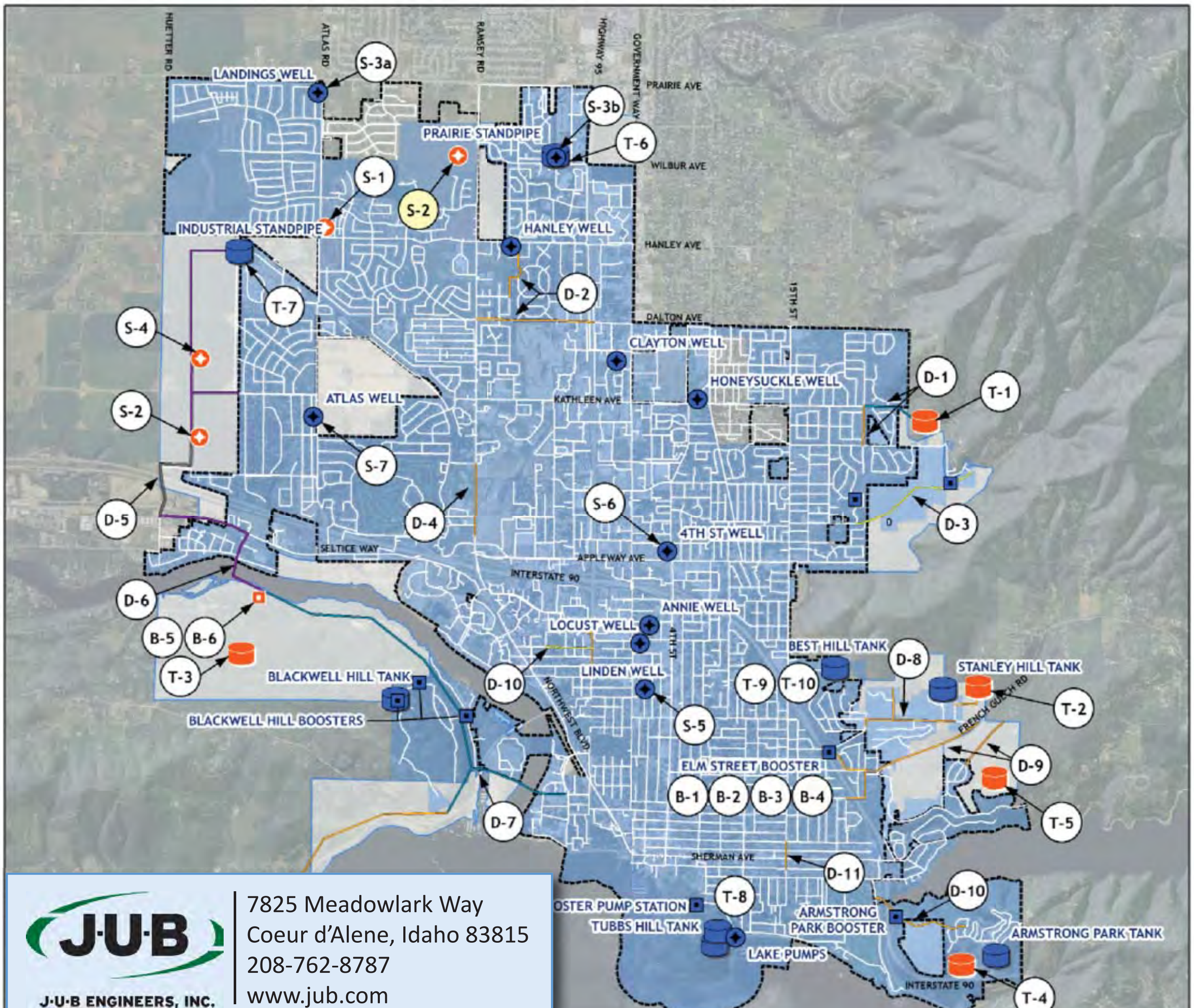




City of Coeur d'Alene

2012 Water System Comprehensive Plan Update

November 2012



J·U·B ENGINEERS, INC.

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J·U·B ENGINEERS, INC.

J-U-B COMPANIES | THE LANGDON GROUP | GATEWAY MAPPING INC.

November 20, 2012

Mr. Jim Markley
City of Coeur d'Alene
Water Department
3820 Ramsey Road
Coeur d'Alene, ID 83815

RE: 2012 WATER SYSTEM COMPREHENSIVE PLAN UPDATE – FINAL SUBMITTAL

Dear Jim:

It is always a pleasure to work with the Coeur d'Alene Water Department since you and your team have done a great job of managing your water system both for current and future needs. This has certainly been true during the conception and completion of your 2012 Water System Comprehensive Planning Update project. The **enclosed** represents the final draft of this report.

The report is summarized in the Executive Summary and includes the following chapters:

Chapter 1 -	Review Criteria	*Includes City review criteria as well as a summary of regulatory issues*
Chapter 2 -	Water Production and Consumption	*Defines the planning boundary, historic water use, and projections for future demand*
Chapter 3 -	Description of Existing System	*Summarizes key components of the existing system*
Chapter 4 -	Water Supply Evaluation	*Evaluates supply requirements by pressure zone and recommended projects*
Chapter 5 -	Water Storage	*Evaluates future storage requirements by pressure zone and recommended projects*
Chapter 6 -	Distribution System	*Presents an analysis of the distribution system and requirements for system build-out, including recommended projects*
Chapter 7 -	Capital Improvement Plan	*Summarizes all of the recommended improvements and planning level budgets*

A financial plan is provided in addition to the Water System Comprehensive Plan Update. We are excited to note that this plan shows that the City will need to make only minor adjustments to current rates to fund upcoming projects.

We have enjoyed working with you to develop this plan and look forward to continuing to work with you to improve service to your ratepayers. Please do not hesitate to call if you have any questions.

Sincerely,

J-U-B ENGINEERS, Inc.

Stephen P. James, P.E., Area Manager

SPJ:bh

Enclosures

City of Coeur d'Alene, Idaho

2012 Water System Comprehensive Plan Update

November 2012

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REGISTERED
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11.20.12
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STEPHEN P. JAMES

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13810
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STATE OF IDAHO
MICHELLE L. JOHNSON

Prepared by

J-U-B

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Typical Abbreviations and Acronyms used in Water System Planning

AC	Asbestos-cement (pipe)
ADD	Average Daily Demand
AF	Acre-foot (43,560 cubic feet or 325,829 gallons)
AI	Aggressiveness index
Alk	Alkalinity
APD	Aquifer Protection District of Kootenai County
ASTM	American Society for Testing and Materials
C	Disinfectant concentration
CAMP	Comprehensive Aquifer Management Plan
cfs	Cubic feet per second
CT	Value time (disinfectant concentration times the contact time)
CU	Color units
CWA	Clean Water Act
DBP	Disinfection byproduct
DEQ/IDEQ	Idaho Department of Environmental Quality
DIC	Dissolved inorganic carbon
DWR/IDWR	Idaho Department of Water Resources
EPA/USEPA	United States Environmental Protection Agency
fps	Feet per second
GI	Gastrointestinal
GMA	Groundwater Management Area
gpcd	Gallons per capita per day
gpd	Gallons per day
gpm	Gallons per minute
GUDI	Groundwater Under the Direct Influence (of Surface Water)
HAA	Halo-acetic acid
IOC	Inorganic chemicals
LSI/LI	Langelier saturation index
MCL	Maximum containment level
MCLG	Maximum containment level goal
MDD	Maximum Daily Demand
MDL	Method detection limit

meq	Milliequivalent, 10-3 equivalents
mg/l	Milligrams per liter = ppm
μg/l	Micrograms per liter = ppb
mgd	Million gallons per day
MPA	Microscopic Particle Analysis
NTU	Nephelometric turbidity unit
NPDES	National Pollutant Discharge Elimination System
PHD	Peak Hour Demand
ppb	Parts per billion
ppm	Parts per million
PQL	Practical Quantitation Limit
PVC	Polyvinyl Chloride (pipe)
RAFN	Reasonably Anticipated Future Needs Provisions of Idaho's Municipal Water Rights Act of 1996
SCADA	Supervising control and data acquisition
SDWA	Safe Drinking Water Act (P.L. 93-523 plus amendments)
SMCL	Secondary maximum containment level
SOC	Synthetic organic chemical
SVRPA/RPA	Spokane Valley-Rathdrum Prairie Aquifer
SWTR	Surface Water Treatment Rule
T	Contact time or temperature
TDS	Total dissolved solids
THM	Trihalomethane
TOC	Total organic carbon
USGS	U.S. Geological Survey
UV	Ultraviolet
VFD	Variable frequency drive
VOC	Volatile organic chemical

Executive Summary

ES-1 Introduction and Purpose

The City of Coeur d'Alene's previous Water System Comprehensive Plan was completed in 1999. Since that time, the City Water Department has implemented all of the recommended improvements. Remarkably, all of the improvements were paid for from operating revenues without the need to add any debt. This plan update is conceived as the next step in continuing the successful management of the City's water system.

The City of Coeur d'Alene, Idaho (City) authorized J-U-B ENGINEERS, Inc. (J-U-B) to update the City's 1999 Water Comprehensive Plan. This plan update incorporates land use changes and establishes a new planning boundary. Using evaluation criteria approved by the City, the entire system was evaluated to determine the impact of future growth. The resulting recommendations presented in this report are for planning immediate and long-term improvements. This Comprehensive Plan Update focuses on improvements required within the next ten years as well as water demands and the system infrastructure needs expected at system build-out. Reviewing the Comprehensive Plan annually and updating as conditions change from the expectations presented here will help maintain excellent water service throughout the planning period.

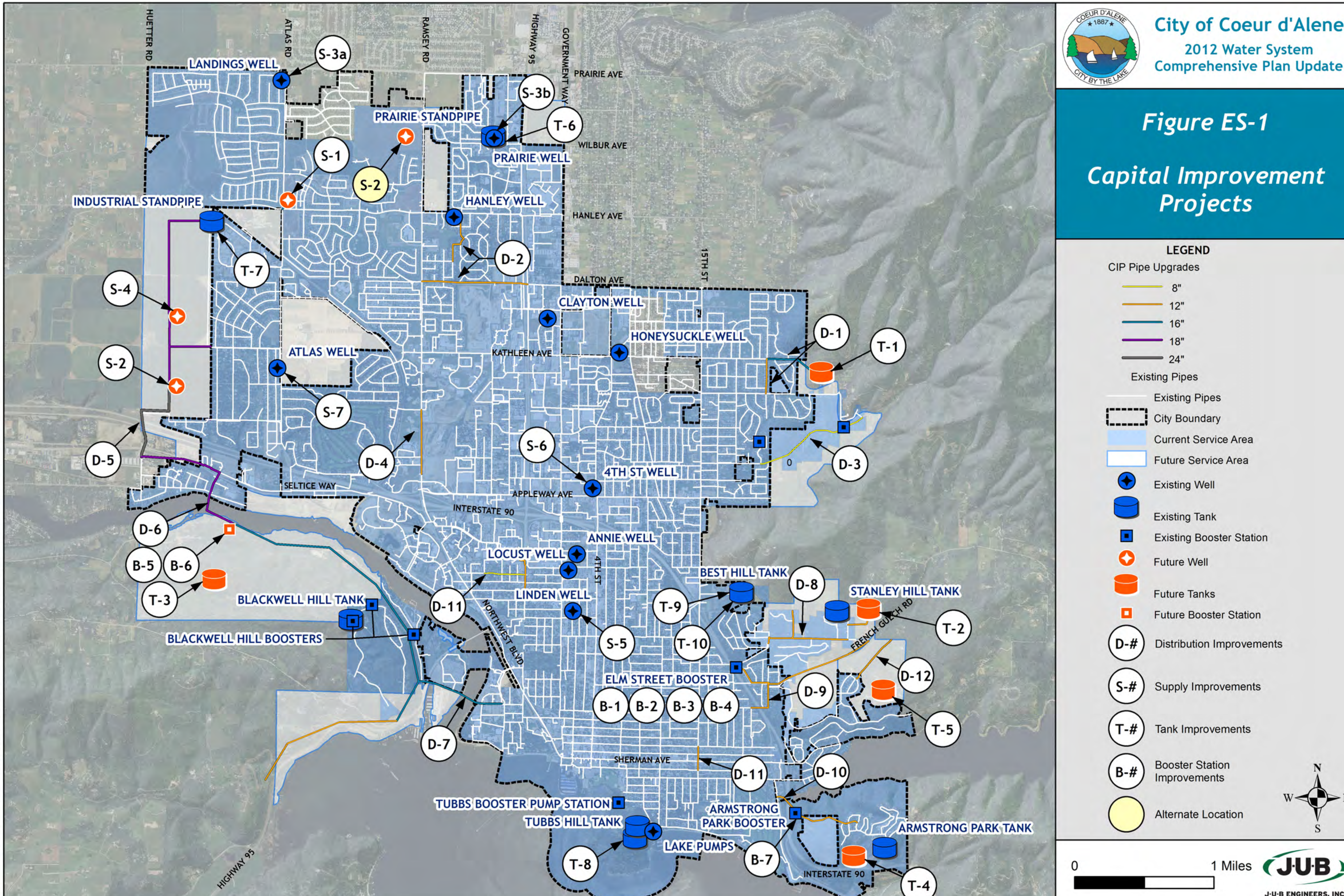
ES-2 Production and Consumption

The City water system boundary serves approximately 6,400 acres and provides drinking water to close to 20,000 metered connections. Over the 20-year planning period, the current population of 45,000 people is expected to continue growing at an average rate of 2 percent. **Table ES-1** includes the projected demands.

Table ES-1 – City of Coeur d'Alene Current and Future Water Demand

	2011 (mgd)	2016 (mgd)	2021 (mgd)	Build-Out (mgd)
Average Daily Demand	10.05	11.32	12.5	13.8
Maximum Daily Demand	32.19	35.77	39.5	43.6
Peak Hour Demand	57.94	64.38	71.10	78.48

Figure ES-1 shows the existing and future planning boundaries for the Water Department. The planning boundary is consistent with the City's Area of City Impact (ACI) on the north, west, and southwest borders. The water planning boundary to the east and southeast have been reduced from the ACE to encompass areas that are thought to be reasonably serviceable by the current system.



City of Coeur d'Alene
2012 Water System Comprehensive Plan Update
Figure ES-1
Capital Improvement Projects
LEGEND
CIP Pipe Upgrades
8"
12"
16"
18"
24"
Existing Pipes
Existing Pipes
City Boundary
Current Service Area
Future Service Area
Existing Well
Existing Tank
Existing Booster Station
Future Well
Future Tanks
Future Booster Station
D-# Distribution Improvements
S-# Supply Improvements
T-# Tank Improvements
B-# Booster Station Improvements
Alternate Location
0
1 Miles
J-U-B ENGINEERS, INC.
N
W
E
S
LANDINGS WELL
PRAIRIE STANDPIPE
PRAIRIE WELL
INDUSTRIAL STANDPIPE
HANLEY WELL
CLAYTON WELL
HONEYSUCKLE WELL
ATLAS WELL
4TH ST WELL
ANNIE WELL
LOCUST WELL
LINDEN WELL
BEST HILL TANK
STANLEY HILL TANK
BLACKWELL HILL TANK
BLACKWELL HILL BOOSTERS
ELM STREET BOOSTER
TUBBS BOOSTER PUMP STATION
TUBBS HILL TANK
LAKE PUMPS
ARMSTRONG PARK BOOSTER
ARMSTRONG PARK TANK
HUETTER RD
ATLAS RD
RAMSEY RD
HIGHWAY 95
GOVERNMENT WAY
PRAIRIE AVE
WILBUR AVE
HANLEY AVE
DALTON AVE
15TH ST
KATHLEEN AVE
SELTICE WAY
APPLEWAY AVE
INTERSTATE 90
4TH ST
NORTHWEST BLVD
FRENCH GULCH RD
SHERMAN AVE
HIGHWAY 95
INTERSTATE 90
S-3a
S-3b
T-6
S-1
S-2
T-7
D-2
S-4
S-2
S-7
D-1
T-1
D-5
D-4
S-6
D-3
D-6
B-5
B-6
T-3
D-11
D-8
T-9
T-2
T-10
S-5
D-12
D-9
B-1
B-2
B-3
B-4
T-5
D-7
D-11
D-10
T-8
B-7
T-4
Path: F:\Projects\JUB\20-12-015_CdA_2012_Wtr_Sys_Comp_Plan_Update\GIS\Maps\Plan Figures\Figure ES-1 Capital Improvement Projects.mxd

ES-3 System Overview

The City of Coeur d'Alene water system is currently in very good condition, which continues to improve through an aggressive replacement program. Water is currently supplied by nine groundwater wells, and storage is provided by seven storage tanks. Six pressure zones are included within the boundary, two of which are served directly by wells and four of which are served by booster stations. The nine wells within the system can provide over 26,000 gpm at the current pump capacities. A summary of these wells is included in Table ES-2.

The City has total water rights of 52.4 cfs (23,518 gpm/33.8 mgd), which meets the current maximum day demand. These water rights have been consolidated to a municipal water right and are looked at for the system as a whole, meaning the City can use up to its full water right regardless of which wells are operating.

The existing storage tanks are typically located at the periphery of the system. **Table ES-3** includes the summary of the existing facilities.

Table ES-2 – Well and Pump Data

Well No.	Original Well Test		Present Pump & Motor	Pump Rated Capacity		Normal Operating Point			Auxiliary Power
	Flow (gpm)	Drawdown (feet)		Flow (gpm)	Head (feet)	Flow (gpm)	System Pressure (psi)	Well Drawdown (feet)	
1. Atlas	6,000	23.2	600 hp Worthington Model 15HH410-7, 7-stage deep well turbine	4,000	420	4,480	53	14.5	600 hp right angle diesel drive [(b)]
2. 4th St.	3,500	20.1	400 hp Byron Jackson 16 GL, 3-stage deep well turbine	3,000	360	2,650	53	15.0	None
3. Hanley	6,000	5.75	500 hp Peerless deep well turbine pump	3,600	410	3,500	65	5.0	None
4. Honeysuckle	2,500	N/A	250 hp Goulds Model 14RJ-DWT, 5-stage deep well turbine	1,650	375	1,600	80	N/A [(a)]	None
5. Linden	3,100	10.7	300 hp Byron Jackson 16 GH 3-stage deep well turbine	2,300	310	2,810	65	13.5	None
6. Locust	3,700	5.9	350 hp Byron Jackson 15 HQ, 6-stage deep well turbine	3,000	350	3,200	55	13.0	None
7. Landings	3,500	14	500 hp Flowserve Model 15EHM/15HZ77, 5-stage deep well turbine	3,000	512	3,100	65	N/A [(c)]	None
8. Prairie	4,000	1	500 hp Flowway Model 16MKM, 6-stage deep well turbine	3,200	380	3,200	59	N/A [(a)]	None
9. Annie	2,500	93	350 hp Peerless Model 16HXB, 5-stage deep well turbine	2,500	429	2,500	N/A [(c)]	12	None
Total	34,800			26,250		27,040			
Firm Capacity				23,040					

(a) *Not available – The existing well depth gage is not operational.*

(b) *Scheduled to be replaced with standby power generation.*

(c) *No appreciable drawdown at current pumping rates.*

Table ES-3 – Summary of Existing Storage

Storage Tank	Capacity (MG)	Operating Characteristics: Overflow Elevation (MSL)	Height (feet)	Pressure Zone	Type of Tank
1. Best Hill	2.0	2,355.35	31.85	General	Ground Level (steel)
2. Tubbs Hill	2.0 1.0	2,355.35 2,355.35	24 24	General General	Ground Level (concrete) Ground Level (steel)
3. Prairie Standpipe	2.0	2,430.5	156.5	Upper	Standpipe (steel)
4. Industrial Standpipe	2.0	2,430.50	160	Upper	Standpipe (steel)
5. Stanley Hill	0.2	2,540.22	31	Stanley	Ground Level (steel)
6. Blackwell Hill	0.012	2,400 [a]	10	Blackwell	Ground Level (concrete)
7. Armstrong Park	0.16	2,882 [a]	32	Armstrong Park	Ground Level (steel)
Total	9.4				

[a] *Approximate elevation*

The City also has four major booster stations that supply the areas of higher elevation. These booster stations are summarized in **Table ES-4**.

Table ES-4 – Summary of Existing Booster Pump Stations

Booster Station	Operating Characteristics						Notes
	Suction Pressure Zone	Discharge Pressure Zone	Pump No.	HP	Capacity (gpm)	TDH [(a)] (ft)	
1. Elm Street	General	Stanley	1	20	200	230	
			2	50	500	230	
			3	20	200	230	
2. Blackwell Hill – Lower [(b)]	General	Blackwell	1	20	90		
			2	20	120		
3. Tubbs Hill	General	Tubbs Hill	1	1.5	30	158	
			2	1.5	30	158	
			3	1.5	30	158	
4. Armstrong Park	General	Armstrong Park	1	50	220	560	
			2	50	220	560	

(a) *Total dynamic head based on nameplate and original pump curve information.*

(b) *Pump HP and TDH not available for Blackwell Hill Boosters.*

The City's water distribution system includes a total of 296 miles of piping. This piping ranges in size and material throughout the system. **Table ES-5** includes a summary of the existing piping by diameter and material.

Table ES-5 – Pipe **Summary** [(a)]

Material	Pipe Length Diameter										Total
	< 6" (miles)	6" (miles)	8" (miles)	10" (miles)	12" (miles)	14" (miles)	16" (miles)	18" (miles)	20" (miles)	24" (miles)	(miles)
AC	5.7	52.3	25.5	2.2	19.8	0.6	1.1				107
Ductile	0.2	1.4	0.2		1.2	0.2	0.1	0.1	0.7	3.3	7
Galvanized	3.5										3
PVC	1.6	28.0	86.0	4.8	44.3		2.8	0.2			168
Steel	2.0	1.9	0.3								4
Other	2.4	2.3	0.3		0.8						6
Total	15.3	85.8	112.3	7.0	66.1	0.8	4.1	0.2	0.7	3.3	296

(a) Pipe material, length, and sizes were generated from the City's GIS water system database as of April 2012.

ES-4 System Analysis

ES-4.1 Supply

The City's existing supply is both high quality and productive. To help ensure reliable water service, water systems strive to meet maximum day demands through "firm" capacity. The "firm" supply required for the system is the supply required with the largest well out of service. **Table ES-6** shows the current firm supply for each of the pressure zones as well as identifies the additional supply that will be required for each of the zones to meet the build-out demands.

Table ES-6 – Supply Analysis

Zone	Current Firm Capacity MGD (gpm)	Build-Out Required Firm Capacity MGD (gpm)	Additional Capacity Required MGD (gpm)
Upper	16.40 (11,400)	24.30 (16,900)	7.90 (5,500)
General	15.80 (11,000)	27.40 (19,000)	11.6 (8,000)
Stanley Hill	0.60 (418)	1.00 (720)	0.52 (302)
Armstrong Park	0.32 (220)	0.63 (440)	0.31 (220)
Blackwell Hill	0.29 (200)	0.89 (620)	0.60 (420)
Fernan Hill	---	1.12 (775)	1.12 (776)

In order to meet the future supply requirements, four supply improvements have been scheduled. One additional 4,000 gpm well will be required in the Upper Zone along with increasing the capacity of two existing wells by 750 gpm each. The General Zone will require an additional 8,000 gpm total at build-out, which will be met with the addition of two new 4,000 gpm wells. These wells may be located in either the Upper or General Zone.

In addition to the additional supply that will be added to the system, a number of other improvements have been recommended, including the replacement of two wellhouses and upgrades to the disinfection systems, along with regular maintenance items such as pump repairs and control system upgrades. A complete discussion of the recommended improvements can be found in **Chapter 4**.

ES-4.2 Storage

The existing storage facilities are generally in good condition. The storage required for each zone is developed based on the City's criteria described in **Chapter 1**, which includes storage for equalization, fire, and emergency supplies. **Table ES-7** includes the current storage, required capacity, and total deficit by zone.

Table ES-7 – Storage Analysis

Zone	Current Usable Capacity (MG)	Build-Out Required Firm Capacity (MG)	Additional Capacity Required (MG)
Upper	2.00	2.90	0.90
General	5.00	4.40	---
Stanley Hill	0.20	0.70	0.50
Armstrong Park	0.16	0.50	0.34
Blackwell Hill	0.00	0.60	0.60
Fernan Hill	N/A	0.70	0.70

An additional 1 MG storage tank is recommended in the Upper Zone. Several tanks will also require re-coating within the next five years. Many of the boosted systems will require additional storage as these areas develop further. Since these are largely development driven, the improvements will be driven by development activity in these areas. A complete discussion of the recommended improvements can be found in **Chapter 5**.

ES-4.3 Distribution

The existing distribution system is generally in good condition. The Water Department schedules replacement of 1 to 2 miles of pipelines each year, focusing their program on the areas with old pipe and undersized pipe. This rate of replacement will allow the entire system to be fully replaced every 150 to 300 years. Ideally, full replacement would occur every 100 to 200 years.

As the system grows toward build-out of the planning area and the demands increase across the system, moving water from the large supply wells to the remainder of the system becomes more difficult. A number of the recommended improvements are driven by the need to move more water throughout the system. **Chapter 6** of the Plan includes a detailed discussion of the recommended improvements.

ES-5 Capital Improvement Plan

The recommended improvements for the system are identified in **Chapters 4, 5,** and **6** and are shown on **Figure ES-1**. These recommended improvements have been scheduled over the 20-year planning period to meet the system requirements and demands. **Table ES-8** shows the phasing of system improvements in 5-year increments.

Table ES-8 – City of Coeur d'Alene Schedule of Improvements

	Capital Cost Opinion by Year (a)		
Item	2013-2017	2018-2022	2023-2027
Supply Improvements			
New Wells	$3,397,400	$2,434,500	
Other Supply Improvements	$925,000	$747,700	$1,238,800
Storage Improvements (b)			
New Tanks		$2,172,700	$508,300
Other Storage Improvements	$308,300	$233,300	$476,500
Distribution Improvements (b)			
Distribution Improvements		$2,073,450	$2,014,078
Annual Water Main Replacement	$3,575,000	$3,575,000	$3,575,000
Booster Stations (b)			
Booster Station Improvements	$185,800	$527,000	
Additional Capital Improvements			
Additional Improvements		$3,000,000	
Totals	$8,391,500	$19,410,150	$7,812,678

(a) *All Opinions of Cost are planning level in 2012 dollars and do not include land purchase costs.*

(b) *Development-driven improvements are included at no cost to the City.*

The cost of these improvements is paid for in different ways, depending on the driving factor for the improvement. Facilities located within the existing system that are driven by growth to supply future connections such as the recommended supply wells, new storage, and water transmission improvements are funded by capitalization fees. Projects that are related to regular maintenance or replacement of existing system components are funded by water rates. Projects that specifically serve a single major new development are expected to be fully funded by the development and donated to the City. **Table ES-8** includes all of the recommended City-funded improvements. The complete list of projects, including those that are developer-funded, can be found on **Table 7-1** to **Table 7-6**.

ES-6 Appendices

The appendices of this report include background and supplementary information:

- **Appendix A** presents the detailed analysis of the population projections for the Water Department and how the specific growth rate was selected.
- **Appendix B** incudes the Water Conservation Plan. This Plan fulfills the requirements of the Idaho Department of Water Resources for applying for future water rights.
- **Appendix C** contains specific information on each of the wells and well pumps.
- **Appendix D** and **Appendix E** include memorandums describing the technical components for the future of the Fernan Hill Zone and the Blackwell Hill Zone.
- **Appendix F** details the technical components that went into the update of the hydraulic water model that was used to evaluate the distribution system.
- **Appendix G** outlines specific criteria for future developments.
- **Appendix H** includes the detailed Capital Improvement Plan.

ES-7 Financial Plan

A financial plan was prepared for this report and is included as a companion document. This document evaluates the cost of the recommended improvements and evaluates how the City can fund these from existing cash flow without adding debt. As a result of this analysis, it presents recommended rate and capitalization fee increases for the next six years.

ES-8 Acknowledgments

Many people were extremely helpful in providing documentation, information, and input. We wish, however, to especially thank the City of Coeur d'Alene Water Department staff who were instrumental in completing this report. Jim Markley, Terry Pickel, Dion Holton, Tom Howard, and Gwain Oka were instrumental in collecting data; presenting improvement ideas; evaluating alternatives; expressing system concerns; and giving timely, pointed feedback. We would also like to thank Dave Yadon, Brian Keating, and Troy Tymesen who all took time to provide planning and financial data as well as give us feedback on specific areas of the Plan. This assistance is gratefully acknowledged.

Chapter 1

Review Criteria

Chapter 1 – Review Criteria

1.1 Introduction

This chapter includes an overview of some of the current and future regulatory requirements facing the Water Department as well as an overall view of the water quality for the City. This chapter also identifies the basic review criteria that will form the basis for this Master Plan Update.

1.2 Regulatory Issues

Rules, regulations, and requirements for groundwater systems have not changed significantly since the last Comprehensive Plan in 1999; however, there are some future regulatory requirements that may impact the City. An overview of future regulatory requirements that may affect the City are discussed in this section.

1.2.1 Existing Water Quality

The City operates a Public Water System (PWS #ID1280053) that is regulated by the State of Idaho Department of Environmental Quality (IDEQ). As a regulated water system, the City must submit water samples each year to verify the quality of water they serve the public.

All nine of the City's wells draw water from the Spokane Valley-Rathdrum Prairie Aquifer (SVRPA). The aquifer was designated as a "Sole-Source Aquifer" by the Environmental Protection Agency in 1978. It has been further protected by Kootenai County and the Panhandle Health District, which limits septic tank wastewater service to one residential equivalent per five acres. Additionally, the Sensitive Resource Aquifer designation in 1997 by the State of Idaho further protects the SVRPA with Idaho's only "non-degradation" management standard.

Monthly coliform bacteria samples that are representative of water throughout the water system are submitted monthly to the IDEQ. In addition to coliform testing, the City is required to perform regular testing for contaminants, including lead and copper, volatile organic chemicals, synthetic organic chemicals, and inorganic chemicals.

Water quality throughout the system is generally very good and rarely elicits customer complaints. The City Water Department performs an excellent job in maintaining the system in good operating order. Water quality reports for the City's well sources show no detection of most chemical contaminates. Slight levels of nitrate exist within some of the City's wells. The highest level reported in 2011 was 2.1 mg/L, which is typical of Rathdrum Prairie wells and is well below the maximum contaminant level (MCL) of 10 mg/L. There is also naturally occurring arsenic in the City wells ranging from 1.22 to 37 µg/L, almost all of which is well below the Maximum Containment Level (MCL) of 10 µg/L.

The two City wells that are near or exceed the MCL for arsenic set by the Environmental Protection Agency (EPA) include the Hanley and Annie wells. The Hanley Well exceeds the MCL, with arsenic levels ranging from 5 to 37 µg/L. The City limits operation of both the Hanley and Annie wells per the agreement with IDEQ (from July 2006) to achieve an annual exposure of less than 10 µg/L to residents of these areas. The Annie Well has arsenic levels at or slightly less than the MCL limit. The City operates this well as a "last on"/"first off" well. Strong protection measures in place for the Spokane Valley-Rathdrum Prairie Aquifer are expected to maintain water quality within water quality limits well beyond the planning period.

1.2.2 Source Water Quantity

The aquifer is supplied by several large surface water sources, including Coeur d'Alene Lake, the Spokane River, Lake Pend Oreille, and Hayden Lake. Other small lake watersheds such as Hauser, Spirit, and Twin Lakes supply the balance of the surface water input to the aquifer. In an average year, precipitation also supplies the aquifer with one quarter of its recharge water. Of course, surface water flows and precipitation are subject to natural variations and will affect aquifer recharge rates. Detailed quantity, flow, and level analyses have been performed on both the Idaho and Washington side of the aquifer as part of the 2007 U.S. Geologic Surveys' "Bi-State" Study and are available on the IDEQ website.

The Spokane Valley-Rathdrum Prairie Aquifer is comprised of a thin layer of soil overlaying 200 to 400 feet of coarse sands and gravels. The alluvial material was deposited by Ice Age floods from Glacial Lake Missoula approximately 12,000 years ago. The 2007 "Bi-State" aquifer study completed by the U.S. Geologic Surveys shows that annual estimated aquifer withdrawals are approximately 22 percent of estimated annual recharge for the aquifer. While adequate aquifer supply appears to exist, pressure has been building from conservation groups to reduce per capita consumption in order to maintain Spokane River flows and water quality.

The Spokane Valley-Rathdrum Prairie Aquifer is the largest source of drinking water within the City's hydrologic area. Treating water from the nearby Spokane River or other surface sources would remove water that recharges the aquifer. It is significantly more costly than continued use of groundwater and could also introduce minimum river flow constraints directly into water supply planning. As a result, it is assumed that the City will continue to use groundwater as its sole water supply. Conserving water is likely the best way the City can reduce its dependence upon the aquifer. The City has been implementing conservation measures over the last few years, including promoting moisture sensors for irrigation systems and xeriscapes, education, ratepayer incentive programs, and 2-block rate structures to promote conservation. Long-term aquifer quantity issues cannot be resolved by the City alone, as it is something that affects all communities located within the hydrologic boundaries of the aquifer.

1.2.3 Future Regulatory Issues

Two new drinking water rules are being proposed by the EPA that could potentially impact the City– the revised Total Coliform Rule and the proposed Radon in Drinking Water Regulation.

The ***Total Coliform Rule*** was effective in 1990, setting health goals and MCLs for total coliform in drinking water. EPA announced intentions to revise the rule in 2003, and proposed revisions were completed in 2010. The revisions to this rule are intended to determine whether a system is vulnerable to microbial contamination and require the problems to be identified and fixed, usually through source protection and disinfection. The rule revisions also allow for reduced monitoring if systems meet specific criteria.

Due to the high quality water and substantial protection measures in place for the Spokane Valley-Rathdrum Prairie Sole Source Aquifer, it does not appear likely that groundwater disinfection will be required for systems on the Rathdrum Prairie Aquifer in the immediate future. The City does, however, already provide wellhead chlorination to reduce the likelihood of positive coliform samples.

There is the potential that Coeur d'Alene may have to develop a specific wellhead protection program to supplement the Sole Source Aquifer protection program already in place. Although we do not anticipate the need for such a plan, the anticipated groundwater disinfection rule may require that larger municipalities covered under the Sole Source Aquifer generate wellhead protection plans.

The second rule that could impact the City is the proposed ***Radon in Drinking Water Regulation***. This rule is intending to address both the issues of radon being released from water and breathed in or consumed while drinking, leading to the rise of lung cancer or stomach cancer, respectively. Monitoring for radon levels and reporting to IDEQ will be the first stage of this regulation. Sampling will be required after the initial year of quarterly monitoring, depending on the average of the levels, to show it compares to the MCL. The MCL is proposed to be 300 picocuries per liter (pCi/L), and the Alternative Maximum Contaminant Level (AMCL) is proposed to be 4,000 pCi/L. Based on historical data from the Rathdrum Prairie Aquifer, it is not expected that the City would have samples exceeding the MCL/AMCL, so the City would likely be eligible for reduced sampling after the initial four consecutive quarterly samples.

1.3 Fire Protection Criteria

Historically, the City water system has been designed to provide adequate water for domestic use only. Although there is no legal requirement for the water system to provide fire protection, the City has made a policy decision to provide reasonable flows and pressures for fire protection.

The current fire protection criteria for the City are based on providing reasonable minimum flows and pressures. Minimum demands that have been placed on the system by existing buildings will be met if possible but will not be the primary focus for any future improvements. Future development will then need to meet the minimum standards established by this Plan. The target minimum flows and pressures are presented in **Table 1-1**.

Table 1-1 – Summary of Fire Flow Targets

		Operating Characteristics		
Land Use and Zoning	Median Home Size (square feet)	Minimum Flow Rate (gpm)	Residual System Pressure (psig)	Duration (hours)
Residential (R-1, R-3, R-8, R-12)	3,600	1,000	20	2
	3,600-5,000	1,750 [(a)]	20	2
1. Commercial (C-17, C-34)		3,500	20	3
2. Industrial (LM, M)		3,500	20	3

[(a)] *On a case-by-case basis for structures greater than 5,000 SF*

In the case of exceptionally high fire flow demands or demands exceeding those in **Table 1-1**, the property owner will be required to provide onsite fire protection (i.e., storage, pumping, and sprinklers) as necessary to meet the required fire flow. For these cases, the additional requirements will need to be approved by the Water Superintendent and Fire Department, and will be at the property owner's expense.

Due to the distributed nature of the City's supply, there is a wide variation in system performance between summer and winter. Since all system wells are operating during the peak summer months, available fire flows tend to be much higher than in the winter months when storage is used more heavily.

The Water Department and Fire Department have jointly determined that the standard system condition under which sprinkler systems shall be designed and fire flows evaluated will be under low-demand, winter conditions with the Honeysuckle Well and the 4th Street Well operating and tank levels just above the minimum pump start levels.

1.4 Minimum Water Service Criteria

The City developed service criteria for the 1999 Comprehensive Water Plan Update to meet regulatory requirements, specific performance criteria, and fire flow criteria. City staff have indicated the criteria from the 1999 Plan have worked well. The criteria to be maintained by the City water system are as follows (only some minor changes were made for this update):

- A normal operating pressure range of 50 to 80 psi at the meter.
- Where possible, a maximum system pressure of 90 psi at the meter. If these pressures are to be exceeded, special arrangements will be made to provide an acceptable pressure range.
- Where possible, a minimum pressure of 40 psi.
- Water supply at least equal to the maximum day demand with the largest well out of service.
- Storage capable of meeting the maximum fire demand plus equalization demand with the largest well out of service during the maximum day while maintaining 50 percent storage in reserve.
- Where possible, meet a minimum fire flow of 3,500 gpm in commercial areas; a minimum fire flow of 1,750 gpm in the R-1 and R-3 (or as modified by PUD) zoning districts; and a minimum fire flow of 1,000 gpm in the R-5 through R-12 zoning districts during normal system operation.
- Minimum residual pressure of 20 psi during fires meeting the fire flow criterion.
- Fire flow demands based on the size of the structure and type of construction exceeding these ranges will require that property owners provide onsite fire protection, including, but not limited to, sprinklers.

Chapter 2

Water Production and Consumption

Chapter 2 – Water Production and Consumption

2.1 Introduction

Growth in the City of Coeur d'Alene has slowed the last few years, but the overall growth between 2000 and 2011 has been substantial. During this time, the Water Department has been able to keep up with the growth, provide good service, and minimize rate increases.

2.2 Coeur d'Alene Demographics

Coeur d'Alene has been growing rapidly over the last decade. U.S. Census data indicates that the City population was 34,514 in 2000 and grew to 44,137 in 2010, an increase of approximately 2.49 percent year-over-year.

The Kootenai Metropolitan Planning Organization (KMPO) estimates Coeur d'Alene's projected average future annual growth rate at 2.5 percent. Avista Utilities uses an average growth rate of 1.5 percent for the next ten years. Discussions with City Planning, the Wastewater Department, and the Water Department resulted in a selected population growth rate of 2 percent for the planning period. A complete discussion of this evaluation is included in **Appendix A**.

2.3 Coeur d'Alene Water Service Boundary

The water service population differs slightly from the City population because the water service boundary and the City boundary are not the same. Several small areas within the limits are served by other water purveyors, including Hoffman Water, Dalton Water Association, Hayden Lake Irrigation District, and Huetter Water. The differences in the City and water service boundaries are shown on **Figure 2-1**. The existing water service boundary encompasses approximately 6,400 acres. This existing service boundary and future service area boundaries are also included on **Figure 2-1**.

The City Water Department currently has close to 17,000 total metered connections. Using the 2010 Census information of 2.25 persons per household, the population of the service area is approximately 38,250 people.

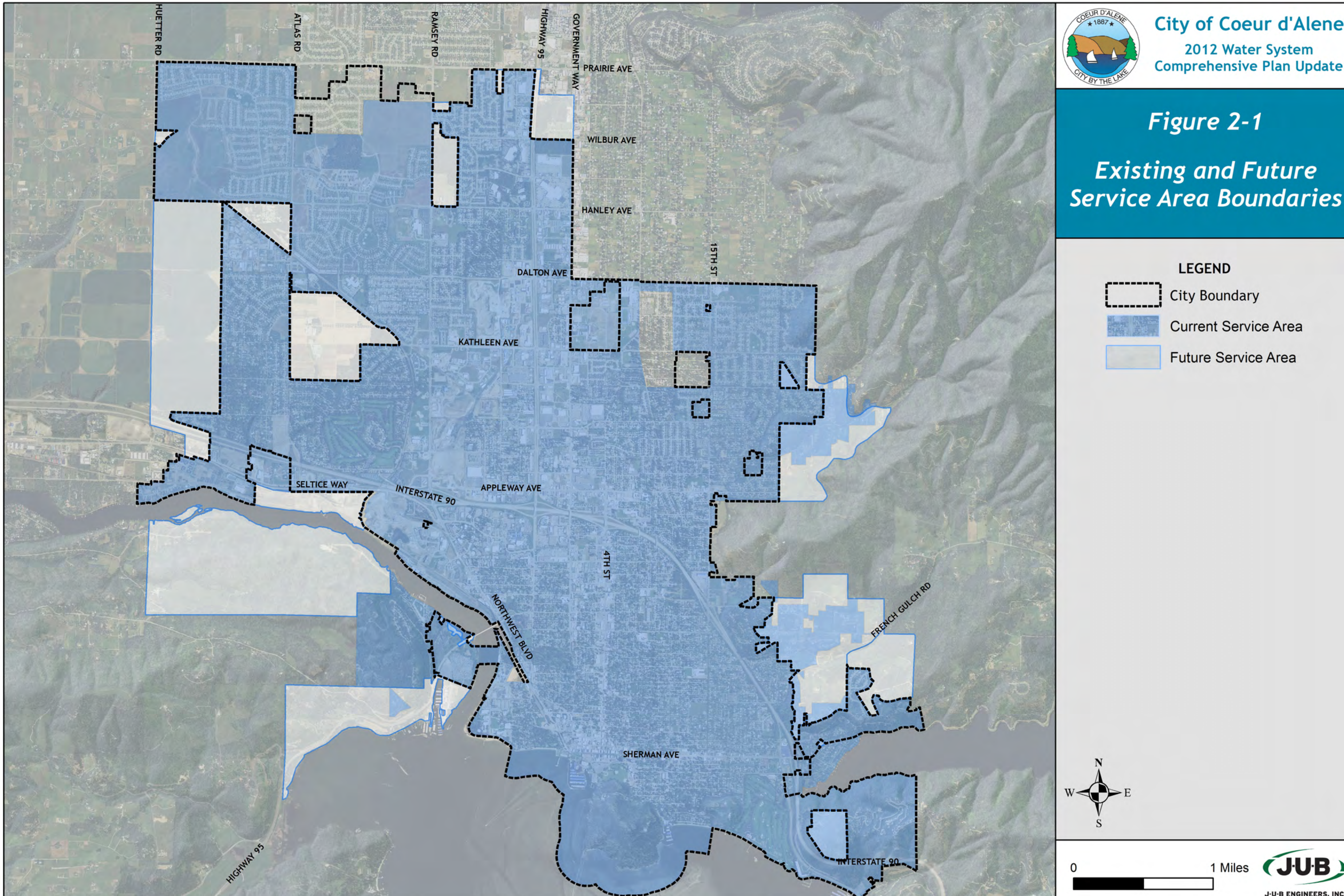


Figure 2-1

Existing and Future Service Area Boundaries

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2.4 Water System Growth and Planning Period

Growth of the water system is restricted on several sides due to adjacent water systems. Adjacent water purveyors exist on the north and west sides of the City along with one small private system within the City. Ross Point Water serves a large portion of the area north of Seltice and west of Huetter, and the Hayden Lake Irrigation District (HLID) borders the City system to the north along Prairie Avenue. The south side of the system is bound by Coeur d'Alene Lake.

The majority of the expected growth in the City of Coeur d'Alene is generally progressing toward the east and south with infill in the northwest, as shown on **Figure 2-1**. Specific areas of growth in the water system include:

- The northwestern portion of town as development fills in toward Prairie Avenue and Huetter
- The portion of town south of Seltice and north of the Spokane River
- The area south of the Spokane River
- The area east of the existing City boundary in the foothills

There are also several relatively small areas within the future City water boundary serviced by independent water systems. These specific areas are Hoffman Water, the Kootenai County Fairgrounds, and the USFS Nursery. These water systems may become part of the City system in the future, increasing demands to the City water system. Build-out water demand projections include the incorporation of the USFS Nursery and fairgrounds into the City for planning purposes. Hoffman Water is assumed to remain independent.

The equivalent served acreage for the City was estimated by comparing build-out water demands with current water usage for land use areas within the system boundary. Based on this equivalent area, it is assumed that there will be a significant increase in water demands within the current system boundary. The total serviceable area for the build-out scenarios of the water system is approximately 10,600 acres.

The anticipated increase in system demand for the water service area is accounted for by applying the growth rate of 2.0 percent for Coeur d'Alene to current peak day flow. Build-out demand for the system was estimated in conjunction with the City Planning Department using current zoning and water demand factors developed for major usage categories and applying these demands to the full build-out acreage. The growth rates were used to estimate approximate timing for service area build-out by projecting flows forward from today's maximum day demand (MDD) at a 2 percent increase. Future projects described in this Plan include dates for planning purposes; however, observed system demand is the more accurate and critical component to scheduling upgrades. Based on these projections, build-out population is estimated to occur between 2028 and 2032.

2.5 Current and Future Water Consumption Demands

Water demands within the City are similar to nearby municipalities, with peak summer demands nearing three times the average daily demand (ADD). The terms below are typically used to define water consumption demands:

Average Day Demand (ADD): The average number of gallons of water consumed per day as calculated over the course of one year.

Maximum Day Demand (MDD): The maximum number of gallons of water used in one day as determined from well production records.

Peak Hour Demand (PHD): The maximum amount of water used in a one-hour period. This number is extrapolated from well production and tank level records.

Daily and hourly pumping records are kept at each well site. The maximum historical recorded peak day demand on July 25, 2006 was 32.2 MG. The observed production has generally declined from 2006 to 2011. This decline is likely a combination of factors, including increased conservation efforts by the City, a new water rate structure, and the economic slowdown. Due to this observed reduction in water use, an average of the observed peaks over the last five years has been used to develop a daily use for projections. The average peak day from 2007 to 2011 is 30.2 MG, with an average MDD per capita water use of 700 gallons per capita per day. This value will be used in combination with the projected growth rate to develop future projected demands. **Table 2-1** illustrates current and future water use within the City's water service area utilizing an annual growth rate of 2.0 percent.

Table 2-1 – City of Coeur d'Alene Current and Future Water Demand

	2011 (mgd)	2016 (mgd)	2021 (mgd)	Build-Out (mgd)
Average Daily Demand	10.05	11.32	12.5	13.8
Maximum Daily Demand	32.19	35.77	39.5	43.6
Peak Hour Demand	57.94	64.38	71.10	78.48

The fluctuation in demands over a 24-hour period is demonstrated on **Figure 2-2** as a percentage of average over a 24-hour period. The demand fluctuation was developed using hourly SCADA information from the maximum day demand in 2011, taking into account pump run times, starts, and stops. The peak hour demand represents the highest rate of water use occurring in a one-hour period during the maximum day. Observed reservoir level fluctuations and pumping records indicate the PHD is approximately 1.8 times the MDD. This peak hour occurs at approximately 5:00 a.m., with a second lesser peak (1.2) at approximately 8:00 p.m. Demands above the base line show periods when equalization storage would be required if firm production capacity matched the peak day demand.

In addition to daily demand fluctuation, domestic water use varies yearly primarily due to irrigation use. **Figure 2-3** shows both the peak day and average day pumping values from 2007 through 2011. Comparing the average annual water demand of 10.4 mgd (7,220 gpm) to the maximum day demand of 30.2 mgd (20,970 gpm) yields a peaking factor of 2.9. This peaking factor is assumed to remain consistent through the planning period.

In addition to the domestic water use and irrigation, typical system demands include fire flow. Fire flow criteria were established by the City and tabulated in **Chapter 1**.

2.6 Unaccounted Water

The City maintains daily water production records for each well in the system. Comparing water production to individual user meter readings indicates unaccounted water ranges from 6 percent to 17 percent annually. The losses for the City are very low and indicate a well-managed and maintained system. A detailed evaluation of Unaccounted for Water is included in **Appendix B** (City of Coeur d'Alene Water System Conservation Plan).

Figure 2-2 – Diurnal Demand

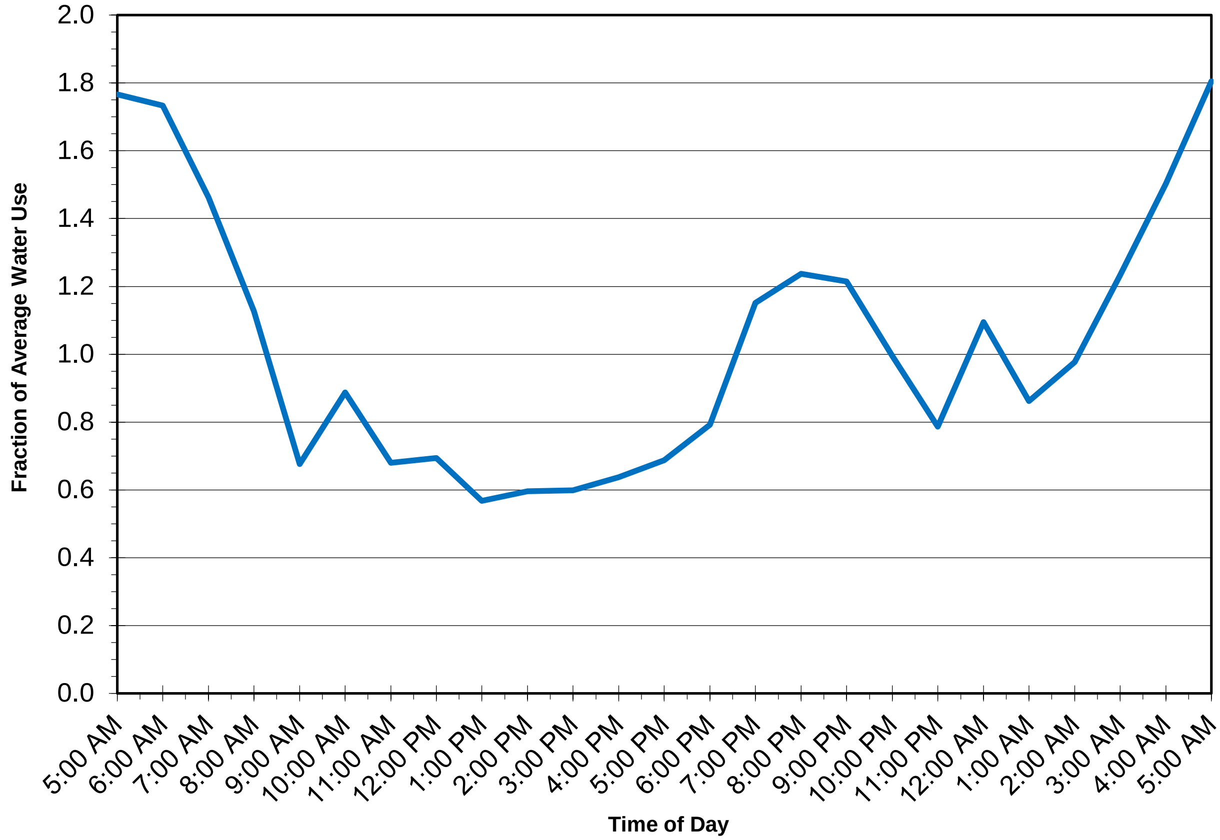
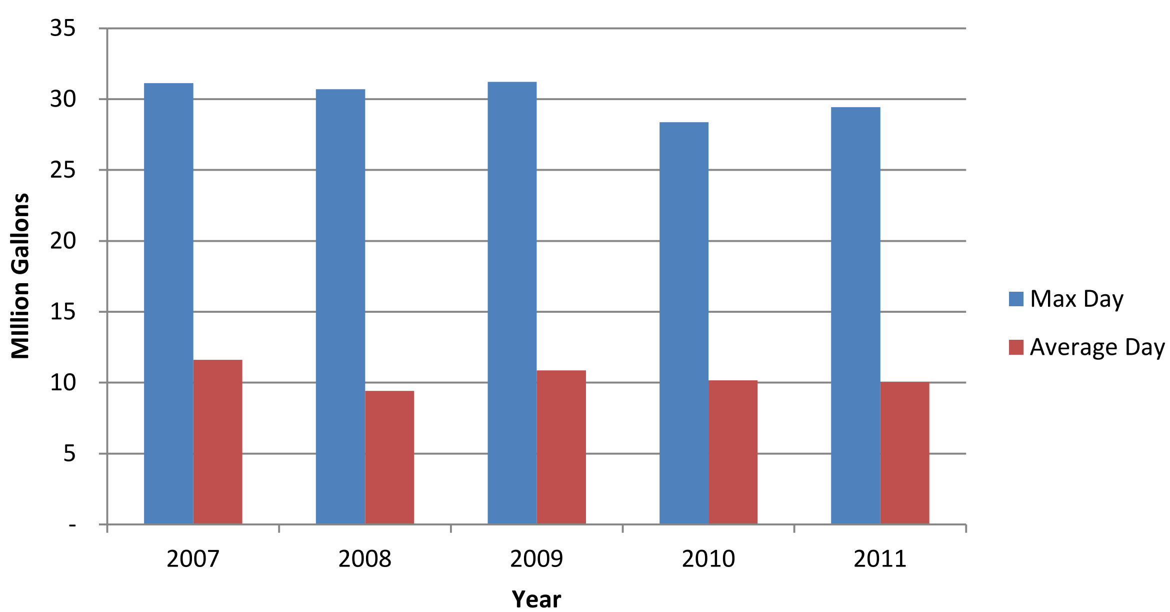


Figure 2-3 – Maximum and Average Day Pumping: 2007-2011



Chapter 3

Description of Existing System

Chapter 3 – Description of Existing System

3.1 Introduction

The Coeur d'Alene water system currently uses groundwater as its primary supply with major storage tanks on Tubbs Hill, Best Hill, Mineral Drive at Wilbur Avenue, and at the Coeur d'Alene Industrial Park.

The existing Coeur d'Alene water system utilizes nine groundwater wells for its supply located throughout the City. These wells deliver water directly to the distribution system and also fill six storage tanks. Use of boosters and pressure-reducing valves has created five distinct pressure zones within the system. **Figure 3-1** shows a map of the water system wells, tanks, and distribution system. The system is in good condition due to excellent maintenance practices on the major system components.

3.2 Water Supply

The municipal water system supply for the City is provided by nine groundwater wells having a combined operating capacity of approximately 37.4 million gallons per day (mgd). A tenth well, the Clayton Well, is currently used for irrigation only at the Fairgrounds. **Table 3-1** summarizes the well and pump operating conditions for all of the existing wells.

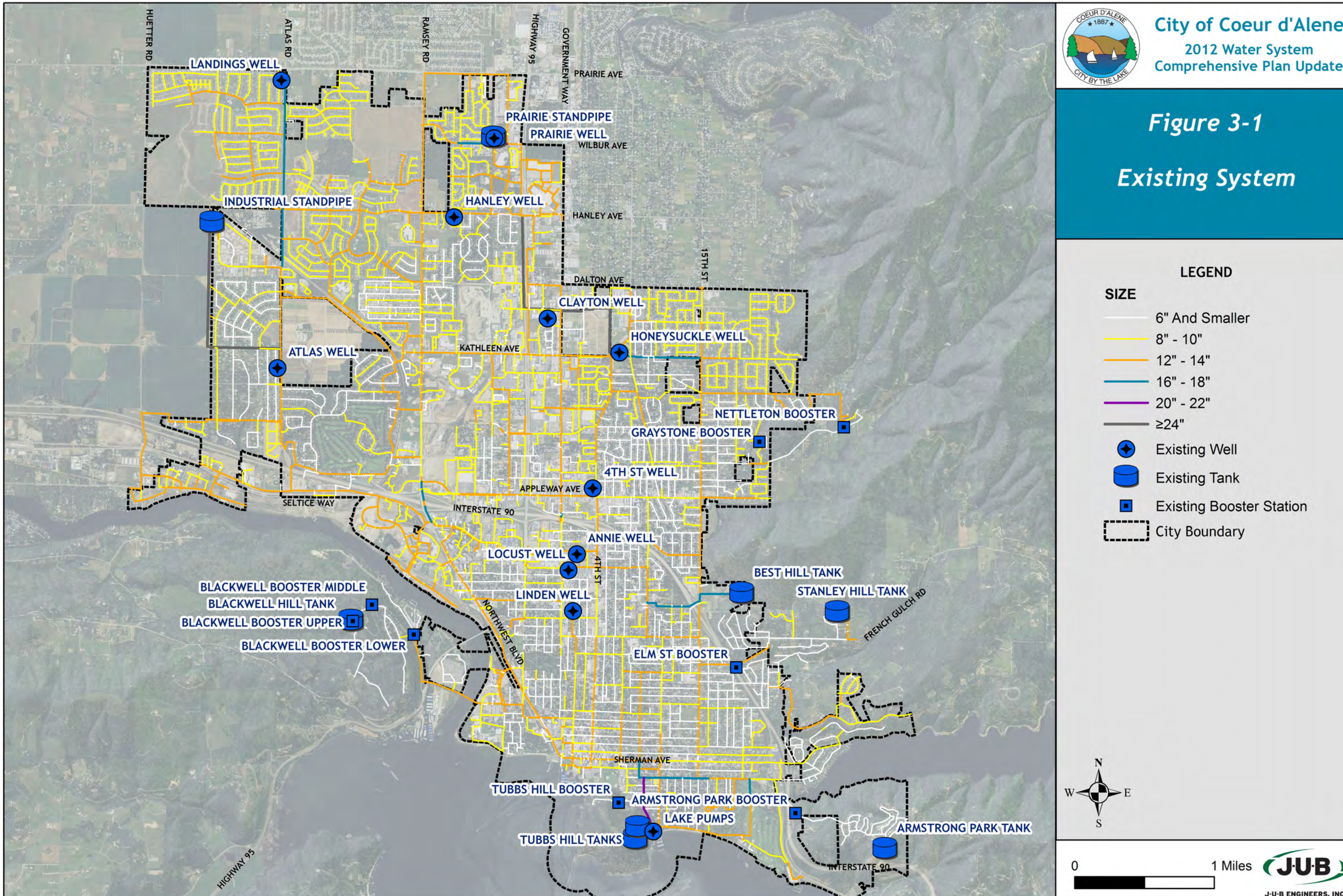
The existing wells utilize line-shaft vertical turbine pumps. Lightning suppression and motor savers are on all pumps. Discharge piping includes check valves and pump control valves. The pump control valves discharge to troughs adjacent to the pump buildings. The condition of all the existing well pumps and housing is excellent due to an aggressive maintenance program by the City Water Department. The wells have historically all utilized downhole chlorination for disinfection, which is mixed in the pump bowls. This was done with a gas chlorination system. The City is currently in the process of converting from gas chlorine to onsite generation of sodium hypochlorite as well as replacing the downhole chlorination with pipeline injection of the disinfectant. Existing autotransformer starters are also being replaced with soft starters.

The City is currently operating all of the well pumps based on tank level. The General Zone Wells (Annie, 4th Street, Linden, and Locust) are operated based on levels in the Tubbs Hill Tanks. Two of the Upper Zone Wells (Atlas and Landings) are operated based on levels in the Industrial Park Standpipe, and the other three wells (Honeysuckle, Hanley, and Prairie) operate based on the Prairie Standpipe levels. The Honeysuckle Well is the first on, last off well and is nearly always on.

City of Coeur d'Alene
2012 Water System Comprehensive Plan Update

Figure 3-1

Existing System



J-U-B ENGINEERS, INC.

Path: F:\Projects\JUB\20-12-015_CdA_2012_Wtr_Sys_Comp_Plan_Update\GIS\Maps\Plan Figures\Figure 3.1 Existing System.mxd

Table 3-1 – Well and Pump Data

Well No.	Original Well Test		Present Pump & Motor	Pump Rated Capacity		Normal Operating Point			Auxiliary Power
	Flow (gpm)	Drawdown (feet)		Flow (gpm)	Head (feet)	Flow (gpm)	System Pressure (psi)	Well Drawdown (feet)	
1. Atlas	6,000	23.2	600 hp Worthington Model 15HH410-7, 7-stage deep well turbine	4,000	420	4,480	53	14.5	600 hp right angle diesel drive [(b)]
2. 4th St.	3,500	20.1	400 hp Byron Jackson 16 GL, 3-stage deep well turbine	3,000	360	2,650	53	15.0	None
3. Hanley	6,000	5.75	500 hp Peerless deep well turbine pump	3,600	410	3,500	65	5.0	None
4. Honeysuckle	2,500	N/A	250 hp Goulds Model 14RJ-DWT, 5-stage deep well turbine	1,650	375	1,600	80	N/A [(a)]	None
5. Linden	3,100	10.7	300 hp Byron Jackson 16 GH 3-stage deep well turbine	2,300	310	2,810	65	13.5	None
6. Locust	3,700	5.9	350 hp Byron Jackson 15 HQ, 6-stage deep well turbine	3,000	350	3,200	55	13.0	None
7. Landings	3,500	14	500 hp Flowserve Model 15EHM/15HZ77, 5-stage deep well turbine	3,000	512	3,100	65	N/A [(c)]	None
8. Prairie	4,000	1.0	500 hp Flowway Model 16MKM, 6-stage deep well turbine	3,200	380	3,200	59	N/A [(a)]	None
9. Annie	2,500	93	350 hp Peerless Model 16HXB, 5-stage deep well turbine	2,500	429	2,500	N/A [(c)]	12	None
Total	34,800			26,250		27,040			

(a) *Not available – The existing well depth gage is not operational.*

(b) *Scheduled to be replaced with standby power generation.*

(c) *No appreciable drawdown at current pumping rates.*

The City has two main operational scenarios–one for high flow, summer months and one for winter months. During winter months, the 4th Street and Honeysuckle wells are used as the primary supplies with the Locust and Landings wells as backups. During the summer months, all wells are utilized as needed. The following paragraphs describe the City's supply wells. Well logs and corresponding pump curves are included in **Appendix C**.

The City also has a surface water source located adjacent to Tubbs Hill. This supply is currently not used due to the high cost of compliance with the Surface Water Treatment Rule (SWTR). Although these pumps are available in the event of an emergency such as groundwater contamination, they are not considered a viable part of the existing system. This report does not examine their use any further.

3.2.1 Upper Zone Wells

The following wells are located in the Upper Pressure Zone and are called to run based on the level in either the Prairie or Industrial standpipes. These wells also supply the General Zone indirectly through pressure-reducing valves between the Upper and General Zones.

3.2.1.1 Atlas Well

The Atlas Well is currently the largest well on the system and has a design flow of 4,000 gallons per minute (gpm); however, during peak periods, this well has produced flows of close to 4,500 gpm. This 600 hp well is used during the summer months when demand is at a peak and the well is needed on a continuous basis. The Atlas Well is controlled by the water level in the Industrial Park Standpipe.

3.2.1.2 Hanley Well

The Hanley Well was constructed in 1991 and at the time was the only well on the Upper Pressure Zone. This pump's nominal capacity is 3,100 gpm, with peaks of up to 3,500 gpm during the maximum day demand (July 28, 1998) conditions. The Hanley Well is controlled by the Prairie Standpipe.

This well has had historical operational challenges, which have forced the pump to be pulled from the well on three separate occasions. Power utility work in the vicinity caused a loss of power, resulting in the pump spinning backwards and shorting out when power was restored. The original submersible pump has since been replaced with a deep well turbine pump.

In the 1990s, water quality sampling of this well detected low concentrations of a regulated compound-trichloroethylene (TCE). Samples are pulled every month for water quality to verify that the average TCE concentration over four successive quarters is below the maximum contaminant level of 5 µg/l. Although individual samples have exceeded 5 µg/l, the average TCE level over four successive quarters has not. Although the exact source of TCE contamination is unknown, some potential sources have been identified and are in the process of being remediated. The Water Department continues to use this well since TCE levels appear to be declining and there are no known health impacts at the low contaminant level.

The Hanley Well has also exhibited arsenic levels above the MCL of 10 µg/l. Water quality sampling has found arsenic levels of 1.22 µg/l to 37.00 µg/l. To meet requirements of the Safe Drinking Water Act per a written agreement between the City and IDEQ from July 2008, the City currently blends the Hanley Well water with lower arsenic water and limits operation to the summer months, significantly reducing annual exposure to arsenic.

3.2.1.3 Honeysuckle Well

The Honeysuckle Well was constructed in 1996 and has a current capacity of 1,600 gpm. The well capacity is limited due to its proximity to the aquifer boundary. This well is currently utilized by the Department as the first pump on and the last pump off. It is called to service based on the water level in the Prairie Standpipe.

3.2.1.4 Landings Well

The Landings Well was drilled in 2004 and was test pumped at a flow rate of 3,500 gpm with negligible drawdown. The well currently operates at 3,000 gpm and 512 feet TDH, with no measurable drawdown. The well is controlled based on the water level in the Industrial Standpipe.

3.2.1.5 Prairie Well

The Prairie Well was completed in 1999. The operational conditions for the Prairie Well are 3,500 gpm and 450 feet TDH. This well has a 500 hp motor and is controlled off the level in the Prairie Standpipe.

3.2.1.6 Clayton Well

The City owns one additional well in the Upper Zone. The Clayton Well has historically had elevated arsenic levels that were originally detected at the well test pump after drilling. This well site was not completed based on the arsenic levels and does not have a wellhouse or standard, large horsepower pump. The Kootenai Fairgrounds uses this well for irrigation, and the school district may in the future. It is recommended that the City continue to regularly monitor the arsenic level, as it appears to be decreasing over time.

3.2.2 General Zone Wells

The following four supply wells are located in the General Zone:

1. Annie Well
2. 4th Street Well
3. Linden Well
4. Locust Well

All four wells are controlled based on the level of the Tubbs Hill Reservoir.

3.2.2.1 Annie Well

The Annie Well was drilled in 2004 and originally test pumped at 2,500 gpm, with 93 feet of drawdown. Additional well development raised production to 2,500 gpm at 12 feet of drawdown. Since its original construction, the well has been re-developed using hydropulse to improve production. The Annie Well's production zone is relatively fine material that has produced elevated arsenic levels. The average arsenic level for the well is less than the MCL of 10 ppb. Operation of this well is based on a 2008 written agreement with IDEQ.

3.2.2.2 4th Street Well

The 4th Street Well was originally hand dug and wood-lined. This well is currently designed to provide 3,000 gpm of flow at 360 feet of head.

Because this well historically has produced some sand, a series of pressure tanks is installed on the discharge that serve as sand traps. This well was also re-developed using Johnson well screens to help eliminate the sand problem.

The original design for this well utilized a 2,200 gpm well pump. The total capacity was increased to 3,000 gpm when the pump was replaced in 2007. This well has historically had problems at high flows rates when the well began to pull air into the well, creating taste and odor problems. This air entrainment was partially caused by cascading upper aquifer. A packer was installed to block out the upper aquifer in 1993 to help with the entrainment and taste and odor problems. The packer is no longer in use, and air entrainment, taste, and odor do not appear to be problems.

3.2.2.3 Linden Well

The current Linden Well pump was installed in 1966 and had a design capacity of 3,100 gpm based on the original pump curve. The current pump in the Linden Well provides 2,800 gallons per minute at 310 feet of head. There are no reported issues with this well.

3.2.2.4 Locust Well

The Locust Well currently has a capacity of 3,000 gpm at 349 feet of discharge head. Originally hand·dug in 1955, the well was expanded in 1968 and most recently in 1990. This well has been one of the system's most reliable producers.

3.2.3 Existing Water Rights

The City currently has a total of 52.4 cfs in claimed groundwater rights and 27.07 cfs in claimed surface water rights. A summary of the rights and their priority dates is included in **Table 3-2**.

Table 3-2 – Summary of Water Rights [(a)]

Right Number	Priority	Amount (cfs)	Nature of Use	Period of Use
95-2111	04/20/1955	3.00	Municipal	1/1 to 12/31
95-2133	07/21/1960	2.27	Municipal	1/1 to 12/31
95-2164	10/03/1964	3.61	Municipal	3/15 to 11/15
95-2198	12/13/1966	5.12	Municipal	1/1 to 12/31
95-7142	05/03/1971	2.45	Municipal	1/1 to 12/31
95-7181	03/14/1972	5.73	Municipal	1/1 to 12/31
95-8565	12/07/1987	7.55	Municipal	1/1 to 12/31
95-8647	03/19/1990	7.30	Municipal	1/1 to 12/31
95-8672	08/27/1990	3.00	Municipal	1/1 to 12/31
95-8938	02/08/1996	4.57	Municipal	1/1 to 12/31
95-9007	01/25/1999	7.80	Municipal	1/1 to 12/31
Total		52.4		

[(a)] *The City's rights have been consolidated as municipal water rights and apply to the system as a whole.*

3.3 Existing Storage

The purpose of water storage in the City is to provide for flow equalization and stabilization of pressures throughout the course of the day as well as to store water for fire flow demands. Tanks also provide emergency storage to alleviate water shortages during water supply interruptions due to mechanical or electrical problems with the existing wells.

Six tanks provide storage for the City of Coeur d'Alene. The total storage capacity of these tanks is 9.2 million gallons. However, because the Prairie and Industrial Park standpipes each have approximately 1.0 mg of storage that is too low to provide adequate pressure, the actual usable storage is 7.1 MG. **Table 3-3** presents characteristics of each of the storage tanks.

Table 3-3 – Summary of Existing Storage

Storage Tank	Capacity (MG)	Operating Characteristics: Overflow Elevation (MSL)	Height (feet)	Pressure Zone	Type of Tank
1. Best Hill	2.0	2,355.35	31.85	General	Ground Level (steel)
2. Tubbs Hill	2.0 1.0	2,355.35 2,355.35	24 24	General General	Ground Level (concrete) Ground Level (steel)
3. Prairie Standpipe	2.0	2,430.5	156.5	Upper	Standpipe (steel)
4. Industrial Standpipe	2.0	2,430.50	160	Upper	Standpipe (steel)
5. Stanley Hill	0.2	2,540.22	31	Stanley	Ground Level (steel)
6. Blackwell Hill	0.012	2,400 [(a)]	10	Blackwell	Ground Level (concrete)
7. Armstrong Park	0.16	2,882 [(a)]	32	Armstrong Park	Ground Level (steel)

[(a)] *Approximate elevation*

3.3.1 Best Hill Tank

The Best Hill Tank is located in the General Zone on the eastern side of the City and is connected via a 16-inch pipe to the water main in Fifteenth Avenue. This tank was constructed in 1971 and has a nominal capacity of 2 million gallons.

The Best Hill Tank water levels typically do not track with the levels in the Tubbs Hill Tanks. Since the Best Hill and Tubbs Hill Tanks are on the same pressure zone, they should “float” at approximately the same level. However, the Best Hill Tank consistently has higher water surface elevation than that of the Tubbs Hill Tanks during peak demands. According to the Water Department, the Best Hill Tank will drop only 6 feet of water elevation when the Tubbs Hill Tank drops 10 feet.

Pressure data taken in the vicinity of the Best Hill Tank indicate the system pressures adjacent to this tank are frequently higher than the altitude valve setting on the tank. Based on the tank’s proximity to three major wells (the Linden Well, the Locust Well, and the 4th Street Well), the hydraulic grade is higher at the Best Hill Tank than at the Tubbs Hill Tanks. This results in higher water levels in the Best Hill Tank.

Currently, the Best Hill Tank drains most rapidly when the Elm Street Booster is running at maximum capacity. However, this occurs only during maximum day demand. Based on existing system hydraulics, it is unlikely that the Best Hill Tank will function as expected until additional development occurs adjacent to the tank with a higher water demand or changes occur in the distribution piping.

The primary concern with the slow tank draining is the potential for water stagnation leading to poor water quality. Water quality testing conducted by City staff has not indicated any increase in coliform bacteria present or decrease in distribution system chlorine residual on 15th Street. As a result, the slow draining during peak events appears to be primarily an operational issue rather than a potential public health issue.

3.3.2 Tubbs Hill Storage

The Tubbs Hill storage system is located in the General Zone and consists of one 2.0 MG concrete tank and one 1.0 MG welded steel tank. The tanks are located on Tubbs Hill in the southern portion of town adjacent to the central business district. They supply a majority of the storage for the General Pressure Zone.

The concrete tank is a post-tensioned pre-cast concrete tank and was constructed in 2004. The telemetry for the General Zone is located on this tank.

The second Tubbs Hill Tank is a 1 MG steel tank on a concrete foundation constructed in 1948. This tank had a sizeable leak in the base, estimated at approximately 10 to 15 gpm, between the concrete base and tank walls where the existing caulking has failed. The City cut and patched the bottom portion of the tank to weld a steel base to the bottom of the tank in 2004, eliminating the leakage.

3.3.3 Prairie Standpipe

The Prairie Standpipe is a 2 MG, 160-foot-tall steel standpipe located in the Upper Zone. This standpipe was constructed in 1992 and primarily supplies water to the Upper Zone but is able to provide the General Pressure Zone through the system PRVs. The tank is located at the northern boundary of the City. The tank is in excellent condition and has had no reported problems since being placed on line.

A pressure transducer located at the base of this tank controls pump starts in the High Pressure Zone for the Honeysuckle, Hanley, and Prairie Wells.

3.3.4 Industrial Standpipe

The Industrial Standpipe is 160 feet tall and holds 2 million gallons. It is a steel standpipe located on the Upper Pressure Zone. This standpipe was constructed in 1999 and supplies water to the Upper Zone, which can supply the General Pressure Zone via pressure-reducing valves. The tank is located at the northwest boundary of the City. The tank is in excellent condition and has had no reported problems since being placed on line.

A pressure transducer located at the base of this tank controls pump starts in the Upper Pressure Zone. The level in this standpipe is the control variable that calls the Landings and the Atlas Wells to run.

3.3.5 Stanley Hill Tank

The Stanley Hill Tank is a 200,000-gallon steel tank that serves the Stanley Hill High Pressure Zone. This tank is located east of the Best Hill Tank. There have been no reported problems with operation of this tank.

Access to the tank is difficult. The current approach is through a local farm under agreement with the landowner. The City has no formal easement allowing access to the tank except for the pipeline easement that is impassible by vehicles.

3.3.6 Blackwell Hill Tank

The Blackwell Hill Tank is a 12,000-gallon tank located at the top of Blackwell Hill. The tank is rectangular in shape and constructed of cast-in-place concrete. The tank is fed by the Blackwell Booster Station at the bottom of the hill and an intermediate in-line booster, which is currently off line. The Blackwell Hill Tank contains a small booster station that feeds the residents at the top of the system.

The tank contains no telemetry back to the booster pumps. Filling of the tank is accomplished through use of a mechanical float valve that opens to allow water to fill the tank and closes when the tank is full. This tank is used as working volume for the residents at the top of the hill and is not available for use by any of the residents below the tank.

3.3.7 Nettleton Gulch Tank

The Nettleton Gulch Tank is an 18,000-gallon tank, which is currently off line and has no telemetry. It was removed from service when the Best Hill Tank was constructed and is not in a usable condition. However, its site elevations are compatible with other tanks and may present a potential site for a future tank to serve either the Upper or General Zone.

3.4 Booster Pump Stations

The City system currently has four booster pump stations. **Table 3-4** summarizes these existing booster stations and their capacities.

Table 3-4 – Summary of Existing Booster Pump Stations

Booster Station	Operating Characteristics						Notes
	Suction Pressure Zone	Discharge Pressure Zone	Pump No.	HP	Capacity (gpm)	TDH [(a)] (ft)	
1. Elm Street	General	Stanley	1	20	200	230	
			2	50	500	230	
			3	20	200	230	
2. Blackwell Hill – Lower [(b)]	General	Blackwell	1	20	90		
Blackwell Hill - Upper			2	20	120		
3. Tubbs Hill	General	Tubbs Hill	1	1.5	30	158	
			2	1.5	30	158	
			3	1.5	30	158	
4. Armstrong Park	Lower	Armstrong Park	1	50	220	560	
			2	50	220	560	

(a) *Total dynamic head based on nameplate and original pump curve information.*

(b) *Pump TDH not available for Blackwell Hill Boosters.*

3.4.1 Elm Street Booster Station

The Elm Street Booster Pump Station consists of two 20 hp, 200 gpm centrifugal booster pump and one 50 hp, 500 gpm centrifugal booster pump manufactured by Byron Jackson. This booster pump station is controlled by levels in the Stanley Hill Tank and serves the Stanley Hill High Pressure Zone. During peak demands, the 20 hp and 50 hp pumps are called to run simultaneously. The design points on the 20 hp and 50 hp pumps have significantly different discharge heads. The 200 gpm pumps have a design head of 230 feet while the 500 gpm pump has a design head of 280 feet. Based on existing SCADA data, the 200 gpm boosters are operating near their shutoff head and discharging very low flows while the 500 gpm booster is operating. Running the 200 gpm booster close to its shutoff head creates premature pump wear and is inefficient.

3.4.2 Blackwell Hill Booster System

The Blackwell Hill system was obtained from the Hayden Pines Water Company in 1993 and consists of three booster stations. The lower station has one 90 gpm booster pump and two 120 gpm booster pump. The middle station has a single pump that pumps water to the storage tank at the top of Blackwell Hill. The upper station has two pumps used to fill six pressure tanks to maintain pressure for the five users.

Responding to complaints of pressure surges caused by starting and stopping these boosters, the Water Department now operates the smaller pump continuously. During periods of low demand, the pump recirculates water. Although not efficient, this has reduced the number of customer complaints.

This system has no usable storage, so the booster pumps are vital for providing water to this system; however, the power supply at the station is adequate to run both larger pumps at one time to provide the required demand. Currently, the boosters are operated solely on system pressure.

As noted, the middle booster has no reliability because it utilizes only a single pump. This pump is required only in times of high usage, but in the event of pump failure, residents on the Upper System would need to rely on storage in the Upper Tank until the pump could be replaced.

3.4.3 Tubbs Hill Booster Station

The Tubbs Hill Booster Station was replaced in 2004 and includes three 1.5 hp, 30 gpm pumps. The TDH of the pumps at 30 gpm is 158 feet. This station provides service to seven connections located above the service elevations of the Tubbs Hill Tanks.

3.4.4 Armstrong Park Booster Station

In 2008, the City replaced the below-grade Armstrong Park Booster Station with a more accessible at-grade facility. The station currently has two 50 hp pumps that pump 220 gpm each and has provisions for a third pump in the future. The flow from the pumps goes directly to a 160,000-gallon storage tank and supplies water to 75 users. The station is designed to supply flow to approximately 150 total connections with the current 2-pump configuration. The pump suction pressure at the station is very low (<20 psi) due to elevation and suction pipe size (6 inches). Provisions for boosting chlorine residual are included in the station but are not currently used.

3.5 Existing Distribution System

3.5.1 Pressure Zones

The distribution system, as shown on **Figure 3-1**, consists of six pressure zones. The purpose of each zone is to maintain working pressures between 50 and 80 psi. The pressure zones are serviced by a combination of wells, water tanks, booster stations, and pressure reducing valves (PRVs). **Figure 3-2** shows the six existing zones and one recommended future pressure zone. The two largest pressure zones (the Upper Zone and the General Zone) contain all of the City wells. The four existing booster zones (Stanley Hill, Armstrong Park, Blackwell Hill, and Tubbs Hill) are all supplied by booster pump stations fed from the General Zone.

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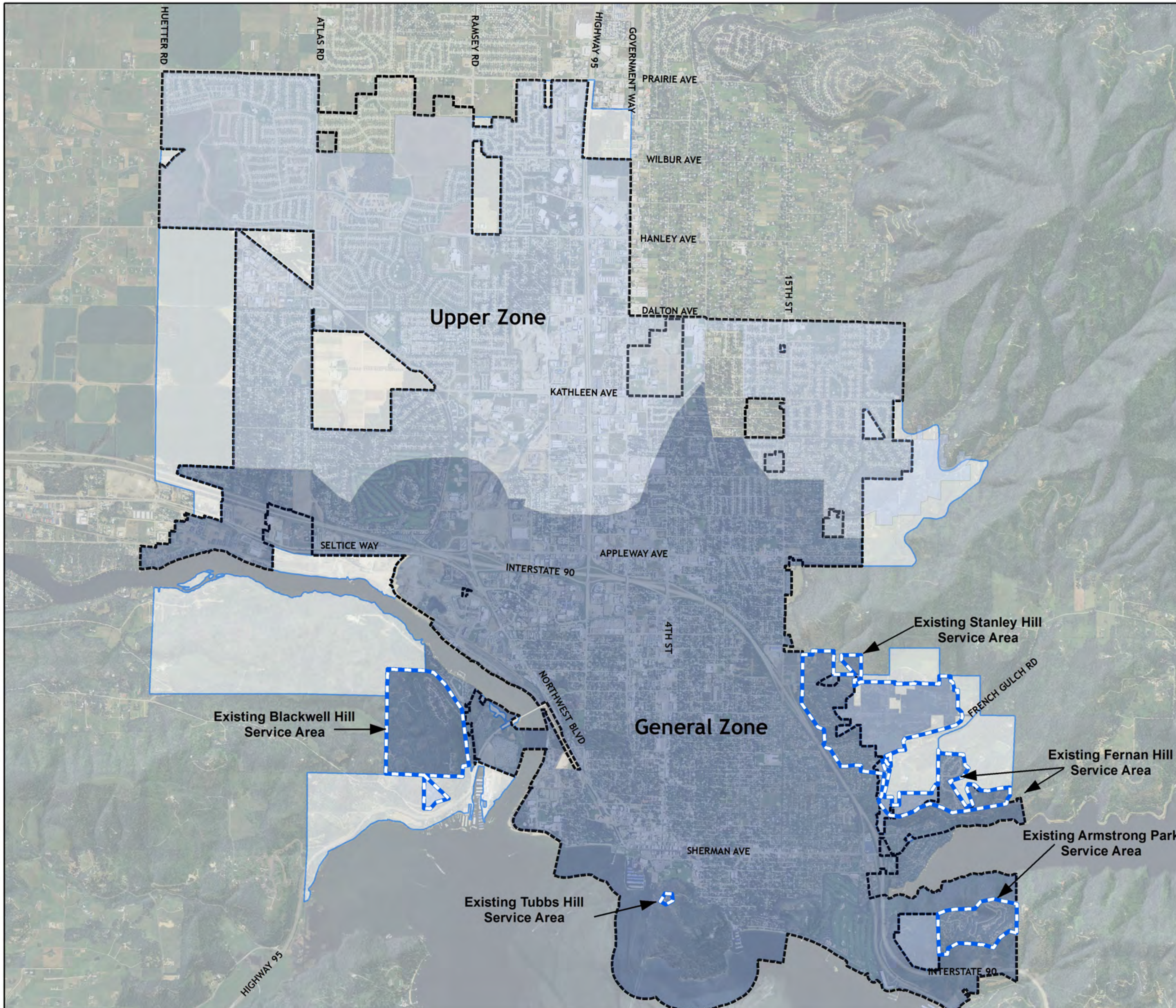


Figure 3-2

Zone Boundaries

LEGEND

- Hill Zone
- City Boundary
- Future Service Area

N W E S

0 1 Miles

J-U-B ENGINEERS, INC.

Path: F:\Projects\JUB\20-12-015_CdA_2012_Wtr_Sys_Comp_Plan_Update\GIS\Maps\Plan Figures\Figure 3.2 Zone Boundaries.mxd

The Upper Pressure Zone is able to provide water to the General Zone via PRVs to control downstream pressure. The identified connections are summarized in **Table 3-5**:

Table 3-5 – Pressure Reducing Valves

Name	Location	Size (Inches)
PRV-1	Abandoned	---
PRV-2	Abandoned	---
PRV-3	Blackwell Hill	8
PRV-4	Atlantic Drive	8
PRV-5	Atlas Road	12
PRV-7	Huetter Road	12
PRV-8	15th	6
PRV-9	Kathleen	6
PRV-10	Costco	6
PRV-11	Appleway	6

3.5.2 Pipe Network

The City owns and maintains approximately 296 miles of water distribution pipe and transmission mains. Pipe sizes and materials range greatly from 1-inch distribution pipe to 24-inch transmission mains. Transmission mains include 16-inch to 24-inch ductile iron and PVC pipes that route water from wells and storage reservoirs into the distribution system. The distribution system is generally comprised of 10-inch to 12-inch pipes installed in a ½ mile grid, with smaller 8-inch and 6-inch lines providing service to patrons. Pipes smaller than 6 inches remain in service within the system; however, City policy now requires replacement to a minimum of 8-inch PVC. Less than 5 percent of the total system piping is smaller than 6 inches, and 2.8 percent of the total is 4 inches. A summary of these sizes and materials within the system is provided in **Table 3-6**. Typically, different pipe materials can be dated back to specific periods depending on available material and the City's preferences at the time.

Table 3-6 – Pipe **Summary** [(a)]

Material	Pipe Length Diameter										Total
	< 6" (miles)	6" (miles)	8" (miles)	10" (miles)	12" (miles)	14" (miles)	16" (miles)	18" (miles)	20" (miles)	24" (miles)	(miles)
AC	5.7	52.3	25.5	2.2	19.8	0.6	1.1				107.2
Ductile	0.2	1.4	0.2		1.2	0.2	0.1	0.1	0.7	3.3	7.4
Galvanized	3.5										3.5
PVC	1.6	28.0	86.0	4.8	44.3		2.8	0.2			167.7
Steel	2.0	1.9	0.3								4.2
Other	2.4	2.3	0.3		0.8						5.8
Total	15.4	85.9	112.3	7.0	66.1	0.8	4.0	0.3	0.7	3.3	295.8

[(a)] *Pipe material, length, and sizes were generated from the City's GIS water system database as of April 2012.*

Chapter 4

Water Supply Evaluation

Chapter 4 – Water Supply Evaluation

4.1 Introduction

This chapter addresses the system's ability to match demand requirements with supply. Generally, the system must be able to supply enough water to meet the maximum daily demand (MDD). The supply to each by zone must also meet the MDD with the largest source out of operation for that zone. This Comprehensive Plan Update defines the worst case as the Atlas Well out of service because it is the largest single source of supply and it serves both the Upper and General Zones.

4.2 Existing Supply Requirements

The existing water system must be able to supply enough water to meet the current system-wide MDD of 32.2 mgd (22,400 gpm). The total pumping capacity with all wells on line is 38.0 mgd (28,200 gpm). Evaluating the system under the worst case (as defined above) with the Atlas Well out of operation results in a current firm pumping capacity of 32.3 mgd (23,200 gpm). Therefore, the existing City-wide water supply meets the current MDD.

The existing supply capacity is summarized in **Table 4-1** for comparison with the existing MDD for both the Upper and the General Zones.

Table 4-1 – Existing Supply Requirements

	Maximum Day Demand	Current Supply Capacity	Reliable Capacity Largest Pump Off Line [(b)]
City Total	32.2 mgd (22,400 gpm) [(a)]	38.0 mgd (26,400 gpm)	32.3 mgd (23,200 gpm)
Upper Zone	16.2 mgd (11,200 gpm)	22.2 mgd (15,400 gpm)	16.5 mgd (11,400 gpm)
General Zone	14.8 mgd (10,300 gpm)	15.8 mgd (11,000 gpm)	15.8 mgd (11,000 gpm)

(a) *Maximum Day Demand based on Summer, 2011.*

(b) *Atlas Well is assumed off line for both the Upper and General Zones.*

All of the City supply is located in the Upper and General Pressure Zones. The Upper Zone can be fed only from wells in the Upper Zone and has a current capacity of 22.2 mgd (15,400 gpm). The General Zone has an available supply of 15.8 mgd (11,000 gpm) and can be fed from wells located in either zone. This analysis assumes that the two zones are independent; however, the ability to feed from the Upper Zone to the General Zone does provide some system flexibility. The three existing boosted zones (Blackwell Hill, Stanley Hill, and Armstrong Park) as well as the future Fernan Hill Zone are all fed from the General Zone. The complete discussion on the future requirements for these zones is included in **Chapter 6**. The supply available in the Upper Zone and the General Zone is adequate to meet the current MDD requirements; however, as the service population increases, additional supply will be necessary.

4.3 Future Supply Requirements

Water system growth will require additional supply sources as development occurs. The year-over-year growth rate assumption approximates a build-out supply requirement of 43.6 mgd (30,300 gpm) MDD occurring between 2026 and 2032. **Table 4-2** summarizes projected supply requirements for 2017, 2022, and build-out of the system as detailed in previous chapters. Based on current projections, build-out of the system could occur as early as 2026. However, actual system demands should be used to program future upgrades at the times they are required.

Table 4-2 – Future Supply Requirements for Planning Period

Year	Average Day Demand (mgd)	Average Day Demand (gpm)	Maximum Day Demand (mgd)	Maximum Day Demand (gpm)
2017	11.5	8,000	36.5	25,300
2022	12.7	8,900	40.3	28,000
Build-Out	13.8	9,600	43.6	30,300

As shown, the projected maximum day demand for the planning boundary is 43.6 mgd. As a minimum, this firm supply capacity must be met. In addition, supply can help meet peak demands, reducing the total amount of storage required. Balancing supply and storage to meet both minimum storage criteria and peak system demands results in a total recommended firm supply of 51.7 mgd.

Four additional sources of supply are required to meet the increased demand and reliability criteria. Supply from one additional well and additional capacity from an existing well are required in the Upper Zone as well as two new wells in the General Zone to meet this demand. Each future well source is assumed to have a capacity of 4,000 gallons per minute. **Figure 4-1** and **Figure 4-2** provide a visual comparison of water system demand and firm capacity for both the Upper and General Zones. These figures also demonstrate the relationship between supply and storage. The triggers for adding supply to the system occur when the firm capacity nears the MDD or when the required storage reaches the available storage.

Table 4-3 shows the approximate years in which a new well source should be added to the City's supply system.

Figure 4-1 – Storage and Capacity Requirements-Upper Zone

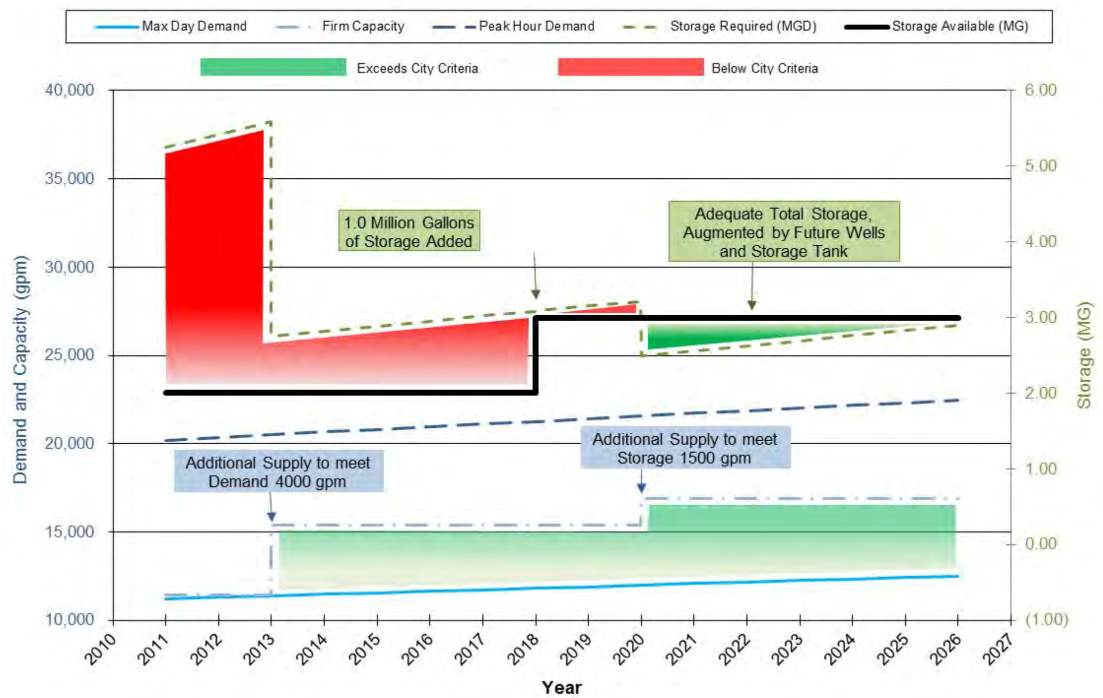


Figure 4-2 – Storage and Capacity Requirements-General Zone

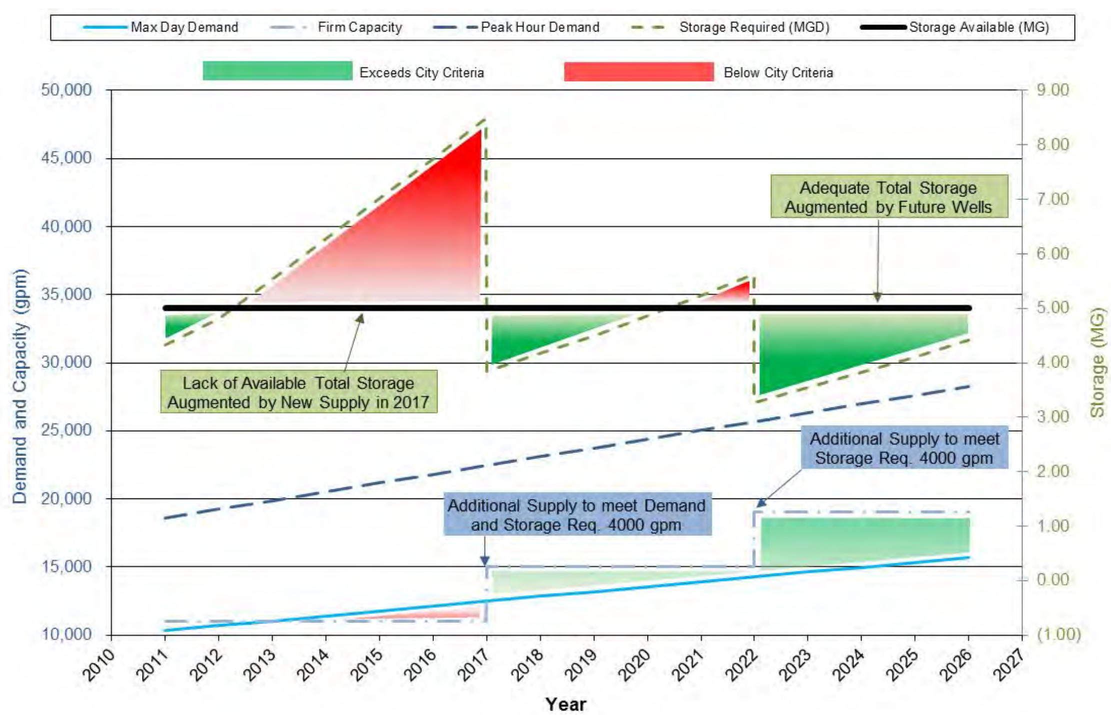


Table 4-3 – Future Supply Trigger Flow Requirements

Need	Additional Supply (gpm)	Estimated Year [(a)]	Maximum Daily Demand Trigger
Upper Zone Supply	4,000	2013	11,400 gpm in Upper Zone
General Zone Supply	4,000	2017	12,500 gpm in General Zone
Upper Zone Supply	1,500	2020	12,000 gpm in Upper Zone
General Zone Supply	4,000	2022	14,300 gpm in General Zone

(a) *Year is approximate based on projected growth rate.*

Although **Table 4-3** gives estimated years for increasing water supply, new well sources should be added to the system before listed MDD conditions occur. The table provides trigger flows for each zone when additional supply is required. If the MDD increases at a rate that is greater than expected, an additional well should be on line when the demand reaches the limits listed in **Table 4-3**, regardless of the year.

4.4 Boosted Pressure Zones Supply Requirements

4.4.1 Stanley Hill Zone

Elm Street Booster Station

The Stanley Hill Zone is supplied by the Elm Street Booster Station and includes the Stanley Hill area in addition to the Fernan area. The long-term plan for the City is to improve pressures in the higher elevations in Fernan Hill by dividing these areas into two separate pressure zones. The Stanley Hill Zone has a current MDD of 577 gpm and a build-out MDD of 762 gpm.

The firm capacity of the existing Elm Street Station (418 gpm) is less than the MDD, making the station vulnerable to supply problems. **Table 4-4** summarizes the anticipated demands for this zone.

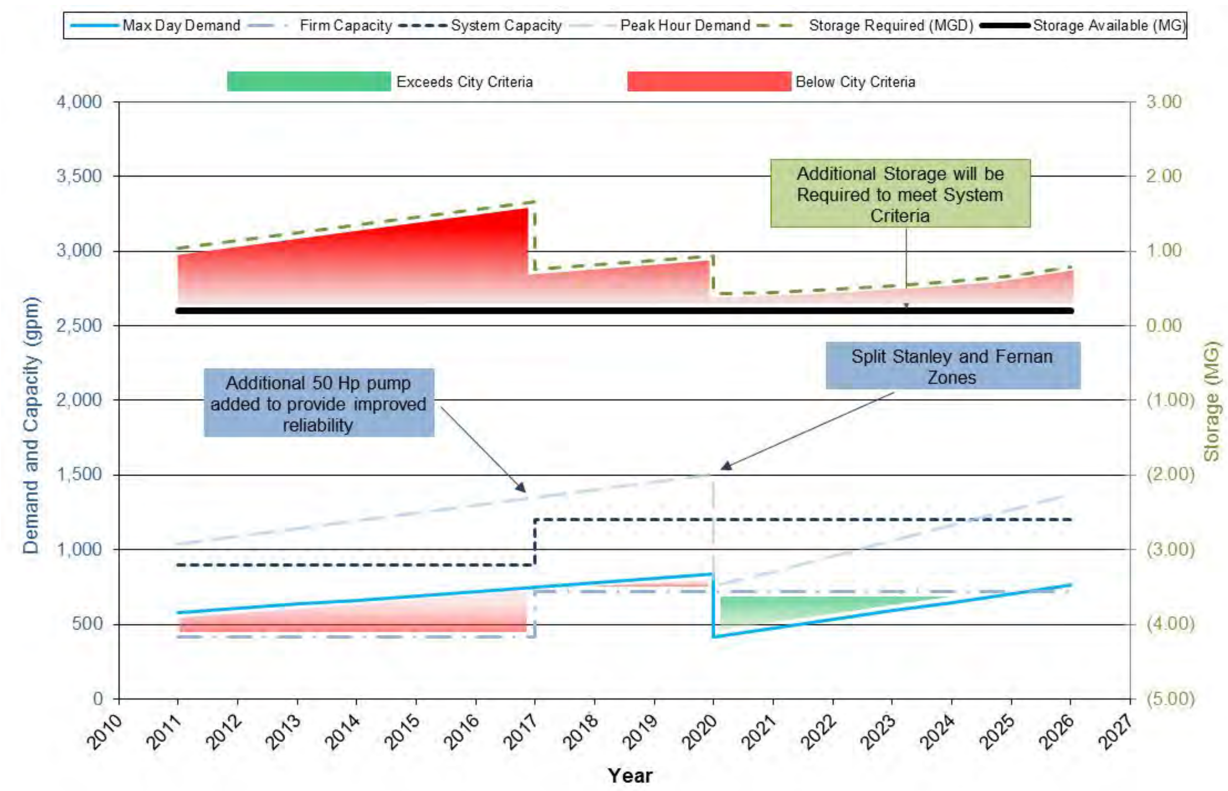
Table 4-4 – Elm Street Booster Station Demands

Year	ADD (MGD)	MDD (MGD)	Required Firm System Capacity (MGD)
2012	0.26	0.83	0.60
2017 [(a)]	0.22	0.69	0.69
2022	0.29	0.92	0.92
Build-Out	0.35	1.10	1.10

(a) *Assumes Fernan Hill Zone served by new Fernan Pump Station*

The supply and storage analysis is presented on **Figure 4-3**.

Figure 4-3 – Supply and Capacity Requirements-Stanley Hill Zone



4.4.2 Fernan Hill Zone

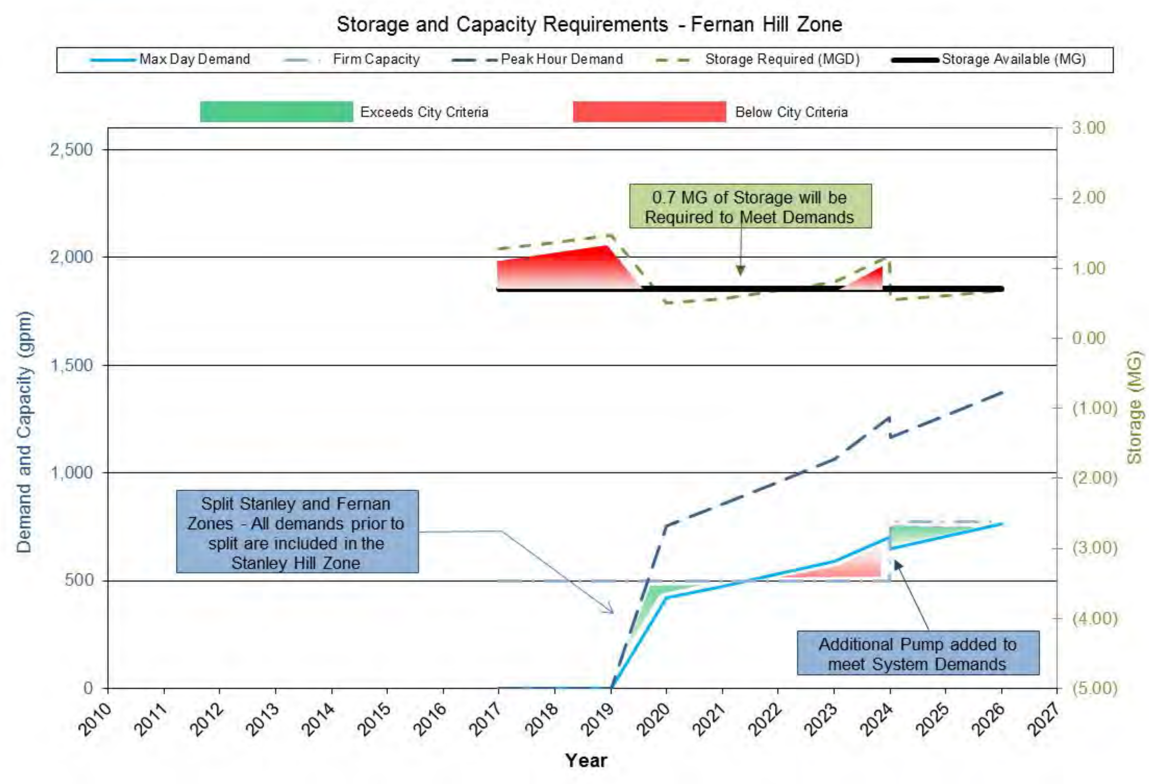
The Fernan Hill Zone is currently part of the Stanley Hill Zone and is supplied by the Elm Street Booster Station. The higher elevations in this area currently have very low system pressures. Splitting these two zones will allow the City to adjust pressures in the area. Low elevation areas will be supplied by the General Zone, and the elevated areas will be divided along French Gulch Road (see **Appendix D** for more detail). **Table 4-5** summarizes the anticipated demands for this zone.

Table 4-5 – Fernan Hill Booster Station

Year	ADD (MGD)	MDD (MGD)	Required Firm System Capacity (MGD)
2012	---	---	---
2017	0.22	0.69	0.69
2022	0.29	0.92	0.92
Build-Out	0.35	1.10	1.10

The balance of the supply and storage for the zone is demonstrated on **Figure 4-4.**

Figure 4-4 – Storage and Capacity Requirements-Fernan Hill Zone



4.4.3 Armstrong Park Zone

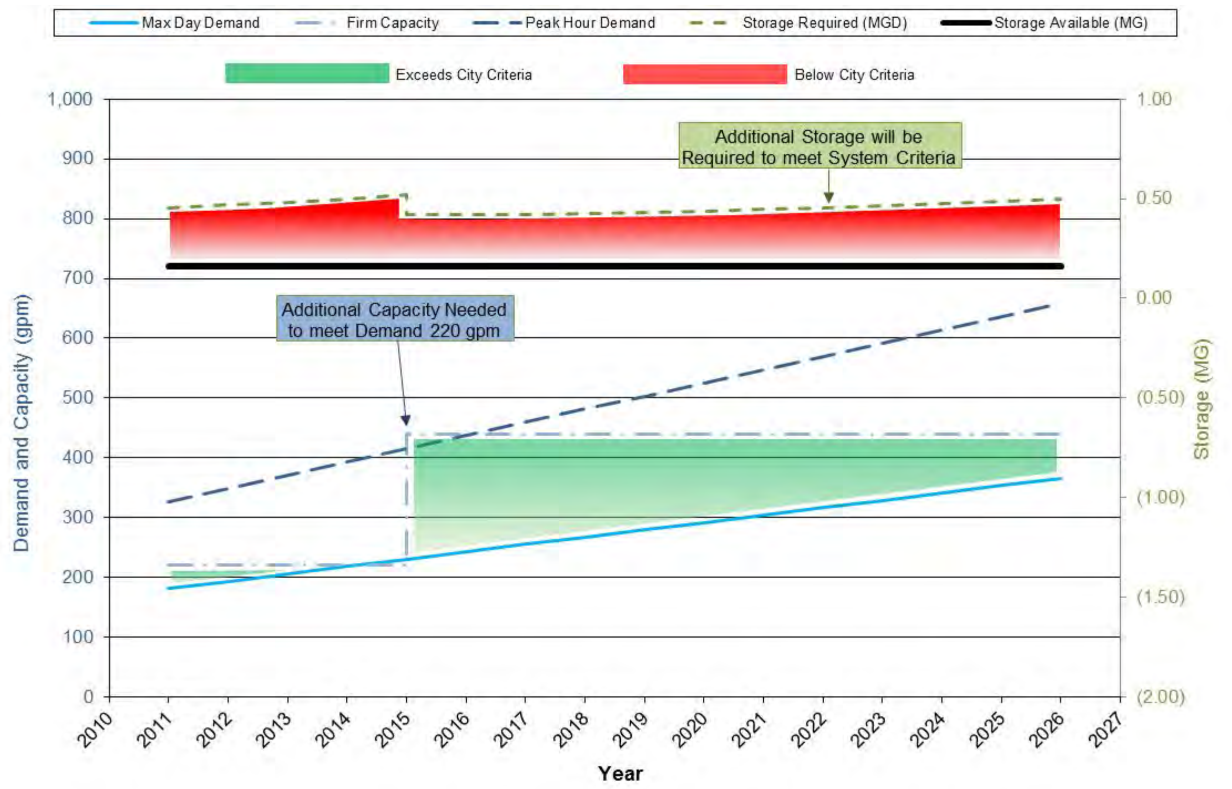
The existing Armstrong Park Station has two 220 gpm pumps with room for a third pump. The existing demand for this zone is 180 gpm. When this demand approaches 220 gpm, the third pump will need to be added. A summary of the anticipated demands for this zone is included in **Table 4-6**.

Table 4-6 – Armstrong Park Booster Station

Year	ADD (MGD)	MDD (MGD)	Required Firm System Capacity (MGD)
2012	0.08	0.26	0.32
2017	0.12	0.37	0.63
2022	0.14	0.46	0.63
Build-Out	0.17	0.53	0.63

The supply and storage analysis is demonstrated on **Figure 4-5**. The storage requirements will be discussed further in **Chapter 5**.

Figure 4-5 – Storage and Capacity Requirements-Armstrong Park Zone



4.4.4 Blackwell Hill Zone

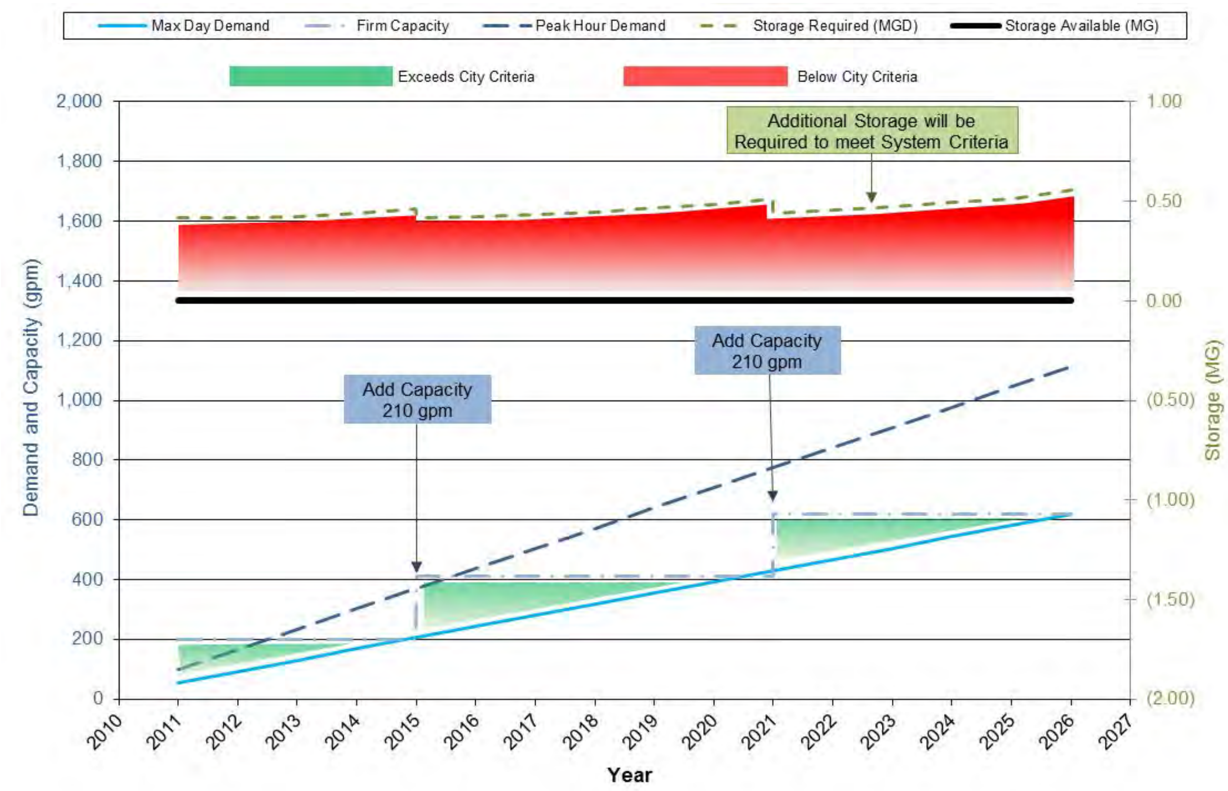
The current demand for the Blackwell Hill service area is 55 gpm and the firm capacity of the lower station is 80 gpm. The build-out demand for this zone is 618 gpm, which could be met by increasing the capacity in multiple upgrades as the area develops. A summary of the anticipated demands for this zone is included in **Table 4-7**.

Table 4-7 – Blackwell Hill Booster Station

Year	ADD (MGD)	MDD (MGD)	Firm System Capacity (MGD)
2012	0.02	0.08	0.30
2017	0.13	0.40	0.59
2022	0.21	0.67	0.89
Build-Out	0.28	0.89	0.89

Balancing the storage and supply will be critical for providing adequate emergency supply and fire storage. This balance is shown on **Figure 4-6**.

Figure 4-6 – Storage and Capacity Requirements-Blackwell Hill Zone



4.5 Water Supply Recommendations by Pressure Zone

4.5.1 Existing Wells

The existing nine wells have been constructed over the life of the water system and while they are in good condition for the most part, there are a number of improvement and maintenance projects that will be required. A summary for each well is included below.

Upper Pressure Zone

Table 4-8 includes a summary of the casing sizes and current capacity of the Upper Zone wells. The Atlas Well has a right angle drive that will be replaced with a standby electric generator, at which time a soft start will also be added to the systems. The fuel containment area will be removed to make room for a portable generator and expansion of the chlorine room to improve access for onsite sodium hypochlorite generation.

Table 4-8 – Upper Zone Wells

	Casing Size (in)	Capacity (gpm)	Drawdown
Atlas	24	4,000	<1'
Landings	24	3,000	<1'
Prairie	24	3,200	<1'

Both Landings and Prairie Wells have 24-inch casing and the potential for increasing capacity. Increasing the capacity in these wells would involve upsizing electrical components and pumps. An additional 1,500 gpm will be required in the Upper Zone near 2020. It is recommended that this be completed by increasing the capacity of both the Landings and Prairie Wells by 750 gpm. The operation of these wells at the higher flow rates will create an area of high pressure due to the relatively close proximity of the two wells. Balancing the operation of these wells to minimize the times they are operating at the same time will help minimize this problem.

The power source at the Landings Well has been problematic in the past, with several outages each year. Provisions for a portable generator to power the Landings Well is recommended to increase reliability in the zone. These provisions could be made at the same time as the pump and electrical upgrades to increase the supply.

General Pressure Zone

A number of the wells in the General Pressure Zone are on smaller lots in highly developed areas. The City would like to procure additional property at the 4th Street and Locust sites. The buildings at 4th Street and Linden also need to be replaced within the next ten years, which would ideally be staged with obtaining additional property.

The boosted zones are all supplied from the General Zone. The demand for these zones is a maximum day demand, and it has been assumed that the booster stations will be designed to supply the MDD and the peak hour demand will be supplied by the storage.

Stanley Hill Pressure Zone

It is recommended that the Stanley Hill and Fernan Zones are split into two zones to better serve these areas. This improvement will require modifications to the Elm Street Booster Station to supply the two separate zones. A detailed discussion of this analysis is included in **Appendix D**. The demand for the Stanley Hill Zone is anticipated to go from a current day demand of 577 gpm to a future demand of 760 gpm after splitting the two zones. The firm capacity of the pump station will need to meet the 760 gpm demand. Additional boosters will be required to serve development that occurs in the higher elevations of this planned service area.

Fernan Hill Pressure Zone

The Fernan Booster Station will be located on the same property as the Elm Street Station. Build-out MDD for this zone is expected to be 760 gpm. A triplex station is the recommended layout. Specific options for the station configuration are included in **Appendix D**. This zone will require an additional station near the tank in order to provide higher elevation properties.

Armstrong Park Pressure Zone

The current demand for this zone is 180 gpm with a firm capacity of 220 gpm. When the demands near 200 gpm, it is recommended that the third pump be installed at the booster station. This third pump will provide a firm capacity of 440 gpm, which will supply the planned service area demand of 370 gpm.

Blackwell Hill Pressure Zone

Blackwell Hill has some significant areas within the planning boundary that can be developed over a range of elevations. The final build-out will require several booster stations or PRVs to service this area. A more detailed discussion of this area is included in **Appendix E**. The current demands of 55 gpm are met by the pumps. Replacement of the station will be required to meet future demands. Additional booster stations will be required to serve upper elevations of this zone.

4.5.2 New Wells

Water supply recommendations include installing one new well in 2013 to meet demand and storage requirements. The well should be installed in the Upper Zone to meet the system demands. Placement of future wells will need to take place on the western edge of the City where the aquifer is productive and water quality is best. Building and improving the pipe network to supply the water from the western side of town to the expected areas of growth in the areas east and south of the City will be critical in providing adequate pressures and flow. **Figure 4-7** shows proposed locations of the new wells. A total of four new wells will be required to serve the system's projected build-out (two within the next ten years). Verification of site requirements with IDEQ should be completed prior to final selection of future well sites.

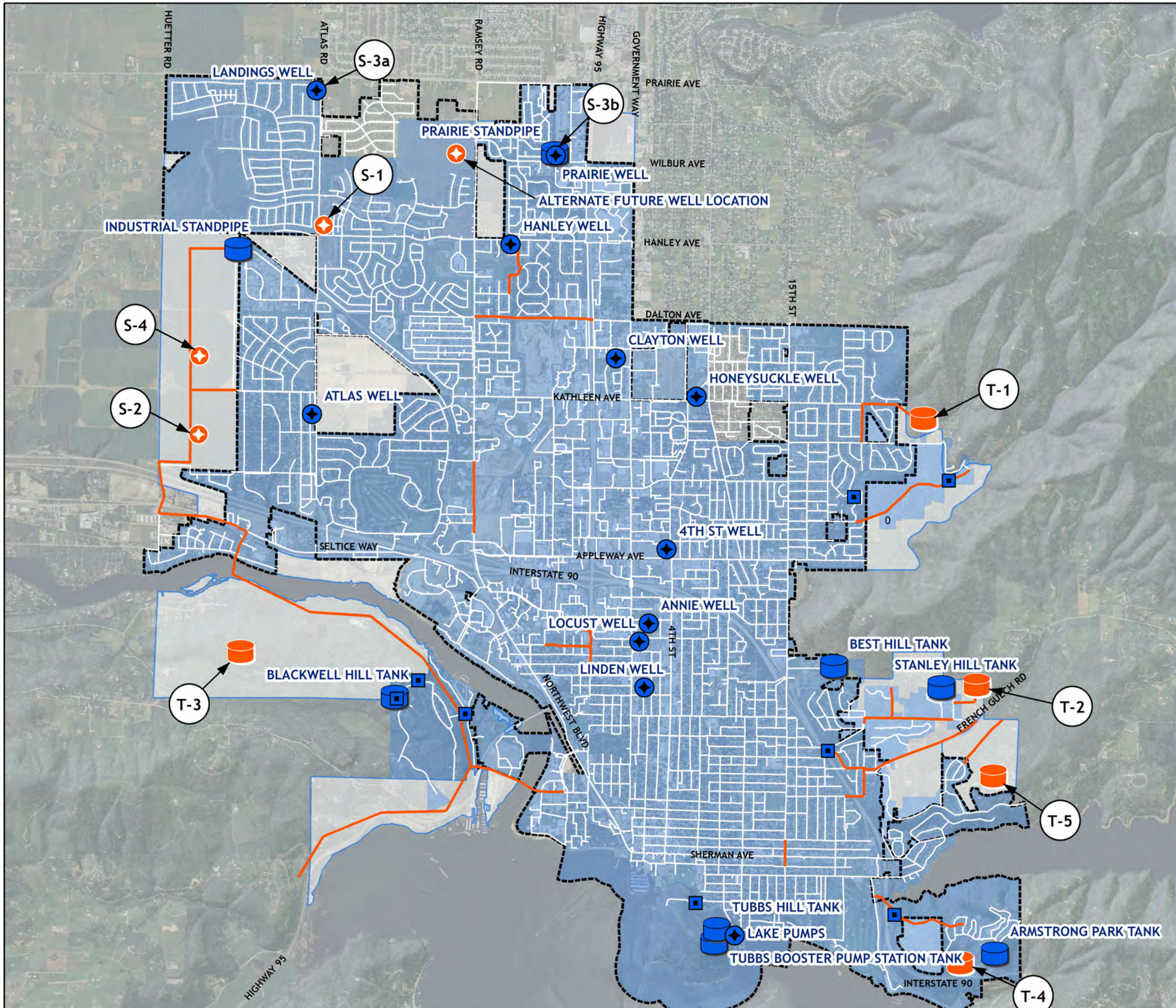


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Figure 4-7

Supply and Storage

LEGEND

- All CIP Pipe Upgrades
- Existing Pipes
- City Boundary
- Current Service Area
- Future Service Area
- Existing Well
- Existing Tank
- Existing Booster Station
- Future Tanks
- Future Well
- S-# Supply Improvements
- T-# Tank Improvements

N W E S

0 1 Miles

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Path: F:\Projects\JUB\20-12-015_CdA_2012_Wtr_Sys_Comp_Plan_Update\GIS\Maps\Plan Figures\Figure 4-7 Supply and Storage Locations.mxd

4.6 Proposed Well Locations

There are four supply recommendations for the City. Three of these recommendations are new wells with anticipated capacities of 4,000 gpm. The first well is scheduled to begin construction in 2013. This well project (S-1) will be located north of Hanley and east of Atlas, as shown on **Figure 4-3**. This well will tie into the 16-inch main on Atlas.

The second supply upgrade recommendation is Project S-2 and is a 4,000 gpm well. The recommended location for this well is east of Huetter and south of Kathleen. This well will supply water to the General Zone.

Project S-3 includes upgrading two existing wells in the Upper Zone to add 1,500 gpm to the supply. It is recommended that both the Landings and Prairie Wells be upsized to increase flow 750 gpm. This will require upgrading the MCCs and replacing the existing pumps.

The fourth project, S-4, will supply water to the General Zone. The recommended location for this well is near that of S-3, east of Huetter and south of Kathleen. This location will allow the well to be easily connected to both the Upper Zone and the General Zone, improving the reliability of the overall system.

Should the property locations not become available, an alternate location for Project S-2 or S-4 is the area west of Ramsey and south of Wilbur. This is an area where good water quality is expected and property is likely available. There are a few drawbacks to this location, including the proximity of this location to the General Zone. This location would place a large percentage of the supply wells in the northwest quadrant of the City, requiring more distribution system upgrades to provide southern portions of the City. The other complication to adding another supply to this portion of the City is the creation of high pressure areas, especially if multiple wells are pumping at the same time. This location would require careful programming to alternate operation of the Prairie Well, Landings Well, new well on Atlas (S-1), and new well on Ramsey (S-3).

4.7 Ultimate Demand and Water Rights

The projected MDD for the City at build-out is 43.6 mgd (30,300 gpm), as shown in **Table 4-1**. The immediate demand requirement at that time must actually exceed 51.7 mgd (35,900 gpm) in order to meet peak hour demands. This capacity is achievable by adding three 4,000 gpm wells as well as an additional 1,500 gpm at existing wells to the current firm supply. Criteria dictate that new sources are installed prior to the MDD reaching the City's firm supply (i.e., total supply with the largest source out of service). These criteria will also limit the equalization storage requirements and take advantage of more cost-effective aquifer storage.

Based on existing total water rights of 52.4 cfs (33.9 mgd), the City will need a minimum additional instantaneous water right of 27.53 cfs (17.8 mgd), for a total of 79.9 cfs (51.7 mgd). The annual required withdrawal is projected to be 5,037 MG during the current planning period.

Additional rights will be required to meet the projected reliable water supply requirement of 79.99 cfs (51.7 mgd). Those rights should be obtained through rights transfers when land with existing rights is annexed into the City and through new water rights applications. New rights should be sought under Idaho Department of Water Resources Reasonably Anticipated Future Needs (RAFN) procedures using this Comprehensive Plan as a basis for the filing. That application should be made within the next five years.

Issues related to long-term aquifer capacity are beyond the planning period and beyond the scope of this study. However, aquifer management is inextricably tied to long-range water system planning and operations for all the regional communities relying on the Rathdrum Prairie Aquifer. The City has long been active in aquifer management through membership on IDWR’s Groundwater Management Plan Technical Advisory Committee, Kootenai County’s Aquifer Protection District, and IDWR’s Comprehensive Aquifer Management Plan (CAMP). Continued proactive participation with other water systems, IDEQ, IDWR, and other local municipalities, including Spokane, should help protect the City's rights to adequate water supply.

4.8 Telemetry

The current SCADA system appears to be adequate for well and reservoir control and alarm initiation; however, there has been difficulty in obtaining service for this system. It is recommended that this system be replaced with a program that can provide local service. The SCADA should continue to monitor trend lines of pumping and reservoir data to aid staff in troubleshooting and system optimization as well as when to plan specific system improvements.

4.9 Power Supply and Reliability

Avista Utilities and Kootenai Electric Cooperative provide power to the City’s wells. Hanley Well and the Landings Well are currently served by Kootenai Electric Cooperative while Avista provides power to the remaining wells. The City can meet the build-out ADD for all zones if KEC has a catastrophic loss of power. This is not true of a catastrophic failure by Avista. It is recommended that provisions be included at a minimum of two wells served by Avista for standby power generation in the case of such emergencies.

4.10 Water Conservation

The Spokane Valley-Rathdrum Prairie Aquifer is the largest source of drinking water within our hydrologic area. The City has been implementing conservation methods for several years. A complete discussion of these processes is included in the City's Water Conservation Plan included in **Appendix B**.

Pumping water is becoming more expensive as energy costs continue to rise. The conservation program helps reduce the amount of energy the City uses and extends the estimated times for adding new well sources as well as reduces demands on the aquifer. The City implemented a block water rate structure in 2008 to promote equity in water charges and aid conservation. Reevaluating the commodity charge for water use has been an effective tool for water conservation in many areas and should be reviewed by the City. A complete evaluation of the City's water conservation efforts and impacts is included in **Appendix B**.

4.11 Capital Costs

Table 4-9 presents a summary of budget costs for adding system supply to meet build-out demands.

Table 4-9 – Opinion of Probable Costs-New Supply

Project No.	Capital Project	Additional Supply (gpm)	Planned Year	Total Estimated Cost [a]
S-1	New Well	4,000	2013/2014	$1,698,700
S-2	New Well	4,000	2017/2018	$1,698,700
S-3	Additional Supply	1,500	2020	$735,800
S-4	New Well	4,000	2022/2023	$1,698,700
	Total			$5,831,900.00

[a] *All opinions of cost are planning level 2012 dollars.*
[b] *Cost of land acquisition not included since property is generally donated to the City.*

These costs are based on data from other wells drilled over the aquifer in Kootenai County. Wells constructed in future years must account for inflation as detailed in **Chapters 6** and **7**.

Capital project budgets planned for improving the existing wellhouses and systems are included in **Table 4-10**.

Table 4-10 – Opinion of Probable Cost-Miscellaneous Water Supply Projects

Project No.	Capital Project	Planned Year	Capital Cost [(a)]
S-5	Linden – Wellhouse Replacement	2020	$522,700
S-6	4th Street – Wellhouse Replacement	2024	$509,800
S-7	Atlas – System Upgrades	2025	$504,000
S-8	Regular Pump Rehabilitation	Biennial	$75,000
S-9	Onsite Chlorine Regeneration	2013-2015	$80,000
S-10	Soft Starter Replacement	Biennial	$75,000
S-11	Transfer Surface Water Rights to Groundwater Rights	2017	$10,000
S-12	Reasonably Anticipated Future Needs	2014	$25,000
S-13	SCADA Conversion	2013	$35,000
		Total	$1,836,500.00

[(a)] *All opinions of cost are planning level 2012 dollars.*

Capital project budgets for improvements to other pressure zone improvements are included in **Table 4-11**.

Table 4-11 – Opinion of Probable Cost-Booster Station Upgrades

Project No.	Capital Project	Planned Year	Total Estimated Cost [(a)]
B-1	Elm Street – Additional Pump	2015	$185,800
B-2	Elm Street – Additional Pump	2021	$64,800
B-3	Fernan Hill – Split with Stanley	2020	$527,000
B-4	Fernan Booster – Additional Pump	2021	$64,800
B-5	Blackwell Hill – New Station	2018	$527,000
B-6	Blackwell Hill – New Station	2025	$527,000
B-7	Armstrong Park – Additional Pump	2016	$64,800
		Total	$1,961,200.00

[(a)] *All opinions of cost are planning level 2012 dollars.*

These opinions of cost are budgetary in nature based on manufacturer's quotations, similar construction projects, discussions with contractors, standard estimating guides, and engineering judgment.

Preliminary designs of the improvement projects should be used to refine these budgets and update them for current market conditions as each project moves toward construction.

Chapter 5

Water Storage

Chapter 5 – Water Storage

5.1 Introduction

The existing water system has historically required less storage than similarly sized systems due to the high volume of groundwater available. When the system is evaluated by zone, additional storage or supply is required to meet future MDD requirements. The emergency storage normally required in a typical system can continue to be provided by adding groundwater wells equipped with emergency generators. Storage will be provided based on Water Department criteria for MDD equalization, fire protection, and emergency storage. Equalization demands vary greatly depending on available supply and MDD.

The total storage requirement in a typical water system includes equalization, fire protection, and emergency storage.

Equalization storage is the water volume required to meet peak hourly demands in excess of what the system can supply. It is generally more economical to provide water supply to meet the maximum day demand and storage to supplement the supply during peak usage hours. As noted in **Chapter 4**, however, the City of Coeur d'Alene can most efficiently meet peak demands through a combination of storage and additional supply. Equalization storage can also be used to decrease power costs by allowing pumps to operate at off-peak power demand periods and avoid excessive pump cycling. **Figure 2-2** showed the peak hourly demand of 180 percent of maximum day demand occurs around 5:00 a.m. during a “typical” maximum day. The sums of these peak demands comprise the required equalization storage volume.

Fire storage is the volume of water that must be stored in excess of available reliable supply to meet fire demands. The required volume was determined by the water system in conjunction with the local fire officials and building code requirements. The maximum fire demand multiplied by the fire duration within each zone determines the total volume. **Table 5-1** lists the fire demand criteria and corresponding storage need.

Table 5-1 – Fire Storage Sizing Criteria

	Recommended Fire Demand (gpm)	Fire Duration (hrs)	Recommended Storage (gallons)
Commercial	3,500	3	630,000
Residential	1,750	2	210,000

Emergency Storage is the additional volume of water stored to meet unexpected events such as power outages. The volume of emergency storage provided by the system is a policy decision by the City. The criteria selected for total storage is to meet equalization and fire storage needs while maintaining 50 percent of total storage in reserve.

The total storage volume required is dependent on the supply available. Increased supply meets more of the peak demand, reducing the equalization volume required. Optimizing storage and supply volumes can help keep both capital and operation and maintenance costs down. This section balances supply and storage to achieve the lowest overall system cost.

5.2 Existing and Future Storage Evaluation and Recommendation

The following sections discuss existing storage as well as future storage requirements for each zone.

5.2.1 Upper Zone

The City's Upper Zone has 4.0 million gallons (MG) of storage, 2.0 MG of which is available elevated storage evenly divided between the Prairie and Industrial Standpipes. **Chapter 4** presented the relationships between the amount of supply available and the storage required. This analysis showed that additional storage will be required to meet the City criteria.

In order to meet the storage criteria for the Upper Zone, it is recommended that 1.0 MG of storage be added in the northeast quadrant of the City. The addition of storage in this area provides required storage to meet system criteria and improves the hydraulic balance of the pressure zone. Since the majority of the supply is located on the west side of the Upper Zone, peak hour demands on the east side require significant water transmission across US 95. The east side storage will help to attenuate the peak demands and minimize transmission piping upgrades.

There are two potential locations for the 1.0 MG tank. A ground level storage tank near the end of Thomas Lane on the hillside is the option included in the Capital Improvement Plan; however, elevated storage near the Honeysuckle Well would also provide the same benefits to the system. The cost of an elevated tank is greater than a ground level tank; however, the City already owns the Honeysuckle property, so it is estimated that the costs for building on these two locations would be similar.

One additional option for emergency storage in the Upper Zone is to add a booster station at the Prairie or Industrial Standpipe that would allow the bottom million gallons of water to be utilized. The addition of a booster station to utilize this volume of water would reduce the overall supply needed for the system. It appears to be more cost effective to build a new supply well and utilize aquifer storage than to construct an emergency supply booster storage; however, if well sites become difficult to identify due to location or water quality, this may be considered.

5.2.2 General Zone

The Tubbs Hill Tanks and Best Hill Tank provide a total of 5.0 MG of usable storage to the General Zone. The existing storage in this zone is adequate for the long term, providing that a new well is brought on line when peak day demands in the area rise above 11,000 gpm as recommended in **Chapter 4**. As previously described, the addition of an additional supply well keeps the equalization storage volume to a minimum by the supply meeting the peak hour demand. If the zone supply is lower, more storage is required to meet the peaks. By adding new wells in a timely manner, the equalization, fire, and emergency criteria can be maintained until system build-out, as previously illustrated in **Figure 4-2**.

The General Zone storage, while adequate, has hydraulic connectivity problems between the Best Hill Tank and Tubbs Hill Tanks. Due to this, the Tubbs Hill Tanks cycle more regularly than the Best Hill Tank. A large pipeline project was completed in 2001, which significantly improved the situation. Although no problems have been encountered in the past, there are still concerns of water age at the Best Hill Tank, especially during low-use times.

No additional storage is recommended for the General Zone. There are several general maintenance projects recommended. The 1.0 MG Tubbs Hill Tank is scheduled for an exterior recoating in 2022, and the Best Hill Tank will require interior and exterior recoating in 2026. The addition of a mixer at the Best Hill Tank may also be considered to improve circulation and reduce concern over water age.

The storage analysis assumes that the City will make the recommended supply improvements as described in the previous chapter. If supply improvements are not made when recommended, storage needs will be much higher and could easily exceed available capacity.

5.2.3 Stanley Hill

The Stanley Hill Tank has a usable volume of 0.20 MG and supplies the Stanley Hill Zone. Based on the review criteria, the existing service area, and pump capacity at the Elm Street Booster, a total of 1.03 MG, is required. This zone has significant potential future development, so any improvements will likely be tied to system expansion.

As noted in **Chapter 4**, the Stanley Hill Zone is recommended to be divided into a Stanley Hill Zone and a Fernan Hill Zone. Following that division, the recommended storage for the Stanley Hill Zone can be reduced to 0.7 MG.

5.2.4 Fernan Hill

The Fernan Hill Zone is currently part of the Stanley Hill Zone. Once these zones are split, the Fernan Hill Zone will be independent and will require storage. The recommended storage for this zone is 0.7 MG. A full analysis of this zone and the division of the two zones is included in **Appendix D**.

5.2.5 Armstrong Park

The Armstrong Park Tank has a current capacity of 0.16 MG, which is less than the current storage criteria of 0.46 MG of storage based on current system demands. It is expected that this area will see some additional development within the planning period, and any improvements in this zone will be driven by development. The recommended total storage for this zone is 0.5 MG and could be completed by adding 0.34 MG of storage to the system.

5.2.6 Blackwell Hill

Blackwell Hill currently has only a small storage tank, providing minimal equalization storage to the Upper Pressure Zone. This area is expected by the City to see significant growth in the future, so any system improvements will be tied to system expansion. Assuming a booster pump station is capable of providing a firm capacity equal to the MDD for the zone, a 0.6 MG tank will be required to meet the required conditions at build-out.

The Blackwell service area is currently very small, with a plan boundary that is significantly larger. This area is also very steep and will require detailed planning (**Appendix E** includes a discussion of the pressure zone analysis for this area). The overall storage requirement for the built-out plan area is 0.6 MG and may be supplied by one or several tanks, depending on design. Preliminary cost opinions for this Plan assume one storage tank and several booster stations for this area, all of which are expected to be developer-funded.

5.2.7 Storage Summary

Table 5-2 shows the expected storage needs by zone for the water system.

Table 5-2 – Storage Requirements by Zone

Scenario	Zone	Equalization Storage [a] (MG)	Fire Protection Demand (MG)	Total Min. Storage Required/Available (MG)
Current Requirements	Upper Zone	1.99	0.63	5.25 / 2.0
	General Zone	1.53	0.63	4.32 / 5.0
	Stanley Hill Zone	0.31	0.21	1.26 / 0.2
	Armstrong Park Zone	0.02	0.21	0.46 / 0.16
	Blackwell Hill Zone	0.00	0.21	0.42 / 0.0
Build-Out Requirements	Upper Zone	0.82	0.63	2.89
	General Zone	1.58	0.63	4.43
	Stanley Hill Zone	0.14	0.21	0.71
	Armstrong Park Zone	0.04	0.21	0.50
	Blackwell Hill Zone	0.07	0.21	0.56
	Fernan Hill Zone	0.13	0.21	0.69

[a] *Adequate equalization storage is based on firm pumping capacity exceeding maximum day demand.*

5.3 Cost Opinions

A summary of the recommended storage projects and potential schedules is included in **Table 5-3**.

Table 5-3 – Cost Opinions-Storage Recommendation

Project No.	Project	Anticipated Year of Construction	Capital Cost
T-1	Upper Zone Storage – 1.0 MG	2018	$1,631,500
T-2	Stanley Hill Storage – 0.5 MG	2026	$1,016,600
T-3	Blackwell Hill – 0.6 MG	2021	$1,068,500
T-4	Armstrong Park – 0.3 MG	2022	$1,016,600
T-5	Fernan Hill – 0.7 MG	2020	$1,269,900
T-6	Recoating Prairie Standpipe	2014	$233,300
T-7	Recoating Industrial Standpipe	2019	$233,300
T-8	Recoating Tubbs Hill – 1.0 MG Tank	2022	$57,500
T-9	Recoating Best Hill Interior/Exterior	2026	$419,000
T-10	Best Hill Circulation	2015	$75,000

Chapter 6

Distribution System

Chapter 6 – Distribution System

6.1 Distribution System Analysis

A hydraulic computer model using WaterGEMs Version 8vi software produced by Haestad Methods was used to understand how the system reacts to various demands, and project how the system growth will impact existing infrastructure. The water model used data from the City's existing GIS database of their water distribution system. Model components, including wells, water storage tanks, PRVs, and PSVs, were imported as sub-models from the previous (2005) water model.

Current water demand was added to the system based on existing winter and summer water meter reading data. Future water demands were extrapolated from existing meter data by determining water usage per acre for existing land uses and assuming full build-out within the planning boundary.

Operating conditions within the sub-models were reviewed and updated based on discussions with the City. Missing or questionable data was reviewed with the City and/or record drawings and then updated as needed. Additional information regarding the development, calibration, and utilization of the water model can be found in **Appendix F** (Technical Memorandum, 2012 Coeur d'Alene Water Model Analysis dated 7/12/12).

6.2 Evaluation of Distribution System

The water model was utilized to identify locations within the existing distribution system that do not meet the system criteria and to understand the impact of future demands on the system within the Water Department's planning boundary. The analysis examined headlosses in each pipe. Based on the review criteria developed with City staff, maximum allowable headloss in the system is 10 feet/1,000 feet. This section examines the current system condition and the system under future demands.

6.2.1 Existing Demand Conditions

The existing system was evaluated under three current demand conditions:

1. 2012 average winter demand with only Honeysuckle and Landings Wells operating
2. 2012 MDD with all wells operating
3. 2012 PHD with all wells operating

Under Demand Conditions 1 and 2, no major system deficiencies were observed. Generally, the distribution system headloss and working pressure appear to be within criteria. Only localized high pressures and headloss gradients were observed near well and booster pumps in operation.

Under Demand Condition 3, several areas exhibit headloss greater than the allowable system criteria of 10 feet per 1,000 feet (0.010 ft/ft). The pressure contour map provided on **Figure 6-1** shows the existing distribution system headloss in feet per 1,000 feet. The areas of high headloss are primarily located adjacent to Highway 95 and south of Hanley Avenue. During peak hour demand, the Honeysuckle Well is unable to meet the demand of the northeast part of the system, so water must come from the water supply in the northwest. Highway 95 has limited crossings, which restricts flow from the water supply in the northwest to the demand in the northeast. Resolving this bottleneck requires either additional transmission piping or storage in the northeast. As noted in **Chapter 5**, storage is more cost effective.

6.2.2 Future Demand Conditions (Build-Out)

As previously discussed, build-out conditions assume complete infill within the current service area and system expansion to the planning boundary according to City zoning. In order to apply build-out demands within the model, the following improvements were assumed:

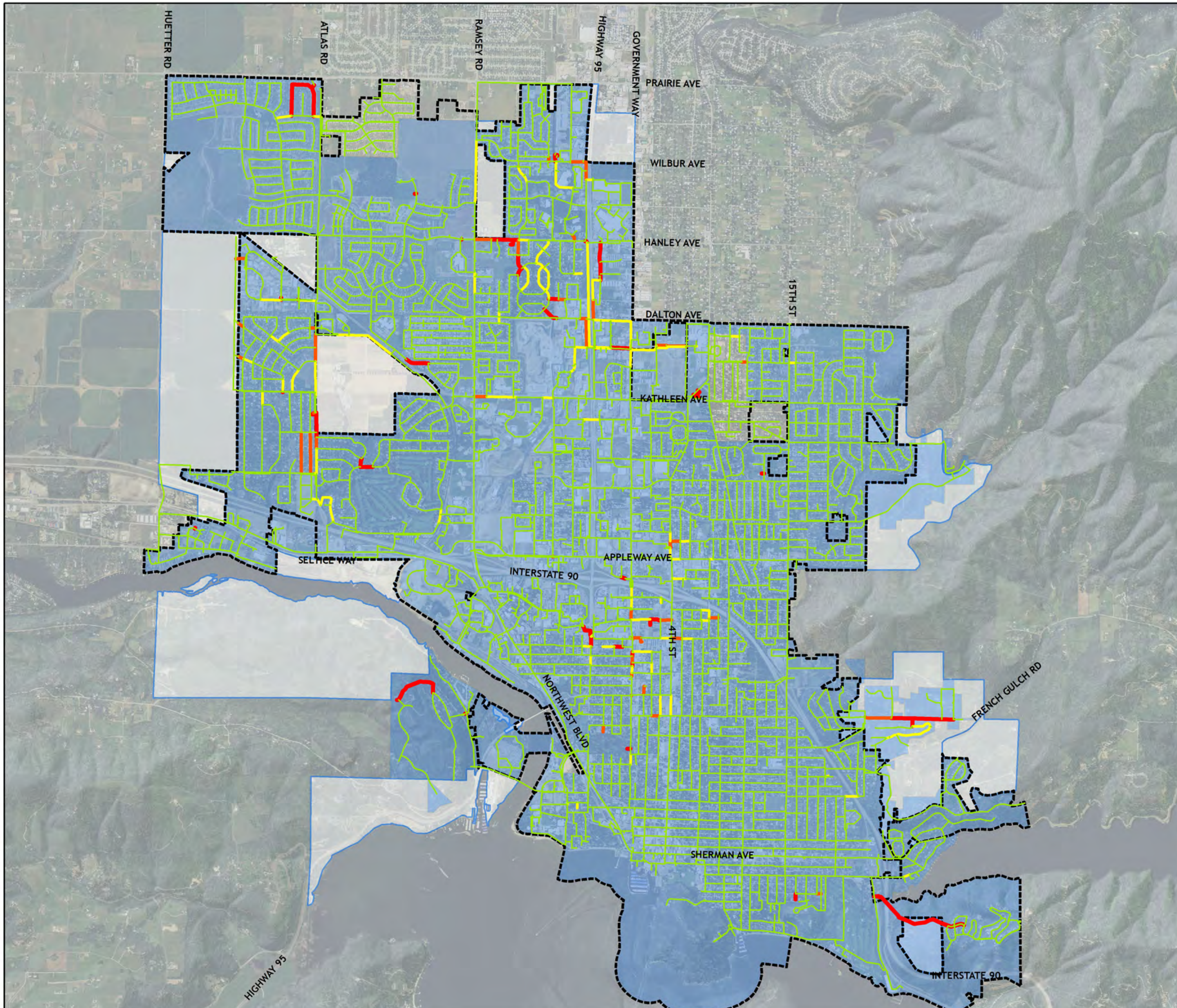
- Additional supply as summarized in **Chapter 4** was added to the northwest quadrant of the system.
- Future distribution pipes were routed to build-out areas (the actual location of future pipes will be determined by future development).

Distribution pipes were routed into future areas to help understand impacts to the existing system under build-out demand conditions, and additional supply was modeled as groundwater wells similar to the City’s existing wells.

The build-out model was run under two demand conditions:

1. Build-out MDD with all but one well operating
2. Build-out PHD with all but one well operating

Multiple areas exhibited pressure and head loss greater than allowable criteria as shown on **Figure 6-2**.



City of Coeur d'Alene
2012 Water System Comprehensive Plan Update

Figure 6-1
Peak Hour Headloss Gradient (Current System)

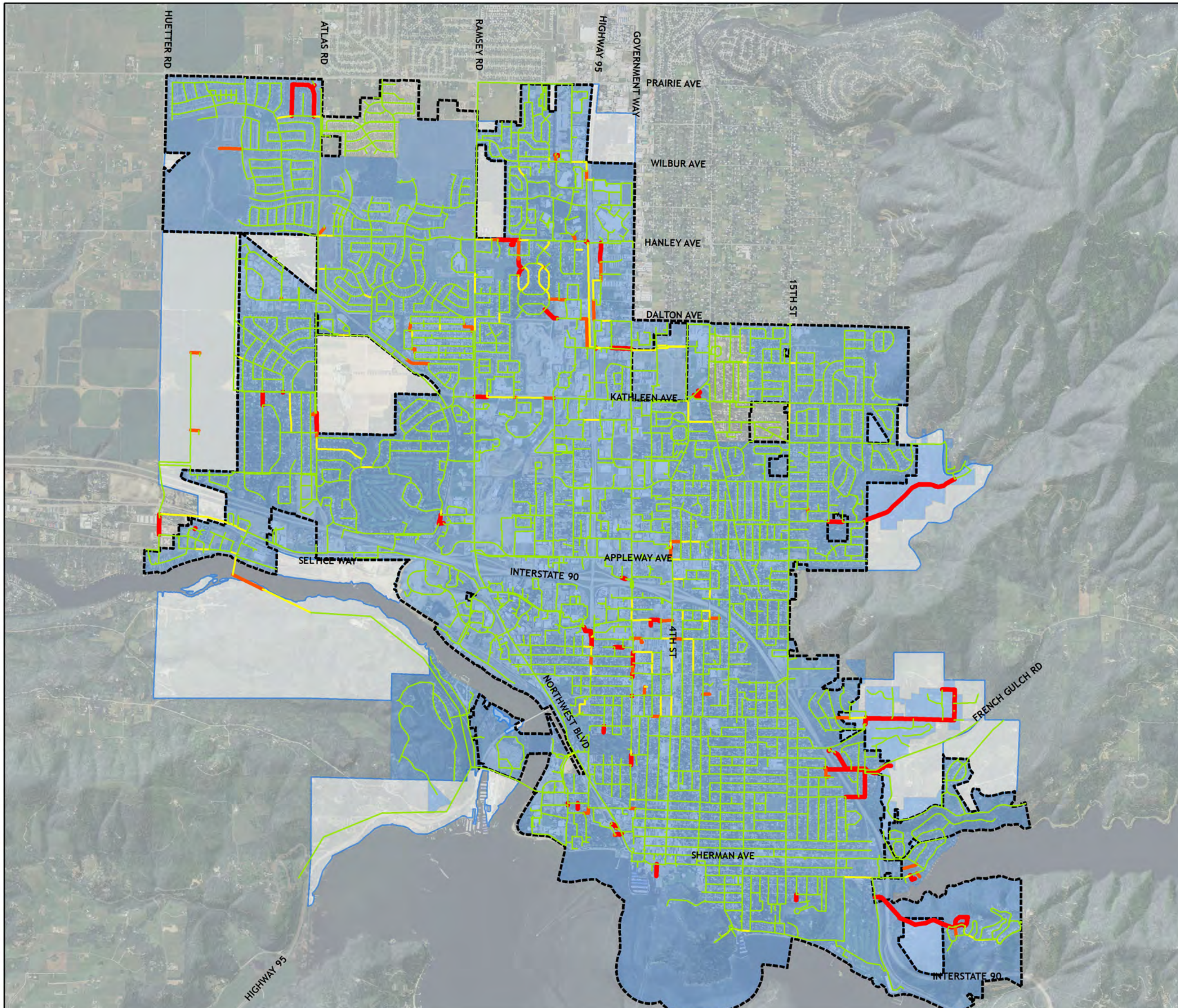
LEGEND

Existing Pipes Headloss Gradient

- 0 - 0.005 ft/1000ft
- 0.005 - 0.0075 ft/1000ft
- 0.0075 - 0.01 ft/1000ft
- >0.01 ft/1000ft
- City Boundary
- Current Service Area
- Future Service Area

J-U-B ENGINEERS, INC.

Path: F:\Projects\JUB\20-12-015_CdA_2012_Wtr_Sys_Comp_Plan_Update\GIS\Maps\Plan Figures\Figure 6.1 Peak Hour Headloss Gradient (Existing).mxd



City of Coeur d'Alene

2012 Water System Comprehensive Plan Update

Figure 6-2

Peak Hour Headloss Gradient (Existing System)

LEGEND

Existing Pipes Headloss Gradient

0 - 0.005	ft/1000ft
0.005 - 0.0075	ft/1000ft
0.0075 - 0.01	ft/1000ft
>0.01	ft/1000ft

City Boundary

Current Service Area

Future Service Area

N W E S

0 1 Miles

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Path: F:\Projects\JUB\20-12-015_CdA_2012_Wtr_Sys_Comp_Plan_Update\GIS\Maps\Plan Figures\Figure 6.2 Peak Hour Headloss Gradient (Build-Out).mxd

6.3 Pressure Zone Boundary Analysis

6.3.1 Upper Zone/General Zone

The existing boundary was evaluated to determine if any changes are warranted. Current system pressures in both zones appear to be within existing pressure criteria, and system operators indicate the current boundaries are functioning well. Evaluation of supply and storage in each zone indicates that the Upper Zone has excess supply but is short on storage. The General Zone is short on supply but has adequate storage. Since the General Zone can be fed by the Upper Zone, supply needs can be met. Additional storage will be provided in the Upper Zone. At this time, no change in boundaries appears necessary.

6.3.2 Stanley/Fernan Boundary

As discussed previously, the Stanley Hill service will be split into the following three areas:

1. The higher elevation service area on Stanley Hill will be fed by the Elm Street boosters. Existing isolation valves near Ponderosa Golf Course will be closed.
2. The low-lying area near Ponderosa Golf Course will be served by the General Zone. This will require upsizing existing small lines under I-90 as part of the City's regular replacement program.
3. Service to residents on Fernan Hill will be from a new Fernan Hill booster pump station located adjacent to the Elm Street Booster. This will require construction of a new 12-inch transmission main to Fernan Hill Road.

6.4 Recommended Improvements

Table 6-1 includes a summary of the deficiencies identified at the build-out scenario as well as the recommended solutions. The improvement numbers are shown on **Figure 6-3**.

6.4.1 Upper Zone

The recommended improvements in the Upper Zone are to upgrade the line along Dalton between Ramsey and Government Way to a 12-inch line in addition to the piping just south of the Hanley Well. Upsizing these pipes will improve the distribution of water from the west side to the east side of the zone.

Improvements connecting the new supply wells into the Upper Zone near the Industrial Park Standpipe are also recommended to allow the supply to be used for either the Upper or General Zone. The recommended pipe size is 18-inch.

The line along Nettleton Gulch Road should be upgraded to an 8-inch line to better supply that area. The recommended improvements for this zone assume that 1.0 MG of storage has been added in the northeast quadrant of the City. If no storage is added, there are additional improvements that will be required to meet future demands.

6.4.2 General Zone

Recommended improvements for the General Zone include upgrading the line along Ramsey from Appleway to the north, adding a new river crossing near Seltice and Huetter, improving the existing river crossing, and adding transmission main for new supply wells. The new 12-inch line on Appleway will improve transmission from the Upper Zone through the General Zone. The new river crossing will provide reliability to the Blackwell Hill area and allow for some transmission from the supply wells in the western portion of the City to downtown.

6.4.3 Stanley Hill Zone

The Stanley Hill recommendations include upsizing the supply lines to the storage tank and upsizing undersized lines.

6.4.4 Fernan Hill Zone

The recommended Fernan Hill Zone will require a new transmission main to supply the new zone from the Elm Street Booster Station site. In addition to this new 12-inch transmission main, areas of future growth will require additional 12-inch transmission mains.

6.4.5 Armstrong Park Zone

It is recommended that the existing supply line to the Armstrong Park Zone be upsized to a 12-inch line in order to supply adequate flows to the booster station at build-out.

6.4.6 Blackwell Hill Zone

No specific recommended improvements to the Blackwell Hill Zone are planned at this time. Improvements in this area will be dependent on locations and sizes of future development(s).

Table 6-1 – Build-Out Deficiencies

Project Number	Pressure Zone	Observed Problem	Recommended Solution	Planned Year	Capital Cost [(a)]
D-1	Piping modifications for addition of NE storage	Headloss gradients are greater than 0.01 ft/ft in the area of recommended NE storage.	Upgrade pipe for new addition of 1.0 MG of storage to NE quadrant.	2018	$582,000
D-2	Upper Zone near Hanley Well	Existing pipes act as a bottleneck as demand is routed to the eastern portion of the Upper Zone.	Upgrades mains near Hanley Well and on Christopher Lane and Ramsey.	2019	$799,800
D-3	Upper Zone - Nettleton Gulch Road	Headloss gradients are greater than 0.01 ft/ft along Nettleton Gulch.	Upsize mains to 8-inch.	2020	$392,500
D-4	General Zone - Ramsey Road	High headloss north of Appleway on Ramsey.	Upgrade main to 12-inch.	2027	$385,400
D-5	General Zone - piping along Huetter and Seltice to supply New River Crossing	Headloss gradients are greater than 0.01 ft/ft in the area as flow is routed to the new Blackwell development area.	New piping along Huetter and Seltice to route flow from new wells into to new river crossing into the Blackwell area.	2022	$1,196,600
D-6	General Zone - Future River Crossing	Headloss gradients are greater than 0.01 ft/ft at new, proposed 12-inch river crossing into Blackwell development area and at the existing 12-inch Blackwell river crossing.	Upsize future river crossing near Huetter to 16-inch to route flow from new wells into the Blackwell area.	2022	$970,600
D-7	General Zone - replacement of Existing River Crossing	Headloss gradients are greater than 0.01 ft/ft at river crossings.	Upsize existing Blackwell river crossing to 16-inch.	2023	$1,190,200

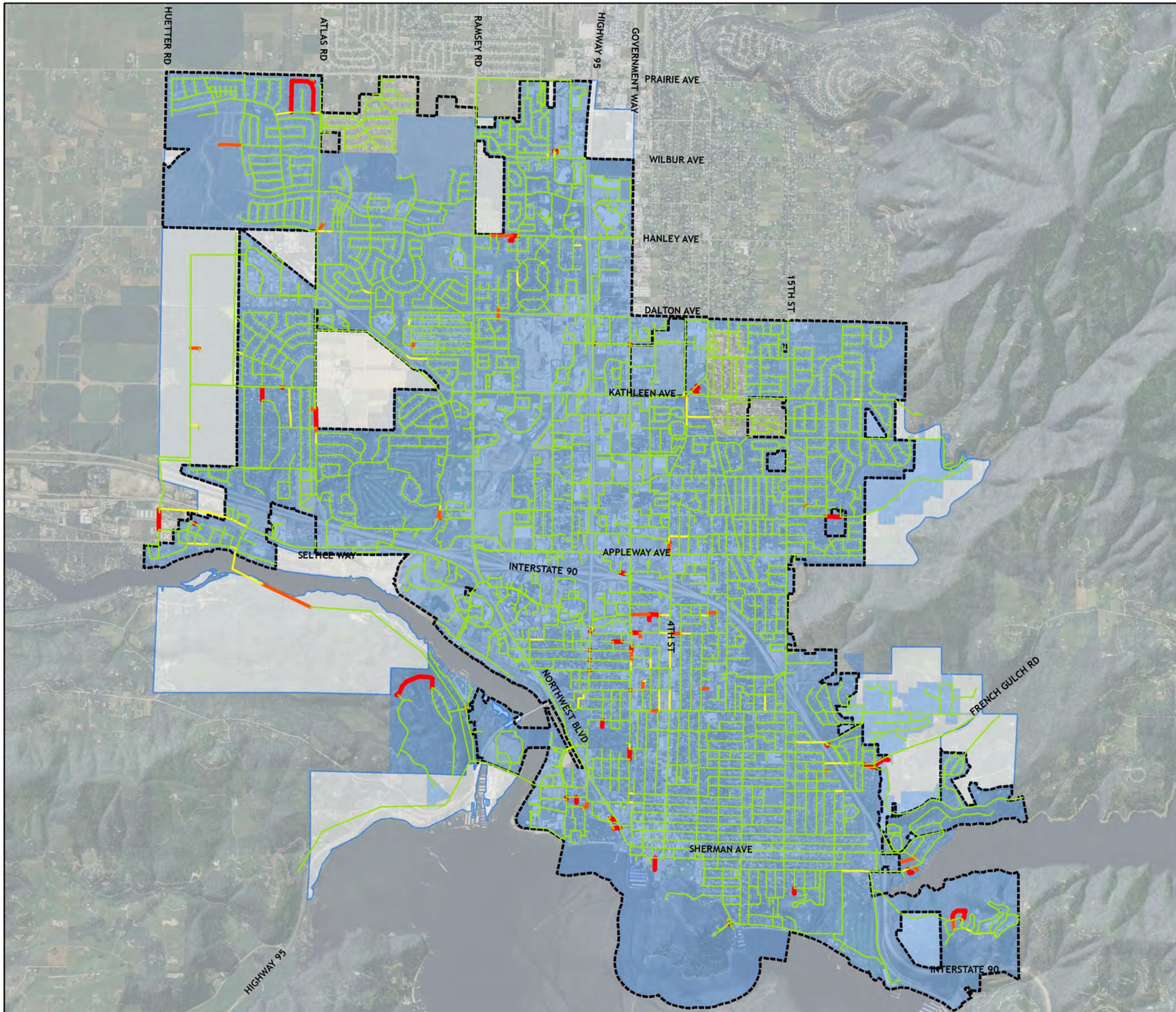
Table 6-1 continued

Project Number	Pressure Zone	Observed Problem	Recommended Solution	Planned Year	Capital Cost [(a)]
D-8	Stanley Hill Zone - transmission piping within the zone	Negative pressures near the Stanley Hill Tank/Johnson Ranch area due to large build-out demands in very small distribution lines. Headloss gradients are greater than 0.01 ft/ft in Stanley Hill area.	Upgrade mains to 12-inch (booster pumps will be required to serve some areas – future development).	2026	$569,400
D-9	Future Fernan Zone - new transmission piping from Elm Street Booster Site to Zone	Negative pressures near the Fernan build-out area due to large build out demands in distribution lines.	Booster station and new Fernan Hill Tank. Transmission piping between the Elm Street site and the new zone will be required.	2017	$483,400
D-10	Armstrong Park Zone transmission line to supply booster station	Headloss gradients are greater than 0.01 ft/ft in 6-inch transmission line to Armstrong Park area.	Upsize transmission line to Armstrong Park to 12-inch.	2023	$352,000
D-11	Miscellaneous Areas around the system	High headloss gradient observed in the Davidson/Mill area as well as other areas with undersized mains.	Annual main replacement.	Annual	$500,000
---	General Zone - 15th Street	Headloss difference of 16-20 ft at build-out PHD between Tubbs Hill and Best Hill Tanks.	No upgrades recommended.	-	-
D-12	Fernan Hill Future Development	Extensions will be required to service future areas.	Main extensions for future development.	2028	$500,000
D-13	New/Replace Meter/ Hydrant/Service Line Work		Annual replacement projects.	Annual	$215,000

[(a)] *All costs in 2012 dollars*

City of Coeur d'Alene
2012 Water System Comprehensive Plan Update

Figure 6-3
Peak Hour Headloss Gradient (Build-Out) with Improvements



LEGEND

Future Pipes Headloss Gradient

- 0 - 0.005 ft/1000ft
- 0.005 - 0.0075 ft/1000ft
- 0.0075 - 0.01 ft/1000ft
- >0.01 ft/1000ft
- City Boundary
- Current Service Area
- Future Service Area

0 1 Miles

J-U-B ENGINEERS, INC.

Path: F:\Projects\JUB\20-12-015_CdA_2012_Wtr_Sys_Comp_Plan_Update\GIS\Maps\Plan Figures\Figure 6.3 Peak Hour Headloss Gradient (Future).mxd

Chapter 7

Capital Improvement Plan

Chapter 7 – Capital Improvement Plan

Chapters 4, 5, and **6** described the recommended water system improvements for the City. These improvements and order of magnitude cost estimates are included in this chapter.

7.1 Order of Magnitude Cost Estimates

The order of magnitude estimates developed at this planning level are order-of-magnitude estimates without any detailed itemization. These estimates may have been based on:

- The advantages of recent bid prices for similar projects
- Budget pricing from specialty contractors or suppliers

These costs also include the following:

- 20 percent contingency
- 20 percent project soft costs (Engineering, etc.)
- 5 percent mobilization
- 2.5 percent bonding and administration

The accuracy of these numbers is expected to range from 50 percent above to 30 percent below the actual cost of design and construction.

7.2 Summary of Existing System Deficiencies and Improvements

Individual components of the system were identified and evaluated in previous sections of the Plan. They are generally grouped into three categories–water supply, water storage, and water distribution. Improvement recommendations and Opinions of Cost are summarized in the following sections. These costs are identified as either City-funded or developer-contribution. The City-funded portions are paid for by rates or cap fees, depending on if the project is due to replacement and rehabilitation (rates) or related to system growth (cap fees). The developer-contribution projects are projects fully funded by a property developer. Criteria for these future projects are included in **Appendix G**.

7.2.1 Water Supply

The water supply needs detailed in **Chapter 4** can be met by drilling additional wells and adding capacity to existing wells. **Table 7-1** summarizes the City's water supply needs, timing/trigger flows for those improvements, and associated Opinion of Costs. This water supply is estimated to fulfill build-out requirements for the Water Department.

Table 7-1 – Water Supply Improvement Costs by Zone

Improvement	Trigger Maximum Day Demand for Upgrades by Zone gpm	Estimated Construction Date (a)	Recommended Pump Size gpm	Opinion of Capital Cost (b)	Funded By
Upper Zone					
New Well	11,400	2013\2014	4,000	$1,698,700	City 100% growth-related
Additional Supply	11,900	2020	1,500	$735,800	City 100% growth-related
General Zone					
New Well	12,400	2017\2018	4,000	$1,698,700	City 100% growth-related
New Well	14,200	2022\2023	4,000	$1,698,700	City 100% growth-related
Total				$5,831,900	

(a) *Year is approximate based on projected growth rate City-wide.*
(b) *All Opinions of Cost are planning level in 2012 dollars and do not include land purchase costs.*

The dates listed are based on wells that produce 4,000 gpm and projected increases in water demand, consistent with planning values. However, growth rates and water conservation effects will fluctuate, so the maximum day demand requirements dictate when a new source is needed. The demand triggers are listed in **Table 7-1**.

In addition to the additional supply required to meet the future needs, there are several wellhouses that will require replacement during this planning period and some other supply improvements that will need to be completed. These improvements are summarized in **Table 7-2**.

Table 7-2 – Additional Supply Improvements

Project No.	Capital Project	Planned Year	Capital Cost (a)	Funded by
S-5	Linden – Wellhouse Replacement	2020	$522,700	City (R&R)
S-6	4th Street – Wellhouse Replacement	2024	$509,800	City (R&R)
S-7	Atlas – System Upgrades	2025	$504,000	City (R&R)
S-8	Regular Pump Rehabilitation	Biennial	$75,000	City (R&R)
S-9	Onsite Chlorine Regeneration	2013-2015	$80,000	City (R&R)
S-10	Soft Starter Replacement	Biennial	$75,000	City (R&R)
S-11	Transfer Surface Water Rights to Groundwater Rights	2017	$10,000	City (R&R)
S-12	Reasonably Anticipated Future Needs	2014	$25,000	City 100% growth related
S-13	SCADA Conversion	2013	$35,000	City (R&R)
	Total		$1,836,500.00	

(a) *All opinions of cost are planning level 2012 dollars*
(b) *Replacement and Rehabilitation*

Several of the booster stations will also require upgrades within the planning period. These improvements are identified in **Table 7-3**.

Table 7-3 – Booster Station Improvements

Project No.	Capital Project	Planned Year	Total Estimated Cost [(a)]	Funded By
B-1	Elm Street – Additional Pump	2015	$185,800	City 100% growth related
B-2	Elm Street – Booster Split	2021	$64,800	100% Developer Contribution
B-3	Fernan Hill – Split with Stanley	2020	$527,000	City 100% growth related
B-4	Fernan Booster – Additional Pump	2021	$64,800	100% Developer Contribution
B-5	Blackwell Hill – New Station	2018	$527,000	100% Developer Contribution
B-6	Blackwell Hill – New Station	2025	$527,000	100% Developer Contribution
B-7	Armstrong Park – Additional Pump	2016	$64,800	100% Developer Contribution
		Total	$1,961,200.00	

(a) *All opinions of cost are planning level 2012 dollars.*

7.2.2 Storage

The recommended storage projects will provide fire, equalization, and emergency storage to build-out of the planning boundary, with the completion of the supply recommendation at the specified demands.

The recommended storage improvements are summarized in **Table 7-4**.

Table 7-4 – Storage Requirements

Project No.	Project	Anticipated Year of Construction	Capital Cost	Funded By
T-1	Upper Zone Storage – 1.0 MG	2018	$1,631,500	City (growth)
T-2	Stanley Hill Storage – 0.5 MG	2026	$1,016,600	50% City/50% Developer
T-3	Blackwell Hill – 0.6 MG	2021	$1,068,500	Developer
T-4	Armstrong Park – 0.3 MG	2022	$1,016,600	Developer
T-5	Fernan Hill – 0.7 MG	2020	$1,269,900	40% City/60% Developer
T-6	Recoating Prairie Standpipe	2014	$233,300	City (R&R) [a]
T-7	Recoating Industrial Standpipe	2019	$233,300	City (R&R) [a]
T-8	Recoating Tubbs Hill – 1.0 MG Tank	2022	$57,500	City (R&R) [a]
T-9	Recoating Best Hill Interior/Exterior	2026	$419,000	City (R&R) [a]
T-10	Best Hill Circulation	2015	$75,000	City (R&R) [a]
		Total	$7,021,200.00	

[a] *R&R – Replacement and rehabilitation*

[b] *All opinions of cost are planning level 2012 dollars.*

7.2.3 Distribution/Piping

The primary piping and booster station deficiencies in the existing distribution system were presented in **Chapter 6**. The existing distribution system is generally capable of meeting system demands due to a good distribution network. The City's distribution system is reported to be in overall good condition. This can be attributed to an annual pipe replacement program. The City's replacement efforts have been focused on improving gaps in the distribution grid and replacing AC pipe less than 8 inches in diameter as well as galvanized, OD, steel, and less common sizes such as 10-inch. The City replaces an average of 1 to 1.5 miles of pipe per year. The City's target is 1.5 to 2 miles per year, which correlates to an average replacement cycle ranging from 150 to 200 years. Typical guidelines suggest that the useful life of domestic distribution systems ranges from 50 to 75 years, with PVC life as long as 125 years.

Table 7-5 identifies the cost of distribution lines anticipated to be necessary through build-out. These improvements are required to complete the City's distribution main grid and to provide firm pumping capacity in the booster pump stations.

Table 7-5 – Build-Out Deficiencies

Project Number	Pressure Zone	Observed Problem	Recommended Solution	Planned Year	Capital Cost [(a)]	Funded By
D-1	Piping modifications for addition of NE storage	Headloss gradients are greater than 0.01 ft/ft in the area of recommended NE storage.	Upgrade pipe for new addition of 1.0 MG of storage to NE quadrant.	2018	$582,000	City – 100% Growth
D-2	Upper Zone near Hanley Well	Existing pipes act as a bottleneck as demand is routed to the eastern portion of the Upper Zone.	Upgrades mains near Hanley Well and on Christopher Lane and Ramsey.	2019	$799,800	City – 100% Growth
D-3	Upper Zone - Nettleton Gulch Road	Headloss gradients are greater than 0.01 ft/ft along Nettleton Gulch.	Upsize mains to 8-inch.	2020	$392,500	City – R&R
D-4	General Zone - Ramsey Road	High headloss north of Appleway on Ramsey.	Upgrade main to 12-inch.	2027	$385,400	City – R&R
D-5	General Zone - piping along Huetter and Seltice New River Crossing	Headloss gradients are greater than 0.01 ft/ft in the area as flow is routed to the new Blackwell development area.	New piping along Huetter and Seltice to route flow from new wells into to new river crossing into the Blackwell area.	2022	$1,196,600	25% City 75% Developer
D-6	General Zone - Future River Crossing	Headloss gradients are greater than 0.01 ft/ft at new, proposed 12-inch river crossing into Blackwell development area and at the existing 12-inch Blackwell river crossing.	Upsize future river crossing near Huetter to 16-inch to route flow from new wells into the Blackwell area.	2022	$970,600	Developer

Table 7-5 continued

Project Number	Pressure Zone	Observed Problem	Recommended Solution	Planned Year	Capital Cost (a)	Funded By
D-7	General Zone - replacement of Existing River Crossing	Headloss gradients are greater than 0.01 ft/ft at river crossings.	Upsize existing Blackwell river crossing to 16-inch.	2023	$1,190,200	90% City/ 10% Developer
D-8	Stanley Hill Zone - transmission piping within the zone	Negative pressures near the Stanley Hill Tank/Johnson Ranch area due to large build-out demands in very small distribution lines. Headloss gradients are greater than 0.01 ft/ft in Stanley Hill area.	Upgrade mains to 12-inch (booster pumps will be required to serve some areas – future development).	2026	$569,400	Piping 50% City/ 50% Developer Both pumps - Developer
D-9	Future Fernan Zone - new transmission piping from Elm Street Booster Site to Zone	Negative pressures near the Fernan build-out area due to large build out demands in distribution lines.	Booster station and new Fernan Hill Tank. Transmission piping between the Elm Street site and the new zone will be required.	2017	$483,400	Developer
D-10	Armstrong Park Zone transmission line to supply booster station	Headloss gradients are greater than 0.01 ft/ft in 6-inch transmission line to Armstrong Park area.	Upsize transmission line to Armstrong Park to 12-inch.	2023	$352,000	Developer
D-11	Miscellaneous Areas around the system	High headloss gradient observed in the Davidson/Mill area as well as other areas with undersized mains.	Annual main replacement.	Annual	$500,000	City –R&R
---	General Zone - 15th Street	Headloss difference of 16-20 ft at build-out PHD between Tubbs Hill and Best Hill Tanks.	No upgrades recommended.	-	-	-

Table 7-5 continued

Project Number	Pressure Zone	Observed Problem	Recommended Solution	Planned Year	Capital Cost [(a)]	Funded By
D-12	Fernan Hill Future Development	Extensions will be required to service future areas.	Main extensions for future development.	2028	$500,000	Developer
D-13	New/Replace Meter/ Hydrant/Service Line Work		Annual replacement projects.	Annual	$215,000	City – R&R

[(a)] *All costs are planning level 2012 dollars*

[(b)] *R&R – Replacement and Rehabilitation*

7.2.4 Additional Improvements

In addition to the previously-recommended projects, replacement of the existing radio read program to a fixed base or other stationary read-type system is recommended. **Table 7-6** includes this recommendation. Improvements will likely take several years.

Table 7-6 – Additional Recommended Improvements

Project No.	Capital Project	Planned Year	Capital Cost [a]	Funded by
M-1	Fixed Base Metering Phase I	2020	$1,000,000	City R&R
M-2	Fixed Base Metering Phase II	2021	$1,000,000	City R&R
M-3	Fixed Base Metering Phase III	2022	$1,000,000	City R&R
M-4	Comprehensive Rate Study	2018	$75,000	City R&R
Total			$3,075,000.00	

(a) All opinions of cost are planning level 2012 dollars

(b) R&R – Replacement and Rehabilitation

7.3 Identification and Scheduling of Improvements

The projects detailed in the Plan have been scheduled based on priority and spread out over the planning period. Many of the projects are dependent on growth of the system and will be dependent on actual system demand. Individual development agreements may reduce capital requirements for the City but have not been considered here due to their unpredictable timing and scope. The overall summary of projected capital improvements is presented in **Table 7-7**. **Figure 7-1** includes a schematic of the locations of the improvements within the City. A detailed Capital Improvement Plan, sheet documents, all the projects and their anticipated funding source are included in **Appendix H**.

Table 7-7 – City of Coeur d'Alene Schedule of Improvements

	City-Funded Capital Cost Opinion by Year [a]		
Item	2013-2017	2018-2022	2023-2027
Supply Improvements			
New Wells	$3,397,400	$2,434,500	
Other Supply Improvements	$925,000	$747,700	$1,238,800
Storage Improvements			
New Tanks		$2,172,700	$508,300
Other Storage Improvements	$308,300	$233,300	$476,500
Distribution Improvements [b]			
Distribution Improvements		$2,073,450	$2,014,078
Annual Water Main Replacement	$3,575,000	$3,575,000	$3,575,000
Booster Stations			
Booster Station Improvements	$185,800	$527,000	0
Additional Capital Improvements			
Additional Improvements		$3,075,000	
Totals	$8,391,500	$19,485,150	$7,812,678

[a] *All Opinions of Cost are planning level in 2012 dollars and do not include land purchase costs.*

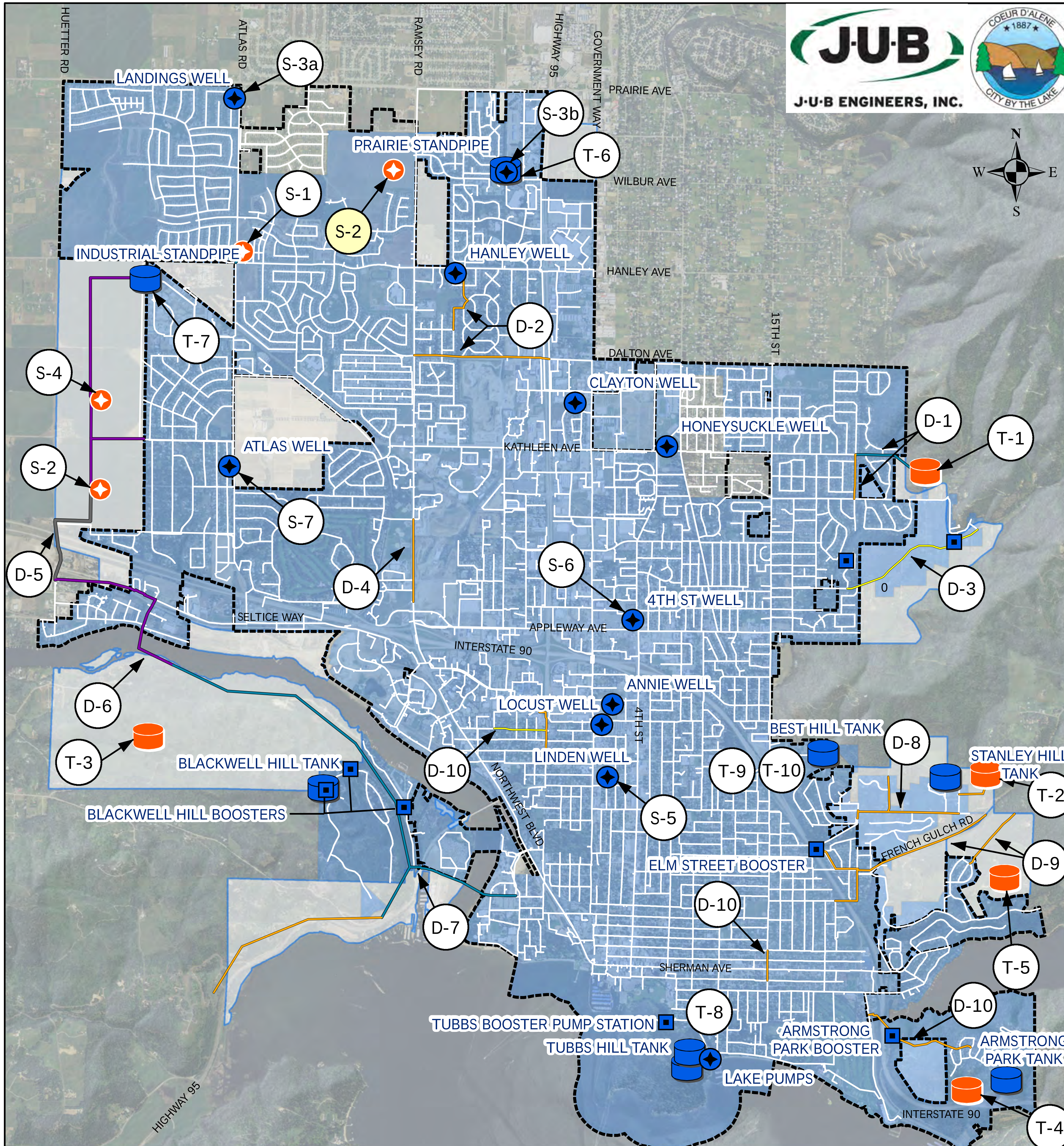
[b] *Development-driven improvements are included at no cost to the City.*

An analysis of the funding requirements for the recommended improvements is discussed in **Volume II** of this report.

City of Coeur d'Alene
2012 Water System Comprehensive Plan Update

J-U-B ENGINEERS, INC.

Figure 7-1
Capital Improvement Projects



LEGEND

CIP Pipe Upgrades
- 8"
- 12"
- 16"
- 18"
- 24"

Existing Pipes
- Existing Pipes
- City Boundary
- Current Service Area
- Future Service Area
- Existing Well
- Existing Tank
- Existing Booster Station
- Future Well
- Future Tanks
- D-# Distribution Improvements
- S-# Supply Improvements
- T-# Tank Improvements
- Alternate Location

0 1 Miles

Appendices

Appendix A

Coeur d'Alene Demographics Discussion/Evaluation

City of Coeur d'Alene

Coeur d'Alene, Idaho

2012 Water System Comprehensive Plan

Appendix A
Population Growth and Study Boundaries

May 2012

Prepared by

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Contents

Appendix A – Population Growth and Study Boundaries

A.1 Population Data and Projections

The City of Coeur d'Alene has experienced variable rates of growth in its history. The most recent growth phases occurred in the late 1990s and again between 2004 and 2008. These periods of growth are bracketed with economic downturns; therefore, the last 20 years is considered representative of historical growth in the area. US Census data and annual average growth rates for the period 1990 through 2010 are summarized in **Table A-1**.

Table A-1 – US Census Bureau Population Data for Coeur d'Alene and Kootenai County

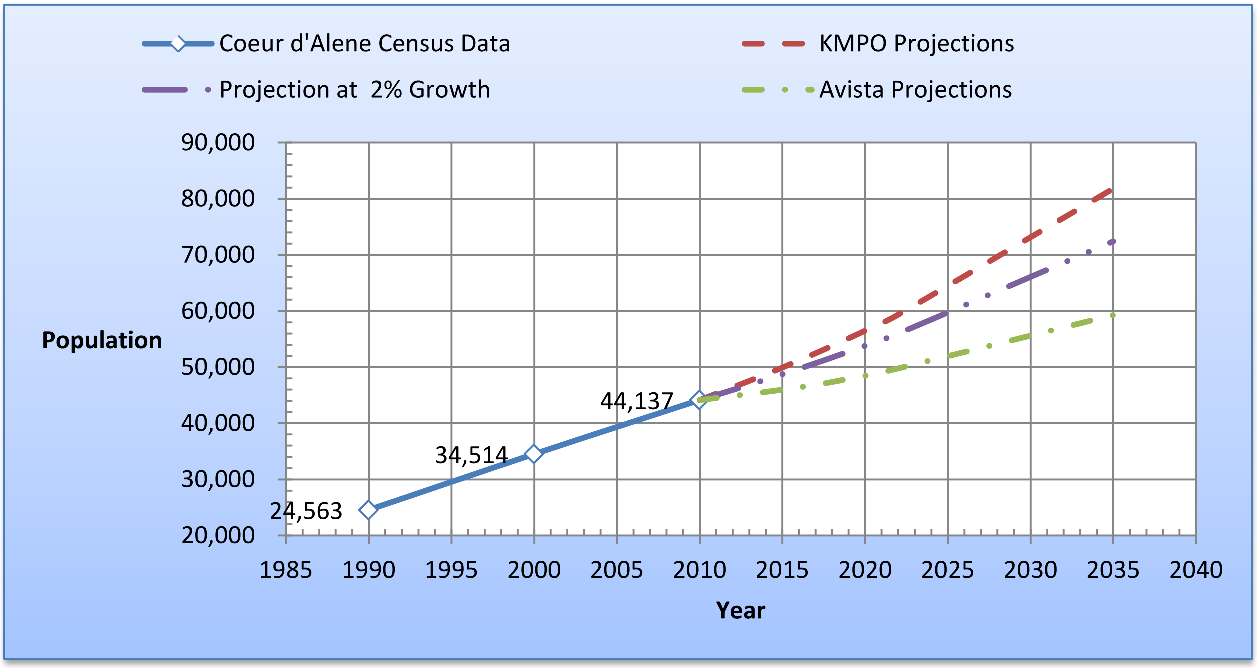
Year	Coeur d'Alene Population	Annual Growth Rate from Prior Period	Kootenai County Population	Annual Growth Rate from Prior Period
1990	24,563	-	69,795	
2000	34,514	3.46%	108,685	4.53%
2010	44,137	2.49%	138,494	2.45%

Population projections for the City of Coeur d'Alene have been developed by Avista Utilities (Randy Barcus, Avista Chief Economist) and the Kootenai Metropolitan Planning Organization, KMPO (Bonnie Gow). A discussion of each is presented below:

- **Avista** serves areas outside the City of Coeur d'Alene; therefore, their projections are for the "Coeur d'Alene metropolitan area". A comparison of the Avista Coeur d'Alene metropolitan area with the Kootenai County census data shows that the populations approximately match for the census years of 1990, 2000, and 2010. The historical annual growth rate for the metropolitan area between 1990 and 2010 has varied between 1.0 and 6.4 percent, with an average rate of 3.4 percent. Avista's forecast period is 2011 through 2041, with population estimates made to the midpoint of each year. Avista expects slower growth for the forecast period, with an annual growth rate for the period ranging from 1.0 to 1.7 percent and averaging 1.5 percent. Mr. Barcus estimates that the City of Coeur d'Alene itself will experience growth at approximately 80 percent of the county. Avista's county-wide projections through the planning period were therefore factored by 80 percent and then applied to the City's 2010 population as reported by the US Census Bureau. This yields an annual growth rate of 0.8 to 1.4 percent and an average of 1.2 percent.
- **KMPO** utilized US Census Bureau data for Kootenai County and the individual cities within the county from 1990, 2000, and 2010 to formulate projections for 2014, 2020, and 2035. Observed annual average growth rates are shown in Table A-1. For the forecast period extending through 2035, KMPO assumed a consistent annual growth rate of 2.5 percent for the City of Coeur d'Alene, and a Kootenai County growth rate of 2.4 percent. Forecasts for Coeur d'Alene were made with a baseline population from the 2010 census.

Additionally, population growth was discussed with the Water Department, the Wastewater Department, and the Planning Department on April 16, 2012. The Planning Department indicated that historical growth rates for Coeur d'Alene have ranged from 1.8 to 2.2 percent and that a 2 percent growth rate was appropriate for forecasting purposes. The population projections from Avista and KMPO, as well as an assumed growth of 2.0 percent, are shown on **Figure A-1**. Projections were not extended beyond 2035 due to the limitations on the KMPO study and to approximately match the near-term objectives of the study.

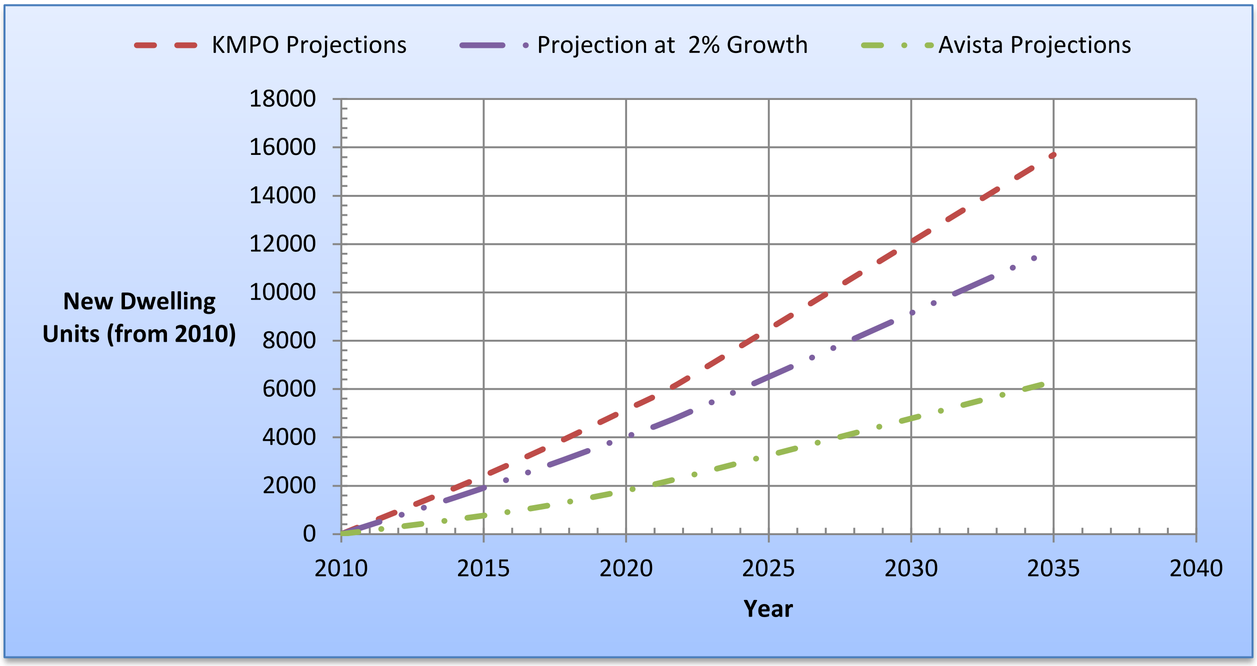
Figure A-1 – City of Coeur d'Alene Population Projections (2010 to 2035)



The Census Bureau statistics indicate persons per household for the period 2006 through 2010 was 2.25. The KMPO data show a current value of 2.40 persons per household based on total occupied housing, which was used in KMPO's subsequent projections for the forecast period. Avista estimated house starts through their forecast period, but no distinction was made between county and city growth. For consistency with the stated KMPO assumption, it is assumed that the number of persons per household will be 2.40 throughout the forecasting period. The corresponding number of new residential dwelling units (2010 baseline) based on the preceding population projections is shown on **Figure A-2**. In summary:

- The Avista population estimates result in approximately 6,300 additional new residential households by 2035.
- The KMPO population estimates result in approximately 15,700 additional new residential households by 2035.
- At an assumed annual growth rate of 2.0 percent, approximately 11,800 additional new residential households will be developed by 2035.
- Although the water service area extends outside the City limits, there are areas within the City limits that are not served by the water system. These areas are approximately equal in size so the current City population will be assumed to be equal to the water system service population.

Figure A-2 – City of Coeur d'Alene New Dwelling Units (2010 to 2035)



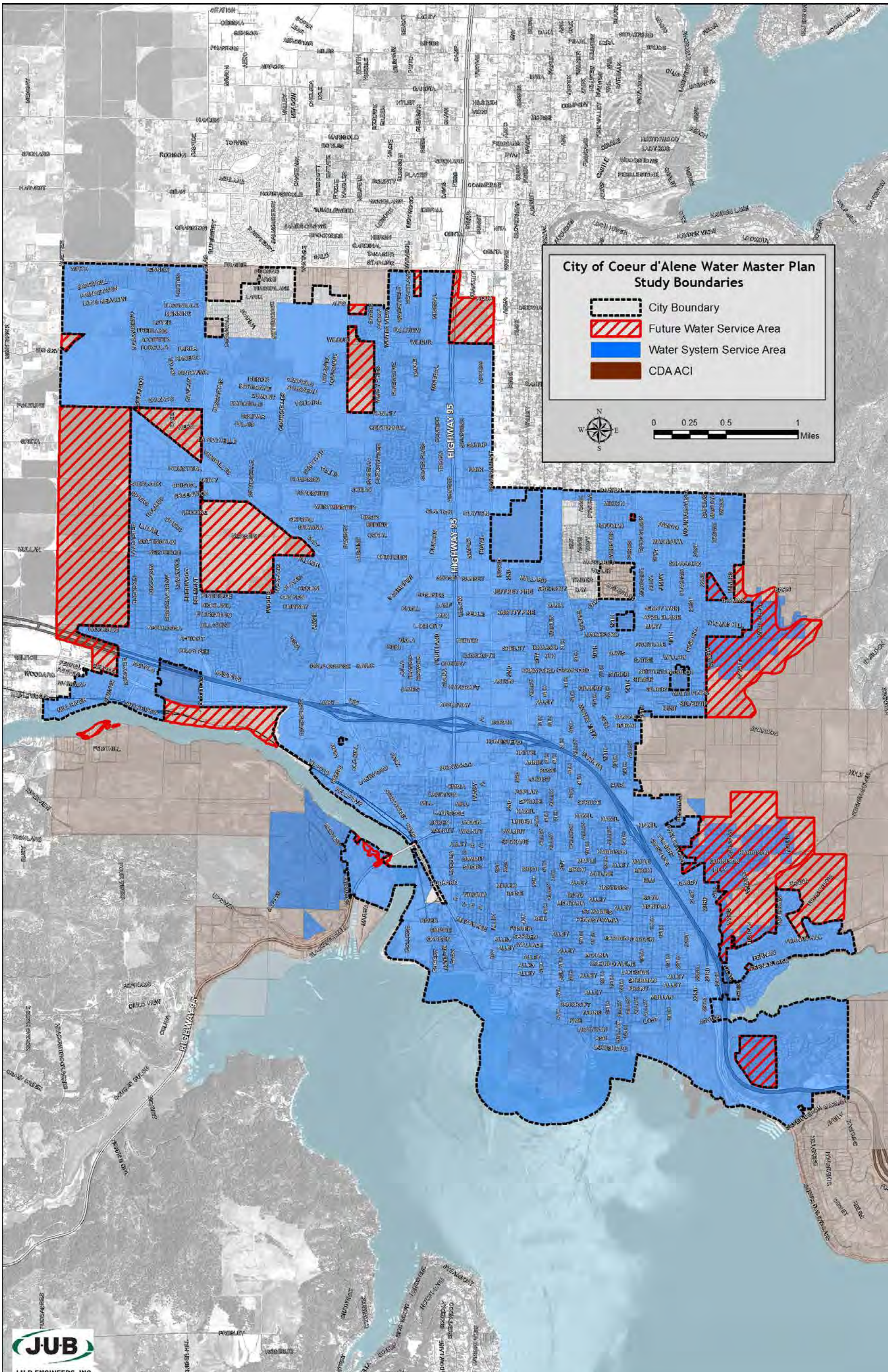
A.2 Infill within Existing City Limits

Approximately 1,080 acres of undeveloped land exists within the City limits. It is assumed that these areas will be developed consistently with the current zoning and the City's Comprehensive Plan (2007-2027). As growth occurs, these areas will likely be developed prior to growth outside the current City limits.

A.3 Future Service Boundary Extents

To define areas of growth outside the city limits and the build-out area, meetings were conducted with the Water, Wastewater, and Planning Departments. The preliminary growth boundaries for the water and wastewater systems were integrated into a single planning figure—reference **Figure A-3**. The total area of growth for water represented by these boundaries is approximately 3,200 acres. Although build-out growth is not expected to the southern and eastern edges of the ACI, expansion to the western and northern edges of the ACI is expected.

Figure A-3 – Study Boundaries



Works Cited

Barcus, Randy. Avista Chief Economist. “RE: Request for population forecast data” (email). April 16, 2012.

Gow, Bonnie. Kootenai Metropolitan Planning Organization (KMPO). “FW: KMPO Growth Projections Final Draft – Correction” (email). January 26, 2012.

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Appendix B

Water System Conservation Plan

City of Coeur d'Alene

Water System Conservation Plan

November 2012

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Appendix B Water System Conservation Plan

I. Introduction

The City of Coeur d'Alene operates a water system that has 292 miles of pipe, utilizes 9 groundwater wells, 7 water storage tanks, and boosts water to 4 elevated pressure zones. The water is supplied from the Rathdrum Prairie-Spokane Valley (RPSV) Aquifer. This aquifer supplies drinking water to half a million people in northern Idaho and eastern Washington, and maintaining this supply for future use has become a significant focus for water purveyors in these areas.

Working to standardize efforts of the water purveyors that are fed from the aquifer, a Ground Water Management Plan was developed by the Rathdrum Prairie Ground Water Advisory Committee, and the final order was adopted in 2005 by the Idaho Department of Water Resources (IDWR). The Management Plan, which is included at the end of this document, defines six goals for use in management of the aquifer resources. The fifth goal of the Management Plan is to "Encourage water conservation efforts by all users of the resource." Part of this goal requires that a water conservation plan be in place for all municipal purveyors that request new water rights, or changes to their existing water rights.

After the Management Plan was adopted, the Idaho Department of Water Resources developed a document for "Water Conservation Measures and Guidelines for Preparing Water Conservation Plans." The draft plan guidance was issued from IDWR in February 2006. These guidelines include the recommended components to be included in a water conservation plan. The recommended components, and those included in this plan, are as follows:

- Development of a water system profile
- Preparation of a demand forecast
- Description of planned facilities
- Development of conservation goals and methods for stakeholder involvement
- Identification of water conservation measures
- Analysis of conservation measures
- Integration of resources and forecast modification
- Implementation and evaluation strategies

This water conservation plan has been developed to meet the requirements of the Management Plan and the IDWR Guidelines for the purpose of applying for future water rights or modifying existing water rights for the City of Coeur d'Alene as necessary. The recommended components are discussed and addressed hereafter.

II. Water System Profile

A. Source Water

The Rathdrum Prairie-Spokane Valley aquifer is supplied by several large surface water sources, including Coeur d'Alene Lake, the Spokane River, Lake Pend Oreille, and Hayden Lake. Other small lake watersheds such as Hauser, Spirit, and Twin supply the balance of the surface water input to the aquifer. In an average year, precipitation also supplies the aquifer with one quarter of its recharge water. Of course, surface water flows and precipitation are subject to natural variations and will affect aquifer recharge rates. Detailed quantity, flow, and level analyses have been performed on both the Idaho and Washington side of the aquifer as part of the 2007 U.S. Geologic Surveys' "Bi-State" Study and are available on the IDEQ website.

The Spokane Valley/Rathdrum Prairie Aquifer is comprised of a thin layer of soil overlaying 200 to 400 feet of coarse sands and gravels. The alluvial material was deposited by Ice Age floods from Glacial Lake Missoula approximately 12,000 years ago. The 2007 "Bi-State" aquifer study completed by the U.S. Geologic Survey shows that annual estimated aquifer withdrawals are approximately 22 percent of estimated annual recharge for the aquifer. While adequate aquifer supply appears to exist, pressure has been building from conservation groups to reduce per capita consumption in order to maintain Spokane River flows and water quality.

The Spokane Valley/Rathdrum Prairie Aquifer is the largest source of drinking water within the City's hydrologic area. Treating water from the nearby Spokane River or other surface sources would remove water that recharges the aquifer. It is significantly more costly than continued use of groundwater and could also introduce minimum river flow constraints directly into water supply planning. As a result, it is assumed that the City will continue to use groundwater as its sole water supply.

B. Existing Water Rights

The City currently has a total of 52.4 cfs in claimed groundwater rights and 27.07 cfs in claimed surface water rights. A summary of the rights and their priority dates is included in **Table B-1**.

Table B-1 – Summary of Water Rights

Right Number	Priority	Amount (cfs)	Nature of Use	Period of Use
95-2111	04/20/1955	3.00	Municipal	1/1 to 12/31
95-2133	07/21/1960	2.27	Municipal	1/1 to 12/31
95-2164	10/03/1964	3.61	Municipal	3/15 to 11/15
95-2198	12/13/1966	5.12	Municipal	1/1 to 12/31
95-7142	05/03/1971	2.45	Municipal	1/1 to 12/31
95-7181	03/14/1972	5.73	Municipal	1/1 to 12/31
95-8565	12/07/1987	7.55	Municipal	1/1 to 12/31
95-8647	03/19/1990	7.30	Municipal	1/1 to 12/31
95-8672	08/27/1990	3.00	Municipal	1/1 to 12/31
95-8938	02/08/1996	4.57	Municipal	1/1 to 12/31
95-9007	01/25/1999	7.80	Municipal	1/1 to 12/31
Total		52.4		

C. Coeur d'Alene Water Service Boundary

The Coeur d'Alene Water Department serves an area that differs only slightly from the City limits. The existing water service boundary encompasses approximately 6,400 acres and is shown on **Figure B-1**. Most of the service area is relatively flat and is served by two main pressure zones and several smaller boosted zones. The perimeter of the service area along the east and south sides is more mountainous and is served by several relatively small pressure zones.

D. Coeur d'Alene Population and Connections Served

Coeur d'Alene has been growing rapidly over the last decade. U.S. Census data indicates the City population in 2000 was 34,514 and grew to 44,137 in 2010, an increase of approximately 2.49 percent year-over-year.

The City Water Department service area differs slightly from the City boundary. The Water Department currently has 20,040 total metered connections, of which, 14,255 are identified as residential connections. Using the 2010 Census information of 2.25 persons per household, the population of the service area is approximately 32,044 people.

E. Existing Facilities and Water Use Categories

The City is currently supplied by nine groundwater wells. These wells and their relative capacities are shown in **Table B-2**.

Table B-2 – Wells and Capacities

Well	Capacity (gpm)
1. Atlas	4,000
2. 4th Street	3,000
3. Hanley	3,600
4. Honeysuckle	1,650
5. Linden	2,300
6. Locust	3,000
7. Landings	3,000
8. Prairie	3,200
9. Annie	2,500
Total	26,250

The water use for the system has been divided into 13 key categories for planning purposes. The water use for each of these categories was evaluated and given a peak day usage designation in gallons per minute per acre (GPM/Ac). The key categories and land use designations are included in **Table B-3**.

Table B-3 – Categories and Land Use Designations

Customer Type	Max Month (gpd)	Total AC Served	Demand/AC (gpm)
Assisted Living Facility	258,200	33.4	5.14
Church	280,133	89.3	1.97
Commercial	2,708,900	1,244.7	2.31
Hotel	561,867	38.5	10.48
Industrial	358,533	409.8	0.82
Office	185,467	42.7	3.25
Open Space	2,416,367	833.4	3.73
Public	492,000	262.0	1.03
Residential – High Density	2,254,733	460.3	4.06
Residential – Low Density	5,756,100	3,817.0	2.47
Residential – Medium Density	10,110,800	2,645.7	3.54
Restaurant	388,400	59.2	4.79
School	1,483,767	262.1	4.02
Total	27,255,267	10,198	

Historic monthly water use for the system from 2006 to 2011 is shown on **Figure B-2**. The trend line shown in the figure indicates there has been a gradual reduction in water use over this period.

F. System Loss

The City water production is measured on an ongoing basis at the wells with flow meters. Individual services are all metered to accurately account for water sold. The service line meters are read on a monthly basis with a radio read metering system. For 2011, the total water produced was 3,669,414,000 and the total water sold was 3,342,782,000. The lost water was 9.7 percent for 2011. This unaccounted water total includes volumes for regular maintenance items such as hydrant flushing, street cleaning and other City maintenance issues. It is estimated that these maintenance uses account for about half of the unaccounted for water.

In order to examine the difference between indoor and outdoor use, losses were also examined for summer months versus winter months. In 2011, the lost water over the year varied between 5 percent in July and 11 percent in January and February.

G. Water System Growth and Planning Period

Growth of the water system is restricted on several sides due to adjacent water systems. Adjacent water purveyors exist on the north and west sides of the City along with one small private system within the City. Ross Point Water serves a large portion of the area north of Seltice and west of Huetter, and the Hayden Lake Irrigation District (HLID) borders the City system to the north along Prairie Avenue. The south side of the system is bound by Coeur d'Alene Lake.

The majority of the expected growth in the City of Coeur d'Alene is generally progressing toward the east and south with infill in the northwest, as shown on **Figure B-1**. Specific areas of growth in the water system include:

- The northwestern portion of town as development fills in toward Prairie Avenue and Huetter
- The portion of town south of Seltice and north of the Spokane River
- The area south of the Spokane River
- The area east of the existing City boundary in the foothills

There are also several relatively small areas within the future City water boundary serviced by smaller, independent water systems. These specific areas are Hoffman Water, the Kootenai County Fairgrounds, and the USFS Nursery. These water systems may become part of the City system in the future, increasing demands to the City water system. Build-out water demand projections include the incorporation of the USFS nursery and fairgrounds into the City for planning purposes. Hoffman Water is assumed to remain independent.

The equivalent served acreage for the City was estimated by comparing build-out water demands with current water usage for land use areas within the system boundary. Based on this equivalent area, it is assumed that there will be a significant increase in water demands within the current system boundary. The total serviceable area for the build-out scenarios of the water system is approximately 10,600 acres.

H. Large Water Users

There were three water users identified as year-round large users when reviewing meter data from July 2011 through March 2012. These consistent large users were the Coeur d'Alene Resort, Oak Crest Mobile Home Park, and Lake Villa Apartment. In November 2011, the total water use for these three facilities was 6,774,000 gallons, which was 4.5 percent of the total 150,365,000 gallons sold that month.

For the 2011 summer months, there were nine users that registered water use greater than 3,000,000 gallons for the September reading. These users are listed in **Table B-4**.

Table B-4 – Highest Water Users

User	Water Use	Percent of Monthly Total (%)
1. Courcelles Parkway Irrigation	12,987,000	1.65
2. Oak Crest Mobile Home Park	7,640,000	0.97
3. Coeur d'Alene Resort	7,040,000	0.89
4. Lake City High School Irrigation	5,930,000	0.75
5. Coeur d'Alene High School	5,265,000	0.67
6. Canfield Park Irrigation	4,460,000	0.57
7. Bluegrass Park Irrigation	3,480,000	0.44
8. Forest Cemetery Irrigation	3,314,000	0.42
9. Toulon Drive Irrigation	3,027,000	0.38
Total	53,143,000	6.74

III. System Demand Forecast

The anticipated increase in system demand for the water service area is accounted for by applying the growth rate of 2.0 percent for Coeur d'Alene to current peak day flow. Build-out demand for the system was estimated in conjunction with the City Planning Department using current zoning and water demand factors developed for major usage categories and applying these demands to the full build-out acreage. The growth rates were used to estimate approximate timing for service area build-out by projecting flows forward from today's MDD at a 2 percent increase. Future projects described in this Plan include dates for planning purposes; however, observed system demand is the more accurate and critical component to scheduling upgrades. Based on these projections, build-out population is estimated to occur between 2028 and 2032.

A. Current and Future Water Consumption Demands

Water demands within the City are similar to nearby municipalities, with peak summer demands nearing three times the average daily demand (ADD). The terms below are typically used to define water consumption demands:

Average Day Demand (ADD): The average number of gallons of water consumed per day as calculated over the course of a year.

Maximum Day Demand (MDD): The maximum number of gallons of water used in one day as determined from well production records.

Peak Hour Demand (PHD): The maximum amount of water used in a one-hour period. This number is extrapolated from well production and tank level records.

Daily and hourly pumping records are kept at each well site. The maximum historical recorded maximum day demand on July 25, 2006 was 32.2 MG. The observed production has generally declined from 2006 to 2011. This decline is likely a combination of factors, including increased conservation efforts by the City and the economic slowdown. Due to this observed reduction in water use, an average of the observed peaks over the last five years has been used to develop a daily use for projections. The average maximum day from 2007 to 2011 is 30.2 MG, with an average MDD per capita water use of 700 gallons per capita per day. This value will be used in combination with the projected growth rate to develop future projected demands. **Table B-5** illustrates current and future water use within the City’s water service area utilizing an annual growth rate of 2.0 percent.

Table B-5 – City of Coeur d’Alene Current and Future Water Demand

	2011 (mgd)	2016 (mgd)	2021 (mgd)	Build-Out (mgd)
Average Daily Demand	10.05	11.32	12.50	13.80
Maximum Daily Demand	32.19	35.77	39.50	43.60
Peak Hour Demand	57.94	64.38	71.10	78.48

The fluctuation in demands over a 24-hour period was developed using hourly SCADA information from the maximum day demand in 2011, taking into account pump run times, starts, and stops. The peak hour demand represents the highest rate of water use occurring in a one-hour period during the maximum day. Observed reservoir level fluctuations and pumping records indicate the PHD is approximately 1.8 times the MDD. This peak hour occurs at approximately 5:00 a.m., with a second lesser peak (1.2) at approximately 8:00 p.m. Demands above the base line show periods when equalization storage would be required if firm production capacity matched the peak day demand.

Domestic water use varies yearly primarily due to irrigation use. **Table B-5** shows the maximum day pumping averages from 2007 through 2011. Comparing the average annual water demand of 10.4 mgd (7,220 gpm) to the maximum day demand of 30.2 mgd (20,970 gpm) yields a peaking factor of 2.9. This peaking factor is assumed to remain consistent through the planning period.

In addition to the domestic water use and irrigation, typical system demands include fire flow.

IV. Planned Facilities

In order to meet the projected build out demands new water supply sources will be required for the City in addition to other improvements outlined in The Comprehensive Plan Update. Three new, 4,000 gpm wells are required in addition to adding 1500 gpm to existing wells to meet the projections for a total of 13,500 gpm to be added to the system. **Table B-6** includes the projected supply improvements and the estimated date that the improvements will be required.

Table B-6 – Supply Improvements

Improvement	Estimated Date of Construction	Recommended Pump Size gpm	Opinion of Capital Cost
Upper Zone			
New Well	2013/2014	4,000	$1,698,700
Additional supply	2020	1,500	$753,800
General Zone			
New Well	2017/2018	4,000	$1,698,700
New well	2022/2023	4,000	$1,698,700

V. Conservation Goals

A. The City has implemented a number of conservation measures that have had an impact on water production. The following goals for the City were developed using the Idaho Department of Water Resources Water Conservation Guidelines for preparing Water Conservation Plans.

The goals the City has selected are as follows:

1. Maintain a low unaccounted for water measurement. Industry standard for lost water is approximately 10 percent, and the City has a current value of approximately 7 percent. Maintaining or reducing this low value over the next few years is a goal for the City. One way the City plans to reduce this value is by replacing aging or poor quality piping within the system. The impact of this Plan can be measured from one year to the next. Keeping this value low and keeping the system in excellent condition will allow the City to minimize the lost water value from future demands.
2. Continue their public education program and encourage smart controllers for irrigation to reduce the peak hour demands on the system.
3. Continue to participate in xeriscaping promotions, data collection, non-revenue water control, and maintaining their partnership that promotes conservation, all discussed in the following section.

VI. Water Conservation Measures

This section includes a discussion of the conservation measures the City has implemented and is currently using.

A. Water Rate Structure

The City of Coeur d'Alene implemented a block rate structure in 2008. This structure included a base rate and two blocks for usage for residential users, with the upper block designed to discourage high residential water use. This rate structure was gradually increased over a 4-year period and is summarized in **Table B-7**.

Table B-7 – Residential Rate Structure

Year	Block 1 (0-30,000 gal)	Block 2 (Over 31,000 gal)	Base Rate (¾" Meter)
2008	0.65	0.94	6.23
2009	0.67	0.97	6.32
2010	0.70	1.01	6.42
2011	0.72	1.04	6.51

B. Promoting Xeriscaping

The Water Department funded the installation of a Xeriscape demonstration garden adjacent to the community garden. The Department funded this project to demonstrate the look of native and low-water landscaping. In addition to the garden demonstration, the Department also distributes packets of wildflower seeds at the Street Fair, Parks Day, Earth Day, the local Farmer's Market, and other community events.

C. Data Collection

Water production and sales are closely monitored by the City. Pumping data is collected on a daily basis, and water meters are read monthly. These data are used to monitor non-revenue water on a regular basis.

D. Non-Revenue Water Control

The City has been reading meters on a monthly basis since 2005. The billing software identifies areas of unexpectedly high consumption, flagging a visit by City staff to determine if there is a leak on the customer's side of the meter. Since the meters are read monthly, this allows the City to rapidly identify any leaks and encourage repairs.

The City is in the process of replacing the larger meters within the system with compound meters that more accurately read both high and low flows to improve the reliability of the non-revenue water data.

The vast majority of smaller meters within the system were replaced during the conversion to radio read meter capabilities, increasing the overall accuracy of the system.

The City has an aggressive water main replacement program. The mains within the system are ranked based on age, size, and pipe material, with the oldest mains receiving a high replacement priority. Replacement of these mains helps minimize the length of leaky pipes within the system.

Any known leaks are immediately repaired.

E. Partnerships

Beginning in 2008, the City began funding the installation of smart controllers for some of the larger water users within the system to help these users reduce their consumption and improve their efficiency with irrigating. Most of these smart controllers have been installed on City park and public school properties.

The City is actively meeting with a new organization called Idaho Washington Aquifer Collaborative (IWAC), which, among other things, will be addressing bi-state conservation issues. The City has partnered with Kootenai Environmental Alliance to evaluate their conservation needs and activities. The City funded a greenhouse rebuild behind the Jewett House as a demonstration facility. The gardens use a highly efficient drip irrigation system that minimizes the amount of water needed.

The City has been and continues to be an active participant in the creation and implementation of the Comprehensive Aquifer Management Plan (CAMP), which includes significant information encouraging wise water use for utilities in Washington and Idaho.

F. Public Outreach and Publicity

The City locally produced a video on "How to Xeriscape," which has been running on the City's television Channel 19. Presentations have been made to the City Council (August 3, 2010) and Kootenai Environmental Alliance (June 2, 2011) to publicize and encourage wise water use.

Each spring, the Department runs a "City Streets" article in the local newspaper, giving tips on wise water use. Wise water use tips have been included in direct City mailings (Talk of the Town). The annual Water Quality Report includes wise watering tips. This report is mailed to each customer and is available on the City's website.

The Department has included articles on wise water use in the Kootenai Environmental Alliance newsletter. The Department has supported a class at North Idaho College on xeriscaping for homeowners, and will credit the cost of the class, including the workbook, for any residential customer who takes and completes the class.

G. Hose Bib Timers

The City has encouraged the use of hose bibb timers and moisture sensors by homeowners to prevent accidental excess lawn watering. Qualifying installations can receive a credit on their utility bills for a portion of the cost to purchase these.

VII. Effects of Conservation Measures

A. The impact of several of the conservation measures discussed previously began at specific times and can be measured when looking at water use over a period of years. The measures that are easily tracked are the following:

- Block water rate structure for residential customers, which was implemented in 2008
- Monthly reading of water meters, which was implemented in 2005
- Funding of smart controllers which happened in 2008

In order to analyze potential impacts, the produced and sold water were both plotted on a per connection basis along with the average daily temperature for the month. This chart is included as Figure B-1.

The water reduction from the installation of the smart controllers has been easily measured by the City as they regularly watch the water use at the City Parks. Based on information from Doug Eastwood in an email dated January 20, 2009, the consumption of irrigation water for City Parks decreased between 30 and 50 percent at several of the parks after the installation of the Smart Controllers.

City wide, the per capita water use in the peak months of July and August was 659 gallons per capita per day in 2006 and 2007. After the implementation of the Block Rate Structure and use of smart metering for parks and school irrigation (2008-2011), the per capita water use decreased to 563 gallons per capita per day, which is a 15 percent reduction. The trendline shown in Figure B-1 demonstrates the overall reduction over time.

The average temperature was also examined for the years evaluated. Although the monthly average temperature was greater in 2006 and 2007 than it was from 2008-2011 as seen in **Figure B-1**, there was still a significant reduction in water use when adjusting temperature.

VIII. Expected Savings

While it is difficult to identify the impact on specific conservation measures, the United States Environmental Protection Agency (USEPA) has provided benchmark data for what can be expected. Specific conservation measures and the expected savings for these measures are included in Appendix B of the USEPA Water Conservation Guidelines. A summary of the expected savings for some specific measures according to EPA is included in **Table B-8**.

Table B-8 – USEPA Water Conservation Measure Benchmark Savings [1]

Conservation Measure	Expected Reduction in Use (%)	Water Use Category Impacted
Universal Metering	20	All
10% Increase in residential rates	2-4	Residential
10% Increase in non-residential rates	5-8	Non-Residential
Public Education	2-5	All
Large Landscape Water Audits	10-20	Non-Residential
Low Water Use Plants	7.5	All

[1] *USEPA Water Conservation Plan Guidelines Appendix B*

The implementation of any or all of these measures would be expected to reduce peak water demand and not expected to drastically impact revenue from water sales.

IX. Future Conservation Measures

Conservation Goals: The City has three main conservation goals moving forward:

1. To maintain non-revenue water at a level below 10 percent
2. To reduce or maintain the peak day and peak month consumption to optimize the use of their existing supply capacity
3. Continue to participate in educational programs, data collection, non-revenue water control, and maintaining their partnership that promotes conservation

In order to meet these goals, the City should continue with the water conservation measures they have been implementing, with continued focus on the following activities:

- Monitor meter reads to identify potential leaks at metered connections
- Compare monthly pumped data with billed data to identify potential distribution system leaks
- Use of compound meters for larger connections for better accuracy of actual use
- Regularly scheduled water main replacement
- Immediate leak repairs
- Use of smart controllers, especially for large irrigated spaces
- Partnerships with area groups such as IWAC, KEA, and CAMP
- Public education
- Promotion of hose bib timers and moisture sensors for all connections that provide irrigation

Some other measures the City may want to consider in the future are as follows:

- The use of reclaimed water for City irrigation
- Re-evaluation of the water rate structure and adding additional blocks
- Mandatory installation of moisture sensors for services that provide irrigation

Figure B-1 – Water System Planning Boundary

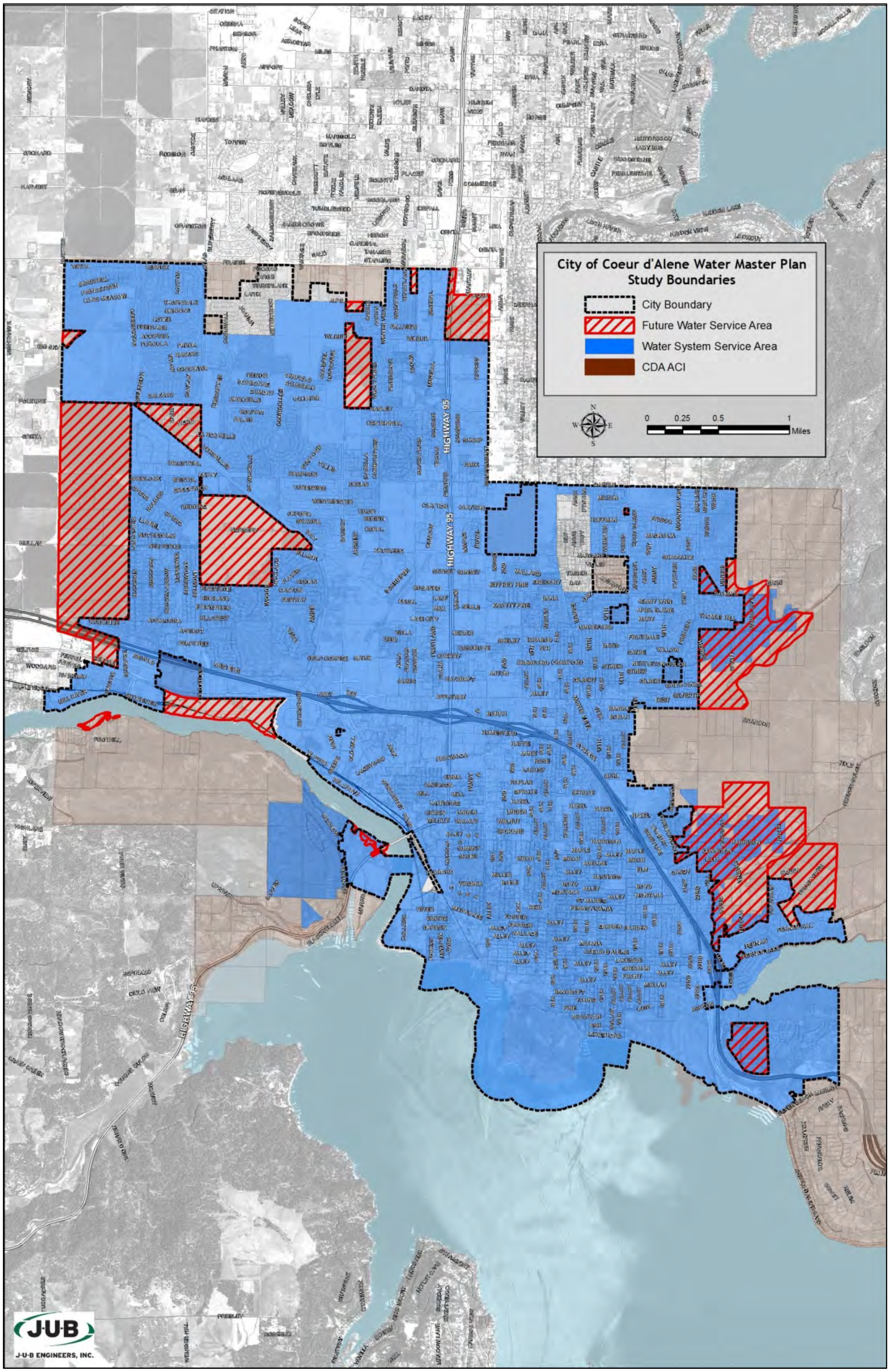
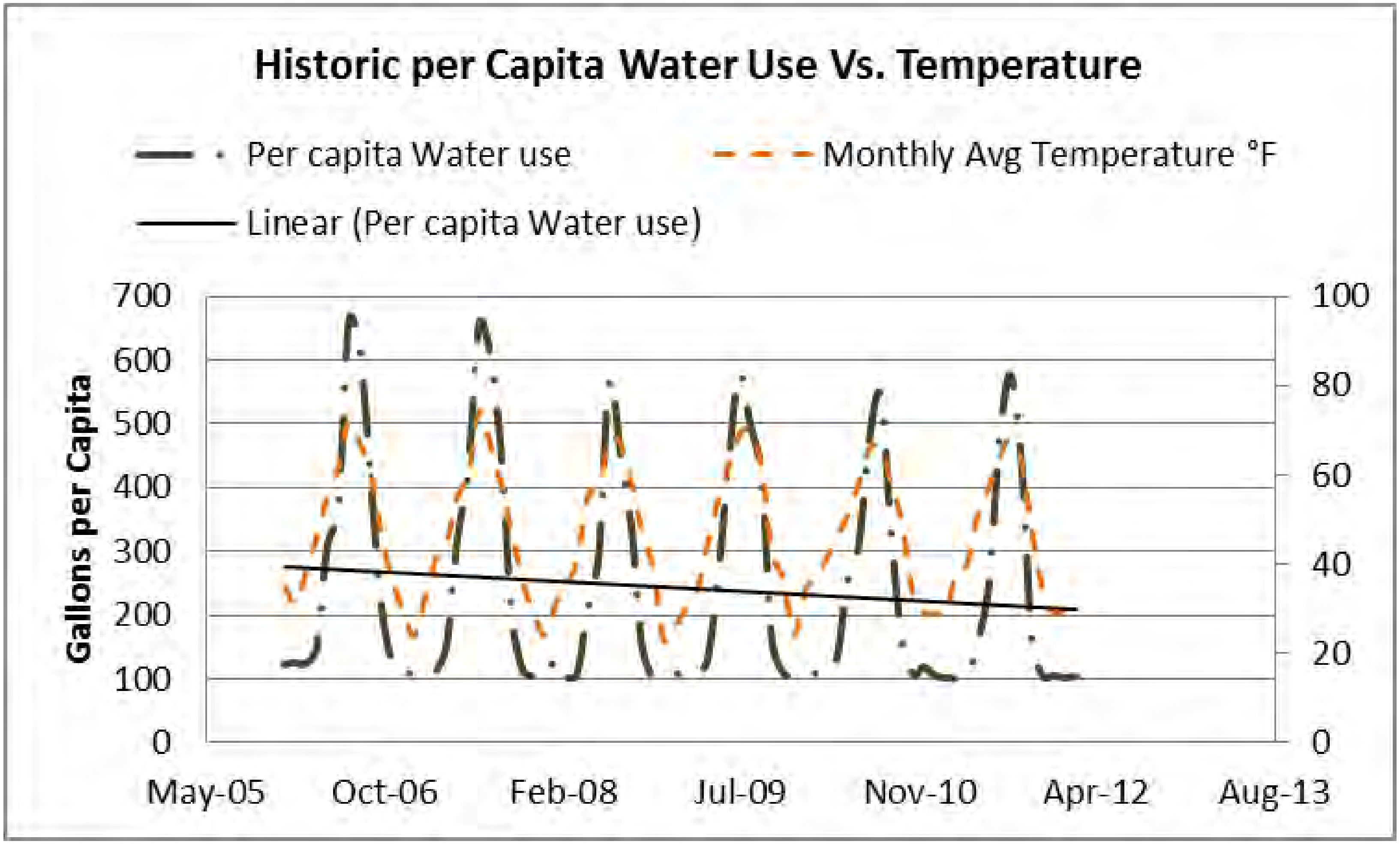


Figure B-2 – Per Capita Water Use vs Temperature



Appendix C

Well Data

Atlas well

PUMP DATA

TYPE: VERTICAL TURBINE

H.P.: 600 H.P.

R.P.M.: 1775

COLUMN SIZE: 14"

WELL DATA

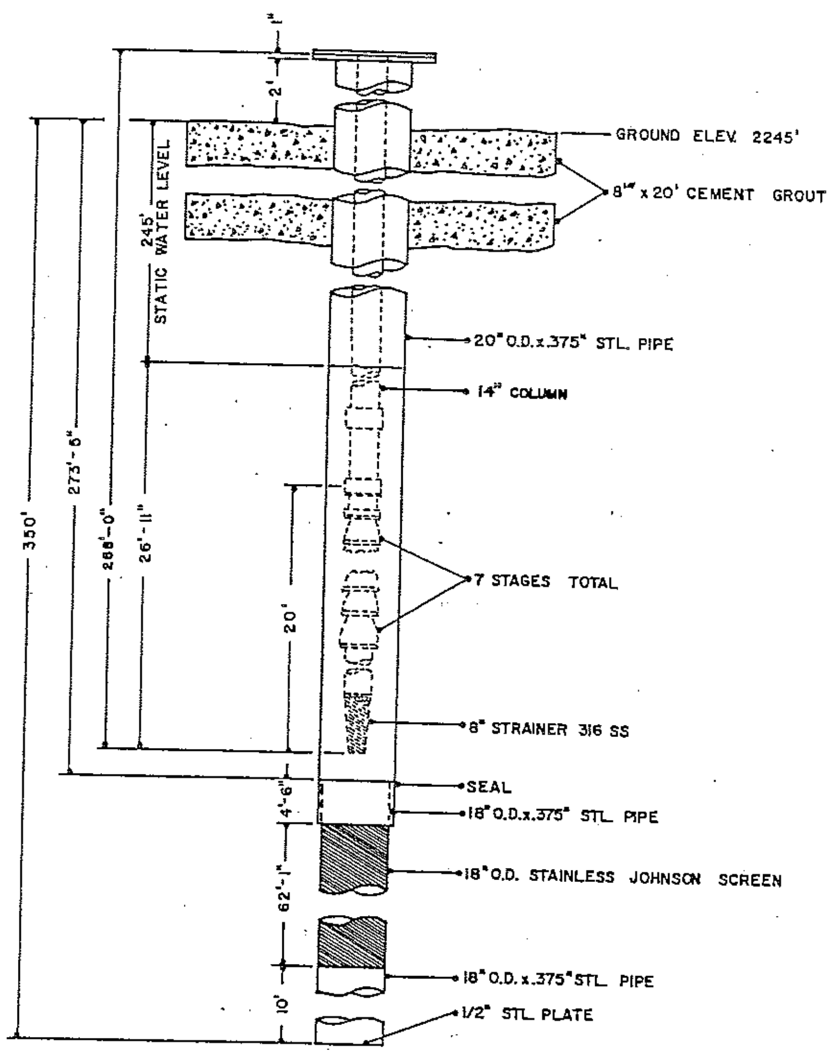
DRILLED DEPTH: 350'

STATIC WATER LEVEL: 245'

PRESENT PUMP CAPACITY: 4000 G.P.M.

TESTED CAPACITY: 6000 G.P.M.

WATER TEMP: 48° FARENHEIT

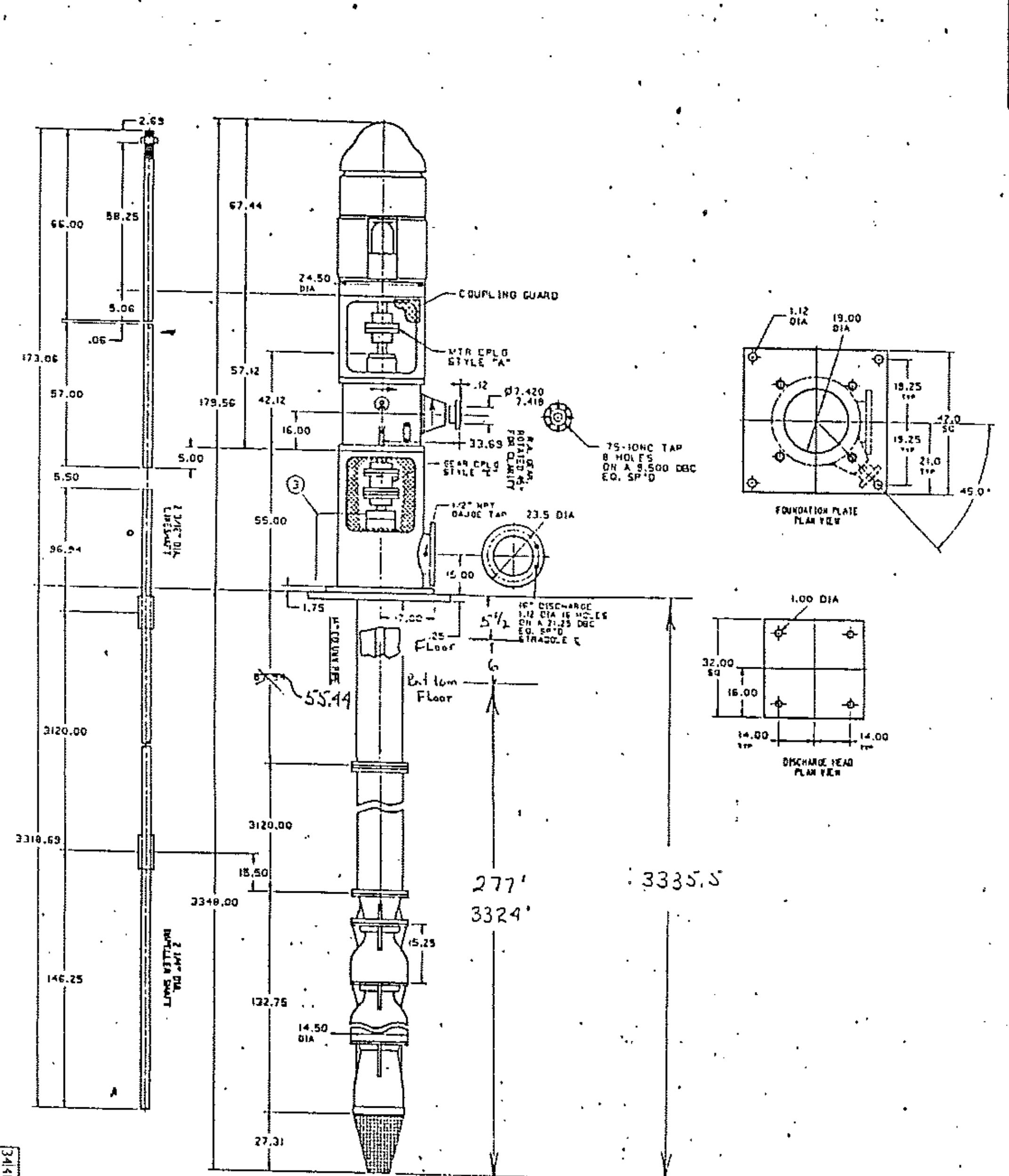


WELL PROFILE

NO SCALE

(FOR LOCATION SEE SHEET 349)

Atlas Well 1



NOTES 1. PAINTING - EXTERIOR OF DISCHARGE HEAD, FOUNDATION PLATE, AND MOTOR TO BE FINISHED WITH WORTHINGTON STANDARD PRIMER.

2. COATING - OD BOWLS, ID/OD COLUMN PIPE, AND ID DISCHARGE HEAD. THEMEC SERIES 20 POTA-POX OR KOPPERS HI-GARD EPOXY COATING. MIN. (3) THREE COATS WITH THICKNESS OF 9 MILS. SURFACE TO BE SANDBLASTED PRIOR TO APPLICATION.

3. A.P.I. PLAN 13 PIPING FURNISHED BY DRESSER STAINLESS STEEL TUBING FROM MECHANICAL SEAL ADAPTOR BACK TO SUCTION.

MOTOR FURNISHED BY DRESSER
MOTOR DATA

MFG	US	FRAME	5808PH
HORSEPOWER	600	RPM	1800
PHASE	3	CYCLES	60
VOLTS	460	ENCL.	ODP

R.A. GEAR FURNISHED BY DRESSER
R.A. GEAR DATA

MFG	AMARILLO	MODEL	C600A
DRIVER RPM	1800	PUMP RPM	1800
RATIO	1:1		

DISCHARGE HEAD : F2416
150 # FLANGE RATING

CAD DWG.-NO MANUAL CHANGES PERMITTED
34140

WORTHINGTON 15HH410-7
VERTICAL TURBINE PUMP ELEVATION
DRESSER PUMP DIVISION, DRESSER INDUSTRIES, INC.
ORDER TVU-60454 DATE 01-07-88 SCALE N.T.S.
MAH AG VX48438 A

01-08-88

Atlas Well 2

PUMP DATA SHEET NO. 1
VERTICAL TURBINE PUMPS

BIDDER'S NAME ________________________ DATE __________

PUMP DATA

RPM	1775
Manufacturer	Worthington
Model No.	15HH410
No. of Stages	7
Nominal Size of Bowls	15"
Max. OD of Bowls	14 1/2
Overall Length Bowl Section	169.38
Pump Shaft Diameter	2 1/4
Pump Shaft Material	416 SS
No. of Pump Bearings	8
Pump Bearing Material	BRONZE
Description of Pump Bearings	SLEEVE
Pump Bowl Catalog No.	15 HH
Pump Bowl Material	C.I.
Pump Bowl Lining	PORCELAIN ENAMEL
Impeller Type (Open, Closed)	CLOSED
Impeller No.	15HH410
Impeller Material	BRONZE
Type Lubrication	Pumped FLUID
HP Demand at Guar. Point	527

Atlas Well 3

COLUMN SHAFT DATA

Column Size	14"
Type Column Couplings	THREADED
Lineshaft Size	2 3/16
Lineshaft Insert Material (SLEEVE)	18-8 SS
Lineshaft Coupling Material	STEEL
No. Lineshaft Bearing Spacers	25
Lineshaft Bearing Materials	Rubber
Lineshaft Bearing Description	SLEEVE
Lineshaft Bearing Spider Material	CAST IRON

DISCHARGE HEAD

Manufacturer	Worthington
Model No.	F-2416
Guide Bearing Material	BRONZE
Guide Bearing Lubrication	Pumped FLUID
Guide Bearing Type	SLEEVE
Weight	1270 #

THRUST BEARING

Manufacturer	U.S. MOTOR
Manufacturer's No.	SKF-29430-MC
Max. Total Thrust at Guar. Point	14757 LBS
Rating Life in Hours	MIN. 50,000 HRS

MOTOR

Manufacturer	U.S MOTOR
Model No. and Type	5808 PH / HU

Atlas Well 4

COEUR D'ALENE/ATLAS P.S. IMP.
R. BEIELER/YKM

B22914A
SEA

Nominal HP ______ 600

Power Factor at Guar. Point ______ 89.0

Weight ______ 3600

Overall Efficiency at Guar. Point ______ 94.6 motor

Heater Rating - Watts ______ NONE

Max. Diameter ______ 39 1/2

The following data are the actual performance characteristics of the pump proposed for installation as specified, but the quantity, head, horsepower, and efficiency at points other than the guarantee point proposed are not guaranteed.

OPERATING CHARACTERISTICS

Quantity GPM	Total Head Feet	Hp Demand by Pump	Overall Efficiency Percent
0 (Shutoff)	791	580	0
1500	651	493	50.0
3000	525	513	77.5
4000 (Guar.)	420	527	80.5
4700	287	512	66.5

* INCLUDES COLUMN FRICTION AND SHAFT H.P. LOSSES

COMBINATION RIGHT-ANGLE GEAR DRIVE DATA

Manufacturer ______ AMARILLO

Model No. ______ A-600

RPM 1775 Speed Ratio (Drive - Driven) 1:1

Rated HP ______ 600

AGMA Service Factor ______ 1.5

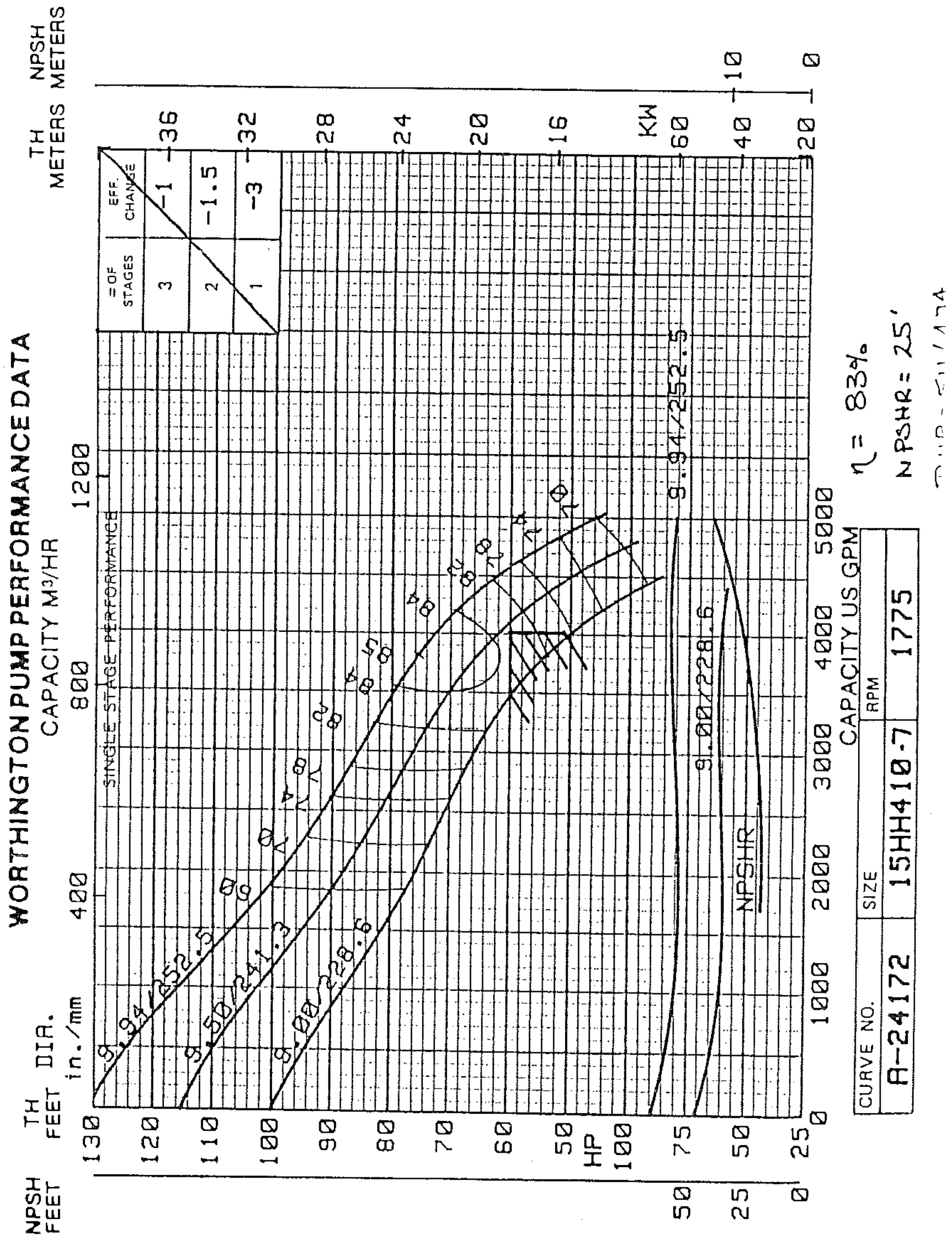
B22914.A1
11004

Atlas Well 5

Customer R.C. Worst & Company	Worthington S.O. Portland	2400-8 Page 7
Project City o' ... ur D' Alene	~~Proposal~~/Order N ... -80303	May 198
Cust. ~~Proposal~~/Order No. 0000984	Certified By T. Knappich	15HH41
Customer Item No. –	Date 1-12-88	1775 RP

Liquid/Service Water Sp. Gr. 1.0 Visc. – SSU

Capacity 4000 Head 420 Temp. 60 °F/°C



WORTHINGTO

Atlas Well 6

Prairie well

FLOWAY PUMPS

HYDROSTATIC TEST REPORT

Rev. No.: 0

Date Issued: 5-14-99

Customer: R.C. WORST & CO.	Parent Job: 76249
Serial Number: 35073-1-1	Customer PO: 18771

Applicable Specification: HI   Witness by Customer: No

Project Engineer: HP   Application Engineer: AB   Ship Date: 6-9-99

	Size	PSIG Req'd	PSIG Tested	Test Date	Tester	Q.C.	Witness	Req'd
Discharge Head:	12 x 24½ 'F'	200	200	6-10-99	E.W.			☐
Outer Shell:								☐
Inner Shell:								☐
Barrel:								☐
Column, Qty:								☐
Bowl(s) Qty:								☐
Discharge Case:								☐
Booster Lead Assy:								☐
Cooling Loop Assy:								☐
Other:								☐

High Tensil Bolting Required: ______   Duration of test per customer specifications: 0 Hrs. 5 Mins.

Additional Hydrotest Requirements:

FLOWAY PUMPS HYDROSTATIC TEST POLICY: STANDARD TEST: Booster lead assembly - 100 PSIG. Parts under discharge pressure 1-1/2 times shut-off pressure or 200 PSIG whichever is greater. (Note: Total discharge pressure is the sum of the suction pressure and pump differential pressure). Standard test will be 5 minutes in duration. API 610: Duration will be 30 minutes minimum. Fire Pumps: U.L. - 1-1/2 times shut-off pressure or a minimum of 250 PSIG. F.M. - 2 times shut-off or a minimum of 250 PSIG. U.L.C. - 2 times shut-off or a minimum of 350 PSIG.

We certify that the identified tests were completed and are in accordance with the stated specifications and that test instrumentation is in a current state of calibration.

[signature] Test Lab   Date: 6-10-99

☐ Quality Control Inspector   Date

☐ Approved by Witness   Date

Req'd

COMPLETED

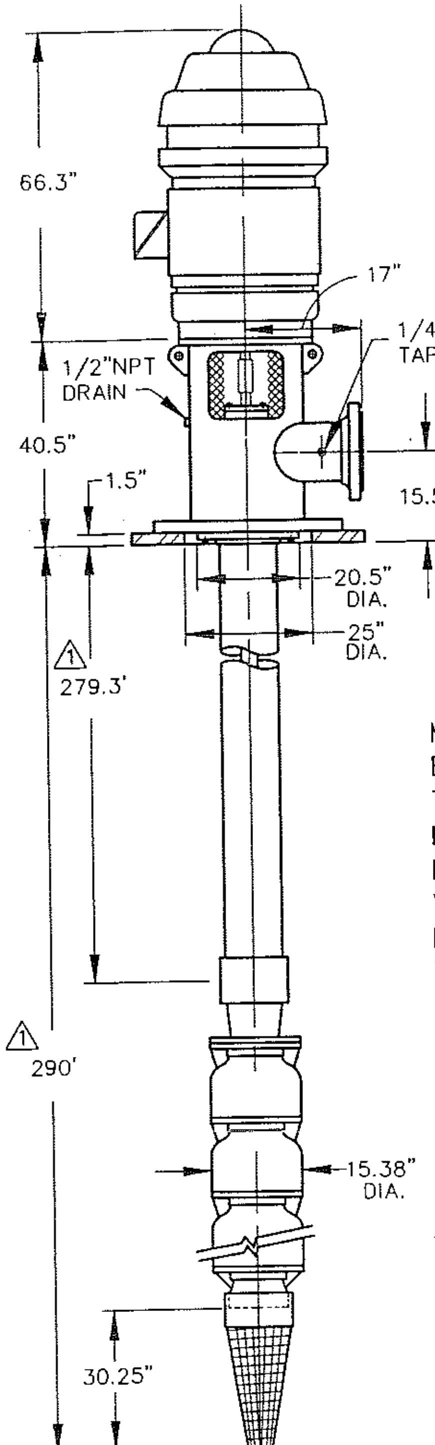
EN-015 R02   Prairie Well

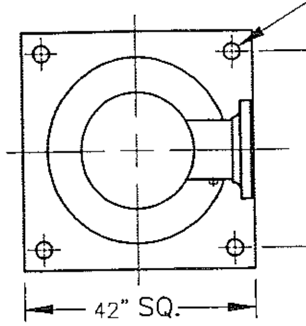
D-1093-T

FLOWAY PUMPS
FRESNO, CALIFORNIA

VERTICAL TURBINE PUMP

TYPE "F"





THIS DRAWING IS CERTIFIED
☐ FOR APPROVAL NO PRODUCTION WILL START UNTIL APPROVED IN WRITING.
☐ FOR CONSTRUCTION PRODUCTION HAS STARTED. ANY CHANGES MAY AFFECT PRICE AND DELIVERY.
OUR ORDER No.: 35073
CUST. ORDER No.: 18771 ⚠1
BY: HP DATE: 7-14-99

DISCHARGE
12" - 300# -R.F.ANSI. FLG.
(16)- 1.25" DIA. HOLES *
17.75" DIA. BOLT CIRCLE
20.5" DIA. FLANGE
* BOLT HOLES STRADDLE VERTICAL ℄

EST. WEIGHT 30,000 lbs
EST. DOWN THRUST 13,458 lbs

MOTOR

MAKE GENERAL ELECTRIC
ENCLOSURE WP-1
TYPE VHS NRR YES
HP 500 RPM 1785
PHASE 3 HERTZ 60
VOLTAGE 460
FRAME NO. L509TP24 ⚠1
TYPE COUPLING THREADED

PUMP

12"x24.5" "F" STL. DISCH HD.
2.25" LINE SHAFT 12" COL
--- SHAFT TUBE
PROD.LUBE YES OIL LUBE NO
TYPE 16 MKM STAGE 6
⚠2 3500 GPM 450' BOWL HD
IMPELLER ENCLOSED
STRAINER YES

MATERIAL

COL PIPE A53-GR.B SCH.30 STL
LINE SHAFT A108-GR.1045 STL
SHAFT TUBE ---
BOWL SHAFT A582-416 SS
MECH. SEAL JC #5610 ⚠1
BRG. RETAINER A536-GR.60 DI
SOLE PLATE A516-GR.70 STL

PUMP BOWL A48-CL.30 CIE
IMPELLER B584-838 BRZ
BEARINGS (BOWL) B505-932 BRZ
BEARINGS (LINESHAFT) NEOPRENE
STRAINER GALV. STL
BOWL W/R STAINLESS STEEL
IMPELLER W/R ---

CUSTOMER CITY OF COEUR d' Alene
PRAIRE PUMP STATION

FLUID WATER
SPEC. GRAVITY 1.0
VISCOSITY ---
TEMPERATURE AMBIENT
PH ---

ORDER NO. 18771 ⚠1
SUPPLIER R.C. WORST & COMPANY INC ⚠1
625 BEST AVENUE
COEUR D'ALENE, ID 83814

DWG. NO. 3507301COD
SERIAL NO. 35073-1-1

A WEIR COMPANY

REMARKS
NO. UNITS REQ'D. 1
DEEP WELL PUMP

⚠2 REV #2, MWA 7/14/99
⚠1 REV #1, MWA 5/18/99
By : MWA/MFC Date : 3/18/99

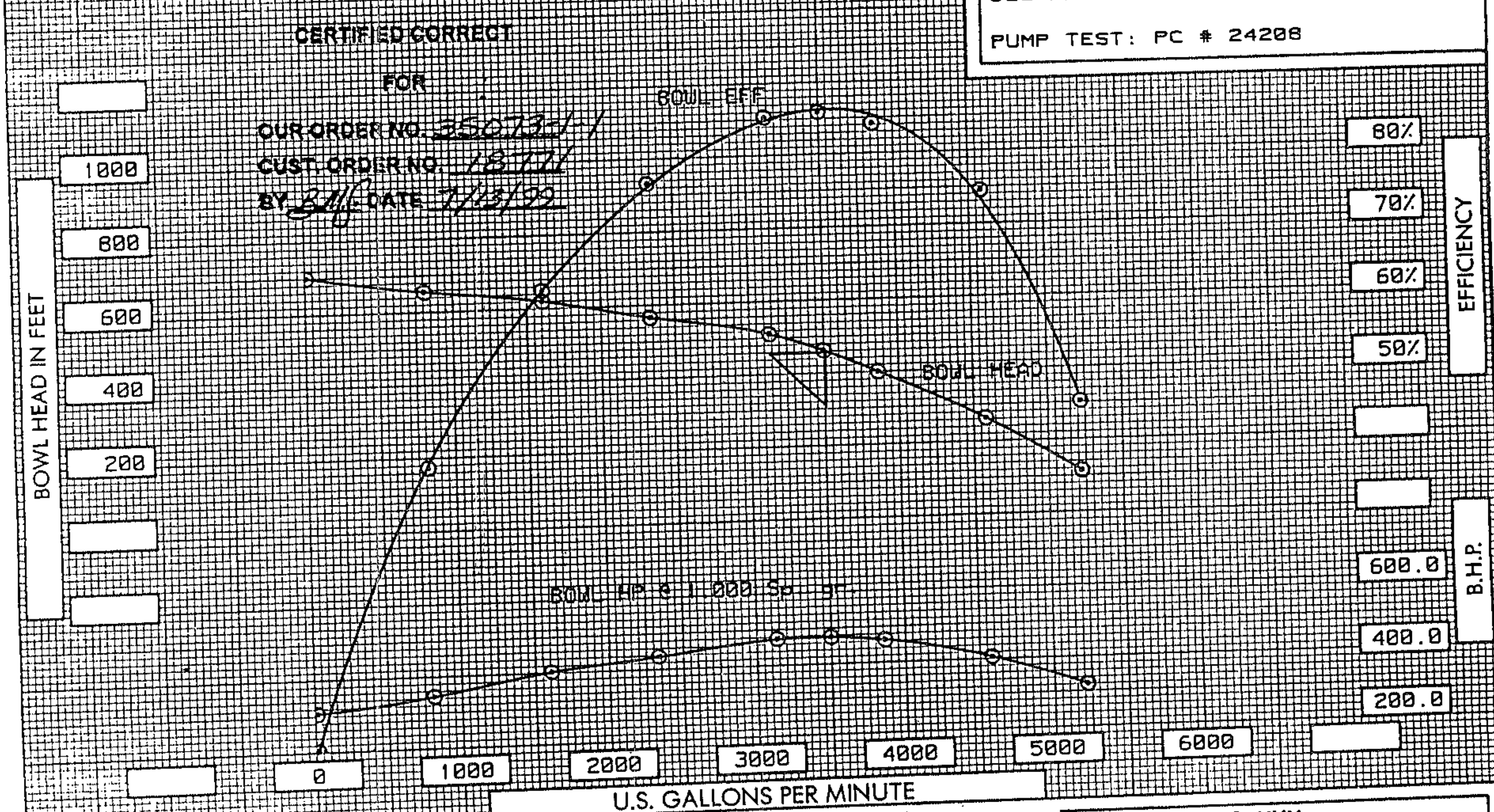
NOT TO BE USED
FOR CONSTRUCTION
UNLESS CERTIFIED

3507301COD

Prairie Well 2

COEUR D`ALENE ID
PRAIRE PUMPING STATION
500 HP DEEP WELL PUMP

PUMP TEST: PC # 24208



R.C. WORST & COMPANY
625 BEST AVE.
COEUR D`ALENE ID 83814

DWG. NO. 35073-1-1-T1 REV. #-1

FLOWAY PUMPS
FRESNO, CALIFORNIA

A WEIR COMPANY

TYPE 16 MKM
NO. OF STAGES 6
R.P.M. 1785
PUMP SERIAL NO. 35073-1-1

DWN. BY B.M.S. DATE 13-Jul-99

PF-614

Prairie Well 3

CHAPTER 3 - LANDINGS WELL HOUSE

3.1 Description

The Landings Well House is located in the northwest corner of Coeur d'Alene on Atlas Road just south of Prairie Avenue. The Landings Well House serves the City's upper pressure zone and is operated on water level signals from the Industrial Park standpipe. **Figure 1-1** shows the location of the Landings well in relation to the other City wells, while **Figure 3-1** shows the existing site plan. Water leaves the well house through a 16-inch ductile iron main, then enters an existing 16-inch PVC main that delivers water south on Atlas Road to the upper zone distribution system and storage. **Figure 3-1** shows the Landings Well site plan.

3.2 Landings Well Pump and Motor

The Landings well pump was supplied by Dickerson Pump manufactured by Flowserve.

Dickerson Pump	Flowserve
Chuck Goodman	Richard Audler
E. 3627 Broadway	2349 South Orange Avenue
Spokane, WA 99201	Fresno, CA 93725
Phone: 509-534-2671	Phone: 559-268-9243
FAX: 509-534-2616	FAX: 559-268-6709

The Landings well pump is a Flowserve Model 15 EHM, 5-stage, vertical line shaft rated at 3000 gpm at 512 feet TDH. The curve number for the pump provided is EC-2392. The motor is a 500 hp unit manufactured by U.S. Motors. The pump and motor at the Landings well operate at a constant speed. **Figure 3-2** shows the pump curve for the Landing Well

3.3 Operations—Landings Pumping System

Operation of the Landings well pump begins when a signal from the City's telemetry system indicates a pump-start elevation has been reached at the Industrial Park standpipe. The system operator selects pump-start and pump-stop elevations through the City's SCADA (telemetry) system interface at the Water Department office. These operational setpoints vary with season and are directly dependent on the water demands within the City.

3.4 Pump-Start Sequence

The pump-start sequence for the Landings well house includes several steps. Please refer to Sheet C6 of the **Record Drawings** in **Appendix A** for specific appurtenances described in the list below, which describes the steps involved with each pump-start.

Prairie Well 4

Landings Well Log

Form 238-7
6/02

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Well ID No. ____
Inspected by ____
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 0033506
DRILLING PERMIT NO. 810406
Water Right or Injection Well No. ____

2. OWNER:
Name City of Coeur d Alene
Address 3800 Ramsey Rd
City Coeur d Alene State ID Zip 83815

3. LOCATION OF WELL by legal description:
You must provide address or Lot, Blk, Sub. or Directions to well.
Twp. 51 N North ☐ or South ☐
Rge. 4 W East ☐ or West ☐
Sec. 28, NE 1/4 NE 1/4 ____ 1/4 (10 acres, 40 acres, 160 acres)
Gov't Lot ____ County Kootenai
Lat: : : Long: : :
Address of Well Site Prairie Ave - Atlas Rd Landings Well
City Coeur d Alene
(Give at least name of road + Distance to Road or Landmark)
Lt. ____ Blk. ____ Sub. Name ____

4. USE:
☐ Domestic ☒ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other ____

5. TYPE OF WORK check all that apply (Replacement etc.)
☒ New Well ☐ Modify ☐ Abandonment ☐ Other ____

6. DRILL METHOD:
☐ Air Rotary ☒ Cable ☐ Mud Rotary ☐ Other ____

7. SEALING PROCEDURES

Seal Material	From	To	Weight / Volume	Seal Placement Method
bentonite	0	60	8 lb	Tremie

Was drive shoe used? ☒Y ☐N Shoe Depth(s) 340
Was drive shoe seal tested? ☐Y ☒N How? ____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
24"	+2	340	.375	Steel	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe 10' Length of Tailpipe 10'
Packer ☒Y ☐N Type Neoprene 333'

9. PERFORATIONS/SCREENS PACKER TYPE
Perforation Method ____
Screen Type & Method of Installation 304 Stainless

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
345	395	80		22"	Stainless	☐	☐
						☐	☐
						☐	☐

10. FILTER PACK

Filter Material	From	To	Weight / Volume	Placement Method
N/A				

11. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
282 ft. below ground Artesian pressure ____ lb.
Depth flow encountered 320 ft. Describe access port or control devices: ____

51N 4W 28

12. WELL TESTS:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
3400	14'	296	4 hr

Water Temp. ____ Bottom hole temp. ____
Water Quality test or comments: good
Depth first Water Encounter 320

13. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
30"	0	60	Brown silty sand-gravel cobbles		X
24"	60	320	Brown silty sand & gravel cobbles		X
24"	320	410	Sand-gravel cobbles water	X	

RECEIVED
SEP 20 2004
IDWR/North

RECEIVED
OCT 01 2004
IDWR/North

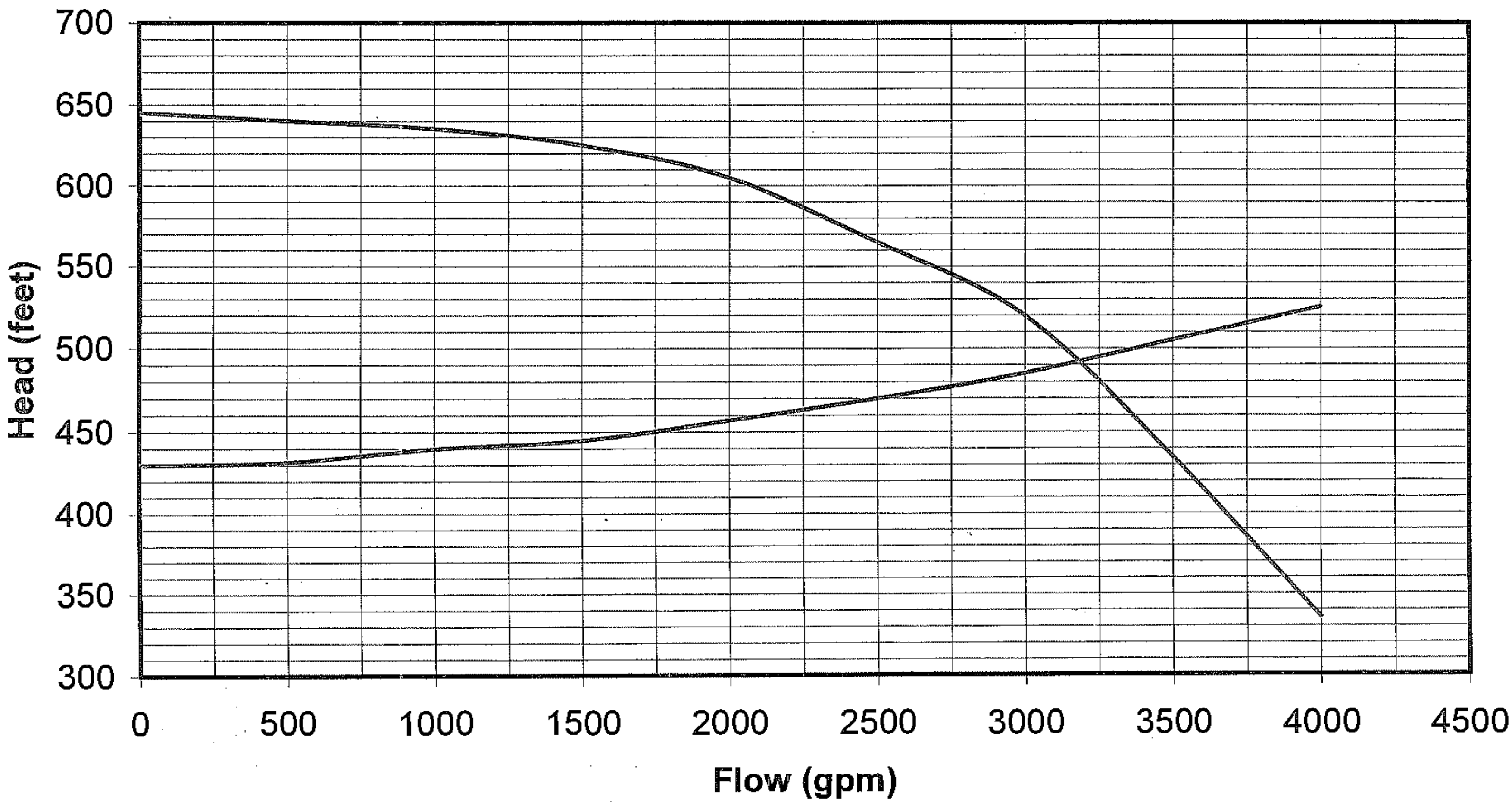
Completed Depth 405 (Measurable)
Date: Started 5/18/04 Completed 8/27/04

14. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
Company Name Holt Drilling Inc Firm No. 596
Principal Driller Wade Iversen Date 9/9/04
and
Driller or Operator II Wade Iversen Date ____
Operator I ____ Date ____
Principal Driller and Rig Operator *Required.*
Operator I must have signature of Driller/Operator II.

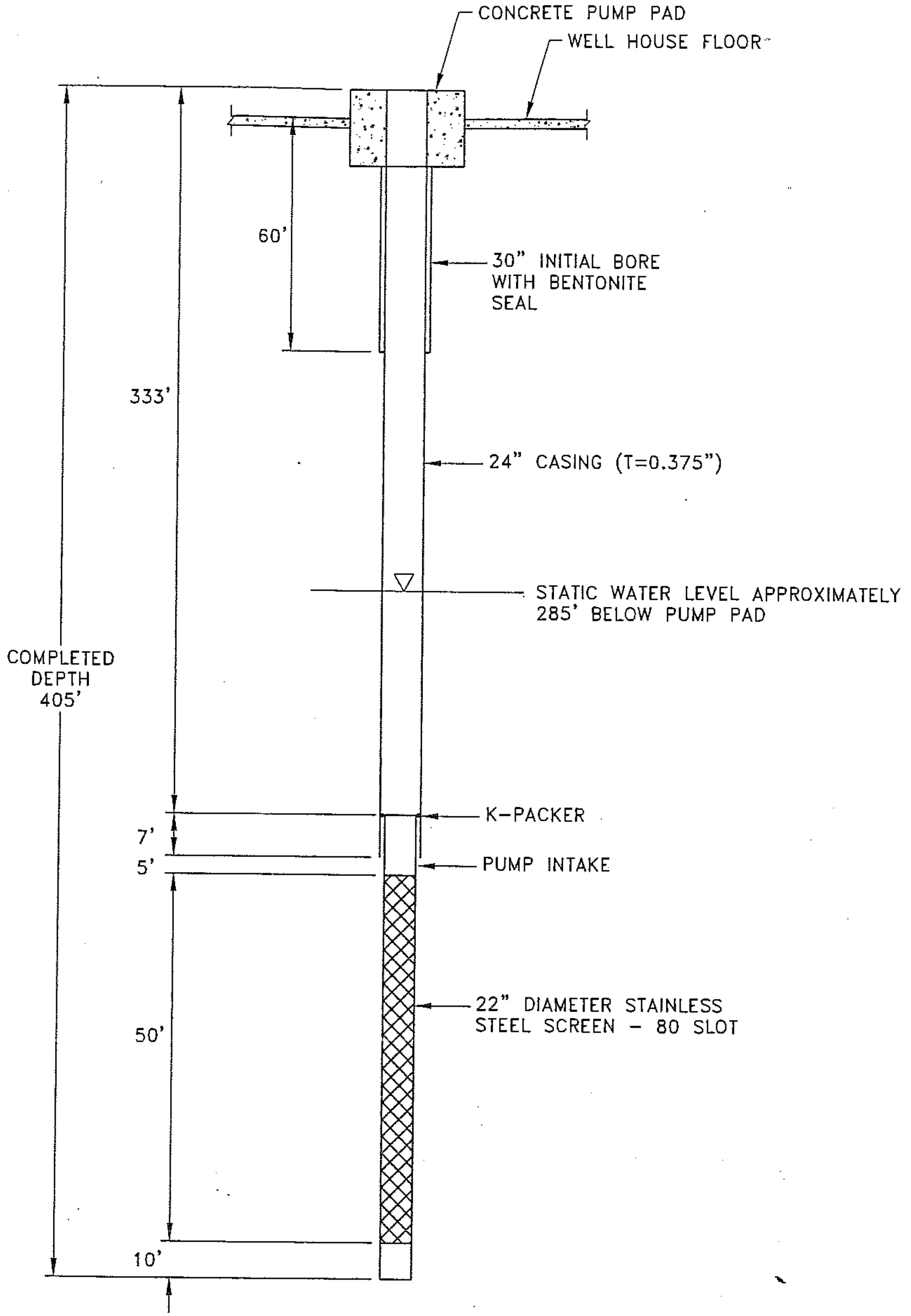
FORWARD WHITE COPY TO WATER RESOURCES

Prairie Well 6

Figure 3-2
Landings Pump Curve
(Flowserve 15EHM/15H277, 5-Stage)



Prairie Well 6



J·U·B

Engineers • Surveyors • Planners

CAD FILE: 20858-LANDING-FIG3-5

FIGURE 3-5
LANDINGS WELL CONSTRUCTION

Prairie Well 7

CHAPTER 2 - ANNIE AVENUE WELL HOUSE

2.1 Description

The Annie Avenue Well House is located on Annie Avenue just west of 3rd Street at the end of a cul-de-sac. The Annie Avenue well site was purchased by the City from the Seventh-Day Adventist Church in January 2004. The Annie Avenue well serves the City's lower pressure zone and is operated based on water level in the Tubbs Hill tanks. **Figure 1-1** shows the location of the Annie well in relation to the other City wells, while **Figure 2-1** shows the existing site plan. Water leaves the well house through a 16-inch ductile iron main, then enters a 16-inch tee that delivers water to the east and the west through 12-inch PVC mains. The main to the west connects to another 12-inch main shown in **Figure 2-1** in Ironwood Drive. A second 12-inch main extends east where it ties into an existing 12-inch main that runs north-south in 4th Street.

2.2 Annie Avenue Well Pump and Motor

The Annie Avenue well pump was supplied by H_2O Well Service and manufactured by Sterling Fluid Systems, Inc.

H_2O Well Service	Sterling Fluid Systems, Inc.
Jim Johnston	2005 Dr. Martin Luther King Jr. Street
582 W. Hayden Avenue	PO Box 7026
Hayden, ID 83835	Indianapolis, IN 46207-7026
Phone: 208-772-4004	Phone: 371-925-9661
FAX: 208-772-4892	FAX: 371-924-7388

The Annie Avenue well pump is a Peerless Model 16 HXB, 5-stage, vertical line shaft rated at 2500 gpm at 429 feet TDH. The serial number is 635702A and the impeller number is 4601399-023. The motor is a premium efficiency 350 HP unit manufactured by U.S. Motors.

A variable frequency drive (VFD) controls the speed of the 350 hp motor and in turn controls the amount of water pumped. The pump ramps to full frequency at each call to start from the Tubbs Hill tanks. The frequency lowers as the tanks reach their maximum levels. The minimum frequency set point utilized is 48 Hz, which produces approximately 900 gpm. The pump curves are included in the manufacturer's O&M Manual. The pump curve shown in **Figure 2-2** shows the approximate system performance based on well drawdown and distribution system data. The figure also shows pump operation at several points based on different percentages of full speed.

2.3 Operations—Annie Avenue Pumping System

Operation of the Annie well pump begins when a signal from the City's telemetry system indicates a pump-start elevation has been reached in the Tubbs Hill tanks. The

Prairie Wells

Annie Avenue Well Log

Form 238-7
6/02

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Well ID No. ______
Inspected by ______
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

RECEIVED SEP 20 2004 IDWR/North

1. WELL TAG NO. D 0033505
DRILLING PERMIT NO. 810405
Water Right or Injection Well No. N 016062

2. OWNER:
Name City of Coeur D Alene
Address 3800 Ramsey Rd
City Coeur D Alene State ID Zip 83815

3. LOCATION OF WELL by legal description:
You must provide address or Lot, Blk, Sub. or Directions to well.
Twp. 50 N North ☐ or South ☐
Rge. 4 W East ☐ or West ☐
Sec. 12 SW 1/4 NW 1/4 ____ 1/4
Gov't Lot ____ County Kootenai
Lat: : : Long: : :
Address of Well Site 3rd St and Anne Ave City Coeur D Alene
Lt. ____ Blk. ____ Sub. Name ____

ENTERED

4. USE:
☐ Domestic ☒ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other ____

5. TYPE OF WORK check all that apply (Replacement etc.)
☒ New Well ☐ Modify ☐ Abandonment ☐ Other ____

6. DRILL METHOD:
☐ Air Rotary ☒ Cable ☐ Mud Rotary ☐ Other ____

7. SEALING PROCEDURES

Seal Material	From	To	Weight / Volume	Seal Placement Method
Bentonite	0	60	8 lb	Tremie

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 301
Was drive shoe seal tested? ☐ Y ☒ N How? ____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
24"	+2	301	.375	Steel	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe 10 Length of Tailpipe 10
Packer ☒ Y ☐ N Type Neoprene d 293

9. PERFORATIONS/SCREENS PACKER TYPE
Perforation Method ____
Screen Type & Method of installation 304 stainless

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
303	343	60		22"	Stainless	☐	☐
						☐	☐
						☐	☐

10. FILTER PACK

Filter Material	From	To	Weight / Volume	Placement Method
N/A				

11. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
187 ft. below ground Artesian pressure ____ lb.
Depth flow encountered 250 ft. Describe access port or control devices: ____

12. WELL TESTS:
☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
2500	93	280'	4 hrs

Water Temp. ____ Bottom hole temp. ____
Water Quality test or comments: quality - good
Depth first Water Encounter 250

13. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
30"	0	60	Brown silty sand + gravel		X
24"	60	65	Brown silty sand + gravel		X
24"	65	117	loose brown sand + gravel		X
24"	117	180	loose brown sand - gravel cobbles		X
24"	180	235	brown sand some gravel		X
24"	235	250	brown - gray sand + silt		X
24"	250	353	brown coarse sand some gravel	X	

RECEIVED OCT 01 2004 IDWR/North

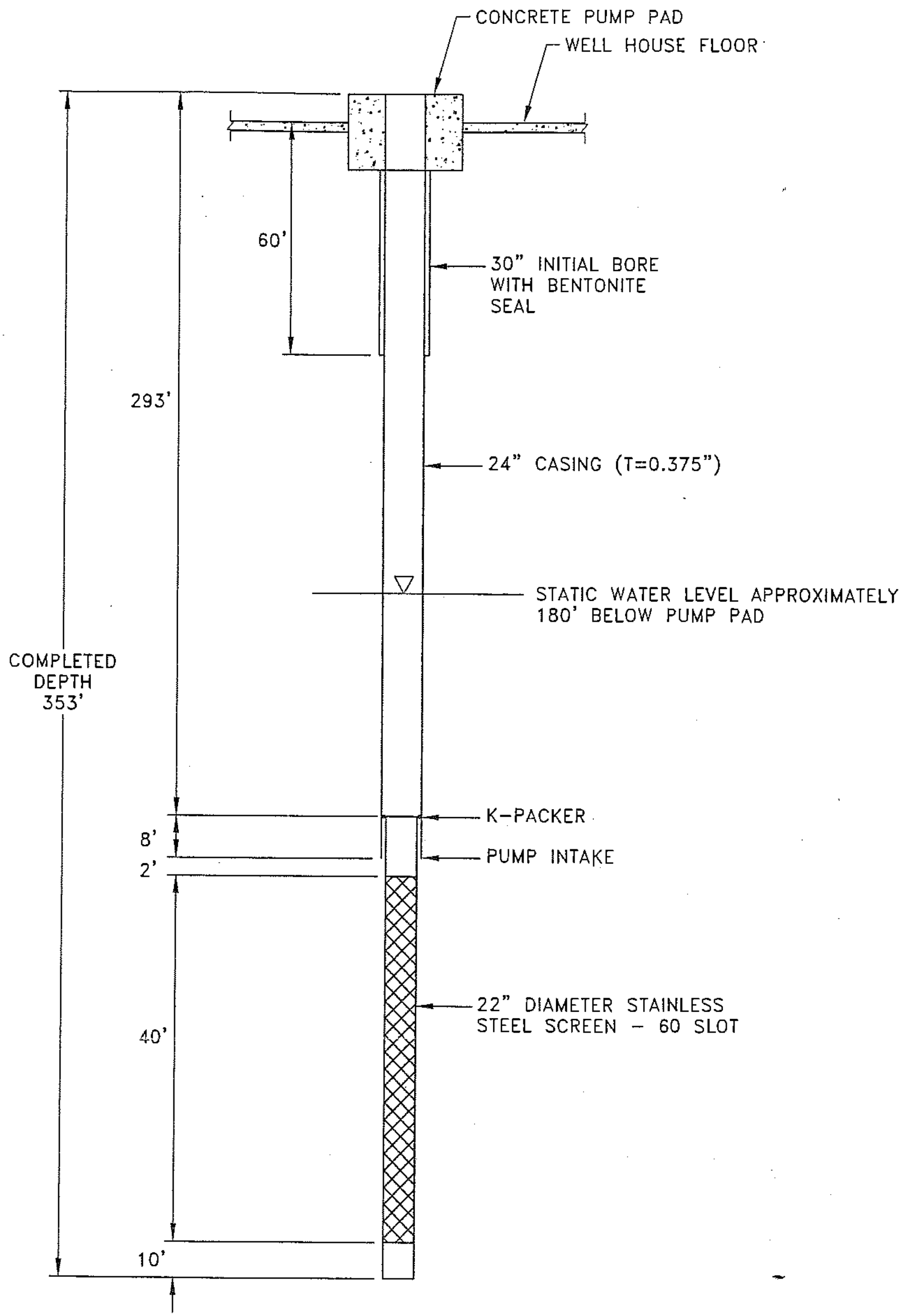
Completed Depth 353 (Measurable)
Date: Started 2/4/04 Completed 4/20/04

14. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Company Name Holt Drilling Inc Firm No. 596
Principal Driller Iversen Date ____
and
Driller or Operator II ____ Date ____
Operator I [signature] Date 9/9/04
Principal Driller and Rig Operator Required.
Operator I must have signature of Driller/Operator II.

FORWARD WHITE COPY TO WATER RESOURCES

Prairie Well 9



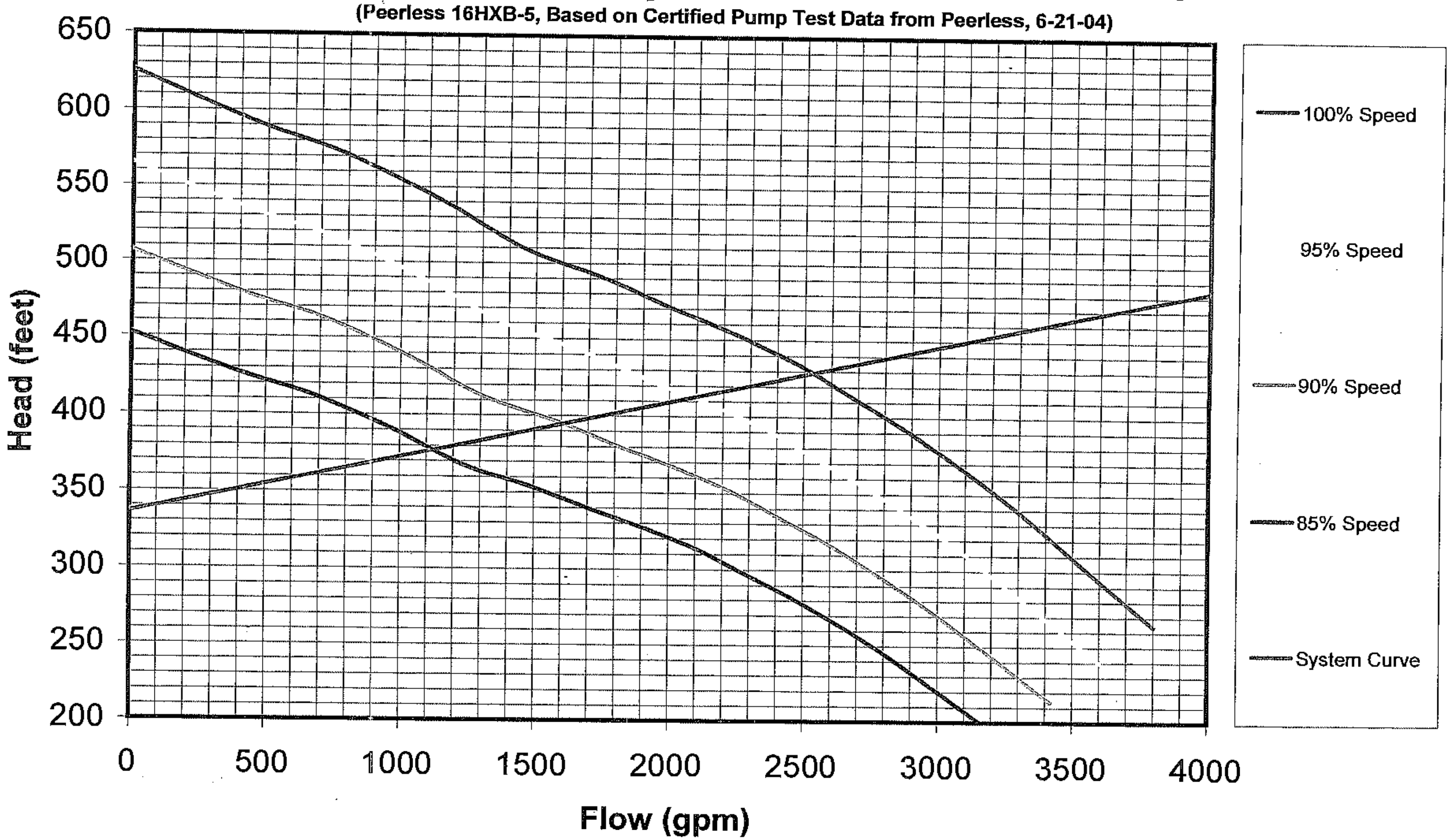
J·U·B Engineers • Surveyors • Planners

CAD FILE: 20868-ANNIE-FIG2-5

FIGURE 2-5
ANNIE AVENUE WELL CONSTRUCTION

Prairie Well 10

Figure 2-2
Annie Well Pump- System Curve and VFD Curves
(Peerless 16HXB-5, Based on Certified Pump Test Data from Peerless, 6-21-04)



Prairie Well 11

4Th STREET WELL

ITT Industries
Engineered for life

Goulds Pumps
Texas Turbine Operation
Lubbock, Texas

Qty	Description
1	VIT-BA-THD 3 Stage 12x16DMC
	Bowl 3 Stage 16DMC
	Strainer, Cone
	Tail Pipe
	SST Strainer Adder

Fourth Street Well 1

PUMP DATA SHEET Turbine 60 Hz

Company: ITT Industries
Name: Rickey Schoor
Date: 03/12/07

Order No:

Pump:

Size: 16DMC (3 stages)

Type: Lineshaft
Synch speed: 1800 rpm

Speed: 1770 rpm
Dia: 11.25 in

Curve: E6416DHPCO

Specific Speeds: Ns: 2859

Pump Notes for Standard Sizes:
Suction Sizes-12",14" Discharge Sizes-12",14"

Vertical Turbine: Bowl size: 16.13 in
Max lateral: 0.75 in
Thrust K factor: 18 lb/ft

Search Criteria:

Flow: 3000 US gpm Head: 360 ft

Fluid:

Water
SG: 1
Viscosity: 1.105 cP
NPSHa: --- ft

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

Motor:

Standard: NEMA

Size: 350 hp
Speed: 1800

Sizing criteria: Max Power on Design Curve

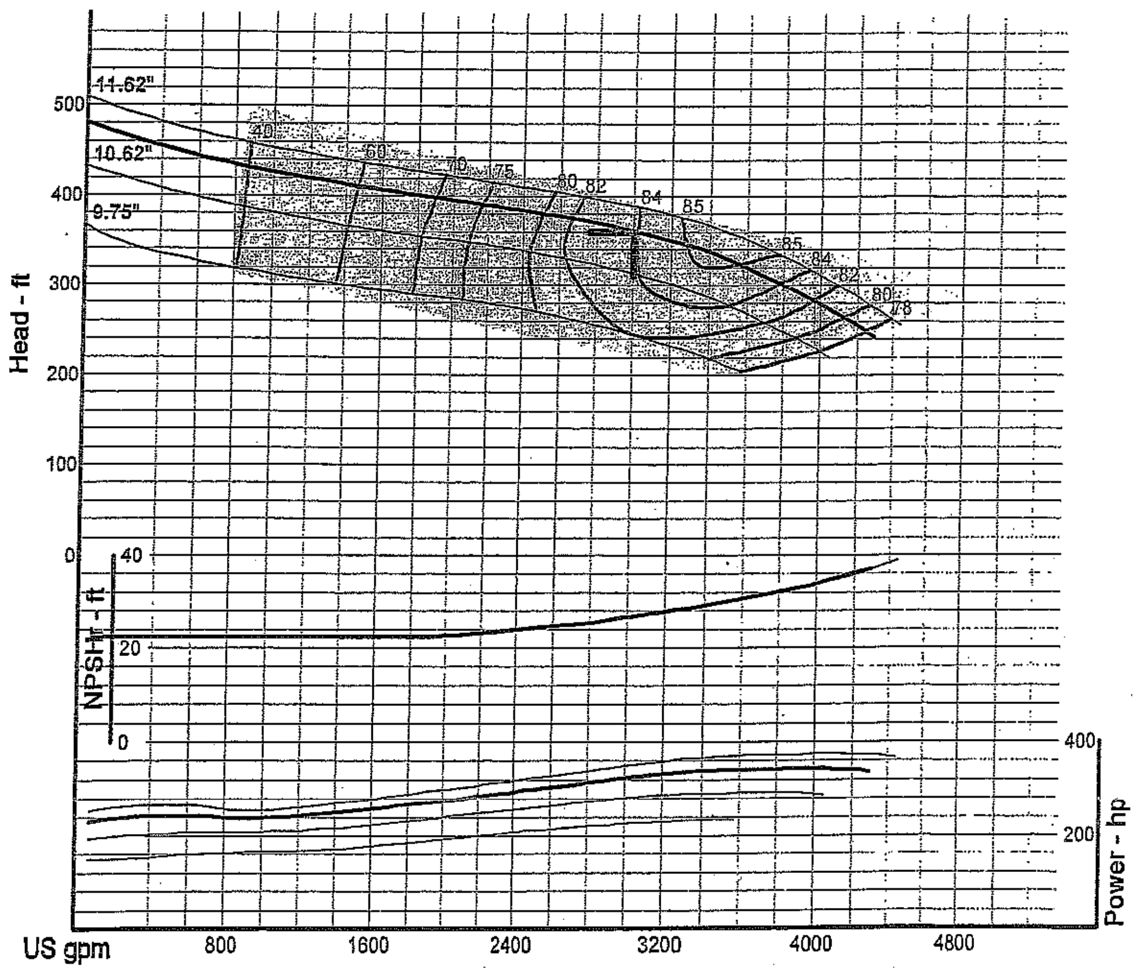
Pump Limits for Standard Construction:

Temperature: 120 °F Pressure: 335 psi g
Sphere size: 0.72 in

---- Data Point ----
Flow: 3000 US gpm
Head: 361 ft
Eff: 83.9%
Power: 326 hp
NPSHr: 26.7 ft

-- Design Curve --
Shutoff Head: 481 ft
Shutoff dP: 208 psi
Min Flow: --- US gpm
BEP: 85.2% eff
@ 3426 US gpm
NOL Pwr: 344 hp
@ 3965 US gpm

-- Max Curve --
Max Pwr: 377 hp
@ 4096 US gpm



Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Pump %eff	Power hp	NPSHr ft
3600	1770	320	84.8	342	30.6
3000	1770	361	83.9	326	26.7
2400	1770	384	78.3	296	23.9
1800	1770	401	67.5	269	22.5
1200	1770	420	50.9	247	22.5

Fourth Street Well 2

ITT Industries
Rickey Schoor

HYDRAULIC ANALYSIS
VIT-BA-THD-W/L
3 Stage 12x16DMC

Overall Pump Parameters

Size and Model:	16DMC	Pump Operating Speed, RPM:	1770
Ca[illegible]city, GPM:	3000	Total Dynamic Head, Ft.:	361.0
Tot[illegible] Pump Length, In.:	72.8	Impeller Trim, In.:	11.3
Pump Type:	OpenSump	Head Type:	A:Cast
Pump K-Factor:	18	Number of Stages:	3
		Pumping Level, In.:	0.0

LineShaft-Related Data

Shaft Diameter, In.:	2.44	Shaft Limit, HP:	1226
Shaft Material:	416SS	Matl Correction Fact:	1.18
LineShaft Length, In.:	0.00	Shaft Elongation, w/o Adder:	
LineShaft Type:	Open	Impeller Running Clearance:	0.00

Bowl Data

Total Bowl Length, In.:	160.50	Bowl Diameter, In.:	16.13
Bowl Shaft Dia, In.:	2.44	Bowl Shaft Limit, HP:	1222
		Bowl Shaft Material:	416SS

Column Data

Column Diameter, In.:	12	Column Load, Lb.:	8928.0
Wall Thickness, In:	0.375	Column Elongation, In.:	0.00

HorsePower Data

Shaft Friction Loss, Hp.:	0.00	Thrust Load Loss, Hp.:	0.91
Bow[illegible] HP At Design, Hp.:	326	Motor HorsePower, Hp.:	350

Head Data

Column Loss, Ft.:	0.00	Head Loss, Ft.:	0.82
		Total Loss, Ft.:	0.82

Other Data

Hydraulic Thrust, Lb.:	6498.0	Thrust at Design, Lb.:	6870.0
Thrust at Shutoff, Lb.:	9029.5	Design NPSH, Ft.:	26.7
Available Lateral, In.:	0.75	Design Lateral, In.:	0.00
Shutoff Lateral, In.:	0.00	Actual Head above Grade, Ft.:	360.18
Suction Pressure, psi:	0.0	Shutoff Disc Pressure, psi:	210.1

Efficiency Data (Efficiencies estimated not guaranteed)

Bowl Efficiency:	83.90	Pump Efficiency:	83.47
Motor Efficiency:		Overall Efficiency:	
		KWH/1000 gallons:	

Component Weights

Bowl Weight, Lbs.:	1614	Column Weight,Lbs.:	0
Head Weight, Lbs.:	0	Can Weight,Lbs.:	0
Motor Weight, Lbs.:		Total Pump Weight,Lbs.:	1614

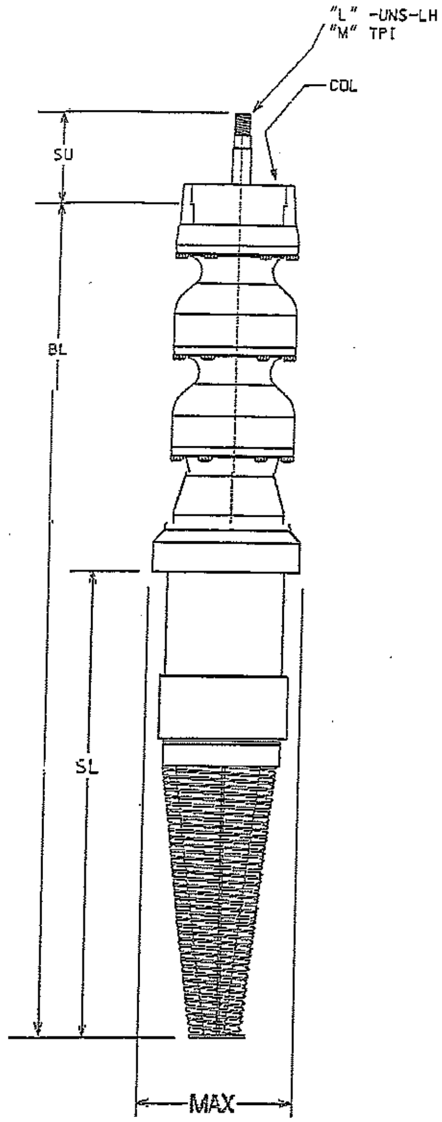
Version: 3.62P

Date: 03-12-2007

Fourth Street Well 3

ITT Industries
Rickey Schoor

DIMENSIONAL OUTLINE
VIT-BA-THD-W/L
3 Stage 12x16DMC



BL:	160.50
COL:	12"
L:	2.44
M:	10
MAX:	16.13
SL:	91.75
SU:	8.00

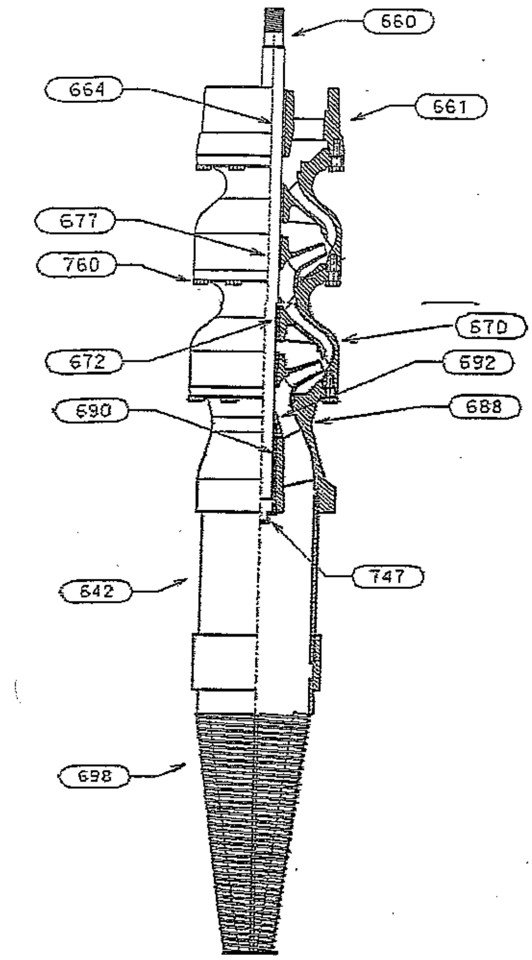
Version: 3.62P

Date: 03-12-2007

Fourth Street Well 4

ITT Industries
Rickey Schoor

SECTIONAL
VIT-BA-THD-W/L
3 Stage 12x16DMC



DISCHARGE HEAD ASSEMBLY

ITEM	NAME	Code	MATERIAL	ASTM

COLUMN AND LINESHAFT ASSEMBLY

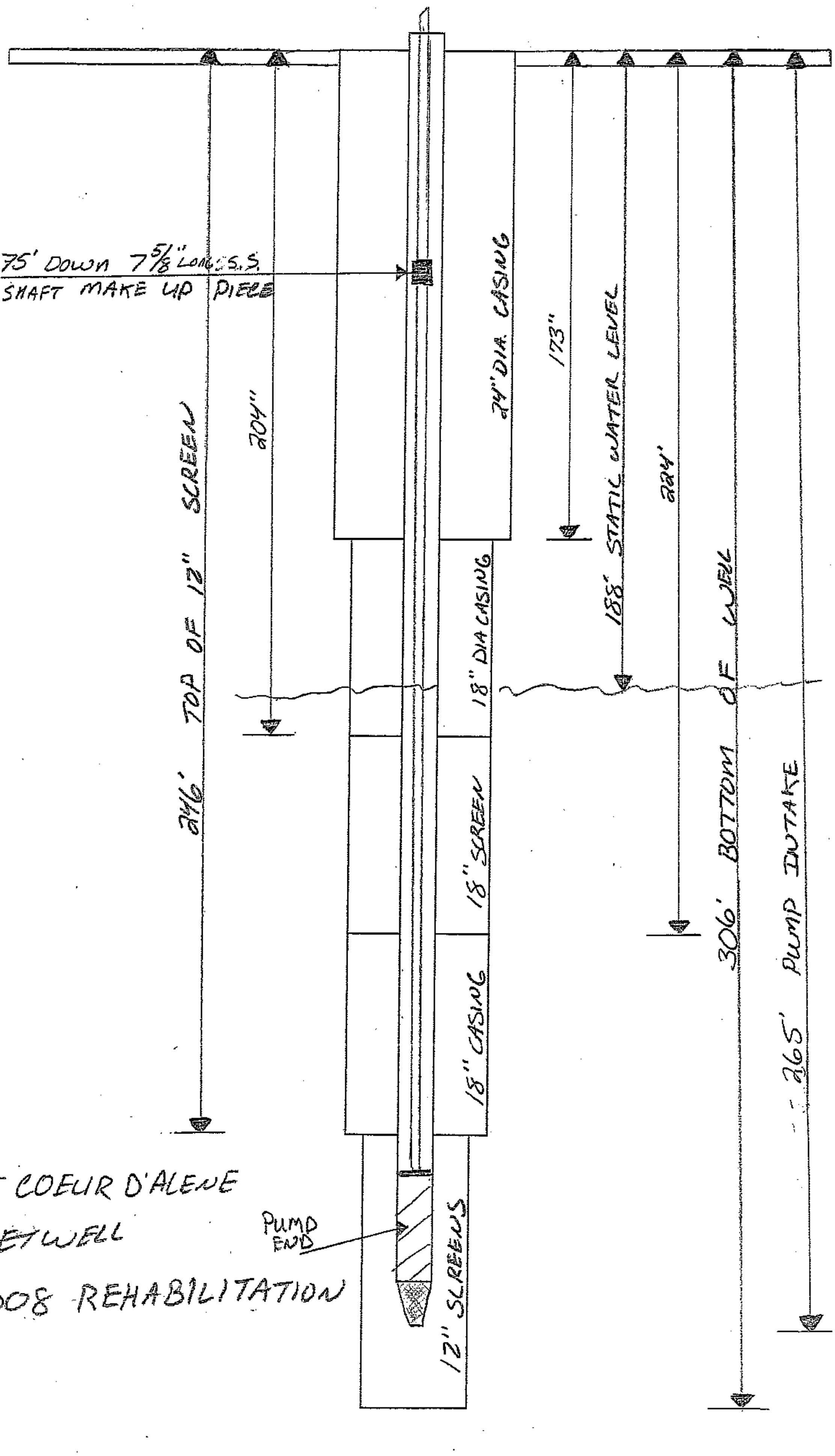
BOWL ASSEMBLY

642	COLUMN PIPE	6501	BLACK PIPE SCH 40	A 53-98
660	SHAFT- BOWL	2227	SST 416	A582M-95b
661	BOWL- DISCHARGE	1003	CAST IRON CL30	A48-94ae1
664	BEARING- DISC BOWL	1109	FEDERALLOY BISMUTH BRZ	B584-00
670	BOWL- INTERMEDIATE	5853	CAST IRON CL30 EPOXY	A48-94e1
672	BEARING- INT BOWL	1109	FEDERALLOY BISMUTH BRZ	B584-00
673	IMPELLER	1102	SILICON BRONZE C87600	B584-00
677	COLLET- IMPELLER	2242	CARBON STEEL 1018	A108-99
688	BOWL/BELL- SUCTION	1003	CAST IRON CL30	A48-94ae1
690	BEARING- SUCTION	1109	FEDERALLOY BISMUTH BRZ	B584-00
692	SANDCOLLAR	1109	FEDERALLOY BISMUTH BRZ	B584-00
698	STRAINER- SUCTION	6913	SST 316 XPND METAL FL	A555-97
747	PLUG- PIPE	1046	MALLEABLE IRON	A197
760	CAPSCREW- HEX	2298	STEEL BOLTING GR 8	J429-99

Version: 3.62P

Date: 03-12-2007

Fourth Street Well 5



CITY OF COEUR D'ALENE
4th STREET WELL
2007/2008 REHABILITATION

7/1/08
Fourth Street Well 6

Appendix D

Technical Memorandum
2012 Fernan Hill Evaluation
August 3, 2012

J·U·B ENGINEERS, INC.

J-U-B COMPANIES THE LANGDON GROUP GATEWAY MAPPING INC.

MEMORANDUM

DATE: 8/3/12

TO: Steve James, PE

CC: Michelle Johnson, PE

FROM: Nicolas Hiebert, EIT

SUBJECT: **2012 Coeur d'Alene Water Update – Fernan Hill Build-Out Area**

The purpose of this technical memorandum is to present a conceptual layout of a future water system in the Fernan Hill area. This includes necessary components and pressure zones required to serve the existing and build-out areas as dictated by City. This analysis was conducted using the following information and assumptions:

- Existing Fernan Hill service elevations range from 2300' to 2450'
- Highest future build-out area elevation of 2560' to the east.
- Sole 12" transmission pipe feeding the Fernan Hill area via new booster pump station near existing Elm St. Booster Station.
- Future Fernan Hill storage reservoir necessary to regulate pressures at high demands
- Future intermediate booster station required to service build-out area.

A cursory review of the Fernan Hill area shows steep contours, indicating multiple pressure zones will likely be required to maintain a desired 50 – 90 psi pressure range. The following conceptual layout was developed and can be seen in the attached Figure:

A. A minimum pressure of 50psi at the highest elevation in the build-out area (2560') requires an system hydraulic grade line (HGL) of approximately 2675'. Therefore, a future storage reservoir overflow elevation should be set to 2675'-2680'. This elevation can be achieved following the ridge line contours east of the existing Fernan Hill area.
B. A high pressure of 90 psi would be reached at an elevation of approximately 2445'. Therefore, Fernan Hill area should be split into two pressure zones, an Upper Fernan Hill and a Lower Fernan Hill pressure zone. A reduction of 40 psi across this boundary would allow for a minimum pressure of 50 psi in the Lower Fernan Hill zone.
C. The Lower Fernan Hill zone would reach a high pressure of 90 psi at an elevation of approximately 2375'. This elevation should be the lowest elevation served by Fernan Hill under the conceptual layout.

D. However, this layout appears to leave a gap in the service areas between the General Zone and the conceptual Lower Fernan Hill zone. The existing HGL in the General Zone is approximately 2350', yielding allowable service pressures at ground elevations of approximately 2240' – 2250'. This leaves a gap between the Lower Fernan Hill zone (2375') and the General Zone (2250') of approximately 125' of head or 55 psi. Potential solutions include:
   1. Serve residents within the gap from Lower Fernan Hill Zone utilizing pressure reducers at the service connection.
   2. Distribute the pressure difference evenly between the Upper and Lower Fernan Hill zones by lowering the zone boundary elevations approximately 75' (thus increasing pressures in the by 25 - 30 psi). This would increase maximum pressures from 90 psi to approximately 120 psi in both the Upper and Lower zones.

Depending on where these pressure zone are established, existing pressures to the Fernan Hill residents may change. This should be given consideration before future layout improvements are selected.

Coeur d' Alene 2012 Water Model
Potential Fernan Hill Layout
2450
2560
2300
2375
2670
Potential Reservoir Site
Overflow Elev of 2675
Upper Fernan Pressure
Zone (Build-out Area):
50-90 psi
Lower Fernan
Pressure
Zone (Existing):
50-90 psi
Lower Fernan Pressure
Zone: High Pressure
Area, 90-120psi
New Fernan
Booster Pump at
Elm St
Verify Lowest
Service Area?
Intermediate
Fernan Booster
Pump

Appendix E

Technical Memorandum
2012 Blackwell Hill Zone Analysis
September 26, 2012

J-U-B ENGINEERS, INC.

J-U-B COMPANIES THE LANGDON GROUP GATEWAY MAPPING INC.

MEMORANDUM

DATE: 9/26/12

TO: Steve James, PE

CC:

FROM: Michelle Johnson, PE

SUBJECT: **2012 Coeur d'Alene Water Update – Blackwell Hill Zone Analysis**

This technical memorandum presents a conceptual analysis of the Blackwell Hill Area at build-out of the current planning boundary. This analysis includes the necessary components and multiple pressure zones required to serve the area. This analysis was conducted using the following information and assumptions:

- The Blackwell Hill planning boundary as established by the City.
- The General Zone serves elevations up to 2225'.
- Highest elevation within the planning boundary is approximately 2455'.
- The future area will be served by two river crossings; the existing crossing will be upsized to a 16-inch crossing and a new 18-inch crossing near the Mill River area on the north west corner of the service area.
- A future Blackwell Hill storage tank will be included to meet City criteria.
- Future intermediate booster stations and pressure reducing valves will be required to service the area.

The Blackwell Hill area is a steep, wooded area overlooking the Spokane River and Coeur d'Alene Lake. The contours indicate that multiple pressure zones will be required to maintain a pressure range of 50 – 90 psi. This approach for this concept is to serve the entire zone with one booster pump station that boosts from the General Zone up to a common storage tank for the entire Blackwell Zone. Several pressure reducing valves would then be required to supply the lower elevations within the zone. This operational scenario is expected to have lower cost and maintenance for the system than the installation of multiple storage tanks and booster stations.

A triplex booster station is recommended, and the required pump capacity for a single pump would be 310 gpm at 140 psi head. This setup would provide a firm capacity equal to the projected peak day flow of 620 gpm. The required storage for a single tank for this zone would be 0.6 million gallons.

The following conceptual layout was developed and can be seen in the attached Figure:

A. A minimum pressure of over 40 psi at the highest elevation in the build-out area (2450') requires a minimum system hydraulic grade line (HGL) of at least 2550'. In order to maintain this minimum pressure, a future elevated storage reservoir would be required with an overflow elevation set at a minimum of 2550'.
B. Based on a tank overflow elevation of 2550', a high pressure of 90 psi would be reached at an elevation of approximately 2440', requiring a second pressure zone.
C. A third pressure zone would cover elevations from 2340 to 2225.

Depending on the final elevations selected for the future pressure zones, pressure for the existing Blackwell Hill residents may change. Consideration of existing water pressures and any significant changes should be taken into consideration and addressed with the property owners when establishing future pressure zones.

Appendix F

Technical Memorandum
2012 Coeur d'Alene
Water Model Analysis
July 12, 2012

MEMORANDUM

DATE: 7/12/12

TO: Steve James, PE

CC: Michelle Johnson, PE

FROM: Nicolas Hiebert, EIT

SUBJECT: **2012 Coeur d'Alene Water Model Analysis**

BACKGROUND

The purpose of this technical memorandum is to summarize the development and analysis of the City of Coeur d'Alene's 2012 water model. The primary purpose of the water model is to provide a hydraulic analysis of the system (does not include extended simulation). This generally includes:

- A snapshot of current system
- Identification of potential existing capacity issues
- An estimate of build-out conditions for the future system
- Identification of potential future capacity issues

The existing model is based on assumptions and parameters that characterize the area and existing system. The assumptions are based on the City's GIS data, characteristics learned from the physical system, similar studies done in the region, as well as general and historical knowledge gained through previous work for the City.

EXISTING MODEL

GIS DEVELOPMENT

The City operates and maintains a detailed GIS database of their water distribution system. This database was used as the main source to develop the base water model and included information of pipe size, length, material, and connectivity. The GIS database was provided in shape file format and converted into a WaterGEMs database utilizing software interface tools. The pipe connectivity and pressure zone boundaries were updated based on GIS isolation valve data, City comments, and the previous (2005) water model. Numerous pipes with a length less than "10-ft" were generated through the GIS conversion process. These short pipes were reviewed and deleted when deemed unnecessary for modeling purposes. Finally, elevation data was assigned to the base model junctions by use of Avista digital elevation model (DEM) data in shape file format and compared to topographic contours. The base model generated by the above process was validated without errors or warnings.

Model components, including wells, water storage tanks, PRVs, and PSVs were imported as sub-models from the previous (2005) water model. Operating conditions within the sub-models were reviewed and updated based on discussion with the City. These operating conditions included:

- PRVs set to 68 psi downstream pressure
- Tank levels set to full
- Pump curves and settings updated based on well cut sheets
- Base elevations compared to Avista DEM and verified

Missing or questionable data was reviewed with the City and/or record drawings and then updated if necessary.

EXISTING DEMAND DEVELOPMENT

The demand for the existing model was developed using actual water meter data from the period between June 2011 and March 2012. The City's water meters were supplied in a geo-referenced shape file showing the location of each meter and the monthly usage data reported as a volume in thousands of gallons. This data was used to establish a maximum summer month usage (June – September) and an average winter month usage (December – March) for each meter within the shape file. This data was then imported into the water model using the "Load Builder" feature within WaterGEMs. This feature geospatially analyzes the location of the meter and corresponding usage and then distributes the usage as a weighted demand to model junctions.

The total maximum month demand applied to the model was compared to the maximum day demand (MDD) that was established by historical usage. The maximum month was found to be less than the MDD by a factor of 1.18; this factor was then used to escalate demands, establishing a system MDD. Similarly peak hour demand (PHD) was established by a peaking factor of 1.8 x MDD. MDD and PHD demands were calculated within the meter GIS shape file and applied to the model with similar methods described above. **Table 1** summarizes the existing demands assigned to the model:

Table 1: Existing Demands

Demand	Value	
	GPM	MGD
Average Month Winter Demand	2,645	3.8
Maximum Month Summer Demand	18,955	27.3
Maximum Day Demand (MDD)	22,380	32.2
Peak Hour Demand (PHD)	40,260	58.0

MODEL CALIBRATION

Calibration is the process of globally modifying assumptions and parameters in order to best approximate actual system performance in multiple locations. The calibration process requires an understanding of the limitations of the data and achievable system accuracies (typically ± 15% accuracies are consider acceptable for water models per industry standards). Water model calibration is performed by observing the systems response and residual pressures under a high demand, such as an open hydrant. Then the model is observed under the same scenario and calibrated to best match the system.

Calibration of the water model was developed by adjusting the Hazen-Williams roughness coefficient, C, of system pipes. These adjustments were based on typical values observed and applied globally based on pipe material. **Table 2** provides a summary of Hazen-Williams C factors used in the model.

Table 2: Pipe C Factors

Pipe Material	"C" Factor
AC	110
Cast Iron	90
Ductile Iron	100
Galvanized Iron	120
HDPE	120
PVC	120

MODEL VERIFICATION RESULTS

Verification of the model calibration was performed by comparing fire flow testing data provided by the City to the model output. As shown in **Table 3**, the calibration results for all six fire hydrants are within the target 15% accuracy range. Given the size and complexity of the City's water system and the limited accuracy of the hydrant tests, this is an acceptable amount of error. Therefore, the model is considered calibrated.

Table 3: Model Verification Results

	Fire Department Testing		Model Output			% Difference	
Address	Static	Residual	Junction	Static	Residual	Static	Residual
1518 N. 3rd. Street	64	59	J-108	61	54.2	-4.7%	-8.1%
2115 N. Government Way [a]	64	38	J-3578	63.5	39.8	-0.8%	4.7%
202 Anton	60	50	J-3460	58.1	48.9	-3.2%	-2.2%
1125 Marie	56	36	J-1606	54.8	40	-2.1%	11.1%
315 Clayton [b]	82	73	J-1447	76.6	67.1	-6.6%	-8.1%
6360 Sunshine	82	76	J-3184	79.9	76.6	-2.6%	0.8%

[a] Residual reading is 440-ft east of hydrant on the 6-ft fire feed line (J-3749).
[b] Residual reading is 500-ft north of hydrant near 12-ft mainline (J-1015).

EXISTING SYSTEM DEFICIENCIES

System deficiencies in the existing model were identified under three demand conditions:

1. 2012 average winter demand with only Honeysuckle and Landings wells operating
2. 2012 MDD with all wells operating
3. 2012 PHD with all wells operating

Under demand conditions 1 and 2, no major system deficiencies were observed with only localized high pressures and headloss gradients observed near the wells in operation. Under demand condition 3 however, several areas exhibit head loss greater than the allowable system criteria. These areas are primarily in the area of Hwy 95 south of Hanley Ave. to Dalton Ave. and will be discussed in greater detail in subsequent sections.

FUTURE MODEL

BUILD-OUT DEMAND DEVELOPMENT

The build-out model considers future conditions within the water system when it is fully developed. This includes infill to undeveloped areas within the current service area and future expansion within the planning area.

The build-out demands were developed by using GIS data from the City's water meter and zoning shape file, and parcel and structure shape files from Kootenai County. Each water meter was linked to multiple shape files to determine the land use type for each water meter. Parcel and structure shape files from Kootenai County were used in this process. Zoning was used as the primary designation to determine the land use type. The commercial zoning designations were further refined using additional characteristics found in the structure shape file. The Low Density Residential land use type comprised all of the single family dwelling units. Medium Density Residential consisted of multi-family dwelling units that contain between two to four dwelling per units, as well as mobile home and RV parks. High Density Residential included all apartments and multi-family dwelling units with over four dwellings per unit. The various land use types are listed below in **Table 4**.

Table 4: Existing Model Land Use Types

Land Use Types	
Assisted Living	Public
Church	Residential – High Density
Commercial	Residential – Medium Density
Hotel	Residential – Low Density
Industrial	Restaurant
Office	School
Open Space	

Once land use types were established, unit flows on a per acre basis were developed by analyzing water meter data of various zoning categories. The maximum summer usage from June – September 2011 was used consistently with existing demand development. Unit flows are shown in **Table 5.**

Table 5: Land Use Unit Flows

Land Use	Maximum Summer Usage (Gallons)	Net Land Use Area (Acre)	Unit Demand (Gallons/Day/Acre)
Assisted Living	258,200	35	7,407
Church	280,133	99	2,840
Commercial [a]	2,708,900	816	3,321
Hotel	561,867	37	15,095
Industrial	358,533	302	1,187
Office	185,467	40	4,685
Open Space [b]	2,416,367	450	5,370
Public	492,000	331	1,486
Residential High	2,254,733	385	5,850
Residential Med	10,110,800	1,985	5,092
Residential Low	5,756,100	1,620	3,553
Restaurant	388,400	56	6,898
School	1,483,767	256	5,789
Totals	**27,255,268**	**6,412**	**4,250**

[a] Includes Hospitals usages in commercial. Hospitals likely have higher usage than typical commercial.
[b] Open Space analysis results are not trustworthy. Multiple parcels are associated with one meter, therefore unit demands are likely much lower than reported.

Unit flows were applied within the GIS shape file to the centroid of individual parcels associated with the City's zoning map. The unit flows were then multiplied by the parcel area to establish build-out demands as shown in **Table 6**. The result was a GIS shape file that was then imported into the water model using the "Load Builder" feature similar to the existing demand development. MDD and PHD demands were adjusted and applied to the model at 43.5 MGD and 78.2 MGD, respectively.

Table 6: Land Use Build-out Demands

Land Use	Net Land Use Area (Acre)[a]	Unit Demand (Gallons/Day/Acre)	Land Use Demand (Gallon/Day)
Assisted Living	33.4	7,407	247,186
Church	89.3	2,840	253,653
Commercial	1,244.7	3,321	4,133,938
Hotel	38.5	15,095	581,807
Industrial	409.8	1,187	486,583
Office	42.7	4,685	200,270
Open Space	833.4	5,370	4,475,290
Public	262.0	1,486	389,238
Residential High	460.3	5,850	2,693,031
Residential Med	2,645.7	5,092	13,473,090
Residential Low	3,817.0	3,553	13,563,183
Restaurant	59.2	6,898	408,611
ROW	28.1		
School	262.1	5,789	1,517,132
TOTAL	**10,226**		**42,423,014**

[a] 394 acres associated with meter with zero usage reading, and therefore not included in net land use area.

BUILD-OUT SYSTEM

In order to apply build-out demands within, additional supply and future distribution pipes were required to model the system, including:

- Three new wells in NW quadrant of the system operating at 3000-4000 gpm
- General future transmission lines routed into future build-out areas. These lines are shown in a general way to help understand impacts to the existing system under build-out conditions.

BUILD-OUT SYSTEM DEFICIENCIES

The build-out model was run under two demand conditions:

1. Build-out MDD with all wells operating
2. Build-out PHD with all wells operating

Multiple areas exhibited pressure and head loss greater than allowable criteria. A summary of these deficiencies and potential solutions are listed in **Table 7**.

Table 7: Build-Out Deficiencies

Scenario [a]	Observed Problem	Potential Solution
1	Headloss gradients are greater than 0.01 ft/ft in the area between Ramsey and Government Way South of Hanley Ave and along Clayton Ave to Colfax St. Existing pipes act as a bottle neck as demand is routed to the eastern portion of the upper zone.	Addition of 0.6 MG of storage to NE quadrant. Then observe the impacts to areas of high headloss in the area between Ramsey and Government Way South of Hanley Ave.
2	Headloss gradients are greater than 0.01 ft/ft in the area as flow is routed to the new Blackwell development area.	Upsize pipe on Atlas to 18-inch to route flow from new wells into to new river crossing into the Blackwell area.
3	Headloss gradients are greater than 0.01 ft/ft at future 12-inch river crossing into Blackwell development area and at the existing 12-inch Blackwell river crossing.	Upsize future river crossing near Atlas to 16-inch to route flow from new wells into the Blackwell area. Then check impact to river crossing off Foster.
3B	Still headloss gradient greater than 0.01 ft/ft near river crossings under Scenarios 2 & 3.	Upsize Atlas from I90 to new river crossing to 24-inch, upsize existing Blackwell river crossing to 16-inch, upsize future river crossing near Atlas to 18-inch, upsize future Blackwell distribution pipes to 16-inch PVC.
4	High headloss gradient observed in the Davidson/Mill area.	Check pipe sizes in Davidson/Mill area.
5	Headloss gradients are greater than 0.01 ft/ft along Nettleton Gulch.	Check pipe sizes and pressure zone boundaries.
6	Headloss gradients are greater than 0.01 ft/ft within 6-inch transmission line to Armstrong Park area.	Upsize transmission line to Armstrong Park, and verify pump capacities.
7	Within the system, between Tubbs Hill and Best Hill Tanks, there appears to be a drop in HGL of approximately 16-20-ft at build out PHD.	Check HGL contours of Tubbs/ Best Hill Tanks. Upsize the distribution main along 15th St. to reduce headloss and even out HGL to within several feet of tank HGLs. How large of a main line would this require?
8	Headloss gradients are greater than 0.01 ft/ft in Stanley Hill area.	Check small pipe sizes and demands in various areas.
9	High pressures (>100psi) observed in the lower portions of the Stanley Hill pressure zone.	Pressure zone modification to include the lower portions of Stanley Hill zone into the Lower pressure zone.
10	Negative pressures near the Stanley Hill Tank/ Johnson Ranch area due to large build out demands applied on very small distribution lines.	Updates could include booster pumps, installing transmission line to new developments, and new pressure zone.
11	Negative pressures near the Fernan build out area due to large build out demands applied on distribution lines.	Booster station and new Fernan Hill Tank.
11B	Considers new Fernan Hill Tank to provide emergency flow and regulate HGL of new Fernan Hill zone.	New tank and intermediate booster Fernan Hill Booster.

[a] *Model Settings:*

- *Analysis at Build out PHD (78MGD)*
- *All existing wells on*
- *Tanks full*
- *Three new wells in NW quadrant, 3000-4000gpm EA*
- *Supply shortage of 15,000gpm - tanks draining*

RECOMMENDED IMPROVEMENTS

Based on the deficiencies identified in Table 7, the recommended projects to correct the deficiencies are included in **Table 8.**

Table 8: Recommended Improvements

Scenario	Recommended Project	Comments
1	New 0.6 MG ground level tank set at contour 2400-ft with max elevation of 2432-ft. 1100 LF of 16-inch transmission line to intersection of Copper and Shadduck, and 1150 LF upgrade from 8-inch to 16-inch along Shadduck to 22nd. 1350 LF upgrade from 8-inch to 12-inch 22nd from Shadduck to Thomas.	The tank HGL was set to match Prairie Stand pipe overflow elevation at 2432-ft.
2	6000 LF of 24-inch pipe from Atlas Well to I90, 3800 LF of 18-inch pipe from I90 south to the new river crossing.	18-inch main was too small to reduce high head losses along Atlas north of the I90.
3	Upsized new river crossing to 16-inch PVC.	Smaller 6-inch lines near Appaloosa still exhibit high headloss gradients and could be considered for annual main replacement projects.
3B	3300 LF 16-inch NW Blvd to Fairmont for existing river crossing, 5000 LF 24-inch from I90 to new river crossing, up sized new river crossing to 18-inch and upsize future Blackwell distribution pipe to 16-inch PVC.	Project addresses high headloss and the existing Blackwell crossing issues.
4	Consider upsizing 1) 1800 LF from 8-inch to 12-inch Ironwood to Mill Ave along Lincoln Way, 2) 900 LF 6-inch to 8-inch Emma Ave Lincoln to Medina St. as annual main replacement projects.	High headloss is on small pipes.
5	High headloss can be eliminated by replacement of this line with a larger, 8-inch main.	
6	Upsize 3500 LF of 6-inch transmission line to 10-inch to Armstrong Park area.	Sizing based on demand build out PHD of 660 gpm and headloss gradient of .005-ft/ft.
7	10,600 LF of 24-inch or 18-inch pipe from Tubbs to Best Hill areas would likely be required to improve this. The cost is expected to be excessive for the benefit. No change is recommended.	It would take a 24-inch main interlinking Tubbs/Best Hill Tanks to even out the HGL within the lower zone too within 2-3-ft of max HGL (16-ft head increase). Upsizing smaller portions makes minimal difference.
8	1800 LF of 4-inch upsized to 8-inch and 1100 LF of 6-inch upsized to 8-inch.	Need to upsize 2-inch, 4-inch, and 6-inch lines in French Gulch and E. Pennsylvania Ave. area.
9	To split the zone, close pipe at N. Hill Dr. and N. Galena Dr. Dedicated transmission line from Elm St. boosters to Fernan Hill. Elevations less than 2240-ft moved into the lower zone.	HGL of the lower zone in approximately 2350-ft, this allows inclusion of high pressure areas within the lower zone up to a ground surface elevation of 2240-ft while maintaining minimum pressures of 50 psi.
10	TBD - Future development design.	Very high headloss from Stanley Tank along Harrison and into high demand areas. Potential PHD at build out around 450 gpm and MDD of 250 gpm.
11	Install new booster near the existing Elm street Boosters, Install 1600 LF 12-inch transmission to connect to existing 12-inch line at 23rd & Boyd Ave.	Build out MDD is 660 gpm, PHD is 1200 gpm. Current total static head appears to be 280-ft.
11A	Install new booster 23rd and Boyd, upsize 1000 LF from 4-inch to 12-inch transmission down 23rd, 1600 LF from 6-inch and 8-inch to 12-inch west along Pennsylvania.	Note there is overlap with Scenario 8. There is still 1200LF 6-inch line with headloss around .015-ft/ft along Boyd from future pump.
11B	TBD - Depending on final HGL of new Fernan Hill zone.	The current highest elevation served in Fernan Hill is 2450-ft. However, the future water service area shows serving to the top of a hill with ground surface elevation of 2560-ft. This would yield a new Tank HGL at 2675-ft and 3000 LF of transmission main to service area boundary.

Appendix G

Minimum System Development Criteria

Minimum System Development Criteria

The 2012 Water System Comprehensive Plan Update summarizes system design criteria for system evaluation regarding regulatory requirements, specific performance criteria, and fire flow. This section presents minimum criteria for system expansion by the City and private development. The criteria to be maintained by the City water system are as follows:

General:

- A normal operating pressure range of 50 to 80 psi at the meter.
- Maximum system pressure of 90 psi at the bottom floor of the service address.
- A minimum pressure of 40 psi at the top story of the service address.
- Minimum residual pressure of 20 psi during fires meeting the fire flow criterion.
- A minimum fire flow in commercial areas of 3,500 gpm and 1,750 gpm in residential areas, or as determined by the current City Fire Code, whichever is greater.
- All system pipelines must be looped unless otherwise agreed to by the City.
- All improvements meet IDEQ and AWWA criteria.
- All improvements meet City of Coeur d'Alene standards.

Boosted Systems:

- Water supply at least equal to the maximum day demand with the largest pump out of service.
- Storage capable of meeting the maximum fire demand plus equalization demand with the largest pump out of service during the maximum day while maintaining 50 percent storage in reserve. The City reserves the right to pay the incremental cost to oversize the storage at the City's discretion.
- A minimum fire flow in commercial areas of 3,500 gpm and 1,750 gpm in residential areas, or as determined by the current City Fire Code, whichever is greater.
- Ability to return water to lower pressure zones as determined by City staff.

Booster Pump Stations:

- Minimum number of service connections = 100
- Minimum of two pumps, each capable of handling maximum day demand
- Standby power required

- Provisions for supplemental disinfection as determined by City staff.
- Building configuration as determined by City staff but that has a minimum of 36-inch clear space around all pumps/pipes/electrical panels and provisions for pump removal.

Water Storage Tanks:

- Welded steel or precast concrete construction with coating systems as approved by City staff.
- Adequate access to and around tank for maintenance (minimum 20-foot-wide access)
- Separate fill/draw lines
- Telemetry as determined by City staff.

Other Provisions:

- Compound meters required on meters greater than 1½ inches

Appendix H

Capital Improvement Plan

Appendix H - Capital Improvement Plan

City of Coeur d'Alene Water Department - Water System Comprehensive Plan Update

Project Number	Capital Improvement Project Title	Description of Project	Targeted Date When Project will Start	Estimated Cost of Improvement	% Allocated to Growth	% Required by City for Oversizing	Developer Contribution	$ Growth (CAP Fees)	$ Existing Users (Rates)	$ Paid by Developers	Additional Capacity Provided (gpm)
	Supply										
S-1	Upper Zone Additional Supply	*4000 gpm well - Upper Zone*	*2013*	$ 1,698,700	100%			$ 1,698,700	$ -	$ -	0
S-2	General Zone Additional Supply	*4000 gpm well - General Zone*	*2017*	$ 1,698,700	100%			$ 1,698,700	$ -	$ -	4000
S-3	Upper Zone Additional Supply	*1500 gpm additional Supply - Upper Zone*	*2020*	$ 735,800	100%			$ 735,800	$ -	$ -	1500
S-4	General Zone Additional Supply	*4000 gpm well - General Zone*	*2022*	$ 1,698,700	100%			$ 1,698,700	$ -	$ -	4000
S-5	Linden - Replacement of Wellhouse	*Replace old building with new block building, purchase additional property*	*2020*	$ 522,700	0%			$ -	$ 522,700	$ -	0
S-6	4th Street - Replacement of Wellhouse	*Replace old building with new block building.*	*2024*	$ 509,800	0%			$ -	$ 509,800	$ -	0
S-7	Atlas - System upgrades	*Replace drive, add soft start, extend chlorine room, and connection for portable generator.*	*2025*	$ 504,000	0%			$ -	$ 504,000	$ -	0
S-8	Regular Pump Rehabilitation	*Rebuild one pump.*	Biennial	$ 75,000	0%			$ -	$ 75,000	$ -	0
S-9	On-Site Generation	*Conversion to on-site generation for disinfection in place of chlorine gas. Two per year until complete.*	*2013 - 2015*	$ 80,000	0%			$ -	$ 80,000	$ -	0
S-10	Soft Starter Replacement	*Install soft starts at all well locations.*	Biennial	$ 75,000	0%			$ -	$ 75,000	$ -	0
S-11	Transfer of surface water rights to groundwater rights		*2017*	$ 10,000	0%			$ -	$ 10,000	$ -	0
S-12	Reasonably Anticipated Future Needs (RAFN) water right process		*2014*	$ 25,000	100%			$ 25,000	$ -	$ -	0
S-13	SCADA Conversion	*Conversion to Wonderware*	*2013*	$ 35,000	0%			$ -	$ 35,000	$ -	0
	Storage										
T-1	Upper Zone Storage	*1 MG storage in the NE quadrant*	*2018*	$ 1,631,500	100%			$ 1,631,500	$ -	$ -	2275
T-2	Stanley Hill Storage	*0.5 MG of storage*	*2026*	$ 1,016,600	60%	40%	50%	$ 609,960	$ 203,320	$ 203,320	333
T-3	Blackwell Hill Storage	*0.6 MG of storage*	*2021*	$ 1,068,500	100%		100%	$ 1,068,500	$ -	$ -	1013
T-4	Armstrong Park Storage	*0.3 MG of storage*	*2022*	$ 1,016,600	75%	25%	100%	$ 762,450	$ -	$ 254,150	333
T-5	Fernan Hill Storage	*0.7 MG of storage*	*2020*	$ 1,262,900	100%		57%	$ 1,262,900	$ -	$ -	1372
T-6	Recoating of Prairie Standpipe	*Recoating of the exterior*	*2014*	$ 233,300	0%			$ -	$ 233,300	$ -	0
T-7	Recoating of Industrial Standpipe	*Recoating of the exterior*	*2019*	$ 233,300	0%			$ -	$ 233,300	$ -	0
T-8	Recoat Tubbs Hill 1M Gal Tank	*Recoat the exterior*	*2022*	$ 57,500	0%			$ -	$ 57,500	$ -	0
T-9	Recoat Best Hill Tank - Internal and External	*Recoat interior and exterior*	*2026*	$ 419,000	0%			$ -	$ 419,000	$ -	0
T-10	Best Hill Circulation	*Recoat interior and exterior*	*2015*	$ 75,000	0%			$ -	$ 75,000	$ -	0
	Distribution										
D-1	Piping Modifications for NE Storage		*2018*	$ 582,000	100%			$ 582,000	$ -	$ -	8000
D-2	Near Hanley Well	Upgrades near Hanley Well to improve east-west transmission. Lines on Christopher Lane and Ramsey.	*2019*	$ 799,800	100%			$ 799,800	$ -	$ -	2275
D-3	Nettleton Gulch Road	Waterline Improvements at Nettleton Gulch	*2020*	$ 392,500	0%			$ -	$ 392,500	$ -	0
D-4	Ramsey Road Upgrades	*3000 feet of main replacement between Kathleen and Appleway*	*2027*	$ 385,400	100%			$ 385,400	$ -	$ -	9660
D-5	Heutter and Seltice	New lines on Heutter and Seltice to route flow to new river crossing for Blackwell.	*2022*	$ 1,196,600	100%		75%	$ 1,196,600	$ -	$ -	1112
D-6	New River Crossing near Heutter		*2022*	$ 970,600	100%		100%	$ 970,600	$ -	$ -	1112
D-7	Replacement of Existing River Crossing		*2023*	$ 1,190,200	0%		11%	$ -	$ 1,059,278	$ 130,922	1013
D-8	Increase transmission mains around Stanley Hill Tank		*2026*	$ 569,400	50%	50%		$ 284,700	$ 284,700	$ -	333
D-9	Piping Modifications for Fernan/Stanley Zone separation.		*2017*	$ 483,400	100%		100%	$ 483,400	$ -	$ -	
D-10	Transmission Improvements to Armstrong Park		*2023*	$ 352,700	100%		100%	$ 352,700	$ -	$ -	333
D-11	Annual Main Replacement	*1.5 miles of main replaced annually, focus on 8 and 12-inch for this planning period*	*Annual*	$ 500,000	44%			$ 220,000	$ 5,880,000	$ -	
D-12	Fernan Hill - Future Development		*2028*	$ 500,000	100%		100%	$ 500,000			
D-13	New/Replace Meter/Hydrant/Serviced Line work		*Annual*	$ 215,000	50%			$ 107,500			
	Booster Stations										
B-1	Elm Street Booster	*Additional pump at station*	*2015*	$ 185,800	100%			$ 185,800	$ -	$ -	27
B-2	Elm Street Booster	*Pump modifications with Fernan Split*	*2021*	$ 64,800	100%		100%	$ 64,800	$ -	$ -	158
B-3	Fernan Booster	*Split Fernan and Elm, New Station to Fernan*	*2020*	$ 527,000	100%			$ 527,000	$ -	$ -	699
B-4	Fernan Booster	*Additional pump at station*	*2021*	$ 64,800	100%		100%	$ 64,800	$ -	$ -	63
B-5	Blackwell Hill	*Add booster station*	*2018*	$ 527,000	100%		100%	$ 527,000	$ -	$ -	375
B-6	Blackwell Hill	*Add booster station*	*2025*	$ 527,000	100%		100%	$ 527,000	$ -	$ -	188
B-7	Armstrong Park	*Additional pump at station*	*2016*	$ 64,800	100%		100%	$ 64,800	$ -	$ -	185
	Additional Capital Improvements										
M-1	Fixed Base Water Metering	*Modifying the existing system to a fixed base system for continuous monitoring.*	*2020*	$ 1,000,000	0%			$ -	$ 1,000,000	$ -	0
M-2	Fixed Base Water Metering	*Modifying the existing system to a fixed base system for continuous monitoring.*	*2021*	$ 1,000,000	0%			$ -	$ 1,000,000	$ -	0
M-3	Fixed Base Water Metering	*Modifying the existing system to a fixed base system for continuous monitoring.*	*2022*	$ 1,000,000	0%			$ -	$ 1,000,000	$ -	0
M-4	Comprehensive Rate Study	*Complete study of water system rate structure.*	*2018*	$ 75,000	0%			$ -	$ 75,000	$ -	1
	TOTAL			**$ 27,856,400**				**$ 19,036,110**	**$ 13,724,398**	**$ 588,392**	

Project Number	2013 Existing Users	2013 Growth	2014 Existing Users	2014 Growth	2015 Existing Users	2015 Growth	2016 Existing Users	2016 Growth	2017 Existing Users	2017 Growth	2018 Existing Users	2018 Growth	2019 Existing Users	2019 Growth
Supply														
S-1	$ -	$ 800,000		$ 898,700										
S-2									$ -	$ 1,698,700				
S-3														
S-4														
S-5														
S-6														
S-7														
S-8			$ 75,000				$ 75,000				$ 75,000			
S-9	$ 160,000		$ 160,000		$ 160,000									
S-10	$ 75,000				$ 75,000				$ 75,000				$ 75,000	
S-11									$ 10,000	$ -				
S-12			$ -	$ 25,000										
S-13	$ 35,000	$ -												
Storage														
T-1											$ -	$ 1,631,500		
T-2														
T-3														
T-4														
T-5														
T-6			$ 233,300	$ -										
T-7													$ 233,300	$ -
T-8														
T-9														
T-10					$ 75,000	$ -								
Distribution														
D-1											$ -	$ 582,000		
D-2													$ -	$ 799,800
D-3														
D-4														
D-5														
D-6														
D-7														
D-8														
D-9									$ -	$ -				
D-10														
D-11	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000
D-12														
D-13	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500
Booster Stations														
B-1					$ -	$ 185,800								
B-2														
B-3														
B-4														
B-5											$ -	$ -		
B-6														
B-7							$ -	$ -						
Additional Capital Improvements														
M-1														
M-2														
M-3														
M-4											$ 75,000	$ -		
TOTAL	**$ 657,500**	**$ 1,127,500**	**$ 855,800**	**$ 1,251,200**	**$ 697,500**	**$ 513,300**	**$ 462,500**	**$ 327,500**	**$ 472,500**	**$ 2,026,200**	**$ 537,500**	**$ 2,541,000**	**$ 695,800**	**$ 1,127,300**

Appendix H - Capital Improvement Plan

City of Coeur d'Alene Water Department - Water System Comprehensive Plan Update

Project Number	Capital Improvement Project Title	Description of Project	Targeted Date When Project will Start	Estimated Cost of Improvement	2020		2021		2022		2023		2024		2025		2026		2027		2028		2029	
					Existing Users	Growth	Existing Users	Growth	Existing Users	Growth	Existing Users	Growth	Existing Users	Growth	Existing Users	Growth	Existing Users	Growth	Existing Users	Growth	Existing Users	Growth	Existing Users	Growth
	Supply																							
S-1	Upper Zone Additional Supply	*4000 gpm well - Upper Zone*	*2013*	$ 1,698,700																				
S-2	General Zone Additional Supply	*4000 gpm well - General Zone*	*2017*	$ 1,698,700																				
S-3	Upper Zone Additional Supply	*1500 gpm additional Supply - Upper Zone*	*2020*	$ 735,800	$ -	$ 735,800																		
S-4	General Zone Additional Supply	*4000 gpm well - General Zone*	*2022*	$ 1,698,700					$ -	$ 1,698,700														
S-5	Linden - Replacement of Wellhouse	*Replace old building with new block building, purchase additional property*	*2020*	$ 522,700	$ 522,700	$ -																		
S-6	4th Street - Replacement of Wellhouse	*Replace old building with new block building.*	*2024*	$ 509,800									$ 509,800	$ -										
S-7	Atlas - System upgrades	*Replace drive, add soft start, extend chlorine room, and connection for portable generator.*	*2025*	$ 504,000											$ 504,000	$ -								
S-8	Regular Pump Rehabilitation	*Rebuild one pump.*	Biennial	$ 75,000																				
S-9	On-Site Generation	*Conversion to on-site generation for disinfection in place of chlorine gas. Two per year until complete.*	*2013 - 2015*	$ 80,000																				
S-10	Soft Starter Replacement	*Install soft starts at all well locations.*	Biennial	$ 75,000			$ 75,000				$ 75,000				$ 75,000				$ 75,000				$ 75,000	
S-11	Transfer of surface water rights to groundwater rights		*2017*	$ 10,000																				
S-12	Reasonably Anticipated Future Needs (RAFN) water right process		*2014*	$ 25,000																				
S-13	SCADA Conversion	*Conversion to Wonderware*	*2013*	$ 35,000																				
	Storage																							
T-1	Upper Zone Storage	*1 MG storage in the NE quadrant*	*2018*	$ 1,631,500																				
T-2	Stanley Hill Storage	*0.5 MG of storage*	*2026*	$ 1,016,600													$ 203,320	$ 304,980						
T-3	Blackwell Hill Storage	*0.6 MG of storage*	*2021*	$ 1,068,500			$ -	$ -																
T-4	Armstrong Park Storage	*0.3 MG of storage*	*2022*	$ 1,016,600					$ -	$ -														
T-5	Fernan Hill Storage	*0.7 MG of storage*	*2020*	$ 1,262,900	$ -	$ 541,243																		
T-6	Recoating of Prairie Standpipe	*Recoating of the exterior*	*2014*	$ 233,300																				
T-7	Recoating of Industrial Standpipe	*Recoating of the exterior*	*2019*	$ 233,300																				
T-8	Recoat Tubbs Hill 1M Gal Tank	*Recoat the exterior*	*2022*	$ 57,500					$ 57,500	$ -														
T-9	Recoat Best Hill Tank - Internal and External	*Recoat interior and exterior*	*2026*	$ 419,000													$ 419,000	$ -						
T-10	Best Hill Circulation	*Recoat interior and exterior*	*2015*	$ 75,000																				
	Distribution																							
D-1	Piping Modifications for NE Storage		*2018*	$ 582,000																				
D-2	Near Hanley Well	Upgrades near Hanley Well to improve east-west transmission. Lines on Christopher Lane and Ramsey.	*2019*	$ 799,800																				
D-3	Nettleton Gulch Road	Waterline Improvements at Nettleton Gulch	*2020*	$ 392,500	$ 392,500	$ -																		
D-4	Ramsey Road Upgrades	*3000 feet of main replacement between Kathleen and Appleway*	*2027*	$ 385,400																$ 385,400				
D-5	Heutter and Seltice	New lines on Heutter and Seltice to route flow to new river crossing for Blackwell.	*2022*	$ 1,196,600					$ -	$ 299,150														
D-6	New River Crossing near Heutter		*2022*	$ 970,600					$ -	$ -														
D-7	Replacement of Existing River Crossing		*2023*	$ 1,190,200							$ 1,059,278	$ -												
D-8	Increase transmission mains around Stanley Hill Tank		*2026*	$ 569,400													$ 284,700	$ 284,700						
D-9	Piping Modifications for Fernan/Stanley Zone separation.		*2017*	$ 483,400																				
D-10	Transmission Improvements to Armstrong Park		*2023*	$ 352,700							$ -	$ -												
D-11	Annual Main Replacement	*1.5 miles of main replaced annually, focus on 8 and 12-inch for this planning period*	*Annual*	$ 500,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000
D-12	Fernan Hill - Future Development		*2028*	$ 500,000																	$ -			
D-13	New/Replace Meter/Hydrant/Serviced Line work		*Annual*	$ 215,000	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500
	Booster Stations																							
B-1	Elm Street Booster	*Additional pump at station*	*2015*	$ 185,800																				
B-2	Elm Street Booster	*Pump modifications with Fernan Split*	*2021*	$ 64,800			$ -	$ -																
B-3	Fernan Booster	*Split Fernan and Elm, New Station to Fernan*	*2020*	$ 527,000	$ -	$ 527,000																		
B-4	Fernan Booster	*Additional pump at station*	*2021*	$ 64,800			$ -	$ -																
B-5	Blackwell Hill	*Add booster station*	*2018*	$ 527,000																				
B-6	Blackwell Hill	*Add booster station*	*2025*	$ 527,000											$ -	$ -								
B-7	Armstrong Park	*Additional pump at station*	*2016*	$ 64,800																				
	Additional Capital Improvements																							
M-1	Fixed Base Water Metering	*Modifying the existing system to a fixed base system for continuous monitoring.*	*2020*	$ 1,000,000	$ 1,000,000	$ -																		
M-2	Fixed Base Water Metering	*Modifying the existing system to a fixed base system for continuous monitoring.*	*2021*	$ 1,000,000			$ 1,000,000	$ -																
M-3	Fixed Base Water Metering	*Modifying the existing system to a fixed base system for continuous monitoring.*	*2022*	$ 1,000,000					$ 1,000,000	$ -														
M-4	Comprehensive Rate Study	*Complete study of water system rate structure.*	*2018*	$ 75,000																				
	TOTAL			**$ 27,856,400**	**$ 2,302,700**	**$ 2,131,543**	**$ 1,462,500**	**$ 327,500**	**$ 1,445,000**	**$ 2,325,350**	**$ 1,521,778**	**$ 327,500**	**$ 897,300**	**$ 327,500**	**$ 966,500**	**$ 327,500**	**$ 1,294,520**	**$ 917,180**	**$ 462,500**	**$ 712,900**	**$ 387,500**	**$ 327,500**	**$ 462,500**	**$ 327,500**

Appendix H - Capital Improvement Plan

City of Coeur d'Alene Water Department - Water System Comprehensive Plan Update

Project Number	Capital Improvement Project Title	Description of Project	Targeted Date When Project will Start	Estimated Cost of Improvement	2030		2031		2032		2033	
					Existing Users	Growth	Existing Users	Growth	Existing Users	Growth	Existing Users	Growth
	Supply											
S-1	Upper Zone Additional Supply	4000 gpm well - Upper Zone	2013	$ 1,698,700								
S-2	General Zone Additional Supply	4000 gpm well - General Zone	2017	$ 1,698,700								
S-3	Upper Zone Additional Supply	1500 gpm additional Supply - Upper Zone	2020	$ 735,800								
S-4	General Zone Additional Supply	4000 gpm well - General Zone	2022	$ 1,698,700								
S-5	Linden - Replacement of Wellhouse	Replace old building with new block building, purchase additional property	2020	$ 522,700								
S-6	4th Street - Replacement of Wellhouse	Replace old building with new block building.	2024	$ 509,800								
S-7	Atlas - System upgrades	Replace drive, add soft start, extend chlorine room, and connection for portable generator.	2025	$ 504,000								
S-8	Regular Pump Rehabilitation	Rebuild one pump.	Biennial	$ 75,000								
S-9	On-Site Generation	Conversion to on-site generation for disinfection in place of chlorine gas. Two per year until complete.	2013 - 2015	$ 80,000								
S-10	Soft Starter Replacement	Install soft starts at all well locations.	Biennial	$ 75,000			$ 75,000				$ 75,000	
S-11	Transfer of surface water rights to groundwater rights		2017	$ 10,000								
S-12	Reasonably Anticipated Future Needs (RAFN) water right process		2014	$ 25,000								
S-13	SCADA Conversion	Conversion to Wonderware	2013	$ 35,000								
	Storage											
T-1	Upper Zone Storage	1 MG storage in the NE quadrant	2018	$ 1,631,500								
T-2	Stanley Hill Storage	0.5 MG of storage	2026	$ 1,016,600								
T-3	Blackwell Hill Storage	0.6 MG of storage	2021	$ 1,068,500								
T-4	Armstrong Park Storage	0.3 MG of storage	2022	$ 1,016,600								
T-5	Fernan Hill Storage	0.7 MG of storage	2020	$ 1,262,900								
T-6	Recoating of Prairie Standpipe	Recoating of the exterior	2014	$ 233,300								
T-7	Recoating of Industrial Standpipe	Recoating of the exterior	2019	$ 233,300								
T-8	Recoat Tubbs Hill 1M Gal Tank	Recoat the exterior	2022	$ 57,500								
T-9	Recoat Best Hill Tank - Internal and External	Recoat interior and exterior	2026	$ 419,000								
T-10	Best Hill Circulation	Recoat interior and exterior	2015	$ 75,000								
	Distribution											
D-1	Piping Modifications for NE Storage		2018	$ 582,000								
D-2	Near Hanley Well	Upgrades near Hanley Well to improve east-west transmission. Lines on Christopher Lane and Ramsey.	2019	$ 799,800								
D-3	Nettleton Gulch Road	Waterline Improvements at Nettleton Gulch	2020	$ 392,500								
D-4	Ramsey Road Upgrades	3000 feet of main replacement between Kathleen and Appleway	2027	$ 385,400								
D-5	Heutter and Seltice	New lines on Heutter and Seltice to route flow to new river crossing for Blackwell.	2022	$ 1,196,600								
D-6	New River Crossing near Heutter		2022	$ 970,600								
D-7	Replacement of Existing River Crossing		2023	$ 1,190,200								
D-8	Increase transmission mains around Stanley Hill Tank		2026	$ 569,400								
D-9	Piping Modifications for Fernan/Stanley Zone separation.		2017	$ 483,400								
D-10	Transmission Improvements to Armstrong Park		2023	$ 352,700								
D-11	Annual Main Replacement	1.5 miles of main replaced annually, focus on 8 and 12-inch for this planning period	Annual	$ 500,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000	$ 280,000	$ 220,000
D-12	Fernan Hill - Future Development		2028	$ 500,000								
D-13	New/Replace Meter/Hydrant/Serviced Line work		Annual	$ 215,000	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500	$ 107,500
	Booster Stations											
B-1	Elm Street Booster	Additional pump at station	2015	$ 185,800					$ 215,000			
B-2	Elm Street Booster	Pump modifications with Fernan Split	2021	$ 64,800								
B-3	Fernan Booster	Split Fernan and Elm, New Station to Fernan	2020	$ 527,000								
B-4	Fernan Booster	Additional pump at station	2021	$ 64,800								
B-5	Blackwell Hill	Add booster station	2018	$ 527,000								
B-6	Blackwell Hill	Add booster station	2025	$ 527,000								
B-7	Armstrong Park	Additional pump at station	2016	$ 64,800								
	Additional Capital Improvements											
M-1	Fixed Base Water Metering	Modifying the existing system to a fixed base system for continuous monitoring.	2020	$ 1,000,000								
M-2	Fixed Base Water Metering	Modifying the existing system to a fixed base system for continuous monitoring.	2021	$ 1,000,000								
M-3	Fixed Base Water Metering	Modifying the existing system to a fixed base system for continuous monitoring.	2022	$ 1,000,000								
M-4	Comprehensive Rate Study	Complete study of water system rate structure.	2018	$ 75,000								
	TOTAL			**$ 27,856,400**	**$ 387,500**	**$ 327,500**	**$ 462,500**	**$ 327,500**	**$ 602,500**	**$ 327,500**	**$ 462,500**	**$ 327,500**