City of Boulder

Wastewater Utility MASTER PLAN

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List of Acronyms

ADWF	Average Dry Weather Flow
AWWA	American Water Works Association
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
BVCP	Boulder Valley Comprehensive Plan
CCTV	Closed-Circuit Television
CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Discharge Permit System
CFR	Code of Federal Regulations
CIP	Capital Improvement Program
COD	Chemical Oxygen Demand
DAFT	Dissolved Air Flotation Thickening
DCS	Design and Construction Standards
DMR-QA	Discharge Monitoring Report-Quality Assurance
DRCOG	Denver Regional Council of Governments
EDC	Endocrine Disrupting Compounds
FOG	Fats, Oil and Grease
FTE	Full Time Equivalent
GFAA	Graphite Furnace Atomic Absorption
GIS	Geographic Information System
GRE	Grease Removal Equipment
HVAC	Heating, Ventilation, and Air Conditioning
ICP	Inductively Coupled Plasma
ICPMS	Inductively Coupled Plasma Mass Spectrometry
IPT	Industrial Pretreatment
IT	Information Technology
LIMS	Laboratory Information Management System
LWM	Liquid Waste Management
MAHL	Maximum Allowable Headworks Loading
mgd	million gallons per day
mg/l	milligrams per liter

MS4	Municipal Separate Storm Sewer System
NP	Nonylphenol
O&M	Operations and Maintenance
P&DS	Planning and Development Services
POTW	Publicly Owned Treatment Works
PQL	Practical Quantitation Limitation
QA/QC	Quality Assurance and Quality Control
SIU	Significant Industrial User
SSO	Sanitary Sewer Overflow
TAZ	Traffic Analysis Zone
TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
UMMS	Utilities Maintenance and Management System
USEPA	United States Environmental Protection Agency
UV	Ultra Violet
WEF	Water Environment Federation
WEL	Wastewater and Environmental Laboratory
WQES	Water Quality and Environmental Services
WQSP	Water Quality Strategic Plan
WRAB	Water Resources Advisory Board
WUSA	Wastewater Utility Service Area
WWCSMP	Wastewater Collection System Master Plan
WWTPMP	Wastewater Treatment Plant Master Plan
WWUMP	Wastewater Utility Master Plan

EXECUTIVE SUMMARY

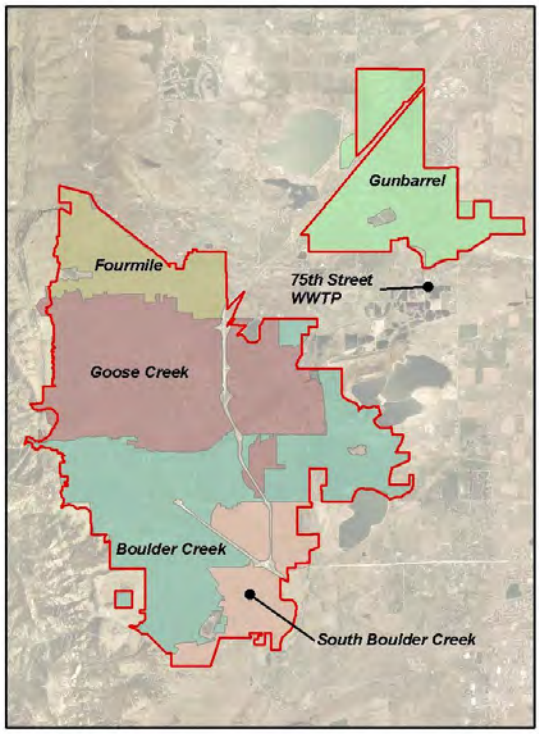
Introduction

The Wastewater Utility Master Plan (WWUMP) is the overarching planning document that is intended to present key issues, programs, projects and associated budgets for the collection system, wastewater treatment plant and water quality programs. The WWUMP is supported by three primary planning documents for the Wastewater Utility: the Wastewater Collection System Master Plan (WWCSMP), the Wastewater Treatment Plant Master Plan (WWTPMP), and the Water Quality Strategic Plan (WQSP).

Boulder's wastewater collection system and the 75th Street WWTP serve residences and businesses within the 26 sq. mile Wastewater Utility Service Area (WUSA). Areas outside the WUSA boundary are served by other utility districts or septic systems. Boulder's wastewater collection system currently serves a population of approximately 110,000 people and 101,000 employees associated with commercial and industrial business. Projected growth is anticipated to occur primarily through in-fill and redevelopment projects resulting in an estimated 128,000 people and 156,000 employees within the WUSA.

A series of guiding principles were used to define the planning process for the Utility. These guiding principles are based on Boulder's planning approach to community sustainability through evaluating social, environmental and economic impacts associated with various program and projects within the city. Specifically, the three guiding principles for the WWUMP are:

- Protect Public Health and Safety
- Protect Boulder's Natural Resources and the Environment
- Maximize the use of the Wastewater Utility's Funds



Boulder's Wastewater Utility Service Area encompasses 26 sq.mi. and contains five interceptor sewer basins

Wastewater Treatment Plant Master Plan

The Wastewater Treatment Plan Master Plan (WWTPMP) documents past decisions, the current facility, and presents the approach that has been used to reach decisions on process selection and introduce some future decisions that will be facing the utility. To continue to provide the level of service required by federal regulations and match the expectations of the community presented in the BVCP Goals, ongoing improvements to the treatment facility are necessary.

The WWTP was upgraded in 2008 to meet future wastewater treatment capacity demands and new ammonia-nitrogen limits that were incorporated in the CDPS permit. The upgrades included improvements to both the liquid stream treatment and solids dewatering processes (Phase 1). The current treatment capacity is 25.0 million gallons per day (mgd) on a maximum month basis and provides adequate capacity to meet population growth past 2025 (the current average annual flow rate is approximately 15 mgd). The Phase 1 improvements also kept the future total nitrogen discharge at or below the current level. The solids dewatering process improvements increased solids from the liquid stream treatment process and reduced the volume of dewatered solids that must be transported from the WWTP site.

Phase 1B construction, currently planned for 2010-2011, will include a UV disinfection system, solids stabilization (anaerobic digester) improvements, and possibly improvements to the headworks facility. Phase 2 construction, scheduled for 2020, includes expansion of the bioreactor with improvements to biologically remove nitrate and phosphorus.

WWTP Evaluation

Even though the City of Boulder recently completed $45 million in major improvements to the liquid and solids handling processes at the 75th Street Wastewater Treatment Plant, new discharge permit requirements are expected in 2010 and will require bringing the entire facility up to the same level of treatment capacity. As such, the City is currently in the process of evaluating the WWTP's treatment process capabilities – specifically focusing on the following three areas:

- Evaluate the plant's anaerobic digestion process (capacity, mixing, heating, etc.) and recommend improvements to provide greater capacity and operational stability.
- Evaluate UV disinfection alternatives to replace the existing gas chlorine and sulfur dioxide systems.
- Evaluate the WWTP's ability to meet the City's upcoming CDPHE permit effluent.

The WWTP Evaluation project was completed in October 2009. The evaluation included recommendations at various plant processes including the following:

- A new UV (ultraviolet) Disinfection system to replace the gaseous chlorine and sulfur dioxide systems.
- New digester mixing to replace the existing gas mixing system.
- Headworks improvements including bar screen replacement, grit conveyance, and screenings and grit removal.

The City is in the process of selecting an engineering consultant to provide the design services. The design is scheduled for 2010, with an anticipated construction bid in late 2010 or early 2011. The construction is estimated at $8,000,000 to $9,000,000.

Future WWTP Modifications

Discharge permit limits are revisited every five years, and it is anticipated that some level of TIN and phosphorus removal may be required by future discharge permits. Additionally, the Boulder WWTP may be required to remove microconstituents. Microconstituents include very small particles such as endocrine disrupting compounds and disinfection byproducts. Other future projects identified in the CIP include modifications to, or the replacement of the Headworks facility.

Wastewater Collection System Master Plan

The WWCSMP is a comprehensive planning document that assesses the conveyance capacity of Boulder's sanitary sewer system and identifies recommendations with associated capital cost estimates to resolve conveyance capacity deficiencies.

Collection System Analysis

The purposes of the conveyance system analysis were to 1) document the analysis of the existing collection system during dry weather and wet weather flows and 2) to identify and characterize hydraulic capacity issues. By analyzing the existing collection system under existing and buildout flow conditions, problem areas were identified for both land use scenarios.

The primary source of data that was used for the collection system hydraulic model and analysis was Boulder's sanitary sewer Geographic Information System (GIS) layers for manholes and sewer pipes. The collection system pipes with identified capacity limitations, established from

the model results, were examined to identify likely hydraulic issues under the various flow scenarios. There are a total of 138 pipes in the analyzed collection system with hydraulic deficiencies identified. A detailed problem identification and characterization process was completed to better understand the nature and extent of these problems. The hydraulic problems were separated into two categories: Type A and Type B. Type A problems consisted of a series of under capacity pipes that were hydraulically connected to one another. Type B problems are isolated hydraulic restrictions that are not hydraulically connected to other problem locations or series of problem pipes.

Recommended Collection System Improvements

The recommended system improvements were developed to resolve the existing and future capacity issues are shown on the following figure. This figure includes both improvements that address Type A and Type B problems.

The recommended improvements were grouped in three tiers to establish implementation priority:

- Tier 1 projects address Type A problems and have the highest priority;
- Tier 2 projects also address Type A problems but have lower priority compared to Tier 1;
- Tier 3 projects address Type B problems which have the lowest priority.

The improvement priorities were assigned based on a number of qualitative factors including the flow conditions in which they occur (existing versus future), extent of the problem, potential for sanitary sewer overflows (SSOs) and service lateral backups, ease of constructability, and relative benefit over other improvement projects. The resulting implementation priorities and associated estimates of capital construction cost are shown in the following table.

Improvement Priority	Capital Construction Cost
Tier I	$4,977,000
Tier II	$22,664,000
Tier III	$2,296,000
	$29,937,000

Collection System Operations and Maintenance

The WWCSMP project team reviewed the collection system operations and maintenance (O&M) procedures. The purpose of this O&M procedure was to review the current state of collection system O&M practices and evaluate potential increases in service levels due to trends

in the regulatory environment in the western United States. In addition, the 2008 QualServe peer review program and self assessment survey evaluated the Utility's overall performance, efficiency and customer service as well as maintaining industry best management practices.

Both the QualServ program and the WWCSMP O&M review found that the Gravity System's Maintenance group operates and maintains the collection system such that it continues to provide a high level of service to its existing customers.

Collection System Rehabilitation Budgeting

Boulder developed a methodology for determining the mileage and cost of the 20-year CIP for rehabilitating wastewater pipes and manholes. This methodology was based on spreadsheet model that characterized pipe failure as a function of time to assist in forecasting long-term budgetary needs for rehabilitation of sanitary sewer pipe. This analysis resulted in a recommendation for an annual manhole and sewer pipe rehabilitation budget of $850,000. This methodology was given an independent review which recommended that an annual sewer rehabilitation budget of $500,000 would be adequate for the 20-year planning period.

Water Quality Strategic Plan

The Water Quality Strategic Plan (WQSP) has been developed, and will be implemented by the City's Water Quality and Environmental Services (WQES) Group within the city of Boulder Public Works, Utilities Division. The Industrial Pretreatment (IPT) and Laboratory Services programs are included in this WQSP as they are directly related to the wastewater utility planning effort.

The purpose of the WQSP is to develop clear and concise water quality goals, develop recommendations and performance measures to achieve these goals, and provide a process to address current and future water quality challenges. The WQES Group is funded through the city's Water, Wastewater, and Stormwater enterprise funds and supports the Utilities Division water services with seven programs.

Water quality goals were developed using an inventory of existing water quality goal statements found in the City's master plans, policies, and regulations, starting with the BVCP. From this exercise, five goal statements were developed and include:

- Provide safe and high quality drinking water.
- Manage pollutants from wastewater and other point-sources.

- Manage pollutants from stormwater and other non-point sources.
- Protect, preserve and restore natural water systems.
- Conserve water resources.

WQSP Recommendations

The recommendations developed for the WQSP are based primarily on the objective of adopting citywide water quality goals, and integrating these goals into planning and policy instruments. In addition, the recommendations address strategies to meet an unprecedented number of new or proposed federal and state water quality regulations. The recommendations include:

- Evaluate and update policies in the Boulder Valley Comprehensive Plan to incorporate water quality goals. WQES staff will review and recommend updates to the BVCP to ensure incorporation of water quality goals. The BVCP is scheduled to be updated in 2010.
- Perform analyses on City plans, policies and projects to identify gaps in meeting water quality goals. WQES staff will review relevant plans, policies, and projects, such as master plans, design and construction standards, and the Boulder Revised Code to: 1) ensure that the City complies with all state and federal laws and regulations on water quality and environmental protections; and, 2) meet water quality goals.
- Develop annual work plans and water quality reports. Annual work plans and reports will be developed for each of the seven WQES Group programs. These programs include: Stormwater Quality, Water Quality Education, Water Conservation, Industrial Pretreatment, Drinking Water Quality, Water Quality Planning and Laboratory Services. Staff will use the work plans to direct program activities specific to the WQSP goals.
- Prepare for future water quality regulations. WQES staff will prepare for future water quality regulations, ensure regulatory compliance, and incorporate capital improvement requirements needed to meet regulations in the City's budget planning process.

Industrial Pretreatment Program

The City's IPT program is part of the Public Works, Utilities, Water WQES Group. The WQES Group serves as an in-house technical resource for Utilities and other City departments to help maintain compliance with various levels of regulations. The current, primary purpose of the city of Boulder IPT program is to control or limit the discharge of toxic or hazardous waste into the sanitary sewers and thus the City's 75th Street WWTP. The primary objectives of the IPT program are described as follows:

- To prevent the introduction of pollutants into the city of Boulder wastewater collection and treatment system that could interfere with plant operation.

- To prevent the pass-through of untreated pollutants into Boulder Creek.
- To improve recycling capabilities of sludge.
- To protect the general health and safety of wastewater treatment plant workers and downstream users.
- To encourage pollution prevention as a feasible alternative to treatment and disposal.

IPT Gaps, Deficiencies and Recommendations

In addition to the ongoing responsibilities of the IPT Program, special studies and/or additional programs are necessary to further characterize industrial and commercial discharges to the city's sanitary sewer system sources, support compliance with WWTP discharge permit requirements and collect data and information in preparation for future regulatory requirements. The following programs or studies should be evaluated and modified or initiated as necessary.

- Fats, Oil and Grease Program
  - Evaluate potential modifications to the existing FOG program and regulations.
- Industrial Waste Survey
  - Consider initiating a comprehensive industrial waste surveys.
- Business Inventory Mailing
  - Send out business questionnaires to determine if targeted businesses continue to be non-significant or move into a significant industrial user category.

Wastewater and Environmental Laboratory Program

The WEL Program currently provides broader support for the WWTP including biosolids analysis, field services including water quality monitoring and management of the laboratory information management system (LIMS) and database system. WEL program responsibilities will continue to expand as increasingly complex and interrelated water quality regulations develop.

WEL Program Gaps, Deficiencies and Recommendations

In addition to the ongoing responsibilities of the WEL Program, special studies and/or additional programs are necessary to further characterize WWTP performance, characterize water quality conditions in Boulder Creek and provide compliance support for State and Federal regulations. It is recommended that the following programs or studies should be evaluated and modified or initiated as necessary.

- Evaluate Laboratory Size and Function
  - Perform Business Case Evaluation on the Wastewater and Environmental Laboratory Program
- Staffing Analysis

- Review staffing levels compared to other municipalities.
- Laboratory Maintenance
  - Ongoing funding for equipment replacement and laboratory upgrades

Wastewater Utility CIP

The Wastewater Utility Master Plan (WWUMP) includes a comprehensive list of Wastewater Utility projects to be completed during the 20-year planning period. These include wastewater treatment plant capital and maintenance related projects, as well as wastewater collection system capital and maintenance related projects. The 2010-2030 Wastewater Utility Fund CIP has numerous line items identifying various projects for the WWTP and the sanitary sewer collection system. The significant CIP expenditures and Water Quality Strategic Plan (WQSP) funding fall into the following categories:

- WWTP Capital Projects
- WWTP Rehabilitation Projects
- WWCS Rehabilitation Projects
- WQSP Funding

WWTP Capital Projects

There are five (5) significant WWTP capital projects currently identified in the 20-yr CIP. The total cost of these projects (in 2008 dollars) is estimated at $40,000,000. These projects, their estimated escalated cost, and their projected timing are listed below:

- UV Disinfection – $4,400,000 – 2010
- Digester Modifications – $4,000,000 – 2010
- Headworks Improvements – $15,600,000 – 2016
- Phase 2 Improvements (Denitrification & Phosphorus removal) – $15,000,000 – 2020
- Endocrine Disrupting Compounds (EDC's) removal – $19,000,000 – 2030

Utilities staff is currently completing a WWTP Evaluation project which is an analysis of the UV Disinfection, Digester Modifications, and Headworks Improvements projects. This analysis will present several process alternatives for the various facilities, their respective estimated costs, and will provide a recommendation regarding their overall priority.

WWTP Rehabilitation Projects

In addition to the WWTP capital projects listed above, there are numerous WWTP rehabilitation projects identified in the CIP to address the plant's aging infrastructure. These projects are listed in the CIP in years 2016 through 2030, and have a combined cost (in 2008

dollars) of $8,500,000. Utilities staff will continue to review the WWTP Rehabilitation analysis annually to identify the estimated timing for the various rehabilitation projects within the 6-year CIP.

WWCS Rehabilitation Projects

Lastly, there are numerous wastewater collection system improvement projects currently identified in the 20-yr CIP. These projects were identified in the Wastewater Collection System Master Plan which was accepted by the WRAB in December 2008. The CIP currently lists four (4) Tier 1 projects (highest priority) and seven (7) Tier 2 projects (second highest priority). The total cost (in 2008 dollars) for these eleven projects is estimated at $28,000,000. The Tier 1 and Tier 2 project groups are listed below with their estimated cost and projecting timing:

- Tier 1 Projects – $5,000,000 – 2016 through 2021
- Tier 2 Projects – $23,000,000 – 2021 through 2030

WQSP Funding

The Water Quality Strategic Plan (WQSP) is implemented by the Water Quality and Environmental Services (WQES) Group. This include recommendations associated with the Water Quality Strategic Plan, Industrial Pretreatment Program and Wastewater and Environmental Laboratory Program. These recommendations provide a strategy that focuses on maintaining and operating existing programs and planning for future regulations and their implications on City regulatory requirements.

The WQSP elements, including Industrial Pretreatment, Wastewater Environmental Laboratory and associated capital projects, are currently being approached in the following funding manor. It should be noted that this element of the WWUMP plan is more of an opportunistic program such that if funds are available, some recommendations can be moved forward as described in the Action Plan recommendations within the WQSP document.

- WQSP Recommendations
    - Requires a $50,000 one-time investment, a $94,000 on-going adjustment to base, and an additional 1.0 FTE.
- Industrial Pretreatment Program
    - Requires a $30,000 one-time investment.
- Wastewater and Environmental Laboratory Program
    - Requires a $30,000 one-time investment and $30,000 ongoing adjustment to base plus 0.5 FTE
- Near Term Capital Improvements

- Requires a $196,000 one-time investment plus an ongoing $124,000 adjustment to base and an additional 1.5 FTE

Investment Program Options

Boulder's Wastewater Utility is financed through an enterprise fund through monthly payments from the city's rate payers. The Wastewater Utility addresses projects both at the WWTP and also in the wastewater collection system. The funding is allocated to a variety of projects and programs according to the facilities' greatest needs. City staff prioritizes the various projects in planning level studies and evaluations, and then identifies the projects and their associated schedule and fee in the CIP.

The WWUMP presents three Utility investment programs based on different levels of funding including the following:

- Fiscally Constrained Plan
- Action Plan
- Vision Plan

These programs implement the policy direction of the WWUMP at the three funding levels.

Fiscally Constrained Plan

The Fiscally Constrained Program reflects an investment strategy which assumes a Wastewater Utility Fund rate increase of two percent (2%) in 2010, and a three percent (3%) annual increase in years 2011 through 2030. Under the Fiscally Constrained program, there are numerous programs and projects which would be either eliminated or have reduced funding. These include the following:

- Either the UV Disinfection or the Digester Modifications project (both scheduled for construction in 2010) would need to be eliminated from the 20-year CIP
- The 2016 Headworks Improvements project would be eliminated from the 20-year CIP
- The 2020 Phase 2 Improvements project (Nutrient Removal) would be eliminated from the 20-year CIP
  - This project would likely be required to address CDPHE permit issues
- The 2030 Endocrine Disrupting Compounds (EDC) removal project would be eliminated from the 20-year CIP
  - This project would likely be required to address CDPHE permit issues
- The WWTP Rehabilitation funding would be eliminated from the 20-year CIP
- The Wastewater Collection System Replacement projects (Tier 1 and Tier 2) would be eliminated from the 20-year CIP

- The Sanitary Sewer System Rehabilitation funding would be eliminated from the 20-year CIP
- Future budget supplementals would be eliminated from the 20-year CIP

Action Plan

The Action Program reflects an investment strategy which assumes an annual Wastewater Utility Fund rate increase of four percent (4%) in years 2016 through 2030, with the following exceptions. The Action Plan will follow the recommended 6-year (2010-2015) CIP which includes the following rate increases: 2010=2%, 2011-2012=3%, 2013=4%, and 2014-1015=6%. There is one period of increased funding which is necessary to maintain a positive fund balance in 2030. Two consecutive years (2019 and 2020) of nine percent (9%) rate increases would be required to fund the Nutrient Removal project. Under the Action Plan, there are a few programs and projects which would be either eliminated or have reduced funding. These include the following:

- The 2030 Endocrine Disrupting Compounds (EDC) removal project would be eliminated from the 20-year CIP
  - This project would likely be required to address CDPHE permit issues
- The Wastewater Collection System Replacement projects (Tier 2) would be eliminated from the 20-year CIP

Vision Plan

The Vision Program reflects an investment strategy which assumes an annual Wastewater Utility Fund rate increase of four percent (4%) in years 2010 through 2030 with the following exceptions. There are three periods of increased funding necessary to maintain a positive fund balance in 2030. Two consecutive years (2014 and 2015) of eight percent (8%) rate increases would be required to fund the Headworks Improvements project. Two consecutive years (2019 and 2020) of eight percent (8%) rate increases would be required to fund the Nutrient removal Improvements project. Two consecutive years (2029 and 2030) of eight percent (8%) rate increases would be required to fund the EDC removal project. Under the Vision Plan, there are no programs that would have reduced funding.

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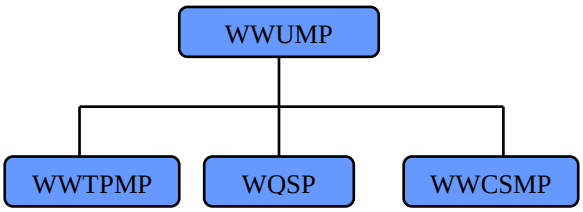
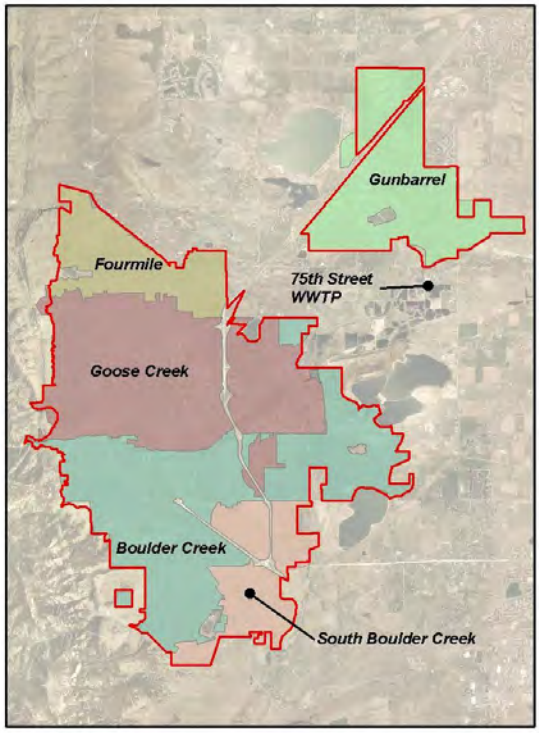
INTRODUCTION AND BACKGROUND

The Wastewater Utility Master Plan (WWUMP) is the overarching planning document for Boulder's Wastewater Utility (Utility). The purpose of the WWUMP is to present key issues, programs, projects and associated budgets for the collection system, wastewater treatment plant and water quality programs. The intent of the WWUMP is to present information regarding the Utility operations, programs and funding plans such that department coordinators, policy makers, and interested citizens can better understand Boulder's Wastewater Utility program. The WWUMP is supported by three primary planning documents for the Wastewater Utility: the Wastewater Collection System Master Plan (WWCSMP), the Wastewater Treatment Plant Master Plan (WWTPMP), and the Water Quality Strategic Plan (WQSP). These three supporting plans contain the technical analysis and recommendations that are used to develop recommendations supporting the operations of the city's wastewater utility. Future updates to the WWUMP and the three supporting documents are anticipated to be done concurrently. Typically utility master plans are updated on a 5-year basis. This update period can be extended if the level of development and infrastructure improvements is not significant.



The Wastewater Utility Master Plan is the overarching planning document for the Utility

Boulder's wastewater collection system and the 75th Street WWTP serve residences and businesses within the Wastewater Utility Service Area (WUSA). The WUSA is comprised of Boulder Valley Comprehensive Plan (BVCP) Area I (within Boulder city limits) and Area II (areas adjacent to the city limits that may be subject to annexation in



Boulder's Wastewater Utility Service Area encompasses 26 sq.mi. and contains five interceptor sewer basins

the future). Areas outside the WUSA boundary are served by other utility districts or septic systems. The resulting WUSA contains approximately 16,340 acres (26 sq. miles).

Boulder's wastewater collection system currently serves a population of approximately 110,000 people and 101,000 employees associated with commercial and industrial business. Projected growth is anticipated to occur primarily through in-fill and redevelopment projects resulting in an estimated 128,000 people and 156,000 employees within the WUSA.

Wastewater Utility Planning Process and Goals

The mission of the Utilities Division is to provide quality water services, as desired by the community, in a manner which emphasizes efficient management of fiscal and natural resources, and protects human and environmental health. In general, the planning process for the Wastewater Utility (Utility) focuses on identifying opportunities that continue the high level of service provided to its customers and evaluating the associated cost of the opportunities. The opportunities and recommendations resulting from the planning process take the form of capital construction projects; system rehabilitation and repair projects; preparing systems and operational processes that anticipate future regulations; and evaluating staffing needs. Wastewater and water quality planning projects, such as the WWTMP, WQSP, and WWCSMP, are the primary tools that provide the detailed analysis that result in the opportunities and recommendations contained within the WWUMP.

The three wastewater and water quality planning documents also include a financial element as they provide costs associated with their specific recommendations. The cost implications with these water quality and wastewater service opportunities are then evaluated against annual operating budgets for the Utility in a Business Plan approach. The Business Planning approach classifies the various projects and programs encompassed by the Utility according to criteria of 1) essential 2) desirable and 3) discretionary. As many of the programs and projects for the Utility are driven by water quality regulations, there are very few items that are classified as desirable or discretionary. However, those projects and programs that are identified as desirable or discretionary have a lower implementation priority when it comes to the budgeting process.

Implementation options for the various programs and projects are evaluated at three funding levels, according to a Fiscally Constrained Plan, Action Plan, and Vision Plan which are defined as:

- Fiscally Constrained Plan (Current Funding) – is a prioritized, refocused service plan within existing budget targets.
- Action Plan – the next step of service expansion or restoration that should be taken when funding is available either within current revenue sources or if new sources are approved.
- Vision Plan – the complete set of services and facilities desired by the community and aligned with values and policies, with alternative proposals to fund them.

Another valuable source of information relating to improvement opportunities within the Utility is from the QualServe program offered by the American Water Works Association (AWWA) and the Water Environment Federation (WEF). The QualServe program is a peer review program, coupled with a self-assessment survey, performed in late 2008 to assist the Utilities Division in evaluating the division's overall performance, efficiency, and customer service as well as maintaining industry best management practices. Results from this peer review are included in the WQSP, WWTPMP, and the WWCSMP sections of the WWUMP.

Water Quality Strategic Plan Goals

The WQSP is the first comprehensive planning effort to address water quality policies and priorities for the city of Boulder (City). The purpose of the WQSP is to develop clear and concise water quality goals, develop recommendations and performance measures to achieve these goals, and provide a process to address current and future water quality challenges. Goals for the water quality strategic plan are to:

Water Quality Strategic Plan is a comprehensive planning effort to address water quality policies and priorities for the city and its water facilities like Barker Reservoir shown here.

- Provide safe and high-quality drinking water.
- Manage pollutants from wastewater and other point sources.
- Manage pollutants from stormwater and other non-point sources.
- Protect, preserve and restore natural water systems.
- Conserve water resources.

Wastewater Treatment Plant Master Plan Goals

The city's Wastewater Treatment Master Plan (WWTPMP) was completed in June 2007 with the purpose and goal to document past decisions, describe the current treatment facility, and

present recommendations for improving the facility in the future. The WWTPMP also documents how the recommended improvements were selected and how these improvements will allow Boulder to meet anticipated future effluent regulations and effluent water quality requirements. The key tasks associated with this included the following:

- Identify current wastewater treatment plant (WWTP) improvements and how they conform to City and County policies and goals;
- Describe how the WWTP is currently operated and compare to historic operations;
- Discuss the economic impacts of the recommended WWTP improvements;
- Provide an implementation plan for improvements;
- Provide strategies for measuring performance of systems;
- Describe anticipated future requirements and develop an implementation plan.

Additionally, the WWTPMP discusses the relationship of the WWTP improvements in conjunction with the city and Boulder Valley Comprehensive Plan (BVCP) goals. These include:

- Improving and protecting water quality
- Reducing waste and improving recycling and reuse of biosolids
- Protecting the general health and safety of plant workers
- Meeting future wastewater capacity demands
- Creating a sustainable community through;
  - Improved energy efficiency
  - Minimization of greenhouse gas emissions
  - Cost savings
  - Minimizing chemical usage

Boulder's Wastewater Treatment Facility

Wastewater Collection System Master Plan Goals

The primary goals of the WWCSMP are to identify capacity problems within the collection system and develop a prioritized list of recommended capital projects to resolve the capacity limitations. These goals were met through the following tasks:

- Develop land use projections within the Wastewater Utility Service Area (WUSA) and associated wastewater flows
- Develop a computer model of the sewer collection system based on the city's Geographic Information System (GIS) data
- Analyze the existing collection system under existing and future land use conditions

- Identify capacity problems within the collection system
- Develop improvement alternatives and identify recommended improvement projects
- Prioritize the recommended improvements and develop planning level estimates of capital construction cost.

Current Environment

Boulder's wastewater treatment plan and collection system are continuously being improved through planning, system rehabilitation and maintenance, and capital improvement projects. This section provides an overview of the current environment of the wastewater system through a general summary of treatment and collection system improvements that have occurred since the previous master plans were published.

Wastewater Treatment Plant Facility

The City of Boulder 75th Street WWTP is located at 4049 N. 75th Street in the SW ¼ of Section 13, T1N, R70W, Boulder County, Colorado. Treated effluent from the WWTP is discharged to Segment 9 of Boulder Creek. The WWTP is defined as a major facility and operates under a CDPS permit (Number CO-0024147) dated February 1, 2003, which expired on January 31, 2008. The permit has been administratively extended and the renewal date is currently in review with CDPHE.

The WWTP was upgraded in 2008 to meet future wastewater treatment capacity demands and new ammonia-nitrogen limits that were incorporated in the CDPS permit. The upgrades included improvements to both the liquid stream treatment and solids dewatering processes (Phase 1). The current treatment capacity is 25.0 million gallons per day (mgd) on a maximum month basis and provides adequate capacity to meet population growth past 2025 (the current average annual flow rate is approximately 15 mgd). The Phase 1 improvements also kept the future total nitrogen discharge at or below the current level. The solids dewatering process improvements increased solids from the liquid stream treatment process and reduced the volume of de-watered solids that must be transported from the WWTP site.

The WWTP is continuously looking toward ways to optimize operations; including energy improvements. The City is currently in the process of constructing a one megawatt (1,000,000 watts) solar photovoltaic (PV) system, located at the WWTP. The PV system is scheduled to be operational in December 2009, or early 2010. The PV system is located on approximately five acres, and will provide approximately 15 percent off the average daily power required at the WWTP. City staff has estimated that annual energy savings will be approximately $43,000.

Wastewater Utility Permitting

The City's WWTP is permitted by the Colorado Department of Public Heath and Environment (CDPHE). The city is required to meet various effluent limit parameters identified in the Colorado Discharge Permit System (CDPS) discharge permit. This permit is typically renewed on a five-year cycle. It is expected that CDPHE will initiate the permit renewal process in the first quarter of 2010. City staff expects the final permit will be completed in the third or the fourth quarter of 2010.

It is expected that the new permit will require more stringent effluent limit parameters such as ammonia, metals, and additional nitrogen series. New regulations often result in the need for WWTP improvement projects which provide a greater level of treatment. City staff does not anticipate that this new permit will require significant plant modifications.

WWTP Evaluation

Even though the City of Boulder recently completed $45 million in major improvements to the liquid and solids handling processes at the 75th Street Wastewater Treatment Plant, new discharge permit requirements are expected in 2010 and will require bringing the entire facility up to the same level of treatment capacity. As such, the City is currently in the process of evaluating the WWTP's treatment process capabilities – specifically focusing on the following three areas:

- Evaluate the plant's anaerobic digestion process (capacity, mixing, heating, etc.) and recommend improvements to provide greater capacity and operational stability.
- Evaluate UV disinfection alternatives to replace the existing gas chlorine and sulfur dioxide systems.
- Evaluate the WWTP's ability to meet the City's upcoming CDPHE permit effluent.

The WWTP Evaluation project was completed in October 2009. The evaluation included recommendations at various plant processes including the following:

- A new UV (ultraviolet) Disinfection system to replace the gaseous chlorine and sulfur dioxide systems.
- New digester mixing to replace the existing gas mixing system.
- Headworks improvements including bar screen replacement, grit conveyance, and screenings and grit removal.

The City is in the process of selecting an engineering consultant to provide the design services. The design is scheduled for 2010, with an anticipated construction bid in late 2010 or early 2011. The construction is estimated at $8,000,000 to $9,000,000.

Phase 1B construction, currently planned for 2010-2011, will include a UV disinfection system, solids stabilization (anaerobic digester) improvements, and possibly improvements to the headworks facility. Phase 2 construction, scheduled for 2020, includes expansion of the bioreactor with improvements to biologically remove nitrate and phosphorus.

Wastewater Collection System

Boulder's wastewater collection system and the 75th Street WWTP serve residences and businesses within the WUSA. The WUSA is comprised of BVCP) Area I (within Boulder city limits) and Area II (areas adjacent to the city limits that may be subject to annexation in the future). Areas outside the WUSA boundary are served by other utility districts or septic systems. The resulting WUSA contains approximately 16,340 acres (26 sq. miles).

There are five sewer basins that contribute wastewater flow to the primary collector and interceptor system and ultimately to the WWTP. The five sewer basins and associated collector sewers are listed in Table 1.

TABLE 1 – SEWER BASINS

Sewer Basin	Area (acres)
Gunbarrel	2803
Fourmile	1677
Goose Creek	5076
Boulder Creek	5234
South Boulder Creek	1551
Total	16,430

The wastewater collection system includes gravity sewers, diversion manholes, one siphon and two lift station/forcemain systems that convey wastewater flow from the five sewer basins to the WWTP. Major features and gravity sewers by pipe size that compose the existing system are summarized in Table 2.

TABLE 2 - EXISTING SEWER SYSTEM SUMMARY

Collection System Feature / Sewer Basin	Gravity Sewer (miles)	Diversion Manholes	Lift Stations	Forcemains	Siphons
Gunbarrel	46.7	3	1 (City-owned)	1 (City-owned)	1
Fourmile	45.4	1	0	0	0
Goose Creek	119	9	0	0	0
Boulder Creek	118	10	0	0	0
South Boulder Creek	34	7	1 (Private)	1 (Private)	0

Recent improvements to the collection system primarily take the form of increased system reliability through repair/rehabilitation projects as well as operations and maintenance processes. Currently, the Utility is budgeting $750,000 per year or pipe repair and rehabilitation and $100,000 per year on manhole repair and rehabilitation. The Utility has also recently improved its collection system planning process through a comprehensive update of the collection system master plan.

Water Quality and Environmental Services

Boulder's Water Quality and Environmental Services (WQES) Group is included within the city of Boulder Public Works, Utilities Division. The WQES Group serves as an in-house technical resource for Utilities and other City departments to help maintain compliance with various levels of regulations. The WQES Group is funded through the city's Water, Wastewater, and Stormwater enterprise funds and supports the Utilities Division water services though multiple programs.

The Industrial Pretreatment (IPT) and Laboratory Services programs are included in this WQSP as they are directly related to the wastewater utility planning effort.

Industrial Pretreatment Program

The City's Industrial Pretreatment (IPT) Program is part of the WQES Group. The current, primary purpose of the city of Boulder IPT program is to control or limit the discharge of toxic or hazardous waste into the sanitary sewers and thus the City's 75th Street WWTP.

The City IPT program must comply with multiple regulatory requirements at the federal, state and local levels. The general philosophy behind national federal standards is to provide consistent application to all industrial users throughout the country. Local standards help to prevent the introduction of pollutants into the sewer system that would interfere with the

normal operation of the system or inhibit the biological process of the WWTP. In addition, local standards are enforced to optimize the cost effective method of WWTP sludge disposal (beneficial reuse) and to prevent any discharge that would result in pass-through of any pollutant resulting in a permit violation or adverse water quality impact of the receiving stream.

General activities of the City's IPT Program are:

- Work Group Involvement
- Monitor and Inspect all Permitted Industries for Compliance with Applicable Regulations.
- Implement Commercial/Domestic Wastewater Source Sampling Program.
- Continue to Implement the Silver Source Control Program.
- WWTP Monitoring

Currently, special studies conducted by the City's IPT Program include:

- Dental Waste Management Program
- Nonylphenol (NP) Outreach and Evaluation

Significant Industrial Users

In order to administer the regulations of the IPT program, authority to take enforcement action is needed. IPT program enforcement response can vary from informal action such as phone calls or warning letters to formal action such as administrative orders or judicial action. In 2007 enforcement response included reminder phone calls, meetings, demand inspections, warning letters, notices of violation. In 2008 enforcement also included penalty assessment at one facility.

The first objective of the IPT Program is to prevent the introduction of pollutants into the city's wastewater collection and treatment system that could interfere with the performance of the WWTP. Traditionally the pollutants of concern have been metals released from manufacturing operations. Table 1 details metals loading data from samples collected at the WWTP influent. In each case the annual average for the pollutant is well below the Maximum Allowable Headworks Loading (MAHL). In some cases loadings have stayed relatively stable in other cases loading have decreased considerably, as in copper and mercury.

Wastewater and Environmental Laboratory Program

The Wastewater and Environmental Laboratory (WEL)Program currently provides broader support for the WWTP including biosolids analysis, field services including water quality monitoring and management of the laboratory information management system (LIMS) and database system. WEL program responsibilities will continue to expand as increasingly complex and interrelated water quality regulations develop.

The WEL Program plays an important function in operational support testing for the wastewater plant operations, process optimization, backup and assistance to the Drinking Water Quality Program, analysis for wastewater collection system and storm drainage projects, and acting as a general resource for chemical safety information, both within Utilities and for other city departments. The WEL Program performed over 57,500 analyses in 2007.

Current Wastewater and Environmental Laboratory Program Special Studies

WEL program staff conduct multiple special studies to support the 75th Street WWTP and other city Departments. Current special studies are as follows.

- DMR-QA Study
- Practical Quantitation Limitation (PQL) Assessment/Development
- Site Specific PQL Development
- Boulder Creek Monitoring
- Copper Translator Development
- *E.* coli Study

Process Optimization Support Group

WEP program staff are actively involved in the WWTP Process Optimization Group. The Process Optimization Group provides WWTP technical input and laboratory analysis support to evaluate and solve WWTP problems that may arise. WEL program staff assistance was provided for the following projects in 2007 and 2008.

- Tracking Ammonia trends during construction
- Centrate/Thickener Study
- Trickling Filters- Decommissioning
- Volatile Acid/Alkalinity Evaluation
- New processes as they come on-line.

Metals Program

Metals analysis is an important component of the WEL Program, which conducted 16,528 metals analysis in 2007. In 2007 it is estimated that the metals program saved over $176,000 by providing metals analysis in-house versus contracting all metals analysis to an outside analytical laboratory.

Quality Control/Quality Assurance Program

Quality Assurance and Quality Control (QA/QC) comprise approximately 29 percent of the total sample load in the WEL Program. The QA/QC program allows continuous evaluation of analytical accuracy and precision, representativeness and scientific validity, which is required by both the USEPA and CDPHE. In 2007 WEL Program QA/QC Manual was updated. The manual establishes systematic, written policies and guidelines to be followed by all laboratory personnel and specifies minimum performance standard criteria to be used in the analytical process.

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KEY POLICIES AND ISSUES

Guiding Principles and Policies

A series of guiding principles, policies and implementation measures were used to define the planning process for the Utility. The guiding principles for the WWUMP are based on Boulder's planning approach to community sustainability through evaluating social, environmental and economic impacts associated with various program and projects within the city. Specifically, the three guiding principles for the WWUMP are:

- Protect Public Health and Safety
- Protect Boulder's Natural Resources and the Environment
- Maximize the use of the Wastewater Utility's Funds

In general, the policies that support the guiding principles noted above are defined by the Boulder Revised Code and the Boulder Valley Comprehensive Plan (BVCP). The WWTPMP, the WWCSMP, and the WQSP provide the implementation measures by defining specific planning elements, requirements, and recommendations, and, where applicable, identifying capital improvement projects.

Boulder's Gravity Systems Maintenance group protects public heath and the environment by reducing sewer back-ups through routine maintenance and system operations

The guiding principles listed above provide the framework to help the City maintain an environmentally sustainable program to provide waste disposal services for the City of Boulder residents and businesses

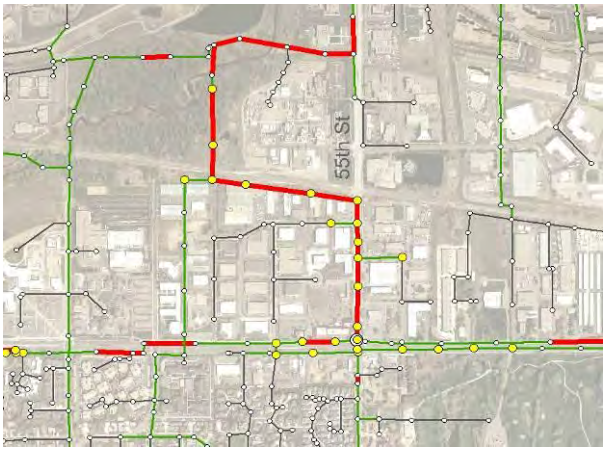
The approach of this section is to present the guiding principles, identify associated policies, and then present the more specific aspects, the implementation measures. Note this document does not attempt to repeat city code or other documents, but rather to capture the general intent and to include the most relevant specifics within the WWUMP. Existing policies related to each of the three guiding principles are summarized in the following sections. The implementation measures used in meeting these policies are shown in italics.

Principle #1 – Protect Public Health and Safety

The Utility protects the public heath and safety through capital projects associated with the collection system and wastewater treatment facility and through various programs within the Utility, including with the Water Quality and Environmental Services (WQES) group and the Gravity Systems Maintenance group.

Boulder Valley Comprehensive Plan

- Plan 8 Wastewater Treatment Master Plan
  - Define service area for the WWTP with determined and limited boundaries
    - √ *This policy is implemented with the WWTPMP and WWCSMP. These documents define the wastewater utility service area based on the BVCP Area I and II boundary definitions. This boundary was also used to identify customer types, land use, and population/employees serviced by the utility.*
  - Describe existing and projected WWTP flows
    - √ *This policy is implemented with the WWTMP and WWCSMP. These documents describe existing and future wastewater flows based on the service area boundary, BVCP population and employment forecasts, and the Denver Regional Council of Governments population and employment forecasts. These population and employment forecasts are used in conjunction with historical data from the wastewater treatment facility to project future wastewater flows.*
  - Describe the collection system contained within the WWTP service area and potential future upgrades and improvements
    - √ *This policy is implemented with the WWCSMP*
- Plan 9 Wastewater Collection System Master Plan
  - Provide wastewater collection at a flow rate required by the city's customers, precluding backups and spills that would endanger human health, personal property and the environment.
    - √ *This policy is implemented with the WWCSMP and the Gravity Systems Maintenance Workgroup.*
    - √ *The WWCSMP leveraged the Boulder's investment in their GIS data to determine the distribution of wastewater flows across the city for Boulder's existing and future customers. Wastewater flows were also developed to include the collection system's response to significant rainfall events and groundwater infiltration. These wastewater flows were used with a computer model to analyze the collection system and identify locations of capacity problems, potential sewer overflows, and areas that could potentially cause sewer back-ups. Upgrades to the collection system were identified to address these potential problems within the collection system.*



Collection system master planning identifies potential problem locations and recommends improvements to reduce sewer overflows and back-ups

    - √ *The Gravity Systems Maintenance Workgroup includes cleaning crews, a construction crew, closed-circuit television (CCTV) crew. Maintenance staff remove obstructions from the collection system pipes, repair failing*

systems, and monitor the performance of the sewer system. As a result, these activities increase the collection system's ability to convey flows from the city's customers and reduce the number and extent of sewer back-ups.

- Require pretreatment of wastewater from certain commercial and industrial customers to reduce the concentration of chemical constituents that may adversely impact the treatment ability of the WWTP.
  - √ *The WQES workgroup includes the Industrial Pretreatment (IPT) program whose purpose is to ensure that commercial and residential entities are not contributing pollutants to the sewer system. The IPT program monitors wastewater flow and constituents at select industrial sites within the service area. In addition to chemical constituents, an additional pollutant the IPT program monitors and addresses is grease or oil from restaurants in levels that could impact the ability of the collection system to convey flow. Although Boulder does not currently have a fully developed fats, oils and grease (FOG) program, current city standards do require oil/grease interceptors in new restaurants in an effort to address this pretreatment activity.*

Boulder Revised Code

- Chapter 11-2 Septic Systems
  - There are a few city properties currently on permitted septic systems. As these properties redevelop or their existing septic systems fail, they are required to connect to the city wastewater system and abandon their septic systems to health department standards.
  - In areas where city sewer service is available to county properties, the city works with the county to facilitate connection to the city wastewater system via annexation or an outside city utility permit.
  - In areas where no city sewer service is available to county properties eligible for annexation or outside city utility permits, the city works with the neighbors and the county to find creative solutions for funding the utility work.
  - If an emergency situation exists, the septic tank is pumped out at the property owner's expense and the applicable processes are expedited to the extent city ordinances and county regulations allow.
- Chapter 11-3 Industrial and Prohibited Discharges
  - Provide for and promote the general health, safety and welfare of the citizens residing within the city and downstream water users and residents
    - √ *As noted previously, the IPT program monitors wastewater flow and constituents at select industrial sites within the service area. In addition, the IPT program addresses oils and grease from new restaurants. Both of these activities improve the ability of the WWTP to discharge clean, safe effluent and meet regulations that protect the waters of Boulder Creek and its downstream users.*

Additional implementation measures are provided through Boulder's Design and Construction Standards (DCS), Chapter 6 Wastewater Design. The pertinent sections of the DSC that relate to protection of public health and safety are summarized below:

- Establish minimum design standards for providing and maintaining the public wastewater utility collection system including, but not limited to main extensions, collection mains, services, and manholes.
  - √ *The design standards defined in the DCS are appropriate. No recommendations for revisions have been identified.*
- Establish standard design flows for any project or development proposal for the purpose of designing wastewater collection mains to convey peak flow.

- √ *The design flows and peaking factors in the DCS are appropriate. No recommendations for revisions have been identified.*

- Provide requirements for utility reports in order to assess the impacts and service demands of any project or development proposal connecting to the public wastewater collection system.
  - √ *The utility report requirements in the DCS are appropriate. No recommendations for revisions have been identified.*

Principle #2 – Protect Boulder's Natural Resources and the Environment

The Utility protects Boulder's natural resources and the environment through the WQES group, Gravity Systems Maintenance group, and WWTP operations and treatment facilities.

Boulder's WWTP meets or exceeds permit requirements defend by the CDPHE and protects the quality of water in Boulder Creek

Boulder Valley Comprehensive Plan

- Plan 8 Wastewater Treatment Master Plan
  - Describe existing and projected WWTP flows
    - √ *As noted in the Policy #1 discussion, the WWTPMP and WWCSMP have developed existing and future wastewater flow projections in order to provide adequate collection system and WWTP hydraulic capacity. This protects the Boulder's natural resources and the environment by reducing the chance of sanitary sewer overflows.*
  - Maintain the current Class B biosolids land application program with a portion of the biosolids production composted at a private composting facility and continuing to track biosolids treatment and recycling research and trends to see if better long-term options become available.
    - √ *The Utility has recently finished a significant investment in its on-going Class B Biosolids program with the completion of the Solids/Dewatering project. This project included new systems that optimize the processing of the solids and their disposal housed within a new building at the WWTP.*
  - Track National Pollutant Discharge Elimination System (NPDES) permit requirements and land use regulations to anticipate more stringent treatment requirements.
    - √ *Boulder WWTP and WQES staff continue to be proactive in anticipating future regulations through discussions with Colorado Department of Public Heath and Environment (CDPHE) staff and through WWTP facility planning studies. For example, the Utility has recently started the WWTP Evaluation where future permit requirements and how those affect the WWTP facilities will be evaluated.*
  - Provide information on future treatment processes
    - √ *The Utility continues to research and study treatment process upgrades that could efficiently work within the existing processes at the WWTP and provide flexibility to address future discharge permit requirements. The previously mentioned WWTP Evaluation planning study will address and identify the future treatment processes that best fit the needs of Boulder.*

Boulder Revised Code

- Chapter 11-3 Industrial and Prohibited Discharges
  - Prevent the introduction of pollutants into the publicly owned treatment works (POTW) thereby affecting the operation of the system and the receiving waters or atmosphere
    - √ *The current IPT Program, within the WQES group, monitors and regulates wastewater discharges from identified industries within the wastewater service area.*
  - Improve the opportunity to recycle biosolids from the system
    - √ *The Class B Biosolids program continues to be optimized and improved. Recent improvements at the WWTP include a new Biosolids Processing facility which utilizes high torque centrifuges to greatly reduce the volume of biosolids removed and transported from the facility.*
  - Protect city personnel who may work with wastewater and biosolids in the course of their employment
    - √ *Safety is of paramount importance to the Utilities Division and its staff. WWTP and Gravity Systems Maintenance staff undergoes safety training and hold the required licenses/classifications.*
    - √ *WWTP has a fully established Safety Committee to address unsafe work conditions as well as a 12-person Emergency Response Team (ER Team) trained specifically to deal with the emergencies encountered at a WWTP.*

The recently completed Solids Dewatering Project optimized the biosolids program and resulted in a more cost effective and environmentally sound process.

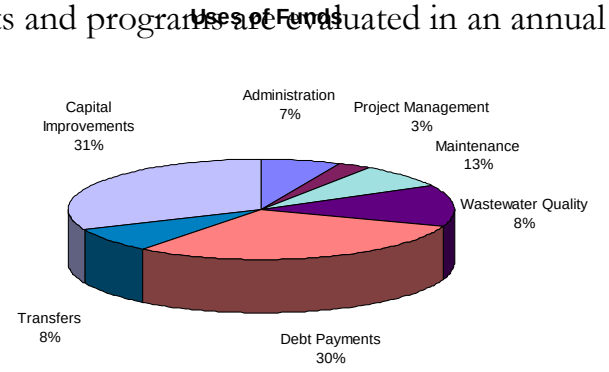
  - Prevent the introduction of wastes that may adversely affect the environment or may cause a violation of the city's National Pollution Discharge Elimination System (NPDES) permit.
    - √ *As noted previously, the IPP Program monitors and regulates industrial wastewater discharges. The result, as it applies to the NPDES permit, is the IPT Program reduces the risk of WWTP operational issues and/or sewer overflows by striving to eliminate problematic chemical and constituents from the wastewater flow.*

Additional implementation measures are provided through the WWTPMP.

- √ *Reduce waste by improving recycling and reuse of biosolids*
- √ *Create a sustainable community through improved energy efficiency, minimization of greenhouse gas emissions, cost savings, and minimizing chemical usage*
- √ *Improve ammonia nitrogen reduction capability*
- √ *Evaluate treatment capacity through facility planning to meet future needs*
- √ *Improve the dewatering process capabilities to meet increased capacity requirements*
- √ *Replace inefficient equipment with newer, improved equipment*

Principle #3 – Maximize the use of the Utility's Funds

The Utility has developed a series of tools and process that evaluate expenditures, revenue and planned capital projects. The various projects and programs are evaluated in an annual budgeting process using a Business Plan approach that incorporates level of service and investment strategies to prioritize programs and needs. The policy of using the Business Plan approach for utility planning is outlined in the "City Plans and Projects Handbook", City of Boulder, November 13th, 2008. The details of the Business Plan approach and its application to the Utility are presented in the Investment Program section of the WWUMP report.



Boulder has adopted a Business Plan approach that incorporates level of service and investment strategies to prioritize programs and needs

Boulder Revised Code

- Chapter 11-2 Wastewater Utility
  - Adopt a system of plant investment fees
    - √ *The City currently utilizes a funding system comprised on plant investment fees (PIF) and monthly user rates to fund the Wastewater Utility Fund Capital Improvements Plan (CIP) and operating budget expenses.*
  - Utility expansion outside city limits shall be consistent with the BVCP and the city charter requirements to insure the most efficient and cost effective service
    - √ *The WWCSMP and WWTPMP have identified the wastewater utility service area based on the boundaries defined by the BVCP Areas I and II. Improvements to existing facilities and system extensions have incorporated this service area boundary into the analysis process. Both of these plans have developed alternatives to existing and future service areas that were evaluated against a set of criteria that included cost effectiveness.*
  - Continue to provide wastewater services as an Enterprise
    - √ *The City will continue to operate the Wastewater Utility Fund as an Enterprise Fund.*
  - Provide for equitable distribution of cost of the wastewater utility among users
    - √ *The City provides an equitable distribution of cost for the Wastewater Utility through PIF's and user rates.*

BVCP Urban Service Criteria and Standards

An additional guiding policy is the Urban Service Criteria and Standards of the BVCP. As referenced in the preceding three guiding principals, Wastewater Treatment Master Plan and Wastewater Collection System Master Plan sections of the BVCP provide policies supporting many of the technical requirements within the Wastewater Utility. The Urban Service Criteria and Standards provide guidance as to the effectiveness of the operation and

financing aspects within the Utility. Specifically the Urban Service Criteria and Standards as they relate to the public sewer system identify service standards as follows:

- Responsiveness to Public Objectives
- Sufficiency of Financing
- Operational Effectiveness
- Proficiency of Personnel
- Location and Adequacy of Equipment and Facilities

Through wastewater system operations, planning, budgeting, and training programs, Boulder is able to meet the service criteria and standards identified in this section of the BVCP. This is evident in the positive feedback the Utility received during the AWWA QualServe peer review process, in the high level of service provided to its wastewater customers, and ability to meet and exceed State water quality permit requirements.

Wastewater Utility Key Issues

Wastewater Treatment Plant Master Plan

The Wastewater Treatment Plan Master Plan (WWTPMP) documents past decisions, the current facility, and presents the approach that has been used to reach decisions on process selection and introduce some future decisions that will be facing the utility. To continue to provide the level of service required by federal regulations and match the expectations of the community presented in the BVCP Goals, ongoing improvements to the treatment facility are necessary.

Boulder's Wastewater Treatment Plant (WWTP) along Boulder Creek at 4049 N. 75th Street

WWTPMP Improvement Alternatives

The WWTPMP investigated various treatment alternatives to support the recommendations contained within that plan and to provide guidance for the Phase 1 WWTP Improvements.

Liquid Stream Improvements Alternatives

The WWTPMP evaluated five treatment processes for upgrading the Boulder WWTP as part of the Phase 1 improvements. These included:

- Tricking Filter – Solids Contact Tank – Nitrifying Trickling Filters – Trickling Filter Recycle – Denitrification Filters – Chemical Phosphorus Removal (TF-SC-NTF-TFR-DNF)
- Trickling Filter – Activated Sludge (TF-AS)
- Activated Sludge (AS)
- Trickling Filter – Membrane Bioreactors (TF-MBR)
- Membrane Bioreactor (MBR)

These alternatives were then evaluated based on economic and non-economic factors to determine the preferred treatment process. Figures 1 and 2 below, from the WWTPMP, show that the activated sludge (AS) process scored the highest as part of the non-economic evaluation and provided the lowest life-cycle cost.

Criteria	Process Performance	Process Reliability	Mechanical Equipment	Chemical Requirement	Constructability	Neighborhood Impacts	Process Testing	Process Energy Efficiency	Sludge Production/Quality	Other Environmental Impacts	Total Score
Alt. 3 - TF/SC, NTF, TFR, DF, CPR	3	4	3	3	5	4	3	5	4	4	38
Alt. 6 - Trickling Filter - Activated Sludge	4	4	4	3	3	4	4	3	4	3	36
Alt. 7 - Activated Sludge	5	4	5	5	4	5	4	4	5	4	45
Alt. 8 - Trickling Filter - Membrane Bioreactor	5	2	2	2	5	2	5	1	4	5	33
Alt. 9 - Membrane Bioreactor	5	2	3	4	5	2	5	1	5	5	37

Note: A higher score is more favorable.

Figure 1. Non-Economic Evaluation of Process Alternatives

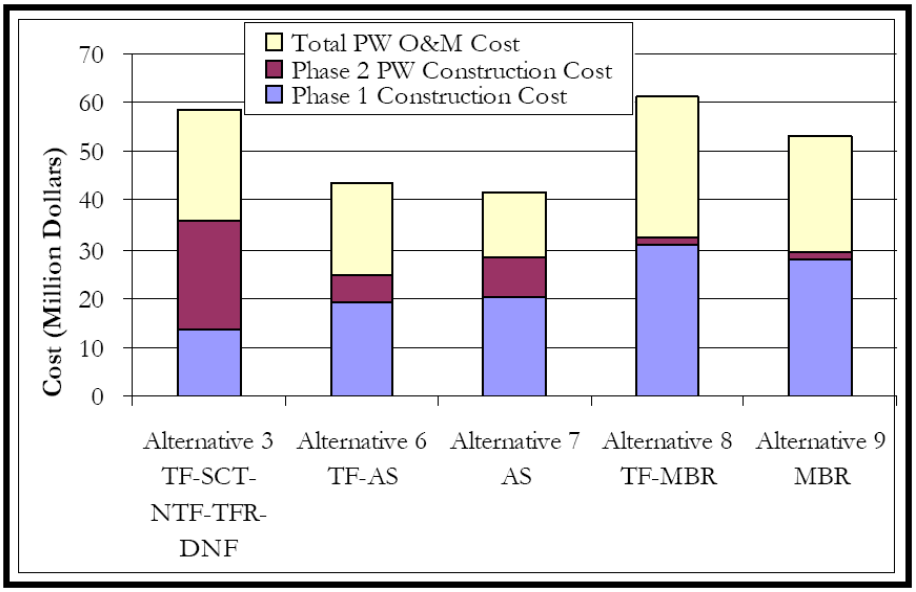


Figure 2. Economic Evaluation of Process Alternatives

As mentioned previously, the Liquid Stream Upgrades project was operational in 2008. The main goal was to improve nutrient removal and increase capacity from 20.5 to 25 mgd. In anticipation of more stringent ammonia limits (and potential future nutrient limits for nitrate, nitrite, total nitrogen, and/or phosphorus), the City converted the Trickling Filter/Solids Contact process to an Activated Sludge process. The new activated sludge process includes three new aeration basins arranged in a three-pass configuration making use of anoxic and aerobic zones. Mixed liquor is recycled from the end of the aerobic zone to the anoxic zone. In the future Phase 2 configuration, the first two anoxic zones will be converted to anaerobic and an additional biological phosphorus recycle will be added to return flows from the end of the anoxic zone to the beginning of the anaerobic zone. Specific improvements included the construction of and/or modifications to the following processes and facilities:

- Three new aeration basins
- Blower building
- Secondary pump station modifications
- Two dissolved air flotation thickening (DAFT) units
- A fourth secondary clarifier
- Removal of two large trickling filters - abandonment of two others
- Xcel Energy dual power feed

Mixed Liquor Wasting Station

Figure 3 below provides a schematic flow diagram of the Boulder WWTP after implementation of Phase 1 improvements.

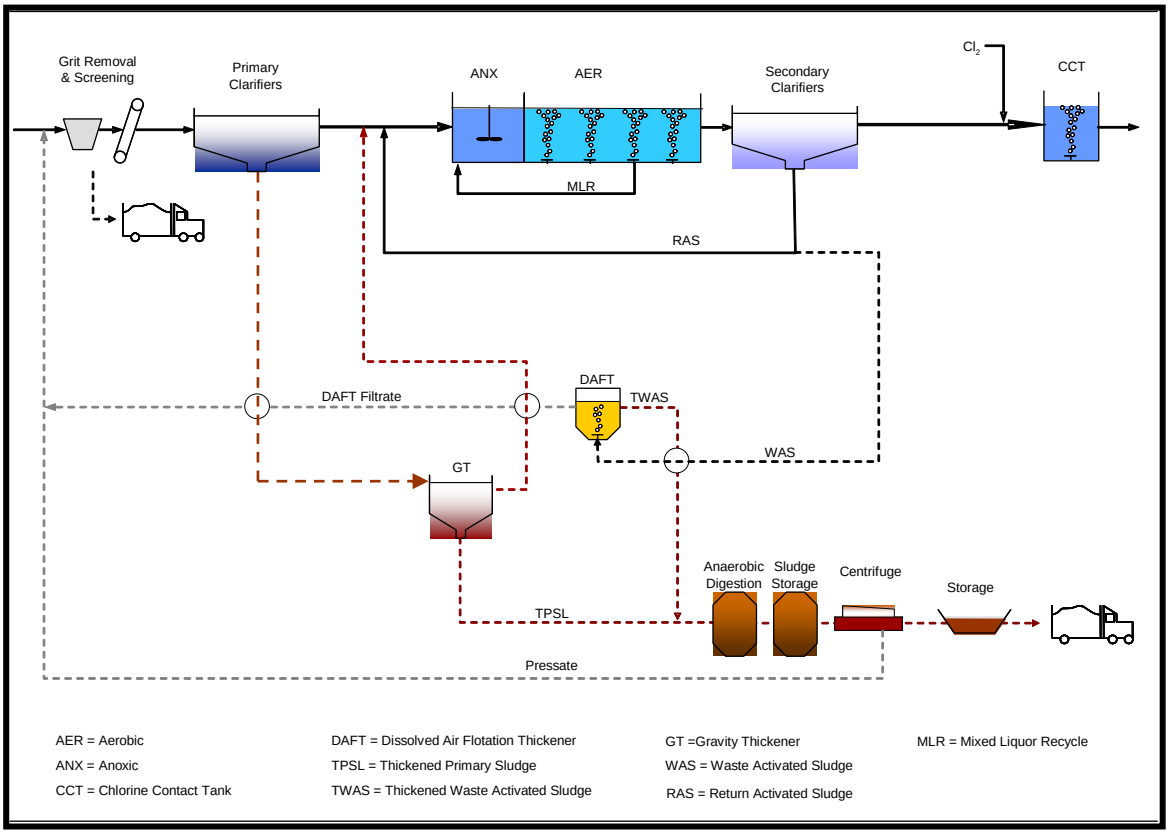


Figure 3. Boulder WWTP Process Schematic after Phase 1 Improvements

Dewatering Improvements Alternatives

The Dewatering Improvements project was initiated to increase the capacity of the existing solids processing facilities in anticipation of increased solids loading from the activated sludge process. The project was recently completed and included a new biosolids dewatering building and three new centrifuges to increase dewatering capability from 6.3 dry tons per day to a maximum of approximately 11.6 dry tons per day. Digested sludge is stored in two new holding tanks prior to dewatering. Dewatered cake from this process is trucked to eastern Colorado for agricultural land application. The centrate is returned to a new 500,000 gallon storage tank and then metered back into the process for treatment. Specific improvements included the construction of and/or modifications to the following processes and facilities:

- New Biosolids Dewatering Building including operations facility
- Three high torque centrifuges
- Dry polymer feed system
- Three sludge cake pumps
- Three sludge cake hoppers
- 500,000 gallon centrate storage tank and pump station
- Abandoned tanker fleet (trucks) and direct relationship with farmers where the city land applied biosolids
- Currently utilize Liquid Waste Management (LWM) for contract hauling (20% cake product) and end-use biosolids disposal

The new Biosolids Dewatering Building at the WWTP

Disinfection System Alternatives

The WWTPMP also evaluated alternatives for replacement of the existing chlorine gas disinfection and gaseous sulfur dioxide dechlorination systems which disinfect the effluent prior to discharge to Boulder Creek. The existing chlorine disinfection system has adequate capacity to meet the needs of the proposed expansion of the 75th Street facility from 20.5 mgd to 25 mgd, however it does not meet current industry standards associated with the safe handling of chlorine and sulfur dioxide gases (both chlorine and sulfur dioxide gases are considered hazardous chemicals). This, along with a broader concern about the safety aspects of transporting and handling hazardous chemicals and the environmental impacts associated with using chlorine as a disinfectant, prompted the City to evaluate replacing the existing chlorine disinfection system with a different system.

The following disinfection alternatives were considered:

- Alternative 1 – Chlorine Gas with Sulfur Dioxide (Existing Gaseous Chemical System)
- Alternative 2 – High Strength Sodium Hypochlorite with Sodium Bisulfite (Liquid Chemical System)
- Alternative 3 – Onsite Sodium Hypochlorite Generation with Sodium Bisulfite (Liquid Chemicals System)
- Alternative 4 – Disinfection with Ultraviolet Light (UV Disinfection)

Figures 4 and 5 below, from the WWTPMP, provide the results from the economic and non-economic evaluations of the alternatives.

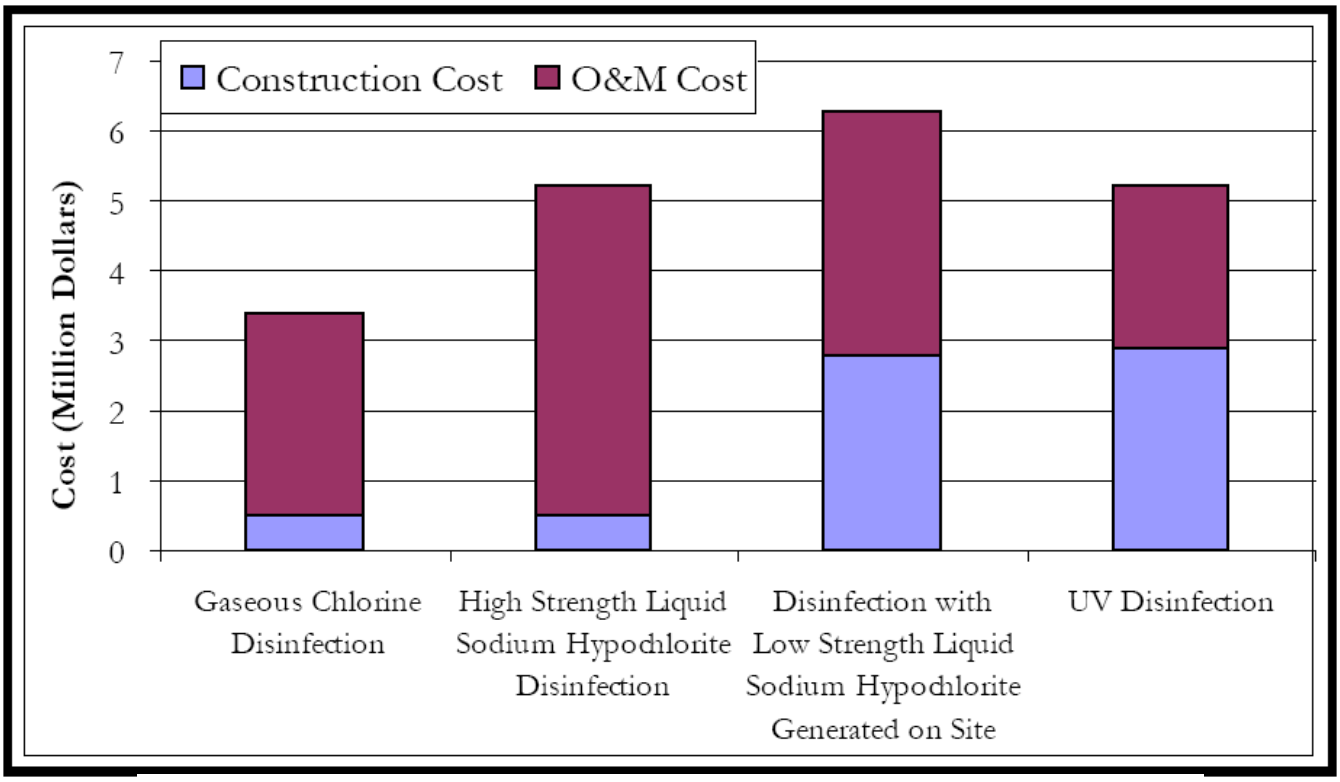


Figure 4. Economic Evaluation for Disinfection Alternatives

Criteria	Process Performance	Process Reliability	Mechanical Equipment	Chemical Requirements	Constructability	Neighborhood Impacts	Testing	Energy Efficiency	Safety	Regulatory Requirements	Other Environmental Impacts11	Total Score
Alt. 1 - Gaseous Chlorine	5	4	4	2	4	4	4	5	1	3	3	39
Alt. 2 - High-Strength Sodium Hypochlorite	5	4	5	4	4	4	4	4	3	4	4	45
Alt. 3 - On-Site Sodium Hypochlorite Generation	5	4	3	3	4	4	4	3	4	4	4	42
Alt. 4 - UV	5	3	5	5	4	4	5	2	5	5	5	48

Note: A higher score is more favorable.

Figure 5. Non-Economic Evaluation for Disinfection Alternatives

UV disinfection was rated the highest of the disinfection alternatives from a non-economic standpoint and scored second for cost. UV disinfection is the safest for the WWTP staff and the community and it eliminates the need for hazardous chemicals to be shipped to and stored at the WWTP. UV disinfection is also very easy to operate and maintain, and will allow the City to continue to meet their effluent disinfection requirements without the negative aspects of chemical addition. UV disinfection was selected as the preferred disinfection method.

Due to budgetary constraints, the UV system was removed from the Phase 1 improvements construction project. Plant staff have identified the gaseous chlorine system as the greatest cost and a significant safety hazard. The City has indicated this system will be replaced as part of the next budgeting cycle.

Future WWTP Modifications

Discharge permit limits are revisited every five years, and it is anticipated that some level of TIN and phosphorus removal may be required by future discharge permits. Chemical addition and/or additional aeration basin volume may be required to remove additional TIN

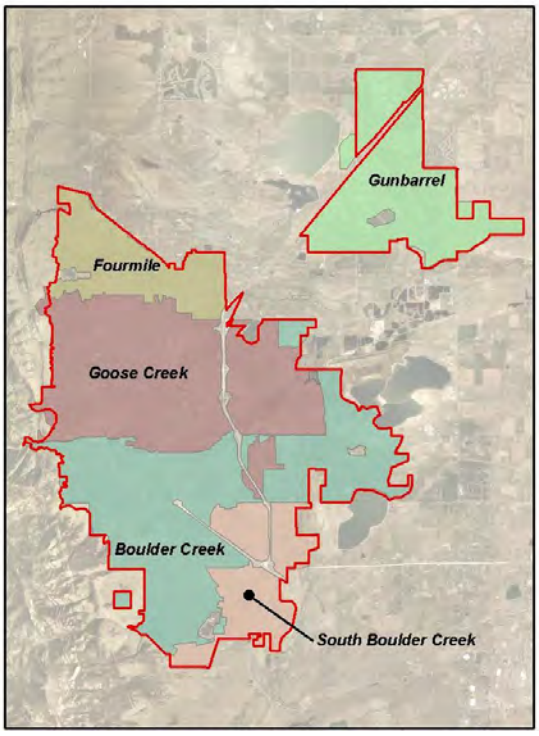
and phosphorus. If extremely low TIN limits are implemented in the future, a tertiary denitrification treatment process may also be required. If extremely low phosphorus limits are imposed, tertiary filtration may be required. The 2005 Liquid Stream Upgrades project design accounted for "Phase 2" improvements (future) to address more stringent CDPHE effluent discharge regulations. The Phase 2 improvements would involve minor modifications to the recently constructed aerations basins (anaerobic & anoxic zones) to specifically address plant denitrification. The Phase 2 improvements might also involve the construction of a fourth aeration basin. This project is tentatively scheduled for 2020.

Additionally, the Boulder WWTP may be required to remove microconstituents. Microconstituents include very small particles such as endocrine disrupting compounds (EDC's) and disinfection byproducts. At present little is known about the significance of these contaminants or appropriate treatment technologies for their removal from wastewater; however, regulatory requirements associated with these contaminants may be adopted in the future. If emerging contaminants removal becomes necessary, public education and additional treatment processes will likely be required. This issue will be evaluated in the future as appropriate.

Other future projects identified in the CIP include modifications to, or the replacement of the Headworks facility. The headworks facility is old and antiquated as several key process components are inefficient and lack redundancy. These components include the bar screens, grit removal system, and rag removal system, and he heating, ventilation and air conditioning (HVAC) system. The bar screens are ¾-inch and lack the ability to remove fine size particles permitting too many debris to pass through the headworks and impact other plant processes. This results in downstream wear and tear on mechanical equipment. The grit system lacks an efficient washing system to maintain the organics in the process flow. The rag system is not adequately sized to work properly with the existing screens, and requires both conveyors to move the rags to the dewatering machine. There is no redundancy in the conveyors or the rags dewatering process. The HVAC system is inadequate to provide heat for the building. Recently, the heating coil froze rendering the system useless. This project is tentatively scheduled for 2015 and may include the construction or modification to the existing maintenance facility. Although not yet identified in the near term the CIP, this project is a priority for the City.

Wastewater Collection System Master Plan

The WWCSMP is a comprehensive planning document that assesses the conveyance capacity of Boulder's sanitary sewer system and identifies recommendations with associated capital cost estimates to resolve conveyance capacity deficiencies. The following is a summary from the WWCSMP report prepared by HDR and published December 2008.



Boulder's Wastewater Utility Service Area encompasses 26 sq.mi. and contains five interceptor sewer basins

Land Use and Flow Projections

Land use planning projections for both population and employment were developed within the WUSA. There are three prominent planning documents that establish population and employment projections for the WUSA and included 1) 2007 DRCOG Traffic Analysis Zones, 2) 2007 WWTP Master Plan and 3) 2008 Boulder Valley Comprehensive Plan (BVCP). These documents include consideration for both existing and future land uses, as well as historical and projected population trends. A summary of the population and employment projections for the WUSA is shown in Table 3. The 2007 Denver Regional Council of Governments (DRCOG) Traffic Analysis Zones (TAZ) data was used to represent existing conditions in the WWCSMP as it was based on census data and provided good correlation with the BVCP. To be consistent with the 2007 WWTPMP, projections for future employment and population were based on data from that document. As a result, buildout condition (2030) population and employment values presented in the 2007 WWTPMP were used for this analysis.

TABLE 3 – 2008 WWCSMP PROJECTIONS FOR WUSA

Year	2008	2015	2020	2025	Buildout (2030)
Population	110,092	119,072	122,529	124,266	128,162
Employment	100,598	128,918	134,381	136,706	155,864

Total average dry weather flow (ADWF) or base flow projections in the collection system for existing and future conditions are comprised of population, employment and Significant

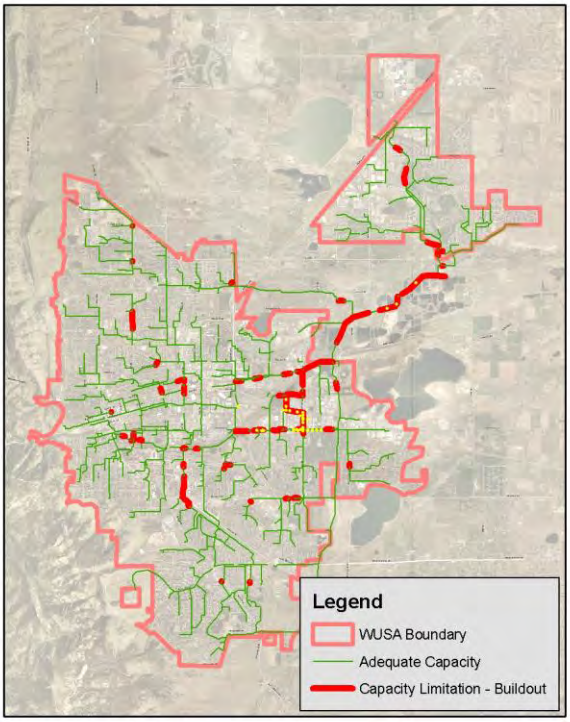
Industrial User (SIU) contributions. The population and employment contributions are combined with the unit flow factors of 102 gpd per capita and 50 gpd per employee. The SIU contributions are based on 2006/2007 flow data from each user adjusted for domestic flow. In addition to existing (2008) and buildout (2030) conditions, flow projections were developed for intermediate years including 2015, 2020, and 2025 for information purposes. Table 4 presents the ADWF projections used as the basis of the Wastewater Utility Master Plan (WWUMP) analysis. It should be noted these ADWF values do not reflect collection system hydraulics including hydrograph attenuation and pump station influences. As a result, the collection system hydraulic model results are anticipated to vary slightly when compared to the values in the table below.

TABLE 4 – AVERAGE DRY WEATHER FLOW PROJECTIONS

Year	2008	2015	2020	2025	Buildout (2030)
Population ADWF (mgd)	11.3	12.1	12.5	12.7	13.1
Employment ADWF (mgd)	5.0	6.5	6.7	6.8	7.8
SIU ADWF (mgd)	0.6	0.6	0.6	0.6	0.6
Total ADWF (mgd)	**16.9**	**19.2**	**19.8**	**20.1**	**21.5**

Collection System Analysis

The purposes of the conveyance system analysis were to 1) document the analysis of the existing collection system during dry weather and wet weather flows and 2) to identify and characterize hydraulic capacity issues. By analyzing the existing collection system under existing and buildout flow conditions, problem areas were identified for both land use scenarios.



Hydraulic analysis of interceptor, collector and local collector sewers was performed to identify existing and future capacity problem areas.

The primary source of data that was used for the collection system hydraulic model development and analysis was Boulder's sanitary sewer Geographic Information System (GIS) layers for manholes and sewer pipes. This database was provided to HDR in November of 2007 and formed the basis of all subsequent work. Combined, the two GIS layers represent 9,596

manholes and 9,671 sewer main pipe segments, ranging in size from 4 to 60 inches in diameter.

Gravity sewers are typically classified as local, collector or interceptor sewers. Local sewers have diameters that are typically less than 10 inches and convey wastewater from relatively small service areas (approximately 20 acres and less). Local sewers have numerous service line connections collecting wastewater from individual customers. Collector sewers have diameters that typically range between 12 and 24 inches. Collector sewers convey flow from multiple local sewers and also include individual service line connections, although not as many as local sewers. Interceptor sewers typically have very few, if any, individual service line connections and convey wastewater from connections with collector sewers to the WWTP.

Many of Boulder's local sewers provide service to relatively large areas with some local sewers serving areas up to 100 acres in size and/or highly developed areas. These small diameter local sewers are an integral part of the gravity sewer system. As a result, these local sewers that serve large areas have been termed "local collectors" for purposes of this study. Additional collection system features included in the model and analysis included lift stations, forcemains, diversion manholes, and siphons.

The collection system pipes with identified capacity limitations, established from the model results, were examined to identify likely hydraulic issues under the various flow scenarios. There are a total of 138 pipes in the analyzed collection system with hydraulic deficiencies identified. A detailed problem identification and characterization process was completed to better understand the nature and extent of these problems. The hydraulic problems were separated into two categories: Type A and Type B. Type A problems consisted of a series of under capacity pipes that were hydraulically connected to one another. Type B problems are isolated hydraulic restrictions that are not hydraulically connected to other problem locations or series of problem pipes.

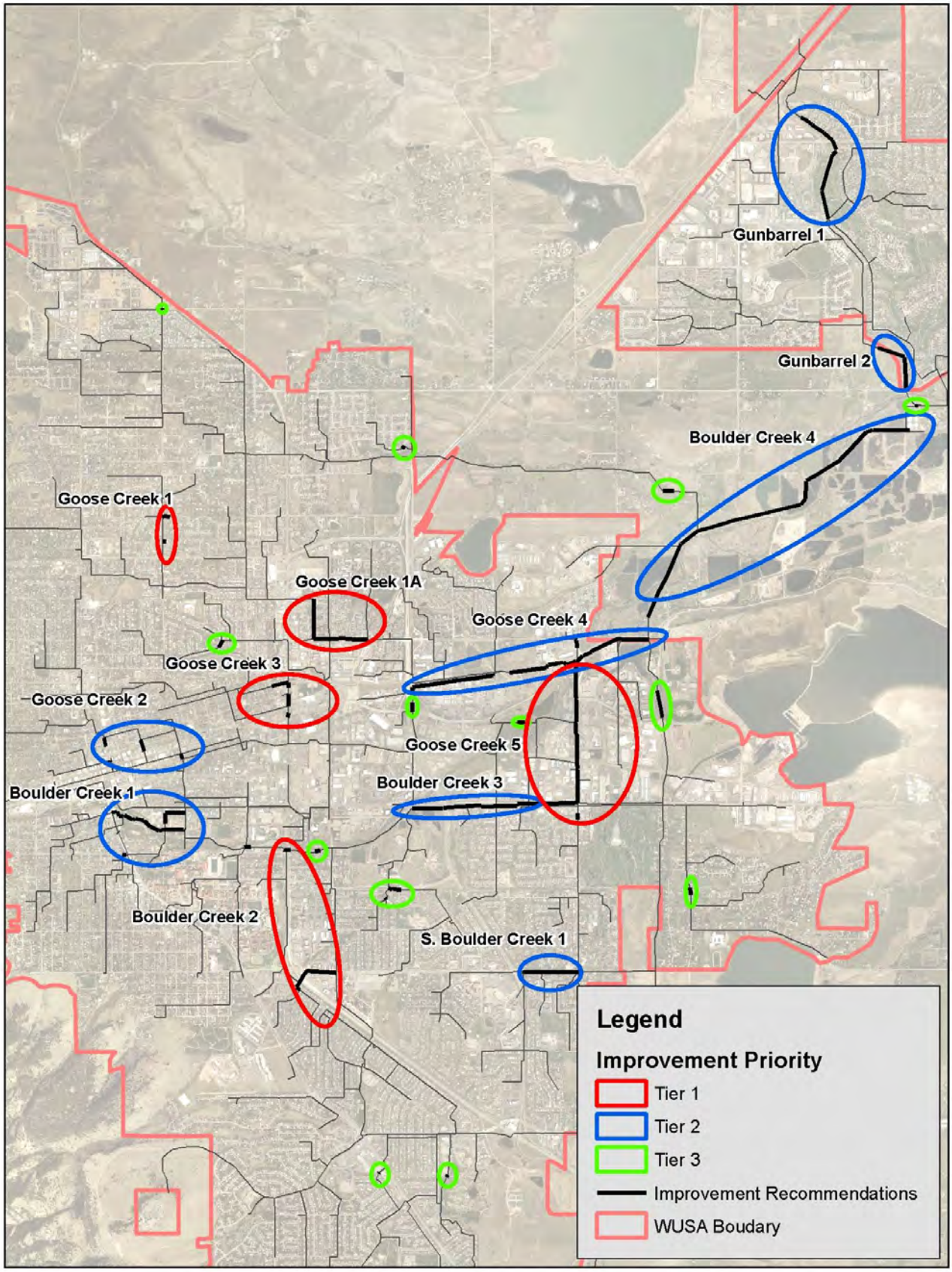
Recommended Collection System Improvements

The recommended system improvements that resolve the existing and future capacity issues are shown on the following figure. This figure includes both improvements that address Type A and Type B problems. The conveyance system analysis separated the hydraulic problems into two categories; Type A and Type B Type A problems consist of a series of problem pipes that are hydraulically connected to one another. Type B problems are

isolated hydraulic restrictions that are not hydraulically connected to other problem locations or series of problem pipes.

The recommended improvements were grouped in three tiers to establish implementation priority:

- Tier 1 projects address Type A problems and have the highest priority;
- Tier 2 projects also address Type A problems but have lower priority compared to Tier 1;
- Tier 3 projects address Type B problems which have the lowest priority.



Recommended improvements were developed and prioritized into Tier 1, 2 and 3 categories.

The improvement priorities were assigned based on a number of qualitative factors including the flow conditions in which they occur (existing versus future), extent of the problem, potential for sanitary sewer overflows (SSOs) and service lateral backups, ease of constructability, and relative benefit over other improvement projects. The relative benefit takes into account the amount of pipe replaced compared to the extent of the problem remedied. The resulting implementation priorities and associated estimates of capital construction cost are shown in Table 5.

TABLE 5 – CAPITAL PROJECT IMPLEMENTATION RECOMMENDATIONS

Problem Priority	Improvement ID	Location	Capital Cost
Tier 1	Boulder Creek 2	Colorado Ave and 28th St	$733,000
Tier 1	Goose Creek 1/1A	Iris Ave and 19th St	$1,203,000
Tier 1	Goose Creek 3	Spruce St and 24th St	$482,000
Tier 1	Goose Creek 5	Arapahoe Ave and 55th St	$2,559,000
		TIER 1 TOTAL	**$4,977,000**
Tier 2	Boulder Creek 1	Colorado Ave and 28th St	$1,653,000
Tier 2	Boulder Creek 3	Arapahoe Ave and Foothills Pkwy	$1,939,000
Tier 2	Boulder Creek 4	Valmont Rd and 61st St to WWTP	$12,356,000
Tier 2	Goose Creek 4	Pearl St, Valmont Rd and Mishal Rd	$3,928,000
Tier 2	Gunbarrel 1	Boulder Supply Canal & Left Hand Ditch	$1,116,000
Tier 2	Gunbarrel 2	Jay Rd and Boulder Supply Canal	$939,000
Tier 2	South Boulder Creek 1	Baseline Rd and 55th St	$733,000
		TIER 2 TOTAL	**$22,664,000**
		TIER 3 TOTAL[1]	**$2,296,000**
		TOTAL ALL PROJECTS TOTAL	**$29,937,000**

[1] Tier 3 costs represent approximately 13 localized improvement projects

Collection System Operations and Maintenance

The WWCSMP project team reviewed the collection system operations and maintenance (O&M) procedures. The purpose of this O&M procedure was to review the current state of collection system O&M practices and evaluate potential increases in service levels due to trends in the regulatory environment in the western United States. In addition, the 2008 QualServe peer review program and self assessment survey evaluated the Utility's overall

performance, efficiency and customer service as well as maintaining industry best management practices.

Both the QualServ program and the WWCSMP O&M review found that the Gravity System's Maintenance group operates and maintains the collection system such that it continues to provide a high level of service to its existing customers. In addition, the WWCSMP O&M review noted that the Utility has the framework in place to address the potential emerging regulations seen in the western United States. Both evaluations noted opportunities for improvement which are discussed in detail in their respective documents. In addition, both evaluations identified three common opportunities for improvement. These common improvement opportunities and potential implementation options (shown in italics) are summarized below:

- Provide a computerized system that incorporates field collected data into the analysis and prioritization of line replacement or rehabilitation
  - √ *The Utilities Planning and Project Management workgroup is going to implement a separate asset management system for which Utilities Maintenance workgroup will provide Utilities Maintenance and Management System (UMMS) data for inclusion in making replacement/rehabilitation decisions. The field reports will be modified to capture pipe and manhole condition, then the UMMS will be modified to capture and sort by maintenance need priority in order to prioritize maintenance work*
- Upgrading CCTV equipment and adopt an industry standard defect coding system
  - √ *The Gravity System Maintenance workgroup is currently in the process of acquiring Granite XP software in order to further evaluate, categorize and characterize the conditions of the sewer mains. This system will provide a more uniform analysis of the pipe conditions and provide a standardized defect coding system.*
- Upgrade the UMMS to include geo-assigning of work orders
  - √ *A planned overhaul of the UMMS work order system includes tasks that will allow the utilities maintenance supervisors/other staff to generate a work order for an asset by interactively selecting that asset from a GIS mapping application.*

An additional outcome of implementing these recommendations will be that rate at which the collection system is cleaned can be optimized based on findings from the CCTV inspections and field collected data logged in the UMMS during cleaning operations.

Collection System Rehabilitation Budgeting

Boulder developed a methodology for determining the mileage and cost of the 20-year CIP for rehabilitating wastewater pipes and manholes. This methodology was based on spreadsheet model that characterized pipe failure as a function of time to assist in forecasting long-term budgetary needs for rehabilitation of sanitary sewer pipe. This analysis resulted in a recommendation for an annual manhole and sewer pipe rehabilitation budget of $850,000.

Boulder's rehabilitation methodology was reviewed by HDR. This independent review noted that several funding scenarios are provided but the model does not identify the return on investment for each scenario. This makes it difficult to determine the most appropriate level of funding for Boulder. Also, the results of each model scenario are primarily driven by the useful life and failure interval assumptions. While the analysis does an excellent job in reviewing the impact of various assumptions for both useful life and failure interval, there is little emphasis placed on quantifying these assumptions based on actual field conditions experienced by Boulder.

HDR recommends that Boulder consider developing a return on investment based funding scenario model. HDR also recommends that the existing conditions assessment data be leveraged to determine the useful life and failure interval of their pipes and manholes. In order to accomplish this, Boulder must first define what failure is for each asset classification. Then an analysis should be performed on the existing condition assessment data to determine how much remaining useful life each asset has before it reaches the failure threshold. Finally, this analysis should be leveraged to estimate the average useful life and the Weibull parameters that define the shape of the curve.

HDR also recommends that Boulder evaluate whether CIPP will be the only technique used to rehabilitate the system. If alternate techniques (e.g. replacement) are warranted in certain circumstances, it is recommended that the condition assessment review also incorporate a component which estimates the appropriate mix of approved techniques based on pipe defects and other inspection results. This will provide a more accurate estimate of the system wide cost of rehabilitation.

Water Quality and Environmental Services Group protect habitat and water quality within the creeks of Boulder

Water Quality Strategic Plan

The Water Quality Strategic Plan (WQSP) addresses water quality policies and priorities for the city. Boulder Creek and its tributaries are vital for providing drinking water, agricultural irrigation water, aquatic habitat, recreation, and power generation. Water quality determines the suitability of water for most of these uses. Water quality in the Boulder Creek Watershed is affected by natural factors such as geology, climate, and physiography, and human-caused factors, such as wastewater effluent,

runoff from roads and urbanized areas, agricultural practices, atmospheric contaminants, and other sources. The relative effect of these factors on water quality has changed over time and will continue to shift as population and urbanization increase and more demands are placed on our water resources.

The WQSP supports many of the principles and policies of the Boulder Valley Comprehensive Plan (BVCP). The WQSP is designed to fit within the broader framework of the BVCP, which provides the overall policy direction for planning decisions within the Boulder Valley. The BVCP also outlines the city's communitywide goals and provides a general statement on the community's desires for development and preservation in the Boulder Valley, including protection of water resources. Protection and improvement of water quality is specifically discussed in Section 4 of the 2005 BVCP. In Section 4.26 the BVCP states: "The city and county will protect, maintain and improve water quality within the Boulder Creek basin and Boulder Valley watersheds as a necessary component of existing ecosystems and as a critical resource for the human community." BVCP Section 4.27 states: "Water resource planning efforts will include such things as water quality master planning."

The BVCP also outlines the city's environmental goals. When the BVCP was adopted in 2005, Boulder City Council established a goal of becoming a national environmental leader. City Council's water-related environmental priorities included promoting water conservation. City Council also aimed to strengthen water quality improvement efforts by protecting biodiversity and native ecosystems, by managing the city's water sources through a larger watershed approach, and by reducing pollution sources.

The city must establish strong but achievable water quality goals to protect the environment and public health, and to address future water quality challenges. The WQES group developed goals for city adoption by first completing a comprehensive inventory of existing water quality goal statements found in the city's master plans, policies, and regulations, starting with the BVCP. The group also reviewed water quality regulatory compliance objectives. The goals support the city of Boulder, Utilities Division Mission Statement:

> *Our Mission is to provide quality water services, as desired by the community, in a manner which emphasizes efficient management of fiscal and natural resources, and protects human and environmental health.*

Water Quality Strategic Plan Implementation

The WQSP has been developed, and will be implemented by, the City's Water Quality and Environmental Services (WQES) Group within the city of Boulder Public Works, Utilities Division. The WQES Group is funded through the city's Water, Wastewater, and Stormwater enterprise funds. The WQES group supports the Utilities Division water services and comprises seven programs:

- Industrial Pretreatment
- Laboratory Services
- Water Conservation
- Water Quality Education
- Drinking Water Quality
- Water Quality Planning
- Stormwater Quality

The primary function of these programs is to protect water quality and ensure compliance with state and federal water quality regulations, such as the federal Clean Water Act and Safe Drinking Water Act. The WQES Group also provides water quality program management and serves as an in-house technical resource for the city's Utilities Division and other city departments. Services include monitoring the performance of wastewater treatment and drinking water treatment processes and monitoring the health of natural systems such as creeks and lakes. The WQES Group provides project management services to integrate water quality enhancement and compliance goals into planning efforts and city capital improvement projects.

Water Quality Strategic Plan Goals

The WQES group developed five goals and supporting statements which will be used to implement the WQSP.

Goal 1. Provide safe and high-quality drinking water

The city is required to provide drinking water that meets all state and federal requirements. Drinking water safety cannot be taken for granted. A number of potential threats to drinking water exist within the raw source water and within the treated water distribution system. Improperly disposed of chemicals, animal and human wastes, pesticides, naturally-occurring substances such as bacteria, and an improperly maintained distribution system all can contaminate drinking water and pose a health risk. To ensure the quality of drinking water, protection strategies must be implemented from "source to tap."

Goal 2. Manage pollutants from wastewater and other point sources.

The city is responsible for operating the 75th Street WWTP and meeting Colorado Discharge Permit System (CDPS) permit requirements. Adequate wastewater treatment is

critical in protecting public health and the environment. Currently, the WWTP treats an average of 16 million gallons of wastewater per day and discharges treated wastewater into Boulder Creek. A number of smaller wastewater treatment systems, as well as individual septic systems, also discharge into the Boulder Creek Watershed. These include the Town of Nederland wastewater treatment plant, which discharges into Barker Reservoir, a source of drinking water for the city of Boulder.

Goal 3. Manage pollutants from stormwater and other nonpoint sources.

The city is required to implement programs required under the State of Colorado Municipal Separate Storm Sewer System (MS4) discharge permit to protect the quality of stormwater, which is discharged into water bodies such as streams. In urban areas, stream and water quality degradation generally are related to development. Adding impervious areas such as roads, parking lots, and buildings to land that once had natural cover increases surface runoff and reduces groundwater infiltration, which damages natural stream hydrology and aquatic systems. Urban and agricultural runoff containing sediment, fertilizers, and pesticides also can pose a threat to water quality. Protecting water quality means managing pollutants from these diverse sources.

Goal 4. Protect, preserve, and restore natural water systems.

Natural water systems include riparian and wetlands habitat as well as stream flow. Intact riparian ecosystems provide ecological benefits, which play an important role in maintaining water quality, protecting aquatic life, and preserving the aesthetic, recreational, and economical value of the city's waterways.

Goal 5. Conserve water resources.

Conserving water is integral to protecting water quality. Water conservation practices can improve water quality by increasing the amount of water flowing in streams and reducing the amount of treated wastewater discharges. Water conservation also diminishes the need to find or construct new water sources. Water conserving landscaping can minimize irrigation runoff, reducing impacts to local streams.

Meeting these five water quality goals will provide water quality protection, which means clean water to drink, clean streams and lakes to swim in, and healthy waterways that support fish and other wildlife.

Water Quality Strategic Plan Recommendations

Water Quality Strategic Plan Recommendations and Performance Measures are outlined in detail in the May 2009 Final WQSP document. A summary of the Recommendations and Performance Measures are as follows:

- Recommendation 1: Evaluate and update policies in the Boulder Valley Comprehensive Plan to incorporate water quality goals.

  WQES staff will review and recommend updates to the Boulder Valley Comprehensive Plan (BVCP) to ensure incorporation of water quality goals. The BVCP is scheduled to be updated in 2010.

  Performance Measure: Adoption of the five water quality goals into the BVCP in 2010.

- Recommendation 2: Perform analysis of City plans, policies and projects to identify gaps in meeting water quality goals.

  WQES staff will review relevant plans, policies and projects, such as master plans, design and construction standards, and the Boulder Revised Code to: 1) ensure that the City complies with all state and federal laws and regulation on water quality and environmental protections; and, 2) to meet water quality goals.

  Performance Measure: Number of formal policy and master plans reviewed and updated to incorporate water quality goals; development of a matrix of water quality indicators and evaluation of plan review based on criteria.

- Recommendation 3: Develop annual work plans and water quality reports.

  Each year the WQES group will identify and outline priorities to achieve the City's water quality goals and to document monitoring, community involvement, watershed management efforts and regulatory compliance. An annual water quality report will be developed detailing the progress on meeting water quality goals. The annual report will be based on specific objectives and water quality indicators, and will present water quality data collected by the WQES Group.

  Performance Measures: Development of a number of program work plans and the annual report.

- Recommendation 4: Prepare for future water quality regulations.

  The City will anticipate and prepare for future water quality regulations, ensure regulatory compliance, and incorporate capital improvement requirements in the

City's budget planning process. The foundation of of water quality planning is forecasting future water quality criteria and permitting issues related to emerging water quality issues and new regulations.

Performance Measures: Success in implementing a program to conduct special studies, track new and proposed regulations, and participate in rule-making activities.

IPT Gaps, Deficiencies and Recommendations

In addition to the ongoing responsibilities of the IPT Program, special studies and/or additional programs are necessary to further characterize industrial and commercial discharges to the city's sanitary sewer system sources, support compliance with WWTP discharge permit requirements and collect data and information in preparation for future regulatory requirements. The following programs or studies should be evaluated and modified or initiated as necessary.

Fats, Oil and Grease Program

One of the major causes of maintenance problems, blockages, and sanitary sewer overflows in Boulder's collection system is fat, oils and grease (FOG). Boulder addresses grease in the collection system through two programs: the sewer cleaning program and in the IPT program.

The purpose of IPT program is to ensure that commercial and residential entities are not contributing pollutants to the system. One of the pollutants is grease or oil in levels that would impact the operation of Boulder's collection system. The IPT program does not have a formal FOG program.

Boulder's FOG program is governed by municipal code regulation with specific section relating to fats, oils, and grease. This code establishes a threshold for dischargers of 100 milligrams per liter (mg/l), or requires a plumbing device for FOG for those who exceed the threshold. Currently the municipal code refers to the International Plumbing Code for the design criteria of grease removal equipment (GRE). The municipal code has minimal requirement for grease removal equipment cleaning, which is every 6 months or as needed.

FOG producing facilities are not currently required to obtain permitting from Boulder. FOG producers are identified by Planning and Development Services (P&DS). When applying for permits, applicants fill out a Business Environmental Questionnaire. If the facility generates wastewater, they are required to fill out an industrial waste survey. Any

applicant determined to exceed the above mentioned discharge threshold is required to install GRE. There is an existing plan check system for restaurants during the initiation phase. Design approval is performed by the Development Review group. During construction, inspection of the GRE is performed by the plumbing inspector.

The FOG municipal code should be modified to require all new grease-producing facilities to install and maintain GRE. Any new facility or remodel of existing facilities that will have a kitchen, cooking equipment, or a food producing facility should contact Boulder to determine the need and size of the grease controlling device. Modifications should be made to the municipal code to allow for the development of a FOG program that can perform inspections and assess violations accordingly.

Specific recommendations for the FOG program include:

- Installation of Grease Removal Devices
  - The FOG municipal code should be modified to require all new grease-producing facilities to install and maintain GRE.
  - Modifications should be made to the municipal code to allow for the development of a FOG program that can perform inspections and assess violations accordingly.
- FOG Inspection & Maintenance Program
  - Outline components of a typical FOG program:
    - √ *Identify database needs*
    - √ *Develop Building Services /Planning interface*
    - √ *Address problem areas in city (hot spots) -*
    - √ *Ongoing compliance - quick touch approach or spot check with pass /fail evaluation and then comprehensive follow up as needed*
  - Boulder should perform a business case for investment in a FOG prevention program. Development of a formal inspection program should be considered to be included in their FOG ordinance.
  - Boulder should identify all of the food service establishments that would require grease removal equipment. There is a database that currently keeps this data, but it is incomplete.
  - Boulder should develop a policy on how to handle existing food service establishments that do not have GREs. Additionally, the FOG program needs to work with P&DS to ensure that all new food establishments are entered into the database.

Industrial Waste Survey

Consider initiating a comprehensive industrial waste survey. Due to the growth in Boulder it may be useful to consider a "full sweep" of the non-domestic users. The goal would be to identify facilities that need to be further regulated.

Business Inventory Mailing

As time permits staff will send out business questionnaires to determine if targeted businesses continue to be non-significant, and /or as new businesses are identified, information will be gathered to determine the nature of operations.

WEL Program Gaps, Deficiencies and Recommendations

In addition to the ongoing responsibilities of the WEL Program, special studies and/or additional programs are necessary to further characterize WWTP performance, characterize water quality conditions in Boulder Creek and provide compliance support for State and Federal regulations. It is recommended that the following programs or studies should be evaluated and modified or initiated as necessary.

Evaluate Laboratory Size and Function

The city last expanded the WEL footprint in 1990. As the demands on the laboratory services increase so do the demands on the counter space. The following laboratory recommendations were identified:

- Perform Business Case Evaluation on the Wastewater and Environmental Laboratory Program
  - Review standard laboratory space needs ranging from laboratory layout to WWTP program needs served by the WEL.
  - Review existing laboratory assets (current equipment, future equipment needs, laboratory benches, hoods and other structures, etc.), develop value and life of assets, develop needed investment plan to maintain assets, and compare to existing WEL budget.
  - Perform Cost Benefit Analysis of maintaining current and future WEL Program operations versus contracting all or part of the WEL Program operations.
  - Review long-term needs of all WQES staff located at the 75th St WWTP for office space, storage and staging areas.
  - Review the exhaust air system of the Instrumentation Room.
  - Review the feasibility of adding organics analysis to the laboratory duties including staffing, budget and capitol costs for instruments and square footage.
  - Review a replacement schedule and costs for the ICP, ICPMS and the GFAA instruments.

Near-Term Capital Improvements

The WEL laboratory area is 20 years old and has had very few improvements made over the 20 year period. Capital improvements, including upgrades to laboratory area and analytical equipment replacement, have been identified and need to be implemented within the next two years (2010 through 2011). These improvements are as follows:

- 2010 Capital Improvements
  - Laboratory Area Upgrades: painting; window repair, chemical storage area upgrade; ceiling tile and ceiling light replacement; laboratory sink replacement/repair (4 sinks total)
  - Laboratory Equipment Replacement: laboratory stools (6 total); dish carts (2 total); spectrophotometer; dishwasher
- 2011 Capital Improvements
  - Laboratory Equipment Replacement: top loader scale (2 total); analytical balance; autoclave; muffle furnace

INVESTMENT PROGRAM

Investment Strategy

The city's investment strategy focuses on a combination of maintaining and operating the existing wastewater treatment and conveyance facilities, and constructing new facilities to meet ongoing State and Federal discharge permit regulations. This strategy serves the Utility's three primary goals to:

- Protect Public Health and Safety
- Protect Boulder's Natural Resources and the Environment
- Maximize the use of the Wastewater Utility's Funds

Wastewater Utility CIP

The Wastewater Utility Master Plan (WWUMP) includes a comprehensive list of Wastewater Utility projects to be completed during the 20-year planning period. These include wastewater treatment plant capital and maintenance related projects, as well as wastewater collection system capital and maintenance related projects. The 2010-2030 Wastewater Utility Fund CIP has numerous line items identifying various projects for the WWTP and the sanitary sewer collection system. The significant CIP expenditures and Water Quality Strategic Plan (WQSP) funding fall into the following categories:

- WWTP Capital Projects
- WWTP Rehabilitation Projects
- WWCS Rehabilitation Projects
- WQSP Funding

WWTP Capital Projects

There are five (5) significant WWTP capital projects currently identified in the 20-yr CIP. The total cost of these projects (in 2008 dollars) is estimated at $40,000,000. These projects, their estimated cost, and their projected timing are listed below:

- UV Disinfection – $4,400,000 – 2010
- Digester Modifications – $4,000,000 – 2010
- Headworks Improvements – $12,300,000 – 2016
- Phase 2 Improvements (Denitrification & Phosphorus removal) – $15,000,000 – 2020
- Endocrine Disrupting Compounds (EDC's) removal – $19,000,000 – 2030

Utilities staff is currently completing a WWTP Evaluation project which is an analysis of the UV Disinfection, Digester Modifications, and Headworks Improvements projects. This analysis will present several process alternatives for the various facilities, their respective estimated costs, and will provide a recommendation regarding their overall priority.

WWTP Rehabilitation Projects

In addition to the WWTP capital projects listed above, there are numerous WWTP rehabilitation projects identified in the CIP to address the plant's aging infrastructure. These projects are listed in the CIP in years 2016 through 2030, and have a combined cost (in 2008 dollars) of $8,500,000. Utilities staff will continue to review the WWTP Rehabilitation analysis annually to identify the correct timing for the various rehabilitation projects within the 6-year CIP.

WWCS Rehabilitation Projects

Lastly, there are numerous wastewater collection system improvement projects currently identified in the 20-yr CIP. These projects were identified in the Wastewater Collection System Master Plan which was accepted by the WRAB in December 2008. The CIP currently lists four (4) Tier 1 projects (highest priority) and seven (7) Tier 2 projects (second highest priority). The total cost (in 2008 dollars) for these eleven projects is estimated at $28,000,000. The Tier 1 and Tier 2 project groups are listed below with their estimated cost and projecting timing:

- Tier 1 Projects – $5,000,000 – 2016 through 2021
- Tier 2 Projects – $23,000,000 – 2021 through 2030

WQSP Funding

The Water Quality Strategic Plan (WQSP) is implemented by the Water Quality and Environmental Services (WQES) Group. This include recommendations associated with the Water Quality Strategic Plan, Industrial Pretreatment Program and Wastewater and Environmental Laboratory Program. These recommendations provide a strategy that focuses on maintaining and operating existing programs and planning for future regulations and their implications on City regulatory requirements.

The WQSP elements, including Industrial Pretreatment, Wastewater Environmental Laboratory and associated capital projects, are currently being approached in the following

funding manor. It should be noted that this element of the WWUMP plan is more of an opportunistic program such that if funds are available, some recommendations can be moved forward as described in the Action Plan recommendations within the WQSP document.

- WQSP Recommendations
  - Requires a $50,000 one-time investment, a $94,000 on-going adjustment to base, and an additional 1.0 FTE.
- Industrial Pretreatment Program
  - Requires a $30,000 one-time investment.
- Wastewater and Environmental Laboratory Program
  - Requires a $30,000 one-time investment and $30,000 ongoing adjustment to base plus 0.5 FTE
- Near Term Capital Improvements
  - Requires a $196,000 one-time investment plus an ongoing $124,000 adjustment to base and an additional 1.5 FTE

Investment Program Options

The WWUMP presents three Utility investment programs based on different levels of funding including the following

- Fiscally Constrained Plan
- Action Plan
- Vision Plan

These programs implement the policy direction of the WWUMP at the three funding levels.

Fiscally Constrained Plan

The Fiscally Constrained Program reflects an investment strategy which assumes a Wastewater Utility Fund rate increase of two percent (2%) in 2010, and a three percent (3%) annual increase in years 2011 through 2030. The 3% increase rate is based on an assumed average annual rate of inflation. Under the Fiscally Constrained program, there are numerous programs and projects which would be either eliminated or have reduced funding. These include the following:

- Either the UV Disinfection or the Digester Modifications project (both scheduled for construction in 2010) would need to be eliminated from the 20-year CIP
- The 2016 Headworks Improvements project would be eliminated from the 20-year CIP

- The 2020 Phase 2 Improvements project (Nutrient Removal) would be eliminated from the 20-year CIP
  - This project would likely be required to address CDPHE permit issues
- The 2030 Endocrine Disrupting Compounds (EDC) removal project would be eliminated from the 20-year CIP
  - This project would likely be required to address CDPHE permit issues
- The WWTP Rehabilitation funding would be eliminated from the 20-year CIP
- The Wastewater Collection System Replacement projects (Tier 1 and Tier 2) would be eliminated from the 20-year CIP
- The Sanitary Sewer System Rehabilitation funding would be eliminated from the 20-year CIP
- Future budget supplementals would be eliminated from the 20-year CIP

Action Plan

The Action Program reflects an investment strategy which assumes an annual Wastewater Utility Fund rate increase of four percent (4%) in years 2016 through 2030, with the following exceptions. The Action Plan will follow the recommended 6-year (2010-2015) CIP which includes the following rate increases: 2010=2%, 2011-2012=3%, 2013=4%, and 2014 to 2015=6%. There is one period of increased funding which is necessary to maintain a positive fund balance in 2030. Two consecutive years (2019 and 2020) of nine percent (9%) rate increases would be required to fund the Nutrient Removal project. Under the Action Plan, there are a few programs and projects which would be either eliminated or have reduced funding. These include the following:

- The 2030 Endocrine Disrupting Compounds (EDC) removal project would be eliminated from the 20-year CIP
  - This project would likely be required to address CDPHE permit issues
- The Wastewater Collection System Replacement projects (Tier 2) would be eliminated from the 20-year CIP

Vision Plan

The Vision Program reflects an investment strategy which assumes an annual Wastewater Utility Fund rate increase of four percent (4%) in years 2010 through 2030 with the following exceptions. There are three periods of increased funding necessary to maintain a positive fund balance in 2030. Two consecutive years (2014 and 2015) of eight percent (8%) rate increases would be required to fund the Headworks Improvements project. Two consecutive years (2019 and 2020) of eight percent (8%) rate increases would be required to fund the Nutrient removal Improvements project. Two consecutive years (2029 and 2030)

of eight percent (8%) rate increases would be required to fund the EDC removal project. Under the Vision Plan, there are no programs that would have reduced funding.

Levels of Service

The three investment program options listed above will involve some combination of providing essential, desirable, and discretionary services. These are defined below.

Essential Services – include the operation, maintenance and administration of existing systems that ensure highly reliable wastewater treatment/delivery in a manner that meets federal and state regulatory criteria or industry standard levels of best practice. These services ensure that customers and employees are in a safe environment, that a basic "customer care" service standard (ie responsiveness, financial or permits) is provided with minimal disruptions. Maintaining quality of life is addressed as a result of these services. These services ensure the health and safety of people and property and collect sufficient funds to maintain these services.

Desirable Services – include the expansion of wastewater treatment and delivery systems that are intended to respond to impacts of future growth or development, meet federal or state goals, or which support city council adopted goals and values. These services might enhance quality of life by providing a higher level of service or ability to access information than is routinely provided by regulatory criteria or industry standards.

Discretionary Services – include enhancements of wastewater treatment or delivery systems that, while not necessary for others to perform their business, do provide added value. These services may provide information to the industry for analysis and comparisons in order to develop future regulations, or may include another way for customers to access information. These services may provide a special convenience to a small number of customers

Investment Program Recommendations

It is recommended that the City proceed with the Action Plan identified above. The Action Plan will ensure that both critical capital and rehabilitation projects continue to be funded adequately through the 20-year CIP planning period.

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HDR