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City of Boulder Wastewater Treatment Plant Master Plan

June 2007

Wastewater Treatment Plant Upgrades

WASTEWATER TREATMENT PLANT MASTER PLAN

Prepared for
City of Boulder
June 2007

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LIST OF ACRONYMS

AS	activated sludge
BOD_5	five-day biochemical oxygen demand
BVCP	Boulder Valley Comprehensive Plan
CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Discharge Permit System
CIP	Capital Improvement Program
DNF	denitrification filters
DRCOG	Denver Regional Council of Governments
EPA	U.S. Environmental Protection Agency
gal	gallon
gpcd	gallons per capita per day
I/I	infiltration and inflow
kWh	kilowatt per hour
LEED	Leadership in Energy and Environmental Design
MBR	membrane bioreactors
mg/L	milligrams per liter
mgd	million gallons per day
MMBtu	million British thermal units
mpg	miles per gallon
MWh	megawatt per hour
NTF	nitrifying trickling filter
O&M	operation and maintenance
SIU	significant indirect user
TF/SC	trickling filter/solids contact
TFR	trickling filter recycle
TIN	total inorganic nitrogen
TMDL	total maximum daily load
UV	ultraviolet
WRAB	Water Resources Advisory Board
WUSA	wastewater utility service area
WWTP	wastewater treatment plant

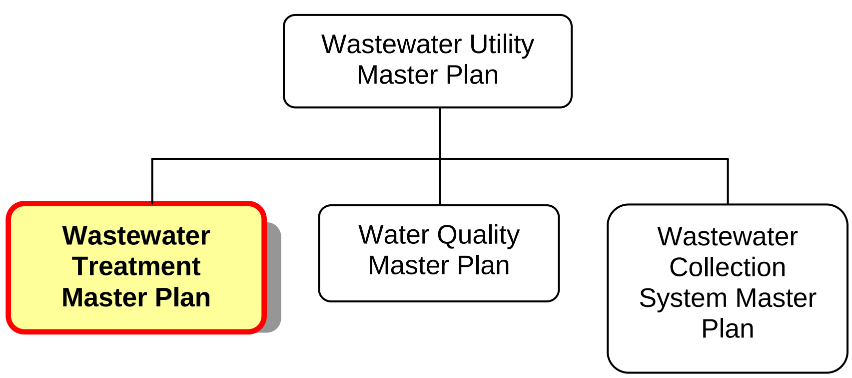
EXECUTIVE SUMMARY

The purpose of this master plan is to document past decisions, to present the approach that has been used to reach decisions on process selection, to describe the current state of the facility, and to 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 Boulder Valley Comprehensive Plan (BVCP) Goals, ongoing improvements to the treatment facility are necessary.

This master plan will be a component of a utility wide Wastewater Utility Master Plan to be completed in 2008. The City of Boulder's most recent wastewater planning documents were the 2002 Utilities Plan; the 1990 Facilities Plan; and the more recent Collection System Master Plan, which was completed in 2003.

The City has adopted a new framework for City departmental planning documents since these documents were prepared. The new framework includes a single master plan for each of the three utilities: Water, Wastewater, and Stormwater and Flood Management. Master plans will address the major categories of each utility. For example the Wastewater Utility Master Plan will include sections on the collection system, the treatment system, and water quality that will be informed by master plans on those components of the utility. Figure 1 illustrates the hierarchy of the City's Wastewater Utility Master Plan and other master plans. (The Water Quality Master Plan is scheduled to be completed in 2008).

Figure 1. City Wastewater Utility Planning Documents



The existing treatment facility includes a trickling filter/solids contact secondary process. This secondary treatment process is being upgraded to an activated sludge process in the Phase 1 improvements project currently under construction. Phase 1 improvements also will include a dissolved air flotation thickener to thicken the solids produced in the activated sludge process and solid handling improvements. These improvements, when put online in early 2008, will allow the effluent to meet the limits in the 2003 discharge permit. Application of the new limits in the permit has been deferred by a compliance schedule intended to allow completion of the new secondary process construction needed to meet the new limits.

The Phase 2 construction, currently planned for 2010, will include any process changes needed to meet permit limits in the 2008 permit. Although components of the Phase 2 project are still speculative at this time, the 2008 permit could contain requirements for nitrogen and/or phosphorus removal that would require additional treatment processes. Additionally, Phase 2 may include noise and odor control units, an ultraviolet (UV) disinfection system, and solids stabilization (anaerobic digester) improvements.

The Colorado Department of Public Health and Environment (CDPHE) issues renewed discharge permits to the City every five years. Federal requirements developed by the U.S. Environmental Protection Agency (EPA) are incorporated in the permits. Wastewater contaminants that may be regulated in the future include endocrine disrupters and disinfection byproducts. Endocrine disrupters have been shown to pass through the plant untreated, and disinfection byproducts are formed in the disinfection process. Although it is uncertain what the future permit requirements will be, discharge permits will continue to be the primary driver for wastewater improvements in the future.

INTRODUCTION

Background

The City of Boulder 75th Street Wastewater Treatment Plant (WWTP) is located in the city at 4049 N. 75th Street in the SW ¼ of Section 13, T1N, R70W, Boulder County, Colorado (see Figure 2). 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 Colorado Discharge Permit System (CDPS) permit (Number CO-0024147) dated February 1, 2003, which expires on January 31, 2008. The WWTP is being upgraded to meet future wastewater treatment capacity demands and new ammonia-nitrogen limits that were incorporated in the CDPS permit.

The Phase 1 upgrades include improvements to both the liquid stream treatment and solids dewatering processes. The Phase 1 WWTP improvements currently under construction will increase the treatment capacity to 25.0 million gallons per day (mgd) on a maximum month basis and provide the capability to reduce ammonia-nitrogen concentrations in the wastewater to levels below that required by the 2003 discharge permit. The Phase 1 improvements also will keep the total nitrogen discharge at or below the current level. In addition to the liquid stream improvements, the solids dewatering process is being improved to handle increased solids from the liquid stream treatment process and to reduce the volume of dewatered solids that must be transported from the WWTP site.

Figure 2. City of Boulder 75th Street Wastewater Treatment Plant

Phase 2 improvements are anticipated to be implemented in 2010 in response to the following drivers:

- More stringent CPDS discharge permit limitations in 2008
- The desire to replace the existing chemical disinfection (chlorine and sulfur dioxide) process with a UV disinfection process
- The need to address biosolids stabilization (digester capacity) limitations

Purpose of Master Plan

This master plan describes how the current WWTP improvements were selected, how they will establish the City of Boulder as a proactive environmental steward with regards to water quality preservation, and how these improvements will position Boulder to meet anticipated future wastewater treatment requirements. The plan also presents the following information:

- The current WWTP improvements and how they conform to City and County policies and goals
- A comparison with historic operations
- The economic impacts of the current WWTP improvements
- The implementation plan for current improvements (Phase 1)
- Strategies for measuring system performance
- Anticipated future requirements and implementation plan (Phase 2)

CURRENT SITUATION

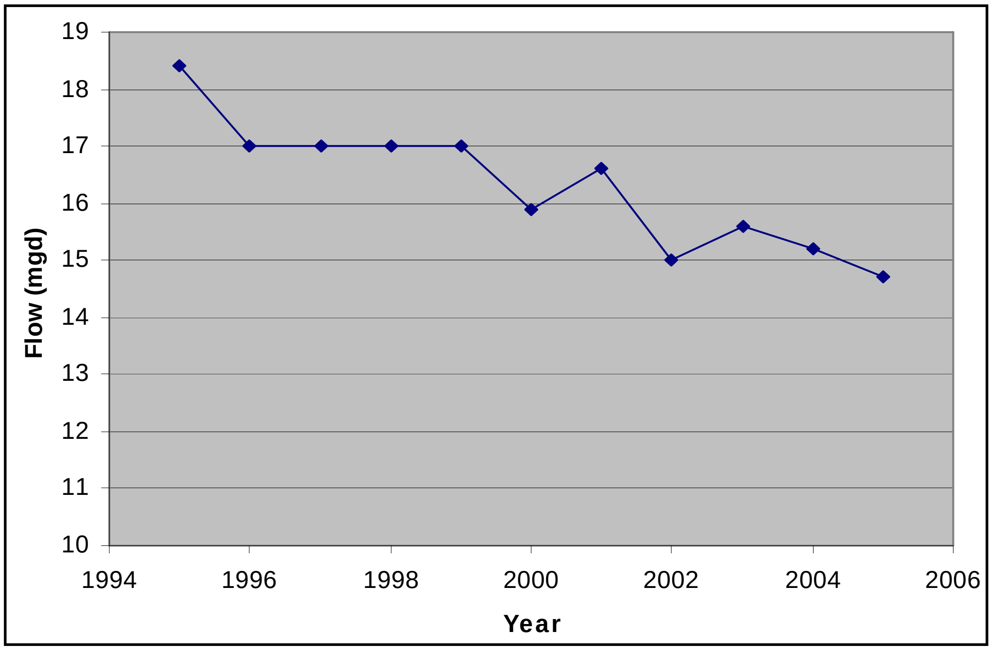
Meeting the Needs of the Community

The existing WWTP is not capable of treating wastewater to the level required to comply with the 2003 discharge permit requirements for ammonia removal. The City, however, has been issued a compliance schedule to allow construction of the new unit processes before those permit limits go into effect. In addition, the existing plant rating for organic material (biochemical oxygen demand) removal is not adequate to treat the increasing organic loads.

Population and Flow Projections

The existing WWTP capacity is adequate to meet the needs of the existing community; however, it is not adequate to treat the wastewater generated by anticipated population and employment growth in the Boulder wastewater service area. The 2004 and 2005 annual average WWTP influent flow has been 15.2 mgd and 14.7 mgd, respectively. As shown in Figure 3, annual average flows have been trending down, or at least not increasing, since 1995 which averaged 18.4 mgd due to the high infiltration experienced during that very wet year.

Figure 3. 1995-2005 WWTP Flows

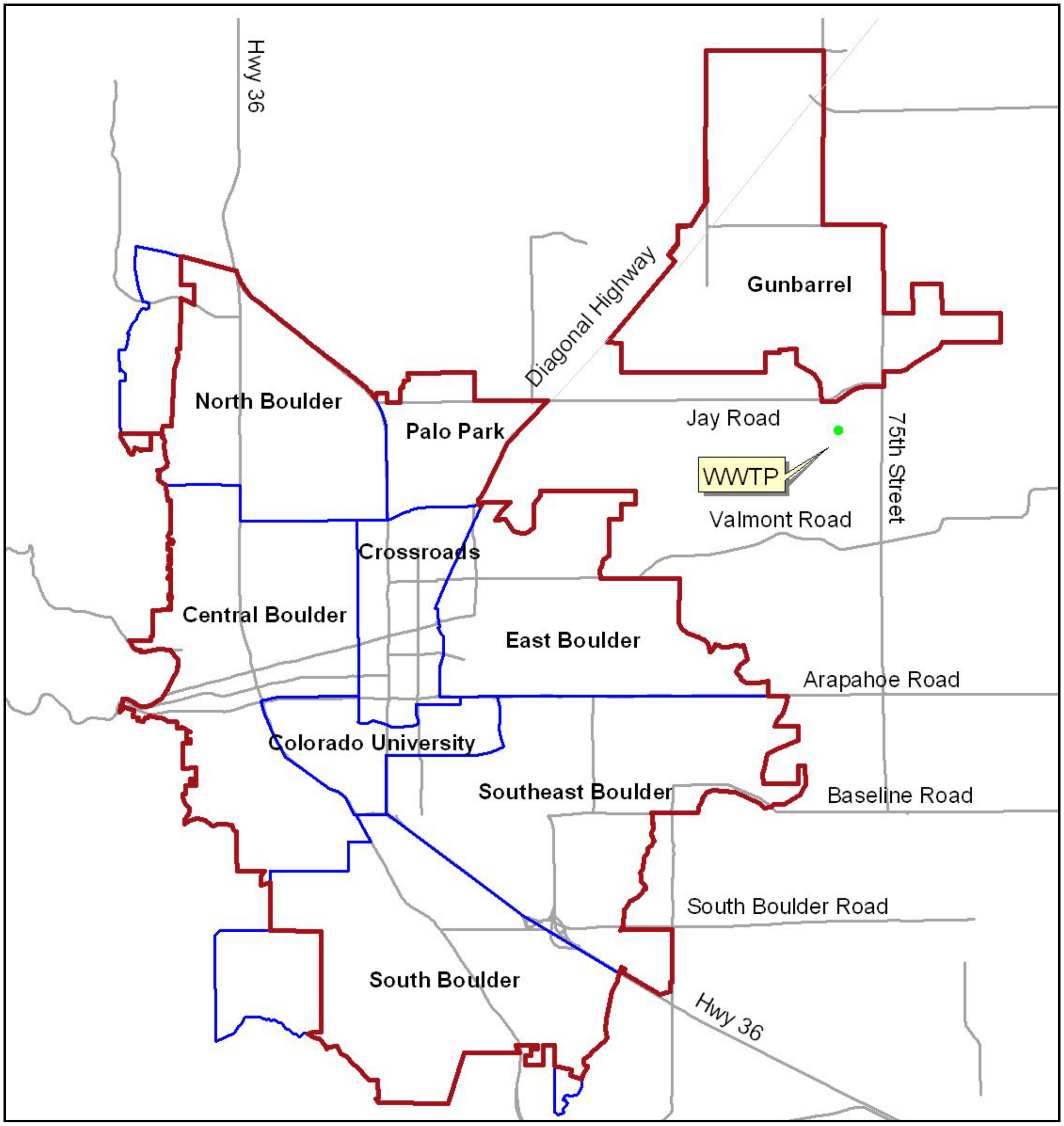


This graph of recent annual average influent flows at the WWTP is informative in depicting the variability that necessitates conservative future flow projections. In 1995 Boulder experienced a very wet year with near record rainfall in May. In contrast, 2002 was the driest in the last 300 years, and the utility requested water conservation efforts that continued into 2003 before they were retracted. However, the customers' water conserving behavior seems to have continued (a phenomenon also referred to as a "drought shadow"). Additionally, the City's ongoing system rehabilitation has reduced groundwater infiltration and surface water inflows (I/I) in the collection system. Thus, Figure 3 shows the impact that wet weather, drought, I/I reduction and conservation efforts can have on WWTP flow.

Hydraulic capacity projections were based upon historic flow per resident and employee, industrial hydraulic load, land use and zoning mapping, and population and employment projections. The extremes, both high and low, were excluded from the averages used to project future hydraulic capacity needs at the WWTP. More historic wastewater flow data can be found in the *City of Boulder Wastewater Collection System Master Plan Update* (July 2003).

The WWTP serves the nine sub-communities of Boulder's wastewater utility service area (WUSA) depicted in Figure 4.

Figure 4. Map of WUSA Area (WUSA area denoted by red line)



Boulder's population and employment continue to grow, with the population expected to reach 128,162 by 2025 based on a revised estimate of Denver Regional Council of Governments (DRCOG) projections. The BVCP population and employment growth expectations are similar.

The wastewater treatment planning documents must use DRCOG's population projection when submitting plans and applying for state level approvals for facility improvements.

The BVCP recently has been revised to include population and employment projections through build-out of the service area. The build-out population is expected to be reached in 2030, but no specific year has been assigned to the employment build-out projections. Throughout the planning period, population and employment estimates from DRCOG closely follow estimates from the BVCP. To keep the values consistent with each other, the employment estimate value from DRCOG in 2025 has been recalculated to reflect the BVCP build-out projection.

The revised values represent a population projection increase of approximately 7,000 people over previous projections for the year 2030 and an employment increase of approximately 23,000 employed persons. Boulder population projections from DRCOG and the BVCP are shown in Table 1. Employment values and projections from the BVCP and DRCOG are summarized in Table 2.

Table 1. Population Summary and Projection for Areas I & II (WUSA)

				Projected Population			
Source	**2000**	**2001**	**2005**	**2010**	**2015**	**2020**	**Build Out**
BVCP	106,200	109,180	112,160	115,140	118,120	121,100	129,878
DRCOG Analysis	--	106,614[1]	109,412[1]	112,341[1]	116,121[1]	119,500[1]	128,162[2]

[1]Original estimate provided by DRCOG
[2]Estimate based on revised BVCP projections

Table 2. Employment Summary and Projection for Areas I & II (WUSA)

				Projected Employment			
Source	**2000**	**2001**	**2005**	**2010**	**2015**	**2020**	**Build-out**
BVCP	101,000	109,260	117,520	125,780	134,040	142,300	167,564
DRCOG Analysis	--	106,407[1]	111,062[1]	119,656[1]	125,228[1]	130,721[1]	155,921[2]

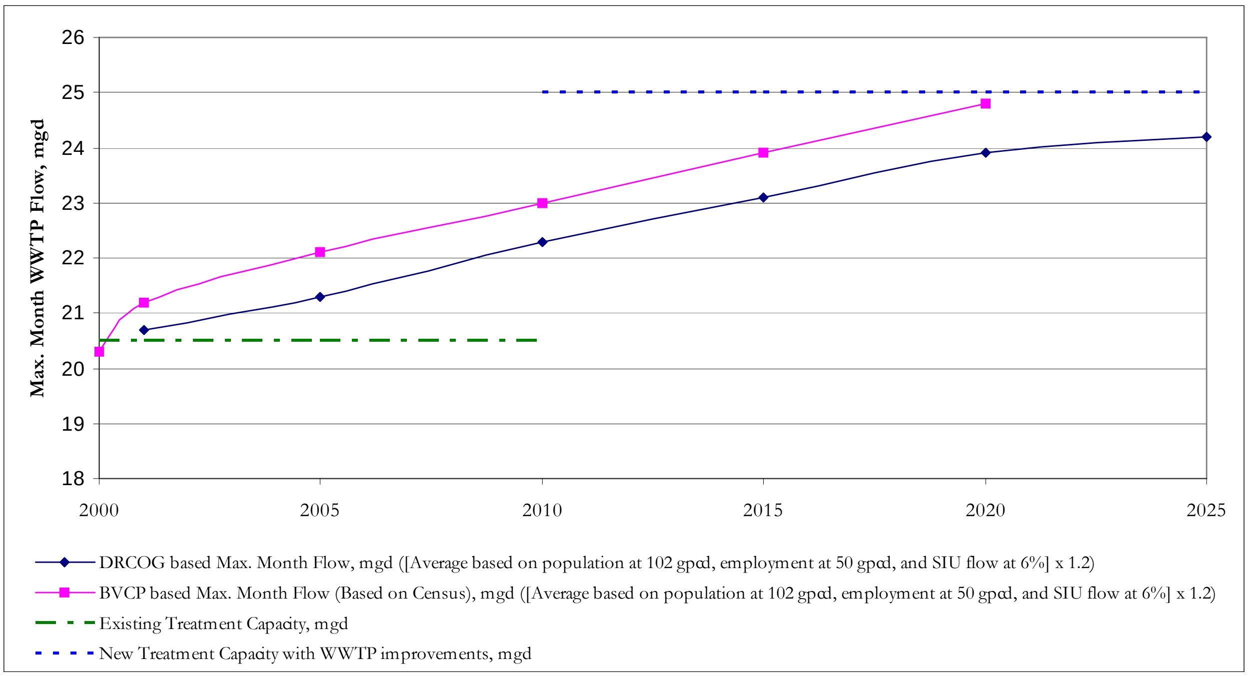
[1]Original estimate provided by DRCOG
[2]Estimate based on revised BVCP projections

Based on historical values of 102 gallons of wastewater generated per capita per day and 50 gallons of wastewater generated per employee per day, an additional flow of approximately 1.1 mgd is anticipated as a result of the changes in population and employment projections. This also represents an additional loading of approximately 2,130 pounds of 5-day biochemical oxygen demand (BOD_5) per day. This represents an increase of 4.4% in the design flow and an increase of 7% in BOD_5 design loading. These increases are generally within the range of accuracy of the initial flow and load projections and therefore are considered to have no significant impact on the capability of the upgraded (i.e., Phase 1 and Phase 2) wastewater treatment facilities to handle the projected flows and loads.

The existing facility is designed to treat 20.5 mgd; however, the projected capacity requirement to meet the 2030 population and build-out employment is approximately 25 mgd. Industrial flow projections are estimated to be 6% of the total annual flow based on the 2000 and 2001 significant industrial user (SIU) flows of approximately 0.97 mgd.

Figure 5 shows existing WWTP capacity (20.5 mgd) versus projected flows.

Figure 5. Projected Maximum Month WWTP Flows and Treatment Capacity



If population values increase beyond those predicted (as shown in Table 1 and Table 2) the WWTP will not provide adequate treatment capacity. In that case, treatment capacity needs will have to be re-examined before the expected build-out date of 2030, and additional expansion of the WWTP capacity may be required before that time. However, as shown in Figure 3, if recent influent flow trends continue, the WWTP will have adequate capacity for the interim period.

Strengths of Existing Wastewater Treatment System

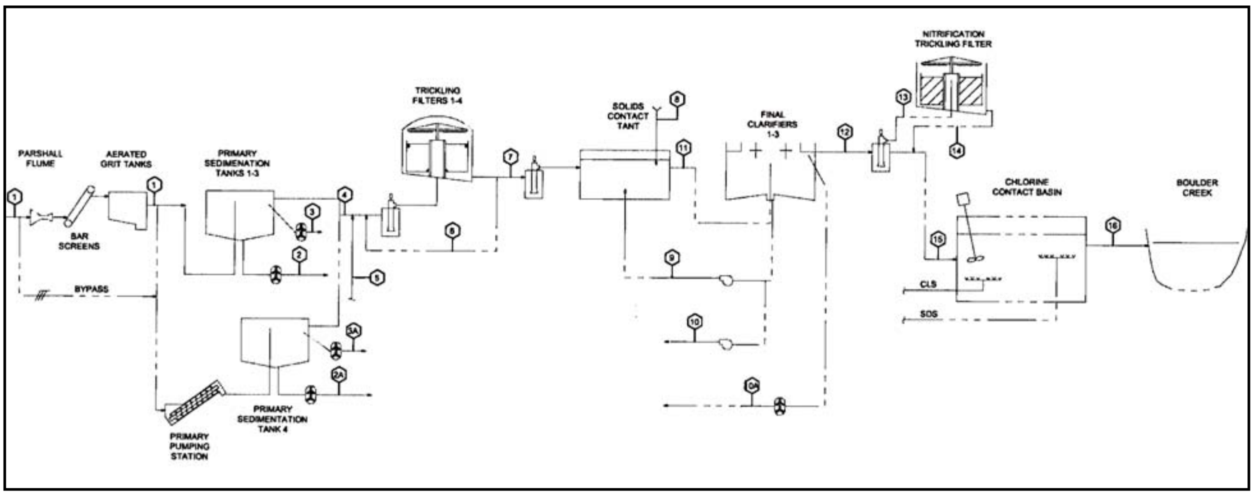
The existing WWTP liquid stream system includes a trickling filter/solids contact process that has been operational since 1989. The existing system is shown schematically in Figure 6. Over the past 18 years the facility generally has met the demands of City residents; maintained permit compliance; and discharged satisfactory treated wastewater, or effluent, to Boulder Creek. For clarification, the liquid stream processes treat the wastewater by removing contaminants, and the solid stream processes treat the solids removed from the wastewater and the solids generated by the liquid stream processes.

Weaknesses of Existing Wastewater Treatment System

The two primary drivers motivating the current Phase 1 WWTP improvements are new ammonia-nitrogen discharge limits and increased wastewater flow. The existing facility, as shown in Figure 6, will be unable to reduce ammonia-nitrogen in the wastewater to the level required by the 2003 discharge permit. In addition, the rated BOD capacity is routinely exceeded and the facility has insufficient capacity to treat the projected wastewater flows. City staff also are concerned about health and safety issues associated with the delivery and use of chlorine in the system.

The improvements will allow the WWTP to treat projected flows and loads through 2030, treat the wastewater to the level required to meet the 2003 discharge permit requirements, provide more operational flexibility to control the level of nitrification and denitrification, and increase equipment efficiency.

Figure 6. Schematic of Existing WWTP



RELATIONSHIP OF THE WASTEWATER TREATMENT IMPROVEMENTS TO CITY AND BVCP GOALS

Both the City of Boulder and Boulder County desire to maintain proactive status regarding environmental stewardship. Consequently, both have established goals in the areas of sustainability and environmental quality. By meeting the objectives of the planned process improvements, the Boulder WWTP also will meet several City and County environmental goals. Relevant City and County goals are listed below:

- Improving and protecting water quality
- Reducing waste by improving recycling and reuse of biosolids
- Protecting the general health and safety of plant workers

- Meeting future wastewater treatment capacity demands
- Creating a sustainable community through
  - Improved energy efficiency
  - Minimization of greenhouse gas emissions
  - Cost savings
  - Minimization of chemical usage

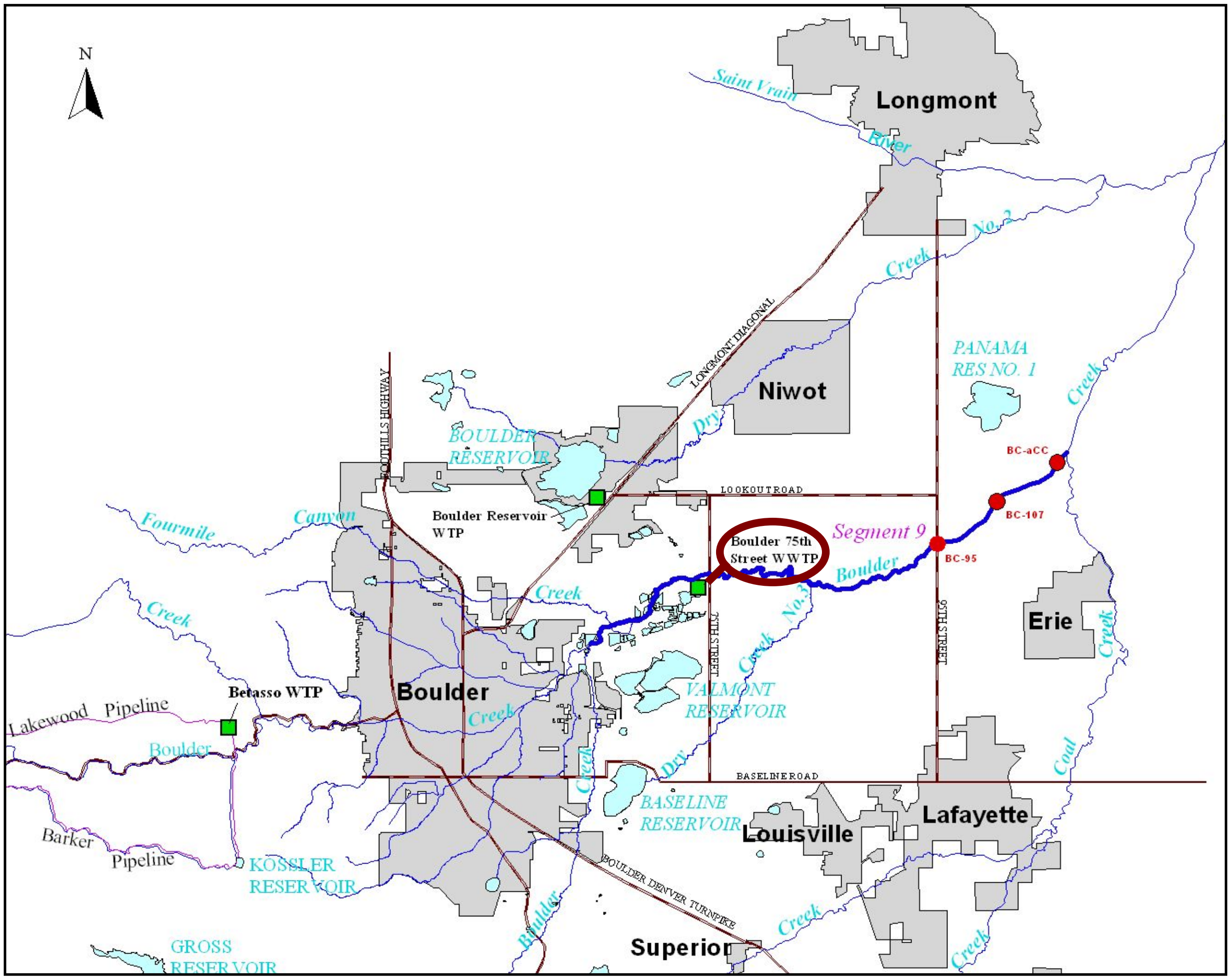
The following paragraphs summarize how the wastewater treatment improvements provide a means to meet these goals.

Improving and Protecting Water Quality

The Colorado 303(d) List is a list of surface waters within Colorado that are considered "impaired" with respect to the water quality required for their intended uses. The 2000 Colorado 303(d) List identifies Segments 9 and 10 of Boulder Creek as being impaired for aquatic life due to elevated un-ionized ammonia. The list identifies municipal WWTPs and possible non-point sources of ammonia as the causes of impairment. This listing necessitated implementation of an ammonia Total Maximum Daily Load (TMDL) study, which subsequently dictated the ammonia-nitrogen limit contained in the Boulder Colorado Discharge Permit. The current permit, issued February 1, 2003, is in effect until February 2008.

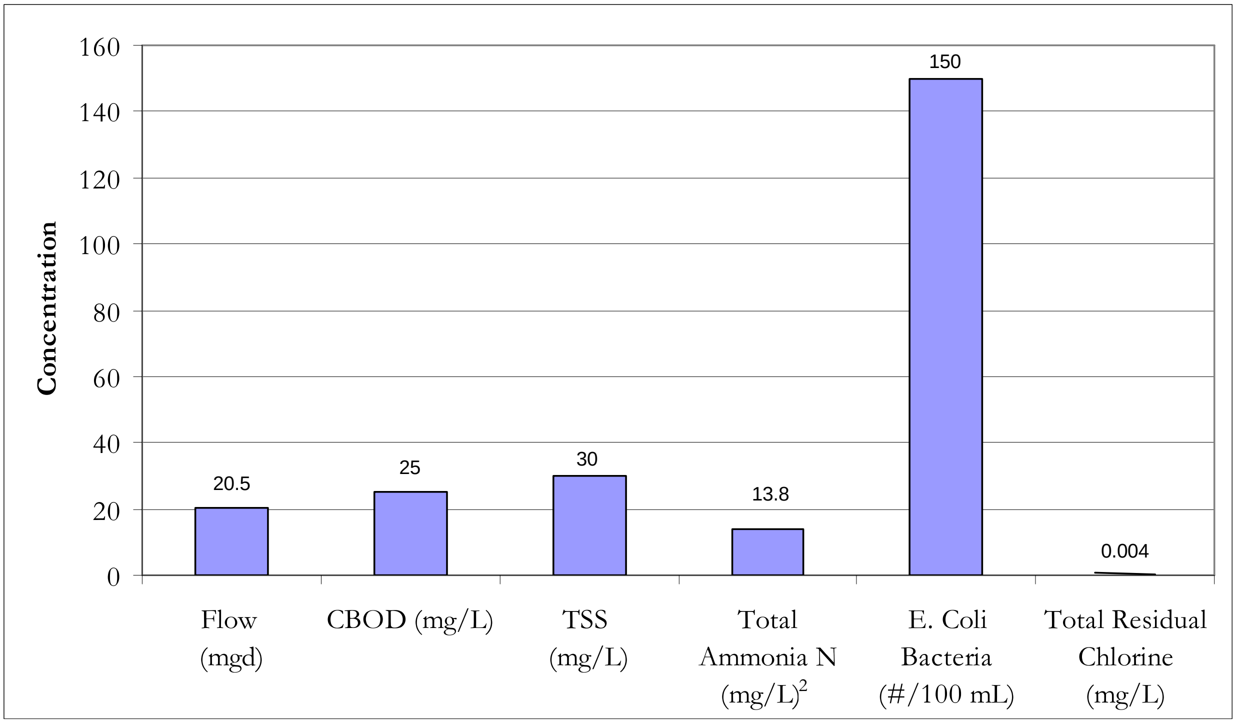
Figure 7 presents an image of Section 9 of Boulder Creek and the location of the Boulder WWTP. Improvements under construction at the WWTP will remove significant amounts of ammonia from the plant's effluent and improve Segment 9's aquatic habitat. Additionally, pretreatment efforts will continue to minimize the "hard to treat" contaminants discharged to the City's sanitary sewers. Although the permit does not place limits on specific nutrients, the City of Boulder recognizes the need to put mechanisms in place to ensure that anticipated future nutrient limits can be met with minimal additional construction. The ammonia limit and potential future nutrient limits will contribute to the protection of aquatic life in Boulder Creek.

Figure 7. Segment 9 of Boulder Creek and the Location of the Boulder WWTP



Current improvements to the WWTP (Phase 1) will allow Boulder to discharge water of substantially higher quality than the 2003 discharge permit requires, while also achieving no net increase in the total amount of nitrogen discharged to Boulder Creek. By complying with permit's limits, the water discharged from the 75th Street WWTP will improve the water quality of Boulder Creek to a level that has been determined to protect downstream users and support aquatic life. Figure 8 presents WWTP effluent constituent concentrations that must be met to ensure compliance with the 2003 discharge permit.

Figure 8. Effluent Limits for Selected Constituents[1]



Note: All values are based on 30-day averages.
[1]Effective until January 31, 2008.
[2]The ammonia-nitrogen value shown is the annual average. Regulatory limits vary monthly and range from 10.9 to 16.9 mg/L. Effective January 25, 2008, the TMDL-based ammonia limits come into effect, resulting in a limit of 5.3 mg/L for March, the most stringent month.

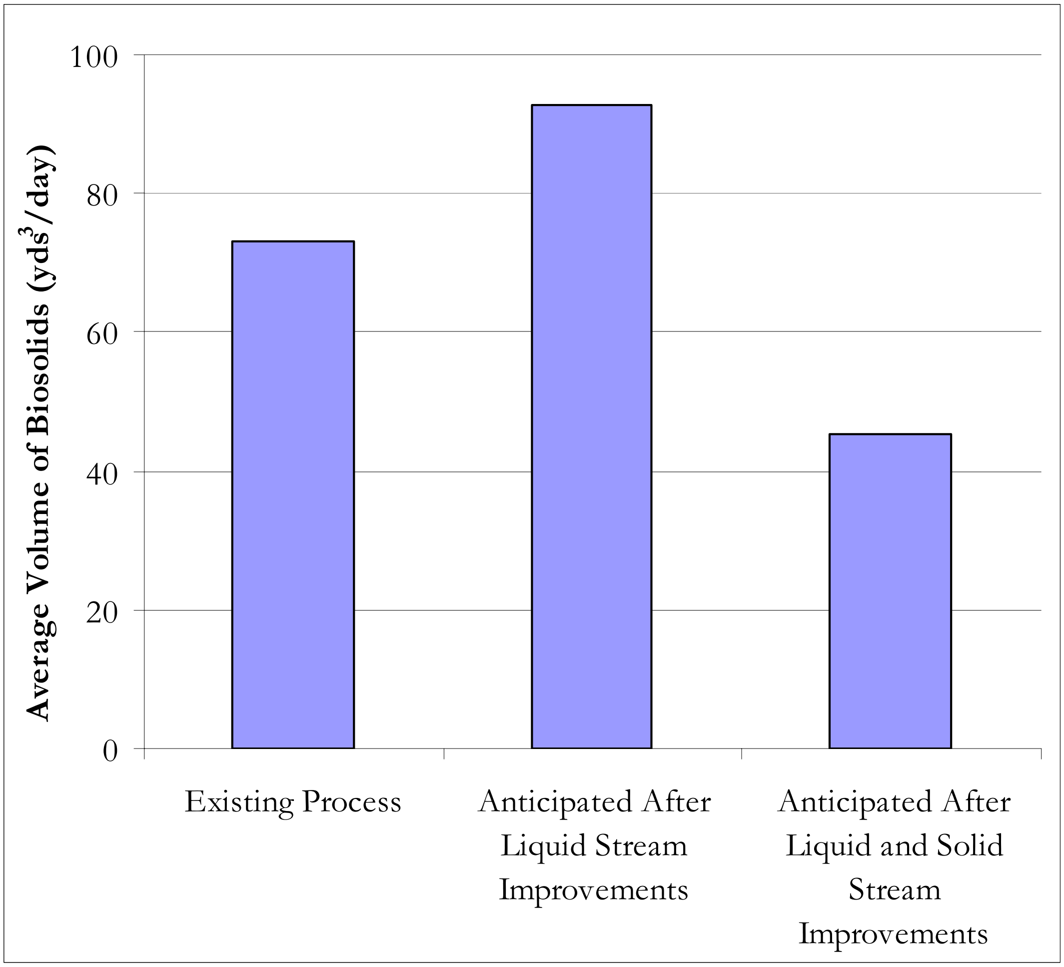
Reducing Waste and Improving Recycling and Reuse

The City's WWTP represents the one of its most significant investments and efforts the City continues to make to reduce and recycle waste generated by the City. As discussed in the following paragraphs, the Phase 1 improvements will reduce the biosolids volume by 50% and promote their reuse through land application.

As shown in Figure 3, water conservation can effectively reduce wastewater influent flows but does not reduce the pollutant load in the wastewater. Therefore, if hydraulic capacity limitations are approached, water conservation efforts in conjunction with collection system rehabilitation to reduce I/I may be used to extend the useful life of a treatment unit's capacity under certain conditions. However, hydraulic loads, organic loads and solids loads all must be within the overall treatment capacity of the facility to achieve adequate treatment.

The upgraded liquid stream treatment processes and the anticipated increase in wastewater flows at the WWTP are expected to increase solids production by 25% to 30%. The solids dewatering improvements are designed to treat this new volume and to remove substantially more water from the solids than historically has been the case. By reducing the amount of excess water contained in the solids, the volume of material removed from the WWTP will decrease by nearly 50%, resulting in reduced hauling costs, and associated fuel usage, and disposal costs. Figure 9 presents a comparison of the existing and anticipated volume of sludge produced as cubic yards per day.

Figure 9. Biosolids Production Volumes



The volumes of sludge presented in Table 7 were calculated from the historical and projected sludge quantities presented in the *Community Environmental Assessment Process for 75th Street Wastewater Treatment Plant Dewatering Improvements* (May 2006). Biosolids densities were assumed to be 64.3 and 66.1 lbs/cubic foot for solids concentrations of 10% and 20%, respectively.

Solids generated in the wastewater treatment process will be anaerobically digested, dewatered, and used as a soil amendment on agricultural lands on Colorado's eastern plains. Alternatively, the solids could be used by a private firm on a contract basis for landscape amendments or other uses.

Boulder also has a pretreatment program that reduces waste loads from industries and some commercial enterprises. The program requires categorical and significant industrial dischargers to limit the pollutants they discharge under a permit issued by the City. The pretreatment program protects the liquid stream processes from harmful loads, protects the quality of the solids, and protects Boulder Creek from the effects of pollutants that could pass through the facility untreated. This program will be important in protecting the plant from future increases in metals and other non-treatable pollutants.

Protecting the General Health and Safety of Plant Workers

There was no work time lost from on-the-job injuries during 2005. The planned improvements will provide improved working conditions and reduce exposure to hazardous chemicals by eliminating the chlorine and sulfur dioxide currently used in the treatment process and replacing it with UV disinfection. The upgrades also will replace old and outdated equipment with newer equipment that will require less maintenance and reduce potential for possible injury associated with operation. This will provide a safer environment for plant workers and for the surrounding neighborhoods and natural areas and will help maintain baseline conditions of zero injuries.

Meeting Future Demands

The population of Boulder is expected to grow to approximately 128,160 people by 2030 and the number of people employed in Boulder to increase to approximately 155,920. The existing facility is not equipped to treat the volume of wastewater generated by this projected growth; therefore, an increase in treatment capacity from 20.5 to 25 mgd is needed. After the Phase 1 improvements are in place, the facility will meet these future demands.

Creating a Sustainable Community

Sustainability in wastewater treatment is achieved through resource conservation, recycling and waste reduction. Resource consumption will be minimized through proper process selection, use of energy efficient equipment, and operational process optimization.

Primary issues of concern pertaining to resource consumption include the following:

- Energy usage
- Greenhouse gas generation
- Costs
- Chemical usage

Energy Usage

Although the energy efficiency of the new plant equipment will be greater than that of the older plant equipment, overall energy consumption is expected to rise due to the higher level of treatment provided and the anticipated increased wastewater flows. In evaluating higher level treatment alternatives, additional energy usage was considered to be an acceptable tradeoff when evaluated against increased chemical usage because of the safety issues and disinfection byproducts.

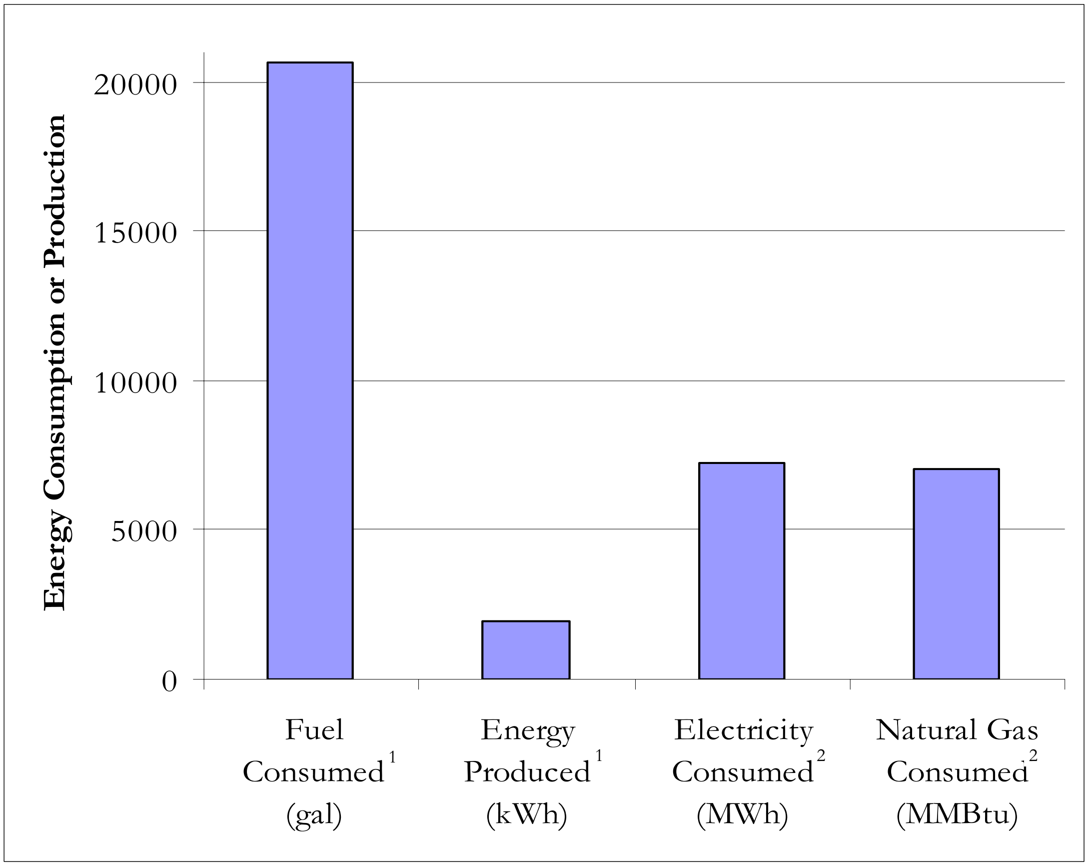
In addition to the criteria listed above, the City is incorporating Leadership in Energy and Environmental Design (LEED) concepts into the design of the new dewatering facility.

Facility upgrades will improve energy efficiency in several ways:

- Less fuel consumed
  - The mileage associated with hauling solids offsite will be decreased by approximately 50%.
  - The anticipated replacement of chemical disinfection (chlorine and sulfur dioxide) with UV disinfection (Phase 2) eliminates the fuel consumption associated with the manufacture and transportation of these chemicals.
- Electricity consumed
  - Improved energy efficiency of newer equipment will reduce energy waste in the liquid stream and solids dewatering processes (however, due to energy demands of the new activated sludge process, electrical energy usage is expected to increase).
- Energy produced
  - Increased production of solids will result in more methane production as wastewater flows increase.

Figure 10 presents data on the energy usage of the existing system.

Figure 10. Energy Usage



1 Based on 2004 data; 2005 data represented an atypical year due to digester cleaning.
2 Based on 2005 data; 2004 data not available.

Greenhouse Gas Generation

The City of Boulder participates in the Cities for Climate Protection Campaign, an agreement between U.S. cities that calls for a reduction in greenhouse gas emissions equivalent to those identified in the Kyoto Protocol. Improvements in energy usage and reduced fuel consumption lower the WWTP's greenhouse gas emissions; however, increased solids production creates more methane gas, one of the six primary greenhouse gases.

Costs

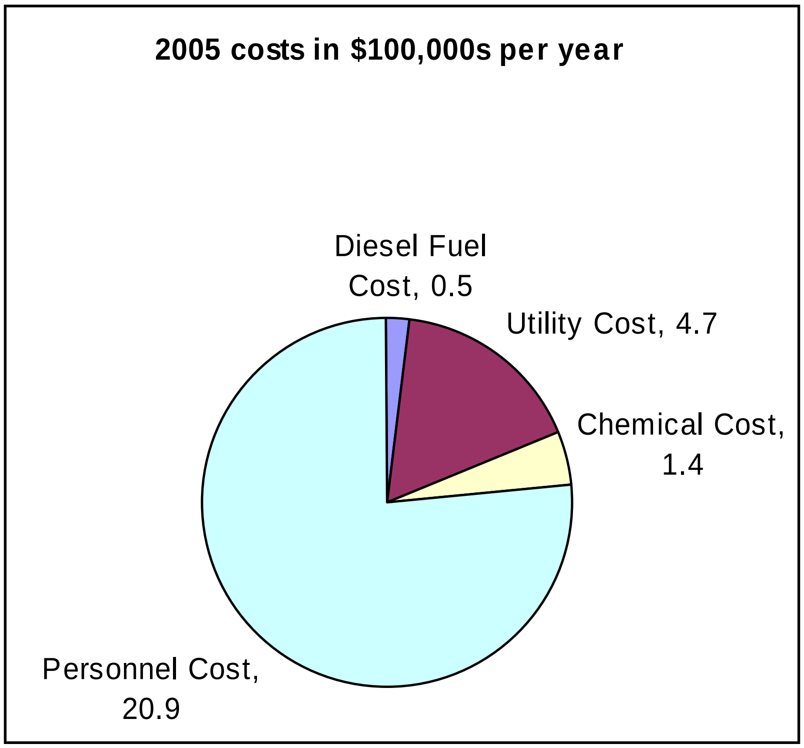
WWTP operating costs are based on the following:

- Fuel consumption
- Energy usage
- Chemical usage

- Equipment costs
- Personnel costs

The improved wastewater treatment processes will be more efficient in many ways; therefore, some operational costs are expected to be reduced. A considerable portion of the 2005 budget was spent on repair and rehabilitation work at the existing WWTP. In addition, biosolids recycling costs increased by approximately 10% and chlorine costs increased by 25% in 2005. Overall upgrades to the treatment process are expected to minimize maintenance and repair costs; however, because the new process will be treating the wastewater to meet more stringent regulations, some additional costs will be incurred. Figure 11 presents various expenditures from the existing WWTP (not including repair and rehabilitation). Diesel fuel cost includes diesel fuel consumption resulting from biosolids recycling operation. This estimation is based on City and contractor hauled biosolids loads and an efficiency of 4 mpg.

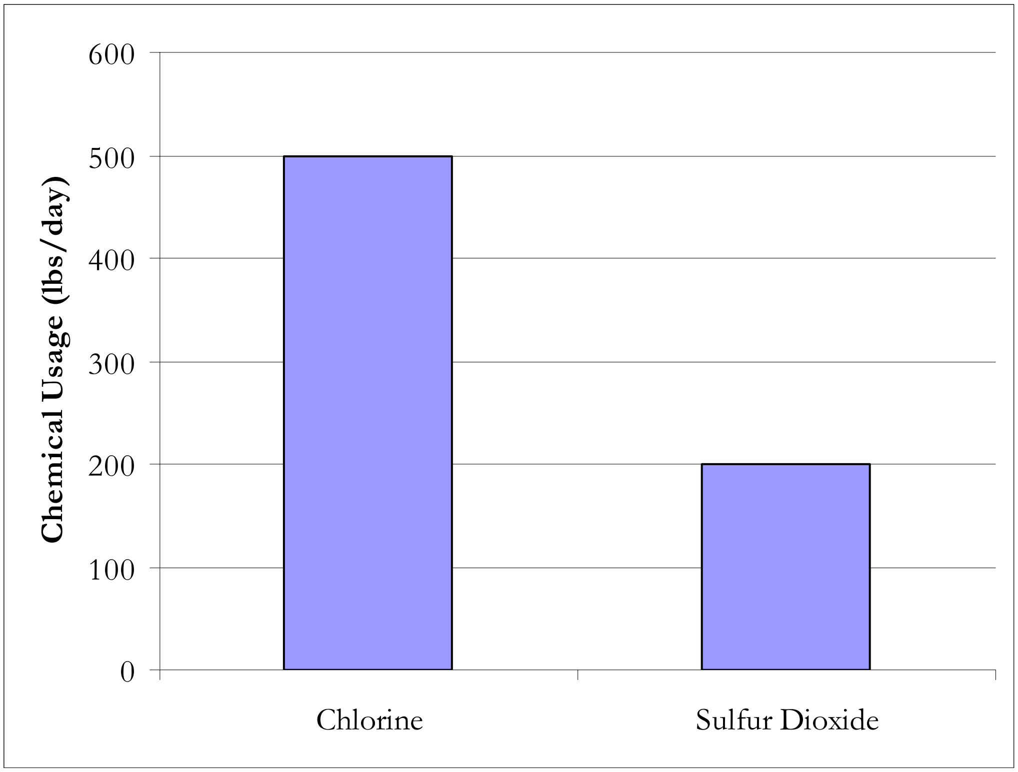
Figure 11. Summary of Existing WWTP Costs



Chemical Usage

The anticipated implementation of UV disinfection, potentially in Phase 2 improvements, will eliminate the need for chlorine and sulfur dioxide chemicals. Figure 12 presents actual chemical usage data for the existing plant.

Figure 12. Chemical Usage Data for the Existing WWTP



The use of additional chemicals was considered during the selection process. Several alternatives evaluated required the addition of methanol to achieve nitrogen removal. The chosen process can remove a substantial amount of nitrogen and phosphorus without the need for chemical addition. This is important since it is anticipated that 2008 CPDS permit discharge limitations will limit the discharge of one or more of these substances (Phase 2).

HOW THE MASTER PLAN AFFECTS LIFE IN BOULDER

WWTP improvements are necessary for the City of Boulder to continue to meet its environmental stewardship goals. By addressing the two main drivers of wastewater treatment improvements – lower ammonia-nitrogen limits and increased wastewater treatment capacity – City goals of furthering community sustainability goals and protecting water quality will be met. The improvements represent a proactive or "Action" approach, to improving water quality in Boulder County because they go beyond the minimum required to meet regulatory requirements.

A comparison between operational goals met by the existing WWTP and the WWTP after Phase 1 improvements are implemented is shown in Table 3.

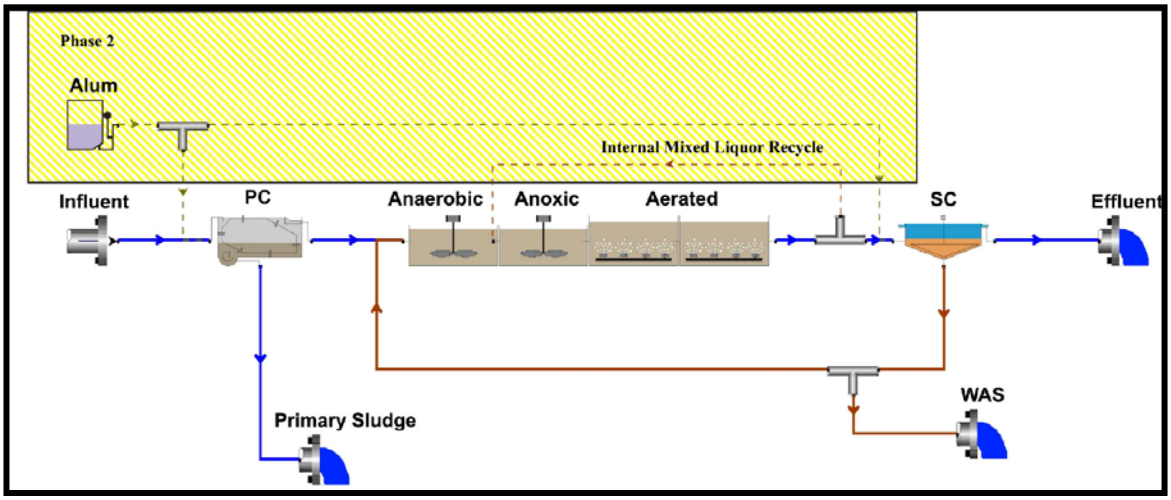
Table 3. Comparison of WWTP Capabilities

	Existing WWTP	WWTP After Phase 1 Improvements
Meet future capacity demands		✓
Meet CDPS 2003 ammonia limits		✓
Provide treatment options for additional nutrient removal		✓
Provide shorter operating time (biosolids dewatering)		✓
Reduce solids handling		✓
Minimize long-term operational costs[1]		✓
Minimize energy requirements[2]	✓	
Minimize greenhouse gas emissions		✓
Minimize neighborhood traffic		✓
Provide adequate odor control[3]	✓	✓
Minimize visual impairment	✓	
Improve air quality	✓	✓

[1]Long-term operational costs associated with the existing plant would increase due to recurring equipment repair and rehabilitation.
[2]Energy use will increase based on Phase 1 improvements due to the increased level of treatment provided. Energy savings from more efficient equipment and the improved dewatering process will help to offset the greater energy demand from larger, more extensive treatment.
[3]Odor controls will be placed on solids processes.

The CDPS permit dated February 1, 2003 includes a compliance schedule that allows the City until January 31, 2008 to comply with the new ammonia limits. The Phase 1 improvements are on schedule to be completed and online before that date. A schematic flow diagram of the WWTP after implementation of Phase 1 improvements is shown in Figure 13.

Figure 13. Schematic Flow Chart of the New WWTP After Phase 1 Improvements



GUIDING PRINCIPLES FOR APPROACH TO WASTEWATER TREATMENT IMPROVEMENTS

As mentioned previously, the primary motivators behind the WWTP upgrades that simultaneously serve City and County goals were as follows:

- Improving ammonia-nitrogen reduction capability
- Increasing treatment capacity
- Improving the dewatering process capabilities to meet increased capacity requirements

Secondary drivers include the following:

- Minimizing long-term life cycle costs while achieving City goals
- Replacing inefficient equipment with newer, improved equipment
- Reducing chemical usage

The City is required to provide adequate treatment capacity and meet regulatory requirements, and these upgrades will allow the City to do so. The secondary drivers could be met simultaneously with only moderate additional cost. These improvements optimize the system and establish the City as responsibly proactive by implementing treatment options that improve effluent quality while potentially minimizing future costs.

LIQUID STREAM ALTERNATIVES ANALYSIS

As part of the preliminary design evaluation, nine process alternatives were initially considered for upgrading the Boulder 75th Street WWTP. Additional information on the original nine treatment options and the selection process can be found in the *City of Boulder Amendment 1 to the Wastewater Utility Plan and Site Application Report* (Brown and Caldwell, 2005).

Based on the initial process review, the following five alternatives were selected for detailed evaluation.

- Alternative 3. Trickling Filter/Solids Contact Tank – Nitrifying Trickling Filters – Trickling Filter Recycle – Denitrification Filters – Chemical Phosphorus Removal (TF/SC-NTF-TFR-DNF-CPR)
- Alternative 6. Trickling Filter – Activated Sludge (TF-AS)
- Alternative 7. Activated Sludge (AS)
- Alternative 8. Trickling Filter – Membrane Bioreactors (TF-MBR)
- Alternative 9. Membrane Bioreactor (MBR)

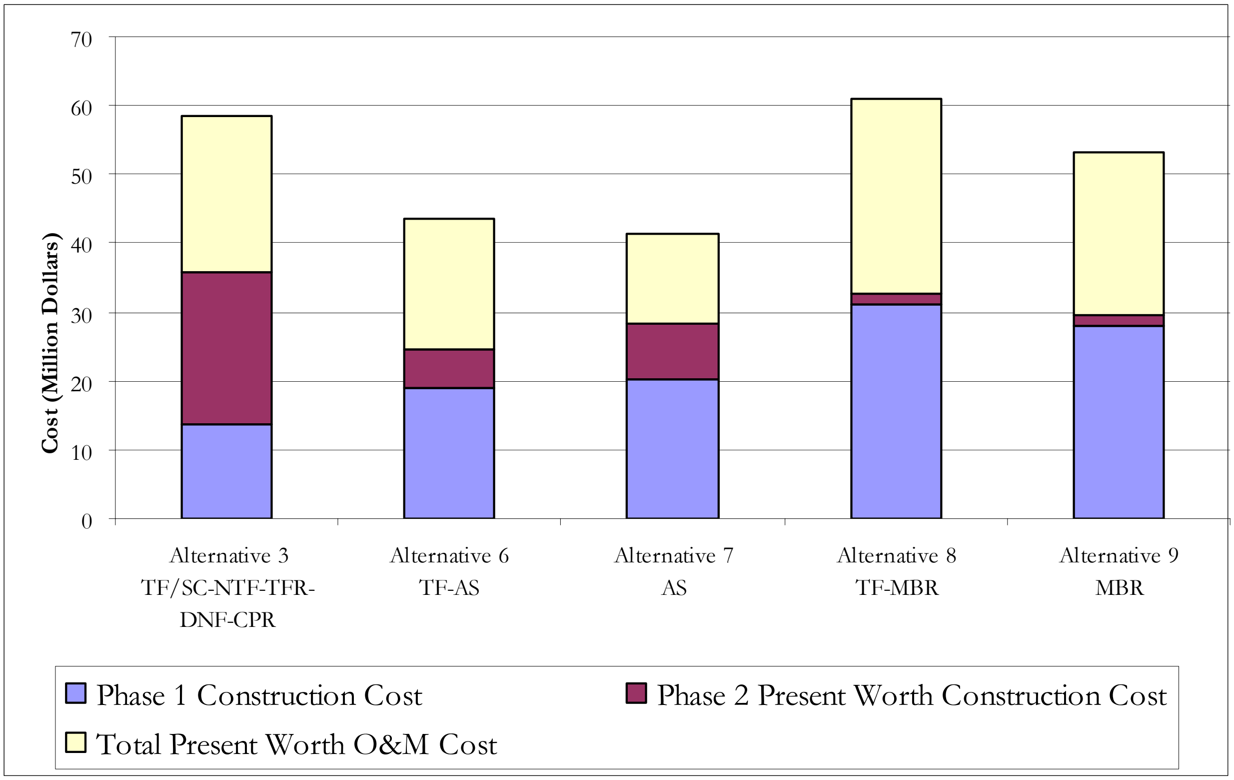
These alternatives were evaluated in detail and the results of the evaluations are presented in Figure 14 and Table 4.

Basis of Economic Evaluation

The economic evaluation includes consideration of initial construction costs and ongoing operation and maintenance (O&M) costs. It is important to consider both types of costs since some alternatives may be capital cost intensive and yet require minimal annual O&M costs, while other alternatives may be less capital cost intensive but require high annual O&M expenditures. Present Worth Analysis is a technique used to put construction and O&M costs on a comparable basis so alternatives can be appropriately evaluated. Present worth costs (2004 dollars) were evaluated over a period of 20 years.

Figure 14 shows the results of the economic, or present worth, evaluation of these alternatives. The alternative selected (Alternative 7) has the lowest life cycle costs.

Figure 14. Economic Evaluation for Process Alternatives[1]



[1] Values rounded to the nearest hundred thousand dollars.

As shown in Figure 14, the most economically feasible alternatives are Alternative 6 (trickling filter-activated sludge) and Alternative 7 (activated sludge). More detailed information about this economic comparison can be found in the *Community and Environmental Assessment Process for the 75th Street Wastewater Treatment Upgrades* document in Appendix A.

Basis of Non-Economic Evaluation

Non-economic factors also were considered in the evaluation of the wastewater treatment alternatives. These non-economic factors are particularly important when the economic evaluation indicates similar costs for two or more alternatives (such as the case with Alternatives 6 and 7 as indicated in Figure 16 or when non-cost issues represent a high priority. The non-economic evaluations for the secondary treatment process alternatives are displayed in Table 4. Each non-economic criterion was scored a value between 1 and 5, with 5 representing the highest or best alternative.

Table 4. Non-Economic Evaluation for Process Alternatives

Criteria	**Process Performance**	**Process Reliability**	**Mechanical Equipments**	**Chemical Requirement**	**Constructability**	**Neighborhood Impacts**	**Process Testing**	**Process Energy Efficiency**	**Sludge Production/Quality**	**Other Environmental Impacts**	**Total Score**
Alt. 3 - TF/SC-NTF-TFR-DNF-CPR	3	4	3	3	5	4	3	5	4	4	38
Alt. 6 – TF-AS	4	4	4	3	3	4	4	3	4	3	36
Alt. 7 - AS	5	4	5	5	4	5	4	4	5	4	45
Alt. 8 – TF-MBR	5	2	2	2	5	2	5	1	4	5	33
Alt. 9 - MBR	5	2	3	4	5	2	5	1	5	5	37

Note: A higher score is more favorable.

The *City of Boulder Amendment 1 to the Wastewater Utility Plan and Site Application Report* (March 25, 2005) contains more details on the non-economic evaluation. As evident from the rating information presented in Table 4, Alternative 7 (activated sludge) was rated the highest overall from a non-economic standpoint.

Disinfection Alternatives

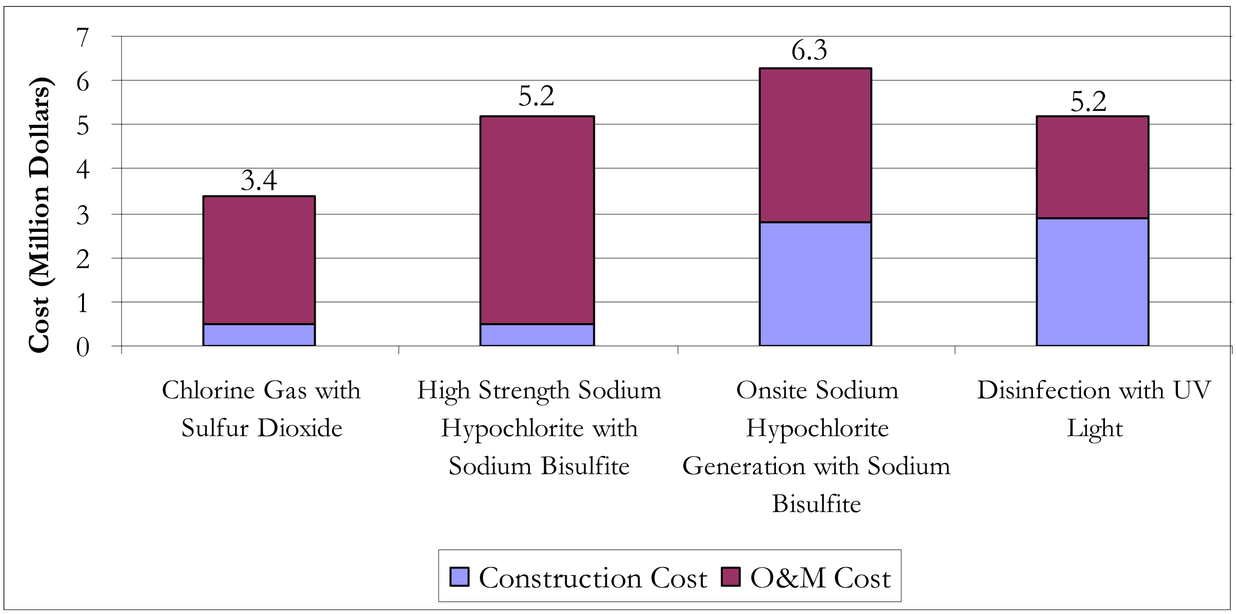
The Boulder 75th Street WWTP currently uses chlorine gas to disinfect the treated wastewater. Gaseous sulfur dioxide is used to remove residual chlorine following disinfection and prior to discharge of the wastewater to Boulder Creek. The existing chlorine disinfection system has adequate capacity to meet the needs of the proposed expansion of the 75th Street WWTP 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)

Figure 15 presents an economic evaluation for disinfection alternatives to be used with the activated sludge process. As shown in Figure 15, the most economical alternative is continued gaseous chlorine disinfection.

Figure 15. Economic Evaluation for Disinfection Alternatives



The results of an evaluation of non-economic factors for disinfection alternatives are presented in Table 5. UV disinfection was rated the highest of the disinfection alternatives from a non-economic standpoint. 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 also is very easy to operate and maintain, and it will allow the City of Boulder to continue to meet effluent disinfection requirements without the negative aspects of chemical addition. Even though UV disinfection was not the most economical alternative, it was selected as the preferred disinfection method based on the non-economic criteria.

Table 5. Non-Economic Evaluation of Disinfection Alternatives

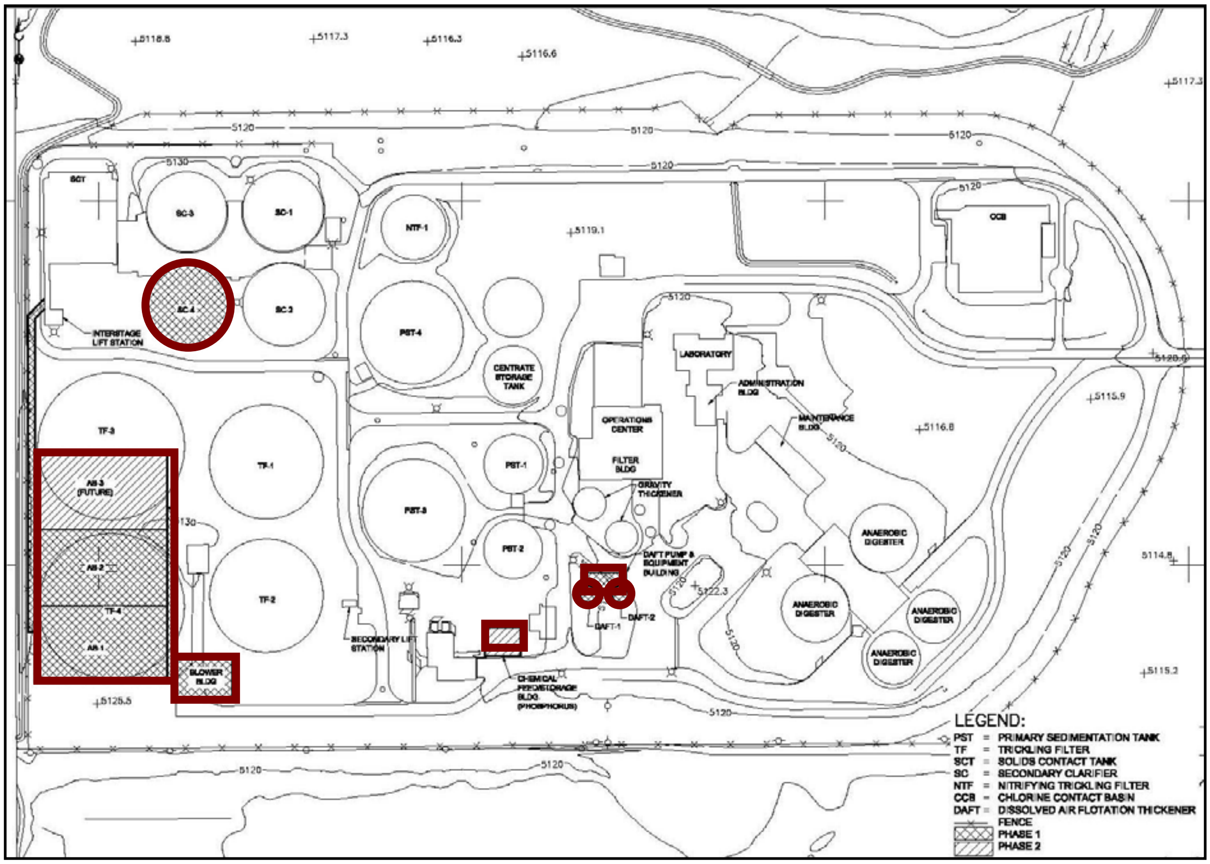
Criteria	**Process Performance**	**Process Reliability**	**Mechanical Equipment**	**Chemical Requirements**	**Constructability**	**Neighborhood Impacts**	**Testing**	**Energy Efficiency**	**Safety**	**Regulatory Requirements**	**Other Environmental Impacts11**	**Total Score**
Alt. 1 - Gaseous Chlorine	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.

Because of funding limitations, replacement of the existing chemical disinfection (chlorine and sulfur dioxide) with UV disinfection is not being implemented as part of the Phase 1 improvement project. It is anticipated this improvement will be implemented as part of the Phase 2 improvements in 2010.

Activated sludge and UV disinfection were selected as the preferred wastewater treatment process to meet Boulder's current and anticipated wastewater treatment needs. Figure 16 illustrates the components of the recommended WWTP upgrades (Phase 1 and Phase 2).

Figure 16. WWTP Upgrades to Existing Facility



SOLIDS DEWATERING ALTERNATIVES ANALYSIS

Three alternatives were evaluated for the solids dewatering process. These alternatives included the following:

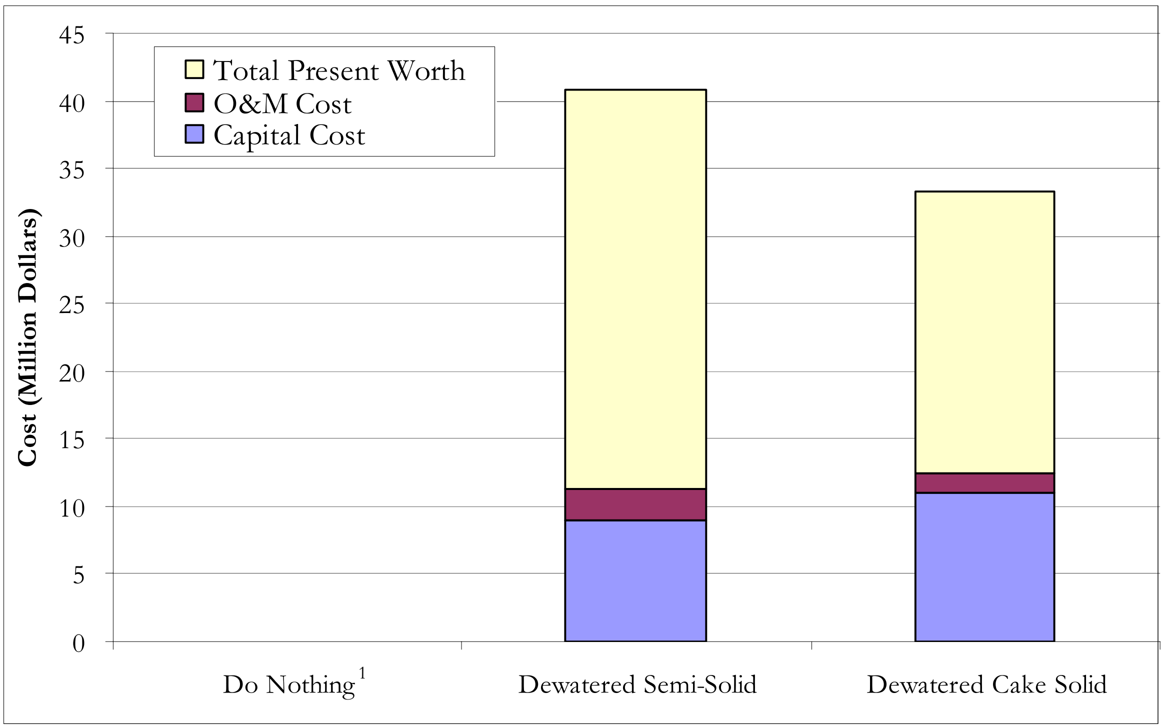
- Alternative 1. Do nothing
- Alternative 2. Maintain semi-solid (10%-12% solids) dewatering (existing process)
- Alternative 3. Transition to a cake (20%-24% solids) product (new process)

The Do Nothing alternative required no capital investment, so neither the O&M nor the total present worth costs have been estimated. The Do Nothing approach was not a valid selection because the existing facility cannot treat the projected generated solids resulting from the new liquid stream improvements.

Basis of Economic Evaluation

Alternatives 2 and 3 are based on centrifuge dewatering of digested biosolids produced from the liquid treatment process. Figure 17 presents an economic evaluation of the biosolids dewatering improvement alternatives. Present worth costs were evaluated over a 20-year period.

Figure 17. Economic Evaluation for Dewatering Improvements Alternatives



[1] The Do Nothing approach is not a valid selection.

The economic evaluations of these alternatives are based upon hauling solids to disposal sites in tractor trailer type trucks that average 5 mpg when on the open road but realize an average of only 3 mpg when loading, unloading, and local road travel are considered. The average mileage of 3 mpg was used in the evaluation. While the semi-solids alternative generates 10%-12% solids, the dewatered cake solids are in the 20%-24% solids range. This results in needing to haul only half the volume with the thicker product.

Tractor trailer trucks made 560 trips in 2006, with an average round-trip distance of 130 miles per trip. Assuming that the majority of the trip is conducted on the open road with an average mileage of 5 mpg, the average yearly fuel consumption is 14,560 gallons (24,266 gallons if based on a mileage of 3 mpg). Assuming 2006 was an average year, by reducing the number of trips by half, approximately 7,280 gallons (or 12,133 if based on 3 mpg) of fuel will be saved each year. Based on an approximate fuel price of $2.50, this results in an average yearly savings of approximately $18,200 (or $30,332 if based on 3 mpg).

More information on this economic evaluation can be found in the *Community Environmental Assessment Process for 75th Street Wastewater Treatment Plant Dewatering Improvements* document in Appendix B.

Basis of Non-Economic Evaluation

Table 6 presents a summary of the non-economic evaluations of the dewatering improvements alternatives. As indicated in Table 6, Alternative 3 represents more advantages and fewer disadvantages than the other alternatives. Based on the economic and non-economic analyses, the recommended improvements for the solids dewatering facility are a new, dewatered cake solid processing facility.

In summary, Alternative 3 was chosen because of the following reasons:

- A cake product is becoming the norm in the industry and produces drier material, which results in fewer truck trips from the WWTP site.
- A new dewatering building is appropriate for the new equipment due to size constraints and age of existing building.
- Retrofitting the existing facilities would result in higher lifetime costs for the WWTP. Cost advantages for constructing a new building include the following:
    - Installation of properly sized equipment with lower operating costs
    - Decreased staffing needs
    - Redundant capacity
    - Greater flexibility
    - Lower maintenance costs

Table 6. Non-Economic Evaluation Criteria for Dewatering Improvements Alternatives

Alternatives	Description	Advantages	Disadvantages
Alternative 1 Do Nothing (10%-12% solids)	Maintain existing system.	• Low costs. • No construction impacts.	• Existing system does not have capability to meet future WWTP solids loading rate at flows of 25 mgd. • Existing system is 20 years old and it is difficult to find replacement parts, reducing reliability and plant redundancy. • Would lead to regulatory non-compliance. • Inability to store non-dewatered biosolids at plant.
Alternative 2 Semi-solid (10%-12% solids) with existing solids dewatering building	New centrifuges would replace existing ones in existing dewatering building.	• Regulatory compliance. • Makes maximum use of existing structures. • Similar operation to existing process; staff is familiar with process.	• New centrifuges would be smaller and would be required to operate longer. • Structural concerns if existing building is modified again; limited ability to modify existing building. • Opinion of probable cost is highest for this alternative due to retrofitting difficulties, longer run times, more frequent equipment failure, and greater staffing needs.
Alternative 3 Cake solid (20%-24% solids) with new solids dewatering building	Producing cake product and new high-solids centrifuge in new building.	• Regulatory compliance. • Makes maximum use of existing structures. • Lower biosolids volume. • Fewer truck costs equal lower O&M costs. • Opinion of probable cost is lowest due to properly sized structure and equipment and reduced staffing and hauling requirements.	• Cake storage is needed. • Requires construction of new facility.

INVESTMENT PROGRAM

The 2005 Wastewater Utility Capital Improvement Program (CIP) developed by the Boulder Department of Public Works includes improvements to both the liquid stream and solids stream wastewater treatment process. In December 2005 the City issued a revenue bond to finance the capital costs associated with the Phase 1 improvements.

The 2005-2010 Wastewater Financial Plan incorporates a series of multi-year rate increases to cover the cost of these projects. Utility rate adjustments are approved by City Council on an annual basis. For 2005 and 2006, the City implemented 20% increases to the wastewater user charges. An additional rate increase of 6% was implemented on January 1, 2007. Table 7 presents a comparison of Boulder wastewater rates compared to those of surrounding communities based on 2005 rates. Even with these rate increases, Boulder rates are consistent with, and even lower than, those of other Front Range utilities.

Table 7. Front Range Community Sewer Rates[1]

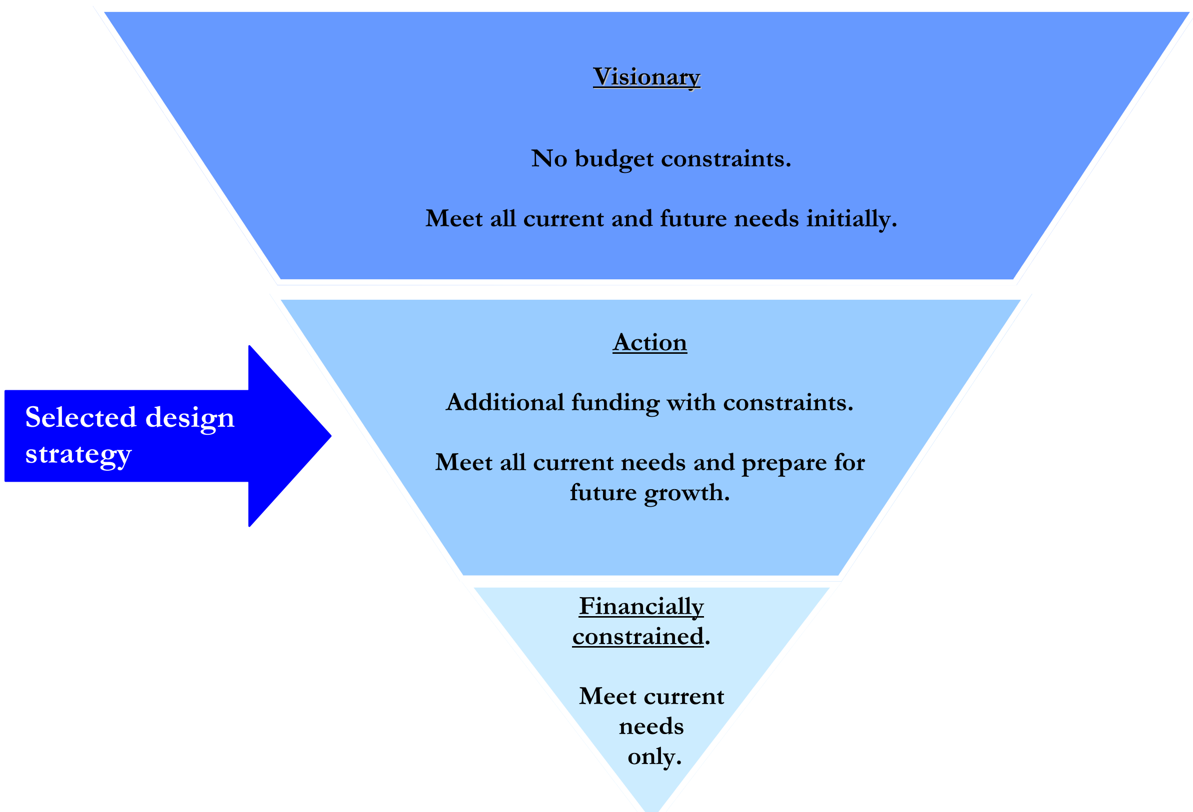
Number	Community	Annual Sewer Service Charge ($)
1	Erie	321.00
2	Colorado Springs	219.29
3	Fort Collins	210.30
4	Longmont	207.00
5	Greeley	195.00
6	Westminster	186.00
7	Broomfield	184.20
8	Northglenn	171.00
9	Boulder	170.76
10	Thornton	163.08
11	Louisville	153.60
12	Arvada	148.86
13	Lafayette	138.84
14	Aurora	130.20
15	Denver	128.16

[1] Based on information collected of Front Range communities conducted in 2005.

Investment Strategies

Figure 18 depicts the range of investment strategies considered in determining the extent of wastewater treatment system upgrades at the 75th Street WWTP.

Figure 18. Comparison of Investment Strategies



The City of Boulder chose to pursue an Action level approach to wastewater treatment improvements. At this level each area that requires immediate attention has been addressed and mechanisms have been put in place to prepare for anticipated future requirements. Unlike actions taken at the visionary level, the upgrade alternatives were selected to provide the City with the most long-term value with respect to cost, system performance, and environmental impact.

The system upgrade approach was initially based on two phases of implementation. This phasing approach allows the City to balance capital expenditures by constructing only necessary components in the near-term, while setting the stage for additional process improvements that may be required to meet more stringent future effluent limits. Phase 1 improvements include those that were required to meet current design flows and permit limits and processes that prepare the plant for the Phase 2 upgrades with only moderate additional costs. Phase 2 upgrades include those that are anticipated to prepare the plant to meet anticipated future limits, reduce chemical usage, and treat any odor concerns that may arise.

Construction of Phase 1 improvements began in 2006, and Phase 2 improvements are expected to begin in 2010. Phase 1 and 2 improvements are as follows:

- Phase 1 (2006): These improvements are required to address the 2003 discharge permit limitations (ammonia-nitrogen) and to increase the capacity of the WWTP. In addition, these improvements position the plant to meet anticipated future discharge permit requirements with only moderate additional construction costs.

- Phase 2 (2010): These improvements are anticipated in response to probable more stringent CPDS discharge permit limitations (nitrogen and phosphorus) in 2008, the desire to replace the existing chemical disinfection (chlorine and sulfur dioxide) process with a UV disinfection process, and the need to address biosolids stabilization (digester capacity) issues.

Phase 1 Implementation Schedule

Figure 19 depicts the implementation schedule for Phase 1 improvements. The schedule includes the time required for total project implementation, beginning with project approval and concluding with fully operational facilities.

Figure 19. Proposed Implementation Schedule

Component	2004	2005	2006	2007	2008	2009
Liquid Stream Improvements						
City Council Approval	♦ April 2004					
Design Upgrades		May 2004 to August 2005				
Bid		♦ March 2005				
Construction					April 2005 to June 2008	
Dewatering Improvements						
City Council Approval		♦ November, 2005				
Design Upgrades				November 2005 to November 2006		
Bid			♦ October, 2006		November 2006 to	
Construction					April 2008	

Table 8 presents the current capital improvement program (CIP) funding for the wastewater treatment projects discussed in this master plan. It does not include funding for ongoing maintenance projects associated with the WWTP.

Table 8. Current CIP Funding for WWTP Projects

	2006	2007	2008	2009	2010	2011	2012
Phase 1 – Liquid Stream	$47,250,000	$0	$0	$0	$0	$0	$0
Phase 2 – Liquid Stream	$0	$100,000	$200,000	$1,000,000	$10,000,000	$0	$0
Phase 2 – Biosolids Digester	$0	$0	$0	$850,000	$8,500,000	$0	$0
Anticipated Rate Increases for Capital and Other Needs		6%	4%	4%	10%	4%	3%

MEASURING PERFORMANCE

City objectives were used as guiding principles for the design of wastewater treatment system improvements and will be used as performance indicators to measure results from the improvement projects. To accomplish this, a baseline of each indicator must be established and compared to indicators measured at specific intervals following the completion of improvement projects. Table 9 presents a summary of suggested performance indicators.

Table 9. Summary of Performance Indicators

City Goals	Performance Indicator
Improving and protecting water quality	▪ Number of occasions WWTP is not in compliance with permit ▪ Nutrient concentration in effluent
Reducing waste and improving recycling and reuse	Volume of exported solids
Protecting health and safety of WWTP operators	Number of WWTP accidents
Meeting wastewater treatment capacity demands	Wastewater flows
Creating a sustainable community through resource conservation	▪ Amount of energy use ▪ Amount of greenhouse gas emissions ▪ Cost of operating plant ▪ Amount of chemical usage

PHASE 2 IMPROVEMENTS

The existing WWTP has met historical needs by providing adequate treatment capacity and appropriate treatment capability. The WWTP is currently being upgraded to treat additional wastewater flows and meet stricter effluent ammonia- nitrogen limits in Phase 1.

These Phase 1 improvements represent an "Action level" position for the City. This position requires that immediate action be taken on items of the most urgent need – capacity requirements and permit limits – with the incorporation of additional proactive elements based on anticipated regulatory concerns, environmental quality, and available funding. Many anticipated treatment challenges can be more cost-effectively dealt with during current construction activities than at a later date.

Additional phases of design and construction are expected to follow. Concerns to be addressed for Phase 2 work include the following:

- Disinfection system
- 2008 discharge permit limits
- Biosolids stabilization (digester capacity)
- Odor and noise

Disinfection System

Because of funding limitations, replacement of the existing chemical disinfection (chlorine and sulfur dioxide) with UV disinfection is not being implemented as part of the Phase 1 improvement project. It is anticipated this improvement will be implemented as part of the Phase 2 improvements in 2010. For reasons outlined in previous sections the implementation of a UV disinfection system is preferred over the existing chemical disinfection process.

2008 Discharge Permit Limits

Discharge permit limits are revisited every five years, and it is anticipated that some level of total inorganic nitrogen (TIN) and phosphorus removal may be required by future discharge permits. Current construction includes provisions to allow these anticipated future limits to be met with minimal additional capital expenditure.

Biosolids Stabilization (Digester Capacity)

Based on current projections, the capacity of the existing digesters will not be sufficient to adequately stabilize the biosolids for continued land application after the year 2012. The need for additional digester capacity will depend on the actual solids production once the improvements are brought online in 2008, whether or not land application continues to be a viable recycling alternative, and the success of privatized composting of the biosolids. These issues will be evaluated over the next several years prior to any additional capital expenditure.

Odor and Noise

The Boulder County 1041 permit stipulates no net increase in either odor or noise from the WWTP. Although additional control measures are not anticipated at this time, the City will continue to monitor odor and noise in compliance with the permit conditions. After the Phase 1 improvements are operational, the need for additional odor and noise control will be re-evaluated and appropriate steps taken as necessary.

FUTURE CONSIDERATIONS FOR WASTEWATER TREATMENT NEEDS

Future considerations that are beyond the scope of this master plan and the current Capital Improvement Program include stringent TIN and phosphorus discharge permit limits, emerging contaminants, and biosolids recycling or disposal flexibility.

Stringent TIN and Phosphorus Discharge Permit Limits

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 also may be required. If extremely low phosphorus limits are imposed, tertiary filtration may be required.

Emerging Contaminants

Emerging contaminants include pollutants such as endocrine disrupting compounds and disinfection byproducts. At present the wastewater treatment industry is just beginning to learn about the significance of these contaminants and appropriate treatment technologies for their removal from wastewater; however, regulatory requirements associated with these contaminants may be adapted in the future. If emerging contaminants removal becomes necessary, public education and additional treatment processes likely will be required. This issue will be evaluated in the future as appropriate.

Biosolids Recycling or Disposal Flexibility

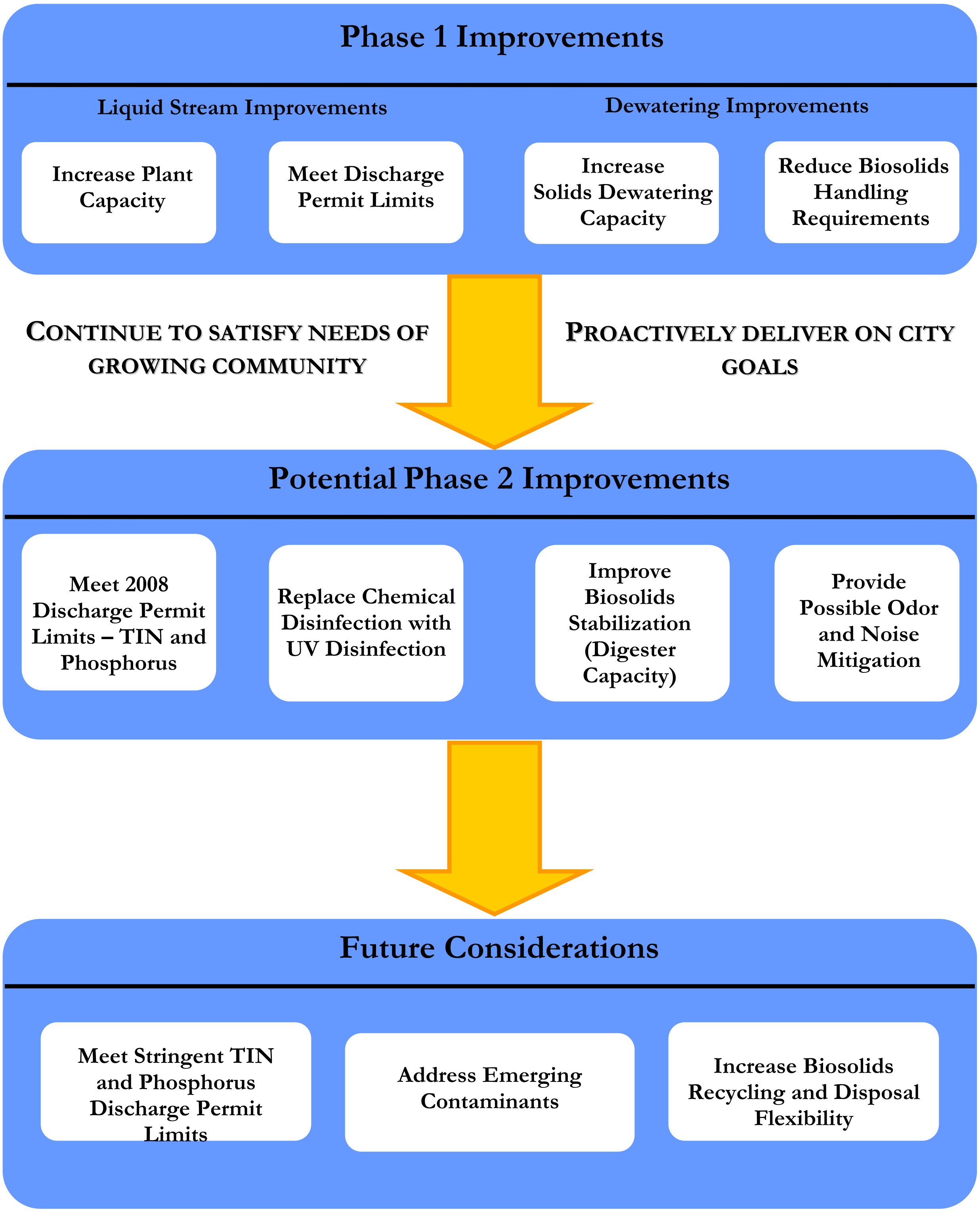
The current WWTP upgrade projects will give the City a variety of future biosolids end-use options. These options include maintaining the existing land application program, transitioning to privatized land application and privatized composting. The method of final disposal of the solids generated by the wastewater treatment process is going to be an issue until a long-term solution can be reached.

Concerns have been raised about whether or not land application should be used when biosolids contain varying quantities of emerging contaminants. Ultimately, the final disposal decision could be dictated to the wastewater permit holders like Boulder through regulatory restrictions. If regulations regarding the end-use of biosolids change, treatment and end-use options will be evaluated. The current approach is to maintain flexibility in disposal options so that the utility is in the best position to respond to regulatory changes and community pressures.

MASTER PLAN TO MEET CITY GOALS

Figure 20 illustrates how the current WWTP improvements and decisions for future consideration are directed toward meeting City needs and goals. The top portion of the figure addresses design elements already incorporated into the WWTP improvements. The bottom portion of the figure identifies additional challenges that must be addressed to continue to meet City goals.

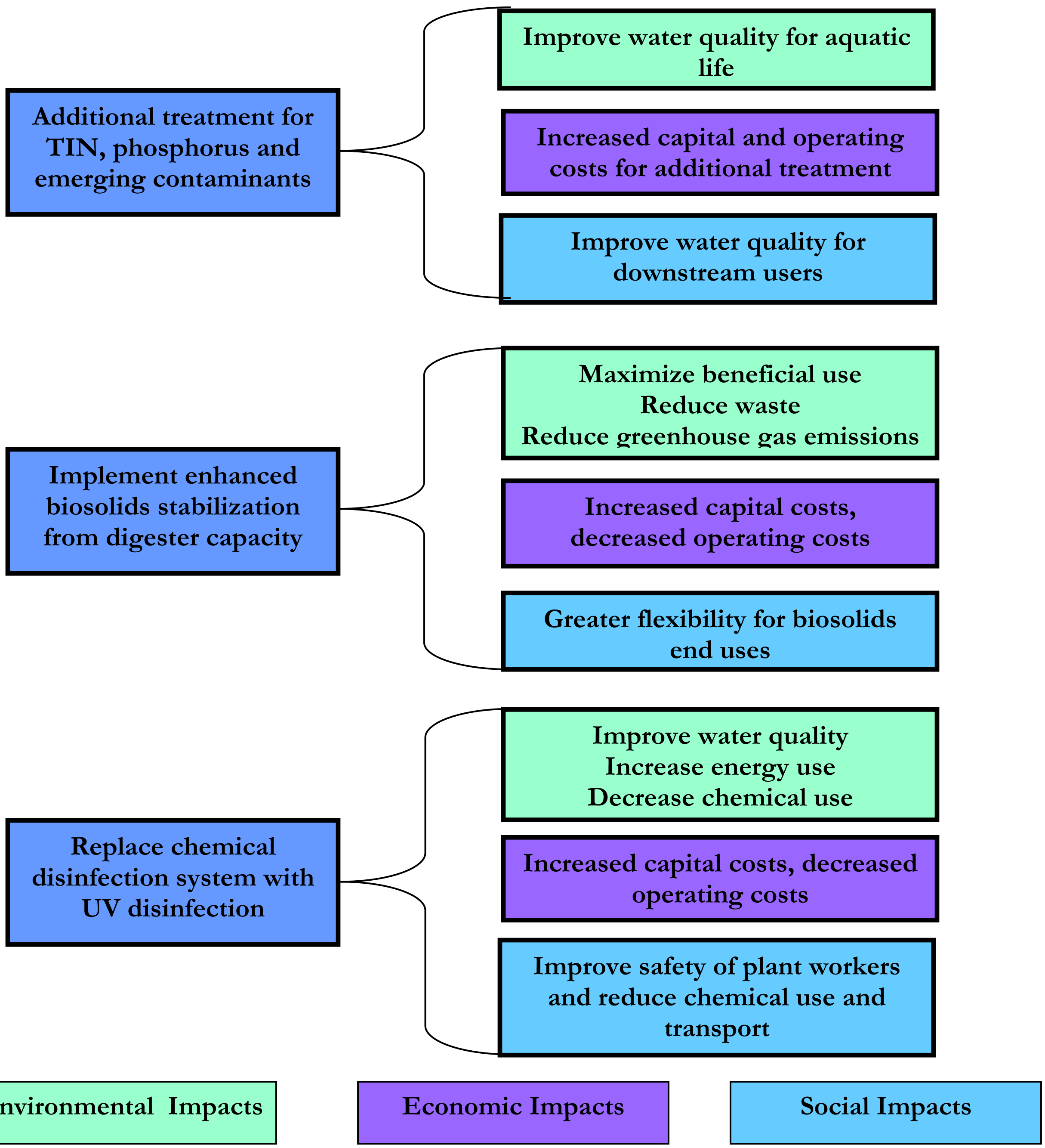
Figure 20. Meeting City Needs and Goals



TRIPLE BOTTOM LINE INDICATORS

The incorporation of additional treatment processes or biosolids handling methods to meet future regulatory requirements will affect environmental, economic, and social aspects of the community – what is also known in industry as a "triple bottom line" because is accounts for the total costs associated with decisions and not just capital costs. Figure 21 illustrates how future decisions may affect the Boulder service community economically, environmentally, and socially.

Figure 21. Summary of Future Decision Making on Environmental, Economic and Social Impacts



SUMMARY

The Boulder 75th Street WWTP historically has served the City of Boulder well by meeting regulatory requirements and discharging high quality effluent to Boulder Creek. Improvements at the wastewater treatment facility are typically driven by state and federal effluent discharge limitations. Phase 1 improvements to the WWTP were necessitated by the imposition of more restrictive ammonia limits on the discharge and by anticipated growth in the Boulder wastewater service area population.

The system upgrades currently under construction include improvements to the liquid stream treatment process and to the solids dewatering process. The liquid stream treatment improvements include converting the existing trickling filter/solids contact process to an activated sludge process. The solids dewatering upgrades include the addition of new dewatering equipment to reduce the volume of solids that must be hauled from the WWTP site. Additional improvements will be required in the future as wastewater discharge and solids handling requirements change. Plans have been made to accommodate these anticipated future upgrades with limited additional capital expenditure.

The current improvements meet City goals and establish Boulder as a proactive environmental steward by improving water quality in Boulder Creek beyond required standards, replacing hazardous chemicals with UV disinfection, reducing solids being hauled from the plant (and associated energy and traffic), and recycling them through land application.

The costs incurred in implementing the current WWTP upgrades have been paid through bond sales and increased user fees.

The current WWTP improvements have been designed with the intent of meeting current treatment requirements and strategically positioning the City of Boulder to economically address anticipated future treatment requirements. The Phase 1 improvements are expected to be completed in 2008. Anticipated future wastewater treatment and biosolids handling improvements will be implemented as necessary.

This Master Plan was presented at several City meetings from January 2007 to June 2007. The agenda items from each meeting are provided in Appendix C as Approval Attachments and include the following items:

- Initial Water Resources Advisory Board (WRAB) agenda (January 2007)
- Final WRAB agenda (March 2007)
- WWTP Council Agenda Item Attachments A-E (includes comments on the Master Plan from the City and WRAB and Planning Board meeting minutes) (April 2007)
- Planning board agenda (May 2007)
- City Council agenda (June 2007)

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APPENDIX A

CEAP Report for Liquid Stream Treatment Facilities

CITY OF BOULDER
COMMUNITY AND ENVIRONMENTAL ASSESSMENT PROCESS

For the 75th Street Wastewater Treatment Plant Upgrades

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February 3, 2004
(revised: March 8, 2004)

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TABLES

FIGURES

ATTACHMENTS

1.0 DESCRIPTION AND LOCATION OF PROJECT

The City of Boulder and Brown and Caldwell are working together to design upgrades to the City of Boulder's 75th Street Wastewater Treatment Plant (WWTP) to treat projected 2025 flows (buildout) and to meet current and anticipated effluent quality limits.

All domestic and industrial wastewater generated within the City of Boulder is processed at the 75th Street WWTP. Septic wastes, hauled to the facility by private haulers, are also processed at the facility.

The City of Boulder's 75th Street WWTP is located at 4049 75th Street in the SW ¼ of Section 13, T1N, R70W, Boulder County, Colorado (Figure 1). Treated effluent is discharged to Segment 9 of Boulder Creek. The WWTP is defined as a major facility by the Colorado Department of Public Health and Environment (CDPHE), and operates under a Colorado Discharge Permit System (CDPS) permit (Number CO-0024147) dated February 2003. The current permit stipulates a system capacity of 20.5 million gallons per day (mgd).

The proposed upgrades will increase plant capacity to 25 mgd. The WWTP expansion will be contained within the existing designated site boundary.

2.0 BACKGROUND, PURPOSE AND NEED FOR THE PROJECT

The 75th Street WWTP was placed in service in 1968 and was originally designed to treat 5.2 mgd. The most recent WWTP upgrade was in 1988, which increased the capacity to 20.5 mgd (maximum 30-day flow). An average of 16.3 million gallons of wastewater per day are processed at the plant (based on 5-year average influent flow from 1998-2002) and treated effluent is discharged to Boulder Creek. Current treatment processes at the WWTP include:

- Influent flow measurement;
- Screening;
- Grit removal;
- Primary sedimentation;
- Secondary treatment employing trickling filters, solids contact basins, and secondary clarifiers;
- Nitrifying trickling filter;
- Chlorination (using gaseous chlorine); and
- Dechlorination (using gaseous sulfur dioxide).

The solids treatment stream includes gravity sludge thickeners, anaerobic digestion, centrifuge dewatering, biosolids storage tanks, and land application of biosolids.

Effluent from the 75th Street plant is discharged to Boulder Creek. This discharge has been regulated under the terms of a discharge permit issued by the CDPHE since the early 1970s.

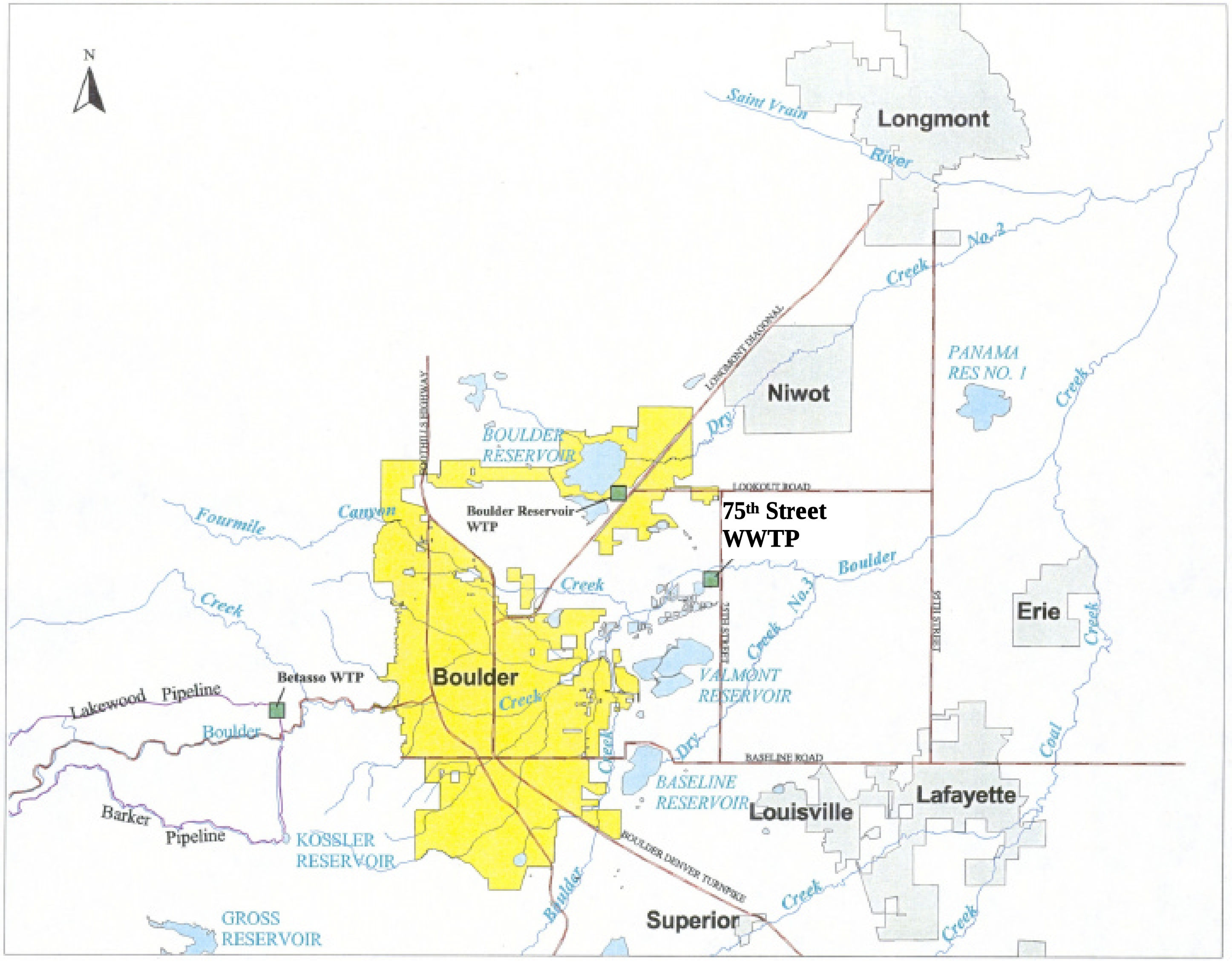


Figure 1. Vicinity Map

The discharge permit establishes quality parameters with which the discharge must legally comply. The current discharge permit limits the 75th Street WWTP effluent ammonia concentration to 10.9 milligrams per liter (mg/L) during the most restrictive season of the year. In 2003, a Total Maximum Daily Load (TMDL) study was completed for Boulder Creek. This study was undertaken to determine the ammonia assimilation capacity of the creek and subsequently to recommend maximum allowable ammonia concentrations in discharges to the creek. The TMDL study recommended that the ammonia concentration in the 75th Street WWTP discharge be made more restrictive than it has been in the past. The proposed limits vary monthly with the most restrictive limit being 5 mg/L during the month of March. Allowable ammonia concentrations during other months are different and less restrictive. The discharge permit is expected to be amended to reflect the ammonia limits recommended in the TMDL study during the first quarter of 2004. Other effluent quality parameters established in the new permit are expected to be slightly different from those contained in the existing permit because the capacity of the treatment system is being increased from 20.5 to 25 mgd. The revised permit will include a "compliance schedule" which establishes the time-table within which the City must make necessary modifications to the treatment system to allow compliance with the new effluent limits. It is anticipated that the City will have between 4 and 5 years to achieve compliance with the effluent limits established in the new discharge permit.

As described in the 2003 Wastewater Collection System Master Plan and the 2002 Wastewater Utility Plan (WWUP), based on population and employment projections obtained from the Denver Regional Council of Governments (DRCOG) and the Boulder Valley Comprehensive Plan (BVCP), the WWTP capacity must be expanded from 20.5 mgd to 25.0 mgd to accommodate projected 2025 wastewater flows.

The project drivers and goals include the following:

1. Provide wastewater treatment capacity to adequately treat anticipated service area buildout wastewater flows of 25 mgd based on maximum 30-day flow conditions

2. Consistently meet current effluent limits for:
   a. Ammonia
   b. Biological oxygen demand (BOD_5)
   c. Total Suspended Solids (TSS)
   d. e. coli/fecal coliform bacteria
   e. Oil and grease
   f. pH

3. Plan to provide a treatment system capable of compliance with anticipated future limits for:
   a. Nitrate and/or Total Inorganic Nitrogen (TIN)
   b. Phosphorus (P)

4. Eliminate the use of gaseous chlorine for wastewater disinfection.

3.0 DESCRIPTION OF PROCESS ALTERNATIVES AND SUMMARY OF MAJOR ISSUES

Several potential process alternatives were evaluated for expansion and upgrade of the 75th Street WWTP. Based on project team discussions and the initial process alternative review, the following five alternatives were evaluated. Each of the five alternatives will provide the level of treatment required for existing and anticipated effluent limits. Phase 1 facilities would be constructed in the near term to provide the capability to treat 25 mgd of wastewater flow and meet current discharge requirements. Phase 2 facilities would be constructed at a later date to achieve compliance with anticipated future discharge requirements. Some alternatives require more chemical addition than others.

- **Fixed Film/Solids Contact (FF/SC).** This alternative utilizes the existing FF/SC process for carbonaceous biochemical oxygen demand (CBOD) reduction, a new secondary clarifier, and new nitrifying trickling filters (NTFs) for nitrification in Phase 1. Phase 2 would include a nitrified recycle to the fixed film reactors and addition of deep-bed denitrification filters with methanol addition for denitrification as well as new chemical feed systems (typically alum or ferric chloride) for phosphorus removal and alkalinity addition.

- **Fixed Film/Activated Sludge.** For Phase 1 this alternative utilizes the existing primary clarifiers and fixed film reactors followed by a new single-sludge activated sludge process. The existing solids contact basins would be maintained and expanded to accommodate the increased biological sludge inventory of the activated sludge process. In Phase 2 denitrification would be achieved by implementing an internal mixed liquor recycle and methanol or acetic acid addition to the anoxic zones of the activated sludge reactor. Phosphorus removal would be accomplished in Phase 2 with the addition of metal coagulant (typically ferric chloride or alum). Dosage points would be at the primary and secondary clarifiers. The existing NTF unit would be abandoned.

- **Activated Sludge.** This alternative utilizes the existing primary clarifiers followed by a 3-stage biological nutrient removal (BNR) activated sludge process for Phase 1. The existing solids contact basins would be maintained and new basins constructed to accommodate the increased biological sludge inventory associated with the activated sludge process. A new secondary clarifier is required, the existing fixed film reactors and NTF would be abandoned and two of the trickling filters demolished to make room for the expanded aeration basins. A new chemical feed system (typically alum or ferric chloride) may be required for phosphorus removal in Phase 2 though some phosphorus removal will be accomplished biologically without requiring chemical addition.

- **Fixed Film/Membrane Bioreactors.** This alternative utilizes the existing primary clarifiers and trickling filters followed by membrane bioreactor (MBR) for Phase 1. Modifications of the existing solids contact reactor are required to house the membrane cassettes. Phase 2 denitrification requires methanol or acetic acid addition in the anoxic zones of the reactor. Phosphorus removal would be accomplished in Phase 2 by the addition of metal coagulant (typically ferric chloride or alum). Dosage points would be at the primary clarifiers and the biological reactors. The existing secondary clarifiers would be used for wet weather treatment and the existing NTF would be abandoned.

- **Membrane Bioreactor.** This alternative utilizes the existing primary clarifiers followed by a MBR to meet Phase 1 treatment requirements. The existing trickling filters and NTF would be abandoned. The secondary clarifiers would be used for wet weather treatment. Modifications of the solids contact tanks are required to house the membrane cassettes within the tank and to add anoxic and aerated zones. Phosphorus removal may require the addition of a metal coagulant (typically ferric chloride or alum) to the primary clarifiers and biological reactors to meet Phase 2 treatment requirements.

Each of these five alternatives was evaluated based on two phases of implementation. This phasing approach allows the City to balance capital expenditures by constructing only necessary components in the near-term, such as those to address current effluent requirements and plant capacity needs, while planning to accommodate additional process facilities that may be required to meet more stringent future effluent limits.

Phase 1 improvements are assumed to be constructed in 2005 and Phase 2 improvements in 2010 or 2015. The phasing is driven by capacity and anticipated effluent limits. In each case, Phase 1 will not include the entire construction project, but will lay the framework for the future Phase 2 additions.

Phase 1 generally includes near-term improvements such as those required to address capacity constraints and hydraulic bottlenecks, and implementation of process changes necessary to meet established ammonia limits. The facilities included in Phase 1 will meet existing effluent limits, including TSS, BOD_5, and ammonia as well as provide 25 mgd of treatment capacity.

Phase 2 includes continued treatment at the Phase 1 level plus the addition of processes and/or chemical addition facilities required to meet potential future effluent criteria, such as nitrate, TIN, and phosphorus limits. Although these future limits are not precisely defined at this time, it is anticipated that limits for nitrate and/or TIN and phosphorus will be established within the next two permit cycles.

3.1 THE MOST FEASIBLE PROCESS ALTERNATIVES

Following the initial alternative evaluation, the two most cost-effective alternatives were determined to be Fixed Film/Solids Contact and Activated Sludge. An additional alternative was also developed to allow consideration of a lower initial cost option. This alternative is termed the Phased Activated Sludge Alternative. These three alternatives were compared and evaluated at a greater level of detail. Figures 2, 3, and 4 display process schematics for FF/SC, activated sludge, and phased activated sludge processes respectively.

Table 1 presents the estimated construction and operations and maintenance (O&M) costs associated with each of the three alternative processes under consideration for the Boulder 75th Street WWTP.

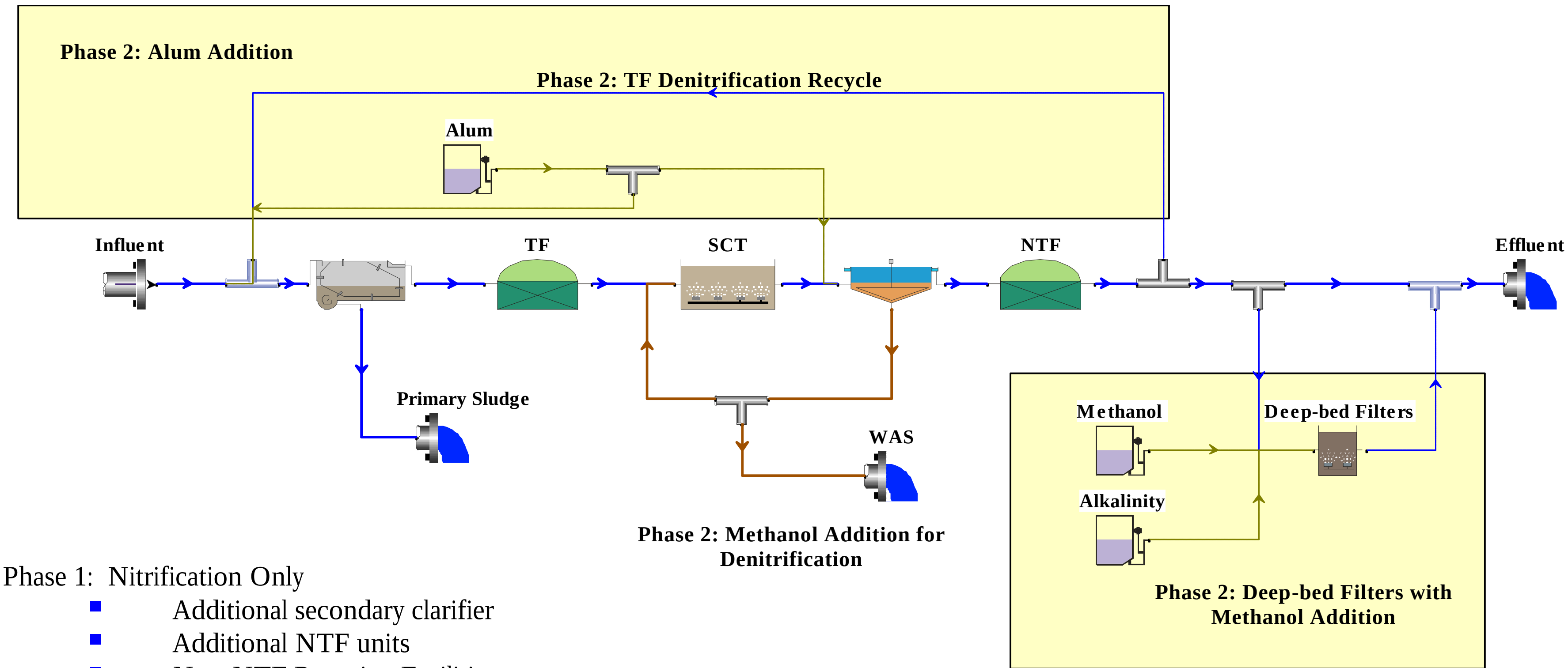
Table 1. Comparative Process Alternative Construction and O&M Costs

Component	Fixed Film/Solids Contact	Activated Sludge	Phased Activated Sludge
Phase 1 Construction Cost	$13,800,000	$20,200,000	$10,200,000
Phase 2 Present Value Construction Cost [1]	$22,000,000	$8,000,000	$21,900,000
Total Comparative Alternative Construction Cost (Present Worth) [1]	**$35,800,000**	**$28,200,000**	**$32,100,000**
Phase 1 Annual O&M Cost	$690,000	$790,000	$690,000
Phase 1 O&M Present Worth (5 yrs) [1]	$3,200,000	$3,700,000	$3,200,000
Phase 2 Annual O&M Cost	$2,054,000	$1,010,000	$1,010,000
Phase 2 O&M Present Worth (15 yrs) [1]	$19,500,000	$9,600,000	$9,600,000
Total Comparative Alternative O&M Cost (Present Worth –2005) [1]	**$22,700,000**	**$13,300,000**	**$12,800,000**
Total Comparative Alternative Present Worth Cost [1]	**$58,500,000**	**$41,500,000**	**$44,900,000**

[1] Present worth costs were calculated using an interest rate of 7 percent and an inflation rate of 3 percent.

The costs presented in Table 1 are preliminary in nature and costs for engineering, administration, and construction management are not included. It is recommended that more refined costs based on a higher level of design detail be used for budgeting, rate setting, and other financial related purposes.

Figure 2. Fixed Film/Solids Contact Process Schematic



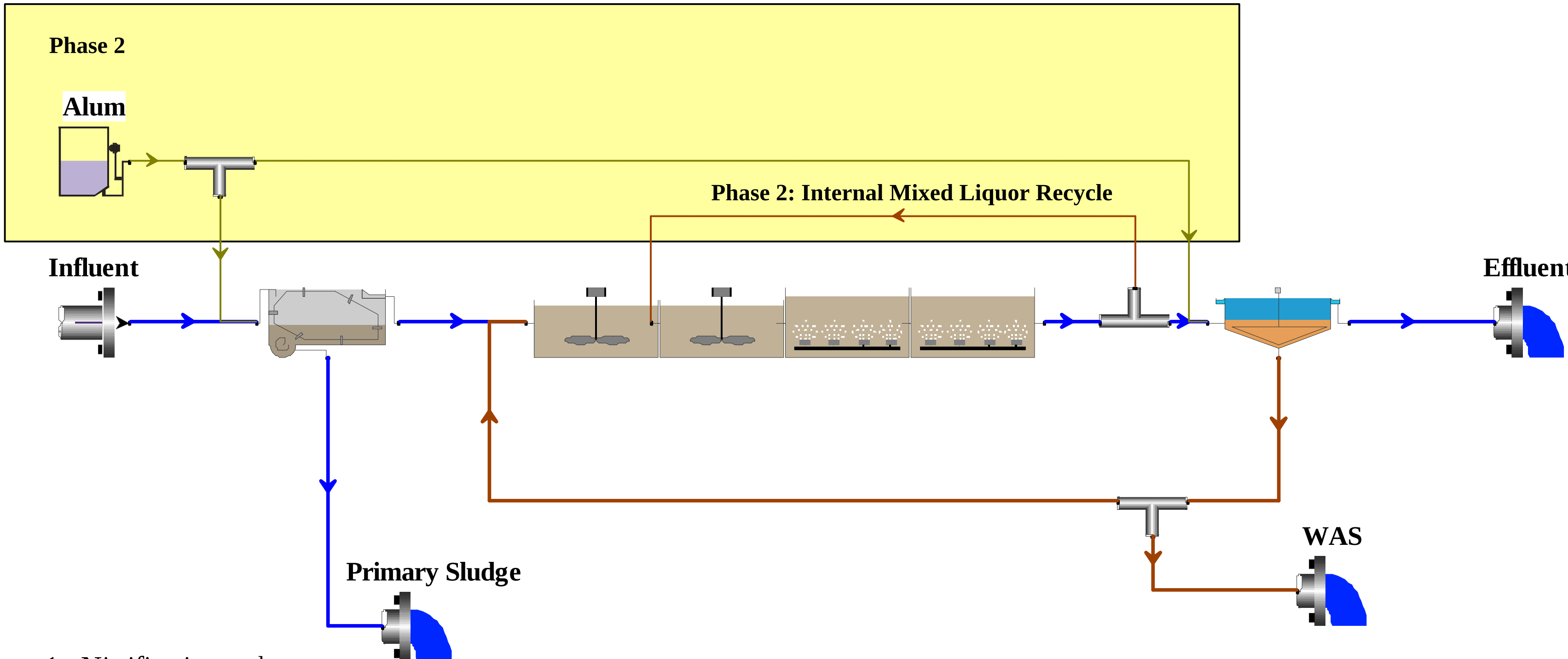
Phase 1: Nitrification Only

- Additional secondary clarifier
- Additional NTF units
- New NTF Pumping Facilities
- Existing Trickling Filter Upgrades
- Existing NTF Upgrades

Phase 2: Nitrification-Denitrification and Chemical Phosphorus Removal

- FF denitrification recycle facilities
- Addition of deep-bed denite filters with methanol addition facilities
- Addition of alum storage and feeding facilities for P removal

Figure 3. Activated Sludge Process Schematic



Phase 1: Nitrification only

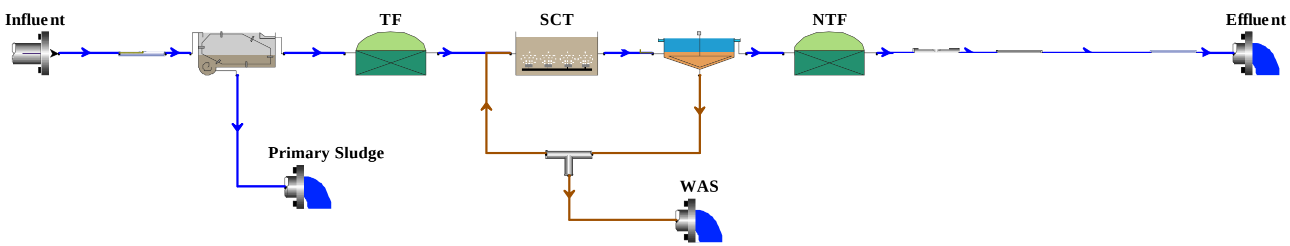
- Expansion of solids contact tanks to handle to increment in biomass inventory
- Add additional secondary clarifier
- Construct new blower building
- Upgrade solids handling facility

Phase 2: Nitrification-Denitrification and Biological/Chemical Phosphorus Removal

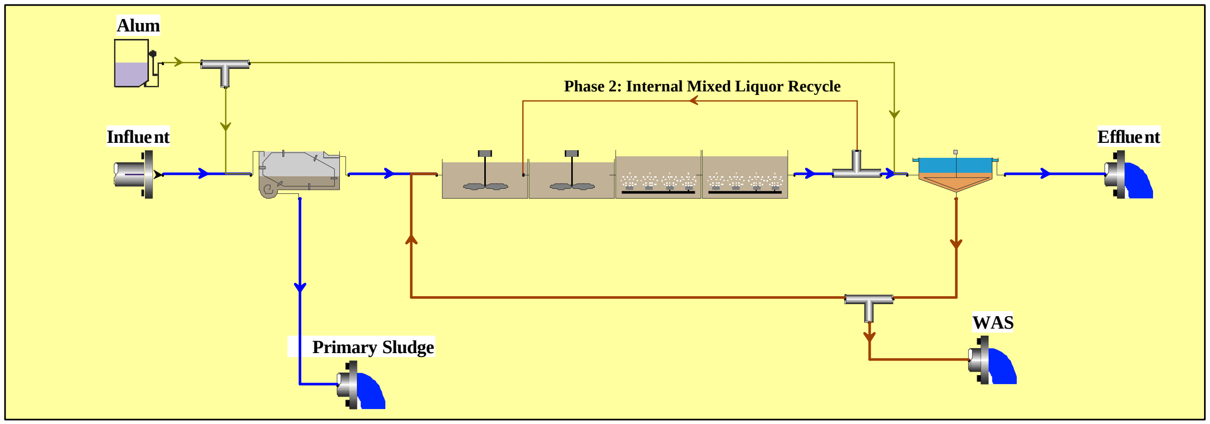
- Additional reactor volume to handle increase solids production due to alum addition
- Internal mixed liquor recycle
- Addition of alum for P removal

Figure 4. Phased Activated Sludge Process Schematic

Phase 1:



Phase 2:



Phase 1: Nitrification Only

- Additional secondary clarifier
- Additional NTF units
- New NTF Pumping Facilities
- New gravity thickener

Phase 2: Conversion to Activated Sludge (Nitrification-Denitrification and Biological/Chemical Phosphorus Removal)

- Expansion of solids contact tanks to handle to increment in biomass inventory
- Construct new blower building
- Upgrade solids handling facility (new DAFT and convert an existing gravity thickener to a DAFT)
- Internal mixed liquor recycle
- Addition of alum storage and feeding facilities for P removal

Table 2 presents a comparison of the anticipated present worth costs for the three alternatives with Phase 2 being implemented 5 years in the future (similar to present worth values presented in Table 1) and Phase 2 being implemented 10 years in the future.

Table 2. Present Worth Comparison of Process Alternative Construction Costs

Component	Fixed Film/Solids Contact	Activated Sludge	Phased Activated Sludge
Present Worth [1] - 5 Years	$58,500,000	$41,500,000	$44,900,000
Present Worth [1] - 10 Years	$49,400,000	$39,300,000	$39,800,000

[1] Present worth costs were calculated using an interest rate of 7 percent and an inflation rate of 3 percent.

4.0 DESCRIPTION OF DISINFECTION ALTERNATIVES AND MAJOR ISSUES

The Boulder WWTP currently uses chlorine gas to disinfect the treated wastewater prior to its discharge to Boulder Creek. Because chlorine is toxic to aquatic life, residual chlorine remaining in the effluent following disinfection must be removed. This "dechlorination" is currently accomplished by the addition of sulfur dioxide gas to the wastewater following disinfection.

Due primarily to safety concerns associated with the delivery, storage, and handling of chlorine and sulfur dioxide gases, the City would like to eliminate the use of these two chemical from their wastewater treatment operation. The principle methods of wastewater disinfection available to the City include:

1. Gaseous chlorine (current disinfection method)
2. Liquid sodium hypochlorite (chlorine bleach)
3. Ultraviolet light

A description of these disinfection methods and advantages and disadvantages associated with each are presented in the following paragraphs:

4.1 Chlorine Gas Disinfection

Although chlorine is typically stored as a pressurized liquid, it is vaporized and dissolved as a gas in water to achieve wastewater disinfection. Though chlorine disinfection is effective, gaseous chlorine is extremely toxic and leaks or spills pose safety and health risks to employees and the public. Primarily due to safety and regulatory concerns, its widespread use as the disinfectant of choice has been decreasing in recent years. Increasingly stringent safety precautions and planning requirements (risk management plans, secondary containment, and neutralization facilities) have increased the costs of chlorine facilities. Many existing facilities must undergo expensive modifications to keep them in compliance with safety and fire codes. While chlorine gas is noncombustible, it can form an explosive mixture with some substances such as turpentine, ammonia, and natural gas.

Chlorine disinfection does offer some distinct advantages when compared with other disinfection methods. These include:

- Effective disinfection.
- Low chemical and power costs compared to other disinfectants.
- Most treatment plant operators are familiar with chlorine handling procedures and feed equipment.
- Chlorine doses can be adjusted to obtain disinfection kills when high flow rates or poor quality effluent are experienced.

However, there are also disadvantages associated with gaseous chlorine disinfection:

- Chlorine and sulfur dioxide are stored under pressure requiring sophisticated containment and gas neutralization systems to handle spills or leaks. These facilities are subject to the requirements of National Fire Protection Association (NFPA) and Uniform Fire Code standards.
- Transportation, storage, and use of chlorine gas represent potential hazards for operators and the public, and special emergency equipment and training are required to mitigate these hazards.
- Increases total dissolved solids concentration in WWTP effluent.
- Chlorine forms potentially toxic or carcinogenic organochlorine by-products during the disinfection process. This can increase the effluent toxicity in the receiving stream.
- Residual chlorine is toxic to aquatic organisms and requires constant, reliable monitoring and control.
- The US Environmental Protection Agency (EPA) requires that Boulder develop a Risk Management Plan (RMP) for the wastewater treatment operation due to the quantity of chlorine gas currently stored at the treatment facility.
- Dechlorination is required prior to discharge to receiving waters.
- Failure of the dechlorination system may result in discharge permit violations as well as harm to aquatic life in the receiving stream.

4.2 Liquid Sodium Hypochlorite (NaOCl) Disinfection

An alternative to gaseous chlorine disinfection is the use of liquid sodium hypochlorite (NaOCl) as a disinfection agent. NaOCl is commercially available in 12-percent solution (high-strength) or can be generated onsite in 0.8 percent solution (low-strength) with specialized equipment. Liquid NaOCl, or bleach, is a liquid form of chlorine that has been used extensively and effectively for wastewater disinfection. A NaOCl disinfection system would include storage tanks for the NaOCl and metering pumps to feed the liquid solution. The existing Boulder WWTP chlorine contact basin would provide the required contact time for NaOCl without any modifications.

As with the gaseous chlorine system, the NaOCl system would have to be supplemented by a dechlorination system to remove residual chlorine from the effluent prior to its discharge to Boulder Creek. Liquid sodium bisulfate ($NaHSO_3$) would be the logical dechlorination agent. The $NaHSO_3$ feed system would be similar to the NaOCl system and would include storage tanks and liquid chemical feed pumps.

NaOCl disinfection offers some distinct advantages over other disinfection methods including:

- Effective disinfectant.
- Operators are generally familiar with the required chemical storage and feeding equipment.
- NaOCl is less hazardous to transport and handle than chlorine gas.
- Chlorine doses can be adjusted to obtain disinfection kills when high flow rates or poor quality effluent are experienced.

Disadvantages associated with liquid NaOCl disinfection include:

- Chemical cost is significantly higher than for chlorine gas.
- A significantly larger volume of chemical must be stored on site as compared to chlorine gas.
- Frequent deliveries of NaOCl (and dechlorination chemical) will be needed.
- Chlorine forms organochlorine by-products, combining with other compounds in the effluent during the disinfection process, which pose potential health risks.
- Dechlorination is required prior to discharge to receiving waters. An excessive amount of dechlorination chemicals or chlorine can increase the effluent toxicity in the receiving stream.
- Increases total dissolved solids concentration in the effluent.
- Residual chlorine is toxic to aquatic organisms and requires constant, reliable control to assure it is not released in the effluent.
- Solution strength deteriorates with time.
- Storage tanks need to be covered.
- Secondary containment is required.
- Sodium hypochlorite releases oxygen gas during decomposition, which causes gas binding within the pumping system.
- NaOCl must be handled as a hazardous chemical by operations staff.
- Failure of the dechlorination system may result in discharge permit violations as well as harm to aquatic life in the receiving stream.

4.3 UV Disinfection

An alternative to chlorine disinfection is disinfection with ultraviolet (UV) light. UV disinfection systems use specialized lamps, which emit the UV light in the germicidal wavelength range, to achieve the required wastewater disinfection.

UV disinfection is a physical process in which the UV radiation penetrates the microorganism cell walls and reacts with the cell DNA to prevent replication and thus destroys the viability of the organism. Short exposure times, usually 5 to 10 seconds, are sufficient to inactivate most microorganisms of concern in wastewater. UV has also been proven to effectively inactivate pathogens such as *Giardia* and *cryptosporidium*; chlorine has not.

UV disinfection offers many distinct advantages over other disinfection methods including:

- No chemicals are added to the water and no known toxic or carcinogenic by-products are created.
- UV-disinfected water does not harm biota.
- No adverse environmental effects due to over-dosing.
- Fewer safety concerns because no hazardous chemicals are used.
- No concerns with transportation, handling, storage, or cost of chemicals.
- Requires very short contact time. (No large contact tanks are needed.)
- Relatively easy operation.
- Does not alter the odor, pH or color of the water.
- Small footprint.
- Risk Management Plan not required.
- Dechlorination not required.

However, there are also disadvantages associated with UV disinfection. These include:

- No residual for downstream protection against re-growth or photo-reactivation (potentially important for reuse applications).
- It is difficult to achieve low bacterial levels in water with a high concentration of suspended solids due to adsorption of UV light. (i.e. UV disinfection effectiveness is sensitive to water quality)
- Relatively high electrical power requirement.
- Lamps contain mercury and must be recycled or disposed of as a hazardous waste. (Lamp manufacturers will typically recycle lamps for a small fee.)
- Slight safety concerns associated with human exposure to UV light, although systems are typically designed to minimize the potential for human exposure.

Anticipated capital and O&M costs associated with each of these disinfection alternatives are presented in Table 3.

Table 3. Disinfection Alternative Costs

Component	Gaseous Chlorine		Liquid Chlorine		UV Light	
	FF/SC	AS	FF/SC	AS	FF/SC	AS
Construction Cost	$500,000	$500,000	$500,000	$500,000	$4,200,000	$2,900,000
Annual O&M Cost	$200,000	$160,000	$350,000	$250,000	$170,000	$120,000
Present Worth O&M Cost *	$3,800,000	$2,900,000	$6,600,000	$4,700,000	$3,200,000	$2,300,000
Total Present Worth Cost *	$4,300,000	$3,400,000	$7,100,000	$5,200,000	$7,400,000	$5,200,000

* Represents 2004 present worth cost amortized over 20 years.

5.0 PREFERRED PROJECT ALTERNATIVE

Table 4 below summarizes the comparative estimated Phase 1 and 2 construction and O&M costs for the three process alternatives. The costs presented in Table 4 include a range of capital and O&M costs for the various disinfection alternatives, as well as a range of capital costs for other miscellaneous capital improvements to the 75th Street WWTP.

Table 4. Comparative Alternative Opinion of Probable Construction and O&M Costs

Component	Fixed Film/Solids Contact	Activated Sludge	Phased Activated Sludge
Phase 1 Construction Cost	$13,800,000	$20,200,000	$10,200,000
Phase 2 Present Value Construction Cost [1]	$22,000,000	$8,000,000	$21,900,000
Total Comparative Alternative Construction Cost (Present Worth) [1]	**$35,800,000**	**$28,200,000**	**$32,100,000**
Phase 1 Annual O&M Cost	$690,000	$790,000	$690,000
Phase 1 O&M Present Worth (5 yrs) [1]	$3,200,000	$3,700,000	$3,200,000
Phase 2 Annual O&M Cost	$2,054,000	$1,010,000	$1,010,000
Phase 2 O&M Present Worth (15 yrs) [1]	$19,500,000	$9,600,000	$9,600,000
Total Comparative Alternative O&M Cost (Present Worth –2004) [1]	**$22,700,000**	**$13,300,000**	**$12,800,000**
Total Comparative Alternative Present Worth Cost1	**$58,500,000**	**$41,500,000**	**$44,900,000**
Disinfection [1, 2]	$4,300,000 - $7,400,000	$3,400,000 - $5,200,000	$3,400,000 – $5,200,000
Other Improvements [2]	$1,000,000 - $5,000,000	$1,000,000 - $5,000,000	$1,000,000 – $5,000,000
Total Present Worth Project Construction Costs [1]	**$63,800,000 – $70,900,000**	**$45,900,000 – $51,700,000**	**$48,300,000 – $55,100,000**

[1] Present worth costs were calculated using an interest rate of 7 percent and an inflation rate of 3 percent.
[2] Equipment has not been selected at this time, therefore costs are provided as a range (2004 dollars). Twenty-year present worth O&M costs are included for disinfection.

Table 4 notes:

- Costs are preliminary. It is recommended that a refined cost estimate based on 30% design level be used for final rate setting.
- Estimates for engineering, administration, and construction management are not included.
- Present worth costs were developed using an annual interest rate of 7 percent and an annual inflation rate of 3 percent.

Based on the alternatives analysis shown in Table 4 above, the preliminary recommendation is that the City of Boulder implement the Activated Sludge process alternative. The primary reasons for this recommendation are:

1. The comparative cost (Phases 1 and 2, combined) for Activated Sludge is significantly less than either FF/SC or the Phased Activated Sludge alternative (Present Worth cost), and

2. The Activated Sludge process relies on biological activity and constituents present in the wastewater to achieve water quality improvements and, therefore, requires considerably less chemical addition to meet current and anticipated future effluent requirements.

UV disinfection is the recommended disinfection method to be used in conjunction with the activated sludge treatment process. UV disinfection is preferred because it is considered the safest and most environmentally friendly disinfection alternative available. It involves no chemical delivery, storage, or handling and consequently generates no chemical residuals in the water.

6.0 PUBLIC INPUT TO DATE

To date, a preliminary project summary was presented to the Boulder Water Resources Advisory Board (WRAB) at the December 15, 2003 meeting.

The City of Boulder's 75th Street WWTP Upgrade project will be reviewed at the following public meetings:

- Preliminary WRAB Review of the Community Environmental Assessment Process (CEAP) report, February 9, 2004
- Final WRAB Review of CEAP report and recommendation to City Council, March 15, 2004
- City Council Acceptance of WRAB CEAP recommendation, March 30, 2004
- Boulder County 1041 Review Process Meetings

7.0 CITY OF BOULDER PROJECT MANAGER

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Jenny Hartfelder, Brown and Caldwell Water/Wastewater Department Manager
Bob Mahoney, Brown and Caldwell Office Manager

9.0 GOALS ASSESSMENT

1. *Using the Boulder Valley Comprehensive Plan (BVCP) and department master plans, describe the primary city goals and benefits that the project will help achieve.*

This project directly helps the City to meet its Facility and Service goals by providing increased treatment capability and capacity to the City's municipal wastewater treatment system.

The City, through its master planning, regulations, policies and programs, will make every effort to create a sustainable community for future generations. Relevant environmental priorities include reducing waste by promoting reuse and recycling (e.g., land application of biosolids); preserving native plant and wildlife habitat; and improving water quality. The planned WWTP Upgrades will continue to provide wastewater service to existing customers as well as future residents and businesses. The upgrades will increase the level of treatment to accommodate anticipated effluent limits and improve water quality in Boulder Creek. The project will accommodate anticipated growth and development within the City while improving the long-term health of the natural environment, the economy, and the community.

2. *What are the trade-offs among city policies and goals in the proposed projects alternatives? (e.g. higher financial investment to gain better long-term services or fewer environmental impacts)*

Upgrades and modifications to the City's WWTP are necessary to expand treatment capacity for projected growth within the City and provide capability to meet current and anticipated effluent limits. The proposed project is planned in two phases (2005 and 2010) to minimize near term capital expenditures. The selected alternative (Activated Sludge with UV disinfection) does represent a larger Phase 1 capital investment than the other alternatives. This larger short-term capital investment will result in substantially smaller future capital investments, allow for lower future operation and maintenance costs, and reduce the number of chemicals used in the treatment process.

3. *Is this project referenced in a master plan? If so, what is the context in terms of goals, objectives, larger system plans, etc.? If not, why not?*

Yes, this project is referenced in the 2002 WWUP and the Boulder Wastewater Collection System Master Plan. The WWUP is necessary to satisfy DRCOG requirements for Wastewater Master Planning and was approved by DRCOG in 2003. The WWUP confirmed and documented the need for the WWTP expansion and upgrade project.

In 2003, the Wastewater Treatment Master Plan Summary of the September 2001 BVCP was updated to include information from the WWUP including the need to expand and upgrade the WWTP.

4. *Will this project be in conflict with the goals or policies in any department master plan?*

This proposed project was referenced in the WWUP and the BVCP and therefore, should not conflict with any City goals or policies.

5. *List other city projects in the project area that are listed in a departmental master plan or CIP.*

Biosolids Composting Project.

6. *How will the project exceed city, state, or federal standards and regulations?*

The project is necessary to meet all current regulations; including effluent ammonia limitations, and incorporates a plan to address anticipated future limits for nitrate and phosphorus. It will also reduce the concentrations of total dissolved solids and organochlorine by-products in the wastewater treatment plant effluent and in Boulder Creek downstream of the effluent discharge point.

10.0 IMPACT ASSESSMENT

The CEAP Checklist Question Form is presented on the following pages as Table 5. Activated sludge is the preferred alternative, TF/SC is designated as Alternative 2, and Phase Activated Sludge is designated as Alternative 3.

Table 5. City of Boulder
Community and Environmental Assessment Process
Checklist

+ Positive effect
— Negative effect
O No effect

Project Title: **CITY OF BOULDER** **WASTEWATER TREATMENT PLANT UPGRADES**	**Preferred Alternative ACTIVATED SLUDGE**	**Alternative 2 FIXED FILM/ SOLIDS CONTACT**	**Alternative 3 PHASED ACTIVATED SLUDGE**
A. Natural Areas or Features			
1. Disturbance to species, communities, habitat, or ecosystems due to:			
a. Construction activities	O	O	O
b. Vegetation removal	O	O	O
c. Human or domestic animal encroachment	O	O	O
d. Chemicals (including petroleum products, fertilizers, pesticides, herbicides)	O	O	O
e. Behavioral displacement of wildlife species (due to noise from use activities)	O	O	O
f. Introduction of non-native plant species in the site landscaping	O	O	O
g. Changes to groundwater or surface runoff	O	O	O
h. Discharge of sediment to any body of water	O	O	O
i. Wind erosion	O	O	O
2. Loss of mature trees or significant plants?	O	O	O
B. Riparian Areas/Floodplains			
1. Encroachment upon the 100-year, conveyance or high hazard flood zones?	O	O	O
2. Disturbance to or fragmentation of a riparian corridor?	O	O	O
C. Wetlands			
1. Disturbance to or loss of a wetland on site?	O	O	O
D. Geology and Soils			
1. a. Impacts to unique geologic or physical features?	O	O	O
b. Geologic development constraints?	O	O	O
c. Substantial changes in topography?	O	O	O
d. Changes in soil or fill material on the site?	O	O	O
E. Water Quality			
1. Impacts to water quality from any of the following?			
a. Excavation	O	O	O

Project Title: **CITY OF BOULDER** **WASTEWATER TREATMENT PLANT UPGRADES**	**Preferred Alternative ACTIVATED SLUDGE**	**Alternative 2 FIXED FILM / SOLIDS CONTACT**	**Alternative 3 PHASED ACTIVATED SLUDGE**
b. Change in hardscape	O	O	O
c. Change in site ground features	O	O	O
d. Change in storm drainage	O	O	O
e. Change in vegetation	O	O	O
f. Change in pedestrian and vehicle traffic	O	O	O
g. Use or storage of chemicals	O	O	O
2. Exposure of groundwater contamination from excavation or pumping?	O	O	O
F. Air Quality			
1. Short or long term impacts to air quality (CO_2 emissions, pollutants)?			
a. From mobile sources?	—	—	—
b. From stationary sources?	—	—	—
G. Resource Conservation			
1. Changes in water use?	O	O	O
2. Increases in energy use?	—	—	—
3. Generation of excess waste?	—	—	—
H. Cultural/Historic Resources			
1. a. Impacts to a prehistoric or archaeological site?	O	O	O
b. Impacts to a building or structure over fifty years of age?	O	O	O
c. Impacts to a historic feature of the site?	O	O	O
d. Impacts to significant agricultural land?	O	O	O
I. Visual Quality			
1. a. Effects on scenic vistas or public views?	O	O	O
b. Effects on the aesthetics of a site open to public view?	O	O	O
c. Effects on views to unique geologic or physical features?	O	O	O
J. Safety			
1. Health hazards, odors, or radon?	—	—	—
2. Site hazards?	—	—	—
K. Physiological Well-being			
1 Exposure to excessive noise?	O	O	O
2. Excessive light or glare?	O	O	O
3. Increase in vibrations?	O	O	O

Project Title: **CITY OF BOULDER** **WASTEWATER TREATMENT PLANT UPGRADES**	**Preferred Alternative** **ACTIVATED SLUDGE**	**Alternative 2** **FIXED FILM/ SOLIDS CONTACT**	**Alternative 3** **PHASED ACTIVATED SLUDGE**
L. Services			
1. Additional need for:			
a. Water or sanitary sewer services?	O	O	O
b. Storm sewer/Flood control features?	O	O	O
c. Maintenance of pipes, culverts and manholes?	O	O	O
d. Police services?	O	O	O
e. Fire protection services?	O	O	O
f. Recreation or parks facilities?	O	O	O
g. Library services?	O	O	O
h. Transportation improvements/traffic mitigation?	O	O	O
i. Parking?	O	O	O
j. Affordable housing?	O	O	O
k. Open space/urban open land?	O	O	O
l. Power or energy use?	—	—	—
m. Telecommunications?	O	O	O
n. Health care/social services?	O	O	O
M. Special Populations			
1. Effects on:			
a. Persons with disabilities?	O	O	O
b. Senior population?	O	O	O
c. Children?	O	O	O
d. Restricted income persons?	O	O	O

* Information presented in Table 5 represents impacts from construction impacts only, and do not reflect long-term project impacts.

Summary of Short-term and Long-term Impacts

Short-term (all alternatives):

- Vegetation, including grasses, shrubs, and forbs, within the fenced boundaries of the City of Boulder's 75th Street WWTP Site (Site) will be disturbed during construction. A construction "staging area" may also be required to the east of the fenced boundaries. If this is required, the area just to the northeast of the main gate will likely be used. This area has been used recently for staging on other construction projects.

- Construction of the WWTP upgrades will result in temporary disturbance (noise and increased traffic flow) to the surrounding communities.

- Temporary and minimal adverse impacts on air quality in the form of increased dust generation and exhaust emissions in the vicinity of the site are expected in association with construction activities. The construction contractor will be required to implement "best management practices" to minimize air quality impacts from the construction activities.

- Minimal soil erosion may occur as a result of construction on the plant size. The construction contractor will be required to implement erosion control measures to minimize soil erosion impacts from construction.

Long-term (all alternatives):

- The primary long-term (positive) impact of the project will be upgrades and modifications to the City's WWTP which will expand treatment capacity for projected growth within the City, increase capability to meet current and anticipated future effluent quality limits, and improve water quality in Boulder Creek.

- The WWTP currently has six air emissions permits, Air Pollutant Emission Notices (APENs), and Permit Exempt Points filed with the CDPHE. Since the WWTP will be upgraded and expanded at its existing location, current air quality issues are expected to remain in the long-term.

- The proposed alternative will require an increased commitment of resources in terms of energy and staffing to construct and operate improved facilities.

- An increased volume of biosolids is expected with the increase in influent flows and loads. The facility would continue to recycle biosolids by land application or composting.

- It is estimated that the difference in odor generation between the alternatives being evaluated is not detectable. The treatment processes that generate the most significant and objectionable odors, include the preliminary, primary, and solids handling processes, which will be the same with any of the alternatives under consideration. If odors become a greater concern in the future, a prioritized approach to odor mitigation will be implemented. Such an approach would focus first on the most significant odor sources such as the preliminary treatment, primary treatment, and solids handling processes. Only after the odors associated with these processes have been mitigated to the extent practical would the focus turn to the secondary and tertiary treatment processes. In anticipation of such an eventuality, all new secondary or tertiary facilities will be designed to allow the installation of covers and other odor control facilities.

- Chemicals currently stored on the site include chlorine gas, sulfur dioxide gas, organic polymers, oil, gasoline, and pesticides. This project will result in the elimination of chlorine and sulfur dioxide gases at the WWTP. If UV light is selected as the disinfection agent, no disinfection chemicals will be required.

The differences between the environmental effects of the proposed process alternative (Activated Sludge) and the FF/SC alternative is primarily chemical usage. Chemicals will be stored and used on site for either alternative. However, the activated sludge alternative will require less chemical addition than the FF/SC process. The activated sludge process does not require methanol addition for denitrification or sodium hydroxide for alkalinity addition. Chlorine and sulfur dioxide gases will be eliminated with the implementation of UV disinfection.

10.1 QUESTIONS

The following questions are a supplement to the CEAP Checklist.

A. Natural Areas and Features

Because there are no known occurrences of listed or sensitive species, nor is there habitat for any of these species within the limits of proposed construction, the project is expected to have no impact on any listed or sensitive species. Although there will be a long-term increase in discharge of water from the treatment plant to Boulder Creek as a result of the projected population growth and employment increase in the service area, no adverse impacts to listed or sensitive plant or animal species are expected to occur as a result of an increase in discharge. Therefore, there is no short or long-term potential for disturbance to or loss of significant species, plant communities, wildlife habitats, or ecosystems with either alternative.

The concentration of ammonia in the effluent discharged to Boulder Creek will be substantially less after the proposed project is completed than it has been in the past. This will result in improved water quality in Boulder Creek.

Some disturbance impacts related to the construction process are unavoidable. However, these impacts will be short-term and minimized where possible. The Site will contain new structures with either alternative, and the area that would be disturbed during construction is estimated at less than 3 acres for either alternative. Construction activities associated with either alternative would not expand outside the current fenced and bermed site boundary with the possible exception of construction staging as described previously.

Plants, animals, and plant communities located within the construction site, such as individual plants, grasses, forbs, or shrubs directly in the footprint of new structures will be disturbed by the construction activities. There will be no potential for disturbance to or loss of mature trees or other large plants. The project will further minimize environmental impacts by restoring vegetation/landscaping disturbed by the construction, where possible. The proposed project will minimize the introduction of non-native plant species in the site landscaping.

During construction, water produced from dewatering activities will be treated, if necessary, and discharged to Boulder Creek in accordance with dewatering permits issued by the CDPHE. A plan to control erosion and sedimentation will also be employed.

The WWTP currently has a Stormwater Management Plan (SWMP) in place that consists of four major components:

- Compliance with the CDPHE Light Industry Permit # COR-01 0865 requirements;
- Routine plant inspections;
- Continued training and drilling of the plant Emergency Response Team; and
- Annual review and revision of emergency response plans, including flood procedures.

An additional SWMP will be developed for construction, which will focus on implementing best management practices (BMPs) that would minimize sources of erosion and capture sediments before they enter surface waters.

Chemicals currently stored on the site include chlorine gas, sulfur dioxide gas, organic polymers, oil, gasoline, and pesticides. As described in the SWMP, plant inspections are conducted at least two times per year to check for potential problems related to stormwater. The inspections include:

1. The plant site is toured to ensure that no chemicals or drums are stored outside or on the loading dock.

2. The oil storage room is inspected to ensure the area is clean, oils are properly stored, and no oil leaks are present.

3. The pesticide storage cabinet is checked for cleanliness and proper storage, and the plant site is checked to make sure no pesticide containers are stored in other areas.

4. The elevated gas tank is checked to ensure the containment area is clear of any standing water and does not have any gasoline spillage.

5. The flood berm flap gates are checked for proper operation and to make sure no debris blocks the gate or channel.

Ten employees typically comprise the plant Emergency Response (ER) Team. The team addresses such issues as chlorine and sulfur dioxide leaks, biogas releases, and other assorted emergency responses, including chemical spills.

The City of Boulder currently has a Risk Management Plan (RMP) as required by EPA. The RMP consists of three general elements including a chlorine and sulfur dioxide hazard assessment, an accident prevention program, and an emergency response plan.

B. Riparian Areas and Floodplains

In 1986, berms were constructed around the plant site to remove it from the 100-year floodplain. No other natural hazards exist at the site. The WWTP expansion would be contained within the existing Site and would not encroach on the Boulder Creek 100-year floodplain. Since the Site is not located in a floodplain, the project is not expected to have a significant direct impact on the floodplain.

C. Wetlands

No wetlands occur within the Site and no dredging or filling of wetlands will be impacted by the project.

D. Geology and Soils

There will be no impacts to unique geological physical features, or significant changes in topography or soil/fill as a result of the project. There are no geological constraints to development at the site.

A site application will be submitted to the CDPHE Water Quality Control Division (Division) for the proposed increase in capacity and modifications to the WWTP. A geotechnical report will be submitted as an attachment identifying geological suitability issues related to the existing site and the measures to be taken to mitigate any identified problems or risks.

E. Water Quality

All three alternatives are expected to have significant positive direct impacts on water quality and quantity downstream of the Site. A reduction in the discharge of ammonia will enhance the downstream aquatic environment for plants and animals. This improvement in water quality will have a direct impact to any endangered species that may be found downstream of the discharge point.

The effluent discharge point was recently moved east to a point downstream of the primary Lafayette water supply intake. As a result of this change, the nearest drinking water supply is located at the Lower Boulder Ditch (95th Street), which is a secondary drinking water diversion point for the City of Lafayette.

Water quality is not expected to be significantly impacted from changes in the amount of hardscape, permanent changes in ground features, changes in the storm drainage from the site, or changes in vegetation. The project will further avoid or minimize environmental impacts by restoring vegetation/landscaping disturbed by the construction, where possible.

The increase in short-term vehicle traffic during construction is not expected to have an impact on water quality.

Temporary or permanent use and/or storage of chemicals should not impact water quality, as all chemicals are stored inside. In addition, an RMP is in place that consists of three general elements including a chlorine and sulfur dioxide hazard assessment, an accident prevention program, and an emergency response plan.

During construction, water produced from dewatering activities will be treated, if necessary, and discharged to Boulder Creek. BMPs as part of the construction SWMP will be implemented during construction to minimize the movement of sediment into surface waters.

The WWTP discharges to Boulder Creek, Segment 9 (Figure 5), which is classified by the Division for the following beneficial uses:

- Recreation Class 1
- Aquatic Life Class 1, warm water
- Water Supply
- Agriculture

At present, none of the classifications are being challenged as being too low to protect present uses.

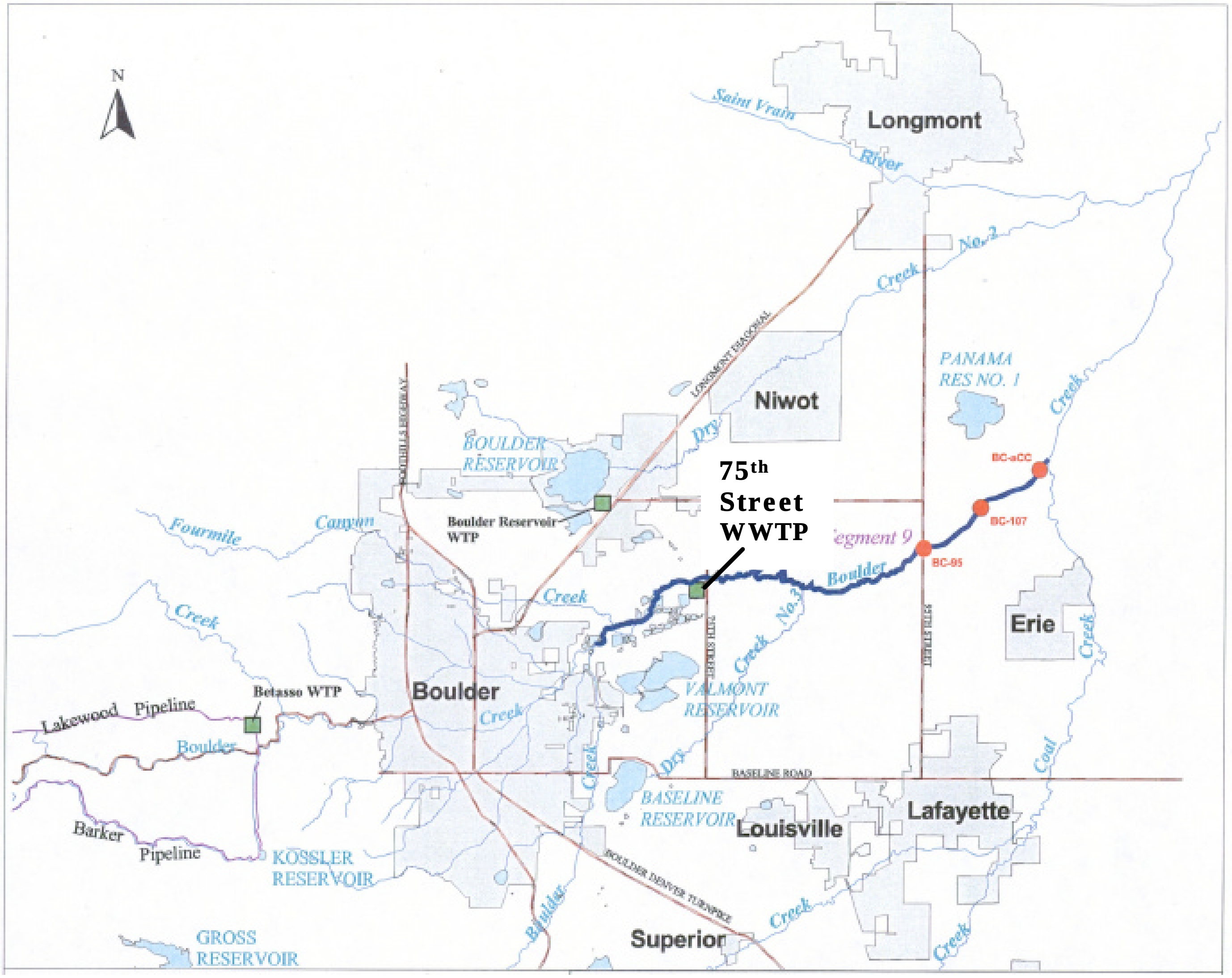

Figure 5. Boulder Creek Segment 9 and 75th Street WWTP

To evaluate potential future WWTP effluent limits, preliminary effluent limits (PELs) were calculated for currently regulated constituents, and also for constituents anticipated to be regulated in the future (next one or two permit cycles). Results of the PEL analysis for currently regulated secondary effluent limits (State Effluent Regulations) and water quality based effluent limits (accounting for antidegradation requirements where required) are included in Attachment A.

The primary constituents not currently regulated but anticipated to be regulated in the future include nitrate and/or TIN, and phosphorus. In addition, the Division has indicated that nitrite is a constituent of concern and included a stipulation in the current CDPS permit that a nitrite study on Boulder Creek be conducted to determine if nitrite needs to be regulated in the next permit. This study is currently underway and the outcome will determine the potential need for nitrite removal at the 75th Street WWTP.

The WWTP expansion will be designed to meet current limitations as listed in the current CDPS permit with provisions to meet anticipated future limits as indicated in the PELs for the expanded treatment capacity of 25 mgd maximum monthly average. A summary of key existing and potential constituents to be regulated at a 25-mgd flow rate is provided in Table 6.

Table 6. Potential Existing and Future Permit Limits for Key Constituents [f]

Constituent	30-Day Average	7-Day Average	Daily Maximum
Existing Regulated Constituents			
CBOD, mg/L	25	40	
TSS, mg/L	30	45	
E. Coli, #/100 ml	146[a]	292[a]	
Total Residual Chlorine, mg/L	0.003[b]		0.02
Total Ammonia, mg/L	5[c]		
Potential Future Regulated Constituents			
Total Inorganic Nitrogen, mg/L			10.8[d]
Total Phosphorus, mg/L	1.0[e]		

[a] Geometric Mean.
[b] Applies if chlorine is used for disinfection.
[c] Most restrictive month (March) based on the ammonia TMDL.
[d] Based on 0 mg/L daily maximum ammonia as calculated by the nitrate model.
[e] Based on typical effluent concentration for WWTPs in surrounding states requiring phosphorus removal.
[f] Based on a maximum month flow of 25.0 mgd.

F. Air Quality

Activities associated with any of the alternatives during construction would have a temporary and minimal adverse impact on air quality in the vicinity of the Site. Short-term increases in dust generation and exhaust emissions in the vicinity of the Site would be associated with construction activities. Water spraying and application of palliatives would be utilized during construction to minimize short-term dust generated by construction activities. Neither alternative is expected to have a significant direct short-term impact on air quality.

The WWTP currently has six air emissions permits, APENs, and Permit Exempt Points filed with the CDPHE. Since the WWTP will be upgraded and expanded at its current location, air quality issues are expected to remain in the long-term. A summary of the air quality permits at the WWTP is included as Attachment B.

It is estimated that the difference in odor between the alternatives is non-detectable. Should odors become a greater concern in the future, a prioritized approach to mitigate odors will be implemented, most likely beginning with preliminary treatment and the solids handling processes.

G. Resource Conservation

Significant changes are not anticipated with water usage at the WWTP. When restoring landscaping, the City will consider low water usage native plants and grasses to minimize water use on the site.

All alternatives would require an increased commitment of resources in terms of energy to construct and operate improved facilities. The WWTP currently produces electricity and heat that is reused on site to help reduce the energy required from Xcel Energy; however, it is anticipated that new electrical feeds would be needed to provide power to the site to operate and maintain the proposed improvements. As a result, the proposed upgrade is expected to have an impact on energy use at the site.

An increased volume of biosolids is expected with the increase in influent flows and loads. The facility would continue to recycle biosolids by land application or composting. None of the alternatives are expected to have a significant impact on solid waste at the site.

H. Cultural/Historic Resources

The upgrades at the WWTP will not extend outside the current site boundaries and so are not expected to impact cultural resources. Since no cultural resources are known to exist at the site, significant direct impacts to cultural resources are not expected. No lands of agricultural importance will be disturbed at the site.

I. Visual Quality

Visually, new buildings associated with the proposed alternative will permanently change the appearance of the site. New buildings will be designed to match existing structures, where appropriate, and to provide a pleasing aesthetic appearance. The proposed alternative is not expected to have a significant impact on physical aspects at the site.

The site has been used as a WWTP facility since 1968. The site includes numerous WWTP structures, with the remaining portions of the property covered with asphalt, concrete, or landscaping. Therefore, scenic views or the aesthetics of the site are not expected to be impacted significantly with any of the alternatives.

The existing site and anticipated changes to the site from each of the three final alternatives are depicted in Figures 6, 7, 8 and 9.

J. Safety

Implementation of proposed improvements would reduce the potential for public health problems. The safety of plant personnel will be improved with infrastructure improvements providing better working conditions.

The activated sludge alternative will require less chemical addition than the TF/SC process. The activated sludge process does not require methanol addition for denitrification or sodium hydroxide for alkalinity. The use of chlorine and sulfur dioxide gases will be eliminated.

Typically ten employees comprise the plant ER Team that addresses chlorine and sulfur dioxide leaks, biogas releases, and other assorted emergency responses, including chemical spills. The team trains on plant specific issues on a monthly basis. In addition, the team members have either completed the 40-hour HAZWOPER course or 24-hour chlorine/sulfur dioxide response class. Sufficient personal protective gear is maintained on site to allow for full Level A suit and Self Contained Breathing Apparatus (SCBA) response to chemical spills or leaks. An ER Team notebook was developed that includes all plant response procedures, equipment instructions, Material Safety Data Sheet (MSDS) information, and safety drill debriefings.

In addition to the ER Team training, the treatment plant operations staff is trained to respond to chlorine and sulfur dioxide leaks. The City of Boulder currently has a RMP as required by EPA. The RMP consists of three general elements including a chlorine and sulfur dioxide hazard assessment, an accident prevention program, and an emergency response plan. It should be noted that many of the existing plant emergency procedures were applicable for inclusion in the RMP. The RMP will be reviewed and revised as necessary in 2004.

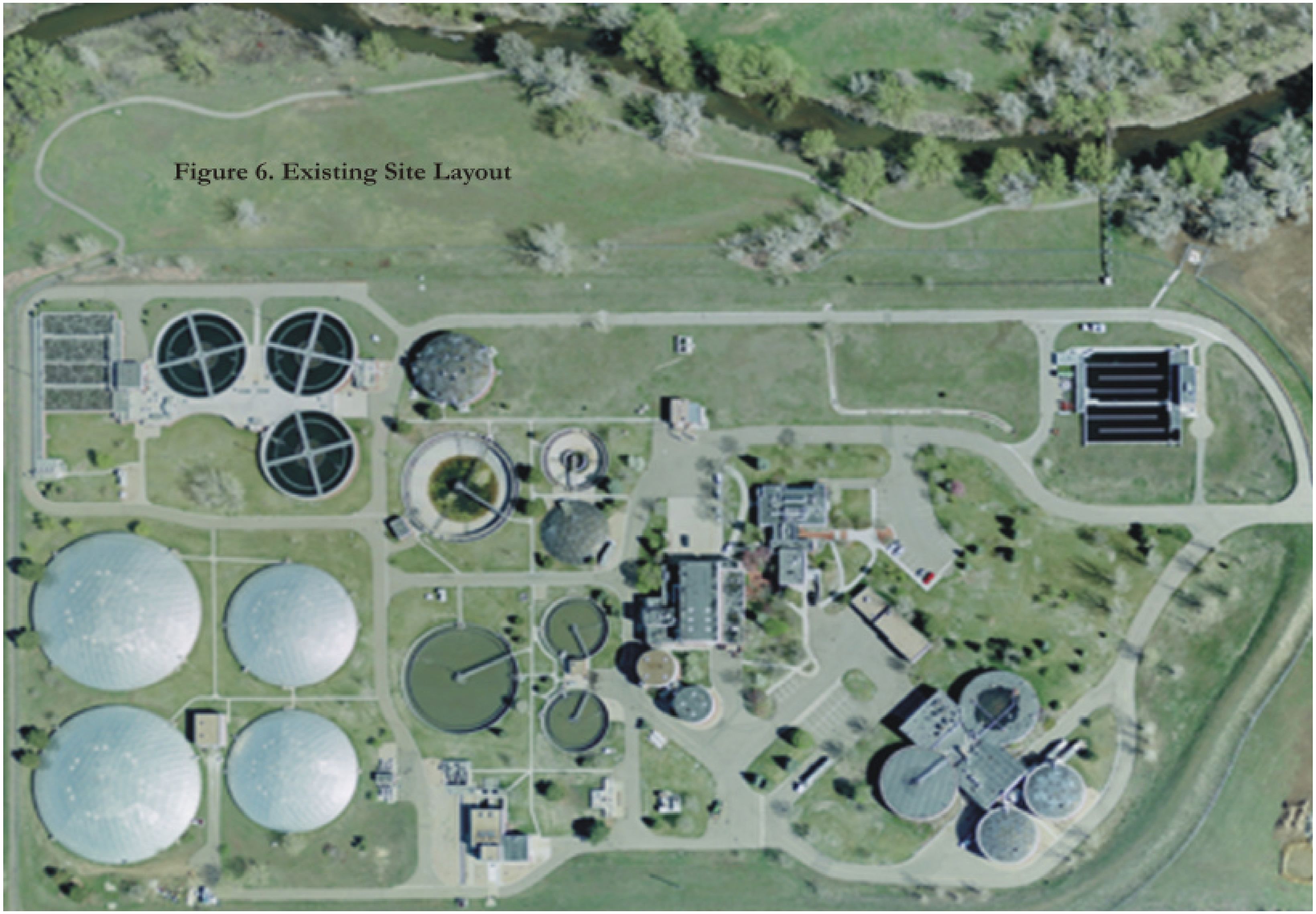
Figure 6. Existing Site Layout

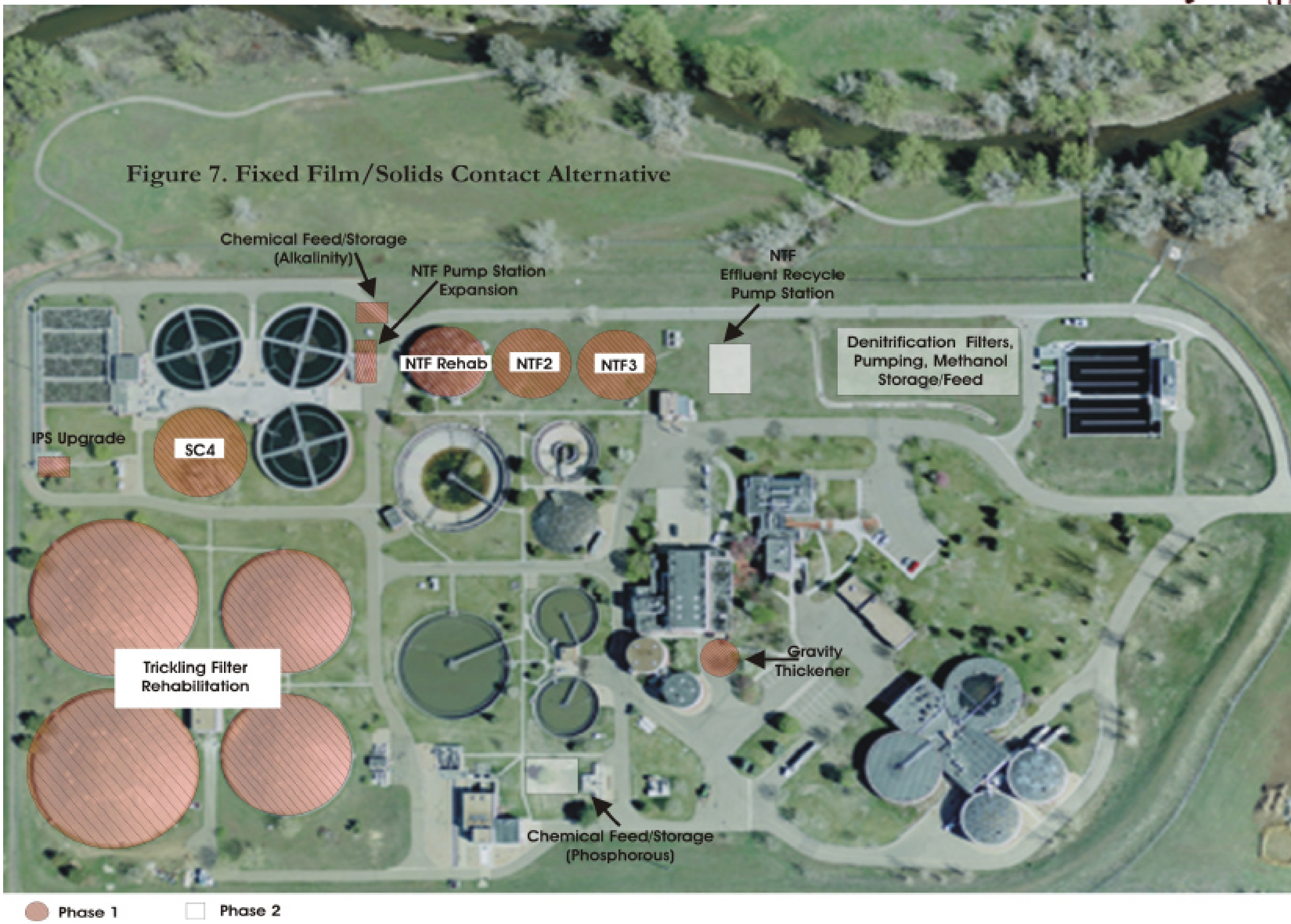

Figure 7. Fixed Film/Solids Contact Alternative
Chemical Feed/Storage (Alkalinity)
NTF Pump Station Expansion
NTF Effluent Recycle Pump Station
Denitrification Filters, Pumping, Methanol Storage/Feed
NTF Rehab
NTF2
NTF3
IPS Upgrade
SC4
Trickling Filter Rehabilitation
Gravity Thickener
Chemical Feed/Storage (Phosphorous)
Phase 1
Phase 2

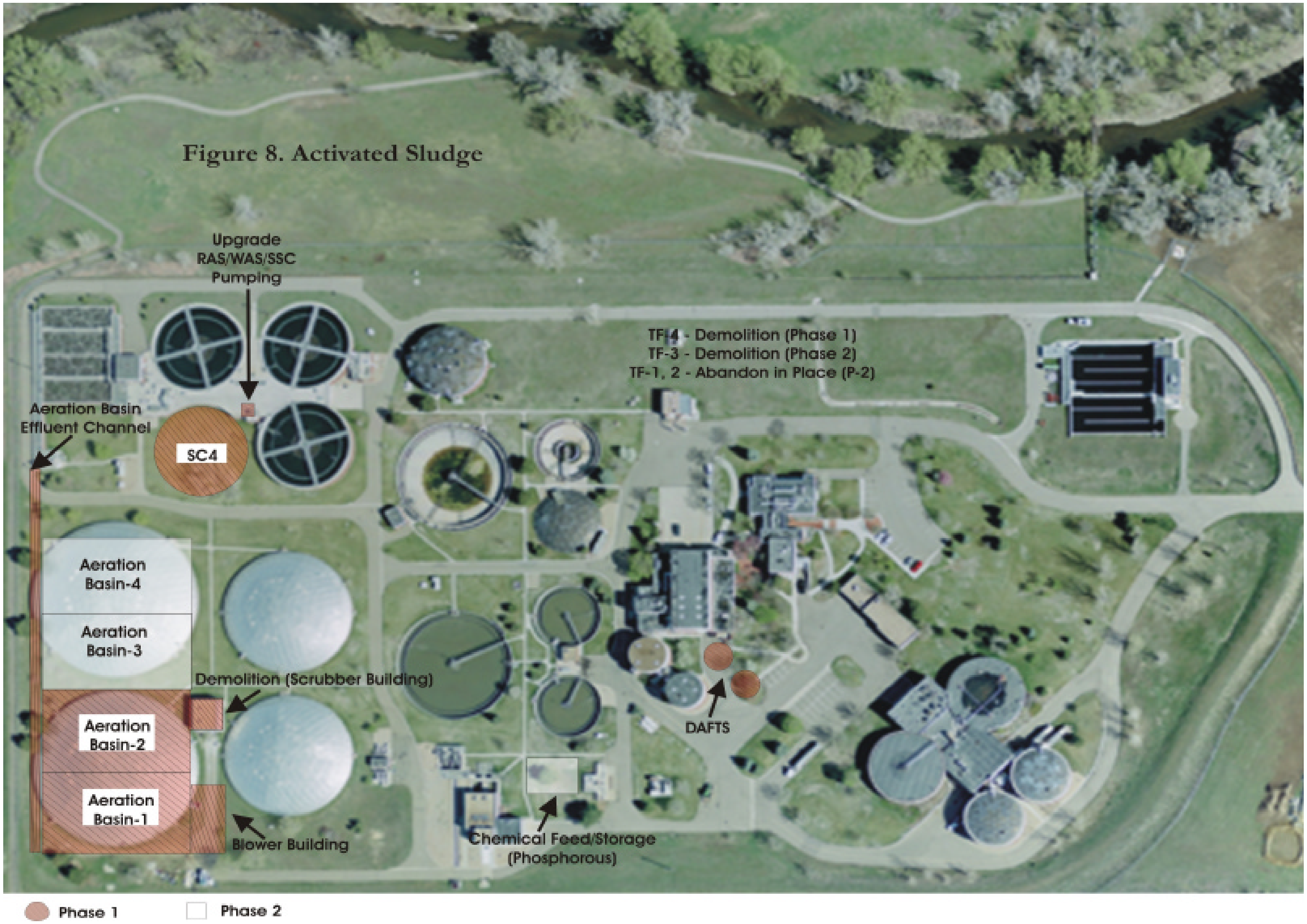
Figure 8. Activated Sludge
Upgrade
RAS/WAS/SSC
Pumping
TF-4 - Demolition (Phase 1)
TF-3 - Demolition (Phase 2)
TF-1, 2 - Abandon in Place (P-2)
Aeration Basin
Effluent Channel
SC4
Aeration
Basin-4
Aeration
Basin-3
Demolition (Scrubber Building)
Aeration
Basin-2
Aeration
Basin-1
Blower Building
Chemical Feed/Storage
(Phosphorous)
DAFTS
Phase 1
Phase 2

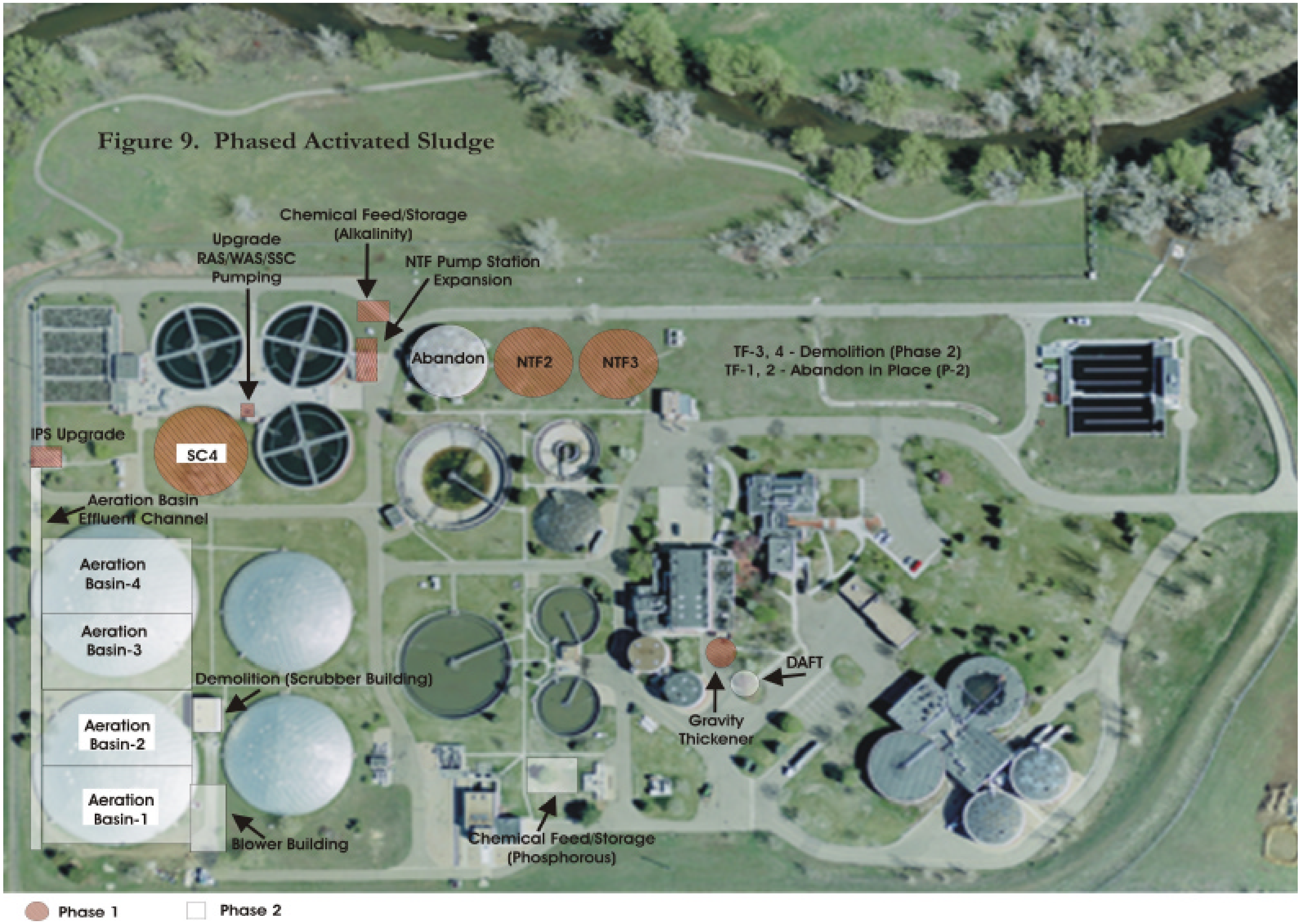

Figure 9. Phased Activated Sludge
Chemical Feed/Storage
(Alkalinity)
Upgrade
RAS/WAS/SSC
Pumping
NTF Pump Station
Expansion
Abandon
NTF2
NTF3
TF-3, 4 - Demolition (Phase 2)
TF-1, 2 - Abandon in Place (P-2)
IPS Upgrade
SC4
Aeration Basin
Effluent Channel
Aeration
Basin-4
Aeration
Basin-3
Demolition (Scrubber Building)
DAFT
Aeration
Basin-2
Gravity
Thickener
Aeration
Basin-1
Blower Building
Chemical Feed/Storage
(Phosphorous)
Phase 1
Phase 2

K. Physiological Well-being

There will be no permanent impacts to physiological well being of nearby residents as a result of the project. Inhabited areas around the Site would not be impacted by the facility expansion, as all construction and new facilities would be contained within the existing site. Some minor, temporary impacts to the neighborhood immediately surrounding the WWTP will occur due to construction. Impacts to traffic, increases in ground vibration, and increases in noise as a result of construction will be minimal and restricted to the immediate vicinity of the Site. Construction will be conducted during daytime hours only, to minimize impacts.

Short-term increases in the noise level at the WWTP would accompany construction activities. Permanent emergency generators may cause nighttime noise exceedences at the site property boundary. Since these generators are used only for emergencies, the overall noise impact would be minimal. The proposed alternative is not expected to have a significant impact on public health at or adjacent to the site.

The beneficial effects of the project include increased WWTP capacity to accommodate planned development and provide higher-quality effluent discharged to Boulder Creek.

L. Services

No increased need for services in the City of Boulder is anticipated as a result of this project.

M. Special Populations

No temporary or long-term impacts to special populations, including persons with disabilities, seniors, or restricted income persons are likely to occur as a result of this project.

As the proposed project will expand an existing facility, no specific benefits or adverse affects are expected for land developers or land values in the area.

Expansion of the WWTP will enable planned development of the service area to continue. Upgrades to the site will improve the surrounding environment by improving water quality and improving aesthetics through additional landscaping. Employment opportunities would be provided over the short-term during construction and start-up, and possibly over the long-term by increased staff requirements.

Funding for the project will place an increased burden on the public through increased tap fees and user charges. The proposed alternative is not expected to have a significant impact on economics and social profile at the site or within the service area.

It is anticipated that annual user charges will need to be increased by 16 to 20 percent for all wastewater system users. This is equivalent to a monthly rate increase of $1.90 to $2.40 for residential customers. This increase will fund the capital and operation and maintenance costs associated with the preferred alternative.

Attachment A.

Preliminary Effluent Limits for Currently Regulated Constituents Based on 75th Street WWTP Based on 25-mgd Discharge Rate

Preliminary Effluent Limits for Currently Regulated Constituents Based on 75th Street WWTP Based on 25-mgd Discharge Rate

Parameter	Effluent Limit at 25 mgd	Rationale and Comments
Flow, mgd	25	Design Capacity – Maximum 30-day flow condition.
$CBOD_5$, mg/L		
30-day average	25	State Effluent Regulations.
7-day average	40	Limits are not dependent on flow.
TSS, mg/L		
30-day average	30	State Effluent Regulations.
7-day average	45	Limits are not dependent on flow.
E. Coli, #/100ml		
30-day geometric mean	146	Water Quality Standard.
7-day geometric mean	292	
Total Residual Chlorine, mg/L		Water Quality Standard.
Daily maximum	n/a	
Chronic	0.003	Implicit Limit.
pH, s.u.		Water Quality Standard.
Minimum – Maximum	6.5 – 9.0	Limits are not dependent on flow.
Oil and Grease, mg/L		State Effluent Regulation
Daily maximum	10	Limit is not dependent on flow.
Total Ammonia (as N), mg/L		Revised *Effluent Ammonia Limits.*
Acute		
January	30.0	
February	21.2	
March	15.1	
April	28.3	
May	30.0	
June	30.0	
July	30.0	
August	30.0	
September	30.0	
October	28.3	
November	29.5	
December	30.0	
Chronic		
January	17.4	
February	10.3	
March	5.0	
April	9.1	
May	10.4	
June	20.8	
July	17.1	
August	15.3	
September	15.2	
October	15.2	
November	20.8	
December	23.4	
Cyanide, Weak Acid Dissociable, ug/L		Water Quality Standards/ Antidegradation
30-day average	30.0	Based on method detection limit.

Parameter	Effluent Limit at 25 mgd	Rationale and Comments
Arsenic, Total, ug/L 30-day average Daily Max	 8.24 Report [1]	Water Quality Standards/ Antidegradation Antidegradation.
Cadmium, PD, ug/L 30-day average Daily Max	 Report or 2.0 [2] Report [1]	Previous Limit/Water Quality Standards 2.0 is Implicit Limit.
Chromium, Hex, Dissolved, ug/L 30-day average Daily Max	 Report or 2.0 [2] Report [1]	Water Quality Standards/ Antidegradation Antidegradation.
Chromium, Tri, TR, ug/L Daily Max	 Report or 7.9 [2]	Water Quality Standards/ Antidegradation Antidegradation
Copper, PD, ug/L Through 12/31/05: 30-day ave Through 12/31/05: Daily Max Through 1/1/06: 30-day ave Through 1/1/06: Daily Max	 25.6 35.2 18 25	 Interim (previously existing) Limits Interim (previously existing) Limits Water Quality Standards Water Quality Standards
Iron, Dissolved, ug/L Through 12/31/05: 30-day ave Through 1/1/06: 30-day ave	 Report [1] 341	Water Quality Standards
Iron, TR, ug/L 30-day average	 Report or 1110 [2]	Water Quality Standards
Lead, PD, ug/L 30-day average	 5.8	Water Quality Standards
Manganese, Dissolved, ug/L 30-day average Daily Max	 54.5 Report [1]	Water Quality Standards
Mercury, Total, ug/L 30-day average	 0.012	Water Quality Standards
Nickel, PD, ug/L 2-year 30-day average	 18 Report or 103 [2]	Water Quality Standards/ Antidegradation Antidegradation Water Quality Standards
Selenium, Total, ug/L Through 12/31/05: 30-day ave Through 12/31/05: Daily Max Through 1/1/06: 30-day ave Through 1/1/06: Daily Max	 Report [1] Report [1] 5.4 19	Water Quality Standards
Silver, PD, ug/L 30-day average Daily Max	 1.07 Report or 6.1 [2]	Water Quality Standards
Zinc, PD, ug/L 30-day average Daily Max	 Report or 233 [2] Report [1]	Water Quality Standards

[1] These limits are currently listed as “Report.”

[2] These limits are currently listed as “Report.” The value provided is a potential numeric limit if one were to be instated at 25.0 mgd.

Attachment B.

75TH Street Wastewater Treatment Plant Air Emissions

75th Street Wastewater Treatment Plant
Air Emissions

The 75th Street Wastewater Treatment Plant has the following air emissions permits:

A. Point 004, Permit #86BO253-1: Waukesha Engine Generator #1
Point 005, Permit #86BO253-2: Waukesha Engine Generator #2

The cogeneration facility consists of two Waukesha engine generators that produce electricity and heat, which is captured to heat the sludge digestion process and approximately half the plant buildings during cold weather. The electricity is sold to Xcel Energy except in cases of electrical service interruption when it is used on site to run the wastewater treatment plant loads. The cogeneration facility has been in commercial electrical production since 1987.

The engine generators typically burn biogas produced in the anaerobic digestion process but can be fueled by natural gas purchased from Xcel Energy. Anaerobic bacteria that break down organic material in the wastewater sludges produce the biogas. The biogas contains approximately 60 percent methane, 39 percent carbon dioxide, and trace amounts of other gasses. Currently, approximately 167,000 standard cubic feet of biogas are produced each day and burned in the engines, generating an average of 250 Kwh per hour.

The combined fuel consumption and emissions from the two engine generators must meet the following permit limits:

Annual fuel consumption:	Not to exceed 101,940,000 SCF per year
Sulfur dioxide:	Not to exceed 12.4 tons per year
Nitrogen oxides:	Not to exceed 81.8 tons per year
Volatile Organic Compounds:	Not to exceed 2.6 tons per year
Carbon monoxide:	Not to exceed 81.8 tons per year

Compliance with the annual limits is determined on a rolling twelve-month rolling total. It should be noted that the engine generators have never exceeded the annual permit limits based on the biogas volume burned and calculated emissions.

B. Point 001, Permit #12BO840-1: Natural Gas Boiler #1

The natural gas boiler was installed in 1980 when the anaerobic sludge digesters were constructed. This boiler allows heating of the digester contents on an ongoing basis, and plant buildings during very cold periods when insufficient biogas is available and the cogeneration facility is out of commission. While the natural gas boiler is kept in operating condition, it has not been used for over ten years.

C. Point 003, Permit #12B0840-3: Biogas Boiler #2

The biogas boiler was installed at the same time as natural gas boiler #1 and can be used for the same purpose. This boiler has not been used for over ten years.

D. Point 002, Permit #12BO840-2: Digester Gas Flare

The digester gas flare was originally installed to burn off excess gas that was not burned in the biogas boiler. After the cogeneration facility was constructed, all biogas, regardless of whether heat was needed, was burned in the engine generators. As a result, the digester gas flare has not been used in many years. Nonetheless, the flare could be used in case the cogeneration facility is out of service and the plant heat demand is low.

E. Point 006, Permit #96BO002-1: Wastewater Treatment Facility – VOC Emissions

Volatile Organic Compound (VOC) emissions are calculated based on an industry standard emission factor of 3.503 pounds of VOCs per million gallons of wastewater treated. Boulder's permit limit of 13.1 tons per year is based on a treatment plant design capacity of 20.5 mgd times 365 days per year times 3.503 pounds of VOC per MG. Compliance is shown by calculating the emissions on a twelve-month rolling total. This permit will need to be modified and submitted to CDPHE for approval to increase the permit limit to 16 tons per year based on the updated treatment plant design capacity of 25 mgd times 365 days per year times 3.503 pounds of VOC per MG.

In addition to the six air emissions permits, the wastewater treatment plant has several APENs and Permit Exempt Points filed with the CDPHE.

A. Air Scrubbers

There are two air scrubbers on the two biosolids storage tanks, two scrubbers on the two gravity sludge thickener tanks, and one scrubber associated with the centrate equalization basin. The scrubbers can use either activated carbon or potassium permanganate impregnated alumina as an odor adsorption material.

B. Permit Exempt Points

The Diagonal Highway Sewage Lift Station has an emergency power generator to keep the lift station operable during power outages. An APEN was submitted and a permit received when the 207 horsepower Kohler diesel generator was installed in 1989. However, an exemption from APEN and permit requirements was granted in 1997 as long as it runs less than 250 hours per year. Typically, the generator runs less than 50 hours per year, mainly for test purposes.

In addition to the cogeneration facility engine generators, the plant has a 500 Kwh, propane fired, Caterpillar engine generator for emergency power production. Due to running the engine generator less than 250 hours per year, the unit was granted an exemption from APEN and permit requirements in 1997. The unit is run less than 100 hours per year.

Attachment C.

Addendum Number 1

City of Boulder
75th Street Wastewater Treatment Plant Upgrades
Community and Environmental Assessment Process (CEAP)
Addendum No. 1
March 8, 2004

Purpose: The purpose of CEAP Addendum No. 1 is to provide additional information relating to the long-term impacts of the alternatives on operational activities at the wastewater treatment plant and on the surrounding community and environment.

Consideration of Non-economic Impacts

A significant part of the alternative evaluation involved consideration of the "non-economic" impacts of each alternative. The non-economic analysis addressed several different criteria or categories such as process reliability, intensity of maintenance requirements, odor generation potential, chemical usage, energy usage, etc. Each criterion was assigned a value or "weighting" number, and then each treatment alternative was rated on a scale of 0 to 5 with respect to each factor, with 0 representing the lowest rating and 5 representing the highest rating. After the weighting and rating process was complete, the weighting number for each category was multiplied by the rating value for each alternative in that category to produce a weighted rating in each category for each alternative. The weighted ratings for each alternative in each category were then added together to produce the overall rating for the alternative. The higher the overall rating number, the more attractive the alternative from a non-economic standpoint.

The results of this rating process are presented in Tables A1-1 and A1-2. Table A1-1 presents ratings for the wastewater treatment process alternatives and Table A1-2 presents the ratings for the disinfection alternatives.

Table A1-1. Non-economic Process Alternative Rating Matrix

Category	Performance	Reliability	Equipment	Chemicals	Constructability	Neighborhood Impacts	Testing	Energy Consumption	Sludge	Other	Totals [2]
Weighting Factor	5	5	3	4	1	3	1	2	2	1	
Activated Sludge [1]	25	20	15	20	4	15	4	8	10	4	125
FF/SC [1]	15	20	9	12	5	12	3	10	8	4	98

[1] Represents weighted rating.

[2] The maximum possible score is 135.

Table A1-2. Non-economic Disinfection Alternative Rating Matrix

Category	Performance	Reliability	Equipment	Chemicals	Constructability	Neighborhood Impacts	Testing	Energy Consumption	Safety	Regulatory	Other	Totals [2]
Weighting Factor	5	5	3	4	1	3	1	2	5	4	4	
Gaseous Chlorine [1]	25	20	12	8	4	12	4	10	8	10	4	124
Liquid NaOCl [1]	25	20	12	16	4	12	4	8	15	16	16	151
UV [1]	25	15	15	20	4	12	5	4	25	20	20	165

[1] Represents weighted rating.
[2] The maximum possible score is 185.

It can be seen from the rating information presented in these tables that activated sludge was rated the highest of the wastewater treatment processes and ultraviolet (UV) disinfection was rated the highest of the disinfection alternatives.

All of the treatment alternatives will have some impact on the visual appearance of the WWTP. Use of the Fixed Film/Solids Contact process would require the addition of two new cylindrical structures approximately 16 feet
high. Use of the activated sludge would require construction of two new rectangular basins in place of one of the existing “domed” trickling filters. All facilities will be designed architecturally to match existing structures at the site.

The anticipated visual impact of these facilities is shown in the following photographs:


Proposal UV Disinfection Building
Dome To Be Removed in Phase 1
Dome To Be Removed in Phase 2
New structures will be no higher than surrounding buildings.


New Aeration Basins to be no higher than this structure.
Dome To Be Removed in Phase 2
Approximate Rendering and Location of Proposed Aeration Basins (does not currently exist)

Community Goals

The Boulder Valley Comprehensive Plan identifies several policies or goals for the community including:

1. Protection of Water Quality
2. Pollution Control
3. Energy Conservation
4. Resource Conservation
5. Reduction of Hazardous Materials Use
6. Reduction in Vehicle Miles Traveled

Each of these goals was considered in the alternative evaluation process. The alternatives were rated as representing a "reactive", "proactive", or "leadership" position with respect to each goal. A summary of the results of this process evaluation are presented in Table A1-3.

Table A1-3. Community Goal Position Summary

	Treatment Process			**Disinfection**		
	Activated Sludge	**Fixed Film/Solids Contact**	**Phased Activated Sludge**	**UV Disinfection**	**Gaseous Chlorine**	**Liquid NaOCl**
Water Quality	Leadership	Reactive	Reactive	Leadership	Reactive	Reactive
Pollution Control	Leadership	Reactive	Reactive	Leadership	Reactive	Reactive
Energy Conservation	Reactive	Proactive	Proactive	Reactive	Proactive	Proactive
Resource Conservation	Leadership	Reactive	Proactive	Leadership	Reactive	Reactive
Hazardous Materials Reduction	Leadership	Reactive	Proactive	Leadership	Reactive	Proactive
Vehicle Miles Reduction	Leadership	Reactive	Proactive	Proactive	Proactive	Reactive

The activated sludge process, which is the preferred alternative, was rated as follows:

1. Protection of Water Quality – Leadership

   The activated sludge process will not only achieve compliance with the new discharge requirement for ammonia, but will also allow the removal of some portion of the total nitrogen and phosphorus in the wastewater. (It is anticipated that removal of both nitrogen and phosphorus will be required at some point in the future, but at this time such requirements have not been established.)

2. Pollution Control – Leadership

   The activated sludge process will not only achieve compliance with the new discharge requirement for ammonia, but will also allow the removal of some portion of the total nitrogen and phosphorus in the wastewater.

3. Energy Conservation – Reactive

   The activated sludge process involves the direct use of more energy than does the Fixed Film/Solids Contact alternative. This is because the oxygen required to maintain the activated sludge biomass is provided by motor driven blowers whereas the oxygen required for the Fixed Film/Solids Contact alternative is provided by motor driven pumps, which require less energy than the activated sludge blowers.

4. Resource Conservation – Leadership

   The activated sludge process requires the addition of fewer chemicals than the Fixed Film/Solids Contact alternative and represents one of the most chemically efficient treatment processes available to achieve nitrogen and phosphorus removal. (No chemical addition is required to achieve moderate levels of both nitrogen and phosphorus removal.)

5. Reduction of Hazardous Materials Use – Leadership

   The activated sludge process requires no hazardous chemicals.

6. Reduction in Vehicle Miles Traveled – Leadership

   Because the activated sludge process requires no chemical addition, there is no requirement for chemical delivery and the associated delivery truck traffic.

The Fixed Film/Solids Contact alternative (Alternative 2) was rated as follows:

1. Protection of Water Quality – Reactive

   The Fixed Film/Solids Contact alternative will achieve compliance with the new discharge requirement for ammonia, but does not provide any total nitrogen or phosphorus removal until some point in the future when discharge requirements are established for these pollutants. (It is anticipated that removal of both nitrogen and phosphorus will be required at some point in the future, but at this time such requirements have not been established.)

2. Pollution Control – Reactive

   The Fixed Film/Solids Contact alternative will achieve compliance with the new discharge limits for ammonia, but will not initially provide removal of total nitrogen or phosphorus.

3. Energy Conservation – Proactive

   The Fixed Film/Solids Contact alternative involves the direct use of less energy than the activated sludge process. This is because the oxygen required for the Fixed Film/Solids Contact process is provided by motor driven pumps while the oxygen for the activated sludge process is provided by motor driven blowers, which require more energy than the pumps for the Fixed Film/Solids Contact process.

4. Resource Conservation – Reactive

   The Fixed Film/Solids Contact alternative requires the addition of more chemicals than the activated sludge alternative.

5. Reduction of Hazardous Materials Use – Reactive

   The Fixed Film/Solids Contact alternative requires the use of chemicals for alkalinity addition and as a carbon source for the nitrogen removal process. The chemicals involved will likely be considered hazardous due to their corrosive or flammable nature.

6. Reduction in Vehicle Miles Traveled – Reactive

   Because the Fixed Film/Solids Contact alternative requires the use of multiple chemicals, chemical delivery will be required. This chemical deliver will be by truck, and therefore will involve an increase in the number of vehicle miles traveled.

The phased activated sludge alternative (Alternative 3), which initially involves the Fixed Film/Solids Contact process with a subsequent conversion to activated sludge, was rated as follows:

1. Protection of Water Quality – Reactive

   The phased activated sludge alternative will achieve compliance with the new discharge requirement for ammonia, but does not provide any total nitrogen or phosphorus removal until some time in the future when discharge requirements are established for these pollutants. (It is anticipated that removal of both nitrogen and phosphorus will be required at some point in the future, but at this time such requirements have not been established.)

2. Pollution Control – Reactive

   The phased activated sludge alternative will achieve compliance with the new discharge limits for ammonia, but will not initially provide removal of total nitrogen or phosphorus.

3. Energy Conservation – Proactive

   The phased activated sludge alternative initially involves the direct use of less energy than the activated sludge process. This is because the oxygen required for the Fixed Film/Solids Contact process, which is used initially, is provided by motor driven pumps. The oxygen for the activated sludge process, which will be utilized at a later date, is provided by motor driven blowers, which require more energy than the pumps for the Fixed Film/Solids Contact process.

4. Resource Conservation – Proactive

   The Fixed Film/Solids Contact alternative, which is utilized initially, requires the addition of more chemicals than the activated sludge alternative to achieve ammonia removal. The activated sludge process, which is to be used ultimately, requires fewer chemicals that the Fixed Film/Solids Contact alternative.

5. Reduction of Hazardous Materials Use – Proactive

   The Fixed Film/Solids Contact alternative, which is to be used initially, requires the use of chemicals for alkalinity addition. The chemicals involved will likely be considered hazardous due to their corrosive nature.

6. Reduction in Vehicle Miles Traveled – Proactive

   Because the Fixed Film/Solids Contact alternative, which is used initially with this alternative, requires the use of chemicals to provide alkalinity addition and consequently chemical delivery will be required. Later on, when the process is converted to activated sludge, the chemical delivery is expected to cease.

Disinfection Alternative Ratings

UV disinfection was rated as follows with respect to achieving the established community goals:

1. Protection of Water Quality – Leadership

   The UV disinfection alternative will achieve compliance with disinfection discharge requirements, but does not result in the addition of any dissolved solids or the creation of disinfection by-products in the water. All other disinfection alternatives do involve the addition of dissolved solids and result in the creation of disinfection by-products in the water, some of which are either toxic or potentially carcinogenic.

2. Pollution Control – Leadership

   The UV disinfection alternative will achieve compliance with disinfection discharge requirements, but does not involve the addition of any dissolved solids or the creation of disinfection by-products in the water. All other disinfection alternatives do involve the addition of dissolved solids and result in the creation of disinfection by-products in the water, some of which are either toxic or potentially carcinogenic.

3. Energy Conservation – Reactive

   The UV disinfection alternative involves the direct use of more electric energy than do the other disinfection alternatives. This is because electric energy is used to generate the UV light.

4. Resource Conservation – Leadership

   The UV disinfection alternative does not require the addition of any chemicals and therefore does not directly involve the consumption of chemical resources. The UV disinfection alternative will require the disposal of spent UV lamps, but these lamps are generally recycled.

5. Reduction of Hazardous Materials Use – Leadership

   The UV disinfection alternative does not involve the use of any hazardous materials.

6. Reduction in Vehicle Miles Traveled – Proactive

Because the UV disinfection alternative does not involve the use of any chemicals, no chemical delivery is required. Delivery of new UV lamps will be required, but this will involve fewer vehicle miles on an annual basis than the chemical delivery required for chemical disinfection.

The chlorine gas disinfection alternative is rated as follows with respect to achieving Boulder's community goals:

1. Protection of Water Quality – Reactive

The gaseous chlorine disinfection alternative will achieve compliance with disinfection discharge requirements but results in the addition of dissolved solids and the creation of disinfection by-products in the water.

2. Pollution Control – Reactive

The gaseous chlorine disinfection alternative will achieve compliance with disinfection discharge requirements but results in the addition of dissolved solids and the creation of disinfection by-products in the water.

3. Energy Conservation – Proactive

The gaseous chlorine disinfection alternative involves the direct use of relatively little electrical energy.

4. Resource Conservation – Reactive

The gaseous chlorine disinfection alternative requires the addition of chemicals for both the disinfection process and the subsequent dechlorination process.

5. Reduction of Hazardous Materials Use – Reactive

The gaseous chlorine disinfection alternative involves the use of gaseous chlorine and gaseous sulfur dioxide, both of which are considered hazardous materials. These chemicals are supplied in pressured one-ton containers delivered to the treatment plant site by truck; therefore these hazardous materials are transported through the surrounding community in route to the treatment plant.

6. Reduction in Vehicle Miles Traveled – Proactive

   The gaseous chlorine disinfection alternative requires the deliver of both chlorine and sulfur dioxide to the treatment plant site along with the attendant vehicle miles. The gaseous chlorine disinfection alternative is rated as proactive in this category since it requires fewer deliveries than the liquid sodium hypochlorite disinfection alternative.

The liquid sodium hypochlorite disinfection alternative is rated as follows with respect to achieving Boulder's Community Goals:

1. Protection of Water Quality – Reactive

   The liquid sodium hypochlorite disinfection alternative will achieve compliance with disinfection discharge requirements but does result in the addition of dissolved solids and the creation of disinfection by-products in the water.

2. Pollution Control – Reactive

   The liquid sodium hypochlorite disinfection alternative will achieve compliance with disinfection discharge requirements but does result in the addition of dissolved solids and the creation of disinfection by-products in the water.

3. Energy Conservation – Proactive

   The liquid sodium hypochlorite disinfection alternative involves the direct use of relatively little electrical energy.

4. Resource Conservation – Reactive

   The liquid sodium hypochlorite disinfection alternative requires the addition of chemicals for both the disinfection process and the subsequent dechlorination process.

5. Reduction of Hazardous Materials Use – Proactive

   The liquid sodium hypochlorite disinfection alternative involves the use of liquid sodium hypochlorite and liquid sodium bisulfate, both of which are considered hazardous materials. These chemicals are delivered to the treatment plant site in liquid form by truck; therefore these hazardous materials are transported through the surrounding community in route to the treatment plant. This alternative is rated as proactive rather than reactive in this category because, though it does involve the use of hazardous chemicals, the chemicals involved are not considered as hazardous as the chemicals associated with the gaseous chlorine disinfection alternative.

6. Reduction in Vehicle Miles Traveled – Reactive

The liquid sodium hypochlorite disinfection alternative requires the deliver of both liquid sodium hypochlorite and liquid sodium bisulfate to the treatment plant site along with the attendant vehicle miles. The liquid sodium hypochlorite disinfection alternative is rated as reactive rather than proactive in this category because it requires more chemical deliveries than the gaseous chlorine disinfection alternative.

The community goal attainment information presented above is summarized in Table A1-3.

Sludge Volume and Character

The alternative treatment processes associated with secondary treatment and nitrogen removal are all expected to generate about the same volume and character of waste sludge. In all cases the sludge will be thickened and treated in anaerobic digesters (and possibly composting) to produce biosolids that will be used as a soil conditioner on agricultural lands or for some other beneficial use.

Waste solids generated from phosphorus removal will differ significantly in character between the two treatment alternatives. The sludge generated from phosphorus removal in the activated sludge process will be a biological sludge and will be handled in the same way as the secondary sludge.

Phosphorus removal provided in conjunction with the Fixed Film/Solids Contact alternative will result in the generation of alum sludge. This is a relatively inert material that may also be handled with the biosolids generated in the secondary process, however it will add significantly to the volume of the sludge but will add nothing to the quality of the biosolids as a soil amendment.

If the phosphorus removal requirements are extremely stringent, alum addition may also be required in conjunction with the activated sludge process. If this is the case, the waste sludge generated from this process will also contain a significant amount of alum sludge.

Phosphorus removal associated with the phased activated sludge alternative will result in the generation of sludge as described for the activated sludge alternative.

User Cost Impacts

The preferred alternatives for the treatment process and the disinfection process are more expensive from a capital cost standpoint than the other alternatives considered. However, any combination of process and disinfection alternatives will require an increase in the fees Boulder charges its sewer service customers. The size of the increase will range from about 4 to 20 percent ($0.50 to $2.40 per month for a typical residential customer), depending on the alternatives selected.

Table A1-3 presents the current average Boulder residential sewer service charge in comparison to those of other communities along the Colorado Front Range.

Table A1-3. Front Range Community Sewer Rates [1]

No.	Community	Monthly Sewer Service Charge	Annual Sewer Service Charge
1	Erie	$23.30	$279.60
2	Longmont	$17.25	$207.00
3	Fort Collins	$15.89	$190.67
4	Greeley	$15.35	$184.20
5	Broomfield	$14.85	$178.20
6	Northglenn	$14.25	$171.00
7	Westminster	$14.20	$170.40
8	Colorado Springs	$13.45	$161.38
9	Louisville	$12.40	$148.80
10	Thornton	$11.91	$142.92
11	Boulder [2]	$11.83	$141.96
12	Arvada	$11.20	$134.40
13	Lafayette	$11.01	$132.12
14	Denver	$10.68	$128.16
15	Aurora	$9.79	$117.48

[1] Based on information collected in a survey of Front Range Communities conducted in August of 2003.
[2] Boulder sewer service rate as of January 1, 2004.

Boulder currently is number 11 on the list. An increase of 4% (or approximately $0.50/mo.) would increase the Boulder sewer service fee to $12.33/month and put Boulder at number 9 on the list, just below Colorado Springs. An increase of 20% (approximately $2.40/mo.) would increase the monthly sewer service fee to $14.23 and put Boulder at number 6 on the list, just below Broomfield.

City of Boulder
75th Street Wastewater Treatment Plant Upgrades
Community and Environmental Assessment Process (CEAP)
Addendum No. 2

Purpose: The purpose of CEAP Addendum No. 2 is to provide review of the advantages and disadvantages of combining Phase 1 and Phase 2 of the recommended Wastewater Treatment Plant Upgrades into a single project.

The Recommended Alternative

Based on results of the preliminary design evaluations, the recommended alternative for upgrading Boulder's 75th Street Wastewater Treatment Plant to meet current and future effluent quality requirements is conversion to the activated sludge treatment process. The upgrades are necessary to achieve compliance with current ammonia limits and anticipated future total nitrogen and phosphorus limits. Ultraviolet (UV) disinfection is the recommended disinfection alternative.

The ammonia limits are currently in place and compliance must be achieved within a specified period of time (by February 2008). Total nitrogen and phosphorus limits are not currently in place but their implementation is anticipated within the next 5 to 10 years. Because of the timing of these treatment requirements, it was proposed that the Wastewater Treatment Plant Upgrade activities be completed in two phases. Phase 1 would involve construction of those facilities required to achieve compliance with the ammonia effluent limits. Phase 2 would be undertaken later and would involve construction of the additional facilities required to meet total nitrogen and phosphorus limits.

Construction Costs

The anticipated construction costs associated with Phase 1 and Phase 2 of the recommended alternative are:

Phase 1 Construction Cost	$25,600,000
Phase 2 Construction Cost	$8,000,000

The Phase 1 costs include $20,200,000 for the activated sludge process, $2,900,000 for the UV disinfection system, and $2,500,000 for "other" system improvements. The Phase 2 costs are shown as present worth of these facilities constructed 5 years in the future as indicated in Table 4 of the CEAP Report.

Implementation Schedule

For evaluation purposes, it was assumed that construction of the Phase 2 facilities would begin in approximately 5 years, when it is anticipated that total nitrogen limits will be implemented on discharges to Boulder Creek.

Combining Phase 1 and Phase 2

Combining the two phases into a single phase would mean that all of the facilities required to achieve ammonia removal, nitrogen removal, and phosphorus removal would be constructed in a single phase with construction beginning in 2005.

Advantages

This would simplify both design and construction and would result in the total project being completed earlier, probably at least four years earlier than would be the case if the project were completed in two separate phases.

A single project would require preparation of only one set of design documents, only one project would be bid, only one contractor mobilization would be required, economies would be realized in the construction itself, and the total time required for construction would be reduced. It is expected that these factors would reduce overall project costs on the order of 5 to 15 percent. This represents a cost savings in the neighborhood of $2,000,000 to $6,000,000. There would also be a slight savings in operations costs due to the energy costs savings realized from operating in the denitrification mode during the Phase 1 operational period.

Non-economic benefits would include a substantially shorter construction period, probably six to eight months shorter, and the resumption of a leadership position in efforts to promote improved water quality in Boulder Creek. Such a leadership is consistent with the goals identified in the Boulder Valley Comprehensive Plan.

Disadvantages

There are also some disadvantages associated with constructing the proposed facilities as one project instead of two. The most obvious is that more capital investment would be required initially. If the second phase were to begin in five years, this would be more than offset by the total savings realized. The longer the second phase is delayed, the more significant this cost disadvantage becomes.

A second disadvantage has to do with the constructability of the activated sludge system components as a single project. Because construction of the Phase 2 facilities will require demolition of a second trickling filter, and because it is necessary to keep three trickling filters in service until the new aeration facilities are in service, it will be necessary to construct the aeration basins for the activated sludge system in two stages.

This is possible but will somewhat reduce the time and construction cost savings that could otherwise be realized if this requirement did not exist.

A third disadvantage results from the fact that the formal treatment requirements for the second phase facilities are not all well defined at this point. The nitrate, nitrite, and total inorganic nitrogen limits have been estimated based on historical data and known water quality standards for Boulder Creek. Phosphorus limits are less well established and therefore more speculative. However, concern about phosphorus is somewhat mitigated by the fact that phosphorus limits are probably further in the future than nitrogen limits are, and they may be no more well established when the second phase facilities become necessary to address nitrogen limits than they are now. For this reason, it is recommended that biological phosphorus removal provisions be included in the design of the single phase project, but that no provisions be made for chemical phosphorus removal. Biological phosphorus removal will likely reduce the phosphorus concentration in the wastewater to near or slightly below 1 mg/l. This capability represents a very modest capital investment and should be sufficient to meet future phosphorus removal requirements. If more restrictive phosphorus limits are adopted at some later date, chemical phosphorus capability can be added at that time.

Summary and Recommendation

Construction of Phase 1 and Phase 2 upgrades together as a single project is expected to cost between $2,000,000 and $6,000,000 less than designing and constructing similar facilities in two separate phases. It will also significantly reduce the duration of construction activities at the treatment plant and place Boulder in a leadership position with respect to improving water quality in Boulder Creek.

If activated sludge is selected as the treatment process for upgrading the 75th Wastewater Treatment Plant, serious consideration should be given to constructing all of the planned facilities in a single construction project.

APPENDIX B

CEAP Report for Solids Handling Facilities

COMMUNITY ENVIRONMENTAL ASSESSMENT PROCESS

for

75TH STREET WASTEWATER TREATMENT PLANT DEWATERING IMPROVEMENTS

for

CITY OF BOULDER
PUBLIC WORKS-UTILITIES DIVISION
1739 BROADWAY
BOULDER, CO 80302

Rothberg, Tamburini & Winsor, Inc.
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RTW Project No. OE-8072-SC

May 2006

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Description and Location of Project

The City of Boulder and Rothberg Tamburini and Winsor, Inc. (RTW) are working together to design upgrades to the Dewatering Facilities at the City of Boulder's 75th Street Wastewater Treatment Plant (WWTP). The new facilities will treat solids produced from the liquid treatment processes at projected 2025 flows (buildout). The solids treatment system will be needed to meet current and anticipated solids production from the treatment of liquid wastewater and regulatory limits for biosolids reuse or disposal. All domestic and industrial wastewater generated within the City of Boulder is processed at the 75th Street WWTP. Septic wastes, hauled to the facility by private haulers, are also processed at the facility. Biosolids are produced from the treatment of these wastewaters.

The City of Boulder's 75th Street WWTP is located at 4049 75th Street in the SW ¼ of Section 13, T1N, R70W, Boulder County, Colorado (Figure 1). Treated effluent is discharged to Segment 9 of Boulder Creek. The WWTP is defined as a major facility by the Colorado Department of Public Health and Environment (CDPHE), and operates under a Colorado Discharge Permit System (CDPS) permit (Number CO-0024147) dated February 2003. The liquid treatment facilities are being expanded to provide capacity for higher flows and to produce a higher quality effluent, as required by the permit. In March 2004, a Community and Environmental Assessment Process (CEAP) report was completed for the WWTP liquid stream improvements project. Biosolids produced from the existing facility are treated and reused either in agricultural land application or via composting at a private facility.

Proposed upgrades to the liquid stream, planned to be on-line in 2007, will increase plant capacity from 20.5 MGD to 25 MGD. Not only will plant capacity increase, more potential pollutants will be removed from the liquid stream. In order to accommodate the increased solids production from these improvements and to upgrade the existing processing equipment, new dewatering facilities and appurtenances will be needed. The WWTP liquid expansion and the solids handling improvements will be contained within the existing designated WWTP site boundary.

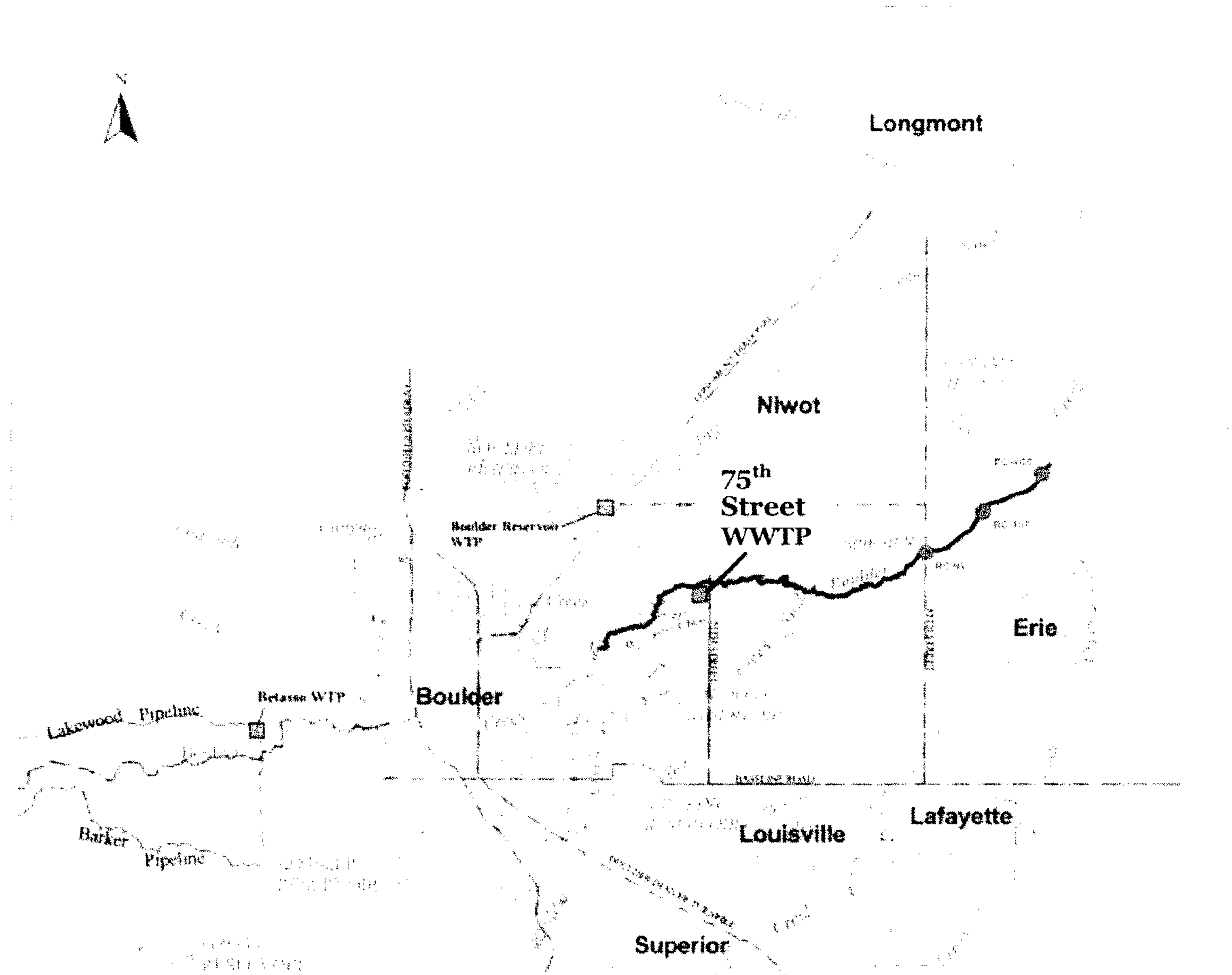

Figure 1 - Boulder Creek Segment 9 and 75th Street WWTP

Rothberg
Tamburini
Winsor

Background; Purpose and Need for the Project

The 75th Street WWTP was placed in service in 1968 and was originally designed to treat 5.2 MGD. The most recent completed WWTP upgrade was in 1988, which increased the capacity to 20.5 MGD (maximum 30-day flow). A construction project was initiated in 2005, with planned completion in 2007, which will increase the capacity to 25 MGD. In addition to higher volumes of flow, the upgraded facilities will remove more contaminants from the wastewater and treat to lower concentration levels. When the new liquid stream treatment system is on line, the estimated annual average production of solids will be approximately 7.4 dry tons of primary solids daily and 7.2 dry tons per day (dtpd) of secondary solids, for a total of 14.6 dtpd. The total solids produced during the maximum month conditions in 2007 are estimated to be 17.5 dtpd. At buildout, the estimated annual average and maximum month solids production will be 17.3 dtpd and 23.3 dtpd, respectively. The digestion process will reduce this volume to approximately 9.6 dtpd and 11.6 dtpd, average and maximum month. This quantity of biosolids will have to be removed from the plant to assure efficient operations.

When the liquid stream improvements are completed, the treatment processes at the WWTP will include:

- Influent flow measurement
- Screening
- Grit removal
- Primary sedimentation
- Secondary treatment employing activated sludge configured to remove nitrogen
- Secondary clarifiers
- Chlorination (using gaseous chlorine) and dechlorination (using gaseous sulfur dioxide); both processes will eventually be replaced with ultraviolet light (UV) disinfection.

Effluent from the 75th Street plant is discharged to Boulder Creek. This discharge has been regulated under the terms of a discharge permit issued by the CDPHE since the early 1970s

Biosolids from the 75th Street plant are produced by treating the waste materials generated by the treatment of liquid wastewater. Once treated, they are dewatered to reduce their volume and stored on-site as a semi-solid material. The biosolids are then trucked to eastern Colorado for agricultural (land) application. If agricultural sites are not available due to poor weather or farming operations, the biosolids are hauled to A-1 Organics, a private composting operation where the biosolids are used to produce Class A compost that is then marketed as a soil amendment. The solids treatment stream includes:

- gravity sludge thickeners
- dissolved air flotation sludge thickeners
- anaerobic digestion
- centrifuge dewatering
- biosolids storage tanks
- dewatered biosolids storage
- truck hauling of dewatered biosolids
- land application of biosolids.

The dewatering facilities are one of the critical steps in the solids process because they reduce the volume of product, which allows the material to be trucked off site efficiently and cost effectively. The removal of solids produced in the treatment process is critical to stable operations and in maintaining permit compliance.

The dewatering facilities were constructed in 1987 and, at that time included two centrifuges and various appurtenances, such as polymer systems and storage tanks. These two original centrifuges are near or at their design life and need to be replaced. Due to the high level of maintenance required and the difficulty in obtaining spare parts, a third centrifuge was installed in 2005. However, due to space limitations in the existing dewatering building, this new centrifuge is not large enough to handle the loads that will occur at build-out when the new liquid treatment systems are on line.

The existing equipment has a total capacity of approximately 320 gallons per minute (gpm), assuming all three devices are in operation. In the future, two, larger centrifuges, each with a capacity of approximately 250 gpm will be needed. In summary, based on the age, condition, and capacity of the existing dewatering equipment, it is necessary to upgrade the dewatering system. Currently these facilities handle, on average, approximately 6.3 dtpd.

The biosolids project goals include the following:

- Provide solids processing and adequate treatment capacity to treat anticipated service area buildout wastewater flows of 25 MGD based on maximum 30-day flow conditions.
- Consistently meet regulatory limits for reuse of biosolids, including:
    - Volatile solids reduction
    - Pathogen reduction
    - Vector attraction reduction
    - Metals

Provide a solids treatment system capable of reducing the volume of material produced to lower total operational costs and reduce the amount of truck traffic that must enter and exit the plant for hauling of biosolids.

- Replace aging dewatering equipment.

Description of Process Alternatives and Summary of Major Issues

Several potential process alternatives were evaluated for expansion and upgrade of the WWTP biosolids processing facilities. Based on previous planning and engineering efforts (1997 Class "A" Biosolids Management Study, and the preliminary engineering for the Biosolids Recycling Center at Valmont Butte), several alternatives that maximize the use of the existing WWTP site were identified. Using project team discussions and the initial process alternatives review, the following three alternatives were developed and evaluated:

1. Do nothing,
2. Maintain semi-solid (10-12% solids) dewatering (existing process)
3. Transition to a cake (20-24% solids) product (new process)

Alternatives 2 and 3 are based on centrifuge dewatering of the digested biosolids produced from the liquid treatment. Whether the final product was a semi-solid or cake, the biosolids could be agriculturally (land) applied or the solids could be delivered to A-1 Organics for privatized composting.

In developing these alternatives, the costs and benefits of using existing structures or constructing new facilities were examined. Two processes were considered: semi-solid (10-12% solids) and cake (20-24% solids) production. Each alternative would provide the level of biosolids processing and treatment required for existing (20.5 MGD) design flows and the projected (25 MDG) design flows solids production. Construction required to implement the chosen alternative would coincide with the liquid stream improvements construction such that the plant's biosolids treatment capabilities grow in parallel with its liquid treatment capability.

The following summaries of these three alternatives present the advantages and disadvantages of each.

Alternative 1: Do Nothing

The "Do Nothing" or "no action" alternative relies on the existing dewatering equipment and facilities. Digested biosolids would continue to be dewatered to a semi-solid state utilizing the three existing centrifuges (two old and one new), then stored and hauled to agricultural land application.

This alternative is not acceptable because the existing equipment does not have the capacity to meet the future WWTP solids loading when plant flows reach 25

MGD. Additionally, the existing equipment is almost 20 years old, and finding replacement parts for the units has proven very difficult, greatly reducing their reliability and the plant redundancy. The existing equipment in operation at the WWTP is insufficient to handle the upgraded plant's biosolids production of 11.6 dry tons/day in approximately 20 years. This alternative, which would eventually lead to regulatory noncompliance at the WWTP, is not an acceptable option.

Pros of this alternative:

- Requires no capital expenditures
- No construction impacts

Cons of this alternative:

- Existing equipment is old and replacement parts are difficult to find
- The short-term inability to meet dewatering and biosolids processing requirements
- Long-term inability to meet dewatering and biosolids processing requirements
- Inability to store non-dewatered biosolids on site
- Violations of permits and regulations

Estimated capital cost for this alternative: $0.
Operations and maintenance cost estimate for this alternative: Not applicable because adequate solids treatment will be impossible at build-out.

Alternative 2: Semi-solid Product

Alternative 2A: Utilize Existing Centrifuge Building

Alternative 2A would be similar in operation to the existing operation by maintaining semi-solid biosolids dewatering. New centrifuges would replace the existing units. Alternative, 2A, would involve installing new centrifuges in the existing dewatering building.

Pros of this alternative:

- Regulatory compliance
- Makes maximum use of existing structures to house the centrifuges
- Similar operation is familiar to existing plant staff

- The semi-solid product is similar to the existing operation and would use liquid storage after the centrifuges, as is currently practiced

Cons of this alternative:

- The new centrifuges must be smaller and operate longer each day due to space limitations
- Structural concerns if existing buildings are modified again
- Limited ability to modify the existing building
- Opinion of probable cost (OPC) is highest for this alternative compared to other alternatives due to retrofitting difficulties, longer run times, more common equipment failure, and greater staffing needs.

Estimated capital cost for this alternative: $9,227,850.
Operations and maintenance cost estimate for this alternative: $2,455,500.
Total present worth of this alternative: $41,168,850

Alternative 2B: Construct New Centrifuge Building

Alternative 2B would involve installing new centrifuges in a new solids dewatering building, constructed adjacent to the existing building.

Pros of this alternative:

- Regulatory compliance
- Upgraded, larger equipment in new building
- The semi-solid product is similar to the existing operation and would use liquid storage after the centrifuges, as is currently practiced

Cons of this alternative:

- Requires construction of a new facility
- OPC is higher for this alternative than for other alternative(s) due to the increased water content of the biosolids and the need for a more expensive, long-term trucking contract.

Estimated capital cost for this alternative: $11,839,350.
Operations and maintenance cost estimate for this alternative: $2,075,500.
Total present worth of this alternative: $38,837,350.

Alternative 3: Cake Product

Alternative 3 would involve producing a cake product that has characteristics more like a solid material. New centrifuges capable of producing 20-24% solids would be utilized.

Alternative 3A: Utilize Existing Centrifuge Building

Alternative 3A would involve installing new high-solids centrifuges in the existing building

Pros of this alternative:

- Regulatory compliance
- Makes maximum use of existing structures to house equipment
- Would produce a drier material, resulting in a lower biosolids volume hauled from the facility
- Fewer trucks required would result in lower O&M costs

Cons of this alternative:

- Cake storage would be needed
- The centrifuges must be smaller and operate longer each day due to space limitations.
- Structural concerns if existing buildings are modified again
- Opinion of probable cost (OPC) is highest for this option due to retrofitting difficulties, longer run times, more common equipment failure, and greater staffing needs.

Estimated capital cost for this alternative: $10,600,750.
Operations and maintenance cost estimate for this alternative: $1,998,800.
Total present worth of this alternative: $36,601,050.

Alternative 3B: Construct New Centrifuge Building

Alternative 3B would involve installing new high-solids centrifuges in a new solids dewatering building, constructed adjacent to the existing building.

Pros of this alternative:

- Regulatory compliance

- Would produce a drier material, resulting in a lower biosolids volume hauled from the facility.
- Fewer trucks required would result in lower O&M costs
- Provides maximum flexibility for the final disposal of biosolids
- OPC for this alternative is the lowest due to properly sized structure and equipment, reduced staffing requirements, and reduced hauling costs.

Cons of this alternative:

- Cake storage would be needed
- Requires construction of a new facility

Estimated capital cost for this alternative: $11,473,000
Operations and maintenance cost estimate for this alternative: $1,775,000
Total present worth of this alternative: $34,562,000

Following the initial alternative evaluation, Alternative 3B (cake product utilizing a new solids dewatering building) was selected for a thorough analysis. This alternative was selected for three reasons.

a. Cake product is becoming the norm in the industry and producing drier material results in fewer truck trips from the WWTP site.

b. A new dewatering building is appropriate for the new equipment due to size constraints and age of the existing building.

c. Based on RTW's OPCs for the alternatives available, it follows that retrofitting the existing facilities would result in higher lifetime costs for the WWTP. These reasons are included in the above bulleted highlights for each alternative. To reiterate, cost advantages for constructing a new building versus using the existing building include:

- Installation of properly sized equipment with lower operating costs,
- Lower staffing needs,
- Redundant capacity,
- Greater flexibility, and
- Lower maintenance costs.

Following the selection of this alternative, more detailed analyses of the facilities were performed. The building configuration and the method of storing biosolids cake were evaluated. Two- and three-story buildings were evaluated, as was storage in either a vertically oriented silo or horizontally oriented hopper.

Table 1 Alternative 3B Building Layout Cost Comparisons

Cost Component/Alternative	3-Story Building with Cake Hopper	2-Story Building with Cake Hopper	2-Story Building with Cake Silo
Capital Cost ($)	12,574,000	11,473,000	10,666,000
Annual Cost ($/yr)	1,781,000	1,775,000	1,802,000
Present Worth of Annual Cost ($)	23,172,000	23,089,000	23,438,000
Total Present Worth ($)	35,746,000	34,562,000	34,104,000

Note: Comparative Costs Developed October 2005

The costs presented in Table 1 are preliminary in nature and costs for administration and construction management are not included. It is recommended that more refined costs based on a higher level of design detail be used for budgeting, rate setting, and other financial related purposes.

Since October 2005, the conceptual layouts have been refined, the capital costs have been further developed, and preferred building layout has been identified. The capital cost of this layout is estimated to be $11,428,000.

Processing the increased volume of biosolids material will necessarily require more and larger equipment. As a result, electrical use at the wastewater facility will increase with all alternatives including "Do Nothing" (due to the requirements to run the existing equipment 24 hours per day, 7 days per week to process the expected solids loads). Table 1 includes significant energy savings in the present worth analysis versus current operations. Because trucking requirements will decrease by approximately 50% for the cake material versus semi-solid material, total miles driven will decrease accordingly. As explained in Section 8, item 2, the transition to biosolids cake production from semi-solid biosolids production will reduce fuel consumption by approximately 22,260 gallons of fuel annually and will result in fuel cost savings of approximately $66,775. At buildout, the new dewatering equipment is designed to operate 10 hours per day, five days per week. This is in comparison to the requirement for the existing equipment to run 24 hours per day, seven days per week. Though the new equipment is larger, its annual energy usage is estimated to be 1.2 million kWhr/yr at buildout. In contrast, the existing dewatering equipment would require in excess of 1.8 million kWhr/yr. This energy savings equates to a financial savings of $42,000 per year at today's energy costs. In addition, two new odor-control systems are being planned as part of the dewatering improvements project. Though these odor systems use additional energy, their value in maintaining the environmental quality near the plant justifies their installation.

Preferred Project Alternative

Based on the costs presented in Table 1 in the previous section, the recommended improvements for the biosolids dewatering facilities are a new, 2-story dewatering building with a storage silo. While the three alternatives are relatively close in present worth costs, the capital costs for this alternative are lowest and the storage of solids in a hopper is preferred from an operational standpoint.

During the evaluation a concern was raised that a silo might be too tall and presents an unacceptable visual impairment; however, with the layout and design as now configured will result in a structure no taller than fifty feet. A site plan and building section are shown in Figures 2 and 3.

FILE PATH: H:\80750E\FIGS\FIG 2.DWG PLOTTED: 3/14/2006 1:41:00 PM (KELLY D. KRAMER)

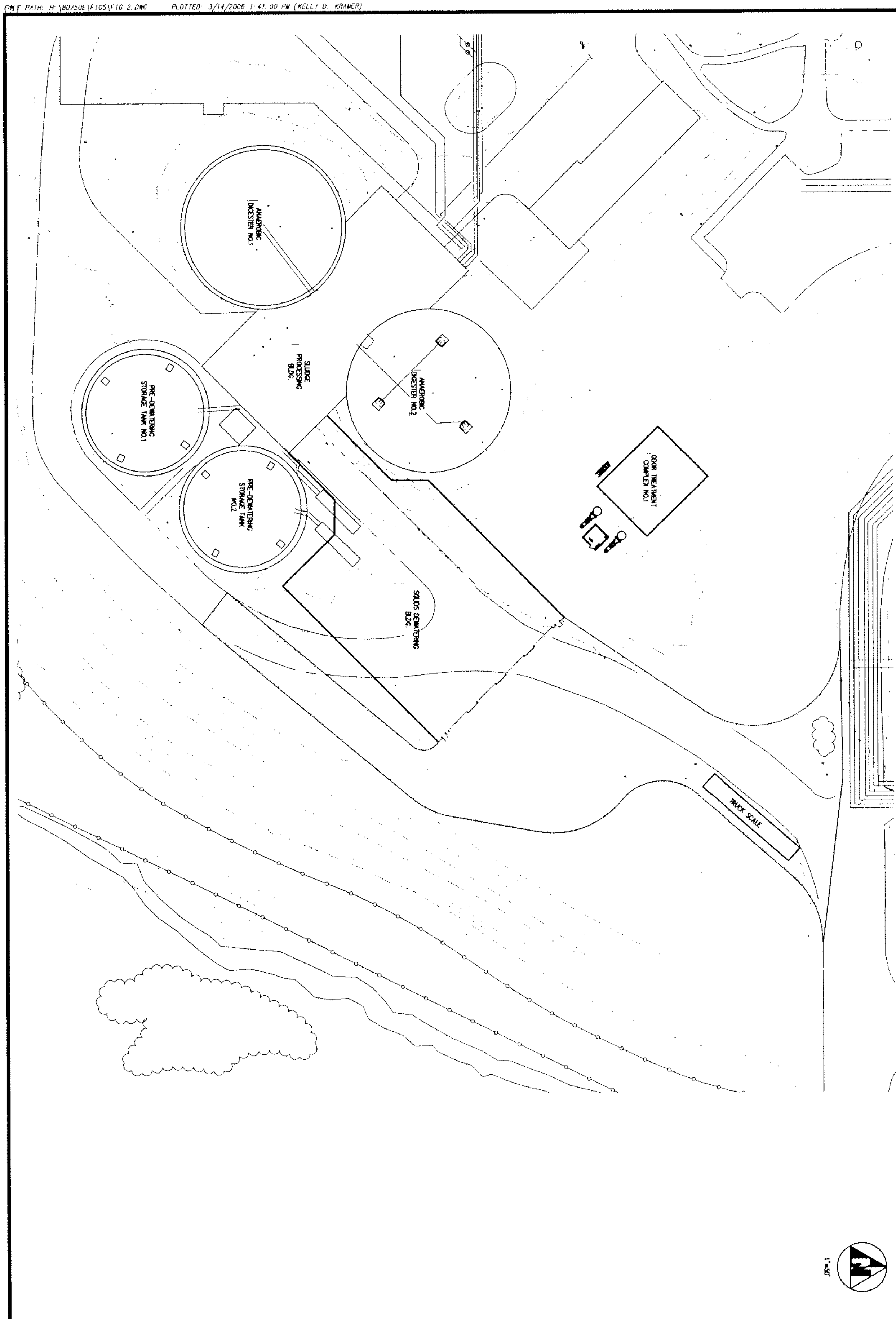

FIGURE 2 Solids Processing Building
Area Site Plan

Rothberg, Tamburini & Winsor, Inc.

FILE PATH: H:\80750E\FIGS\FIG 3.DWG   PLOTTED: 3/14/2006 1:39:32 PM (KELLY D. KRAMER)

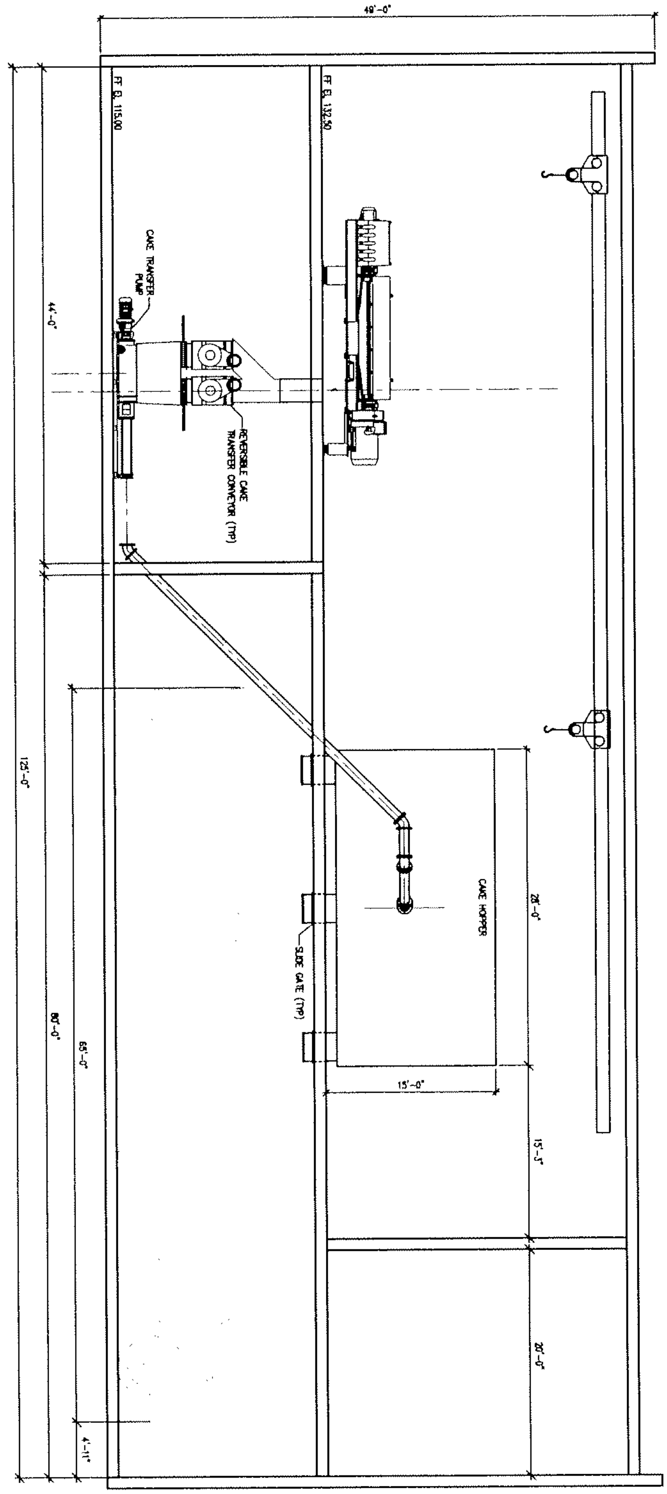

FIGURE 3 Solids Dewatering Building Section

Rothberg, Tamburini & Winsor, Inc.

Public Input to Date

To date, a preliminary project summary has been presented to the City of Boulder. The City of Boulder's 75th Street WWTP Dewatering Improvements project will be reviewed at the following public meetings:

- CEAP Review Committee Meeting – April 3, 2006
- Water Resources Advisory Board (WRAB) meeting: April 17, 2006
  - Review Community and Environmental Assessment Process (CEAP) report
- Public meeting: May 9, 2006
  - See summary below
- WRAB meeting: May 15, 2006
  - Request for recommendation to construct WWTP Dewatering Improvements
- City Council Meeting: Summer 2006

Public Meeting Summary

City staff conducted a public meeting at the Harvest Baptist Church on May 9, 2006. City personnel, as well as engineering and architectural consultants, were present to answer questions.

The primary public concerns appear to be those associated with potential impacts. City staff explained that the short-term impacts are those typically associated with construction activities including traffic, noise, and dust. These impacts will be minimized to the extent possible through best management practices (BMPs) during the construction.

The primary long-term concerns are typically noise, odor, traffic, and visual impacts. City staff explained that there will be no increase in noise or odor at the WWTP. The city will be conducting a noise and odor monitoring program over the next two years to develop a baseline level for each which will be used to compare future noise and odor levels. All of the new solids processing equipment will be enclosed in the new solids building. Additionally, the city has proposed various odor control measures for the new processes which are not currently in place.

Traffic associated with the solids processing will actually be reduced. The new high solids centrifuges, which will remove considerably more water from the process, will greatly reduce the volume of solids trucked off site, and thereby reduce the number of truck trips to and from the plant.

The new solids building will represent a visual impact at the WWTP, as it will be located at the east end of the plant site and in view from 75th Street. The building footprint has been minimized by utilizing the existing building to the extent possible. The building will match the existing WWTP architecture in an effort to blend the new building with existing structures. Additionally, trees will be planted on the east side of the building to soften its appearance.

City of Boulder Project Manager

The City's primary contact for the WWTP Dewatering Improvements project is:

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David W. Oerke, Project Manager
José F. Velazquez, Project Engineer

Goals Assessment

1. *Using the Boulder Valley Comprehensive Plan (BVCP) and department master plans, describe the primary city goals and benefits that the project will help achieve.*

This project directly helps the City to meet its Facility and Service goals by providing increased treatment capability and capacity to the City's municipal wastewater treatment system. The City, through its master planning, regulations, policies and programs, will make every effort to create a sustainable community for future generations. Relevant environmental priorities include reducing waste by promoting reuse and recycling (e.g., land application of biosolids), preserving native plant and wildlife habitat, and improving water quality. The planned Dewatering Improvements Project will continue to provide wastewater service to existing customers as well as future residents and businesses. The upgrades will increase the level of treatment to accommodate higher levels of liquid treatment that are being provided and assure compliance with biosolids reuse requirements. The project will accommodate anticipated growth and development within the City while improving the long-term health of the natural environment, the economy, and the community.

2. *What are the trade-offs among city policies and goals in the proposed projects alternatives? (e.g. higher financial investment to gain better long-term services or fewer environmental impacts)?*

Upgrades and modifications to the City's dewatering facilities are necessary to expand solids treatment capacity to match the production from the liquid stream treatment process. The liquid stream capacity of the 75th Street WWTP is being expanded to handle projected growth within the City and provide capability to meet current and anticipated effluent limits. The proposed project is planned in one phase to minimize near-term capital expenditures and to coincide with the liquid stream upgrades. The relatively large short-term capital investment for the new facilities will result in substantially smaller future capital investments, allow for lower operation and maintenance costs, and reduce the number of vehicles, and thus fuel needed, to operate the biosolids management program.

Due to the increased volume of biosolids requiring processing, more and larger equipment will be required at the dewatering facility. However, as mentioned in Section 3, the larger equipment will run for shorter periods of time and will use less energy, on an annual basis, as compared to the existing equipment. Additional energy use by the two new odor-control systems is justified, as they will maintain the environmental quality near the plant. The design of the new facility also maximizes energy savings through efficient building design, utilizing heat generated from the equipment for heating, increased warm-weather airflow in the building, and removing older, inefficient equipment. Finally, the transition to a biosolids cake product from a semi-solid product will reduce fuel consumption by approximately 50%. At buildout, the city will be required to haul 27 truckloads of semi-solid biosolids to east Adams County each week. The trucks, which will make the 130-mile round trip five days a week, average 4.1 miles per gallon (mpg). This hauling activity requires fuel consumption of approximately 44,520 gallons of diesel fuel annually, which at $3/per gallon, equates to approximately $134,000 per year. The high-solids centrifuges will remove twice the water compared to the existing units, thereby, reducing truck trips by 50%. This trip reduction equates to a savings of approximately 22,260 gallons of fuel annually, and fuel cost savings of approximately $66,775 at the $3 per gallon price for fuel. If the cost of fuel increases to $4 per gallon, the cost savings would be approximately $89,000. In summary, the new facility will dewater the additional biosolids volume in the most energy-efficient manner possible.

3. *Is this project referenced in a master plan? If so, what is the context in terms of goals, objectives, larger system plans, etc.? If not, why not?*

Yes, this project is referenced in the 2002 Wastewater Utility Plan (WWUP). The WWUP is necessary to satisfy Denver Regional Council of Governments (DRCOG) requirements for Wastewater Master Planning and was approved by DRCOG in 2003. The WWUP confirmed and documented the need for the WWTP expansion and upgrade project. In 2003, the Wastewater Treatment Master Plan Summary of the September 2001 BVCP was updated to include information from the WWUP including the need to expand and upgrade the WWTP. In order to accommodate the expansion, both liquid and solids treatment facilities are needed.

4. *Will this project be in conflict with the goals or policies in any department master plan?*

This proposed project was referenced in the WWUP and the BVCP and therefore, and is consistent with the City goals and policies. More efficient biosolids management supports the BVCP sustainability policies.

5. *List other city projects in the project area that are listed in a departmental master plan or CIP.*

- Wastewater Treatment Plant Liquid Steam Improvements

6. *How will the project exceed city, state, or federal standards and regulations?*

The project is necessary to meet all current regulations; including pathogen and vector attraction reductions. The significant fuel consumption reduction will help reduce green house gas emissions.

Impact Assessment

The CEAP Checklist Question Form is presented on the following pages as Table 2. Alternative 1 is in reference to the "Do Nothing" alternative. Alternative 2 refers to the process resulting in the semi-solid (10-12% solids) material. Within alternative 2, 2A refers to a process that utilizes the existing structure, while 2B refers to a process that occurs within a newly constructed building. Alternative 3 refers to the process resulting in cake (>20% solids) material. Within Alternative 3, 3A refers to a process that utilizes the existing structure, while 3B refers to a process that occurs within a newly constructed building. Alternative 3B is the preferred alternative.

1. Using the attached checklist, identify the potential short or long-term impacts of the proposed project or (if applicable) the project alternatives.

Table 2 Community and Environmental Assessment Process Checklist

+ Positive effect
— Negative effect
O No effect

Project Title: CITY OF BOULDER BIOSOLIDS DEWATERING UPGRADES	**Alternative 1**	**Alternative 2**		**Alternative 3**	
		2a	2b	3a	3b*
A. Natural Areas or Features					
1. Disturbance to species, communities, habitat, or ecosystems due to:					
a. Construction activities	O	—	—	—	—
b. Vegetation removal	O	O	—	O	—
c. Human or domestic animal encroachment	O	O	O	O	O
d. Chemicals (including petroleum products, fertilizers, pesticides, herbicides)	O	O	O	O	O
e. Behavioral displacement of wildlife species (due to noise from use activities)	O	O	O	O	O
f. Introduction of non-native plant species in the site landscaping	O	O	O	O	O
g. Changes to groundwater or surface runoff	O	O	O	O	O
h. Discharge of sediment to any body of water	O	O	O	O	O
i. Wind erosion	O	O	O	O	O
2. Loss of mature trees or significant plants?	O	O	O	O	O
B. Riparian Areas/Floodplains					
1. Encroachment upon the 100-year, conveyance or high hazard flood zones?	O	O	O	O	O
2. Disturbance to or fragmentation of a riparian corridor?	O	O	O	O	O
C. Wetlands					
1. Disturbance to or loss of a wetland on site?	O	O	O	O	O
D. Geology and Soils					
1. a. Impacts to unique geologic or physical features?	O	O	O	O	O

b. Geologic development constraints?	O	O	O	O	O
c. Substantial changes in topography?	O	O	O	O	O
d. Changes in soil or fill material on the site?	O	O	O	O	O
E. Water Quality					
1. Impacts to water quality from any of the following?					
a. Excavation	O	O	—	O	—
b. Change in hardscape	O	O	O	O	O
c. Change in site ground features	O	O	O	O	O
d. Change in storm drainage	O	O	O	O	O
e. Change in vegetation	O	O	O	O	O
f. Change in pedestrian and vehicle traffic	O	O	O	O	O
g. Use or storage of chemicals	O	O	O	O	O
2. Exposure of groundwater contamination from excavation or pumping?	O	O	O	O	O
F. Air Quality 1. Short or long term impacts to air quality (CO2 emissions, pollutants)?	—	—	—	—	—
a. From mobile sources?	—	—	—	—	—
b. From stationary sources?	O	O	O	O	O
G. Resource Conservation					
1. Changes in water use?	O	O	O	O	O
2. Increases in energy use?	—	—	—	—	—
3. Generation of excess waste?	O	O	O	O	O
H. Cultural/Historic Resources					
1. a. Impacts to a prehistoric or archaeological site?	O	O	O	O	O
b. Impacts to a building or structure over fifty years of age?	O	O	O	O	O
c. Impacts to a historic feature of the site?	O	O	O	O	O
d. Impacts to significant agricultural land?	O	O	O	O	O
I. Visual Quality					
1. a. Effects on scenic vistas or public views?	O	O	O	O	O
b. Effects on the aesthetics of a site open to public view?	O	O	O	O	O
c. Effects on views to unique geologic or physical features?	O	O	O	O	O
J. Safety					
1. Health hazards, odors, or radon?	O	O	O	O	O
2. Site hazards?	O	O	O	O	O
K. Physiological Well-being					
1 Exposure to excessive noise?	O	O	O	O	O
2. Excessive light or glare?	O	O	O	O	O
3. Increase in vibrations?	O	O	O	O	O
L. Services					
1. Additional need for:					
a. Water or sanitary sewer services?	O	O	O	O	O
b. Storm sewer/Flood control features?	O	O	O	O	O
c. Maintenance of pipes, culverts and manholes?	O	O	O	O	O
d. Police services?	O	O	O	O	O
e. Fire protection services?	O	O	O	O	O
f. Recreation or parks facilities?	O	O	O	O	O

g. Library services?	O	O	O	O	O
h. Transportation improvements/traffic mitigation?	O	O	O	O	O
i. Parking?	O	O	O	O	O
j. Affordable housing?	O	O	O	O	O
k. Open space/urban open land?	O	O	O	O	O
l. Power or energy use?	O	O	O	O	O
m. Telecommunications?	O	O	O	O	O
n. Health care/social services?	O	O	O	O	O
M. Special Populations					
1. Effects on:					
a. Persons with disabilities?	O	O	O	O	O
b. Senior population?	O	O	O	O	O
c. Children?	O	O	O	O	O
d. Restricted income persons?	O	O	O	O	O

*Alternative 3b is the preferred alternative.

Summary of Short-term and Long-term Impacts

Short-term (all alternatives):

- Vegetation, including grasses, shrubs, and forbs, within the fenced boundaries of the City of Boulder's 75th Street WWTP Site (site) will be disturbed during construction. A construction "staging area" may also be required to the east of the fenced boundaries. If this is required, the area just to the northeast of the main gate will likely be used. This area has been used recently for staging on other construction projects.
- Construction of the WWTP dewatering facilities upgrades will result in temporary disturbance (noise and increased traffic flow) to the surrounding communities.
- Temporary and minimal adverse impacts on air quality in the form of increased dust generation and exhaust emissions in the vicinity of the site are expected in association with construction activities. The construction contractor will be required to implement "best management practices" to minimize air quality impacts from the construction activities.

Minimal soil erosion may occur as a result of construction. The construction contractor will be required to implement erosion control measures to minimize soil erosion impacts from construction.

Long-term (all alternatives):

- The primary long-term (positive) impact of the project will be upgrades and modifications to the City's WWTP which will expand solids treatment capacity for projected growth within the City, increase capability to meet current and anticipated future effluent quality limits, reduce truck traffic from the WWTP associated with biosolids handling, and improve water quality in Boulder Creek.

- The WWTP currently has six air emissions permits, Air Pollutant Emission Notices (APENs), and Permit Exempt Points filed with the CDPHE. Since the WWTP will be upgraded and expanded at its existing location, current air quality issues are expected to remain in the long-term.
- The proposed alternative will require an increased commitment of resources in terms of energy and staffing to construct and operate improved facilities.
- An increased volume of biosolids is expected with the increase in influent flows and loads. The facility would continue to recycle biosolids by land application or at private composting facilities.
- It is estimated that the difference in odor generation between the alternatives being evaluated is not detectable. The treatment processes that generate the most significant and objectionable odors, include the preliminary, primary, and solids handling processes, which will be the same with any of the alternatives under consideration. Solids handling processes in this project will be constructed with odor control facilities
- Chemicals currently stored on the site include chlorine gas, sulfur dioxide gas, organic polymers, oil, gasoline, and pesticides. Once UV disinfection is implemented, chlorine gas and sulfur dioxide gas will not be used. This project will require that polymer use continue. No other chemicals will be used during operations.
- The drier cake biosolids will require 50% fewer trips to the disposal facility and will therefore significantly reduce truck traffic and fuel needed for hauling. An estimated 22,260 gallons of diesel fuel will be saved annually.

Questions

The following questions are a supplement to the CEAP Checklist.

A. Natural Areas and Features

Because there are no known occurrences of listed or sensitive species, nor is there habitat for any of these species within the limits of proposed construction, the project is expected to have no impact on any listed or sensitive species. Although there will be a long-term increase in discharge of water from the treatment plant to Boulder Creek as a result of the projected population growth and employment increase in the service area, no adverse impacts to listed or sensitive plant or animal species are expected to occur as a result of an increase in discharge. Therefore, there is no short or long-term potential for disturbance to or loss of significant species, plant communities, wildlife habitats, or ecosystems with either alternative. The biosolids dewatering facilities will have no adverse impact on the liquid stream discharged to Boulder Creek. Importantly, the construction of the proposed alternative will result in operations that are more reliable and with redundant capacity. As a result, Boulder Creek water quality will be better protected.

Some disturbance impacts related to the construction process are unavoidable. However, these impacts will be short-term and minimized when possible. The site will contain one new building structure and an odor control mechanism. The area that would be disturbed during the construction is estimated at less than one acre for any of the alternatives. Construction activities associated with any of the alternatives would not expand outside the current fenced and bermed site boundary with the possible exception of construction staging as described previously.

Plants, animals, and plant communities located within the construction site, such as individual plants, grasses, forbs, or shrubs directly in the footprint of new structures will be disturbed by the construction activities. There will be no potential for disturbance to or loss of mature trees or other large plants. The project will further minimize environmental impacts by restoring vegetation/landscaping disturbed by the construction, where possible. The proposed project will minimize the introduction of non-native plant species in the site landscaping.

During construction, water produced from construction site dewatering will be treated, if necessary, and discharged to Boulder Creek in accordance with permits issued by the CDPHE. A plan to control erosion and sedimentation will also be employed.

The WWTP currently has a Stormwater Management Plan (SWMP) in place that consists of four major components:

- Compliance with the CDPHE Light Industry Permit # COR-01 0865 requirements;
- Routine plant inspections;
- Continued training and drilling of the plant Emergency Response Team; and
- Annual review and revision of emergency response plans, including flood procedures.

An additional SWMP will be developed for construction, which will focus on implementing best management practices (BMPs) that would minimize sources of erosion and capture sediments before they enter surface waters.

Chemicals currently stored on the site include chlorine gas, sulfur dioxide gas, organic polymers, oil, gasoline, and pesticides. As described in the SWMP, plant inspections are conducted at least two times per year to check for potential problems related to stormwater. The inspections include:

1. The plant site is toured to ensure that no chemicals or drums are stored outside or on the loading dock.
2. The oil storage room is inspected to ensure the area is clean, oils are properly stored, and no oil leaks are present.
3. The pesticide storage cabinet is checked for cleanliness and proper storage, and the plant site is checked to make sure no pesticide containers are stored in other areas.
4. The elevated gas tank is checked to ensure the containment area is clear of any standing water and does not have any gasoline spillage.
5. The flood berm flap gates are checked for proper operation and to make sure no debris blocks the gate or channel.

Ten employees typically comprise the plant Emergency Response (ER) Team. The team addresses such issues as chlorine and sulfur dioxide leaks, biogas releases, and other assorted emergency responses, including chemical spills.

The City of Boulder currently has a Risk Management Plan (RMP) as required by EPA. The RMP consists of three general elements including a chlorine and sulfur dioxide hazard assessment, an accident prevention program, and an emergency response plan.

B. Riparian Areas and Floodplains

In 1986, berms were constructed around the plant site to remove it from the 100-year floodplain. No other natural hazards exist at the site. The Dewatering Improvements project would be contained within the existing site and would not encroach on the Boulder Creek 100-year floodplain. Since the site is not located in a floodplain, the project is not expected to have a significant direct impact on the floodplain.

C. Wetlands

No wetlands occur within the site and no dredging or filling of wetlands will be impacted by the project.

D. Geology and Soils

There will be no impacts to unique geological physical features, or significant changes in topography or soil/fill as a result of the project. There are no geological constraints to development at the site. A site application will be submitted to the CDPHE Water Quality Control Division (Division) for the proposed increase in capacity and modifications to the WWTP. A geotechnical report will be submitted as an attachment identifying geological suitability issues related to the existing site and the measures to be taken to mitigate any identified problems or risks.

E. Water Quality

All three alternatives are expected to have minimal direct impact on water quality and quantity downstream of the site. The new dewatering equipment will be more reliable than the existing equipment and thus potential for operational failures will be reduced. The more reliable processing facilities will provide better protection of downstream aquatic environment for plants and animals.

Water quality is not expected to be significantly impacted from changes in the amount of hardscape, permanent changes in ground features, changes in the storm drainage from the site, or changes in vegetation. The project will further avoid or minimize environmental impacts by restoring vegetation/landscaping disturbed by the construction, where possible.

The increase in short-term vehicle traffic during construction is not expected to have an impact on water quality.

Temporary or permanent use and/or storage of chemicals should not impact water quality, as all chemicals are stored inside. In addition, an RMP is in place that consists of three general elements including a chlorine and sulfur dioxide hazard assessment, an accident prevention program, and an emergency response plan.

During construction, water produced from construction site dewatering will be treated, if necessary, and discharged to Boulder Creek in accordance with permits issued by the CDPHE. BMPs as part of the construction SWMP will be implemented during construction to minimize the movement of sediment into surface waters.

The WWTP discharges to Boulder Creek, Segment 9, which is classified by the Division for the following beneficial uses:

- Recreation Class 1
- Aquatic Life Class 1, warm water
- Water Supply
- Agriculture

At present, none of the classifications are being challenged as being too low to protect present uses. If the "No Action" alternative was selected, discharge permit violations would likely occur.

F. Air Quality

Activities associated with the proposed alternatives during construction would have a temporary and minimal adverse impact on air quality in the vicinity of the site. Short-term increases in dust generation and exhaust emissions in the vicinity of the site would be associated with construction activities. Water spraying and application of other remedies would be utilized during construction to minimize short-term dust generated by construction activities. The proposed alternative is not expected to have a significant direct short-term impact on air quality. The WWTP currently has six air emissions permits, APENs, and Permit Exempt Points filed with the CDPHE. Since the WWTP will be upgraded and expanded at its current location, air quality issues are expected to remain in the long-term.

Once completed, the new dewatering facilities will produce a significantly drier cake and thus less volume than current operations. The lower volume will require fewer trucks, thus exhaust emissions over the long-term will be reduced. This fuel consumption reduction will contribute to reducing green house gas emissions.

It is estimated that the difference in odor between the alternatives is non-detectable. The new dewatering facilities will be constructed with odor control systems to minimize the escape of potentially odorous air. Should odors become a greater concern in the future a prioritized approach to mitigate odors will be implemented, most likely beginning with preliminary treatment.

G. Resource Conservation

As mentioned previously, the transition to producing a biosolids cake product from a semi-solid product, utilizing high-solids centrifuges, will reduce fuel consumption by approximately 50%. This trip reduction equates to a savings of approximately 22,260 gallons of fuel annually, and fuel cost savings of approximately $66,775. Because the new equipment is larger, more efficient, and will operate for shorter periods of time, the chosen alternative uses less energy than the "Do Nothing" alternative. As mentioned previously in Section 8, energy is conserved in the design, wherever possible.

Significant changes are not anticipated with water usage at the WWTP. When restoring landscaping, the City will consider low water usage native plants and grasses to minimize water use on the site. All alternatives would require an increased commitment of resources in terms of energy to construct and operate improved facilities. The WWTP currently produces electricity and heat that is reused on site to help reduce the energy required from Xcel Energy; however, it is anticipated that new electrical feeds would be needed to provide power to the site to operate and maintain the proposed improvements. As a result, the proposed upgrade is expected to have an impact on energy use at the site.

An increased volume of biosolids is expected with the increase in influent flows and loads. The facility would continue to recycle biosolids by land application or composting. None of the alternatives are expected to have a significant impact on solid waste at the site.

H. Cultural/Historic Resources

The upgrades at the WWTP will not extend outside the current site boundaries and so are not expected to impact cultural resources. Since no cultural resources are known to exist at the site, significant direct impacts to cultural resources are not expected. No lands of agricultural importance will be disturbed at the site.

I. Visual Quality

Visually, new buildings associated with the proposed alternative will permanently change the appearance of the site. New buildings will be designed to match existing structures, where appropriate, and to provide a pleasing aesthetic appearance. The proposed alternative is not expected to have a significant impact on the existing physical aspects at the site.

The site has been used as a WWTP facility since 1968. The site includes numerous WWTP structures, with the remaining portions of the property covered with asphalt, concrete, or landscaping. Therefore, scenic views or the aesthetics of the site are not expected to be impacted significantly with any of the proposed alternatives. Figure 4 is a photograph of the existing structure.

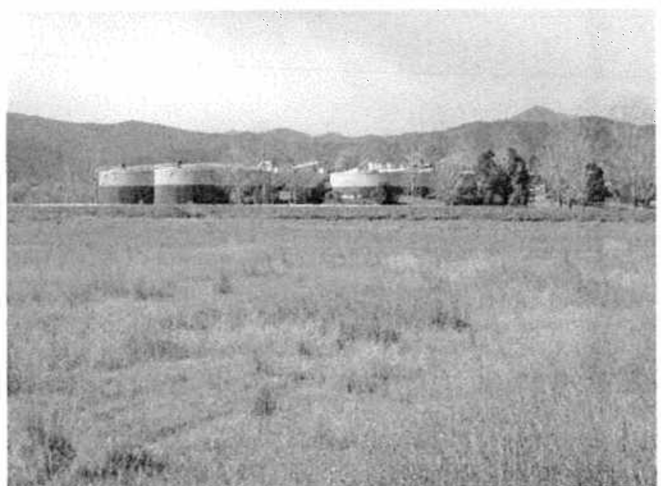

Figure 4 – Existing Dewatering Facilities

Figures 5 through 7 illustrate the visual aspects of the finished facility at buildout.

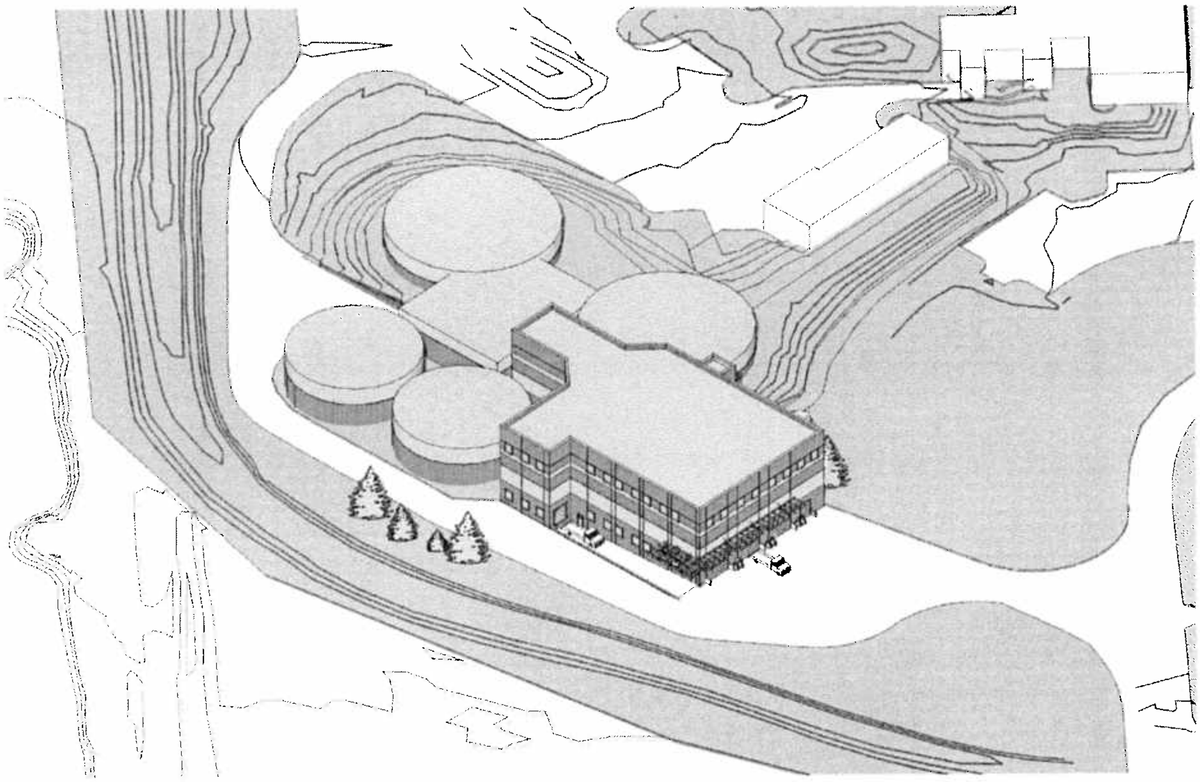

Figure 5 – New Dewatering Facilities (looking west)

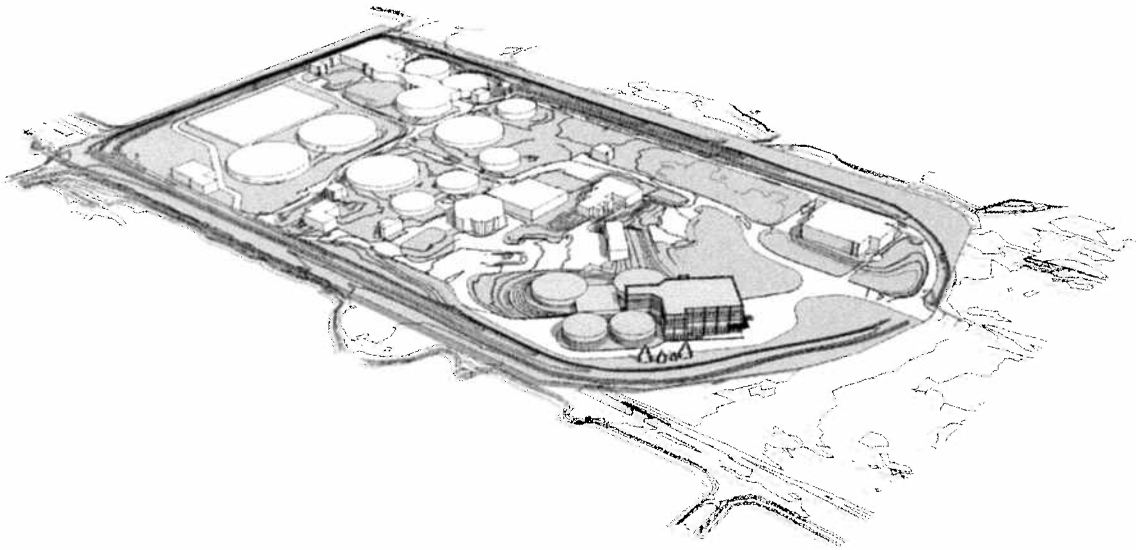

Figure 6 – Overall Site View with New Dewatering Facilities

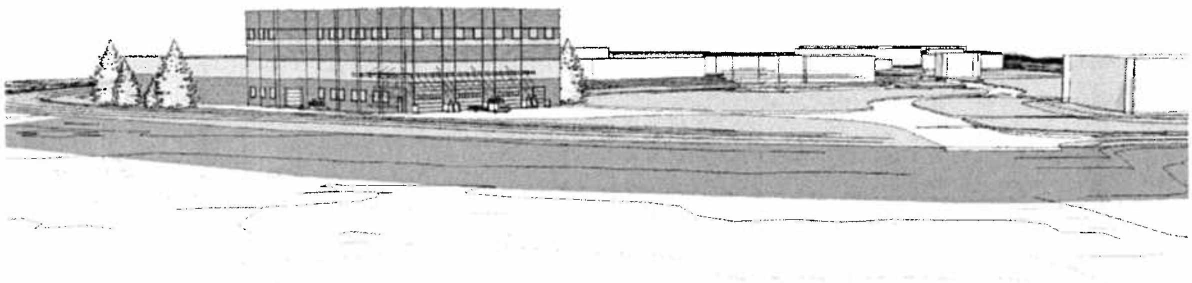

Figure 7 – New Dewatering Facilities from 75th Street

J. Safety

Implementation of proposed improvements would reduce the potential for public health problems. The safety of plant personnel will be improved with infrastructure improvements providing better working conditions.

Typically ten employees comprise the plant ER Team that addresses chlorine and sulfur dioxide leaks, biogas releases, and other assorted emergency responses, including chemical spills. The team trains on plant specific issues on a monthly basis. In addition, the team members have either completed the 40-hour HAZWOPER course or 24-hour chlorine/sulfur dioxide response class. Sufficient personal protective gear is maintained on site to allow for full Level A suit and Self Contained Breathing Apparatus (SCBA) response to chemical spills or leaks. An ER Team notebook was developed that includes all plant response procedures, equipment instructions, Material Safety Data Sheet (MSDS) information, and safety drill debriefings.

In addition to the ER Team training, the treatment plant operations staff is trained to respond to chlorine and sulfur dioxide leaks. The City of Boulder currently has a RMP as required by EPA. The RMP consists of three general elements including a chlorine and sulfur dioxide hazard assessment, an accident prevention program, and an emergency response plan. It should be noted that many of the existing plant emergency procedures were applicable for inclusion in the RMP. The RMP will be reviewed and revised as necessary in 2007.

K. Physiological Well-being

There will be no permanent impacts to physiological well being of nearby residents as a result of the project. Inhabited areas around the site would not be impacted by the facility expansion, as all construction and new facilities would be contained within the existing site. Some minor, temporary impacts to the neighborhood immediately surrounding the WWTP will occur due to construction. Impacts to traffic, increases in ground vibration, and increases in noise as a result of construction will be minimal and restricted to the immediate vicinity of the site. Construction will be conducted during daytime hours only, to minimize impacts.

Short-term increases in the noise level at the WWTP would accompany construction activities. The proposed alternative is not expected to have an adverse impact on public health at or adjacent to the site. However, due to increased reliability and redundancy of the proposed alternative, public health can be better protected.

The beneficial effects of the project include increased WWTP capacity to accommodate planned development and reductions in truck traffic associated with biosolids hauling to and from the site. Also, more reliable dewatering facilities are more protective of the water quality in Boulder Creek.

L. Services

No increased need for services in the City of Boulder is anticipated as a result of this project. Contract hauling services will be reduced at the WWTP and will result in fewer trucks on nearby roads.

M. Special Populations

No temporary or long-term impacts to special populations, including persons with disabilities, seniors, or restricted income persons are likely to occur as a result of this project. As the proposed project will expand an existing facility, no specific benefits or adverse affects are expected for land developers or land values in the area.

Expansion of the dewatering facilities at the WWTP will enable planned development of the service area to continue. Upgrades to the site will improve the surrounding environment by improving water quality and improving aesthetics through additional landscaping.

Employment opportunities would be provided over the short-term during construction and start-up and possibly over the long-term by increased staff requirements.

The city increased wastewater rates on January 1, 2006 to provide sufficient revenue to fund this project. Revenue bonds were issued in 2005 for the construction of this project as well as the liquid stream improvement project. The proposed alternative is not expected to have a significant impact on economic and social profiles near the site or within the service area.

APPENDIX C

Meeting Agenda Items

CITY OF BOUNDER WASTEWATER TREATMENT PLANT MASTER PLAN

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CITY OF BOULDER WASTEWATER TREATMENT PLANT MASTER PLAN

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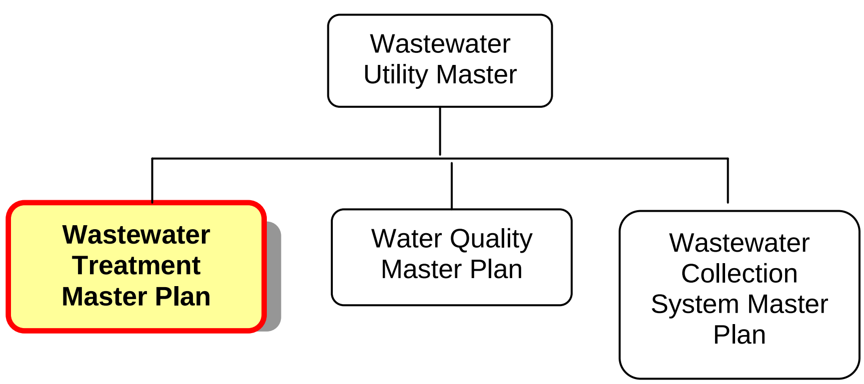
Executive Summary:

The purpose of this master plan is to document past decisions, the facility today, to present 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 Boulder Valley Comprehensive Plan Goals, ongoing improvements to the treatment facility are necessary.

This master plan will be a component of a utility wide Wastewater Utility Master Plan. The City of Boulder's most recent wastewater planning documents were the 2002 Utilities Plan and the 1990 Facilities Plan and the more recent Collection System Master Plan was completed in 2003.

The City has adopted a new framework for City departmental planning documents since these documents were prepared. The new framework includes a single master plan for each of the three Utilities; Water, Wastewater, and Stormwater and Flood Management. Master plans will address the major categories of each utility. For example the Wastewater Utility Master Plan will include sections on the collection system, the treatment system, and water quality that will be informed by master plans on those components of the utility. The following graphic illustrates the hierarchy of the City's Wastewater Utility master plans and master plans.

City Wastewater Utility Planning Documents



The existing treatment facility includes a trickling filter – solids contact secondary process. This secondary treatment process is being upgraded to an activated sludge process in the Phase 1 improvements project currently under construction. Phase 1 improvements will also include a dissolved air floatation thickener to thicken the solids produced in the activated sludge process and solid handling improvements. These improvements, when put on line in early 2008 will allow the effluent to meet the limits in the 2003 discharge permit. The application of the new limits in the permit has been delayed by a compliance schedule intended to allow completion of the new secondary process construction needed to meet the new limits.

The Phase 2 construction, currently planned for 2010, will include any process changes needed to meet permit limits in the 2008 permit. Additionally, it may include noise and odor control units, a UV disinfection system, and solids stabilization (anaerobic digester) improvements. The components of the Phase 2 project are still speculative at this time. The 2008 permit will again drive the facility needs in the Phase 2 project to a large extent. The 2008 permit could contain requirements for nitrogen and/or phosphorus removal that would require additional treatment processes that would have to be included in Phase 2 construction.

The Colorado Department of Public Health and Environment (CDPHE) issues renewed discharge permits to the city every five years. Federal requirements developed by the Environmental Protection Agency (EPA) are incorporated in the permits.

Wastewater contaminates that may be regulated in the future include endocrine disrupters and disinfection byproducts (DBPs). Endocrine disrupters have been shown to pass through the plant untreated and DBPs are formed in the disinfection process. Although it is uncertain what the future permit requirements will be, discharge permits will continue to be the primary driver for wastewater improvements in the future.

CITY OF BOULDER 75TH STREET WASTEWATER TREATMENT PLANT

INTRODUCTION

Background

The City of Boulder 75th Street Wastewater Treatment Plant (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 Colorado Discharge Permit System (CDPS) permit (Number CO-0024147) dated February 1, 2003, which expires on January 31, 2008. The WWTP is being upgraded to meet future wastewater treatment capacity demands and new ammonia-nitrogen limits that were incorporated in the CDPS permit. The upgrades include improvements to both the liquid stream treatment and solids dewatering processes (Phase 1). The WWTP improvements currently under construction (Phase 1) will increase the treatment capacity to 25.0 million gallons per day (MGD) on a maximum month basis and provide the capability to reduce ammonia-nitrogen concentrations in the wastewater to levels below that required by the 2003 discharge permit. The Phase 1 improvements will also keep the total nitrogen discharge at or below the current level.

In addition to the liquid stream improvements, the solids dewatering process is being improved to handle increased solids from the liquid stream treatment process and to reduce the volume of de-watered solids that must be transported from the WWTP site.

It is anticipated that Phase 2 improvements will be implemented in 2010 in response to:

- more stringent CPDS discharge permit limitations in 2008,
- the desire to replace the existing chemical disinfection (chlorine and sulfur dioxide) process with an ultraviolet (UV) disinfection process,
- and the need to address biosolids stabilization (digester capacity) limitations.

Purpose of Master Plan

This master plan describes how the current WWTP improvements were selected, how they will establish the City of Boulder as a proactive environmental steward with regards to water quality preservation, and how these improvements will position Boulder to meet anticipated future wastewater treatment requirements. The plan also presents:

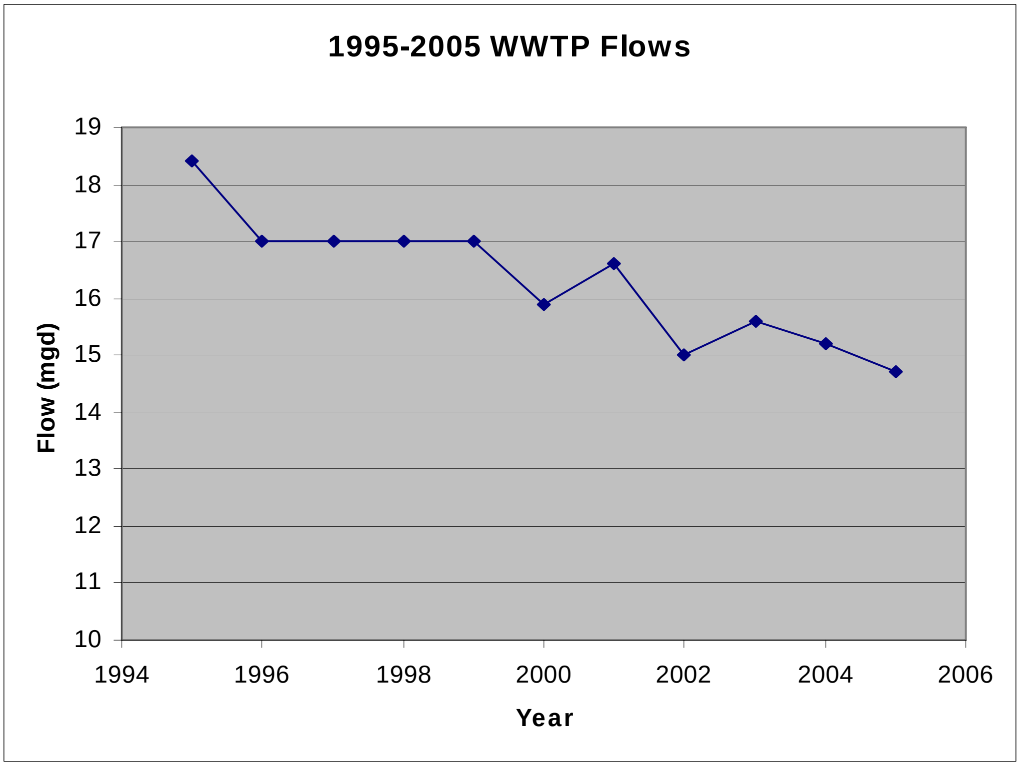
- The current WWTP improvements and how they conform to City and County policies and goals;
- A comparison with historic operations;
- The economic impacts of the current WWTP improvements;
- The implementation plan for current improvements (Phase 1);
- Strategies for measuring system performance; and
- Anticipated future requirements and implementation plan (Phase 2)

CURRENT SITUATION

Meeting the Needs of the Community

The existing WWTP is not capable of treating wastewater to the level required to comply with the 2003 discharge permit requirements for ammonia removal. But the city has been issued a compliance schedule to allow construction of the new unit processes before those limits go into effect. In addition, the existing plant rating for organic material (Biochemical Oxygen Demand) removal is not adequate to treat the increasing organic loads.
The existing WWTP capacity is adequate to meet the needs of the existing community; however, it is not adequate to treat the wastewater generated by anticipated population and employment growth in the Boulder wastewater service area. The 2004 and 2005 annual average wastewater treatment plant influent flow has been 15.2 mgd and 14.7 mgd respectively. As shown in Figure 1, annual average flows have been trending down, or at least not increasing, since 1995 which averaged 18.4 mgd due to the high infiltration experienced during that very wet year.

Figure 1. 1995-2005 WWTP Flows

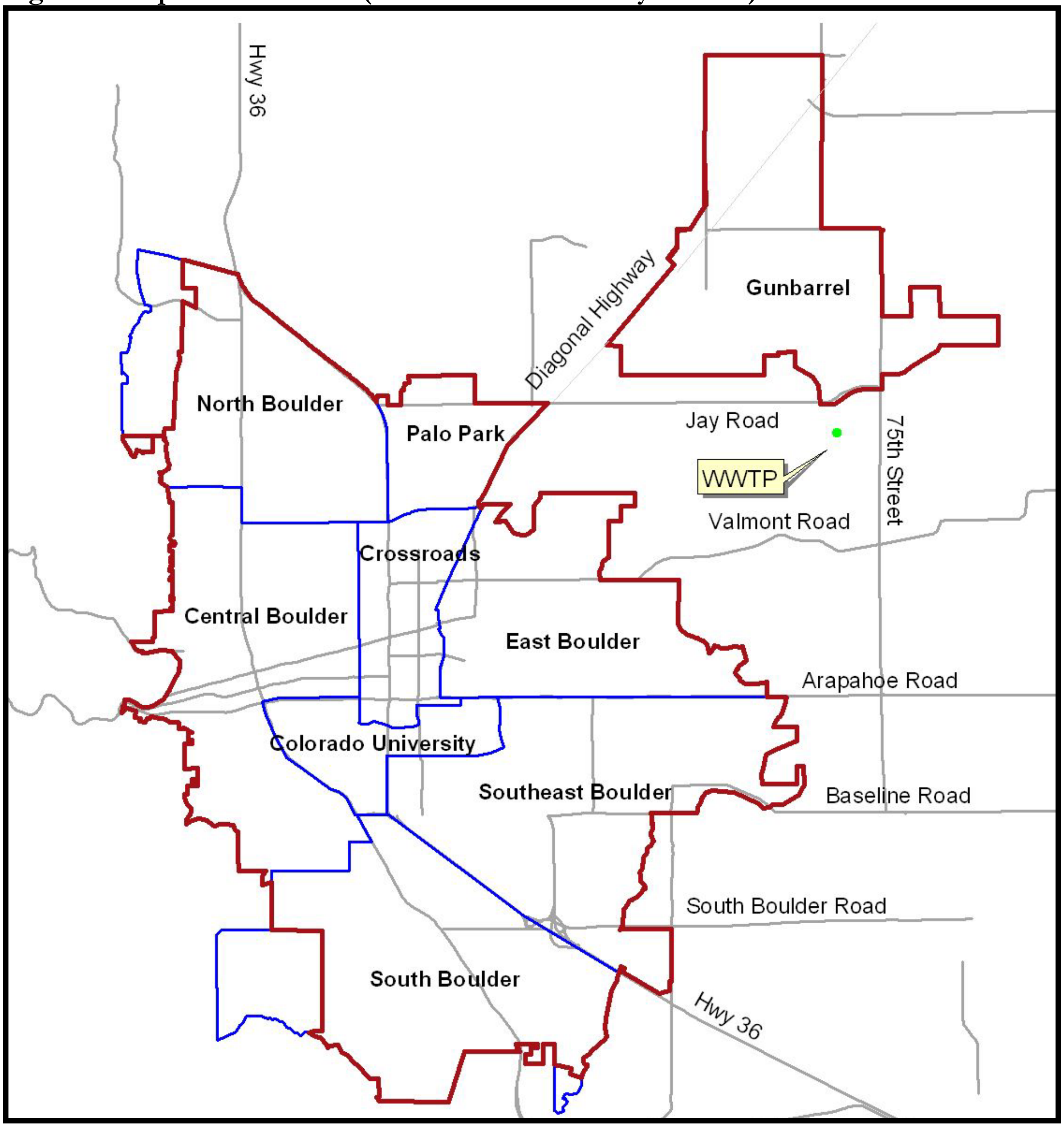


This graph of recent annual average influent flows at the WWTP is informative in depicting the variability that necessitates conservative future flow projections. In 1995 Boulder experienced a very wet year with near record rainfall in May. Then 2002 was the driest in the last 300 years and the utility requested water conservation efforts that continued into 2003 before they were retracted. However, the customers' water conserving behavior seems to have continued. Additionally, the city's ongoing system rehabilitation has reduced groundwater infiltration and surface water inflows (I & I) in the collection system. So, this graph shows the impact wet weather, drought, I & I reduction and conservation efforts can have on wastewater treatment plant flow.

Hydraulic capacity projections were based upon historic flow per resident and employee, industrial hydraulic load, land use and zoning mapping, and population and employment projections. The extremes, both high and low, were excluded from the averages used to project future hydraulic capacity needs at the WWTP. More historic wastewater flow data can be found in the 'July 2003, City of Boulder Wastewater Collection System Master Plan Update.'

The WWTP serves the nine sub-communities of Boulder's wastewater utility service area (WUSA) depicted in Figure 2.

Figure 2. Map of WUSA Area (WUSA area denoted by red line)



Boulder's population and employment continue to grow with the population expected to reach 128,400 by 2030 based on the most recent city projections. The Boulder Valley Comprehensive Plan (BVCP) population and employment growth expectations are similar. The wastewater treatment planning documents must use DRCOG's population projection when submitting plans and applying for state level approvals for facility improvements.

The BVCP has recently been revised to include population and employment projections through build-out of the service area. The build-out population is expected to be reached in 2030, but no specific year has been assigned to the employment build-out projections.

Throughout the planning period, population and employment estimates from DRCOG closely follow estimates from the BVCP.

The current projections represent a population projection increase of approximately 7,000 people over previous projections for the year 2030 and an employment increase of approximately 23,000 employed persons. Boulder population projections from DRCOG and the BVCP are shown in Table 1.

Table 1. Population Summary and Projection for Areas I & II (WUSA)

Source		Projected Population			
	2005	2010	2015	2020	2030/ Build Out
BVCP	111,500	114,300	117,200	120,200	128,400[2]
DRCOG Analysis	109,400[1]	112,300[1]	116,100[1]	119,500[1]	128,200[1]

[1]Estimate provided by DRCOG based upon 2001 TAZ Analysis used for Phase I WWTP Improvements CEAP
[2]Estimate includes potential additional population based on draft Transit Village Area Plan projections that was used for this analysis.

Employment values and projections from the BVCP and DRCOG are summarized in Table 2.

Table 2. Employment Summary and Projection for Areas I & II (WUSA)

Source		Projected Employment				
	2005	2010	2015	2020	2030	Build-out
BVCP	98,900	102,900	107,100	115,500	120,700	167,200
DRCOG Analysis	111,100[1]	119,700[1]	125,200[1]	130,700[1]	141,500	155,900[1]

[1] Original estimate provided by DRCOG based upon 2001 TAZ

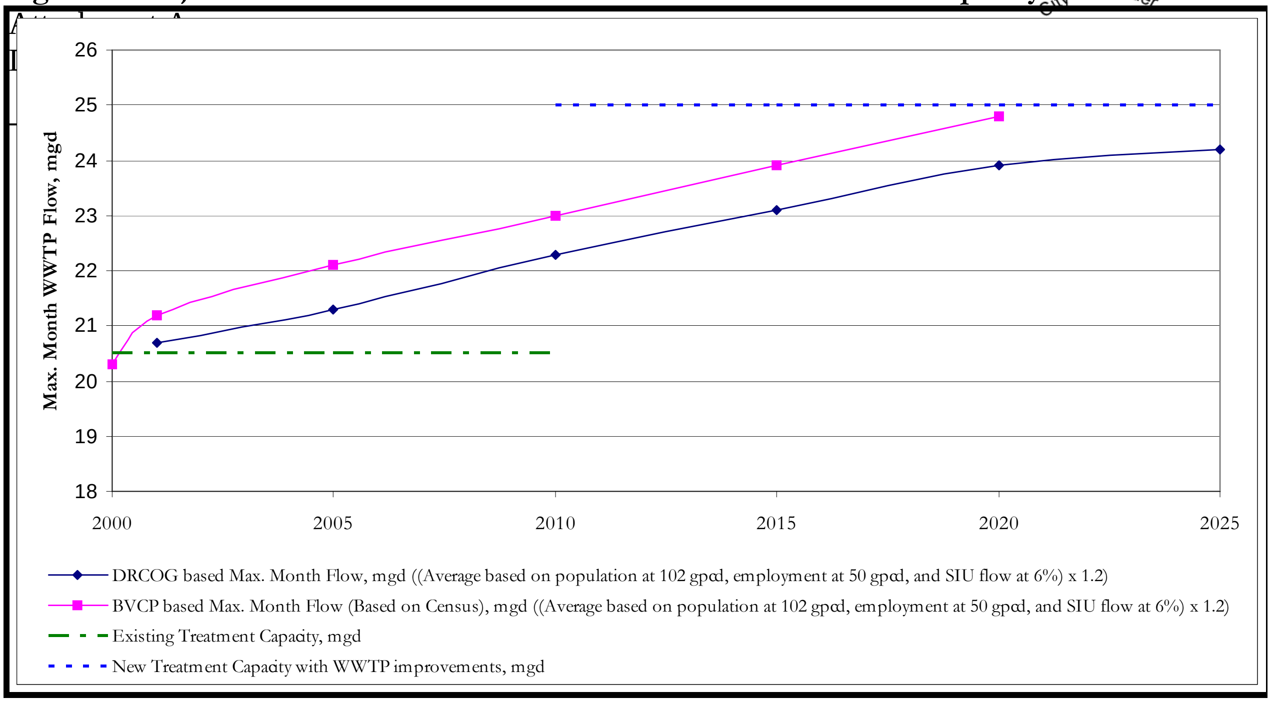
Based on historical values of 102 gallons of wastewater generated per capita per day and 50 gallons of wastewater generated per employee per day, an additional flow of approximately 1.1 MGD are anticipated as a result of the changes in population and employment projections. This also represents an additional loading of approximately 2,130 pounds of five-day biological oxygen demand (BOD_5) per day. This represents an increase of 4.4% in the design flow and an increase of 7% in BOD_5 design loading. These increases are generally within the range of accuracy of the initial flow and load projections and therefore are considered to have no significant impact on the capability of the upgraded wastewater treatment facilities to handle the projected flows and loads.

The existing facility is designed to treat 20.5 MGD; however, the projected capacity requirement to meet the 2030 population and build-out employment is approximately 25 MGD. Industrial flow projections are estimated to be 6% of the total annual flow based on the 2000 and 2001 significant industrial user flows of approximately 0.97 MGD.

Figure 3 shows existing WWTP capacity (20.5 MGD) versus projected flows.

If population values increase beyond those predicted (as shown in Tables 1 and 2) the WWTP will not provide adequate treatment capacity. In that case, treatment capacity needs will have to be re-examined before the expected build-out date of 2030, and additional expansion of the WWTP capacity may be required before that time. However, as shown in Figure 1 if recent influent flow trends continue, the WWTP will have adequate capacity for the interim period.

Figure 3. Projected Maximum Month WWTP Flows and Treatment Capacity



Strengths of Existing Wastewater Treatment System

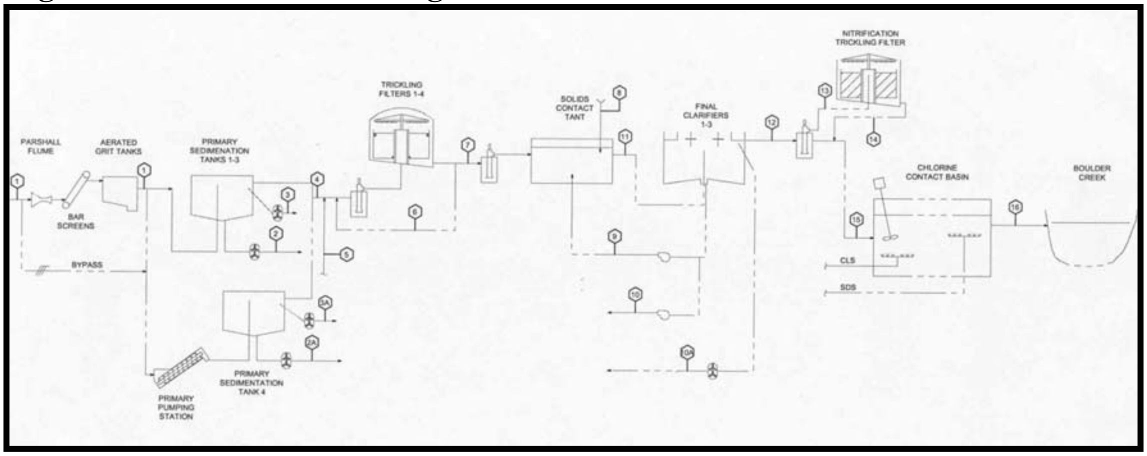
The existing WWTP liquid stream system includes a "Trickling Filter/Solids Contact" process that has been operational since 1989. The existing system is shown schematically in Figure 3. Over the past 18 years the facility has generally met the demands of City residents, maintained permit compliance, and has discharged satisfactory treated wastewater, or effluent, to Boulder Creek. For clarification, the liquid stream processes treat the wastewater removing contaminates and the solid stream processes treat the solids removed from the wastewater and the solids generated by the liquid stream process.

Weaknesses of Existing Wastewater Treatment System

The two primary drivers motivating the current WWTP improvements (Phase 1) are new ammonia nitrogen discharge limits and increased wastewater flow. The existing facility, as shown in Figure 4, will be unable to reduce ammonia nitrogen in the wastewater to the level required by the 2003 discharge permit, the rated BOD capacity is routinely exceeded and it has insufficient capacity to treat the projected wastewater flows.

The improvements will allow the WWTP to treat projected flows and loads through 2030, treat the wastewater to the level required to meet the 2003 discharge permit requirements, provide more operational flexibility, and increase equipment efficiency.

Figure 4. Schematic of Existing WWTP



RELATIONSHIP OF THE WASTEWATER TREATMENT IMPROVEMENTS TO CITY AND BOULDER VALLEY COMPREHENSIVE PLAN (BVCP) GOALS

Both the City of Boulder and Boulder County desire to maintain their proactive status regarding environmental stewardship. Consequently, they have established goals in the areas of sustainability and environmental quality. By meeting the objectives of the planned process improvements, the Boulder WWTP will also meet several City and County environmental goals. Relevant City and County goals are listed below:

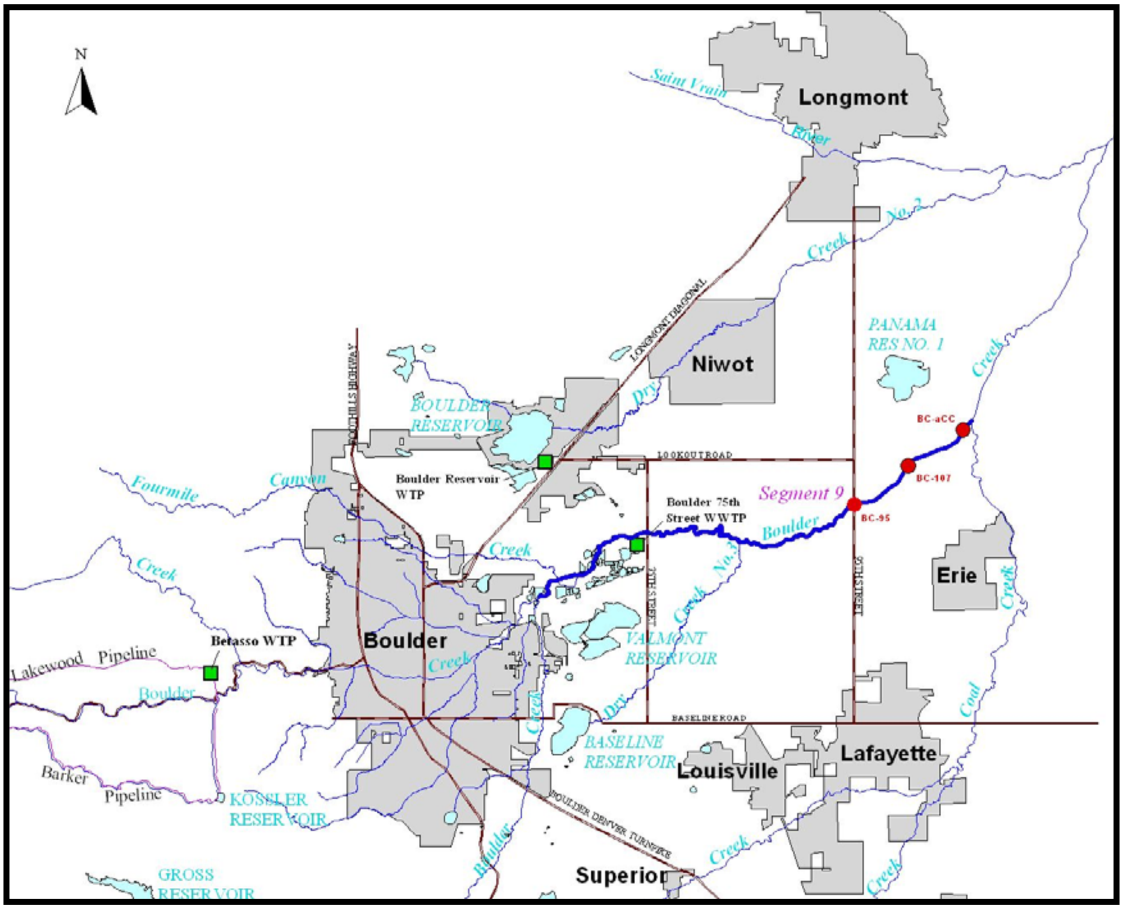
- Improving and protecting water quality;
- Reducing waste by improving recycling and reuse of biosolids;
- Protecting the general health and safety of plant workers;
- Meeting future wastewater treatment capacity demands; and
- Creating a sustainable community through;
    - Improved energy efficiency,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

Improving and Protecting Water Quality

The Colorado "303 (d) List" is a list of surface waters within Colorado that are considered "impaired" with respect to the water quality required for their intended uses. The 2000 Colorado 303 (d) List identifies Segments 9 and 10 of Boulder Creek as being impaired for aquatic life due to elevated unionized ammonia. The list identified municipal WWTPs and possible non-point sources of ammonia as the cause of impairment. This listing necessitated implementation of an ammonia Total Maximum Daily Load (TMDL) study, which subsequently dictated the ammonia nitrogen limit contained in the Boulder Colorado Discharge Permit. The current permit, issued February 1, 2003, is in effect until February 2008. Improvements under construction at the WWTPs will remove significant amounts of ammonia from the plant's effluent and improve Segment 9s aquatic habitat. Additionally, pretreatment efforts will continue to minimize the 'hard to treat' contaminates discharged to the city's sanitary sewers. Although the permit does not place limits on specific nutrients, the City of Boulder recognizes the need to put mechanisms in place to ensure that anticipated future nutrient limits can be met with minimal additional construction. The ammonia limit and potential future nutrient limits will contribute to the protection of aquatic life in Boulder Creek. Figure 5 presents an image of Section 9 of Boulder Creek and the location of the Boulder WWTP.

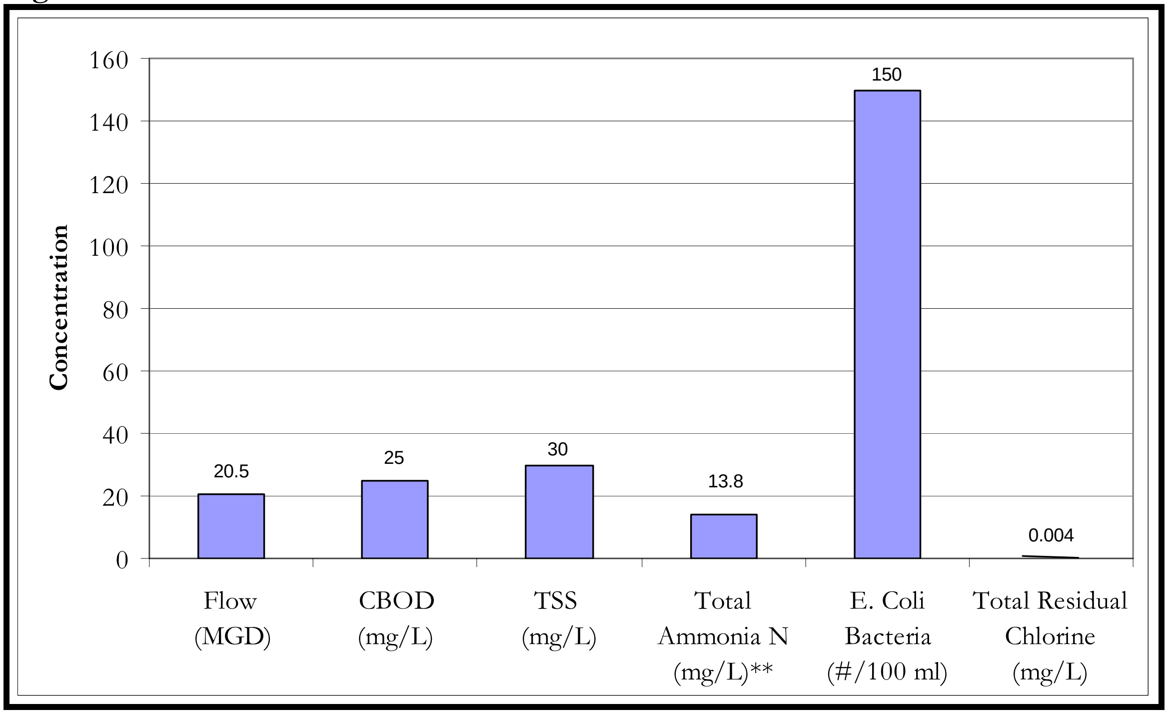
In March 2007, the Colorado Water Quality Control Commission approved the Water Quality Control Division's proposal for revised ammonia water quality criteria. The new ammonia criteria are based on the Environmental Protection Agency (EPA) *1999 Update of the Ambient Water Quality Criteria for Ammonia* document. Dischargers will be given a Temporary Modification for the existing ammonia criteria through 2011. For receiving waters with a warm water designation, such as Boulder Creek, Segment 9, the new EPA ammonia criteria (chronic) are more restrictive, by as much as 50 percent in some cases depending on the receiving water pH and temperature. Although the new ammonia criteria were not adopted when Boulder completed the design of the new WWTP treatment facilities, potential impacts of the new criteria were integrated in to the design criteria for both chronic ammonia effluent limits and potential total inorganic nitrogen effluent limits, which addresses acute ammonia effluent limits.

Figure 5. Segment 9 of Boulder Creek and the Location of the Boulder WWTP



Current improvements to the WWTP (Phase 1) will allow Boulder to discharge water of substantially higher quality than the 2003 discharge permit requires, while also achieving no net increase in the total amount of nitrogen discharged to Boulder Creek. By complying with permit's limits, the water discharged from the Boulder WWTP will improve the water quality of Boulder Creek to a level that has been determined will protect downstream users and support aquatic life. Figure 6 presents WWTP effluent constituent concentrations that must be met to ensure compliance with the 2003 discharge permit.

Figure 6. Current Effluent Limits for Selected Constituents*



Note: All values are based on 30-day averages.
*Effective until January 31, 2008
**The ammonia nitrogen value shown is the annual average. Regulatory limits vary monthly and range from 10.9 to 16.9 mg/L. Effective January 25, 2008, the TMDL-based ammonia limits come into effect resulting in a limit of 5.3 mg/l for March, the most stringent month.

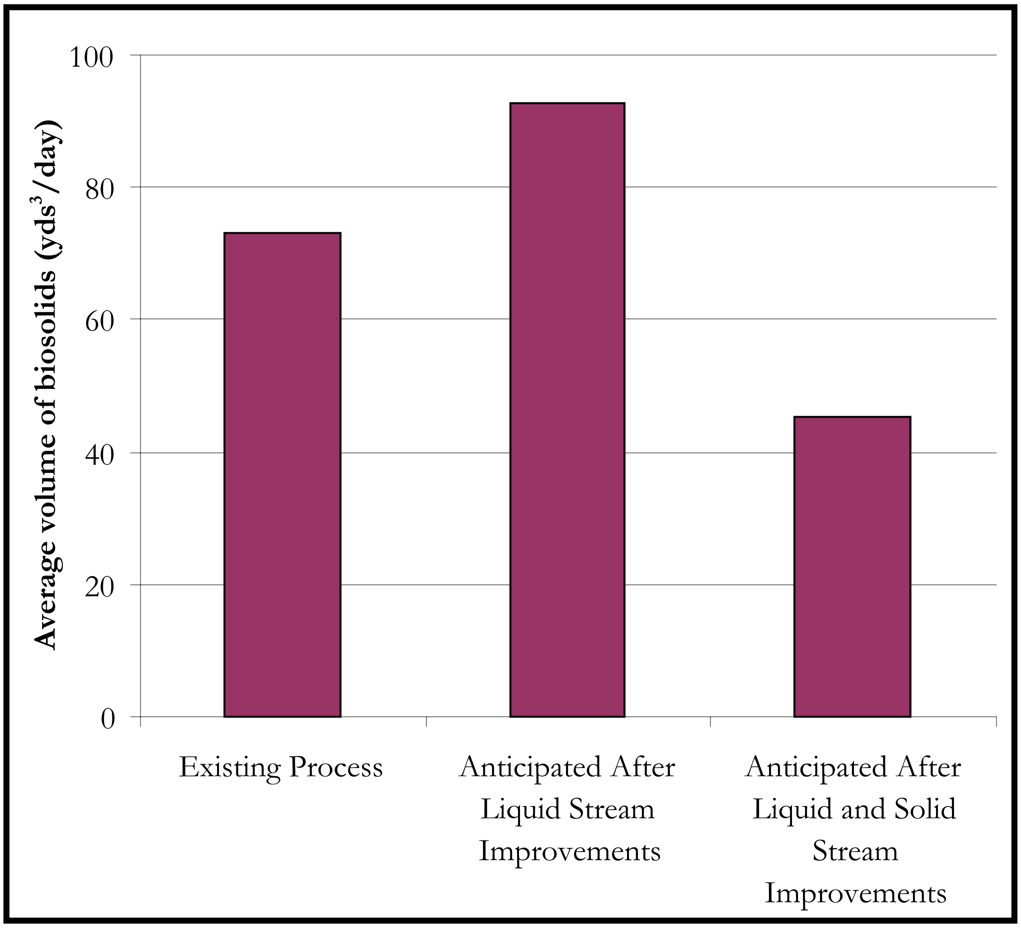
Reducing Waste and Improving Recycling and Reuse

The city's WWTP represents the one of the biggest investments and efforts the city continues to make to reduce and recycle waste generated by the city.

As shown previously in Figure 1, water conservation can effectively reduce wastewater influent flows but do not reduce the pollutant load in the wastewater. So if hydraulic capacity limitations are approached, water conservation efforts in conjunction with collection system rehabilitation to reduce infiltration may be used to extend the useful life of treatment unit's capacity under certain conditions. But hydraulic loads, organic loads and solids loads must all be within the overall treatment capacity of the facility to achieve adequate treatment.

The upgraded liquid stream treatment processes and the anticipated increase in wastewater flows at the WWTP are expected to increase solids production by 25 to 30 percent. The solids dewatering improvements are designed to treat this new volume and to remove substantially more water from the solids than has historically been the case. By reducing the amount of excess water contained in the solids, the volume of material removed from the WWTP will decrease by nearly 50%, resulting in reduced hauling costs and associated fuel usage, and disposal costs. Figure 7 presents a comparison of the existing and anticipated volume of sludge produced as cubic yards per day.

Figure 7. Biosolids Production Volumes



The volumes of sludge presented in Table 7 were calculated from the historical and projected sludge quantities presented in the Community Environmental Assessment Process for 75th Street Wastewater Treatment Plant Dewatering Improvements. Biosolids densities were assumed to be 64.3 and 66.1 lbs/cubic foot for solids concentrations of 10 and 20 percent respectively.

Solids generated in the wastewater treatment process will be anaerobically digested, dewatered, and used as a soil amendment on agricultural lands on Colorado's eastern plains. Alternatively, the solids could be used by a private firm on a contract basis for landscape amendments or other uses.

Boulder also has a pretreatment program that reduces waste loads from industries and some commercial enterprises. The program requires categorical and significant industrial dischargers to limit the pollutants they discharge under a permit issued by the city. The pretreatment program protects the liquid stream processes from harmful loads, protects the quality of the solids, and protects the Boulder Creek from the effects of pollutants that could pass thought the facility untreated. This program will be important in protecting the plant from future increases in metals and other non-treatable pollutants.

Protecting the General Health and Safety of Plant Workers

There was no work time lost from on the job injuries during 2005. The planned improvements will provide improved working conditions and reduce exposure to hazardous chemicals. The upgrades will replace old and outdated equipment with newer equipment that will require less maintenance and reduce potential for possible injury associated with operation. This will provide a safer environment for plant workers and for the surrounding neighborhoods and natural areas and will help maintain baseline conditions of zero injuries.

Meeting Future Demands

The population of Boulder is expected to grow to approximately 128,160 people by 2030 and the number of people employed in Boulder to increase to approximately 155,920. The existing facility is not equipped to treat the volume of wastewater generated by this projected growth, subsequently; an increase in treatment capacity from 20.5 to 25 MGD is needed. After the Phase 1 improvements in place, the facility will meet these future demands.

Creating a Sustainable Community

Sustainability in wastewater treatment is achieved through resource conservation, recycling and waste reduction. Resource consumption will be minimized through proper process selection, use of energy efficient equipment, and operational process optimization.

Primary issues of concern include:

- Energy usage,
- Greenhouse gas generation,
- Costs, and
- Chemical usage

<u>Energy Usage</u>

Although the energy efficiency of the new plant equipment will be greater than that of the older plant equipment, overall energy consumption is expected to rise due to the higher level of treatment provided and the anticipated higher wastewater flows. In evaluating higher level treatment alternatives, additional energy usage was considered to be an acceptable tradeoff when evaluated against increased chemical usage.

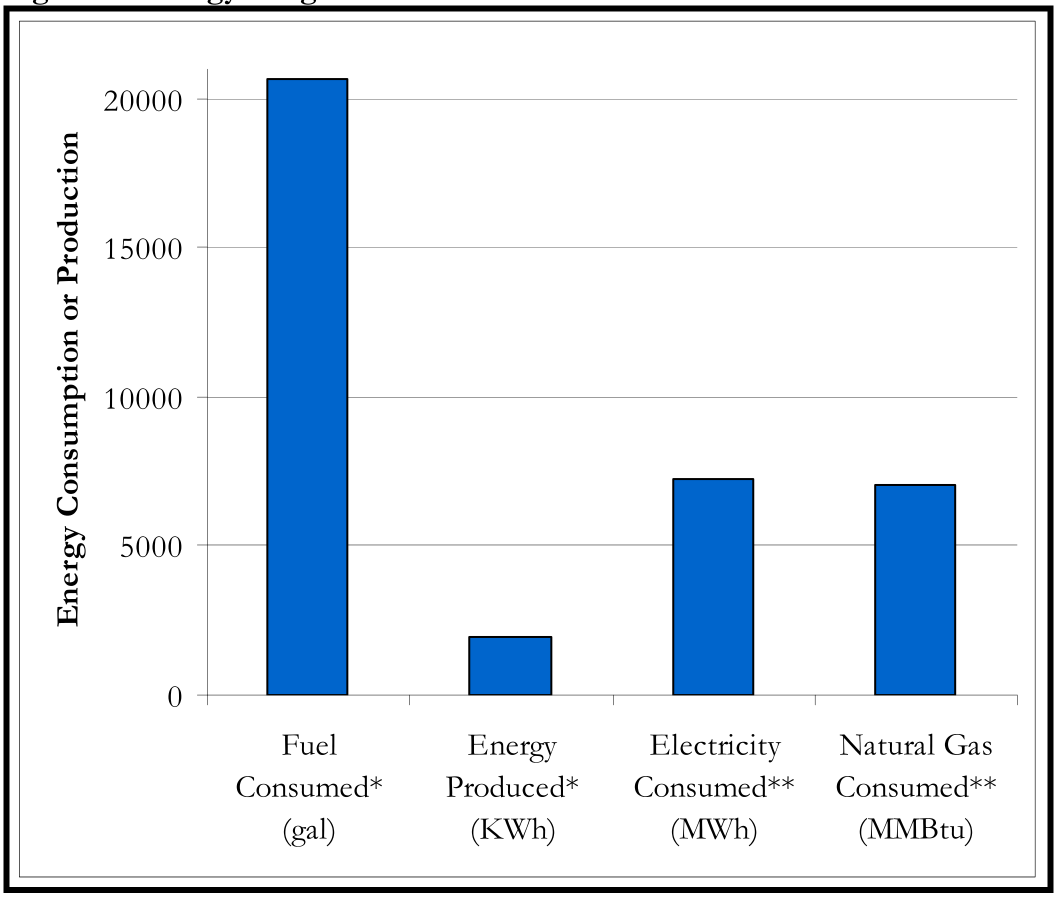
In addition to the criteria listed above, the City is incorporating Leadership in Energy and Environmental Design (LEED) concepts into the design of the new dewatering facility.

Facility upgrades will improve energy efficiency in several ways:

- Less fuel consumed
    - The mileage associated with hauling of solids offsite will be decreased by approximately 50%.
    - The anticipated replacement of chemical disinfection (chlorine and sulfur dioxide) with UV disinfection (Phase 2) eliminates the fuel consumption associated with the manufacture and transportation of these chemicals.
- Electricity consumed
    - Improved energy efficiency of newer equipment will reduce energy waste in the liquid stream and solids dewatering processes (however, due to energy demands of the new activated sludge process, electrical energy usage is expected to increase).
- Energy produced
    - Increased production of solids will result in more methane production as wastewater flows increase.

Figure 8 presents data on energy usage of existing system.

Figure 8. Energy Usage



*Based on 2004 data; 2005 data represented an atypical year due to digester cleaning
**Based on 2005 data; 2004 data not available.

Greenhouse Gas Generation

The City of Boulder participates in the Cities for Climate Protection Campaign, an agreement between U.S. cities that calls for a reduction in greenhouse gas emissions equivalent to those identified in the Kyoto Protocol. Improvements in energy usage and reduced fuel consumption lower the WWTP's greenhouse gas emissions; however increased solids production creates more methane gas, one of the six primary greenhouse gases.

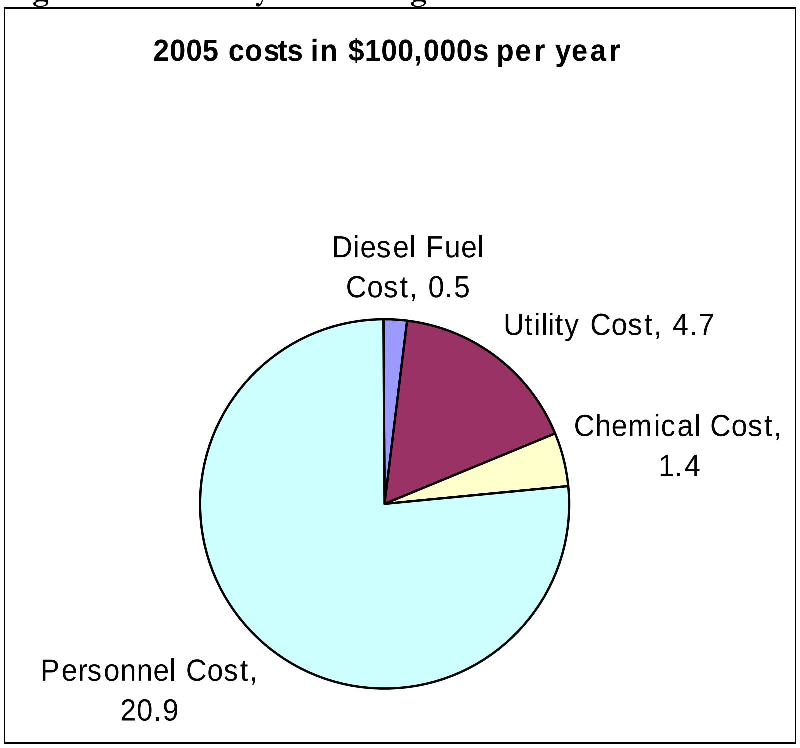
Costs

WWTP operating costs are based on:

- Fuel consumption
- Energy usage
- Chemical usage
- Equipment costs
- Personnel costs

The improved wastewater treatment processes will be more efficient in many ways, and therefore, some operational costs are expected to be reduced. A considerable portion of the 2005 budget was spent on repair and rehabilitation work at the existing WWTP. In addition, biosolids recycling costs increased by approximately 10% and chlorine costs increased by 25% in 2005. Overall upgrades to the treatment process are expected to minimize maintenance and repair costs; however, because the new process will be treating the wastewater to a higher level, some additional costs will be incurred. Figure 9 presents various expenditures from the existing WWTP.

Figure 9. Summary of Existing WWTP Costs

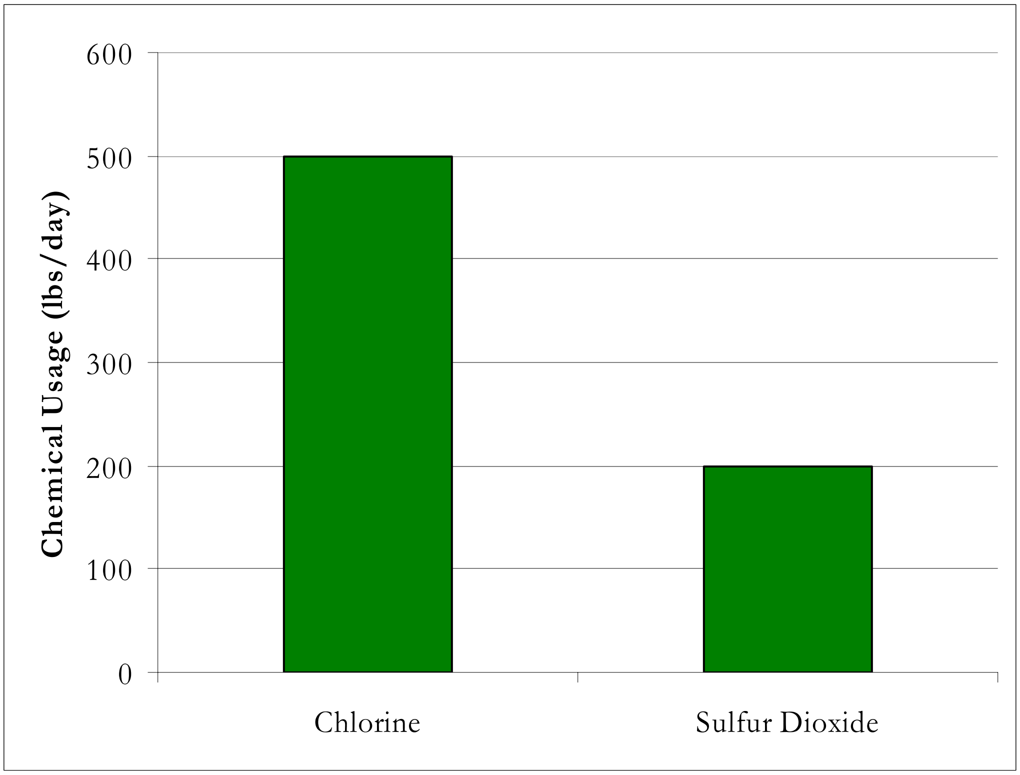


Diesel fuel cost includes diesel fuel consumption resulting from biosolids recycling operation. Estimation based on city and contractor hauled biosolids loads and an efficiency 4 mpg.

Chemical Usage

The anticipated implementation of UV disinfection, potentially in Phase 2 improvements, will eliminate the need for chlorine and sulfur dioxide chemicals. Figure 10 presents actual chemical usage data for the existing plant.

Figure 10. Chemical Usage Data for the Existing WWTP



The use of additional chemicals was considered during the selection process. Several alternatives evaluated required the addition of methanol to achieve nitrogen removal. The chosen process can remove a substantial amount of nitrogen and phosphorus without the need for chemical addition. This is important since it is anticipated that 2009 CPDS permit discharge limitations will limit the discharge of one or more of these substances (Phase 2).

HOW THE MASTER PLAN AFFECTS LIFE IN BOULDER

WWTP improvements are necessary for the City of Boulder to continue to meet their environmental stewardship goals. By addressing the two main drivers of wastewater treatment improvements, lower ammonia nitrogen limits and increased wastewater treatment capacity, City goals of furthering community sustainability goals and protecting water quality will be met. The improvements represent a proactive, or "action" approach, to improving water quality in Boulder County because they go beyond the minimum required to meet regulatory requirements.

A comparison between operation goals met by the existing WWTP and the WWTP after Phase 1 improvements are implemented is shown in Table 3.

Table 3. Comparison of WWTP Capabilities

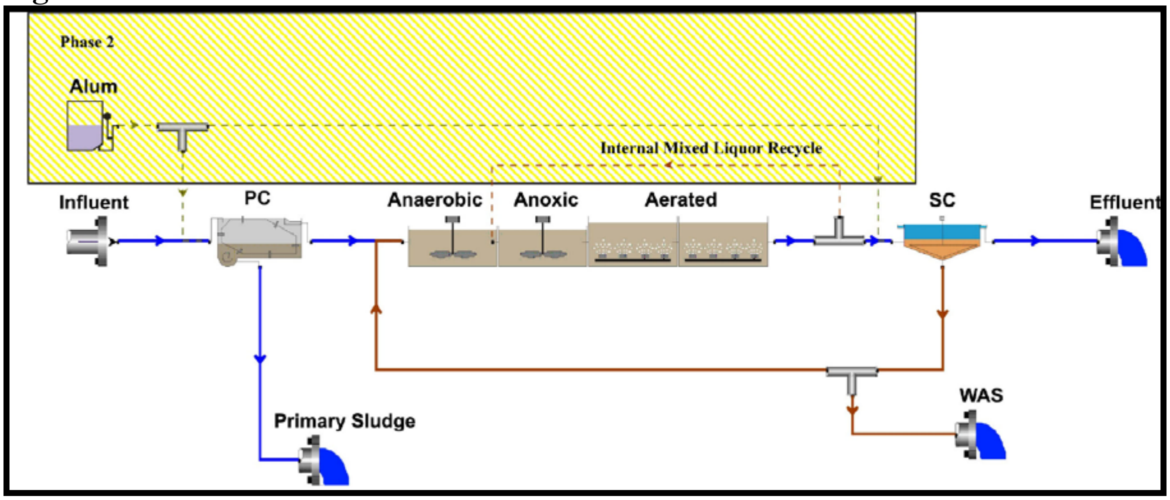
	Existing WWTP	WWTP After Phase 1 Improvements
Meet future capacity demands		✓
Meet new ammonia limits (CDPS 2003)		✓
Provide treatment options for additional nutrient removal		✓
Provide shorter operating time (biosolids dewatering)		✓
Eliminate chemical use		✓ – Phase 2
Reduce solids handling		✓
Minimize long-term operational costs[1]		✓
Minimize energy requirements[2]	✓	
Minimize greenhouse gas emissions		✓
Minimize neighborhood traffic		✓
Provide adequate odor control[3]	✓	✓
Minimize visual impairment	✓	
Improve air quality	✓	✓

[1] Long-term operational costs associated with the existing plant would increase due to reoccurring equipment repair and rehabilitation.
[2]Energy use will increase based on Phase 1 Improvements due to the increased level of treatment provided. Energy savings from more efficient equipment and the improved dewatering process will help to offset the greater energy demand from larger, more extensive treatment.
[3]Odor controls will be placed on solids processes.

The CDPS permit dated February 1, 2003 includes a compliance schedule that allows the City until January 31, 2008 to comply with the new ammonia limits. The Phase 1 improvements are on schedule to be completed and online before that date.

A schematic flow diagram of the WWTP after implementation of Phase 1 improvements is shown in Figure 11.

Figure 11. Schematic Flow Chart of the New WWTP



PRINCIPLES GUIDE APPROACH TO WASTEWATER TREATMENT IMPROVEMENTS

As mentioned previously, the primary motivators behind the WWTP upgrades that simultaneously serve City and County goals were:

- Improving ammonia nitrogen reduction capability,
- Increasing treatment capacity, and
- Improving the dewatering process capabilities to meet increased capacity requirements.

Secondary drivers include:

- Replacing inefficient equipment with newer, improved equipment; and
- Reducing chemical usage.

The City is required to provide adequate treatment capacity and meet regulatory requirements and these upgrades will allow the City to do so. The secondary drivers could be met simultaneously with only moderate additional cost. These improvements optimize the system and establish the City as responsibly proactive by implementing treatment options that improve effluent quality while potentially minimizing future costs.

LIQUID STREAM ALTERNATIVES ANALYSIS

As part of the preliminary design evaluation, nine process alternatives were initially considered for upgrading the Boulder 75th Street WWTP. For more information on the original nine treatment options and the selection process refer to the City of Boulder Wastewater Utility Plan Amendment 1 and Site Application Report (Brown and Caldwell, 2005).

Based on the initial process review the following five alternatives were selected for detailed evaluation.

- Alternative 3. Trickling Filter – Solids Contact Tank – Nitrifying Trickling Filters – Trickling Filter Recycle – Denitrification Filters – Chemical Phosphorus Removal (TF-SC-NTF-TFR-DNF)
- Alternative 6. Trickling Filter – Activated Sludge (TF-AS)
- Alternative 7. Activated Sludge (AS)
- Alternative 8. Trickling Filter – Membrane Bioreactors (TF-MBR)
- Alternative 9. Membrane Bioreactor (MBR)

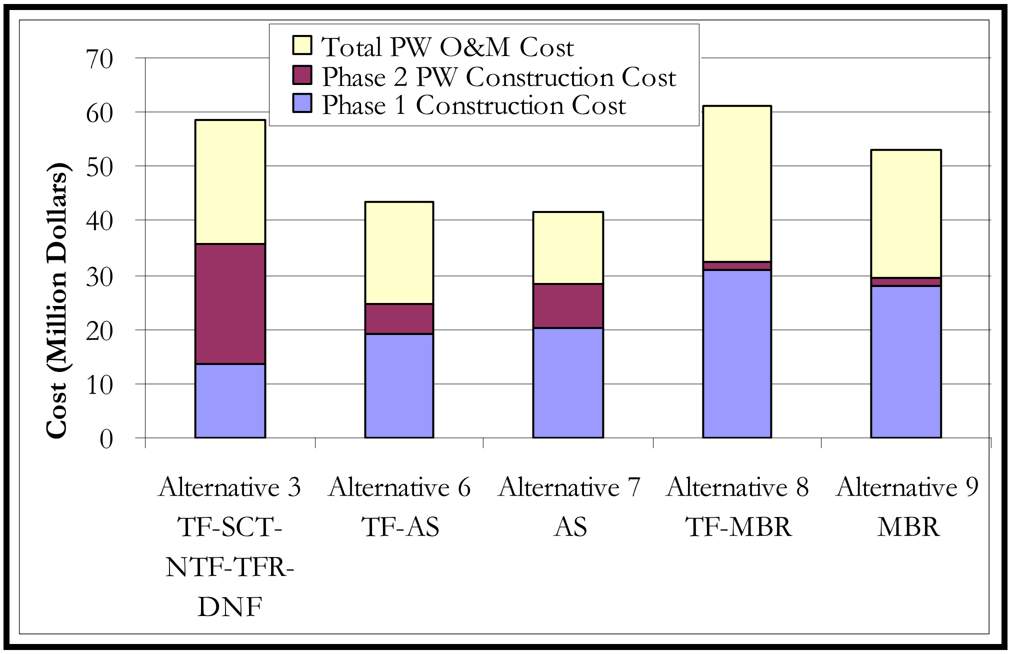
These alternatives were evaluated in detail and the results of the evaluations are presented in Figure 13 and Table 4.

Basis of Economic Evaluation

The economic evaluation includes consideration of initial construction costs and ongoing operation and maintenance (O&M) costs. It is important to consider both types of costs since some alternatives may be capital cost intensive and yet require minimal annual O&M costs, while other alternatives may be less capital cost intensive but require high annual O&M expenditures. Present Worth Analysis is a technique used to put construction and O&M costs on a comparable basis so alternatives can be appropriately evaluated. Present worth costs were evaluated over a period of 20 years.

Figure 12 shows the results of the economic, or present worth, evaluation of these alternatives.

Figure 12. Economic Evaluation for Process Alternatives[1]



[1] Values rounded to the nearest hundred thousand dollars.

As shown in Figure 12, the most economically feasible alternatives are Alternative 6 (trickling filter-activated sludge) and Alternative 7 (activated sludge).

Basis of Non-Economic Evaluation

Non-economic factors were also considered in the evaluation of the wastewater treatment alternatives. These non-economic factors are particularly important when the economic evaluation indicates similar costs for two or more alternatives (such as the case with Alternatives 6 and 7 as indicated in Figure 14) or when non-cost issues represent a high priority. The non-economic evaluations for the secondary treatment process alternatives are displayed in Table 4. Each non-economic criterion was scored a value between 1 and 5, with 5 representing the highest or best alternative.

Table 4. Non-Economic Evaluation for Process Alternatives

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.

Refer to the City of Boulder Wastewater Utility Plan Amendment, September 2004, for more details on the non-economic evaluation. As seen from the rating information presented in Table 4, Alternative 7 (activated sludge) was rated the highest overall from a non-economic standpoint.

<u>Disinfection Alternatives</u>

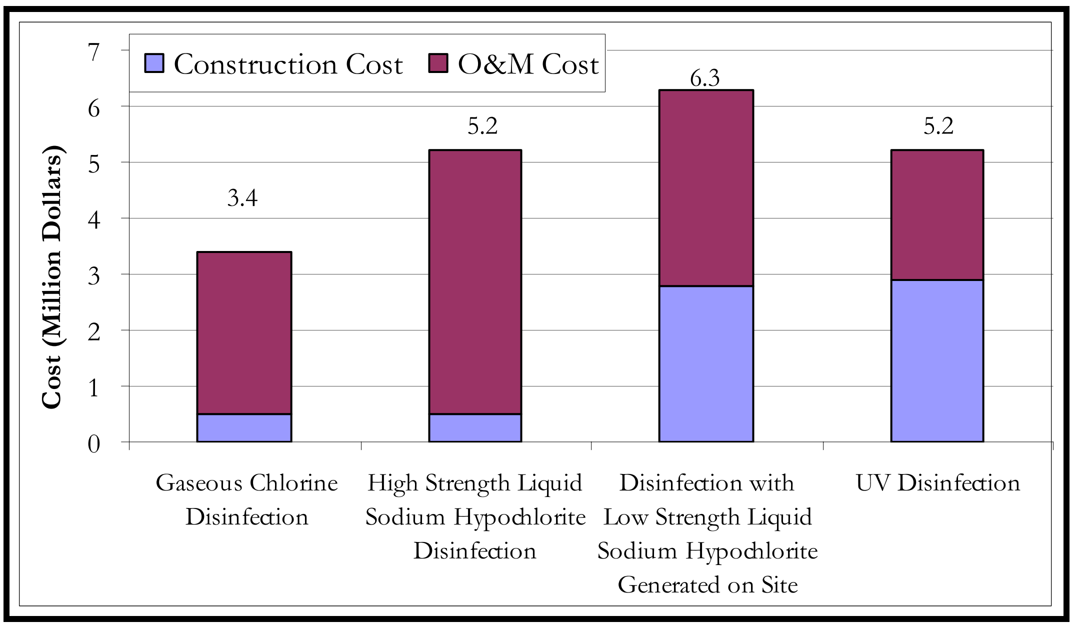
The Boulder 75th Street WWTP currently uses chlorine gas to disinfect the treated wastewater. Gaseous sulfur dioxide is used to remove residual chlorine following disinfection and prior to discharge of the wastewater to Boulder Creek. The existing chlorine disinfection system has adequate capacity to 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)

Figure 13 presents an economic evaluation for disinfection alternatives to be used with the activated sludge process.

Figure 13. Economic Evaluation for Disinfection Alternatives



As shown in Figure 13, the most economical alternative is continued gaseous chlorine disinfection.

The results of an evaluation of non-economic factors for disinfection alternatives are presented in Table 5.

Table 5. Non-Economic Evaluation of 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

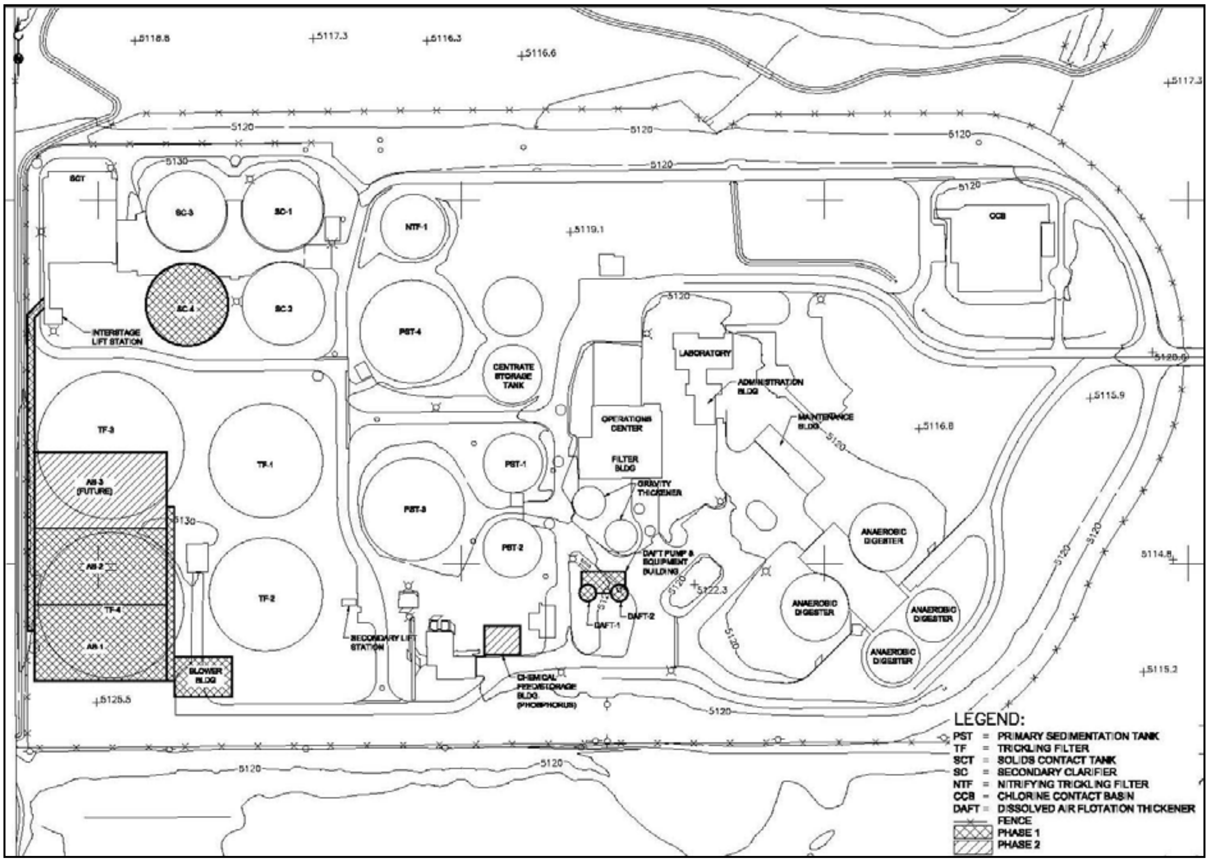
Note: A higher score is more favorable.

UV disinfection was rated the highest of the disinfection alternatives from a non-economic standpoint. 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 of Boulder to continue to meet their effluent disinfection requirements without the negative aspects of chemical addition. Even though UV disinfection was not the most economical alternative, it was selected as the preferred disinfection method based on the non-economic criteria.

Because of funding limitations, replacement of the existing chemical disinfection (chlorine and sulfur dioxide) with UV disinfection is not being implemented as part of the Phase 1 improvement project. It is anticipated this improvement will be implemented as part of the Phase 2 improvements in 2010.

Activated sludge and UV disinfection were selected as the preferred wastewater treatment process to meet Boulder's current and anticipated wastewater treatment needs. Figure 14 illustrate the components of the recommended WWTP upgrades.

Figure 14. WWTP Upgrades to Existing Facility



SOLIDS DEWATERING ALTERNATIVES ANALYSIS

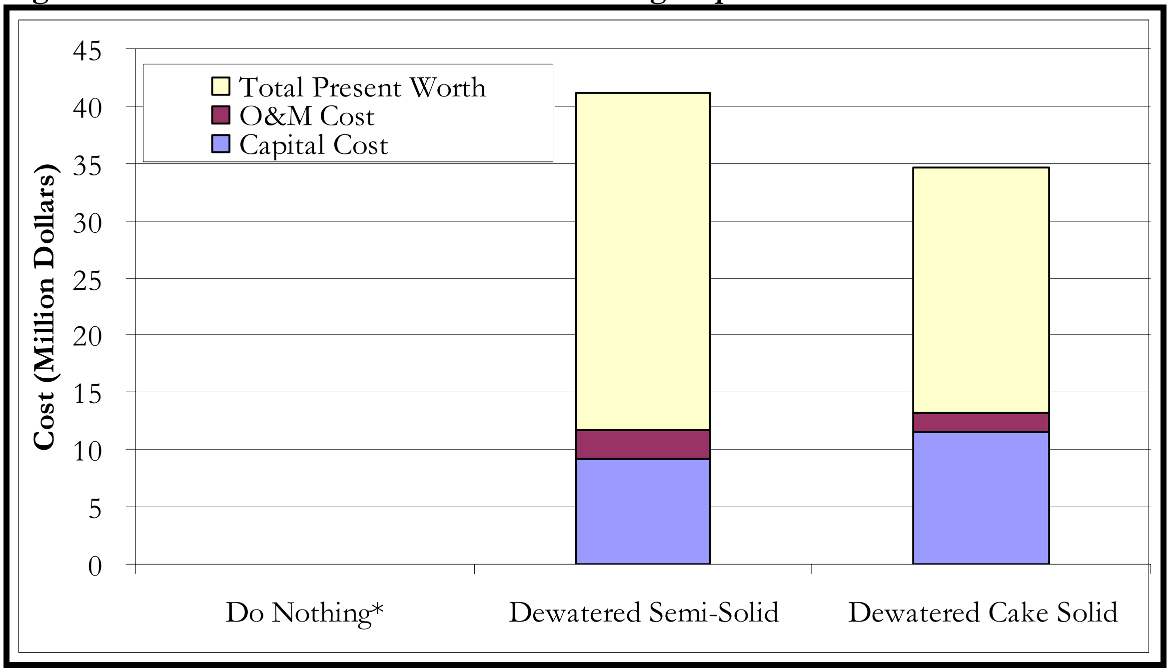
Three alternatives were evaluated for the solids dewatering process. These alternatives included:

- Alternative 1: Do nothing
- Alternative 2: Maintain semi-solid (10-12% solids) dewatering (existing process)
- Alternative 3: Transition to a cake (20-24% solids) product (new process)

The Do Nothing alternative requires no capital investment and neither the operations and maintenance nor the total present worth costs have been estimated. The Do Nothing approach is not a valid selection because the existing facility cannot treat the projected generated solids resulting from the new liquid stream improvements.

Alternatives 2 and 3 are based on centrifuge dewatering of digested biosolids produced from the liquid treatment process. Figure 15 presents an economic evaluation of the biosolids dewatering improvement alternatives. Present worth costs were evaluated over a 20-year period.

Figure 15. Economic Evaluation for Dewatering Improvements Alternatives



*Note: The Do Nothing approach is not a valid selection.

Table 6 presents a summary of the non-economic evaluations of the dewatering improvements alternatives.

The economic evaluations of these alternatives is based upon hauling solids to disposal sites in tractor trailer type trucks that average 5 miles per gallon (mpg) when on the open road but realize an average of only 3 mpg when loading, unloading, and local road travel is considered. The average mileage of 3 mpg was used in the evaluation. While the semi-solids alternative generates 10-12% solids, the dewatered cake solids are in the 20-24% solids range. This results in needing to only haul ½ the volume with the thicker product.

Tractor trailer trucks made 560 trips in 2006 with an average roundtrip distance of 130 miles per trip. Assuming that the majority of the trip is conducted on the open road with an average mileage of 5 mpg the average yearly fuel consumption is 14,560 gallons (24,266 gallons if based on a mileage of 3 mpg). Assuming 2006 was an average year, by reducing the number of trips by half, approximately 7,280 gallons (or 12,133 if based on 3 mpg) of fuel will be saved each year. Based on an approximate fuel price of $2.50 this results in an average yearly savings of approximately $18,200 (or $30,332 if based on 3 mpg).

More information on this economic evaluation can be found in the Community Environmental Assessment Process for 75th Street Wastewater Treatment Plant Dewatering Improvements document in the appendix of this plan.

Table 6. Non-Economic Evaluation Criteria for Dewatering Improvements Alternatives

Alternatives	Description	Advantages	Disadvantages
Alternative 1 Do Nothing (10-12% solids)	Maintain existing system.	• Low costs. • No construction impacts.	• Existing system does not have capability to meet future WWTP solids loading rate at flows of 25 MGD. • Existing system is 20 years old and it is difficult to find replacement parts, reducing reliability and plant redundancy. • Would lead to regulatory non-compliance. • Inability to store non-dewatered biosolids at plant.
Alternative 2 Semi-solid (10-12% solids) with existing solids dewatering building	New centrifuges would replace existing ones in existing dewatering building.	• Regulatory compliance. • Makes maximum use of existing structures. • Similar operation to existing process; staff is familiar with process.	• New centrifuges would be smaller and would be required to operate longer. • Structural concerns if existing building are modified again, limited ability to modify existing building. • Opinion of probable cost is highest for this alternative due to retrofitting difficulties, longer run times, more frequent equipment failure, and greater staffing needs.
Alternative 3 Cake solid (20-24% solids) with new solids dewatering building	Producing cake product and new high-solids centrifuge in new building.	• Regulatory compliance. • Makes maximum use of existing structures. • Lower biosolids volume. • Fewer truck costs equal lower O&M costs. • Opinion of probable cost is lowest due to properly sized structure and equipment, reducing staffing and hauling requirements.	• Cake storage is needed. • Requires construction of new facility.

As indicated in Table 6, Alternative 3 represents more advantages and fewer disadvantages than the other alternatives.

Based on the economic and non-economic analysis, the recommended improvements for the solids dewatering facility are a new, dewatered cake solid processing facility.

In summary, Alternative 3 was chosen because:

1. A cake product is becoming the norm in the industry and produces drier material, which results in fewer truck trips from the WWTP site.

2. A new dewatering building is appropriate for the new equipment due to size constraints and age of existing building.

3. Retrofitting the existing facilities would result in higher lifetime costs for the WWTP. Cost advantages for constructing a new building include:

    a. Installation of properly sized equipment with lower operating costs,
    b. Lower staffing needs,
    c. Redundant capacity,
    d. Greater flexibility, and
    e. Lower maintenance costs.

INVESTMENT PROGRAM

The 2005 Wastewater Utility Capital Improvement Program (CIP) developed by the Boulder Department of Public Works includes improvements to both the liquid stream and solids stream wastewater treatment process. In December 2005 the City issued a revenue bond to finance the capital costs associated with the Phase 1 improvements.

The 2005-2010 Wastewater Financial Plan incorporates a series of multi-year rate increases to cover the cost of these projects. Utility rate adjustments are approved by City Council on an annual basis. For 2005 and 2006, the City implemented 20 percent increases to the wastewater user charges. An additional rate increase of 6 percent was implemented on January 1, 2007. Table 7 presents a comparison of Boulder wastewater rates compared to those of surrounding communities based on 2005 rates.

Table 7. Front Range Community Sewer Rates[1]

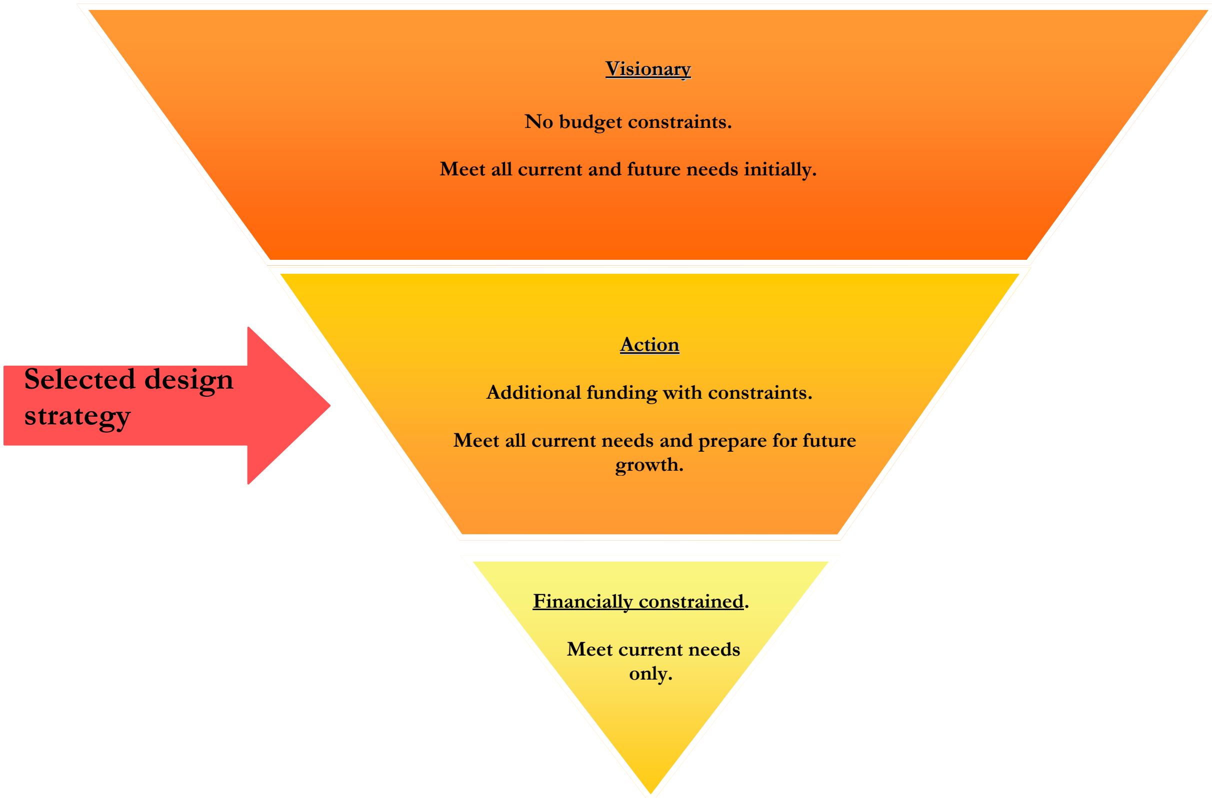
Number	Community	Annual Sewer Service Charge ($)
1	Erie	321.00
2	Colorado Springs	219.29
3	Fort Collins	210.30
4	Longmont	207.00
5	Greeley	195.00
6	Westminster	186.00
7	Broomfield	184.20
8	Northglenn	171.00
9	Boulder	170.76
10	Thornton	163.08
11	Louisville	153.60
12	Arvada	148.86
13	Lafayette	138.84
14	Aurora	130.20
15	Denver	128.16

[1] Based on information collected of Front Range Communities conducted in 2005.

Investment Strategies

Figure 16 depicts the range of investment strategies considered in determining the extent of wastewater treatment system upgrades at the Boulder 75th Street WWTP.

Figure 16. Comparison of Investment Strategies



The City of Boulder chose to pursue an action level approach to wastewater treatment improvements. At this level each area that requires immediate attention has been addressed and mechanisms have been put in place to prepare for anticipated future requirements. Unlike actions taken at the visionary level, the upgrade alternatives were selected to provide the City with the most long term value with respect to cost, system performance, and environmental impact.

The system upgrade approach was initially based on two phases of implementation. This phasing approach allows the City to balance capital expenditures by constructing only necessary components in the near-term, while setting the stage for additional process improvements that may be required to meet more stringent future effluent limits. Phase 1 improvements include those that were required to meet current design flows and permit limits and processes that prepare the plant for the Phase 2 upgrades with only moderate additional costs. Phase 2 upgrades include those that are anticipated to prepare the plant to meet anticipated future limits, reduce chemical usage, and treat any odor concerns that may arise.

Construction of Phase 1 improvements began in 2006 and Phase 2 improvements are expected to begin in 2010. Phase 1 and 2 improvements are as follows:

- Phase 1 (2006): These improvements are required to address the 2003 discharge permit limitations (ammonia nitrogen) and to increase the capacity of the WWTP. In addition, these improvements position the plant to meet anticipated future discharge permit requirements with only moderate additional construction costs.

- Phase 2 (2010): These improvements are anticipated in response to probable more stringent CPDS discharge permit limitations (nitrogen and phosphorus) in 2008, the desire to replace the existing chemical disinfection (chlorine and sulfur dioxide) process with an ultraviolet (UV) disinfection process, the need to address biosolids stabilization (digester capacity) issues.

Phase 1 Implementation Schedule

Figure 17 depicts the implementation schedule for Phase 1 improvements. The schedule includes the time required for total project implementation, beginning with project approval and concluding with fully operational facilities.

Figure 17. Proposed Implementation Schedule

Component	2004	2005	2006	2007	2008	2009
Liquid Stream Improvements						
City Coucil Approval	♦ April 2004					
Design Upgrades	May 2004 to August 2005					
Bid		♦ March 2005				
Construction		April 2005 to June 2008				
Dewatering Improvements						
City Coucil Approval		♦ November, 2005				
Design Upgrades		November 2005 to November 2006				
Bid			♦ October, 2006			
Construction			November 2006 to April 2008			

The following table presents the current capital improvement program (CIP) funding for the wastewater treatment projects discussed in this master plan. It does not include funding for on-going maintenance projects associated with the WWTP.

Table 8. Current CIP Funding for WWTP Projects

	2006	2007	2008	2009	2010	2011	2012
Phase 1 – Liquid Stream	$47,250,000	$0	$0	$0	$0	$0	$0
Phase 2 – Liquid Stream	$0	$100,000	$200,000	$1,000,000	$10,000,000	$0	$0
Phase 2 - Biosolids Digester	$0	$0	$0	$850,000	$8,500,000	$0	$0
Anticipated Rate Increases for Capital and Other Needs		6%	4%	4%	10%	4%	3%

MEASURING PERFORMANCE

City objectives were used as guiding principles for the design of wastewater treatment system improvements and will be used as performance indicators to measure results from the improvement projects. To accomplish this, a baseline of each indicator must be established and compared to indicators measured at specific intervals following the completion of improvement projects. Table 8 presents a summary of suggested performance indicators.

Table 8. Summary of Performance Indicators

City goals	Performance Indicator
Improving and protecting water quality	1. Number of occasions WWTP is not in compliance with permit 2. Nutrient concentration in effluent
Reduce waste and improve recycling and reuse	Volume of exported solids
Improve health and safety of WWTP operators	Number of WWTP accidents
Meeting wastewater treatment capacity demands	Wastewater flows
Creating a sustainable community through resource conservation	1. Amount of Energy use 2. Amount of Greenhouse gas emissions 3. Cost of operating plant 4. Amount of Chemical usage

PHASE II IMPROVEMENTS

The existing WWTP has met historical needs by providing adequate treatment capacity and appropriate treatment capability. The WWTP is currently being upgraded to treat additional wastewater flows and meet stricter effluent ammonia nitrogen limits in Phase1.

These Phase 1 improvements represent an "action level" position for the City. This position requires that immediate action be taken on items of the most urgent need; capacity requirements and permit limits, with the incorporation of additional proactive elements based on anticipated regulatory concerns, environmental quality, and available funding. Many anticipated treatment challenges can be more cost effectively dealt with during current construction activities than at a later date.

Additional phases of design and construction are expected to follow. Concerns to be addressed for Phase 2 work include:

- Disinfection system,
- 2008 discharge permit limits,
- Biosolids stabilization (digester capacity)
- Odor and noise

Disinfection System

Because of funding limitations, replacement of the existing chemical disinfection (chlorine and sulfur dioxide) with UV disinfection is not being implemented as part of the Phase 1 improvement project. It is anticipated this improvement will be implemented as part of the Phase 2 improvements in 2010. For reasons outlined in previous sections the implementation of an UV disinfection system is preferred over the existing chemical disinfection process.

2009 Discharge Permit Limits

Discharge permit limits are revisited every five years, and it is anticipated that some level of total inorganic nitrogen (TIN) and phosphorus removal may be required by future discharge permits. Current construction includes provisions to allow these anticipated future limits to be met with minimal additional capital expenditure.

Biosolids Stabilization (Digester Capacity)

Based on current projections, the capacity of the existing digesters will not be sufficient to adequately stabilize the biosolids for continued land application after the year 2012. The need for additional digester capacity will depend on the actual solids production once the improvements are brought on-line in 2008, whether or not land application continues to be a viable recycling alternative, and the success of privatized composting of the biosolids. These issues will be evaluated over the next several years prior to any additional capital expenditure.

Odor and Noise

The Boulder County 1041 permit stipulates no net increase in either odor or noise from the WWTP. Although additional control measures are not anticipated at this time, the City will continue to monitor odor and noise in compliance with the permit conditions. After the Phase 1 improvements are operational, the need for additional odor and noise control will be re-evaluated and appropriate steps taken as necessary.

FUTURE CONSIDERATIONS FOR WASTEWATER TREATMENT NEEDS

Future considerations that are beyond the scope of this master plan and the current Capital Improvement Program include 1) stringent total inorganic nitrogen (TIN) and phosphorus discharge permit limits, 2) emerging contaminants and 3) biosolids recycling or disposal flexibility.

Stringent Total Inorganic Nitrogen (TIN) and Phosphorus Discharge Permit Limits

Chemical addition and/or additional aeration basin volume may be required to remove additional total nitrogen (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.

Emerging Contaminants

Emerging contaminants includes pollutants such as endocrine disrupting compounds 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 adapted 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.

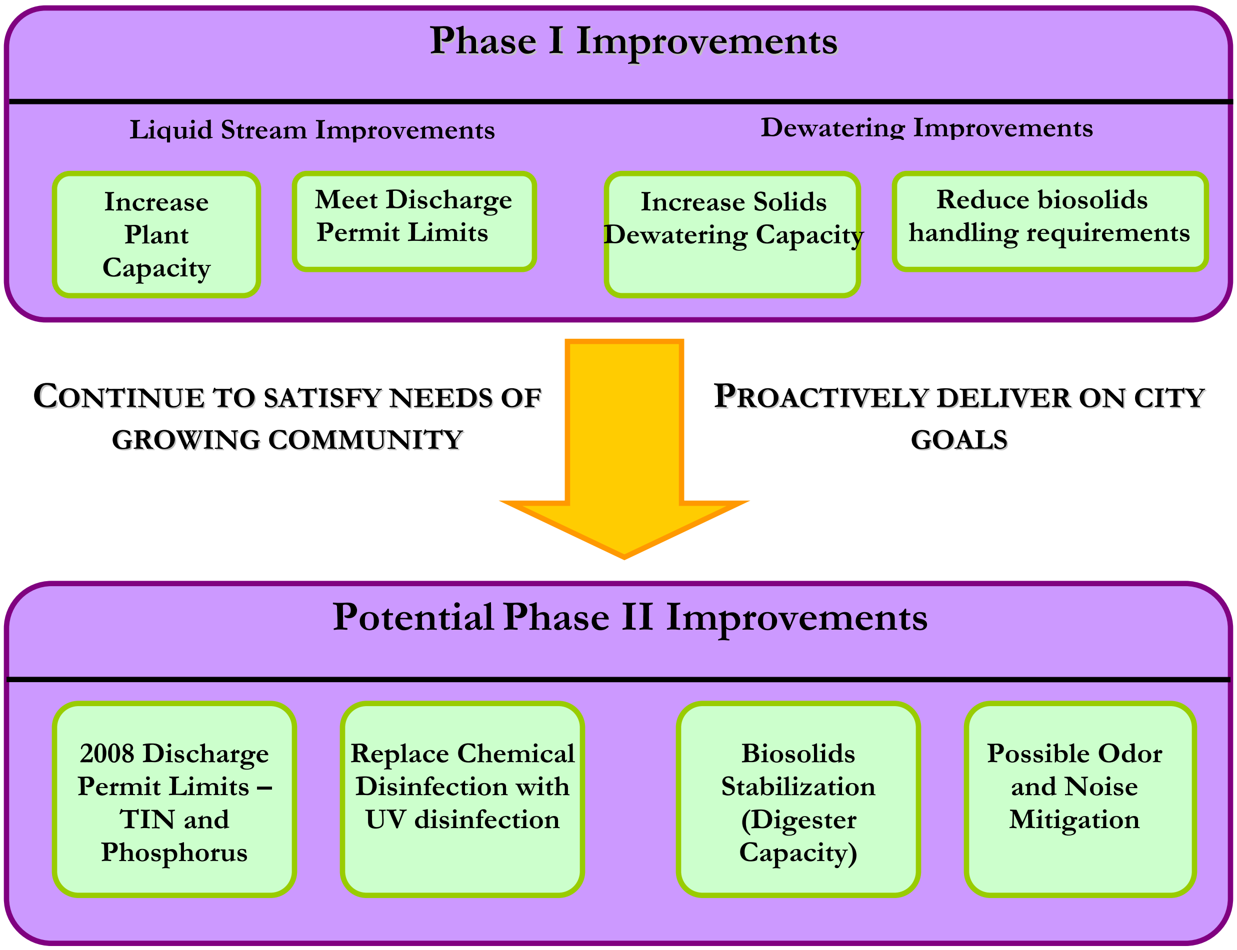
Biosolids Recycling or Disposal Flexibility

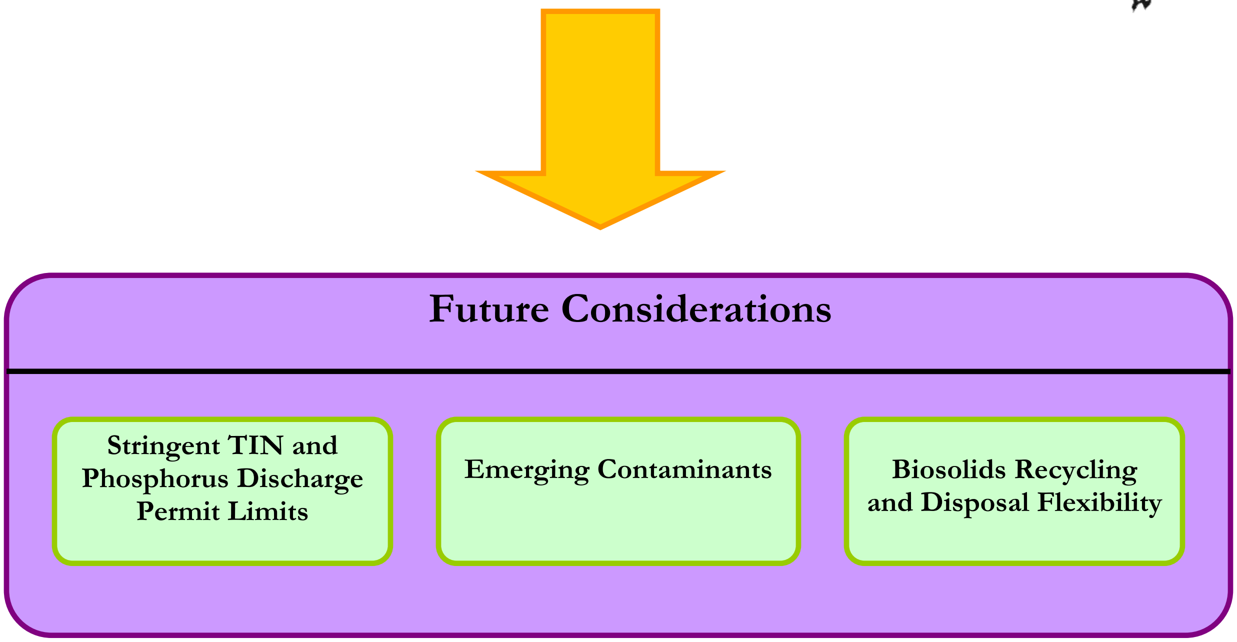
The current WWTP upgrade projects will give the City a variety of future biosolids end-use options. These options include maintaining the existing land application program, transitioning to privatized land application and privatized composting. The method of final disposal of the solids generated by the wastewater treatment process is going to be an issued until a long term solution can be reached. Concerns have been raised about whether land application should be used when biosolids contain varying quantities of emerging contaminants. If regulations regarding the end-use of biosolids change, treatment and end-use options will be evaluated. The current approach is to maintain flexibility in disposal options so that the utility is in the best position to respond to regulatory changes and community pressures. Ultimately, the final disposal decision could be dictated to the wastewater permit holders like Boulder through regulatory restrictions.

MASTER PLAN TO MEET CITY GOALS

Figure 19 illustrates how the current WWTP improvements and decisions for future consideration are directed toward meeting City needs and goals. The top portion of the figure addresses design elements already incorporated into the WWTP improvements. The bottom portion of the figure identifies additional challenges that must be addressed to continue to meet City goals.

Figure 19. Meeting City Needs and Goals

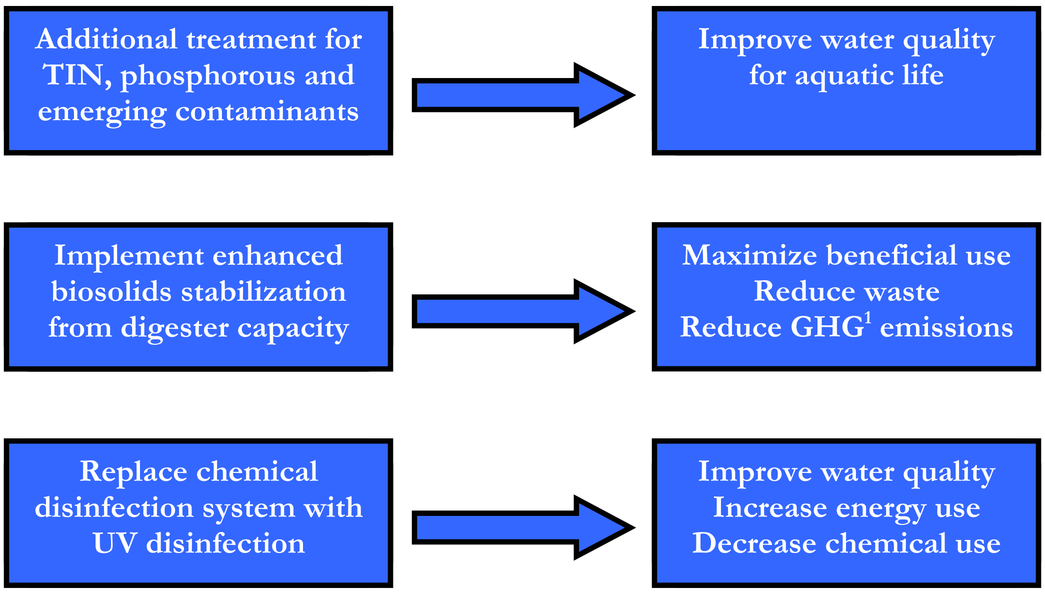



Future Considerations
Stringent TIN and Phosphorus Discharge Permit Limits
Emerging Contaminants
Biosolids Recycling and Disposal Flexibility

TRIPLE BOTTOM LINE INDICATORS

The incorporation of additional treatment processes or biosolids handling methods to meet future regulatory requirements will affect environmental, economic, and social aspects of the community. Figures 20 - 22 illustrate how future decisions may affect the Boulder service community economically, environmentally, and socially.

Figure 20. Summary of future decision making on environmental impacts



[1]GHGs (greenhouse gases)

Figure 21. Summary of future decision making on economic impacts

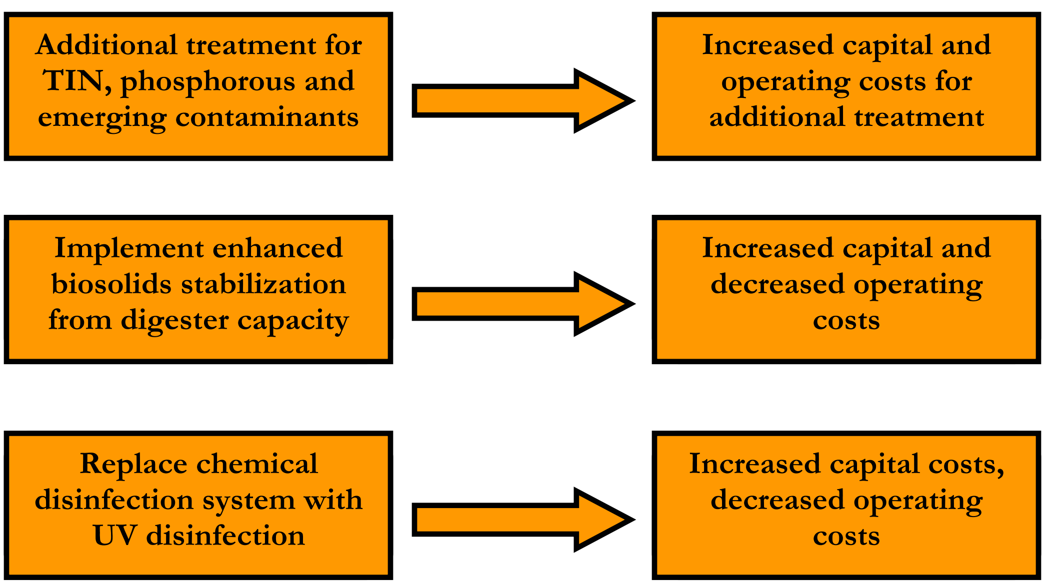
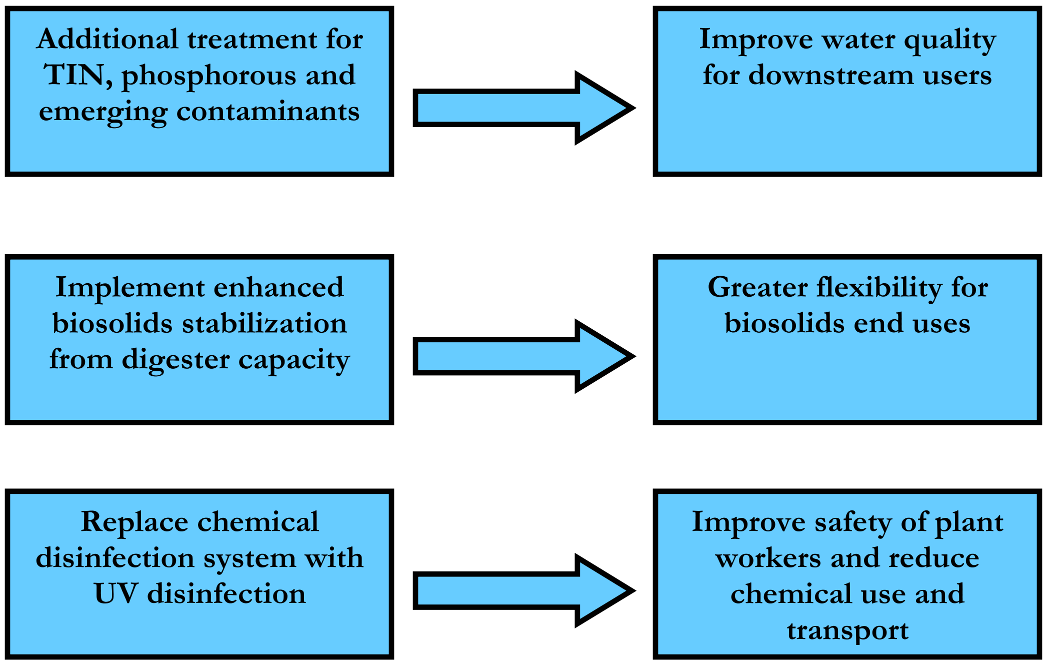


Figure 22. Summary of future decision making on social impacts



SUMMARY

The Boulder 75th Street WWTP has historically served the City of Boulder well by meeting regulatory requirements and discharging high quality effluent to Boulder Creek. Improvements at the wastewater treatment facility are typically driven by state and federal effluent discharge limitations. Phase 1 improvements to the WWTP were necessitated by the imposition of more restrictive ammonia limits on the discharge and by anticipated growth in the Boulder wastewater service area population. The system upgrades currently under construction include improvement to the liquid stream treatment process and to the solids dewatering process. The liquid stream treatment improvements include converting the existing trickling filter solids-contact process to an activated sludge process. The solids dewatering upgrades include the addition of new dewatering equipment to reduce the volume of solids that must be hauled from the WWTP site. Additional improvements will be required in the future as wastewater discharge and solids handling requirements change. Plans have been made to accommodate these anticipated future upgrades with limited additional capital expenditure.

The current improvements meet City goals and establish Boulder as a proactive environmental steward.

The costs incurred in implementing the current WWTP upgrades have been paid through bond sales and increased user fees.

The current WWTP improvements have been designed with the intent of meeting current treatment requirements and strategically positioning the City of Boulder to economically address anticipated future treatment requirements. The Phase 1 improvements are expected to be completed in 2008. Anticipated future wastewater treatment and biosolids handling improvements will be implemented as necessary.

REFERENCES

Boulder County. 2006 Boulder Valley Comprehensive Plan.

Brown and Caldwell. March 25, 2005. Amendment 1 and Site Application Report (March 25, 2005) to the City of Boulder Wastewater Utility Plan (November 15, 2002).

Brown and Caldwell. March 8, 2004. City of Boulder 75th Street Wastewater Treatment Plant Upgrades Community and Environmental Assessment Process (CEAP) Addendum No. 1 March 8, 2004.

Brown and Caldwell, July 2003. City of Boulder Wastewater Collection System Master Plan Update.

Rothberg, Tamburini & Windsor, Inc. May 2006. Community Environmental Assessment Process for 75th Street Wastewater Treatment Plant Dewatering Improvements.

8. Wastewater Treatment Master Plan Summary

Background Information

All domestic and industrial wastewater generated within the city of Boulder is processed at the city's 75th Street Wastewater Treatment Plant (WWTP). Septic wastes, hauled to the facility by private haulers, are also processed at the facility. Treated liquid effluent is discharged to Boulder Creek, and anaerobically digested sludge generated at the wastewater treatment plant is hauled away and is applied to farmland. Annual average influent flows treated at the plant have varied from 14.7 million gallons a day (mgd) to 17 mgd in recent years..

The *WWTP Master Plan* was developed in 2007. It updates the *Wastewater Utility Plan*, prepared in 2002 to meet the Denver Regional Council of Governments' Clean Water 2000 requirements. The Wastewater Utility anticipates developing a Wastewater Utility Master Plan that would combine the 2007 *WWTP Master Plan* with the *2003 Wastewater Collection System Master Plan* and elements of the *Water Quality Plan* (not yet complete) that would outline goals, future improvements and service delivery direction for the entire utility.

The wastewater treatment plant is required to meet water quality standards set in the National Pollutant Discharge Elimination System (NPDES) permit. State stream classifications determine the amount of various chemical substances allowed in streams, and discharge permits are issued to assure compliance by point sources such as wastewater treatment plants. Boulder's treatment plant is required to be in compliance with state standards, and the city continues to make improvements to the WWTP to assure this.

Currently, the WWTP provides sludge treatment through an anaerobic digestion process to meet state and federal Class B biosolids regulations. The Class B biosolids are then applied to agriculture land outside Boulder County. However, producing a higher classification, or more stable form, of biosolids could become more beneficial and cost-effective approach in the future. The utility continues to track biosolids treatment and recycling research and trends to see if better long term options become available.

Future Service Projections and Programs

The liquid stream improvements at the WWTP should provide adequate treatment of the city's wastewater through the year 2025, provided the current discharge permit and land use regulations do not change substantially. However, it is likely that the discharge permit requirements will become more stringent, perhaps requiring nutrient removal, in the future. These anticipated limits for nutrient removal will require the city to further improve the treatment process. The improvements being constructed now will treat the 25.0 million gallons per day flows expected in 2025. This flow represents the 'build out' condition at the existing allowable land use densities.

More information on Boulder's Wastewater Treatment operations can be found on the Web at: http://www.ci.boulder.co.us/publicworks/depts/uw4.html

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State stream classifications set the amount of various chemical substances allowed in streams, and discharge permits are issued to assure compliance by point sources such as wastewater treatment plants. Boulder's treatment plant is required to be in compliance with state standards, and the city is initiating major improvements to the WWTP to assure this.

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Utility Plan recommended two improvements to the solids handling facilities at the plant:

1. Construction of a Class A biosolids composting facility.
2. Improve the biosolids handling and dewatering process at the WWTP.

The City Council provided direction in August 2005 regarding biosolids. This includes: maintaining the current Class B biosolids land application program with a portion of the biosolids production composted at a private composting facility and continuing to

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Approved May 24, 2007

CITY OF BOULDER
PLANNING BOARD ACTION MINUTES
May 3, 2007
1777 Broadway, Council Chambers

A permanent set of these minutes and a tape recording (maintained for a period of seven years) are retained in Central Records (telephone: 303-441-3043). Minutes and streaming audio are also available on the web at: http://www.ci.boulder.co.us/planning/planningboard/agendas

PLANNING BOARD MEMBERS PRESENT:
Elise Jones, Chair
Phil Shull
Adrian Sopher
Richard Sosa
Willa Johnson
Bill Holicky, recused/absent
Andrew Shoemaker, arrived 6:36

STAFF PRESENT:
Ruth McHeyser, Acting Planning Director
David Gehr, Assistant City Attorney
Louise Grauer, Senior Planner
Marie Zuzack, Planner
Randall Rutsch, Transportation
Jeff Arthur, Engineering Review Manager
Douglas Sullivan, Engineering Project Manager
Randy Earley, Utilities Project Manager
Robert Harberg, Engineering Project Management Coordinator
Michelle Allen, Administrative Specialist

1. CALL TO ORDER

Chair, **E. Jones**, declared a quorum at 6:09 p.m. and the following business was conducted.

2. APPROVAL OF MINUTES

On a motion by **P. Shull**, seconded by **R. Sosa**, the Planning Board approved as amended the February 22, 2007 Planning Board minutes. Vote 3-4 (**E. Jones** and **W. Johnson**, abstain **B. Holicky** and **A. Shoemaker** absent)

3. PUBLIC PARTICIPATION

None

4. DISCUSSION OF DISPOSITIONS, PLANNING BOARD CALL-UPS

850 8th St., no comments

5. ACTION ITEMS

A. Public Hearing and consideration of:

- A recommendation to City Council concerning the Stormwater Master Plan and;
- Approval of the Boulder Valley Comprehensive Plan (BVCP) Comprehensive Flood and Stormwater Utility Master Plan Summary.

Public Participation
None

On a motion by **W. Johnson**, seconded by **A. Sopher**, Planning Board recommended City Council approval of the Stormwater Master Plan and approved the proposed Comprehensive Flood and Stormwater Utility Master Plan Summary for inclusion in the Boulder Valley Comprehensive Plan contingent on the plan being accepted by the City Council. Vote 6-0 (**B. Holicky** absent)

B. Public Hearing and consideration of:

- A recommendation to City Council concerning the Wastewater Treatment Plant (WWTP) Master Plan and;
- Approval of the Boulder Valley Comprehensive Plan (BVCP) Wastewater Treatment Master Plan Summary.

Public Participation

On a motion by **P. Shull**, seconded by **R. Sosa** Planning Board recommended City Council approval of the Wastewater Treatment Plant Master Plan and approved the proposed Wastewater Treatment Master Plan Summary for inclusion in the Boulder Valley Comprehensive Plan contingent on the plan being accepted by the City Council. Vote 6-0 (**B. Holicky** absent)

C. Public hearing and discussion of the Transit Village Area Plan (TVAP) including:

- Any items continued from April 26
- Transportation Connections
- Streetscapes
- City Funding of Key Public Improvements

Public Participation
John Pawlowski, 10649 Goose Haven Dr., Lafayette CO
Roy Young, 1329 5th St., Boulder
Joe Kent 531 Columbine, Broomfield CO
Bob Louden, Manitou Springs, CO

The Board discussed the questions identified in the staff memo and provided preliminary direction as noted below. Final direction on these items will be determined following the public hearing at time of plan adoption. Where noted in parentheses below, the preliminary direction was based on a straw vote of the Board.

1. Does the Board have any comments or questions on the proposed connections map? Does the Board have any comments or questions on the draft Chapter 3: Transportation Connections Plan?

29th ½ Street:
should be an alley and should straddle the property line (6-0)
Bring back analysis of two alignment options:

- 29th ½ Street dogleg east out to 30th: (2)
- 29th ½ Street: reduced width/ alley from Valmont to Bluff (3)

Bluff west of 30th:

- should extend from 29th to 30th without a dogleg (i.e., not align with Bluff east of 30th Street (6-0)

Streets in the SE quadrant:

- Wilderness to Pearl Pkwy across Goose Creek: prefer eastern alignment going with Frontier. Explore options to address property owners' concerns about the alignment north of Goose Creek
- Eliminate alternative A north-south connection between Pearl Pkwy and Pearl Street (6-0)
- Multi-use path along Pearl Pkwy not needed on the north side between Foothills Pkwy and the Slough (6-0)

Junction Place south of the creek should have a sinuous alignment (6-0)
Junction Place north of Bluff

- should be farther west and straight north of Bluff (5-1)
- should connect nicely to depot plaza (6-0)

Depot plaza should be at the end of Bluff (6-0)
There should still be a flexible street connection shown on the Sutherland property (6-0)
Keep the multi-use path along the creek from the creek to the rail platform.

4. Does the Board agree with the proposed land use designations?
a. Service commercial along Valmont; and
b. Mixed use 1 on the west side of 30th Street?

Public Participation
Roy Young, 1329 5th St., Boulder
Andy Cookler, PO 358, Nederland CO
Bob Louden, Manitou Springs, CO

Support Mixed Use-1 in the entire area west of 30th (6-0)
Explore options for service commercial zoning that preserves the existing use types but allows additional development.

- One option is to make changes to the zone but not until phase II.

Leave Service Commercial zone district as is along Valmont east of 30th Street (4-2)
South side of Old Pearl: change to MU-2 (5-1)

3. Does the Board have any comments or questions about N. Junction Place and Depot Plaza?

Public Participation
None

- Need a cross section/streetscape that shows the train corridor.

- Junction Pl needs to get close to the depot and depot plaza
- The plaza can be designed to accommodate a straighter junction place
- Leave depot plaza at the end of Bluff and adjacent to the tracks
- Staff will try to bring location options for the plaza back to PB before the plan goes to CC.
- The board questions the alley that jogs over from junction place to run along the RR tracks just S of the train platform
- How does the N/S multi-use path along the RR tracks S of the train platform work? The path and alley are an opportunity and potentially a challenge from a design perspective.

Straw Vote:

1. With the new road proposal it makes more sense to make Junction Place straighter and not curve E through Sutherlands property. (5-1)

2. *Does the Board have any comments or questions on the proposed streetscape sections to be included in Chapter 2: Land Use and Urban Design in the draft plan?*

Public Participation
None

30th Street cross-section with on-street parking ok (4-2)

5. *Does the Board have any comments or questions on the City Council's May 1 discussion and direction on funding key public improvements?*

Public Participation
John Pawlowski, 10649 Goose Haven Dr., Lafayette CO

No Board comments

6. MATTERS FROM THE PLANNING BOARD, PLANNING DIRECTOR, AND CITY ATTORNEY

Brief Summary of the Community Dialogue initiative

7. DEBRIEF/AGENDA CHECK

8. ADJOURNMENT
The Planning Board adjourned the meeting at 12:03 p.m.

APPROVED BY

____
Board Chair

____
DATE

Attachment D

CITY OF BOULDER, COLORADO
BOARDS AND COMMISSIONS MEETING SUMMARY FORM

NAME OF BOARD/COMMISSION: Water Resources Advisory Board

DATE OF MEETING: January 22, 2007

NAME/TELEPHONE OF PERSON PREPARING SUMMARY: Jennifer Gray, 303-441-4073

NAMES OF MEMBERS, COUNCIL, STAFF, AND INVITED GUESTS PRESENT:
BOARD MEMBERS – Ken Wilson, Jim Knopf, Robin Byers, Bart Miller, Kelly DiNatale
STAFF – Ned Williams, Bob Harberg, Joanna Crean, Carol Linn, Randy Earley, Floyd Bebler, Carter Coolidge (intern), Jennifer Gray- Secretary

WHAT TYPE OF MEETING (BOLD ONE) [REGULAR] [SPECIAL] [QUASI-JUDICIAL]

Agenda Item 1 – Call to Order
The meeting was called to order at 7:03 p.m.

Agenda Item 2 – Meeting Minutes –December 18, 2006

> **Motion: Motion to accept the meeting minutes with corrections by <u>DiNatale</u>**
> **Seconded: <u>Knopf</u>**
> **Vote: 5-0 in favor, Passed**

Agenda Item 3 – Public participation and comment.

- **Lawrence Budd, water auditor from Fort Collins**: I have concerns about the water budget program. The single family budgets are well done. I am very concerned about the commercial and multifamily properties. There are some properties that have been given way too much water allocation and others that are not given enough. If people are getting too much water, they are not going to contact the City of Boulder to change that, so we are not promoting conservation. I think the City of Boulder should look into this further.

Public Participation was closed.

Agenda Item 4 – Update on Utility Financial Reserves / Rate Stabilization Reserve
Linn presented on the Utility Financial Reserves and Rate Stabilization Reserve. She presented the board with summary results of a survey of 10 other communities as well as where Boulder stands in this analysis. Red Oak Consulting (John Gallagher and Andrew Rheem) also presented information on their report. Linn asked the Board for feedback.

WRAB questions and comment:

- **DiNatale**: When would the capital reserve be used? **Linn**: It could be used when there is an unexpected capital cost or a revenue shortfall.
- **Wilson:** Why didn't we use the large reserves during the drought? **Linn**: We did reduce our reserve that year, in addition to reducing operating and capital costs as a way to save money. **Williams**: We were going into an unpredictable situation and duration and the prudent thing was to save money since we didn't know how long we would be in the drought.
- **Wilson:** What we have reserves for is not consistent Why would we change what we have a reserve for?. **Harberg**: Updates in technology and such can change what we have reserves for.
- **Wilson**: What happens when the operating reserves keeps growing? I think we should make an effort to adjust the rate increases so that we are close to the amounts that we may need.
- **DiNatale**: How can you get these funds? **Williams**: If the funds have been appropriated, a conversation between staff, myself and the Finance Department or City Manager's office is prudent in order to access the funds. **DiNatale**: Would the capital reserves be appropriated? **Williams**: No, not unless we changed our normal process to have the funds appropriated during the annual budget process.
- **Byers**: Would you use rate reserves for demand hardening? **DiNatale**: No, since reserves are for temporary issues, not on-going revenue reductions
- **Byers**: For the entities reviewed, which ones are TABOR enterprises and which are not? Would there be constraints due to TABOR regulations on reserve funds? **Consultant**: The surveyed Colorado communities are similar to Boulder. **DiNatale**: Boulder utilities meet the TABOR definition of an enterprise and are therefore exempt from TABOR regulations. **Williams**: We will check on this.

- **Byers**: Why isn't there any community from the west slope and why use Arizona, Texas, etc? **Williams**: I wanted to go outside Colorado to see other places that had water conservation programs. **Byers**: Why not Irvine Ranch, CA., or Highlands Ranch or Centennial, CO.? **Williams**: We felt we had enough communities closer than California for a good representation..

Agenda Item 5 – Update on the Wastewater Treatment Strategic Plan
Harberg and Earley presented the Wastewater Treatment Strategic Plan for the board's review and comment. Earley asked for feedback from the board.

WRAB questions and comment:
- **Byers:** With the County being more restrictive about septic systems during the County permit process, will we get more applications for hookup to our sewer system? **Harberg**: We have accounted for those areas in our planning process.
- **Miller:** Suggested several format changes regarding the presentation of the plan.
- **Miller:** I think the energy level issues are prevalent. Is fleet hauling efficient? **Bebler**: The majority of the hauling is done by private/outside contractors and we do not monitor or control their fleet and fuel systems. The city's Biosolids fleet is on the older side and not as efficient as newer models. We are not anticipating replacing the city fleet because we're relying on the private haulers.
- **Byers:** Is the Utilities department exempt from carbon tax? **Williams**: No, the city departments will pay the tax. But, the commercial rate is lower than the residential rate.
- **Miller:** Is there a way to anticipate if this WWTP upgrade will help with our rating of ammonia? **Bebler**: That is a driving force and it will help our treatment/removal of ammonia.
- **Miller:** It might be useful to throw in how citizens can help with issues at the front end by disposing of the materials.
- **DiNatale:** In the future, linking all of these plans together would be useful. It would also be nice to show historical flow data as well in this plan.

Agenda Item 6- Update on the Benchmark Study to Evaluate Utility Performance
Coolidge, Crean and Harberg presented on the Benchmark Study to Evaluate Utility Performance including summary results of the study conducted on this subject as well as Boulder's position within this study.

WRAB questions and comment:
- **Byers:** Why is the utilities information in the Benchmark Study from the other communities confidential? **Coolidge**: Perhaps they are not forthcoming with that information in case they are not doing well. **DiNatale:** Also, it helps in getting communities to respond to surveys if you tell them the specific info/data will only be released in summary form. The data is public information and is available from each community, but someone needs to expend a lot of time to get it.
- **Wilson:** Something seems wrong in the calculations since we are so much higher in water distribution percentages. **DiNatale & Harberg**: That is because we are a mature community that is more stable and able to put funds forth for maintenance and that varies the depreciation value that goes into this calculation.
- **Wilson:** The theoretical value for the system renewal/replacement rate seems a bit high at $39 million. **Harberg**: We will have to check that.
- **Wilson:** There are issues with some calculations, but it is good to look at. **DiNatale**: A peer group survey would be great.

Agenda Item 7-

Matters From Staff –
- **Williams**: There is an upcoming study session on Valmont Butte for City Council on Jan. 30. I also have updates the South Platte River Wells issue. Finally, I have a copy of the water budget Rules on how we calculate water budgets that are out for the public review and comment right now.
- The City Council retreat is this Friday and Saturday if you are interested. There is no public comment.

- There is a public meeting on the dental amalgam meeting this Thursday at the Municipal Services Center.
- South Boulder Creek flood study information will be on the Web and functioning by the first of February, but we may not be able to present this at the next meeting. We will know around Feb. 17-20 if the South Boulder Creek flood study will be an agenda item on Feb.26.

Matters from Board –

- **Knopf:** On the water budget bills, there seemed to be a problem in the mailing system. **Williams**: There were about 1,600 bills that had to be printed on old stationary because of a delay in a shipment of new material.
- **Byers:** The County is proposing land use regulation changes, possibly limiting house size and development rate. It could impact different utility projects if it goes through.

Agenda Item 8 – Discussion of schedule for future meetings.

Agenda Item 9- Adjournment
Motion: Motion to adjourn by Byers
Seconded by Miller
Vote: 5-0 in favor, passed.
Meeting adjourned at 10:17 PM

Date, Time, and Location of Next Meeting:
The next meeting will be Monday, Feb. 26 – 6 p.m., regular meeting with a special, early time, Municipal Services Center, 5050 East Pearl Street unless otherwise decided by staff and the board.

These are summary minutes. Audio tapes are available through Central Records for full record.

Minutes approved by: ____________________
Date: ____________________

Attachment E

CITY OF BOULDER, COLORADO
BOARDS AND COMMISSIONS MEETING SUMMARY FORM

NAME OF BOARD/COMMISSION: Water Resources Advisory Board

DATE OF MEETING: March 19, 2007

NAME/TELEPHONE OF PERSON PREPARING SUMMARY: Jennifer Gray, 303-441-4073

NAMES OF MEMBERS, COUNCIL, STAFF, AND INVITED GUESTS PRESENT:
BOARD MEMBERS – Ken Wilson, Jim Knopf, Robin Byers, Bart Miller, Kelly DiNatale
STAFF – Ned Williams, Bob Harberg, Annie Noble, Randy Earley, Bret Linenfelser, Jim Shelley, Amy Struthers, Jennifer Gray- Secretary

WHAT TYPE OF MEETING (BOLD ONE) [REGULAR] [SPECIAL] [QUASI-JUDICIAL]

Agenda Item 1 – Call to Order
The meeting was called to order at 7:01 p.m.

Agenda Item 2 – Meeting Minutes –February 26, 2007

> **Motion: Motion by Knopf to accept the meeting minutes with corrections**
> **Seconded: Byers**
> **Vote: 5-0 in favor, Passed**

Agenda Item 3 – Public participation and comment.

There was none. Public Participation was closed.

Agenda Item 4 – Presentation for parting chair Ken Wilson
Williams presented Wilson with a plaque and cake for his commitment to the WRAB over the past five years.

Agenda Item 5 – Final recommendation on the Wastewater Treatment Master Plan
Earley and Harberg presented the Wastewater Treatment Master Plan and asked for the Board to make a final recommendation to City Council.

WRAB questions and comment:

- **Byers**: On figure 18, I had asked for labels on the "y" axis. Can we add arrows or something to make it more instructive? **Earley**: I will try to revise it again.
- **Byers**: Did the CDPHE change the ammonia standards? Will those standards get included in the new permit process? **Linenfelser**: We don't think the new standards will be implemented in the next permit cycle.
- **Miller:** Do you know if the costs for treatment relate to flow quantity more so than population increases/decreases? **Earley**: The plant is presently being expanded to account for the hydraulic loading (flows) that are anticipated for build-out conditions. The strength of the waste (pollutant load based on population) does not decrease when the flows decrease. Therefore, the treatment costs should not change much as either the flows or population change, except for the power (electricity) costs to operate some pumps.
- **Miller:** The current decrease in flow has understandably not been included, but if this level were to continue, is there a way to factor that in? **Earley**: We are not factoring that in at the present time. While there has been a decrease in flows recently because of water conservation efforts and lower ground-water levels, our long-range planning effort uses a conservative approach that anticipates flows to gradually increase back to more historical levels, at least on a cyclical basis.
- **Knopf:** How will the Transit Village affect this? **Earley**: It will increase our flows, but flows will still be within the hydraulic loading we can handle.
- **Byers:** Will annexations make a difference in flow levels? **Earley**: There are some small properties that may annex and increase flows, but these areas are part of our anticipated service area.

Public Hearing: No public comments.

Motion: Wilson moves that the Water Resources Advisory Board (WRAB) approve the presented draft of the Wastewater Treatment Master Plan and to forward this recommendation to City

Attachment E

Council (the presented draft has mislabeled the date).
Seconded: Byers
Vote: 5-0, Passed

Agenda Item 6- Update on the evaluation of source water protection for Boulder Reservoir, including additional treatment and the Carter Lake Pipeline Project

Noble, along with consultant Chris Tadanier with Black & Veatch, presented on the evaluation of source water protection for Boulder Reservoir, including additional treatment and the Carter Lake Pipeline Project.

WRAB Discussion:

- **Wilson:** Do we own storage in Carter Lake? **Williams**: We do not own storage, but we can order water from there. The only reason we are limited today is because winter conditions prohibit the operation of Boulder Feeder Canal.
- **Byers:** What would the CEAP include? Improvements, new projects? **Harberg**: All of those and everything, including alternatives.
- **Knopf:** What is the projected rate increase? **Noble**: Inflation rate increase in 2008-2010 is at 3%. More information is in the memo. **Knopf:** Can we get this kind of information for wastewater?
- **Byers:** Will money from the settlement with Xcel on the RECs go to the general fund or utilities? **Williams**: I do not think that money is part of the settlement. Also, it has not yet been determined how to use the credits for the city's RECs.
- **Byers:** Are some concerns that we have driving or motivating entities (such as Left Hand) for this as well? **Tadanier:** Yes. Winter water is their driving issue.
- **Miller:** Did any of the alternatives look at the affect the city or county could have on land uses such that land use regulations could prevent the degradation? Struthers: The city is currently trying to work with Northern on this, although Northern is hesitant to control land use or outfalls. It would be on the city's shoulders to secure approval to change outfalls.
- **DiNatale:** The studies are very biased. You are assuming there will be no change in Carter Lake water quality. You are assuming there will be no change in future drinking water requirements. You assume there will be no major renovations to the Boulder Reservoir treatment plant within the 20-year planning period. This study has a pre-determined outcome. It lacks credibility. I don't disagree with the conclusion, just the way we are getting there.
- **DiNatale:** Did you look at the ultra-filtration membrane processes? **Tadanier**: No, because it provides an ultimate barrier for bacteria but only a partial barrier for viruses**. DiNatale:** I disagree. Ultra-filtration with chlorination will meet the city's virus treatment goals.
- **DiNatale**: I am surprised you didn't work with policy-makers on the performance criteria and weighting. .
- **Miller:** Can you double check your cost estimate numbers for granular activated carbon as well as the spike in costs related to steel pipe in the Pipeline alternative? **Tadanier**: We will look into this.
- **DiNatale:** I would like to see the integration of this study with the source water strategic plan to see how this relates. **Harberg**: We are running behind schedule on the source water strategic plan and the Boulder Reservoir project will need to move forward before then for 2008 budgeting purposes.
- **Wilson:** This study has come forward in a good direction, but you are having a hard time selling it.
- **DiNatale:** I would like to see what the long-term (20 years) plans are for managing the Boulder Reservoir WTP.
- **Harberg:** Staff will use the comments WRAB has given during this meeting to improve our report/analysis, and then return to WRAB in the future for this project.

Agenda Item 7-

Matters From Staff –

- South Boulder Creek Flood Study will be presented to Planning Board on Thursday.

Matters from Board –

- **Byers:** How much did the double-billing (sending two bills in January) cost us? **Williams**: I do not know.

Attachment E

▪ **DiNatale:** I got a call from a citizen who said he had to give away his Anderson Ditch water rights in order to get a building permit. **Williams**: I am aware of this issue and the city and property owner are currently working on a mutually agreeable solution. ▪ **Byers:** What is happening with the South Platte River Wells' case? **Williams**: It is in recess now, but it is still ongoing and will resume later in March. ▪ **Byers:** Where is Valmont Butte project with respect to the Trust for Public Land (TPL) acquisition? **Williams**: The city is waiting for the TPL to submit a proposal and proceed with fund-raising.
Agenda Item 8 – Discussion of schedule for future meetings.
Agenda Item 9- Adjournment **Motion: Motion to adjourn by Wilson** **Seconded by Knopf** **Vote: 5-0 in favor, passed.** **Meeting adjourned at 10:35 PM**
Date, Time, and Location of Next Meeting: The next meeting will be Monday, April 16 – 7 p.m., regular meeting, Municipal Services Center, 5050 East Pearl Street unless otherwise decided by staff and the board.

These are summary minutes. Audio tapes for full record are available through Central Records.

Minutes approved by: _____________________
Date: _____________________

C I T Y O F B O U L D E R
WATER RESOURCES ADVISORY BOARD
AGENDA ITEM

MEETING DATE: January 22, 2007

AGENDA TITLE: Introduction of the Wastewater Treatment Plant (WWTP) Strategic Plan

PRESENTERS:
Ned Williams, Director of Public Works for Utilities
Robert Harberg, Utility Planning and Project Management Coordinator
Floyd Bebler, Coordinator of Wastewater Treatment
Randy Earley, Engineering Project Manager

EXECUTIVE SUMMARY:

The attached draft Wastewater Treatment Plant (WWTP) Strategic plan is presented to the Water Resources Advisory Board (WRAB) for comment and review.

The Facilities Plan, prepared in 1990, and the Utility Plan, revised in 2002, were the last planning documents addressing the WWTP needs. This strategic plan has been prepared to bring the wastewater utility planning documents into the new city master plan framework. The wastewater treatment utility will eventually have a single, utility wide, master plan. This strategic plan is intended to inform the Wastewater Utility Master Plan on issues related to wastewater treatment. The draft strategic plan is based upon existing documents including the Utility Plan submitted to the Denver Regional Council of Governments (DRCOG), the Community Environmental Assessment Process (CEAP) for the WWTP Liquid Stream Improvements project, the CEAP for the Solids Handling Improvements project (both now in various phases of construction), and updated population projects.

This agenda item requests a review of the plan by the Board and comments on how to improve the draft plan. The draft plan will be revised based upon comments and ideas received within the next month and presented to the WRAB at a future meeting, possibly the March meeting, for acceptance.

Fiscal Impacts:

Budgetary: The plan itself has no budgetary impact. Funding for the first phase of the construction cited in the plan is in place. Additional funding will be required to carryout the second phase of the construction. The Capital

Improvements Project (CIP) budget includes $18,500,000 of improvements in 2010. Future funding of additional construction will probably require additional user rate increases.

Staff Time: The impact of the future potential improvements identified on staff time is unknown at this time.

Other Impacts:

The potential future projects identified in the plan generally improve water quality in Boulder Creek, protect downstream water users or reduce local impacts from the treatment facility. The potential future improvements will keep the plant in compliance with its discharge permit and local requirements.

Economic: The future projects could potentially result in unbalanced social impacts because lower income customers would be dis-proportionally impacted by any rate increase.

Community: The impacts depend upon the improvements selected. For example, residents in close proximity to the facility could have fewer odors and noise if noise and odor treatment components are required in future work.

Other Board and Commission feedback: The strategic plan is in draft form and it has not been presented outside the city staff to the public or other Boards.

Public feedback: None received as yet.

Staff recommendation: Staff recommends that the WRAB review the strategic plan and provide comments and questions to improve the document and make it more understandable and useful for future planning.

Analysis:

In most communities WWTP improvements are driven by growth and regulatory requirements. However, Boulder's growth limitations have minimized the impact of growth as a 'driver' of plant improvements. Boulder's WWTP improvements are typically driven by regulatory requirements included in the Colorado Department of Public Health and Environment (CDPHE) issued discharge permit. The discharge permit focuses on reducing impacts of the wastewater discharge to the aquatic habitat and protecting downstream water uses.

This strategic plan addresses the improvements to the existing facility required to meet the 2003 discharge permit limits. The plan also attempts to conservatively estimate improvements required to meet more stringent discharge permit limits that will likely be associated with the 2009 permit renewal. The plan presents some future decisions that will be vital to the WWTP facility's continued success in meeting regulatory requirements and the Boulder Valley Comprehensive Plan Goals. The strategic plan demonstrates the approach that has been used to keep the WWTP in compliance with regulatory requirements and meet community objectives.

All the potential second phase and future improvements presented here will require a CEAP and, probably, a Boulder County 1041 'Matters of State Interest' review and approval. As previously mentioned, this plan will be incorporated into the Wastewater Utility Master Plan.

WRAB can comment on the draft plan either at the Jan. 22 WRAB meeting or by e-mailing comments to earleyr@bouldercolorado.gov. This will enable the draft to be edited prior to final presentation at an upcoming meeting in which the WRAB will be asked to accept the draft as a Strategic Plan for the WWTP. The acceptance of the revised strategic plan will move the utility toward conformance with the business plan model the city of Boulder has adopted as a framework for master plans.

Attachments

- Attachment A: City of Boulder's Draft Wastewater Treatment Plant (WWTP) Strategic Plan

C I T Y O F B O U L D E R
WATER RESOURCES ADVISORY BOARD
AGENDA ITEM

MEETING DATE: March 19, 2007

AGENDA TITLE: Final recommendation on the Wastewater Treatment Plant (WWTP) Master Plan

PRESENTERS:
Ned Williams, Director of Public Works for Utilities
Robert Harberg, Utility Planning and Project Management Coordinator
Floyd Bebler, Coordinator of Wastewater Treatment
Randy Earley, Engineering Project Manager

BOARD ACTION REQUESTED: Consideration of a motion to recommend to City Council that the Wastewater Treatment Plant (WWTP) Master Plan be accepted.

EXECUTIVE SUMMARY:

The attached draft Wastewater Treatment Plant (WWTP) Master Plan is presented to the Water Resources Advisory Board (WRAB) for review and consideration of a motion to recommend to City Council that the WWTP Master Plan be accepted. This WWTP Master Plan was presented to the WRAB in January as a strategic plan but planning staff determined that the document should go forward as a master plan that will include a Planning Board recommendation and City Council acceptance. This Master Plan presents the approach used to meet the new regulatory requirements and community goals described in the Boulder Valley Comprehensive Plan (BVCP).

Previous planning documents for the WWTP include The Facilities Plan, prepared in 1990, and the Utility Plan, revised in 2002. This Master Plan has been developed to recognize the significant wastewater treatment improvements required by the 2003 discharge permit and to plan for future improvements that may be required by new permit restrictions in 2008.

The Wastewater Utility will eventually have a single, utility wide, master plan. The WWTP Master Plan will inform that Wastewater Utility Master Plan on wastewater

treatment issues. The utility staff expects to develop the system wide Wastewater Utility Master Plan later this year and present it for approval in 2008.

This agenda item requests a recommendation of acceptance of the draft Master Plan by the Board. The attached draft plan has been revised based upon comments and ideas received at, and since, the January WRAB meeting. Additional comments can still be included in the draft plan. The current draft plan has been posted on the city's Web site for public review.

IMPACTS:
Fiscal Impacts:

Budgetary: The plan itself has no budgetary impact. Funding for the first phase of the construction cited in the plan is in place. Additional funding will be required to carryout the second phase of the construction. The Capital Improvements Project (CIP) budget includes $18,500,000 of WWTP improvements in 2010. Future funding of additional construction will probably require additional user rate increases.

Staff Time: The impact of the potential improvements identified on staff time is unknown at this time.

Other Impacts:

The future projects identified in the plan generally improve water quality in Boulder Creek, protect downstream water users or reduce local impacts from the treatment facility. The potential future improvements will keep the plant in compliance with its discharge permit and local requirements.

Economic: The future projects could potentially result in unbalanced social impacts because lower income customers would be dis-proportionally impacted by any rate increase.

Community: The impacts depend upon the improvements selected. For example, residents in close proximity to the facility could have fewer odors and noise if noise and odor treatment components are required in future work.

ANALYSIS:

In most communities WWTP improvements are driven by growth and regulatory requirements. However, Boulder’s growth limitations have minimized the impact of growth as a ‘driver’ of plant improvements. Boulder’s WWTP improvements are typically driven by regulatory requirements included in the Colorado Department of Public Health and Environment (CDPHE) issued discharge permit. The discharge permit focuses on reducing impacts of the wastewater discharge to the aquatic habitat and protecting downstream water uses.

This Master Plan addresses the improvements to the existing facility required to meet the 2003 discharge permit limits. The plan also attempts to conservatively estimate improvements required to meet more stringent discharge permit limits that will likely be associated with the 2008 permit renewal. The plan presents some future decisions that will be vital to the WWTP facility’s continued success in meeting regulatory requirements and the Boulder Valley Comprehensive Plan Goals. The Master Plan explains the approach that has been used to keep the WWTP in compliance with regulatory requirements and meet community objectives.

The projects defined in the Master Plan are considered to be "Essential Services" and "Action Level" per the city's Business Plan guidelines.

PUBLIC PROCESS TO DATE:
The Master Plan is in revised draft form and has not been presented outside of the January WRAB meeting to the public or other Boards. It has been posted on the city's Web site for interested parties to review.

NEXT STEPS:
WRAB can comment on the draft plan either at the March 19 WRAB meeting or by e-mailing comments to earleyr@bouldercolorado.gov. This WWTP Master Plan will be presented to the Planning Board for review and to city council for final acceptance.

All the potential second phase and future improvements presented here will require a Community Enviornment Assessment Process (CEAP) and a Boulder County 1041 'Matters of State Interest' review and approval. As previously mentioned, this plan will be incorporated into the Wastewater Utility Master Plan anticipated to be developed later this year.

STAFF RECOMMENDATION:
Staff recommends that the WRAB recommend acceptance of the revised, draft Master Plan and note additional comments or revisions they would like to see to improve the final document prior to moving forward through the approval process.

Attachments

- Attachment A: City of Boulder's Draft Wastewater Treatment Plant (WWTP) Master Plan

C I T Y O F B O U L D E R
PLANNING BOARD AGENDA ITEM

MEETING DATE: May 3, 2007
(Agenda Item Preparation Date: April 26, 2007)

AGENDA TITLE:

Public Hearing and consideration of a recommendation to City Council concerning the Wastewater Treatment Plant (WWTP) Master Plan Update.

REQUESTING DEPARTMENT:

Planning Department
Ruth McHeyser, Acting Planning Director
Susan Richstone, Acting Long Range Planning Manager
Jean Gatza, Presenter

Utilities Division
Ned Williams, Director of Public Works for Utilities
Bob Harberg, Engineering Project Management Coordinator
Randy Earley, Utilities Project Manager

EXECUTIVE SUMMARY:
The purpose of this meeting is to review the Wastewater Treatment Plant Master Plan Update and provide a recommendation to City Council prior to acceptance of the Plan. The master plan will guide the approach used to meet the new regulatory requirements for treatment plant improvements and operations.

The Planning Board's role in reviewing master plans is to look for consistency with the Boulder Valley Comprehensive Plan (BVCP) goals and policies before the plans are accepted by the City Council. The City Council will consider acceptance of the plan in June or July. The specific questions before the Planning Board are:

1. Is the master plan consistent with the goals, policies, and growth projections of the BVCP?
2. Does the Master Plan outline the BVCP Service Standards and a plan to meet them in the future?
3. Does the plan/update describe and assess capital needs and a funding plan for them?

Attachment A contains the draft 2007 Wastewater Treatment Plant Master Plan. Attachment B contains the revised BVCP Wastewater Treatment Program Summary.

BACKGROUND AND WASTEWATER TREATMENT PLANT MASTER PLAN OVERVIEW

The Wastewater Treatment Master Plan replaces the WWTP Facilities Plan prepared in 1990 and the WWTP Utility Plan revised in 2002. This Master Plan has been developed to describe the Phase I wastewater treatment improvements required by the 2003 discharge permit currently under construction and to plan for Phase II future improvements that will likely be required by new permit restrictions in 2008.

Boulder's WWTP improvements are typically driven by regulatory requirements included in the Colorado Department of Public Health and Environment (CDPHE) issued discharge permit. The discharge permit focuses on reducing impacts of the wastewater discharge to the aquatic habitat and protecting downstream water uses. Because these improvements are both costly and take many years to design and construct, the utility must work to anticipate future needs many years before they are required.

The plan presents future improvements that will be vital to the WWTP facility's continued success in meeting regulatory requirements and Boulder Valley Comprehensive Plan goals and service standards.

Phase I improvements are anticipated to be complete in early 2008 and include:

- Liquid stream improvements to increase plant capacity and meet discharge permit limits (reduce ammonia nitrogen discharge), and
- Dewatering improvements to increase solids dewatering capacity and reduce biosolids handling requirements.

Phase II improvements will likely be required by new permit restrictions to be issued in 2008 and may include:

- Liquid stream improvements to reduce discharge of total inorganic nitrogen and phosphorus,
- Replace chemical disinfection with UV disinfection,
- Increase biosolids stabilization (digester capacity), and
- Possible odor and noise mitigation

STAFF RECOMMENDATION:

Staff recommends that the Planning Board:

1. Recommend that the City Council accept the Wastewater Treatment Plant Master Plan, and
2. Approve the proposed changes to the BVCP Wastewater Treatment Master Plan Summary.

PURPOSE:

Purpose of Planning Board Review of Master Plans:

The Boulder Valley Comprehensive Plan (BVCP) provides a general statement of the community's long-term desired future. Departmental and system master plans take the goals and policies of the BVCP and provide specific guidance for delivering city services. Master plans establish detailed policies, priorities, service standards, facility and system needs and capital budgeting for the delivery of services.

The Planning Board's role in reviewing master plans is to look for consistency with the BVCP goals and policies before the plans are accepted by the City Council. Because of its role in reviewing the CIP, the Planning Board also reviews master plans to ensure that they identify needed improvements and financial strategies to meet adopted service standards. Master plans provide a bridge between the Comprehensive Plan, service delivery, future capital needs, and the CIP. The questions that are the focus of the Board's review are:

1. Is the master plan consistent with the goals, policies, and growth projections of the Boulder Valley Comprehensive Plan?
2. Does the Master Plan outline the BVCP Service Standards and a plan to meet them into the future?
3. Does the plan/update describe and assess capital needs and a funding plan for them?

After the Planning Board's review of the Wastewater Treatment Plant Master Plan Update, the document will be forwarded to City Council for acceptance. The Planning Board's recommendations will be included in the staff memorandum.

PUBLIC PROCESS AND FEEDBACK:

The draft Wastewater Treatment Plant Master Plan Update has been review internally by wastewater utility staff and was distributed to the members of the city's interdepartmental master planning staff group for review and comment.

The Water Resources Advisory Board (WRAB) reviewed the WWTPMP on January 22, 2007 in a public hearing, and again on March 19, 2007 when the board unanimously recommended approval of the plan and the associated capital improvements. (See Attachment C for the summary minutes.) No public comments were received at either WRAB meeting. In the March meeting, the WRAB did question the impact of recent downward flow trends.

All the potential second phase and future improvements presented in the plan will require a Community and Environmental Assessment Process (CEAP) and a Boulder County 1041 'Matters of State Interest' review and approval. Additionally, a wastewater utility wide master plan will be brought forward in 2008 that will combine this master plan with elements of the Water Quality Master Plan and the 2003 Collection System Master Plan.

ANALYSIS:

Issues for Planning Board Review:

1. Is the master plan consistent with the goals, policies, and growth projections of the Boulder Valley Comprehensive Plan?

This section focuses on the policies in the comprehensive plan that are most relevant to the WWTP Master Plan. In particular, the following plan policies are relevant:

- Leadership in Sustainability (1.07)
- Protection of Water Quality (4.26)
- Water Resource Planning (4.27)
- Pollution Control (4.33)
- Wastewater (4.34)

1.07 Leadership in Sustainability.

The city and county will apply the principles of sustainability to their actions and decisions. The city and county will act as community leaders and stewards of our resources, serving as a role model for others and striving to create a sustainable community that lives conscientiously as part of the planet and ecosystems we inhabit and that are influenced by our actions. Through their master plans, regulations, policies and programs, the city and county will strive to create a healthy, vibrant and sustainable community for future generations.

4.26 Protection of Water Quality.

Water quality is a critical health, economic and aesthetic concern. 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. The city and county will seek to reduce point and nonpoint sources of pollutants. Special emphasis will be placed on regional efforts such as watershed planning and protection.

4.27 Water Resource Planning.

The city and county will work together and with other governmental agencies to develop and implement appropriate water quality standards, water resource allocations, and water quality protection programs. Water resource planning efforts will include such things as water quality master planning, surface and ground water conservation, and evaluation of pollutant sources.

4.33 Pollution Control.

The city and county will seek to control both point and non-point sources of water through pollution prevention, improved land use configurations, wetland detention areas, erosion control and other construction standards, standards to control degradation of streams and lakes caused by storm runoff in urban and rural areas, and control and monitoring of direct sources of discharge, including those of gravel extraction and wastewater treatment facilities.

4.34 Wastewater.
The city will meet all requirements for wastewater treatment under its National Pollution Discharge Elimination System Permit and evaluate additional voluntary standards as appropriate. The city and county support the County Board of Health's policy discouraging the installation of private sewage disposal systems where municipal collection systems are available or where a potential pollution or health hazard would be created. The city and county will support the development of programs to monitor problems associated with failing septic systems.

The primary purpose of the plan is to outline necessary capital projects and operating changes to improve the treatment plant to meet regulatory requirements. In addition to achieving this goal, the plan describes an approach for improvements to the WWTP to further a proactive status regarding environmental stewardship and treatment plant efficiency.

Changes to the treatment processes will improve water quality discharge into Boulder Creek. Improvements under construction will remove significant amounts of ammonia from the plant's effluent and improve aquatic habitat. These phase I improvements are designed to facilitate additional improvements to remove additional nutrient as may be required by the new permit in 2008.

Improvements to the solids dewatering process will result in the volume of material removed from the WWTP to decrease by nearly 50%, resulting in reduced hauling costs and associated fuel usage and disposal costs. Annual fuel cost savings have been estimated from $18,200 to $30,300. But these figures don't include other costs, like manpower and equipment replacement savings, associated with hauling and disposal of a reduced volume of biosolids.

The planned improvements will provide improved working conditions and reduce exposure to hazardous chemicals. This will provide a safer environment for plant workers and for the surrounding neighborhoods.

The improvements will allow the plant to provide additional treatment capacity for the growth projected in both population and employment based on the projections in the Boulder Valley Comprehensive Plan.

2. Does the master plan outline BVCP Service Standards and a plan to meet them into the future?

Policies 3.01 (Provision of Urban Services in the Boulder Valley), 3.02 (Definition of Adequate Urban Facilities and Services), 3.03 (Phased Extension of Urban Service / Capital Improvements Program) and the defined Urban Service Criteria and Standards describe the service standards service delivery expectations and the capital planning process. The master planning process is where the Comprehensive Plan requirements are translated into specific components of service delivery.

For wastewater collection services, the Comprehensive Plan outlines various service standards (pg. 140 in the BVCP). The existing WWTP has met the service standards and is being upgraded to treat additional wastewater flows and meet stricter effluent ammonia nitrogen limits in Phase I. Phase II improvements are anticipated in response to probable more stringent discharge permit limitations (nitrogen and phosphorus) in 2008, the desire to replace the existing chemical disinfection (chorine and sulfur dioxide) process with an ultraviolet (UV) disinfection process, and the need to address biosolids stabilization (digester capacity) issues.

3. Does the plan/update describe and assess capital needs and a funding plan for them?
Phase I improvements were funded by wastewater utility rate increases in 2005, 2006 and 2007. Utility rate adjustments are approved by City Council on an annual basis. The Phase I improvements represent an "action level" position meaning that immediate action be taken on items of the most urgent need - capacity requirements and permit limits, with the incorporation of additional proactive elements based on anticipated regulatory concerns, environmental quality, and available funding.

Phase II future improvements have been considered in the design and construction of Phase I to minimize costs in the future. Many anticipated treatment challenges can be more cost effectively dealt with during current construction activities than at a later date. Additional funding for Phase II may require additional rate increases and will be evaluated by the utility and City Council on an annual basis.

Conclusion:

1. In answering the questions before the Planning Board, staff believes that the Wastewater Treatment Plant Master Plan is consistent with the goals, policies and growth projections of the BVCP.
2. One of the primary purposes of the WWTP Master Plan is to ensure that the treatment plant continues to meet the BVCP service standards for urban sewer. The master plan describes the facility's roles, project priorities and management plans that will guide future operations.
3. Consistent with the city's business plan, the proposed master plan presents a phased plan for capital needs. The plan outlines anticipated capital and operating needs as well as costs for these improvements.

Approved By:

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Ruth McHeyser
Acting Planning Director

ATTACHMENTS:

A	Wastewater Treatment Plant Master Plan
B	Revisions to the BVCP Wastewater Treatment Master Plan Summary
C	Summary Minutes from the March 19, 2007 Water Resources Advisory Board Meeting.

C I T Y O F B O U L D E R
CITY COUNCIL AGENDA ITEM

MEETING DATE: June 5, 2007

AGENDA TITLE: Consideration of a motion accepting the Wastewater Treatment Plant Master Plan and the associated revision of the Boulder Valley Comprehensive Plan Wastewater Treatment Plan Summary

PRESENTER/S:
Ned Williams, Director of Public Works for Utilities
Bob Harberg, Engineering Project Management Coordinator
Randy Earley, Utilities Project Manager

EXECUTIVE SUMMARY:

The attached Wastewater Treatment Plant Master Plan (WWTP MP) presents the approach and drivers for improvements at the wastewater treatment plant (WWTP). Also attached is a revised WWTP MP summary for inclusion in the Boulder Valley Comprehensive Plan (BVCP).

The Facilities Plan, prepared in 1990, and the Utilities Plan, revised in 2002, were the last planning documents addressing WWTP needs. The WWTP MP is based upon existing documents, including the Utility Plan submitted to the Denver Regional Council of Governments (DRCOG), the Community Environmental Assessment Process (CEAP) for the WWTP Liquid Stream Improvements and the CEAP for the Solids Handling Improvements Project, both now under construction, and updated population projections. This master plan was prepared to bring the wastewater planning documents into the city master plan framework.

Colorado State Department of Public Health and Environment (CDPHE) sets discharge requirements contained in Boulder's National Pollutant Discharge Elimination System (NPDES) permit. The need for improved water quality in the plant effluent, set by the discharge permit, is the primary driver for improvements at the WWTP. The WWTP MP presents the approach that was used to determine the processes best suited to meet the regulatory requirements in the current permit and potential improvements that may be needed to meet future permit requirements. However, because specific future permit limits are unknown, new challenges may be presented every permit cycle, which is five years, because there is the potential for more stringent effluent requirements with each new permit.

This item requests the City Council accept the WWTP MP, which guides future decisions on wastewater treatment plant improvements and services, and the revised BVCP WWTP master plan summary that incorporates the WWTP MP.

STAFF RECOMMENDATION:

Staff recommends that the Council accept the Wastewater Treatment Plant Master Plan and approve the BVCP WWTP MP summary changes.

COUNCIL FILTER IMPACTS:

- **Economic:** The planned second phase of the wastewater treatment plant liquid stream improvements project may require user rate increases. To continue meeting conditions of future discharge permits, further improvements are anticipated that may also result in future rate increases to support the improvements to effluent quality.
- **Environmental:** The long term impact of this master plan is the continued improvement of water quality in Boulder Creek. Additionally, the approach outlined in the plan will allow the city of Boulder to continue meeting CDPHE discharge permit requirements. Environmental costs of treating wastewater include impacts associated with energy consumption and chemical use.
- **Social:** The potential, future rate increases can disproportionately affect lower income residential customers. But improved water quality in Boulder Creek has wide societal benefits.

OTHER IMPACTS:

- **Fiscal:** The projects identified in the master plan are included in the 2008-2013 Capital Improvements (CIP) budget. The proposed second phase of the WWTP construction is scheduled in 2010 to address anticipated changes to the discharge permit effluent limits to be issued by the CDPHE in 2008.
- **Staff time:** The work needed to construct and operate the WWTP in the future is normal for the utilities group.

BOARD AND COMMISSION FEEDBACK:

The WWTP Master Plan was presented to the Water Resources Advisory Board (WRAB) as an informational item in January 2007 and then again in March 2007 for a final recommendation. The Planning Board heard the WWTP MP agenda item on May 3, 2007, which included the revisions to the BVCP Wastewater Treatment Plan summary. The WRAB and the Planning Board voted unanimously to recommend acceptance of the master plan to the City Council. The Planning Board also voted unanimously to recommend the revisions to the BVCP Wastewater Treatment Plan summary.

PUBLIC FEEDBACK:

No public comments were made at the two WRAB meetings or at the Planning Board meeting concerning the WWTP MP.

ANALYSIS:

The approach used to determine the phase 1 improvements is presented in this WWTP MP. Ongoing phase 1 construction improvements will provide enhanced ammonia removal and increase the hydraulic capacity for future 2025 flows as required by the 2003 NPDES permit. The plan also presents anticipated phase 2 improvements, which may be needed to meet the 2008 NPDES permit conditions. Those improvements are still undetermined, but may include process improvements to meet limits on total nitrogen, work on the existing digesters to improve solids stabilization, construction of an ultraviolet light disinfection system and/or possible construction of noise and odor control measures. The plan also includes some additional speculative potential future requirements.

This master plan represents the action level of response to future needs. The approach presented in the WWTP MP does more than meet the minimum requirements of the present discharge permit which would be the fiscally constrained level of action. This master plan approach anticipates future needs to invest in facilities that will provide service as far as possible into the future. This is accomplished by researching the industry trends to project where future discharge limitations might be headed and by selecting treatment processes that offer the most flexibility in the future. Other approaches could cost less in the short term but eventually could result in higher long term expenses.

The city of Boulder is required by federal and state regulations to meet the conditions set forth in CDPHE issued NPDES permit. It can be difficult to meet these requirements because the permit is re-issued every 5 years and each new permit can contain major revisions to discharge limits that require construction of new treatment processes. The approach presented in this master plan allows continued compliance with the permit conditions. Council should consider acceptance of the WWTP MP to provide guidance for future WWTP operation and capital improvement decisions. If this master plan is accepted by Council, it will be used in conjunction with Boulder's 2003 Collection System Master Plan and components from the Water Quality Master Plan, currently being prepared, to create a wastewater utility-wide master plan.

Council can choose not to accept this master plan and elect to wait for the creation of the utility wide master plan before acceptance. However, the city's next NPDES permit is scheduled for renewal in early 2008, which is likely to occur before the utility-wide master plan can be ready. The decision to maintain the status quo would result in the continued use of the CEAP as the sole city approval process for required improvements, which may result in some loss of the planning element.

Approved By:

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Frank W. Bruno,
City Manager

ATTACHMENTS:
Attachment A -Wastewater Treatment Plant Master Plan
Attachment B - Revised Boulder Valley Comprehensive Plan (BVCP) Wastewater Treatment Plant Master Plan Summary
Attachment C - May 3, 2007 Planning Board meeting minutes
Attachment D - January 22, 2007 Water Resources Advisory Board Meeting Summary
Attachment E -March 19, 2007 Water Resources Advisory Board Meeting Summary

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