



Executive Summary

1.1 Background and Purpose

This report serves as an update to the previous, comprehensive Wastewater Treatment Master Plan for the City of Leavenworth prepared by Black & Veatch (B&V) in 2002. In accordance with the current National Pollutant Discharge Elimination System (NPDES) permit, this Master Plan Update will provide a recommendation for the implementation of disinfection facilities and an evaluation of facility improvements to meet the proposed nutrient goal levels. In addition, this report includes an update to the collection system Inflow and Infiltration (I&I) Reduction Program. The contents of this report fulfill the requirements outlined in the current permit, which has been included in *Appendix A*.

1.2 Disinfection Improvements

The Kansas Department of Health and Environment (KDHE) has established disinfection requirements for wastewater facilities that discharge to receiving waters in the State of Kansas. The City's current permit mandates the disinfection of treated effluent from April through October each year with facilities on line and able to disinfect by December 31, 2012.

In compliance with the permit, this study evaluated two alternatives to implement disinfection at the Leavenworth WWTP; (1) Bulk Sodium Hypochlorite, and (2) Ultraviolet (UV) Light. The evaluation consisted of a regulatory review, technology review, bench scale testing of chlorine and UV, conceptual layout development, and an economic and non-economic evaluation. The economic evaluation considered capital costs and operations and maintenance (O&M) costs.

Based on the results of this evaluation, UV disinfection is recommended for implementation at the Leavenworth WWTP. Recommended design criteria and a conceptual layout of the UV Disinfection Facility is included in Chapter 3.0.



1.3 Nutrient Removal Evaluation

The nutrient removal improvements study conducted for this report included the identification and development of a preferred process that could be implemented on the existing WWTP site to accomplish the nutrient removal goals outlined in the permit. In addition, the evaluation addressed the potential for nutrient credit trading through external and internal sources, although, this practice is not currently endorsed by KDHE. The concept of nutrient credit trading is based on the broad view of nutrient reduction on a regional level. Through nutrient credit trading, nutrient removal goals are still achieved from a regional perspective. While this concept has its merits, the evaluation indicated that it is unattractive from an economic standpoint.

The Activated Sludge Process was identified as the process that could be implemented on the existing WWTP site to accomplish the nutrient removal goals outlined in the permit. Chapter 2.0 contains a more detailed description of the activated sludge process. The project team evaluated this process and identified operational changes, biological treatment additions, and physical and chemical treatment additions needed to meet the three levels of nutrient goals. The evaluation also included the development of capital and O&M costs.

It is also important to note that before making a commitment to a specific process, the condition of the existing facilities should be assessed. If the trickling filter media and structures have significant remaining useful life, then other processes may be more economical.

1.4 Collection System – I&I Assessment and Reduction Plan

The City of Leavenworth, with the assistance from TREKK Design Group, LLC (TREKK) has developed the I&I Assessment and Reduction Plan included in Chapter 4.0 which presents procedures for identifying and cost-effectively reducing extraneous wet-weather induced wastewater flows within the City. The plan also presents a recommended schedule for identifying and eliminating I&I sources by the year 2025.



The City has already completed several I&I related rehabilitation projects identified in the *Sanitary Sewer Evaluation Study – SUB01* (Wade, 2005). Despite these repairs, the City is still experiencing substantial peak wet weather flow at the WWTP during rain events. This indicates the need for additional I&I elimination.

It is recommended that the City continue with its efforts to identify and eliminate cost effective I&I from their collection system. Through an evaluation of the previous study by Wade, TREKK has developed a prioritized “plan of attack” for eliminating the remaining cost effective I&I from SUB01 and prepared an assessment and reduction plan for the remaining system. These recommendations are included in Chapter 4.0.

Implementation of this improvement plan will require the City to continue with the main line rehabilitation program and initiate a manhole rehabilitation program and a private sector I&I disconnect program. The ultimate success of this improvement plan for reducing wastewater surcharges and backups will depend largely upon the success of continuing and implementing these programs. Partial implementation will not result in satisfactory reductions and transport of peak wet-weather-induced wastewater flows. The recommended improvement plan also entails flow monitoring of the collection system. The previous collection system flow monitoring was conducted as part of the *Wastewater Master Plan* (B&V, 2001). The collection system flow monitoring data is over 10 years old and may not accurately represent current flows in the system.

The total estimated cost to perform the recommended improvements to the mini-basins within Sub-System 01 and additional flow monitoring in the remaining subsystems is approximately \$4,063,000.

1.5 Implementation

Chapter 5.0 summarizes implementation recommendations for the proposed disinfection facilities and provides a phasing plan for future nutrient removal facilities at the Leavenworth WWTP. In addition, the implementation chapter discusses other plant improvements to consider, future staffing levels, improvements to plant hydraulics, site considerations, capital and O&M costs, and project schedule.



Capital and O&M costs for implementing UV Disinfection are included in *Table ES-1* and a proposed project schedule is included in *Table ES-2*. Capital and O&M costs for implementing nutrient removal at the three goal levels are included in *Table ES-3*.

Table ES-1		
Capital and O&M Costs for UV Disinfection		
	UV Disinfection and Generator	3,248,000
CAPITAL COSTS	GENERAL REQUIREMENTS 12%	400,000
	SITWORK 10%	300,000
	ELECTRICAL & I&C 22%	800,000
	CONTINGENCY 25%	800,000
	CONSTRUCTION SUBTOTAL	5,548,000
	ENGINEERING 20%	1,100,000
	TOTAL CAPITAL COST	6,648,000
O&M COSTS	Annual O&M Cost	188,000
	20-year PW of O&M	3,074,000
	TOTAL PW COST	9,722,000

Table ES-2	
Disinfection Compliance Schedule	
Item	Months
Testing & Preselection	3 (April 2011)
Detailed Design	9 (January 2012)
Bidding & Award	2 (March 2012)
Construction	11 (February 2013)
Start-up	1 (March 2013)



Table ES-3				
Capital and O&M Cost for Various Levels of Nutrient Removal				
Phase of Treatment	Facility	Goal Level 1	Goal Level 2	Goal Level 3
Preliminary Treatment	EQ Basin	1,814,500		
Primary Treatment	Fermenter	601,000		
	Gravity Thickener/Fermenter PS	818,000		
	Gravity Thickener	251,000		
Secondary Treatment	BNR	7,663,500		
	Blower Building	1,987,000		
	Final Sludge PS	2,066,000		
	Final Clarifiers	3,992,000		
Tertiary Treatment	Intermediate Pumping Station	1,053,200		
	Filters		4,006,000	
Disinfection	Disinfection			
Solids	WAS Thickening	1,388,500		
	Aerated TWAS Storage	696,000		
Ancillary	Chemical Feed		944,000	
	Additional Lab/Storage Space	393,000		
COST MULTIPLIERS	SUBTOTAL	22,723,700	4,950,000	0
	GENERAL REQUIREMENTS 15%	3,400,000	700,000	0
	SITWORK 15%	3,400,000	700,000	0
	ELECTRICAL & I&C 25%	6,500,000	1,400,000	0
	CONTINGENCY 30%	10,800,000	2,300,000	0
	CONSTRUCTION SUBTOTAL	46,823,700	10,050,000	0
	ENGINEERING 20%	9,400,000	2,000,000	0
TOTAL CAPITAL COST	56,223,700	12,050,000	0	
O&M COSTS	Annual O&M Cost	666,000	673,000	749,000
	20-year PW of O&M	10,890,000	11,004,000	12,247,000
TOTAL PW COST		67,113,700	23,054,000	12,247,000