PUBLIC WORKS DEPARTMENT
MEMORANDUM #2011 – 24

DATE: June 9, 2011

TO: Honorable Mayor Joyce Downing and City Council Members

FROM: William A. Simmons, City Manager
David H. Willett, Director of Public Works

SUBJECT: Action Item – Submit Wastewater Utility Plan Update to Planning Organizations

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BACKGROUND

On June 11, 2009 City Council approved CR-67 that executed a Professional Service Agreement between the City of Northglenn and HDR Engineering, Inc (HDR) to update the Wastewater Treatment Plant Utility Plan (Utility Plan). The updated Utility Plan was brought to City Council study session for discussion in November 2010. At the November study session, Council requested that the population projections for 2020 and 2035 include the constrained condition identified in the Northglenn/Thornton Intergovernmental Agreement (IGA). Staff brought the Utility Plan back to Council study session on April 21, 2011 with constrained and unconstrained population projections. At the April study session Council directed staff to constrain the wastewater capital improvement project summary. The Utility Plan as currently formatted references these projects in association with the current planning cycle (see Table 1-9, pg 1-11). Future projects are referred to as projects that may occur in future planning cycles (see Table 1-10, pg 1-12). The capital improvement summary (see Table 1-11, pg 1-19) includes only projects and cost estimates within the current planning cycle.

The Utility Plan is an essential document that incorporates all current information that directly impacts the *wastewater treatment system*. Staff will use the document for capital project planning as the Utility Plan will identify potential future discharge requirements and water projections. Utility plans are typically updated every 5-7 years. The 2011 Wastewater Utility Plan Update builds upon the 2003 Wastewater Utility Plan.

SERVICE AREAS

Uniquely the Northglenn wastewater service area includes two separate geographical areas. The Southern Service Area (SSA) consists of the area within the corporate boundaries. Growth in the SSA is expected to be in the form of redevelopment and densification. The Northern Service Area (NSA) consists of Section 36, also within corporate boundaries, and adjacent land located in Weld County. The NSA could be impacted by the development density identified in the IGA. This is an important factor in the long range Capital Improvement Program (CIP) related to plant capacity as the primary growth occurs in the NSA, with potential full build-out by 2035. Anticipate near term CIP are identified based on regulatory drivers and operational improvements.

PLANT CONFIGURATION

The WWTP was originally built as an Aerated Lagoon Treatment System and later upgraded biological nutrient removal (BNR) treatment facility in 2006. However, due to funding constraints, a number of process units recommended in the 2003 Utility Plan, and included in the Site Application submitted to Colorado Department of Public Health and Environment (CDPHE), were not constructed including an influent headworks facility, primary clarifier, and solids handling. Therefore, plant influent still flows through the first two aerated cells of the original Aerated Lagoon Treatment System prior to the BNR Treatment System to equalize flow (due to capacity restrictions in the new BNR Treatment System) and provide for some settling and removal of biological and inert solids (due to lack of headworks).

The WWTP is currently meeting the water quality standards set by Colorado Department of Public Health and Environment.

RECOMENDATION

Proposed Steps:

1. Staff will submit the Utility Plan to Colorado Department of Public Health and Environment (CDPHE) and North Front Range Water Quality Planning Association (NFRWQPA) for planning jurisdiction review.
2. Staff and HDR will address comments from the two organizations and make any necessary revisions for *conditional approval* of the Utility Plan by Planning Organizations.
3. Receive *final approval* from City Council of the Utility Plan.
4. Receive DRCOG and CDPHE *final approval* of the Utility Plan.

STAFF REFERENCE

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Attachments:

A. Wastewater Utility Plan Update Executive Summary

1.0 Executive Summary

1.1. Introduction

In 2009 the City of Northglenn undertook the task of updating the plan for the future of the City's wastewater collection and treatment facility. The goals of the planning effort were to define the conditions of the existing infrastructure, describe improvements necessary to meet discharge permit and operational requirements, protect water resources, evaluate growth trends and estimate future impacts, and accommodate existing users and future growth. A capital improvements plan and financial program was developed to ensure the goals of the utility are accomplished. This document builds upon and revises the information presented in the 2003 Wastewater Utility Plan (2003 Plan) included in Appendix A. As noted in the Table of Contents, some information required for review of this document did not change and is included in the original 2003 Plan. This executive summary briefly describes the chapter contents, conclusions and recommendations arising from this document.

1.2. Objectives and Purpose

The purpose of this chapter is to provide a summary of the key components contained in this Wastewater Utility Plan Update.

1.3. Basis of Planning (Chapter 2)

Determination of the demand on the wastewater collection and treatment system is dependent on land use, population density, the magnitude and type of commercial activity to be served, the condition of the existing system and regulatory requirements. The area studied in this document was established through meetings with City Staff and by examination of zoning, planning jurisdiction and environmental conditions. The Northglenn wastewater utility service area (WUSA) includes two separate geographical areas. The Southern Service Area (SSA) consists of the area within the Northglenn corporate boundaries and three Enclaves within the City of Thornton adjacent to the southern boundary of Northglenn. The Northern Service Area (NSA) consists of Section 36, a portion of the Intergovernmental Agreement (IGA) area decreed in 1993, and adjacent land located in Weld County north and east of the Northglenn WWTP.

Estimates of population were developed using three data sources; the NFRWQPA 2007 Water Quality Plan Update, the 2009 Northglenn Comprehensive Plan and the Denver Regional Council of Governments (DRCOG)'s Transportation Analysis Zone (TAZ) model results. The most recent large population increase occurred in the mid 90's with the addition of the Fox Run subdivision. The current (2010 Census) population estimate within the city limits is approximately 35,789. It is expected the current economic slow down being experienced across the nation has also slowed growth rates within the City of Northglenn. However, since redevelopment and densification in the SSA is expected and there is

potential for some development in the NSA, population should increase in the future until buildout conditions are reached in approximately 2035. Theoretical build-out of the study area was calculated based on two scenarios; a constrained IGA and an unconstrained IGA. Both scenarios assume that all developable land within the study area will be developed, giving a maximum density for the study area. Based on the 1993 IGA agreement with Thornton, density is limited to 1 unit per acre. The population forecast for the IGA constrained scenario is summarized in Table 1-1. Table 1-2 summarizes the IGA unconstrained scenario which assumes the land within the WUSA which also is located in the IGA can be developed at a much higher density. The land use developed for the NSA WUSA based on the IGA unconstrained scenario is shown on Figure 2-10 and was developed through numerous workshops with City Planning Staff.

Table 1-1: Northglenn Predicted Study Area Population - IGA Constrained Scenario

Year	Population	Added Population	Annual Percentage Growth	Employment
2010	35,789	-	-	11,529
2020	42,029	6,240	1.7%	16,008
2035	48,959	6,930	1.6%	21,598

Source: Population and employment numbers from Tables 2-14 and 2-17.

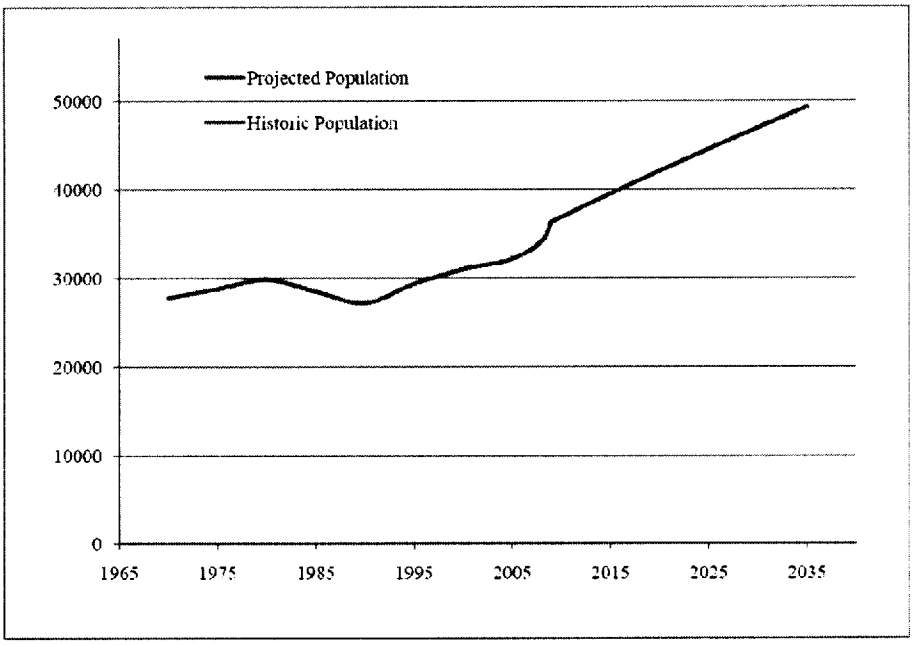
Table 1-2: Northglenn Predicted Study Area Population - IGA Unconstrained Scenario

Year	Population	Added Population	Annual Percentage Growth	Employment
2010	35,789	-	-	11,529
2020	45,244	9,455	2.6%	17,757
2035	56,986	11,742	2.6%	25,754

Source: Population and employment numbers from Tables 2-14 and 2-18.

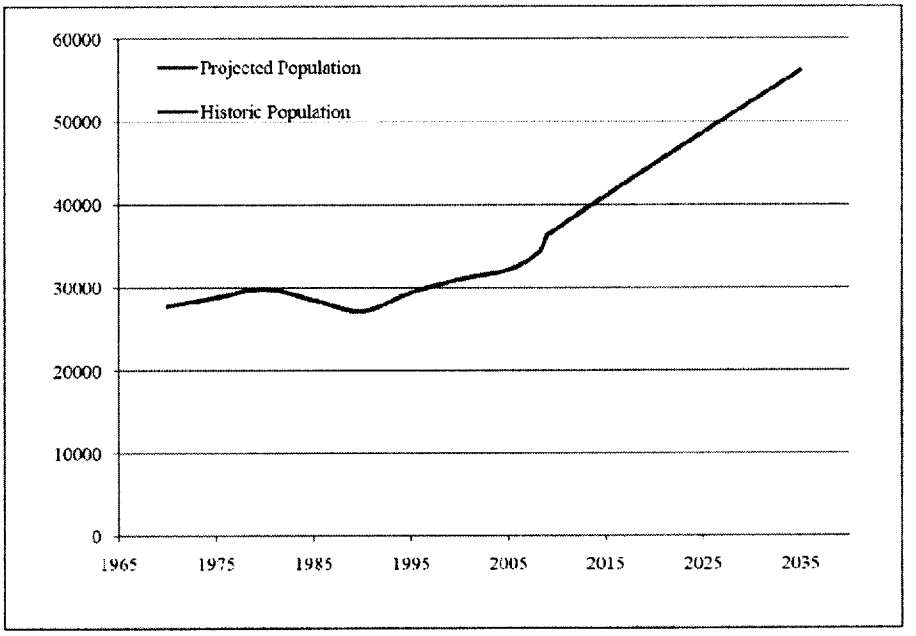
Chart 1-1 and 1-2 below provides the total WUSA population and employment forecasts based on the IGA constrained and unconstrained scenarios.

Chart 1-1: Study Area Projections within the WUSA – IGA Constrained Scenario



Source: Historical population provided by the U.S. Census and DRCOG.
Note: The historic population is displayed as a running five year average.

Chart 1-2: Study Area Projections within the WUSA – IGA Unconstrained Scenario



Source: Historical Population provided by the U.S. Census and DRCOG.
Note: The historic population is displayed as a running five year average.

To appropriately plan for necessary improvements to the wastewater collection and treatment systems, meet current and future permit requirements, meet operational

requirements, and to adequately meet the demands of existing and future population, historical flow and loading data was first examined and unit loadings and peaking factors established. These factors were then used in conjunction with population projections to arrive at projected flow and loading to the wastewater treatment plant. The per capita unit loadings are combined with population and peaking factors to generate projections of future loading for the IGA constrained and unconstrained scenarios. Tables 1-3 and 1-4 summarize existing and projected flow and loading.

Table 1-3: IGA Constrained Scenario - Northglenn WWTP Existing and Projected Wastewater Loading

Criteria	Year 2010	Year 2020	Year 2035
Sewered Population	36,304	42,034	48,959
Average Daily Flow, MGD	3.82[1]	4.35	5.14
Peak Hour Dry-Weather Flow, MGD[2]	6.95	7.92	9.35
Peak Hour Wet-Weather Flow, MGD[3]	11.46	15.27	21.38
Influent BOD_5, lb/d	7,644[1]	8,849	10,308
Influent TSS, lb/d	7,965[1]	9,221	10,741
Influent Total Ammonia, lb/d	803[1]	930	1,083

[1]Yearly average from 2008 flow data.
[2]Calculated from the average dry-weather flow multiplied by the established peak hour dry weather peaking factor (1.82).
[3]Calculated by adding the average dry-weather flow with peak hour wet-weather flow using I&I factor of 2,389 gpd/acre multiplied by the sewered area.

Table 1-4: IGA Unconstrained Scenario – Northglenn WWTP Existing and Projected Wastewater Loading

Criteria	Year 2010	Year 2020	Year 2035
Sewered Population	36,304	45,422	56,986
Average Daily Flow, MGD	3.82[1]	4.72	5.85
Peak Hour-Dry Weather Flow, MGD[2]	6.95	8.59	10.65
Peak Hour-Wet Weather Flow, MGD[3]	11.46	15.64	22.06
Influent BOD_5, lb/d	7,644[1]	9,564	11,998
Influent TSS, lb/d	7,965[1]	9,965	12,503
Influent Total Ammonia, lb/d	803[1]	1,005	1,260

[1]Yearly average from 2008 flow data.
[2]Calculated from the average dry-weather flow multiplied by the established peak hour dry weather peaking factor (1.82).
[3]Calculated by adding the average dry-weather flow with peak hour wet-weather flow using I&I factor of 2,389 gpd/acre multiplied by the sewered area.

1.4. Regulatory Drivers (Chapter 3)

Prior to selecting and sizing wastewater treatment facilities, a thorough understanding of current and future regulatory drivers is required. Chief among the permitting requirements is the April 1, 2010 Colorado Discharge Permit CO-0036757, which set updated effluent discharge standards for Big Dry Creek (the permit also set updated standards for the Thompson Ditch and Bull Canal discharges as well). Another significant action with implications for the Northglenn discharge is the recent reassessment of the South Platte River as a potential water supply. These permit issues govern effluent quality and have implications for the wastewater management choices available to the City.

Effluent from the Northglenn WWTP is discharged to a number of locations including Bull Reservoir, Bull Canal via Bull Reservoir, Thompson Ditch, and Big Dry Creek. The City of Northglenn WWTP discharge permit provides the same discharge limits for each outfall. Presently, the City discharges all effluent to Bull Canal, however in the future, discharge to Big Dry Creek is preferred. Flow in Big Dry Creek is dominated by irrigation diversions, storm water flows, reuse water, and wastewater effluent discharges and is designated as Use Protected, Warm Water Aquatic Life 2, Class P Recreation, Agriculture. Based on the April 1, 2010 Colorado Discharge Permit CO-0036757, the site specific in-stream water quality standards for this stretch of river is provided in Table 1-5.

Table 1-5. Water Quality Standards for Stream Segment COSPBD01 Based on Colorado Discharge Permit CO-0036757

Parameter	Value	Units
Physical and Biological		
Dissolved Oxygen (DO)	5	mg/L
pH	6.5-9	s.u.
Fecal Coliform	325	Colonies/100mL
E. Coli	205	Colonies/100mL
Inorganic		
Un-Ionized Ammonia - Acute	TVS	
Un-Ionized Ammonia - Chronic	0.1	mg/L
Chlorine - Acute	0.019	mg/L
Chlorine - Chronic	0.011	mg/L
Free Cyanide - Acute	0.005	mg/L
Sulfide - Chronic	0.0002	mg/L
Boron - Chronic	0.75	mg/L
Nitrite	4.5	mg/L
Chloride - Chronic	250	mg/L
Sulfate - Chronic	Water Standard	mg/L

Parameter	Value	Units
Metals		
Total Recoverable Arsenic - Acute	100	µg /L
Dissolved Beryllium - Chronic	100	µg /L
Dissolved Cadmium - Acute/Chronic	15.7/5.2	µg /L
Dissolved Trivalent Chromium - Acute/Chronic	1,451/189	µg /L
Dissolved Hexavalent Chromium - Acute/Chronic	16/11	µg /L
Dissolved Copper - Acute/Chronic	39.4/23.7	µg /L
Total Recoverable Iron - Chronic	1,000	µg /L
Dissolved Lead - Acute/Chronic	218/8.5	µg /L
Dissolved Manganese - Acute/Chronic	4,366/2,412	µg /L
Total Mercury - Chronic	0.01	µg /L
Dissolved Nickel - Acute/Chronic	1,229/136	µg /L
Dissolved Selenium - Acute/Chronic	19.1 (Nov 1 to March 31)/ 7.4 (Apr 1 to Oct 31), 15 (other periods)	µg /L
Dissolved Silver - Acute/Chronic	14.4/2.3	µg /L
Dissolved Zinc - Acute/Chronic	308/308	µg /L

Based on limits discussed in Colorado Discharge Permit CO-0036757 and continued conversations with CDPHE permitting staff, the future effluent requirements are expected to include a limit on nitrate or total nitrogen and a limit on phosphorus. The following water quality targets will be used for the 10 year planning window:

Biochemical Oxygen Demand (BOD5)	30 mg/L
Total Suspended Solids (TSS)	30 mg/L
Ammonia Nitrogen	2 mg/L
Total Inorganic Nitrogen (TIN)	7 mg/L
Total Phosphorus	1 mg/L

1.5. Wastewater Treatment Facility Evaluation and Alternatives Development (Chapter 4)

The City of Northglenn operates a wastewater treatment plant (WWTP) that treats domestic and commercial wastewater collected within the sewer service area. The WWTP is located approximately 9 miles to the north in Weld County within the Big Dry Creek basin. The Northglenn WWTP was originally planned as a regional facility to serve new developments in the area north of 100th Avenue and east of I-25. The Northglenn WWTP was originally built as an Aerated Lagoon Treatment System and later upgraded with a 3-train BNR treatment facility in 2006. However, due to funding constraints, a number of

process units recommended in the 2003 Plan and included in the Site Application were not constructed including an influent headworks facility, primary clarification, and solids handling. Therefore, plant influent still flows through the first two aerated cells of the original Aerated Lagoon Treatment System prior to the BNR (biological nutrient removal) Treatment System to equalize flow (due to capacity restrictions in the new BNR Treatment System) and provide for some settling and removal of biological and inert solids (due to lack of headworks).

The WWTP process includes the following components:

- Influent splitter box at the Aerated Lagoon Treatment System.
- First two cells of the original Aerated Lagoon Treatment System each with a volume of 11.6 MG.
- Three BNR activated sludge treatment trains (anaerobic, anoxic, and aerobic zones) each with a volume of 1 MG.
- Blower building.
- Two 65 foot diameter round Secondary Clarifiers.
- Final effluent pumping system.
- UV disinfection system.
- Return activated sludge pumping system.
- Waste activated sludge pumping system.
- One 20 MG sludge storage and stabilization lagoon (part of the original Aerated Lagoon Treatment System).

The capacity of the existing treatment plant was evaluated against current and predicted flow and loading conditions. Tables 1-6 and 1-7 summarize the capacity of each process unit based on the IGA constrained and unconstrained scenarios.

Table 1-6: IGA Constrained Scenario – Northglenn WWTP Capacity Rating Evaluation Summary

Unit Process	Capacity Criteria	Rated Capacity Ave/Peak	Current Condition Ave[1]/Peak[2]	Year 2020 Ave[1]/Peak[2]	Year 2035 Ave[1]/Peak[2]	Comment
Influent Pipeline	Hydraulic	20.6 MGD/ 20.6 MGD	3.82 MGD/ 11.46 MGD	4.35 MGD/ 15.27 MGD	5.14 MGD/ 21.38 MGD	Adequate capacity for future
Influent Flow Control Box	Hydraulic	11.3 MGD/ 20 MGD	3.82 MGD/ 11.46 MGD	4.35 MGD/ 15.27 MGD	5.14 MGD/ 21.38 MGD	Adequate capacity for future
BNR Treatment System	BOD and nutrient removal	5.0 MGD / 16 MGD	3.82 MGD/ 11.46 MGD	4.35 MGD/ 15.27 MGD	5.14 MGD/ 21.38 MGD	Adequate capacity to meet 2020 conditions
Secondary Clarifiers	Solids Loading	4.0 MGD/ 8 MGD	3.82 MGD/ 11.46 MGD	4.35 MGD/ 15.27 MGD	5.14 MGD/ 21.38 MGD	Lacking redundancy to allow for periodic maintenance

Unit Process	Capacity Criteria	Rated Capacity Ave/Peak	Current Condition Ave[1]/Peak[2]	Year 2020 Ave[1]/Peak[2]	Year 2035 Ave[1]/Peak[2]	Comment
Return Activated Sludge Pumping	Hydraulic	2 MGD/ 4 MGD	3.82 MGD/ 6.65 MGD[3]	4.35 MGD/ 7.57 MGD[3]	5.14 MGD/ 8.94 MGD[3]	Capacity limited for a RAS rate of 100% influent maximum month flow
Secondary Scum Pumping	Hydraulic	180 gpm	96 gpm	121 gpm	150 gpm	Adequate capacity for future
Waste Activated Sludge	Solids	280 gpm	60 gpm	76 gpm	95 gpm	Adequate capacity for future
UV Disinfection Equipment and Channels	Hydraulic	4 MGD/ 10 MGD	3.82 MGD/ 11.46 MGD	4.35 MGD/ 15.27 MGD	5.14 MGD/ 21.38 MGD	Additional capacity needed for UV disinfection system to meet peak demands
Sludge Storage	Storage Time	365 days	242 days	190 days	153 days	Adequate capacity for future
Sludge Land Application	Land Required	143 acres	203 acres	259 acres	321 acres	Assuming crops will be harvested only once a year

[1] Average Daily Flow
[2] Peak Hour Wet Weather Flow
[3] Maximum Monthly Flow. Calculated by multiplying average daily flow by 1.74.

Table 1-7: IGA Unconstrained Scenario – Northglenn WWTP Capacity Rating Evaluation Summary

Unit Process	Capacity Criteria	Rated Capacity Ave/Peak	Current Condition Ave[1]/Peak[2]	Year 2020 Ave[1]/Peak[2]	Year 2035 Ave[1]/Peak[2]	Comment
Influent Pipeline	Hydraulic	20.6 MGD/ 20.6 MGD	3.82 MGD/ 11.46 MGD	4.72 MGD/ 15.64 MGD	5.85 MGD/ 22.06 MGD	Adequate capacity for future
Influent Flow Control Box	Hydraulic	11.3 MGD/ 20 MGD	3.82 MGD/ 11.46 MGD	4.72 MGD/ 15.64 MGD	5.85 MGD/ 22.06 MGD	Adequate capacity for future
BNR Treatment System	BOD and nutrient removal	5.0 MGD / 16 MGD	3.82 MGD/ 11.46 MGD	4.72 MGD/ 15.64 MGD	5.85 MGD/ 22.06 MGD	Adequate capacity to meet 2020 conditions
Secondary Clarifiers	Solids Loading	4.0 MGD/ 8 MGD	3.82 MGD/ 11.46 MGD	4.72 MGD/ 15.64 MGD	5.85 MGD/ 22.06 MGD	Lacking redundancy to allow for periodic maintenance
Return Activated Sludge Pumping	Hydraulic	2 MGD/ 4 MGD	3.82 MGD/ 6.65 MGD[3]	4.72 MGD/ 15.64 MGD	5.85 MGD/ 22.06 MGD	Capacity limited for a RAS rate of 100% influent maximum month flow

Unit Process	Capacity Criteria	Rated Capacity Ave/Peak	Current Condition Ave[1]/Peak[2]	Year 2020 Ave[1]/Peak[2]	Year 2035 Ave[1]/Peak[2]	Comment
Secondary Scum Pumping	Hydraulic	180 gpm	96 gpm	121 gpm	150 gpm	Adequate capacity for future
Waste Activated Sludge	Solids	280 gpm	60 gpm	76 gpm	95 gpm	Adequate capacity for future
UV Disinfection Equipment and Channels	Hydraulic	4 MGD/ 10 MGD	3.82 MGD/ 11.46 MGD	4.72 MGD/ 15.64 MGD	5.85 MGD/ 22.06 MGD	Additional capacity needed for UV disinfection system to meet peak demands
Sludge Storage	Storage Time	365 days	242 days	190 days	153 days	Adequate capacity for future
Sludge Land Application	Land Required	143 acres	203 acres	259 acres	321 acres	Assuming crops will be harvested only once a year

[1] Average Daily Flow
[2] Peak Hour Wet Weather Flow
[3] Maximum Monthly Flow. Calculated by multiplying average daily flow by 1.74.

Changing water quality regulations may dictate improvements to treated wastewater effluent quality. These regulations were taken into consideration when evaluating treatment alternatives. Alternatives were identified and evaluated through an interactive process involving City and consultant staff. Driving forces considered in the evaluation process included permit revisions, age and condition of existing facilities, service area and population growth, process improvement, and impact to neighboring properties. Table 1-8 summarizes the processes evaluated, the alternatives considered, and the alternatives selected for detailed analysis.

Table 1-8: Northglenn WWTP – Alternative Development Ideas and Initial Screening Results

Idea		Triggers	Initial Screening Result
Headworks:			
Alternative H1	No Action - Operate activated sludge process without Headworks	Current operations. However, WWTP is out of compliance with CDPHE as headworks was included in original Site Application	Retain for evaluation. Existing system.
Alternative H2	Construct new Headworks Facility with fine screening and grit removal	Brings facility into compliance with Site Application. Reduces operational problems.	Retain for evaluation.

Idea		Triggers	Initial Screening Result
Primary Treatment:			
Alternative P1	No Action - Operate activated sludge process making use of existing Aerated Lagoon Treatment System (no Primary Clarification)	Current operations. Numerous operational issues including high energy cost, reduced carbon to BNR system, and poor inorganics removal.	Retain for evaluation. Compatible with existing solids handling system.
Alternative P2	Operate activated sludge without existing Aerated Lagoon Treatment System and no Primary Clarification	Allows for operation of the BNR Treatment System as originally designed. Allows for nitrate removal.	Retain for evaluation. Compatible with existing solids handling system.
Alternative P3	Construct new Primary Clarifiers	Allows for reduced solids loading to the BNR Treatment System thereby increasing treatment capacity.	Retain for evaluation. Requires new solids handling system.
Biological Process:			
Alternative B1	Convert existing Anoxic Zone No.2 to swing anoxic/aerobic, convert existing Anaerobic Zone to swing anaerobic/anoxic	Required to increase aerobic capacity.	Retain for evaluation.
Alternative B2	Construct third Secondary Clarifier to provide operational redundancy	Required initially to provide redundancy and in the future to meet flow requirements.	Retain for evaluation.
Alternative B3	Convert Aerobic Zone to IFAS	Required to increase aerobic capacity.	Retain for evaluation.
Alternative B4	Construct fourth BNR Treatment Basin	Required to increase aerobic capacity.	Retain for evaluation.
Alternative B5	Effluent Filtration	Required to meet future effluent phosphorus limits.	Retain for evaluation in case effluent limits get tighter or reclaimed water is desired.
Solids Handling:			
Alternative S1	No Action - Maintain solids stabilization in the Sludge Storage Lagoon and liquid application to agricultural land east of WWTP	Current operations. Limits City's ability to use Bull Reservoir for other uses.	Retain for evaluation. Existing system.
Alternative S2	Construct Sludge Thickening, Digestion, and Dewatering Systems	Reduces solids handling footprint and allows Bull Reservoir to used for other uses.	Retain for evaluation.
Alternative S3	Maintain solids stabilization in the Sludge Storage Lagoon and dewater to create a Class A product	Only required if there is a regulatory driver.	Retain for evaluation.

Idea		Triggers	Initial Screening Result
Alternative S4	Landfill	Not sustainable.	Fail. Too expensive and does not promote use of valuable product.
Support Facilities:			
Alternative SF1	Installation of standby power	Required by CDPHE.	Retain for evaluation.
Alternative SF2	Construction of new administration/operations building	Limited space for operations and maintenance activities.	Retain for evaluation.
Alternative SF3	Additional support facilities -Non-potable water system -Paving	Required as necessary.	Retain for evaluation.

Detailed analysis of retained alternatives for the Headworks, Primary Treatment, Biological Process, Solids Handling, Biosolids Management, and Support Facilities was performed. Recommendations for the current planning cycle (2011 through 2018) treatment plant improvements were based on regulatory compliance and operational requirements and include the following:

Table 1-9: Northglenn WWTP Current Planning Cycle Recommended Improvements

Recommended Improvements	Trigger
Construction of a new Headworks Facility with fine screening, grit removal, and odor control.	• Impaired operations and maintenance • Site application compliance • Regulatory compliance
Construct third secondary clarifier to provide redundancy and additional capacity.	• Impaired operations and maintenance
Decommissioning of the existing Aerated Lagoon Treatment System (cells 1 and 2).	• Impaired operations and maintenance • Site application compliance • Regulatory compliance
Improvements to the BNR Treatment System to increase organic and ammonia capacity to handle additional load from decommissioning of Aerated Lagoon Treatment System: • Converting Anoxic Zone No. 2 to a swing anoxic/aerobic. • Converting Anaerobic Zone to a swing anaerobic/anoxic. • Remove baffle curtains and replace with concrete partition walls. • Remove geothermal heat loop piping from bioreactor.	• Permit requirements • Capacity once Aerated Lagoon Treatment System is decommissioned
Lift Station A Improvements.	• Impaired operations and maintenance
Installation of standby power.	• Impaired operations and maintenance
Improvements to non-potable water system.	• Impaired operations and maintenance
Pave interior access roads at WWTP.	• Impaired operations and maintenance • Regulatory compliance
Expansion of laboratory and operations space.	• Impaired operations and maintenance

Once the current planning cycle capital improvements are completed, the decoupling of the BNR Treatment System from the original Aerated Lagoon Treatment System can be addressed. Following is a list of the future planning cycle (2018 through 2030) recommended improvements.

Table 1-10: Northglenn WWTP Future Planning Cycle Recommended Improvements

Recommended Improvements	Trigger
Decommissioning of Sludge Storage Lagoons and construction of new solids handling system including primary clarification, thickening, digestion, and dewatering.	• Site application compliance • Decouple BNR Treatment System from original Aerated Lagoon Treatment System
Forcemain A Parallel Pipeline	• Redundancy
When necessary, expand biological process capacity through addition of IFAS media to existing basins (increases capacity to approximately 5 MGD) or the construction of a fourth BNR Treatment Basin (increases capacity to approximately 6.7 MGD).	• Capacity
Miscellaneous operations and maintenance improvements. • Replacement of existing UV equipment.	• Impaired operations and maintenance
Installation of effluent filtration.	• Regulatory compliance • Reuse opportunities (water rights)
Develop alternatives for generation of Class A biosolids product.	• Regulatory compliance

1.6. Conveyance Facilities Evaluation (Chapter 5)

1.6.1 Southern Service Area (SSA)

Northglenn's existing wastewater collection system in the SSA consists of approximately 112 miles of pipeline and ten active pump stations. The collection system is divided into several service zones by the local terrain and physical barriers such as arterial roads and Interstate Highway 25 (I-25). I-25 divides the wastewater collection system into two major zones. Most of the flow from the area west of the I-25 corridor flows under the highway through an 18-IN diameter interceptor located just north of 105th Avenue. A small area south of 120th Avenue and west of I-25 is pumped under the highway through a 6-IN diameter force main. Almost all of the wastewater ultimately flows into Pump Station A located on Irma Drive at 105th Place. The remainder of the wastewater flows to the Bunker Hill Lift Station. From Pump Station A and the Bunker Hill Lift Station, the wastewater is conveyed to the Northglenn WWTP through the 8.7 mile, 27-IN diameter Forcemain A.

The flow projections in the SSA, presented in Chapter 2, do not increase substantially between existing and buildout conditions. The increased flows, approximately 0.32 MGD, are mostly due to redevelopment and are relatively spread out with the exception of the Bunker Hill area. The Bunker Hill area has not reached buildout and denser commercial and mixed use development will occur in the near future. For these reasons, the increased flows are assumed to not cause significant future problems within the gravity infrastructure.

Lift Station A and Bunker Hill Lift Station are expected to be affected by the flow increase. However, based on available firm pumping capacity of each lift station and the projected future flows, Lift Station A and Bunker Hill Lift Station appear to provide adequate capacity to meet future conditions.

Lift Station A is critical to delivering wastewater flows from most of the system in the SSA to the WWTP through the 27-IN Forcemain A. Lift Station A was built in 1981 and is twenty-eight years old and in poor condition. Lift Station A operated without a failure from startup in 1981 until 1989. In the period from 1989 through 2001, Lift Station A experienced four failures and three shutdowns due to breaks in the 27-IN Forcemain A. The existing firm capacity for Lift Station A is 13.54 MGD (9,400 gpm) with a total capacity of 20.74 MGD (14,400 gpm). With the peak hour wet-weather buildout flow projection of 10.57 MGD (7,340 gpm), Lift Station A should have enough capacity to handle all future flows. Additionally, Lift Station A is nearing the end of its useful life. URS recently completed an evaluation of Lift Station A in August of 2010. Following is a summary of the major findings and recommendations from the URS "2010 Lift Station A Existing Condition Assessment and Workplan – Final Report of Findings" dated August 27, 2010.

- Lift Station A has a firm pumping capacity with one pump out of service of 13.5 MGD. Based on a future peak hour flow rate of 10.57 MGD, the station has adequate firm pumping capacity.
- Discharge valves can not be reliably closed to isolate the facility from the forcemain and allow for pump maintenance.
- Wet well concrete corrosion due to hydrogen sulfide exposure.
- Numerous area classification violations.
- Isolation valves are original equipment and no longer seal properly.
- Dry well is lacking proper access. Requires a secondary egress.
- Existing Clow pump is at the end of its useful life.

Recommended initial improvements are estimated to cost approximately $685,000 and address a number of the operational and safety issues including valve replacement and electrical code compliance improvements. These improvements will be completed early in the current planning cycle and are estimated to cost $685,000. Assuming Lift Station A is not replaced; the additional improvements will be completed later in current planning cycle. Preliminary construction cost for the additional improvements are estimated at $659,500.

Although the existing 27-IN Forcemain A can meet the projected future demand, the infrastructure is aging and there has been three shutdowns due failures since 1989. When a failure occurs, the City of Northglenn is able divert flow to an overflow structure located at Lift Station A. With a limited capacity, this structure only allows for the Forcemain to be down for short durations (less than a day). If a future failure occurs which requires Forcemain A to be down for an extended amount of time, the City of Northglenn must pay a fee Metro Wastewater Reclamation District, based on quantity and quality, to send flow to the neighboring utility of Thornton through an existing connection. As the main artery connecting the SSA with the WWTP, the 27-IN Forcemain A is an essential component of the conveyance system. As the system continues to age it is crucial to evaluate the need for

construction a parallel forcemain to add redundancy to the system. Based on a total length of approximately 8.7 miles, construction of a parallel forcemain would cost approximately $15.6 million in 2011 dollars.

1.6.2 Northern Service Area (NSA)

Currently, there is no existing sewer infrastructure in the NSA with the exception of the 27-IN Forcemain A that conveys water to the WWTP. The remainder of the NSA is served presently by septic systems. The preliminary NSA wastewater collection and conveyance system plan includes only collector and interceptor for general capital planning purposes.

Using the design criteria and the hydraulic model a preliminary collection and conveyance system was developed for the NSA. The plan includes gravity sewer (manholes with collector and interceptor mains), two lift station forcemains, and the outlet to the existing WWTP.

For the NSA, construction of infrastructure in the future will be needed to meet long term growth predictions. Chapter 5 provides a preliminary layout of the main collection system; however, a detailed preliminary evaluation of the collection is required based on the final land use. Construction of the infrastructure in the NSA will be performed and paid for by the developers through agreements with the City. As a result, costs have not been included in this plan for NSA improvements.

1.7. Odor Control Evaluation and Alternatives Development (Chapter 6)

Encroaching development in the vicinity of the once remote, Northglenn WWTP has brought odor emissions from the facility to the forefront of concern. Odorous emissions and corrosion in the interior of the forcemain to the WWTP are also of primary concern to the City. Northglenn has taken measures to reduce odor emissions from the WWTP and along the pipeline to the plant. Northglenn performed an odor evaluation on their wastewater system in 2007 (Odor Evaluation Report – 2007) and a follow-up evaluation in 2008 (Follow-up Odor Testing Report – 2008). The 2007 Evaluation measured the average H_2S concentration at the WWTP influent splitter box to be 300 ppm.

Odors are caused by several compounds, including H_2S. The generation of other odorous compounds occurs under similar reductive environmental conditions as H_2S; mitigation of those conditions for H_2S will generally treat other compounds as well. There are several control options that may be used effectively to reduce or eliminate odors. Odor control options include both liquid phase and air phase treatment. In addition, steps can be taken to minimize the generation of odor emission by modifying system operations.

Conditions at Northglenn WWTP and in the forcemain leading to the WWTP are ideal for the generation of and release of H_2S and other odorous emissions. As shown in the 2007 and 2008 Odor Evaluations, the ORP at Lift Station A, which is a measure of oxidation reduction, was measured to be approximately -150 mV. Additionally, wastewater is conveyed to the WWTP at a velocity of approximately 1.5 FT/s for more than 5.5 of the total

6.3 hours spent in conveyance. This long detention time further facilitates the production of H_2S and other reduced sulfur compounds. Additionally, wastewater is retained in the Aerated Lagoon Treatment System for an average of 6 days. The lagoons have a very large surface area that facilitates stripping of volatile hydrogen sulfide from the water surface by the prevailing winds.

The single most beneficial alternative for the reduction of odors emitted from the Northglenn WWTP is taking the Aerated Lagoon Treatment System out of service. As illustrated in the 2007 and 2008 Odor Evaluations, the influent lagoons account for more than 90 percent of total odor emissions from the plant. Once the Headworks Facility is constructed, the Aerated Lagoon Treatment System can be taken out of service. Odor control will be provided for the Headworks Facility through the use of a biotower or biofilter. The proposed odor control facility will be designed to treat emissions from the Influent Box, Headworks Facility, and grit chamber. Additionally, chemical addition at Lift Station A must be continued to protect the pipeline from corrosion. The proposed odor control improvements are included in the current planning cycle WWTP improvements.

1.8. Bull Reservoir Effluent Pumping Evaluation and pH Control (Chapter 7)

1.8.1 Bull Reservoir Effluent Pumping

The existing Northglenn WWTP has infrastructure in place to discharge treated effluent to Big Dry Creek, Thompson Ditch, Bull Canal, or Bull Reservoir. It is hydraulically possible to discharge by gravity to Big Dry Creek or Thompson Ditch from the UV disinfection building. However because the treatment system lacks a headworks facility, inorganic solids are carried through in the effluent stream and limit discharge to Bull Canal. For current operations, effluent is pumped from the UV disinfection effluent channel to Bull Reservoir. Effluent can then be pumped from Bull Reservoir to canals which intersect with Bull Canal to the west and Big Dry Creek to the southeast. However, the existing pump station is not adequately meeting the needs of the City of Northglenn due to a lack of operational flexibility and high energy costs. The current energy cost to operate the Bull Canal effluent pumps with one pump continuously in operation and the second pump in operation a quarter of the time to meet peak daily flows is approximately $6,000 a month ($72,000 annually).

The existing pump station provides some operational flexibility, but it comes at a cost. To meet future effluent discharge requirements while decreasing operational costs, the existing effluent pumping system requires upgrades. Adding a second stage to the existing pumps will increase the range of the pumps enabling them to operate at the higher total dynamic head (TDH) and lower flow ranges that are required when the Reservoir is low. The reduction in flow will also decrease energy consumption, by reducing the need to pump the effluent several times before it is released. This modification will also require replacing the existing motors that can operate at 150 hp @ 900 rpm to ensure that the motors will not see an overload condition at the new operating points. The existing variable frequency

drives (VFDs) may be able to be reused, however new VFDs were included in the estimated cost to provide a conservative estimate of the total capital costs of these modifications. Cost for this alternative is approximately $284,000 in 2011 dollars. The Bull Reservoir effluent pumping improvements are scheduled for inclusion in the current planning cycle.

1.8.2 Bull Reservoir pH Control

Effluent which is currently pumped and stored in Bull Reservoir contains nutrients such as nitrogen and phosphorus. The presence of these nutrients in combination with the sunny climate of Colorado provides prime conditions for the promotion of algae growth. As the algal blooms expand, they consume CO_2 increasing pH in Bull Reservoir. Without an adequate buffering capacity, due to low alkalinity in the WWTP's effluent, the pH levels rise above the permitted limit of 9 (s.u.).

To ensure the City of Northglenn can meet their permitted effluent pH, and fit into the immediate operations plan, alternatives that have been considered include effluent blending and chemical dosing. These two alternatives are highly effective to prevent high effluent pH from being released. However, with the capital cost of the alternatives being the driving factor, the alternative recommended for implementation is the Sulfuric Acid dosing system. To mitigate the safety risk of handling Sulfuric Acid, City staff implemented this alternative in 2011 and included installation of a dosing system set up next to the existing Effluent Pump Station building. The system consists of a double contained cross linked HDPE chemical tank to store the acid in lieu of using totes, two chemical metering pumps and the chemical piping required to dose acid prior to entering the old chlorine contact basin next to the building. The system is currently housed in the existing chlorine building. Operator safety has also been addressed with a portable emergency eye wash and showers.

1.9. Systems Recommendations and Capital Improvements Plan (Chapter 8)

The City of Northglenn has limited resources to invest in wastewater infrastructure, making prioritization of capital improvement projects a necessity. Multiple criteria govern the prioritization of capital improvement projects. The following list highlights the criteria that dictate capital improvements priorities for wastewater treatment and conveyance:

- Impaired Operations and Maintenance
- Permit Requirements
- Surface Water Protection
- Protection of Public Health
- Collection and Treatment System Reliability and Operations Requirements
- Coordination and Compatibility With Other Capital Programs
- Renewal and Replacement
- Regulatory Compliance
- Growth

As discussed previously, the Northglenn WWTP and collection system improvements are categorized by priority. The Wastewater Utility Plan is required to be updated every 5 to 7 years. As such, the current planning cycle improvements are included in this capital improvements plan. Improvements in future planning cycles are discussed; however, they are not included in the capital improvements plan. The overall improvements are as follows:

The current planning cycle capital improvements (2011 through 2018) include the following projects:

- Improvements to the BNR Treatment System including the following. Estimated cost is approximately $724,000 in 2011 dollars.
    - Converting Anoxic Zone No. 2 to a swing anoxic/aerobic.
    - Converting Anaerobic Zone to a swing anaerobic/anoxic.
    - Removing baffle curtains and replacing with concrete partition walls.
    - Removing geothermal heat loop piping from bioreactor.
- Install standby power. Estimated cost is approximately $224,000 in 2011 dollars.
- Design and construction of a new Headworks Facility with fine screening, grit removal, and odor control to reduce operations and maintenance and meet the requirements of the Site Application. Estimated cost is approximately $4,433,000 in 2011 dollars.
- Design and construction a third Secondary Clarifier to provide required redundancy and allow for maintenance of the existing two units. Estimated cost is approximately $2,074,000 in 2011 dollars.
- Decommissioning the existing Aerated Lagoon Treatment System (cells 1 and 2) to reduce operations costs and meet the requirements of the Site Application. Estimated cost is approximately $1,321,000 in 2011 dollars.
- Lift Station A Improvements. Estimated cost is approximately $1,344,500 in 2011 dollars.
- Constructing improvements to Bull Reservoir effluent pumping. Estimated cost is approximately $284,000 in 2011 dollars.
- Paving required access roads at WWTP. Estimated cost is approximately $565,000 in 2011 dollars.
- Expanding laboratory and operations space. Estimated cost is approximately $600,000 in 2011 dollars.

The total estimated cost of the recommended current planning cycle capital improvements is approximately $11,569,500 in 2011 dollars.

To fully decouple the BNR Treatment System from the original Aerated Lagoon Treatment System, the Sludge Storage Lagoons should be decommissioned and a solids handling facility constructed. These improvements are scheduled for a future planning cycle (2018 through 2030) and include the following:

- Decommissioning of Sludge Storage Lagoons and construction of new solids handling system including:
    - Primary clarification

- Thickening
- Digestion
- Dewatering

Once the solids handling improvements are completed, attention should next be focused on improvements to Forcemain A. Additionally, the WWTP may need additional capacity or improvements to meet new regulatory requirements. Other future planning cycle capital improvements include the following:

- Forcemain A Parallel Pipeline.
- When necessary due to growth in the system, expanding biological process capacity through addition of IFAS media to existing basins (increases capacity to approximately 5 MGD) or the construction of a fourth BNR Treatment Basin (increases capacity to approximately 6.7 MGD).
- Miscellaneous operations and maintenance improvements including replacing existing UV equipment.
- Installing effluent filtration due to phosphorus limit (may be required sooner if regulations change).
- Developing/implementing alternatives for generation of Class A biosolids product (may be required sooner if regulations change).

Table 1-11 summarizes the recommended capital improvements by year for the current planning cycle (2011 through 2018). Figure 1-1 provides a schematic of the recommended improvement plan.

Table 1-11. Capital Improvements Summary – Current Planning Cycle (2011-2018)

Project Description	Trigger	Estimated Cost							
		2011	2012	2013	2014	2015	2016	2017	2018
Installation of standby power	• Impaired operations and maintenance	Design/Const-$224,000							
Improvements to the BNR Treatment System to increase organic and ammonia capacity to handle additional load from decommissioning of Aerated Lagoon Treatment System: • Converting Anoxic Zone No. 2 to a swing anoxic/aerobic. • Converting Anaerobic Zone to a swing anaerobic/anoxic. • Remove baffle curtains and replace with concrete partition walls. • Remove geothermal heat loop piping from bioreactor.	• Permit requirements • Capacity once Aerated Lagoon Treatment System is decommissioned		Design/Const-$724,000						
Construct New Headworks Facility	• Impaired operations and maintenance • Site application compliance • Regulatory compliance				Design-$734,000	Construction-$1,849,500	Construction-$1,849,500		
Construct Third Secondary Clarifier	• Impaired operations and maintenance				Design-$346,000	Construction-$864,000	Construction-$864,000		
Decommission Existing Aerated Lagoon Treatment System (cells 1 and 2)	• Impaired operations and maintenance • Site application compliance • Regulatory compliance					Design-$220,000	Construction-$550,500	Construction-$550,500	
Pave Access Roads	• WWTP improvements are completed								Design/Const-$565,000
Construct Bull Reservoir Effluent Pumping Improvements	• Required only if reservoir is still operated for effluent storage • Impaired operations and maintenance								Design/Const-$284,000
Lift Station A Improvements	• Impaired operations and maintenance				Design/Const-$685,000				Design/Const-$659,500
Expansion of Laboratory and Operations Space	• Impaired operations and maintenance								Design/Const-$600,000
Total Costs by Year		**$224,000**	**$724,000**	**$0**	**$1,765,000**	**$2,933,500**	**$3,264,000**	**$550,500**	**$2,108,500**
Total Current Planning Cycle Improvements	**$11,569,500**								

Figure 1-1. Capital Improvements Plan Summary