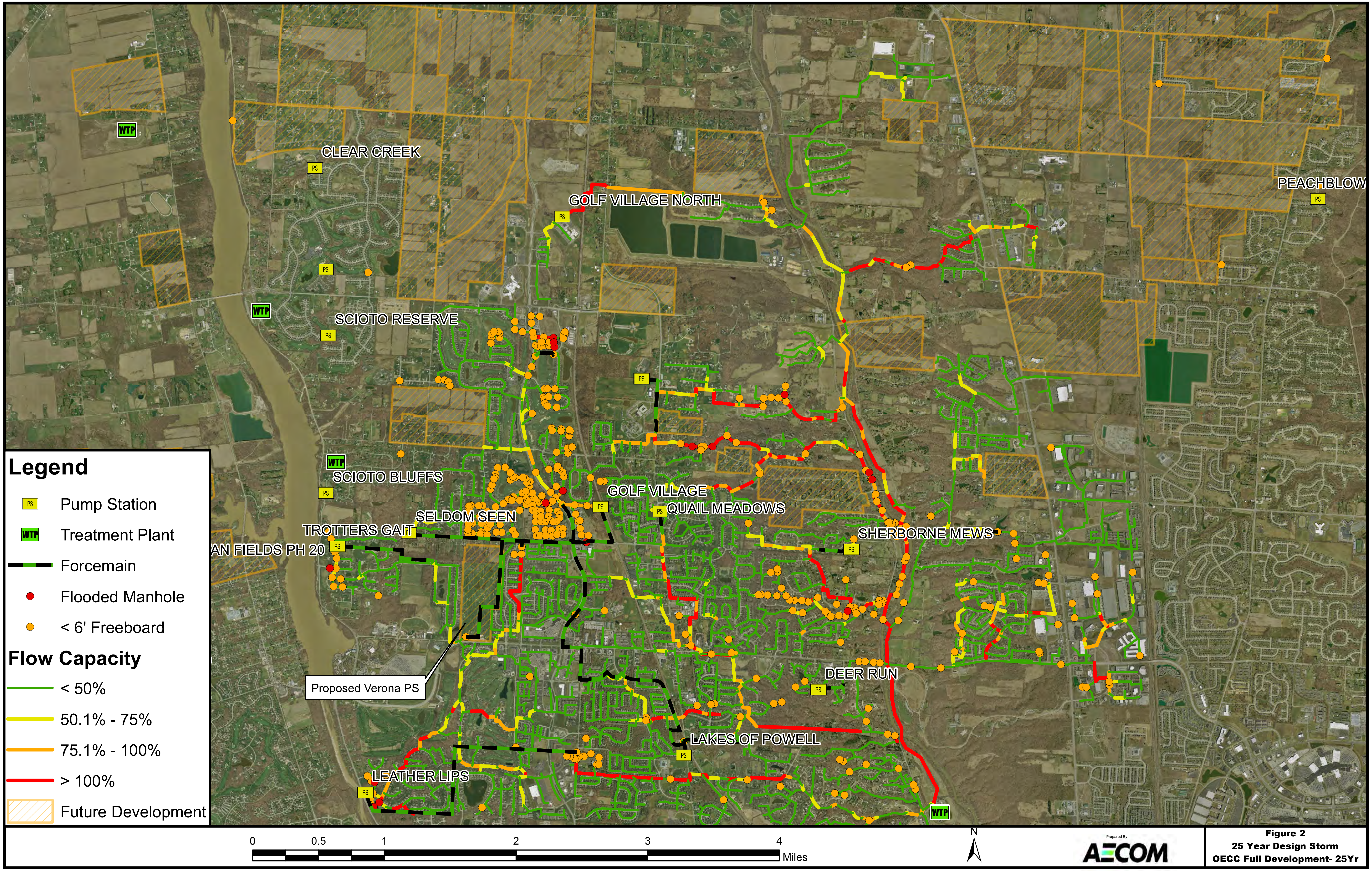


Figure 2
25 Year Design Storm
OECC Full Development- 25Yr

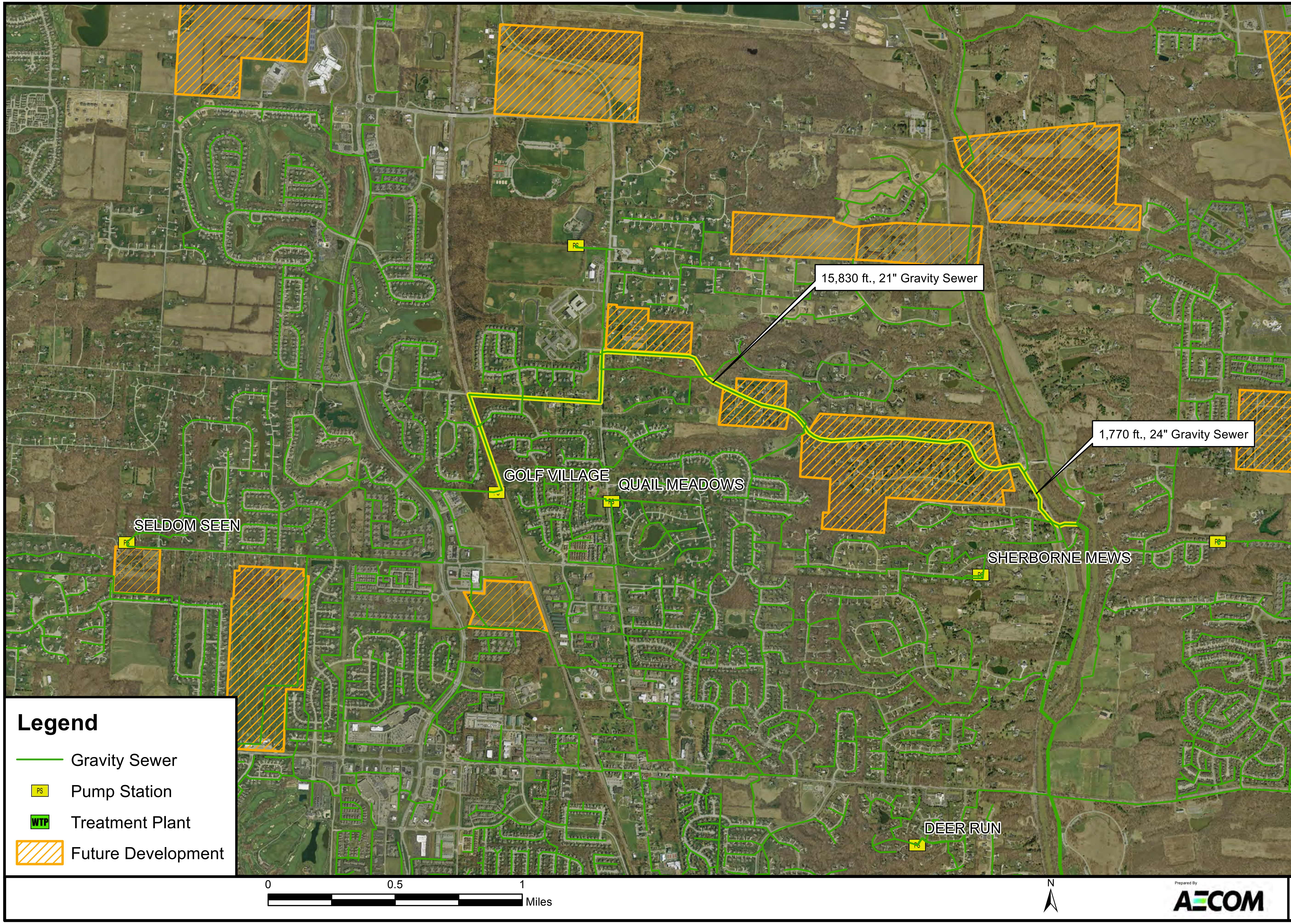
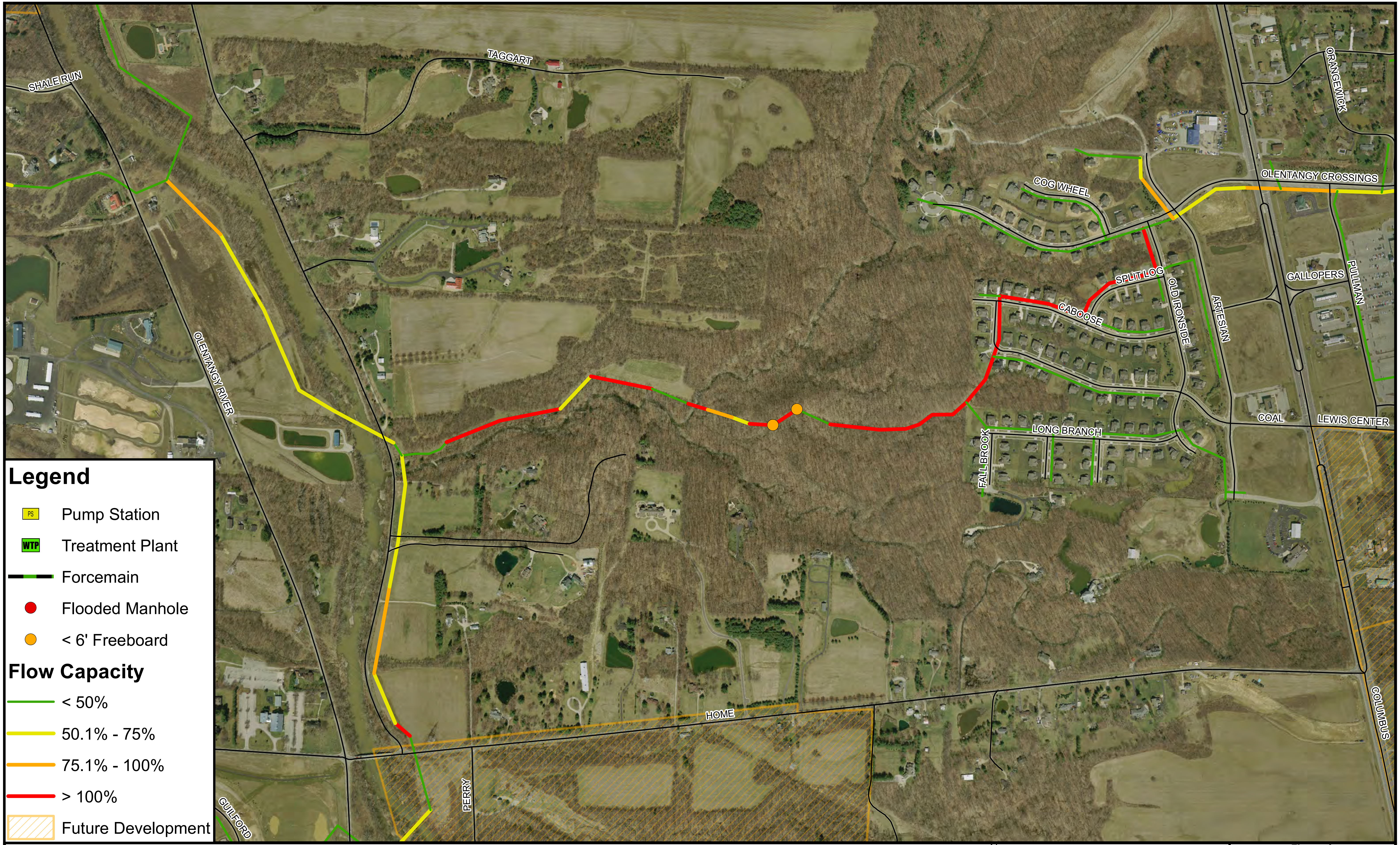


Figure 3
Golf Village Gravity Sewer
Full Development - 25yr



0 250 500 1,000 1,500 2,000
Feet

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Figure 4
Olentangy Crossing Bottleneck
25 Year Design Storm

Figure 5
Trotters Gait Bottleneck
25 Year Design Storm

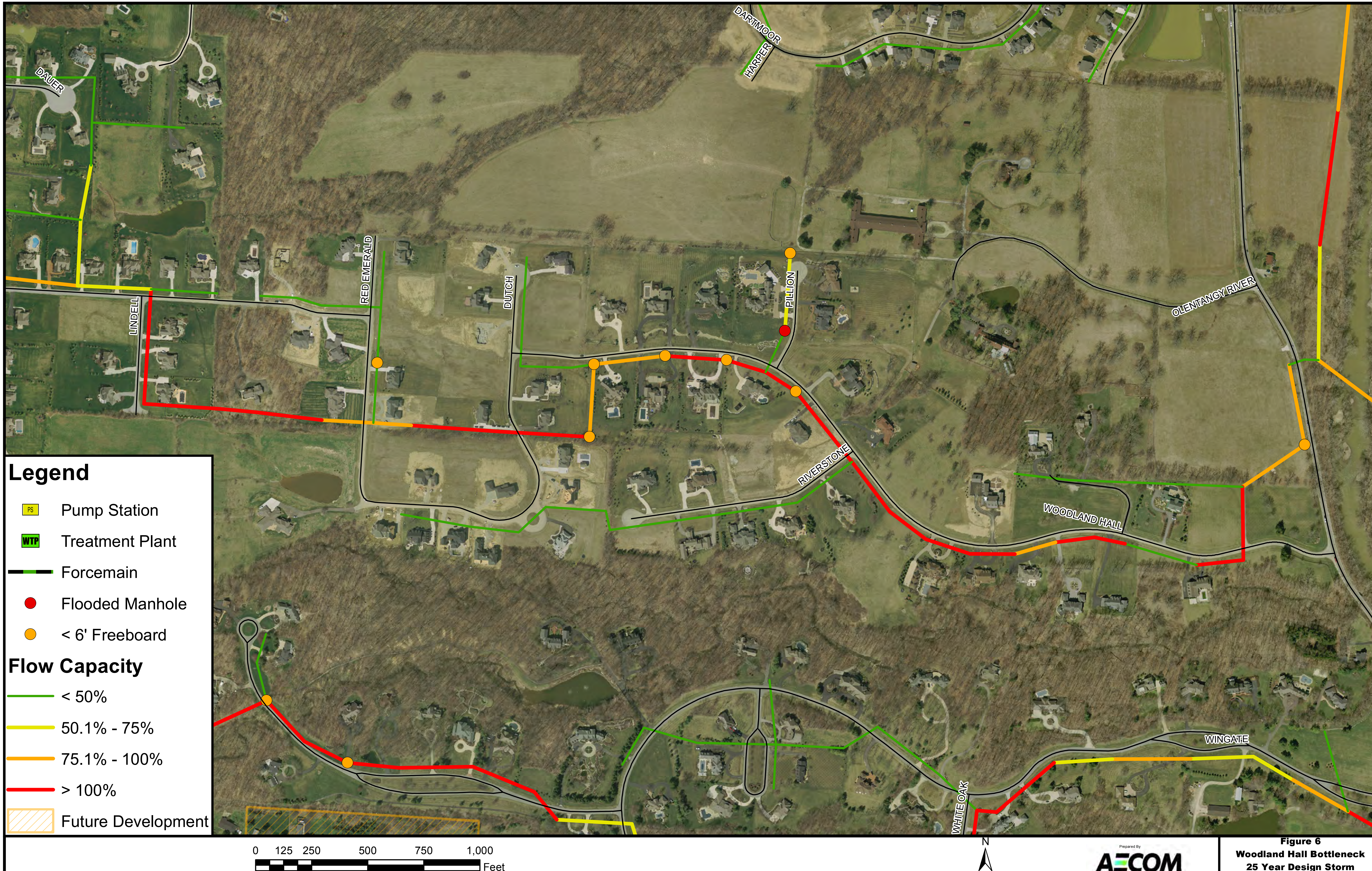

Figure 6
Woodland Hall Bottleneck
25 Year Design Storm

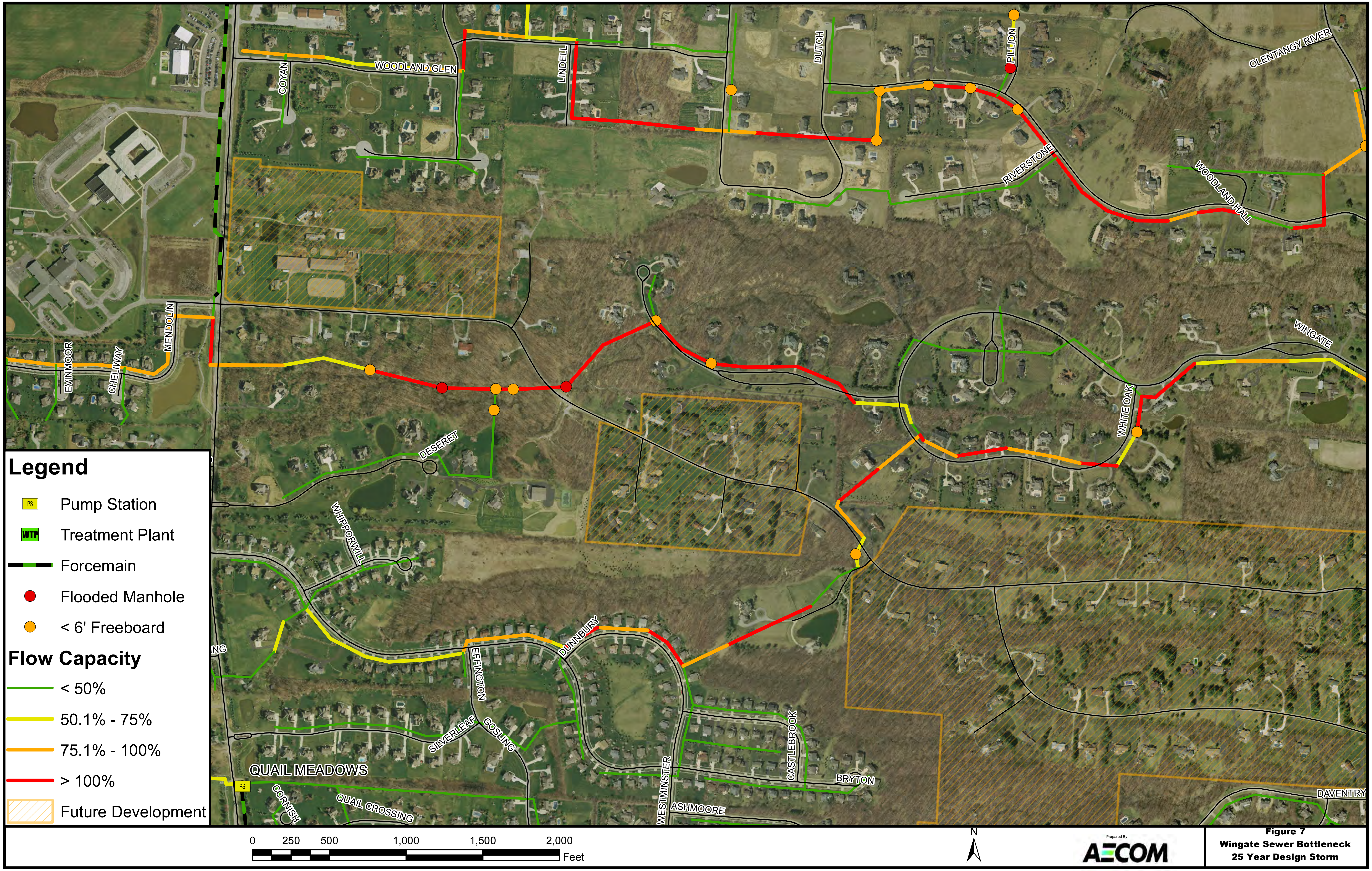

Figure 7
Wingate Sewer Bottleneck
25 Year Design Storm

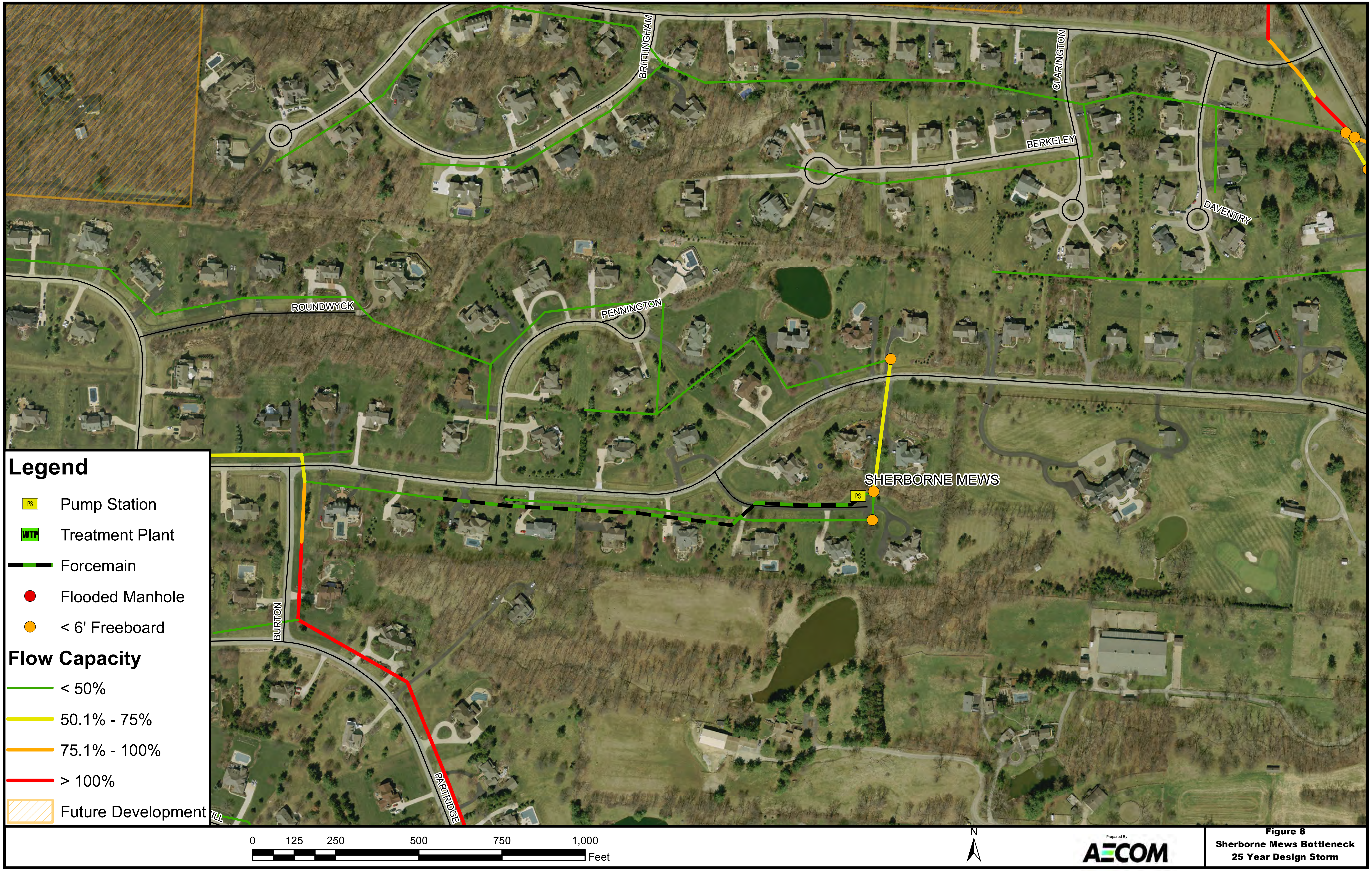

Figure 8
Sherborne Mews Bottleneck
25 Year Design Storm

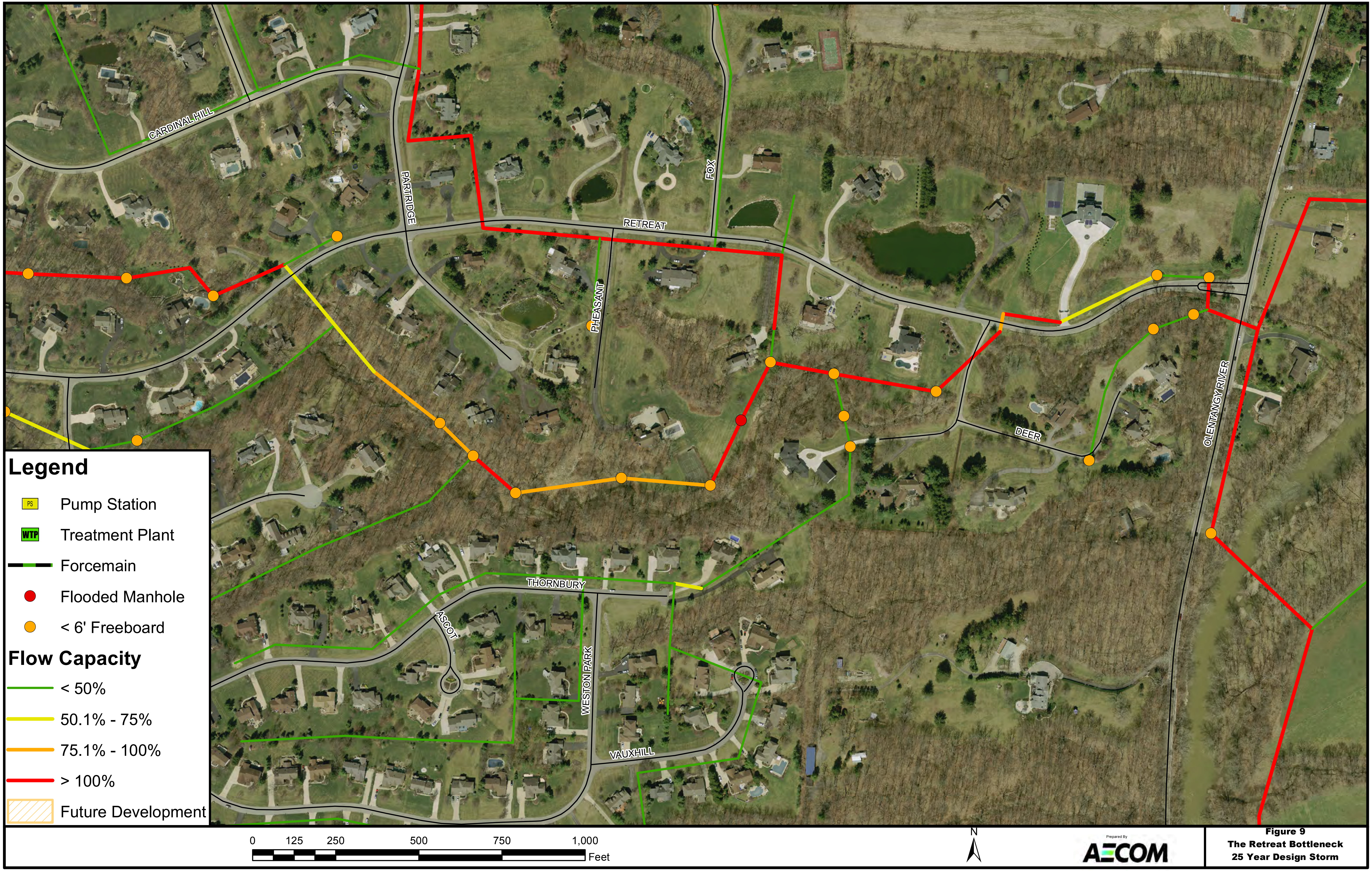

Figure 9
The Retreat Bottleneck
25 Year Design Storm

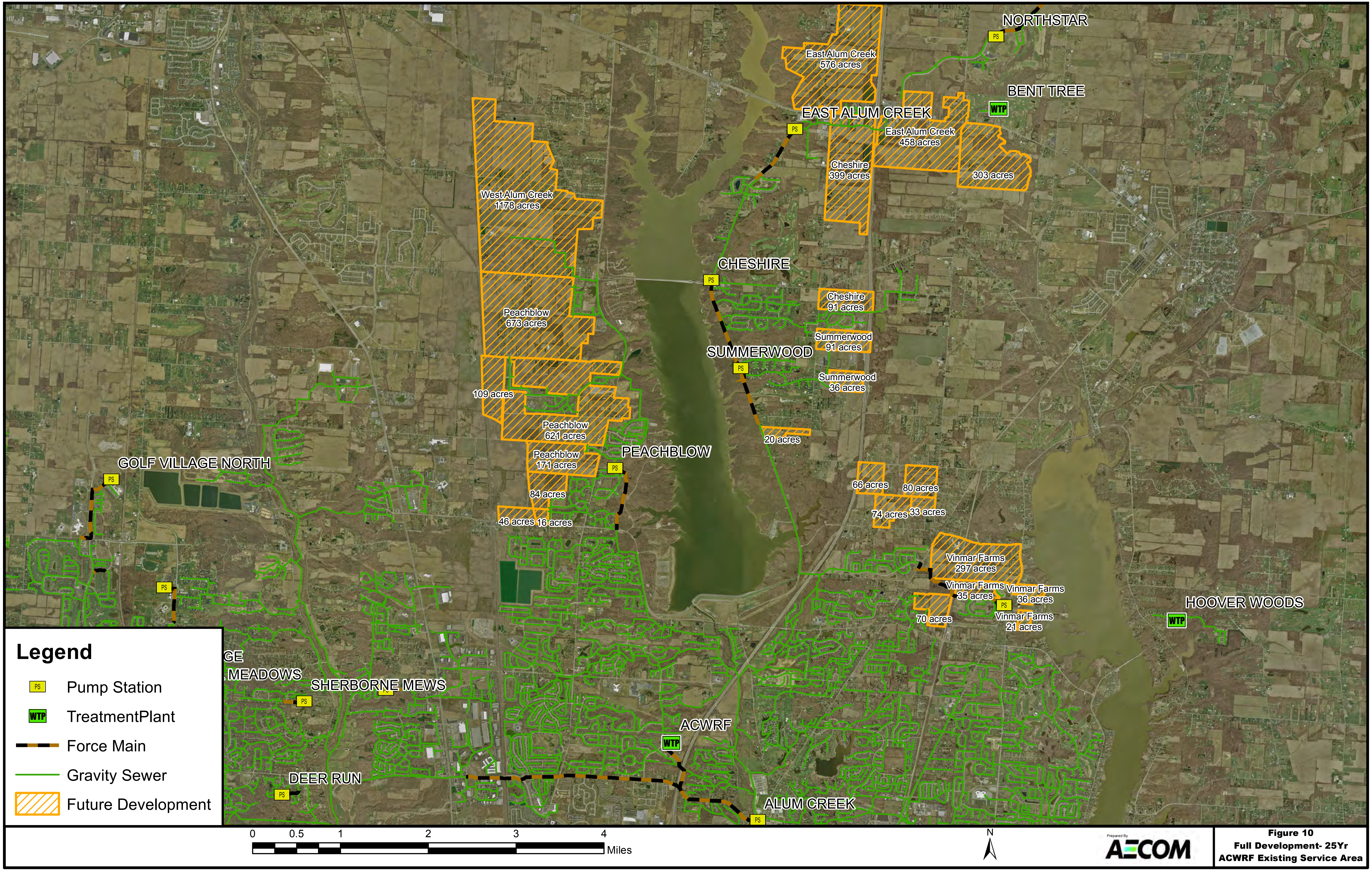

Figure 10
Full Development- 25Yr
ACWRF Existing Service Area

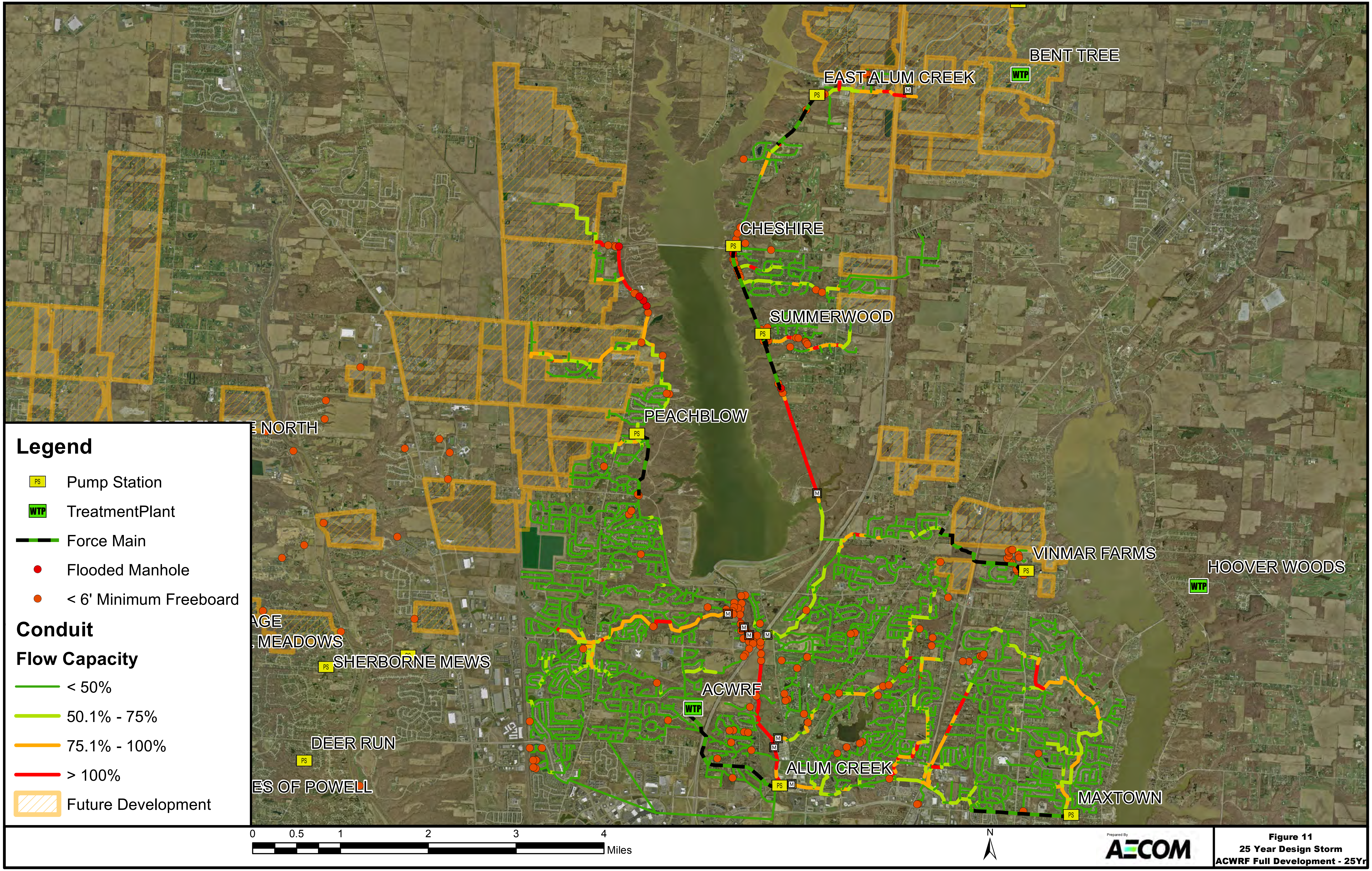

Figure 11
25 Year Design Storm
ACWRF Full Development - 25Yr

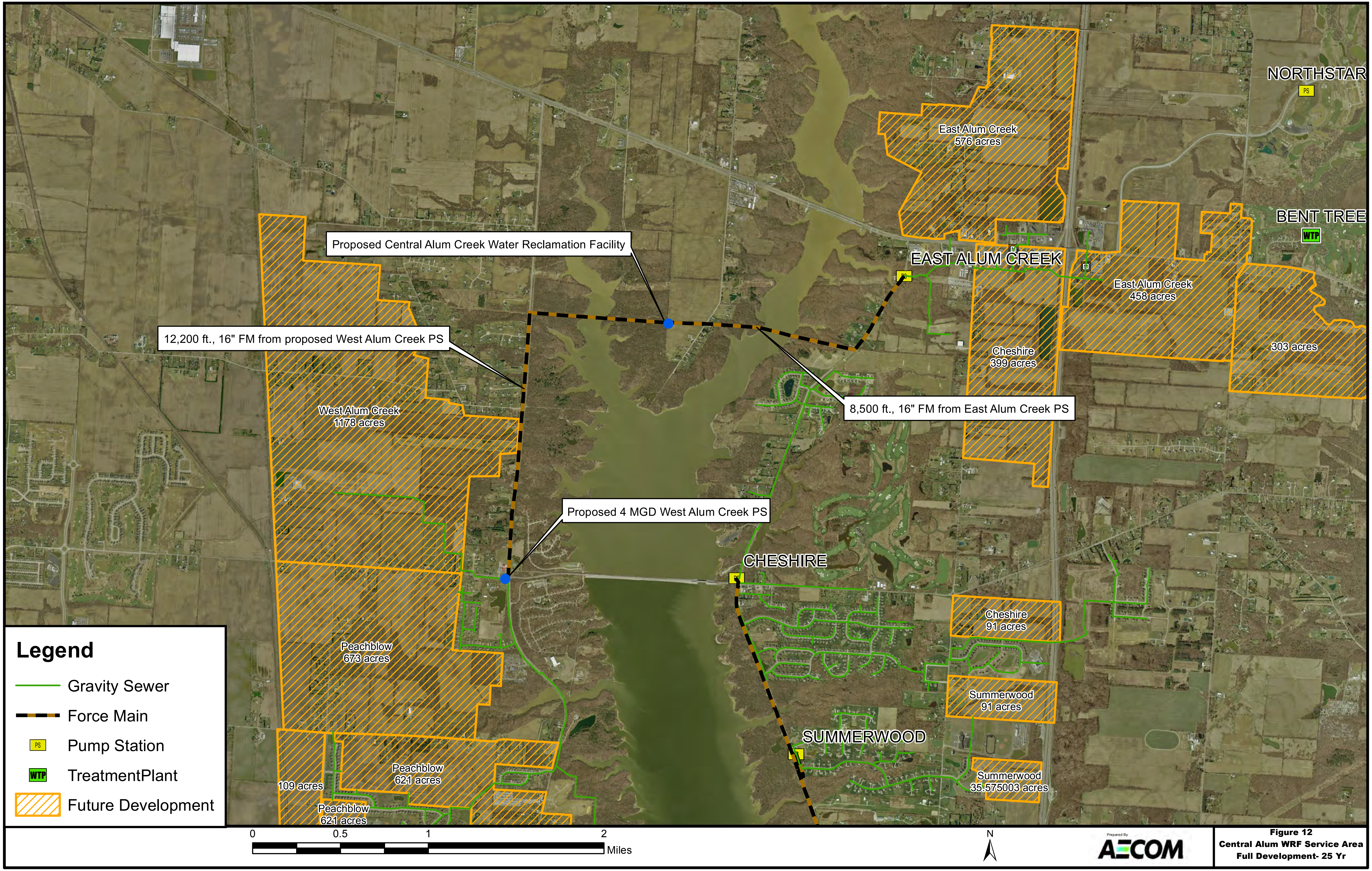

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Figure 12
Central Alum WRF Service Area
Full Development- 25 Yr

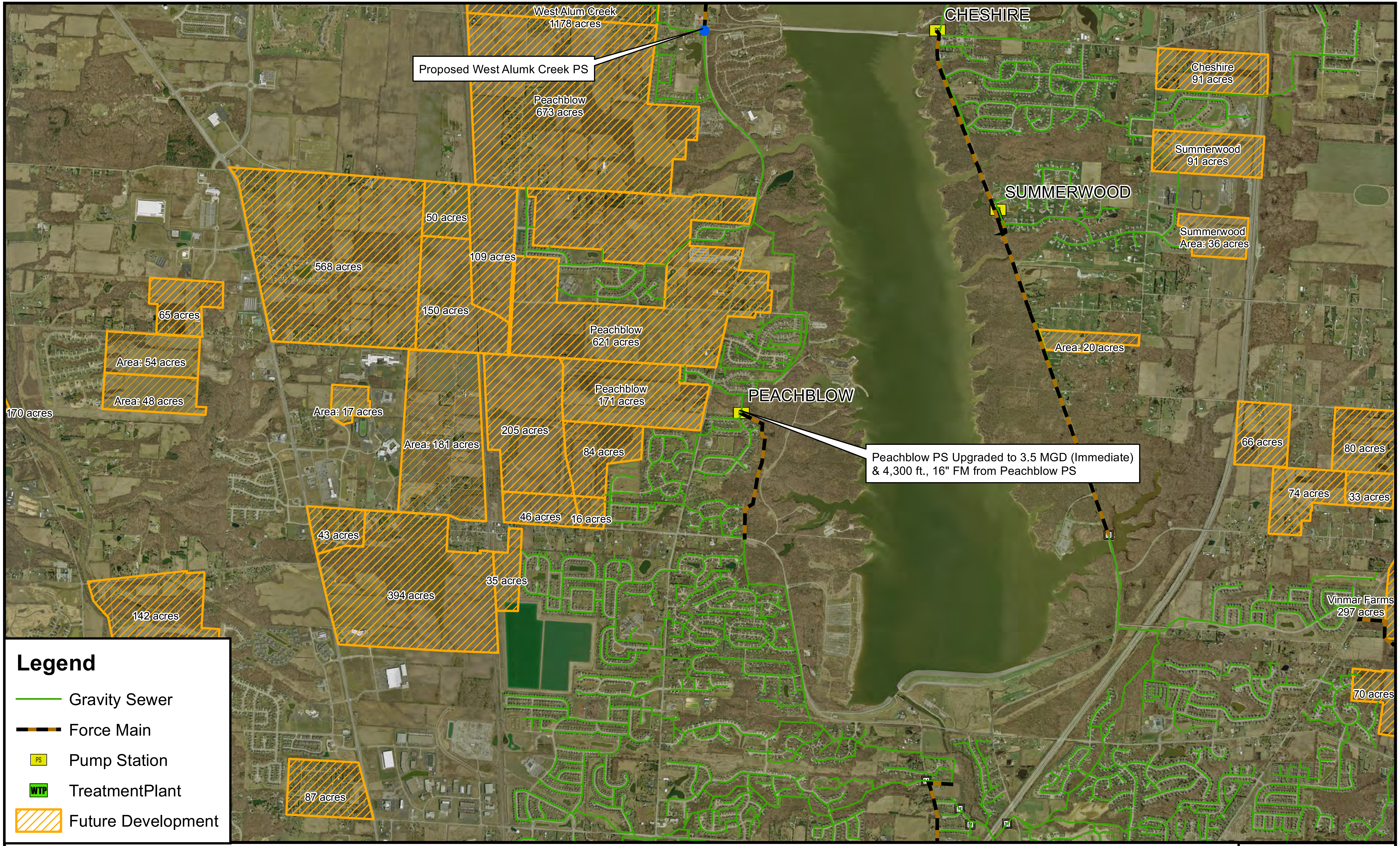


Figure 13
Peachblow PS - Proposed
Full Development- 25 Yr

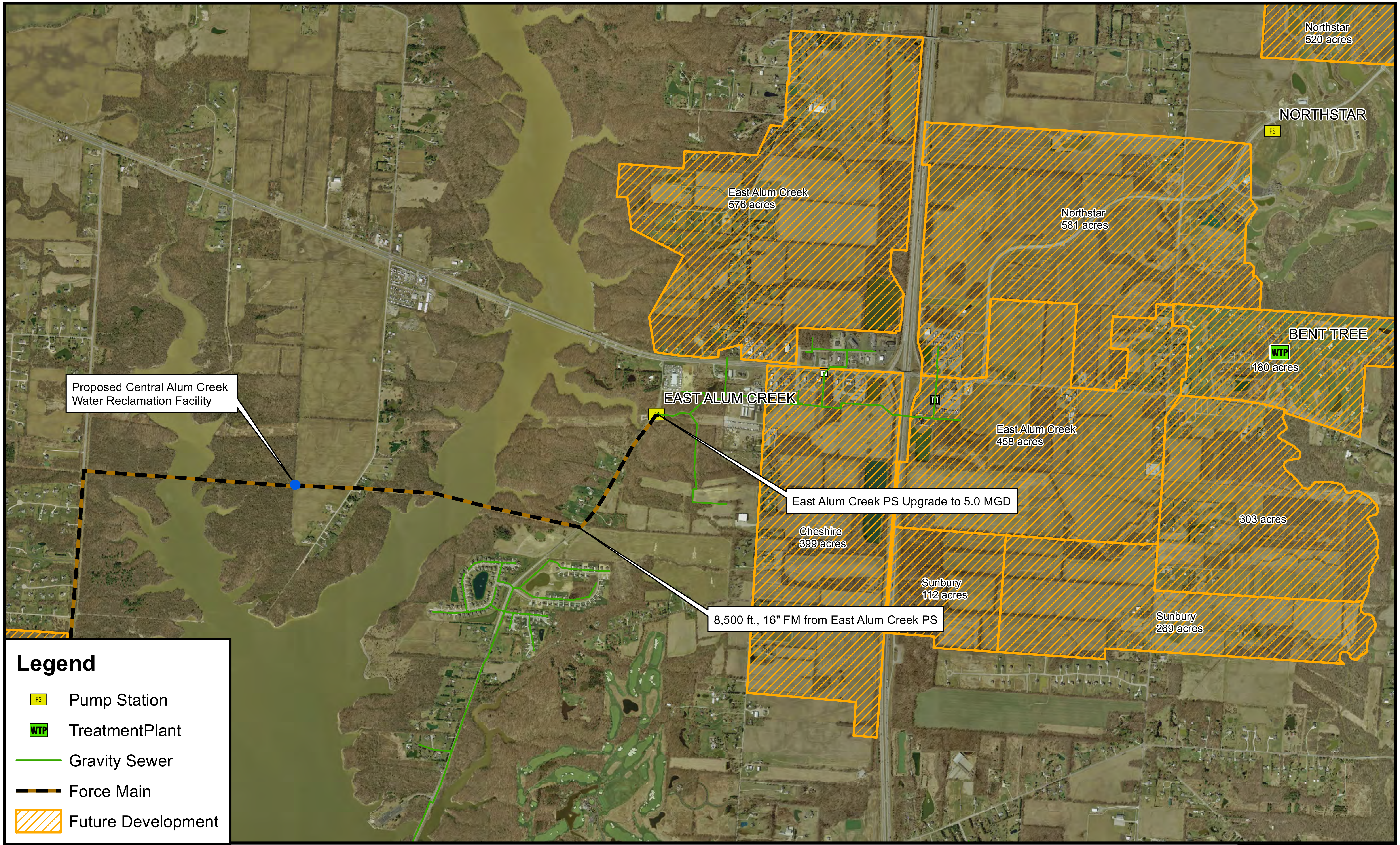


Figure 14
East Alum Creek PS - Proposed Full Development- 25 Yr

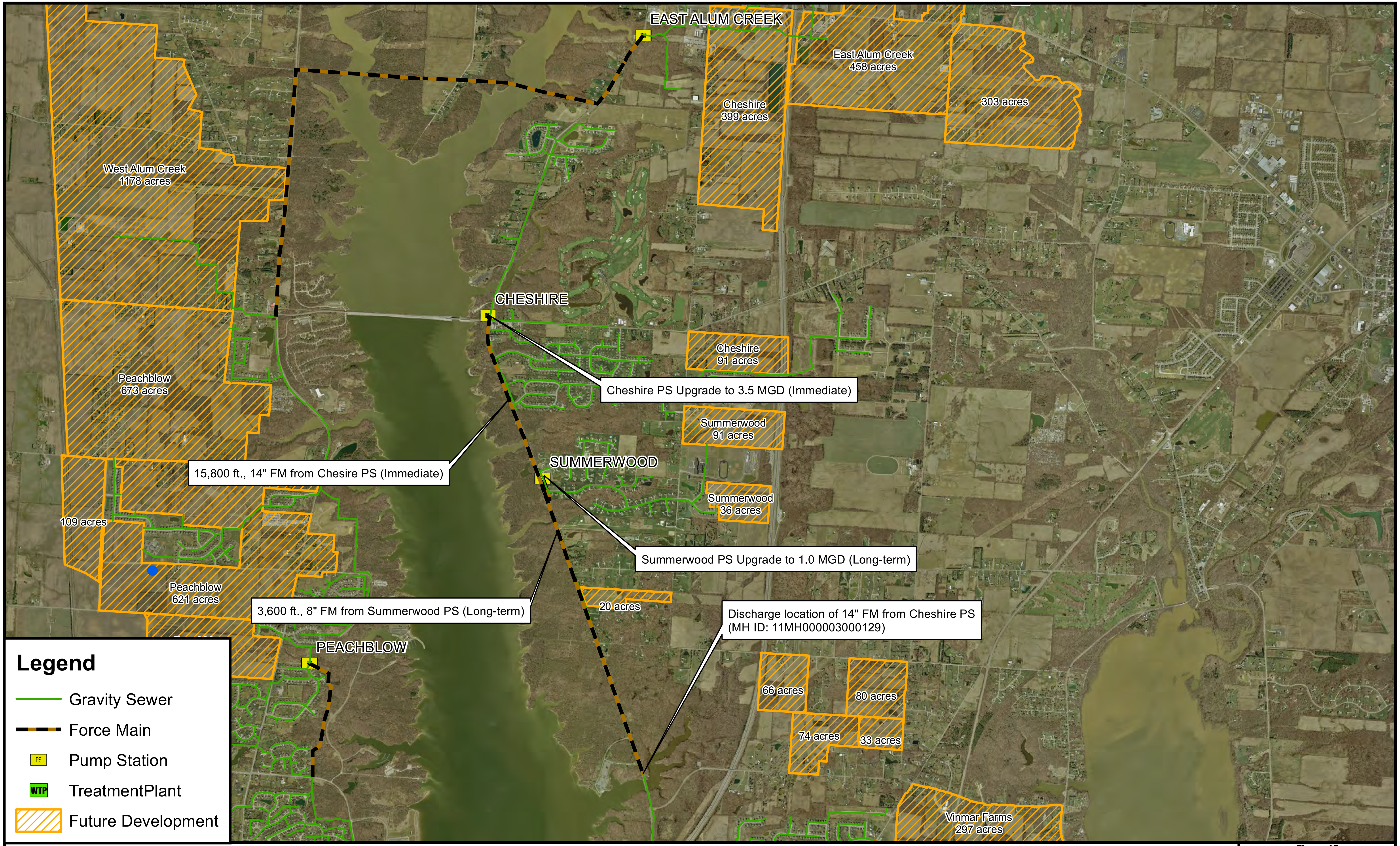


Figure 15
Cheshire/Summerwood - Proposed
Full Development- 25 Yr

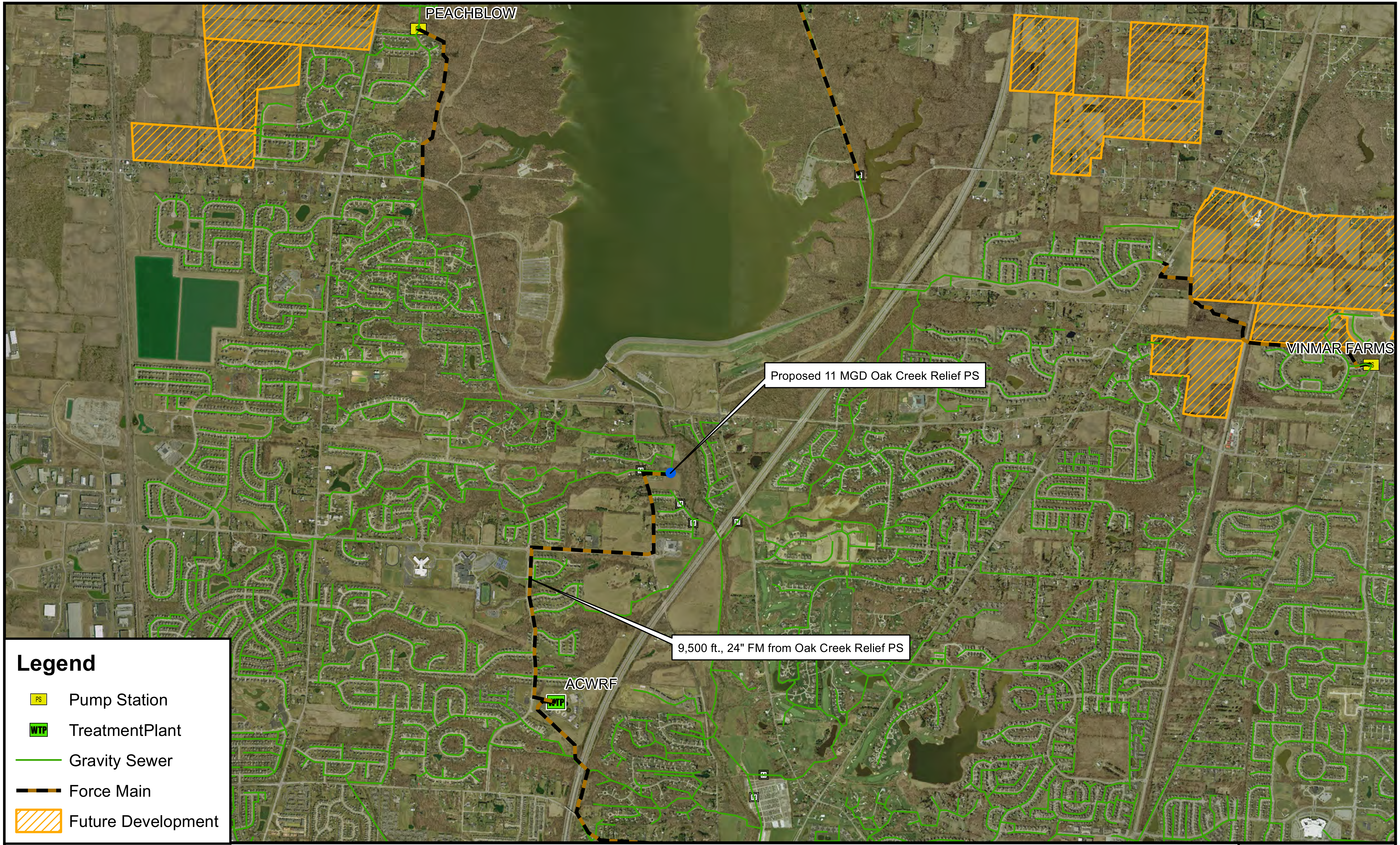


Figure 16
Oak Creek Relief Pump Station
Full Development- 25 Yr

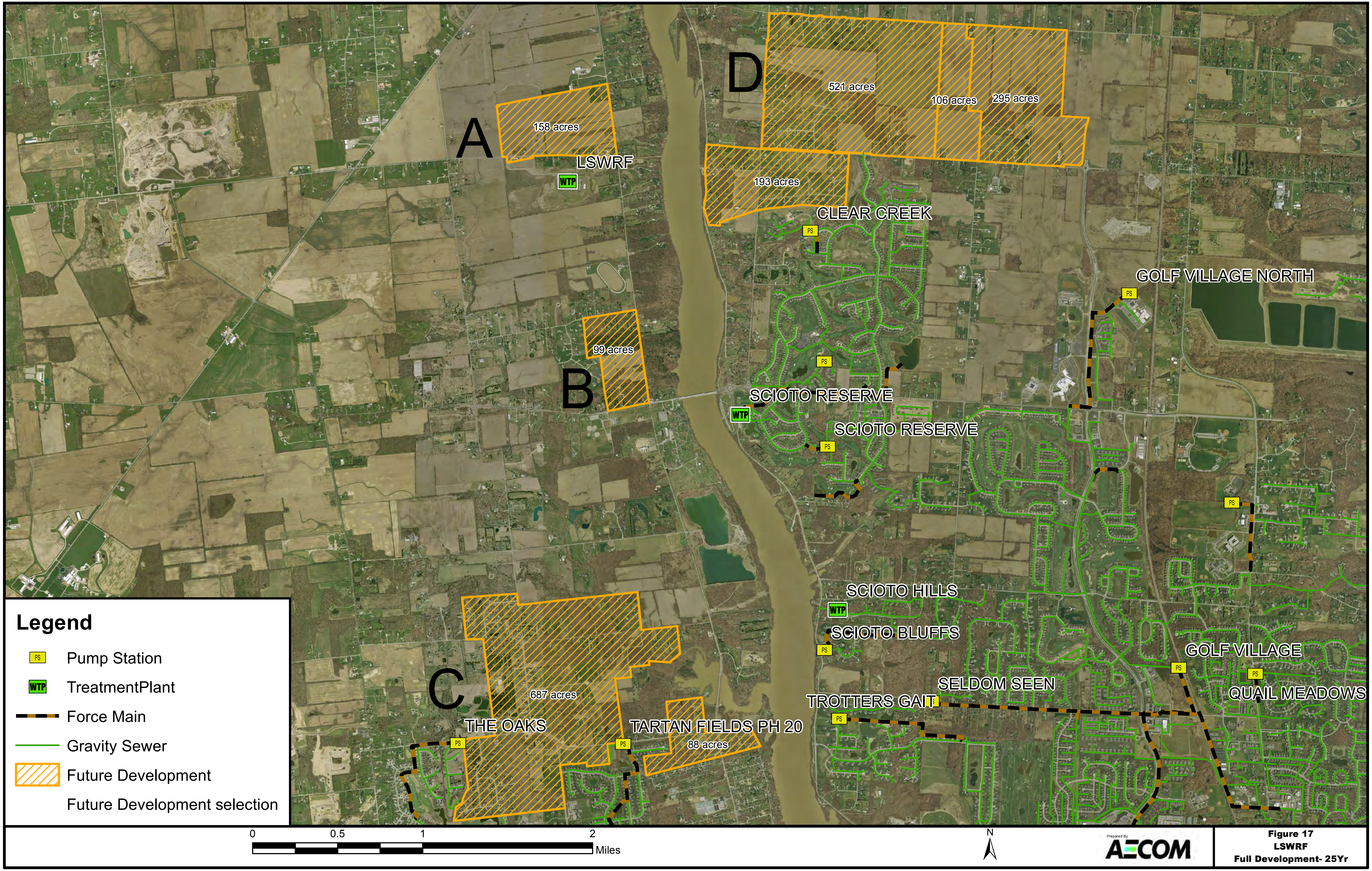


Figure 17
LSWRF
Full Development- 25Yr

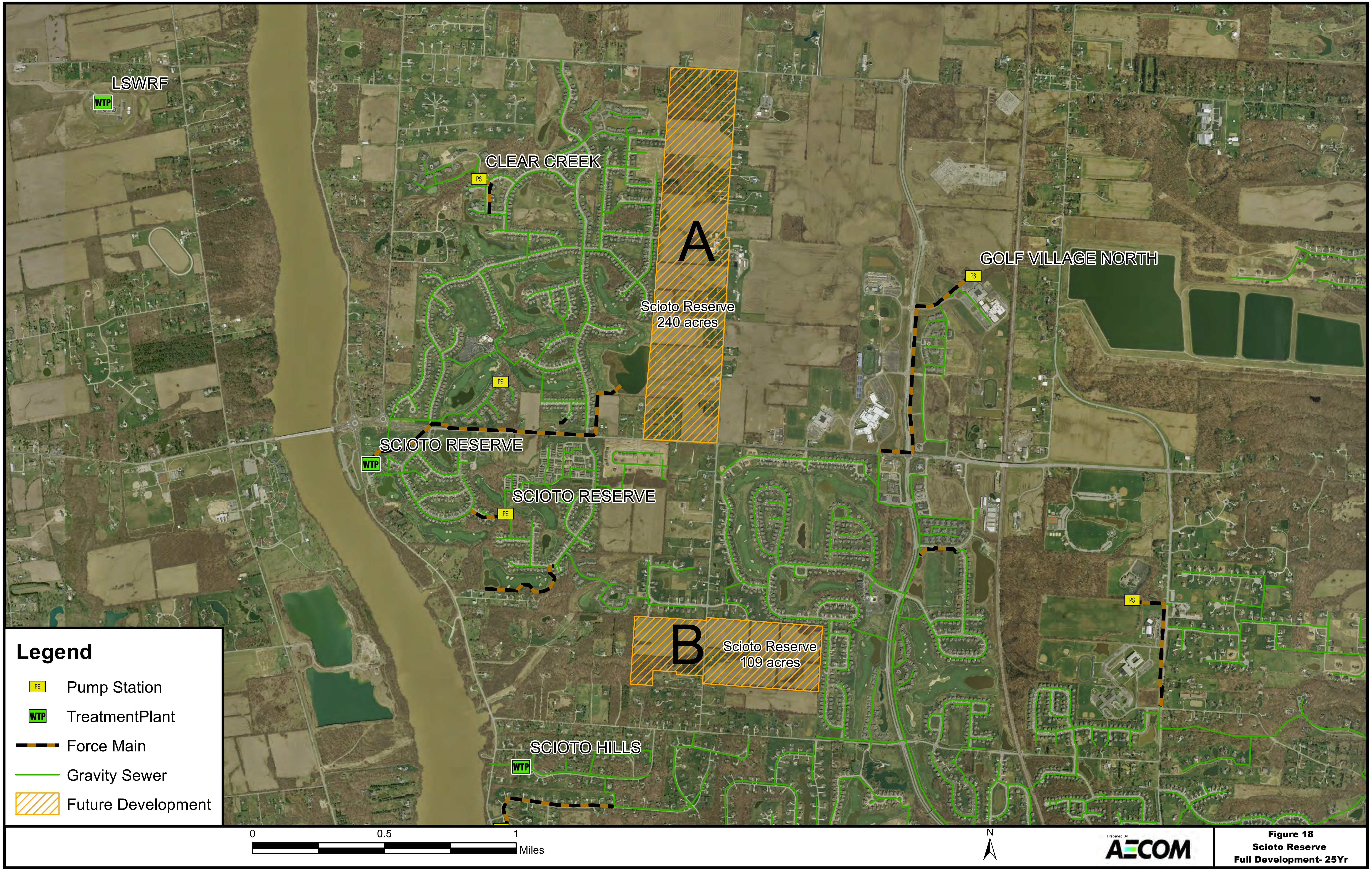
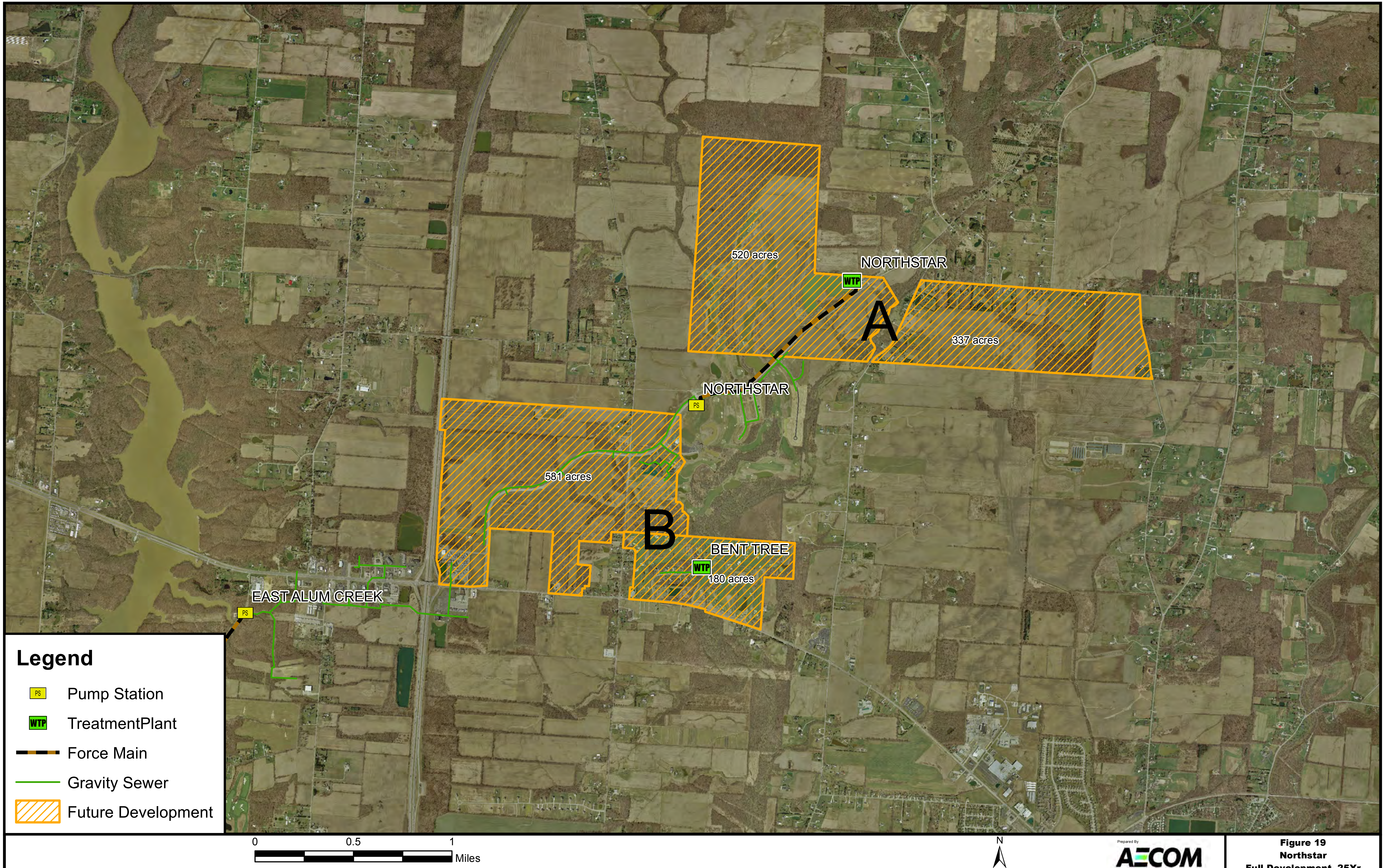


Figure 18
Scioto Reserve
Full Development- 25Yr



Prepared By AECOM

Figure 19
Northstar
Full Development- 25Yr

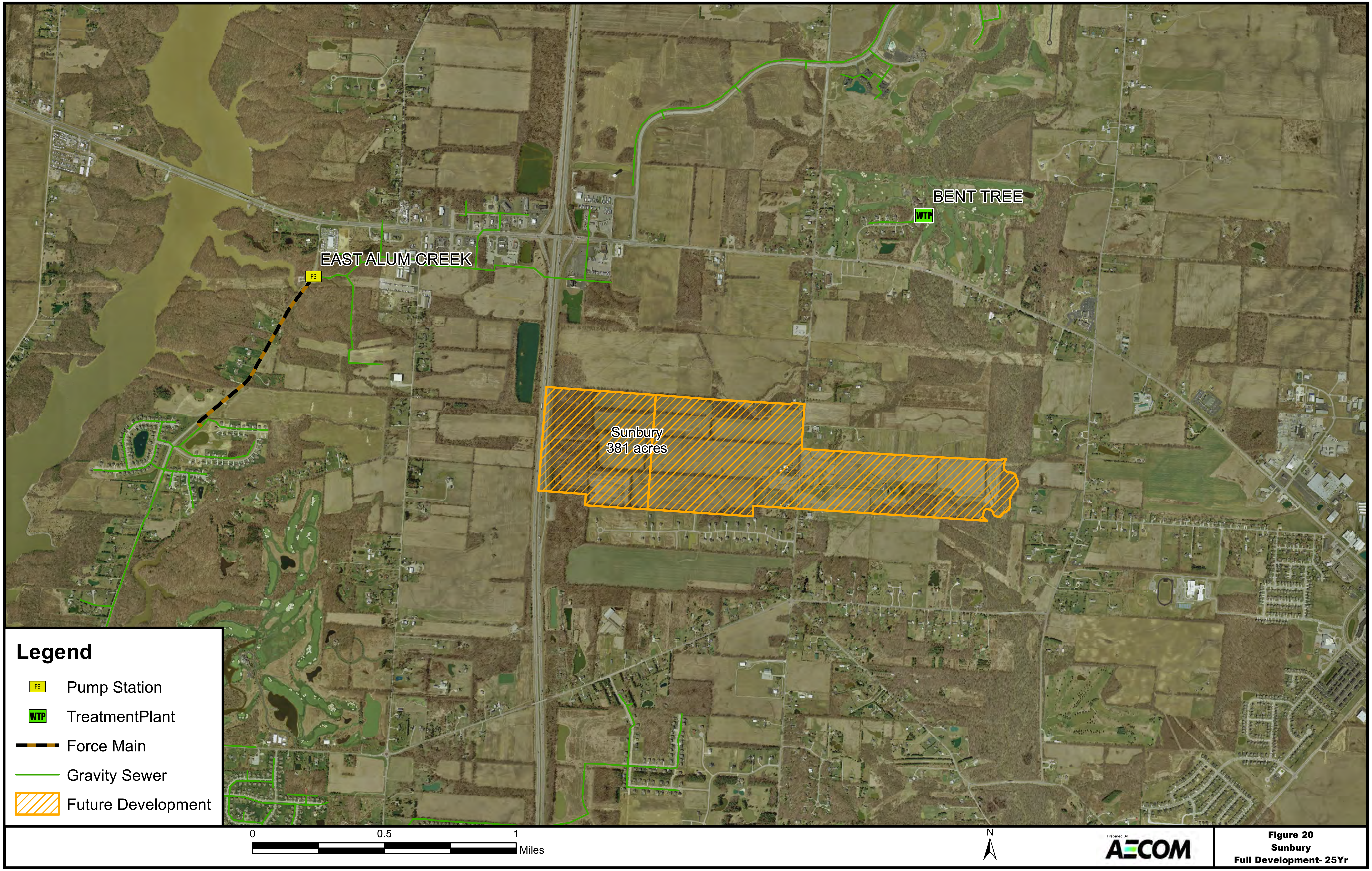


Figure 20
Sunbury
Full Development- 25Yr