ENGINEERING REPORT
AND
ENVIRONMENTAL INFORMATION DOCUMENT

WASTEWATER TREATMENT SYSTEM IMPROVEMENTS

TOWN OF PITTSBORO
NORTH CAROLINA

TOWN OF PITTSBORO

FEBRUARY 2016

NORTH CAROLINA PROFESSIONAL SEAL 43162 ENGINEER MILES R. GALLOWAY
29-FEB-2016

NORTH CAROLINA PROFESSIONAL SEAL 040525 ENGINEER CARL W. SCHARFE
02/29/16

MILES R. GALLOWAY, PE
PROJECT/PROCESS ENGINEER

CARL W SCHARFE, PE
PROJECT MANAGER/PROCESS ENGINEER

THE WOOTEN COMPANY

TOWN CONTACT INFORMATION

APPLICANT:	TOWN OF PITTSBORO
CONTACT NAME:	BRYAN GRUESBECK, TOWN MANAGER
ADDRESS:	635 EAST STREET
	PO BOX 759
	PITTSBORO, NC 27312
TELEPHONE:	(919) 542-4621
FAX:	(252) 747-8131

CONSULTING ENGINEER CONTACT INFORMATION

FIRM:	THE WOOTEN COMPANY
ENGINEER:	CARL W. SCHARFE, PE
ADDRESS:	120 N. BOYLAN AVENUE
	RALEIGH, NC 27603
TELEPHONE:	(919) 828-0531
FAX:	(919) 834-3589
EMAIL:	CSCHARFE@THEWOOTENCOMPANY.COM

TABLE OF CONTENTS

Executive Summary **1**
Project Description 1
Reason for Proposed Project 1
Alternatives Analysis Results 2
Environmental Impacts and Mitigative Measures Summary 3
Project Funding and User Fee Increases 3
1.0 Introduction **5**
1.1 Background 5
1.2 Purpose and Scope 6
1.3 Planning Area 7
2.0 Current Situation **10**
2.1 Collection System Overview 10
2.2 WWTP Existing Conditions 10
2.2.1 General WWTP Condition 10
2.2.2 Condition of WWTP Equipment 16
2.2.3 Permit Information 18
2.3 Current Service Population 19
2.4 Historical and Current Wastewater Flow 20
2.4.1 Influent Wastewater Flow 20
2.4.2 Inflow and Infiltration Analysis 23
2.5 Influent Wastewater Characteristics and Current Performance 27
3.0 Future Situation **28**
3.1 Population Projections 28
3.2 Flow Projections 29
4.0 Purpose and Need **32**
5.0 Alternatives Analysis **33**
5.1 Alternatives Overview 33
5.2 Alternatives Description 34
5.2.1 Alternative No. 1: No Action 35
5.2.2 Alternative No. 2: Refurbish Existing WWTP, Pump to Sanford, Regional WWTP 35
5.2.3 Alternative No. 3: WWTP expansion and Regional WWTPs 39
5.2.4 Alternative No. 4: Decommission Existing WWTP, Pump to Sanford, Regional WWTP 41
5.3 Present Worth Analysis 43
5.4 Alternatives comparison and preferred alternative 45
6.0 Proposed Project Description **49**
7.0 Environmental Information Document **53**
8.0 Financial Analysis **54**
9.0 Public Participation **56**

INDEX OF FIGURES

Figure 1.1 – Project Vicinity Map 8
Figure 1.2 – Project Location Map 9
Figure 2.1 – Wastewater Collection System 13
Figure 2.2 – Existing WWTP Schematic 14
Figure 2.3 – Existing Aerial Site Plan 15
Figure 2.4 – Existing WWTP Influent Flow Schematic 22
Figure 2.5 – Town of Pittsboro WWTP 2014 25
Figure 2.6 – Town of Pittsboro WWTP 2015 26
Figure 3.1 – Wastewater Flow Projections 31
Figure 5.1 – Alternative 2: Refurbish WWTP, 2 MGD to Sanford, Regional WWTP 37
Figure 5.2 – Proposed Forcemain Route 38
Figure 5.3 – Alternative 3: Existing WWTP Expansion, Regional Plant 40
Figure 5.4 – Alternative 4: 2 MGD to Sanford, Decommission Existing WWTP, Regional WWTP 42
Figure 6.1 – New Pump Station Aerial Plan 50

INDEX OF TABLES

Table 2.1 – Current and Future NPDES Nitrogen Limits (starting Year 2022) 19
Table 2.2 – Current Population Analysis 19
Table 2.3 – Average Daily Flows (2011-2015) 20
Table 2.4 – Inflnent Wet Well Flow Summary Statistics 23
Table 2.5 – Inflow and Rainfall Event Summary 24
Table 3.1 – Service Area Population Projections 29
Table 3.2 – Wastewater Flow Projections (GPD) 30
Table 5.1 – Alternative Cost Summary Table 44
Table 5.2 – Non-Monetary Advantages/Disadvantages Table 47
Table 5.3 – Alternative Analysis Summary 48

INDEX OF APPENDICES

Appendix A

Table A.1 – Existing WWTP Equipment Capacities
Existing Pittsboro WWTP Photographs
WWTP Process Operation Maintenance Information

Appendix B

NPDES Permit No. NC0020354
2014-2015 Pittsboro WWTP By-Pass Events

Appendix C

Daily Monitoring Reports Summary 2011 - 2014
2014 Water and Sewer Billings

Appendix D

Town of Pittsboro Planning Department Population Estimates
Chatham Park Development Population Estimates

Appendix E

Chatham Park Development Plan
McKim and Creed – Memo of Initial Infrastructure Implementation Chatham Park
WWTP BNR Schematic
Conventional BNR Proposed Layout
WWTP MBR Schematic
MBR Proposed Layout
WWTP IFAS Schematic
IFAS Proposed Layout
Step Capacity Chart – Town Only

Appendix F

Nitrogen Limit Implications
Sanford Debt Service Information
Email - Chatham Park Cost Information
Alternative No. 2 – Present Worth Analysis
Alternative No. 3 – Present Worth Analysis
Alternative No. 4 – Present Worth Analysis

Appendix G

Environmental Information Document
Figure G.1.1 – Topography and Floodplains WWTP
Figure G.1.2 – Topography and Floodplains Forcemain
Figure G.2.1 – Soil Types WWTP
Figure G.2.2 – Soil Types Forcemain
Figure G.3.1 – Prime Farmland Classification WWTP

Figure G.3.2 – Prime Farmland Classification Forcemain
Figure G.4.1 – Land Use/Cover Classification WWTP
Figure G.4.2 – Land Use/Cover Classification Forcemain
Figure G.5.1 – Forest Resources WWTP
Figure G.5.2 – Forest Resources Forcemain
Figure G.6.1 – Wetlands WWTP
Figure G.6.2 – Wetlands Forcemain
Figure G.7.1 – Forcemain Stream Crossings
Figure G.8.1 – Water Resources
Figure G.11.1 – Chatham County USFWS Endangered Species
Figure G.11.2 – Lee County USFWS Endangered Species
Figure G.13.1 – Public Land Resources Features WWTP
Figure G.13.2 – Public Land Resources Features Forcemain
Figure G.14.1 – Archeological/Historical Features WWTP
Figure G.14.2 – Archeological/Historical Features Forcemain
Figure G.15.1 – Air Quality
Figure G.16.1 – Chatham County Noise Ordinance
Figure G.16.2 – Lee County Noise Ordinance
Figure G.18.1 – Percent Minority by Block Group WWTP
Figure G.18.2 – Percent Low/Moderate Income by Block Group WWTP
Figure G.18.3 – Percent Minority by Block Group Forcemain
Figure G.18.4 – Percent Low/Moderate Income by Block Group Forcemain
Figure G.18.5 – EJ ACS 2008-2012 BG 370370208003
Figure G.18.6 – EJ Census 2010 BG 370370208003
Figure G.18.7 – EJ ACS 2008-2012 BG 370370208004
Figure G.18.8 – EJ Census 2010 BG 370370208004
Figure G.18.9 – EJ ACS 2008-2012 BG 370370206002
Figure G.18.10 – EJ Census 2010 BG 370370206002
Figure G.18.11 – EJ ACS 2008-2012 BG 371050307011
Figure G.18.12 – EJ Census 2010 BG 371050307011
Figure G.18.13 – EJ ACS 2008-2012 BG 371050306012
Figure G.18.14 – EJ Census 2010 BG 371050306012

Appendix H

Utility Rates and Fees FY 2015-2016
LGC 108C
LOIF – Pittsboro Wastewater Treatment System Improvements
Financial Analysis – Preferred Alternative

Appendix I

DMCA Checklist

EXECUTIVE SUMMARY

PROJECT DESCRIPTION

Pittsboro, North Carolina is a historic town centrally located along the rolling hills of Chatham County at the intersection of US Hwy 64 and Hwy 15-501. The Town operates a conventional wastewater treatment plant (WWTP) southeast of downtown that treats the wastewater generated within the Town borders. **Figure 1.1** depicts the location of Town within the County. **Figure 1.2** shows the location of the existing WWTP, the Town's corporate limits, the Town's extra-territorial jurisdiction (ETJ), and the future outline of a proposed 7,000-acre +/- future development named Chatham Park. **Figure 1.2** also shows the location of 3M, an industrial user which purchases reuse water (treated effluent from the WWTP) from the Town on a daily basis.

The preferred alternative (Alternative 2) will consist of refurbishing of the existing WWTP (at the existing capacity of 0.75 MGD) and constructing a new pump station and associated force main for pumping up to 2.0 MGD of wastewater from the existing WWTP site to the City of Sanford Big Buffalo Wastewater Treatment Facility. The existing WWTP would be refurbished to address aging equipment, older controls, peak flows, and future Total Nitrogen limits. The project is considered the first phase in the overall 20-year planning horizon and will provide 2.75 MGD of wastewater capacity.

The existing NPDES permit for the WWTP is currently being renewed. In 2022, the NPDES permit limits discharge of total nitrogen to approximately 100 pounds per day. In Phase 1 of the project, only 0.75 mgd will be discharged under the permit and thus the existing WWTP would need to meet a 15 mg/L Total N discharge limit. It is planned to pump wastewater to the equalization basin at the Sanford WWTP. The City of Sanford has indicated that the raw wastewater will first need to be screened and have the grit removed before pumping to their WWTP in order to be discharged to the equalization basin.

Figure 5.2 shows the proposed preliminary forcemain route for pumping to Sanford from the existing WWTP site property. Screening, grit removal and the new pump station would be located on the existing WWTP site, north of the existing package plants and east of the existing influent screen (**Figure 6.1**).

REASON FOR PROPOSED PROJECT

The Town of Pittsboro currently has a sewer collection system and wastewater treatment plant that serves customers inside the Town limits and extraterritorial jurisdiction (ETJ). A new 7,000-acre development named Chatham Park is planned in and outside of the existing ETJ. The Chatham Park development area is larger than the existing Town limits and will generate future wastewater flows that cannot be accommodated by the existing WTTP.

During storm events the existing WWTP can receive up to 1.4 MGD. The existing equalization pumping and storage system is not adequate to prevent by-passing of wastewater around the filters during peak storms. There are portions of the existing WWTP that have equipment that is over 20 years old. Portions of the aeration structures

basin (concrete walls, metal walls, gratings, etc) need repair work or replacing. Major equipment, such as the clarifier drives, aeration diffusers and blowers, RAS/WAS pumps, and internals of the tertiary filters need to be replaced.

Finally, starting in 2022, the existing WWTP will need to meet a Total Nitrogen limit of 15 mg/L. Year 2011 to 2014 effluent data indicates that the effluent Total Nitrogen currently varies from 20 mg/L to 29 mg/L. Based on the evaluated data there is a need to add treatment of nitrogen to the existing WWTP to meet the future Total Nitrogen permit limits that apply in 2022.

This project will address the expected increases in wastewater flows, address peak storm flows, upgrade equipment at the WWTP and provide for future nitrogen treatment. The timing of any future project phases will be dictated by the actual growth rates experienced and are not included in this project.

ALTERNATIVES ANALYSIS RESULTS

Four alternatives were evaluated in the ER/EID. These alternatives included the following:

- Alternative 1: No Action
- Alternative 2: Refurbish Existing WWTP, Pump to Sanford, Regional WWTP
- Alternative 3: Expand Existing WWTP, Regional Treatment Plants
- Alternative 4: Decommission Existing WWTP, Pump to Sanford, Regional WWTP

Alternative 1 is rejected because it does address any of the reasons listed above for the project. The existing WWTP would be overloaded with a loss of treatment and increased by-passing would occur with deleterious effects to Robeson Creek. The lack of capacity would limit growth in the Town and Chatham Park. Thus, No Action is not a feasible alternative.

A present worth cost analysis indicates that the present worth of Alternative 3 is over 25% greater than Alternatives 2 and 4. There are no over-riding, non-monetary advantages for Alternative 3 that would outweigh the additional costs. In fact, Alternative 3 has more disadvantages than Alternatives 2 and 4 due to the multiple capacity steps, the greater treatment requirements, and more complicated operation. Thus, Alternative 3 is rejected on both a cost basis and a non-monetary factor basis.

Alternatives 2 and 4 are close enough in present worth cost to be considered approximately equal. Alternative 2 is the preferred alternative over Alternative 4 for several non-monetary reasons. In Alternative 2, flow would be split between the existing WWTP and pumping to Sanford whereas in Alternative 4, all flow would be pumped to Sanford immediately. Flow splitting will allow more flexibility handling peak flows. Under Alternative 2, the Town can continue to provide reclaimed water to 3M fulfilling its contractual agreement (which is not the case for Alternative 4). Alternative 2 provides up to 2.75 MGD of capacity in the first capacity step (i.e. Phase 1) whereas

Alternative 4 would provide 2 MGD. Alternative 2 also pushes the need for construction of a future regional plant back 2 to 4 years versus Alternative 4.

Although Alternative 4 will not require operation of the WWTP, it will be necessary to keep renewing the NPDES permit to ensure discharge capacity for future discharges (in future capacity steps). In addition, to fully utilize all the capacity at each permitted outfall, it is likely that re-commissioning the existing WWTP in the future would be considered in the future under Alternative 4. If the existing Robeson Creek discharge was not utilized at all under Alternative 4, then a permit modification would be necessary to increase the discharge at the Haw River above the existing 1.97 MGD to 2.5 MGD to meet future demands. Alternative 2 also utilizes the existing WWTP equalization pumping and storage capacity installed in 2010. The Town is still paying debt service on this upgrade and thus this investment would continue to be used.

Alternatives 2 and 4 will both require wastewater screening and grit removal at the existing WWTP and approximately equal land requirements. The regulatory requirements and construction permitting will be essentially equal for the two alternatives. Thus, Alternative 4 offers no advantage in these areas.

Alternative 2 is the preferred alternative due to the reasons listed above and has been approved as the preferred alternative by the Town of Pittsboro Board of Commissioners.

ENVIRONMENTAL IMPACTS AND MITIGATIVE MEASURES SUMMARY

An Environmental Information Document has been prepared for the proposed alternative of this project and can be found in **Appendix G** along with supporting figures and information. The most significant impacts due to construction are mainly limited to the improvements at the WWTP project site. These impacts are related to the earthwork and excavation required for the construction of the new pump station. Temporary disturbances to wildlife and vegetation along the forcemain route are potential impacts related to the forcemain construction; however, all possible efforts will be utilized to mitigate these disturbances. Increased noise levels during construction are expected, but all construction will be conducted during normal day-time hours and will be temporary. There are no anticipated impacts related to both water and land resources as a result of the projeet's construction, all sedimentation and erosion control practices will be followed. All construction at the WWTP and along the forcemain route is expected to be conducted in previously disturbed soil within the WWTP property or in existing utility easements and rights-of-way. There are no significant potential direct impacts or secondary and cumulative impacts expected as a result of the proposed project.

PROJECT FUNDING AND USER FEE INCREASES

The estimated capital cost for this project (Phase 1) is $21,585,000. The Town has received a Letter of Intent to Fund (LOIF) this project through a 20-year, 1.84% interest loan from the Clean Water State Revolving Fund (CWSRF) program. This funding is administered by the North Carolina Division of Water Infrastructure (DWI). The estimated annual loan debt repayment schedule would be approximately $1.48 million dollars. There would also

be annual capacity fees and volume charges from the City of Sanford and the normal cost to operate the existing WWTF (estimated at ~ $1,400,000).

A user rate evaluation was performed based on projected users added by the end of construction. Additional revenues would include increased revenue for volume charges, sewer access and recovery fees for the projected new customers to be added by Chatham Park each year (375 residential and 75 commercial customer per year). This analysis resulted in little to no user fee increases with this pace of growth. It is uncertain at this point exactly what the total customer base increase per year will be from the Chatham Park development. This project would be funded by a collaboration of the Town and the Chatham Park through a developer agreement to be formulated as the project proceeds forward.

The project will also require an interlocal agreement between the Town of Pittsboro and City of Sanford to provide wastewater service. The Town and City are working on this agreement and a draft of this agreement (unsigned) will be submitted as soon as it is available.

1.0 INTRODUCTION

1.1 BACKGROUND

Pittsboro, North Carolina is a historic town centrally located along the rolling hills of Chatham County at the intersection of US Hwy 64 and Hwy 15-501. The Town operates a conventional wastewater treatment plant (WWTP) southeast of downtown that treats the wastewater generated within the Town borders. **Figure 1.1** depicts the location of Town within the County. **Figure 1.2** shows the location of the existing WWTP, the Town's corporate limits, the Town's extra-territorial jurisdiction (ETJ), and the future outline of a proposed 7,000-acre future development named Chatham Park. **Figure 1.2** also shows the location of 3M, an industrial user which purchases reuse water (treated effluent from the WWTP) from the Town on a daily basis. The Town has grown through the years to an approximate population of 3,934 today and has been able to provide wastewater sewer service for the Town with the existing WWTP.

Over the past five years, Pittsboro has invested significant time and effort in planning for impending growth within the Town's corporate limits and ETJ service area, and the subsequent management of increased wastewater treatment capacity needs created through such growth. This work lead to the preparation and approval of an Environmental Impact Statement (EIS) in 2010 that thoronghly evaluated and projected population growth within the service area and evaluated wastewater discharge options for flow capacities above the permitted Robeson Creek NPDES discharge of 0.75 MGD. The resnlting EIS recommendations identified a flow capacity need of 3.22 MGD, developed a second wastewater discharge outfall at the Haw River (Hwy 64 bridge), and addressed the Total Mass Daily Limit (TMDL) for both Total Nitrogen (TN) and Total Phosphorous (TP) delivered to Jordan Lake resulting from the Jordan Lake Nutrient Management Strategy – Wastewater Discharge Requirements, T15A NCAC 02B .0270. Accordingly, in June 2011 NCDENR issued Pittsboro a major modification to its NPDES Permit establishing a flow capacity limit of 3.22 MGD divided into the Robeson Creek Outfall (001) at 0.75 MGD and the Haw River Outfall (002) at 2.47 MGD. The Permit also established TMDL limits for TN and TP ***delivered to*** Jordan Lake and ***discharged from*** the WWTP (i.e. end of pipe) along with associated transport factors. The delivered TN allocation was set at 27,514 lb/yr and the discharge TN was set at 36,202 lb/yr. Likewise, the delivered TP allocation was set at 3,731 lb/yr and the discharge TP was set at 4,551 lb/yr. Additionally, a seasonal TMDL of 322 lbs. remained for TP discharge to Robeson Creek between the summer months of April 1 through October 31 each year

Subsequently, the Town performed additional study in 2012 to determine a cost effective manner in which to expand their wastewater treatment capacity and address future wastewater needs. Pittsboro staff and elected officials held discussions with NCDENR staff in January and August of 2013 that culminated in an agreed approach to increase discharge capacity into Robeson Creek. This approach included a 0.499 MGD increase in discharge to Robeson Creek to a capacity of 1.249 MGD and reduced the total discharge to the Haw River to 1.971 MGD accordingly while still maintaining the Town's allowable permitted discharge of 3.22 MGD. This increase to the Robeson Creek discharge was determined to effectively meet the Town's near term needs and not trigger an additional SEPA

environmental study. Ultimately, the Town was able to modify their NPDES Permit, effective August 1, 2014, for these flow changes while maintaining the combined TN and TP TMDLs delivered to Jordan Lake.

Concurrent with the Town's efforts as described above, has been the evolution of the multi-faceted development known as Chatham Park. In June 2014, the master plan for this pending development was approved by the Town Commissioners. A review of the master plan document reveals the original intent of a de-centralized wastewater treatment approach culminating in a goal of 100% reuse of treated effluent within Chatham Park proper. However, as this Engineering Report proceeded, Chatham Park indicated it wished to work with the Town in determining a joint solution to treating the Town's and to Chatham Park's future wastewater needs cooperatively. Chatham Park has purchased property (Townsend Site) that was formerly used as spray irrigation of wastewater from a now closed turkey processing facility. Chatham Park could potentially upgrade this irrigation facility for spray irrigation of treated effluent in the future. The location of this property is also shown on **Figure 1.2**.

During the development of this ER/EID, the Town and Chatham Park have meet to discuss how they will approach future sewer service. The alternatives in the ER/EID were developed looking only at meeting Town needs and looking at a collaborative effort with Chatham Park to meet combined needs.

1.2 PURPOSE AND SCOPE

The purpose of the Engineering Report/Environmental Information Document (ER/EID) is to evaluate wastewater treatment system alternatives and then determine the most cost effective and beneficially alternative to meet future wastewater treatment needs. The ER/EID is a required submittal for project funding from the Department of Water Infrastructure (DWI) within the North Carolina Department of Environmental Quality (NCDEQ). The scope of the report includes the following:

- Evaluate the capacity and condition of the existing WWTP;
- Evaluate existing flows and loads and project future wastewater flows and loads for a 20-year time frame;
- Detail the need and purpose of the project;
- Evaluate wastewater treatment alternatives and recommend an alternative to meet the future need;
- Complete the Environmental Information Document (EID) for the selected alternative; and
- Provide a preliminary financial analysis on required user charges to the extent possible at this time.

The project is a unique project due to the large potential impact Chatham Park will have on the Town's wastewater system. For this ER/EID, Chatham Park representatives provided projected development within the park and the timing for such development up to year 2060. This report is limited to evaluating wastewater treatment needs and solutions for the next 20 years (~ 2035). As the growth rate of Chatham Park is not known with certainty, phasing of wastewater improvements were evaluated. In addition, in order to evaluate various possibilities, alternatives were

evaluated if the Town provides for its own wastewater needs only (termed Town Only), or in combination with Chatham Park. This is reflected in the alternatives analysis section of the report.

This project is considered a "minor" project under DWI's criteria as the flow capacity increase in the initial phase in any WWTP upgrade would be less than 0.499 MGD and any regional pumping alternative would have a pumping capacity less than 1,750 gpm. Due to the unique nature of this project, the ER/EID has not been formatted in strict conformance with a "minor" project under the DWI report guideline. Discussions with DWI staff (Ken Pohlig) indicated this would be acceptable if the report includes the information required in the standard format.

1.3 PLANNING AREA

The planning area for this study is depicted in **Figure 1.2** and includes the Town corporate limits, the Town ETJ and the Chatham Park development. As Chatham Park is still in development the extent to which it will be built in the next 20 year is not certain. Therefore, the extent of the sewer service planning area for Chatham Park is subject to change.

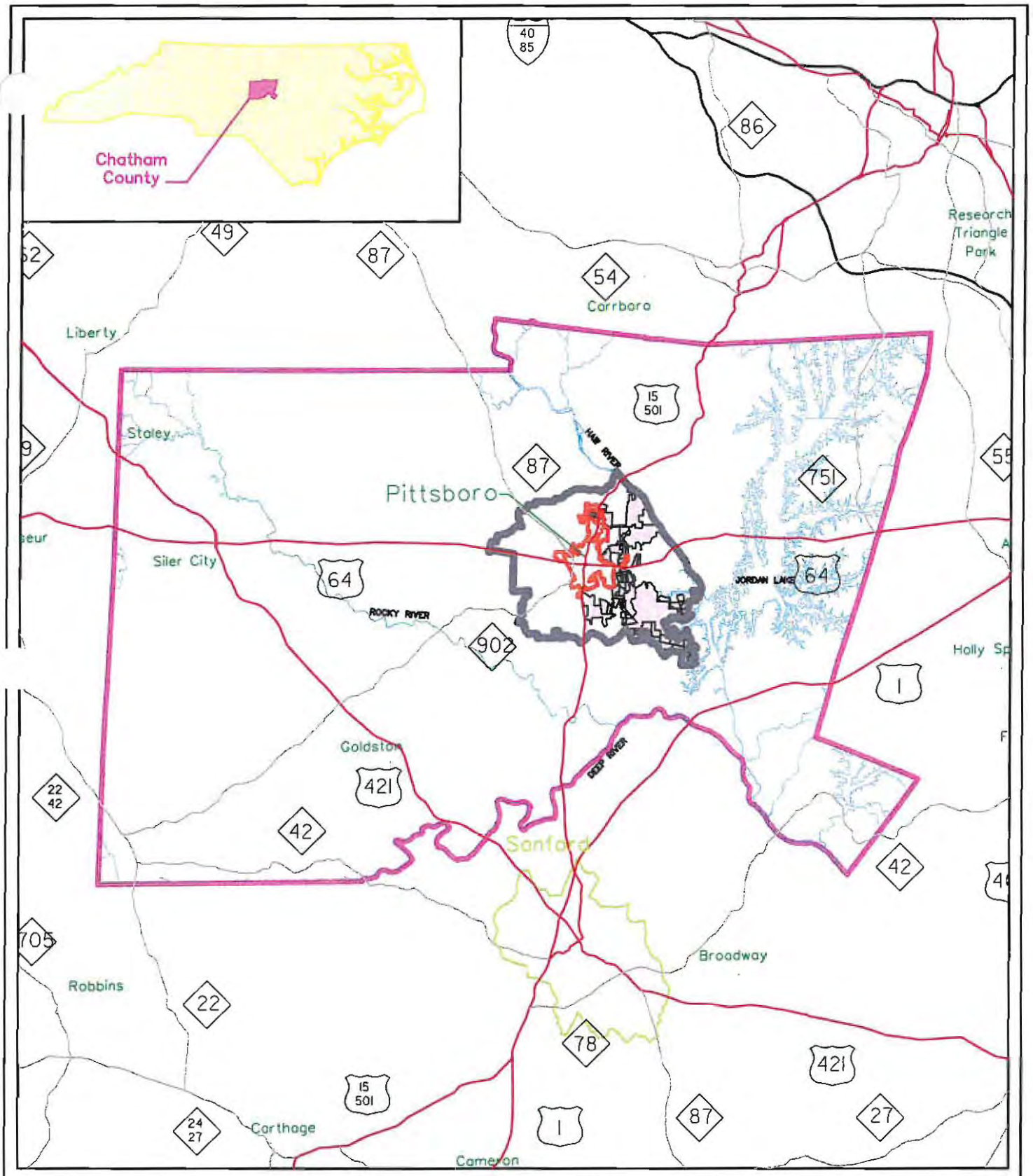


Figure 1.1
Vicinity / Project Location

Pittsboro ER / EID

LEGEND

- TOWN OF PITTSBORO LIMITS
- PITTSBORO ETJ
- CHATHAM PARK FUTURE DEVELOPMENT

TOWN OF PITTSBORO

THE WOOTEN COMPANY

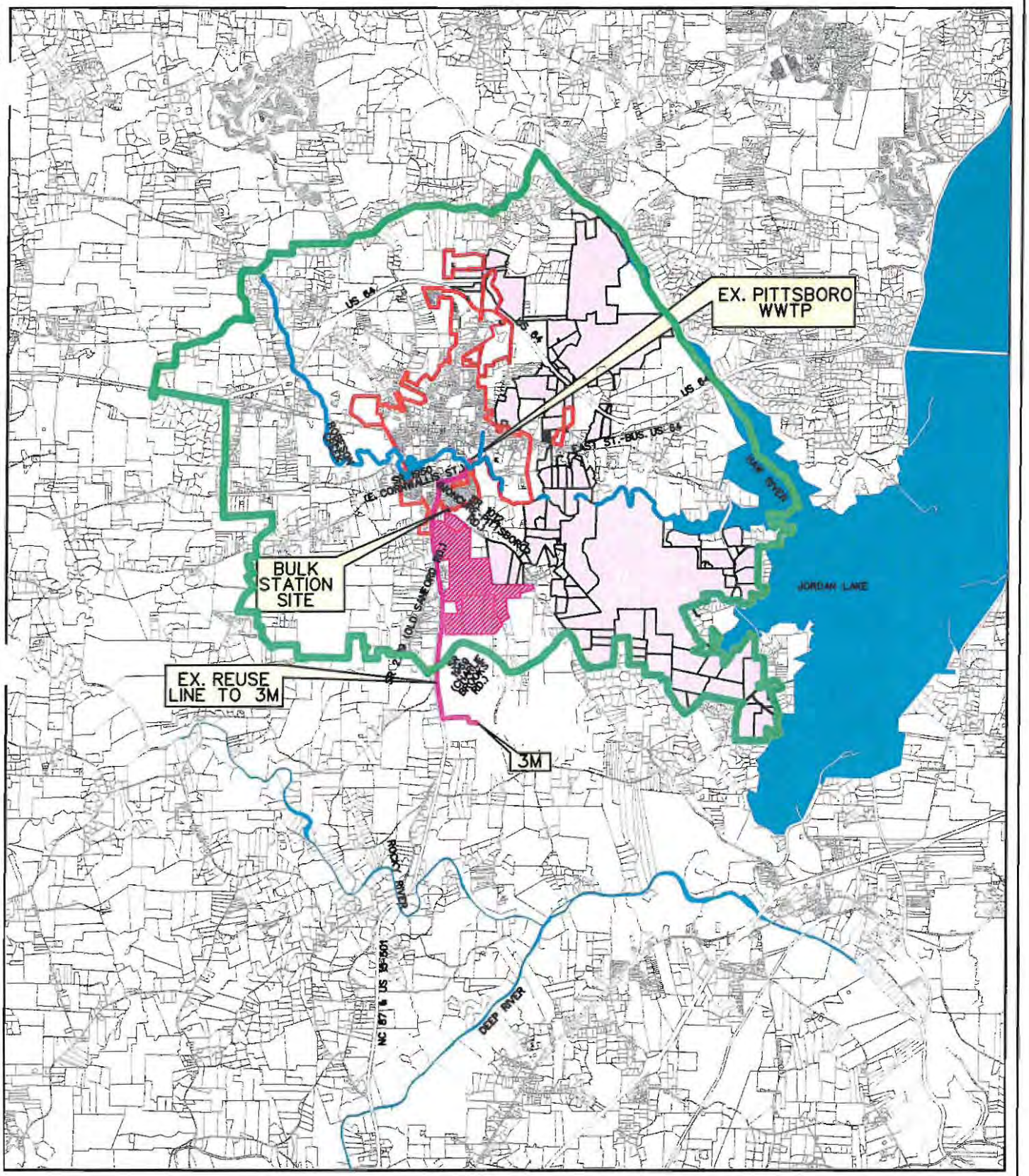


Figure 1.2
Vicinity / Project Location

Pittsboro ER / EID

LEGEND

- TOWN OF PITTSBORO LIMITS
- PITTSBORO ETJ
- CHATHAM PARK FUTURE DEVELOPMENT
- POTENTIAL FUTURE SPRAY IRRIGATION AREA (TOWNSEND SITE)

TOWN OF PITTSBORO

THE WOOTEN COMPANY

2.0 CURRENT SITUATION

2.1 COLLECTION SYSTEM OVERVIEW

The Town of Pittsboro's collection system has approximately 30.6 miles of gravity sewer, 4.4 miles of force mains, six (6) lift stations, and 729 manholes. A majority of the gravity sewer lines (approx. 21 miles) are known to be older than 20 years of age. The collection system serves the existing Town limits and a few small areas outside the Town limits. A figure of the collection system service area is provided in **Figure 2.1.** This map shows the existing collection system in relation to the Town limit and the Town extra-territorial jurisdiction (ETJ).

An ER/EID is being developed on behalf of the Town of the Pittsboro under a separate contract which addresses needs in the Town's collection system. A comprehensive Sanitary Sewer Evaluation Survey (SSES) is being conducted to identify major sources of infiltration and inflow, and to conduct initial rehabilitation on a limited set of the highest ranking infrastructure identified and verified by the SSES. The collection system study also includes up-dating collection system inspections and GIS inventory, and a prioritized CIP program development with cost estimates. The study will also begin the process of making repairs to the highest ranking system defects that are causing excessive wet weather inflows at the wastewater treatment plant (WWTP). These repairs are needed and essential in efforts to help lower peak wet weather flows at the WWTP.

As the separate study addresses I/I in the collection system, this report focusses on the upgrade/expansion of the existing WWTP. The wastewater treatment plant (WWTP) has a permitted capacity of 0.75 MGD. Significant peak day and peak hour flows occur at the WWTP during rainfall events. The WWTP has equalization tanks to help store these flows, but they do not have sufficient capacity at present. These high flows have overwhelmed the plant's treatment capacity on several occasions and plant operators have had to take emergency operational measures (by-passing the filters) to manage wastewater treatment, storage and discharge. Discussion of the I/I flows and their impact on the WWTP is presented in the discussion of influent flows to the wastewater treatment plant.

The Town is not currently under, nor negotiating a Special Order by Consent (SOC) with the NC Department of Environmental Quality. There are no known unsewered areas (operational septic tanks) within the project area.

2.2 WWTP EXISTING CONDITIONS

2.2.1 GENERAL WWTP CONDITION

The Town of Pittsboro operates a 0.75 MGD wastewater treatment plant. The Pittsboro WWTP was originally constructed in 1977 followed by upgrades in 1988 and 2010. The influent channel, influent wet well, and aeration basin no. 1 are from the original plant construction. The 1988 expansion added an additional aeration basin, clarifiers, filters, mechanical bar screens, and a UV system. In 2010, equalization (EQ) basins and a new UV system were added. The original concrete structures are showing signs of deterioration (aeration basins, junction boxes), as well as the steel and mechanical structures (clarifiers, sweep arms, air lifts). The EQ basins and the UV system are in

good condition. Also, in 2011 the influent mechanical bar screen was rebuilt, and in 2013 a new generator was installed for the emergency power need for the entire plant. A schematic of the existing wastewater treatment process flow is shown in **Figure 2.2.** An aerial picture of the existing WWTP is shown in **Figure 2.3.**

The liquid treatment train includes screening, influent pumping, two activated sludge package plants (aeration basins and clarifiers), tertiary filtration, UV disinfection and cascade aeration. The equalization (EQ) system consists of a dedicated EQ pump station, two EQ tanks (with floating mixers in each tank), and controlled EQ volume return via a controller pinch valve. The Town also has a water reuse system that provides water to an industrial user (3M) south of the Town. The reuse system includes chlorination and a dedicated reuse pump. The system is permitted for 300,000 gpd of reclaimed water use; however, the current demand at 3M averages between 50,000 and 60,000 gallons per day at present.

Wastewater from the collection system flows by gravity through the influent mechanical bar screen and then to the influent wet well. The influent pumps normally pump the wastewater at a flow rate set by the operators and that can be varied with the level in the wet well (via pump speed controllers). Under normal conditions, wastewater is pumped to a splitter box and the flow split to each of two circular activated sludge package plants. Each package plant has an outer aeration ring and an inner circular clarifier. Biological treatment is accomplished in the package plants. The clarified water from both units is chemically treated for phosphorus removal and gravity flows to three cell expanded sand bed filtration units followed by UV disinfection. The water receives post cascade aeration and is discharged to Robeson Creek. A portion of the treated effluent is pumped to the 3M manufacturing facility as reclaimed water. Pictures of the process units are provided in **Appendix A**.

During storm events, excess peak flows cause the level to rise in the influent wet well to a point where the control system automatically turns on the EQ pumps. The EQ pumps are located in a separate underground dry well with suction lines in the influent wet well. Excess flow is pumped to the above-round EQ tanks and stored. Once the rain event has passed and flows have subsided, then the volume in the EQ tanks is returned to the influent wet well at a controlled rate until the tanks are emptied.

The solids treatment train includes the waste activated sludge (WAS) pumps, a sludge thickening unit with associated polymer system, two digester/storage basins and off-site liquid sludge hauling. WAS is pumped approximately 4 to 6 hours per day to a rotary drum thickener (producing 4-6% thickened solids) and then discharged to two in-ground concrete basins. These basins act as storage basins and are periodically aerated as necessary by two digester blowers. The waste solids are stored in the two aerobic digesters until removed out and land applied by an outside contractor.

The Town currently has an agreement with 3M Company to provide reclaimed/reuse water from the existing WWTP. This is a long-term contract (20+ years) with a maximum contract volume of up to 300,000 gpd. The current average daily volume provided to 3M now is 50,000 to 60,000 gpd. The existing WWTP has the required treatment and pumping facilities to provide the contractual volume.

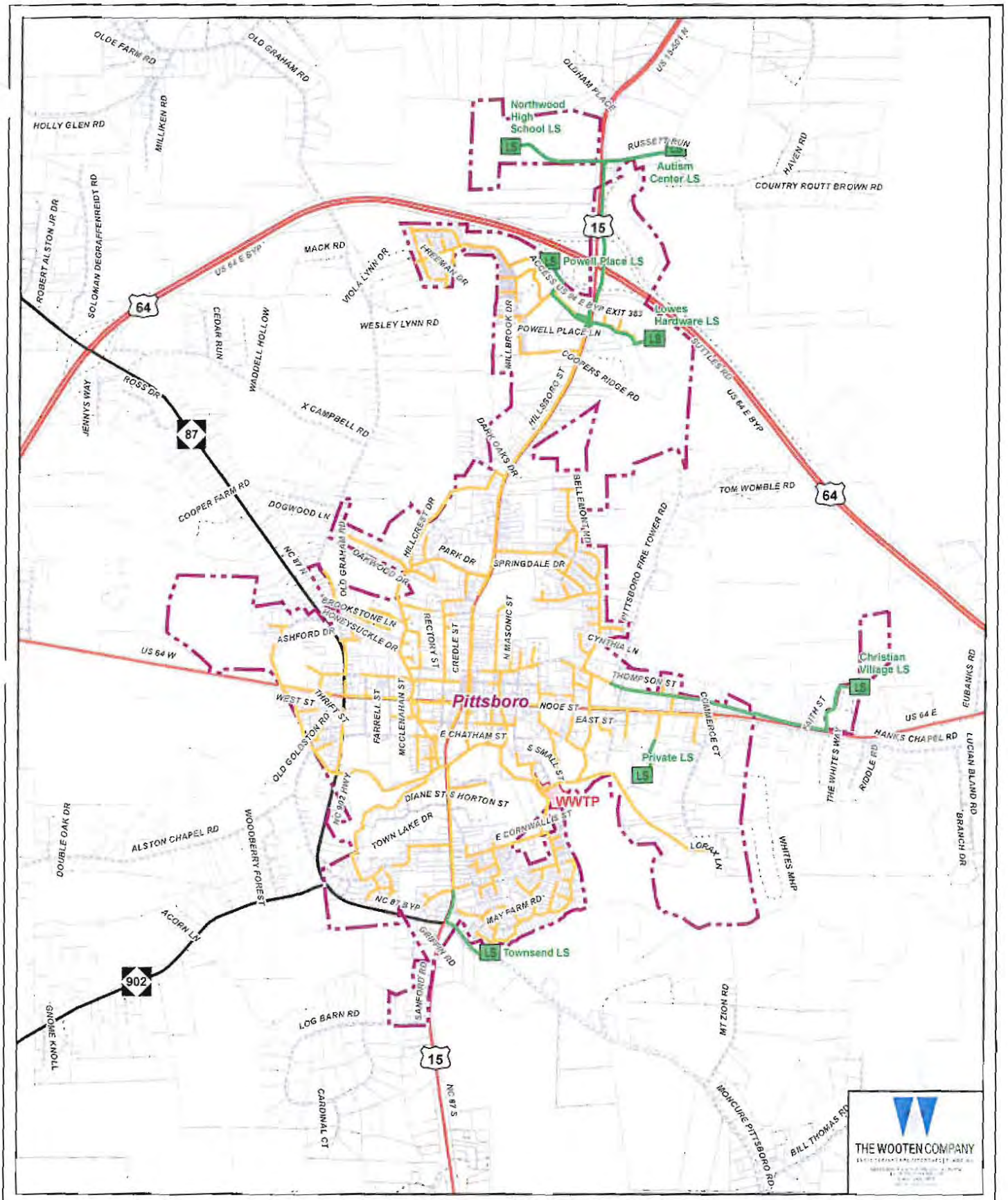


Figure 2.1
Sewer Collection Map
Pittsboro, NC

February 2016

TOWN OF PITTSBORO

Legend

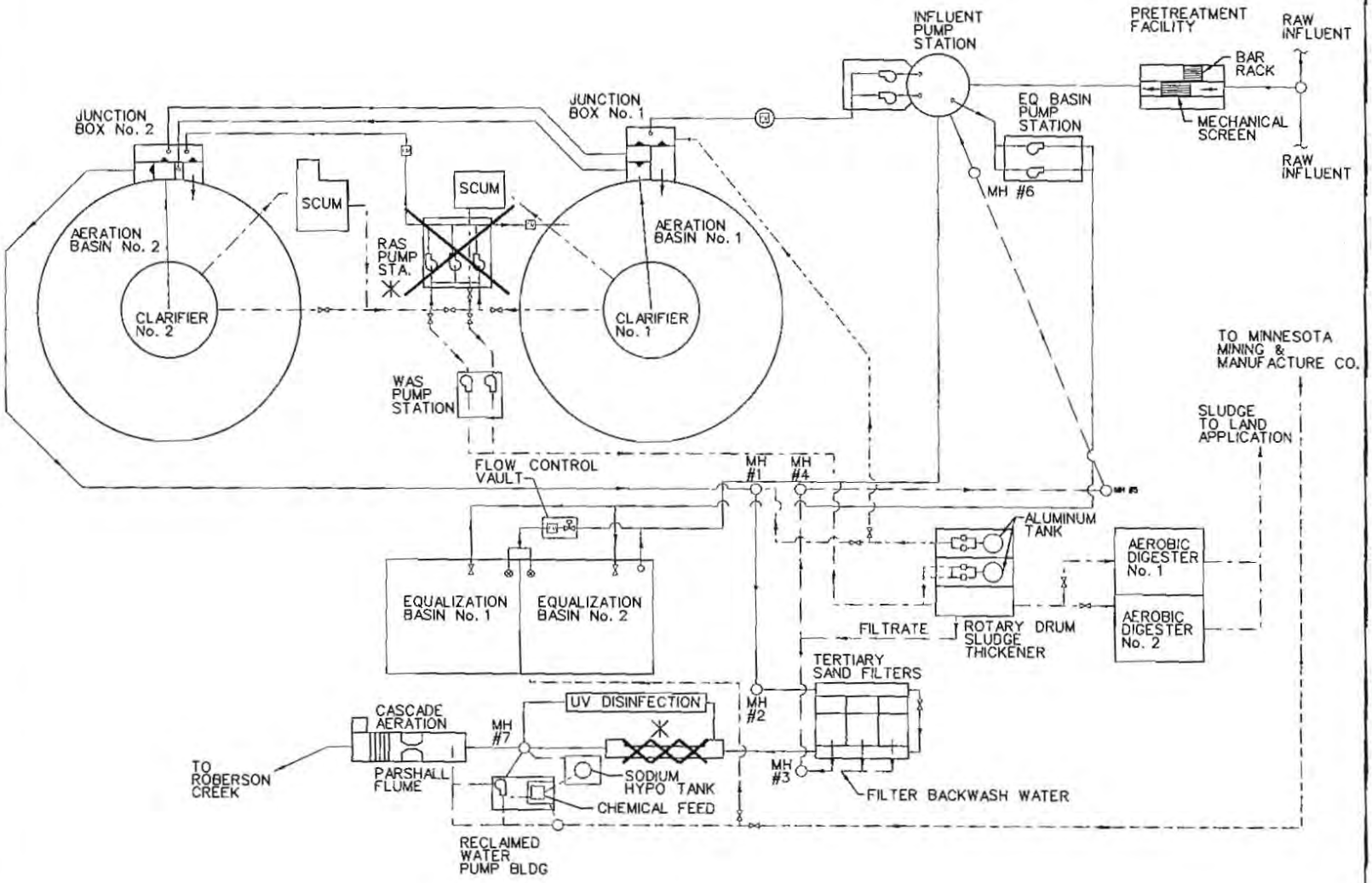
- Lift Station
- US Route
- NC Route
- Streets
- Gravity Mains
- Force Main
- WWTP
- Parcels
- Municipal Boundaries

0 1,000 2,000
Feet

The Wooten Company makes every effort to produce and publish GIS maps using the most current and accurate information possible, however the maps are strictly for planning purposes only. The maps are compiled from recorded deeds, plats, and other public and private records and data. Users of the maps are hereby notified that the aforementioned public primary information sources should be consulted for verification of the information on this map. The Wooten Company assumes NO responsibility for the information contained on the maps unless the map is signed and sealed by a licensed Professional Land Surveyor. Please contact the GIS Group at (919) 828-0591 or teohsan@thewootencompany.com for data source information.

Document Path: U:\Pittsboro-2526\F-WWTP Expansion\PER\Maps\SystemMap.mxd

Date Saved: 2/22/2016 10:31:43 AM



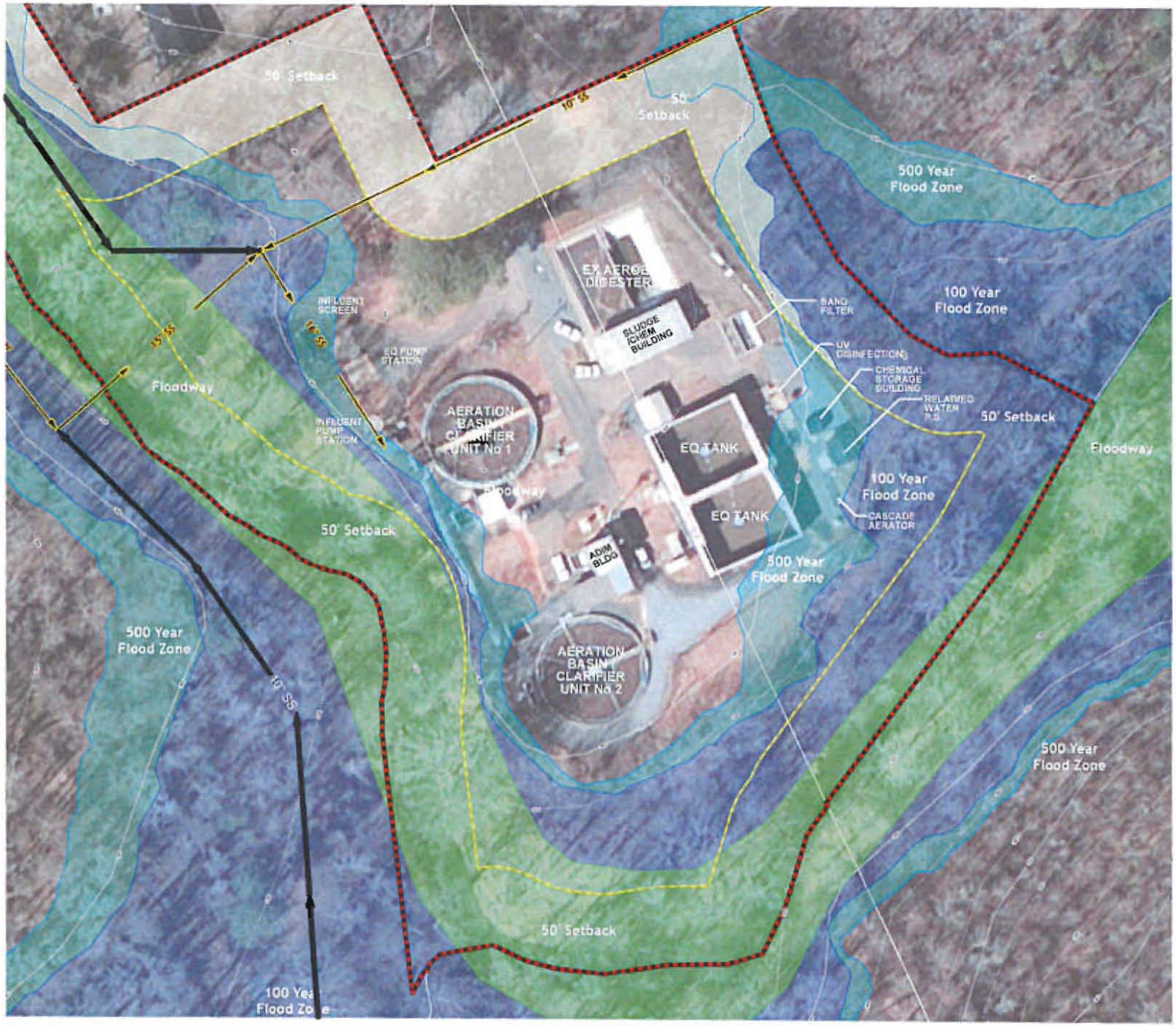
✳ UNITS CURRENTLY NOT USED (ABANDONED)

THE WOOTEN COMPANY

TOWN OF PITTSBORO

Figure 2.2
Existing Schematic

Pittsboro ER / EID



LEGEND

WWTP PROPERTY LINE

WWTP PROPERTY SETBACK

THE WOOTEN COMPANY

TOWN OF PITTSBORO

Figure 2.3
Existing Site Plan
Aerial

Pittsboro ER / EID

2.2.2 CONDITION OF WWTP EQUIPMENT

The Pittsboro WWTP has gone through multiple upgrades such that equipment condition varies with the type of system. **Table A.1** in **Appendix A** lists design information on the major equipment components. **Appendix A** also contains pictures of various process units and a summary of operator notes regarding the equipment. The condition of the equipment is rated (good, fair, poor) in the following bulleted items:

- **Influent mechanical climber screen and fixed bar rack.** This screen was refurbished in 2012 and is in good condition. The rated capacity of this screen is up to a maximum of 2 MGD (~ 1,400 gpm) as long as the downstream water level is 1 foot or less. As indicated in the following discussion on I/I flows, flows to the influent pump station (that pass through the screen) have exceeded this capacity at times. The practical result of this is a higher water level upstream of the screen.
- **Influent pump station with two (2) suction lift pumps.** These pumps have recently been rebuilt and considered to be in good condition. Variable frequency drives control the speed of these pumps and are also in good condition. Maximum station capacity is estimated to be 1,300 gpm with two pumps running.
- **Equalization pump station with two (2) 1,100 gpm suction lift pumps.** These pumps were installed in the latest upgrade and thus are approximately 5 years old and in good to excellent condition. Maximum capacity with two pumps running is estimated to be 1,500 gpm.
- **Two (2) 330,000 gallon equalization basins with 7.5 Hp floating mechanical aerator in each basin.** These concrete tanks and floating aeration equipment were installed in the last upgrade and are 5 years old and in good to excellent condition. The tank discharge pinch valve and associated controls are also in good to excellent condition. No repair or replacement of this equipment is necessary at present.
- **Package Plants.** Influent splitter box; two (2) aeration basins with diffuser tube aeration and two (2) 26 ft. diameter secondary clarifiers and air lift pumps. The condition of the package plant concrete walls is poor with spalling and paint chipping off. The conditions of the metal clarifier walls and internal metal and piping of the package plants is also in poor condition. The interior concrete wall and bottom of the package plants are in poor condition. The existing Wyss tube diffusers were replaced approximately 10 years ago in one of the two package plants, but are in poor condition in the other plant. The existing walkways are severely corroded and need replacing. The clarifier center drives are the original units and are over 20 years old each. Overall, the package plant concrete needs to be coated and painted and the metal sand-blasted and painted.
- **Aeration Blowers.** There are two 400 SCFM and two 800 SCFM positive displacement constant speed blowers. These blowers are the original blowers and are over 20 years old and due for replacement. The blowers all discharge to the main header and adjustment of flow between the package plants can be difficult. The blowers are located outside under a metal roof with no walls and are exposed to the elements. Future blower replacement should include outdoor rated sound enclosures, variable frequency drives for

speed control, and piping changes to dedicate two blowers to each package plant (with interconnecting piping).

- **Three (3) RAS return pumps (100 to 300 gpm).** New pumps were installed in the 2010 upgrade to replace air lift pumps, but did not function properly (lost prime). Two of the three pumps have been removed and sold by the Town. Thus, new pumps that will function properly are needed to replace the air lift pumps. Currently, RAS flow is controlled via air lift pumps at each package plant.
- **Three (3) upflow sand tertiary filters.** The upflow raised bed sand filters (Dynasand filters) were installed in the 1988 upgrade and are in fair condition. The concrete filter basins were constructed approximately 20 feet underground. The operators have indicated that a number of items need replacing including the sand and air lift equipment in all three filters, the two 7.5 HP air compressors, the control gates, and the above and below grade air lines. In addition, there is a concern about the condition of the interior concrete walls in the filters. Therefore inspection and potential coating of these interior walls may be warranted.
- **Ultraviolet (UV) Disinfection.** There is one operating UV disinfection system installed in 2010 that is in good condition. A second older UV unit is located adjacent to the new unit and is not currently functional. There is no back-up unit for final disinfection and supply of reclaimed water. A back-up UV unit is recommended.
- **Cascade type post aeration structure.** The existing concrete step cascade area is in fair to good condition and does not need repairs to the structure at this time.
- **Two (2) waste activated sludge pump (350 gpm each).** These two pumps are located in an outdoor fiberglass enclosure near the first package plant and were installed as part of the 1988 upgrade. Thus, these pumps are approximately 28 years old. They are in fair to poor condition and the operators have indicated they are due for replacement and addition of variable frequency drives for speed control.
- **Sludge Thickening and Digestion.** There is one (1) 75 gpm rotary drum thickener is in fair condition, but is over 20 years old and is due for replacement. The two (2) 75,000 aerobic digesters are concrete basins and in fair condition and can continue to be used. The two (2) existing digester blowers are used occasionally and are in fair to good condition and are not in need of repair or rebuilding at this time.
- **Land Application.** Class B biosolids are currently disposed of by land application using an outside contractor (Synagro Technologies). This arrangement has worked but does not offer a great degree of flexibility. The WWTP operators are interested in dewatering sludge to a cake to provide more options for off-site disposal/composting.
- **SCADA System, flow measurement and recording.** Controls at the existing WWTP are dedicated control panels located adjacent to the processes they control. The flow recorder is a circular chart recorder type that is old and in need of modernization. The various controls panels condition ranges from poor to good but they are not linked to a central SCADA system. The WWTP operators have indicated a centralized SCADA system tying all the separate control panels together
- **WWTP Emergency Generator.** The WWTP emergency generator was recently replaced and is in good to excellent condition.

- **Reclaimed/Reuse Water System**. The reclaimed water system consists of a 315 gpm reclaimed water pump, instrumentation, sodium hypochlorite feed system, 8-inch reclaimed water main, and 500,000 gallon reclaimed water storage tank (at a remote location not on the WWTP site). All this equipment is in good condition and no major work is needed. However, a future bulk water station to allow general contractors to utilize reuse water for construction activities is included in this ER/EID. This would be a new station would be located approximately 1.25 miles to the southwest of the existing WWTP.
- **Administration Building**. The existing administration building consists of a ground floor with a laboratory, small bathroom and storage room and a second story control room. This building is in fair condition and can continue to provide future service. However, there is no dedicated break/lunch room for the operators. Typically the operators will eat near the process area they work at or in the control room. Although a small bathroom is located in the building, there are no men's and women's bathrooms for use by visiting Town staff or other visitors to the WWTP. Addition of a break/lunch room and bathroom facilities is a future goal at the WWTP.

2.2.3 PERMIT INFORMATION

The Town of Pittsboro NPDES permit details current and future wastewater treatment requirements for continued discharge of treated effluent to Robeson Creek and for potential future discharge to the Haw River (to accommodate future growth). The permit allows expansion in stages starting with increased discharge at the existing Robeson Creek Outfall 001 from 0.75 MGD to 1.259 MGD and then upon expansion above 1.249 MGD, allowing discharge to the Haw River Outfall 002 at a flow of up to 1.971 MGD. **Appendix B** contains a copy of the NPDES permit and the effluent concentration limit tables for BOD, TSS, NH_3 (ammonia), total residual chlorine, fecal coliforms, and nickel. The BOD, TSS and nickel limits are the same as the existing limits for each outfall and for all flows.

Based on discussion with DEQ staff (Mike Templeton and Teresa Rodriquez) there are no individual total nitrogen mass limits for each outfall. Thus, the total nitrogen treatment requirements at the Pittsboro WWTP will vary based on whether there is discharge to the Haw because there is a combined mass limit. The Town is currently renewing the NPDES permit and there are not any expected changes to the mass or concentration limits. However, DEQ staff has indicated the compliance date for total nitrogen will be extended to Year 2022 (versus 2019). The table below summarizes potential Total N effluent limits for three different flow split scenarios at the two outfalls. The values in Table 2.1 are endpoints. There are multiple other combinations possible depending on the flow split between Robeson Creek and the Haw and the total volume discharged to both creeks.

TABLE 2.1 – CURRENT AND FUTURE NPDES NITROGEN LIMITS (STARTING YEAR 2022)			
Scenario	Discharge Location	Effluent Flow (MGD)	Effluent Total N (mg/L)
Robeson discharge only (current capacity)			
Outfall 001	Robeson Creek	0.75	15
Outfall 002	Haw River	0	--
Robeson discharge only (maximum discharge)			
Outfall 001	Robeson Creek	1.249	9
Outfall 002	Haw River	0	--
Robeson with Haw discharge at 1.97 mgd			
Outfall 001	Robeson Creek	1.249	3
Outfall 002	Haw River	1.97	3

For phosphorus, Robeson Creek has individual limits that are essentially not impacted by discharge to the Haw River. The future phosphorus effluent mass discharge at the Haw River would equal approximately 2,000 lbs/yr (annual average Total P effluent concentration of ~ 0.33 mg/L at 1.97 MGD). The more stringent fecal limits for the Haw River will require a higher level of disinfection for that outfall discharge than for the Haw River.

2.3 CURRENT SERVICE POPULATION

The current service population in the Town of Pittsboro is estimated to be 3,934. This estimate is based on the US Census population of 3,743 and a 1% annual growth rate through 2015. This is the accepted methodology as performed by the Town of Pittsboro Planning Department. The Town of Pittsboro contains approximately 2,673 acres of incorporated area, or 4.17 square miles, with the Town population being served by the existing WWTP. Based on the land area of the current sewer service area, the population density per square mile is approximately 943 per square mile. A summary table of these values is listed below.

TABLE 2.2 – CURRENT POPULATION ANALYSIS	
2010 US Census Population:	3,743
2015 Estimated Population (1% Annual Growth Rate):	3,934
Incorporated Area (miles):	4.17
WWTP Service Area (miles):	4.17
Population per Square Miles in Service Area:	943
% of Incorporated Area in WWTP Service Area:	100%
Current Estimated Population in Service Area:	**3,934**

2.4 HISTORICAL AND CURRENT WASTEWATER FLOW

2.4.1 INFLUENT WASTEWATER FLOW

Currently wastewater flow to the WWTP is from residential and commercial sources. There are no significant industrial flows discharged to the collection system. The Town does not have any WWTP flow capacity committed to outside municipalities or private users at this time.

Wastewater influent flows from the collection system, flows through the influent screen and then into the influent pump station wet well. The pumping rate to the package plants is set by the operators via VFD controls in the control room and modulated by the floats in the wet well. The EQ pumps are triggered to turn on based on level in the wet well. Ideally, the plant would operate at the target setting (usually between 250 and 400 gpm). Influent wastewater flow above the target flow setting is pumped to the EQ tanks. Flow is returned from the EQ tanks back to the influent pump station during periods when the flow is less than the target flow setting. **Figure 2.4** shows the arrangement. Flow equalization helps to maintain a more constant flow to the treatment units resulting in steadier performance from the treatment process during non-storm event periods.

The flow chart in the control room records the total treated meter flow as wastewater is being pumped from the influent pump station to the package plant influent splitter box. Influent sampling is also performed at the influent splitter box. The daily treated meter flow is then recorded into Daily Monitoring Reports (DMRs) each day. The historical average of daily influent wastewater flow was determined by examining the past five (5) years of DMR data (see **Appendix C**). The following table summarizes the average daily flow (ADF) for the past five years and compares the current average flow against the permitted capacity of the WWTP. Based on the current estimated population in **Table 2.2** (3,934 people) and the ADF for the last 5 year (~ 0.46 MGD), the average per capita wastewater generation is approximately 117 gallon per capita day (gpcd).

TABLE 2.3 – AVERAGE DAILY FLOWS (2011-2015)			
NPDES Permit No.		NC0020354	
Year	**ADF (MGD)**	**Year**	**ADF (MGD)**
2011	0.438	2013	0.465
2012	0.376	2014	0.506
Current Flow (MGD):		0.534 (2015 ADF)	
WWTP Permitted Flow (MGD):		0.750	
Percentage of Capacity Currently Utilized:		72%	

The treated meter flows represent the total flows processed in the WWTP. However, peak flow variations in the influent wet well are dampened by the diversion to the EQ tanks. Thus, the treated average daily flow does not characterize the full fluctuations of flow being delivered to the influent wet well from the collection system. The flows to the influent wet well are important in determining the effect of storm events on flows to the WWTP. For this reason, a further analysis was conducted to estimate the flow to the influent pump station to help identify the

infiltration and inflow (I/I) flows to the influent pump station. The existing I/I values are incorporated into the evaluation of projected future wastewater flows.

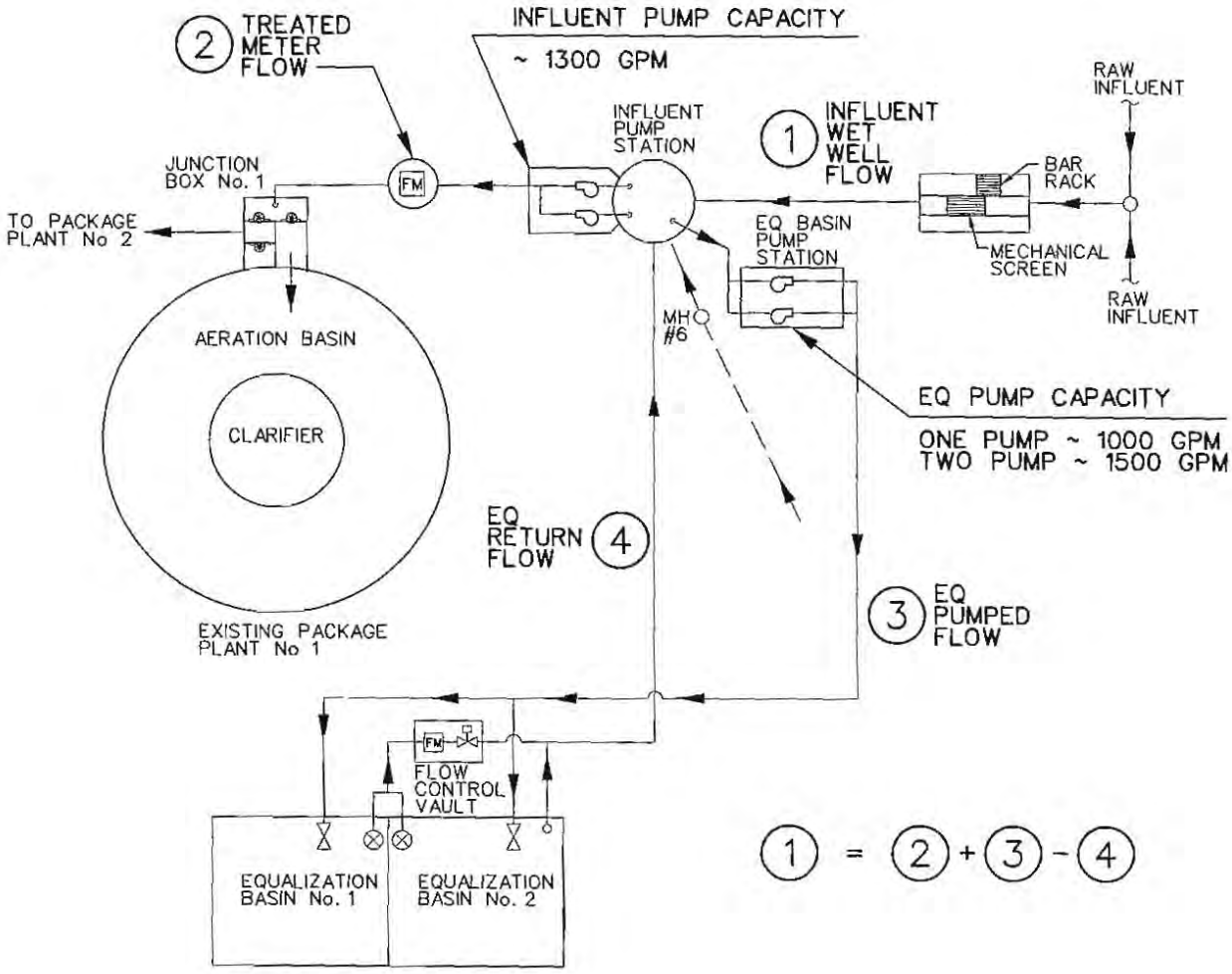
Per **Figure 2.4**, the flow to the influent pump station can be determined as follows:

Daily Influent Wet Well Flow = Treated Metered Flow (gallons)

+ EQ Volume Pumped to EQ Tank (gallons)

– EQ Returned to Influent Wet Well (gallons)

The WWTP staff records daily the treated meter flow volume, the EQ pump hours (which can provide an estimated volume based on pumping rate), and the EQ return volume. Daily data collected by operating staff from 2014 and 2015 were used to approximate daily flow to the influent pump station from the collection system. The influent pump stations flows were used in the I/I evaluation which follows in the next subsection.



THE WOOTEN COMPANY

TOWN OF PITTSBORO

Figure 2.4
Existing WWTP
Influent Flow
Schematic

Pittsboro ER / EID

2.4.2 INFLOW AND INFILTRATION ANALYSIS

The determination of I/I flows started with water usage data. Water usage data was obtained from the Town for 2014 (see **Appendix C**) and a ten percent consumptive loss factor was applied to estimate the total wastewater volume to the sewer as generated by users. This flow is the estimated sewer flow with no influence from inflow or infiltration (leak proof sewers). Second, using best engineering judgement, daily flows were identified during periods of low and/or no rainfall to estimate the average dry weather base flow. This flow includes sewer flow and dry weather infiltration. The difference between the dry weather base flow and sewer flow is the average flow influenced by precipitation inflow. The following table details the influent flow summary statistics for 2014 and 2015 at the influent wet well. The I/I values in the following table are used as current base values in future flow projections.

TABLE 2.4 – INFLUENT WET WELL FLOW SUMMARY STATISTICS

Flow Type	Flow (GPD)	
	2014	2015
Average Daily Flow	0.513	0.520
Sewer Flow (based on water billings)	0.267	0.267*
Dry Weather Base Flow	0.350	0.350*
Dry Weather I/I Flow	0.083	0.083
Average Annual Wet Weather I/I	0.163	0.170
Peak Daily Flow	1,444,000	1,327,000
Peak Sustained 3-day Flow	1,189,000	1,303,000

"*" Assumed to be approximately equal to 2014 data

Peak hour flows to the package plants (treated meter flows) have exceeded the 1,000 gpm capacity of the influent flow meter and chart recorder. Based on evaluation of the existing influent pump curves, the estimated maximum capacity with two influent pumps running is approximately 1,300 gpm. The estimated capacity of one EQ pump running is 1,000 gpm and the flow with two pumps running is estimated to be 1,500 gpm. Thus, the maximum possible flow with all four pumps running would be approximately 2,800 gpm. However, the operators have indicated that they have not observed four pumps running at the same time. Thus, a peak hour flow to the influent wet well of 2,500 gpm (two EQ pumps and one influent pump running) is used.

The estimated flows to the influent pump station (calculated using the formula in *Section 2.4.1*) as compared to recorded daily rainfall volumes are shown graphically on **Figures 2.5** and **2.6**. The 2014 and 2015 graphs clearly show the rapid response of influent flows to rainfall events. Peak daily flows are approximately 2.75 times higher than the average annual flow and 4 times the dry weather base flows. Peak hour flows are estimated to be up to 7 times the average hourly flow.

A further analysis was conducted to quantify the impact of inflow on the collection system and the average daily flow during rainfall events. Thirteen (13) representative rainfall events of 0.5 inches or greater were identified for

evaluation. The rainfall events were examined and an estimated inflow volume during each individual event was determined. The following table presents the identified events and the estimated inflow per inch of rain.

TABLE 2.5 – INFLOW AND RAINFALL EVENT SUMMARY			
Storm Event Period	**Total Rainfall (in.)**	**Estimated Inflow (MG)**	**Inflow/Inch of Rain, (MG/in.)**
Jan. 10 to Jan. 13 – 2014	2.5	1.80	0.72
Feb. 3 to Feb. 9 – 2014	0.7	0.46	0.66
Mar. 7 to Mar. 12 – 2014	3.6	1.99	0.55
Jun. 15 to Jun. 18 – 2014	5.5	1.78	0.32
Aug. 9 to Aug 14. – 2014	3.6	1.86	0.52
Nov. 23 to Nov. 27 – 2014	2.9	1.46	0.51
Dec. 20 to Dec. 28 - 2014	3.1	1.98	0.63
Jan. 12 to Jan. 17 – 2015	1.55	1.28	0.83
Feb. 9 to Feb. 12 – 2015	0.95	0.48	0.50
Mar. 5 to Mar. 8 – 2015	1.3	0.58	0.48
Apr. 9 to Apr. 13 – 2015	4.0	2.14	0.42
Apr. 14 to Apr. 17 – 2015	1.4	0.58	0.41
Apr. 19 to Apr. 24 – 2015	3.1	1.98	0.65
		Average Inflow per Inch of Rain:	**0.55**

Based on the above analysis, the average impact of inflow is approximately 0.55 million gallons per inch of rainfall. From a plant operation standpoint, this influx of excess water leads to significant operational issues with regards to treatment capacity. During larger storm events (typically greater than 3 inch events) or when multiple events occur in the same week, the WWTP operators have been forced to by-pass flow around the filter units. The existing WWTP is able to process a peak flow of approximately 600 gpm (capacity of the existing clarifiers). When flows exceed this value, solids can be lost out of the clarifier and the operators must by-pass the existing tertiary filters. The operators at times turn the air off to portions of or to all parts of the aeration basins to help settle solids to avoid solids washout. In these cases the wastewater is partially treated. During the past two years, rainfall events have resulted in approximately 25 days of by-passes during approximately 11 storm events. In addition, there was recently a by-pass during the first week of February 2016. The by-passes and treatment problems are reported to DENR when they occur. A listing of the by-passes over 2014 to 2015 is provided in **Appendix B**. There has been at least one situation where a peak storm filled the EQ tanks and flow occurred over the top of the walls of the aeration tanks.

Even though by-pass events have occurred over 2014 and 2015, only one Notice of Violation (NOV) of effluent limits (for fecal coliform in April, 2015) has been issued.

2.5 INFLUENT WASTEWATER CHARACTERISTICS AND CURRENT PERFORMANCE

Daily Monitoring Report (DMR) data and effluent compliance records for January 2013 through September 2015 were reviewed. Influent average BOD_5 and TSS is 261 mg/l and 200 mg/l respectively. Total Kjeldahl Nitrogen (TKN) influent data is limited, however influent TKN is estimated to be around 40 mg/L. Total phosphorous (TP) influent data from January through August 2014 indicates an average influent concentration of 4.6 mg/L. A brief look at the pertinent ratios for successful biological nutrient removal (BNR) design indicate a BOD_5/TKN ratio of 6.5 and a BOD_5/TP ratio of 57 exist at the Robeson Creek plant. Compare these ratios with the acceptable ranges for BOD_5/TKN of 3.0 to 4.0 and BOD_5/TP of 20 to 25 for BNR plants.

The existing plant is performing excellent in terms of average effluent BOD and TSS values (generally both less than 1 mg/L). Effluent ammonia is typically well under 1.0 mg/L. In 2013, the annual average effluent phosphorus was right at 0.14 mg/L (which would meet the future summer limit at 1.249 MGD). The plant supervisor indicated this was achieved by increasing the sodium aluminate chemical dosing. Thus, chemical addition with effluent filtration is a viable option for meeting the effluent Total P future limit. Effluent nitrate/nitrite averaged approximately 20 mg/L which is expected for a plant with no denitrification. Effluent fecal coliforms are typically near zero with a peak month value of 16/100 ml. The effluent values indicate that overall plant performance is excellent. The EQ tanks aid in treatment by allowing a more steady influent flow to the treatment units.

As explained previously, the operation of the plant has been upset in the past during storm events. Typically, rainfall events of 2 to 3 inches can be accommodated with the existing EQ tanks. However, rainfall events with greater rainfall or multiple rain events in a week can exceed the plant capacity with a resulting loss of treatment.

3.0 FUTURE SITUATION

As noted in Section 1, the Town of Pittsboro is expected to experience significant growth in its ETJ service area with the planned development of the multi-faceted Chatham Park, as well as the continual growth within the Town's corporate limits. The following sections detail the methodology of both the population projections and flow projections for the Town limits and the ETJ service area.

3.1 POPULATION PROJECTIONS

The WWTP service area population projections include four components: the incorporated town limits, planned developments within the ETJ (excluding Chatham Park), remaining unplanned ETJ development, and Chatham Park. The Town of Pittsboro Planning Department provided population growth estimates for the areas inside the Town limits and inside the planned and remaining unplanned ETJ (not including Chatham Park). This information was used in this ER/EID and can be found in **Appendix D**. Growth estimates for Chatham Park were provided by representatives of Chatham Park and were in the form of future flow values.

The Town's Planning Department has established a 1% annual growth rate within the corporate limits. This growth rate is based on the average growth experienced over the past 10 years, and is used to project the future populations. Second, the Town currently has 2,600-acres of planned developments within its ETJ, of which are expected to be 10% built-out by 2020, 30% by 2030, 50% by 2040, 70% by 2050, and 100% by 2060. These projections assume a housing density of 4 households per acre, with a population per household of 2.33. Third, the remaining area of ETJ which isn't currently planned for development is zoned for future development. The expected area of this development is approximately 9,940 acres, with a housing density of 0.4 households per acre. It is estimated the 9,940 acres will be build-out by 2% by 2020, 10% by 2030, 30% by 2040, 50% by 2050, and 70% by 2060. The populations for years 2025 and 2035 are linear interpolations between the even numbered decades.

Chatham Park has determined a development build-out plan, but the rate at which these developments will be completed is not certain at this time. A wastewater flow table provided by Chatham Park to the Wooten Company is included in **Appendix D**. Based on the information provided in this table; Chatham Park is projected to generate 50,000 GPD of wastewater in the first year of development and 100,000 gpd by the second year. By year 2035, the estimated wastewater flow generated is expected to be approximately 2,700,000 GPD. A follow-up conversations with the Chatham Park engineer indicates that the projected population is 33,500 people in Chatham Park by 2035. This equates to approximately 80 gpcd from Chatham Park. This information is the basis for the population and flow projections in this report. To determine the population projections for the Chatham Park development, the population and wastewater flows were projected at a constant linear rate from 2020 to 2035 assuming an initial lower population for the first two years of development. **Table 3.1** summarizes the population projections for the different components of the WWTP future service area.

TABLE 3.1 – SERVICE AREA POPULATION PROJECTIONS					
Year	**Town Limits**	**ETJ (Planned Development)**	**Remaining ETJ Development**	**Chatham Park**	**Total Population**
2015	3,934	0	0	0	**3,934**
2020	4,135	2,423	185	6,670	**13,413**
2025	4,346	4,846	556	15,700	**25,448**
2030	4,567	7,269	926	24,730	**37,492**
2035	4,800	9,692	1,853	33,500	**49,845**

3.2 FLOW PROJECTIONS

Based on the population projections presented in **Table 3.1**, future flows for both the Town limits and the ETJ, excluding Chatham Park, were developed using standard planning guidelines which project four components of wastewater flow: residential flow, commercial flow, industrial flow, and infiltration and inflow (I/I). Flow projections for Chatham Park are those provided by the Chatham Park developers.

Residential and commercial flows are based on 70 GPD per capita and 15 GPD per capita, respectively, and industrial flow is assumed to be 10% of residential and commercial flows. Future I/I was projected by first estimating the surface area (in inch-diameter miles, IDM) of new sewer lines required to serve the future population and then multiplying the new area by 100 GPD/IDM (typical for new sewer lines). At present, the Town's wastewater collection system consists of 240 IDM of sewer lines and serves a population of 3,934. Thus, assuming development patterns do not significantly change, as the population increases the collection system will expand at a rate of 0.061 IDM per capita (240-IDM / 3,934), and I/I will increase at a rate of 6.1 GPD per capita (0.061-IDM per capita x 100 GPD/IDM).

The following table summarizes the flow projections for the different components of the WWTP future service area.

TABLE 3.2 – WASTEWATER FLOW PROJECTIONS (GPD)					
Year	**Town Limits**	**ETJ (Planned Development)**	**Remaining ETJ Development**	**Chatham Park**	**Total Flow Projections**
2015	513,000	0	0	0	**513,000**
2020	533,000	241,300	18,500	533,500	**1,326,300**
2025	554,000	482,600	55,400	1,256,000	**2,348,000**
2030	576,000	724,000	92,200	1,978,500	**3,370,700**
2035	599,200	965,300	184,500	2,701,000	**4,450,000**

Figure 3.1 on the following page illustrates the wastewater flow projections up to 2035. The plot presents both the projected flow of the Town alone (green line) and the combined flow of the Town and the Chatham Park development (red line). The plot also identifies the current plant capacity and the available effluent discharge capacity as listed in the current Pittsboro NPDES permit. **Figure 3.1** illustrates the following key points:

- The capacity of the existing WWTP (0.75 MGD) will be reached in approximately 3 to 5 years if growth proceeds at the projected rate.
- A single discharge to Robeson Creek will not meet the needs for the Town flows (green line) if the Town were to treat no wastewater from Chatham Park. The Town would need to provide a second outfall to the Haw River it the Town treats and discharges its own wastewater exclusive of Chatham Park.
- The available total discharge under the current NPDES permit (3.22 MGD) is not sufficient for the combined flow of the Town and Chatham Park (~ 4.5 MGD). Chatham Park indicated in its original Master Plan that reuse/non-discharge is a component of future development plans. Reuse or non-discharge (i.e. spray irrigation or regional treatment at another WWTP facility) will need to be used in the future at some point to divert future treated wastewater from stream discharge under the existing NPDES flow capacity limits.

4.0 PURPOSE AND NEED

The Town of Pittsboro currently has a sewer collection system and wastewater treatment plant that serves customers inside the Town limits and extraterritorial jurisdiction (ETJ). A 7,000-acre new development named Chatham Park is planned in and outside of the existing ETJ. A project location map showing the location of the Town boundaries, the ETJ, the future Town ETJ to be served and the Chatham Park development area was shown previously in **Figure 1.2**. The Chatham Park development area is larger than the existing Town limits. The Town has a NPDES discharge permit allowing discharge of up to 1.249 MGD to Robeson Creek (existing outfall) and 1.971 to the Haw River (future outfall).

The current annual average wastewater flow from the Town is approximately 0.5 MGD. Peak daily flows can reach 1.4 MGD and the three-day sustained peak flow is 1.2 MGD. Although an equalization pumping and storage system is available, the peak flows to the plant can exceed the capacity of the existing equalization and WWTP capacity and the tertiary filters have been by-passed approximately 11 times during storm events in the last two years (2014 to 2015). Thus, peak flows are currently a recurring problem for the WWTP and need to be addressed.

There are portions of the existing WWTP that has equipment that is over 20 years old. Portions of the structures of the package plants (concrete walls, metal walls, gratings, etc) need repair work or replacing. Major equipment, such as the clarifier drives, aeration diffusers and blowers, RAS/WAS pumps, and tertiary filters need to be replaced. This project addresses those needs.

Future flow projections indicate an annual average wastewater flow increase for the Town and Chatham Park combined of 0.15 to 0.2 MGD per year. This growth in flow volume cannot be accommodated by the existing WWTP. In fact, flow projections indicate the plant's existing rated capacity will be reached within the next 3 to 5 years. Thus, this project is needed to address the future wastewater needs as flows increase.

Also, the Town's existing NPDES permit includes a requirement to meet future Total Nitrogen mass limits by January 1, 2022. This requirement indicates that for discharges to Robeson Creek and/or future discharges to the Haw River will require treatment of wastewater for total nitrogen removal. Initially, Total Nitrogen will need to be treated to a concentration of 15 mg/L at the existing WWTP which would eventually drop to approximately 9 mg/L in the future (at the existing WWTP capacity of 0.75 MGD). Effluent data from 2011 to 2014 indicates that the effluent Total Nitrogen varies from 20 mg/L to 29 mg/L at present. Based on the evaluated data there is a need to add treatment of nitrogen to the existing WWTP to meet the future Total Nitrogen permit limits.

The purpose of this ER/EID is to evaluate alternatives and recommend the best alternative to accommodate future growth in the Town and Chatham which address current and future issues that the Town's wastewater system is will need to address (peak flows, older equipment, and future Total Nitrogen effluent limits). This report looks at an overall time horizon of 20 years. However, due to the uncertainty associated with the pace and timing of future growth, phasing (stepped capacity changes) of the project is recommended to allow flexibility.

5.0 ALTERNATIVES ANALYSIS

5.1 ALTERNATIVES OVERVIEW

The scale of the future development plans for Chatham Park is a unique situation that most small Towns in North Carolina do not encounter. The alternatives evaluated to accommodate this future growth have evolved as the engineering analysis proceeded on this project. Chatham Park initially developed a decentralized approach to handling wastewater generated in the new development which was presented in the 2014 Master Plan. A figure of this original proposal in included in **Appendix E**. In this plan the development goal was 100% reuse of treated effluent within Chatham Park proper with no stream discharge of treated wastewater.

At that time, Chatham Park proposed building a 0.5 MGD wastewater reclamation facility or WRF in stages. This WRF would serve the first development in Chatham Park and consist of an initial 0.25 MGD plant with a follow-up 0.25 MGD increase. Treated water from the WRF would either be totally reused (100 percent reuse) and/or discharged south to the Townsend WWTF site (spray irrigation facility) for ultimate disposal. Chatham Park has purchased the Townsend site. The plan included constructing a future WRF facility near Highway 64 with discharge to the Haw River as wastewater flows increased above 0.5 MGD. The original technical memo on this approach is also provided in **Appendix E**. The original plan relied on Chatham Park building infrastructure and treatment for the wastewater it would generate without asking the Town to provide sewer service.

As Chatham Park originally was planning for 100 % reuse, alternatives for the Town were initially evaluated to accommodate wastewater flows from the Town's projected growth not including Chatham Park (the green line in **Figure 3.1**). This evaluation included looking at regional treatment (pumping to Sanford) or phased expansion of the existing WWTP in combination with other future plant construction. Specifically, these alternatives treating the Town flow included the following:

- Option 1: Expand the existing WWTP to 1.249 MGD and then provide an additional future 0.75 MGD in a future expansion. Due to the small existing WWTP site footprint, treatment technologies for expansion to 1.249 MGD included buying property and using convention biological nutrient removal (BNR), building a membrane bioreactor (MBR) plant, or building an integrated fixed film activated sludge (IFAS) plant. Costs were developed for each of these treatment technologies.
- Option 2: Pump (2.0 MGD) to the Sanford Big Buffalo WWTP. This plant has a treatment capacity of 12 MGD and a current average daily flow of 4.0 MGD. Thus, this plant has the capacity to accept an additional 2.0 MGD of raw wastewater flow for treatment.
- Option 3: Build 2.0 MGD conventional WWTP and discharge 1.249 to Robeson Creek and 0.75 to a new discharge to the Haw River. This would require buying additional property to the east of the existing WWTP.

Appendix E contains process flow diagrams, site layouts and a summary cost table for the options listed above. The costs developed in this initial analysis were in accordance with DWI procedures. The lowest cost option in these alternatives was pumping the Town's wastewater to Sanford.

The relatively high costs for the alternatives above would be a significant burden for the Town residents. In addition, meetings between the Town and Chatham Park (and Sanford representatives) indicated that addressing future wastewater needs in a joint effort between the Town and Chatham Park would be more cost effective and potentially more advantageous. A Town council meeting workshop was held in September 2015 and it was decided that a joint effort was favored. Thus, alternatives for addressing the combined wastewater flow of Chatham Park and the Town were developed. The costs developed in this initial evaluation were used in subsequent cost determinations for the combined alternatives. These alternatives are presented next and formed the basis for decision making by the Town on a recommended plan.

5.2 ALTERNATIVES DESCRIPTION

The alternatives evaluated in this ER/EID are for the combined wastewater flows of the Town and Chatham Park. The planning period is 20 years (design Year 2035). As the growth rate for the Chatham Park development is a best estimate, alternatives were developed and evaluated looking at stepped capacity increases to allow for flexibility. In general, capacity steps included pumping wastewater to Sanford, and/or treating wastewater in existing or new wastewater treatment plants was evaluated.

Two meetings were held in August and September of 2015 with representatives from the City of Sanford to discuss the option of pumping wastewater to the Sanford Big Buffalo WWTP. These discussions indicated that the City of Sanford is receptive to accepting Pittsboro raw wastewater. The City of Sanford provided annual fees for 2 MGD reserve capacity (**Appendix F**) and per gallon charges (~ $1.25/gallon) for use in alternative cost estimations. A capacity of 2.0 MGD was evaluated for the purposes of this ER/EID. The option of additional pumping is possible, but was not evaluated because pumping any flow beyond 2 MGD requires an interbasin transfer approval by the State of North Carolina's Environmental Management Commission (EMC). This is typically a 3 to 5 year approval process and the ability to get approval in the future is not certain. Therefore, for alternatives with pumping to Sanford as an initial capacity step, future treatment needs are provided by building regional WWTPs versus assuming any additional pumping capacity to Sanford.

The Town currently has an agreement with 3M Company to provide reclaim/reuse water from the existing WWTP. This is a long-term contract (20+ years) with a maximum contract volume of up to 300,000 gpd. The current average daily volume provided to 3M now is 50,000 to 60,000 gpd. The existing WWTP has the required treatment and pumping facilities to provide the contract volume. This contractual volume of reclaim/reuse water must be provided in any future alternative.

As part of the initial development plan, Chatham Park has developed cost estimates for future water reclamation facilities (WRFs) which would have the capability to produce reclaim/reuse quality water. Chatham Park provided

these cost estimates which were used in the step capacity increases in the alternatives for combined Town and Chatham Park wastewater treatment in this report. Four alternatives were developed in this ER/EID:

- Alternative 1: No Action
- Alternative 2: Refurbish Existing WWTP, Pump to Sanford, Regional WWTP
- Alternative 3: Expand Existing WWTP, Regional Treatment Plants
- Alternative 4: Decommission Existing WWTP, Pump to Sanford, Regional WWTP

These alternatives are described and evaluated below.

5.2.1 ALTERNATIVE NO. 1: NO ACTION

The No Action alternative is required to be included in the analysis as a condition of DWI funding. This alternative is rejected because no action would do nothing to alleviate current peak flow problems during storm events at the WWTP, would not address aging equipment at the WWTP, and would not address future wastewater generated from growth in the Town and in Chatham Park. If no actions are taken, then the ability of the Town to grow and Chatham Park to be built will be halted. The No Action alternative would result in repeated existing by-passes at the existing WWTP and degraded stream and Lake Jordan water quality. It is not possible to make operational changes at the existing WWTP to alleviate the current flow situation or to accommodate any future growth in wastewater flows. Thus, this alternative is not feasible and is rejected and there is no further evaluation of Alternative 1.

5.2.2 ALTERNATIVE NO. 2: REFURBISH EXISTING WWTP, PUMP TO SANFORD, REGIONAL WWTP

In this alternative, there would be two capacity steps as shown in **Figure 5.1**. The first step would include continuing to operate the existing WWTP at a capacity of 0.75 MGD and installing a pump station and force main to the City of Sanford Buffalo Creek WWTP. The existing WWTP would be refurbished to addressing aging equipment, older controls, and future Total Nitrogen limits. The first step or phase would provide approximately 2.75 MGD of capacity. This phase would be followed by a second capacity step or phase consisting of construction of a new 1.75 MGD WWTP with discharge to the Haw River. It is assumed the new WWTP would be located in the approximate location shown in the original Chatham Park master plan (see **Appendix E**).

The existing NPDES permit for the WWTP is currently being renewed. DEQ has indicated that the Total Nitrogen mass limit will need to be met in 2022 (versus 2019 in the existing permit). In 2022, the NPDES permit allows approximately 100 pound per day discharge of nitrogen. Initially, only 0.75 MGD will be discharged and thus the existing WWTP would need to meet a 15 mg/L Total N discharge limit. At a future time when the second step/phase is implemented, the new plant would need to be meet a 3 mg/L Total Nitrogen limit and the existing WWTP limit would drop to approximately 8 to 9 mg/L.

The major components of this alternative would be as follows:

- **Existing WWTP refurbishment.** This work would include WWTP improvements to the following major areas: Influent flow measurement, SCADA system, package plant concrete and metal componeut repair/repainting, clarifier drives replacement, aeration diffuser and blower system replacements, total nitrogen treatment upgrades (treat to 15 mg/L), RAS/WAS pump replacements, tertiary filter rehabilitation, UV disinfection capacity increase, sludge dewatering upgrade, and miscellaneous site structures additions. Treatment plant capacity would stay at 0.75 MGD. Also included under this category and related to the reclaimed water system at the WWTP, a new bulk water station would be constructed as part of this project to serve general contractors. This station would be located approximately 1 mile from the WWTP near the intersection of Sanford and Moncure-Pittsboro Road along the existing reuse water line from the WWTP to the 3M facility site.
- **Pump Station and Forcemain to Sanford Big Buffalo Creek WWTP.** A new below-grade pump station with a capacity of 1740 gpm would be installed at the existing WWTP site. Screening and grit removal would also be added at the existing WWTP site prior to the new pump station to allow direct discharge of wastewater from the pump station to the Big Buffalo Creek equalization tanks. The forcemain would be routed primarily along US 15-501 and the Little Buffalo PS force main to the Sanford WWTP for a total length of approximately 14 miles. Of that length, a portion of US 15-501 from SR 2219 to the county line is considered controlled access (~ 33,800 feet) and may need to be located outside of the right-of-way dependent on NCDOT requirements. The preliminary high point for the line is approximately 150 feet above the existing WWTP site. **Figure 5.2** shows the proposed route for this alternative.
- **Future 1.75 MGD regional WWTP and discharge to the Haw River.** This portion of Alternative 1 would occur as Phase 2 of the alternative and be fully developed at a future time. The future 1.75 MGD plant would have biological nutrient removal (BNR) to meet a Total Nitrogen concentration limit of 3 mg/L and would be capable of producing reuse quality water. The plant would be located south of Highway 64 and a new 11,000 foot long discharge line to the Haw River would be installed. A new outfall would also be installed at the Haw River near the Highway 64 bridge over the Haw River.

5.2.3 ALTERNATIVE NO. 3: WWTP EXPANSION AND REGIONAL WWTPS

In this alternative, there would be multiple capacity steps as shown in **Figure 5.3**. The early steps include both expansion of the existing WWTP to 1.249 MGD (0.49 MGD expansion) and construction of the decentralized water reclamation facility (WRF) by Chatham Park. The decentralized WRF would be in the location shown in Appendix E. The decentralized WRF would serve the initial development in Chatham Park and provide for water reuse/non-discharge (utilizing the Townsend spray irrigation site). Chatham Park would build the decentralized plant in two 0.25 MGD steps. In 2020 to 2021, a new 1.25 MGD regional wastewater plant would be constructed in the same location as described in Alternative 2. Discharge to the Haw would be the same route as in Alternative 2. At a later date, the new regional WWTP would be expanded to a final capacity of 2.75 MGD. **Figure 5.3** shows the current limit of NPDES discharge of 3.22 MGD. Under this alternative, approximately 1.28 MGD of treated effluent would need to be reused/reclaimed or spray irrigated. The original decentralized plant would provide for 0.5 MGD of non-discharge. Thus, an additional 0.78 MGD of reuse/non-discharge capacity would be need to be provided.

As for Alternative 2, the treatment plants in Alternative 3 would have to meet combined Total Nitrogen limits. The expanded existing WWTP would initially need to meet an effluent total N concentration of 9 mg/L while the decentralized plant and the new regional WWTP plant would need to meet 3 mg/L. Eventually, as the regional plant discharges more wastewater to the Haw River, the upgraded Robeson Creek WWTP would need to meet a Total N limit of 3mg/L. The decentralized and new regional plant would need to meet more stringent disinfection limits if reuse is to be used to achieve non-discharge.

The major components of this alternative would be as follows:

- **WWTP Expansion to 1.249 MGD**. This work would include WWTP improvements to the following major areas: Influent flow measurement, SCADA system, package plant concrete and metal component repair/repainting, clarifier drives replacement, aeration diffuser and blower system replacements, total nitrogen treatment upgrades (treat to 15 mg/L), RAS/WAS pump replacements, tertiary filter rehabilitation, UV disinfection capacity increase, sludge dewatering upgrade, and miscellaneous site structures additions. Treatment plant capacity would stay at 0.75 MGD.
- **Build Decentralized WRF with non-discharge**. This plant would be constructed by Chatham Park in the approximate location shown in the first figure in Appendix E. The WRF would original have a capacity of 0.25 MGD and be expanded to 0.5 MGD. Water treated in the WRF would either flow by gravity to the Townsend site for spray irrigation or be reused for various purposes in the Chatham Park development.
- **Construct future regional WWTP and discharge to the Haw River.** The future regional WWTP plant would initially have a capacity of 1.25 MGD and be expanded to a total capacity of 2.75 MGD. The location of the plant, the discharge line, and the outfall would be the same as for Alternative 3.