Background

The City of Franklin is seeking to complete an Integrated Water Resource Plan (IWRP) that will incorporate potable water, wastewater, reclaimed water, and stormwater into a long-term plan identifying infrastructure improvements and management tools to meet the City's needs and customer requirements. The City of Franklin's unique community–characterized by its commitment to preserve the City's history and heritage coupled with its location in one of the fastest growing regions of the country–makes Franklin a popular place to reside and conduct business. From 1997 through 2008, the population of the City nearly doubled which is a trend expected to continue. Population data along with population projections from several sources is provided in **Figure 1**.

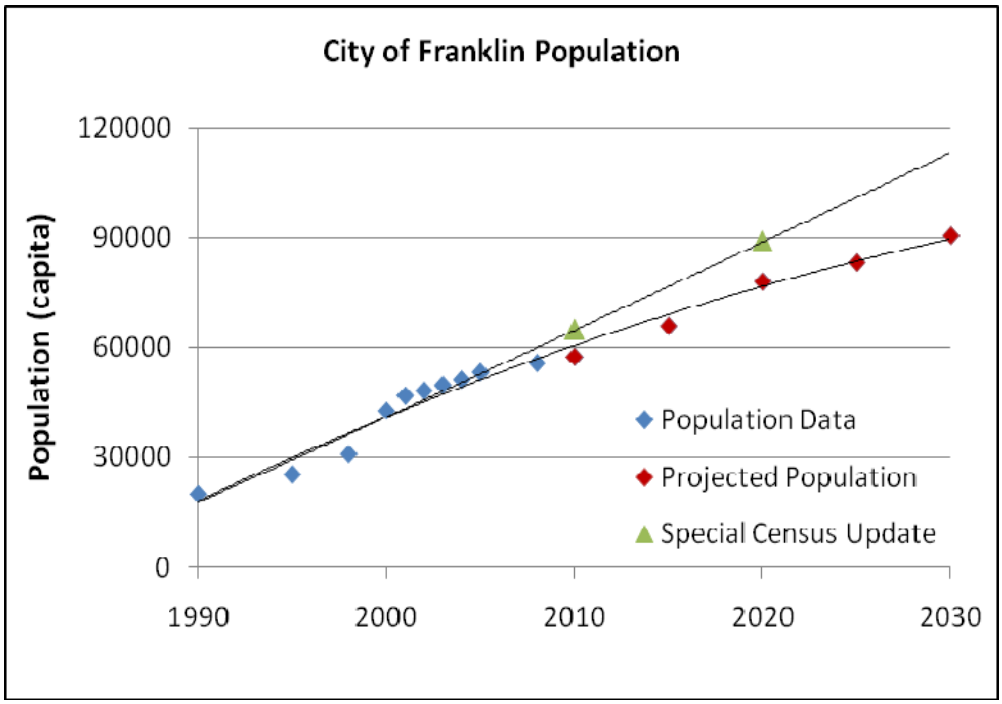

Figure 1
Population Data and Projections for Franklin
(data referenced from: http://www.idcide.com/citydata/tn/franklin.htm; http://www.citypopulation.de/USA-Tennessee.html; ANNEXATION FEASIBILITY STUDY, City of Franklin, TN Planning Department. November 2006; Population Projections for the State of Tennessee 2005 to 2025, Tennessee Advisory Commission on Intergovernmental Relations and the University of Tennessee, December 2003; Fiscal Year 2005-2006 operating budget, City of Franklin, Tennessee)

With continued growth comes increasing pressure on City services and infrastructure. All areas of the City's infrastructure have experienced growth pressure, including roads and streets, water supply and treatment, wastewater treatment and disposal and other services. These ever increasing demands have led the City administration and staff to reevaluate their water resources from a long-term, holistic perspective that encompasses water supply and treatment,

stormwater management, wastewater collection and treatment, and reclaimed water distribution. The process that will be used to accomplish this goal is an integrated water resources plan which is a facilitated process that engages stakeholders from the inception of the project throughout the entire planning process. This process includes defining the objectives of the plan, identifying potential solutions, collaborating on the formulation of analysis tools, and providing recommendations for the Board of Mayor and Aldermen (BOMA). On December 17, 2009, the Introductory Stakeholders Meeting was held at the Franklin City Hall. During this meeting, the approach and timeline for Phase I of the IWRP project was presented. The roles of the stakeholders were defined and as a result, the stakeholders requested background information to assist them in their roles. This background summary has been prepared in response to that request. The attached information is being provided to the Stakeholders in preparation for Workshop 1 in which the objectives, performance measures, and constraints will be identified as follows:

> ***Objectives:*** The objectives defined will represent the consensus voice of the stakeholders from beginning to end of the project. All subsequent analysis and comparisons will be linked to these objectives so that decisions can be made around agreeable goals for Franklin. Examples of project objectives might include lowest capital cost, improve conditions of the Harpeth River, increase efficiency of resource utilization, etc. Ideally, facilitators will work with the stakeholders to identify commonality or redundancy in voiced objectives, and produce a list of approximately 5 – 8 governing objectives.
>
> ***Performance Measures:*** Performance measures are quantifiable and/or qualifiable characteristics of alternatives that can be compared in direct relation to the project objectives. Examples of performance measures might include low flow frequency in the Harpeth River, life-cycle cost, likelihood of permitting constraints/hurdles, environmental impacts, etc.
>
> ***Constraints:*** Constraints help bound the IWRP and avoid consuming unnecessary time analyzing or debating alternatives that are physically, economically, environmentally, or even politically infeasible. These constraints will be defined as part of the stakeholder process.

Specific data with respect to the water, wastewater, reclaimed water, and stormwater management systems, as well as the Harpeth River are provided in the following Sections along with maps of the various service areas. The relationships between these systems are shown in **Figure 2**.

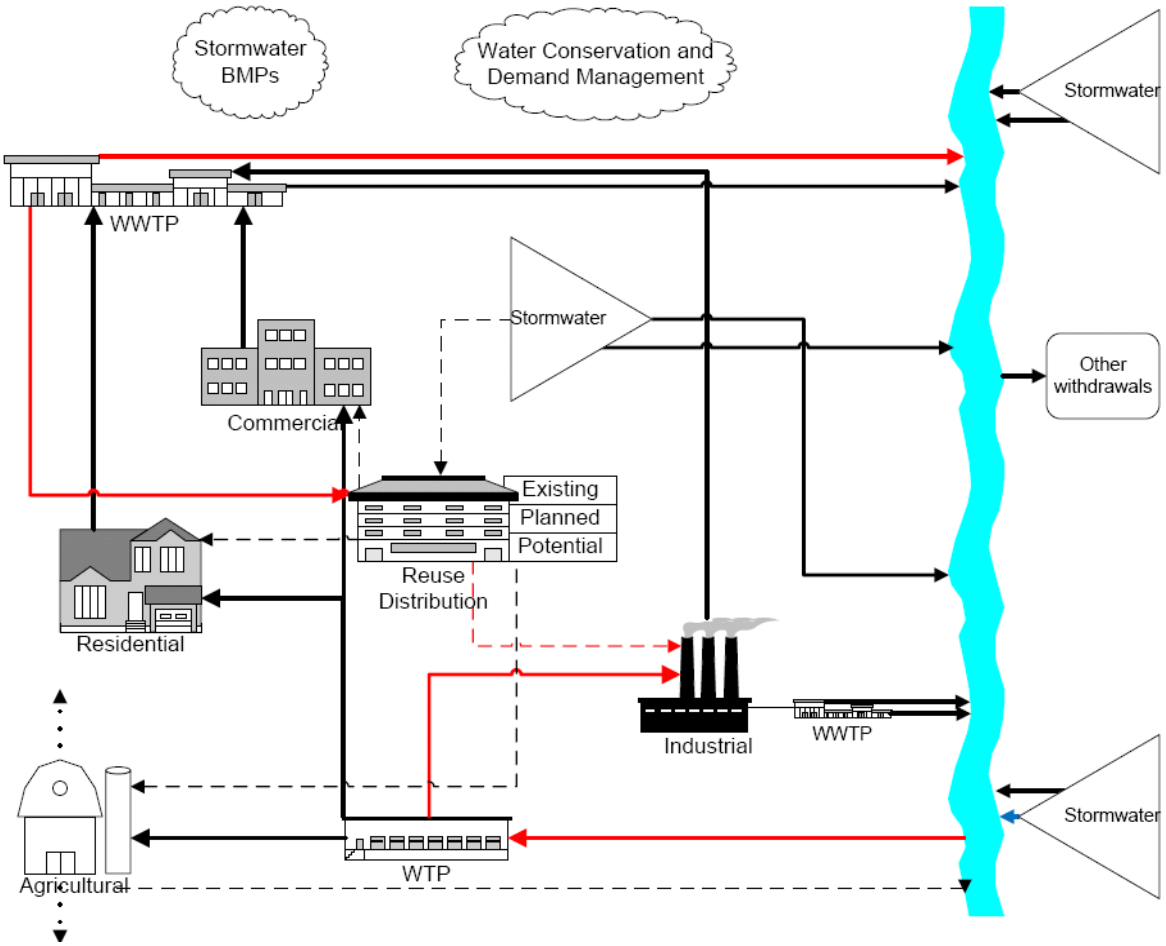

Figure 2
City of Franklin System Network Model

Potable Water

The City of Franklin owns and operates a 2.1 million gallon per day (mgd) capacity water treatment plant (WTP) at 838 Lewisburg Pike. The raw water source is the Harpeth River at river mile 89.9. A map of the water service area, River, water treatment plant and adjacent utilities is shown in **Figure 3**. In 1978, the City entered into a contract with Harpeth River Utilities District (HVUD) to purchase potable water in excess of its WTP capacity. The purchase price varies on an annual and sometimes monthly basis. A summary of the existing demand, plant production and water purchase is provided along with projected demands and plant production referenced from the *Design Report: Franklin Water Treatment Plant* (CTE, July 2006).

Existing Average Demand = 6.2 mgd
Existing Average Treatment Plant Production = 2.1 mgd
Existing Average Water Purchased = 4.1 mgd
Projected Demand in 2020 = 9 mgd
Planned Treatment Plant Production = 4 mgd

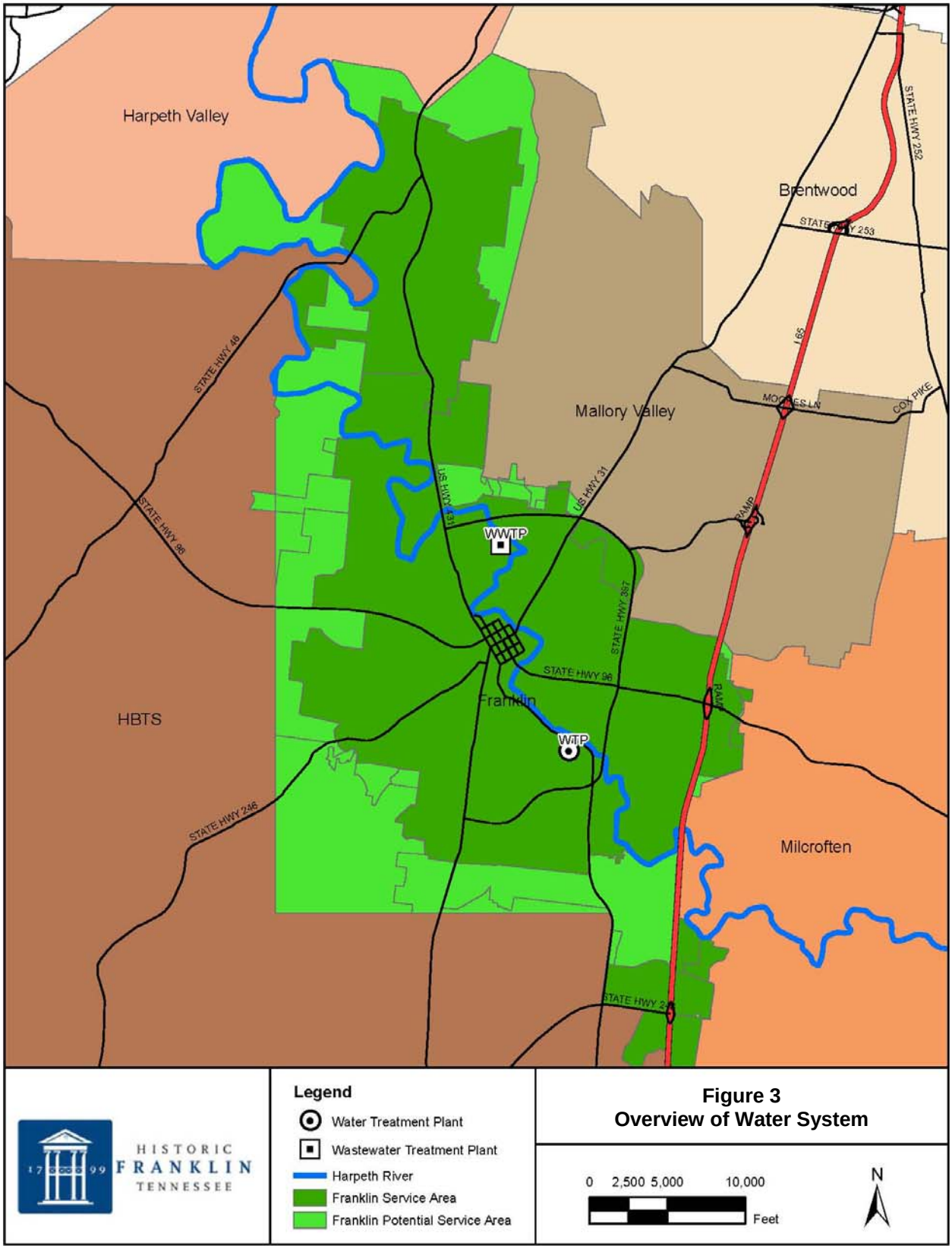

Figure 3
Overview of Water System

Wastewater

The City of Franklin is authorized to discharge treated municipal wastewater to the Harpeth River at mile 85.2. The permitted discharge consists of municipal wastewater from a treatment facility with a design capacity of 12 MGD. A map of the Harpeth River, location of the wastewater treatment plant and the wastewater service area are provided in **Figure 4**. The current flows and future projected flows (based on population projections and a per capita wastewater demand of 150 gallons per day) from the facility are provided below:

Average Daily Flow = 6.3 mgd
Maximum Daily Flows = 10.3 mgd
Permitted Discharge = 12 mgd
Projected 2020 flow = 11.7 to 13.4 mgd,

.

The discharge permit requirements include discharge limits and monitoring by the permittee as specified in **Tables 1** and **2**. While the limits specified represent the current discharge requirements, a new draft permit has been released; the final discharge permit will have potential implications that will be considered in the IWRP formulation.

Table 1
Wastewater Treatment Plant Discharge Permit Requirements

Effluent Characteristics	Effluent Limitations						Monitoring Requirements		
	Monthly Avg. Conc. (mg/L)	Monthly Avg. Amount (lb/day)	Weekly Avg. Conc. (mg/L)	Weekly Avg. Amount (lb/day)	Daily Max. Conc. (mg/L)	Daily Min. Percent Removal	Measurement Frequency	Sample Type	Sampling Point
$CBOD_5$ (May 1 – Oct 31)	6 Report	601	9	901	12 Report	40	7/week 7/week	composite composite	effluent influent
$CBOD_5$ (Nov 1 – Apr 30)	10 Report	1001	15	1500	20 Report	40	7/week 7/week	composite composite	effluent influent
Ammonia as N (May 1 – Oct 31)	0.4	40	0.6	60	0.8	-	7/week	composite	effluent
Ammonia as N (Nov 1 - Apr 30)	1.5	150	2.3	230	3	-	7/week	composite	effluent
Total Nitrogen* (May 1 – Oct 31)	5.0	-	-	-	-	-	2/month	composite	effluent
Total Nitrogen (Nov 1 – Apr 30)	Report	-	-	-	-	-	2/month	composite	effluent
Total Phosphorus	Report	-	-	-	-	-	2/month	composite	effluent
Suspended Solids	30 Report	3002	40	4003	45 Report	40	7/week 7/week	composite composite	effluent influent

*The permittee must comply with a seasonal average of 377 pounds per day for the period from May 1 through October 31. The seasonal average will be reported on the October DMR.

Table 2
Wastewater Treatment Plant Discharge Permit Requirements

Effluent Characteristics	Effluent Limitations			Monitoring Requirements		
	Monthly Average	Daily Minimum	Daily Maximum	Measurement Frequency	Sample Type	Sampling Point
Fecal Coliform	200 colonies/ 100 ml	-	1000/100 ml	7/week	grab	effluent
E. coli	126 colonies / 100 ml	-	-	7/week	grab	effluent
Chlorine residual (Total)	-	-	0.02* mg/l instantaneous	7/week	grab	effluent
Settleable solids	-	-	1.0 ml/l	7/week	composite	effluent
Dissolved oxygen	-	8.0 mg/l instantaneous	-	7/week	grab	effluent
pH (Standard Units)	-	6.0 .	9.0	7/week	grab	effluent
Flow (MGD)	Report Report	-	Report Report	7/week 7/week	continuous continuous	influent effluent
IC25	Survival, reproduction and growth in 100% concentration			1/quarter	composite	effluent

* To be applied only If chlorine is used for disinfection or when the effluent may be reasonably expected to contain chlorine.

Reclaimed Water

Effluent from the wastewater treatment plant that is treated to reclaimed water standards is distributed to users that exert a demand on this resource that is in addition to the potable water demand. This description has been provided so that it is clear that this water use could be interpreted as an offset to the potable water demand. The Franklin Reclaimed Water System has been in place since 1992. The City has made conscious and determined efforts to expand the program of beneficial reuse of treated effluent and agreed upon a mission statement in 2003 that included recycling treated wastewater as part of the effective management of its water resources. The City of Franklin currently has approximately 80,500 linear feet of reclaimed water distribution pipeline installed or under construction. The system also boasts a new high service pump station, completed in 2007, capable of delivering in excess of 6 mgd. With additional pumps, the station would be capable of pumping in excess of 12 mgd to the City's reclaimed water customers.

The reclaimed water system currently services 18 customers, including two golf courses that purchase an average of 3.5 mgd during the dry summer months. The maximum flow delivered during the summer of 2008 was 5.5 mgd. Additional customers have been identified in close proximity to existing lines or lines under design and construction that would represent an estimated 2.6 mgd in average daily demand. Maximum daily demand from these additional customers is estimated to be 5.5 mgd.

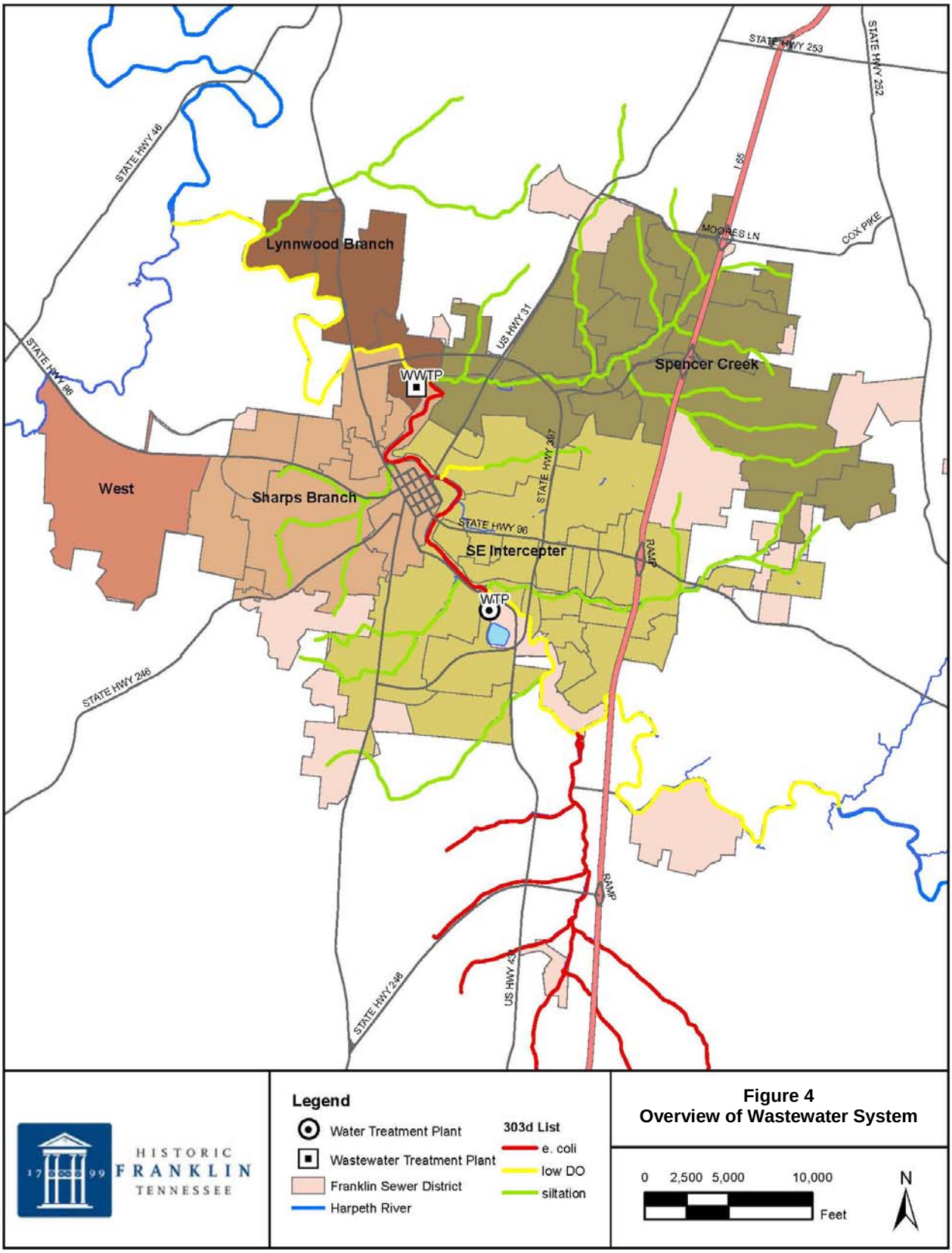

Figure 4
Overview of Wastewater System

Harpeth River

The Harpeth River has highly variable flows that are generally determined by local rainfall. For example, the mean discharge recorded by the USGS at its Highway 96 Bridge gage station, at River Mile 88.4, was 910 mgd during an extremely wet month (Mark 1994). Conversely, during an extremely dry month (September 1999), the daily average discharge was only 0.87 mgd. Based on data collected from the USGS Highway 96 Bridge gage, for the period 1974 – 2004, the average monthly river flows follow along with the low stream flow records for the same period (*Design Report: Franklin Water Treatment Plant*, CTE, July 2006).

Max month flow (average, March) = 418 mgd
Min month flow (average, August) = 26 mgd
7Q10 flow= 0.108 mgd
30Q2 flow= 0.767 mgd

The 7Q10 is defined as the streamflow that occurs over 7 consecutive days and has a 10-year recurrence interval period, or a 1 in 10 chance of occurring in any one year. Daily streamflows in the 7Q10 range are considered general indicators of prevalent drought conditions in large areas. The 7Q10 values are used by the State for regulating water withdrawals and discharges into streams. The 30Q2 is defined as the streamflow that occurs over 30 consecutive days and has a 2-year recurrence interval period, or a 1 in 2 chance of occurring in any one year. Daily streamflows in the 30Q2 range are general indicators of initial drought conditions which may cover large areas, and may be used by State regulators in determining water-use restrictions.

The Harpeth River is both a source for drinking water and receiving stream for wastewater assimilation. As part of Section 303(d) of the Federal Clean Water Act requirements, the Tennessee Department of Environment and Conservation (TDEC) has developed Total Maximum Daily Load (TMDL) studies for the Harpeth River. A TMDL quantifies the amount of a pollutant in a stream, identifies the sources of the pollutant, and recommends regulatory or other actions that may need to be taken in order for the stream to cease being polluted. For the Harpeth River, TDEC has developed TMDLs for Siltation & Habitat Alteration, Metals, and *Escherichia coli (E. coli)*; the TMDL for Organic Enrichment/Low Dissolved Oxygen (DO) was completed by the US Environmental Protection Agency (EPA). A summary of these TMDLs is provided in the following sections.

TMDL for Siltation and Habitat Alteration in the Harpeth River Watershed (TDEC, May 2002)

The Siltation and Habitat Alteration TMDL was developed to primarily address wet weather sources of sediment which are discharged as a result of the storm events. These wet weather sources can be broadly defined as those regulated by the National Pollutant Discharge Elimination System (NPDES) program, and wet weather sources not regulated by NPDES. Those regulated by the NPDES program include industrial activities (which includes certain

construction activities), and discharges from Municipal Separate Storm Sewer Systems (MS4s). The NPDES regulated sources are provided a Waste Load Allocation (WLA) and all other wet weather sources of sediment (those not regulated by NPDES) are provided a Load Allocation (LA). It is important to note that TDEC has reported that sediment loads to receiving streams from wastewater treatment facilities are negligible in relation to sediment discharges caused by storm water runoff.

This TMDL was established to attain the fish and aquatic life designated uses of the waterbody because all other uses will be protected by this approach. A summary of the impaired stream segments that are relevant to this study are summarized in **Table 3** and shown graphically in **Figure 4**, along with the wastewater system overview. The full TMDL for Siltation and Habitat Alteration in the Harpeth River Watershed can be obtained at http://www.tn.gov/environment/wpc/tmdl/approved.shtml#group1

Table 3
Stream Segments Impaired for Siltation and Habitat Alteration and TMDL Requirements

Waterbody ID	1998 303(d) Listed Waterbody Harpeth River Tributaries	TMDL [lbs/acre/year]
TN05130204016B	Spencer Creek Watson Creek Five Mile Creek Lynnwood Creek	660

TMDL for Metals in the Harpeth River Watershed (TDEC, October 2002)

The Harpeth River, from the confluence with the West Fork Harpeth River to its headwaters, was identified in the 1998 303(d) list as partially supporting its designated uses due, in part, to contaminated sediment caused by the presence of legacy materials from the General Smelting & Refining (GSR) facility at RM 110.3. Antimony, arsenic, lead, and zinc were identified on the 1998 303(d) list due to the presence of these metals in battery casings found in the stream bank near RM 113, not on water quality monitoring data. The Harpeth River watershed was reassessed in 2000, and further refined in 2002, using more recent data and a revised waterbody identification system. This analysis showed the only segment identified as impaired due to metals is the 2.7 mile section in the vicinity of the GSR facility in the upper portion of the watershed, near College Grove. The full TMDL for Metals in the Harpeth River Watershed can be obtained at http://www.tn.gov/environment/wpc/tmdl/approved.shtml#group1

TMDL for E. coli in the Harpeth River Watershed (TDEC, February 2006)

An important part of the *E. coli* TMDL analysis was the identification of individual sources, or source categories of pollutants that affect pathogen loading and the amount of loading contributed by each of these sources. Under the Clean Water Act, sources are classified as either point or nonpoint sources. Under 40 CFR §122.2, a point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged

to surface waters. Point sources of pathogens include: NPDES regulated municipal and industrial wastewater treatment facilities, NPDES regulated industrial and municipal storm water discharges, and NPDES regulated Concentrated Animal Feeding Operations (CAFOs). The pathogen TMDL must provide WLAs for all NPDES regulated point sources. Nonpoint sources are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location, thus all sources of pollutant loading not regulated by NPDES permits were considered nonpoint sources and the TMDL must provide a LA for these sources.

This TMDL was established to attain the recreation designated use of the waterbody because of the use classifications with numeric criteria for pathogens; this use classification is the most stringent and was used to establish target levels for TMDL development. The impaired stream segments most relevant to this study are shown in **Figure 4**, along with the wastewater system overview. A summary of the waste load allocations and load allocations for *E. coli* in the Five Mile Creek and Harpeth River drainage areas, as highlighted in **Figure 4**, are summarized in **Table 4**. The full TMDL for *E. coli* in the Harpeth River Watershed can be obtained at http://www.tn.gov/environment/wpc/tmdl/approved.shtml#group1

Table 4
TMDL, WLAs and LAs for *E. Coli* for the Impaired Five Mile Creek and Harpeth River Drainage Areas

TMDL	WLAs				LAs	
	WWTFs		CAFOs	MS4s	Precipitation Induced Nonpoint Sources	Other Direct Sources
	Monthly Average	Daily Max				
[% Red.]	[CFU/day]	[CFU/day]	[% Red.]	[CFU/day]	[% Red.]	[CFU/day]
>60.8	$5.742x10^{10}$	$4.288x10^{11}$	0	>64.7	>64.7	0

TMDL for Organic Enrichment/Low Dissolved Oxygen in the Harpeth River Watershed (TDEC, September 2004)

This TMDL is comprised of three components: a watershed nutrient load reduction evaluation to address the water quality impacts in the tributaries; an assessment of dissolved oxygen (DO) impacts of the upper mainstem of the Harpeth River; and an assessment of DO impacts of the lower Harpeth River from River Mile 88.1 to River Mile 32.4. These components contain source assessments, documentation of existing conditions, and an evaluation of the pollutant load reductions necessary to attain water quality standards. The allowable pollutant loads for each component of this TMDL are summarized in the following sections.

Nutrients

The allowable nutrient loads for these impaired subwatersheds of the Harpeth River were calculated using an interpretation of the narrative criteria for biological integrity set forth in TDEC's water quality standards. Numeric instream target concentrations for total nitrogen and total phosphorus necessary to meet the biological integrity criteria were determined using data collected from reference sites within the eco-regions where the impaired waters in the Harpeth

River watershed are located. Allowable nutrient loads are established as shown in **Table 5** to ensure that numeric target concentrations are achieved in the tributaries to the Harpeth River.

Table 5
Nutrient Reduction TMDL to Protect the Tributaries to the Harpeth River

Total Nitrogen		Total Nitrogen	Total Phosphorus		Total Phosphorus
[lbs/month]		reduction, (%)	[lbs/month]		reduction, (%)
Summer	Winter		Summer	Winter	
5864	18260	49.4	483	1505	83.8

In the upper Harpeth River, the principal cause for the DO deficit is the presence of excessive sediment oxygen demanding material. A 65% reduction of this material is necessary to achieve the 5.0 mg/l DO criterion. The nutrient and carbonaceous biochemical oxygen demand (CBOD) loads from nonpoint sources in the upper part of the watershed are targeted for pollutant load reductions in order to reduce the sediment oxygen demanding material sufficient to attain the DO criterion.

The lower Harpeth River from River Mile 88.1 to river mile 34.2 is also impaired due to low DO under low flow conditions. This portion of the River was modeled to assess existing conditions as well as predict impacts of potential pollutant sources including point sources regulated under the NPDES program. The model documents that the most severe DO deficit, 1.0 mg/l DO, under existing conditions occurs about 40 miles downstream of the Franklin Sewage Treatment Plant (STP) discharge. The assessment of the DO deficit indicated that sediment oxygen demand within the mainstem Harpeth River has to be reduced by 40% to ensure that the DO criterion of 5.0 mg/l will consistently be attained. EPA believes that the nutrient reductions described earlier as well as the waste load allocations assigned to three sewerage treatment plants in the watershed are sufficient to enable the lower Harpeth River to attain water quality standards. The WLA assigned to the Franklin STP is provided in **Table 6** and the WLA assigned to the Franklin MS4 is provided in **Table 7**. Additional details with regard to the MS4 permit requirements are provided in the following Storm Water section.

Table 6
WLA to the Franklin STP to Protect DO Levels in the Lower Harpeth River

Design Flow	CBOD5				Ammonia				Total Nitrogen	
	Summer		Winter		Summer		Winter			
MGD	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L
12	400	4	1001	10	40	0.4	150	1.5	290	2.9

Table 7
WLAs (MS4 area) and LAs to Watershed Runoff Protect DO levels in the Lower Harpeth River

Total Nitrogen		WLA in MS4 area reduction, (%)	LA in rural area reduction, (%)
[lbs/month]			
Summer	Winter		
5864	18260	49.4	49.4

This TMDL was established to attain the fish and aquatic life designated uses of the waterbody because all other uses will be protected by this approach. A summary of the impaired stream segments that are relevant to this study are shown graphically in **Figure 4**, along with the wastewater system overview. The full TMDL for Siltation and Habitat Alteration in the Harpeth River Watershed can be obtained at http://www.tn.gov/environment/wpc/tmdl/approved.shtml

Further, the TMDLs, WLAs, and LAs described here have been put forth by TDEC with the intent of being the first phase of a long term effort to restore the water quality in the Harpeth River Watershed through reduction of excessive pollutant loading. Adaptive management methods, within the context of the State's rotating watershed management approach, will be used to implement these TMDLs, WLAs, and LAs to meet water quality goals.

Storm Water

The City of Franklin must develop, implement, and enforce a storm water management program designed to reduce the discharge of pollutants to the maximum extent practicable (MEP), to protect water quality, and to satisfy the appropriate water quality requirements of the Clean Water Act under the requirements for the general MS4 permit. The storm water management program is required to include management practices; control techniques and system, design, and engineering methods; and such other provisions as the division determines appropriate for the control of such pollutants. The storm water management program must include the following information for each of the six minimum control measures:

- Public education and outreach on storm water impacts
- Public involvement/participation
- Illicit discharge detection and elimination
- Construction site storm water runoff control
- Post-construction storm water management in new development and re-development
- Pollution prevention/good housekeeping for municipal operations

Figure 5 provides an overview of the storm water system.

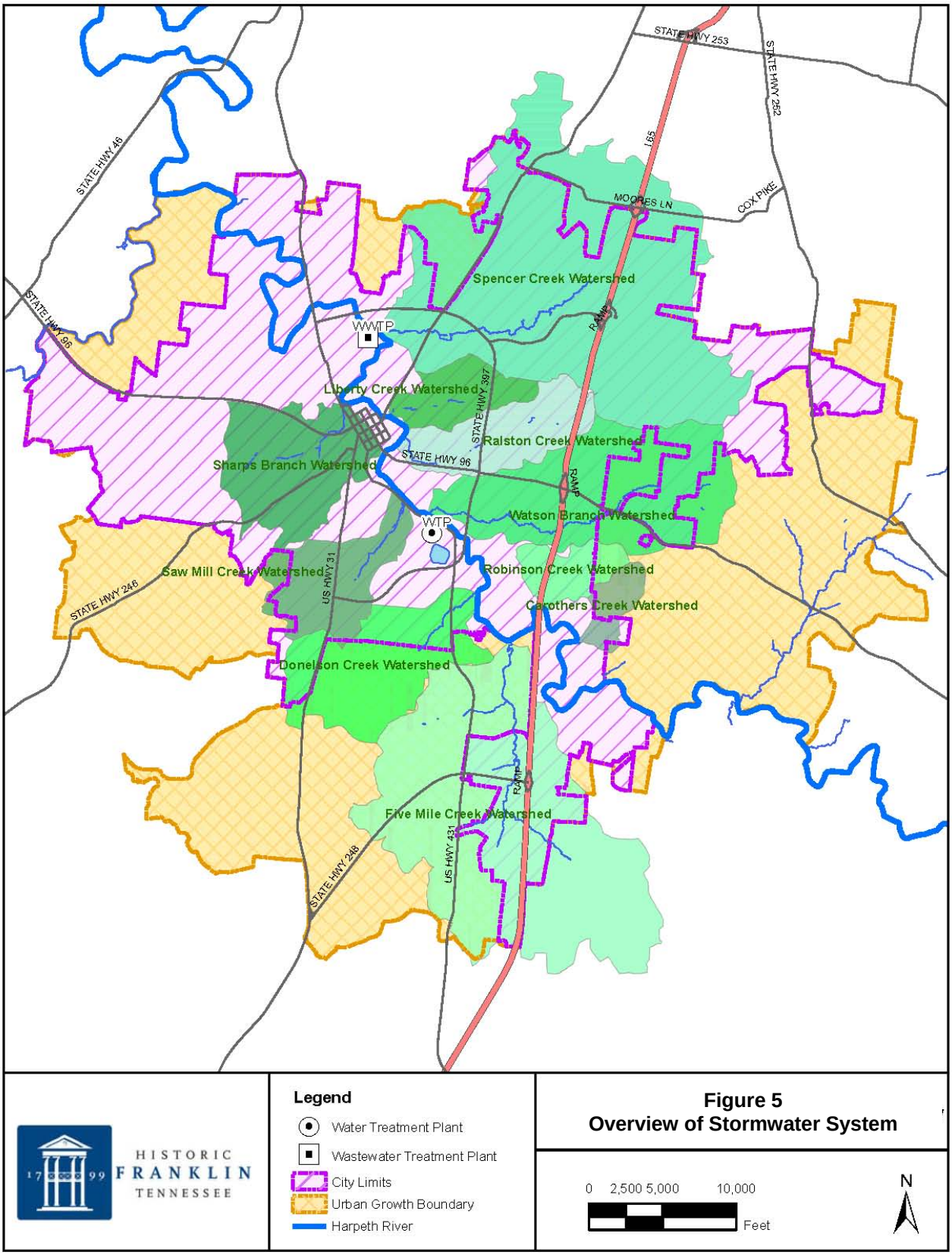

Figure 5
Overview of Stormwater System