CITY OF AMES IOWA

City of Ames

Water Pollution Control

Long Range Facility Plan

HDR

Introduction

Over 25 years ago, the City of Ames last completed a Wastewater Facility Plan. That Facility Plan prompted design and construction of the existing Water Pollution Control Facility (WPCF), which has now been in operation since late 1989. The WPCF has and continues to meet National Pollutant Discharge Elimination System (NPDES) Permit requirements.

As the WPCF approaches 25 years in age, a number of considerations need to be addressed in the context of minimizing customer rate impacts over the long term.

- increasing repair and replacement needs
- a corresponding need and desire to enhance asset management
- wet weather hydraulic capacity issues that must be addressed
- potential growth related needs
- a desire to independently verify and compare high strength rate surcharges
- regulatory challenges on the horizon

This document provides an overview of the Long Range Facility Plan prepared by City and HDR Engineering staff in 2012 to address those considerations. The Long Range Facility Plan provides a road map to the future that guides ongoing repair and replacement, addresses capacity needs, prepares for future nutrient standards, and enables long term/rate revenue planning. It also provides a template for enhanced asset management and provides insight to refine high strength rate surcharges.

The document is organized as follows:

- WPCF Age & Condition
- WPCF Capacity
- Flows & Loadings
- Wet Weather Flows
- Anticipated Regulatory Requirements
- Capital Improvements Plan
- Asset Management Plan
- High Strength Waste

Ames WPCF

WPCF Age & Condition

Detailed physical and operational assessments of the existing WPCF indicate the following:

- There are no major process equipment constraints on the Facility's ability to meet NPDES permit requirements under normal circumstances
- Buildings, tanks, and structures are generally in good structural condition
- Heating, ventilation, and air conditioning equipment is well maintained and, in most cases, very functional albeit not "state of the art"
- Electrical equipment, with few exceptions, is approaching the end of it's useful life
- Field mounted instrumentation is in fairly good working condition with improvements made in 2007-2008 providing a reliable system that appears to be functioning well.

At the same time, the WPCF is reflecting its age in the following ways:

- A number of equipment components are approaching the end of their useful life
- Buildings are beginning to show the wear of over 20 years of service without significant remodeling or rehabilitation, and there are a number of current code related fire and life safety issues
- Heating, ventilating, and air conditioning equipment is approaching the end of its useful life and a central monitoring location would aid in future maintenance
- Electrical equipment life could be extended through implementation of an electrical preventive maintenance program before complete replacement, and lamps and ballasts, as they fail, should be replaced with more energy efficient types
- Continued dependency on original Remote Terminal Units (RTUs) that include components no longer in use presents challenges in troubleshooting and maintenance.

$43.5 million of age and condition related repairs and replacements are recommended, including $6.1 million for trickling filter rehabilitation.

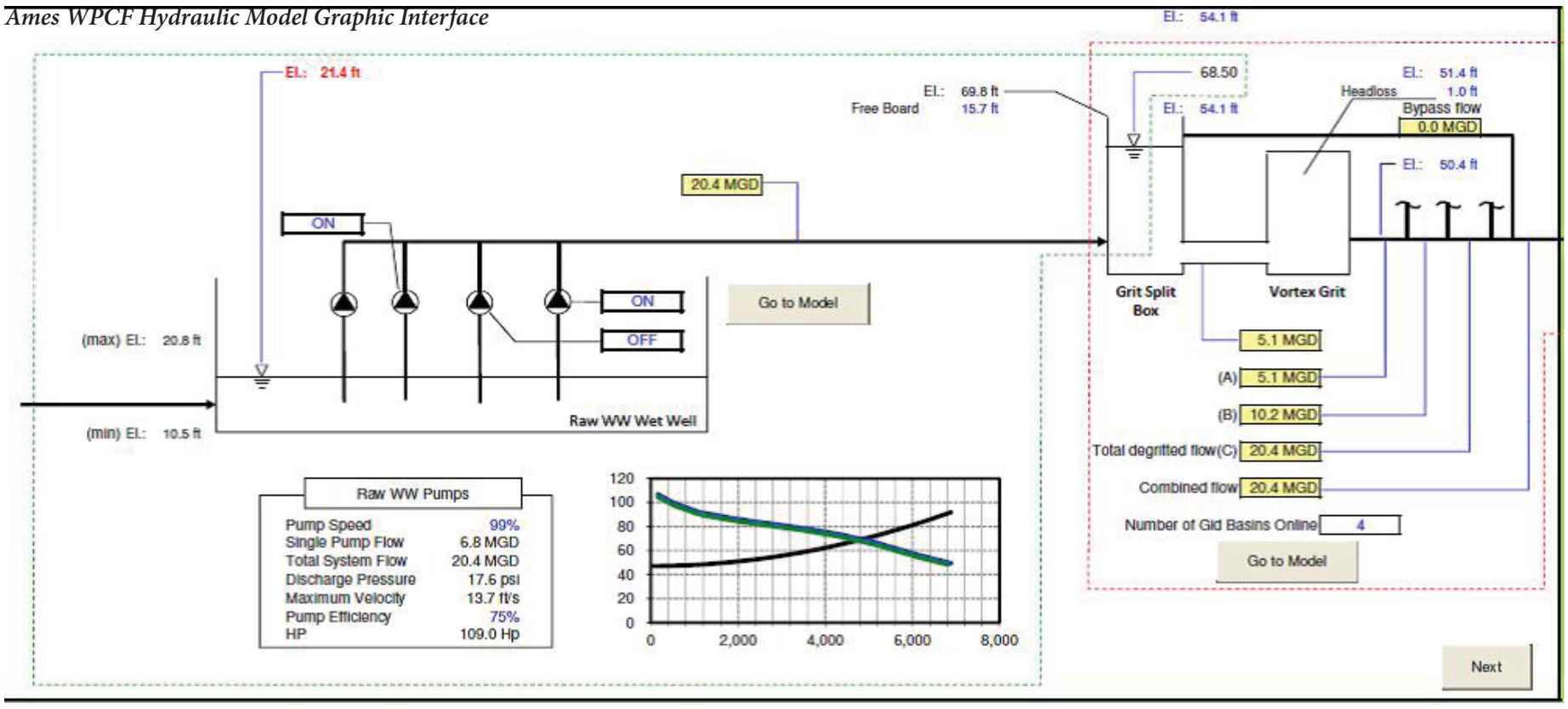
Ames WPCF Condition Assessment

WPCF Capacity

Unit process by unit process analysis and hydraulic modeling of the entire WPCF identifies the maximum day hydraulic capacity to be 26.4 mgd; over 20 percent more than the original design basis for the WPCF. At 26.4 mgd, hydraulic loadings on individual treatment processes are manageable and flow can be accommodated without submerging weirs or overflowing structures when all treatment units are in operation.

To maximize performance at this increased hydraulic capacity, several modifications are suggested, most notably modifying the raw wastewater discharge piping to enable five not just four of the six raw wastewater pumps to discharge to the WPCF. Doing so provides redundant raw wastewater pumping capacity at the higher 26.4 mgd hydraulic capacity and provides a basis for the City to pursue an increase in the actual rated maximum day hydraulic capacity with IDNR.

Ames WPCF Hydraulic Model Graphic Interface

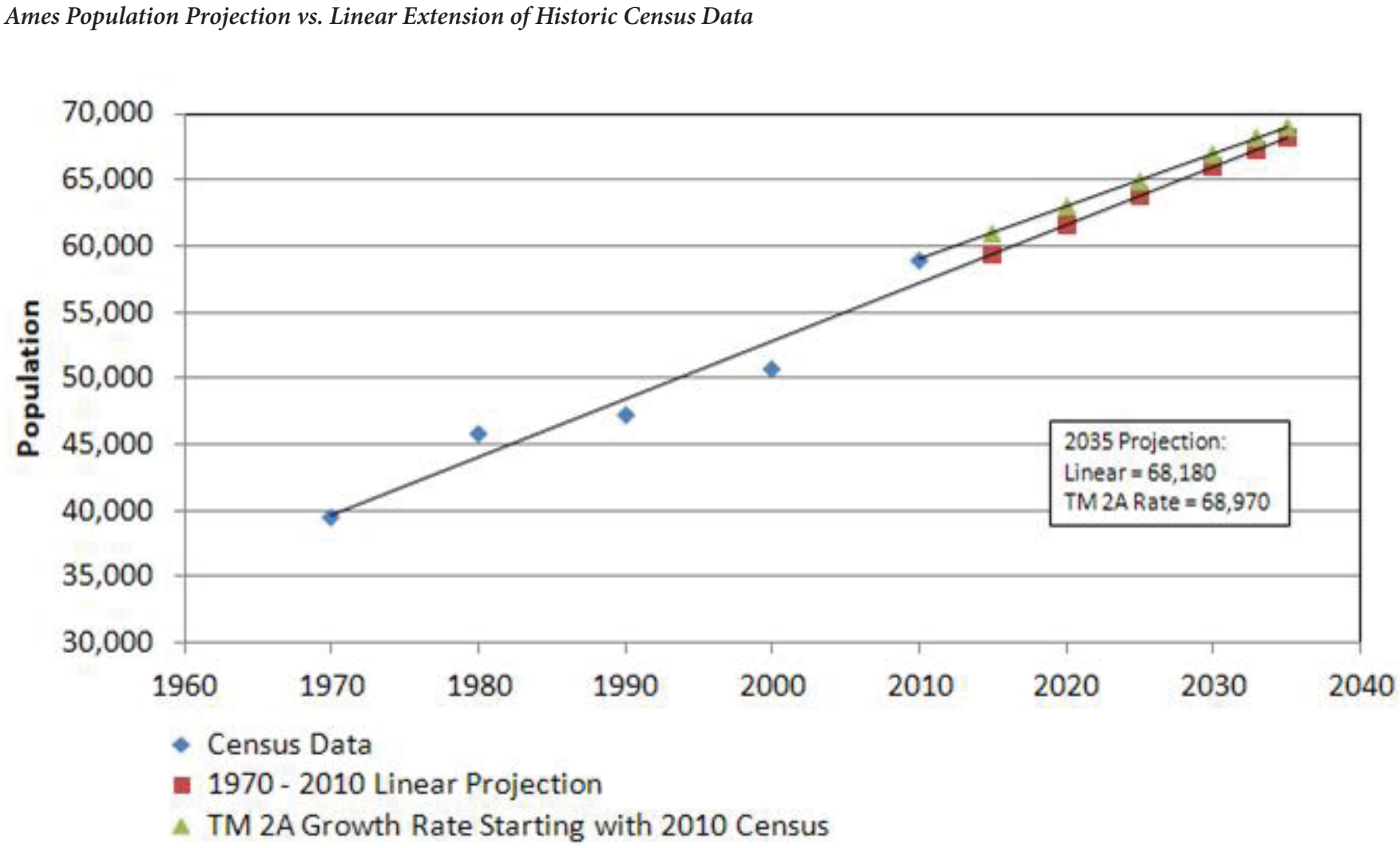


Unit process by unit process analysis and process modeling of the entire WPCF also identified the organic capacity of the WPCF to be as tabulated. That capacity is shown relative to original design capacity and current loadings. It reflects current wastewater characteristics and current NPDES permit limits.

Ames WPCF Organic Capacity – Maximum Month

Parameter	Original	Current	Capacity
Flow, MGD	**12.1**	10.1	14.7
BOD_5, lbs/day	**16,150**	10,700	15,600
TSS, lbs/day	**16,190**	16,600	24,200
TKN, lbs/day	**4,950**	2,320	3,310
NH_3-N, lbs/day	**2,750**	1,530	2,210

Ames Population Projection vs. Linear Extension of Historic Census Data



Flows and Loadings

Consistent with forecasts for the Water Plant, average daily and maximum month flows to the WPCF are projected to increase from 6.0 to 8.5 and 10.1 to 13.3 million gallons per day (mgd), respectively, for the planning period through 2035. Organic loadings are anticipated to increase proportionally as well.

Without additional regulatory requirements, the existing WPCF provides the required capacity through 2035. However, anticipated regulatory requirements, more stringent ammonia requirements in particular, would effectively reduce the capacity of the existing WPCF

Analysis of historic flow data indicates that, on average, approximately 38 percent of the total volume and 75 percent of the maximum day flows treated at the WPCF are extraneous infiltration and inflow from the collection system. Elimination of even a portion of the extraneous infiltration and inflow could reduce WPCF pumping costs, collection and treatment operations and maintenance costs, and capital costs for future collection and treatment capacity expansion.

Ames WPCF Historic Flows

Year	Total		I / I Contribution	
	Annual Volume (MG)	Maximum Day (mgd)	% of Annual Volume	% of Maximum Day Flow
2001	2,032	10.60	35%	66%
2002	1,955	8.10	33%	56%
2003	1,937	12.33	32%	71%
2004	2,121	21.19	38%	83%
2005	1,977	11.82	34%	70%
2006	1,688	7.95	22%	55%
2007	2,464	28.41	47%	87%
2008	2,594	37.19	49%	90%
2009	2,213	18.54	41%	81%
2010	2,641	35.73	50%	90%
Maximum	2,641	37.19	50%	90%
Average	2,162	19.19	38%	75%

Ames WPCF Current & Projected Wastewater Flows and Loads

Parameter	Current	2035		
		Projected	Reserve	Total
Flow, MGD				
Average Annual	6	7.0	1.5	8.5
Maximum Month	10.1	11.8	1.5	13.3
Maximum Day	24	28.1	1.5	29.6
BOD_5, lb/d				
Average Annual	7,800	9,100	2,000	11,100
Maximum Month	10,700	12,500	1,600	14,100
Maximum Day	14,600	17,100	900	18,000
TSS, lb/d				
Average Annual	10,600	12,400	2,700	15,100
Maximum Month	16,600	19,400	2,500	21,900
Maximum Day	25,800	30,200	1,600	31,800
Ammonia, lb/d				
Average Annual	1,130	1,300	280	1,580
Maximum Month	1,530	1,800	230	2,030
Maximum Day	2,080	2,400	130	2,530

Wet Weather Flows

The WPCF has an IDNR rated maximum day capacity of 20.4 mgd. The Main Outfall sewer delivering flows from the collection system to the WPCF has a much greater full flow capacity of approximately 61.2 mgd. Equalization basins (EQ Basins) at the WPCF provide an effective volume of 4.4 million gallons (MG) to store wet weather flows above 20.4 mgd for subsequent treatment.

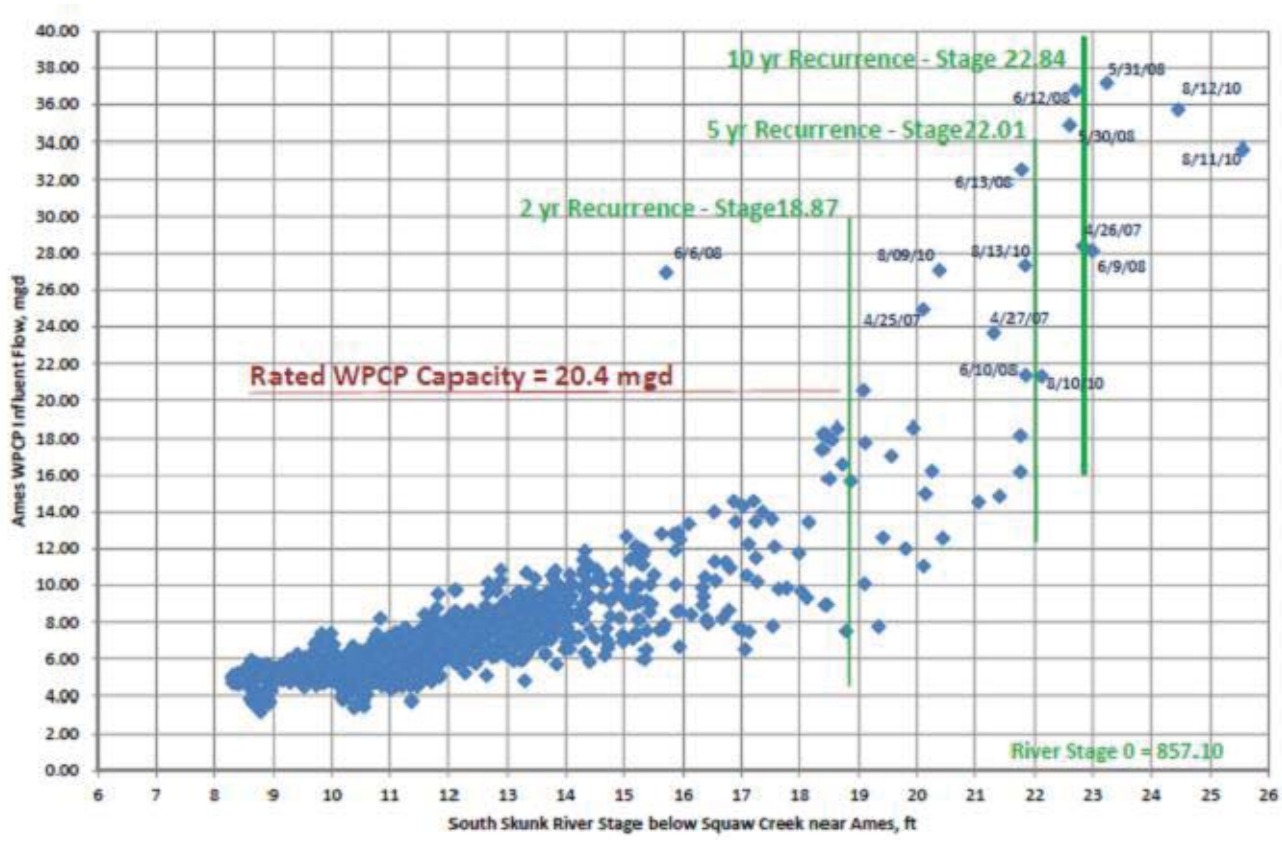
Peak wet weather flows into the WPCF have infrequently exceeded the capability of the WPCF and EQ Basins. At these times, the EQ Basins overflowed and discharged to the Skunk River. Records indicate that the EQ basins overflowed to the Skunk River a few hours in total from 1999 through 2006 and portions of 23 different days in 2007 through 2011.

Analysis indicates that peak flows and EQ Basin overflows are coincidental with wet weather extremes and elevated Skunk River stages. At mean daily Skunk River stages up to 18 feet, WPCF influent flows show a slight upward trend with increasing river stage. However, at or above mean daily Skunk River stages of 18 to 19 feet, approximately the 2 year recurrence interval, WPCF influent flows show a much more notable increase with increasing river stage. This may point to problems in those portions of the collection system that become submerged at River stages of 18 to 19 feet and above.

EQ Basin overflows are recognized by IDNR as a "bypass" to be eliminated at a storm recurrence interval of five years or less. A Settlement Agreement between the City of Ames and the IDNR requires completion of this Long Range WPCF Plan, a parallel Sanitary Sewer System Evaluation, and a resulting plan by July 1, 2014 to accommodate peak wet weather flows without EQ Basin overflows.

The recommendation for accommodating peak wet weather flows is a combination of reduction of extraneous infiltration and inflow in the collection system and an increase in WPCF

Ames WPCF Influent Flows versus Skunk River Stage



wet weather capacity. More specifically, subject to refinement on completion of the Sanitary Sewer System Evaluation Study, the recommendation is to expand the EQ Basins to 10.4 mgd coincidental with pursuing an increase in the rated hydraulic capacity of the WPCF and targeting a 25 percent reduction in the volume of infiltration and inflow during extreme wet weather events through collection system rehabilitation.

The capital cost of the EQ Basin expansion in 2012 dollars is estimates of $1.1 million. The capital cost to achieve the targeted reductions in extraneous infiltrations and inflow has yet to be determined.

Anticipated Regulatory Requirements

The Ames WPCF will likely be significantly impacted by two regulatory drivers.

First, it is anticipated that EPA will move forward in 2013 with rulemaking for more stringent effluent ammonia standards based on lower ammonia toxicity criteria to protect endangered freshwater mussels and snails. With the more stringent ammonia standards, the capacity of the existing WPCF is effectively reduced to 10.1 mgd which is not sufficient for current or projected loadings.

To provide the required capacity for projected 2035 flows and loadings with the more stringent ammonia standards, incorporation of IFAS media into the existing solids contact basins is recommended. It is the most favorable of four alternatives considered. The estimated capital cost in 2012 dollars is $2.4 million.

Second, the recently published, but yet to be approved, Iowa Nutrient Reduction Strategy targets significant reductions in nutrient loadings from both wastewater treatment plant point source discharges and urban and rural nonpoint source runoff discharges. The driver for the reductions is to decrease nutrient loadings from the Mississippi River to address water quality issues in the Gulf of Mexico.

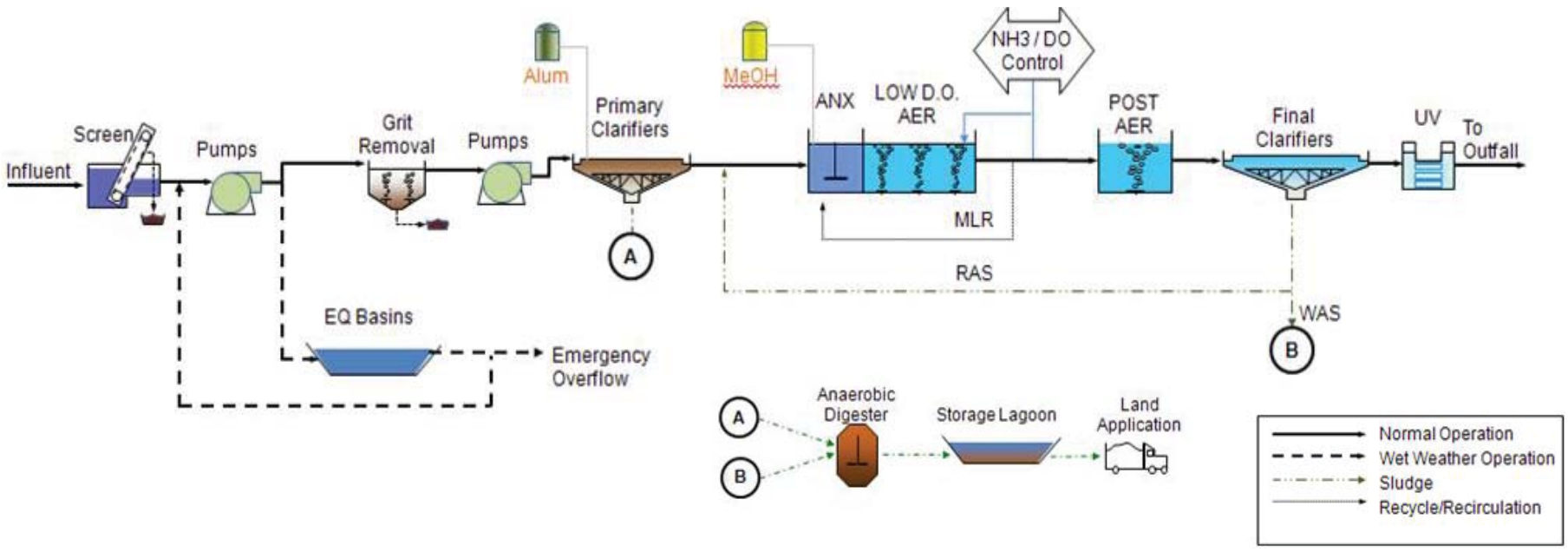
It is anticipated that Iowa point source discharges, like the Ames WPCF, will be focused on achieving the least stringent of three generally discussed levels of nutrient reduction shown, ie Nutrient Scenario 1, over the next 5 to 10 years.

Nutrient Reduction Scenarios

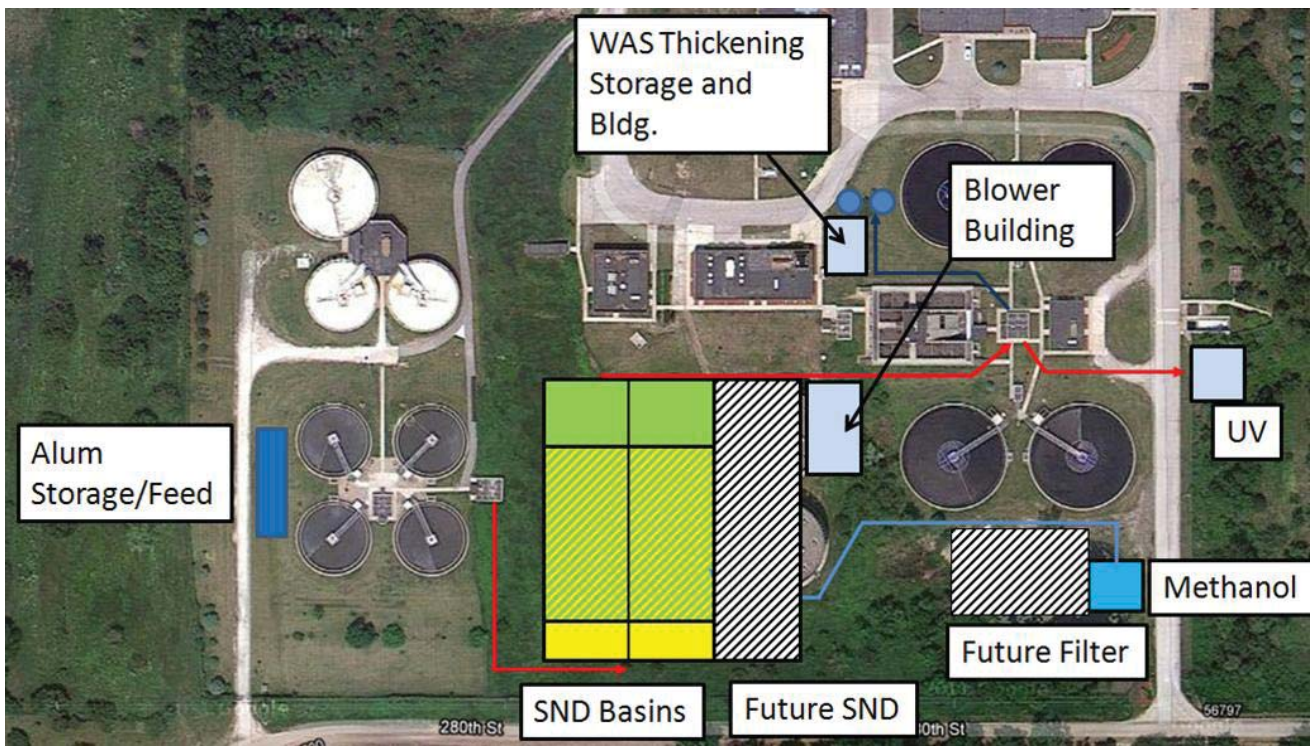
Nutrient Scenario	Typical Technology	Total Nitrogen mg/l	Total Phosphorus mg/l
1	Biological Nutrient Removal (BNR)	10	1
2	Enhanced Nutrient Removal (ENR)	5	0.5
3	Limits of Technology Nutrient Removal (LOT)	3	0.3

Following rigorous monetary and nonmonetary evaluation, Simultaneous Nitrification/Denitrification (SND) activated sludge is recommended as the most favorable of four alternatives considered to achieve the anticipated nutrient reduction. SND had essentially the lowest capital cost, the lowest operations and maintenance cost, and the most favorable nonmonetary ratings. It will replace the existing Trickling Filters. The estimated capital cost in 2012 dollars is $25.0 million.

Simultaneous Nitrification Denitrification Activated Sludge Flow Schematic



Ames WPCF Simultaneous Nitrification Denitrification Activated Sludge Site Layout



Capital Improvements Plan

The recommended capital improvements plan includes the major cost components identified herein as well as $5.8 million of carryover from the current CIP. It is structured to provide flexibility for several possible scenarios as follows.

All costs are order of magnitude estimates for planning purposes, reported in 2012 dollars, and include both engineering and construction.

Ames WPCF Capital Improvements Plan Scenarios

Possibility	Summary	10 year Capital Need $ millions	20 year Capital Need $ millions
No change in Regulatory Standards	• Carryover of current CIP • Wet weather capacity needs • Age and condition related repairs & replacement • Rehabilitation of trickling filters	$36.1	$50.3
More stringent Ammonia Standards Only	• Carryover of current CIP • Wet weather capacity needs • Age and condition related repairs & replacement • Rehabilitation of trickling filters • Incorporation of IFAS into existing solids contact basins	$38.5	$52.7
More stringent Nutrient Standards	• Carryover of current CIP • Wet weather capacity needs • Age and condition related repairs & replacement • Construct simultaneous nitrification denitrification activated sludge in lieu of tricking filter rehabilitation and in lieu of incorporating IFAS into solids contact basins	$54.9	$69.2

Reflecting current understanding and expectations, the third scenario is most likely. More specifically, the City should anticipate preparing a Preliminary Engineering Report for SND activated sludge nutrient reduction facilities in fiscal year 2017 followed by design and construction of those facilities in fiscal years 2019 through 2022. Doing so, will likely avoid the need to incorporate IFAS media in the solids contact basins or make interim repairs or replacement of the trickling filters.

However, implementation of anticipated ammonia standards on a more aggressive timeline or accelerated deterioration of the trickling filters, media in particular, could accelerate this timeline. Either could prompt implementation of SND activated sludge nutrient reduction facilities more quickly or prompt a decision to proceed with incorporation of IFAS in the solids contact basins or interim repairs or replacement of the trickling filters.

In the shorter term, the City needs to continue with carryover CIP items, proceed with age and condition related repairs and replacements consistent with this expectation, and needs to address wet weather capacity needs.

Asset Management Plan

The WPCF has historically, and continues to make infrastructure maintenance, repair, and replacement decisions to optimize the life-cycle cost of WPCF while providing reliable and dependable wastewater service to customers. A straw man document with a set of concepts, considerations, and ideas has been developed for implementation of a more formal asset management program.

Implementation will require the commitment of one full time equivalent and an estimated $150,000 investment in planning, software, process improvement, and training. While a major undertaking over several years, the goal in implementing a more formal asset management plan is to more rigorously define and meet customer needs and expected levels of service through sound fiscal planning and improved infrastructure management.

Ames WPCF Strawman Asset Management Plan Structure

1. Customer Service Levels	1.1 Sustainable Levels of Service 1.2 Cost of Service Expectations
2. Customer Focus	2.1 Future Demands 2.2. Regulatory Interface 2.3 Internal & External Communications 2.4 Competitiveness
3. Financial	3.1 Life Cycle Planning 3.2 Asset Decision Making 3.3 Financial Reporting 3.4 Cost Stream Forecasting
4. Asset Reliability	4.1 Asset Knowledge 4.2 Operation & Maintenance Strategy 4.3 Condition Monitoring
5. Asset Planning	5.1 Business Case Evaluations 5.2 Asset Replacement & Rehabilitation 5.3 Asset Acquisition
6. Risk Management	6.1 Risk Identification 6.2 Risk Analysis 6.3 Risk Mitigation
7. Performance Management	7.1 Service Level Metrics 7.2 Procedures 7.3 Quality Assurance
8. Organizational Excellence	8.1 Active Strategic Planning 8.2 Knowledge Sharing 8.3 Resource Management 8.4 Employee Development

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