SARATOGA WATER MASTER PLAN, LEVEL I

July 2019

Prepared for:

Wyoming Water Development Commission
6920 Yellowtail Road
Cheyenne, WY 82002
Phone: 307.777.7626
Website: http://wwdc.state.wy.us/

And

Town of Saratoga
110 E. Spring Ave.
Saratoga, WY 82331
Phone: 307.326.8335

Authored by:

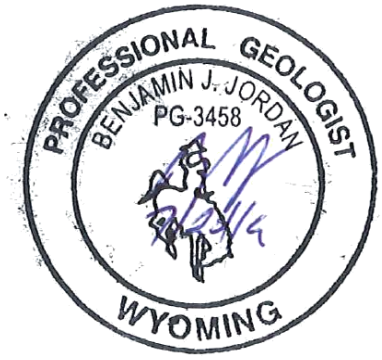
FORSGREN Associates Inc.
849 Front Street Suite 201,
Evanston, Wyoming 82930
Phone: 307.789.6735
Website: www.forsgren.com

In association with:

WESTON GROUNDWATER ENGINEERING
1050 North 3rd Street, Suite E
Laramie, Wyoming 82072
Phone: 307.745.6118
Website: www.westonengineering.com

SARATOGA WATER MASTER PLAN, LEVEL I

July 2019



FORSGREN Associates Inc.
849 Front Street Suite 201,
Evanston, Wyoming 82930
Phone: 307.789.6735
Website: www.forsgren.com

WESTON GROUNDWATER ENGINEERING
1050 North 3rd Street, Suite E
Laramie, Wyoming 82072
Phone: 307.745.6118
Website: www.westonengineering.com

Saratoga Water Master Plan Level I
Contents

1.0 EXECUTIVE SUMMARY 1
2.0 INTRODUCTION 2
2.1 Project History and Overview 2
2.2 Study Area 3
2.3 Project Sponsor 3
2.4 Master Plan Study Objectives 3
2.5 Previous WWDC Studies 3
2.5.1 Other Studies 5
3.0 EXISTING MUNICIPAL SYSTEM DESCRIPTION 5
3.1 General 5
3.2 Present Population Served 6
3.3 Population Forecast 6
3.4 Water User Rates 8
3.5 Existing System Components 9
3.5.1 Water Supply Sources – Saratoga Well Field 9
3.5.2 System Storage 10
3.5.3 Transmission Lines 12
3.5.4 River Crossings 13
3.5.5 Distribution System / Pressure Zones 14
4.0 WATER DEMAND AND SUPPLY 16
4.1 Identification of Domestic Water Use 16
4.1.1 Existing Per-Capita Consumption: 16
4.1.2 Future Projected Demands 17
4.1.3 Water Loss 18
4.1.4 Production Costs 20
4.2 Growth in Saratoga 21
4.3 Regionalization 25
4.4 Water Rights 26
4.4.1 Well Permit Conditions, Limitations and Conclusions: 27
4.5 Water Supply vs Sewage & Treatment 28
4.6 Well Histories and Physical Yields 29

4.6.1 Well Production 30
4.7 Well Construction and Pump Testing 32
4.7.1 Geologic Overview 32
4.7.2 Hydrogeologic Overview 34
4.7.3 Saratoga Well #1 35
4.7.4 Saratoga Well #2 42
4.7.5 Saratoga Well #3 47
4.7.6 Saratoga Well #4 56
4.7.7 Saratoga Well #5 61
4.8 Saratoga Monitoring Wells 66
4.9 Saratoga Wellfield Water Level Trends 67
4.10 Saratoga Wellfield Production Capacity 74
4.11 Water Quality 75
5.0 SYSTEM MODELING AND GIS MAPPING 78
5.1 System Modeling 78
5.1.1 Water Age Evaluations 82
5.2 GIS Mapping and Database Creation 88
6.0 ALTERNATIVE EVALUATIONS 91
6.1 Design Criteria and Intent 91
6.2 Fire Protection 91
6.3 Saratoga Well Field 92
6.3.1 Alternative Power Evaluations 93
6.4 System Storage 94
6.4.1 Bolted Steel Standpipe Storage Tank Issues 95
6.4.2 Storage Conclusions/Recommendations: 97
6.5 Transmission and Distribution Piping 103
6.5.1 Water Supply Transmission Lines 103
6.5.2 Town of Saratoga Distribution Piping 103
7.0 RECOMMENDATIONS AND CONCLUSIONS 109
7.1 Conclusions and Recommended System Improvements 109
7.1.1 Storage Recommendations 109
7.1.2 Tank Mixers 113
7.1.3 System Flushing 115

7.1.4 Tank Operational Controls 116
7.1.5 SCADA Upgrade 116
7.1.6 Distribution System Improvements 118
7.1.7 Transmission System Improvements 120
7.1.8 Mountain View Estates - Regionalization 123
7.1.9 Alternative Power 128
7.1.10 Water Loss Program 129
7.1.11 Additional Metering 130
7.1.12 Well Field Conclusions and Recommendations 131
7.2 Priorities 139
7.3 Economics 140
7.3.1 Estimated Project Costs 140
7.3.2 Estimated Additional Operational Costs 140
7.3.3 Financing 140
7.3.4 Existing System Financials/Budget 142
7.3.5 Project Rate Impacts / Financial Capacity 144
7.3.6 Operational Cost Impacts 147
7.3.7 Ability to Pay 148
7.4 Project Permitting 148
8.0 References 149

List of Figures

Figure 2.1 – Vicinity Map of Saratoga 2
Figure 3.1 – Saratoga System Map 5
Figure 3.2 –Saratoga Population Forecast – Wyoming Department of Administration and Information 6
Figure 3.3 – Carbon County Population Forecast – Wyoming Department of Administration and Information 7
Figure 3.4 – Well #3 9
Figure 3.5 – Welded Standpipe 10
Figure 3.6 – Bolted Standpipe 11
Figure 3.7 – Saratoga System Storage 12
Figure 3.8 – Transmission Lines & River Crossings 14
Figure 3.9 – Existing System Map 15
Figure 4.1 Supply Locations 16

Figure 4.2 Historical Water Loss 20
Figure 4.3 Saratoga/Carbon County Joint Planning Area 23
Figure 4.4 Saratoga Zoning Map 24
Figure 4.5 Master Meter Locations 25
Figure 4.6 Mountain View Estates Area 26
Figure 4.7 WWTP Location Map 29
Figure 4.8 – Interior Well #3 Building – Chlorine Disinfection System 30
Figure 4.9 Saratoga Valley Stratigraphy 33
Figure 4.10 Well #1 As-Built 37
Figure 4.11 Well #1 2019 Step Rate Test 42
Figure 4.12 Well #2 As-Built 45
Figure 4.13 Well #2 Step-Rate Test 47
Figure 4.14 Well #3 As-Built 50
Figure 4.15 Well #3 2019 Step-Rate Test 52
Figure 4.16 Well #3 Pump Column Pipe 53
Figure 4.17 Well #4 As-Built 58
Figure 4.18 Well #4 2019 Step-Rate Test 61
Figure 4.19 Well #5 As-Built 64
Figure 4.20 Well #5 2019 Step-Rate Test 66
Figure 4.21 Well #1 2018 Water Level Summary 68
Figure 4.22 Well #2 2018 Water Level Summary 69
Figure 4.23 Well #3 2018 Water Level Summary 70
Figure 4.24 Well #4 2018 Water Level Summary 71
Figure 4.25 Well #5 2018 Water Level Summary 72
Figure 5.1 Diurnal Curve (Based on AWWA M32 Figure 2-12) 79
Figure 5.2 – Extended Period Simulation (EPS) 79
Figure 5.3 – Current MDD Existing System Pressures 80
Figure 5.4 – Future MDD Existing System Pressures 81
Figure 5.5 Winter ADD Water Age – Existing Controls, No Flush, No Mixing 82
Figure 5.6 Winter ADD Water Age – Existing Controls, Mixing, No Flush 83
Figure 5.7 Winter ADD Water Age – Existing Controls, Mixing, Weekly Flush (2.0 hrs @ 1,000 gpm) 83
Figure 5.8 Winter ADD Water Age – Existing Controls, Mixing, Weekly Flush (2.0 hrs @ 1,700 gpm) 84
Figure 5.9 Winter ADD Water Age – New Level Controls, No Flush, Completely Mixed 84
Figure 5.10 Winter ADD Water Age – New Level Controls, Completely Mixed, Weekly Flush (2.0 hrs @ 1,000 gpm) 85
Figure 5.11 Winter ADD Water Age – New Level Controls, Completely Mixed, No Flush, One Tank 86

Figure 5.12 Winter ADD Water Age – New Level Controls, Completely Mixed, Weekly Flush (2.0 hrs @ 1,000 gpm), One Tank 86
Figure 5.13 – Optimum Flushing Location 87
Figure 5.14 – GPS/GIS Data Collection 90
Figure 6.1- Available Fire Flows MDD w/Fire Flow (gpm) 92
Figure 6.2- Recommended New 750K Tank Location 99
Figure 6.3- Recommended 750K Tank Water Age 100
Figure 6.4- Transmission Lines & River Crossings 103
Figure 6.5- Transmission and Distribution Problem Areas 104
Figure 6.6- Distribution & Transmission Improvements 108
Figure 7.1- Storage Recommendations Map 112
Figure 7.2 Typical Tank Mixing Unit and Flow Pattern 113
Figure 7.3 Typical Tank Mixer Control Panel 114
Figure 7.4 Preliminary Mountain View Estates Transmission Alignment 124
Figure 7.5 Preliminary Mountain View Estates Distribution 125
Figure 7.6 Anticipated New Well Location 137
Figure 7.7 – Overall Capital Improvement Map 138

List of Tables

Table 2.1 Recommendations – Previous Studies 4
Table 3.1 Town of Saratoga Water Connection Fees 8
Table 3.2 Town of Saratoga Water Usage Fees 9
Table 4.1 Current Demands - Production 17
Table 4.2 2049 - Future Demands 18
Table 4.3 2016-2018 Water Loss 18
Table 4.4 2005-2007 Water Loss 19
Table 4.5 FY 2015 thru 2017 Production Costs 20
Table 4.6 Saratoga Municipal Wellfield Water Rights Summary 27
Table 4.7 Town of Saratoga Well Production Data 31
Table 4.8 Saratoga Well #1 Summary 39
Table 4.9 Saratoga Well #1 – 2006 Step-Rate Pumping Test Summary 40
Table 4.10 Saratoga Well #1 – February 26, 2019 Step-Rate Test Summary 41
Table 4.11 Saratoga Well #2 Summary 44
Table 4.12 Saratoga Well #2 – February 26, 2019 Step-Rate Summary 46
Table 4.13 Saratoga Well #3 Summary 49
Table 4.14 Saratoga Well #3 – February 27, 2019 Step-Rate Test Summary 51
Table 4.15 Saratoga Well #3 – Video Log Description March 19, 2019 55
Table 4.16 Saratoga Well #4 Summary 57

Table 4.17 Saratoga Well #4 – 2006 Step-Rate Pumping Test Summary 59
Table 4.18 Saratoga Well #4 – February 27, 2019 Step-Rate Test Summary 60
Table 4.19 Saratoga Well #5 Summary 63
Table 4.20 Saratoga Well #5 – February 28, 2019 Step-Rate Test Summary 65
Table 4.21 Saratoga Wellfield Water Level Summary 73
Table 4.22 Saratoga Well Field Maximum Pumping Rate to Maintain Submergence 75
Table 4.23 Town of Saratoga Water Quality Analysis Results 77
Table 6.1 - Wyoming DEQ chapter 12 Section 9.b.i 93
Table 6.2 Alternative Power – Saratoga Well Field 94
Table 6.3 Required Future Storage - Town 95
Table 6.4 Existing vs Required Storage - Town 95
Table 6.5 Distribution/Transmission Improvements 106
Table 6.6 Fire Hydrant Type Data 109
Table 7.1 New 750K Storage Tank Funding 110
Table 7.2 New 750K Storage Tank Cost Estimate 111
Table 7.3 – Welded Tank Storage Bubbler Mixer Installation 115
Table 7.4 Tank Mixer Funding 115
Table 7.5 – Annual Flushing Cost 116
Table 7.6 – Winter vs. Summer Flushing Comparison 116
Table 7.7 SCADA Upgrades Funding 117
Table 7.8 SCADA Upgrades Cost Estimate 117
Table 7.9 Distribution Improvements Funding 118
Table 7.10 Distribution Improvements Cost Estimate 119
Table 7.11 Airport Transmission Line Funding 120
Table 7.12 Airport Transmission Line Cost Estimate 121
Table 7.13 WTP Transmission Line Funding 122
Table 7.14 WTP Transmission Line Cost Estimate 123
Table 7.15 MVE Transmission Line Funding 125
Table 7.16 MVE Transmission Line Cost Estimate 126
Table 7.17 MVE Distribution Cost Estimate 127
Table 7.18 MVE Distribution Funding 128
Table 7.19 Alternative Power Funding 128
Table 7.20 Alternative Power Cost Estimate 129
Table 7.21 Additional Metering Funding 130
Table 7.22 Additional Metering Cost Estimate 131
Table 7.23 Well Rehabilitation Funding 133
Table 7.24 Well Rehabilitation Cost Estimate 134
Table 7.25 New Saratoga Well #6 - Funding 135
Table 7.26 New Saratoga #6 Well Cost Estimate 136
Table 7.27 – Recommended Improvements 139

Table 7.28 – Project Cost Estimates Summary 140
Table 7.29 – Additional Operational Cost Estimates Summary 140
Table 7.30 – Suggested Budget 143
Table 7.31 – Scenario #1 No Project Funding 144
Table 7.32 – Scenario #2 WWDC Grant & Loan and Self-Funding Remaining 145
Table 7.33 – Scenario #3 WWDC Grant and SRF Loan 146
Table 7.34 – EDU Factors 147
Table 7.35 – Operational Cost Impact 147

1.0 EXECUTIVE SUMMARY

Executive Summary is provided under separate cover.

2.0 INTRODUCTION

2.1 Project History and Overview

The Town of Saratoga has been proactive in upgrading its water system in the past 20 years. Since the Town's last Level I water study was completed in 2003, with a supplemental Level II test well study completed in 2007, the Town has updated its water system dramatically with a switch from a surface water treatment system to a ground water supply system well field (2009). It was decided, in early 2018, with the Saratoga Carbon County Impact Joint Powers Board (SCCIJPB) and the Wyoming Water Development Commission (WWDC) that a Level I study of the system would provide the SCCIJPB with a more current understanding of their water system.

In general, the overall condition of the water system is dated and in need of updating. As with many municipalities in Wyoming, limited resources have allowed for the Town to replace or rehabilitate water system components on an as-needed basis rather than a preventative basis. This is not to say that the Town does not update its system (particularly with replacing water meters in 2013), but that this master plan can provide a "map/guide/priority list" for the Town in maintaining and updating its water infrastructure going forward.

The system serves approximately 990 service tap connections serving a present population of approximately 1,655.

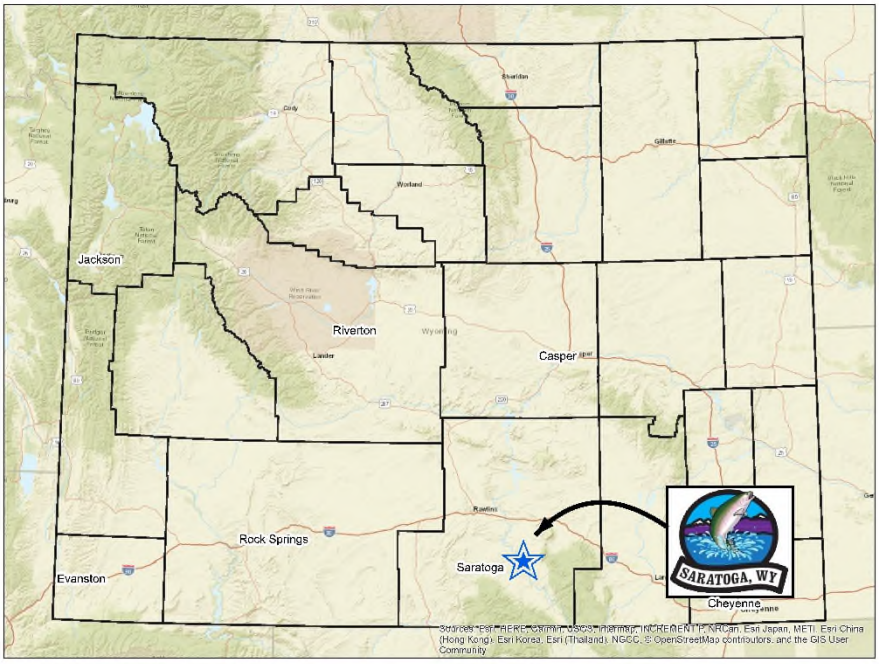


Figure 2.1 – Vicinity Map of Saratoga

2.2 Study Area

The Town of Saratoga is located in the southeastern portion of Wyoming in Carbon County. The Town is approximately 20 miles East of Rawlins, WY and approximately 20 miles south on Wyoming Highway 130 along the North Platte River.

2.3 Project Sponsor

This Saratoga Water Level I Master Plan study is provided under separate contract with the Wyoming Water Development Commission. The Town of Saratoga Water System is owned by the Saratoga Carbon County Impact Joint Powers Board (SCCIJPB) and is operated by the Town of Saratoga, who is the sponsor for this study. The SCCIJPB is composed of seven (7) members with three (3) appointments made by the Board of Carbon County Commissioners and four (4) by the Saratoga Town Council.

2.4 Master Plan Study Objectives

This Master Plan's objectives included first analyzing current and forecasted water system supply and demands, storage, assessing (through onsite investigation) the condition of existing system components, and hydraulic modeling. Based on these objectives the analysis, priorities, lifecycles, and cost estimates were established and contained herein.

2.5 Previous WWDC Studies

- Saratoga Master Plan Update and Level I Study – PMPC – March 2003
- Saratoga Test Well Level II Study – Hinckley Consulting – June 2007
- Platte River Basin Plan 2016 Update – Wenck Associates Inc. – December 2016

Table 2.1 below tabulates the recommended water system improvements from the above mentioned WWDC studies, including the actions taken by Saratoga.

Table 2.1 Recommendations – Previous Studies

Study	By	Date	Recommendations	Implemented (Yes/No)	Date of Implementation
Saratoga Master Plan Update and Leve II Study	PMPC Civil Engineers	Mar-03	Pre-sedimentation Basin to control turbidity in WTP	No	NA
-	-	-	Well exploration program to confirm the productivity and groundwater quality of the North Park Formation east and Northeast of Saratoga	Yes	2007
-	-	-	Waterline installations to supply 3,000 population Section 6.2 of report 6-1 thru 6-5 no, 7-1 yes, 7-2 no, 7-3 partially, 7-4 no, 7-5 no, 7-6 no, 7-7 no.	Yes & No	2008-2012
-	-	-	WTP Alternatives; Alt. 1: Construct Pre-Sediment Basin and add a second ozone generator; Alt. 2: Convert existing DE Filters to roughing filters and add coagulation assisted microfiltration for particle and DBP precursor removal. Retain the ozone system to oxidize organic precursors, install baffles in the clearwell and retain the existing chlorination system. Recommended to pursue Alt. 1.	No	NA
-	-	-	Individual pressure reducing valves on services exceeding 70 psi.	Yes	2009
-	-	-	Installing water meters on unmetered services	No	NA
-	-	-	Touch or radio read meter system/meter replacement program	Yes	2009
-	-	-	Remove Pressure Reducing Valve Installations	Yes	2009
Saratoga Test Well Level II Study	Hinckley Consulting	Jun-07	SWTP Upgrade - Pre-Sedimentation Clarifier	No	NA
			SWTP Upgrade - Pre-Sedimentation Clarifier and Membrane Filtration	No	NA
			Ground Water Development & Transmission	Yes	2009-2010
			Additional North Platte River Crossing	Yes	2008
			Pic Pike Road Pipeline Upgrade (8" to 14")	No	NA

2.5.1 Other Studies

The Town of Saratoga's recent 2016 Comprehensive Master Plan is additionally used as reference in this report. It was completed by Community Builders, Inc., Douglas, WY.

3.0 EXISTING MUNICIPAL SYSTEM DESCRIPTION

3.1 General

The Saratoga Water System is supplied by five (5) water supply wells which are 3.5 miles east of Town. The Town was originally supplied by surface water from the North Platte River but has since moved to a total groundwater source since well and transmission completions in 2009-2010. A 14" transmission line delivers water from the wells to the Town. The Town's distribution system consists of pipe diameters ranging from 4" to 14" and varying pipe materials from Asbestos Cement pipe to PVC pipe. The age of the distribution system pipes range from pre-1970s to 2010s. There are two (2) 1.0 million-gallon (MG) standpipes that provide the storage and pressure control for the entire system (there is only one (1) pressure zone). The Town has a SCADA system that monitors tank levels and controls well pumping. There are also two (2) independent systems that the Town supplies, the Old Baldy Club and the Medicine Waters Trailer Park.

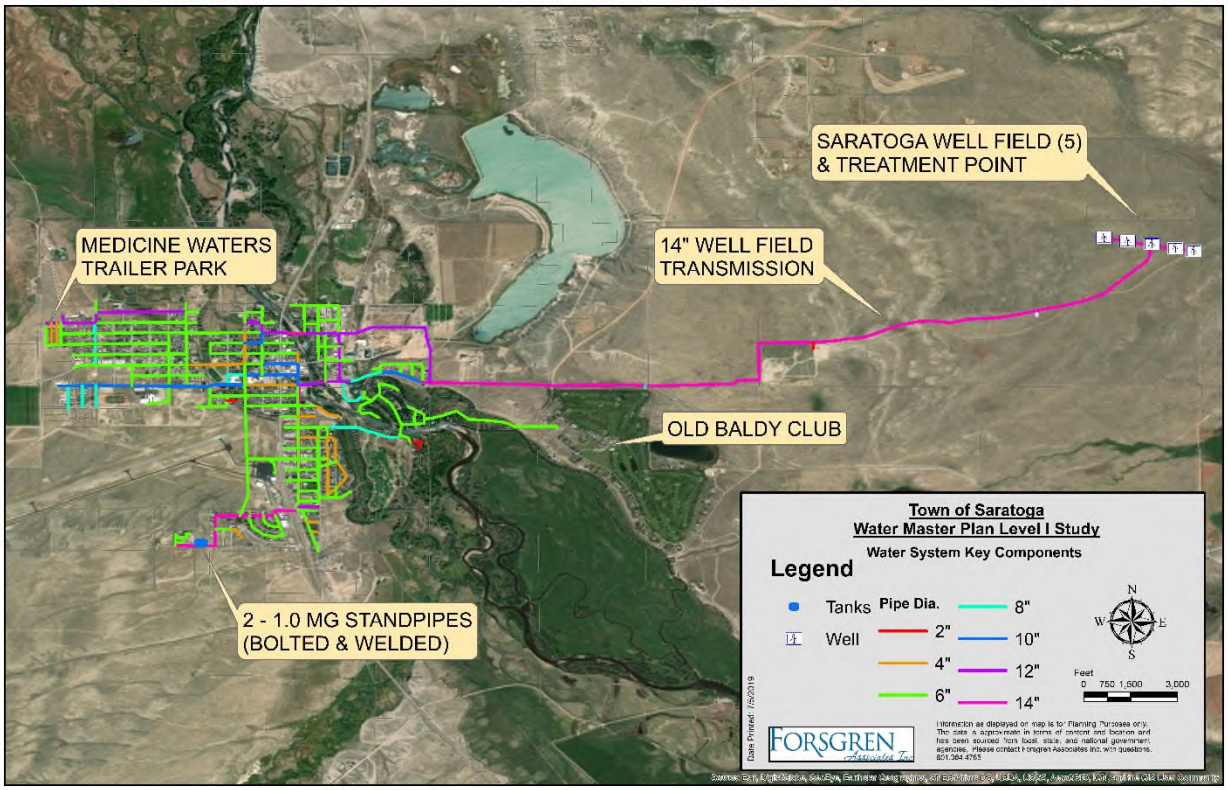


Figure 3.1 – Saratoga System Map

3.2 Present Population Served

According to the Wyoming: 2010 Population and Housing Report, it was estimated that the Town of Saratoga had a population of 1,690 in 2010 and projected a 2019 population of 1,737. The 2017 population estimates from the US Census Bureau estimate the Town's population to be approximately 1,655. This report will conservatively use the Wyoming: 2010 Population and Housing Report projections for a 2019 population of 1,737.

3.3 Population Forecast

Population forecasts for the Town of Saratoga and Carbon County published by the Wyoming Department of Administration and Information Office for the years 2010-2030 shows a moderate increase in population through the year 2022 and a moderate decrease in population through years 2023 to 2030.

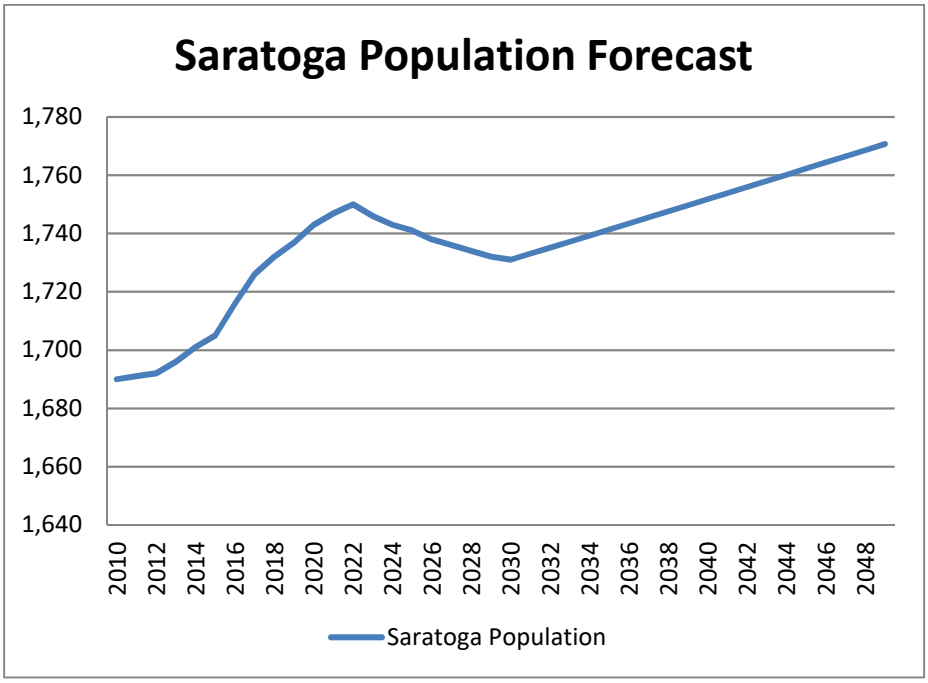


Figure 3.2 –Saratoga Population Forecast – Wyoming Department of Administration and Information

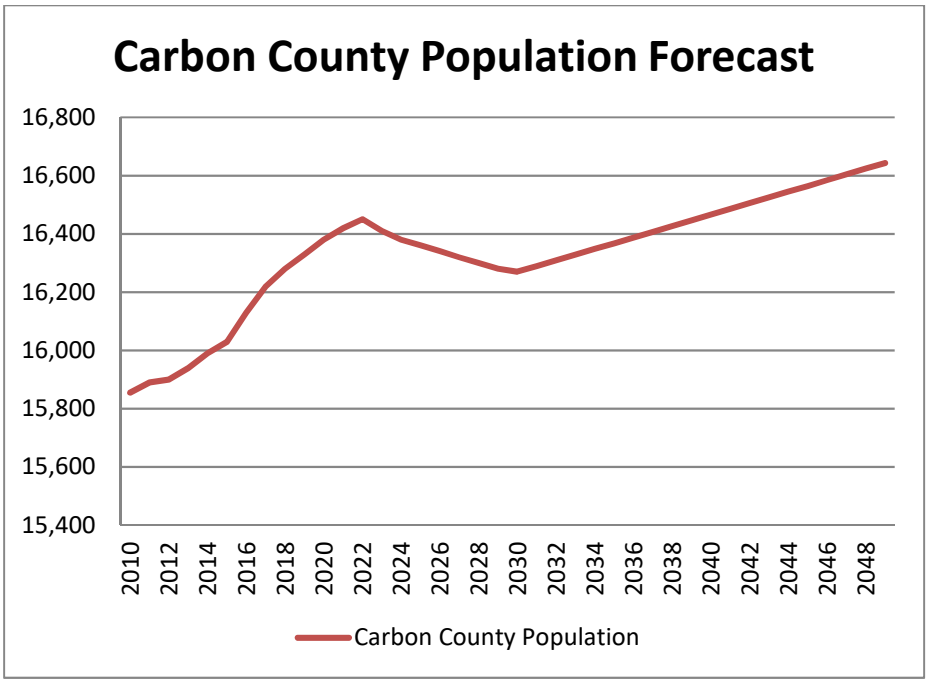


Figure 3.3 – Carbon County Population Forecast – Wyoming Department of Administration and Information

The average year over year forecasted growth rate for the Town and Carbon County for the years 2010-2030 is 0.12%. Using this growth rate, the Town's population forecasted for the year 2049 is 1,771 persons as shown in Figure 3.2.

Prior studies have used a forecasted population of 3,000 in considerations for the planning & design of the Saratoga Water System as defined by the ad hoc citizens group, Saratoga 3,000, which determined that a population of 3,000 is needed to ensure that the community would be economically viable. Using the average year over year projection of 0.12% it would take Saratoga approximately 300 years to reach such population. Population projections of this magnitude can be of benefit in planning for the long-term future of a Town. However, infrastructure improvements based on greatly inflated projections can be of detriment as the life-cycle of infrastructure typically does not last for 300 plus years let alone 100 years. Meaning, infrastructure improvements now for that 3,000 population will most likely require re-build multiple times until those population projections are met.

For this report we will utilize the population projections estimated by the Wyoming Department of Administration and Information (2010 – 2030) and the year over year average growth of 0.12% for an estimated 2049 population of 1,771. The 3,000 population has been utilized as a comparison tool in the hydraulic modeling efforts, but is not used in the recommendations of this report.

3.4 Water User Rates

The Town of Saratoga has a tiered rate schedule for both service connection fees and water supply fees, which are based primarily upon size of the service line and usage (in gallons). In 2011, the SCCIJPB passed an ordinance to increase the water supply user fees 3% annually to recover lost revenue in the water system funds. The SCCIJPB has currently not decided on increasing rates by 3% for this year (2019) but instead are considering re-evaluating its tiered rate system. This is due to the effective user rates of the Old Baldy Club and the Medicine Waters Trailer Park where the effective user rates much less per month. Tables 3.1 and 3.2 below illustrate existing service connection fees and user rate fees respectively.

Table 3.1 Town of Saratoga Water Connection Fees

Town of Saratoga Service Tap Fees			
Tap Size	By Whom	Direct Cost	
3/4"	Town	$	3,500.00
3/4"	Contractor	$	2,500.00
1"	Contractor	$	4,000.00
1-1/2"	Contractor	$	4,500.00
2"	Contractor	$	5,500.00
3"	Contractor	$	6,500.00
4"	Contractor	$	7,500.00
6"	Contractor	$	9,500.00
Fire Suppression Connection Fees			
Tap Size	By Whom	Direct Cost	
2"	Contractor	$	1,500.00
4"	Contractor	$	1,500.00
6"	Contractor	$	3,000.00
8"	Contractor	$	5,000.00

Table 3.2 Town of Saratoga Water Usage Fees

2018-Residential Water User Fees					
Gallons Used Minimum	Gallons Used Maximum	Base Rate	Cost per 1,000 Gallons Over Minimum	Minimum Cost	Maximum Cost
0	7000	$ 30.76	$ -	$ 30.76	$ 30.76
7001	20000	$ 30.76	$ 2.75	$ 30.76	$ 66.51
20001	60000	$ 66.51	$ 3.09	$ 66.51	$ 190.11
60000	+	$ 190.11	$ 3.71	$ 190.11	+
2018-Commercial Water User Fees					
Gallons Used Minimum	Gallons Used Maximum	Base Rate	Cost per 1,000 Gallons Over Minimum	Minimum Cost	Maximum Cost
0	7000	$ 34.48	$ -	$ 34.48	$ 34.48
7001	20000	$ 32.50	$ 2.75	$ 32.50	$ 68.25
20001	60000	$ 68.25	$ 3.09	$ 68.25	$ 191.85
60001	250000	$ 191.85	$ 3.71	$ 191.85	$ 896.75
250000	+	$ 896.75	$ 6.15	$ 896.75	+

3.5 Existing System Components

The Town's existing water system consists of five (5) groundwater supply wells, two (2) 1.0 MG water storage standpipes and approximately 160,000 feet (approx. 30 miles) of 4" to 14" water transmission and distribution lines.

3.5.1 Water Supply Sources – Saratoga Well Field

The Town of Saratoga utilized treated water from the North Platte River (NPR) for meeting the needs of the users for more than 40 years. Treatment during periods of high turbidity during spring runoff and the drought of the 2000's affecting the availability of water from the NPR was challenging and it was determined that providing high quality water and meeting applicable regulations would require upgrades to the plant. Level I and II investigations were performed to determine whether upgrades to the water treatment plant or changing to a groundwater-based system would best serve the Town. A series of borings and exploration wells indicated that a groundwater wellfield in the North Park Aquifer east of the Town could meet the potable water needs of Saratoga. In 2008 and 2009 a Level III Project included the construction of three additional wells, the

Figure 3.4 – Well #3

equipping of the five wells with pumps, and the construction of control buildings, chlorine disinfection facilities, and a 14-inch transmission line from the wellfield to the Town. The wells were put into production in early 2009 and the water treatment plant was decommissioned.

3.5.2 System Storage

- **Welded Steel Storage Standpipe**
  This welded standpipe (Figure 3.5) is a 100 foot tall, 1,000,000 gallon water storage tank located in the southwest portion of the Town, see Figure 3.7. Construction of the tank was completed in 1979 and rehabilitated in 2005 to address some blistering and corrosion issues. The tank appears to be in relatively good condition, especially for its age (40 years). Apart from the rehabilitation project in 2005 the Town has not had to provide much maintenance beyond periodic tank inspections.

  Figure 3.5 – Welded Standpipe

  The most recent tank inspection was performed by Liquid Engineering Corp. in September of 2014. The comments from that inspection mentioned that there was 1-inch of iron sediment in all quadrants of the floor, minor delamination on the upper walls and that the tank should be cleaned and inspected in three (3) years. The next tank inspection has not been scheduled yet, but a tank should be inspected every 3-5 years and since the last inspection was in 2014 the Town should plan on scheduling an inspection soon.

  The tank's water level is maintained by the well field controls through the transmission and distribution system. The tank has a single inlet/outlet design, which means that the tank is filled by the same line that also serves as the outlet. This tank along with the bolted steel tank (described below) are the controlling system components for the distribution system pressures for the Town. As a standpipe, the tank needs to maintain a minimum water elevation of approximately 40' to maintain minimum distribution system pressures. Therefore, the effective usable storage of the tank is 600K gallons.

  The Town typically has two (2) operation ranges for this tank, summer and winter. In the summer the Town keeps the tank's elevation levels at 90-96 feet and in the winter at 80-86 feet. One potential issue that this tank has is water age as discussed further in Section

5.1.1. This is due to its location at essentially a dead end in the Town's system and its operational features.

- **Bolted Steel Storage Standpipe**

  Similar to the welded storage standpipe, this tank is a 100 foot tall 1,000,000 gallon water storage tank. It is located approximately 60 feet to the west of the welded tank and is connected to the system by the same feed line via a tee. This tank was constructed in 2002 and based upon interviews with the system operators, has had issues since it was put online. These issues are delved into in Section 6.4.1. In general, the tank has been leaking from many of its panels for the majority of its life.

Figure 3.6 – Bolted Standpipe

  This tank and the welded tank are hydraulically equal, meaning that this tank operates on the same control parameters as mentioned above for the welded tank. Combining the two tanks, there is a total of 2.0 MG of stored water but with a minimum tank level of 40' the total effective useable storage is 1.2 MG.

  This tank was last inspected in September of 2014 by Liquid Engineering Corp. The comments from the report are fairly general in stating that there is debris on the floor, several spots leaking on the walls and to clean and inspect in three (3) years. The next inspection has not been scheduled but should be scheduled soon.

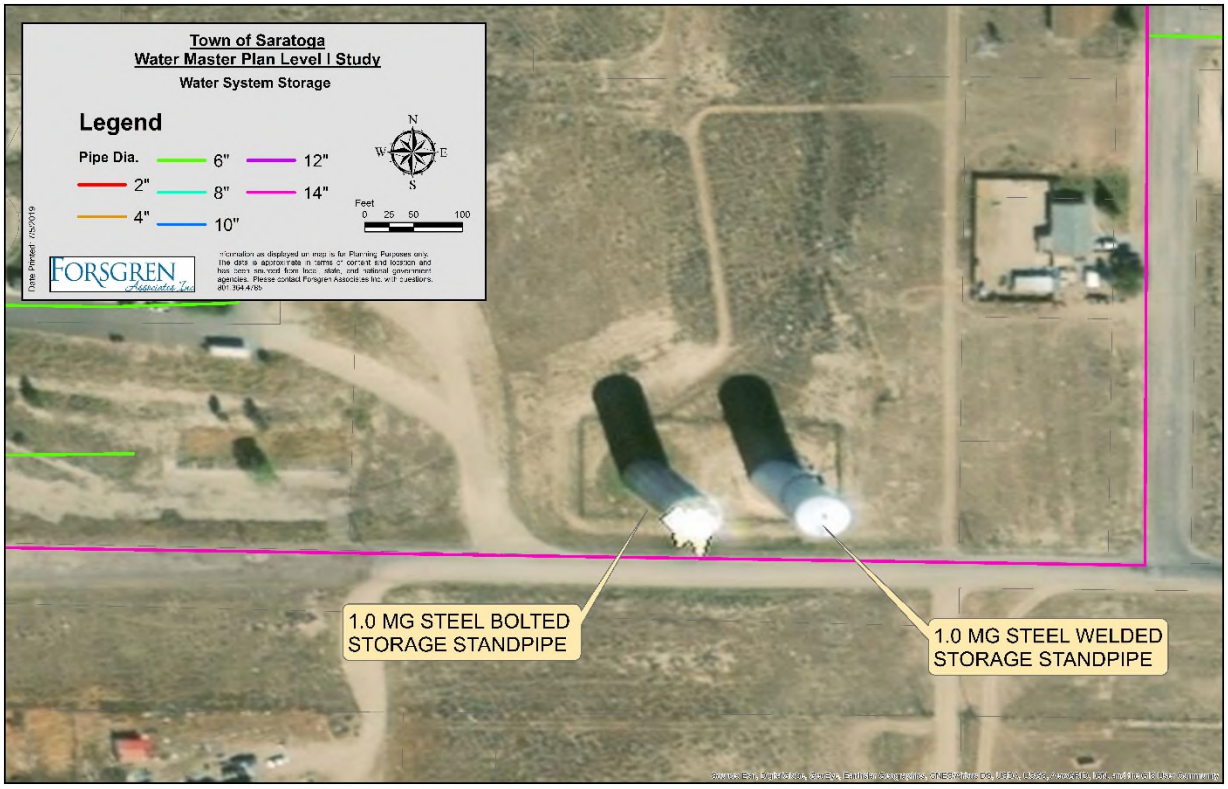


Figure 3.7 – Saratoga System Storage

3.5.3 Transmission Lines

- **Well Field Transmission**
  This 14-inch PVC transmission line runs west from the well field to the north of the landfill/transfer station and along Ryan Park Road (C.R. 504) until it connects with the eastern end of the distribution system on Pic Pike Road. There are multiple fire hydrants and air release valve stations along the transmission line. There are a few service connections on the transmission line with the most notable being the second (2nd) connection and an 8" master meter for the Old Baldy Club at the northeastern corner of the club, see Figure 3.8.

- **North Transmission Line**
  This 12-inch PVC transmission line is a branch of the Well Field Transmission Line, branching from the 14" line to the north along the access road to the cemetery. This line then cuts across the lumber mill and connects to the distribution system at East Rochester Street, see Figure 3.8.

- **Airport Transmission Line**
  This 6-inch cast iron transmission line was originally the outlet of the old Saratoga tank that no longer exists. This line tees off of the 14" ductile iron WTP Transmission Line

and veers northeast towards the airport running through residential property. The line continues north across the airport and connects to the distribution system at South 3rd Street, see Figure 3.8.

- **Old WTP Transmission**
  This 14-inch ductile iron line originally served as the primary transmission line from the old WTP (Water Treatment Plant) south along River Street and crosses State Highway 130 to the west towards the storage standpipes. Since the Town has moved from the WTP to the well field as the source of water, this line in essence is still a transmission line as it is the primary feed line for the tanks but serves dual purpose as a distribution line. See Figure 3.8.

3.5.4 River Crossings

- **South River Crossing**
  This "original" river crossing consists of a 12-inch PVC line that connects Pic Pike Road to River Street (near the old WTP). This line was originally constructed to provide treated water to the east side of the river to expand the Saratoga distribution system. See Figure 3.8.

- **North River Crossing**
  In 2008, in conjunction with the well field development, a new river crossing was constructed. This line consists of a 14-inch HDPE line that was open cut with concrete ballasts across the river connecting the 12-inch PVC lines on East Rochester Avenue and East Rochester Street. This second major crossing was developed primarily as a redundant line for protection against breaks of the South River Crossing and vice versa. If one crossing has a problem the other crossing can still supply water to the tanks. See Figure 3.8.

- **South East River Crossing**
  This crossing is a 6-inch ductile iron line that crosses the river near the bridge on Texas Trail Road near the Saratoga Hot Springs Resort Golf Course. This crossing was essentially a distribution service line to the residents on the south side of the bridge until 2011-12 when a 8-inch line was constructed to run along Wyoming Way and eventually connect to Cypress Ave. This line can provide a small measure of protection against breaks on the other two crossings but is limited due to the 6-inch size of the crossing which limits it in providing the necessary supply flows for the system.

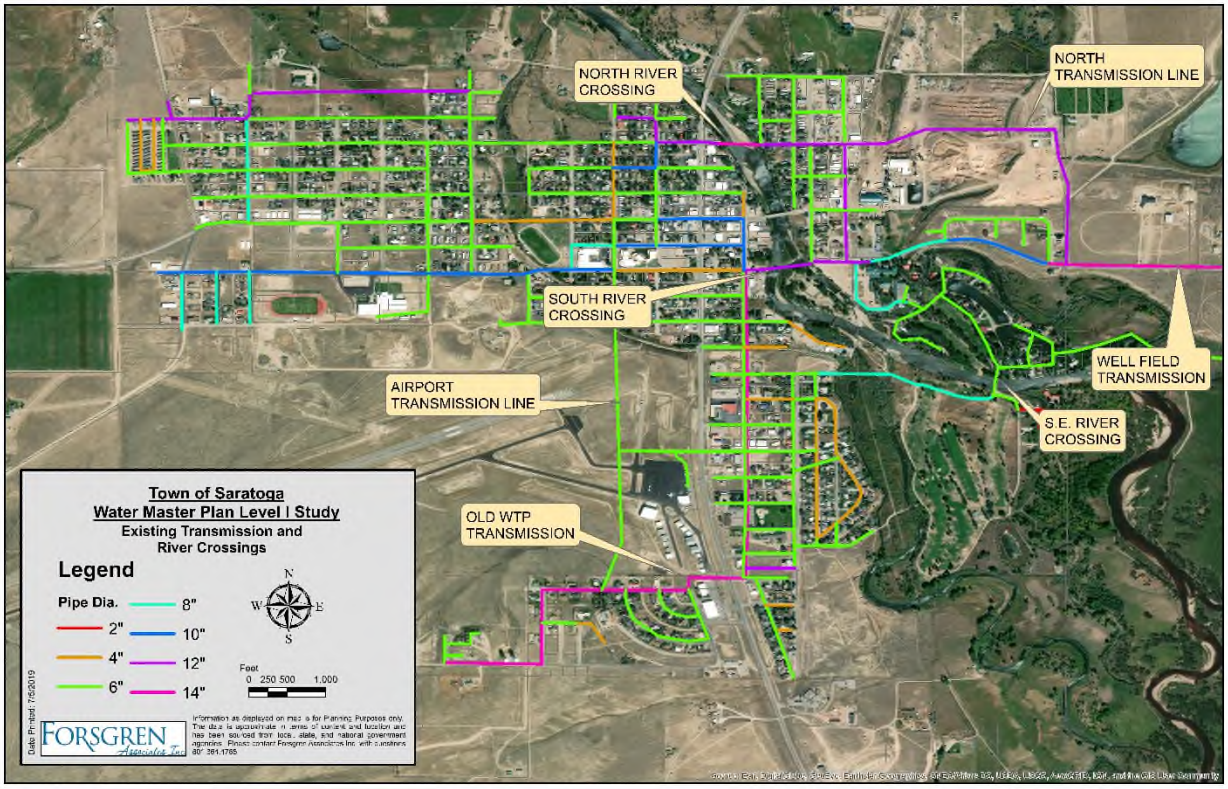


Figure 3.8 – Transmission Lines & River Crossings

3.5.5 Distribution System / Pressure Zones

The distribution system in Saratoga consists of approximately 122,000 feet (approx. 23 miles) of 4-inch to 10-inch water lines. From these distribution lines, water services are metered by meters ranging in size from ¾-inch to 8-inch, with the 6-inch and 8-inch meters being the master meter connections to the Medicine Waters Trailer Park (6-inch) and the Old Baldy Club (6-inch & 8-inch). In 2009, the meters in the Town were replaced with Sensus SRII (3/4-inch to 1-inch) and Sensus OMNI C2 (1 ½-inch +) radio read meters in order to streamline monthly meter readings.

Currently there is only one pressure zone in the system which is controlled by the standpipe tanks' water level. There were originally 3 pressure zones but the pressure controlling stations were bypassed in 2009. As a result, individual PRVs are required for all system users in excess of 70 psi (variance with signed waiver), those PRVs are either Apollo or Watts brand.

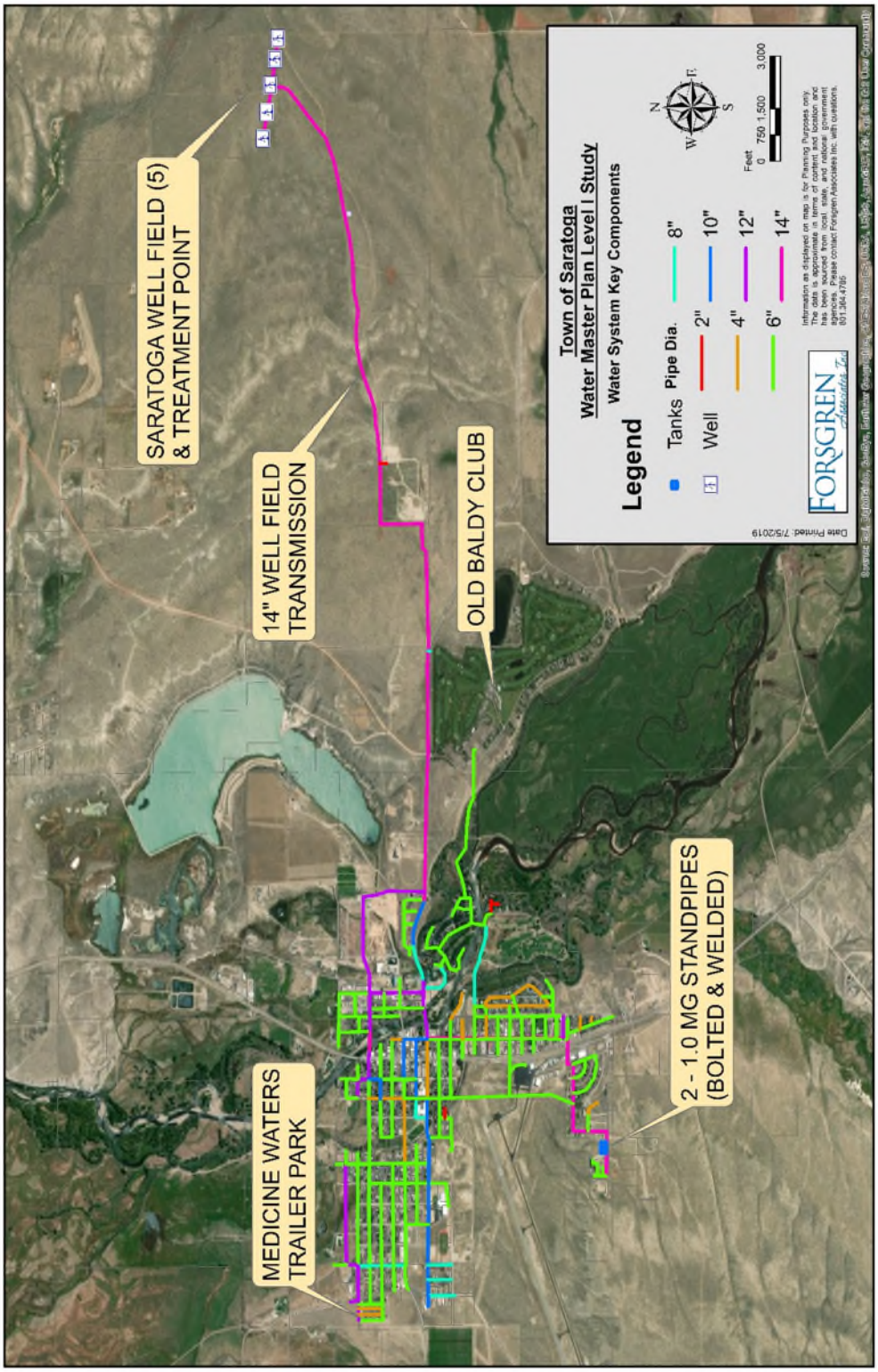


Figure 3.9 – Existing System Map

4.0 WATER DEMAND AND SUPPLY

The Town of Saratoga's water system is monitored and controlled by the Town's water operators. The automatic control of the system is between the well field and the storage standpipes utilizing a SCADA system. This SCADA system automatically records and stores operational data which includes well production, individual well meter readings, standpipe tank levels and well water levels. For this report, the monthly well production records for the years 2013 thru 2018 were used. These records were provided by the Town in EXCEL file format. The records for the Town's usage were provided via hard copy. This usage record has monthly metered usage records for the years 2005 thru 2007 and annual metered usage for the years 2016 thru 2018. Metered usage for the years 2008-2015 was not provided. The production and usage records for the Town are included in this report in Appendix A. The configuration of the Town's well field is shown on Figure 4.1 below.

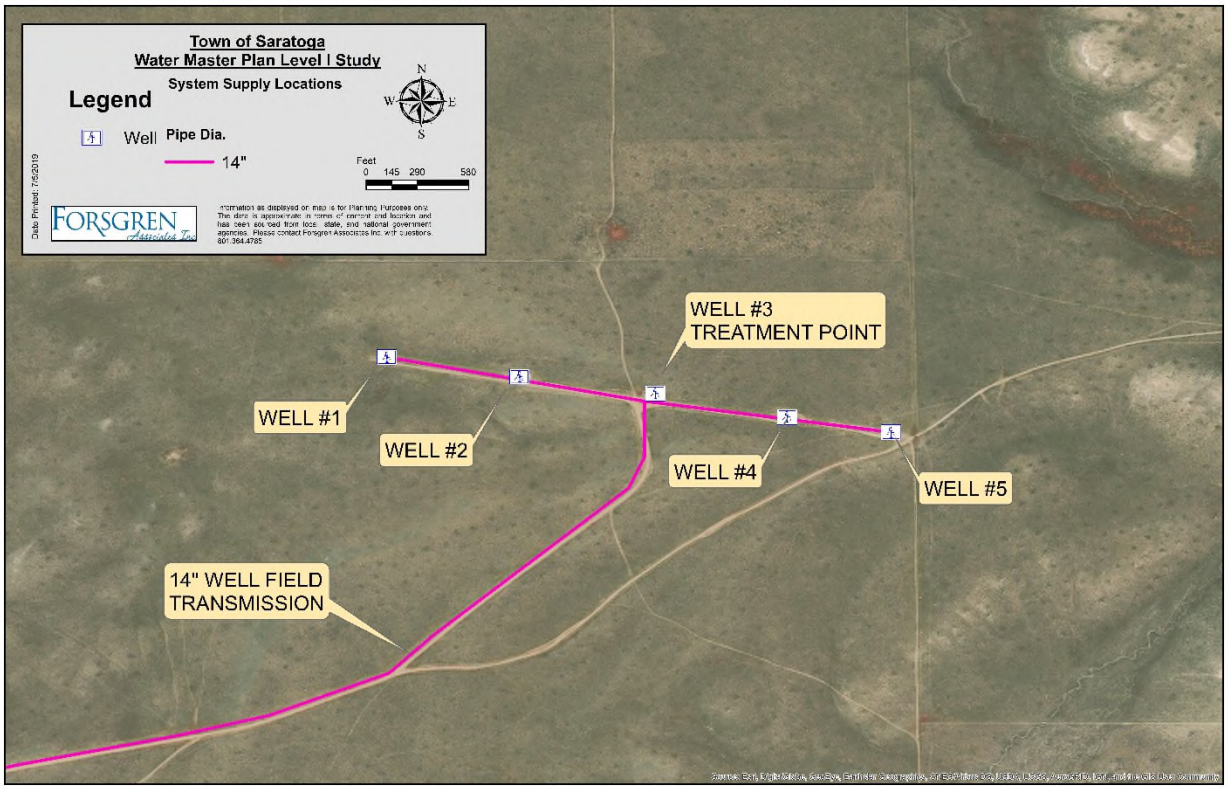


Figure 4.1 Supply Locations

4.1 Identification of Domestic Water Use

4.1.1 Existing Per-Capita Consumption:

In determining the domestic water use of the Saratoga Water System, production and annual user meter readings were used. Production records of the 5 wells were provided by the Town for the years 2013 thru 2018. Those well records showed that the water system experienced an Average

Day Demand (ADD) of 462,031 gallons per day (gpd) or 321 gallons per minute (gpm) over the six (6) year period. The Town's annual metered usage for the years 2016-18 showed an ADD for water use of 315,107 gpd or 218 gpm. The difference between the production and metered ADD, for the respective time periods, indicates that there is unaccounted water use or loss. The American Water Works Association (AWWA) recommends a production water loss of 10% or less and reports that the average water loss for municipal water systems is 16%. Comparing the production and metered ADD for the years 2016-18 the system shows unaccounted water loss/use at approximately 25.6% of production. Although 25.6% seems excessive, the Town does have unmetered usage in its parks, municipal buildings, hot pool and has identified an unmetered connection on the southwestern part of the system that is utilized for irrigation. From the data received for water usage by the Town, the water operators estimated that annually, approximately 3,500,000 gallons were used by non-metered connections for the years 2005-2007. That estimated non-metered usage was also used for the years 2016-18 (which is hard to justify with a 9-year gap between dates and no metering to verify). The average loss of 25.6% equates to a loss of production of approximately 77 gpm, which is significant in relation to the production of just one of the wells. Additionally, since the meters have been installed in 2009, the Town has not calibrated the meters. Every mechanical meter, no matter how advanced, has some level of error in which water usage is typically not accurately accounted for (i.e. low flows less than 0.25 gpm on smaller meters) and a percentage of error in readings. Additionally, in interviews with system operators, the western/northwestern side of the system has been experiencing issues with service saddles eroding, poor bedding and corrosive soils which can be contributing factors leading to water loss. With nearly one-third of the water production being lost, it is a major issue for the system with regards to production costs and infrastructure (well pumps) life cycles. The issue is that the water loss is quite inconsistent and explored further in Section 4.1.3 below.

For the years 2013 thru 2018 a Maximum Day Demand (MDD) of 1,196,955 gpd was recorded on August 12, 2015. This is approximately 2.6 times the ADD of the system. For this report a peaking factor of 3.0 was conservatively used for calculating the design MDD, and a peaking factor of 5.0 was used for calculating the Peak Hour Demand (PHD). Table 4.1 indicates the current ADD, MDD and PHD for the Saratoga water system.

Table 4.1 Current Demands - Production

ADD (gpd)	MDD (gpd)	PHD (gpd)
462,031	**1,196,955**	**2,310,154**

4.1.2 Future Projected Demands

Based on a year over year growth rate of 0.12%, 1,771 persons are estimated to be served by the Saratoga water system in the year 2049. This is an increase of 3.4% or 58 individuals from the

2013-18 average census population. When the ADD is increased by 3.4% to project the 2049 population it results in a future ADD of 477,692 gpd for the system. Table 4.2 summarizes the estimated future system demands.

Table 4.2 2049 - Future Demands

ADD (gpd)	MDD (gpd)	PHD (gpd)
477,692	**1,237,527**	**2,388,458**

4.1.3 Water Loss

As mentioned above in Section 4.1.1. The average water loss for the system for the years 2016-18 with relation to production and metered usage is approximately 26%. Also mentioned above is that the estimated non-metered usage used for the years 2016-18 equates to the average estimated non-metered usage for the years 2005-07 (3.5 million gallons). Since those are estimates, it's hard to argue against or verify those numbers. Maybe the non-metered usage stayed the same or maybe it went up or down. Either way, 3.5 million gallons per year equates to approximately 6.7 gpm, which is a fraction of the total estimated losses. The Town knows of multiple non-metered connections both municipal and private, and this report recommends installing meters for those services. Another potential loss direction could lie in the Town's Ordinance to not meter fire protection connections to the system. Any of those fire connection systems could be leaking and go unnoticed. For the years 2016-2018 the following data was provided relating to water loss in Table 4.3 below.

Table 4.3 2016-2018 Water Loss

Year	Production	Metered Water	Estimated Non Metered	Total Accountable Water	Loss (Gallons)	Loss (%)	Accountable (%)
2016	165,096,475	132,528,000	3,500,000	136,028,000	29,068,475	17.61	82.39
2017	160,555,088	105,257,000	3,500,000	108,757,000	51,798,088	32.26	67.74
2018	151,481,818	107,257,000	3,500,000	110,757,000	40,724,818	26.88	73.12
Averages	159,044,460	115,014,000	3,500,000	118,514,000	40,530,460	25.58	74.42

In looking at the data above there isn't much that can be inferred other than inconsistencies with water loss and no definable trend. The Town has been notified of the request for monthly meter readings but have not yet been received. Monthly data from the years 2005-2007 was received as shown below in Table 4.4.

Table 4.4 2005-2007 Water Loss

Month-Year	Production	Metered Water	Estimated Non Metered	Total Accountable Water	Loss (Gallons)	Loss (%)	Accountable (%)
Jan-05	4803600	4268000	100000	4368000	435600	9.07	90.93
Feb-05	4155600	4037000	100000	4137000	18600	0.45	99.55
Mar-05	5154800	5000000	100000	5100000	54800	1.06	98.94
Apr-05	5449200	4480000	250000	4730000	719200	13.20	86.80
May-05	9762400	5657000	250000	5907000	3855400	39.49	60.51
Jun-05	14996800	14643000	250000	14893000	103800	0.69	99.31
Jul-05	23275000	18308000	1000000	19308000	3967000	17.04	82.96
Aug-05	16631400	16112000	500000	16612000	19400	0.12	99.88
Sep-05	13115900	11310000	500000	11810000	1305900	9.96	90.04
Oct-05	6368500	5405000	250000	5655000	713500	11.20	88.80
Nov-05	5582900	4793000	100000	4893000	689900	12.36	87.64
Dec-05	5110400	4436000	100000	4536000	574400	11.24	88.76
2005 Totals	114406500	98449000	3500000	101949000	12457500	10.89	89.11
Jan-06	5305900	4706000	100000	4806000	499900	9.42	90.58
Feb-06	4767600	3600000	100000	3700000	1067600	22.39	77.61
Mar-06	6122100	4652000	100000	4752000	1370100	22.38	77.62
Apr-06	7407900	4526000	250000	4776000	2631900	35.53	64.47
May-06	15342100	10665000	500000	11165000	4177100	27.23	72.77
Jun-06	23120200	19506000	1000000	20506000	2614200	11.31	88.69
Jul-06	22999000	16001000	1000000	17001000	5998000	26.08	73.92
Aug-06	21002700	19261000	1000000	20261000	741700	3.53	96.47
Sep-06	13591200	9801000	500000	10301000	3290200	24.21	75.79
Oct-06	8957000	5818000	250000	6068000	2889000	32.25	67.75
Nov-06	6396300	4067000	100000	4167000	2229300	34.85	65.15
Dec-06	7642600	4524000	100000	4624000	3018600	39.50	60.50
2006 Totals	142654600	107127000	5000000	112127000	30527600	21.40	78.60
Jan-07	8571100	5677000	100000	5777000	2794100	32.60	67.40
Feb-07	7731000	4637000	100000	4737000	2994000	38.73	61.27
Mar-07	7241100	4475000	100000	4575000	2666100	36.82	63.18
Apr-07	6139000	4558000	250000	4808000	1331000	21.68	78.32
May-07	11507400	9989000	500000	10489000	1018400	8.85	91.15
Jun-07	16023600	13207000	1000000	14207000	1816600	11.34	88.66
Jul-07	26910400	16872000	1000000	17872000	9038400	33.59	66.41

Figure 4.2 below illustrates month over month percentage loss for the years 2005-07.

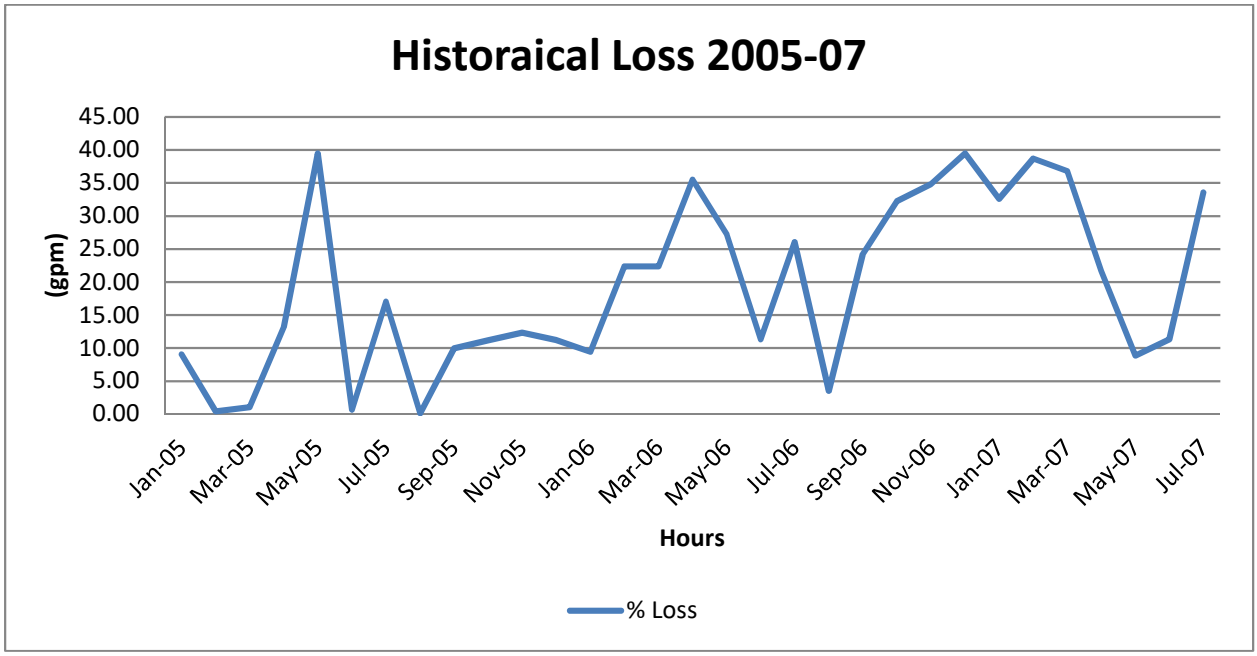


Figure 4.2 Historical Water Loss

As shown in Table 4.4 and Figure 4.2, the inconsistent water loss has been prevalent for some time. As such, it is difficult to identify a pattern and does not mandate leak detection. What it does indicate is a loss/leak detection program be implemented, recommendations of such are included in Section 7.1.10.

4.1.4 Production Costs

Utilizing the Town's Water Department Fiscal Year Expenditures Records and the water production records Table 4.5 was formed.

Table 4.5 FY 2015 thru 2017 Production Costs

Saratoga Water Production Costs				
Fiscal Year (July-June)	Water Department Costs	Water Production (gal)	Cost of Production per Gallon	Cost of Production per 1000 Gallons
2015-2016	$380,820.92	167,529,694	$0.0023	$2.27
2016-2017	$366,427.37	168,627,914	$0.0022	$2.17
2017-2018	$346,198.86	159,069,140	$0.0022	$2.18
Average	$364,482.38	165,075,583	$0.0022	$2.21

As shown in the above Table 4.5, the cost of water production has been quite steady for the past 3 fiscal years with an average cost of production per gallon of water being $0.0022 and a cost of $2.21 per 1,000 gallons. Copies of these Fiscal Year Expenditures can be found in Appendix J.

4.2 Growth in Saratoga

As mentioned above, growth in Saratoga appears to be moderate to low at a year over year growth rate of approximately 0.12%. According to Saratoga's 2016 Comprehensive Master Plan the largest employers in the Saratoga area include seasonal tourism and travel, public schools, retail and local government. Employment is the largest driving factor when evaluating growth potential. Unfortunately, apart from seasonal tourism, the main employers are those of necessity in public services (i.e. government and schools instead of those that drive growth). These employers don't really have much room to grow dependent upon themselves and need outside (private) employment to force the need for more personnel. Mining, gas production and correctional facilities are major employers in Carbon County and does have an effect on employment and population in the Saratoga Area. Due to its location however, much of the housing needs for the major employers (Sinclair Refinery and State Penitentiary) in the area are served by closer locations such as Rawlins and Sinclair. The upcoming Chokecherry Wind Farm, south of Sinclair, may provide a boost in population to Saratoga should the required housing needs exceed the capacities of Rawlins and Sinclair.

In the 2003 Saratoga Master Plan, multiple water service area expansion lines were discussed should the Town experience growth, see Section 2.5. This master plan reiterates that those improvements would be recommended should that time come, but for this master plan and the projections for the next 30 years it is not anticipated that those potential service areas will become viable options due to anticipated growth.

Saratoga's 2016 Comprehensive Plan developed some housing goals which included channeling growth and investment towards existing, developed areas of the community to make efficient use of existing infrastructure and services and to encourage reuse of existing buildings, redevelopment or intensification of underutilized properties. This master plan concurs with these goals as interior development is more financially viable for the community to best utilize existing infrastructure.

Figure 4.3 below is the Saratoga Carbon County Joint Planning Area Map developed as part of this 2016 Comprehensive Plan. It identifies Saratoga's existing buffer zones, Town limits and potential annexation areas. In evaluating this map, most of the possible annexation areas (WWTP, Landfill, Wells, Whistle Pig Bar, Private Property) are reasonable/feasible. The Old Baldy Club is also identified as one of these potential annexation areas. It is a logical annexation on the Town's part but it is unknown whether the club would be willing or have the want/desire to annex. The one possible regionalization area that could give the Town some trepidation in

terms of infrastructure and maintenance would be the Mountain View Estates area. It is quite feasible to service this area, in terms of modeling, but the expense of running transmission and distribution lines could be immense. Though this is not recommended in this report, a conceptual cost estimate for servicing this area (Transmission & Distribution) are included in Section 7.1.8 for reference should the opportunity arise.

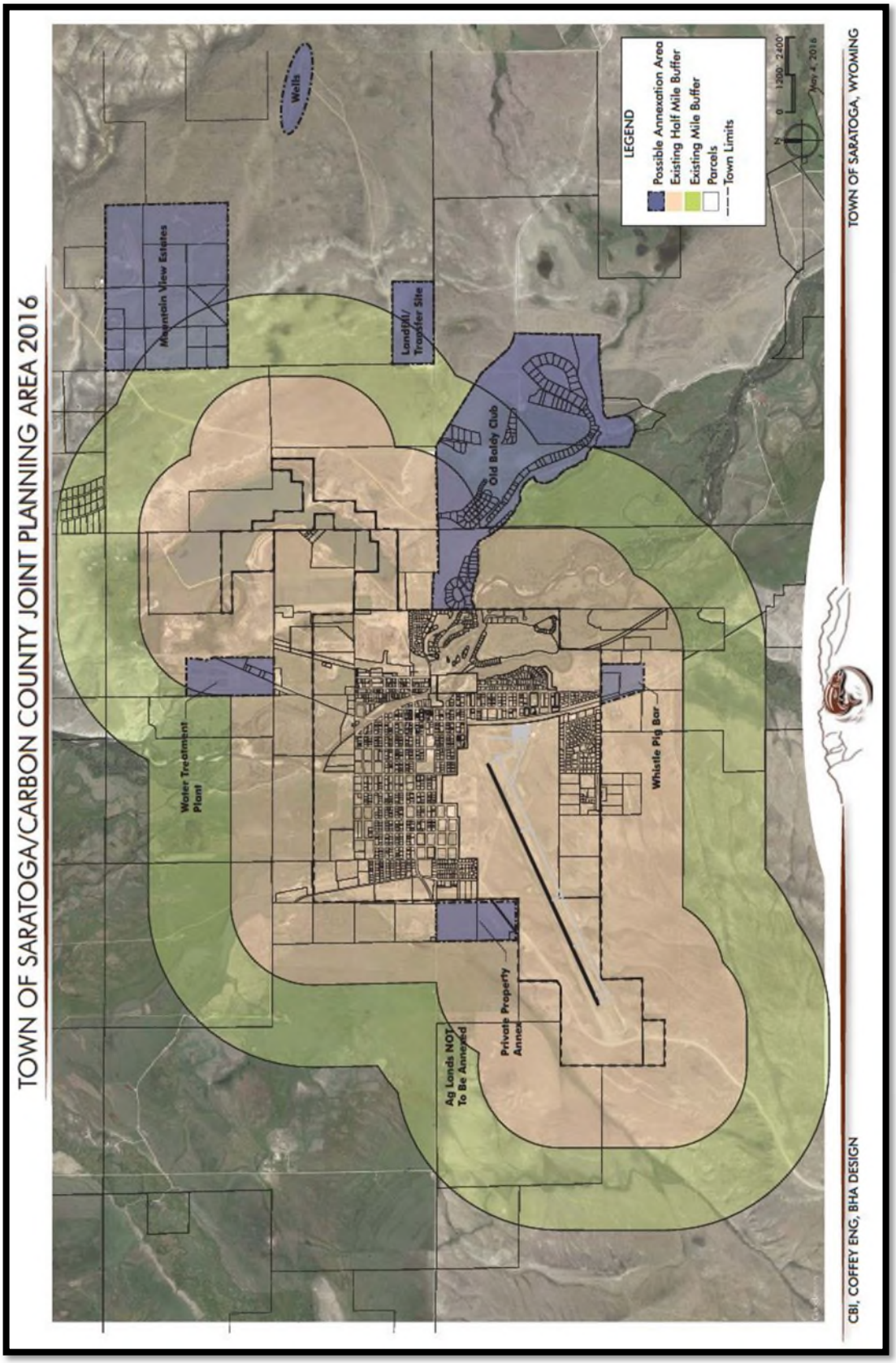


Figure 4.3 Saratoga/Carbon County Joint Planning Area

Figure 4.4 below shows the Town's Zoning Map (from the 2016 Comprehensive Plan). As mentioned above, this master plan concurs with the statements/goals made as part of the Comprehensive Plan to encourage and invest in infill and internal development of the Town.

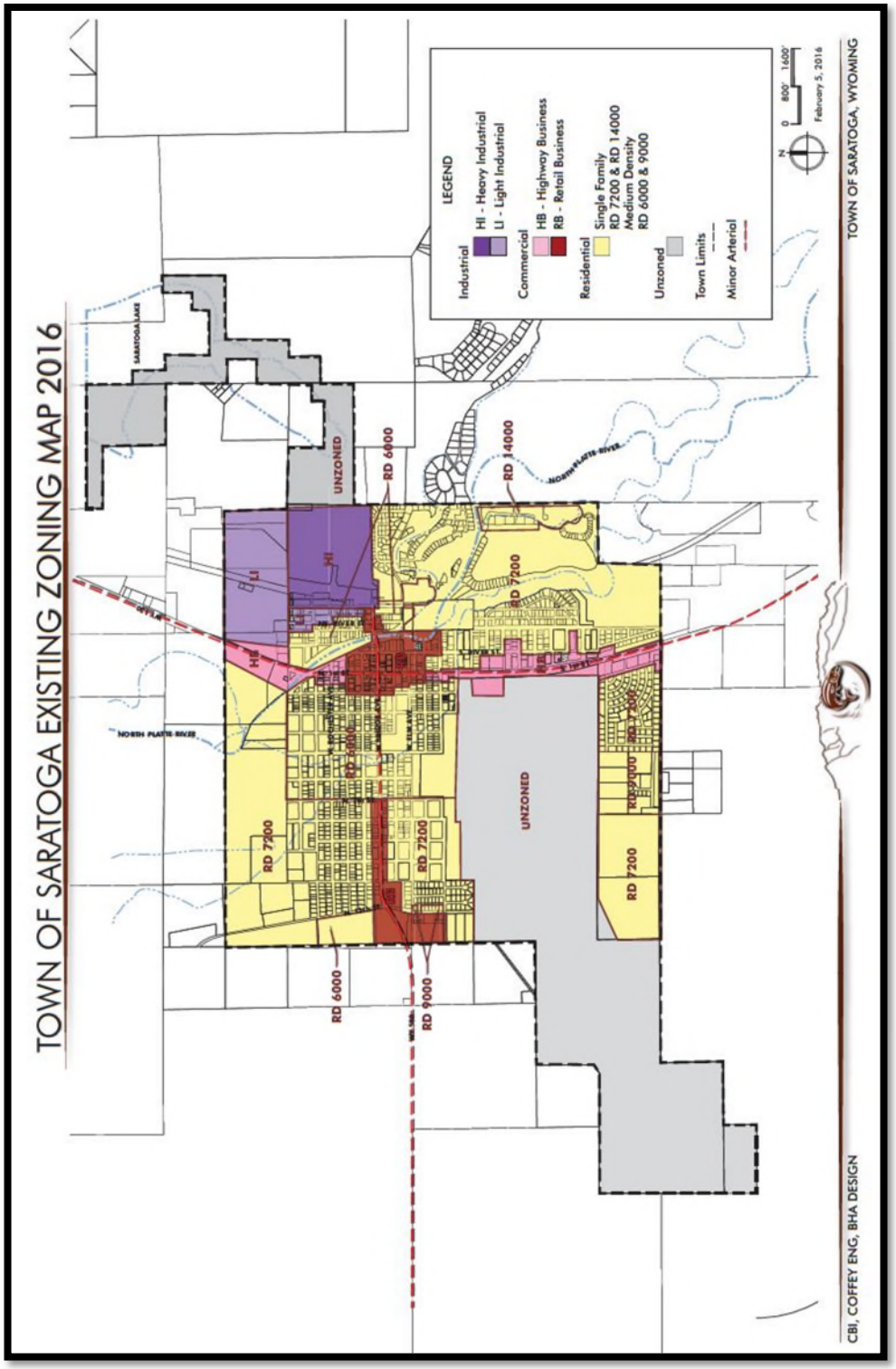


Figure 4.4 Saratoga Zoning Map

4.3 Regionalization

As part of this master plan study, regionalization was considered. Currently the Town operates as a quasi-regionalized system as such that it serves as the source supply for two independent systems (Medicine Waters Trailer Park and the Old Baldy Club). The trailer park is annexed to the Town but remains as an independent system supplied by a master meter while the club remains unannexed and served by two (2) master meter connections. Figure 4.5 below identifies the locations of those master meters and their connections to the Saratoga water system. The closest potential for additional regionalization would be, as mentioned above, the Mountain View Estates to the Northeast of Saratoga. Currently those residents operate off of individual ground water wells. Serving that area is feasible for the Saratoga system but would require sizeable infrastructure. As mentioned above, a conceptual cost estimate for the installation of transmission and distribution lines for the Mountain View Estates area is included in Section 7.1.8 for reference.

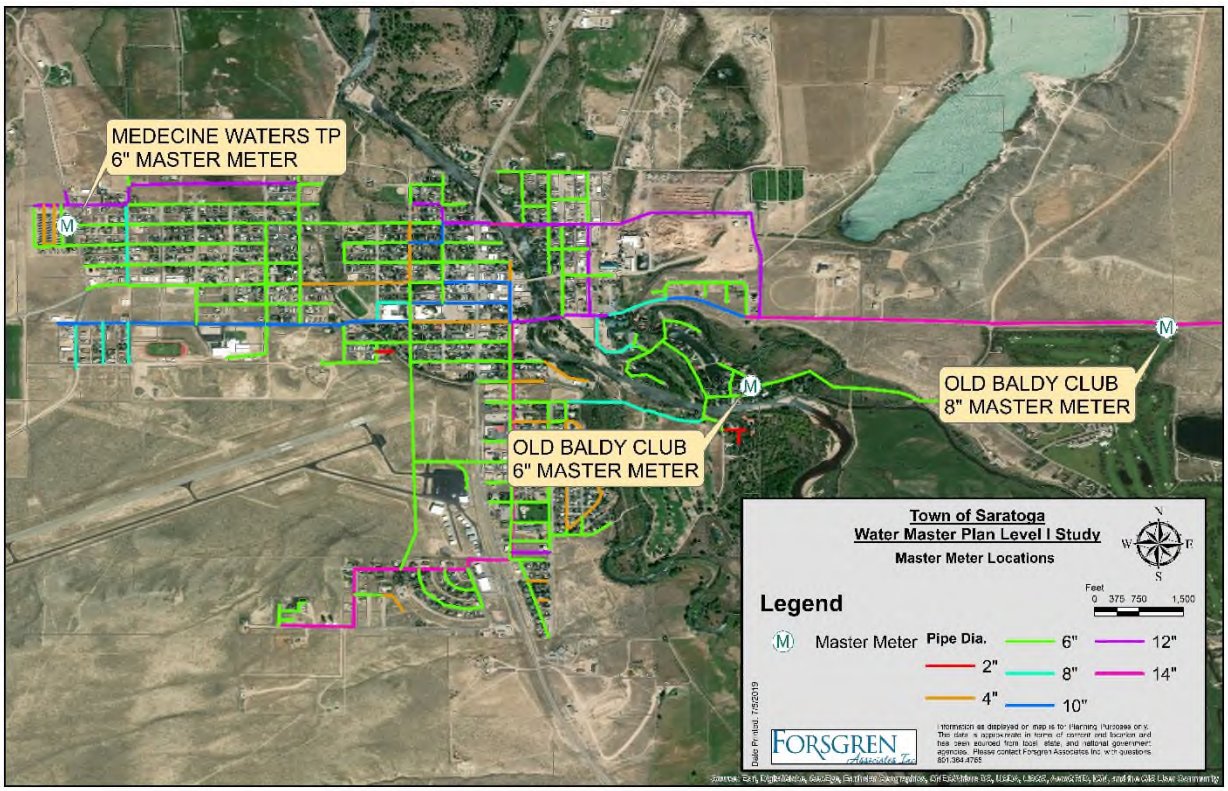


Figure 4.5 Master Meter Locations

One thing that should be considered is the amount of impact such regionalization would have compared to the cost of regionalization. Currently, there are not many residents that live in the Mountain View Estates area, as shown in Figure 4.6 below, that could help buffer the cost of regionalization.

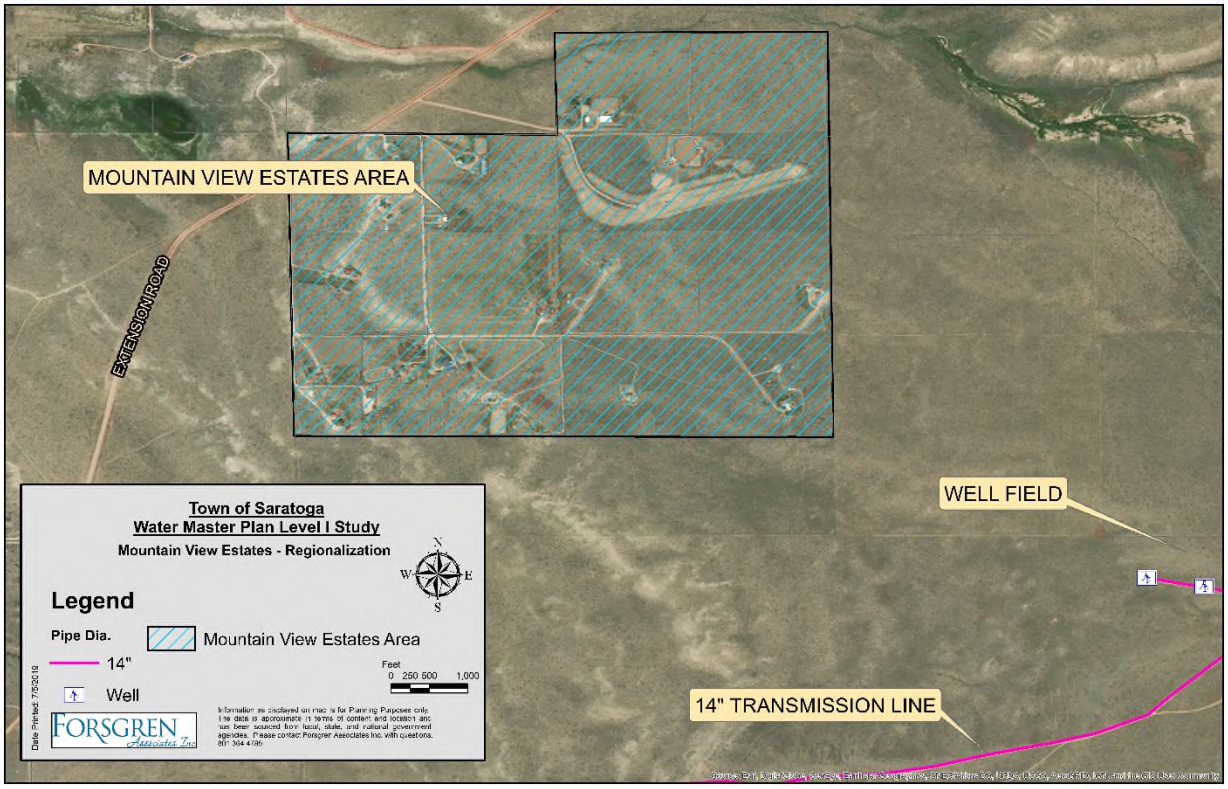


Figure 4.6 Mountain View Estates Area

4.4 Water Rights

The five (5) wells are permitted with the Wyoming State Engineers Office (SEO) for municipal use. The rights are summarized in Table 4.6 and copies of the well permits are presented in Appendix C. All five wells have a priority date of July 24, 2007 and are fully adjudicated for municipal use. The permitted maximum pumping rate for each of the wells is listed in Table 4.6. According to the Certificate Records No. U.W. 21, Pages 70 through 74 for the Saratoga wellfield wells, the appropriations for each well "in combination, allow the Saratoga Municipal Water System to pump a total quantity of 605 acre-feet of ground water on an average annual basis and a combined total quantity of no more than 756 acre-feet of groundwater in any one calendar year from its water well filed. Such average annual pumping shall be computed on the basis of ten consecutive years commencing with the calendar year 2014. The Saratoga Municipal Water System shall pump no more than 6,050 acre-feet of ground water in any ten-year period from its water well field provided, however, that the State Engineer may, pursuant to application, permit the Saratoga Municipal Water System to withdraw additional quantities of ground water."

Table 4.6 Saratoga Municipal Wellfield Water Rights Summary

SEO Permit Number	Priority Date	Source	Permitted Instantaneous Production Rate (GPM)
U.W. 183913	7/24/2007	Saratoga Well #1	200 GPM
U.W. 183914	7/24/2007	Saratoga Well #2	200 GPM
U.W. 183915	7/24/2007	Saratoga Well #3	150 GPM
U.W. 183916	7/24/2007	Saratoga Well #4	200 GPM
U.W. 183917	7/24/2007	Saratoga Well #5	175 GPM

4.4.1 Well Permit Conditions, Limitations and Conclusions:

- **Saratoga Wells -** Conditions and limitations of each of the permits for U.W. 183913, U.W. 183914, U.W. 183915, U.W. 183916 and U.W. 183917 are as follows:

1. This permit is issued subject to the terms of the Platte River Recovery Implementation Program (PRRIP) of January 1, 2007. The use of this municipal well is covered under the Platte River Recovery Implementation Program of January 1, 2007, as a Baseline No. 2 existing water related activity of municipal water use.

2. A water meter acceptable to the State Engineer is required to accurately measure the total quantity of water produced from this well.

3. The Town of Saratoga shall be subject to reporting requirements for two different entities within the State Engineer's Office for its water well field.

    a. With respect to reporting to the Ground Water Division of State Engineer's Office, an annual report shall be submitted to the State Engineer no later than February 15 of each year stating the total amount of water produced from this well each month during the previous January 1 to December 31, twelve (12) month period. The report shall identify the well by name, location, permit number and shall identify the type of meter used for the measurement.

    The report shall contain at least two (2) semi-annual measurements of the static water level in the well as measured twenty-four (24) consecutive hours after pumping has ceased. The dates the measurements were obtained and the period of time the well was "shut-in" prior to obtaining the measurements must be specified.

b. With respect to reporting for the Platte River Recovery Implementation Program, an annual report shall be submitted to this office addressed to the State Coordinator of Wyoming's Depletions Plan reporting the total amount of water produced from the well field. The report shall include monthly diversions of total municipal water use, i.e., ground water diverted from the well field and surface water diversions, and the resulting measurable effluent (return flow), if any. The report shall be submitted no later than November 1st of each year.

4. The State Engineer reserves the right, upon written request, to modify or waive all or any portion of these conditions and limitations.

Discussion with SEO staff indicate that the annual reports required in the conditions and limitations have been submitted to the North Platte River Recovery Program and the Groundwater Division staff have production reports for all of the years except 2011. In the future, the Town should report monthly water production and static water levels from each well to the Groundwater Division. A review of the volumes of water produced from the well field found that the annual production cap (605 acre-ft) has not been exceeded and that the average annual water production from 2009 to 2018 has been 485.7 acre-feet. Peak production occurred in 2013 when 549.5 acre-feet of water was produced.

4.5 Water Supply vs Sewage & Treatment

Currently the Town's sewage needs are supplied by a gravity collection system, two lift stations with force mains, a treatment plant and outfall. This treatment plant is located in the northern most portion of Saratoga as shown in Figure 4.7 below. It is not anticipated and highly unlikely that the sewage system and its treatment plant have any effect on the Water Quality of the Source Ground Water Supply from the wells as the well field is approximately 3.5 miles east of the Town.

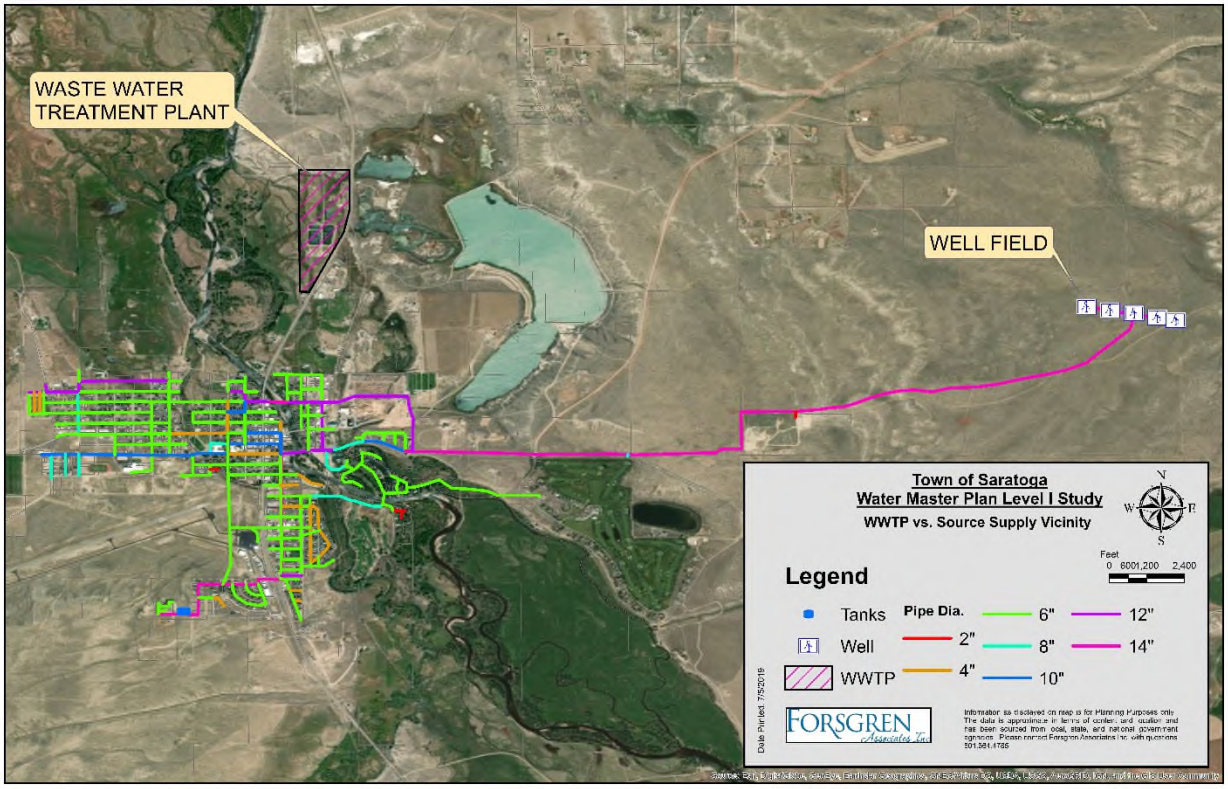


Figure 4.7 WWTP Location Map

4.6 Well Histories and Physical Yields

The Town of Saratoga water supply system is comprised of five water supply wells, a gaseous chlorine disinfection system, and two water storage tanks. The locations of the wells are provided on Figure 4.1. The water from all five wells is pumped into Saratoga's water distribution system through a 14-inch water line that connects to the system on the east side of the Town. The pumps in the wells are controlled by variable frequency drive (VFD) controls actuated by water level sensors in the tanks. The Town water system operators maintain pre-set high and low levels in the tanks that turn the well pumps on and off.

The five wells that comprise the Saratoga wellfield were drilled as a result of the Saratoga Level II project in order to replace the water treatment plant that was subsequently decommissioned after the wellfield was completed in 2009. The five wells are completed in permeable sandstones of the Tertiary North Park Formation and range in depth from 305 to 430 feet. As depicted in Figure 4.1, the wells are situated along a west-northwest to east-southeast line encompassing a distance of 2,190 feet with a spacing between each well of approximately 580 feet.

As part of this study, the five Saratoga wells were pump tested by WESTON from February 26 to 28, 2019. The testing program consisted of pumping each well individually at or near target rates of 100, 150, and 225 gallons per minute (gpm) for one hour at each rate. The pumping rates were measured using the 6-inch totalizing flow meters in the well buildings and were

controlled using the frequency settings on the variable frequency drives VFDs through the SCADA system. Water levels in the wells were monitored and recorded using the pressure transducers in the wells and airline readings were taken from each well, except Well No. 5. The airlines for Well No. 5 were frozen and not operable. The pressure transducers had significant electrical interference from the VFDs, which resulted in fluctuations in the water levels reported. The wells demonstrating the highest levels of interference were Well Nos. 2, 3, and 4. Prior to conducting the tests, the well being tested and the adjacent well(s) were not pumped for at least 12 hours to allow the water levels in the wells to recover.

Figure 4.8 – Interior Well #3 Building – Chlorine Disinfection System

4.6.1 Well Production

The Town of Saratoga water system operators have maintained records for the amount of water produced by the five wells for periods from 2009 to 2018. Table 4.7 provides a summary of the available annual well production volumes. Months with data missing from the SCADA historian are highlighted in yellow. The reported annual volume of water produced from the wells ranges from a low of 120,570,122 gallons in 2009 and a high of 179,040,329 gallons in 2013. The average annual production rates range from 330,329 gallons per day (229.4 gpm) to 490,521 gallons per day (340.6 gpm). These average daily production rates are all lower than the reported capacities of the wells.

The maximum month demand occurred in July of 2017 when a total of 29,195,907 gallons of water was produced, highlighted in red. The average daily demand during that peak month was 941,803 gallons, which equals 654 gpm. The maximum daily demand occurred on August 12, 2015 when the amount of water produced by the wells was 1,196,955 gallons, which equals 831 gpm.

Table 4.7 Town of Saratoga Well Production Data

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	AVERAGE 2009 - 2017
January	6,272,952	7,784,642	7,417,702	8,210,426	11,437,915	9,489,654	11,927,101	9,597,688	8,593,551	6,256,583	**8,970,181**
February	6,651,891	5,728,487	7,612,707	7,099,354	10,606,090	9,132,597	9,899,549	8,090,773	7,858,324	5,481,102	**8,075,530**
March	8,601,745	6,339,734	8,029,024	8,113,225	12,001,569	9,304,246	9,894,159	9,256,933	9,433,034	5,738,449	**8,997,074**
April	8,803,267	7,662,313	8,250,368	10,757,735	11,750,684	8,817,843	11,401,993	8,096,727	9,596,592	9,001,050	**9,459,725**
May	1,265,048	11,457,379	10,698,675	19,995,552	16,716,585	14,542,077	13,419,275	11,730,563	15,141,036	15,177,366	**12,774,021**
June	14,648,281	19,135,479	21,084,278	26,055,114	25,966,107	24,071,731	22,607,123	25,505,343	25,141,929	22,096,623	**22,690,598**
July	24,148,128	27,406,280	22,068,241	25,425,666	25,226,629	27,647,588	26,625,122	24,344,593	29,195,907	26,210,841	**25,787,573**
August	19,933,273	20,653,774	22,391,031	23,186,993	22,805,321	20,638,280	25,377,941	25,950,837	24,015,227	22,754,544	**22,772,520**
September	16,970,846	16,988,228	14,373,523	18,951,553	15,777,475	14,528,420	17,023,821	16,913,605	18,208,914	18,608,365	**16,637,376**
October	6,214,504	8,730,751	8,302,002	9,729,531	9,203,419	11,239,807	11,446,930	9,587,729	9,659,077	7,156,895	**9,345,972**
November	5,639,440		6,741,459	8,684,941	8,086,293	9,894,813	8,008,260	7,735,458	6,738,842	6,304,550	**6,836,612**
December	1,420,747		5,908,870	9,520,876	9,462,242	10,619,122	8,769,593	8,295,226	6,622,073	6,140,896	**6,735,417**
TOTAL	**120,570,122**	**131,887,067**	**142,877,880**	**175,730,966**	**179,040,329**	**169,926,178**	**176,400,867**	**165,105,475**	**170,204,506**	**150,927,264**	**158,267,065**
ADD	**330,329**	**361,334**	**391,446**	**481,455**	**490,521**	**465,551**	**483,290**	**452,344**	**466,314**	**413,499**	**433,608**
ACRE-FEET	**370.0**	**404.7**	**438.5**	**539.3**	**549.5**	**521.5**	**541.4**	**506.7**	**522.3**	**463.2**	**485.7**

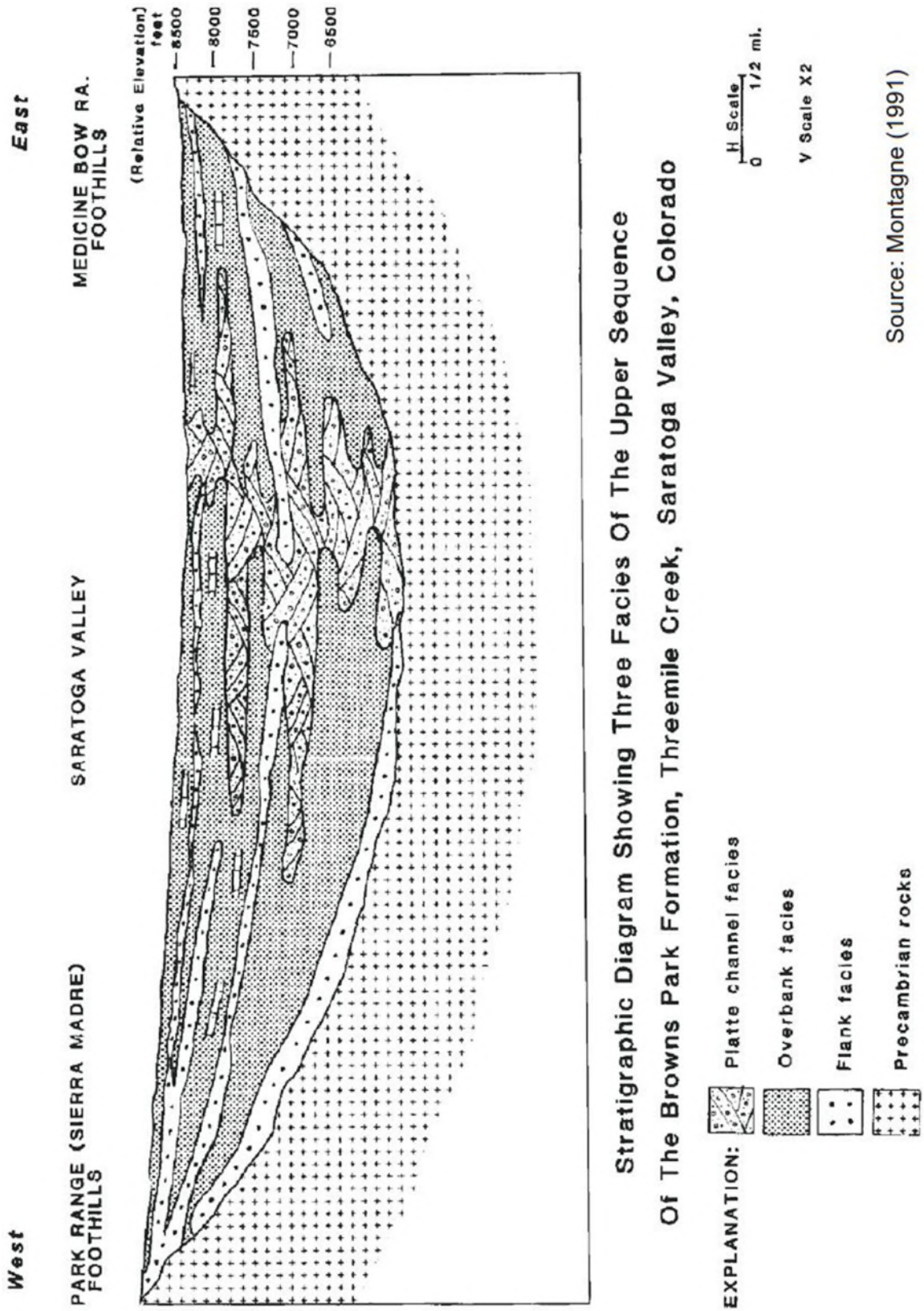
4.7 Well Construction and Pump Testing

4.7.1 Geologic Overview

The Saratoga Valley is a northwest-trending synclinal basin structure that developed during the Laramide Orogeny in Late Cretaceous time. The synclinal structure, which extends northward into Wyoming from North Park, Colorado, deepens with plunge north and south from the centrally elevated divide. According to Montagne (1991), who has extensively studied the Cenozoic history of the Saratoga Valley, periods of tectonic activity since the Laramide Orogeny have resulted in the deposition of variable sequences of Miocene-aged fluvial and alluvial deposits throughout the valley. Late Oligocene extensional deformation warped the landscape and allowed the North Platte River to establish a channel northward through the Saratoga trough. Resulting tributaries to the North Platte River deposited the coarse basal debris-flow and fluvial units of the early to middle Miocene sediments north of Saratoga. Additional tectonic activity caused the area north of Saratoga to drop, resulting in ponding and fining of the basin sediments.

The Saratoga Valley is underlain by rocks of every post-Proterozoic period except Ordovician, Silurian, and Devonian (Montagne, 1991). Precambrian rocks comprise the majority of the Medicine Bow and Sierra Madre ranges and were important source materials for later sedimentary formations. The late Tertiary (Miocene) North Park Formation covers the surface of the entire area of investigation. Lowry and others (1973) describe the North Park Formation as a separate unit from the underlying Arikaree Formation. However, Montagne (1991) termed both units as the “upper” and “lower” units of the Browns Park Formation. Crist (1990) noted a lower sandstone unit but grouped the entire Miocene sequence as a single hydrogeologic unit. Both an upper and lower unit are present in the area of this investigation and will be referred to as the North Park Formation, based on recent literature (PMPC, 2003). Because the North Park Formation is the subject of this investigation, the following discussion will focus only on that unit. Figure 4.9 provides a schematic cross section by Montagne (1991) of the North Park Formation sequence showing the stratigraphy in the Saratoga Valley.

Figure 4.9 Saratoga Valley Stratigraphy



The North Park Formation in the Saratoga Valley represents an episode of continuous deposition from early Miocene through late middle Miocene time (Montagne, 1991). North of Saratoga, the unit consists of a basal conglomerate that grades upward into a coarse cross-bedded ferruginous sandstone and siltstone. The lower North Park Formation is overlain by gray tuffaceous sandstone, siltstone, and shale, and by pastel green to brown lake bed sediments and fluvial conglomerates of the ancestral North Platte River.

As described in the Saratoga Test Well Level II Study Report (Hinckley, 2007), "the predominant material in the North Park Formation penetrated by the exploration wells is very-fine to fine-grained sandstone, commonly very weakly to weakly-cemented with thin beds of well-cemented material." It was also reported that the stratigraphy in the area is sufficiently variable that individual strata cannot be correlated across the study area and even geophysical logs for wells only a few hundred feet apart provide few clear stratigraphic correlations.

Based on drilling data gathered during the Level II study, the North Park Formation can roughly be divided between an upper section composed of higher permeability materials underlain by a lower permeability section. Because the general dip of the formation is eastward, the low permeability section is at depth in the Saratoga wellfield and is present at the surface near Saratoga Lake, located approximately two miles west of the wellfield. It was observed that the coarsest and cleanest sands in the North Park Formation were encountered in the shallowest portions of the boreholes and in some cases the highest permeability sandstones were present above the water table. In general, the increasing silt and clay content was observed at depths ranging from 260 feet to 410 feet from west to east across the wellfield.

The full thickness of the North Park Formation in the study area is unknown. The formation thins to zero against outcrops of the underlying granitic rocks within 3 to 4 miles south and east, respectively of the wellfield. Although thickness contours provided by Crist (1990) indicate an estimated thickness of 500 feet, the 2003 monitoring well drilled as part of the Saratoga Level II Study drilled to 810 feet without encountering the bottom of the Formation.

4.7.2 Hydrogeologic Overview

Based on data summarized by Crist (1990), groundwater in the North Park Aquifer generally moves from recharge areas in the mountains east and west of the Town of Saratoga, converging on the North Platte River, a major discharge point. In the immediate vicinity of the Saratoga wellfield, which is located east of the North Platte River, groundwater flows from east to west. Irregularities in the contour spacing are likely a result of the variability in permeability distribution within the formation materials.

Due to the complex nature of the sediments that comprise the North Park Formation, permeability and groundwater quality are highly variable, producing well yields of over 1,000 gpm of high-quality groundwater developed by irrigation wells located approximately five miles north of the Saratoga wellfield along Lake Creek. These high-production wells produce water from a localized high permeability sandstone that is not present throughout the study area. In contrast, the area near Saratoga Lake, located a few miles west of the study area is characterized by domestic wells that produce less than 10 gpm of poor-quality water.

The location for the Saratoga wellfield was selected based on the apparent trend of better quality water in the North Park Aquifer east of the Town of Saratoga, sufficient saturated thickness of permeable sandstone units, lack of interference with other nearby wells that are completed in the North Park Aquifer, and relatively close proximity to the Town of Saratoga water supply system infrastructure.

Based on data collected from the monitoring program for the 2006 long-term pumping tests, the transmissivity of the North Park Aquifer in Saratoga Well No. 4, obtained from data gathered during the 13-day pumping test, was approximately 25,000 gpd/foot with a specific yield of approximately 0.03. The transmissivity of the North Park Aquifer near the Saratoga Well No. 1, determined from data obtained from the 8-day pumping test, was approximately 11,000 gpd/foot with a specific yield of approximately 0.04.

4.7.3 Saratoga Well #1

Well Drilling and Construction Data: Well No. 1, which is located at the western end of the wellfield, approximately four miles northeast of the Town of Saratoga, was drilled and constructed in 2006 by Kelley Dewatering and Construction. The well was drilled as part of the Level II test well program as the 2006 Site No. 2 Test Well (U.W. 174666). Construction details for Well No. 1 from the Statement of Completion (WSEO Form U.W.6) are provided in Table 4.8 and on Figure 4.10.

The Statement of Completion for Well No. 1 reports that the well has a total depth of 305 feet and is completed with 7-inch steel casing to a depth of 305 feet with 0.050-inch wire wrap screens placed from 100 to 170 feet; 200 to 215 feet; and 278 to 293 feet.

Hinckley (2007) provides a detailed lithologic log for Well No. 1 in the Level II project report. The lithologic and geophysical logs were used to identify sandstones for placement of screens in the well. The Statement of Completion and well construction report for Well No. 1 reports that brown and green very fine grained sandstone was encountered from 60 feet to the total depth of the borehole. The well screens are gravel packed using 8X12 Colorado Silica sand from 35 to 305 feet and Portland neat cement was tremied into the borehole annulus from 35 feet to the

ground surface. The static water level when the well was completed was 62 feet. Well No. 1 is equipped with a Grundfos 230S300-9 submersible pump set with the intake at a depth of 224 feet.

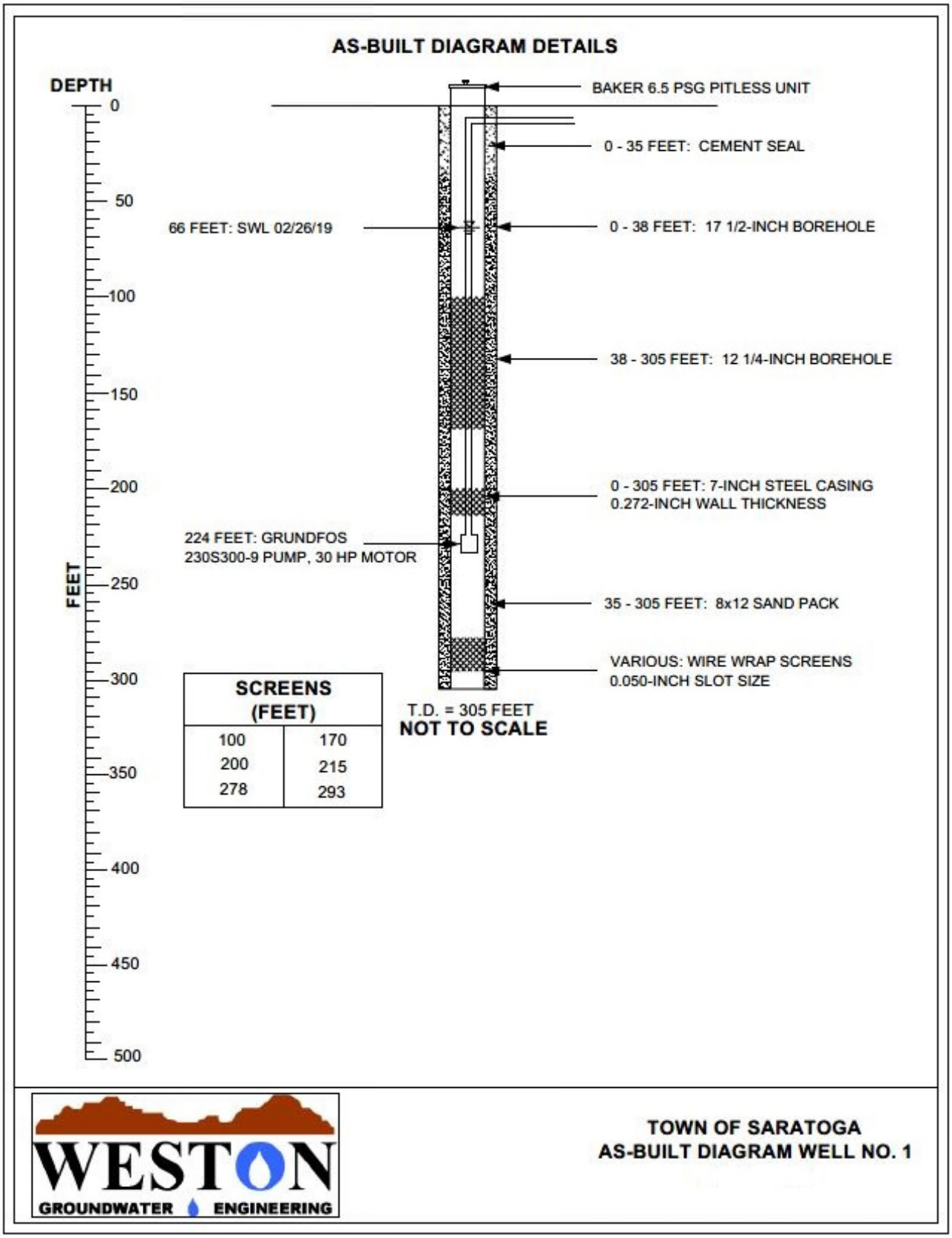


Figure 4.10 Well #1 As-Built

2006 Pump Testing: The Level II report summary for Well No. 1 reports that step-rate tests and recovery and a constant-rate test and recovery were performed in October, 2006. The step-rate test was performed with five steps of increasing pumping rates with a duration of 30 minutes per step conducted on October 9, 2006. On October 23, 2006, a higher capacity pump was installed in the well for additional step testing at rates of 150, 250, and 330 gpm. The pumping rates, drawdown, and specific capacity derived from the data are summarized in Table 4.9. The specific capacity for a well is calculated by dividing the pumping rate by the drawdown in the well at the end of each step and the units are gallons per minute per foot of drawdown (gpm/foot). The values are used to determine the efficiency of the entry of water into the wells. A 100-percent efficient well will allow the entry of water through the screens under laminar conditions and the specific capacity will remain the same under normal conditions. However, if the well screens are plugged, the production intervals are dewatered, or the pumping rate exceeds the capacity of the aquifer then at higher pumping rates the specific capacity will decline. Step-rate test results can be compared to earlier tests to determine if the specific capacity has decreased over time. As shown on Table 4.9, the specific capacity values at the lower pumping rates ranged between values of 2.0 and 4.99 gpm/foot of drawdown. The specific capacity values at higher rates decreased significantly, likely due to head loss as groundwater is forced to move more quickly into the wellbore. In addition, at the highest discharge rates, the upper well screens are being dewatered, reducing the saturated thickness of the aquifer. The 30-minute steps were likely influenced by the effects of casing storage, resulting in slightly elevated specific capacity values compared to a typical 60-minute step.

A 185-hour constant rate pump test was conducted at a rate of 200 gpm from October 10 to October 18, 2006 with a maximum drawdown of 64 feet. The specific capacity computed from the long-term test was 3.13 gpm/foot of drawdown. The aquifer's transmissivity, as determined from the late-time drawdown data from Well No. 1 by Hinckley (2007), is 11,000 gallons per day per foot (gpd/foot).

Table 4.8 Saratoga Well #1 Summary

SEO Permit:	U.W. 183913, 200 gpm
Location:	NW NE Section 9, Township 17 North, Range 83 West, 6th P.M. Latitude: 41.46583°, Longitude: -106.73555°
Surface Elevation:	6,929 feet, AMSL
Total Depth Drilled:	305 feet
Completed Depth:	305 feet
Geologic Formation:	0 – 305 feet: North Park Formation
Hole Diameter:	0 – 38 feet: 17 1/2 inches 38-305 feet: 12 1/4-inches
Casing:	+2- 305 feet: 7-inch steel casing, 0.272-inch wall
Production Intervals:	Wire wrap screens: 100-170, 200-215, and 278-293 feet (0.050-inch slot)
Grout Seal:	0 – 35 feet: Portland neat cement
Filter Pack:	35 – 305 feet: 8X12 sand
Static Water Level:	62 feet below ground level (January 13, 2009) 66 feet below ground level (February 26, 2019)
Well Development Time:	7 hours, 20 minutes
Air Line & Transducer Setting:	217 feet
Completion Date:	January 13, 2009 (pump installation)
Testing Information:	330 gpm for 0.5 hours with 160 feet drawdown 200 gpm for 192 hours with 64 feet drawdown
Pump Information:	Grundfos 230S300-9, 30 HP motor, intake set at 224 feet 3-inch black steel pump column pipe #8 AWG pump cable
Contractor:	Kelley Dewatering & Construction Company, Wyoming, MI

Table 4.9 Saratoga Well #1 – 2006 Step-Rate Pumping Test Summary

Test Date	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/foot)
1/9/2006	21	4.57	4.53
10/9/2006	40	8.1	4.99
10/9/2006	76	17.52	4.35
10/23/2006	150	31.39	4.78
10/9/2006	153	37.27	4.11
10/10/2006	200	50.74	3.94
10/9/2006	230	65.99	3.49
10/23/2006	250	67.69	3.69
10/23/2006	300	150.31	2.0
10/23/2006	330	160.24	2.1

2019 Pump Testing: As shown in Table 4.10, Saratoga Well No. 1 was tested at rates of 100, 150, and 223 gpm for a period of 60 minutes for each step on February 26, 2019. The test data is provided in Appendix E. The results of testing of Well No. 1 indicate that the well loses efficiency with increased pumping rates, with a loss of 0.87 gpm/foot between the 100 and 223 gpm rates, or 21.4 percent. The decrease in specific capacity appears to be the result of dewatering of well screens and associated turbulent flow of water into the well and is shown graphically on Figure 4.11 as the data plots significantly to the right of the line with a slope of one. Comparison of the 2019 data to the drawdown of 58.65 feet measured 60 minutes into the long-term test in 2006 suggests that the specific capacity of the well has decreased by approximately 15.6 percent over the 13-year period. Based on the finding of significant volumes of sand in Saratoga Well No. 3, it is possible that Well No. 1 could have sand covering the lower screens.

During the February 26, 2019 test, the 100-gpm pumping rate dewatered 13.5 feet of the 20-foot long upper screen. The entire 20-foot long screen was dewatered at the 148 and 222 gpm pumping rates. Water from the well had rust flakes at 100 and 150 gpm steps and when the

water level on the transducer was less than 83.6 feet (pumping water level of 133 feet) the water produced from the well was infused with air at the 222 gpm rate.

Table 4.10 Saratoga Well #1 – February 26, 2019 Step-Rate Test Summary

PUMPING RATE (GPM)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FOOT)
100	24.7 (transducer) 25.4 (airline)	4.05 (transducer) 3.94 (airline)
150	38.4 (transducer) 38.1 (airline)	3.91 (transducer) 3.93 (airline)
223	70.2 (transducer)	3.18 (transducer)

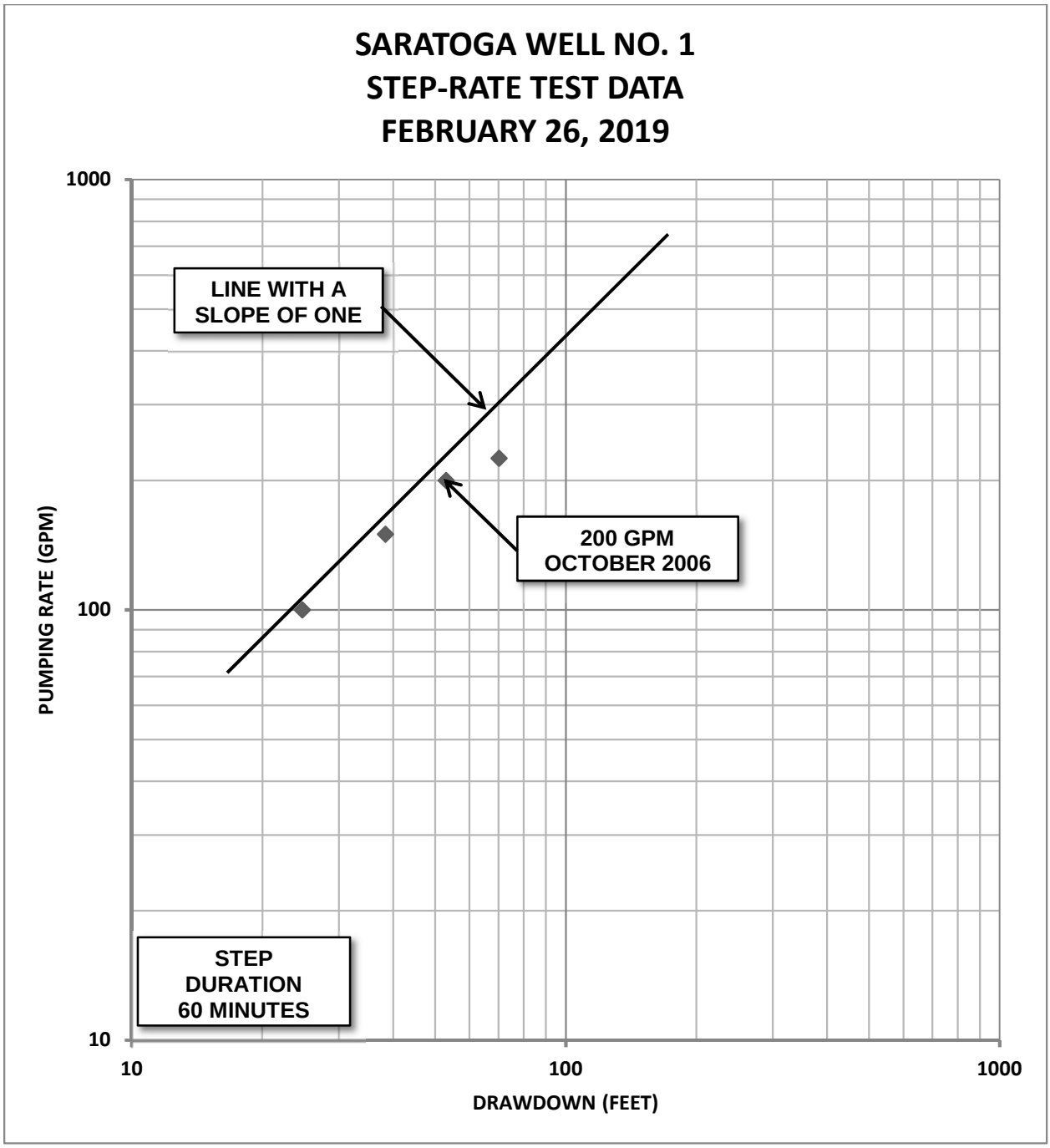


Figure 4.11 Well #1 2019 Step Rate Test

4.7.4 Saratoga Well #2

Well Drilling and Construction Data: Well No. 2, which is located approximately 580 feet east-southeast of Well No. 1, was drilled and constructed during 2008 and 2009 by Kelley Dewatering and Construction, of Wyoming, Minnesota. Construction details for Well No. 2 from the Statement of Completion are provided in Table 4.11 and on Figure 4.12.

The Statement of Completion for Well No. 2 reports that the well has a total depth of 352 feet and is completed with 7-inch steel casing to a depth of 352 feet with 0.050-inch wire wrap screens placed from 140 to 180 feet; 200 to 250 feet; 280 to 300 feet; and from 320 to 350 feet.

The Statement of Completion and well construction report for Well No. 2 reports that the entire borehole penetrated thinly-bedded strata of the North Park Formation, consisting of a buff-light gray, loose to moderately indurated very fine to fine grained sandstone. The well screens are gravel packed using 8X12 Colorado Silica sand from 35 to 352 feet and Portland neat cement was tremied into the borehole annulus from 35 feet to the ground surface. The static water level when the well was drilled was 78 feet. Well No. 2 is equipped with a Grundfos 230S300-9 submersible pump and 30 HP Franklin motor with the pump intake set at a depth of 245 feet.

Table 4.11 Saratoga Well #2 Summary

SEO Permit:	U.W. 183914
Location:	NW NE Section 9, Township 17 North, Range 83 West, 6th P.M. Latitude: 41.46553°, Longitude: -106.73347°
Surface Elevation:	6,953 feet, AMSL
Total Depth Drilled:	352 feet
Completed Depth:	352 feet
Geologic Formation:	0 – 352 feet: North Park Formation
Hole Diameter:	0 – 352 feet: 12 1/4-inches
Casing:	+2 – 352 feet: 7-inch steel casing, 0.272-inch wall
Production Intervals:	Wire wrap screens: 140-180, 200-250, 280-300, and 320-350 feet (0.050-inch slot)
Grout Seal:	0 – 35 feet: Portland neat cement
Filter Pack:	35 – 352 feet: 8X12 sand
Well Development Time:	16 hours
Static Water Level:	78 feet below ground level (January 13, 2009) 73.4 feet below ground level (February 26, 2019)
Air Line & Transducer Setting:	238 feet
Completion Date:	January 13, 2009 (pump installation)
Testing Information:	40 gpm for 0.5 hours with 8.4 feet drawdown 350 gpm for 23 hours with 23 feet drawdown
Pump Information:	Grundfos 230S300-9, 30 HP, intake set at 245 feet 3-inch black steel pump column pipe #8 AWG pump cable
Contractor:	Kelley Dewatering & Construction Company, Wyoming, MI

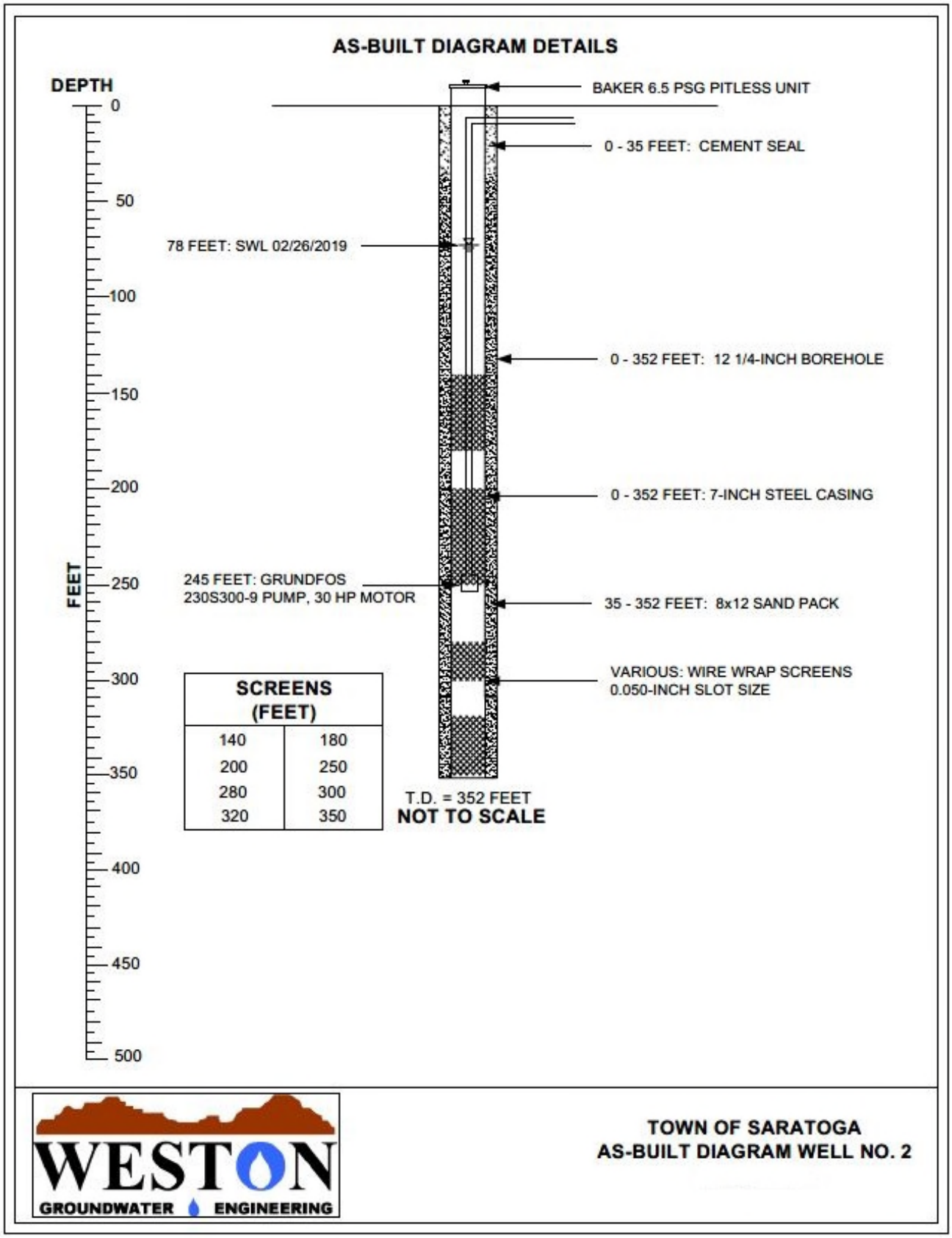


Figure 4.12 Well #2 As-Built

2008 Pump Testing: According the Statement of Completion, Well No. 2 was pump tested at a rate of 350 gpm for a period of 23 hours with a maximum drawdown of 116 feet in October 2008. No records were found for step-rate testing of Well No. 2. The aquifer's transmissivity, as determined from the late-time drawdown data from Well No. 2, is 11,000 gpd/foot with a specific capacity of 3.02 gpm/foot.

2019 Pump Testing: As shown in Table 4.12, Saratoga Well No. 2 was tested at rates of 97, 142, and 221 gpm for a period of 60 minutes for each step on February 26, 2019. The test data is provided in Appendix E. The specific capacity values provided in Table 4.12 indicate that the entrance of water into the well becomes more inefficient at higher pumping rates, with a loss of 0.89 gpm/foot between the 97 and 221 gpm rates. The difference in the specific capacity between these pumping rates is 20 percent. The specific capacity from the drawdown 60 minutes into the 2008 24-hour test was 3.38 gpm/foot. The specific capacity from the 2008 24-hour test conducted at 350 gpm is slightly less than the value from the 221 gpm step and plots along a trend line of the February 2019 data on a log-log plot, as shown on Figure 4.13. The trend suggests that the well has not lost efficiency over time.

Rust flakes were observed in the water from Well No. 2 during the 150 gpm step and the well produced sand at the 221 gpm step. Six feet of the uppermost well screen in Well No. 2 was dewatered at the 221 gpm step. No air was observed in the water during the testing.

Table 4.12 Saratoga Well #2 – February 26, 2019 Step-Rate Summary

PUMPING RATE (GPM)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FOOT)
97	12.1 (transducer) 21.9 (airline)	8.02 (transducer) 4.43 (airline)
142	32.4 (transducer) 35.8 (airline)	4.38 (transducer) 3.97 (airline)
221	60.9 (transducer) 62.4 (airline)	3.63 (transducer) 3.54 (airline)

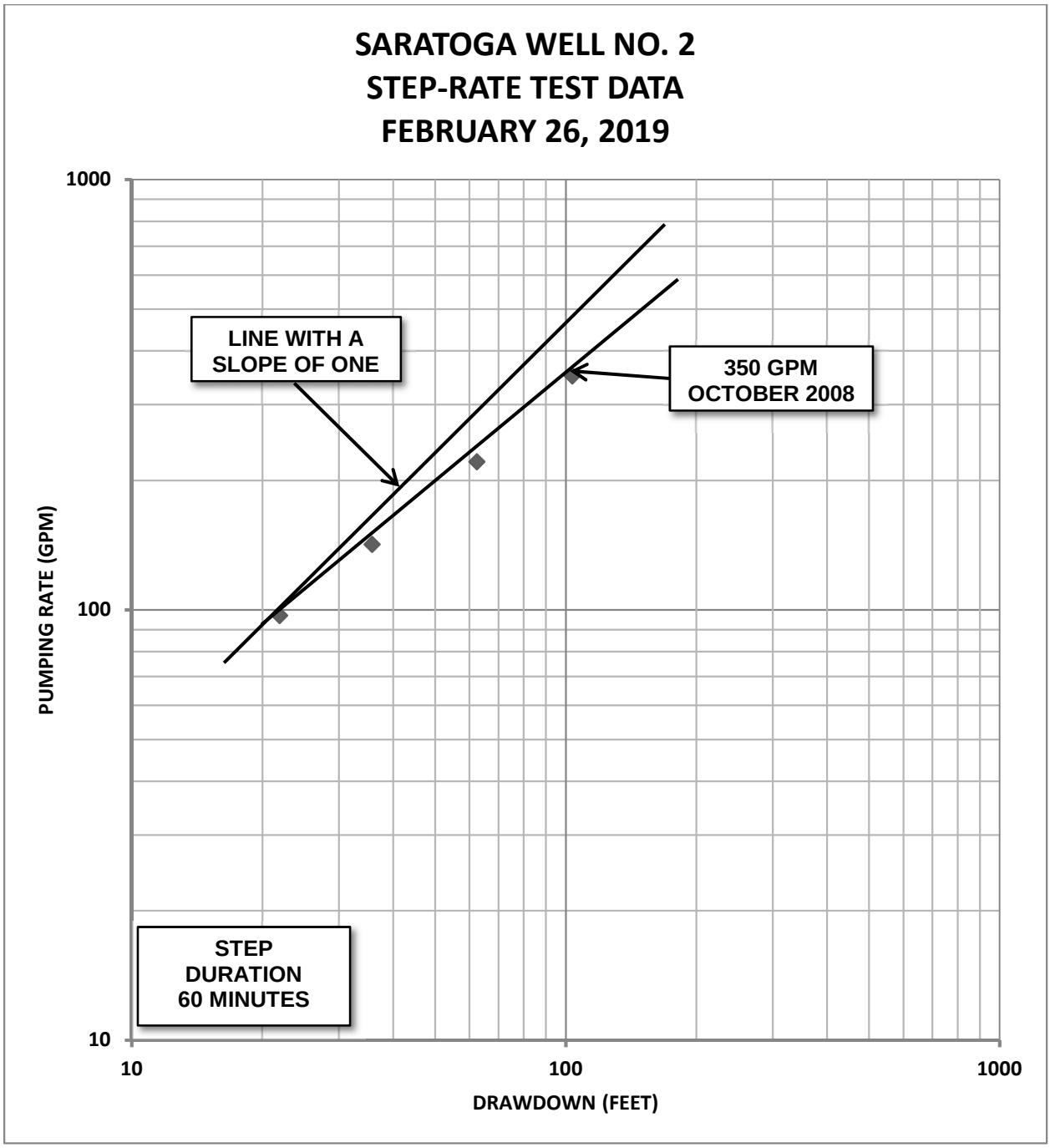


Figure 4.13 Well #2 Step-Rate Test

4.7.5 Saratoga Well #3

Well Drilling and Construction Data: Well No. 3, which is located approximately 580 feet east-southeast of Well No. 2, was drilled and constructed during 2008 and 2009 by Kelley Dewatering and Construction, of Wyoming, Minnesota. Construction details for Well No. 3 from the Statement of Completion are provided in Table 4.13 and on Figure 4.14.

The Statement of Completion for Well No. 3 reports that the well has a. total depth of 390 feet and is completed with 7-inch steel casing to a depth of 390 feet with 0.050-inch wire wrap screens placed from 135 to 150 feet; 155 to 180 feet; 187 to 197 feet; 220 to 255 feet; 280 to 290 feet; 312 to 327 feet; and 355 to 390 feet.

The Statement of Completion and well construction report for Well No. 3 indicates that the entire borehole penetrated thinly-bedded strata of the North Park Formation, consisting of a buff-light gray, loose to moderately indurated very fine to fine grained sandstone. The well screens are gravel packed using 8X12 Colorado Silica sand from 35 to 390 feet and Portland neat cement was tremied into the borehole annulus from 35 feet to the ground surface. The static water level when the well was drilled was 98 feet. Well No. 3 is equipped with a Grundfos 230S300-9 submersible pump with the intake set at a depth of 245 feet.

Table 4.13 Saratoga Well #3 Summary

SEO Permit:	U.W. 183915, 150 gpm
Location:	NE NE Section 9, Township 17 North, Range 83 West, 6th P.M. Latitude: 41.46526°, Longitude: -106.73139°
Surface Elevation:	6,972 feet, AMSL
Total Depth Drilled:	390 feet
Completed Depth:	390 feet
Geologic Formation:	0 – 390 feet: North Park Formation
Hole Diameter:	0 – 390 feet: 12 1/4-inches
Casing:	+2 – 390 feet: 7-inch steel casing, 0.272-inch wall
Production Intervals:	Wire wrap screens: (0.050-inch slot) 135-150, 155-180, 187-197, 220-255, 280-290, 312-327, and 355-390 feet
Grout Seal:	0 – 35 feet: Portland neat cement
Filter Pack:	35 – 390 feet: 8X12 sand
Well Development Time:	16 hours
Static Water Level:	98 feet below ground level (January 13, 2009) 106.7 feet below ground level (February 27, 2019)
Air Line & Transducer Setting:	238 feet
Completion Date:	January 13, 2009 (pump installation)
Testing Information:	32 gpm for 0.5 hours with 6 feet drawdown 350 gpm for 37 hours with 84 feet drawdown
Pump Information:	Grundfos 230S300-9, 30 HP motor, intake set at 245 feet 3-inch black steel pump column pipe #8 AWG pump cable
Contractor:	Kelley Dewatering & Construction Company, Wyoming, MI

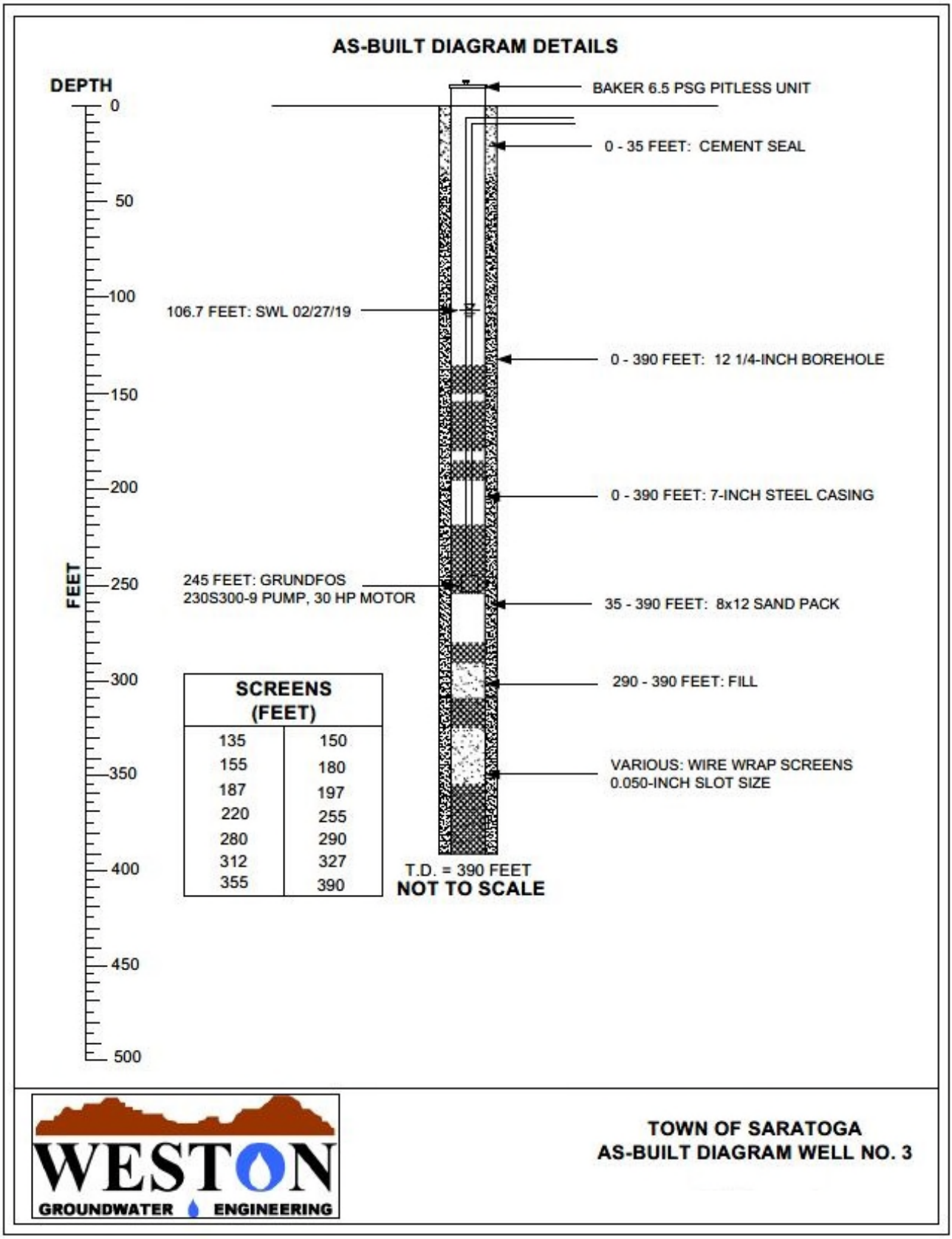


Figure 4.14 Well #3 As-Built

2008 Pump Testing: According the Statement of Completion, Well No. 3 was pump tested at a rate of 350 gpm in October 2008 for a period of 37 hours with a maximum drawdown of 84 feet. Apparent adjustments to the pumping rate affected the late-time drawdown data from Well No. 3 and prevent calculating an aquifer transmissivity.

2019 Pump Testing: As shown in Table 4.14, Saratoga Well No. 3 was tested at rates of 100, 150, and 225 gpm for a period of 60 minutes for each step on February 27, 2019. The test data is provided in Appendix E. The specific capacity values presented in Table 4.14 indicate that the entrance of water becomes slightly less efficient at higher pumping rates, with a difference of 0.24 gpm/foot between the 100 and 225 gpm rates. The difference in the specific capacity is 5.2 percent. The specific capacity from the drawdown data obtained 60 minutes into the 36-hour test conducted in 2008 was 4.86 gpm/foot. The specific capacity from the 36-hour test is 0.53 gpm/foot greater than the value from the 2019 - 225 gpm step and plots to the left of the line with a slope of one on the log-log plot on Figure 4.15. The data presented in Table 4.14 suggest that the specific capacity from Well No. 3 should decrease at higher pumping rates. The difference in the results of the 2008 pump test data and the data from the February 2019 step testing indicate that the entry of water has become less efficient during the ten years since the well was put into production with a loss of efficiency of at least 11 percent.

The 150 gpm step dewatered five feet of the 15-foot long uppermost screen and the 225 gpm step dewatered the entire 15-foot long upper screen and four feet of the second screened interval. Both rust and sand were observed in the water produced from the well during the 150 and 225 gpm steps. The flow meter stopped working and had to be cleaned during the 225 gpm step because of the production of rust flakes. No air was observed in the water produced from the well.

Table 4.14 Saratoga Well #3 – February 27, 2019 Step-Rate Test Summary

PUMPING RATE (GPM)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FOOT)
100	21.1 (transducer) 21.9 (airline)	4.74 (transducer) 4.57 (airline)
150	32.5 (transducer) 33.5 (airline)	4.62 (transducer) 4.48 (airline)
225	50.4 (transducer) 52.0 (airline)	4.46 (transducer) 4.33 (airline)

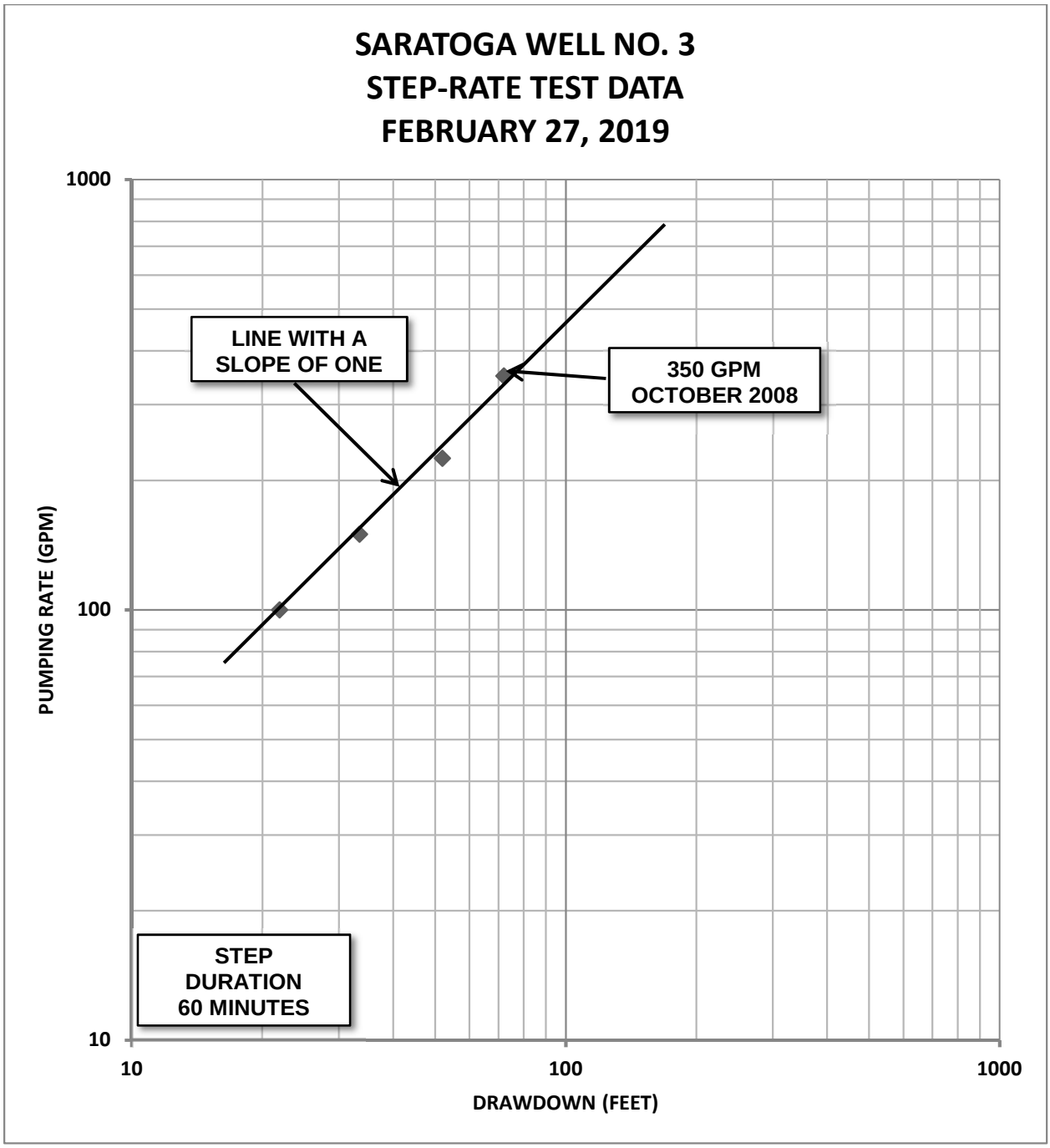


Figure 4.15 Well #3 2019 Step-Rate Test

Downhole Well Inspection: On March 8, 2019 the pumping equipment was removed from Saratoga Well No. 3 for inspection of the down-hole pumping equipment and to prepare for a video log of the well. Watson Well Service, of Laramie, Wyoming, mobilized a pump service unit to the site to perform the pump removal and subsequent re-installation.

The inspection indicated that the wellhead completion is a Baker Monitor Model 6.5PS6 pitless unit with a water-tight vented cap. The two airlines and the pressure transducer cable are contained within a conduit that extends from the top of the well and is buried between the wellhead and the pump controls and metering building. The pump cable is #8 AWG flat jacketed cable with ground wire that was strapped and taped to the pump column pipe. One scuff through the pump cable sheathing was observed at a depth of approximately 170 feet. The scuff was repaired with electrical and green vinyl pump tape.

The pump column pipe consists of eleven 21-foot long joints of 3-inch diameter black steel pipe. The total length of the pump column string is 231 feet. The top joint of the pump column pipe has two nuts welded onto it for providing a lifting point for elevators and the pump column pipe was welded to the couplings with a ¼-inch wide piece of steel which were cut off during the pump removal. Significant rust, scaling, and rusty bulbous deposits (tubercles) were present on the pump column pipe below 112 feet. The amount of pitting and turbercle development increased with depth. A deep "cut" was observed on the pump column pipe at a depth of approximately 155 feet, the result of corrosion of the steel pipe along the seam of the casing that is welded beneath a stainless steel band. The corrosion nearly penetrated the full thickness of the pump column pipe. Additional similar corrosion of the pipe along the fusion seam was observed on subsequent joints of pump column pipe, but the corrosion was not as deep. Photographs of the tubercles, scale, and corrosion are shown in the photographs presented in Figure 4.16.

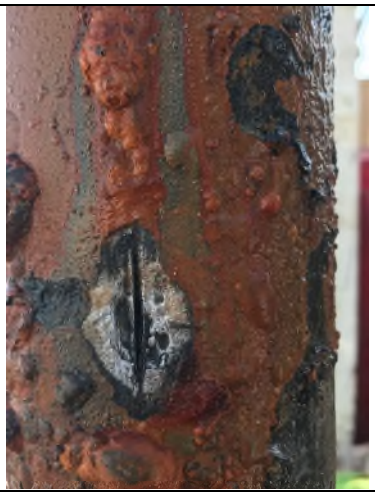
		
Scale on pump column pipe below 112 feet.	Corrosion of pipe seam and tubercles at approximately 155 feet.	Corrosion of pipe seam below 175 feet.

Figure 4.16 Well #3 Pump Column Pipe

The pump and motor are set below a Simmons 685SB 3-inch high flow check valve and a 2-foot long 3-inch joint of pipe. The pump and motor appeared to be in good working order; however, there is likely some wear of the pump impellers as a result of pumping iron scale. The pump in

all five wells is a Grundfos 230S300-9 pump with a Franklin 6-inch 30 HP, 3 phase, 460 volt motor.

The airline and transducer are housed in Schedule 80 1 ¼-inch PVC threaded pipe with an end cap. The PVC hung up on the bottom of the pitless spool receiver because it was not secured to the pump column pipe. The bottom joint of the PVC has an end cap and perforations.

Observations from the video log performed on Well No. 3 on March 19, 2019 are summarized in Table 4.15. As detailed in the table, the well casing has tubercles throughout the submerged portion of the casing. Tubercles are areas of corrosion of steel that often are precipitated by iron-related bacteria. Pitting can be observed beneath many tubercles. The well screens had rust flakes and some pieces of tubercles in them, as well as soft reddish-brown materials. The flakes and soft materials were mobilized during the removal of the pumping equipment and lodged in the screens when water was flushed down the well to help clarify the water for obtaining good video imaging.

Although the video log found no structural issues with the casing or screens, the tubercles may actually be pitting the casing. The greatest concern with the well is the 100 feet of bottom fill, which covers 50 feet of screens and prevents them from yielding water to the well.

Table 4.15 Saratoga Well #3 – Video Log Description March 19, 2019

DEPTH (FEET)	DESCRIPTION
0.0	Top of pitless adaptor.
5.5	Pitless spool receiver.
34	Camera lens fogs.
102	Water level, some tubercles on casing below water level.
113+	Increase in tubercles on casing below static water level.
136	Top of well screens.
137.4	Screen slots are filled with fine reddish-brown loose debris. Material is from removal of the pumping equipment and was pushed to the screens by the water used to clarify the video imaging; it is not plugging the screens. No sand pack visible behind uppermost screened interval.
139.5	First visible sand pack behind screens.
141	Decrease in loose debris in screens, can see sand pack clearly.
142.1	Rust flake or broken tubercle in screen.
167.4	Bottom of first screen.
167.7	Top of second screen. Rust flakes visible in the screens.
172+	Less debris in screens.
182.5	Bottom of second screen. Water is clear and casing below screen has some tubercles.
189.7	Top of third screen, screen has reddish-brown, loose debris in screens.
193	Small area of blockage of screen. Possibly clay intrusion through screen. Increase in amount of reddish-brown debris in the screens. Note: screens are open.
199	Increase in scale and small pieces of yellowish orange debris in screens.
199.6	Bottom of third screen. Casing beneath has a few tubercles.
222.9	Top of fourth screen. Rust flakes in the screens and rusty deposit plugging part of screens. Plugging is not affecting well performance.
237.8	Bottom of fourth screen and start of fifth screen.
243.9	Minor deposit on the screens.
244.2	Large rust flake or tubercle flake in screens.
246.1	Iron staining on the screen and orange deposits on the screens. Adjacent to motor setting.
247	Rusty appearance on the screen.
252+	Multiple rust flakes in the screens.
258	Bottom of fifth screen.
258+	Extensive tubercles on casing below the screens. Heaviest concentration observed in the well. Below the dynamic pumping water level zone and water is cloudy.
283	Top of sixth screen. Lot of fine sediments and minor encrustation on the screen.
290.9	Stainless steel band. Picture turns cloudy because camera encounters fill in the well. Well has 100 feet of fill.

4.7.6 Saratoga Well #4

Well Drilling and Construction Data: Saratoga Well No. 4 was originally drilled as part of the Level II test well program as the 2006 Site No. 1 Test Well (U.W. 159838). The well, which is located approximately 580 feet east-southeast of Well No. 3, was drilled and constructed in 2006 by Kelley Dewatering and Construction. Construction details for Well No. 4 from the Statement of Completion are provided in Table 4.16 and on Figure 4.17.

The Statement of Completion for Well No. 4 reports that the well has a total depth of 412 feet and is completed with 7-inch steel casing to a depth of 412 feet with 0.050-inch wire wrap screens placed from 145 to 160 feet; 185 to 215 feet; 245 to 260 feet; 285 to 305 feet; and 380 to 400 feet.

The Statement of Completion and well construction report for Well No. 4 reports that the entire borehole penetrated thinly-bedded strata of the North Park Formation, consisting of a buff-light gray, loose to moderately indurated very fine to fine grained sandstone. The well screens are gravel packed using 8X12 Colorado Silica sand from 35 to 412 feet and Portland neat cement was tremied into the borehole annulus from 35 feet to the ground surface. The static water level when the well was drilled was 100 feet. Well No. 3 is equipped with a Grundfos 230S300-9 submersible pump set at a depth of 245 feet.

2006 Pump Testing: The Level II report summary for Well No. 4 reports that step-rate tests and recovery and a constant-rate test and recovery were performed in October 2006. The step-rate test was performed with three steps at rates of 195, 300, and 408 gpm with a duration of 30 minutes per step conducted on October 24, 2006. On November 14, 2006, step-rate testing at rates of 31.5, 76.1, and 158 gpm were also conducted. The pumping rates, drawdown, and specific capacity derived from the data are summarized in Table 4.17. As shown on Table 4.17, the specific capacity values at the lower pumping rates ranged between values of 4.57 and 5.03 gpm/foot of drawdown. However, the specific capacity values at higher rates decreased, likely due to head loss as groundwater is forced to move more quickly into the well. In addition, at the highest discharge rates the upper well screens were dewatered, reducing the saturated thickness of the aquifer.

According the Statement of Completion, Well No. 4 was pump tested at a rate of 375 gpm for a period of 312 hours with a maximum drawdown of 119 feet. The transmissivity computed from the drawdown data was 25,000 gpd/foot (Hinckley, 2007). The specific capacity determined during the test was 3.15 gpm/foot and a storage coefficient of 0.03 was derived from observation well data.

Table 4.16 Saratoga Well #4 Summary

SEO Permit:	U.W. 183916, 200 gpm
Location:	NE NE Section 9, Township 17 North, Range 83 West, 6th P.M. Latitude: 41.46496°, Longitude: -106.72930°
Surface Elevation:	6,953 feet, AMSL
Total Depth Drilled:	412 feet
Completed Depth:	412 feet
Geologic Formation:	0 – 412 feet: North Park Formation
Hole Diameter:	0 – 412 feet: 12 1/4-inches
Casing:	+2 – 412 feet: 7-inch steel casing, 0.272-inch wall
Production Intervals:	Wire wrap screens: (0.050-inch slot) 145-160, 185-215, 245-260, 285-305, and 380-400 feet
Grout Seal:	0 – 35 feet: Portland neat cement
Filter Pack:	35 – 412 feet: 8X12 sand
Static Water Level:	100 feet below ground level (January 13, 2009) 106.6 feet below ground level (February 27, 2019)
Well Development Time:	5 hours
Air Line & Transducer Setting:	238 feet
Completion Date:	January 13, 2009 (pump installation)
Testing Information:	408 gpm for 0.5 hours with 112 feet drawdown 375 gpm for 312 hours with 119 feet drawdown
Pump Information:	Grundfos 230S300-9, 30 HP intake set at 245 feet 3-inch black steel pump column pipe #8 AWG pump cable
Contractor:	Kelley Dewatering & Construction Company, Wyoming, MI

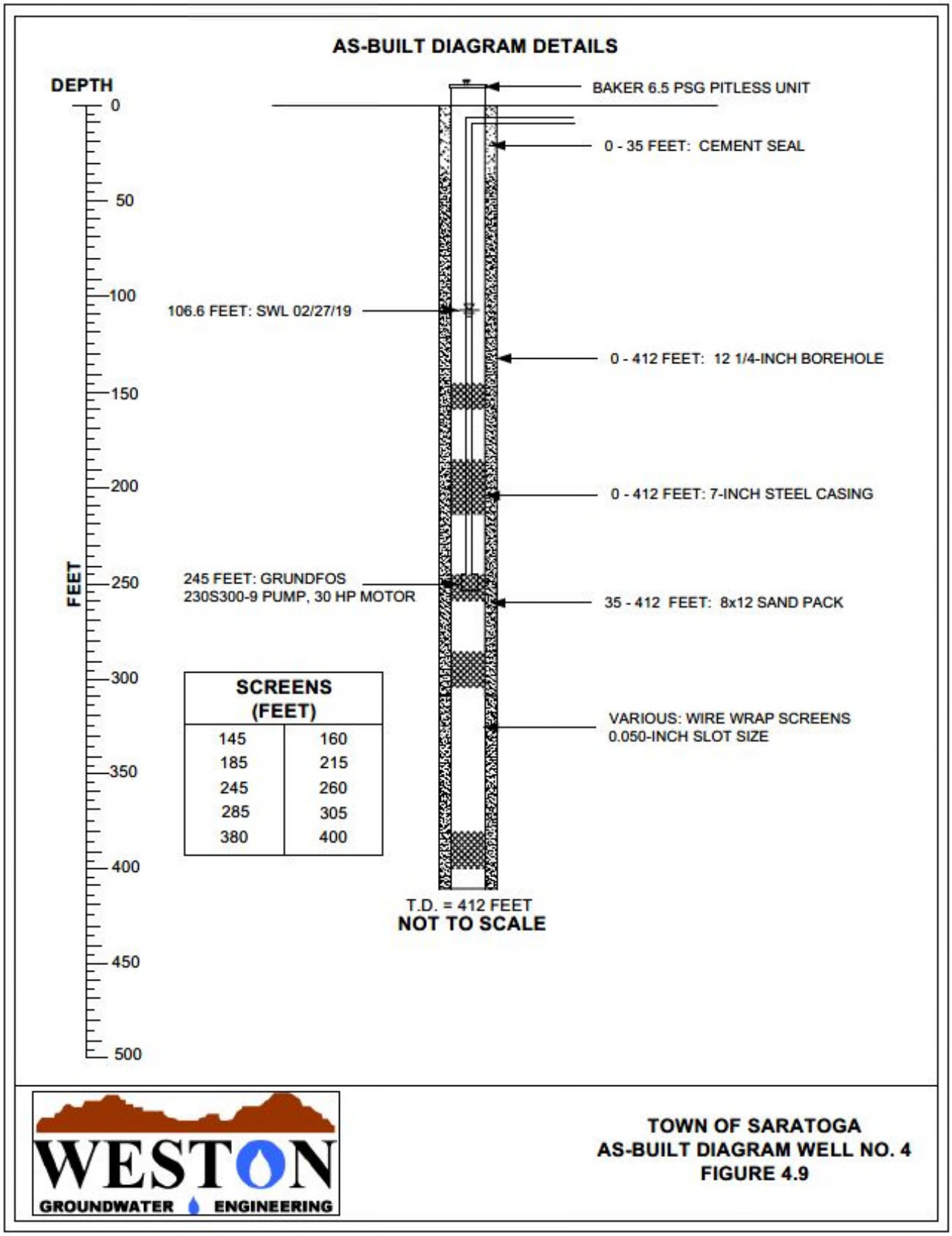


Figure 4.17 Well #4 As-Built

Table 4.17 Saratoga Well #4 – 2006 Step-Rate Pumping Test Summary

Date	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/foot)
11/14/06	31.5	6.74	4.67
11/14/06	76.1	15.17	5.03
11/14/06	158	33.71	4.69
10/24/06	195	46.28	4.21
10/24/06	300	75.76	3.96
10/24/06	408	111.91	3.65

2019 Pump Testing: As shown in Table 4.18, Saratoga Well No. 4 was tested at rates of 105, 150, and 224 gpm for a period of 60 minutes for each step on February 27, 2019. The test data is provided in Appendix E. The specific capacity values presented in Table 4.18 indicate that the entrance of water into the well becomes less efficient at higher pumping rates, with a difference of 1.04 gpm/foot between the 105 and 224 gpm rates. The difference in the efficiency is 17.1 percent. As depicted in Figure 4.18, comparison of the 2006 step-rate tests and the 2019 step-rate tests for drawdown data 30 minutes into each step, indicate that the specific capacity has increased by 0.82 to 1.27 gpm/foot over the 13-year period. It is possible that the apparent increase in the well's specific capacity is the result of additional development with continued production of water from the well. However, the 30-minute data is likely impacted by casing storage and may not be accurate.

The pumping water level in Well No. 4 during the first two steps was above the upper-most screened interval. The uppermost six feet of the 15-foot long top screen was dewatered at the end of the 224 gpm step. No sand, rust, or air was observed during the testing of Well No. 4.

Table 4.18 Saratoga Well #4 – February 27, 2019 Step-Rate Test Summary

PUMPING RATE (GPM)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FOOT)
105	17.3	6.07
150	28.3	5.30
224	44.5	5.03

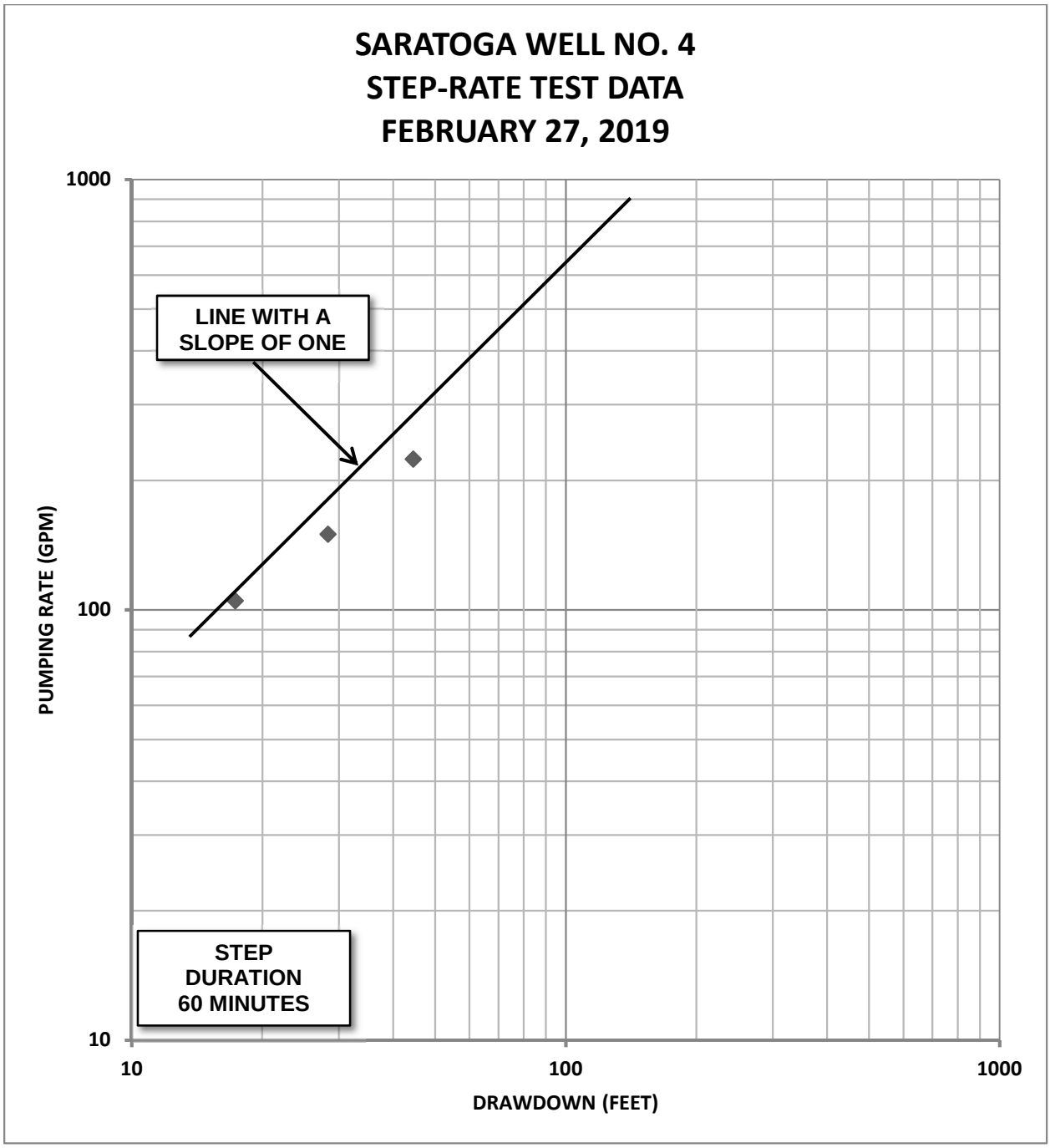


Figure 4.18 Well #4 2019 Step-Rate Test

4.7.7 Saratoga Well #5

Well Drilling and Construction Data: Well No. 5, which is located approximately 580 feet east-southeast of Well No. 4 and at the eastern end of the Saratoga wellfield, was drilled and constructed during 2008 and 2009 by Kelley Dewatering and Construction, of Wyoming, Minnesota. Well No. 5 is located 15 feet from the 2005 Test Well No. 1, which was permitted

by the SEO as U.W. 159841. Construction details for Well No. 5 from the Statement of are provided in Table 4.19 and on Figure 4.19.

The Statement of Completion for Well No. 5 reports that the well has a. total depth of 430 feet and is completed with 7-inch steel casing to a depth of 430 feet with 0.050-inch wire wrap screens placed from 110 to 130 feet; 170 to 190 feet; 245 to 275 feet; 295 to 310 feet; 320 to 330 feet; 340 to 355 feet; and 390 to 415 feet.

The Statement of Completion and well construction report for Well No. 5 reports that the borehole penetrated light brown, soft, slightly silty sandstone with increasing silts below 330 feet and the interval from 230 to 440 feet consisted of brown, soft, very fine sandy siltstone with a trace of clay. The well screens are gravel packed using 8X12 Colorado Silica sand from 35 to 430 feet and Portland neat cement was tremied into the borehole annulus from 35 feet to the ground surface. The static water level when the well was drilled was 100 feet. Well No. 5 is equipped with a Grundfos 230S300-9 submersible pump with the intake at a depth of 245 feet.

2008 Pump Testing: According the Statement of Completion, Well No. 5 was pump tested at a rate of 305 gpm for a period of 24 hours with a maximum drawdown of 112 feet. The aquifer's transmissivity, as determined from the late-time drawdown data from Well No. 5, is 23,000 gpd/foot with a specific capacity of 2.72 gpm/foot.

2019 Pump Testing: As shown in Table 4.20, Saratoga Well No. 5 was tested at rates of 100, 148, and 222 gpm for a period of 60 minutes for each step on February 27, 2019. The test data is provided in Appendix E. The specific capacity values for the 100 and 148 gpm steps for Well No. 5 are identical at 4.98 gpm/foot. However, the specific capacity decreases significantly at the 222 gpm pumping rate, or 31 percent. This decline is shown graphically by the deviation of the line with a slope of one on Figure 4.20. The specific capacity from the drawdown 60 minutes into the 24-hour test conducted in 2008 was 2.82 gpm/foot. There does not appear to be a loss in the specific capacity of Well No. 5 since it was brought online approximately ten years ago. Well No. 5 exhibits significant declines in the specific capacity of the well at higher pumping rates, likely as a result of dewatering the most productive intervals in the well.

The 100 gpm step dewatered 13.5 feet of the 20-foot long uppermost screen. Both the 148 gpm and 222 gpm steps dewatered the entire 20-foot long upper screen. Rust was observed in water from Well No. 5 at all three step rates, but no air was observed.

Table 4.19 Saratoga Well #5 Summary

SEO Permit:	U.W. 183917, 175 gpm
Location:	NE NE Section 9, Township 17 North, Range 83 West, 6th P.M. Latitude: 41.46470°, Longitude: -106.72769°
Surface Elevation:	6,988 feet, AMSL
Total Depth Drilled:	430 feet
Completed Depth:	430 feet
Geologic Formation:	0 – 430 feet: North Park Formation
Hole Diameter:	0 – 430 feet: 12 1/4-inches
Casing:	+2 – 430 feet: 7-inch steel casing, 0.272-inch wall
Production Intervals:	Wire wrap screens: (0.050-inch slot) 110-130, 170-190, 245-275, 295-310, 320-330, 340-355, and 390-415 feet
Grout Seal:	0 – 35 feet: Portland neat cement
Filter Pack:	35 – 430 feet: 8X12 sand
Static Water Level:	100 feet below ground level (January 13, 2009) 103.4 feet below ground level (February 28, 2019)
Well Development Time:	30 hours
Air Line & Transducer Setting:	238 feet
Completion Date:	January 13, 2009 (pump installation)
Testing Information:	305 gpm for 24 hours with 112 feet drawdown
Pump Information:	Grundfos 230S300-9, 30 HP motor, intake set at 245 feet 3-inch black steel pump column pipe #8 AWG pump cable
Contractor:	Kelley Dewatering & Construction Company, Wyoming, MI

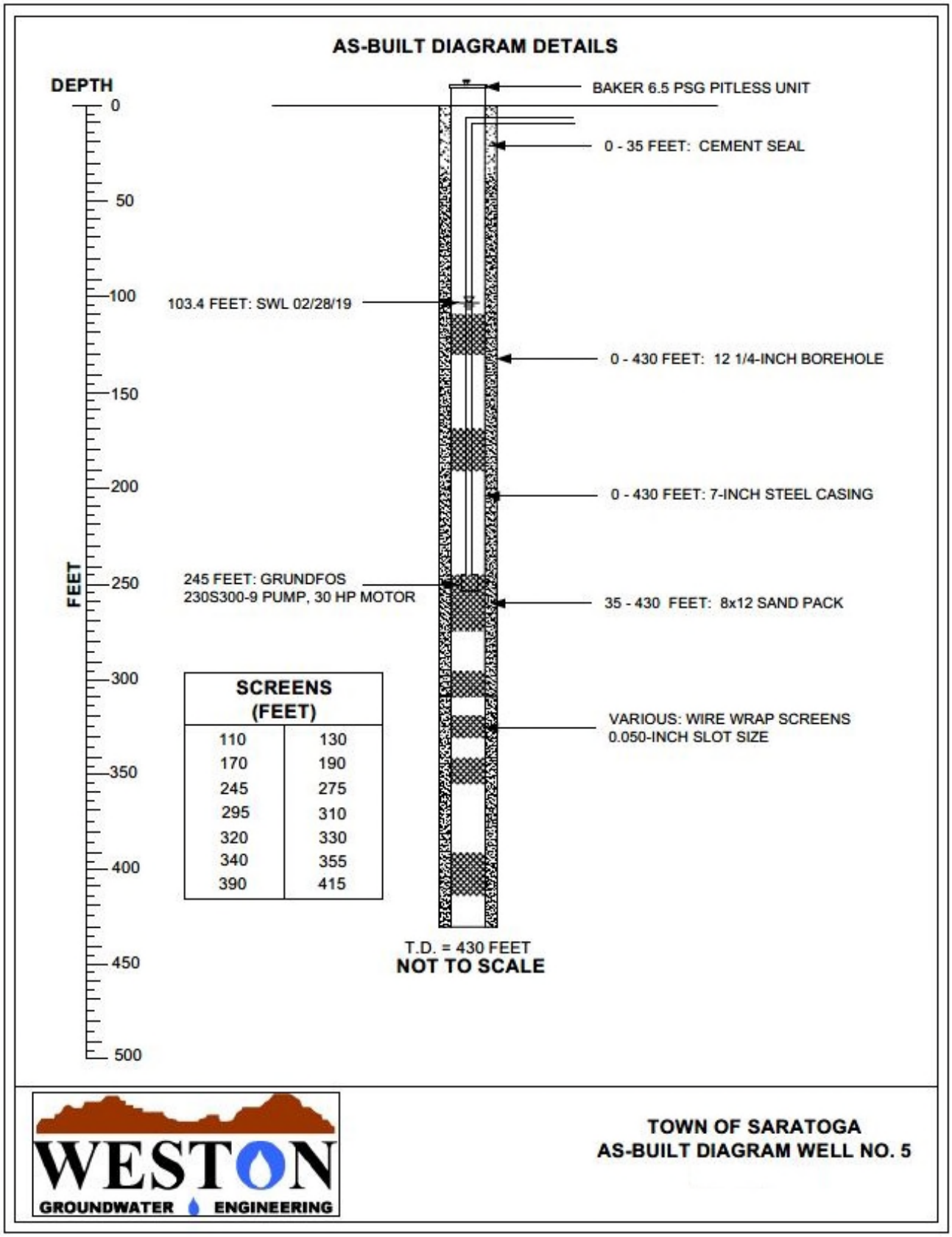


Figure 4.19 Well #5 As-Built

Table 4.20 Saratoga Well #5 – February 28, 2019 Step-Rate Test Summary

PUMPING RATE (GPM)	DRAWDOWN (FEET)	SPECIFIC CAPACITY (GPM/FOOT)
100	20.1	4.98
148	29.7	4.98
222	64.5	3.44

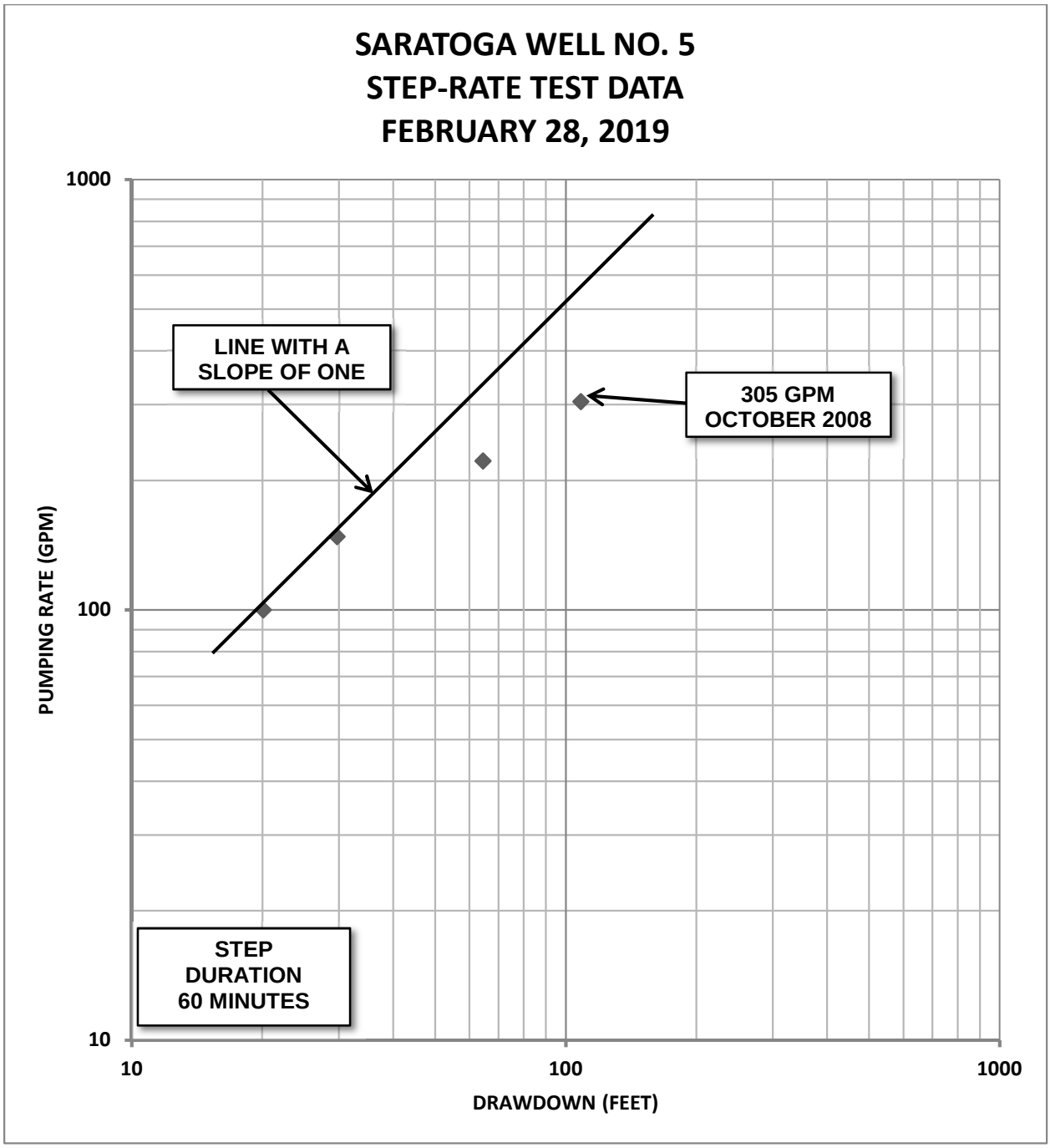


Figure 4.20 Well #5 2019 Step-Rate Test

4.8 Saratoga Monitoring Wells

During the 2006 long-term pumping tests of Saratoga Well Nos. 1 and 4, three monitoring wells associated with the Saratoga wellfield were used as observation wells to collect aquifer data. Hinckley described the monitoring wells as follows:

1) The first monitoring well, known as the Millhouse Well (SEO Permit No. P183937W) is the 2003 test well, located in T17N, R3W, Section 5, SESE. Above ground, the well consists of a 7-inch steel casing with locking cap, welded inside a 13 inch steel casing. It is accessed by an existing two-track road along the east-west fence line.

2) The second monitoring well was the former 2005 Test Well No. 1, which is located approximately 15 feet from the existing Saratoga Well No. 5. The monitoring well is permitted as SEO Permit P159841W. Above ground, it consists of a 7-inch steel casing with locking cap.

3) The third monitoring well was drilled as a companion to the 2006 Test Well No. 2, which is currently Saratoga Well No. 1. The well is permitted as P183937W and is located approximately 230 feet east-southeast of Saratoga Well No. 1. Above ground, it consists of a 4-inch PVC casing with locking cap.

Based on descriptions by the Town of Saratoga staff, the well casing in the monitoring wells was cut off below ground level, sealed with glued PVC caps, and buried. The buried wells are marked by T-posts. Because water levels in the municipal wells are continuously monitored by the SCADA system, it is our opinion that the monitoring wells are not needed and should be plugged and abandoned.

4.9 Saratoga Wellfield Water Level Trends

The depth of water over the pressure transducers in the Saratoga municipal wells is recorded by the SCADA system as a four-hour average. The water levels in the five Saratoga wells using the SCADA data were converted to depth to water below ground level and plotted for 2018 in Figures 4.21 through 4.25. The depth to water data presented in the figures is near continuous data, representing static and pumping conditions. The figures also show depth to the top of the screened intervals (red blocking) in each well to visually demonstrate when screens are dewatered. Data from the wells from 2012 through 2018 are presented in plots in Appendix F.

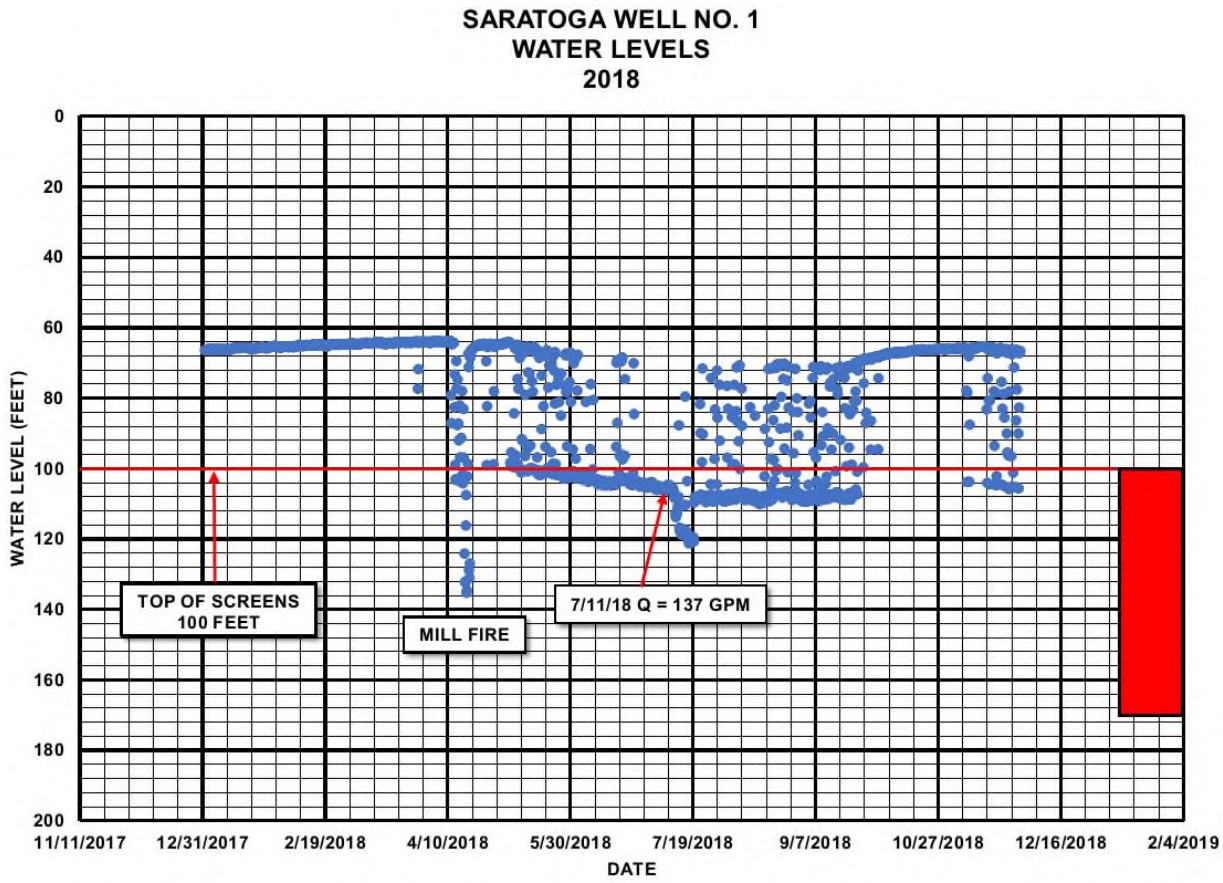


Figure 4.21 Well #1 2018 Water Level Summary

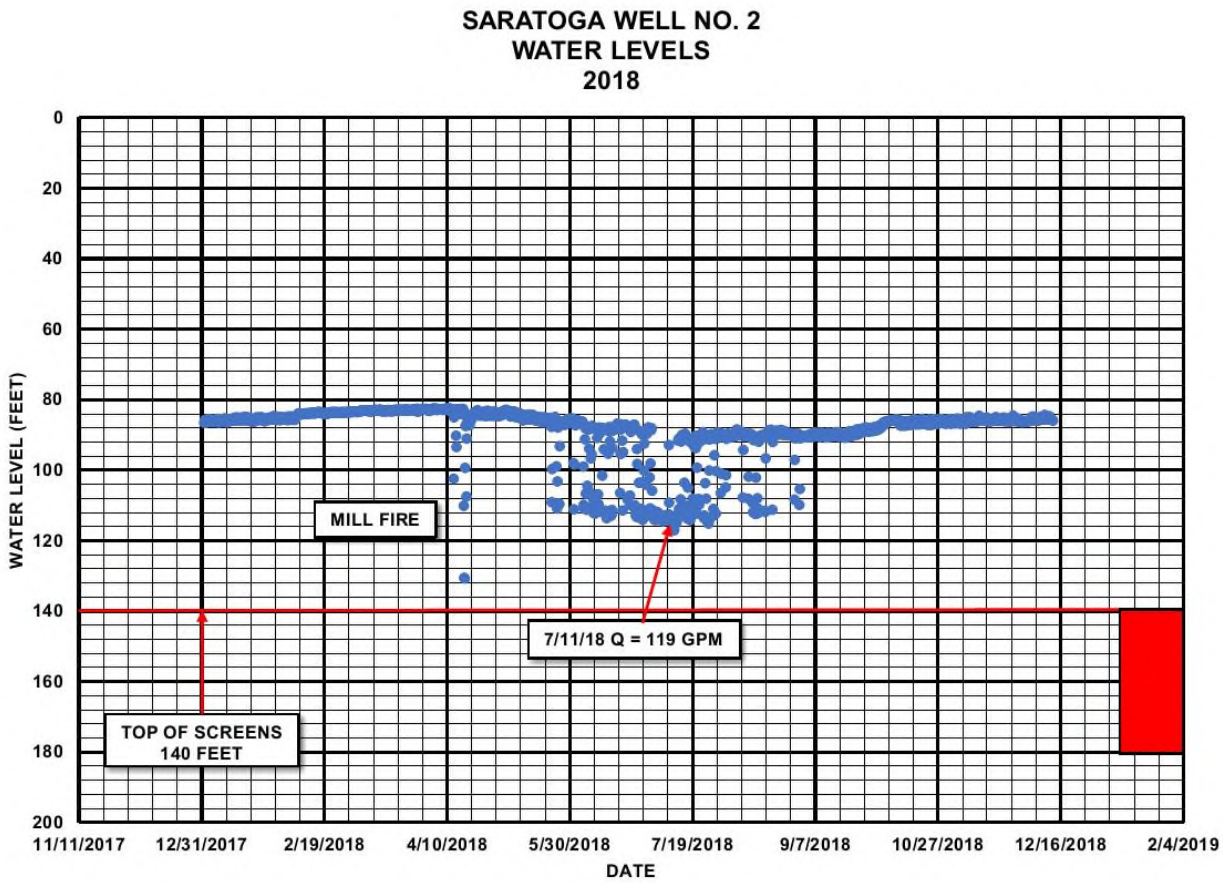


Figure 4.22 Well #2 2018 Water Level Summary

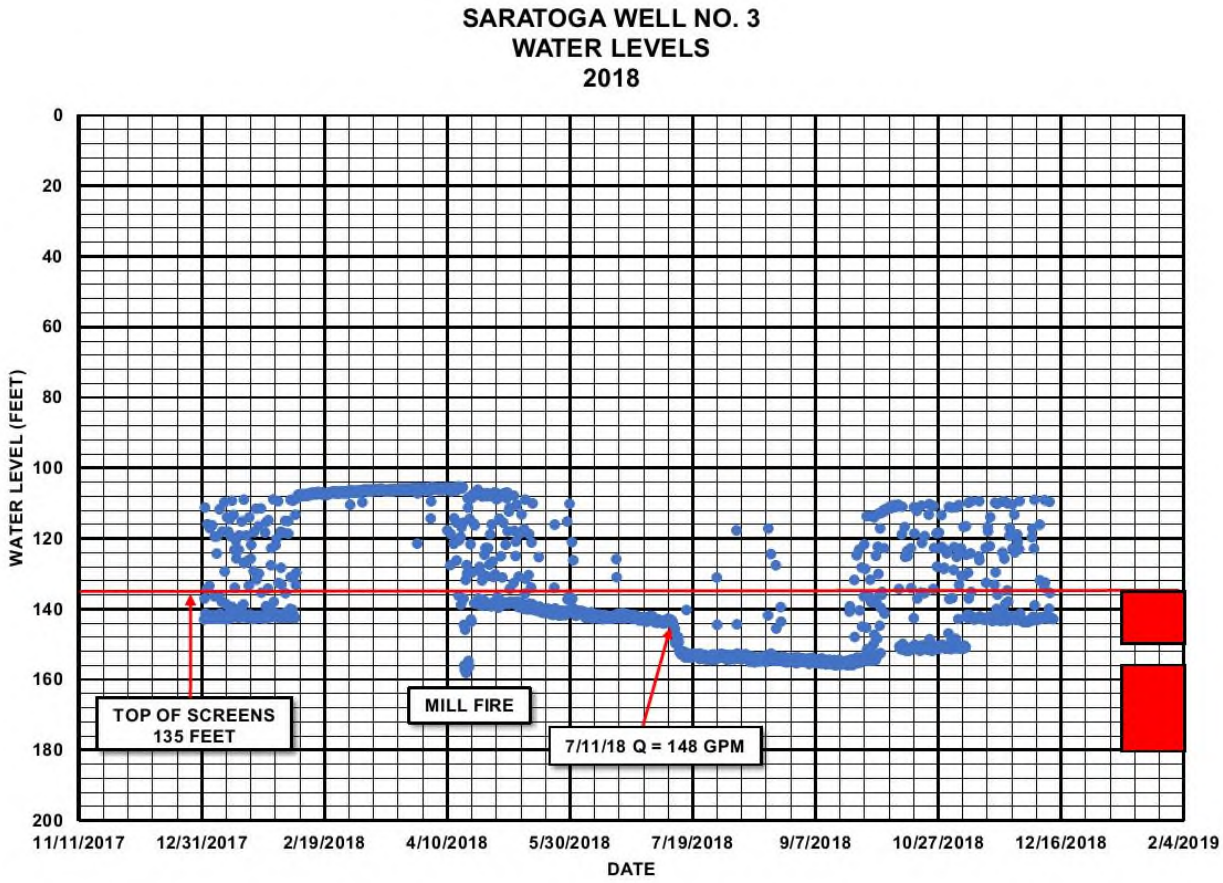


Figure 4.23 Well #3 2018 Water Level Summary

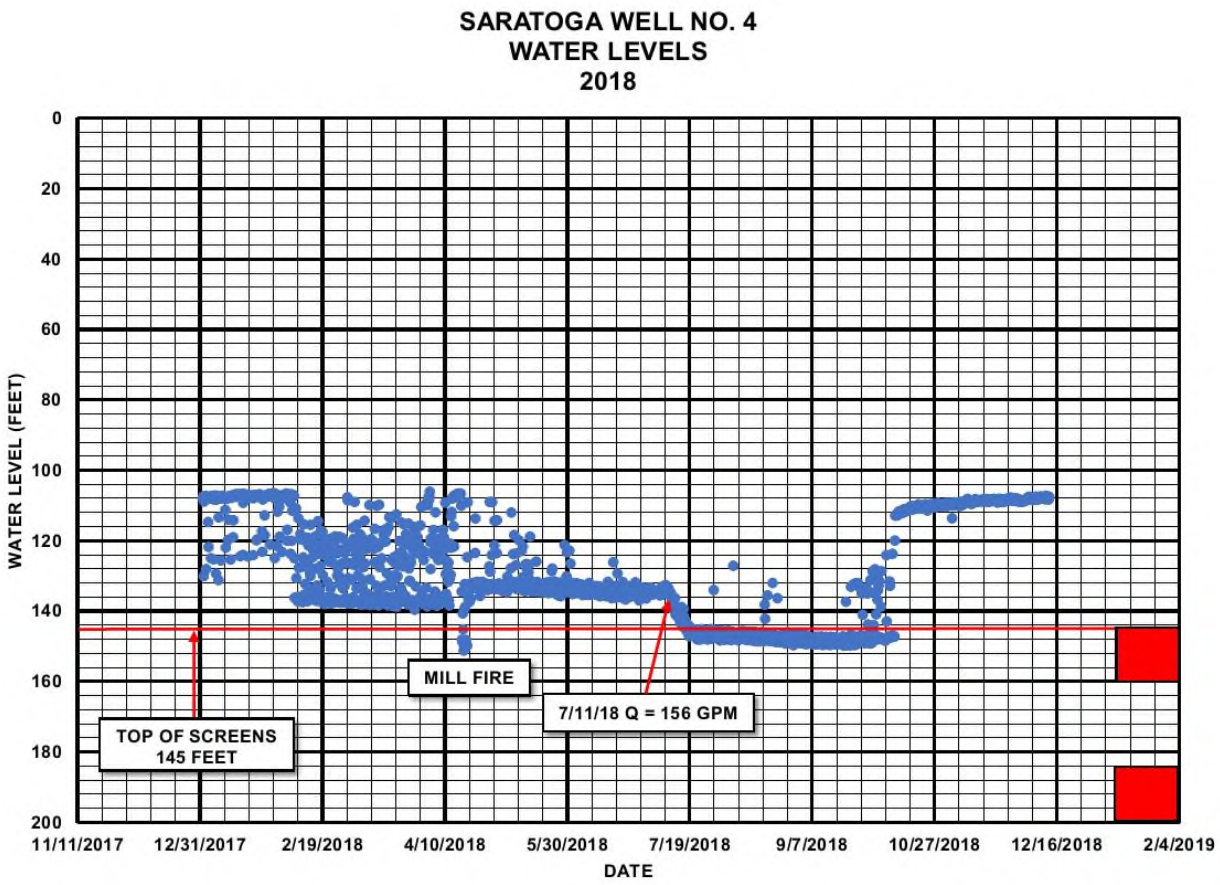


Figure 4.24 Well #4 2018 Water Level Summary

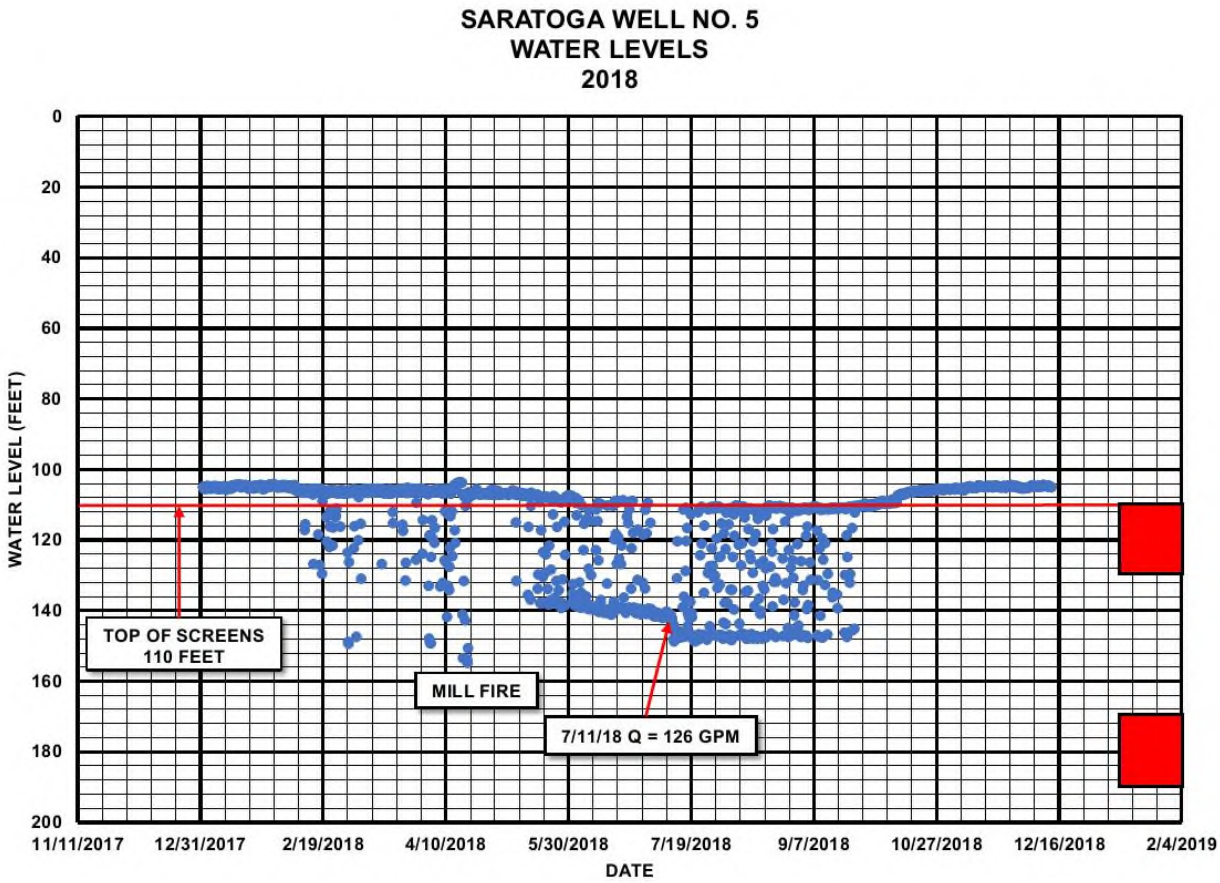


Figure 4.25 Well #5 2018 Water Level Summary

The 2018 data was reviewed to determine the date and depth of the highest water level in each well. For all but Well No. 4, the highest water level occurred in mid-April. The high-water level in Well No. 4 occurred in December because it was being pumped the hardest in April. The differences in the water levels in the wells at their highest in 2018 and the original water levels reported on the Statements of Completion are presented in Table 4.21. The differences in the water levels range from 2.72 to 7.29 feet. The declines in water level are not unexpected since the wellfield has been in operation for ten years. The greater declines in Well Nos. 3 and 4 appear to be a function of their relative position in the wellfield and because they were pumped extensively in 2018.

Table 4.21 Saratoga Wellfield Water Level Summary

Well No.	Original Water Level (2009) (feet, bgl)	Date of 2018 Highest Water Level	2018 Highest Water Level (feet, bgl)	Difference in Water Level 2009 to 2018 (feet)
1	62	April 10	66.72	2.72
2	78	April 16	84.63	4.63
3	98	April 15	107.29	7.29
4	100	December 11	109.24	7.24
5	100	April 16	105.76	3.76

Saratoga Well No. 1 was not pumped in 2018 until April. A fire at the Saratoga lumber mill started on April 13, 2018 and continued for several days. On April 17, 2018 the water level in Well No. 1 had dropped significantly to 135 feet. Approximately half of the uppermost production interval in the well was dewatered during the fire event. Well No. 1 was pumped more frequently starting on May 5, 2018. The pumping water level in the well declined by eight feet from May 6th to July 11th, which is 0.12 feet per day. The pumping rate of Well No. 1 on July 11th was 126 gpm. As demands for water increased to more than 875,000 gallons per day from July 10th to 12th the water level in Well No. 1 dropped by an additional 14.73 feet. Pumping of the well continued throughout the summer and the water level over the transducer remained relatively constant at or about 108 to 110 feet. The water level from July through September dewatered approximately 10 feet of the uppermost screen's 70-foot length.

Saratoga Well No. 2 was not pumped extensively in 2018, according to interpretation of the water level data presented in Figure 4.22. The well was pumped to provide water for fire suppression in April and was not pumped again until May 22nd. The well was pumped intermittently throughout the summer until August 31st. The instantaneous pumping rate on July 11, 2018 was 119 gpm. As indicated on Figure 4.22, the pumping water level in the well remained above the top screened intervals throughout the year.

Based on data presented in Figure 4.23, Saratoga Well No. 3 was pumped extensively throughout 2018. It was the lead well from January 1st through February 7, 2018. Water from the well was needed for fire fighting in April and the water level dropped 21 feet below the top of the well screens. During this time period the entire 15-foot upper screen was dewatered. From April 22nd to July 11, 2018 the well was pumped frequently and the water level declined by approximately

7.3 feet. The average rate of the decline over the 80-day period was 0.1 feet per day. On July 11th, the instantaneous pumping rate of the well was observed to be 148 gpm. The duration of pumping was increased from July 10th to 12th, and the water level dropped by an additional 8.6 feet by July 18th. The water level in the well dropped to 82 feet of water over the transducer by September 17th, which was a slow decline of approximately 0.05 feet per day. The data presented in Figure 4.23 indicates that when Well No. 3 is pumped steadily the water level drops below the uppermost screened interval. During the summer of 2018, pumping of the well completely dewatered the uppermost screened interval which is set from 135 to 150 feet below ground level. The data presented in Figure 4.23 indicates that Well No. 3 continued to be pumped intermittently through the end of the year.

Well No. 4 was pumped intermittently from the beginning of 2018 until February 7th, when it was put in the lead. The water level in the well declined slowly but remained above the uppermost screened interval until the mill fire occurred. During the mill fire, the pumping water level dipped six feet into the upper 10-foot long screen. As summer demands increase on July 10th, the duration of pumping of Well No. 4 increased and the water level dropped by approximately 11.3 feet and the pumping water level was at the top of the uppermost screen. Between July 21st and September 22nd the water level declined an additional 2.20 feet, which equals an average daily decline of 0.04 feet per day. Well No. 4 was taken out of the lead in early October and the water levels recovered to nearly the same depth as the beginning of 2018.

Saratoga Well No. 5 was pumped intermittently in February and March 2018. Because the static water level is only slightly above the uppermost well screen, any time the well is pumped the upper screen is dewatered. The well was used more often beginning in May 2018 and in mid-July the maximum observed pumping water for the year was 148.75 feet. Despite intermittent pumping of the well during the summer months, the upper screen was completely dewatered. Well No. 5 was not pumped after September 23, 2018 and the water level recovered to the same depth as in early 2018.

4.10 Saratoga Wellfield Production Capacity

The instantaneous SEO-permitted pumping capacity of the Saratoga municipal wellfield is 925 gpm. Although it is preferred that the pumping water levels not drop below the top of the well screens to prevent air entrainment and promoting biologic growth in the wells, this is not possible for some of the Saratoga wells.

An evaluation of the pumping rates by PMPC for the wellfield project Operations and Maintenance manual provided a table summarizing the maximum pumping rate of each well to maintain water over the uppermost screened interval. The results of that analysis are presented in Table 4.22 and indicate that the total wellfield yield under this scenario is 606 gpm.

Table 4.22 Saratoga Well Field Maximum Pumping Rate to Maintain Submergence

Well No.	1	2	3	4	5
Static Water Level (feet)	62	78	98	100	100
Top of Screens (feet)	100	140	135	145	110
Maximum Pumping Rate (gpm)	125	175	126	150	30

Source: PMPC O&M Manual Table 6-1

Water level data plots of the wells from 2018, presented in Figures 4.21 to 4.25, were analyzed to provide an estimated wellfield yield. The conclusions from that analysis are:

- Saratoga Well No. 1 could yield approximately 135 gpm while dewatering the upper 10 feet of screen;
- Saratoga Well No. 2 could be used more extensively than in past years and, based on the data in Figure 4.20 and a specific capacity of 4.38 gpm/ft, the well could potentially produce approximately 135 to 140 gpm without significant dewatering of the upper screens;
- Saratoga Well No. 3 has proven to be able to produce 145 gpm while dewatering the uppermost 10-foot long screened interval;
- Saratoga Well No. 4 can yield approximately 155 gpm with the pumping water level dropping slightly into the upper screen; and
- Saratoga Well No. 5 can produce 125 gpm from a pumping water level of approximately 150 feet, which dewaters the upper screen.

The data analyzed for this study indicate that the wellfield can yield up to 695 gpm with minimal dewatering of the screens. As presented above, the only time that air was observed in water produced from the wells was when Well No. 1 was pumped at a rate of 222 gpm. On a short-term basis, the wellfield can likely produce more water, and has historically produced more water to meet peak day demands. However, pumping the wells at higher rates will likely result in increased dewatering of screens and the potential for air production.

4.11 Water Quality

Table 4.23 provides a summary of historical water quality results for the five Saratoga water supply wells. The data presented is from routine sampling conducted by Saratoga for their own tracking of water quality trends. While the quality of water produced by the Saratoga wells is hard, it is excellent drinking water and the results fall well below the Safe Drinking Water standards. The historical results provided in Table 4.23 indicate that the quality of water

produced by the wells has remained relatively constant between 2009 and 2017 except that some constituents such as sulfate and total dissolved solids (TDS), have increased slightly. From 2009 to 2014, the TDS values ranged from a low of 180 mg/L in the Well Nos. 1 and 2 samples to a high of 230 mg/L in the Well No. 5 sample collected in 2014. The sulfate levels range from a low of 6.1 mg/L in the Well No. 1 sample in 2009 to a high of 10 mg/L in 2017 and the Well No. 5 sulfate levels ranged from a low of 22 mg/L in the 2009 sample to a high of 42 mg/L in the 2017 sample. However, all of these results remain far below the recommended secondary drinking water standards. An elevated iron concentration was measured from the Well No. 5 sample in November 2014. That result is abnormal and may have been the result of rust flakes in the sample.

It is recommended that the Town of Saratoga continues to routinely collect water quality samples from the wells to assess any changes to the water quality.

Table 4.23 Town of Saratoga Water Quality Analysis Results

ANALYTE (all results in mg/L unless otherwise noted)	Well #1				Well #2				Well #3				Well #4				Well #5			
	4/2/2009	5/10/2012	11/19/2014	5/24/2017	4/2/2009	5/10/2012	11/19/2014	5/24/2017	4/2/2009	5/10/2012	11/19/2014	5/24/2017	4/2/2009	5/10/2012	11/19/2014	5/24/2017	4/2/2009	5/10/2012	11/19/2014	5/24/2017
CALCIUM HARDNESS	120	140	130	135	120	130	120	134	160	150	130	161	170	160	130	197	160	170	150	197
ALKALINITY	130	150	150	145	130	150	150	144	150	160	150	157	160	160	160	171	140	170	170	172
BICARBONATE	160	180	180	177	160	180	180	176	180	190	190	191	190	200	200	208	170	200	200	201
CARBONATE	0	0	2		0	0	<2		0	0	<2		0	0	<2		0	0	<2	
CONDUCTIVITY	270	334	330	305	290	322	320	300	350	340	360	348	380	376	370	419	350	388	420	416
pH (pH units)	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.89	7.9	7.8	7.9	7.84	8	7.8	7.9	7.78	7.8	7.8	7.9	7.79
CALCIUM	37	43	50.9	43	38	41	49.1	42	48	46	53.9	51	53	50	53.3	63	50	51	59.3	63
COPPER	0.001	<0.001	<0.001		0.002	0.002	0.001		0.003	0.001	<0.001		<0.001	0.001	<0.001		0.001	0.024	<0.001	
IRON	0.091	<0.02	<0.02		0.09	<0.02	0.027		0.032	0.028	0.031		0.083	<0.02	0.082		0.84	<0.02	35.5	
LEAD	0.001	0.001	<0.001		0.004	0.001	0.002		0.009	0.001	<0.001		0.005	0.001	<0.001		<0.001	0.001	<0.001	
MAGNESIUM	6.7	7.69	7.69	7	7.2	7.7	8.07	7	8.8	8.5	8.12	8	9.4	8.8	9.17	10	8.3	9.3	8.54	10
MANGANESE	0.005	<0.001	<0.001		0.003	0.001	0.001		0.004	0.001	<0.001		0.004	0.001	0.001		0.016	<0.001	0.092	
POTASSIUM	6	4.9	5.04	6	5.3	5.1	5.29	6	4.8	5.3	4.79	6	5.3	5.4	5.9	5	4.6	5.3	4.59	6
SODIUM	8	7.5	7.8	8	7.5	7.2	7.87	8	7.6	8	7.33	9	7.8	7	8.37	8	7.7	7.5	7.2	8
ZINC	0.008	0.008	0.021		0.006	0.012	0.015		0.009	0.01	0.012		0.004	0.012	0.013		0.006	0.012	0.026	
CORROSIVITY	0	-0.02	-0.24		0	-0.06	-0.26		0.15	0.03	-0.21		0.28	0.04	-0.20		0.03	0.1	-0.13	
TDS by Summation	150	170	180		150	170	180		190	180	200		200	200	210		180	210	230	
CHLORIDE	1.6	3.4	2.9	2	1.9	2.3	2.8	2	3	2.5	3.3	4	2.9	2.8	3.1	5	3.8	2.8	3.8	4
FLUORIDE	0.5	0.5	0.4	0.5	0.6	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4
NITRATE (as N)	0.19	1.7	1.21	0.3	0.4	0.64	0.9	0.4	0.6	0.51	0.79	0.6	0.54	0.47	0.64	0.6	0.68	0.52	0.71	0.7
NITRITE (as N)	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05		0.05	<0.05	0.05		<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	
SULFATE	6.1	12	11	10	8	12	13	9	23	16	25	19	28	27	24	42	22	31	40	42

Source: Town of Saratoga files.

Note: Blank field indicates not sampled.

5.0 SYSTEM MODELING AND GIS MAPPING

5.1 System Modeling

This master plan effort included the development of a system-wide computer model of the Town of Saratoga water system. In general. modeling of the water system showed that much of the infrastructure sizes and capabilities were capable of handling current and future demands, while several locations could use some updating to help remedy old/deteriorating pipe, undersized lines, water age, etc. The results of the modeling will be discussed in further detail under this Section and Sections 6 and 7.

The system was modeled utilizing the most current Bentley WaterGEMS CONNECT Edition software with extended period simulations to analyze how the water system performed over an extended period. In addition, this model was used to evaluate the water age of the system particularly with relation to the standpipe storage tanks. The diurnal curves used for modeling the demands on the system are shown in Figure 5.1. This curve is based off a typical diurnal curve from the AWWA M32 Manual. For clarification, a diurnal curve fluctuates the demands on a system based upon typical usage patterns (i.e. not as much water is in demand at 5:00 AM as is demanded at 5:00 PM. Figure 5.2 shows extended period simulation demands for the MDD on the system over a 168 hour or weekly period. This model will provide the Town with a "living" tool to evaluate current system operations and to plan for future growth. In order to ensure that this model was reflective of the actual system, the following tasks were performed:

- System Mapping and Documentation: Schematic system mapping showing pipeline sizes and location, and system components, were researched based on available mapping, as-built drawings, field investigations, and input from system operators.

- Model Calibration: This water model was calibrated against recorded residual pressures from the Town's Water System Operator's during fire hydrant testing. This model also incorporates information provided by the system operators with regards to standpipe level operating ranges. Typically, water models are calibrated against fire flows but in testing the fire hydrants the only data recorded was the residual pressures.

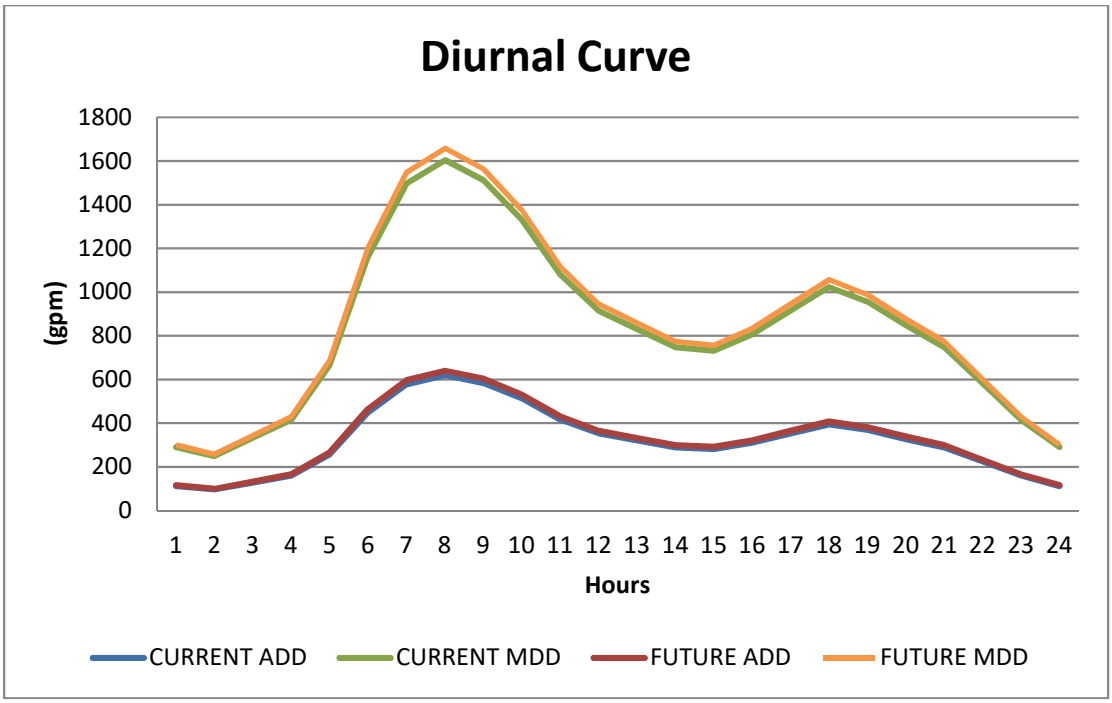


Figure 5.1 Diurnal Curve (Based on AWWA M32 Figure 2-12)

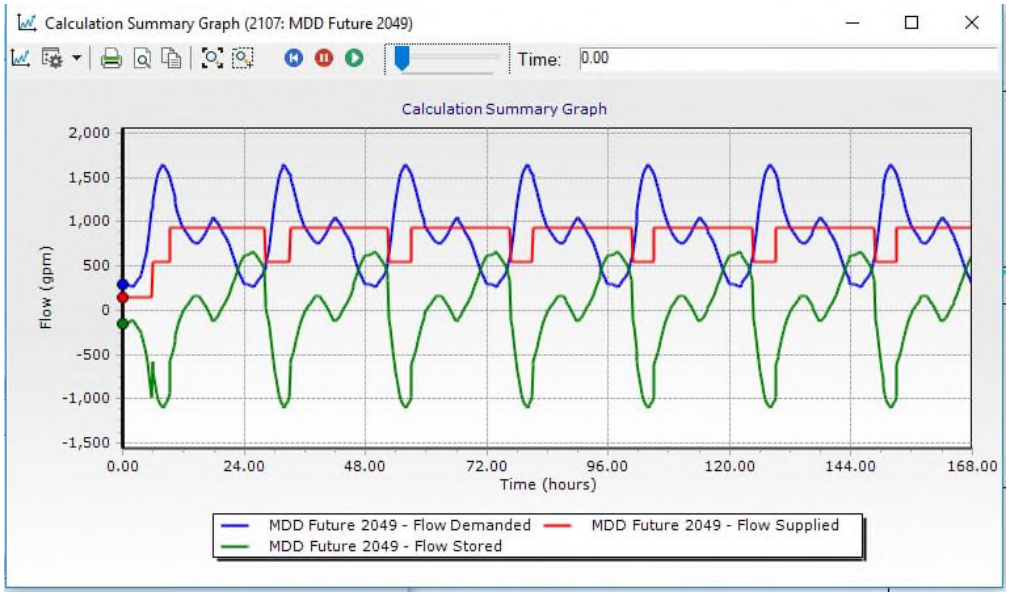


Figure 5.2 – Extended Period Simulation (EPS)

Multiple simulations using existing and future ADD, MDD and PHD were analyzed for the existing water system. In general, the modeling showed that most line configurations, sizes, and system components were adequate for current and future demands, while there are several lines that are undersized for fire protection and old deteriorating lines. Figures 5.3 and 5.4 show the Town pressures during the current and future MDD on the existing system.

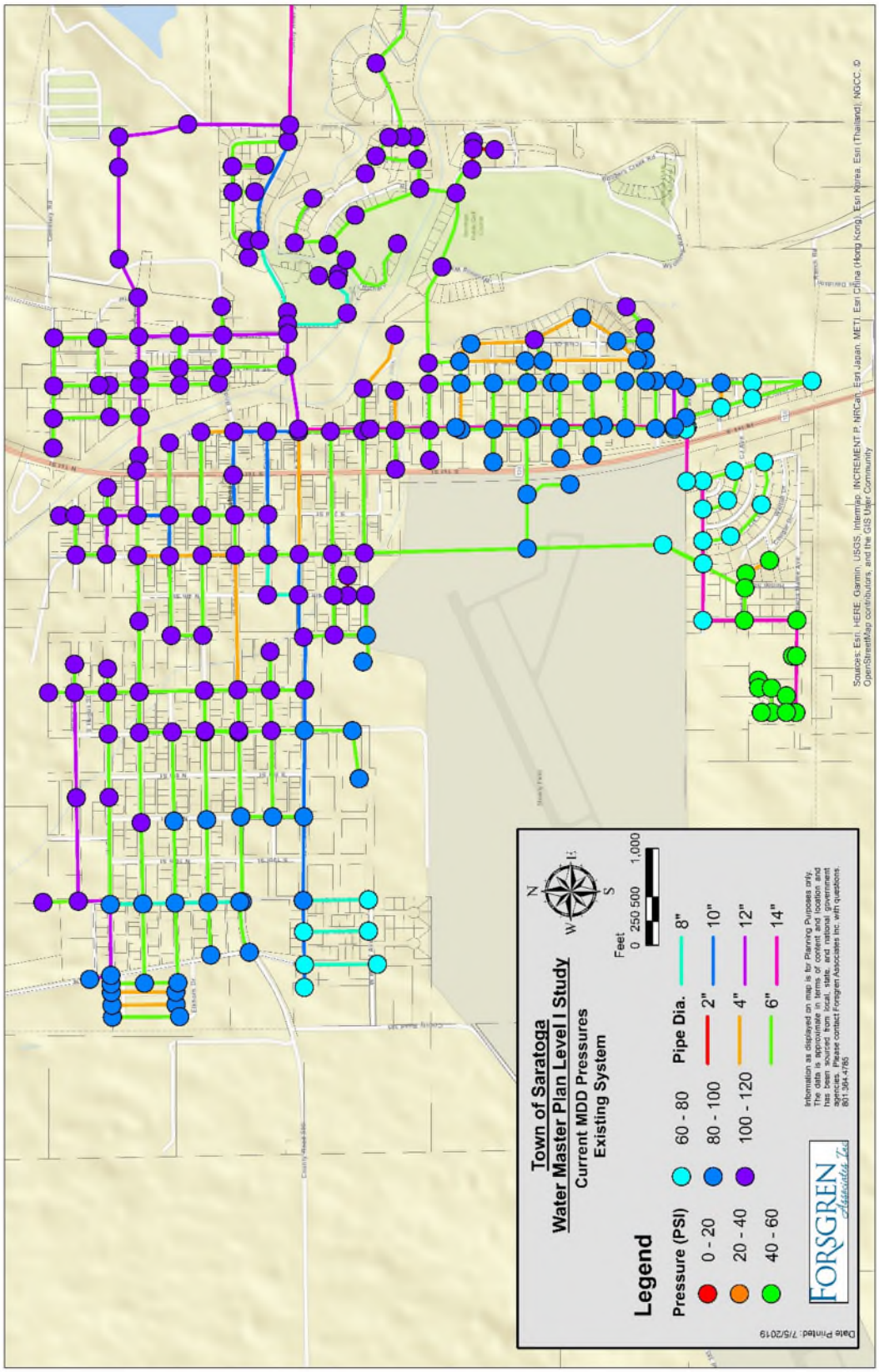


Figure 5.3 – Current MDD Existing System Pressures

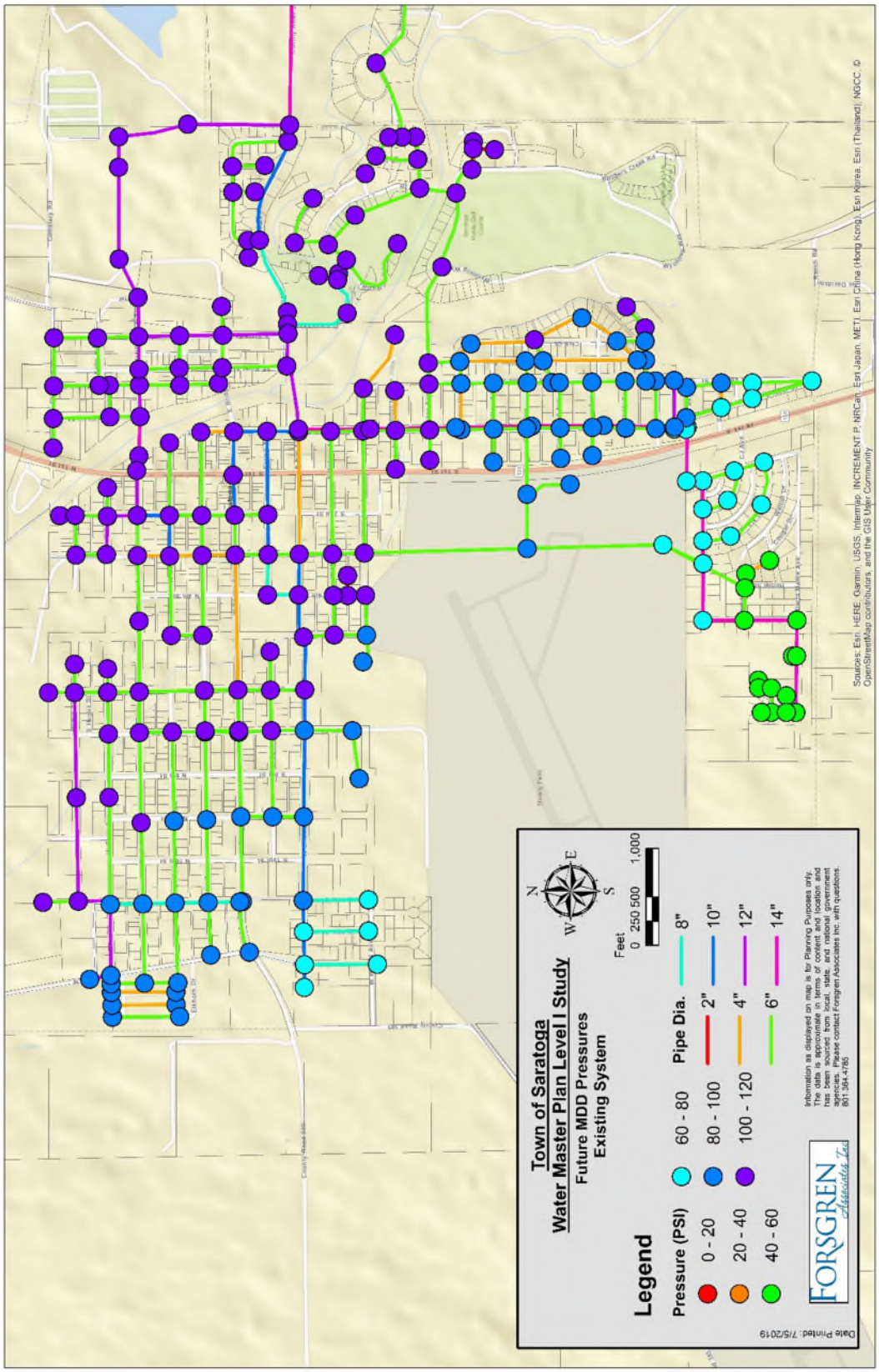
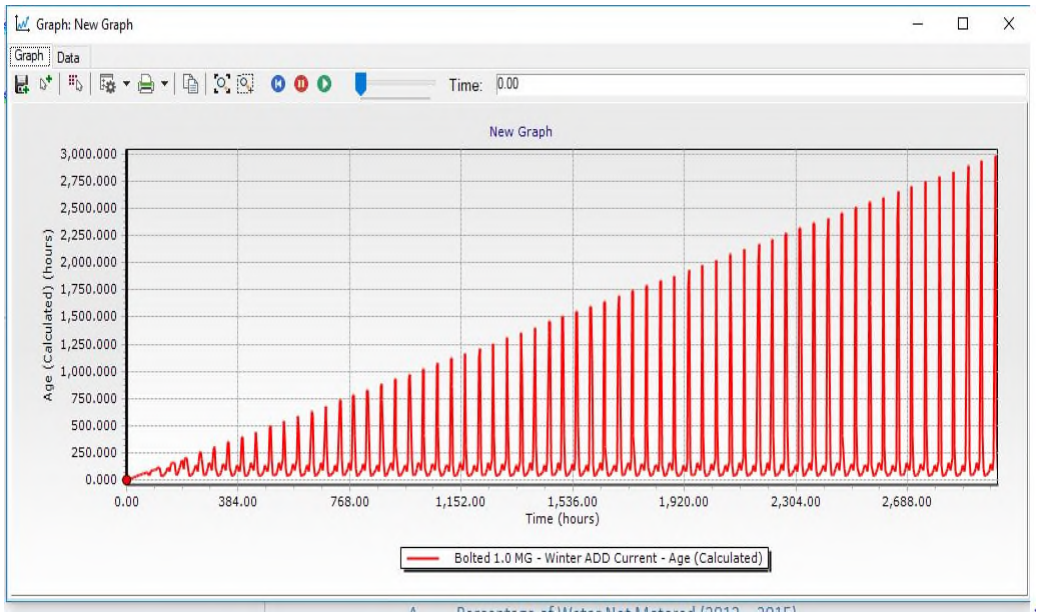


Figure 5.4 – Future MDD Existing System Pressures

5.1.1 Water Age Evaluations

Due to a growing concern throughout the state, the Wyoming Water Development Commission is requiring water age evaluations in Master Plans. The water age in the two 1.0 million gallon standpipes are of major concern. Because the tanks are essentially at a dead end in the system, farthest away from the water source, fed through the distribution and have a single inlet/outlet configuration, the water in these tanks really do not have the opportunity to circulate. In general, the modeling found that as water is pumped into the distribution system, water with higher age is pushed right back into the tanks. This causes a major concern as high water age can introduce disinfectant decay, byproduct formation and nitrification, to name a few. The Town currently operates the tanks water levels (100 foot tall tanks) at 90-96 feet in the summer and 80-86 feet in the winter. Keeping such tight levels does a few things (some bad and some good), it keeps the water pressures fairly consistent, causes well pumps to turn on and off a lot and doesn't allow for much turnover in the stored water. In an effort to see what would help reduce water age in the tanks, multiple modeling scenarios were analyzed. In these scenarios, water age starts at zero (0) which is not typical of a system but what we are looking for is when the water age reaches its equilibrium point (levels off). These scenarios also look at a mixture of different settings including the addition of mixers, flushing, frequency of flushing, operations, etc.

Figures 5.5 thru 5.12 from WaterGEMS modeling show the water age results for the Storage Tanks using Winter ADD. The current Winter ADD is approximately 199 gpm for the years of 2013-18 for the months of November thru March. The reason the Winter ADD is used is because it illustrates the worst possible water age conditions due to the lower demand.



3,000 hrs +

Figure 5.5 Winter ADD Water Age – Existing Controls, No Flush, No Mixing

Figure 5.5's scenario shows the current water age conditions of the existing system. As shown, the water age is continually increasing.

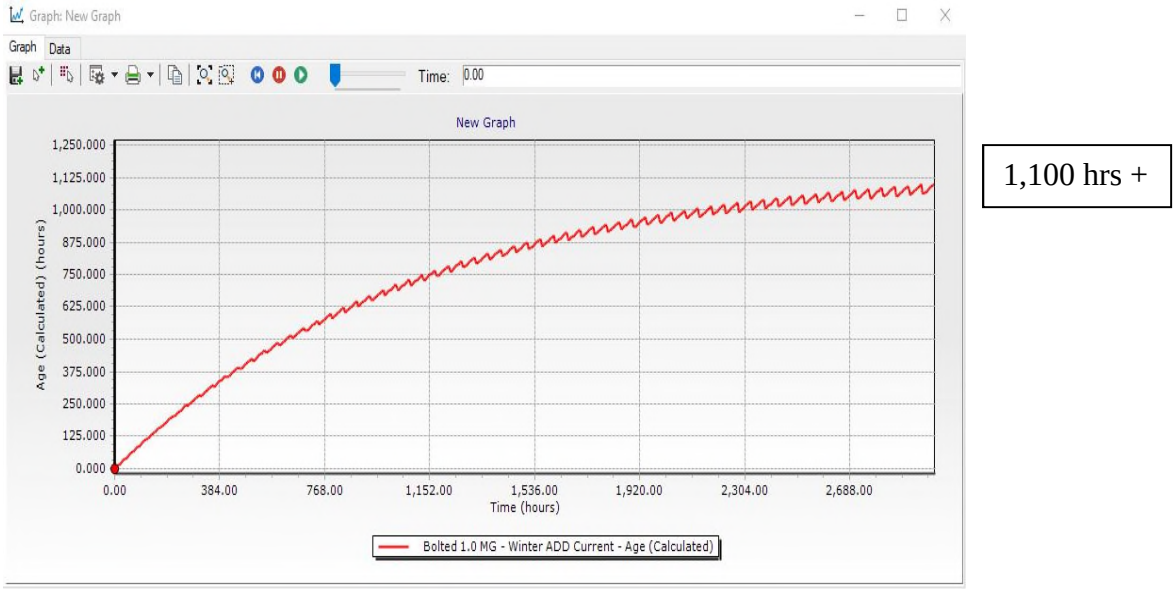


Figure 5.6 Winter ADD Water Age – Existing Controls, Mixing, No Flush

Figure 5.6 shows the modeling results for water age with the addition of a mixing system to both tanks. Currently the tanks operate under a First-In-Last-Out scenario (FILO), meaning that the first water into the tank is the last that comes out and with how the tanks are currently operated that "first-in" water doesn't leave the tank. By adding a mixer to the tanks, it helps create a more uniform water age throughout the tank and provides a little better water age. As shown above, with a mixer, the water age begins to equalize around 1,100 hours but is still climbing.

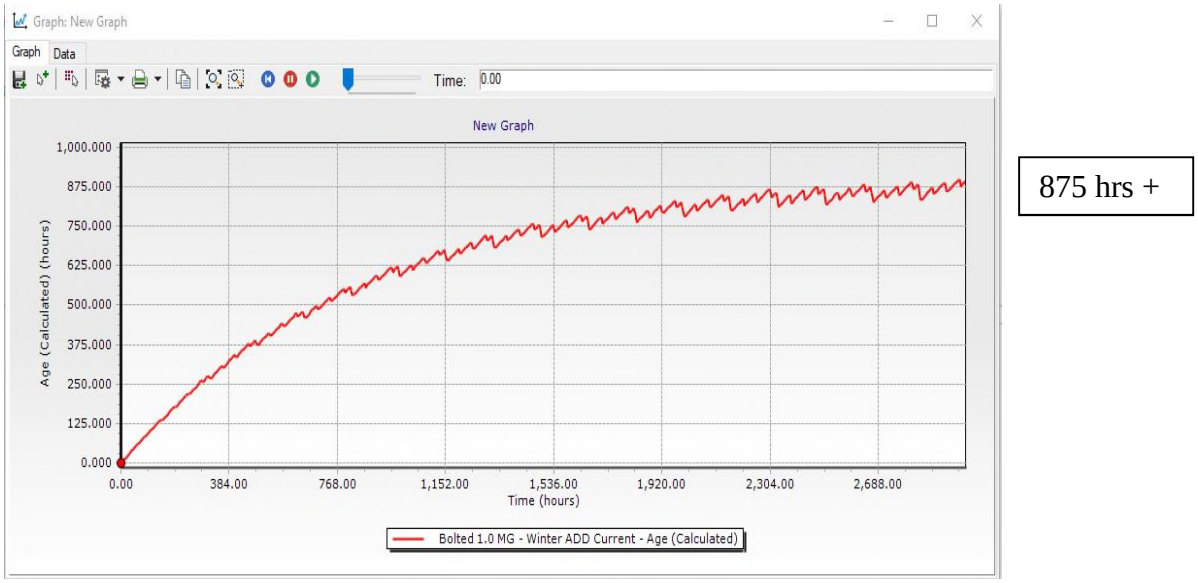
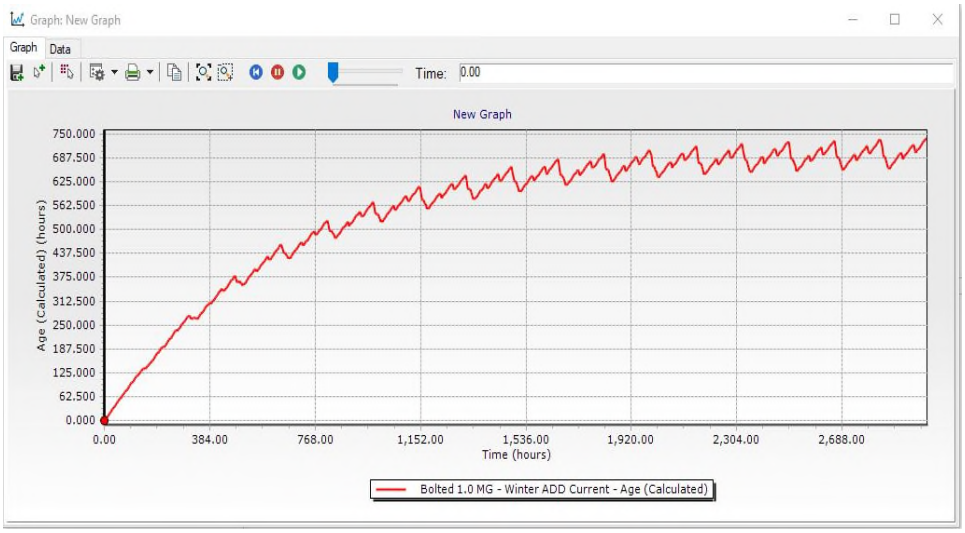


Figure 5.7 Winter ADD Water Age – Existing Controls, Mixing, Weekly Flush (2.0 hrs @ 1,000 gpm)

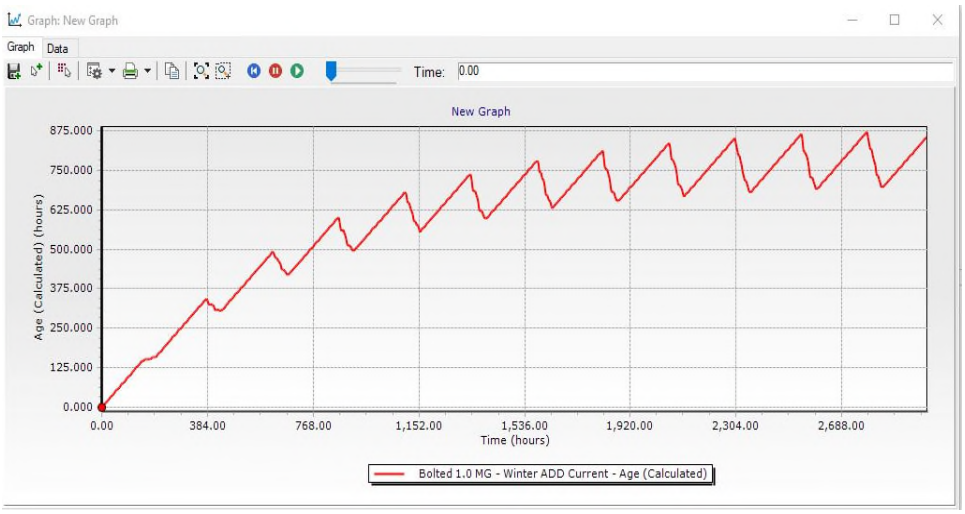
Figure 5.7 shows the water age modeling with current controls, fully mixed and a weekly flush of 2.0 hours at 1,000 gpm (120,000 gallons per week). As shown, the water age begins to level off around 875 hours but continues to slowly climb.



690 hrs

Figure 5.8 Winter ADD Water Age – Existing Controls, Mixing, Weekly Flush (2.0 hrs @ 1,700 gpm)

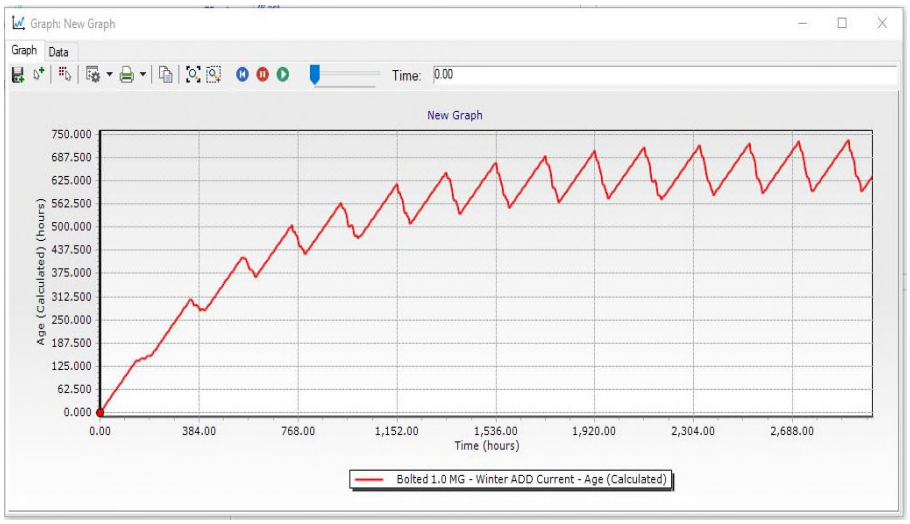
At this point in the modeling we began to think "what more can we do" to try and make a dent into the water age and find an equilibrium point. For Figure 5.8 we bumped the flushing amount up to the amount that is available for fire flows at the closest hydrant location. As shown, the water age finally begins to level out around 690 hours.



800 hrs

Figure 5.9 Winter ADD Water Age – New Level Controls, No Flush, Completely Mixed

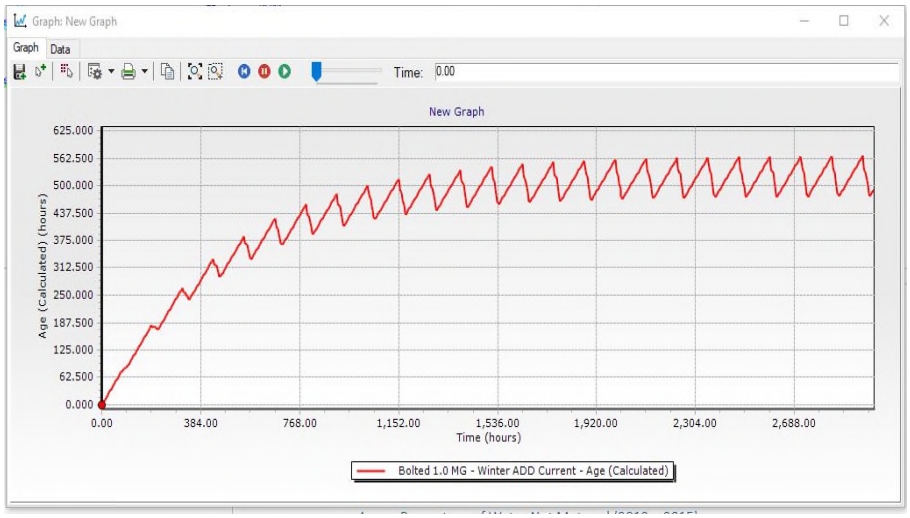
The 1,700 gpm flush seemed a little drastic so for this next modeling scenario we looked at changing the operational parameters of the tanks. Particularly with level control and pumping frequency. Currently the Town maintains tank levels during the winter months between 80 and 86 feet. We understand that the Town needs to maintain at least 40-feet for minimum system pressures but what would happen to the water age if we allowed the tank to draw down further before the wells kick on. For this scenario we looked at a situation in which the level parameters for the winter months are set at a minimum of 70 feet in the tank with the maximum of 86 feet remaining. As shown on Figure 5.9, the water age with just level control changes and mixing the water age begins to level off at approximately 800 hours.



650 hrs

Figure 5.10 Winter ADD Water Age – New Level Controls, Completely Mixed, Weekly Flush (2.0 hrs @ 1,000 gpm)

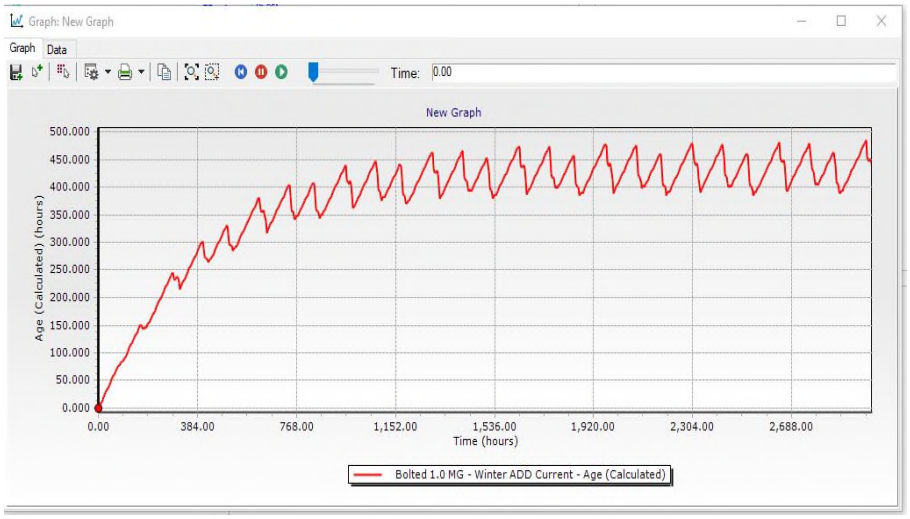
For Figure 5.10 the water age modeling shows that with a completely mixed storage, a weekly flush and updated level controls the water age begins to level off around 650 hours.



530 hrs

Figure 5.11 Winter ADD Water Age – New Level Controls, Completely Mixed, No Flush, One Tank

For Figure 5.11 this scenario looked at what the water age would be if there was only one tank (see storage evaluations in Section 6.4), new level controls, completely mixed and no flush. As shown, the water age levels off at approximately 530 hours.



425 hrs

Figure 5.12 Winter ADD Water Age – New Level Controls, Completely Mixed, Weekly Flush (2.0 hrs @ 1,000 gpm), One Tank

For Figure 5.12 this scenario looked at what the water age would be if there was only one tank (see storage evaluations in Section 6.4), new level controls, completely mixed and a weekly 1,000 gpm flush for 2 hours. As shown, the water age levels off at approximately 425 hours.

Figure 5.13 below indicates the most effective flushing location used to model the storage tanks water age results.

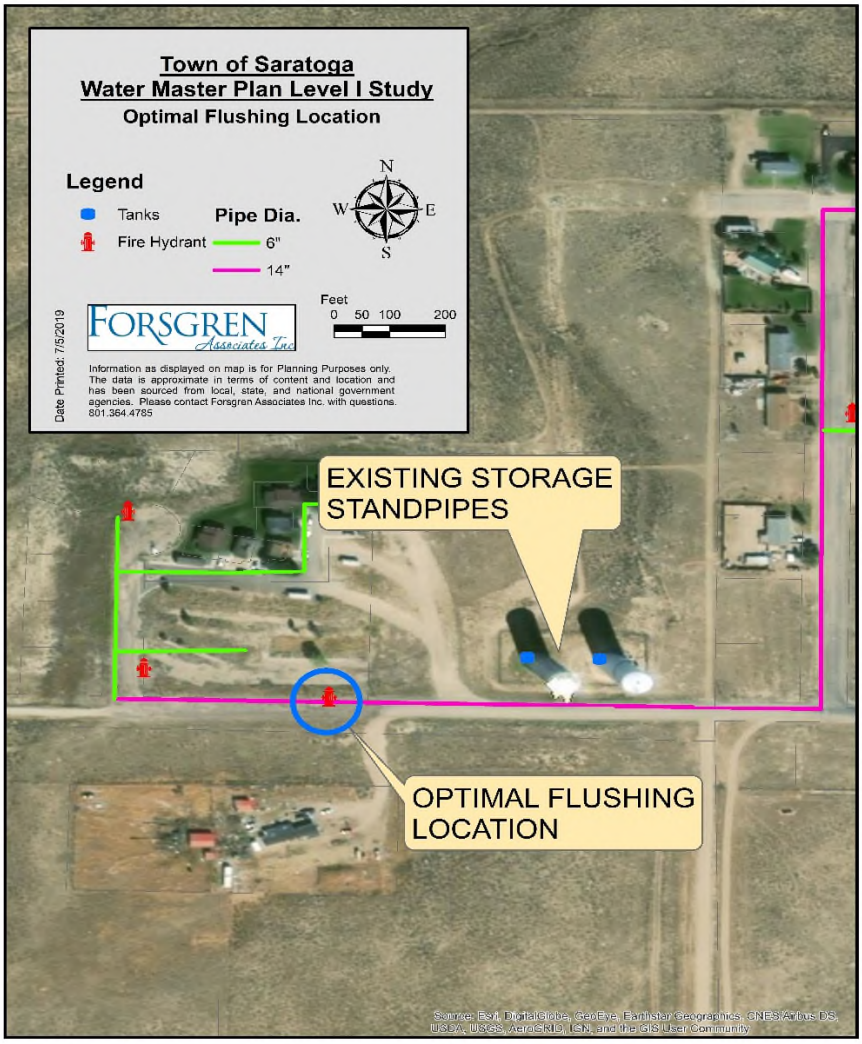


Figure 5.13 – Optimum Flushing Location

<u>Tank Flushing:</u> As mentioned above, Figure 5.13 illustrates the optimum location for tank flushing. This is due mainly to prevent the introduction of a higher age of water, within the tanks, to enter the distribution system. At this time, it is anticipated that the flushing of the tanks is to waste due to the optimum flushing hydrant's location. Should the water be needed elsewhere, the SCCJIPB/Town may elect to haul the flushed water. Other options may include the sale of bulk water or irrigation. These options are not evaluated further in the remainder of this report.

<u>Tank Level Controls:</u> By utilizing the above-mentioned tank level controls for the low demand months, the Town will be able to help reduce water age in its storage tanks. This however does

have some effect on the fire flows of the Town. At its lowest level (proposed 70 feet) the fire flow capacities for the Town hydrants are reduced by approximately 50 gpm. Although this does affect the fire flow capacities of the Town it does not compromise the existing fire flows available such that the Town will be able to maintain operations. As this level control is recommended, some residual pressures (nearest the tanks) at its lowest level (70 feet) remain below 35 psi which is a recommendation by the Wyoming Department of Environmental Quality for normal operating conditions. Due to the location of the tanks and the nearby residential units higher water levels are needed for increased pressure. Considerations should be made however in this situation as increased water age can have immediate impacts on the quality of the total system.

Conclusion: As Figures 5.5 thru 5.12 show, the Town's water system age is concerning but can be reduced by the implementation of mixing the tanks, flushing, expanding level controls, etc. The water age can further be reduced by removing one of the tanks (Bolted Tank) from service (see Storage Evaluations Section 6.4). At a minimum, it is recommended that the Town consider installing a mixing system for the tanks and a weekly flush to help reduce the water age in the system during low demand times (winter months). As stated above, the location and configuration of the tanks is less than ideal with consideration to water age, but there are some options in an effort to try and reduce that water age and make it more consistent. As a mixing system is considered solely a water quality issue such a project could not be funded by WWDC. Other funding options are available and described later in this report.

5.2 GIS Mapping and Database Creation

A Geodatabase for the Town was created with two purposes in mind: 1) for modeling analysis and 2) for a computerized database inventory/mapping of the system to meet the Wyoming Development Office's newly developed GIS Standards.

The line work utilized in the modeling was created in ESRI's ArcGIS software. The source of the information was derived from the Town's As-Built sheets, hard copy maps, operator interviews and review of Wyoming DEQ's project records. The digitization of this information enables the line work to cartographically represent the water system as it has been constructed. Of course, no engineering design or dispute resolutions should be based upon the line work generated for this model. This is simply a graphic representation of what is in place. Actual location of the line work as it represents the real world location of the pipes and system features should be considered at a planning level, which is plus or minus 200 feet in location accuracy. The data, meaning the line work, is not intended to meet a survey grade standard.

The GIS base mapping information was sourced from the Carbon County Office of Planning & Engineering. This data information in this report uses the following Coordinate System:

NAD_1983_StatePlane_Wyoming_E_Central_FIPS_4902_US_Feet

As such, the same Coordinate System was integrated into the Town of Saratoga's Water System geodatabase created for this project. Both digitized mapping data and mapping-grade GPS information was used in the geodatabase creation. The GPS used for collection is the Trimble GeoXH, which has sub-meter accuracy. The system fire hydrants, hydrant valves, wells, and system valves were shot using the GPS unit with a data dictionary that matched the fields in the geodatabase.

An area base map has been created to maintain the water system inventory and contains the following layers:

- Water System Pipe Lines Geodatabase File – Forsgren Created
- Water System Structures Geodatabase File – Forsgren Created
- Street Centerlines Shapefile – Carbon County
- Parcels Shapefile – Carbon County
- City Boundaries Shapefile – Carbon County
- Aerial Photo – NAIP 2006 USDA

In addition to the ArcMap .mxd files of the water system geodatabase, the Town has received a Published Map File (PMF), with the water system geodatabase and background files, that can be viewed in ESRI's free ArcView reader. In addition, the Town has received hard copies of the system mapping created from the geodatabase and water modeling features. Town record drawings were used to locate existing features for inclusion in the GPS data collection. Figure 5.14 shows a sample of the data collected.

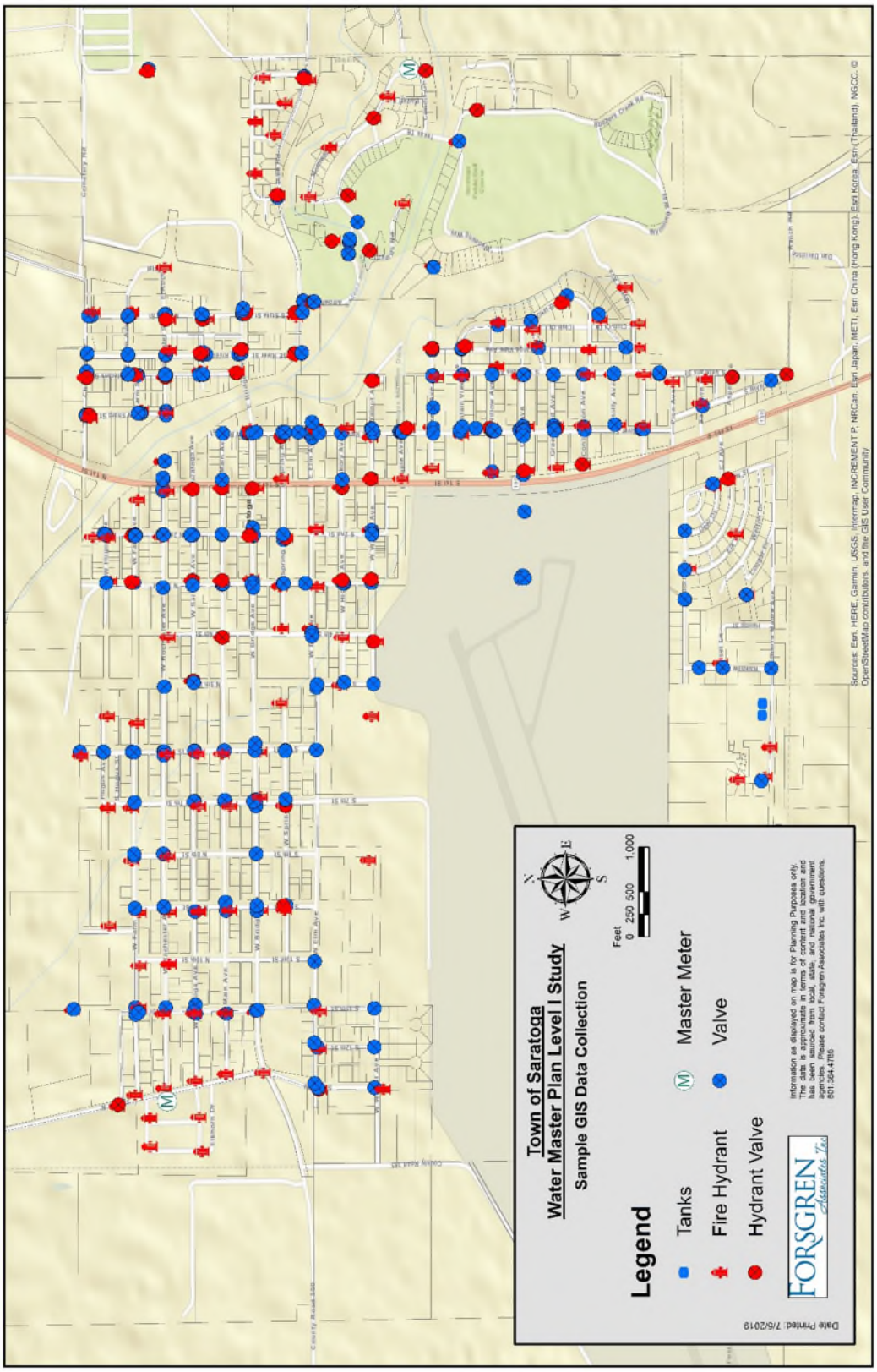


Figure 5.14 – GPS/GIS Data Collection

6.0 ALTERNATIVE EVALUATIONS

6.1 Design Criteria and Intent

When evaluating the needs of the Town of Saratoga Water System, three major concerns must be addressed as follows:

- Health and Safety: The ability to provide an adequate, safe drinking water supply that meets Wyoming DEQ-WQD regulations (WDEQ-WQD, 2012-REV) and USEPA safe drinking water standards is of primary importance.

- System Reliability: Events such as power interruption and line breakages are a normal fact of life. They should not, in our opinion, result in water service interruption to the community at large. Adequate reserve facilities and redundancy of critical system components can minimize that risk.

- Ability to Accommodate Growth: This criteria involves not only the magnitude of growth, but also the locations of that growth. As only moderate growth is expected for Saratoga and Carbon County in the foreseeable future this may not seem like a concern for the system, but growth projections are not always accurate. Understanding the adequacy of the water system under different demand locations, fire events and scenarios is important for current and future planning.

6.2 Fire Protection

Wyoming DEQ-WQD Chapter 12 regulations require that systems "maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow." This requirement includes fire demands under peak use conditions. Chapter 12 regulations also require that the minimum pipe size serving a fire hydrant be 6-inches (8" if line is over 250 feet and not looped).

Wyoming DEQ-WQD Chapter 12 regulations also state that "Water systems serving from 50,000 gallons to 500,000 gallons on the design average daily demand shall provide system storage equal to the ADD (average day demand) plus fire storage". Saratoga's current ADD of 462,031 and future ADD of 477,692 meet the above requirements.

Fire flows for the Town are established by the 2016 Comprehensive Master Plan (Coffey Engineering and Surveying, 2016) citing a design fire flow of 1,000 gpm for a 2-hour design fire flow or a design fire flow storage of 120,000 gallons. In general, most of the distribution piping and storage supplying the Town are adequately sized for the current and future fire flow demands. There are several locations within the distribution system though that do not meet the

current Wyoming Department of Environmental Quality (WyDEQ) standards. The Wyoming DEQ Chapter 12 guidance on fire protection line sizing states "The minimum size of a watermain for providing fire protection and serving fire hydrants shall be 6 inches diameter when service is provided from 2 directions, or where the maximum length of 6 inch pipe serving from 1 direction does not exceed 250 feet, or 8 inches where service is provided from 1 direction only". Such locations within the Town's distribution system can be found in Section 6.5. Figure 6.1 shows the available fire flows for the Saratoga Water System with current piping. Modeling fire flow reports can be found in Appendix G. For reference, in interviews with system operators, the multi-day "Mill Fire" in April 2018 put a real test on the capacity of the system. In general, the wells performed well and kept up with system demand while the tanks were able to maintain approximately an 80% fill level.

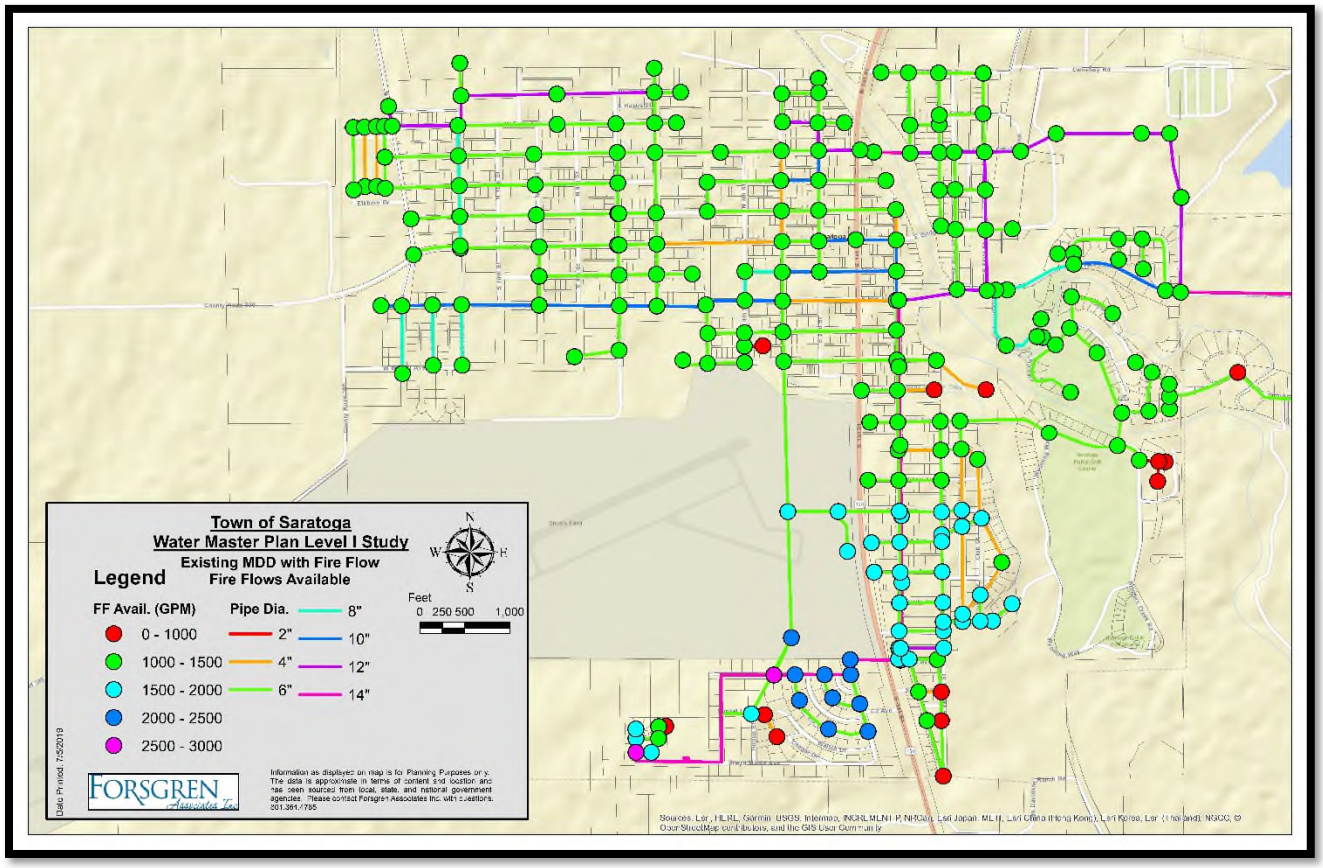


Figure 6.1- Available Fire Flows MDD w/Fire Flow (gpm)

6.3 Saratoga Well Field

The Saratoga Water System, as stated in previous sections, is currently supplied from the five (5) wells of the Saratoga Well Field, see Figure 4.1. The capacity and history of the wells supplying the Saratoga system are discussed at length in Section 4.6 of this report.

Wyoming DEQ-WQD Chapter 12 Section 9.b.i states the following in regards to minimum system supply and storage:

> *The total developed groundwater source, along with other water sources, shall provide a combined capacity that shall equal or exceed the design maximum daily demand. A minimum of 2 wells, or 1 well and finished water storage equal to twice the maximum daily demand shall be provided. Where 2 wells are provided, the sources shall be capable of equaling or exceeding the design average daily demand with the largest producing well out of service.*

Table 6.1 shows how the existing Saratoga Water System supply compares to current and future demands on the system per Wyoming DEQ-WQD regulations stated above.

Table 6.1 - Wyoming DEQ chapter 12 Section 9.b.i

Wyoming DEQ Chapter 12 Section 9.b.i	Current MDD (gpd)	Future MDD (gpd)	Current ADD (gpd)	Future ADD (gpd)	Wells and Storage (gpd)
Equal to or Exceed MDD (Wells #1 thru #5)	1,196,955	1,237,527	-	-	1,332,000
2 Wells or 1 Well plus FWS = 2xMDD (Well #1 & Useable Storage - Tanks)	2,393,910	2,475,053	-	-	1,488,000
ADD with largest well out of service (Wells #2 thru #5)	-	-	462,031	477,692	1,044,000

As shown in Table 6.1 the first and third requirements are met with regards to the well supply. For the second requirement it can be seen that the Saratoga Water System falls short. Even if the full 2.0 MG is used in the evaluation (2,228,000 gallons) the system still falls short of this regulation. In reviewing the Saratoga Test Well Level II Study (Hinckley Consulting, 2007), the above statement from WyDEQ Chapter 12 is stated but only the first and third regulations are commented upon, seemingly dismissing the second regulation. As identified is Section 6.4, there is currently more than enough system storage to meet demands, therefore this report recommends evaluating further options on expanding Saratoga's groundwater supply to meet WyDEQ regulations.

6.3.1 Alternative Power Evaluations

As part of this report, Alternative Power at the well field is evaluated in terms of WyDEQ's requirements. WyDEQ Chapter 12 Section 8 (d)(iii) states "Where the finished water storage volume that floats on the distribution system is not capable of supplying the maximum daily demand, an alternative power shall be provided for the finished water pumps. The combined finished water storage and pumping capacity supplied by alternative power shall be adequate to provide the maximum day demand. Acceptable alternative power sources include an engine

generator, engine drive pumps, or a second independent electrical supply." Table 6.2 below summarizes the evaluation of the Town's water system to this regulation.

Table 6.2 Alternative Power – Saratoga Well Field

	MDD	FWS	MDD < FWS / Need for Alternative Power
Current	1,196,955	1,200,000	Yes/No
Future 2049	1,237,527	1,200,000	No/Yes

As can be seen in Table 6.2 above, the current MDD demands on the system does not mandate an alternative power supply to the system. For the projected 2049 MDD forecast though, the system would require alternative power at the well field. Only one pump with alternative power would be required to push the envelope beyond the requirement for alternative power. The costs however for providing alternative power for just one well are considerable. Jumping ahead, if the Town were to be able to provide more finished water storage than they currently are able then there would be no need for an alternative power source. Section 6.4 below identifies one option, such that by removing one of the current storage standpipes (bolted tank) and constructing a new tank along the transmission line that has a higher effective storage capacity for a total system storage of approximately 1.3 MG exceeding the projected future demands and eliminating the need for alternative power.

6.4 System Storage

Section 13 of Wyoming DEQ-WQD Chapter 12 regulations require that "*Water system serving from 50,000 to 500,000 gallons on the design average daily demand shall provide clearwell and system storage capacity equal to the average daily demand plus fire storage, based on recommendations established by the State Fire Marshall or local fire agency.*"

The Town's storage capacity is served by the two (2) 1.0 MG Standpipes totaling 2.0 MG of water storage capacity. As mentioned above, with the tank's lower limit of a 40' water level (out of a 100' standpipe) limits the useable storage to 1.2 MG. There are concerns with the Town's bolted steel tank (as it is leaking) as well as with water age and stagnation due to the tanks' location within the system and its configuration. The required future storage for the Town is calculated as follows.

Table 6.3 Required Future Storage - Town

Town Required Storage	MG
1,000 GPM (2HR) Fire Storage	0.120
Future ADD	0.478
Total Required Town	**0.598**

Table 6.4 Existing vs Required Storage - Town

Existing Storage – Town	MG
Welded Standpipe - Effective	0.600
Bolted Standpipe - Effective	0.600
Total Volume (MG)	1.200
Total Required Town	0.598
Surplus Volume	0.602

As the totals show in Tables 6.3 thru 6.4, the Saratoga Water System currently has enough storage capacity to meet the Wyoming DEQ-WQD Chapter 12 regulations for its current and forecasted water demands. In fact, the totals indicate that there is enough storage in one of the standpipes to meet such requirements.

6.4.1 Bolted Steel Standpipe Storage Tank Issues

In evaluating the condition of the Bolted Storage Tank, as well as the Welded Tank, there were multiple factors in consideration:

- **Tank Histories:**

  Welded Tank: This tank was constructed in 1979 and was later rehabilitated in 2005 to address some peeling issues on the interior of the tank. Based upon the most current tank inspection report and in discussions with Town operators, this tank appears to be in fair condition especially considering its age. While 40 years is closely approaching the design life of the tank, the upkeep of maintenance has this tank in a good position to remain adequate for at least the next 10-15 years.

  Bolted Tank: This tank was initially constructed in 2001 and based upon system operator interviews, and some limited documentation provided by the Town, this tank has had issues ever since construction (See Appendix H). This tank was installed to provide redundancy to the storage of the Town. In review of what has been provided by the Town and what this study has determined, there are five (5) key issues that are part of our consideration for this study:

1. This tank was the first tank that the manufacturer/designer had ever built/designed of this height (100 feet).
2. Upon tank completion and while filling the tank, the floor of the tank buckled. The reasoning behind this failure, as given by the manufacturer/designer, was that the additional weight of the water caused the floor to buckle and the ground to settle.
3. The manufacturer/designer has since gone bankrupt.
4. Based upon interviews with system operators, the tank has been leaking from the start.
5. The tank(s) experience ice formation, which can lead to rubbing/scraping of interior panels and bolts.
6. This tank, along with the welded tank are located at essentially a dead end in the system and as such have potential for water age issues.

Based upon just these issues, Town needs some guidance in addressing the issues of this tank.

- **Tank Supplier/Inspector Recommendations:** As part of this study, multiple tank suppliers, manufacturers and inspectors were questioned on possible solutions to the Bolted Tank. Below is a list of thoughts/recommendations composed through these discussions:

  1. Initial thoughts by most suppliers/inspectors/manufacturers was a reluctancy to have anything to do with the tank, particularly with regards to the history of the tank and its original manufacturer/designer (primarily due to the bankruptcy issue).
  2. Many of the entities recommended having someone tighten the bolts on the tank, and see what happens before inspections were to happen. In discussions with the Public Works Director, Jon Winter, he does not have a record of what has been done to the tank, but has been informed that the tank's bolts have been tightened sometime after initial construction.
  3. Visual (Dry) inspections wouldn't yield much information than is already available/visible. Based upon limited historical information it is recommended that more in depth investigations are needed to properly identify issues particularly with regards to structural analysis of the tank's foundation, testing the corrosion levels, individually test each panel (vacuum test each joint), etc.
  4. There is concern that the leaking could have caused the ground surrounding and beneath the tank to become saturated. Particularly due to its construction

history of foundation failure (see above). System operators should routinely monitor the surrounding ground and foundation for signs of saturation, settling, concrete erosion, deep cracks, exposed reinforcement steel, etc.

5. Sealing the tank is a very temporary solution (1-3 years) for glass lined tanks. A more permanent (long-term) solution would be to replace panels.
6. Ice formation is a concern with these types of tanks (standpipes) due to ice rubbing and scraping interior panels/coatings and bolts. According to the AWWA (American Water Work Association) Steel Water-Storage Tanks Manual M42, "If the coatings are not abused or damaged, the anticipated life expectancy of bolted tanks is more than 30 years". This Section of AWWA Manual M42 also states that "tanks located in areas with the LODMT (Lowest one-day mean temperature) warmer than -5 degrees Fahrenheit normally will not experience cold-weather operational problems". The tanks in Saratoga sit in between the LODMT isothermal lines of -25 and -30 degrees Fahrenheit. Additionally, as stated above, these tanks have a very low turnover as evidenced by their water age. AWWA Specifications do not dismiss that freezing is not a problem with these tanks.

6.4.2 Storage Conclusions/Recommendations:

In conclusion for the tanks, there are some significant issues with the existing Saratoga Standpipe Water Tanks including water age/stagnation, freezing, leaking, potential foundation failure, operational ranges, location, etc. As part of this report, thoughts, conclusions and recommendations were drawn as stated below:

- **Decommission the Bolted Steel Tank:** As shown above in Table 6.3, there is enough storage in one tank (welded tank) to meet the storage demands now, and in the future (30 years). Below are some factors to consider with this option:

    1. Operational Impacts: One of the intended purposes of this additional tank was to allow for one tank to be taken "off-line" for inspections/maintenance while still maintaining storage capacities. Many communities are capable of utilizing one tank as long as the source supply is capable of maintaining and delivering on the demands of the system.
    2. The well field has the permitted capacity to provide approximately 925 gpm or 1,332,000 gallons per day (gpd) which is more than enough to keep up with the future MDD of 1,237,527 gpd let alone the future ADD of 477,692 gpd.
    3. The water age in the system will significantly drop. Along with other recommendations, it is shown in Figures 5.11 and 5.12 that the water age becomes a more acceptable level than currently configured.

- **"Saratoga 3,000 (Northstar Economics, 2004)":** As stated above, many of the improvements and recommendations to the Saratoga water system as well as being the basis of prior studies were based off of a citizen's ad hoc group, "Saratoga 3,000", identifying that for Saratoga to be economically viable a population of 3,000 is necessary. While those efforts and goals are well and good and the potential may have been available at that time, it can be seen that such a population is not projected or anticipated in the next 30 years let alone the next 100 plus years. By building something now that anticipates a future population of 3,000 a few issues arise, specifically with relation to infrastructure life cycles. Most infrastructure is not intended/designed to exceed 30-50 years of life expectancy. As a result, infrastructure will likely have to be reconstructed multiple times before a 3,000 population is reached in Saratoga. As a note, these master plans, as commissioned by the Wyoming Water Development Commission, are not intended to be a "catch-all-end-all" plan. They are intended to be a 30 year life cycle analysis of the system and updated every 10 to 15 years.

- **Decommission both Tanks and Install a New Tank at a Different Location:** This study looked at the possibility of removing both existing tanks from service and installing a 750,000 gallon tank along the well transmission line that is higher in elevation than the existing tanks (approximately 35 feet higher in elevation), see Figure 6.2. In an effort to maintain existing operations and minimum tank levels this new tank would have a minimum water level of approximately 5 (five) feet to maintain system pressures (minimum 35 psi). So, constructing this tank with a 65 foot height (to meet the existing tank's 100 foot maximum elevation) and 45 foot diameter a 750,000 gallon tank is presented. By utilizing the higher elevation this tank can be lower profile (65' height vs. 100' height) and an effective usable storage capacity of approximately 710,000 gallons (minimum 5' water level) which meets both current and future demands. Additionally, water age evaluations on such a tank are presented below in Figure 6.3.

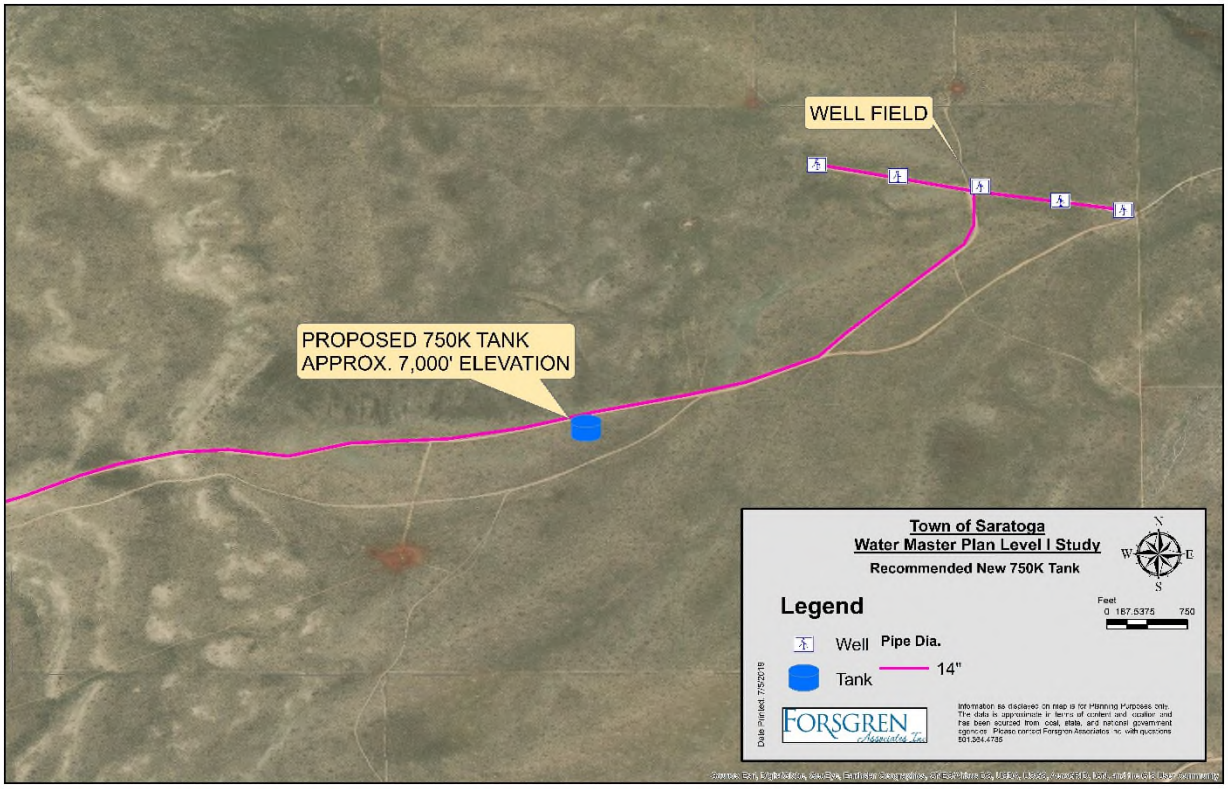
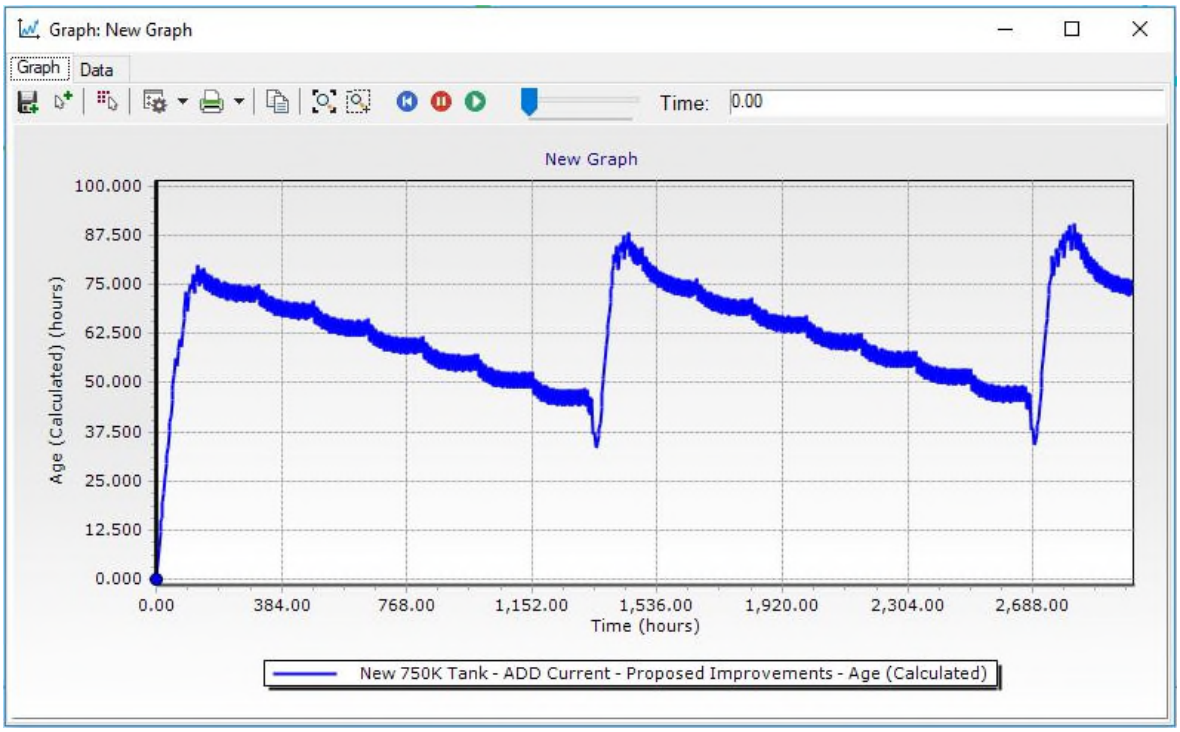


Figure 6.2- Recommended New 750K Tank Location



75 hours

Figure 6.3- Recommended 750K Tank Water Age

This option does not come without its challenges. Wyoming DEQ Chapter 12 Section 8 (d)(iii) states "Where the finished water storage volume that floats on the distribution system is not capable of supplying the maximum daily demand, an alternative power shall be provided for the finished water pumps". As shown above in Section 6.3.1, the finished water storage of 1.2 MG is able to provide the current MDD while the projected future MDD exceeds the total finished water storage and would require alternative power for the wells. If the Town decommissions both tanks and installs the single proposed tank then there would be an immediate need for alternative power to the wells. In either case, whether the existing tanks remain or they are removed and replaced by a single tank, alternative power becomes a need for the system. Another challenge is redundancy, as stated above one of the main reasons that the bolted tank was installed was to provide redundancy such that if one tank needed to be taken off line for inspections/maintenance then the other tank would be capable of handling the storage demands. The Town has expressed it desire to maintain redundancy with its storage but more directed towards having storage on both sides of the river, in the event that the river crossings become damaged. With the wells being permitted to supply approximately 925 gpm or 1,332,000 gpd the maximum day demands can be met for both current and future (2049) projected demands.

- **Decommission just the Bolted Tank and Install New Tank:** This study also looked at removing just the bolted tank and installing a new tank as described above. While the welded tank would still be at a less than desirable location it does address some of the issues as noted above. Additionally, while the tank is approximately 40 years of age proper maintenance and rehabilitation have left this tank with useable life remaining. The issue that this option addresses is the need for alternative power at the wells. In combining the effective storage capacities of both tanks (Welded – 600K and New Tank – 710K) the total effective storage capacity would equal 1,310,000 gallons which exceeds both the current and future max day demands essentially eliminating the need for alternative power at the well field for the next 30 plus years.

- **Tank Mixing:** As noted above in Section 5.1.1 this report recommends mixers for each tank, whether that be the two existing tanks or new tank. This is recommended for two purposes in mind; 1) To create a more uniform water age within the tanks to better control water age, and 2) To reduce the formation of ice within the tanks.

- **Tank Flushing:** As mentioned above, in an effort to reduce the water age in the Town's existing tanks, implementing a weekly flush during the winter/low demand months (worst case scenario), and higher demand months can help reduce/stabilize water age within the tanks.

- **Tank Level Control Modifications:** In this study's efforts to evaluate the water age in the tanks, we found that adjusting the controls of the tanks significantly reduced the water age and provided more turn over in the storage volume. As stated above, the Town currently operates the tanks at water levels of 80-86 feet (which corresponds to 80-86 % full) during winter/low demand months (during higher demand months at 90-95 feet). This causes tanks to become stagnant which causes the formation of ice, causes the tank levels to rise and drop quickly (due to the limited range 80-86 feet) and causes the pumps to turn on and off more frequently than necessary. By adjusting the tank level controls to a minimum of 70 feet and a maximum of 86 feet, the low demand months, the water age in the tanks significantly improve as shown in Section 5.1.1 above and provides less frequency on pump operations.

- **Do Nothing Approach:** This option is just as it states, do nothing, change nothing and continue to operate the tanks as they currently are. In some cases, this approach is an actual option but for the purposes of this study and through its findings there isn't a practical or effective "do nothing approach" for the Town's storage facilities.

- **Repair Bolted Tank:** This option is intended to look at repairing the bolted tank. As of right now the overall integrity of the tank is unknown and a dry (visual) inspection will not provide more answers or conclusions than what is already known, the tank is leaking and the glass lining is peeling/cracked. A thorough inspection is recommended as part of this study to evaluate the structure as a whole, as stated above. This study could recommend sealing or replacing panels at this time but due to the uncertainty regarding the structural integrity of the tank, possible saturated ground surrounding/beneath the tank and lack of history (requested from the Town) put a major asterisk in any recommendation apart from a thorough structural evaluation/inspection of the tank. This study does however provide cost comparisons for sealing the interior of the tank and replacing all panels, see Section 7.1.1 below.

- **Minimum Recommendations:** At a minimum the following are recommended improvements/modifications assuming the existing tanks remain in service as presently composed:

    1. Structural/Geotechnical Evaluation/Inspection Determination (Bolted Tank)
    2. Remedy Leaking (sealing, panel replacement, etc. as determined by Item 1)
    3. Install Tank Mixing System (for both tanks)
    4. Implement Weekly 2 hr @ 1,000 gpm Flush
    5. Adjust Tank Elevation Controls to allow more turn over in the tanks

- **Report Optimal Recommendations:** To optimize the system storage the following recommendations are made:

    1. Decommission/Remove Bolted Tank from Service
    2. Install 750K Standpipe Tank along Well Transmission Line at Higher Elevation
    3. Install/Implement Tank Mixing System for Welded Tank and New Tank
    4. Implement Weekly 2hr @ 1,000 gpm Flush
    5. Adjust Tank Elevation Controls to Allow more turn over in the tanks

- **Final Thoughts:** As stated multiple times in this report, the current location and configuration of the existing tanks (Welded and Bolted) is less than desirable. By utilizing the recommendations above or combination thereof, they will help the Town in mitigating the issues that present itself in providing adequate system storage.

6.5 Transmission and Distribution Piping

6.5.1 Water Supply Transmission Lines

As stated above, there are four (4) identified transmission lines which convey water from the supply into the distribution system as well as from the storage to the distribution system. Figure 6.4 below shows the relative locations of these transmission lines. Though the transmission lines were not visually inspected, interviews with system operators indicate that the newer (2008-) transmission lines appear to be in good condition while the older transmission lines appear to have issues with regard to age and durability. This report recommends the replacement of these older transmission lines or parts thereof as indicated in Section 7.1.7 below. Cost estimates have been prepared and can be found in Section 7.1.7 and Appendix I.

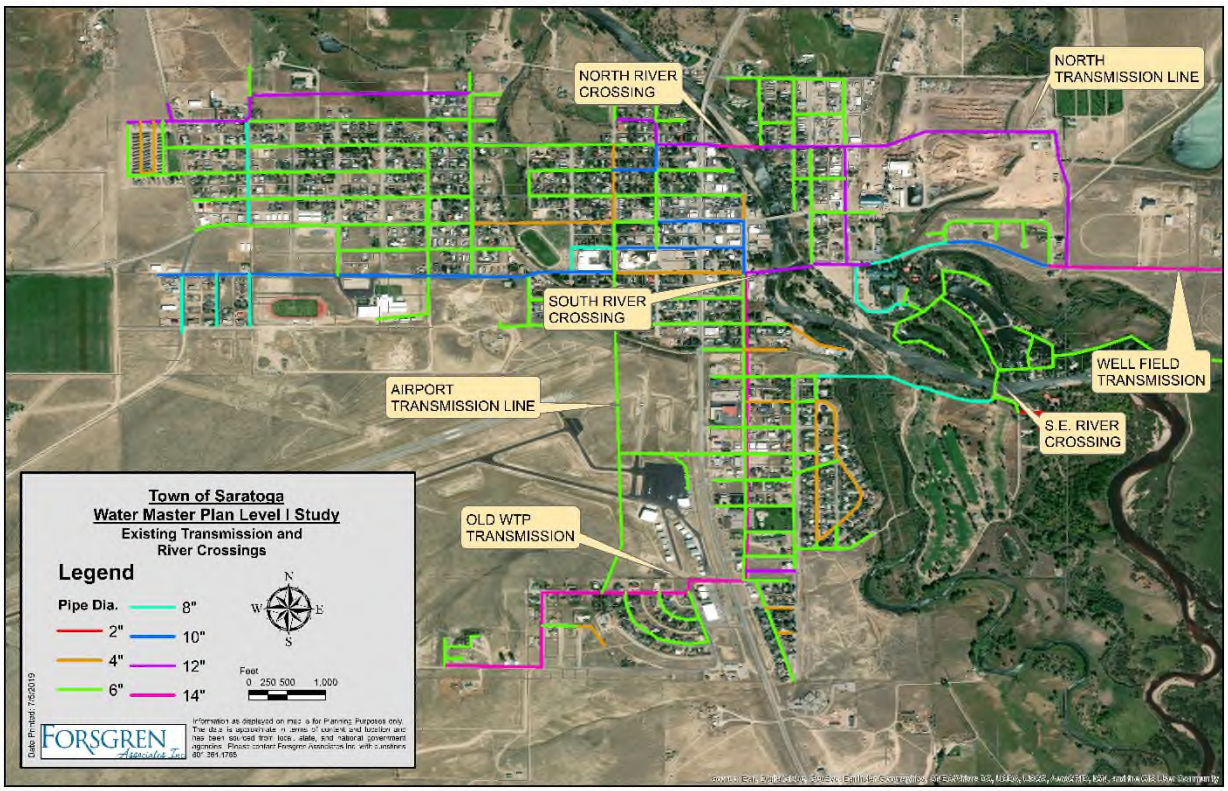


Figure 6.4- Transmission Lines & River Crossings

6.5.2 Town of Saratoga Distribution Piping

The Town of Saratoga's water distribution system primarily consists of 4" thru 14" waterlines ranging from PVC to Cast Iron. As stated above, many of the distribution lines appear to be in good condition while others have required "more than usual" maintenance with regards to the increasing age of the system and identified waterline breaks and leaks. Figure 6.5 below identifies some of the recorded distribution and transmission problem areas as identified through

system operator interviews. Results from the system modeling show that, in general, the lines are adequately sized for current and future system demands though fire protection regulations (WyDEQ) mandate some modifications to meet regulations WyDEQ Chapter 12 Section 14 (b)(ii) states "The minimum size of a water main for providing fire protection and serving fire hydrants shall be 6 inches diameter when service is provided from 2 directions, or where the maximum length of 6 inches pipe serving the hydrant from 1 direction does not exceed 250 feet, or 8 inches where service is provided from 1 direction only". The following list of distribution system replacements/improvements are recommended in this report as follows in Table 6.5. An overall distribution system piping recommendation cost estimate is provided in Section 7.1.6. Figure 6.6 below also identifies such system improvements.

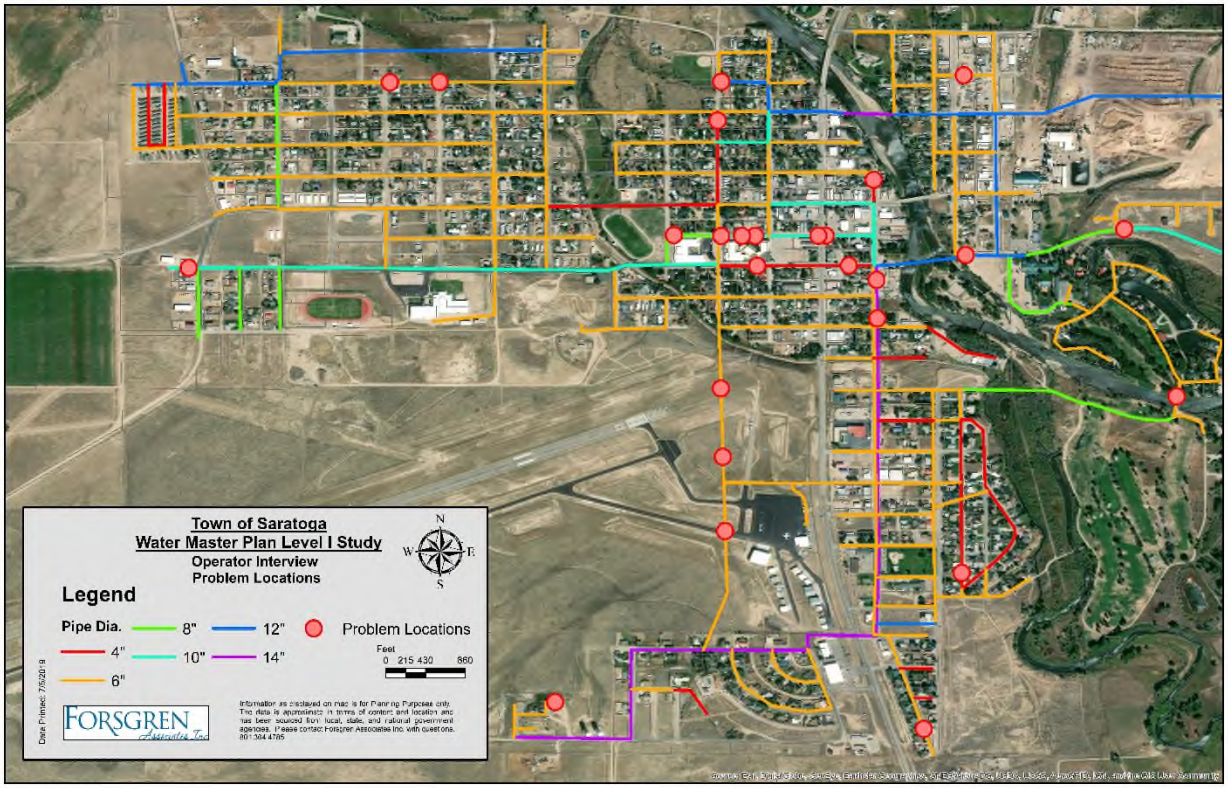


Figure 6.5- Transmission and Distribution Problem Areas

- **Valve Replacement/Additions Program:** As part of the recommended distribution system replacement/improvements, the Town should also consider a valve replacement/addition program to address defective valving and create more manageable line isolation situations. With the GPS data collected of system valving, the maps included with this report and operational testing, the Town can create a more operational system. Many locations for isolation valve needs are included in the distribution improvements, but there are locations that just need additional valving such that long stretches and sections of the distribution system will not need to be out of water should a break occur. This report does not define individual isolation valve locations, as there are

many locations and uncertainty with which side of a tee or cross a GPSed valve sits. This report relies on the Town operator's discretion and prioritized needs of isolation valve locations.

- **Fire Hydrant Replacement Program:** In evaluating the distribution system and in the efforts in collecting distribution system GIS data, a number of identifiable fire hydrant issues arose, 1) There are a number of hydrants that are currently partially buried or taped off and deemed unfunctional, 2) There are at least 7 (seven) different fire hydrant types throughout Town and 3) Due to the multitude of fire hydrant types, repair of these hydrant requires that the Town stock parts for each hydrant type. Currently the Town does not repair hydrants if they are not of a specified type of hydrant and replaces the hydrant instead. Below, Table 6.6 identifies the amounts of each hydrant type. It is recommended that the Town continues to install acceptable hydrant types and ensure that these types of hydrants are installed with any new construction or replacement of hydrants. This report does not recommend replacing hydrants proactively but it does recommend that the Town continue to replace hydrants that are not of the one or two selected types become unusable or deficient with a hydrant of one of the selected types as funds are available.

Table 6.5 Distribution/Transmission Improvements

	General Details									Basis for Improvements					
Line Number	Water Line	Beginning	End	Approx. Length (ft)	Pipe Age	Existing Size	Recommended Size	Existing Material	Recommended Material	Fire Protection	Size	Material	Age	Maintenance	Notes
Distribution															
1	West Farm Ave	N 11th Street	N 7th Street	1800	1970s	6"	6"	Schedule 40	PVC	No	No	Yes	Yes	Yes	Replacing Aging 6" Schedule 40 PVC with new 6" PVC
2	North 3rd Street	W Rochester Ave	W Bridge Ave	1100	1970s	4"	6"	Cast Iron	PVC	Yes	Yes	Yes	Yes	Yes	Replace Aging 4" Cast Iron
3	East Farm Avenue	N Veterans Street	N State Street	400	1970s	6"	6"	Asbestos Cement	PVC	No	No	Yes	Yes	Yes	Replace Aging 6" Asbestos Cement
4	South 7th Street - Eliminate D.I. Pipe	W Main Ave	W Bridge Ave	400	1970s	6"	NA	Ductile Iron	NA	NA	NA	NA	NA	Yes	Disconnect Existing 6" DI Pipe and connect services to PVC Pipe - 2 lines in this road.
5	West Bridge	S 3rd Street	S 6th Street	1500	1970s	4"	6"	Cast Iron	PVC	Yes	Yes	Yes	Yes	Yes	Replace 4" Cast Iron with 6" PVC, there is a Record Drawing of this line being completed in 2011 but in interviews with system operators they indicate it is still cast iron.
6	North River Street	E Bridge Ave	E Main Street	400	1970s	4"	6"	Ductile Iron	PVC	Yes	Yes	No	Yes	Yes	Replace 4" Ductile Iron with 6" PVC for Fire, Looping, Maintenance
7	High School FH Line	W Elm Ave	FH Behind High School	1000	Unknown	6"	8"	Unknown	PVC	Yes	Yes	No	No	No	Greater than 250' (WyDEQ) dead end to fire hydrant
8	West Spring Ave	N 6th Street	East - Dead End	320	1980s	6"	8"	PVC	PVC	Yes	Yes	No	No	No	Greater than 250' (WyDEQ) dead end to fire hydrant
9	West Elm Ave	S 3rd Street	S River Street	1300	1970s	4"	6"	Cast Iron	PVC	Yes	Yes	Yes	Yes	Yes	Replace 4" CI with 6" PVC
10	East Walnut Ave	S River Street	East to FH	450	1970s	6"	8"	Ductile Iron	PVC	Yes	Yes	No	Yes	No	Greater than 250' (WyDEQ) dead end to fire hydrant
11	Cypress Avenue	S River Street	West Dead End	400	1970s	6"	8"	Ductile Iron	PVC	Yes	Yes	No	Yes	No	Greater than 250' (WyDEQ) dead end to fire hydrant
12	Cypress Avenue	S River Street	Range View Ave	700	1970s	6"	6"	Asbestos Cement	PVC	No	No	Yes	Yes	Yes	Replace AC Pipe
13	Mountain View Ave	S River Street	S Veterans St	500	1970s	4"	6"	Ductile Iron	PVC	Yes	Yes	No	Yes	No	Fire Looping

Table 6.5 Distribution/Transmission Improvements Cont…

14	Maple Ave	S 1st Street	S River Street	400	1990s	6"	8"	Ductile Iron	PVC	Yes	Yes	No	No	No	Greater than 250' (WyDEQ) dead end to fire hydrant
15	Range View Ave	Mountain View Ave	Myrtle Ave	1900	1970s	4"	6"	Ductile Iron	PVC	Yes	Yes	No	Yes	Yes	Fire Looping & Maintenance
16	Cliff Drive	Mountain View Ave	Range View Ave	2500	1970s	4"	6"	Ductile Iron	PVC	Yes	Yes	No	Yes	No	Fire Looping
17	Willow Ave	S 1st Street	S River Street	400	1970s	6"	8"	Ductile Iron	PVC	Yes	Yes	No	Yes	No	Greater than 250' (WyDEQ) dead end to fire hydrant
18	Greenwood Ave	S 1st Street	S River Street	350	1970s	6"	8"	Ductile Iron	PVC	Yes	Yes	No	Yes	No	Greater than 250' (WyDEQ) dead end to fire hydrant
19	Constitution Ave	S 1st Street	S River Street	300	1970s	6"	8"	Ductile Iron	PVC	Yes	Yes	No	Yes	No	Greater than 250' (WyDEQ) dead end to fire hydrant
20	Sunset Lane Ave	Hill Top Drive	East to FH Dead End	800	1970s & 1980s	6" & 4"	8"	Ductile Iron	PVC	Yes	Yes	No	Yes	No	Greater than 250' (WyDEQ) dead end to fire hydrant
21	Veterans Street	Pine Ave	S River Street	1400	NA	NA	6"	NA	PVC	Yes	NA	NA	NA	NA	Fire Looping
22	S River Street	Aspen Ave	Veterans St	650	1970s	6"	6"	Asbestos Cement	PVC	No	No	No	Yes	Yes	Maintenance Issues
23	Hyland Court	Sierra Madre	North To FH Dead End	350	1970s & 2000s	6"	8"	Ductile Iron	PVC	Yes	Yes	No	Yes & No	No	Greater than 250' (WyDEQ) dead end to fire hydrant
24	East Spring Ave	N 3rd Street	S River Street	1300	1970s to 2000s	10"	10"	Ductile Iron	PVC	No	No	No	No	Yes	Multiple Breaks
	Transmission														
25	Airport Transmission	Air Port Ave	W Bridge Ave	5000	1970s	6"	8"	Cast Iron	PVC & HDPE	Yes	Yes	Yes	Yes	Yes	Replace Airport Transmission, Connect on Airport Ave and Abandon Connection near Sunset Lane (Old Storage Tanks Site)
26	WTP Transmission	W Elm Ave	Cypress Ave	1400	1970s	14"	14"	Ductile Iron	PVC	No	No	No	Yes	Yes	Multiple Breaks and Valving Issues

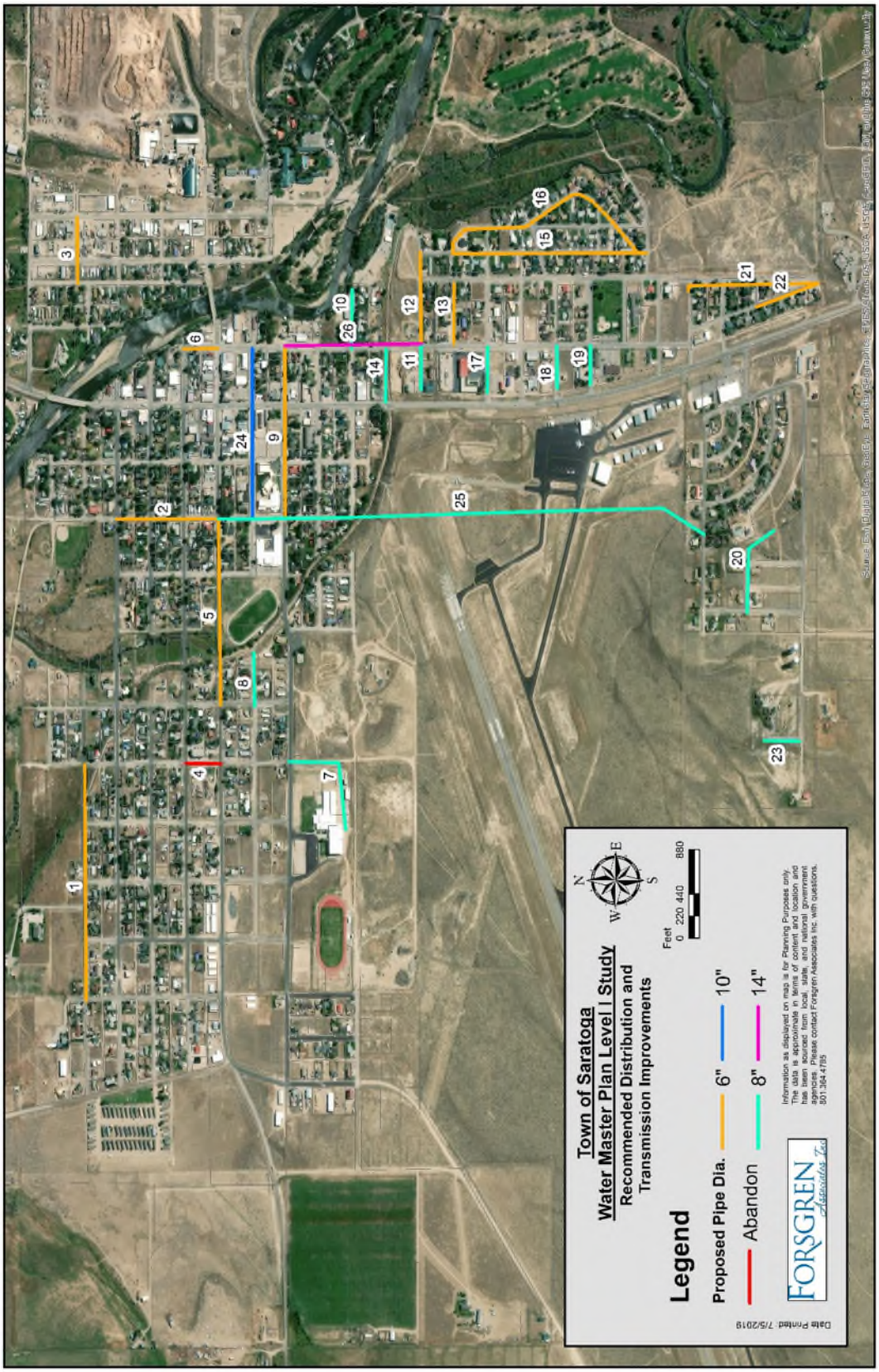


Figure 6.6- Distribution & Transmission Improvements

Table 6.6 Fire Hydrant Type Data

	Mueller	Kennedy	Waterous	American Darling	Pacific States	MH Regent	Unknown	Approximate Total Hydrants
Fire Hydrants	77	10	41	37	3	2	12	182

7.0 RECOMMENDATIONS AND CONCLUSIONS

7.1 Conclusions and Recommended System Improvements

Based upon the findings of this Master Plan Level I Study, several conclusions and recommendations are drawn as follows:

7.1.1 Storage Recommendations

As discussed above in Section 6.4, the optimal recommendation is for the bolted steel tank to be decommissioned and a new 750K gallon tank be installed along the transmission line. The basis of this recommendation draws mainly from the bolted tank's construction history and history of leaking and water age. As mentioned in this report there are other factors in consideration for evaluating the storage, including operational issues and surplus of storage. Typically, water age becomes a problem when disinfection by-products (DBP) are detected in the system. Water quality testing of the Town's water has not detected or reported any DBPs, although the configuration and location of the tanks doesn't allow for much influence on the distribution water quality. **This recommendation also is derived due to the Town's desire to maintain its system storage redundancy by having storage on either side of the river as opposed to the same location.** In addition to the new tank, the SCCIJPB has expressed interest in installing water quality monitoring at this tank location particularly with measuring chlorine residuals and contact time. A detailed cost estimate for the decommission of the bolted tank and installation of a new 750,000 gallon tank can be found in Appendix I. The cost for this recommendation is approximately $1,962,819.35. This cost includes permitting, legal fees and right-of-way acquisition fees. To project this estimate for future construction inflation factors were also added to the estimate.

Typically, WWDC does not provide funding for water quality projects, however as this project would not only address water quality but also storage requirements and deficiencies it is assumed that WWDC will provide funding for this project. Aside from WWDC there are other funding avenues available such as State Revolving Fund (SRF) and Mineral Royalties Grant (MRG). Based upon the Town's AMHI (Annual Median Household Income $73,476 – 120.58% of State's AMHI) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, a funding breakdown is provided in Table 7.1 for the financing of

decommissioning the bolted tank and constructing the new storage tank with a 67% WWDC Grant and 33% DWSRF Loan.

Table 7.1 New 750K Storage Tank Funding

Estimated Capital Improvement Cost	ASSUMED FUNDING SOURCE			Total Payment
	WWDC Grant (67% Eligible)	DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC	Annual Payment	
$1,863,893.30	$1,248,808.51	$619,505.29	$39,739.49	$794,789.71

It is our recommendation that the Town decommission the existing bolted storage tank and install a 750K gallon tank along the transmission line at a higher elevation such that the effective storage capacity is greater than the that of the bolted tank. It is recommended that the existing welded tank remain to live out the remainder of its life cycle to provide operational redundancy. Although such redundancy is unnecessary as the source supply is capable of supplying in excess of the max day demand, the redundancy in storage on both sides of the river can help provide some ease of mind in the short term. If the welded tank and/or the bolted tank are left in service additional recommendations are provided below. This project will help with water age, eliminate the issues associated with the bolted tank and provide required storage. A cost estimate has been prepared for this recommendation and is included in Table 7.2 below.

- **Alternative Storage Recommendations/Cost Estimates:** Though this study recommends the above scenario for the Town's storage, this study also provides some cost estimates for alternative solutions. These solutions include the acquisition/completion of an in-depth structural and geotechnical evaluation of the bolted tank, sealing of the bolted tank and replacement of panels of the bolted tank. These cost estimates are provided in Appendix I of this report.

Table 7.2 New 750K Storage Tank Cost Estimate

Project:	Decommission Bolted Standpipe and Install 750K Tank Along Transmission Line			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
Schedule #1 General					
1	**Mobilization (Not to Exceed 5% of Construction Costs)**	**LS**	**Job**	**$70,000.00**	**$70,000.00**
2	**Exploratory Excavation**	**HR**	**10**	**$300.00**	**$3,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$15,000.00**	**$15,000.00**
4	**Traffic Control/Public Coordination**	**LS**	**Job**	**$5,000.00**	**$5,000.00**
Schedule #2 Decommission Bolted Standpipe					
5	**Disconnect Bolted Standpipe from System**	**LS**	**Job**	**$2,500.00**	**$2,500.00**
6	**Drain Standpipe**	**LS**	**Job**	**$3,000.00**	**$3,000.00**
7	**Disassemble and Dispose of Standpipe Components**	**LS**	**Job**	**$55,000.00**	**$55,000.00**
8	**Demolish & Dispose of Standpipe Foundation**	**LS**	**Job**	**$15,000.00**	**$15,000.00**
9	**Site Grading**	**LS**	**Job**	**$1,500.00**	**$1,500.00**
Schedule #3 New 750K Tank					
10	**Site Grading**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
11	**Standpipe Foundation**	**LS**	**Job**	**$30,000.00**	**$30,000.00**
12	**750K Gallon Steel Standpipe**	**Gallon**	**750,000**	**$1.50**	**$1,125,000.00**
13	**Tank Hardware & Piping**	**LS**	**Job**	**$25,000.00**	**$25,000.00**
14	**Disinfection & Testing**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
15	**14" D.I. Waterline**	**LF**	**200**	**$100.00**	**$20,000.00**
16	**14" Gate Valve**	**Each**	**4**	**$5,500.00**	**$22,000.00**
17	**14" Tee**	**Each**	**2**	**$3,000.00**	**$6,000.00**
18	**Chain Link Fence**	**LF**	**600**	**$45.00**	**$27,000.00**
19	**Pipe Bedding**	**LF**	**200**	**$8.00**	**$1,600.00**
				Eligible Total	**$1,446,600.00**
WWDC Non-Eligible Costs					
20	**Water Quality Monitoring Equipment (Chlorine Residuals)**	**LS**	**Job**	**$4,200.00**	**$4,200.00**
				Non-Eligible Total	**$4,200.00**
Cost of Eligible Project Components (Subtotal #2)				**$1,446,600.00**	
Preparation of Final Designs and Specifications				**$144,660.00**	
Permitting & Mitigation				**$10,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$20,000.00**	
Pre-Construction Costs (Subtotal #1)					**$179,660.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$1,446,600.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$144,600.00**	
Components and Engineering Cost (Subtotal #3)				**$1,591,260.00**	
Total Construction Cost (Subtotal #4)					**$1,591,260.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$1,770,920.00**
Inflation (5% per year)		Year	2		**$92,973.30**
Total Eligible Project Cost with Inflation				-	**$1,863,893.30**
Total Non-Eligible Project Cost Portion				-	**$4,200.00**
Inflation (5% per year)		Year	2	-	**$220.50**
Total Non-Eligible Project Cost Portion with Inflation				-	**$4,420.50**
Total Project Cost with Inflation				-	**$1,868,313.80**

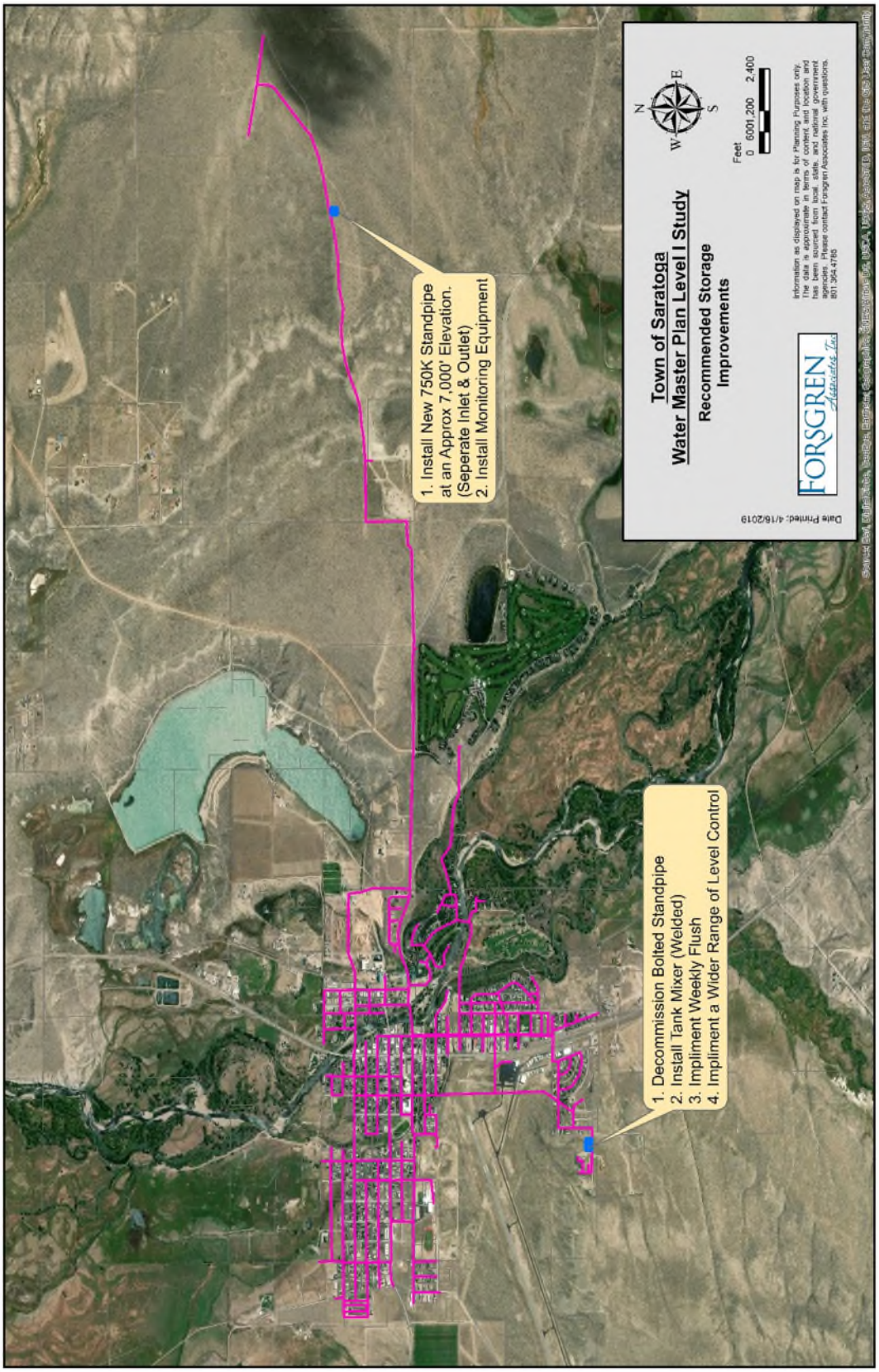


Figure 7.1- Storage Recommendations Map

7.1.2 Tank Mixers

To help alleviate some of the water age issues found in the storage tanks during the modeling, this report looked at the installation of a tank mixer. The purpose of a tank mixer is to minimize the stratification/water age of the system as well as to prevent stagnation of the water within the tank itself. Currently the tanks operate with a single inlet/outlet configuration and as standpipes they operate as "First in Last Out Tanks", meaning the water that first enters the tank is the last to leave. By installing a mixer in each tank, the age of the water becomes more uniform and easier to control/mitigate. A mixer will also help with the prevention of ice buildup within the tanks and their stratified layers. There were three options that were looked at as part of this study for potential mixing solutions. The first option was to look at the possibility of reconfiguring the piping such that the tank would fill from the top and empty from the bottom, the second option was a jetted system utilizing flow from incoming water and the third potion was the installation of a tank bubbling mixer. Due to other higher prioritized recommendations regarding the bolted tank and the age of the welded tank, reconfiguring the inlet/outlet scheme of the tanks is deemed unnecessary as part of this study. A separate transmission line for the inlet line would be needed to have an impact on water age. Due to the distance from the well pumps and the size of the line entering the tanks, a jetted system would not have the desired results particularly with such a tall tank. This report recommends the installation of a tank mixing/bubbling system in the welded tank.

Figures 7.2 thru 7.3 show the main components of a tank bubbling system as well as an example diagram of water flow.

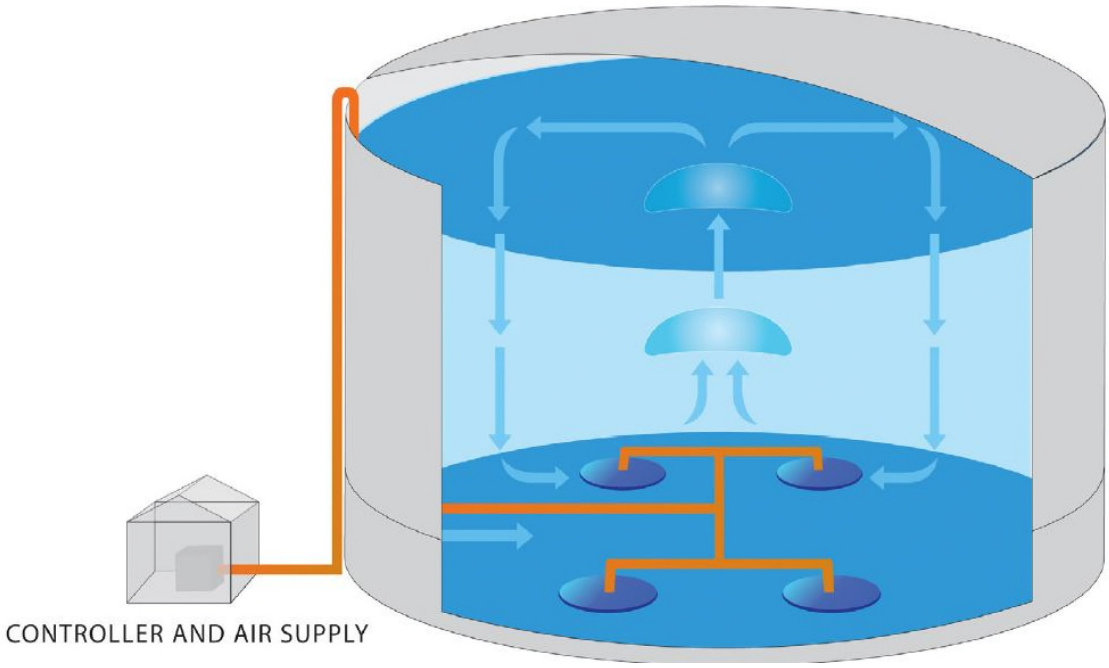


Figure 7.2 Typical Tank Mixing Unit and Flow Pattern

Figure 7.3 Typical Tank Mixer Control Panel

The estimated cost for the installation of a bubbler mixer is approximately $72,621.71. A detailed cost estimate can be found in Table 7.3 below and in Appendix I.

Table 7.3 – Welded Tank Storage Bubbler Mixer Installation

Project:	Welded Tank Mixer			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
Schedule #1 Bubbler Tank Mixer					
1	**Bubbler Tank Mixer**	**LS**	**Job**	**$40,250.00**	**$40,250.00**
2	**Manufacturer Deliver & Install**	**LS**	**Job**	**$3,450.00**	**$3,450.00**
3	**Power to Site**	**LS**	**Job**	**$5,750.00**	**$5,750.00**
				Non-Eligible Total	**$49,450.00**
Cost of Eligible Components (Subtotal #2)				**$0.00**	
Preparation of Final Designs and Specifications				**$4,945.00**	
Permitting & Mitigation				**$1,500.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$6,445.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$49,450.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$4,945.00**	
Components and Engineering Cost (Subtotal #3)				**$54,395.00**	
Total Construction Cost (Subtotal #4)					**$54,395.00**
Total Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$60,840.00**
Inflation (5% per year)		Year	2		**$3,194.10**
Total Non-Eligible Project Cost with Inflation				-	**$64,034.10**

Typically, with this kind of project, a water quality project, WWDC does not provide funding. There are other funding avenues available such as SRF and MRG. Based upon the Town's AMHI (Annual Median Household Income) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, a funding breakdown is provided in Table 7.4 for the financing of the tank mixer using a 100% DWSRF Loan option.

Table 7.4 Tank Mixer Funding

	ASSUMED FUNDING SOURCE			**Total Payment**
Estimated Capital Improvement Cost	**WWDC Grant (67% Eligible)**	**DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC**	**Annual Payment**	
$64,034.10	$0.00	$64,034.10	$4,107.60	$82,152.07

7.1.3 System Flushing

As discussed in Section 5.1.1, it is recommended that the Town perform weekly flushing on the system as a supplementary solution to the increased water age. The most effective flush analyzed was a weekly flush of 1,000 gpm for 2 hours or 120,000 gallons per week. This recommendation does not require any capital improvement but it does however come with the

additional cost of production as shown below in Table 7.5. Table 7.6 shows a comparison of the summer and winter average well production increase required to implement a weekly flushing schedule of 120,000 gallons per week. The optimal flushing location can be found above in Figure 5.13.

Table 7.5 – Annual Flushing Cost

Weekly Flushing Cost				
Weekly Flush (gal)	Weeks per Year	Gallons Per Year	Production Cost Per 1,000 gallons (ref Table 4.5)	Total Annual Additional Production Cost
120,000	52	6,240,000	$2.21	$13,790.40

Table 7.6 – Winter vs. Summer Flushing Comparison

	Monthly Average (gal)	120,000 gal Weekly Flush (gal per month)	Total (gal)	Increase of Production (%)
Summer 13-18	24,429,558	480,000	24,909,558	2%
Winter 13-18	8,606,207	480,000	9,086,207	5.6%

7.1.4 Tank Operational Controls

As discussed above, this study recommends adjusting the operational controls of the existing tanks such that a minimum tank elevation of 70 feet is met prior to "re-fill". Currently the tanks operate at levels in the summer from 90-95 feet and at 80-86 feet in the winter. With such tight ranges, the opportunity for water turnover is minimal. By adjusting those ranges to 70-95 feet in the summer and 70-86 feet in the winter, the stored water is able to turn over more, water age will decrease and can help prevent ice buildup inside the tanks. Although this effort will reduce pressures nearest to the tanks below 35 psi (but not below 30 psi) considerations should be made with respect to the overall safety of the system as water age can have negative effects on the system. This recommendation does not require any capital improvement but may require some time in evaluation/implementation by the water operators.

7.1.5 SCADA Upgrade

The SCADA system was installed in 2009 and the computer equipment has exceeded design life and needs to be upgraded to increase communications speed and because the computer operating system is outdated. The recommended components for a SCADA system upgrade include:

- 900 point iFix software upgrade for most current version that is Windows 7 compatible, with historian software and customer support;
- New version of Win 911 software with Dialogic modem;

- Labor to install software packages on computer, load databases, load graphics and resize screen images, and test all protocol drivers and operating systems; includes travel time and expenses and on site deployment;
- Airtop i7 solid state computer, MS Office, 24-inch monitor, and five year offsite warranty.

The cost for these SCADA upgrades is approximately $23,481.28. WWDC does not fund maintenance issues therefore this project would be self funded or funded through another funding agency such as SRF or MRG. A funding breakdown can be seen below in Table 7.7 assuming a full 100% DWSRF funding. A detailed cost estimate can be found in Table 7.8 and Appendix I.

Table 7.7 SCADA Upgrades Funding

Estimated Capital Improvement Cost	ASSUMED FUNDING SOURCE			Total Payment
	WWDC Grant (67% Eligible)	DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC	Annual Payment	
$20,418.50	$0.00	$20,418.50	$1,309.79	$26,195.76

Table 7.8 SCADA Upgrades Cost Estimate

Project:	SCADA Upgrades			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
Schedule #1 SCADA Upgrades					
1	**Software Upgrade**	**LS**	**Job**	**$5,200.00**	**$5,200.00**
2	**New Dialogic Modem**	**LS**	**Job**	**$2,500.00**	**$2,500.00**
3	**Labor & Install**	**LS**	**Job**	**$6,200.00**	**$6,200.00**
4	**New Sold State Computer (5 Year Warranty)**	**LS**	**Job**	**$3,000.00**	**$3,000.00**
5	**System Cloud Backup**	**LS**	**Job**	**$2,500.00**	**$2,500.00**
				Non-Eligible Total	**$19,400.00**
Cost of Eligible Components (Subtotal #2)				**$0.00**	
Preparation of Final Designs and Specifications				**$0.00**	
Permitting & Mitigation				**$0.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$0.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$0.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$0.00**	
Components and Engineering Cost (Subtotal #3)				**$19,400.00**	
Total Construction Cost (Subtotal #4)					**$19,400.00**
Total Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$19,400.00**
Inflation (5% per year)		Year	2		**$1,018.50**
Total Non-Eligible Project Cost with Inflation				-	**$20,418.50**

7.1.6 Distribution System Improvements

As discussed in Section 6.5.2 above, there are multiple distribution system replacement/installations that are recommended as part of this Master Plan. Table 6.5 identifies these improvements as well as shown in Figure 6.6. A detailed cost estimate for the total recommended distribution system upgrades can be found in Table 7.10 and Appendix I.

WWDC Typically does not fund distribution system improvements. However, there are other funding avenues available such as SRF and MRG. Based upon the Town's AMHI (Annual Median Household Income) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, a funding breakdown is provided in Table 7.9 for the financing of the distribution improvements using a 100% DWSRF Loan option.

- **Fire Hydrant Replacement Program:** As mentioned above, it is recommended that the Town continue with its Fire Hydrant Replacement Program, such that as hydrants become worn down or broken they are replaced with one of the two selected fire hydrant types. As mentioned above there are over seven (7) different types of fire hydrant in the Town. This recommendation is not an immediate capital improvement project but more of a recommendation to continue operational procedures. Typical fire hydrant costs can be found in associated line items from the distribution system improvements cost estimate.

- **Valve Replacement/Installation Program**: Similar to the above recommendation, it is recommended that the Town routinely (annually) check its valving for functionality and effectiveness and implement a plan to address any issues promptly. In discussion with system operators and in evaluation of the system there are multiple locations in which valves are known to be leaking. The Town should consider investing capital to maintain its system promptly when the need arises. There are also many locations where existing valving does not present a clear understanding of how to control water flow or a lack of valving presents issues with line isolation. This recommendation does not involve any immediate capital improvements. This recommendation relies on operator knowledge and need for additional valving and as such should be added to funding requests of the above distribution system improvements. Typical valve costs can be found in the associated line items above.

Table 7.9 Distribution Improvements Funding

Estimated Capital Improvement Cost	ASSUMED FUNDING SOURCE			Total Payment
	WWDC Grant (67% Eligible)	DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC	Annual Payment	
$4,790,818.77	$0.00	$4,790,818.77	$307,317.27	$6,146,345.37

Table 7.10 Distribution Improvements Cost Estimate

Project:	Distribution System Improvements			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
Schedule #1 Distribution System Improvements					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$210,000.00**	**$210,000.00**
2	**Exploratory Excavation**	**HR**	**50**	**$300.00**	**$15,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$100,000.00**	**$100,000.00**
4	**Dust Control & Watering**	**LS**	**Job**	**$50,000.00**	**$50,000.00**
5	**Traffic Control/Public Coordination**	**LS**	**Job**	**$75,000.00**	**$75,000.00**
6	**6" C-900 DR 18 PVC Waterline**	**LF**	**14,000**	**$50.00**	**$700,000.00**
7	**8" C-900 DR 18 PVC Waterline**	**LF**	**4,800**	**$55.00**	**$264,000.00**
8	**10" C-900 DR 18 PVC Waterline**	**LF**	**1,350**	**$60.00**	**$81,000.00**
9	**Imported Pipe Bedding**	**LF**	**20,150**	**$8.00**	**$161,200.00**
10	**Imported Trench Backfill**	**LF**	**20,150**	**$16.00**	**$322,400.00**
11	**6" MJ Fittings**	**EACH**	**47**	**$750.00**	**$35,000.00**
12	**8" MJ Fittings**	**EACH**	**16**	**$1,000.00**	**$16,000.00**
13	**10" MJ Fittings**	**EACH**	**5**	**$1,500.00**	**$6,750.00**
14	**6" Gate Valves**	**EACH**	**53**	**$3,000.00**	**$158,490.57**
15	**8" Gate Valve**	**EACH**	**18**	**$3,500.00**	**$63,396.23**
16	**10" Gate Valves**	**EACH**	**5**	**$4,000.00**	**$20,377.36**
17	**Fire Hydrant w/Isolation Valve and Mainline Tee**	**EACH**	**45**	**$6,000.00**	**$270,000.00**
18	**Service Line & Connections**	**EACH**	**180**	**$2,500.00**	**$450,000.00**
19	**Asphalt Street Repair w/Road Base**	**SY**	**13,000**	**$55.00**	**$715,000.00**
20	**Rock Excavation**	**CY**	**50**	**$500.00**	**$25,000.00**
				Non-Eligible Total	**$3,738,614.15**
Cost of Eligible Components (Subtotal #2)				**$0.00**	
Preparation of Final Designs and Specifications				**$373,861.42**	
Permitting & Mitigation				**$20,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$5,000.00**	
Pre-Construction Costs (Subtotal #1)					**$403,861.42**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$3,738,614.15**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$373,861.42**	
Components and Engineering Cost (Subtotal #3)				**$4,112,475.57**	
Total Construction Cost (Subtotal #4)					**$4,112,475.57**
Total Eligible Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				**-**	**$4,516,336.98**
Inflation (5% per year)		Year	5		**$274,481.79**
Total Non-Eligible Project Cost with Inflation				**-**	**$4,790,818.77**

It is anticipated that a project of this magnitude will require a financing plan (rate increases) over a period of time. It is also anticipated that these improvements will be phased, such that

regionalized areas of the system are replaced at one time instead of the entire recommendation list at one time.

7.1.7 Transmission System Improvements

As noted above in Section 6.5.1, this report has identified two (2) locations for replacement of transmission lines, the 6" Airport Transmission Line and part of the old 14" WTP Transmission Line.

- **Airport Transmission Line:** The existing 6" Cast Iron transmission line has been identified as in need of replacement, in part due to its age, maintenance issues, and material. Currently this transmission line, as mentioned above, runs north-south with its southern connection connecting near the old storage tank location and running through private property until it reaches the airport property line. It connects to the system on the north end at the intersection of South 3rd Street and West Walnut. It is recommended that this line be replaced with an 8" PVC/HDPE line (HDPE for boring under airport infrastructure) along the same alignment while connecting on the south end to the 14" line along Airport Avenue as opposed to its existing connection. Figure 6.6 and Table 6.5 identifies such improvements. Table 7.12 below provides a detailed cost estimate for the Installation of this Transmission Line as well as in Appendix I.

  It is assumed that WWDC will provide funding for this project. Aside from WWDC there are other funding avenues available such as SRF and MRG. Based upon the Town's AMHI (Annual Median Household Income) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, a funding breakdown is provided in Table 7.11 for the financing of the Airport Transmission Line with a 67% WWDC Grant and 33% DWSRF Loan.

Table 7.11 Airport Transmission Line Funding

	ASSUMED FUNDING SOURCE			Total Payment
Estimated Capital Improvement Cost	**WWDC Grant (67% Eligible)**	**DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC**	**Annual Payment**	
$1,177,180.34	$788,710.83	$388,469.51	$24,919.20	$498,384.08

Table 7.12 Airport Transmission Line Cost Estimate

Project:	Airport Transmission Replacement			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
WWDC Eligible Costs					
Schedule #1 Airport Transmission Replacement					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$45,000.00**	**$45,000.00**
2	**Exploratory Excavation**	**LS**	**20**	**$300.00**	**$6,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
4	**Dust Control & Watering**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
5	**Traffic Control/Public Coordination**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
6	**8" C-900 DR 18 PVC Waterline**	**LF**	**4,100**	**$55.00**	**$225,500.00**
7	**8" HDPE Water Line**	**LF**	**900**	**$70.00**	**$63,000.00**
8	**Directional Boring (Under Runway)**	**LF**	**900**	**$150.00**	**$135,000.00**
9	**Imported Pipe Bedding**	**LF**	**4,100**	**$8.00**	**$32,800.00**
10	**Imported Trench Backfill**	**LF**	**4,100**	**$16.00**	**$65,600.00**
11	**8" MJ Fittings**	**EACH**	**14**	**$1,000.00**	**$13,666.67**
12	**8" Gate Valve**	**EACH**	**15**	**$3,500.00**	**$54,150.94**
13	**Fire Hydrant w/Isolation Valve and Mainline Tee**	**EACH**	**8**	**$6,000.00**	**$48,000.00**
14	**Service Line & Connections**	**EACH**	**30**	**$2,500.00**	**$75,000.00**
15	**Asphalt Street Repair**	**SY**	**1,500**	**$55.00**	**$82,500.00**
16	**Rock Excavation**	**CY**	**50**	**$500.00**	**$25,000.00**
				Eligible Total	**$911,217.61**
Cost of Eligible Components (Subtotal #2)				**$911,217.61**	
Preparation of Final Designs and Specifications				**$91,121.76**	
Permitting & Mitigation				**$10,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$10,000.00**	
Pre-Construction Costs (Subtotal #1)					**$116,121.76**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$911,217.61**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$91,121.76**	
Components and Engineering Cost (Subtotal #3)				**$1,002,339.37**	
Total Construction Cost (Subtotal #4)					**$1,002,339.37**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				**-**	**$1,118,461.13**
Inflation (5% per year)		Year	2		**$58,719.21**
Total Eligible Project Cost with Inflation				**-**	**$1,177,180.34**

- **WTP Transmission Line:** The existing 14" ductile iron transmission line has also been identified as need of partial replacement. As mentioned above the transmission line from West Elm Avenue to Cypress Avenue has experienced issues with regards to maintenance, age, and confusion (primarily with isolation). It is recommended that this line as identified in Figure 6.6 and Table 6.5 be replaced with 14" PVC line and

associated appurtenances. Table 7.14 below provides a detailed cost estimate for the installation of this transmission line as well as in Appendix I.

It is assumed that WWDC will provide funding for this project. Aside from WWDC there are other funding avenues available such as SRF and MRG. Based upon the Town's AMHI (Annual Median Household Income) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, a funding breakdown is provided in Table 7.13 for the financing of the WTP Transmission Line with a 67% WWDC Grant and 33% DWSRF Loan.

Table 7.13 WTP Transmission Line Funding

	ASSUMED FUNDING SOURCE			Total Payment
Estimated Capital Improvement Cost	**WWDC Grant (67% Eligible)**	**DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC**	**Annual Payment**	
$631,836.80	$423,330.66	$208,506.14	$13,375.07	$267,501.41

Table 7.14 WTP Transmission Line Cost Estimate

Project:	WTP Transmission Replacement			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
WWDC Eligible Costs					
Schedule #1 WTP Transmission Replacement					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$24,000.00**	**$24,000.00**
2	**Exploratory Excavation**	**LS**	**10**	**$300.00**	**$3,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
4	**Dust Control & Watering**	**LS**	**Job**	**$5,000.00**	**$5,000.00**
5	**Traffic Control/Public Coordination**	**LS**	**Job**	**$7,500.00**	**$7,500.00**
6	**14" C-900 Waterline**	**LF**	**1,400**	**$80.00**	**$112,000.00**
7	**Imported Pipe Bedding**	**LF**	**1,400**	**$8.00**	**$11,200.00**
8	**Imported Trench Backfill**	**LF**	**1,400**	**$16.00**	**$22,400.00**
9	**14" MJ Fittings**	**EACH**	**10**	**$3,000.00**	**$30,000.00**
10	**14" Gate Valve**	**EACH**	**12**	**$5,500.00**	**$66,000.00**
11	**Fire Hydrant w/Isolation Valve and Mainline Tee**	**EACH**	**5**	**$6,000.00**	**$30,000.00**
12	**Service Line & Connections**	**EACH**	**30**	**$2,500.00**	**$75,000.00**
13	**Asphalt Street Repair**	**SY**	**1,500**	**$55.00**	**$82,500.00**
14	**Rock Excavation**	**CY**	**10**	**$500.00**	**$5,000.00**
				Eligible Total	**$483,600.00**
Cost of Eligible Components (Subtotal #2)				**$483,600.00**	
Preparation of Final Designs and Specifications				**$48,360.00**	
Permitting & Mitigation				**$10,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$5,000.00**	
Pre-Construction Costs (Subtotal #1)					**$68,360.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$483,600.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$48,360.00**	
Components and Engineering Cost (Subtotal #3)				**$531,960.00**	
Total Construction Cost (Subtotal #4)					**$531,960.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$600,320.00**
Inflation (5% per year)		Year	2		**$31,516.80**
Total Eligible Project Cost with Inflation				-	**$631,836.80**

7.1.8 Mountain View Estates - Regionalization

As mentioned above in Section 4.3, a Mountain View Estates Subdivision has been identified as a potential water system regionalization location. This section does not act as a recommendation but only represents a notification of potential and comparative costs associated should the Town wish to pursue regionalization efforts with Mountain View Estates. Figures 7.4 and 7.5 below identify a preliminary alignment for transmission to Mountain View Estates and potential distribution piping respectively. Table 7.16 summarizes a detailed cost estimate for the installation of this line. Table 7.17 summarizes a detailed cost estimate for the installation of distribution lines for the identified area of the Mountain View Estates.

It is assumed that WWDC will provide funding for the transmission side of this project. Aside from WWDC there are other funding avenues available such as SRF and MRG. Based upon the Town's AMHI (Annual Median Household Income) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, funding breakdowns are provided in Table 7.15 and Table 7.18 for the financing of the Mountain View Estates Transmission with a 67% WWDC Grant and 33% DWSRF Loan and the financing of the Distribution with a 100% DWSRF Loan.

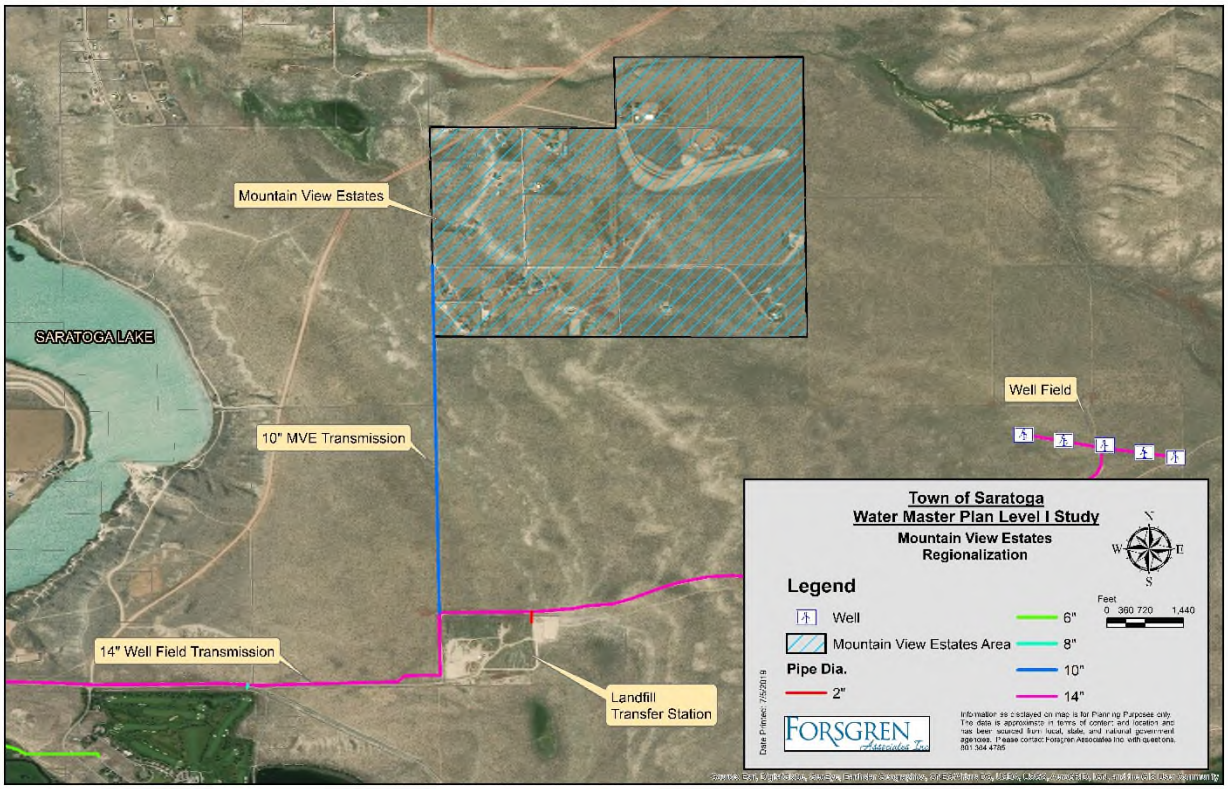


Figure 7.4 Preliminary Mountain View Estates Transmission Alignment

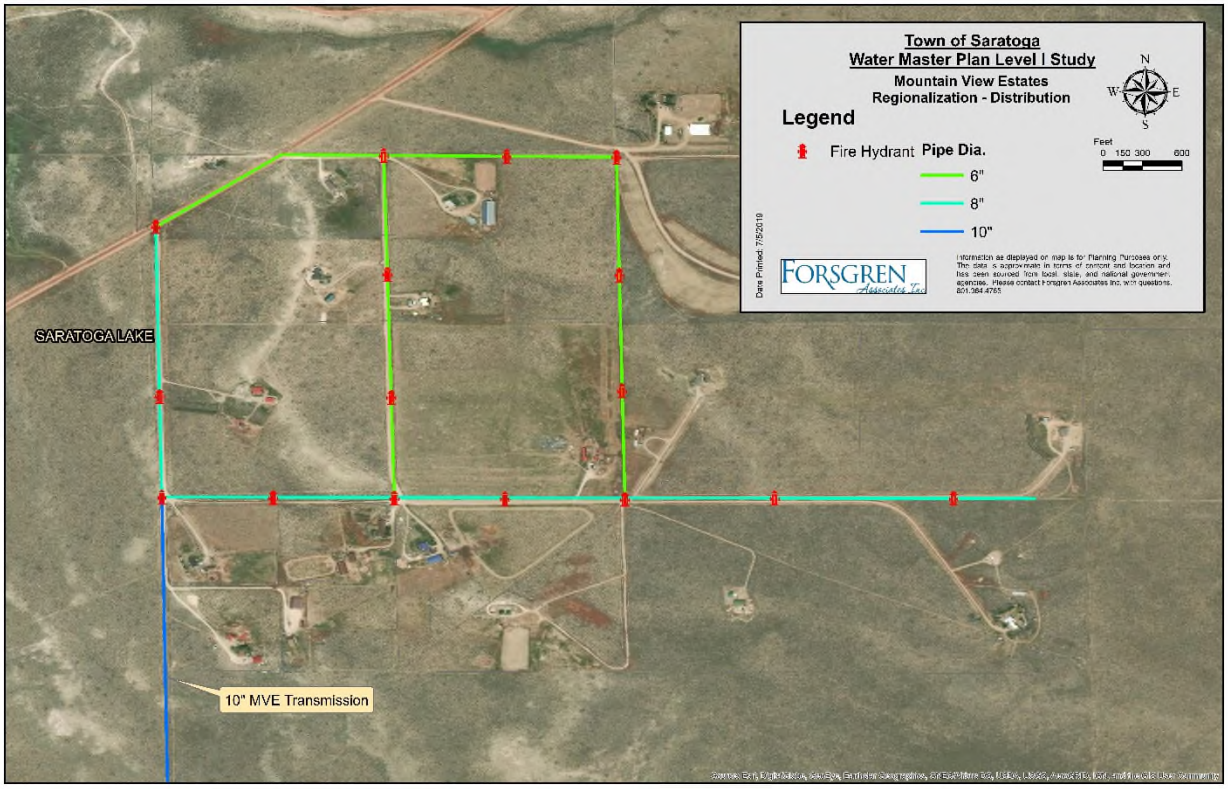


Figure 7.5 Preliminary Mountain View Estates Distribution

Table 7.15 MVE Transmission Line Funding

Estimated Capital Improvement Cost	ASSUMED FUNDING SOURCE			Total Payment
	WWDC Grant (67% Eligible)	DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC	Annual Payment	
$791,901.00	$530,573.67	$261,327.33	$16,763.40	$335,267.96

Table 7.16 MVE Transmission Line Cost Estimate

Project:	Mountain View Estates Transmission - Regionalization			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
	Mobilization (5% Construction Costs)	**LS**	**Job**	**$30,000.00**	**$30,000.00**
	Exploratory Excavation	**HR**	**10**	**$300.00**	**$3,000.00**
	Site Restoration & Cleanup	**LS**	**Job**	**$10,000.00**	**$10,000.00**
	Dust Control & Watering	**LS**	**Job**	**$7,500.00**	**$7,500.00**
	Traffic Control/Public Coordination	**LS**	**Job**	**$2,000.00**	**$2,000.00**
	10" C-900 DR 18 PVC Waterline	**LF**	**6,000**	**$60.00**	**$360,000.00**
	10" MJ Fittings	**Each**	**6**	**$2,000.00**	**$12,000.00**
	10" Gate Valves	**Each**	**8**	**$4,000.00**	**$30,000.00**
	14" Fittings	**Each**	**1**	**$3,500.00**	**$3,500.00**
	Imported Pipe Bedding	**LF**	**6,000**	**$8.00**	**$48,000.00**
	Native Trench Backfill	**LF**	**6,000**	**$5.00**	**$30,000.00**
	Fire Hydrant w/Isolation Valve and Mainline Tee	**Each**	**8**	**$6,000.00**	**$45,000.00**
	Rock Excavation	**CY**	**10**	**$500.00**	**$5,000.00**
	Air Release Valves (with Vault)	**Each**	**2**	**$8,000.00**	**$16,000.00**
				Eligible Total	**$602,000.00**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
Cost of Eligible Components (Subtotal #2)				**$602,000.00**	
Preparation of Final Designs and Specifications				**$60,200.00**	
Permitting & Mitigation				**$5,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$20,000.00**	
Pre-Construction Costs (Subtotal #1)					**$90,200.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$602,000.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$60,200.00**	
Components and Engineering Cost (Subtotal #3)				**$662,200.00**	
Total Construction Cost (Subtotal #4)					**$662,200.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$752,400.00**
Inflation (5% per year)		Year	2		**$39,501.00**
Total Eligible Project Cost with Inflation				-	**$791,901.00**

Table 7.17 MVE Distribution Cost Estimate

Project:	MVE Distribution System			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
Schedule #1 Distribution System Improvements					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$95,000.00**	**$95,000.00**
2	**Exploratory Excavation**	**HR**	**10**	**$300.00**	**$3,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
4	**Dust Control & Watering**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
5	**Traffic Control/Public Coordination**	**LS**	**Job**	**$5,000.00**	**$5,000.00**
6	**6" C-900 DR 18 PVC Waterline**	**LF**	**8,000**	**$50.00**	**$400,000.00**
7	**8" C-900 DR 18 PVC Waterline**	**LF**	**7,000**	**$55.00**	**$385,000.00**
8	**Imported Pipe Bedding**	**LF**	**15,000**	**$8.00**	**$120,000.00**
9	**Imported Trench Backfill**	**LF**	**15,000**	**$16.00**	**$240,000.00**
10	**6" MJ Fittings**	**EACH**	**13**	**$750.00**	**$10,000.00**
11	**8" MJ Fittings**	**EACH**	**23**	**$1,000.00**	**$23,333.33**
12	**6" Gate Valves**	**EACH**	**30**	**$3,000.00**	**$90,566.04**
13	**8" Gate Valve**	**EACH**	**26**	**$3,500.00**	**$92,452.83**
14	**Fire Hydrant w/Isolation Valve and Mainline Tee**	**EACH**	**16**	**$6,000.00**	**$96,000.00**
15	**Service Line & Connections (Including Meters)**	**EACH**	**16**	**$7,500.00**	**$120,000.00**
16	**Gravel Road Repair**	**LF**	**16,000**	**$20.00**	**$320,000.00**
				Non-Eligible Total	**$2,040,352.20**
Cost of Eligible Components (Subtotal #2)				**$0.00**	
Preparation of Final Designs and Specifications				**$204,035.22**	
Permitting & Mitigation				**$20,000.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$15,000.00**	
Pre-Construction Costs (Subtotal #1)					**$239,035.22**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$2,040,352.20**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$204,035.22**	
Components and Engineering Cost (Subtotal #3)				**$2,244,387.42**	
Total Construction Cost (Subtotal #4)					**$2,244,387.42**
Total Eligible Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				**-**	**$2,483,422.64**
Inflation (5% per year)		Year	2		**$130,379.69**
Total Non-Eligible Project Cost with Inflation				**-**	**$2,613,802.33**

Table 7.18 MVE Distribution Funding

Estimated Capital Improvement Cost	ASSUMED FUNDING SOURCE			Total Payment
	WWDC Grant (67% Eligible)	DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC	Annual Payment	
$2,613,802.33	$0.00	$2,613,802.33	$167,667.91	$3,353,358.29

7.1.9 Alternative Power

It should be noted that alternative power only becomes a need should the Town maintain its existing storage features, or if both existing storage tanks are decommissioned and a single tank is installed along the transmission line. As the storage recommendation of this study utilizes the welded tank and a new tank along the well transmission line alternative power will not be required now or within this studies life cycle (2049). Should the need for alternative power arise, as mentioned above in Section 6.3.1, alternative power will only be necessary to provide power for one (1) of the well sources to meet WyDEQ requirements. Table 7.20 below provides a cost estimate for a standby generator at the well field location.

It is assumed that WWDC will provide funding for this project. Aside from WWDC there are other funding avenues available such as SRF and MRG. Based upon the Town's AMHI (Annual Median Household Income) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, a funding breakdown is provided in Table 7.19 for the financing of the Alternative Power Stand-by Generator with a 67% WWDC Grant and 33% DWSRF Loan.

Table 7.19 Alternative Power Funding

Estimated Capital Improvement Cost	ASSUMED FUNDING SOURCE			Total Payment
	WWDC Grant (67% Eligible)	DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC	Annual Payment	
$119,072.03	$79,778.26	$39,293.77	$2,520.58	$50,411.65

Table 7.20 Alternative Power Cost Estimate

Project:	Well Field Alternative Power - Standby Generator			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
Schedule #1 Standby Generator					
	Mobilization (Not to Exceed 5% of Construction Costs)	**LS**	**Job**	**$4,300.00**	**$4,300.00**
	Site Grading	**LS**	**Job**	**$3,500.00**	**$3,500.00**
	Electrical Conduit Trenching	**LS**	**Job**	**$4,000.00**	**$4,000.00**
	Site Electrical Work	**LS**	**Job**	**$8,500.00**	**$8,500.00**
	Concrete Pad	**LS**	**Job**	**$7,500.00**	**$7,500.00**
	Furnish & Install Standby Generator	**LS**	**Job**	**$48,000.00**	**$48,000.00**
	Generator Startup & Testing	**LS**	**Job**	**$7,000.00**	**$7,000.00**
	Chain Link Fencing	**LS**	**Job**	**$5,000.00**	**$5,000.00**
				Eligible Total	**$87,800.00**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
Cost of Eligible Components (Subtotal #2)				**$87,800.00**	
Preparation of Final Designs and Specifications				**$13,170.00**	
Permitting & Mitigation				**$2,500.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$15,670.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$87,800.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$8,780.00**	
Components and Engineering Cost (Subtotal #3)				**$96,580.00**	
Total Construction Cost (Subtotal #4)					**$96,580.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$112,250.00**
Inflation (5% per year)		Year	2		**$6,822.03**
Total Eligible Project Cost with Inflation				-	**$119,072.03**

7.1.10 Water Loss Program

As discussed in Section 4.1.3 above, the inconsistent water loss/unaccounted for water loss percentages does not mandate a leak detection survey. Utilizing system data inventory, system operator interviews and modeling most of the identifiable potential leak/water loss locations are accounted for in the above mentioned distribution system improvements. These locations are not a guarantee of water loss mitigation though. Water loss can be occurring at many locations in the system as much of the system is old and potentially deteriorating. Multiple "pinhole" leaks add up and can be of major impact to the system. As part of this master plan, it is recommended that the Town consider developing a systematic water loss program to, at a minimum, include the following:

1. Implement a data collection/storage system identifying known water loss locations (including non-metered locations) and remedies.

2. Systematic annual meter calibration (currently the Town does not have a meter calibration program but checks meters if there are any known issues). This should include residential and commercial meters, master meters and well meters.
3. Develop a better grasp of known unaccounted for water at non-metered connections to the system, particularly at Town parks and municipal buildings. It is recommended that the Town install meters at all usage connections to better identify its water loss.
4. Implement a distribution system replacement plan (See Section 7.1.6). Aging waterlines and services do not last forever and the chances of leaking only increase with age.
5. Testing: At the Town's discretion, leak detection can be easily identified by the Town in terms of individual distribution lines. By isolating individual waterlines and installing a pressure gauge, leaks on the isolated sections should present themselves quickly.
6. Develop guidelines for how quickly identified and known leaks are remedied (i.e. budget accordingly)

This report recommends that the Town/Board implement a water loss program to better identify system water losses and method(s) of remedy.

7.1.11 Additional Metering

As mentioned above, the Town recently replaced its distribution meters in the system with Sensus meters. The recommendations of this report include a systematic calibration of the existing meters and installation of meters on existing known un-metered connections (parks, municipal buildings, irrigation connections). These recommendations come in conjunction with the recommendations developed under Section 7.1.10 for a water loss program. As noted above, approximately 77 gpm is lost/unaccounted for water. For comparison, utilizing the production cost per gallon developed above, this water loss is costing the Town $89,036.64 ($0.0022 per gallon) per year in production costs or lost revenue. Table 7.22 below represents a cost estimate for installing meters at the current unmetered connections for the purposes of accounting for water in the system and its usage.

It is assumed that WWDC will not provide funding for this project. Aside from WWDC there are other funding avenues available such as SRF and MRG. Based upon the Town's AMHI (Annual Median Household Income) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, a funding breakdown is provided in Table 7.21 for the financing of the additional metering with a 100% DWSRF Loan.

Table 7.21 Additional Metering Funding

Estimated Capital Improvement Cost	ASSUMED FUNDING SOURCE			Total Payment
	WWDC Grant (67% Eligible)	DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC	Annual Payment	
$202,737.81	$0.00	$202,737.81	$13,005.05	$260,100.97

Table 7.22 Additional Metering Cost Estimate

Project:	Additional Metering - Non-Metered Connections			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$7,700.00**	**$7,700.00**
2	**Exploratory Excavations**	**HR**	**10**	**$300.00**	**$3,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$3,500.00**	**$3,500.00**
4	**Traffic Control/Public Coordination**	**LS**	**Job**	**$3,500.00**	**$3,500.00**
5	**Pavement & Concrete Removal & Disposal**	**SY**	**350**	**$15.00**	**$5,250.00**
6	**1" Copper Service Line**	**LF**	**300**	**$45.00**	**$13,500.00**
7	**Water Service Connection**	**Each**	**15**	**$1,000.00**	**$15,000.00**
8	**Meter Pit Installation**	**Each**	**15**	**$1,500.00**	**$22,500.00**
9	**1" Meter (Check Valves, PRV)**	**Each**	**15**	**$3,500.00**	**$52,500.00**
10	**Imported Fill**	**LF**	**300**	**$20.00**	**$6,000.00**
11	**Pavement & Concrete Replacement w/Road Base**	**SY**	**350**	**$55.00**	**$19,250.00**
				Non-Eligible Total	**$151,700.00**
Cost of Non-Eligible Components (Subtotal #2)				**$151,700.00**	
Preparation of Final Designs and Specifications				**$22,755.00**	
Permitting & Mitigation				**$3,000.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$25,755.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$151,700.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$15,170.00**	
Components and Engineering Cost (Subtotal #3)				**$166,870.00**	
Total Construction Cost (Subtotal #4)					**$166,870.00**
Total Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$192,625.00**
Inflation (5% per year)		Year	2		**$10,112.81**
Total Non-Eligible Project Cost with Inflation				-	**$202,737.81**

7.1.12 Well Field Conclusions and Recommendations

The five Town of Saratoga municipal wells have been in production for 10 years and have demonstrated the ability to meet the Town's water demands. The quality of the water is very good and meets Safe Drinking Water Act standards. There have been issues related to pumping of iron flakes from the wells, especially Well Nos. 3 and 4 and inspection of Well No. 3 indicates that the source of the iron is the pump column pipe. In the past, air production has been problematic during periods of high demands and care must be exercised to not drop the pumping water levels too close to the pump intake. The wellfield is permitted by the SEO for an instantaneous combined production of 925 gpm. Analysis of the water levels in the wells suggests that the maximum pumping rate of the wellfield is approximately 695 gpm. The peak day water demand for Saratoga was 831 gpm and the average demand for the peak month was 654 gpm.

Pump testing of the wells as part of this project suggest that all of the wells experience declines in efficiency at higher pumping rates. One hundred feet of fill in Well No. 3 has reduced the well production capacity because it covers screened intervals and it is possible that the other wells also have sand covering production intervals. A well rehabilitation program is recommended for the Saratoga wells to remove sediments that may be covering well screens and to determine the condition of down-hole pumping equipment. Given the amount of rust observed in the discharged water from the wells and the observations of the pumping equipment in Well No. 3, there may be issues with the pump column pipe in all of the wells.

Rehabilitation of the wells could significantly increase the efficiency of the wells and result in more shallow pumping water levels, increased production capacity, and less dewatering of well screens. The recommended components of a rehabilitation program include the following for each well:

- Remove the pumping equipment from the well;
- Inspect and document condition of pump, motor, and other downhole equipment;
- Determine depth of fill in the well;
- Remove the fill by airlifting;
- Brush well casing and screens;
- Use surge block and treatment chemicals across screened intervals to remove fine grained materials and any iron-related bacteria;
- Clear debris and sand by airlifting;
- Install new pump column pipe in the well;
- OPTION: Replace well pump and motor;
- Reinstall pump, motor, pump cable, airlines, and PVC tubing;
- Disinfect well;
- Pump well to waste; and
- Perform post rehabilitation step-rate testing.

The estimated cost for performing well rehabilitation on the wells is presented in Table 7.24. Replacement of the pump column pipe with oil field tubing may help to reduce the amount of rust that is generated in the wells. Three-inch O.D. 2.992 I.D. (0.254 inch wall) EUE L80 tubing has similar dimensions to the pump column that is in the wells now, but the composition of the tubing resists corrosion. It is recommended that a corrosion specialist be retained to provide recommendations for corrosion control. The well rehabilitation program will need to occur during periods of low water demand and that one well be treated at a time so that demands can be met and treatment chemicals are not drawn from the well being treated to an adjacent well.

The 2005 Test Well No. 1 and 2006 Test Well No. 2 wells do not serve a useful purpose to the Town and are a direct conduit into the aquifer used by the municipal wells, it is recommended that the old wells be plugged and abandoned. The estimated cost of well abandonment is included in Table 7.24.

It is assumed that WWDC will provide funding for this project once the well field has reached a fifteen-year age, WWDC will not provide funding for rehabilitation within the first fifteen years after implementation. Aside from WWDC there are other funding avenues available such as SRF and MRG. Based upon the Town's AMHI (Annual Median Household Income) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, a funding breakdown is provided in Table 7.23 for the financing of the Well Rehabilitation with a 67% WWDC Grant and 33% DWSRF Loan.

Table 7.23 Well Rehabilitation Funding

Estimated Capital Improvement Cost	ASSUMED FUNDING SOURCE			Total Payment
	WWDC Grant (67% Eligible)	DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC	Annual Payment	
$185,599.34	$124,351.56	$61,247.78	$3,928.87	$78,577.39

Table 7.24 Well Rehabilitation Cost Estimate

Project:	Well Rehabilitation			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
WWDC Eligible Costs					
1	**Mobilization, Bonding, Etc.**	**LS**	**Job**	**$15,000.00**	**$15,000.00**
2	**Remove Pumping Equipment**	**Each**	**5**	**$1,000.00**	**$5,000.00**
3	**Remove Fill from Wells by Airlifting**	**Hours**	**25**	**$550.00**	**$13,750.00**
4	**Scrape/Brush Casing**	**Hours**	**13**	**$350.00**	**$4,375.00**
5	**Well Development by Airlifting**	**Hours**	**20**	**$550.00**	**$11,000.00**
6	**Furnish & Inject Treatment Solution**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
7	**Surge Treatment Solution**	**Hours**	**40**	**$350.00**	**$14,000.00**
8	**Remove Treatment Solution**	**Hours**	**20**	**$350.00**	**$7,000.00**
9	**Super Chlorinate Wells**	**Each**	**5**	**$1,500.00**	**$7,500.00**
10	**Reinstall Pumping Equipment & Banding**	**Each**	**5**	**$1,250.00**	**$6,250.00**
11	**OPTION: Install 2 7/8-inch Pump Column Tubing**	**LF**	**1,407**	**$20.00**	**$28,140.00**
12	**OPTION: Corrosion Control Consultant**	**LS**	**Job**	**$4,500.00**	**$4,500.00**
13	**Water Quality Testing**	**LS**	**Job**	**$1,500.00**	**$1,500.00**
14	**Plug and Abandon Two Monitoring Wells**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
				Eligible Total	**$148,015.00**
Cost of Eligible Components (Subtotal #2)				**$148,015.00**	
Preparation of Final Designs and Specifications				**$10,000.00**	
Permitting & Mitigation				**$750.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$10,750.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$148,015.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$14,801.50**	
Components and Engineering Cost (Subtotal #3)				**$162,816.50**	
Total Construction Cost (Subtotal #4)					**$162,816.50**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$173,566.50**
Inflation (5% per year)		Year	5		**$12,032.74**
Total Eligible Project Cost with Inflation				-	**$185,599.34**

As shown in Figure 7.6, a new proposed well location has been selected at a site located approximately ¼ mile southwest of Saratoga Well No. 3. The proposed site has the following advantages: the site is located in close proximity to existing infrastructure; the proposed location is a sufficient distance from the existing wellfield to minimize the potential for interference; the proposed site is close enough to the existing wellfield to provide assurance that the well will intercept approximately similar water bearing zones as those encountered in Well No. 3; and because the proposed site is located on BLM land, access agreements will be similar to those in place for the existing wellfield. It is assumed that the proposed new well will be completed at a

depth of approximately 400 feet with an anticipated static water level of approximately 100 feet below ground surface. The well design should be similar to the existing Saratoga municipal wells. A new well is not recommended at this time, it is recommended that the Town consider the rehabilitation on the wells and evaluation prior to considering an additional well(s). The estimated costs for a new well construction and testing of a new well is shown in Table 7.26.

It is assumed that WWDC would provide funding for this project. Aside from WWDC there are other funding avenues available such as SRF and MRG. Based upon the Town's AMHI (Annual Median Household Income) it may be difficult to obtain grants or forgiveness of loan portions. For the purposes of this study, a funding breakdown is provided in Table 7.25 for the financing of the Well Rehabilitation with a 67% WWDC Grant and 33% DWSRF Loan.

Table 7.25 New Saratoga Well #6 - Funding

Estimated Capital Improvement Cost	ASSUMED FUNDING SOURCE			Total Payment
	WWDC Grant (67% Eligible)	DWSRF Loan (2.5%, 20-year) Remaining Eligible & Non-Eligible WWDC	Annual Payment	
$243,838.34	$163,371.69	$80,466.65	$5,161.70	$103,2334.09

Table 7.26 New Saratoga #6 Well Cost Estimate

Project:	New - Saratoga Well #6			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
WWDC Eligible Costs					
1	**Mobilization, Bonding, Etc.**	**LS**	**Job**	**$35,000.00**	**$35,000.00**
2	**Drill for, Furnish, Install, & Cement 13 3/8-inch Surface Casing**	**LF**	**30**	**$200.00**	**$6,000.00**
3	**Drill 6 1/4-inch Diameter Borehole**	**LF**	**370**	**$26.00**	**$9,620.00**
4	**Open Hole Geophysical Logging**	**LS**	**Job**	**$7,000.00**	**$7,000.00**
5	**Ream Borehole to 12 1/4 inches**	**LF**	**370**	**$40.00**	**$14,800.00**
6	**Furnish & Install 8 5/8-inch O.D. Steel Casing**	**LF**	**270**	**$32.00**	**$8,640.00**
7	**Furnish & Install 8-inch Stainless Steel Well Screens**	**LF**	**130**	**$200.00**	**$26,000.00**
8	**Furnish & Install Graded Sand Pack**	**LF**	**250**	**$30.00**	**$7,500.00**
9	**Furnish & Install Cement Seal**	**LF**	**250**	**$36.00**	**$9,000.00**
10	**Well Development & Rig Time**	**Hours**	**18**	**$500.00**	**$9,000.00**
11	**Air Development**	**Hours**	**24**	**$550.00**	**$13,200.00**
12	**Furnish, Install & Remove Pump Testing Equipment**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
13	**Conduct Pump Test**	**Hours**	**176**	**$200.00**	**$35,200.00**
				Eligible Total	**$200,960.00**
Cost of Eligible Components (Subtotal #2)				**$200,960.00**	
Preparation of Final Designs and Specifications				**$10,000.00**	
Permitting & Mitigation				**$750.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$10,750.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$200,960.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$20,096.00**	
Components and Engineering Cost (Subtotal #3)				**$221,056.00**	
Total Construction Cost (Subtotal #4)					**$221,056.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)					**$231,806.00**
Inflation (5% per year)		Year	5		**$12,032.84**
Total Eligible Project Cost With Inflation					**$243,838.84**

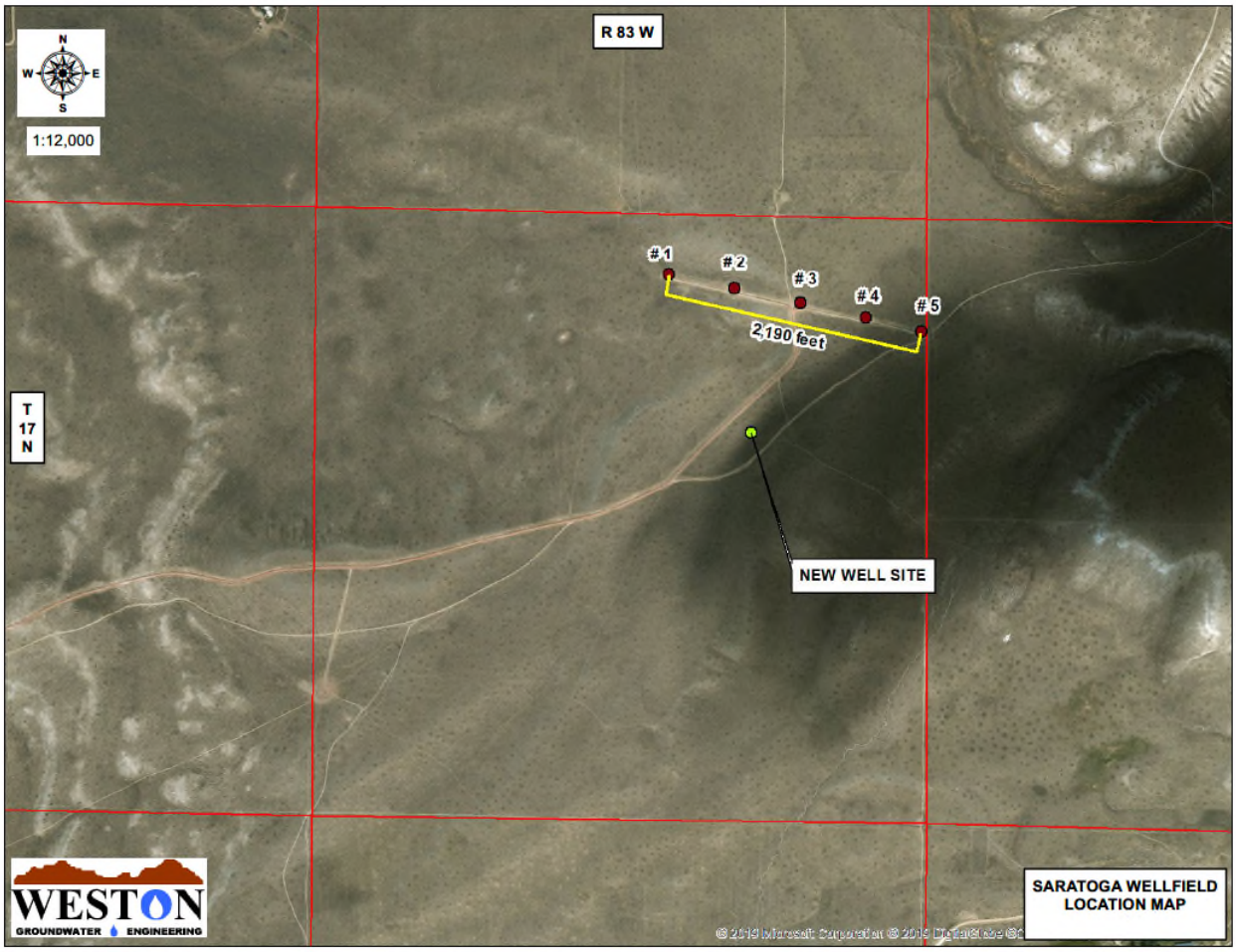


Figure 7.6 Anticipated New Well Location

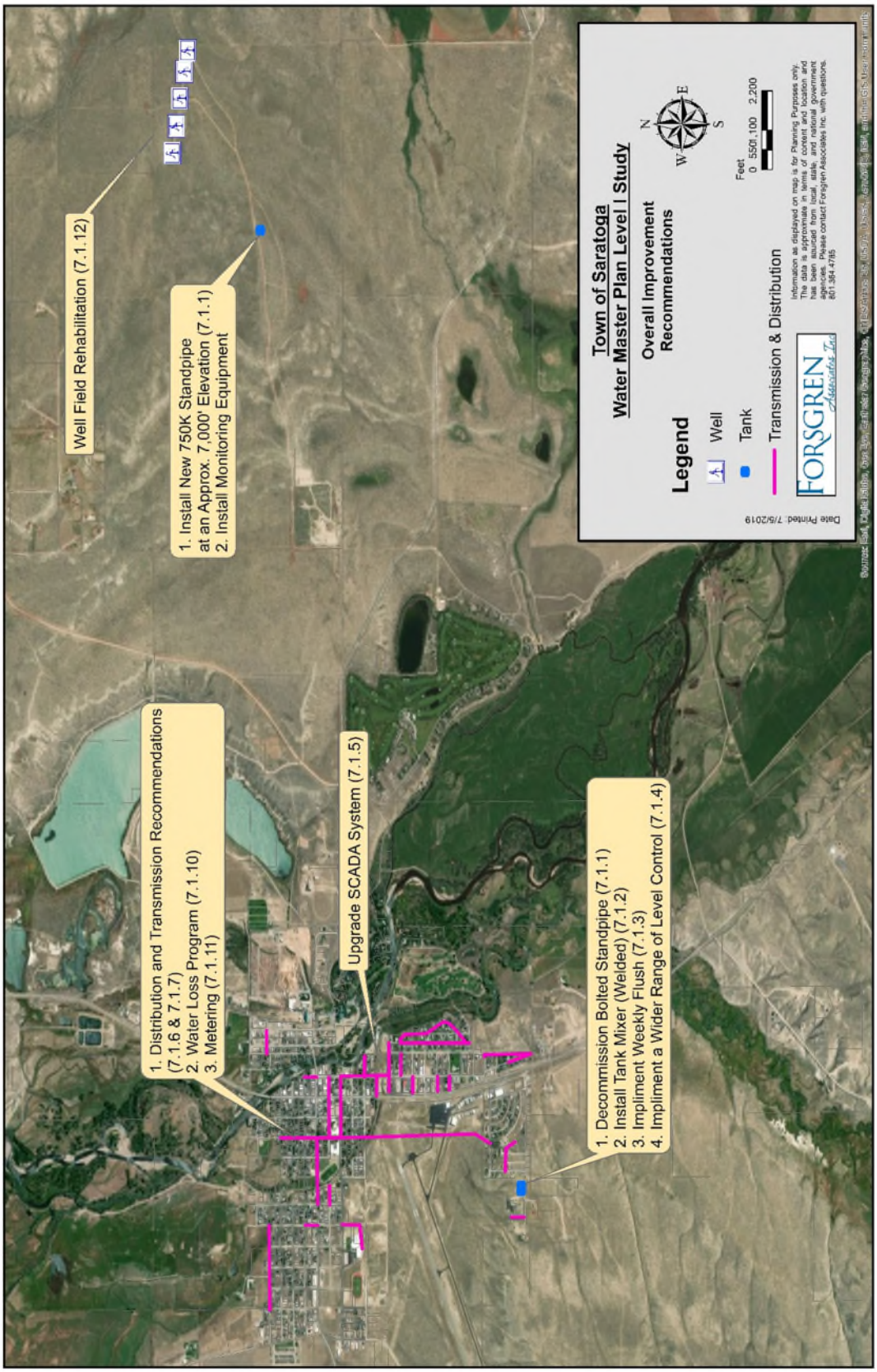


Figure 7.7 – Overall Capital Improvement Map

7.2 Priorities

Table 7.27 shows the recommended improvements/operations and priorities.

Table 7.27 – Recommended Improvements

Priority	Description	Notes
1	**Well Field Rehabilitation (7.1.12)**	***Rehabilitation of the Wells could significantly increase the capacity of the wells and result in more shallow pumping water levels, increased production capacity and less dewatering of well screens.***
2	**Decommission Bolted Steel 1.0 MG Standpipe and Install New 750K Tank along Transmission Line (7.1.1)**	***Bolted Steel Tank has leaking deficiencies. As noted above, the location of the existing tanks is less than desirable. By installing a new tank along the transmission line, the Town retains its redundancy with storage while also providing redundancy by having storage on both sides of the river.***
3	**Tank Mixers (7.1.2)**	***A tank mixer will help with the stagnation in the Town's Storage Tanks as well as stabilize overall water age.***
4	**System Flushing (7.1.3)**	***A 120,000 gallon weekly flush (2.0 hrs @ 1,000 gpm) will reduce the Town's water age in the Tanks.***
5	**SCADA Upgrades (7.1.5)**	***Upgrades/Updates the Town's SCADA System will provide better operational control of the system and a more useable control for the system.***
6	**Tank Operational Controls (7.1.4)**	***Allowing for a wider range of operational controls on the system's storage and pumping will allow for better control of water age.***
7	**Water Loss Program (7.1.10)**	***The Implementation of a water loss program will allow the Town to better understand loss in the system, maintain more accurate records and develop priorities for system replacement/repair.***
8	**Transmission Line Improvements (7.1.7)**	***Updating existing transmission lines will provide the Town with a more reliable conveyance of system delivery.***
9	**Distribution Line Improvements (7.1.6)**	***Updating existing distribution lines will provide the Town with a more reliable conveyance of system delivery, address the issues of an aging system, reduce water loss, etc.***
10	**Additional Metering (7.1.11)**	***The installation of additional metering, specifically at locations in which the system is unmetered (parks, municipal buildings, etc.), will allow for a better accounting of water use in the system.***

7.3 Economics

7.3.1 Estimated Project Costs

Estimated costs for recommended projects are summarized in Table 7.28. These costs are reflective of estimated construction costs at the estimated time of construction and include engineering plus inflation as required by WWDC. Detailed cost estimates can be found in Appendix I of this report.

Table 7.28 – Project Cost Estimates Summary

Item No.	Description	Estimated Cost (inclusive of engineering and inflation)
1	**Well Field Rehabilitation**	**$185,599.34**
2	**Decommission Bolted Steel 1.0 MG Standpipe and Install New 750K Tank along Transmission Line**	**$1,868,313.80**
3	**Tank Mixers**	**$64,034.10**
4	**SCADA Upgrades**	**$20,418.50**
5	**Transmission Line Improvements (WTP & Airport)**	**$1,809,017.14**
6	**Distribution Line Improvements**	**$4,790,818.77**
7	**Additional Metering**	**$202,737.81**

7.3.2 Estimated Additional Operational Costs

Estimated operational costs for the recommended weekly flush of 120,000 gallons (2.0 hrs @ 1,000 gpm) are summarized in Table 7.29. This cost is reflective of the Town's current productions cost of $0.0022 per gallon produced as shown in Table 4.5.

Table 7.29 – Additional Operational Cost Estimates Summary

Item No.	Description	Estimated Annual Operational Cost
1	**Weekly Flush (120,000gal)**	**$13,728**

7.3.3 Financing

- WWDC Funding: An assumption of 67% grant assistance for new construction from WWDC is used in this financial analysis based on discussions with WWDC staff and experience with other similar projects. Eligible project expenses include

supply, transmission, and storage. Distribution piping, services/maintenance, meters and water quality projects are typically not eligible for WWDC funding participation.

- USDA Rural Development: The USDA Rural Development Services (RUS) program favors rural low-to-moderate income communities. Eligibility criteria for grant funding is based on population size and median household income levels. USDA-RUS makes direct loans and grants to build or improve essential public use facilities such as water and sewer facilities, storm sewers, and solid waste facilities. Applicants must have a population less than 10,000 with the legal capacity to borrow money and be financially sound and be able to manage the facility, and have satisfactory sources of income to pay costs of operating, debt services, and reserve. Loans can have up to a 40-year payback period, based on the useful life of the facilities financed. The loan interest rates are fixed and are based on the need for the project and the median household income of the area to be served. USDA RD funding will require compliance with NEPA and other federal requirements

- State of Wyoming Drinking Water Revolving Fund (DWSRF): Portions of this project are likely eligible for DWSRF loan funding (for balance of the project not grant funded.) A DWSRF loan at 2.5% over a period of 20 years has been assumed. Although not shown in the finance options, recent loans from DWSRF have included up to a 25% principle forgiveness. DWSRF funding will require compliance with NEPA and other federal requirements. Saratoga is on the FY2019 DWSRF Intended Use Plan (IUP).

- State of Wyoming Mineral Royalty Grants (MRG): The MRG program awards grants to alleviate an emergency situation which poses a direct and immediate threat to public health, safety or welfare. It is also available to applicants to comply with federal or state mandates and provide an essential public service.

- Abandoned Mine Land Division – Public Facilities Funding Program: This Wyoming DEQ Grant Program is intended to assist local communities and other public agencies to mitigate the impacts of historic coal and mineral mining and processing. This program is a re-implementation of a program that closed nearly ten (10) years ago. The anticipated funds for the current cycle are up to $20 million. This funding program is quite similar to the MRG Grant in its requirements and elements of consideration. This funding opportunity is also limited to certain counties and communities in Wyoming (entirety of Carbon County is eligible for consideration). It is unknown whether this program will continue in the future or what funding amounts will be available if it does.

- Wyoming Business Council Grant: This grant is intended to help cover the costs to communities in providing "business ready" and "community development" projects. Based upon the growth plan for the Town to develop "in-fill" of its existing boundaries it is not anticipated that the recommended projects would qualify as "business ready". The Community Development Block Grant (CDBG) however does provide funding for projects that pose a serious or immediate threat to the health or welfare of the community. It can be assumed that some of the recommended project would qualify. This grant is quite limited in the amount of funding it has available per year ($2.2 to $3.75 million) and takes into consideration low to moderate income communities. With Saratoga's AMHI being well above the state average it may be difficult to obtain this grant.
- Specific Purpose Tax 2019: This funding source is a Carbon County tax recently passed in which the County and communities can raise funding for specific project by the use of an expiring tax increase. For this tax, the Town of Saratoga has identified four (4) specific projects dealing with distribution/transmission replacement and tank rehabilitation for a total amount of approximately $3,200,000.00. The Town did not bond for this tax so quarterly payments will be made to the Town with the amount varying upon the tax accrued. The Town anticipates approximately $42,000.00 per month on average to be transferred to the Town through 2035 with approximately forty percent (40%) of that being for water projects. A copy of the Saratoga Specific Purpose Tax Projects List can be found in Appendix L.

7.3.4 Existing System Financials/Budget

For this section the water systems financials are analyzed to ensure that the water system is financially self-supporting such that the revenues generated from the water system are sufficient to accomplish the following:

- Retire existing water related debt (principal and interest)
- Pay the costs for employees
- Pay the costs of materials, supplies, utilities, and outside services necessary to operate and maintain the water system and provide normal improvements and replacement requirements for the system
- Pay for administrative and overhead expenses
- Provide an emergency fund that annually accrues at least an amount equal to 1.5% - 2.5% of the operating expenses
- Provide a fund that accrues sufficient reserves to pay for major repairs and replacement that will be required during the life of any associated project

In general, as shown in Appendix J, the system is quite healthy with regards to covering its expenses with the revenue generated. The net revenue for the system for the last three (3) years

has increased approximately $35,000.00 per year (approximately $150K in net revenue each year). However, there is not an emergency fund or major repairs/replacement fund included in the expenditures. While transferring funds from one department to another is not an uncommon practice, the SCCIJPB should consider investing some of the net revenue into emergency and major repair/replacement funds. Table 7.30 below shows a suggested annual budget based upon the 2016 thru 2018 expenditures/revenue reports.

Table 7.30 – Suggested Budget

	2019-2020 FY
Expenditures	Budget
Salaries	$98,000.00
Payroll Benefits	$12,500.00
Health Insurance	$47,000.00
Retirement	$14,000.00
Advertising	$750.00
Communications	$500.00
Travel	$1,500.00
Training	$1,500.00
Supplies	$10,000.00
Supplies - Treatment	$1,500.00
Memberships, Dues, Subscriptions	$1,500.00
Repair & Maintenance - Equipment	$25,000.00
Water Line Repair	$15,000.00
Repair & Maintenance - Vehicles	$1,500.00
Vehicle - Fuel	$4,500.00
Repair & Maintenance - Buildings/Grounds	$500.00
Utilities	$35,000.00
Telephone	$3,500.00
Professional Fees	$3,200.00
Contract Services	$10,000.00
Special Department - Meters	$1,500.00
Special Department - Testing	$2,000.00
Insurance - Property	$3,000.00
Insurance - Liability	$1,500.00
Capital Improvements	$25,000.00
Capital Equipment	$25,000.00
JPB - Loan Payment*	$117,301.97
JPB - Administration	$12,000.00
Emergency Fund	$15,000.00
Major Repair/Replacement Fund	$50,000.00
Total Expenditures	$539,251.97
Revenues	
Interest Income	$500.00
Reimbursements	$5,000.00
Water Sales to Customer*	$550,000.00
Water Tap Fees	$3,000.00
Water Meter Fees	$7,500.00
Water Line Repair	$1,000.00
Water Other	$1,500.00
Total Revenues	$568,500.00
Net Revenue over Expenses	$29,248.03

*Anticipated to increase should recommended projects move forward. Rates should be adjusted accordingly (Section 7.3.5) to increase revenues for those loan payments.

7.3.5 Project Rate Impacts / Financial Capacity

Project Costs and rate payer impacts based on an assumed funding scenario are summarized in Tables 7.31 thru 7.33. Project loan payments are broken down by monthly cost per existing connection to determine the average potential rate impact. Table 7.31 (Scenario #1) assumes no project funding available and rate impacts reflect accruing funds for projects within two (2) years. Table 7.32 (Scenario #2) assumes a 67% WWDC Grant on eligible components, 33% WWDC 4% Loan on eligible components and the remaining funds assumed directly from Saratoga without other funding with the rate impacts reflecting fund accrual within two (2) years. Table 7.33 assumes a 67% WWDC Grant on eligible components and an SRF 2.5% Loan on remaining funding.

A detailed five-year budget projection is contained in Appendix K. This spreadsheet is based on the capacity development worksheet format developed by the Wyoming SLIB/SRF program. Capital costs and loan payments for the proposed improvements recommended in this study have been included.

It was assumed that the capital improvements recommended in this study would be constructed/implemented beginning in 2020.

Table 7.31 – Scenario #1 No Project Funding

Item #	Description	Estimated Project Cost	ASSUMED FUNDING SOURCE	Monthly Cost per Ratepayer *(Based on 990 current users)* To Raise Funds in 2 Years
			None - Costs Assumed by SCCIJPB Directly	
1	Well Field Rehabilitation	$185,599	$185,599	$7.81
2	Decommission Bolted Steel 1.0 MG Standpipe and Install New 750K Tank along Transmission Line	$1,868,314	$1,868,314	$78.63
3	Tank Mixers	$64,034	$64,034	$2.70
4	SCADA Upgrades	$20,419	$20,419	$0.86
5	Transmission Line Improvements (WTP & Airport)	$1,809,017	$1,809,017	$76.14
6	Distribution Line Improvements	$4,790,819	$4,790,819	$201.63
7	Additional Metering	$202,738	$202,738	$8.53
Monthly Cost per Ratepayer			Total	$376.30

Table 7.32 – Scenario #2 WWDC Grant & Loan and Self-Funding Remaining

Item #	Description	Estimated Project Cost	ASSUMED FUNDING SOURCE				Monthly Cost per Ratepayer *(Based on 990 current users)* To Raise Self Assumed Funds in 2 Years	Monthly Cost per Ratepayer *(Based on 990 current users)* Loan Payment
			WWDC Grant (67% Eligible new construction)	WWDC Loan (4%, 20-year) Eligible	Annual Loan Payment	Remaining Non-Eligible Cost Assumed by Town		
1	Well Field Rehabilitation	$185,599	$124,352	$61,248	$4,507	$0	$0.00	$0.38
2	Decommission Bolted Steel 1.0 MG Standpipe and Install New 750K Tank along Transmission Line	$1,868,314	$1,251,770	$616,544	$45,366	$4,421	$0.19	$3.82
3	Tank Mixers	$64,034	$0	$0	$0	$64,034	$2.70	$0.00
4	SCADA Upgrades	$20,419	$0	$0	$0	$20,419	$0.86	$0.00
5	Transmission Line Improvements (WTP & Airport)	$1,809,017	$1,212,041	$596,976	$43,927	$0	$0.00	$3.70
6	Distribution Line Improvements	$4,790,819	$0	$0	$0	$4,790,819	$201.63	$0.00
7	Additional Metering	$202,738	$0	$0	$0	$202,738	$8.53	$0.00
Monthly Cost per Ratepayer						Total	$213.91	$7.90

Table 7.33 – Scenario #3 WWDC Grant and SRF Loan

Item #	Description	Estimated Project Cost	ASSUMED FUNDING SOURCE			Monthly Cost per Ratepayer *(Based on 990 current users)*
			WWDC Grant (67% new Eligible construction)	SRF Loan (2.5%, 20-year)	Annual Payment	
1	Well Field Rehabilitation	$185,599	$124,352	$61,248	$3,929	$0.33
2	Decommission Bolted Steel 1.0 MG Standpipe and Install New 750K Tank along Transmission Line	$1,868,314	$1,251,770	$616,544	$39,739	$3.35
3	Tank Mixers	$64,034	$0	$64,034	$4,108	$0.35
4	SCADA Upgrades	$20,419	$0	$20,419	$1,310	$0.11
5	Transmission Line Improvements (WTP & Airport)	$1,809,017	$1,212,041	$596,976	$38,294	$3.22
6	Distribution Line Improvements	$4,790,819	$0	$4,790,819	$307,317	$25.87
7	Additional Metering	$202,738	$0	$202,738	$13,005	$1.09
Monthly Cost per Ratepayer					Total	$34.32

These tables do not factor in potential loan forgiveness or any additional grants that may be applied for (i.e. MRG, AML, etc.) which could reduce the rate payer impacts for system improvements.

The American Water Works Association (AWWA) has developed a standard for average monthly residential water bills which is a factor of the Annual Median Household Income (AMHI) multiplied by 2.5% and divided by 12 months. As the Saratoga AMHI is $73,476.00 the AWWA standard for average residential water bills is approximately $153.00. With the base residential rate of $30.76 it can be assumed that there is room to expand/increase water rates according to the AWWA standard. In evaluating the options as presented above in Tables 7.31 thru 7.33 it can be seen that Scenario #3 (Table 7.33) is likely the more user rate friendly bringing the residential base rate to approximately $65.08 to cover the costs of the projects. It is assumed that the SCCIJPB would likely phase rate increases over time.

Additionally, as the SCCIJPB is currently reviewing water rates it may be beneficial to look at a more aggressive rate structure particularly with regards to Equivalent Dwelling Units (EDUs). This is a method of rate structuring that accounts for the capacity of individual service connection sizes. For example, a 4-inch line/meter has the capacity to supply a larger amount of

water than a 1-inch line/meter. The 4-inch line may flow the same amount of water as the 1-inch line at times but it has the capacity for much larger flows. Because the user has installed the 4-inch line the SCCIJPB has to be able to provide for the max capacity of the 4-inch line, which in turn causes more cost than supplying the maximum capacity of a 1-inch line. This method of rate structuring can provide a little relief to the above-mentioned rate payer impacts in Table 7.31 for those users that have a smaller capacity line. Table 7.34 below provides EDU equivalency factors for different line sizes based upon line size flow cross-sectional areas with the cross-sectional area of a ¾" service being 1 EDU.

Table 7.34 – EDU Factors

Line Size	3/4"	1"	1.5"	2"	3"	4"	6"	8"
Cross Sectional Area (in^2)	0.003	0.005	0.012	0.022	0.049	0.087	0.196	0.349
ERU Factor	1	1.778	4	7.111	16	28.444	64	113.778
Base Rate Example ($30.76)	$30.76	$54.68	$123.04	$218.74	$492.16	$874.95	$1,968.64	$3,499.80
Base Tap Fee Example ($2,500.00)	$2,500.00	$4,444.00	$10,000.00	$17,778.00	$40,000.00	$71,111.00	$160,000.00	$284,444.00

The rates may seem a little extreme but this does a few things for the benefit of the SCCIJPB it promotes water conservation and helps recover costs the SCCIJPB incurs to provide the water capacity to users with larger services. This is not a recommendation in this report but is intended as a guide/supplemental information for the SCCIJPB in its determination of water rates. As shown in Section 7.3.4 the existing rates and rate structure have provided the SCCIJPB increased flexibility with relation to expanding its net revenue on the system. Minor adjustments to make the system users fees more "fair" (i.e. rates as described above regarding Old Baldy Club and Medicine Waters Trailer Park) for all users.

7.3.6 Operational Cost Impacts

Operational Costs are summarized in Table 7.35. This table assumes that all operational cost would be incurred by the Town with no increase to consumer rates. It is assumed that the recommended operations would be implemented in 2019 with the average production cost of $0.0022 per gallon of water produced.

Table 7.35 – Operational Cost Impact

Item #	Description	Estimated Annual Production Cost	Monthly Operational Cost
1	**Weekly Flush (120,000 gal)**	**$13,728**	**$1,144.00**
Monthly Operational Cost		**Total**	**$1,144.00**

7.3.7 Ability to Pay

The SCCIJPB's ability to pay for a project in a timely manner is a key consideration in WWDC's funding decisions, as well as for other funding agencies. It is important that the SCCIJPB be proactive in advancing specific financing plans for projects as it will put higher priority on those projects in funding agencies eyes.

7.4 Project Permitting

The following permit requirements are anticipated for the implementation of the recommendations herein:

- **Wyoming DEQ-WQD Permit to Construct:** This permit is required for all public water system projects. Wyoming DEQ-WQD will require final plans and specifications as part of the application and review process.

- **Right-of-way Acquisition**: It is likely that recommended improvements will be constructed within existing easements or public rights-of-way.

- **WYDOT License Agreement**: Waterline construction within WYDOT right-of-way, will require a license agreement issued by WYDOT District 1,
    - 3411 South Third Street, Laramie, WY, 82070, Phone – 307-745-2100

Using Federal funds for this project will trigger the need for NEPA clearances. This could involve a categorical exclusion (cat-ex), or more likely an Environmental Assessment with a likely Finding of No Significant Impact (EA/FNSI) if construction disturbances are limited to previously disturbed areas.

8.0 References

American Water Works Association (AWWA). (2013). *M-42: Steel Water Storage Tanks, Revised Edition.*

American Water Works Association (AWWA). (2016). *M-36: Water Audits and Loss Control Programs, Fourth Edition.*

American Water Works Association (AWWA). (2017). *M-32: Computer Modeling of Water Distribution Systems, Fourth Edition.*

American Water Works Association (AWWA). (2019). *Water Rate and Wastewater Rate Survey.*

Bureau, U. C. (2010 Census). *Population and Housing Unit Counts.* U.S. Census Bureau.

Community Builders Inc. (2016). *2016 Comprehensive Master Plan: Town of Saratoga, Wyoming.*

Cooper, H.H., Jr., and C.E. Jacob. (1946). *A Generalized Graphical Method of Evaluating Formation Constants and Summarizing Well Field History: Trans. American Geophysics Union, 27, 8pp.*

Crist, M.A. (1990). *A Concept of the Shallow Gound-Water System Along the North Platte River, South-Central Wyoming: USGS Water-Resources Investigation Report 89-4078.*

Hinkley Consulting. (2007). *Saratoga Test Well Level II Study Final Report: Consultant report for the Wyoming Water Development Commission and Town of Saratoga, June 2007.*

Lowry, M.E., S.J. Drucker, IV, and K.L. Wahl. (1973). *Water Resources of the Laramie, Shirley, Hanna Basins and Adjacent Areas, Southeastern Wyoming: USGS Survey Hydraulic Atlas HA-471.*

Montagne, J. de la. (1991). *Cenozoic History of the Saratoga Valley Area, Wyoming and Colorado: Contributions to Geology, University of Wyoming, v. 29, no. 1, pp 13-70.*

Northstar Economics, Inc. (2004). *A Strategic Economic Development Plan for the Town of Saratoga, Wyoming, November 2004.*

PMPC Civil Engineers. (2003). *Saratoga Master Plan Update and Level I Study: Consultant report for the Wyoming Water Development Commission and Town of Saratoga, March 2003.*

WDEQ-WQD. (2012-REV). *Wyoming Department of Environmental Quality - Water Quality Division, Chapter 12 - Design and Construcion Standards for PWS.*

WSEO. (2019). *Various, Water Well Records; Water well permits archived in the Herschler Building, Cheyenne, Wyoming.* Wyoming State Engineers Office.

Town of Saratoga Water Master Plan Level I

APPENDIX

A. Well Production Data 2009-2018
B. Metered Water Use 2005-2007 & 2016-2018
C. Water Rights
D. Water Quality Report
E. Well Testing Data 2019
F. Well Level Data 2012-2018
G. Fire Flow Report – MDD w/Fire Flow
H. Bolted Standpipe Tank Letters
I. Cost Estimates
J. Fiscal Year Expenditures/Revenues 2016-2018
K. Financial Capacity Development Worksheets
L. 2019 Saratoga Specific Purpose Tax Projects
M. Draft Report Presentation

A. Well Production Data 2009-2018

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	AVERAGE 2009 - 2017
January	6,272,952	7,784,642	7,417,702	8,210,426	11,437,915	9,489,654	11,927,101	9,597,688	8,593,551	6,256,583	**8,970,181**
February	6,651,891	5,728,487	7,612,707	7,099,354	10,606,090	9,132,597	9,899,549	8,090,773	7,858,324	5,481,102	**8,075,530**
March	8,601,745	6,339,734	8,029,024	8,113,225	12,001,569	9,304,246	9,894,159	9,256,933	9,433,034	5,738,449	**8,997,074**
April	8,803,267	7,662,313	8,250,368	10,757,735	11,750,684	8,817,843	11,401,993	8,096,727	9,596,592	9,001,050	**9,459,725**
May	1,265,048	11,457,379	10,698,675	19,995,552	16,716,585	14,542,077	13,419,275	11,730,563	15,141,036	15,177,366	**12,774,021**
June	14,648,281	19,135,479	21,084,278	26,055,114	25,966,107	24,071,731	22,607,123	25,505,343	25,141,929	22,096,623	**22,690,598**
July	24,148,128	27,406,280	22,068,241	25,425,666	25,226,629	27,647,588	26,625,122	24,344,593	29,195,907	26,210,841	**25,787,573**
August	19,933,273	20,653,774	22,391,031	23,186,993	22,805,321	20,638,280	25,377,941	25,950,837	24,015,227	22,754,544	**22,772,520**
September	16,970,846	16,988,228	14,373,523	18,951,553	15,777,475	14,528,420	17,023,821	16,913,605	18,208,914	18,608,365	**16,637,376**
October	6,214,504	8,730,751	8,302,002	9,729,531	9,203,419	11,239,807	11,446,930	9,587,729	9,659,077	7,156,895	**9,345,972**
November	5,639,440		6,741,459	8,684,941	8,086,293	9,894,813	8,008,260	7,735,458	6,738,842	6,304,550	**6,836,612**
December	1,420,747		5,908,870	9,520,876	9,462,242	10,619,122	8,769,593	8,295,226	6,622,073	6,140,896	**6,735,417**
TOTAL	**120,570,122**	**131,887,067**	**142,877,880**	**175,730,966**	**179,040,329**	**169,926,178**	**176,400,867**	**165,105,475**	**170,204,506**	**150,927,264**	**158,267,065**
ADD	**330,329**	**361,334**	**391,446**	**481,455**	**490,521**	**465,551**	**483,290**	**452,344**	**466,314**	**413,499**	**433,608**
ACRE-FEET	**370.0**	**404.7**	**438.5**	**539.3**	**549.5**	**521.5**	**541.4**	**506.7**	**522.3**	**463.2**	**485.7**

B. Metered Water Use 2005-2007 & 2016-2018

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Usage	1,217	10,208	16,742	2,477	73,850	690	73	0	105,257

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Amount	5,831.29	57,732.44	23,873.94	13,198.06	388,965.67	3,348.66	355.04	-	493,305.10
Total Charges:	5,831.29	57,732.44	23,873.94	13,198.06	388,965.67	3,348.66	355.04	-	493,305.10

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
Previous Balance	383.30-	6,590.34	1,829.63	2,928.76	43,967.45	220.86	65.02	-	55,218.76
Payments	6,119.03-	56,587.87-	23,616.45-	12,688.08-	394,080.78-	3,354.00-	362.50-	-	496,808.71-
Contract Adjustments	-	-	-	-	-	-	-	-	-
Assistance Applied	-	-	-	-	-	-	-	-	-
Deposits Applied	-	-	-	-	-	-	-	-	-
Interest Applied	-	-	-	-	-	-	-	-	-
Balance Transfers	-	-	-	-	-	-	-	-	-
Balance Write-offs	-	-	-	-	-	-	-	-	-
Reallocations	-	-	-	-	-	-	-	-	-
Total Charges	5,831.29	57,732.44	23,873.94	13,198.06	388,965.67	3,348.66	355.04	-	493,305.10
Current Balance:	671.04-	7,734.91	2,087.12	3,438.74	38,852.33	215.52	57.56	-	51,715.14

Year To Date: 01/01/2018 - 11/30/2018

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Usage	1,217	10,208	16,742	2,477	73,850	690	73	0	105,257

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Amount	5,831.29	57,732.44	23,873.94	13,198.06	388,965.67	3,348.66	355.04	-	493,305.10
Total Charges:	5,831.29	57,732.44	23,873.94	13,198.06	388,965.67	3,348.66	355.04	-	493,305.10

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
Previous Balance	383.30-	6,590.34	1,829.63	2,928.76	43,967.45	220.86	65.02	-	55,218.76
Payments	6,119.03-	56,587.87-	23,616.45-	12,688.08-	394,080.78-	3,354.00-	362.50-	-	496,808.71-
Contract Adjustments	-	-	-	-	-	-	-	-	-
Assistance Applied	-	-	-	-	-	-	-	-	-
Deposits Applied	-	-	-	-	-	-	-	-	-
Interest Applied	-	-	-	-	-	-	-	-	-
Balance Transfers	-	-	-	-	-	-	-	-	-
Balance Write-offs	-	-	-	-	-	-	-	-	-
Reallocations	-	-	-	-	-	-	-	-	-
Total Charges	5,831.29	57,732.44	23,873.94	13,198.06	388,965.67	3,348.66	355.04	-	493,305.10
Current Balance:	671.04-	7,734.91	2,087.12	3,438.74	38,852.33	215.52	57.56	-	51,715.14

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Usage	1,436	10,777	11,752	2,280	72,216	993	69	0	99,523

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Amount	6,837.57	59,087.95	24,037.27	13,641.73	398,351.68	3,568.06	366.25	-	505,890.51
Total Charges:	6,837.57	59,087.95	24,037.27	13,641.73	398,351.68	3,568.06	366.25	-	505,890.51

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
Previous Balance	719.24-	6,023.11	1,945.96	2,699.70	43,922.48	206.64	28.01	-	54,106.66
Payments	6,501.63-	58,520.72-	24,040.16-	13,412.67-	398,306.71-	3,553.84-	329.24-	-	504,664.97-
Contract Adjustments	-	-	-	-	-	-	-	-	-
Assistance Applied	-	-	-	-	-	-	-	-	-
Deposits Applied	-	-	-	-	-	-	-	-	-
Interest Applied	-	-	-	-	-	-	-	-	-
Balance Transfers	-	-	113.44-	-	-	-	-	-	113.44-
Balance Write-offs	-	-	-	-	-	-	-	-	-
Reallocations	-	-	-	-	-	-	-	-	-
Total Charges	6,837.57	59,087.95	24,037.27	13,641.73	398,351.68	3,568.06	366.25	-	505,890.51
Current Balance:	383.30-	6,590.34	1,829.63	2,928.76	43,967.45	220.86	65.02	-	55,218.76

Year To Date: 01/01/2017 - 12/31/2017

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Usage	1,436	10,777	11,752	2,280	72,216	993	69	0	99,523

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Amount	6,837.57	59,087.95	24,037.27	13,641.73	398,351.68	3,568.06	366.25	-	505,890.51
Total Charges:	6,837.57	59,087.95	24,037.27	13,641.73	398,351.68	3,568.06	366.25	-	505,890.51

Billing and Usage Summary
Report Dates: 01/01/2017 - 12/31/2017

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
Previous Balance	719.24-	6,023.11	1,945.96	2,699.70	43,922.48	206.64	28.01	-	54,106.66
Payments	6,501.63-	58,520.72-	24,040.16-	13,412.67-	398,306.71-	3,553.84-	329.24-	-	504,664.97-
Contract Adjustments	-	-	-	-	-	-	-	-	-
Assistance Applied	-	-	-	-	-	-	-	-	-
Deposits Applied	-	-	-	-	-	-	-	-	-
Interest Applied	-	-	-	-	-	-	-	-	-
Balance Transfers	-	-	113.44-	-	-	-	-	-	113.44-
Balance Write-offs	-	-	-	-	-	-	-	-	-
Reallocations	-	-	-	-	-	-	-	-	-
Total Charges	6,837.57	59,087.95	24,037.27	13,641.73	398,351.68	3,568.06	366.25	-	505,890.51
Current Balance:	383.30-	6,590.34	1,829.63	2,928.76	43,967.45	220.86	65.02	-	55,218.76

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Usage	1,315	11,816	11,289	2,773	104,721	588	26	0	132,528

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Amount	6,284.76	59,342.66	23,023.90	14,539.64	384,871.64	3,049.12	347.88	-	491,459.60
Total Charges:	6,284.76	59,342.66	23,023.90	14,539.64	384,871.64	3,049.12	347.88	-	491,459.60

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
Previous Balance	510.75-	5,099.21	2,014.32	2,075.88	34,772.25	71.34	28.15	-	43,550.40
Payments	6,493.25-	58,418.76-	23,092.26-	13,915.82-	375,721.41-	2,913.82-	348.02-	-	480,903.34-
Contract Adjustments	-	-	-	-	-	-	-	-	-
Assistance Applied	-	-	-	-	-	-	-	-	-
Deposits Applied	-	-	-	-	-	-	-	-	-
Interest Applied	-	-	-	-	-	-	-	-	-
Balance Transfers	-	-	-	-	-	-	-	-	-
Balance Write-offs	-	-	-	-	-	-	-	-	-
Reallocations	-	-	-	-	-	-	-	-	-
Total Charges	6,284.76	59,342.66	23,023.90	14,539.64	384,871.64	3,049.12	347.88	-	491,459.60
Current Balance:	719.24-	6,023.11	1,945.96	2,699.70	43,922.48	206.64	28.01	-	54,106.66

Year To Date: 01/01/2016 - 12/31/2016

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Usage	1,315	11,816	11,289	2,773	104,721	588	26	0	132,528

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
WATER Amount	6,284.76	59,342.66	23,023.90	14,539.64	384,871.64	3,049.12	347.88	-	491,459.60
Total Charges:	6,284.76	59,342.66	23,023.90	14,539.64	384,871.64	3,049.12	347.88	-	491,459.60

Billing and Usage Summary
Report Dates: 01/01/2016 - 12/31/2016

Description	CHURCHES	COMMERCIAL	None	RENTALS	RESIDENTIAL	SCHOOLS	SEASONAL BUSIN	VACANT	Totals
Previous Balance	510.75-	5,099.21	2,014.32	2,075.88	34,772.25	71.34	28.15	-	43,550.40
Payments	6,493.25-	58,418.76-	23,092.26-	13,915.82-	375,721.41-	2,913.82-	348.02-	-	480,903.34-
Contract Adjustments	-	-	-	-	-	-	-	-	-
Assistance Applied	-	-	-	-	-	-	-	-	-
Deposits Applied	-	-	-	-	-	-	-	-	-
Interest Applied	-	-	-	-	-	-	-	-	-
Balance Transfers	-	-	-	-	-	-	-	-	-
Balance Write-offs	-	-	-	-	-	-	-	-	-
Reallocations	-	-	-	-	-	-	-	-	-
Total Charges	6,284.76	59,342.66	23,023.90	14,539.64	384,871.64	3,049.12	347.88	-	491,459.60
Current Balance:	719.24-	6,023.11	1,945.96	2,699.70	43,922.48	206.64	28.01	-	54,106.66

MONTH-YEAR	PRODUCTION	METERED WATER	ESTIMATED NON-METERED*	TOTAL ACCOUNTABLE WATER	LOSS (GALLONS)	LOSS (%)	ACCOUNTABLE (%)			
Jan-05	4,803,600	4,268,000	100,000	4,368,000	435,600	9.07	90.93			
Feb-05	4,155,600	4,037,000	100,000	4,137,000	18,600	0.45	99.55			
Mar-05	5,154,800	5,000,000	100,000	5,100,000	54,800	1.06	98.94			
Apr-05	5,449,200	4,480,000	250,000	4,730,000	719,200	13.20	86.80			
May-05	9,762,400	5,657,000	250,000	5,907,000	3,855,400	39.49	60.51			
Jun-05	14,996,800	14,643,000	250,000	14,893,000	103,800	0.69	99.31			
Jul-05	23,275,000	18,308,000	1,000,000	19,308,000	3,967,000	17.04	82.96			
Aug-05	16,631,400	16,112,000	500,000	16,612,000	19,400	0.12	99.88			
Sep-05	13,115,900	11,310,000	500,000	11,810,000	1,305,900	9.96	90.04			
Oct-05	6,368,500	5,405,000	250,000	5,655,000	713,500	11.20	88.80			
Nov-05	5,582,900	4,793,000	100,000	4,893,000	689,900	12.36	87.64			
Dec-05	5,110,400	4,436,000	100,000	4,536,000	574,400	11.24	88.76	98,449,000		
Jan-06	5,305,900	4,706,000	100,000	4,806,000	499,900	9.42	90.58	114,406,500		
Feb-06	4,767,600	3,600,000	100,000	3,700,000	1,067,600	22.39	77.61	3,500,000		
Mar-06	6,122,100	4,652,000	100,000	4,752,000	1,370,100	22.38	77.62	291,666.67		
Apr-06	7,407,900	4,526,000	250,000	4,776,000	2,631,900	35.53	64.47			
May-06	15,342,100	10,665,000	500,000	11,165,000	4,177,100	27.23	72.77			
Jun-06	23,120,200	19,506,000	1,000,000	20,506,000	2,614,200	11.31	88.69			
Jul-06	22,999,000	16,001,000	1,000,000	17,001,000	5,998,000	26.08	73.92			
Aug-06	21,002,700	19,261,000	1,000,000	20,261,000	741,700	3.53	96.47			
Sep-06	13,591,200	9,801,000	500,000	10,301,000	3,290,200	24.21	75.79			
Oct-06	8,957,000	5,818,000	250,000	6,068,000	2,889,000	32.25	67.75			
Nov-06	6,396,300	4,067,000	100,000	4,167,000	2,229,300	34.85	65.15			
Dec-06	7,642,600	4,524,000	100,000	4,624,000	3,018,600	39.50	60.50			
Jan-07	8,571,100	5,677,000	100,000	5,777,000	2,794,100	32.60	67.40			
Feb-07	7,731,000	4,637,000	100,000	4,737,000	2,994,000	38.73	61.27			
Mar-07	7,241,100	4,475,000	100,000	4,575,000	2,666,100	36.82	63.18			
Apr-07	6,139,000	4,558,000	250,000	4,808,000	1,331,000	21.68	78.32			
May-07	11,507,400	9,989,000	500,000	10,489,000	1,018,400	8.85	91.15			
Jun-07	16,023,600	13,207,000	1,000,000	14,207,000	1,816,600	11.34	88.66			
Jul-07	26,910,400	16,872,000	1,000,000	17,872,000	9,038,400	33.59	66.41	80.70		
2016	165,096,475	132,528,000	3,500,000	136,028,000	29,068,475	17.61	82.39			
2017	160,555,088	105,257,000	3,500,000	108,757,000	51,798,088	32.26	67.74	Ave 2016 - 2018 year to date		
2018	151,481,818	107,257,000	3,500,000	110,757,000	40,724,818	26.88	73.12	74.42		
	2018 Nov & Dec estimated									

C. Water Rights

i. Proof of Appropriation

Rev. June, 2007

RECEIVED JUN 12 2014 WYOMING STATE BOARD OF CONTROL

SCANNED APR 24 2015

Form U.W. 8iii

STATE OF WYOMING
OFFICE OF THE STATE ENGINEER

Proof Number U.W. 06874

CRUW 21/070

PROOF OF APPROPRIATION AND BENEFICIAL USE OF GROUND WATER
PART III

WATER DIVISION 1 DIST. 16 17
Permit NO. U.W. 183913
NAME OF WELL Saratoga Well #1

COUNTY Carbon
U.W. DISTRICT None
DATE OF PRIORITY July 24, 2007
LOCATION NW ¼ NE ¼
SECTION 9 T. 17 N., R. 83 W.

Name of Claimant Town of Saratoga
Address P.O. Box 486
City Saratoga State WY Zip Code 82331

What documentary evidence is attached showing your ownership or control of the following lands? Municipality

AMOUNT TO BE APPROPRIATED: 200 **G.P.M.**

Use (s): Describe fully below. Municipal

ACREAGE TABULATION AND/OR POINTS OF USE

Twp	Range	Sec	NE¼				NW¼				SW¼				SE¼				Total
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
			See Proof Attachment Sheet for Description of Use and Area of Use																

Subject to the terms of the Platte River Recovery Implementation Program.

Do other wells commingle in this system? [X] Yes [ ] No If yes, describe The water from this well is commingled with water from Saratoga Well #2, #3, #4, and #5, Permit Nos. U.W. 183914, U.W. 183915, U.W. 183916, and U.W. 183917 respectively to serve the use and area of use described on the Proof Attachment Sheet.

Description of conveyance of water From well site via 6" line approximately 1,100 feet SE to a junction with a 14" transmission line. Via said transmission line and then 12" transmission line approximately 24,000 feet SW to two 1,000,000 gallon capacity storage tanks. From said storage tanks via 12" line and smaller main lines to serve the Service Area. See map for details.

Any active Surface Water sources? [ ] Yes [X] No If yes, describe

DESCRIPTION OF PUMP AND WELL: Size of Surface Casing 7" Flowing well? No

Make of Pump Grundfos Type Submersible I.D. No. Mod. No. 230S300-9

Rated H.P. 30 Type of Power Electric Make Grundfos I.D. No. N/A

Discharge Pressure N/A psi Static Water Level No Access Pumping Water Level No Access

Size of Discharge Line 6" Od Amount of Water Produced 200 (measured 186 gpm) GPM

How was production determined? Sensus 6" In-Line Flowmeter

Is there anything visible at the well site that indicates the information shown on the Statement of Completion for this well is inaccurate?

[ ] Yes [X] No If Yes, describe:

Is there anything visible at the well site concerning the construction or operation of the well that indicates the well does not comply with the State Engineer's Office Water Well Minimum Construction Standards? [ ] Yes [X] No If Yes, describe

SPRINKLER SYSTEMS: Type N/A Length Make

I.D. No. Nozzle size & spacing @ No. of Towers

Mainline Size Lateral Lines End Gun

System Pressure psi Where Measured?

COMMENTS: If there is anything about this right which requires further explanation, please detail here:

Do you recommend approval? [X] Yes [ ] No

THE STATE OF WYOMING
X County of Carbon } SS.

X I, John Zeiger do depose and say that I have read the Proof of Appropriation and Beneficial Use of Ground Water and am aware that a field inspection was conducted on the 12th day of August, 20 10 I agree with the findings of said inspection and exceptions as noted above. I further agree to the amendment of existing records to reflect the findings of this inspection.

X JOHN ZEIGER
Claimant (If business, give position)
X 6-6-14
Date

Inspected by me this 12th day of August, 20 10

Representative of State Engineer

The foregoing instrument was acknowledged before me this 6th day of June, 20 14

Witness my hand and official seal.

Notary Public

My commission expires: 8-10-16

JOHNATHON N. MOORE - NOTARY PUBLIC
COUNTY OF CARBON
STATE OF WYOMING
My Commission Expires 8-10-16

Filed in the office of the State Board of Control
12th Day of June, 20 14

Ex-officio Secretary, State Board of Control
By

Fees Paid $ 300 Rec. No. 160035

Proof No. U.W. 06874

PROOF OF APPROPRIATION OF GROUND WATER

Permit No. U.W. 183913

Division No. 1 District No. 16

C.R. U.W. 21 Pg. 70

Order Record 90 Pg. 58

Adjudication Map No. 509G

SCANNED APR 24 2015

06874 06874

SCANNED APR 24 2015

PROOF ATTACHMENT SHEET FOR Saratoga Well #1, Permit No. U.W. 183913

The appropriations listed below, in combination, allow the Saratoga Municipal Water System to pump a total combined quantity of 605 acre-feet of ground water on an average annual basis and a combined total quantity of no more than 756 acre-feet of ground water in any one calendar year from its water well field. Such average annual pumping shall be computed on the basis of ten (10) consecutive years commencing with the calendar year 2014. The Saratoga Municipal Water System shall pump no more than 6,050 acre-feet of ground water in any ten (10) year period from its water well field provided however, that the State Engineer may, pursuant to application, permit the Saratoga Municipal Water System to withdraw additional quantities of ground water.

Saratoga Well #1, Permit No. U.W. 183913
Saratoga Well #2, Permit No. U.W. 183914
Saratoga Well #3, Permit No. U.W. 183915
Saratoga Well #4, Permit No. U.W. 183916
Saratoga Well #5, Permit No. U.W. 183917

The water from this well is used for Municipal purposes within the Service Area of the Town of Saratoga Municipal Water System. Said Service Area comprises all or parts of the following described areas:

TWN	RGE	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
ORIGINAL SURVEY																			
								Lot 1	Lot 2			Lot 3							
17N	83W	7					X	X	X	X		X							
								Lot 1	Lot 2			Lot 3	Lot 4						
17N	83W	18	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
17N	83W	19		X															
~~DEPENDENT RESURVEY~~ O.S.																			
17N	84W	1															X	X	
17N	84W	10	X			X									X			X	
17N	84W	11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
17N	84W	12	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
17N	84W	13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
17N	84W	14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
17N	84W	15	X			X					X	X	X	X	X	X	X	X	
17N	84W	16																X	
Dep Resurvey 17N	84W	21	X			X													
								X											
							Lot 1												
Dep. Resurvey 17N	84W	22					X												
							Lot 2												
Dep. Resurvey 17N	84W	22					X												

06874
06875
06876
06877
06878

CARBON COUNTY NOTICE TO APPROPRIATORS OF WATER

Public notice is hereby given that the following listed water users have completed the requirements of proof of appropriation and beneficial use of ground water for the following wells approved by the State Engineer. Pursuant to Section 41-4-511, Wyoming Statutes, 1977, the below listed proofs of appropriation will be held open for public inspection from 9:00 a.m. until 4:00 p.m. during October 13 through October 17, 2014, at the following location(s): 1. State Engineer's Office, Herschler Building, Cheyenne, Wyoming. 2. Office of the Division Superintendent, 510 West 27th, Torrington, Wyoming. As allowed by Section 41-4-312, any person claiming a water right interest in the same sources of supply to which the below advertised proofs refer may inform the Water Division Superintendent of his desire to contest the rights of the person or persons seeking adjudication. The statement of contest shall be presented within fifteen days after the closing of the public inspection and shall state with reasonable certainty the grounds of the contest. The statement must be verified by the sworn affidavit of the contestant, his agent or attorney. If no contest is initiated, the advertised proofs will be submitted to the State Board of Control for consideration during its meeting beginning on November 3, 2014 with the Division Superintendent's recommendation that certificates of appropriation be issued.

CLAIMANT	U.W. PERMIT/W.R. OR S.C. NUMBER	NAME OF WELL	PRIORITY DATE	WELL LOCATION			AMOUNT OF ACREAGE	GAL. PER MINUTE	USE
				Sec.	Twp.	Range			
Brush Creek LLC	Permit No. U.W. 194799	Meyers #2	April 6, 2010	27	16N	82W	0 ac.	8 gpm	Misc.
Brush Creek LLC	Permit No. U.W. 194800	Brush Creek Ranch-6	April 6, 2010	27	16N	82W	0 ac.	15 gpm	Misc.
Brush Creek LLC	Permit No. U.W. 194801	Brush Creek Ranch-4	April 6, 2010	27	16N	82W	0 ac.	25 gpm	Misc.
Brush Creek LLC	Permit No. U.W. 189941	Brush Creek - 3	March 12, 2009	21	16N	82W	0 ac.	7 gpm	Misc.
Brush Creek LLC	Permit No. U.W. 199898	Enl. Brush Creek - 3	March 11, 2013	21	16N	82W	0 ac.	0 gpm	Misc.
Brush Creek LLC	Permit No. U.W. 189909	Brush Creek - 5	March 12, 2009	27	16N	82W	0 ac.	18 gpm	Dom.
Brush Creek LLC	Permit No. U.W. 198126	Brush Creek Ranch-GC	May 14, 2012	14	16N	82W	0 ac.	10 gpm	Misc.
Brush Creek LLC	Permit No. U.W. 193942	TZ Ranch - 1	September 24, 2010	7	16N	81W	0 ac.	14 gpm	Misc.
Brush Creek LLC	Permit No. U.W. 195291	TZ Ranch - 2	March 28, 2011	13	16N	83W	0 ac.	2 gpm	Misc.
Brush Creek LLC	Permit No. U.W. 199896	BCR 1	March 11, 2013	22	16N	82W	0 ac.	20 gpm	Misc.
Town of Saratoga	Permit No. U.W. 183913	Saratoga Well #1	July 24, 2007	9	17N	83W	0 ac.	200 gpm	Mun.
Town of Saratoga	Permit No. U.W. 183914	Saratoga Well #2	July 24, 2007	9	17N	83W	0 ac.	200 gpm	Mun.
Town of Saratoga	Permit No. U.W. 183915	Saratoga Well #3	July 24, 2007	9	17N	83W	0 ac.	150 gpm	Mun.
Town of Saratoga	Permit No. U.W. 183916	Saratoga Well #4	July 24, 2007	9	17N	83W	0 ac.	200 gpm	Mun.
Town of Saratoga	Permit No. U.W. 183917	Saratoga Well #5	July 24, 2007	9	17N	83W	0 ac.	175 gpm	Mun.

BRIAN PUGSLEY, SUPERINTENDENT, WATER DIVISION ONE

Legal #6420 Published in the Saratoga Sun Sept. 24, 2014

SCANNED APR 24 2015

RECEIVED

06874
06875
06876
06877
06878

SCANNED APR 24 2015

Affidavit of Publication

THE STATE OF WYOMING)
COUNTY OF CARBON)

I, Elizabeth E. Wood
being first duly sworn
do depose that I am General Manager

of the **Saratoga Sun** a legal newspaper of general circulation in Carbon County, Wyoming, and printed and published in the English language once a week at Saratoga in said County and State:

That the **Saratoga Sun** has been regularly and consecutively published for more than fifty-two weeks prior to the first publication of the thereof:
That the Legal #6420 a copy of which is here to attached and forms a part of this affidavit, issue(s) of the following dates, to-wit:
September 24, 2014
And that the said notice was published in the regular and entire issue of said **Saratoga Sun** for said above dates and in the newspaper proper and not in a supplement thereof.

Signed: Elizabeth E. Wood

Subscribed in My presence and sworn to me at Saratoga, Wyoming on this, the 25th day of September, 2014.

Elizabeth A. Martin

Notary Public

My commission expires on the 22nd day of January, 2018.

Clipping from **Saratoga Sun** of notice as published

Public notice is he
the following wells
open for public in
Herschler Buildin
person claiming a
his desire to conte
the public inspect
his agent or attor
on November 3, 2

CLAIMA

Brush Creek LLC
Brush Creek LLC
Brush Creek LLC
Brush Creek LLC
Brush Creek LLC
Brush Creek LLC
Brush Creek LLC
Brush Creek LLC
Brush Creek LLC
Brush Creek LLC
Town of Saratoga
Town of Saratoga
Town of Saratoga
Town of Saratoga
Town of Saratoga

BRIAN PUGSLEY

Legal #6420

ing a gra
Living Trust
Meadow Gold Dai
Mf Athletic
Mid-American Research Chem
Motorola Solutior
MPM Corp Dba Evergreen Dispo
MSR West, Inc.
Musician's Friend
Pearson Educatio
PCD Engineerir Inc.
Pederson, Susan
Perkins Oil Compa
Pine Cove Consulting, LLC
Platte River Therapy LLC
Porter, Muirhead, Cornia & Howarc
Prairie Dog Electric, LLC
Quill Corporation
Rawlins Daily Tim
Rawlins Fire Extinguisher Serv
Ricoh USA
Rocky Mountain Power
Ryan Electronics, I
Saddleback Educational, Inc.
Saratoga Auto Glas
Saratoga Auto Parts, Inc.
Saratoga Sun
Scambler, Douglas J. Ph. D.
Shepard Construction, Inc.

SEP 29 2014

ELIZABETH A. MARTIN - NOTARY PUBLIC
COUNTY OF CARBON
STATE OF WYOMING
My Commission Expires 1-22-2018

ii. Statements of Completion and Description of Wells

FORM U.W 6
Rev. 2/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

PERMIT NO. U.W. 183913 NAME OF WELL (SPRING) Saratoga Well #1

1. NAME OF OWNER Town of Saratoga

2. ADDRESS P.O. Box 486
   [ ] Please check if address has changed from that shown on permit
   City Saratoga State Wyoming Zip Code 82331 Phone No. 307-326-8335

3. USE OF WATER: [ ] Domestic [ ] Stock Watering [ ] Irrigation [x] Municipal [ ] Industrial [ ] Miscellaneous
   [ ] Monitor or Test [ ] Coal Bed Methane Explain proposed use (Example: One single family dwelling)
   One of five wells used for public water-supply for Town of Saratoga.

4. LOCATION OF WELL (SPRING): NW 1/4 NE 1/4 of Section 9, T. 17 N., R. 83 W., of the 6th P.M. (or W.R.M.)
   Subdivision Name _____ Lot _____ Block _____
   Resurvey Location Tract _____ or Lot _____ Datum [ ] NAD27 [x] NAD83
   Geographic Coordinates: Latitude 41.46583 N Longitude 106.73555 W (degrees, minutes, seconds)
   UTM: Zone _____ Northing _____ Easting _____ (meters)
   State Plane Coordinates: Zone _____ Northing _____ Easting _____ (Feet)
   Land surface elevation (ft. above mean sea level) 6929 Datum: [ ] NAVD29 [x] NAVD88
   Source: [ ] GPS [ ] Map [x] Survey [ ] Unknown [ ] Other [ ] Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION: [x] Drilled mud rotary (type of rig, and fluid used, if any) [ ] Dug [ ] Driven [ ] Other
   Describe: _____

6. CONSTRUCTION: Total Depth of Well/Spring 305 ft.
   Depth to Static Water Level 62 ft. (below land surface) Casing height 2 ft. above ground
   a. Diameter of borehole (bit size) 12 1/4 inches.
   b. Casing Schedule [x] New [ ] Used Joint type: [x] Threaded [ ] Glued [ ] Welded
   7" diameter from 0 ft. to 305 ft. Material Steel Gage 0.272-wall
   _____ diameter from _____ ft. to _____ ft. Material _____ Gage _____
   c. Cemented/grouted interval, from 0 ft. to 35 ft.
   Amount of grout used: _____ (example: 10 sacks) type: Neat cement (example: bentonite pellets)
   d. Type of completion: [ ] Customized perforations [ ] Open hole [x] Factory screen
   Type of perforater used _____
   Size of perforations _____ inches by _____ inches.
   Number of perforations and depths where perforated:
   _____ perforations from _____ ft. to _____ feet.
   _____ perforations from _____ ft. to _____ feet.
   Open hole from _____ ft. to _____ ft.
   Well screen details:
   Diameter: 7" slot size: 0.050-slot set from 100 ft. to 170 ft.
   Diameter: 7" slot size: 0.050-slot set from 200 ft. to 215 ft.
   Diameter: 7" slot size: 0.050-slot set from 278 ft. to 293 ft.
   e. Well development method chemical, airlift, airjet, water-jet How long was well developed? 7 hrs, 20 min
   f. Was a filter/gravel pack installed? [x] Yes [ ] No Size of sand/gravel 8/12
   Filter/gravel pack installed from 305 ft. to 35 ft.
   g. Was surface casing used? [x] Yes [ ] No Was it cemented in place? [ ] Yes [ ] No
   Surface casing installed from 0 ft. to 38 ft. surface casing only temporary; removed

7. NAME AND ADDRESS OF DRILLING COMPANY Kelley Dewatering & Const. Co., 5175 Clay Ave SW, Wyoming, MI 49548

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 1/13/2009

9. PUMP INFORMATION: Manufacturer Grundfos, 230S300-9 Type submersible
   Source of power electricity Horsepower 30 Depth of pump setting or intake 293'
   Amount of water being pumped 230 gal./min.* (For springs or flowing wells, see item 10.)
   Total volumetric gallons used per calendar year.* 645 ac-ft (210,300,000 gallons)

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
    If well yields artesian flow, yield is _____ gal./min.* Surface pressure is _____ lb./sq.inch, or _____ feet of water.
    The flow is controlled by: [ ] Valve [ ] Cap [ ] Plug
    Does well leak around casing? [ ] Yes [ ] No
    *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. 183913 Book No. _____ Page No. _____

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right.)

12. PUMP TEST: Was a pump test made? [x] Yes [ ] No
If so, by whom? Hinckley Consulting, P.O. Box 452, Laramie, Wyoming 82073
Yield: 330 gal./min. with 160 foot drawdown after 0.5 hours.
Yield: 200 gal./min. with 64 foot drawdown after 192 hours.

13. LOG OF WELL: Total depth drilled 305 feet.
Depth of completed well 305 feet. Diameter of well 7 inches.
Depth to first water bearing formation 62 feet.
Depth to principal water bearing formation. Top 62 feet to Bottom 305 feet.

DRILL CUTTINGS DESCRIPTION:

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface	20	Brn, vf-med, sand with crs-vcrs snd	North Park Fm.	
20	40	All disaggregated sand, crs-vcrs, red grains of qtz and red chert	North Park Fm.	
40	90	Brn, soft, calc, vf-medgr, ang-rnd sst; crs qtz grains	North Park Fm.	Yes
90	100	Brn, soft, non-calc, vf-fgr sst	North Park Fm.	Yes
100	150	Green, soft, non-calc, vf sst	North Park Fm.	Yes
150	305	Brn, s&p, soft, vf-fgr, non-calc sst	North Park Fm.	Yes
		For more details, see lithologic log accompanying P174666W		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? [x] Yes [ ] No

15. QUALITY OF WATER INFORMATION:
Does a chemical and/or bacteriological water quality analysis accompany this form? [x] Yes [ ] No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the water as: [ ] Good [ ] Acceptable [ ] Poor [ ] Unusable

REMARKS: This well is the same well as P174666W and this Statement of Completion replaces the previous one. This well is now part of the 5-well wellfield being used for public-water supply by the Town of Saratoga.

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct and complete.

Signature of Owner or Authorized Agent

4/28, 20 09
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W.

Date of Receipt

Date of Priority

Date of Approval , 20

for State Engineer

FORM U.W.6
Rev 2/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

PERMIT NO. U.W. **183914** NAME OF WELL (SPRING) Saratoga Well #2

1. NAME OF OWNER Town of Saratoga

2. ADDRESS P.O. Box 486
   [ ] Please check if address has changed from that shown on permit
   City Saratoga State Wyoming Zip Code 82331 Phone No. 307-326-8335

3. USE OF WATER: [ ] Domestic [ ] Stock Watering [ ] Irrigation [x] Municipal [ ] Industrial [ ] Miscellaneous
   [ ] Monitor or Test [ ] Coal Bed Methane Explain proposed use (Example: One single family dwelling)
   One of five wells used for public water-supply for Town of Saratoga.

4. LOCATION OF WELL (SPRING): NW 1/4 NE 1/4 of Section 9 ,T. 17 N.,R. 83 W., of the 6th P.M. (or W.R.M.)
   Subdivision Name Lot Block
   Resurvey Location Tract or Lot Datum [ ] NAD27 [x] NAD83
   Geographic Coordinates: Latitude 41.46553 N Longitude 106.73347 W (degrees, minutes, seconds)
   UTM: Zone Northing Easting (meters)
   State Plane Coordinates: Zone Northing Easting (Feet)
   Land surface elevation (ft. above mean sea level) 6953 Datum: [ ] NAVD29 [x] NAVD88
   Source: [ ] GPS [ ] Map [x] Survey [ ] Unknown [ ] Other [ ] Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION: [x] Drilled mud rotary (type of rig, and fluid used, if any) [ ] Dug [ ] Driven [ ] Other
   Describe:

6. CONSTRUCTION: Total Depth of Well/Spring 352 ft.
   Depth to Static Water Level 78 ft. (below land surface) Casing height 2 ft. above ground
   a. Diameter of borehole (bit size) 12 1/4 inches.
   b. Casing Schedule [x] New [ ] Used Joint type: [x] Threaded [ ] Glued [ ] Welded
   7" diameter from 0 ft. to 352 ft. Material Steel Gage 0.272-wall
   diameter from ft. to ft. Material Gage
   c. Cemented/grouted interval, from 0 ft. to 35 ft.
   Amount of grout used: (example: 10 sacks) type: Neat cement (example: bentonite pellets)
   d. Type of completion: [ ] Customized perforations [ ] Open hole [x] Factory screen
   Type of perforater used
   Size of perforations inches by inches.
   Number of perforations and depths where perforated:
   perforations from ft. to feet.
   perforations from ft. to feet.
   Open hole from ft. to ft.
   Well screen details:
   Diameter: 8" telescope slot size: 0.050-slot set from 140 ft. to 180 ft.
   Diameter: 8" telescope slot size: 0.050-slot set from 200 ft. to 250 ft.
   Diameter: 8" telescope slot size: 0.050-slot set from 280 ft. to 300 ft.
   Diameter: 8" telescope slot size: 0.050-slot set from 320 ft. to 350 ft.
   e. Well development method chemical, airlift, airjet, water-jet How long was well developed? 16 hrs
   f. Was a filter/gravel pack installed? [x] Yes [ ] No Size of sand/gravel 8/12
   Filter/gravel pack installed from 352 ft. to 35 ft.
   g. Was surface casing used? [x] Yes [ ] No Was it cemented in place? [ ] Yes [ ] No
   Surface casing installed from 0 ft. to 40 ft. surface casing only temporary; removed

7. NAME AND ADDRESS OF DRILLING COMPANY Kelley Dewatering & Const. Co., 5175 Clay Ave SW, Wyoming, MI 49548

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 1/13/2009

9. PUMP INFORMATION: Manufacturer Grundfos, 230S300-9 Type submersible
   Source of power electricity Horsepower 30 Depth of pump setting or intake 350'
   Amount of water being pumped 230 gal./min.* (For springs or flowing wells, see item 10.)
   Total volumetric gallons used per calendar year.* 645 ac-ft (210,300,000 gallons)

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
    If well yields artesian flow, yield is gal./min.* Surface pressure is lb./sq.inch, or feet of water.
    The flow is controlled by: [ ] Valve [ ] Cap [ ] Plug
    Does well leak around casing? [ ] Yes [ ] No
    *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. **183914** Book No. Page No.

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right.)

12. PUMP TEST: Was a pump test made? [x] Yes [ ] No
If so, by whom? Hinckley Consulting, P.O. Box 452, Laramie, Wyoming 82073
Yield: 40 gal./min. with 8.4 foot drawdown after 0.5 hours.
Yield: 350 gal./min. with 116 foot drawdown after 23 hours.

13. LOG OF WELL: Total depth drilled 352 feet.
Depth of completed well 352 feet. Diameter of well _____ inches.
Depth to first water bearing formation 78 feet.
Depth to principal water bearing formation. Top 78 feet to Bottom 352 feet.

DRILL CUTTINGS DESCRIPTION:

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface				
50	60	samples with med-crs gr fraction	North Park Fm.	
90	100	samples with silt fraction	North Park Fm.	Yes
110	120	samples with med-crs gr fraction	North Park Fm.	Yes
130	150	samples with silt fraction	North Park Fm.	Yes
150	160	samples with med-crs gr fraction	North Park Fm.	Yes
160	170	samples with silt fraction	North Park Fm.	Yes
170	180	samples with med-crs gr fraction	North Park Fm.	Yes
200	210	samples with silt fraction	North Park Fm.	Yes
220	230	samples with med-crs gr fraction	North Park Fm.	Yes
230	240	samples with silt fraction	North Park Fm.	Yes
250	320	samples with silt fraction	North Park Fm.	Yes
320	330	samples with med-crs gr fraction	North Park Fm.	Yes
340	350	samples with med-crs gr fraction	North Park Fm.	Yes
The entire interval penetrated by this well consists of thinly-bedded strata of the North Park Fm., a buff-lgt gry, loose-mod ind, vf-f gr sst.				

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? [x] Yes [ ] No

15. QUALITY OF WATER INFORMATION:
Does a chemical and/or bacteriological water quality analysis accompany this form? [x] Yes [ ] No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the water as: [ ] Good [ ] Acceptable [ ] Poor [ ] Unusable

REMARKS: This well is part of the 5-well wellfield being used for public-water supply by the Town of Saratoga.

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct and complete.

Signature of Owner or Authorized Agent

4/28, 20 09
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. _____

Date of Receipt _____ **Date of Approval** _____, 20____

Date of Priority _____

for State Engineer

FORM U.W.6
Rev 2/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

PERMIT NO. U.W. 183915 NAME OF WELL (SPRING) Saratoga Well #3

1. NAME OF OWNER Town of Saratoga

2. ADDRESS P.O. Box 486
   [ ] Please check if address has changed from that shown on permit
   City Saratoga State Wyoming Zip Code 82331 Phone No. 307-326-8335

3. USE OF WATER: [ ] Domestic [ ] Stock Watering [ ] Irrigation [x] Municipal [ ] Industrial [ ] Miscellaneous
   [ ] Monitor or Test [ ] Coal Bed Methane Explain proposed use (Example: One single family dwelling)
   One of five wells used for public water-supply for Town of Saratoga.

4. LOCATION OF WELL (SPRING): NE 1/4 NE 1/4 of Section 9, T. 17 N., R. 83 W., of the 6th P.M. (or W.R.M.)
   Subdivision Name _____ Lot _____ Block _____
   Resurvey Location Tract _____ or Lot _____ Datum [ ] NAD27 [x] NAD83
   Geographic Coordinates: Latitude 41.46526 N Longitude 106.73139 W (degrees, minutes, seconds)
   UTM: Zone _____ Northing _____ Easting _____ (meters)
   State Plane Coordinates: Zone _____ Northing _____ Easting _____ (Feet)
   Land surface elevation (ft. above mean sea level) 6979 Datum: [ ] NAVD29 [x] NAVD88
   Source: [ ] GPS [ ] Map [x] Survey [ ] Unknown [ ] Other [ ] Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION: [x] Drilled mud rotary (type of rig, and fluid used, if any) [ ] Dug [ ] Driven [ ] Other
   Describe: _____

6. CONSTRUCTION: Total Depth of Well/Spring 390 ft.
   Depth to Static Water Level 98 ft. (below land surface) Casing height 2 ft. above ground
   a. Diameter of borehole (bit size) 12 1/4 inches.
   b. Casing Schedule [x] New [ ] Used Joint type: [x] Threaded [ ] Glued [ ] Welded
   7" diameter from 0 ft. to 390 ft. Material Steel Gage 0.272-wall
   c. Cemented/grouted interval, from 0 ft. to 35 ft.
   Amount of grout used: _____ (example: 10 sacks) type: Neat cement (example: bentonite pellets)
   d. Type of completion: [ ] Customized perforations [ ] Open hole [x] Factory screen
   Type of perforater used _____
   Size of perforations _____ inches by _____ inches.
   Number of perforations and depths where perforated:
   _____ perforations from _____ ft. to _____ feet.
   Open hole from _____ ft. to _____ ft.
   Well screen details:

Diameter:	8" telescope	slot size:	0.050-slot	set from	135	ft. to	150 ft.
Diameter:	8" telescope	slot size:	0.050-slot	set from	155	ft. to	180 ft.
Diameter:	8" telescope	slot size:	0.050-slot	set from	187	ft. to	197 ft.
Diameter:	8" telescope	slot size:	0.050-slot	set from	220	ft. to	255 ft.
Diameter:	8" telescope	slot size:	0.050-slot	set from	280	ft. to	290 ft.
Diameter:	8" telescope	slot size:	0.050-slot	set from	312	ft. to	327 ft.
Diameter:	8" telescope	slot size:	0.050-slot	set from	355	ft. to	390 ft.

   e. Well development method chemical, airlift, airjet, water-jet How long was well developed? 16 hrs
   f. Was a filter/gravel pack installed? [x] Yes [ ] No Size of sand/gravel 8/12
   Filter/gravel pack installed from 390 ft. to 35 ft.
   g. Was surface casing used? [x] Yes [ ] No Was it cemented in place? [ ] Yes [ ] No
   Surface casing installed from 0 ft. to 40 ft. surface casing only temporary; removed

7. NAME AND ADDRESS OF DRILLING COMPANY Kelley Dewatering & Const. Co., 5175 Clay Ave SW, Wyoming, MI 49548

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 1/13/2009

9. PUMP INFORMATION: Manufacturer Grundfos, 230S300-9 Type submersible
   Source of power electricity Horsepower 30 Depth of pump setting or intake 390'
   Amount of water being pumped 230 gal./min.* (For springs or flowing wells, see item 10.)
   Total volumetric gallons used per calendar year.* 645 ac-ft (210,300,000 gallons)

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
    If well yields artesian flow, yield is _____ gal./min.* Surface pressure is _____ lb./sq.inch, or _____ feet of water.
    The flow is controlled by: [ ] Valve [ ] Cap [ ] Plug
    Does well leak around casing? [ ] Yes [ ] No
    *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. 183915 Book No. _____ Page No. _____

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right.)

12. PUMP TEST: Was a pump test made? [x] Yes [ ] No
If so, by whom? Hinckley Consulting, P.O. Box 452, Laramie, Wyoming 82073
Yield: 32 gal./min. with 6.0 foot drawdown after 0.5 hours.
Yield: 350 gal./min. with 84 foot drawdown after 37 hours.

13. LOG OF WELL: Total depth drilled 390 feet.
Depth of completed well 390 feet. Diameter of well 7 inches.
Depth to first water bearing formation 98 feet.
Depth to principal water bearing formation. Top 98 feet to Bottom 390 feet.

DRILL CUTTINGS DESCRIPTION:

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface				
120	140	samples with silt fraction	North Park Fm.	Yes
150	160	samples with med-crs gr fraction	North Park Fm.	Yes
210	220	samples with silt fraction	North Park Fm.	Yes
260	290	samples with med-crs gr fraction	North Park Fm.	Yes
290	380	samples with silt fraction	North Park Fm.	Yes
395	400	samples with silt fraction	North Park Fm.	Yes
The entire interval penetrated by this well consists of thinly-bedded strata of the North Park Fm., a buff-lgt gry, loose-mod ind, vf-f gr sst.				

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? [x] Yes [ ] No

15. QUALITY OF WATER INFORMATION:
Does a chemical and/or bacteriological water quality analysis accompany this form? [x] Yes [ ] No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the water as: [ ] Good [ ] Acceptable [ ] Poor [ ] Unusable

REMARKS: This well is part of the 5-well wellfield being used for public-water supply by the Town of Saratoga.

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct and complete.

Signature of Owner or Authorized Agent

4/28, 20 09
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W.

Date of Receipt

Date of Priority

Date of Approval , 20

for State Engineer

FORM U.W.6
Rev 2/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE Do not fold this form Use typewriter or print neatly with black ink.

PERMIT NO. U.W. **183916** NAME OF WELL (SPRING) Saratoga Well #4

1. NAME OF OWNER Town of Saratoga

2. ADDRESS P.O. Box 486
   [ ] Please check if address has changed from that shown on permit
   City Saratoga State Wyoming Zip Code 82331 Phone No. 307-326-8335

3. USE OF WATER: [ ] Domestic [ ] Stock Watering [ ] Irrigation [x] Municipal [ ] Industrial [ ] Miscellaneous
   [ ] Monitor or Test [ ] Coal Bed Methane Explain proposed use (Example: One single family dwelling)
   One of five wells used for public water-supply for Town of Saratoga.

4. LOCATION OF WELL (SPRING): NE 1/4 NE 1/4 of Section 9 ,T. 17 N.,R. 83 W., of the 6th P.M. (or W.R.M.)
   Subdivision Name Lot Block
   Resurvey Location Tract or Lot Datum [ ] NAD27 [x] NAD83
   Geographic Coordinates: Latitude 41.46496 N Longitude 106.72930 W (degrees, minutes, seconds)
   UTM: Zone Northing Easting (meters)
   State Plane Coordinates: Zone Northing Easting (Feet)
   Land surface elevation (ft. above mean sea level) 6985 Datum: [ ] NAVD29 [x] NAVD88
   Source: [ ] GPS [ ] Map [x] Survey [ ] Unknown [ ] Other [ ] Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION: [x] Drilled mud rotary (type of rig, and fluid used, if any) [ ] Dug [ ] Driven [ ] Other
   Describe:

6. CONSTRUCTION: Total Depth of Well/Spring 412 ft.
   Depth to Static Water Level 100 ft. (below land surface) Casing height 2 ft. above ground
   a. Diameter of borehole (bit size) 12 1/4 inches.
   b. Casing Schedule [x] New [ ] Used Joint type: [x] Threaded [ ] Glued [ ] Welded
   7" diameter from 0 ft. to 412 ft. Material Steel Gage 0.272-wall
   c. Cemented/grouted interval, from 0 ft. to 35 ft.
   Amount of grout used: (example: 10 sacks) type: Neat cement (example: bentonite pellets)
   d. Type of completion: [ ] Customized perforations [ ] Open hole [x] Factory screen
   Type of perforater used
   Size of perforations inches by inches.
   Number of perforations and depths where perforated:
   perforations from ft. to feet.
   Open hole from ft. to ft.
   Well screen details:

Diameter:	7"	slot size:	0.050-slot	set from	145	ft. to	160 ft.
Diameter:	7"	slot size:	0.050-slot	set from	185	ft. to	215 ft.
Diameter:	7"	slot size:	0.050-slot	set from	245	ft. to	260 ft.
Diameter:	7"	slot size:	0.050-slot	set from	285	ft. to	305 ft.
Diameter:	7"	slot size:	0.050-slot	set from	380	ft. to	400 ft.

   e. Well development method chemical, airlift, airjet, water-jet How long was well developed? 5 hrs
   f. Was a filter/gravel pack installed? [x] Yes [ ] No Size of sand/gravel 8/12
   Filter/gravel pack installed from 412 ft. to 35 ft.
   g. Was surface casing used? [x] Yes [ ] No Was it cemented in place? [ ] Yes [ ] No
   Surface casing installed from 0 ft. to 39 ft. surface casing only temporary; removed

7. NAME AND ADDRESS OF DRILLING COMPANY Kelley Dewatering & Const. Co., 5175 Clay Ave SW, Wyoming, MI 49548

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 1/13/2009

9. PUMP INFORMATION: Manufacturer Grundfos, 230S300-9 Type submersible
   Source of power electricity Horsepower 30 Depth of pump setting or intake 400'
   Amount of water being pumped 230 gal./min.* (For springs or flowing wells, see item 10.)
   Total volumetric gallons used per calendar year.* 645 ac-ft (210,300,000 gallons)

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
    If well yields artesian flow, yield is gal./min.* Surface pressure is lb./sq.inch, or feet of water.
    The flow is controlled by: [ ] Valve [ ] Cap [ ] Plug
    Does well leak around casing? [ ] Yes [ ] No
    *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. **183916** Book No. Page No.

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right.)

12. PUMP TEST: Was a pump test made? [x] Yes [ ] No
If so, by whom? Hinckley Consulting, P.O. Box 452, Laramie, Wyoming 82073
Yield: 408 gal./min. with 112 foot drawdown after 0.5 hours.
Yield: 375 gal./min. with 119 foot drawdown after 312 hours.

13. LOG OF WELL: Total depth drilled 412 feet.
Depth of completed well 412 feet. Diameter of well 7 inches.
Depth to first water bearing formation 100 feet.
Depth to principal water bearing formation. Top 100 feet to Bottom 412 feet.

DRILL CUTTINGS DESCRIPTION:

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface	50	Brn, gray, soft, vf-fgr sst	North Park Fm.	
50	130	Brn, soft, vf-mgr, non-calc, s&p sst; crs qtz	North Park Fm.	Yes
130	180	White, soft, vf-mgr, calc, s&p, sst; rounded crs qtz	North Park Fm.	Yes
180	270	Brn, soft, non-calc, vf-fg sst	North Park Fm.	Yes
270	330	Brn, soft, mod-ind, vfgr, non-calc, s & p sst	North Park Fm.	Yes
330	370	Brn, soft, mod-ind, non-calc, vf-fg, s & p qtz sst aa	North Park Fm.	Yes
370	380	Med-crs, rounded qtz grains	North Park Fm.	Yes
380	412	Med-crs qtz sand & white vfn sandy mudst	North Park Fm.	Yes
		For more details, see lithologic log accompanying P159838W		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? [x] Yes [ ] No

15. QUALITY OF WATER INFORMATION:
Does a chemical and/or bacteriological water quality analysis accompany this form? [x] Yes [ ] No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the water as: [ ] Good [ ] Acceptable [ ] Poor [ ] Unusable

REMARKS: This well is the same well as P159838W and this Statement of Completion replaces the previous one. This well is now part of the 5-well wellfield being used for public-water supply by the Town of Saratoga.

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct and complete.

Signature of Owner or Authorized Agent

4/28, 20 09
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W.

Date of Receipt

Date of Priority

Date of Approval , 20

for State Engineer

FORM U.W.6
Rev 2/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

PERMIT NO. U.W. **183917** NAME OF WELL (SPRING) Saratoga Well #5

1. NAME OF OWNER Town of Saratoga

2. ADDRESS P.O. Box 486
   [ ] Please check if address has changed from that shown on permit
   City Saratoga State Wyoming Zip Code 82331 Phone No. 307-326-8335

3. USE OF WATER: [ ] Domestic [ ] Stock Watering [ ] Irrigation [x] Municipal [ ] Industrial [ ] Miscellaneous
   [ ] Monitor or Test [ ] Coal Bed Methane Explain proposed use (Example: One single family dwelling)
   One of five wells used for public water-supply for Town of Saratoga.

4. LOCATION OF WELL (SPRING): NE 1/4 NE 1/4 of Section 9, T. 17 N., R. 83 W., of the 6th P.M. (or W.R.M.)
   Subdivision Name Lot Block
   Resurvey Location Tract or Lot Datum [ ] NAD27 [x] NAD83
   Geographic Coordinates: Latitude 41.46470 N Longitude 106.72769 W (degrees, minutes, seconds)
   UTM: Zone Northing Easting (meters)
   State Plane Coordinates: Zone Northing Easting (Feet)
   Land surface elevation (ft. above mean sea level) 6988 Datum: [ ] NAVD29 [x] NAVD88
   Source: [ ] GPS [ ] Map [x] Survey [ ] Unknown [ ] Other [ ] Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION: [x] Drilled mud rotary (type of rig, and fluid used, if any) [ ] Dug [ ] Driven [ ] Other
   Describe:

6. CONSTRUCTION: Total Depth of Well/Spring 430 ft.
   Depth to Static Water Level 100 ft. (below land surface) Casing height 2 ft. above ground
   a. Diameter of borehole (bit size) 12 1/4 inches.
   b. Casing Schedule [x] New [ ] Used Joint type: [x] Threaded [ ] Glued [ ] Welded
   7" diameter from 0 ft. to 430 ft. Material Steel Gage 0.272-wall
   c. Cemented/grouted interval, from 0 ft. to 35 ft.
   Amount of grout used: (example: 10 sacks) type: Neat cement (example: bentonite pellets)
   d. Type of completion: [ ] Customized perforations [ ] Open hole [x] Factory screen
   Type of perforater used
   Size of perforations inches by inches.
   Number of perforations and depths where perforated:
   perforations from ft. to feet.
   Open hole from ft. to ft.
   Well screen details:

Diameter	slot size	set from	ft. to	
8" telescope	0.050-slot	110	130	ft.
8" telescope	0.050-slot	170	190	ft.
8" telescope	0.050-slot	245	275	ft.
8" telescope	0.050-slot	295	310	ft.
8" telescope	0.050-slot	320	330	ft.
8" telescope	0.050-slot	340	355	ft.
8" telescope	0.050-slot	390	415	ft.

   e. Well development method chemical, airlift, airjet, water-jet, bailer How long was well developed? 30 hrs
   f. Was a filter/gravel pack installed? [x] Yes [ ] No Size of sand/gravel 8/12
   Filter/gravel pack installed from 430 ft. to 35 ft.
   g. Was surface casing used? [x] Yes [ ] No Was it cemented in place? [ ] Yes [ ] No
   Surface casing installed from 0 ft. to 40 ft. surface casing only temporary; removed

7. NAME AND ADDRESS OF DRILLING COMPANY Kelley Dewatering & Const. Co., 5175 Clay Ave SW, Wyoming, MI 49548

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 1/13/2009

9. PUMP INFORMATION: Manufacturer Grundfos, 230S300-9 Type submersible
   Source of power electricity Horsepower 30 Depth of pump setting or intake 415'
   Amount of water being pumped 230 gal./min.* (For springs or flowing wells, see item 10.)
   Total volumetric gallons used per calendar year.* 645 ac-ft (210,300,000 gallons)

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
    If well yields artesian flow, yield is gal./min.* Surface pressure is lb./sq.inch, or feet of water.
    The flow is controlled by: [ ] Valve [ ] Cap [ ] Plug
    Does well leak around casing? [ ] Yes [ ] No
    *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. **183917** Book No. Page No.

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right.)

12. PUMP TEST: Was a pump test made? [x] Yes [ ] No
If so, by whom? Hinckley Consulting, P.O. Box 452, Laramie, Wyoming 82073
Yield: 33 gal./min. with 6.3 foot drawdown after 0.5 hours.
Yield: 305 gal./min. with 112 foot drawdown after 24 hours.

13. LOG OF WELL: Total depth drilled 430 feet.
Depth of completed well 430 feet. Diameter of well 7 inches.
Depth to first water bearing formation 100 feet.
Depth to principal water bearing formation. Top 100 feet to Bottom 430 feet.

DRILL CUTTINGS DESCRIPTION:

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface	30	loose, vfgr-fg sand; cobbles and gravel	North Park Fm.	
30	430	lgt brn, soft, sli silty sst; increasing silts below 330 ft.	North Park Fm.	Yes
430	440	brn, soft, non-calc, vf sandy siltst; tr clay	North Park Fm.	Yes
		For more details, see lithologic log accompanying P159841W		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? [x] Yes [ ] No

15. QUALITY OF WATER INFORMATION:
Does a chemical and/or bacteriological water quality analysis accompany this form? [x] Yes [ ] No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the water as: [ ] Good [ ] Acceptable [ ] Poor [ ] Unusable

REMARKS: This well is not the same well as P159841W but is only 30 feet away and the lithologic log for P159841W was used for this well. This well is part of the 5-well wellfield being used for public-water supply by the Town of Saratoga.

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct and complete.

Signature of Owner or Authorized Agent

4/28, 20 09
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W.

Date of Receipt

Date of Priority

Date of Approval , 20

for State Engineer

Table 4.18 - Town of Saratoga Wellfield Historical Water Quality Results

ANALYTE (all results in mg/L unless otherwise noted)	Well #1				Well #2				Well #3				Well #4				Well #5			
	4/2/2009	5/10/2012	11/19/2014	5/24/2017	4/2/2009	5/10/2012	11/19/2014	5/24/2017	4/2/2009	5/10/2012	11/19/2014	5/24/2017	4/2/2009	5/10/2012	11/19/2014	5/24/2017	4/2/2009	5/10/2012	11/19/2014	5/24/2017
CALCIUM HARDNESS	120	140	130	135	120	130	120	134	160	150	130	161	170	160	130	197	160	170	150	197
ALKALINITY	130	150	150	145	130	150	150	144	150	160	150	157	160	160	160	171	140	170	170	172
BICARBONATE	160	180	180	177	160	180	180	176	180	190	190	191	190	200	200	208	170	200	200	201
CARBONATE	0	0	2		0	0	<2		0	0	<2		0	0	<2		0	0	<2	
CONDUCTIVITY	270	334	330	305	290	322	320	300	350	340	360	348	380	376	370	419	350	388	420	416
pH (pH units)	7.9	7.8	7.9	7.9	7.9	7.8	7.9	7.89	7.9	7.8	7.9	7.84	8	7.8	7.9	7.78	7.8	7.8	7.9	7.79
CALCIUM	37	43	50.9	43	38	41	49.1	42	48	46	53.9	51	53	50	53.3	63	50	51	59.3	63
COPPER	0.001	<0.001	<0.001		0.002	0.002	0.001		0.003	0.001	<0.001		<0.001	0.001	<0.001		0.001	0.024	<0.001	
IRON	0.091	<0.02	<0.02		0.09	<0.02	0.027		0.032	0.028	0.031		0.083	<0.02	0.082		0.84	<0.02	35.5	
LEAD	0.001	0.001	<0.001		0.004	0.001	0.002		0.009	0.001	<0.001		0.005	0.001	<0.001		<0.001	0.001	<0.001	
MAGNESIUM	6.7	7.69	7.69	7	7.2	7.7	8.07	7	8.8	8.5	8.12	8	9.4	8.8	9.17	10	8.3	9.3	8.54	10
MANGANESE	0.005	<0.001	<0.001		0.003	0.001	0.001		0.004	0.001	<0.001		0.004	0.001	0.001		0.016	<0.001	0.092	
POTASSIUM	6	4.9	5.04	6	5.3	5.1	5.29	6	4.8	5.3	4.79	6	5.3	5.4	5.9	5	4.6	5.3	4.59	6
SODIUM	8	7.5	7.8	8	7.5	7.2	7.87	8	7.6	8	7.33	9	7.8	7	8.37	8	7.7	7.5	7.2	8
ZINC	0.008	0.008	0.021		0.006	0.012	0.015		0.009	0.01	0.012		0.004	0.012	0.013		0.006	0.012	0.026	
CORROSIVITY	0	-0.02	-0.24		0	-0.06	-0.26		0.15	0.03	-0.21		0.28	0.04	-0.20		0.03	0.1	-0.13	
TDS by Summation	150	170	180		150	170	180		190	180	200		200	200	210		180	210	230	
CHLORIDE	1.6	3.4	2.9	2	1.9	2.3	2.8	2	3	2.5	3.3	4	2.9	2.8	3.1	5	3.8	2.8	3.8	4
FLUORIDE	0.5	0.5	0.4	0.5	0.6	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4
NITRATE (as N)	0.19	1.7	1.21	0.3	0.4	0.64	0.9	0.4	0.6	0.51	0.79	0.6	0.54	0.47	0.64	0.6	0.68	0.52	0.71	0.7
NITRITE (as N)	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05		0.05	<0.05	0.05		<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	
SULFATE	6.1	12	11	10	8	12	13	9	23	16	25	19	28	27	24	42	22	31	40	42

Note: Blank field indicates not sampled.

SARATOGA WELL NO. 1
STEP-RATE PUMP TEST DATA

Date: #######

Tested by: Weston Engineering, Inc.

Supervised by: Weston Engineering, Inc.

Pumping Equipment: Grundfos 230S300-9 pump and 30 HP Franklin motor

Monitoring Equipment: Water level measured by airline and transducer set at 218 feet
Pumping rate controlled by VFD, measured with 6-inch Sensus W2000 flow meter

Discharge: 100 gpm, 150 gpm, 223 gpm

Clock Time	Elapsed Time (min)	Pumping Rate (gpm)	Transducer (feet)	Airline (psi)	Transducer Drawdown (feet)	Airline Drawdown (feet)	Comments
9:45	0		151.1	71	0	0	
9:50	0	0	151.1		0	0	Start test
9:51	1	93	134.4		16.7		Adjusting rate to 100 gpm target
9:52	2	114	129.1		22.0		
9:53	3	113	127.2		23.9		
9:54	4	103	128.3		22.8		
9:55	5	100	128.5		22.6		
10:00	10	100	127.3		23.8		
10:05	15	101	127.0		24.1		
10:07	17			60.5		24.3	
10:10	20	101	127.1		24.0		
10:15	25	100	127.2		23.9		
10:20	30	100	126.7		24.4		
10:30	40	100	126.5		24.6		
10:40	50	101	126.8		24.3		
10:45	55			60.0		25.4	
10:50	60	100	126.4		24.7		
10:52	62	141	117.4		33.7		Increase rate to 150 gpm target
10:54	64	150	115.1		36.0		
10:56	66	151	114.1		37.0		
10:58	68	151	114.5		36.6		
11:00	70	151	114.4		36.7		
11:02	72			55.0		37.0	
11:10	80	151	114.0		37.1		
11:20	90	150	113.5		37.6		
11:30	100	150	113.0		38.1		
11:33	103			54.5		38.1	
11:40	110	150	113.0		38.1		
11:41	111			54.5		38.1	
11:50	120	150	112.7		38.4		
11:52	122	215	96.0		55.1		Increase rate to 225 gpm target
11:54	124	223	89.5		61.6		
11:56	126			43.0		64.7	
12:00	130	223	86.0		65.1		
12:05	135			42.5		65.8	
12:10	140	222	83.6		67.5		
12:20	150	223	83.1		68.0		
12:25	155			42.0		67.0	AIR IN WATER
12:30	160	220	83.0		68.1		
12:40	170	223	81.3		69.8		

12:50	180	223	80.9	70.2	
12:51	1		134.5	16.6	End test, record recovery data
12:52	2		141.8	9.3	
12:53	3		144.2	6.9	
12:54	4		145.4	5.7	
12:55	5		145.8	5.3	
12:56	6		146.6	4.5	
12:57	7		146.7	4.4	
12:58	8		146.9	4.2	
12:59	9		147.3	3.8	
13:00	10		147.8	3.3	
13:15	15		148.6	2.5	Saratoga #2 test started at 13:20
13:24	24		149.1	2.0	
13:26	26		148.0	3.1	
13:28	28		148.8	2.3	
13:29	29		149.6	1.5	
13:40	40		149.0	2.1	
13:53	53		149.2	1.9	
14:20	80		149.4	1.7	
14:24	84		149.9	1.2	
14:26	86		150.0	1.1	
14:48	108		150.2	0.9	
15:10	130		150.4	0.7	
15:20	140		149.9	1.2	
15:42	162		150.2	0.9	
15:56	176		150.2	0.9	
16:10	190		150.6	0.5	
16:20	200		150.5	0.6	
17:00	240		150.8	0.3	

SARATOGA WELL NO. 2
STEP-RATE PUMP TEST DATA

Date: 2/26/2019

Tested by: Weston Engineering, Inc.

Supervised by: Weston Engineering, Inc.

Pumping Equipment: Grundfos 230S300-9 pump and 30 HP Franklin motor

Monitoring Equipment: Water level measured by airline and transducer set at 238 feet

Pumping rate controlled by VFD, measured with 6-inch Sensus W2000 flow meter

Discharge: 97 gpm, 142 gpm, 221 gpm

Clock Time	Elapsed Time (min)	Pumping Rate (gpm)	Transducer (feet)	Airline (psi)	Transducer Drawdown (feet)	Airline Drawdown (feet)	Comments
13:10	0	0	154.6	72.5	0	0.0	
13:20	0	0	154.6		0		Start test. Adjusting to 100 gpm
13:23	3	171	140.6		14.0		
13:24	4		138.4		16.2		
13:25	5	124	139.8		14.8		
13:26	6	107	140.6		14.0		
13:27	7	107	142.2		12.4		
13:28	8	96	141.3		13.3		
13:29	9	92	143.0		11.6		
13:30	10	102	142.5		12.1		
13:33	13		140.0		14.6		
13:35	15			64.0		19.6	
13:40	20	101	140.3		14.3		Transducer range is 7 feet +/-
13:43	23	97	143.0		11.6		
13:53	33		140.6		14.0		
13:54	34			63.5		20.8	
14:04	44	100	141.9		12.7		Transducer range is 7 feet +/-
14:15	55			63.0		21.9	
14:20	60	95	142.5		12.1		Increase rate to 150 gpm target
14:22	62	147	128.7		25.9		
14:24	64	145	130.8		23.8		
14:26	66	145	129.0		25.6		
14:28	68	145	129.8		24.8		
14:30	70	142	122.4		32.2		
14:33	73			58.0		33.5	
14:43	83			58.0		33.5	
14:48	88	141	128.7		25.9		
15:00	100	145		57.5		34.7	
15:10	110	142	127.6		27.0		
15:15	115			57.0		35.8	
15:20	120	142	122.2		32.4		
15:22	122	226	101.6		53.0		Increase rate to 225 gpm target
15:25	125			47.5		57.8	
15:30	130	220		46.5		60.1	
15:35	135	221		46.0		61.2	
15:40	140			46.0		61.2	
15:42	142	222	98.6		56.0		
15:50	150						SCADA screen stuck
15:52	152	220		45.75		61.8	
15:56	156	221	95.7		58.9		

16:05	165	221		45.5		62.4	Sand in water
16:10	170		96.1		58.5		
16:15	175			45.5		62.4	
16:20	180	221	93.7		60.9		End test, record recovery data
16:21	1	0	138.5		16.1		
16:22	2	0	142.5		12.1		
16:23	3	0	144.1		10.5		
16:24	4	0	145.1		9.5		
16:25	5	0	146.1		8.5		
16:26	6	0	146.7		7.9		
16:27	7	0	147.3		7.3		
16:28	8	0	147.7		6.9		
16:29	9	0	148.0		6.6		
16:30	10	0	148.3		6.3		
16:34	14	0		70.3		5.2	
16:43	83	0	150.6		4.0		
16:50	90	0	151.1		3.5		
17:00	100	0	151.6		3.0		

SARATOGA WELL NO. 3
STEP-RATE PUMP TEST DATA

Date: 2/27/2019

Tested by: Weston Engineering, Inc.

Supervised by: Weston Engineering, Inc.

Pumping Equipment: Grundfos 230S300-9 pump and 30 HP Franklin motor

Monitoring Equipment: Water level measured by airline and transducer set at 238 feet
Pumping rate controlled by VFD, measured with 6-inch Sensus W2000 flow meter

Discharge: 100 gpm, 150 gpm, 225 gpm

Clock Time	Elapsed Time (min)	Pumping Rate (gpm)	Transducer (feet)	Airline (psi)	Drawdown (feet)	Airline Drawdown (feet)	Comments
9:05	0		131.3	63.5	0	0.0	
9:10	0		131.3		0		Start test. Adjusting VFD frequency
9:11	1	100	114.5		16.8		Adjusting rate to 100 gpm target
9:12	2		113.1		18.2		
9:13	3	100	112.7		18.6		
9:14	4	100	112.5	55.5	18.8	18.5	
9:15	5		112.2		19.1		
9:20	10		111.6	55.0	19.7	19.6	
9:25	15		111.1	54.5	20.2	20.8	
9:30	20	98	111.0	54.25	20.3	21.4	
9:35	25	99	110.8	54.25	20.5	21.4	
9:40	30	98	110.7	54.0	20.6	21.9	
9:45	35	98	110.5	54.0	20.8	21.9	
9:50	40	99	110.5	54.0	20.8	21.9	
10:00	50	100	110.2	54.0	21.1	21.9	
10:10	60	100	110.2	54.0	21.1	21.9	Increase rate to 150 gpm target
10:11	61	153	101.7	50.5	29.6	30.0	
10:12	62	150	101.3	50.25	30.0	30.6	
10:14	64	150	100.6	50.0	30.7	31.2	
10:15	65	150	100.5	50.0	30.8	31.2	
10:20	70	151	100.0	50.0	31.3	31.2	
10:25	75	151	99.6	49.5	31.7	32.3	
10:30	80	150	99.5	49.5	31.8	32.3	
10:40	90	150	99.0	49.25	32.3	32.9	
10:50	100	151	99.0	49.0	32.3	33.5	
11:00	110	150	98.9	49.0	32.4	33.5	
11:10	120	150	98.8	49.0	32.5	33.5	Increase rate to 225 gpm target
11:11	121	223	86.9	44.5	44.4	43.9	
11:12	122	223	84.5	44.25	46.8	44.5	
11:13	123	225	83.7	43.0	47.6	47.4	
11:15	125	225	83.2	42.5	48.1	48.5	
11:20	130	225	82.5	42.25	48.8	49.1	
11:25	135	225	82.0	42.0	49.3	49.7	
11:30	140		81.5	42.0	49.8	49.7	
11:32	142						Flow meter stops working
11:34	144						Stop pump
11:55	0	225					Restart test at 225 gpm
11:57	2		89.3		42.0		
12:00	5		85.5	43.0	45.8	47.4	Flow meter erratic
12:05	10	225	83.8	42.25	47.5	49.1	Flow meter steady
12:15	20	225	82.4	42.0	48.9	49.7	

12:25	30	224	81.9	41.5	49.4	50.8	
12:35	40	224	81.5	41.5	49.8	50.8	
12:45	50	225	80.9	41.0	50.4	52.0	
12:55	60	225	80.9	41.0	50.4	52.0	End test, record recovery data
12:56	1	0	119.2	58.5	12.1	11.6	
12:57	2	0	122.1	59.5	9.2	9.2	
12:58	3	0	123.4	60.0	7.9	8.1	
12:59	4	0	124.0	60.5	7.3	6.9	
13:00	5	0	124.9	60.5	6.4	6.9	
13:02	7	0	125.9	61.0	5.4	5.8	
13:04	9	0	126.3		5		
13:08	13	0	127.1		4.2		
13:36	41	0	128.9		2.4		Saratoga #4 test started
13:38	43	0	129.1		2.2		
14:05	70	0	129.7		1.6		
14:16	81	0	129.9		1.4		
14:26	91	0	129.9		1.4		
14:35	100	0	130.1		1.2		
14:36	101	0	130.0		1.3		
14:51	116	0	130.1		1.2		
15:05	125	0	130.2		1.1		
15:20	140	0	130.2		1.1		
15:35	155	0	130.3		1.0		
15:40	160	0	130.3		1.0		
15:50	170	0	130.3		1.0		
15:55	175	0	130.4		0.9		
16:15	195	0	130.3		1.0		
16:25	205	0	130.3		1.0		
16:35	215	0	130.3		1.0		
16:36	216	0	130.3		1.0		
16:38	218	0	130.3		1.0		
16:39	219	0	130.3		1.0		
16:41	221	0	130.3		1.0		
16:43	223	0	130.3		1.0		
16:55	235	0	130.3		1.0		

SARATOGA WELL NO. 4
STEP-RATE PUMP TEST DATA

Date: 2/27/2019

Tested by: Weston Engineering, Inc.

Supervised by: Weston Engineering, Inc.

Pumping Equipment: Grundfos 230S300-9 pump and 30 HP Franklin motor

Monitoring Equipment: Water level measured by airline and transducer set at 238 feet
Pumping rate controlled by VFD, measured with 6-inch Sensus W2000 flow meter

Discharge: 105 gpm, 150 gpm, 224 gpm

Clock Time	Elapsed Time (min)	Pumping Rate (gpm)	Transducer (feet)	Airline (psi)	Transducer Drawdown (feet)	Airline Drawdown (feet)	Comments
13:22	0	0	131.4	63.0	0	0.0	
13:35	0	0	131.4	63.0	0	0.0	Start test. Adjusting VFD frequency
13:37	2	118	119.8		11.6		Adjusting rate to 100 gpm target
13:38	3	109	122.4		9.0		
13:39	4	92	119.6		11.8		
13:40	5	105	120.8		10.6		
13:41	6	105	120.3		11.1		
13:43	8			56.0		16.2	Air in water
13:49	14	105	120.3		11.1		
13:56	21						No air in water
14:00	25			55.75		16.7	
14:05	30	105	116.9		14.5		
14:06	31		116.5		14.9		
14:16	41	105	116.3		15.1		Transducer range is 2.6' +/-
14:21	46			55.5		17.3	
14:26	51	104	116.5		14.9		
14:30	55			55.5		17.3	
14:35	60	105	115.5		15.9		Increase rate to 150 gpm target
14:36	61	147	109.4		22.0		
14:37	62	150	110.9		20.5		
14:38	63	149	110.9		20.5		
14:42	67			51.25		27.1	
14:51	76	150	107.1		24.3		
14:55	80	148	108.2		23.2		
15:05	90	149	106.1		25.3		
15:10	95			51.0		27.7	
15:20	105	148	104.3		27.1		
15:25	110	148	104.2		27.2		
15:30	115	149		50.75		28.3	
15:35	120	150	103.5		27.9		Increase rate to 225 gpm target
15:36	121	219	95.4		36.0		
15:37	122	217	89.8		41.6		
15:38	123	218	92.7		38.7		
15:39	124	218	91.9		39.5		
15:40	125	217	90.4		41.0		
15:41	126	225	89.9		41.5		
15:44	129	225		44.25		43.3	

15:50	135	224	87.8		43.6		
15:55	140	224	88.1		43.3		
16:00	145			44.0		43.9	
16:10	155			43.75		44.5	
16:15	160	223	89.7		41.7		
16:20	165	224	89.7		41.7		
16:25	170	224	87.0		44.4		
16:30	175			43.75		44.5	
16:35	180	224	87.5		43.9		End test, record recovery data
16:36	1	0	122.3		9.1		
16:37	2	0	124.5		6.9		
16:38	3	0	125.5		5.9		
16:39	4	0	126.5		4.9		
16:40	5	0	127.0		4.4		
16:41	6	0	127.1		4.3		
16:42	7	0	127.6		3.8		
16:43	8	0	127.9		3.5		
16:44	9	0	128.1		3.3		
16:45	10	0	128.4		3.0		
16:49	14	0		62.0		2.3	
16:52	17	0	129.0		2.4		
16:55	20	0	129.5		1.9		

SARATOGA WELL NO. 5
STEP-RATE PUMP TEST DATA

Date: 2/28/2019

Tested by: Weston Engineering, Inc.

Supervised by: Weston Engineering, Inc.

Pumping Equipment: Grundfos 230S300-9 pump and 30 HP Franklin motor

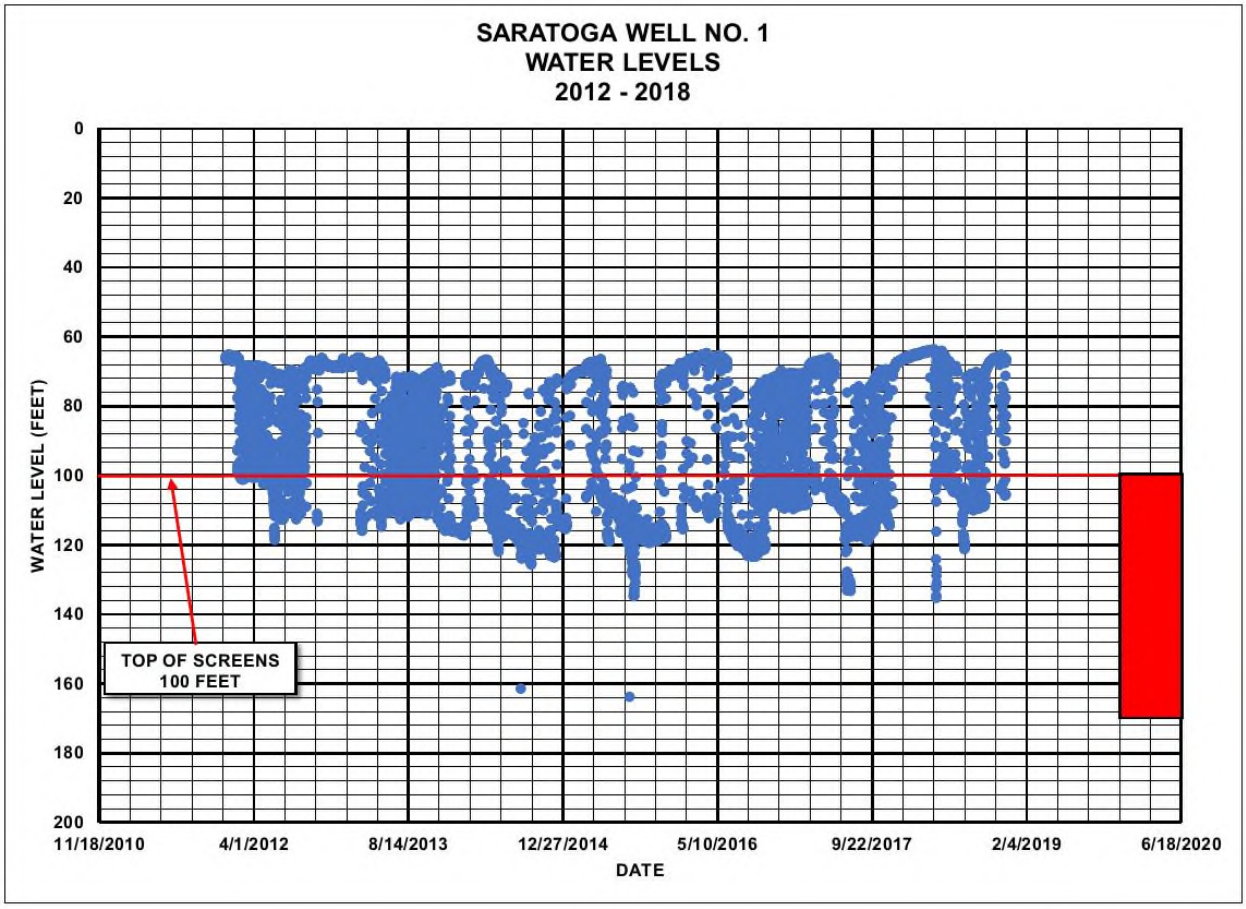
Monitoring Equipment: Water level measured by airline and transducer set at 238 feet
Pumping rate controlled by VFD, measured with 6-inch Sensus W2000 flow meter

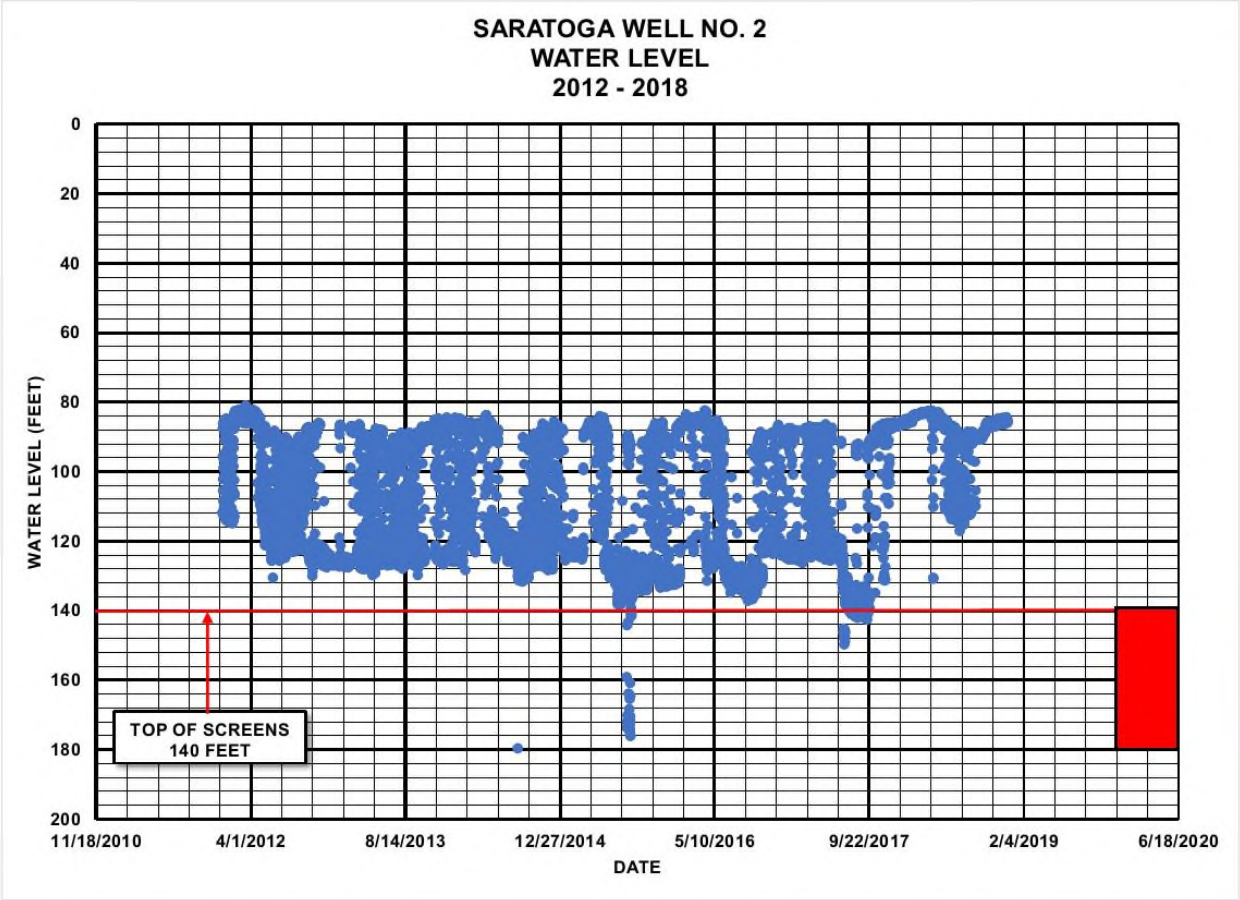
Discharge: 100 gpm, 148 gpm, 222 gpm

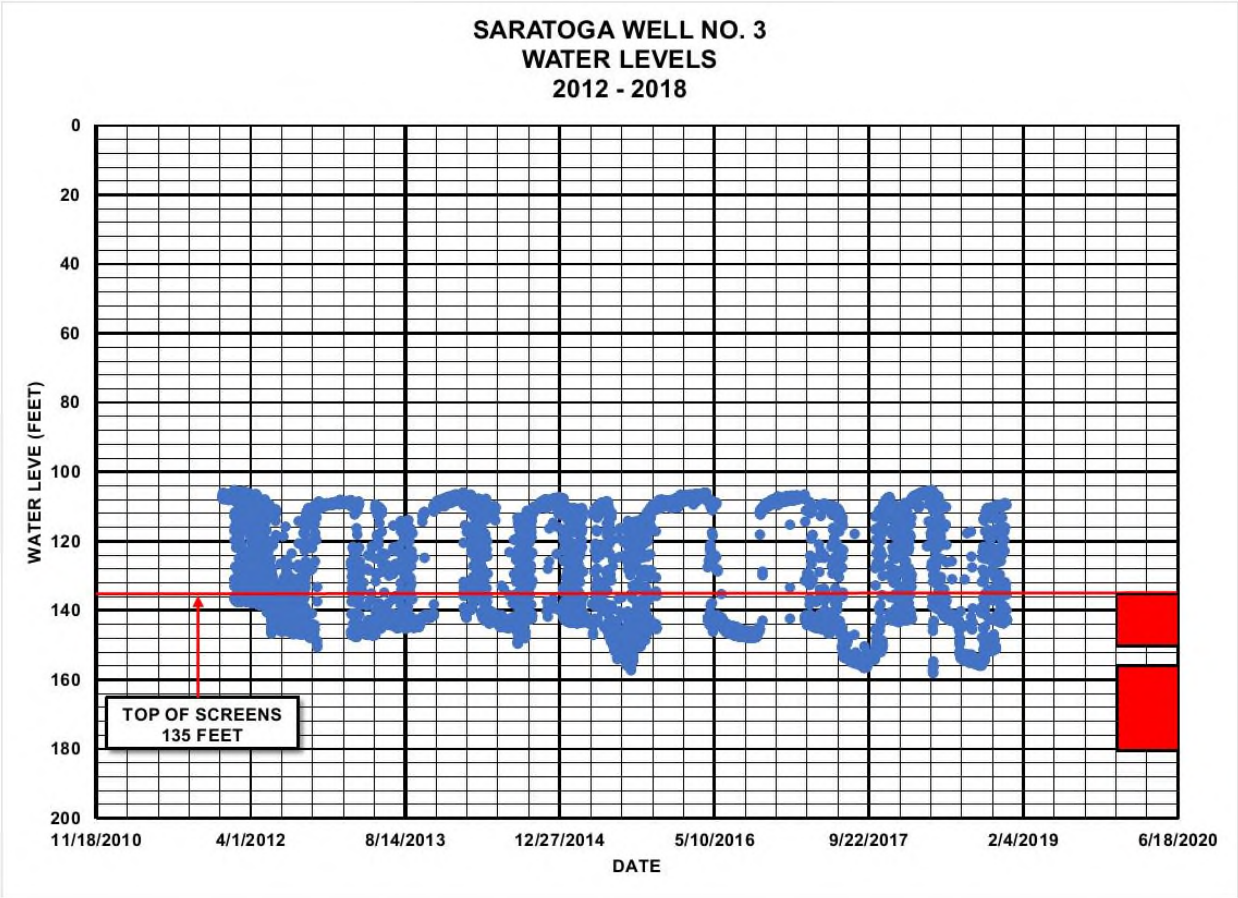
Clock Time	Elapsed Time (min)	Pumping Rate (gpm)	Transducer (feet)	Airline (psi)	Transducer Drawdown (feet)	Airline Drawdown (feet)	Comments
9:40	0	0	134.6		0		
9:45	0	0			0		Start test. Adjusting VFD frequency
9:46	1	173					Adjusting rate to 100 gpm target
9:47	2	94	118.9		15.7		
9:48	3	102	119.8		14.8		
9:49	4	95	120.8		13.8		
9:50	5		120.7		13.9		
9:51	6	100	120.5		14.1		
9:52	7	99	120.3		14.3		
9:53	8	95	120.2		14.4		
9:54	9	95	120.0		14.6		
9:55	10	98	120.1		14.5		
10:03	18	91	119.5		15.1		
10:07	22	100	118.5		16.1		
10:08	23	105	118.3		16.3		
10:11	26	104	117.6		17.0		
10:15	30	103	117.4		17.2		
10:20	35	105	117.4		17.2		
10:21	40	95	117.0		17.6		
10:30	45	99	117.0		17.6		
10:32	47	101	116.1		18.5		
10:40	55	104	114.4		20.2		
10:45	60	99	114.5		20.1		Increase rate to 150 gpm target
10:46	61	100	106.3		28.3		
10:47	62	107	109.3		25.3		
10:48	63	119	108.3		26.3		
10:49	64	156	108.1		26.5		
10:50	65	143	107.8		26.8		
11:00	75	160	105.4		29.2		
11:05	80	150	105.5		29.1		
11:15	90	144	105.1		29.5		
11:35	110	147	104.9		29.7		
11:40	115	144	104.9		29.7		
11:45	120	148	104.9		29.7		Increase rate to 225 gpm target
11:46	121	174	100.3		34.3		
11:47	122	191	94.1		40.5		
11:48	123	197	88.1		46.5		
11:49	124	215	80.1		54.5		
11:50	125	225	76.4		58.2		
11:55	130	222	72.1		62.5		
12:00	135	222	73.5		61.1		

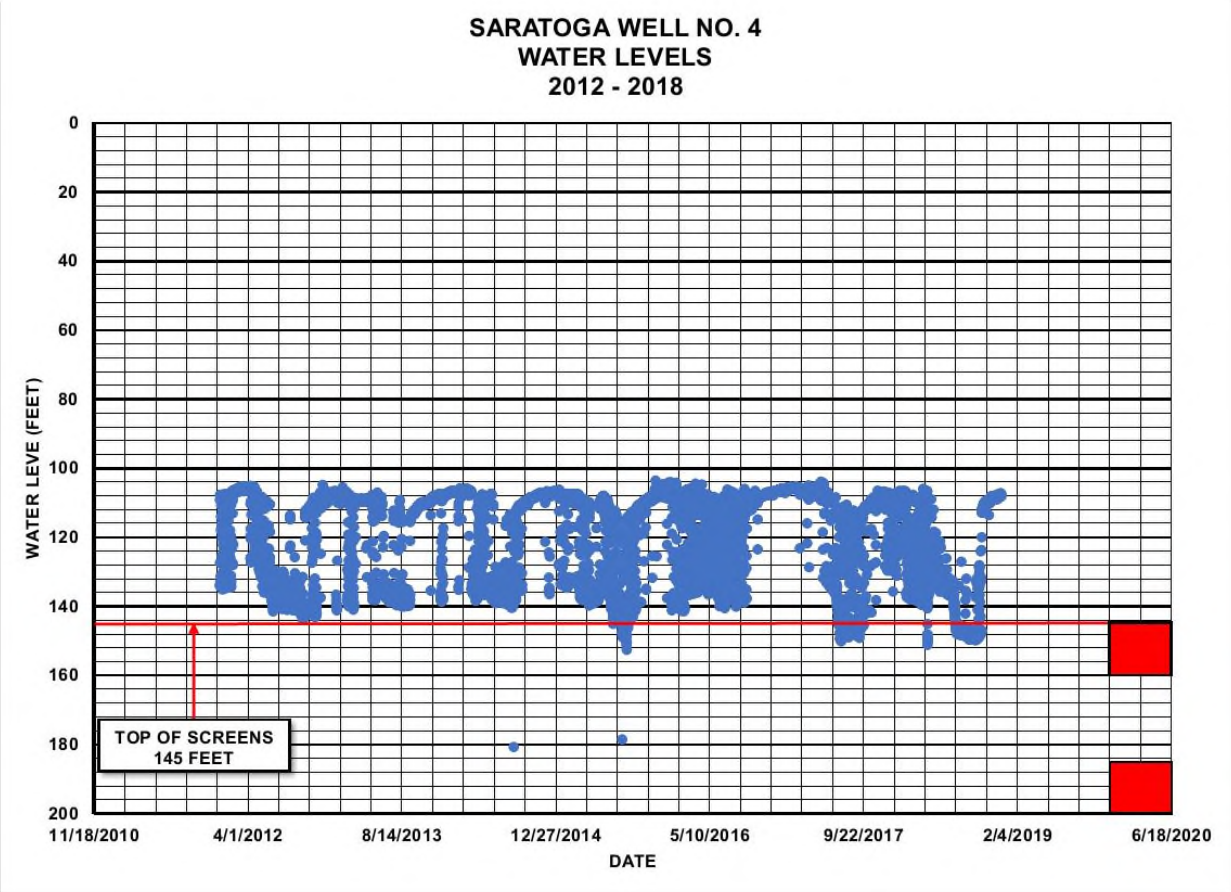
12:10	145	222	73.2	61.4	
12:15	150	222	73.2	61.4	
12:25	160	222	72.1	62.5	
12:27	162	222	70.6	64.0	
12:30	165	222	70.8	63.8	
12:45	180	222	70.1	64.5	End test, record recovery data
12:46	1	0	112.7	21.9	
12:47	2	0	119.4	15.2	
12:48	3	0	122.1	12.5	
12:49	4	0	127.1	7.5	
12:50	5	0	129.1	5.5	
12:51	6	0	130.0	4.6	
12:52	7	0	130.3	4.3	
12:53	8	0	130.6	4.0	
12:54	9	0	131.0	3.6	
12:55	10	0	131.2	3.4	
12:57	12	0	131.5	3.1	
13:00	15	0	132.0	2.6	
13:05	20	0	132.3	2.3	
13:15	30	0	132.7	1.9	
13:20	35	0	132.9	1.7	

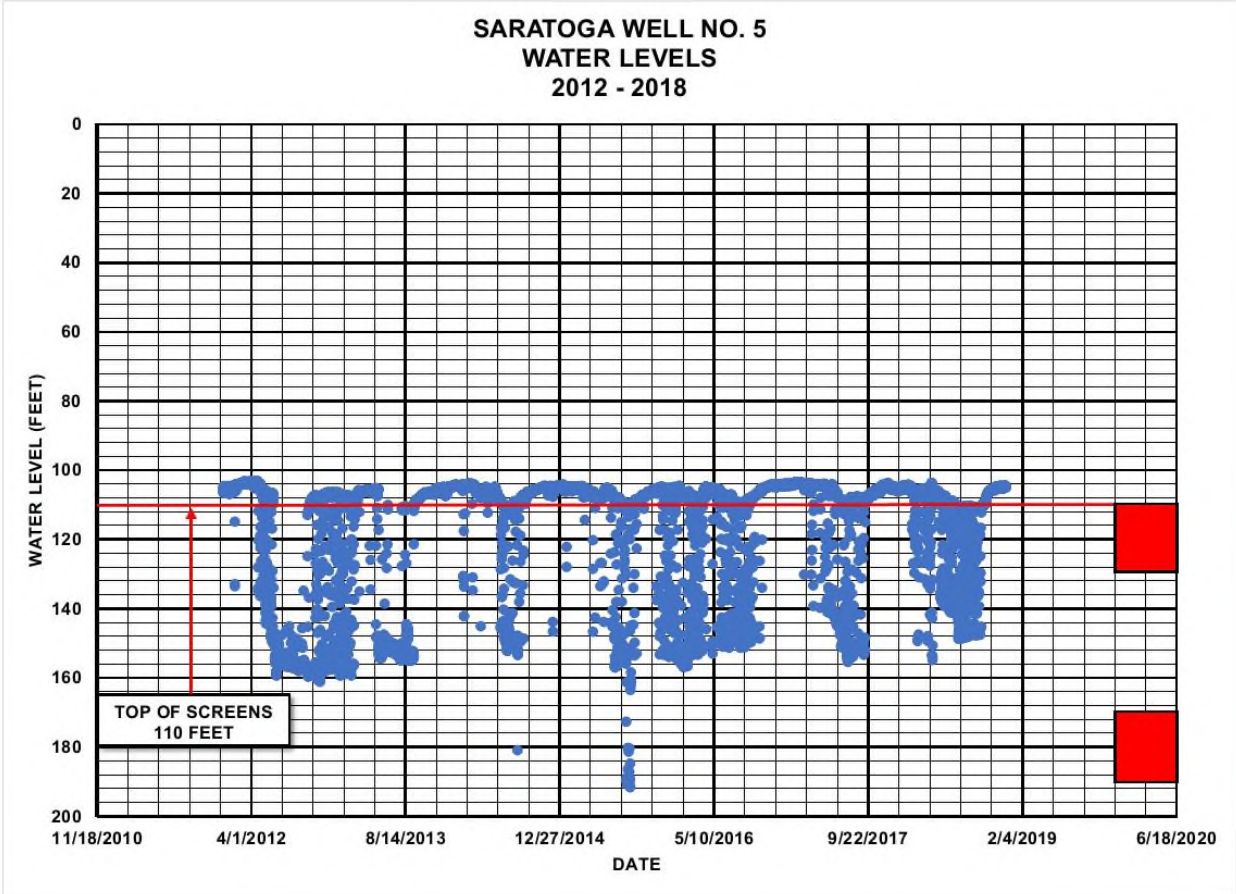
F. Well Level Data 2012-2018




SARATOGA WELL NO. 2
WATER LEVEL
2012 - 2018
WATER LEVEL (FEET)
0
20
40
60
80
100
120
140
160
180
200
TOP OF SCREENS
140 FEET
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
DATE


SARATOGA WELL NO. 3
WATER LEVELS
2012 - 2018
WATER LEVE (FEET)
0
20
40
60
80
100
120
140
160
180
200
TOP OF SCREENS
135 FEET
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
DATE


SARATOGA WELL NO. 4
WATER LEVELS
2012 - 2018
WATER LEVE (FEET)
0
20
40
60
80
100
120
140
160
180
200
TOP OF SCREENS
145 FEET
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
DATE


SARATOGA WELL NO. 5
WATER LEVELS
2012 - 2018
WATER LEVEL (FEET)
0
20
40
60
80
100
120
140
160
180
200
TOP OF SCREENS
110 FEET
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
DATE

G. Fire Flow Report – MDD w/Fire Flow

Scenario: MDD Current w/Fire Flow
Current Time Step: 0.000 h
Fire Flow Node FlexTable: Fire Flow Report

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
J-857	Saratoga PZ	(N/A)	False	1,000	(N/A)	(N/A)	(N/A)	20	(N/A)	20	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	False
J-283	Saratoga PZ	5	False	1,000	735	1,000	735	20	37	20	20	J-288	(N/A)	20	J-288	True
J-284	Saratoga PZ	5	False	1,000	735	1,000	735	20	24	20	20	J-288	(N/A)	20	J-288	True
J-285	Saratoga PZ	3	False	1,000	527	1,000	527	20	20	20	23	J-288	(N/A)	23	J-288	True
J-288	Saratoga PZ	3	False	1,000	735	1,003	738	20	20	20	22	J-285	(N/A)	22	J-285	True
J-290	Saratoga PZ	5	False	1,000	749	1,003	752	20	27	20	20	J-288	(N/A)	20	J-288	True
J-293	Saratoga PZ	5	False	1,000	776	1,003	779	20	22	20	20	J-288	(N/A)	20	J-288	True
J-295	Saratoga PZ	6	False	1,000	789	1,003	792	20	38	20	20	J-288	(N/A)	20	J-288	True
J-299	Saratoga PZ	7	False	1,000	816	1,003	819	20	47	20	20	J-288	(N/A)	20	J-288	True
J-302	Saratoga PZ	7	False	1,000	832	1,003	835	20	60	20	20	J-288	(N/A)	20	J-288	True
J-303	Saratoga PZ	3	False	1,000	189	1,003	192	20	20	20	27	J-288	(N/A)	27	J-288	True
J-304	Saratoga PZ	7	False	1,000	851	1,003	854	20	77	20	20	J-288	(N/A)	20	J-288	True
J-305	Saratoga PZ	7	False	1,000	869	1,003	873	20	57	20	20	J-288	(N/A)	20	J-288	True
J-307	Saratoga PZ	7	False	1,000	878	1,003	881	20	61	20	20	J-288	(N/A)	20	J-288	True
J-308	Saratoga PZ	7	False	1,000	881	1,003	884	20	59	20	20	J-288	(N/A)	20	J-288	True
J-311	Saratoga PZ	14	False	1,000	920	1,003	924	20	77	20	20	J-288	(N/A)	20	J-288	True
J-312	Saratoga PZ	14	False	1,000	921	1,003	924	20	77	20	20	J-288	(N/A)	20	J-288	True
J-316	Saratoga PZ	14	False	1,000	970	1,003	973	20	71	20	20	J-288	(N/A)	20	J-288	True
J-410	Saratoga PZ	5	False	1,000	599	1,003	602	20	60	20	20	J-412	(N/A)	20	J-412	True
J-411	Saratoga PZ	3	False	1,000	521	1,003	524	20	20	20	20	J-412	(N/A)	20	J-412	True
J-412	Saratoga PZ	3	False	1,000	518	1,003	521	20	20	20	20	J-411	(N/A)	20	J-411	True
J-420	Saratoga PZ	17	False	1,000	217	1,003	220	20	21	20	21	J-422	(N/A)	21	J-422	True
J-421	Saratoga PZ	3	False	1,000	188	1,003	191	20	20	20	27	J-288	(N/A)	27	J-288	True
J-422	Saratoga PZ	3	False	1,000	150	1,003	153	20	20	20	27	J-288	(N/A)	27	J-288	True
J-458	Saratoga PZ	3	False	1,000	922	1,003	925	20	20	20	23	J-288	(N/A)	23	J-288	True
J-462	Saratoga PZ	3	False	1,000	709	1,003	712	20	20	20	25	J-288	(N/A)	25	J-288	True
J-576	Saratoga PZ	3	False	1,000	254	1,003	257	20	20	20	27	J-288	(N/A)	27	J-288	True
J-621	Saratoga PZ	3	False	1,000	822	1,003	826	20	20	20	25	J-288	(N/A)	25	J-288	True
J-623	Saratoga PZ	3	False	1,000	834	1,003	837	20	20	20	25	J-288	(N/A)	25	J-288	True
J-624	Saratoga PZ	3	False	1,000	942	1,003	945	20	20	20	24	J-288	(N/A)	24	J-288	True
J-645	Saratoga PZ	3	False	1,000	761	1,003	764	20	20	20	26	J-288	(N/A)	26	J-288	True
J-646	Saratoga PZ	3	False	1,000	529	1,003	532	20	20	20	27	J-288	(N/A)	27	J-288	True
J-655	Saratoga PZ	18	False	1,000	986	1,003	989	20	20	20	22	J-654	(N/A)	22	J-654	True
J-664	Saratoga PZ	5	False	1,000	727	1,000	727	20	20	20	20	J-285	(N/A)	20	J-285	True
J-665	Saratoga PZ	5	False	1,000	735	1,000	735	20	34	20	20	J-288	(N/A)	20	J-288	True
J-759	Saratoga PZ	5	False	1,000	823	1,003	826	20	65	20	20	J-412	(N/A)	20	J-412	True
J-856	Saratoga PZ	3	False	1,000	982	1,000	982	20	20	20	20	J-856	(N/A)	16	J-288	True
J-318	Saratoga PZ	13	True	1,000	1,055	1,003	1,058	20	92	20	20	J-288	(N/A)	20	J-288	True
J-319	Saratoga PZ	13	True	1,000	1,084	1,003	1,087	20	94	20	20	J-288	(N/A)	20	J-288	True
J-321	Saratoga PZ	13	True	1,000	1,104	1,003	1,107	20	101	20	20	J-288	(N/A)	20	J-288	True
J-322	Saratoga PZ	13	True	1,000	1,153	1,003	1,156	20	107	20	20	J-288	(N/A)	20	J-288	True
J-323	Saratoga PZ	6	True	1,000	1,174	1,003	1,177	20	107	20	20	J-288	(N/A)	20	J-288	True
J-324	Saratoga PZ	6	True	1,000	1,191	1,003	1,194	20	108	20	20	J-288	(N/A)	20	J-288	True
J-326	Saratoga PZ	7	True	1,000	1,195	1,003	1,198	20	102	20	20	J-288	(N/A)	20	J-288	True
J-327	Saratoga PZ	7	True	1,000	1,195	1,003	1,198	20	104	20	20	J-288	(N/A)	20	J-288	True
J-328	Saratoga PZ	6	True	1,000	1,195	1,003	1,199	20	106	20	20	J-288	(N/A)	20	J-288	True
J-330	Saratoga PZ	6	True	1,000	1,194	1,003	1,197	20	105	20	20	J-288	(N/A)	20	J-288	True
J-331	Saratoga PZ	6	True	1,000	1,196	1,003	1,199	20	108	20	20	J-288	(N/A)	20	J-288	True
J-332	Saratoga PZ	6	True	1,000	1,198	1,003	1,201	20	110	20	20	J-288	(N/A)	20	J-288	True
J-333	Saratoga PZ	6	True	1,000	1,196	1,003	1,199	20	107	20	20	J-288	(N/A)	20	J-288	True
J-336	Saratoga PZ	7	True	1,000	1,196	1,003	1,199	20	102	20	20	J-288	(N/A)	20	J-288	True
J-337	Saratoga PZ	15	True	1,000	1,196	1,003	1,199	20	92	20	20	J-288	(N/A)	20	J-288	True
J-338	Saratoga PZ	6	True	1,000	1,197	1,003	1,200	20	106	20	20	J-288	(N/A)	20	J-288	True
J-339	Saratoga PZ	6	True	1,000	1,202	1,003	1,206	20	108	20	20	J-288	(N/A)	20	J-288	True
J-340	Saratoga PZ	6	True	1,000	1,199	1,003	1,202	20	105	20	20	J-288	(N/A)	20	J-288	True
J-341	Saratoga PZ	15	True	1,000	1,199	1,003	1,202	20	90	20	20	J-288	(N/A)	20	J-288	True
J-342	Saratoga PZ	6	True	1,000	1,200	1,003	1,203	20	107	20	20	J-288	(N/A)	20	J-288	True
J-344	Saratoga PZ	6	True	1,000	1,197	1,003	1,200	20	108	20	20	J-288	(N/A)	20	J-288	True
J-345	Saratoga PZ	6	True	1,000	1,203	1,003	1,206	20	107	20	20	J-288	(N/A)	20	J-288	True
J-346	Saratoga PZ	15	True	1,000	1,203	1,003	1,206	20	96	20	20	J-288	(N/A)	20	J-288	True
J-349	Saratoga PZ	6	True	1,000	1,209	1,003	1,212	20	106	20	20	J-288	(N/A)	20	J-288	True
J-350	Saratoga PZ	6	True	1,000	1,208	1,003	1,211	20	105	20	20	J-288	(N/A)	20	J-288	True
J-351	Saratoga PZ	6	True	1,000	1,204	1,003	1,208	20	106	20	20	J-288	(N/A)	20	J-288	True
J-354	Saratoga PZ	13	True	1,000	1,093	1,003	1,096	20	97	20	20	J-288	(N/A)	20	J-288	True
J-355	Saratoga PZ	14	True	1,000	1,084	1,003	1,087	20	94	20	20	J-288	(N/A)	20	J-288	True
J-356	Saratoga PZ	15	True	1,000	1,084	1,003	1,087	20	89	20	20	J-288	(N/A)	20	J-288	True

J-360	Saratoga PZ	15	True	1,000	1,073	1,003	1,076	20	87	20	20	J-288	(N/A)	20	J-288	True
J-361	Saratoga PZ	15	True	1,000	1,071	1,003	1,074	20	86	20	20	J-288	(N/A)	20	J-288	True
J-365	Saratoga PZ	13	True	1,000	1,057	1,003	1,060	20	92	20	20	J-288	(N/A)	20	J-288	True
J-370	Saratoga PZ	14	True	1,000	1,071	1,003	1,074	20	76	20	20	J-288	(N/A)	20	J-288	True
J-371	Saratoga PZ	14	True	1,000	1,072	1,003	1,076	20	79	20	20	J-288	(N/A)	20	J-288	True
J-372	Saratoga PZ	6	True	1,000	1,274	1,003	1,277	20	43	20	20	J-288	(N/A)	20	J-288	True
J-375	Saratoga PZ	7	True	1,000	1,274	1,003	1,277	20	69	20	20	J-288	(N/A)	20	J-288	True
J-377	Saratoga PZ	16	True	1,000	1,273	1,003	1,276	20	88	20	20	J-288	(N/A)	20	J-288	True
J-378	Saratoga PZ	8	True	1,000	1,258	1,003	1,262	20	93	20	20	J-288	(N/A)	20	J-288	True
J-380	Saratoga PZ	7	True	1,000	1,244	1,003	1,247	20	97	20	20	J-288	(N/A)	20	J-288	True
J-381	Saratoga PZ	15	True	1,000	1,244	1,003	1,247	20	89	20	20	J-288	(N/A)	20	J-288	True
J-385	Saratoga PZ	6	True	1,000	1,235	1,003	1,238	20	101	20	20	J-288	(N/A)	20	J-288	True
J-391	Saratoga PZ	6	True	1,000	1,258	1,003	1,262	20	45	20	20	J-288	(N/A)	20	J-288	True
J-392	Saratoga PZ	9	True	1,000	1,297	1,003	1,300	20	80	20	20	J-288	(N/A)	20	J-288	True
J-395	Saratoga PZ	9	True	1,000	1,333	1,003	1,336	20	72	20	20	J-288	(N/A)	20	J-288	True
J-396	Saratoga PZ	6	True	1,000	1,203	1,003	1,206	20	64	20	20	J-412	(N/A)	20	J-412	True
J-399	Saratoga PZ	5	True	1,000	1,151	1,003	1,154	20	62	20	20	J-412	(N/A)	20	J-412	True
J-400	Saratoga PZ	5	True	1,000	1,151	1,003	1,154	20	53	20	20	J-412	(N/A)	20	J-412	True
J-401	Saratoga PZ	5	True	1,000	1,128	1,003	1,131	20	65	20	20	J-412	(N/A)	20	J-412	True
J-402	Saratoga PZ	5	True	1,000	1,112	1,003	1,115	20	64	20	20	J-412	(N/A)	20	J-412	True
J-413	Saratoga PZ	6	True	1,000	1,139	1,003	1,143	20	64	20	20	J-412	(N/A)	20	J-412	True
J-415	Saratoga PZ	9	True	1,000	1,351	1,003	1,354	20	74	20	20	J-288	(N/A)	20	J-288	True
J-427	Saratoga PZ	9	True	1,000	1,385	1,003	1,388	20	79	20	20	J-288	(N/A)	20	J-288	True
J-431	Saratoga PZ	7	True	1,000	1,454	1,003	1,457	20	88	20	20	J-288	(N/A)	20	J-288	True
J-432	Saratoga PZ	7	True	1,000	1,462	1,003	1,465	20	87	20	20	J-288	(N/A)	20	J-288	True
J-433	Saratoga PZ	8	True	1,000	1,472	1,003	1,475	20	77	20	20	J-288	(N/A)	20	J-288	True
J-434	Saratoga PZ	8	True	1,000	1,471	1,003	1,474	20	77	20	20	J-288	(N/A)	20	J-288	True
J-436	Saratoga PZ	6	True	1,000	1,495	1,003	1,498	20	33	20	20	J-288	(N/A)	20	J-288	True
J-438	Saratoga PZ	15	True	1,000	1,527	1,003	1,530	20	76	20	20	J-288	(N/A)	20	J-288	True
J-440	Saratoga PZ	3	True	1,000	1,384	1,003	1,387	20	20	20	21	J-288	(N/A)	21	J-288	True
J-443	Saratoga PZ	7	True	1,000	1,573	1,003	1,576	20	55	20	20	J-288	(N/A)	20	J-288	True
J-444	Saratoga PZ	14	True	1,000	1,575	1,003	1,578	20	67	20	20	J-288	(N/A)	20	J-288	True
J-445	Saratoga PZ	7	True	1,000	1,576	1,003	1,579	20	61	20	20	J-288	(N/A)	20	J-288	True
J-446	Saratoga PZ	6	True	1,000	1,576	1,003	1,579	20	47	20	20	J-288	(N/A)	20	J-288	True
J-447	Saratoga PZ	14	True	1,000	1,576	1,003	1,579	20	63	20	20	J-288	(N/A)	20	J-288	True
J-448	Saratoga PZ	15	True	1,000	1,578	1,003	1,581	20	68	20	20	J-288	(N/A)	20	J-288	True
J-449	Saratoga PZ	8	True	1,000	1,526	1,003	1,529	20	77	20	20	J-288	(N/A)	20	J-288	True
J-450	Saratoga PZ	15	True	1,000	1,511	1,003	1,514	20	73	20	20	J-288	(N/A)	20	J-288	True
J-452	Saratoga PZ	7	True	1,000	1,511	1,003	1,514	20	76	20	20	J-288	(N/A)	20	J-288	True
J-453	Saratoga PZ	8	True	1,000	1,491	1,003	1,495	20	74	20	20	J-288	(N/A)	20	J-288	True
J-460	Saratoga PZ	14	True	1,000	1,360	1,003	1,363	20	73	20	20	J-288	(N/A)	20	J-288	True
J-463	Saratoga PZ	6	True	1,000	1,286	1,003	1,289	20	107	20	20	J-288	(N/A)	20	J-288	True
J-466	Saratoga PZ	6	True	1,000	1,226	1,003	1,229	20	108	20	20	J-288	(N/A)	20	J-288	True
J-468	Saratoga PZ	6	True	1,000	1,211	1,003	1,214	20	106	20	20	J-288	(N/A)	20	J-288	True
J-469	Saratoga PZ	6	True	1,000	1,286	1,003	1,289	20	107	20	20	J-288	(N/A)	20	J-288	True
J-470	Saratoga PZ	6	True	1,000	1,282	1,003	1,285	20	107	20	20	J-288	(N/A)	20	J-288	True
J-471	Saratoga PZ	6	True	1,000	1,278	1,003	1,281	20	107	20	20	J-288	(N/A)	20	J-288	True
J-472	Saratoga PZ	15	True	1,000	1,262	1,003	1,265	20	88	20	20	J-288	(N/A)	20	J-288	True
J-473	Saratoga PZ	6	True	1,000	1,251	1,003	1,254	20	106	20	20	J-288	(N/A)	20	J-288	True
J-474	Saratoga PZ	6	True	1,000	1,275	1,003	1,278	20	107	20	20	J-288	(N/A)	20	J-288	True
J-475	Saratoga PZ	6	True	1,000	1,276	1,003	1,279	20	106	20	20	J-288	(N/A)	20	J-288	True
J-477	Saratoga PZ	6	True	1,000	1,282	1,003	1,285	20	107	20	20	J-288	(N/A)	20	J-288	True
J-478	Saratoga PZ	6	True	1,000	1,276	1,003	1,279	20	105	20	20	J-288	(N/A)	20	J-288	True
J-479	Saratoga PZ	7	True	1,000	1,244	1,003	1,248	20	102	20	20	J-288	(N/A)	20	J-288	True
J-480	Saratoga PZ	6	True	1,000	1,221	1,003	1,224	20	108	20	20	J-288	(N/A)	20	J-288	True
J-481	Saratoga PZ	6	True	1,000	1,224	1,003	1,227	20	107	20	20	J-288	(N/A)	20	J-288	True
J-482	Saratoga PZ	15	True	1,000	1,234	1,003	1,237	20	96	20	20	J-288	(N/A)	20	J-288	True
J-483	Saratoga PZ	15	True	1,000	1,235	1,003	1,238	20	96	20	20	J-288	(N/A)	20	J-288	True
J-484	Saratoga PZ	7	True	1,000	1,234	1,003	1,238	20	104	20	20	J-288	(N/A)	20	J-288	True
J-485	Saratoga PZ	6	True	1,000	1,214	1,003	1,217	20	109	20	20	J-288	(N/A)	20	J-288	True
J-486	Saratoga PZ	6	True	1,000	1,221	1,003	1,224	20	73	20	20	J-288	(N/A)	20	J-288	True
J-487	Saratoga PZ	6	True	1,000	1,208	1,003	1,211	20	109	20	20	J-288	(N/A)	20	J-288	True
J-488	Saratoga PZ	6	True	1,000	1,205	1,003	1,209	20	108	20	20	J-288	(N/A)	20	J-288	True
J-489	Saratoga PZ	6	True	1,000	1,214	1,003	1,217	20	108	20	20	J-288	(N/A)	20	J-288	True
J-490	Saratoga PZ	15	True	1,000	1,214	1,003	1,217	20	95	20	20	J-288	(N/A)	20	J-288	True
J-491	Saratoga PZ	6	True	1,000	1,214	1,003	1,217	20	109	20	20	J-288	(N/A)	20	J-288	True
J-492	Saratoga PZ	7	True	1,000	1,214	1,003	1,217	20	104	20	20	J-288	(N/A)	20	J-288	True
J-493	Saratoga PZ	7	True	1,000	1,214	1,003	1,217	20	102	20	20	J-288	(N/A)	20	J-288	True
J-494	Saratoga PZ	15	True	1,000	1,214	1,003	1,217	20	95	20	20	J-288	(N/A)	20	J-288	True
J-495	Saratoga PZ	15	True	1,000	1,258	1,003	1,261	20	97	20	20	J-288	(N/A)	20	J-288	True
J-496	Saratoga PZ	7	True	1,000	1,275	1,003	1,278	20	97	20	20	J-288	(N/A)	20	J-288	True
J-497	Saratoga PZ	8	True	1,000	1,276	1,003	1,279	20	93	20	20	J-288	(N/A)	20	J-288	True
J-498	Saratoga PZ	15	True	1,000	1,276	1,003	1,279	20	85	20	20	J-288	(N/A)	20	J-288	True
J-499	Saratoga PZ	8	True	1,000	1,277	1,003	1,280	20	93	20	20	J-288	(N/A)	20	J-288	True
J-500	Saratoga PZ	14	True	1,000	1,276	1,003	1,279	20	82	20	20	J-288	(N/A)	20	J-288	True
J-501	Saratoga PZ	14	True	1,000	1,276	1,003	1,279	20	80	20	20	J-288	(N/A)	20	J-288	True
J-502	Saratoga PZ	8	True	1,000	1,277	1,003	1,280	20	93	20	20	J-288	(N/A)	20	J-288	True
J-504	Saratoga PZ	8	True	1,000	1,277	1,003	1,280	20	82	20	20	J-288	(N/A)	20	J-288	True
J-505																

	Saratoga PZ	14	True	1,000	1,277	1,003	1,280	20	74	20	20	J-288	(N/A)	20	J-288	True
J-508	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	75	20	20	J-288	(N/A)	20	J-288	True
J-509	Saratoga PZ	8	True	1,000	1,276	1,003	1,280	20	92	20	20	J-288	(N/A)	20	J-288	True
J-510	Saratoga PZ	14	True	1,000	1,276	1,003	1,279	20	73	20	20	J-288	(N/A)	20	J-288	True
J-511	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	74	20	20	J-288	(N/A)	20	J-288	True
J-512	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	70	20	20	J-288	(N/A)	20	J-288	True
J-513	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	70	20	20	J-288	(N/A)	20	J-288	True
J-514	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	69	20	20	J-288	(N/A)	20	J-288	True
J-515	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	69	20	20	J-288	(N/A)	20	J-288	True
J-516	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	68	20	20	J-288	(N/A)	20	J-288	True
J-517	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	69	20	20	J-288	(N/A)	20	J-288	True
J-518	Saratoga PZ	14	True	1,000	1,277	1,003	1,280	20	59	20	20	J-288	(N/A)	20	J-288	True
J-519	Saratoga PZ	14	True	1,000	1,277	1,003	1,280	20	64	20	20	J-288	(N/A)	20	J-288	True
J-520	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	65	20	20	J-288	(N/A)	20	J-288	True
J-521	Saratoga PZ	3	True	1,000	1,176	1,003	1,179	20	20	20	21	J-288	(N/A)	21	J-288	True
J-522	Saratoga PZ	3	True	1,000	1,168	1,003	1,171	20	20	20	21	J-288	(N/A)	21	J-288	True
J-523	Saratoga PZ	15	True	1,000	1,277	1,003	1,280	20	72	20	20	J-288	(N/A)	20	J-288	True
J-524	Saratoga PZ	8	True	1,000	1,278	1,003	1,281	20	92	20	20	J-288	(N/A)	20	J-288	True
J-526	Saratoga PZ	8	True	1,000	1,278	1,003	1,282	20	94	20	20	J-288	(N/A)	20	J-288	True
J-527	Saratoga PZ	7	True	1,000	1,279	1,003	1,282	20	92	20	20	J-288	(N/A)	20	J-288	True
J-528	Saratoga PZ	7	True	1,000	1,279	1,003	1,282	20	92	20	20	J-288	(N/A)	20	J-288	True
J-529	Saratoga PZ	15	True	1,000	1,278	1,003	1,281	20	69	20	20	J-288	(N/A)	20	J-288	True
J-530	Saratoga PZ	7	True	1,000	1,278	1,003	1,281	20	48	20	20	J-288	(N/A)	20	J-288	True
J-531	Saratoga PZ	15	True	1,000	1,278	1,003	1,281	20	67	20	20	J-288	(N/A)	20	J-288	True
J-534	Saratoga PZ	6	True	1,000	1,278	1,003	1,281	20	38	20	20	J-288	(N/A)	20	J-288	True
J-536	Saratoga PZ	15	True	1,000	1,278	1,003	1,281	20	67	20	20	J-288	(N/A)	20	J-288	True
J-537	Saratoga PZ	15	True	1,000	1,280	1,003	1,284	20	74	20	20	J-288	(N/A)	20	J-288	True
J-538	Saratoga PZ	7	True	1,000	1,280	1,003	1,283	20	91	20	20	J-288	(N/A)	20	J-288	True
J-539	Saratoga PZ	7	True	1,000	1,280	1,003	1,283	20	90	20	20	J-288	(N/A)	20	J-288	True
J-540	Saratoga PZ	7	True	1,000	1,282	1,003	1,285	20	89	20	20	J-288	(N/A)	20	J-288	True
J-541	Saratoga PZ	7	True	1,000	1,282	1,003	1,285	20	93	20	20	J-288	(N/A)	20	J-288	True
J-542	Saratoga PZ	7	True	1,000	1,280	1,003	1,283	20	93	20	20	J-288	(N/A)	20	J-288	True
J-544	Saratoga PZ	6	True	1,000	1,283	1,003	1,287	20	107	20	20	J-288	(N/A)	20	J-288	True
J-546	Saratoga PZ	6	True	1,000	1,286	1,003	1,289	20	107	20	20	J-288	(N/A)	20	J-288	True
J-547	Saratoga PZ	6	True	1,000	1,289	1,003	1,292	20	107	20	20	J-288	(N/A)	20	J-288	True
J-550	Saratoga PZ	6	True	1,000	1,288	1,003	1,291	20	98	20	20	J-288	(N/A)	20	J-288	True
J-552	Saratoga PZ	7	True	1,000	1,285	1,003	1,288	20	89	20	20	J-288	(N/A)	20	J-288	True
J-553	Saratoga PZ	14	True	1,000	1,282	1,003	1,285	20	81	20	20	J-288	(N/A)	20	J-288	True
J-554	Saratoga PZ	7	True	1,000	1,284	1,003	1,287	20	82	20	20	J-288	(N/A)	20	J-288	True
J-555	Saratoga PZ	8	True	1,000	1,282	1,003	1,285	20	74	20	20	J-288	(N/A)	20	J-288	True
J-556	Saratoga PZ	8	True	1,000	1,283	1,003	1,286	20	77	20	20	J-288	(N/A)	20	J-288	True
J-557	Saratoga PZ	7	True	1,000	1,284	1,003	1,287	20	52	20	20	J-288	(N/A)	20	J-288	True
J-558	Saratoga PZ	5	True	1,000	1,283	1,003	1,286	20	33	20	20	J-288	(N/A)	20	J-288	True
J-559	Saratoga PZ	15	True	1,000	1,283	1,003	1,286	20	65	20	20	J-288	(N/A)	20	J-288	True
J-560	Saratoga PZ	15	True	1,000	1,283	1,003	1,286	20	60	20	20	J-288	(N/A)	20	J-288	True
J-561	Saratoga PZ	14	True	1,000	1,283	1,003	1,286	20	57	20	20	J-288	(N/A)	20	J-288	True
J-562	Saratoga PZ	14	True	1,000	1,283	1,003	1,286	20	56	20	20	J-288	(N/A)	20	J-288	True
J-563	Saratoga PZ	13	True	1,000	1,283	1,003	1,286	20	48	20	20	J-288	(N/A)	20	J-288	True
J-564	Saratoga PZ	14	True	1,000	1,283	1,003	1,286	20	52	20	20	J-288	(N/A)	20	J-288	True
J-565	Saratoga PZ	13	True	1,000	1,282	1,003	1,286	20	47	20	20	J-288	(N/A)	20	J-288	True
J-566	Saratoga PZ	6	True	1,000	1,327	1,003	1,330	20	102	20	20	J-288	(N/A)	20	J-288	True
J-567	Saratoga PZ	6	True	1,000	1,361	1,003	1,364	20	99	20	20	J-288	(N/A)	20	J-288	True
J-568	Saratoga PZ	7	True	1,000	1,408	1,003	1,411	20	94	20	20	J-288	(N/A)	20	J-288	True
J-569	Saratoga PZ	14	True	1,000	1,408	1,003	1,411	20	70	20	20	J-288	(N/A)	20	J-288	True
J-571	Saratoga PZ	7	True	1,000	1,359	1,003	1,362	20	99	20	20	J-288	(N/A)	20	J-288	True
J-572	Saratoga PZ	6	True	1,000	1,317	1,003	1,320	20	104	20	20	J-288	(N/A)	20	J-288	True
J-573	Saratoga PZ	6	True	1,000	1,291	1,003	1,294	20	106	20	20	J-288	(N/A)	20	J-288	True
J-574	Saratoga PZ	8	True	1,000	1,300	1,003	1,303	20	89	20	20	J-288	(N/A)	20	J-288	True
J-575	Saratoga PZ	15	True	1,000	1,299	1,003	1,302	20	83	20	20	J-288	(N/A)	20	J-288	True
J-577	Saratoga PZ	15	True	1,000	1,298	1,003	1,301	20	79	20	20	J-288	(N/A)	20	J-288	True
J-578	Saratoga PZ	15	True	1,000	1,298	1,003	1,301	20	72	20	20	J-288	(N/A)	20	J-288	True
J-579	Saratoga PZ	8	True	1,000	1,296	1,003	1,300	20	88	20	20	J-288	(N/A)	20	J-288	True
J-582	Saratoga PZ	7	True	1,000	1,298	1,003	1,301	20	52	20	20	J-288	(N/A)	20	J-288	True
J-583	Saratoga PZ	15	True	1,000	1,606	1,003	1,609	20	61	20	20	J-288	(N/A)	20	J-288	True
J-584	Saratoga PZ	15	True	1,000	1,557	1,003	1,560	20	61	20	20	J-288	(N/A)	20	J-288	True
J-589	Saratoga PZ	6	True	1,000	1,557	1,003	1,560	20	31	20	20	J-288	(N/A)	20	J-288	True
J-590	Saratoga PZ	7	True	1,000	1,513	1,003	1,516	20	75	20	20	J-288	(N/A)	20	J-288	True
J-593	Saratoga PZ	8	True	1,000	1,490	1,003	1,494	20	73	20	20	J-288	(N/A)	20	J-288	True
J-594	Saratoga PZ	7	True	1,000	1,490	1,003	1,494	20	49	20	20	J-288	(N/A)	20	J-288	True
J-595	Saratoga PZ	7	True	1,000	1,453	1,003	1,456	20	86	20	20	J-288	(N/A)	20	J-288	True
J-596	Saratoga PZ	14	True	1,000	1,452	1,003	1,455	20	65	20	20	J-288	(N/A)	20	J-288	True
J-597	Saratoga PZ	7	True	1,000	1,524	1,003	1,527	20	75	20	20	J-288	(N/A)	20	J-288	True
J-598	Saratoga PZ	7	True	1,000	1,531	1,003	1,534	20	75	20	20	J-288	(N/A)	20	J-288	True
J-600	Saratoga PZ	8	True	1,000	1,533	1,003	1,536	20	69	20	20	J-288	(N/A)	20	J-288	True
J-601	Saratoga PZ	7	True	1,000	1,533	1,003	1,536	20	43	20	20	J-288	(N/A)	20	J-288	True
J-602	Saratoga PZ	8	True	1,000	1,554	1,003	1,557	20	71	20	20	J-288	(N/A)	20	J-288	True
J-604	Saratoga PZ	15	True	1,000	1,554	1,003	1,557	20	64	20	20	J-288	(N/A)	20	J-288	True
J-605	Saratoga PZ	7	True	1,000	1,554	1,003	1,557	20	41	20	20	J-288	(N/A)	20	J-288	True
J-606																

	Saratoga PZ	15	True	1,000	1,572	1,003	1,575	20	62	20	20	J-288	(N/A)	20	J-288	True
J-608	Saratoga PZ	8	True	1,000	1,571	1,003	1,574	20	68	20	20	J-288	(N/A)	20	J-288	True
J-609	Saratoga PZ	7	True	1,000	1,592	1,003	1,595	20	69	20	20	J-288	(N/A)	20	J-288	True
J-610	Saratoga PZ	7	True	1,000	1,613	1,003	1,616	20	71	20	20	J-288	(N/A)	20	J-288	True
J-612	Saratoga PZ	14	True	1,000	1,588	1,003	1,591	20	57	20	20	J-288	(N/A)	20	J-288	True
J-614	Saratoga PZ	13	True	1,000	1,752	1,003	1,755	20	74	20	20	J-288	(N/A)	20	J-288	True
J-615	Saratoga PZ	12	True	1,000	1,782	1,003	1,785	20	72	20	20	J-288	(N/A)	20	J-288	True
J-616	Saratoga PZ	9	True	1,000	1,588	1,003	1,591	20	41	20	20	J-288	(N/A)	20	J-288	True
J-617	Saratoga PZ	3	True	1,000	1,361	1,003	1,364	20	20	20	22	J-288	(N/A)	22	J-288	True
J-618	Saratoga PZ	5	True	1,000	1,533	1,003	1,536	20	26	20	20	J-622	(N/A)	20	J-622	True
J-619	Saratoga PZ	8	True	1,000	1,588	1,003	1,591	20	31	20	20	J-288	(N/A)	20	J-288	True
J-620	Saratoga PZ	5	True	1,000	1,247	1,003	1,250	20	25	20	20	J-622	(N/A)	20	J-622	True
J-622	Saratoga PZ	3	True	1,000	1,092	1,003	1,095	20	20	20	23	J-623	(N/A)	23	J-623	True
J-625	Saratoga PZ	12	True	1,000	1,821	1,003	1,824	20	71	20	20	J-288	(N/A)	20	J-288	True
J-626	Saratoga PZ	5	True	1,000	2,014	1,003	2,017	20	69	20	20	J-288	(N/A)	20	J-288	True
J-627	Saratoga PZ	5	True	1,000	2,082	1,003	2,085	20	66	20	20	J-288	(N/A)	20	J-288	True
J-628	Saratoga PZ	5	True	1,000	2,196	1,003	2,199	20	66	20	20	J-288	(N/A)	20	J-288	True
J-629	Saratoga PZ	5	True	1,000	2,361	1,003	2,364	20	63	20	20	J-288	(N/A)	20	J-288	True
J-630	Saratoga PZ	5	True	1,000	3,054	1,003	3,057	20	52	20	20	J-288	(N/A)	20	J-288	True
J-631	Saratoga PZ	2	True	1,000	3,500	1,003	3,503	20	38	20	21	J-288	(N/A)	21	J-288	True
J-632	Saratoga PZ	4	True	1,000	1,901	1,003	1,904	20	20	20	21	J-645	(N/A)	21	J-645	True
J-634	Saratoga PZ	3	True	1,000	2,059	1,003	2,062	20	20	20	20	J-288	(N/A)	20	J-288	True
J-635	Saratoga PZ	5	True	1,000	2,191	1,003	2,194	20	52	20	20	J-288	(N/A)	20	J-288	True
J-636	Saratoga PZ	7	True	1,000	2,238	1,003	2,241	20	30	20	20	J-288	(N/A)	20	J-288	True
J-647	Saratoga PZ	2	True	1,000	3,500	1,003	3,503	20	38	20	24	J-288	(N/A)	24	J-288	True
J-648	Saratoga PZ	2	True	1,000	3,500	1,003	3,503	20	36	20	27	J-288	(N/A)	27	J-288	True
J-649	Saratoga PZ	3	True	1,000	2,618	1,003	2,622	20	20	20	20	J-652	(N/A)	20	J-652	True
J-650	Saratoga PZ	5	True	1,000	1,631	1,003	1,634	20	22	20	20	J-653	(N/A)	20	J-653	True
J-651	Saratoga PZ	3	True	1,000	1,526	1,003	1,529	20	20	20	22	J-653	(N/A)	22	J-653	True
J-652	Saratoga PZ	3	True	1,000	1,576	1,003	1,580	20	20	20	28	J-288	(N/A)	28	J-288	True
J-653	Saratoga PZ	3	True	1,000	1,138	1,003	1,141	20	20	20	21	J-654	(N/A)	21	J-654	True
J-654	Saratoga PZ	2	True	1,000	1,028	1,003	1,031	20	20	20	21	J-655	(N/A)	21	J-655	True
J-657	Saratoga PZ	8	True	1,000	1,473	1,003	1,476	20	74	20	20	J-288	(N/A)	20	J-288	True
J-658	Saratoga PZ	13	True	1,000	1,635	1,003	1,639	20	74	20	20	J-288	(N/A)	20	J-288	True
J-659	Saratoga PZ	13	True	1,000	1,522	1,003	1,525	20	83	20	20	J-288	(N/A)	20	J-288	True
J-660	Saratoga PZ	13	True	1,000	1,428	1,003	1,431	20	85	20	20	J-288	(N/A)	20	J-288	True
J-661	Saratoga PZ	6	True	1,000	1,344	1,003	1,347	20	106	20	20	J-288	(N/A)	20	J-288	True
J-662	Saratoga PZ	2	True	1,000	3,500	1,000	3,500	20	43	20	27	J-288	(N/A)	27	J-288	True
J-663	Saratoga PZ	2	True	1,000	3,500	1,003	3,503	20	42	20	27	J-288	(N/A)	27	J-288	True
J-782	Saratoga PZ	14	True	1,000	1,276	1,003	1,279	20	80	20	20	J-288	(N/A)	20	J-288	True
J-783	Saratoga PZ	14	True	1,000	1,277	1,003	1,280	20	67	20	20	J-288	(N/A)	20	J-288	True
J-784	Saratoga PZ	14	True	1,000	1,278	1,003	1,281	20	66	20	20	J-288	(N/A)	20	J-288	True
J-832	Saratoga PZ	6	True	1,000	2,195	1,003	2,198	20	51	20	20	J-288	(N/A)	20	J-288	True
J-841	Saratoga PZ	7	True	1,000	2,316	1,003	2,319	20	35	20	20	J-288	(N/A)	20	J-288	True
J-842	Saratoga PZ	6	True	1,000	2,277	1,003	2,280	20	23	20	20	J-288	(N/A)	20	J-288	True
J-844	Saratoga PZ	7	True	1,000	1,245	1,003	1,248	20	97	20	20	J-288	(N/A)	20	J-288	True
J-845	Saratoga PZ	15	True	1,000	1,276	1,003	1,280	20	84	20	20	J-288	(N/A)	20	J-288	True
J-846	Saratoga PZ	13	True	1,000	1,113	1,003	1,116	20	102	20	20	J-288	(N/A)	20	J-288	True
J-848	Saratoga PZ	9	True	1,000	1,351	1,003	1,354	20	54	20	20	J-288	(N/A)	20	J-288	True
J-855	Saratoga PZ	5	True	1,000	2,516	1,000	2,516	20	60	20	20	J-288	(N/A)	20	J-288	True

H:\8 - GIS\WaterGems Models\Wyoming\Saratoga\Saratoga Water Model Current.wtg

H. Bolted Standpipe Tank Letters

PMPC CIVIL ENGINEERS

P.O. BOX 370 118 E. BRIDGE AVE. SARATOGA, WYOMING 82331 PHONE (307) 326-8301 FAX (307) 326-8302

7012.079

September 17, 2002

Mr. Jason Sixberry
Engineering America, Inc.
1851 Buerkle Road
White Bear Lake , MN 55110

Re: 1 MG Water Standpipe Project, Saratoga, WY

Dear Mr. Sixberry:

As per our telephone conversation this morning, the 11-month inspection of the 1 MG Water Standpipe Project will be conducted on November 19, 2002 at 10:00 A.M. at the standpipe site, Saratoga, Wyoming. The standpipe will be drained and rinsed out by Town personnel prior to inspection. Please bring a holiday tester or arrange to have one sent to the site as the integrity of the floor coating is of primary concern.

If you have any questions or require additional information, please contact me at your earliest convenience.

Sincerely,

Kent Smith

Kent Smith
PMPC

xc: SCCIJPB
Town of Saratoga
Saratoga Water and Sewer Department
Andy Cunningham, EAI

www.pmpc-eng.com e-mail: pmpc@pmpc-eng.com

PMPC CIVIL ENGINEERS

P.O. BOX 370 118 E. BRIDGE AVE. SARATOGA, WYOMING 82331 PHONE (307) 326-8301 FAX (307) 326-8302

7012.079

November 22, 2002

Mr. Louis Bensen
Saratoga, Carbon County, Impact Joint Powers Board
P.O. Box 486
Saratoga, WY 82331

Re: 1 MG Water Standpipe Project

Dear Mr. Bensen:

On Tuesday, November 19, we performed the 11-month inspection of the 1 MG Water Standpipe. In attendance were Gary Vitzthum of Engineering America Inc. (EAI), Roger Manbeck of the Town of Saratoga Water Department and myself. The water department had drained and cleaned the tank prior to the inspection.

The walls of the tank are in excellent shape and only minor scrapes from ice movement were observed. The wall coating is not damaged. The roof of the tank has several discolored panels. We were unable to get close enough to determine why they appeared that way. I do not believe they are damaged in any way but we will attempt to examine them closer at the next inspection. The floor panels that had defective spots repaired during construction showed no signs of additional defects or corrosion at the repaired locations. The outer ring of floor panels and the center panel are all damaged however. The gravel below the floor has settled slightly causing the panels to buckle over the floor angle and the foundation wall. This buckling caused the glass lining to crack and peel. The center panel has cracks in the glass lining at most of the bolts. Gary dried and sealed all damaged areas. The tank was disinfected by the water department and Roger started filling today.

The tank has a 5 year warranty and the floor will not affect service or safety during that time. I have been in contact with Andy Cunningham and Jason Sixberry of EAI. This is the first tank of this height they have constructed. The problem of the buckling around the outer ring of floor panels is not uncommon but never before observed to this extent. EAI believes the additional water weight has caused the problem. Replacing the floor with the same gauge panels will not remedy the situation as they expect the new panels to react the same way. EAI has been in contact with the tank manufacturer to determine a course of action. Possible repair alternatives include replacing the floor with heavier gauge panels or installing a second floor over the existing one. EAI intends to have a proposal for repairs to us by January, 2003. Repairs will be scheduled for sometime from late September through November (after irrigation demands and prior to ice forming in the tank) within the warranty period. We will attempt to get a closer look at the underside of the roof at that time.

www.pmpc-eng.com e-mail: pmpc@pmpc-eng.com

PMPC CIVIL ENGINEERS

P.O. BOX 370 118 E. BRIDGE AVE. SARATOGA, WYOMING 82331 PHONE (307) 326-8301 FAX (307) 326-8302

7012.079

Please call if you have any questions.

Sincerely,

Kent Smith

Kent Smith
PMPC

Xc: Andy Cunningham, EAI
Roger Manbeck, Saratoga Water Department
Chuck Bartlett, Saratoga Town Engineer

www.pmpc-eng.com e-mail: pmpc@pmpc-eng.com

ENGINEERING AMERICA, INC.

February 18, 2003

Mr. Kent Smith
PMPC Civil Engineers
P.O. Box 370
118 E. Bridge Ave.
Saratoga, Wyoming 82331

Re: Floor repair, Water Storage Tank, Saratoga, WY.

Engineering America, Inc. (EAI) and Engineered Storage Products Company (ESPC) intend to repair the floor defects in the Saratoga, WY Storage tank.

The proposed method of repair will consist of installing new epoxy coated outer ring floor panels and a center cover plate over the existing damaged panels and center plate. Engineered Storage Products believes the epoxy-coated panels and double panel thickness will stand up to the flexing or settling problem, creating a permanent repair that will stand up for the full life of the tank. A Manus sealer membrane will be applied between the new and existing sheets to fill or provide a cushion for any voids.

EAI and ESPC will furnish all material and labor to perform the repairs, plus all documented Engineering fees. The repair work would take approximately one (1) work-week with an additional week for cure time.

On 11/19/02 our field supervisor Gary Vitzthum covered all steel exposed areas with Manus Sealant. This is an approved method of repair and should furnish a strong temporary coating, up to three years. Therefore, if the proposed method of repair is acceptable, the repair work can be scheduled at the convenience of the city.

I have spoken to Mike Poole of ESPC about installing cathodic protection for this tank and ESPC firmly does not recommend cathodic protection because it may cause some adhesion problems for the interior epoxy coated sheets.

EAI will comply with the original contract document (supplied with this project) warranty provisions stated in section 13200, section 1.08. The five year warranty will begin upon completion of the proposed repair work stated in this letter.

Sincerely,

Anthony J. Sellen For Andy Cunningham
2/18/03

Andy Cunningham
Vice President, Construction

1851 Buerkle Road • White Bear Lake, MN 55110 • (651) 777-4041 • Fax (651) 777-5312 • www.engamerica.com

EAI West, Inc.

May 9, 2005

Mr. Mike Glode, Chairman
Joint Powers Board of Saratoga
P. O. Box 486
Saratoga, WY 82331

RE: Water Standpipe Project

Dear Mr. Glode:

As previously agreed, EAI West was to inspect the tank prior to The City of Saratoga removing the field welded tank from service for required maintenance/refurbishment. A time frame was established between Roger Manbeck and EAI West, Inc.

On Wednesday, April 27th I met with Roger Manbeck to visually inspect the tank exterior. Roger and I walked the tank perimeter viewing the foundation and sidewall. Our findings are as follows:

- Roger stated that the water level within the tank was 90 – 95 feet
- The foundation curb was dry
- No leaks were present on the sidewall

Therefore, the tank being dry (no leaks), we see no reason why the field welded tank should not be removed from service and the required maintenance performed as scheduled.

Sincerely,

Kendall Smith
Regional Manager
EAI West, Inc.

Pc: T. Belden, A. Cunningham – Engineering America, Inc.
G. Steele – PMPC Civil Engineers
R. Manbeck – City of Saratoga

6706 North Franklin • Loveland, Colorado 80538 • (970) 962-9400 • Fax (970) 962-9412 • www.eaiwest.com

I. Cost Estimates

i. Decommission Bolted Standpipe and Install 750K Tank along Transmission Line

Project:	Decommission Bolted Standpipe and Install 750K Tank Along Transmission Line			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
Schedule #1 General					
1	**Mobilization (Not to Exceed 5% of Construction Costs)**	**LS**	**Job**	**$70,000.00**	**$70,000.00**
2	**Exploratory Excavation**	**HR**	**10**	**$300.00**	**$3,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$15,000.00**	**$15,000.00**
4	**Traffic Control/Public Coordination**	**LS**	**Job**	**$5,000.00**	**$5,000.00**
Schedule #2 Decommission Bolted Standpipe					
5	**Disconnect Bolted Standpipe from System**	**LS**	**Job**	**$2,500.00**	**$2,500.00**
6	**Drain Standpipe**	**LS**	**Job**	**$3,000.00**	**$3,000.00**
7	**Disassemble and Dispose of Standpipe Components**	**LS**	**Job**	**$55,000.00**	**$55,000.00**
8	**Demolish & Dispose of Standpipe Foundation**	**LS**	**Job**	**$15,000.00**	**$15,000.00**
9	**Site Grading**	**LS**	**Job**	**$1,500.00**	**$1,500.00**
Schedule #3 New 750K Tank					
10	**Site Grading**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
11	**Standpipe Foundation**	**LS**	**Job**	**$30,000.00**	**$30,000.00**
12	**750K Gallon Steel Standpipe**	**Gallon**	**750,000**	**$1.50**	**$1,125,000.00**
13	**Tank Hardware & Piping**	**LS**	**Job**	**$25,000.00**	**$25,000.00**
14	**Disinfection & Testing**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
15	**14" D.I. Waterline**	**LF**	**200**	**$100.00**	**$20,000.00**
16	**14" Gate Valve**	**Each**	**4**	**$5,500.00**	**$22,000.00**
17	**14" Tee**	**Each**	**2**	**$3,000.00**	**$6,000.00**
18	**Chain Link Fence**	**LF**	**600**	**$45.00**	**$27,000.00**
19	**Pipe Bedding**	**LF**	**200**	**$8.00**	**$1,600.00**
				Eligible Total	**$1,446,600.00**
WWDC Non-Eligible Costs					
20	**Water Quality Monitoring Equipment (Chlorine Residuals)**	**LS**	**Job**	**$4,200.00**	**$4,200.00**
				Non-Eligible Total	**$4,200.00**
Cost of Eligible Project Components (Subtotal #2)				**$1,446,600.00**	
Preparation of Final Designs and Specifications				**$144,660.00**	
Permitting & Mitigation				**$10,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$20,000.00**	
Pre-Construction Costs (Subtotal #1)					**$179,660.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$1,446,600.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$144,600.00**	
Components and Engineering Cost (Subtotal #3)				**$1,591,260.00**	
Total Construction Cost (Subtotal #4)					**$1,591,260.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$1,770,920.00**
Inflation (5% per year)		Year	2		**$92,973.30**
Total Eligible Project Cost with Inflation				-	**$1,863,893.30**
Total Non-Eligible Project Cost Portion				-	**$4,200.00**
Inflation (5% per year)		Year	2	-	**$220.50**
Total Non-Eligible Project Cost Portion with Inflation				-	**$4,420.50**
Total Project Cost with Inflation				-	**$1,868,313.80**

ii. Airport Transmission Replacement

Project:	Airport Transmission Replacement			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
WWDC Eligible Costs					
Schedule #1 Airport Transmission Replacement					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$45,000.00**	**$45,000.00**
2	**Exploratory Excavation**	**LS**	**20**	**$300.00**	**$6,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
4	**Dust Control & Watering**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
5	**Traffic Control/Public Coordination**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
6	**8" C-900 DR 18 PVC Waterline**	**LF**	**4,100**	**$55.00**	**$225,500.00**
7	**8" HDPE Water Line**	**LF**	**900**	**$70.00**	**$63,000.00**
8	**Directional Boring (Under Runway)**	**LF**	**900**	**$150.00**	**$135,000.00**
9	**Imported Pipe Bedding**	**LF**	**4,100**	**$8.00**	**$32,800.00**
10	**Imported Trench Backfill**	**LF**	**4,100**	**$16.00**	**$65,600.00**
11	**8" MJ Fittings**	**EACH**	**14**	**$1,000.00**	**$13,666.67**
12	**8" Gate Valve**	**EACH**	**15**	**$3,500.00**	**$54,150.94**
13	**Fire Hydrant w/Isolation Valve and Mainline Tee**	**EACH**	**8**	**$6,000.00**	**$48,000.00**
14	**Service Line & Connections**	**EACH**	**30**	**$2,500.00**	**$75,000.00**
15	**Asphalt Street Repair**	**SY**	**1,500**	**$55.00**	**$82,500.00**
16	**Rock Excavation**	**CY**	**50**	**$500.00**	**$25,000.00**
				Eligible Total	**$911,217.61**
Cost of Eligible Components (Subtotal #2)				**$911,217.61**	
Preparation of Final Designs and Specifications				**$91,121.76**	
Permitting & Mitigation				**$10,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$10,000.00**	
Pre-Construction Costs (Subtotal #1)					**$116,121.76**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$911,217.61**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$91,121.76**	
Components and Engineering Cost (Subtotal #3)				**$1,002,339.37**	
Total Construction Cost (Subtotal #4)					**$1,002,339.37**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				**-**	**$1,118,461.13**
Inflation (5% per year)		Year	2		**$58,719.21**
Total Eligible Project Cost with Inflation				**-**	**$1,177,180.34**

iii. WTP Transmission Replacement

Project:	WTP Transmission Replacement			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
WWDC Eligible Costs					
Schedule #1 WTP Transmission Replacement					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$24,000.00**	**$24,000.00**
2	**Exploratory Excavation**	**LS**	**10**	**$300.00**	**$3,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
4	**Dust Control & Watering**	**LS**	**Job**	**$5,000.00**	**$5,000.00**
5	**Traffic Control/Public Coordination**	**LS**	**Job**	**$7,500.00**	**$7,500.00**
6	**14" C-900 Waterline**	**LF**	**1,400**	**$80.00**	**$112,000.00**
7	**Imported Pipe Bedding**	**LF**	**1,400**	**$8.00**	**$11,200.00**
8	**Imported Trench Backfill**	**LF**	**1,400**	**$16.00**	**$22,400.00**
9	**14" MJ Fittings**	**EACH**	**10**	**$3,000.00**	**$30,000.00**
10	**14" Gate Valve**	**EACH**	**12**	**$5,500.00**	**$66,000.00**
11	**Fire Hydrant w/Isolation Valve and Mainline Tee**	**EACH**	**5**	**$6,000.00**	**$30,000.00**
12	**Service Line & Connections**	**EACH**	**30**	**$2,500.00**	**$75,000.00**
13	**Asphalt Street Repair**	**SY**	**1,500**	**$55.00**	**$82,500.00**
14	**Rock Excavation**	**CY**	**10**	**$500.00**	**$5,000.00**
				Eligible Total	**$483,600.00**
Cost of Eligible Components (Subtotal #2)				**$483,600.00**	
Preparation of Final Designs and Specifications				**$48,360.00**	
Permitting & Mitigation				**$10,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$5,000.00**	
Pre-Construction Costs (Subtotal #1)					**$68,360.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$483,600.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$48,360.00**	
Components and Engineering Cost (Subtotal #3)				**$531,960.00**	
Total Construction Cost (Subtotal #4)					**$531,960.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$600,320.00**
Inflation (5% per year)		Year	2		**$31,516.80**
Total Eligible Project Cost with Inflation				-	**$631,836.80**

iv. SCADA Upgrades

Project:	SCADA Upgrades			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
Schedule #1 SCADA Upgrades					
1	**Software Upgrade**	**LS**	**Job**	**$5,200.00**	**$5,200.00**
2	**New Dialogic Modem**	**LS**	**Job**	**$2,500.00**	**$2,500.00**
3	**Labor & Install**	**LS**	**Job**	**$6,200.00**	**$6,200.00**
4	**New Sold State Computer (5 Year Warranty)**	**LS**	**Job**	**$3,000.00**	**$3,000.00**
5	**System Cloud Backup**	**LS**	**Job**	**$2,500.00**	**$2,500.00**
				Non-Eligible Total	**$19,400.00**
Cost of Eligible Components (Subtotal #2)				**$0.00**	
Preparation of Final Designs and Specifications				**$0.00**	
Permitting & Mitigation				**$0.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$0.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$0.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$0.00**	
Components and Engineering Cost (Subtotal #3)				**$19,400.00**	
Total Construction Cost (Subtotal #4)					**$19,400.00**
Total Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$19,400.00**
Inflation (5% per year)		Year	2		**$1,018.50**
Total Non-Eligible Project Cost with Inflation				-	**$20,418.50**

V. Tank Mixer

Project:	Welded Tank Mixer			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
Schedule #1 Bubbler Tank Mixer					
1	**Bubbler Tank Mixer**	**LS**	**Job**	**$40,250.00**	**$40,250.00**
2	**Manufacturer Deliver & Install**	**LS**	**Job**	**$3,450.00**	**$3,450.00**
3	**Power to Site**	**LS**	**Job**	**$5,750.00**	**$5,750.00**
				Non-Eligible Total	**$49,450.00**
Cost of Eligible Components (Subtotal #2)				**$0.00**	
Preparation of Final Designs and Specifications				**$4,945.00**	
Permitting & Mitigation				**$1,500.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$6,445.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$49,450.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$4,945.00**	
Components and Engineering Cost (Subtotal #3)				**$54,395.00**	
Total Construction Cost (Subtotal #4)					**$54,395.00**
Total Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$60,840.00**
Inflation (5% per year)		Year	2		**$3,194.10**
Total Non-Eligible Project Cost with Inflation				-	**$64,034.10**

vi. Well Rehabilitation

Project:	Well Rehabilitation			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
WWDC Eligible Costs					
1	**Mobilization, Bonding, Etc.**	**LS**	**Job**	**$15,000.00**	**$15,000.00**
2	**Remove Pumping Equipment**	**Each**	**5**	**$1,000.00**	**$5,000.00**
3	**Remove Fill from Wells by Airlifting**	**Hours**	**25**	**$550.00**	**$13,750.00**
4	**Scrape/Brush Casing**	**Hours**	**13**	**$350.00**	**$4,375.00**
5	**Well Development by Airlifting**	**Hours**	**20**	**$550.00**	**$11,000.00**
6	**Furnish & Inject Treatment Solution**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
7	**Surge Treatment Solution**	**Hours**	**40**	**$350.00**	**$14,000.00**
8	**Remove Treatment Solution**	**Hours**	**20**	**$350.00**	**$7,000.00**
9	**Super Chlorinate Wells**	**Each**	**5**	**$1,500.00**	**$7,500.00**
10	**Reinstall Pumping Equipment & Banding**	**Each**	**5**	**$1,250.00**	**$6,250.00**
11	**OPTION: Install 2 7/8-inch Pump Column Tubing**	**LF**	**1,407**	**$20.00**	**$28,140.00**
12	**OPTION: Corrosion Control Consultant**	**LS**	**Job**	**$4,500.00**	**$4,500.00**
13	**Water Quality Testing**	**LS**	**Job**	**$1,500.00**	**$1,500.00**
14	**Plug and Abandon Two Monitoring Wells**	**LS**	**Job**	**$10,000.00**	**$10,000.00**
				Eligible Total	**$148,015.00**
Cost of Eligible Components (Subtotal #2)				**$148,015.00**	
Preparation of Final Designs and Specifications				**$10,000.00**	
Permitting & Mitigation				**$750.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$10,750.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$148,015.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$14,801.50**	
Components and Engineering Cost (Subtotal #3)				**$162,816.50**	
Total Construction Cost (Subtotal #4)					**$162,816.50**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$173,566.50**
Inflation (5% per year)		Year	5		**$12,032.84**
Total Eligible Project Cost with Inflation				-	**$185,599.34**

vii. Additional Metering

Project:	Additional Metering - Non-Metered Connections			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$7,700.00**	**$7,700.00**
2	**Exploratory Excavations**	**HR**	**10**	**$300.00**	**$3,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$3,500.00**	**$3,500.00**
4	**Traffic Control/Public Coordination**	**LS**	**Job**	**$3,500.00**	**$3,500.00**
5	**Pavement & Concrete Removal & Disposal**	**SY**	**350**	**$15.00**	**$5,250.00**
6	**1" Copper Service Line**	**LF**	**300**	**$45.00**	**$13,500.00**
7	**Water Service Connection**	**Each**	**15**	**$1,000.00**	**$15,000.00**
8	**Meter Pit Installation**	**Each**	**15**	**$1,500.00**	**$22,500.00**
9	**1" Meter (Check Valves, PRV)**	**Each**	**15**	**$3,500.00**	**$52,500.00**
10	**Imported Fill**	**LF**	**300**	**$20.00**	**$6,000.00**
11	**Pavement & Concrete Replacement w/Road Base**	**SY**	**350**	**$55.00**	**$19,250.00**
				Non-Eligible Total	**$151,700.00**
Cost of Non-Eligible Components (Subtotal #2)				**$151,700.00**	
Preparation of Final Designs and Specifications				**$22,755.00**	
Permitting & Mitigation				**$3,000.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$25,755.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$151,700.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$15,170.00**	
Components and Engineering Cost (Subtotal #3)				**$166,870.00**	
Total Construction Cost (Subtotal #4)					**$166,870.00**
Total Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$192,625.00**
Inflation (5% per year)		Year	2		**$10,112.81**
Total Non-Eligible Project Cost with Inflation				-	**$202,737.81**

viii. Distribution System Improvements

Project:	Distribution System Improvements			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
Schedule #1 Distribution System Improvements					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$210,000.00**	**$210,000.00**
2	**Exploratory Excavation**	**HR**	**50**	**$300.00**	**$15,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$100,000.00**	**$100,000.00**
4	**Dust Control & Watering**	**LS**	**Job**	**$50,000.00**	**$50,000.00**
5	**Traffic Control/Public Coordination**	**LS**	**Job**	**$75,000.00**	**$75,000.00**
6	**6" C-900 DR 18 PVC Waterline**	**LF**	**14,000**	**$50.00**	**$700,000.00**
7	**8" C-900 DR 18 PVC Waterline**	**LF**	**4,800**	**$55.00**	**$264,000.00**
8	**10" C-900 DR 18 PVC Waterline**	**LF**	**1,350**	**$60.00**	**$81,000.00**
9	**Imported Pipe Bedding**	**LF**	**20,150**	**$8.00**	**$161,200.00**
10	**Imported Trench Backfill**	**LF**	**20,150**	**$16.00**	**$322,400.00**
11	**6" MJ Fittings**	**EACH**	**47**	**$750.00**	**$35,000.00**
12	**8" MJ Fittings**	**EACH**	**16**	**$1,000.00**	**$16,000.00**
13	**10" MJ Fittings**	**EACH**	**5**	**$1,500.00**	**$6,750.00**
14	**6" Gate Valves**	**EACH**	**53**	**$3,000.00**	**$158,490.57**
15	**8" Gate Valve**	**EACH**	**18**	**$3,500.00**	**$63,396.23**
16	**10" Gate Valves**	**EACH**	**5**	**$4,000.00**	**$20,377.36**
17	**Fire Hydrant w/Isolation Valve and Mainline Tee**	**EACH**	**45**	**$6,000.00**	**$270,000.00**
18	**Service Line & Connections**	**EACH**	**180**	**$2,500.00**	**$450,000.00**
19	**Asphalt Street Repair w/Road Base**	**SY**	**13,000**	**$55.00**	**$715,000.00**
20	**Rock Excavation**	**CY**	**50**	**$500.00**	**$25,000.00**
				Non-Eligible Total	**$3,738,614.15**
Cost of Eligible Components (Subtotal #2)				**$0.00**	
Preparation of Final Designs and Specifications				**$373,861.42**	
Permitting & Mitigation				**$20,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$5,000.00**	
Pre-Construction Costs (Subtotal #1)					**$403,861.42**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$3,738,614.15**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$373,861.42**	
Components and Engineering Cost (Subtotal #3)				**$4,112,475.57**	
Total Construction Cost (Subtotal #4)					**$4,112,475.57**
Total Eligible Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				**-**	**$4,516,336.98**
Inflation (5% per year)		Year	5		**$274,481.79**
Total Non-Eligible Project Cost with Inflation				**-**	**$4,790,818.77**

ix. Alternative Power

Project:	Well Field Alternative Power - Standby Generator			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
Schedule #1 Standby Generator					
	Mobilization (Not to Exceed 5% of Construction Costs)	**LS**	**Job**	**$4,300.00**	**$4,300.00**
	Site Grading	**LS**	**Job**	**$3,500.00**	**$3,500.00**
	Electrical Conduit Trenching	**LS**	**Job**	**$4,000.00**	**$4,000.00**
	Site Electrical Work	**LS**	**Job**	**$8,500.00**	**$8,500.00**
	Concrete Pad	**LS**	**Job**	**$7,500.00**	**$7,500.00**
	Furnish & Install Standby Generator	**LS**	**Job**	**$48,000.00**	**$48,000.00**
	Generator Startup & Testing	**LS**	**Job**	**$7,000.00**	**$7,000.00**
	Chain Link Fencing	**LS**	**Job**	**$5,000.00**	**$5,000.00**
				Eligible Total	**$87,800.00**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
Cost of Eligible Components (Subtotal #2)				**$87,800.00**	
Preparation of Final Designs and Specifications				**$13,170.00**	
Permitting & Mitigation				**$2,500.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$15,670.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$87,800.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$8,780.00**	
Components and Engineering Cost (Subtotal #3)				**$96,580.00**	
Total Construction Cost (Subtotal #4)					**$96,580.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$112,250.00**
Inflation (5% per year)		Year	2		**$6,822.03**
Total Eligible Project Cost with Inflation				-	**$119,072.03**

X. Mountain View Estates Transmission

Project:	Mountain View Estates Transmission - Regionalization			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
	Mobilization (5% Construction Costs)	**LS**	**Job**	**$30,000.00**	**$30,000.00**
	Exploratory Excavation	**HR**	**10**	**$300.00**	**$3,000.00**
	Site Restoration & Cleanup	**LS**	**Job**	**$10,000.00**	**$10,000.00**
	Dust Control & Watering	**LS**	**Job**	**$7,500.00**	**$7,500.00**
	Traffic Control/Public Coordination	**LS**	**Job**	**$2,000.00**	**$2,000.00**
	10" C-900 DR 18 PVC Waterline	**LF**	**6,000**	**$60.00**	**$360,000.00**
	10" MJ Fittings	**Each**	**6**	**$2,000.00**	**$12,000.00**
	10" Gate Valves	**Each**	**8**	**$4,000.00**	**$30,000.00**
	14" Fittings	**Each**	**1**	**$3,500.00**	**$3,500.00**
	Imported Pipe Bedding	**LF**	**6,000**	**$8.00**	**$48,000.00**
	Native Trench Backfill	**LF**	**6,000**	**$5.00**	**$30,000.00**
	Fire Hydrant w/Isolation Valve and Mainline Tee	**Each**	**8**	**$6,000.00**	**$45,000.00**
	Rock Excavation	**CY**	**10**	**$500.00**	**$5,000.00**
	Air Release Valves (with Vault)	**Each**	**2**	**$8,000.00**	**$16,000.00**
				Eligible Total	**$602,000.00**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
Cost of Eligible Components (Subtotal #2)				**$602,000.00**	
Preparation of Final Designs and Specifications				**$60,200.00**	
Permitting & Mitigation				**$5,000.00**	
Title of Opinion				**$5,000.00**	
Acquisition of Access and Rights of Way				**$20,000.00**	
Pre-Construction Costs (Subtotal #1)					**$90,200.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$602,000.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$60,200.00**	
Components and Engineering Cost (Subtotal #3)				**$662,200.00**	
Total Construction Cost (Subtotal #4)					**$662,200.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$752,400.00**
Inflation (5% per year)		Year	2		**$39,501.00**
Total Eligible Project Cost with Inflation				-	**$791,901.00**

xi. Mountain View Estates Distribution

Project:	MVE Distribution System			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
NA					
				Eligible Total	**$0.00**
WWDC Non-Eligible Costs					
Schedule #1 Distribution System Improvements					
1	**Mobilization (5% Construction Costs)**	**LS**	**Job**	**$95,000.00**	**$95,000.00**
2	**Exploratory Excavation**	**HR**	**10**	**$300.00**	**$3,000.00**
3	**Site Restoration & Cleanup**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
4	**Dust Control & Watering**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
5	**Traffic Control/Public Coordination**	**LS**	**Job**	**$5,000.00**	**$5,000.00**
6	**6" C-900 DR 18 PVC Waterline**	**LF**	**8,000**	**$50.00**	**$400,000.00**
7	**8" C-900 DR 18 PVC Waterline**	**LF**	**7,000**	**$55.00**	**$385,000.00**
8	**Imported Pipe Bedding**	**LF**	**15,000**	**$8.00**	**$120,000.00**
9	**Imported Trench Backfill**	**LF**	**15,000**	**$16.00**	**$240,000.00**
10	**6" MJ Fittings**	**EACH**	**13**	**$750.00**	**$10,000.00**
11	**8" MJ Fittings**	**EACH**	**23**	**$1,000.00**	**$23,333.33**
12	**6" Gate Valves**	**EACH**	**30**	**$3,000.00**	**$90,566.04**
13	**8" Gate Valve**	**EACH**	**26**	**$3,500.00**	**$92,452.83**
14	**Fire Hydrant w/Isolation Valve and Mainline Tee**	**EACH**	**16**	**$6,000.00**	**$96,000.00**
15	**Service Line & Connections (Including Meters)**	**EACH**	**16**	**$7,500.00**	**$120,000.00**
16	**Gravel Road Repair**	**LF**	**16,000**	**$20.00**	**$320,000.00**
				Non-Eligible Total	**$2,040,352.20**
Cost of Eligible Components (Subtotal #2)				**$0.00**	
Preparation of Final Designs and Specifications				**$204,035.22**	
Permitting & Mitigation				**$20,000.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$15,000.00**	
Pre-Construction Costs (Subtotal #1)					**$239,035.22**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$2,040,352.20**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$204,035.22**	
Components and Engineering Cost (Subtotal #3)				**$2,244,387.42**	
Total Construction Cost (Subtotal #4)					**$2,244,387.42**
Total Eligible Non-Eligible Project Cost (Subtotal #1 +Subtotal #4)				**-**	**$2,483,422.64**
Inflation (5% per year)		Year	2		**$130,379.69**
Total Non-Eligible Project Cost with Inflation				**-**	**$2,613,802.33**

xii. Replace Panels – Bolted Tank

Project:	Structural & Geotechnical Evaluation of Bolted Standpipe and Replace Sidewall Sections			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
Schedule #1 Structural & Geotechnical Evaluations					
1	**Structural Evaluation**	**LS**	**Job**	**$12,500.00**	**$12,500.00**
2	**Geotechnical Evaluation**	**LS**	**Job**	**$7,500.00**	**$7,500.00**
Schedule #2 Replace Sidewall Sections					
3	**Preliminary Site Investigation**	**LS**	**Job**	**$2,000.00**	**$2,000.00**
4	**Replace Sidewall Sections**	**LS**	**Job**	**$368,000.00**	**$368,000.00**
				Eligible Total	**$390,000.00**
WWDC Non-Eligible Costs					
				Non-Eligible Total	**$0.00**
Cost of Eligible Components (Subtotal #2)				**$390,000.00**	
Preparation of Final Designs and Specifications				**$39,000.00**	
Permitting & Mitigation				**$8,000.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$47,000.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$390,000.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$39,000.00**	
Components and Engineering Cost (Subtotal #3)				**$429,000.00**	
Total Construction Cost (Subtotal #4)					**$429,000.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$476,000.00**
Inflation (5% per year)		Year	2		**$24,990.00**
Total Eligible Project Cost with Inflation				-	**$500,990.00**
Total Non-Eligible Project Cost				-	**$0.00**
Inflation (5% per year)		Year	2	-	**$0.00**
Total Non-Eligible Project Cost with Inflation				-	**$0.00**
Total Project Cost with Inflation				-	**$500,990.00**

xiii. Re-Seal Bolted Tank

Project:	Structural & Geotechnical Evaluation of Bolted Standpipe and Re-Seal Tank Interior			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Eligible Costs					
Schedule #1 Structural & Geotechnical Evaluations					
1	**Structural Evaluation**	**LS**	**Job**	**$12,500.00**	**$12,500.00**
2	**Geotechnical Evaluation**	**LS**	**Job**	**$7,500.00**	**$7,500.00**
Schedule #2 Re-Seal Bolted Tank Interior					
3	**Preliminary Site Investigation**	**LS**	**Job**	**$2,000.00**	**$2,000.00**
4	**Re-Seal Tank Interior**	**LS**	**Job**	**$149,500.00**	**$149,500.00**
				Eligible Total	**$171,500.00**
WWDC Non-Eligible Costs					
	NA				
				Non-Eligible Total	**$0.00**
Cost of Eligible Components (Subtotal #2)				**$171,500.00**	
Preparation of Final Designs and Specifications				**$17,150.00**	
Permitting & Mitigation				**$4,000.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$21,150.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$171,500.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$17,150.00**	
Components and Engineering Cost (Subtotal #3)				**$188,650.00**	
Total Construction Cost (Subtotal #4)					**$188,650.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)				-	**$209,800.00**
Inflation (5% per year)		Year	2		**$11,014.50**
Total Eligible Project Cost with Inflation				-	**$220,814.50**
Total Non-Eligible Project Cost				-	**$0.00**
Inflation (5% per year)		Year	2	-	**$0.00**
Total Non-Eligible Project Cost with Inflation				-	**$0.00**
Total Project Cost with Inflation				-	**$220,814.50**

xiv. New Saratoga Well #6

Project:	New - Saratoga Well #6			Date:	5/1/2019
Bid	**Description**	**Units**	**Estimated Quantity**	**Unit Cost**	**Estimated Cost**
WWDC Non-Eligible Costs					
NA					
				Non-Eligible Total	**$0.00**
WWDC Eligible Costs					
1	**Mobilization, Bonding, Etc.**	**LS**	**Job**	**$35,000.00**	**$35,000.00**
2	**Drill for, Furnish, Install, & Cement 13 3/8-inch Surface Casing**	**LF**	**30**	**$200.00**	**$6,000.00**
3	**Drill 6 1/4-inch Diameter Borehole**	**LF**	**370**	**$26.00**	**$9,620.00**
4	**Open Hole Geophysical Logging**	**LS**	**Job**	**$7,000.00**	**$7,000.00**
5	**Ream Borehole to 12 1/4 inches**	**LF**	**370**	**$40.00**	**$14,800.00**
6	**Furnish & Install 8 5/8-inch O.D. Steel Casing**	**LF**	**270**	**$32.00**	**$8,640.00**
7	**Furnish & Install 8-inch Stainless Steel Well Screens**	**LF**	**130**	**$200.00**	**$26,000.00**
8	**Furnish & Install Graded Sand Pack**	**LF**	**250**	**$30.00**	**$7,500.00**
9	**Furnish & Install Cement Seal**	**LF**	**250**	**$36.00**	**$9,000.00**
10	**Well Development & Rig Time**	**Hours**	**18**	**$500.00**	**$9,000.00**
11	**Air Development**	**Hours**	**24**	**$550.00**	**$13,200.00**
12	**Furnish, Install & Remove Pump Testing Equipment**	**LS**	**Job**	**$20,000.00**	**$20,000.00**
13	**Conduct Pump Test**	**Hours**	**176**	**$200.00**	**$35,200.00**
				Eligible Total	**$200,960.00**
Cost of Eligible Components (Subtotal #2)				**$200,960.00**	
Preparation of Final Designs and Specifications				**$10,000.00**	
Permitting & Mitigation				**$750.00**	
Title of Opinion				**$0.00**	
Acquisition of Access and Rights of Way				**$0.00**	
Pre-Construction Costs (Subtotal #1)					**$10,750.00**
Cost of Project Components (Subtotal #2) See Construction Estimate				**$200,960.00**	
Construction Engineering Cost (Subtotal #2 x 10%)				**$20,096.00**	
Components and Engineering Cost (Subtotal #3)				**$221,056.00**	
Total Construction Cost (Subtotal #4)					**$221,056.00**
Total Eligible Project Cost (Subtotal #1 +Subtotal #4)					**$231,806.00**
Inflation (5% per year)		Year	5		**$12,032.84**
Total Eligible Project Cost With Inflation					**$243,838.84**

J. Fiscal Expenditures/Revenues 2016-2018

	2015-2016 FY			2016-2017 FY			2017-2018 FY		
Expenditures	YTD Actual	Budget	Unexpended	YTD Actual	Budget	Unexpended	YTD Actual	Budget	Unexpended
Salaries	$84,178.91	$110,000.00	$25,821.09	$88,848.39	$110,000.00	$21,151.61	$88,320.24	$98,500.00	$10,179.76
Payroll Benfits	$9,374.62	$14,500.00	$5,125.38	$10,802.88	$12,500.00	$1,697.12	$11,662.37	$11,500.00	-$162.37
Health Insurance	$29,030.77	$45,000.00	$15,969.23	$37,750.17	$45,000.00	$7,249.83	$39,694.09	$44,500.00	$4,805.91
Retirement	$11,398.70	$14,500.00	$3,101.30	$12,807.13	$14,500.00	$1,692.87	$12,765.12	$13,500.00	$734.88
Advertising	$857.50	$1,000.00	$142.50	$531.63	$1,000.00	$468.37	$71.50	$1,000.00	$928.50
Communications	$0.00	$1,000.00	$1,000.00	$0.00	$1,000.00	$1,000.00	$0.00	$500.00	$500.00
Travel	$787.68	$2,500.00	$1,712.32	$1,109.59	$5,000.00	$3,890.41	$160.00	$2,000.00	$1,840.00
Training	$749.53	$3,000.00	$2,250.47	$830.00	$5,000.00	$4,170.00	$632.50	$3,000.00	$2,367.50
Supplies	$4,176.29	$25,000.00	$20,823.71	$11,717.32	$25,000.00	$13,282.68	$4,602.57	$25,000.00	$20,397.43
Supplies - Treatment	$675.48	$4,000.00	$3,324.52	$352.93	$3,000.00	$2,647.07	$1,185.23	$3,000.00	$1,814.77
Memberships, Dues, Subscriptions	$979.00	$2,000.00	$1,021.00	$1,325.00	$1,000.00	-$325.00	$535.00	$2,000.00	$1,465.00
Repair & Maintenance - Equipment	$34,115.50	$35,000.00	$884.50	$1,523.58	$35,000.00	$33,476.42	$2,264.37	$22,500.00	$20,235.63
Water Line Repair	$9,681.17	$10,000.00	$318.83	$15,297.49	$12,000.00	-$3,297.49	$5,094.18	$21,000.00	$15,905.82
Repair & Maintenance - Vehicles	$1,143.53	$2,500.00	$1,356.47	$810.51	$2,500.00	$1,689.49	$152.53	$2,500.00	$2,347.47
Vehicle - Fuel	$3,065.35	$9,000.00	$5,934.65	$3,195.83	$8,000.00	$4,804.17	$3,930.19	$6,000.00	$2,069.81
Repair & Maintenance - Buildings/Grounds	$493.42	$3,000.00	$2,506.58	$63.81	$1,000.00	$936.19	$1,011.09	$0.00	-$1,011.09
Utilities	$36,266.81	$45,000.00	$8,733.19	$35,311.38	$45,000.00	$9,688.62	$30,995.11	$37,500.00	$6,504.89
Telephone	$2,300.65	$2,000.00	-$300.65	$2,104.19	$2,000.00	-$104.19	$3,266.95	$2,500.00	-$766.95
Professional Fees	$2,241.53	$4,000.00	$1,758.47	$1,811.10	$4,000.00	$2,188.90	$2,425.27	$3,500.00	$1,074.73
Contract Services	$13,448.42	$4,500.00	-$8,948.42	$6,090.81	$5,000.00	-$1,090.81	$5,495.98	$10,000.00	$4,504.02
Special Department - Meters	$0.00	$2,500.00	$2,500.00	$0.00	$2,000.00	$2,000.00	$0.00	$2,000.00	$2,000.00
Special Department - Testing	$752.59	$4,000.00	$3,247.41	$2,938.91	$5,000.00	$2,061.09	$329.00	$4,500.00	$4,171.00
Insurance - Property	$1,475.00	$1,475.00	$0.00	$1,410.00	$1,480.00	$70.00	$2,868.27	$1,410.00	-$1,458.27
Insurance - Liability	$0.00	$800.00	$800.00	$1,369.50	$800.00	-$569.50	$570.33	$775.00	$204.67
Capital Improvements	$7,414.50	$55,000.00	$47,585.50	$1,431.00	$38,420.00	$36,989.00	$1,000.00	$40,000.00	$39,000.00
Capital Equipment	$0.00	$25,000.00	$25,000.00	$0.00	$23,000.00	$23,000.00	$0.00	$40,000.00	$40,000.00
JPB - Loan Payment	$117,301.97	$120,000.00	$2,698.03	$117,301.97	$118,000.00	$698.03	$117,301.97	$108,000.00	-$9,301.97
JPB - Administration	$8,912.00	$10,000.00	$1,088.00	$9,692.25	$10,000.00	$307.75	$9,865.00	$15,000.00	$5,135.00
Totals	$380,820.92	$556,275.00	$175,454.08	$366,427.37	$536,200.00	$169,772.63	$346,198.86	$521,685.00	$175,486.14
Revenues									
Interest Income	$312.17	$500.00	$187.83	$0.00	$500.00	$500.00	$0.00	$500.00	$500.00
Reimbursements	$77.15	$20,000.00	$19,922.85	$0.00	$15,000.00	$15,000.00	$0.00	$15,000.00	$15,000.00
Water Sales to Customer	$483,611.50	$540,100.00	$56,488.50	$498,583.40	$520,000.00	$21,416.60	$511,580.94	$530,500.00	$18,919.06
Water Tap Fees	$4,250.00	$4,500.00	$250.00	$17,500.00	$36,000.00	$18,500.00	$12,500.00	$48,000.00	$35,500.00
Water Meter Fees	$1,900.00	$5,000.00	$3,100.00	$0.00	$15,000.00	$15,000.00	$2,725.00	$5,000.00	$2,275.00
Water Line Repair	-	-	-	$0.00	$2,000.00	$2,000.00	$0.00	$3,000.00	$3,000.00
Water Other	$118.53	$5,000.00	$4,881.47	1177.26	15200	$14,022.74	5	15000	$14,995.00
Totals	$490,269.35	$575,100.00	$84,830.65	$517,260.66	$603,700.00	$86,439.34	$526,810.94	$617,000.00	$90,189.06
Net Revenue over Expenses	**$109,448.43**			**$150,833.29**			**$180,612.08**		

K. Financial Capacity Development Worksheets

CAPACITY DEVELOPMENT

Additional Financial Worksheets for DWSRF Loan Recipients and New Community Water Systems (CWS) and New Non-Transient Non-Community Water Systems

SUMMARY

Five Year Projections	Last Year Actual	Current Year Budget	Year 2 Projected	Year 3 Projected	Year 4 Projected	Year 5 Projected
Beginning Cash on Hand	$0	$189,237	$214,638	$238,783	$262,295	$287,872
Add:						
Cash Receipts (worksheet 1, 5T)	$526,811	$548,750	$5,154,467	$591,000	$615,380	$6,769,124
Less:						
Operating Expenditures (worksheet 2, 8T)	$228,897	$414,673	$370,678	$378,811	$386,126	$393,587
Debt Service (worksheet 3, 9T)	$108,677	$108,677	$108,677	$108,677	$108,677	$176,097
Capital Improvements (worksheet 4, 10T)	$0	$0	$4,585,967	$0	$0	$6,129,449
Deposits to Reserves (worksheet 5, 11T)	$0	$0	$65,000	$80,000	$95,000	$110,000
Ending Cash on Hand	$189,237	$214,638	$238,783	$262,295	$287,872	$247,863

Number of Customer Accounts	990	990	991	992	994	995
Average Annual User Charge per account	$516.75	$535.61	$554.89	$576.39	$598.73	$621.93
Coverage Ratio ((3T-8T)/9T)	2.74	1.23	1.82	1.95	2.11	1.40
Operating Ratio (1T/8T)	2.24	1.28	1.48	1.51	1.54	1.57

Applicant: Town of Saratoga/ SCCIJPB

Completed by: Suzie Cox - Town Clerk (Forsgren Associates - Master Plan)

Date: May 1, 2019

WORKSHEET 1 - RECEIPTS

Five Year Projections	Last Year Actual	Current Year Budget	Year 2 Projected	Year 3 Projected	Year 4 Projected	Year 5 Projected
1. Cash Receipts From Water Revenues:						
a. Unmetered Water Revenue	$0	$0	$0	$0	$0	$0
b. Metered Water Revenue	$511,581	$530,000	$550,000	$572,000	$594,880	$618,675
c. Other Water Revenue	$5	$250	$0	$0	$0	$0
1T. Total Water Revenues (1a thru 1c)	$511,586	$530,250	$550,000	$572,000	$594,880	$618,675
2. Cash Receipts From Other Income						
a. Connection Fees	$15,225	$10,500	$11,000	$11,500	$12,000	$12,500
b. Interest and Dividend Income	$0	$5,500	$5,500	$5,500	$5,500	$5,500
c. Other	$0	$2,500	$2,000	$2,000	$3,000	$3,000
2T. Total Other Income (2a thru 2c)	$15,225	$18,500	$18,500	$19,000	$20,500	$21,000
3T. Total Cash Revenues (1T + 2T)	$526,811	$548,750	$568,500	$591,000	$615,380	$639,675
4. Other Cash Receipts						
a. Transfers in	$0	$0	$0	$0	$0	$0
b. Loans, Grants or other Cash Received	$0	$0	$4,585,967	$0	$0	$6,129,449
(please specify)			WWDC & SLIB			SLIB
4T. Total Other Cash Receipts (4a + 4b)	$0	$0	$4,585,967	$0	$0	$6,129,449
5T. Total Cash Receipts (3T + 4T)	$526,811	$548,750	$5,154,467	$591,000	$615,380	$6,769,124

WORKSHEET 2 - OPERATING EXPENDITURES

Five Year Projections	Last Year Actual	Current Year Budget	Year 2 Projected	Year 3 Projected	Year 4 Projected	Year 5 Projected
6. Operating Expenses						
a. Salaries	$88,320	$98,500	$98,000	$100,940	$102,959	$105,018
b. Payroll Benefits	$11,662	$11,500	$12,500	$12,750	$13,005	$13,265
c. Health Insurance	$39,694	$44,500	$47,000	$47,940	$48,899	$49,877
d. Retirement	$12,765	$13,500	$14,000	$14,280	$14,566	$14,857
e. Advertising	$72	$1,000	$750	$765	$780	$796
f. Communications	$0	$500	$500	$510	$520	$531
g. Travel	$160	$2,000	$1,500	$1,530	$1,561	$1,592
h. Training	$633	$3,000	$1,500	$1,530	$1,561	$1,592
i. Supplies	$4,603	$25,000	$10,000	$10,200	$10,404	$10,612
j. Supplies-Treatment	$1,185	$3,000	$1,500	$1,530	$1,561	$1,592
k. Memberships, Dues, Subscriptions	$535	$2,000	$1,500	$1,530	$1,561	$1,592
l. Repair & Maintenance - Equipment	$2,264	$22,500	$25,000	$25,500	$26,010	$26,530
m. Water Line Repair	$5,094	$21,000	$15,000	$15,300	$15,606	$15,918
n. Repair & Maintenance - Vehicles	$153	$2,500	$1,500	$1,530	$1,561	$1,592
o. Vehicle - Fuel	$3,930	$6,000	$4,500	$4,590	$4,682	$4,775
p. Repair & Maintenance - Buildings/Grounds	$1,011	$0	$500	$510	$520	$531
q. Utilities	$30,995	$37,500	$35,000	$35,700	$36,414	$37,142
r. Telephone	$3,267	$2,500	$3,500	$3,570	$3,641	$3,714
s. Professional Fees	$2,425	$3,500	$3,200	$3,264	$3,329	$3,396
t. Contract Services	$5,496	$10,000	$10,000	$10,200	$10,404	$10,612
u. Special Department - Meters	$0	$2,000	$1,500	$1,530	$1,561	$1,592
v. Special Department - Testing	$329	$4,500	$2,000	$2,040	$2,081	$2,122
w. Insurance - Property	$2,868	$2,173	$3,000	$3,060	$3,121	$3,184
x. Insurance - Liability	$570	$1,000	$1,500	$1,530	$1,561	$1,592
y. Capital Improvements	$1,000	$40,000	$25,000	$25,500	$26,010	$26,530
z. Capital Equipment	$0	$40,000	$25,000	$25,500	$26,010	$26,530
ab. JPB - Administration	$9,865	$15,000	$12,000	$12,240	$12,485	$12,734
n. Proposed Master Plan Operating Exp.	$0	$0	$13,728	$13,742	$13,755	$13,769
6T. Total Operating Expenses (6a thru 6p)	$228,897	$414,673	$370,678	$378,811	$386,126	$393,587

7. Replacements:						
a. Replacement Expenditures	$0	$0	$0	$0	$0	$0
b. Other	$0	$0	$0	$0	$0	$0
7T. Total Replacement Expenditures	$0	$0	$0	$0	$0	$0

8T. Total OM&R Expenditures (6T+ 7T)	$228,897	$414,673	$370,678	$378,811	$386,126	$393,587

WORKSHEET 3 - DEBT SERVICE

Five Year Projections	Last Year Actual	Current Year Budget	Year 2 Projected	Year 3 Projected	Year 4 Projected	Year 5 Projected
9. Debt Service						
a. Capital Lease Payments						
(name, number, or description for each)						
b. Loan Principal Repayments						
1. DWSRF Loan #078 - Well Project	$83,133	$85,182	$87,283	$89,435	$91,640	$93,900
2. Proposed Well Rehab (DWSRF Loan)						$4,405
3. Proposed Tank (DWSRF Loan)						$41,889
4. Proposed Tank Mixer (DWSRF Loan)						$4,658
5. Proposed SCADA Upgrade (DWSRF Loan)						$1,506
6. Proposed Metering (DWSRF Loan)						$14,962
7. Proposed Transmission Replacements (DWSRF Loan)						
8. Proposed Distribution Improvements (DWSRF Loan)						
c. Loan Interest Payments						
1. DWSRF Loan #078 - Well Project	$25,544	$23,495	$21,394	$19,242	$17,037	$14,777
d. Transfers Out						
9T. Total Debt Service/Transfers Out	$108,677	$108,677	$108,677	$108,677	$108,677	$176,097

WORKSHEET 4 - CAPITAL IMPROVEMENTS

Five Year Projections	Last Year Actual	Current Year Budget	Year 2 Projected	Year 3 Projected	Year 4 Projected	Year 5 Projected
10. Capital Improvements (briefly describe each project)						
(project description)						
1. Proposed Well Rehab (DWSRF Loan)	$0	$0	$208,068	$0	$0	$0
2. Proposed Tank (DWSRF Loan)			$1,962,819			
3. Proposed Tank Mixer (DWSRF Loan)			$72,622			
4. Proposed SCADA Upgrade (DWSRF Loan)			$23,481			
5. Proposed Metering (DWSRF Loan)			$233,252			
6. Proposed Transmission Replacements (DWSRF Loan)			$2,085,725			
7. Proposed Distribution Improvements (DWSRF Loan)						$6,129,449
10T. Total Capital Improvements	$0	$0	$4,585,967	$0	$0	$6,129,449

WORKSHEET 5 - DEPOSITS TO RESERVES

Five Year Projections	Last Year Actual	Current Year Budget	Year 2 Projected	Year 3 Projected	Year 4 Projected	Year 5 Projected
11. Deposits to Reserves:						
a. Debt Service Reserve						
b. Bond Retirement Reserve						
c. Capital Improvement Reserve						
d. Replacement Reserve	$0	$0	$50,000	$60,000	$70,000	$80,000
e. Other (Emergency Fund)	$0	$0	$15,000	$20,000	$25,000	$30,000
11T. Total Deposits to Reserves (11a thru 11e)	$0	$0	$65,000	$80,000	$95,000	$110,000

L. 2019 Saratoga Specific Purpose Tax Projects

Town of Saratoga
2019 Specific Purpose Tax Projects
Final Project List
November 29, 2018

	General Title	ID	Project Name	Description	Total Budgetary Project Cost Estimate
WATER	Rehabilitation of Water Transmission & Distribution Mains	W1	Watermain River Crossing Rehabilitation	Rehabilitation and/or replacement of existing watermain under the North Platte River. Construction method(s) may include traditional open-cut removal and replacement or pipe-bursting if determined to be feasible. (see attached)	$ 788,990.00
		W2	Critical Watermain Rehabilitation	Rehabilitation and/or replacement of approx. 1,700 linear feet of existing cast iron and ductile iron watermain in Spring Ave. that is at high risk of catastrophic failure due to corrosion and graphitization. Construction method(s) may include traditional open-cut removal and replacement or pipe-bursting if determined to be feasible. (see attached)	$ 733,710.00
		W3	Critical Watermain Rehabilitation	Rehabilitation and/or replacement of approx. 4,380 linear feet of existing cast iron and ductile iron watermain in River St. that is at high risk of catastrophic failure due to corrosion and graphitization. Construction method(s) may include traditional open-cut removal and replacement or pipe-bursting if determined to be feasible. (see attached)	$ 1,406,850.00
	Water Source & Storage Improvements	W4	Water Storage Tank Rehabilitation	Install 120 mil polyurea spray elastomer liner system; DuraChem 580 or similar (NSF Rated), within interior of existing 1,000,000 gallon bolted steel water storage tank. Includes prep of surfaces, mobilization, and product warranty. (quote from AmTech)	$ 264,230.00
SEWER	Rehabilitation of Sewerage Collection System	S1	Sewer Main Replacement	Rehabilitation and/or replacement of approx. 2,750 linear feet of existing clay tile sewer mains in alley ways from 6th Street and 7th Street between Elm and Saratoga that are at high risk of failure due to age and deterioration. Construction method(s) may include traditional open-cut removal and replacement or pipe-bursting if determined to be feasible. (see attached)	$ 1,259,480.00
		S2	Sewer Main Replacement	Rehabilitation and/or replacement of approx. 4,185 linear feet of existing clay tile sewer mains in 6th Street from Elm to Hugus that are at high risk of failure due to age and deterioration. Construction method(s) may include traditional open-cut removal and replacement or pipe-bursting if determined to be feasible. (see attached)	$ 1,392,310.00
		S3	Sewer Main Replacement	Rehabilitation and/or replacement of approx. 1,050 linear feet of existing clay tile sewer mains in alley ways from 7th Street and 9th Street between Elm and Rochester that cannot be cleaner or accessed due to stair-step construction. Construction method will include traditional open-cut removal and replacement. (see attached)	$ 523,420.00
ROADWAYS	Street Resurfacing & Subgrade Improvements	R1	Street Replacement	The roadway in Spring Avenue from River Street to 4th Street and in 13th Street from Bridge Avenue to the town limits is badly deteriorated due to the age of the surface course as well as the poor subgrade and base course originally installed. This project will replace the complete roadway section including the subgrade, base course, and surface course. Lime treatment may also be used to stabilize the subgrade.	$ 931,810.00
		R2	Milling & Overlays	Numerous town streets are deteriorating and in poor condition due to age and heavy commercial traffic loading. This project will in several cases mill the existing asphalt and install 2"-4" of new asphalt in the following proposed locations: Rochester, Saratoga, and Main Avenues between 10th and 13th Streets; Chatterton Avenue; State Street; Walnut Street between River and 3rd Streets; and River Street between Walnut and Main Avenues.	$ 306,990.00
PARKS & RECREATION	Swimming Pool Improvements	P1	Wading Pool Rehabilitation	The wading pool is currently facing major operational issues with the circulation, filtration, and heating equipment and appurtenances. This project will replace the plumbing running to the wading pool, as well as necessary equipment and appurtenances.	$ 71,450.00
		P2	Pool Deck Resurfacing	Then the wading pool is rehabilitated, the pool deck surrounding the pool will need to be removed for construciton. This project will replace the concrete pool deck surrounding the wading pool as well as portions of the deck around the swimming pool.	$ 103,200.00
EMERGENCY SERVICES	Ambulance	E1	SCWEMS Addition	SCWEMS has proposed to build a new addition at the Saratoga ambulance barn in order to move administrative operations from their Elk Mountain location. The Town of Saratoga wishes to sponsor SCWEMS in order to obtain the necessary funding to build the addition.	$ 150,000.00
				Total Budgetary Cost Estimates for Proposed Projects	**$ 7,932,440.00**

The Town of Saratoga has identified a need and is therefore requesting $7,932,440 for the specific purpose of rehabilitating and improving portions of the water source, transmission, distribution and storage system; rehabilitating portions of the sewer collection and wastewater treatment system; rehabilitating and resurfacing streets; repairs and improvements to parks and recreation; and for facilities improvements for SCWEMS.

M. Draft Report Presentation
    a. Presentation Slides
    b. Meeting Notification
    c. Meeting Record
        i. Digital record of the public meeting is contained within the Project Notebook.

Saratoga Water Master Plan, Level I Study Draft Report Presentation

May 8, 2019

FORSGREN Associates Inc.

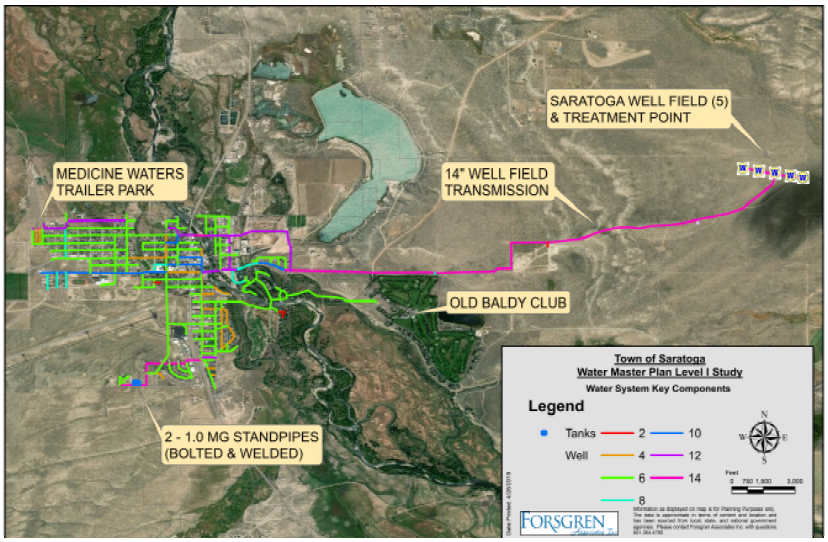
Wyoming Water Development Commission

and the Town of Saratoga, WY/CCIJPB

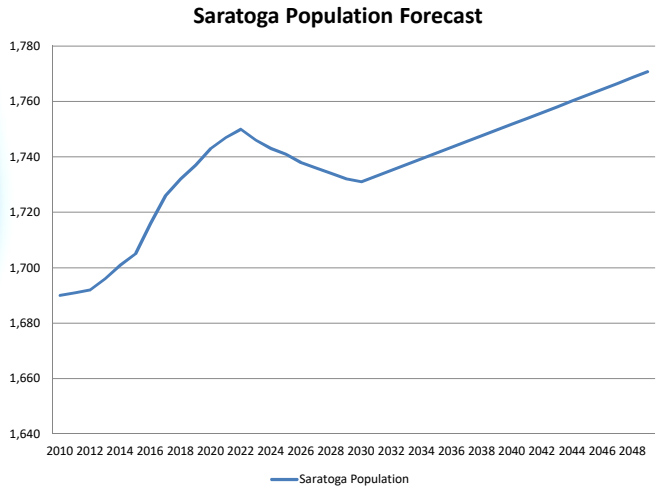
Saratoga Water Master Plan

- System Supply & Demands
- Storage
- System Assessment
- Hydraulic Modeling
- Operations

Saratoga Water System

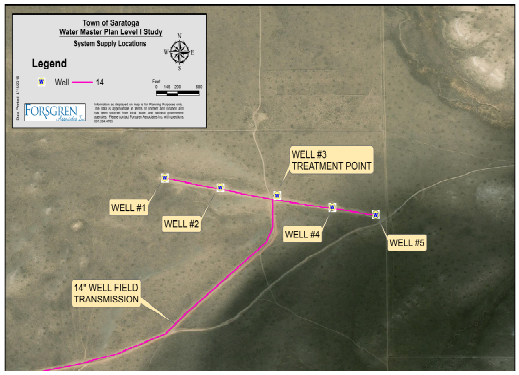


Population Forecast



Supply & Demand

Supply Locations



Current Demands

ADD (gpd)	MDD (gpd)	PHD (gpd)
462,031	1,196,955	2,310,154

Future Demands

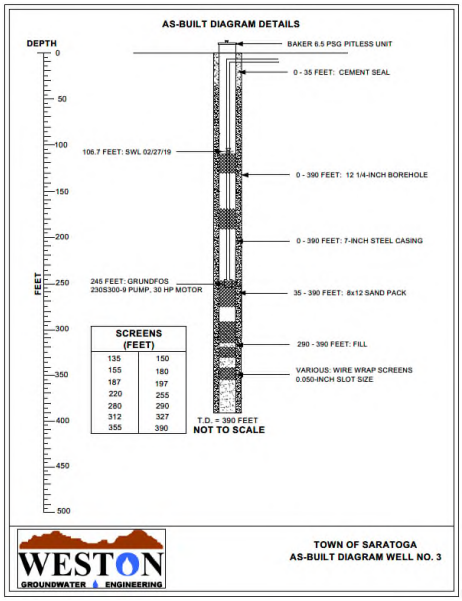
ADD (gpd)	MDD (gpd)	PHD (gpd)
477,692	1,237,527	2,388,458

Water Rights & Well Capacity

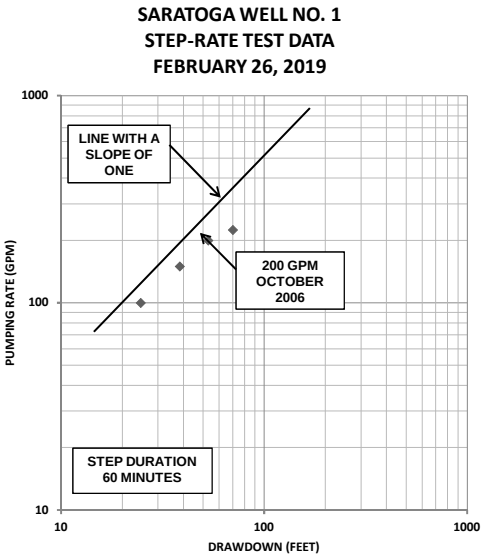
SEO Permit Number	Priority Date	Source	Permitted Instantaneous Production Rate (GPM)	Available Flow
U.W. 183913	7/24/2007	Saratoga No. 1	200	135*
U.W. 183914	7/24/2007	Saratoga No. 2	200	135
U.W. 183915	7/24/2007	Saratoga No. 3	150	145*
U.W. 183916	7/24/2007	Saratoga No. 4	200	155*
U.W. 183916	7/24/2007	Saratoga No. 5	175	125*
		Total	925	695

*Pumping Rate with uppermost screens dewatered

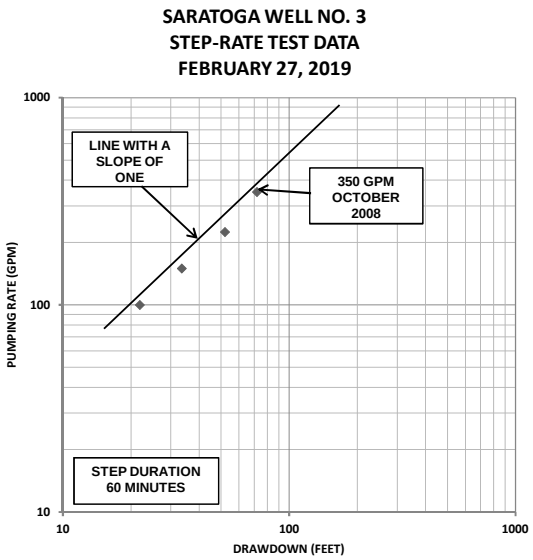
Well #3 As-Built



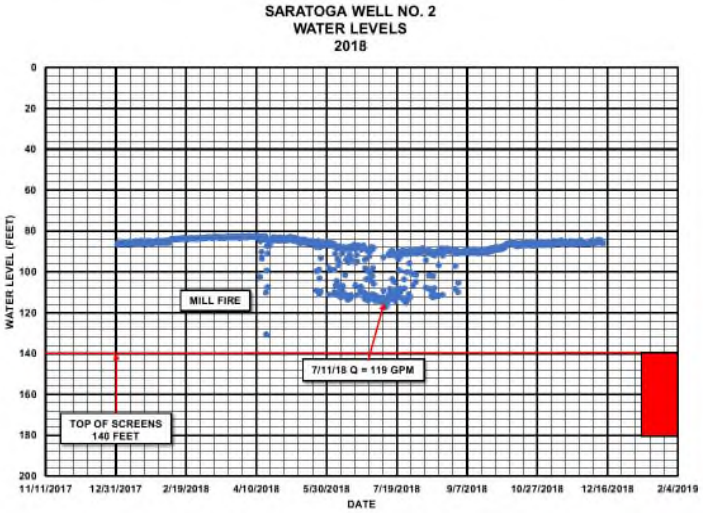
Well #1 Step-Rate (2019) – cont.



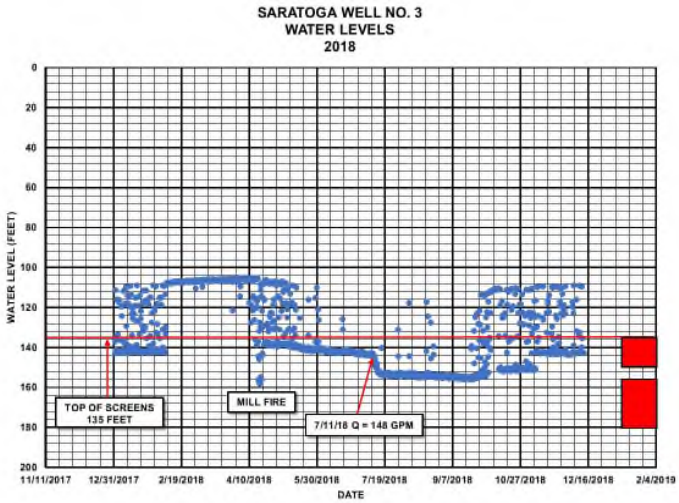
Well #3 Step-Rate (2019) – cont.



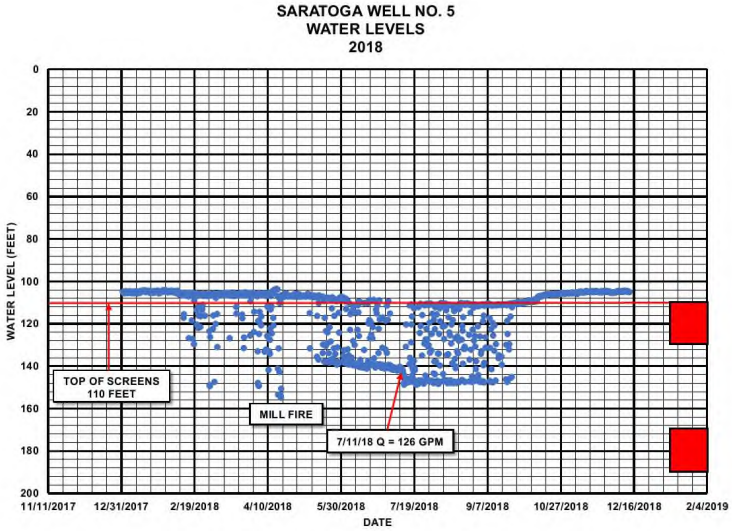
Well #2 - Water Level



Well #3 - Water Level



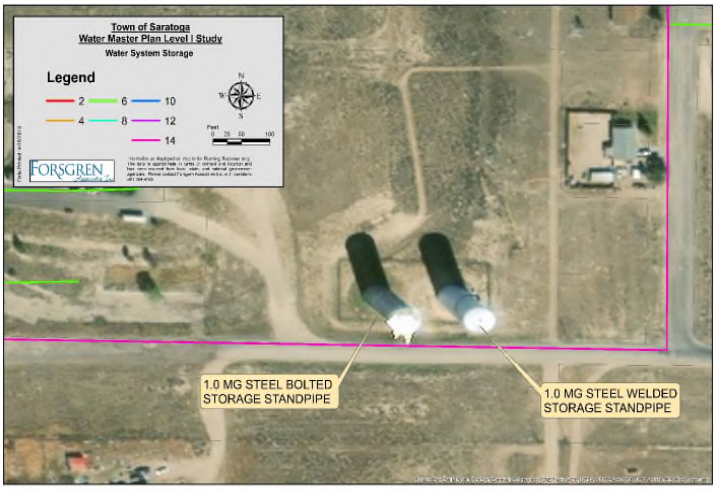
Well #5 - Water Level



Well #3 – Pump Column (2019)

1. Scale on Pump Column Pipe below 112 feet.
2. Corrosion of Pipe Seam and Tubercles at approx. 155 feet.
3. Corrosion of Pipe Seam below 175 feet.

Storage



Storage Requirements

Town Required Storage	MG
1,000 GPM (2HR) Fire Storage	0.120
Future ADD	0.478
Total Required Town	0.598

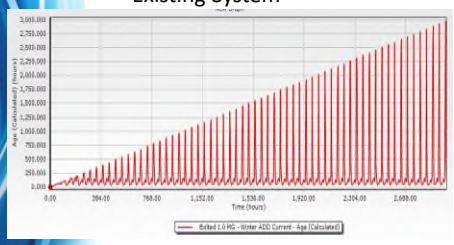
Existing Storage – Town	MG
Welded Standpipe - Effective	0.600
Bolted Standpipe - Effective	0.600
Total Volume (MG)	1.200
Total Required Town	0.598
Surplus Volume	0.602

Bolted Tank (est. 2002)

- Rough Start
- Leaking
- Could Replace Panels & Seal
- Need?
- Redundancy
- Location, Location, Location

Storage – Water Age

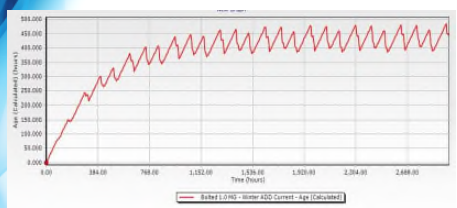
- Existing System



3,000 hrs +

- Continually Increasing
- Low Turnover
- Stagnation

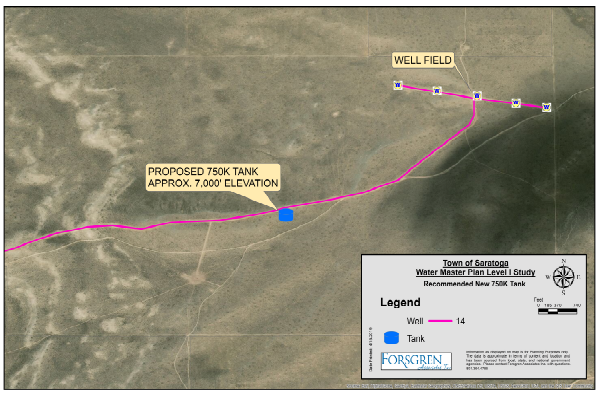
- System Recommendations



425 hrs

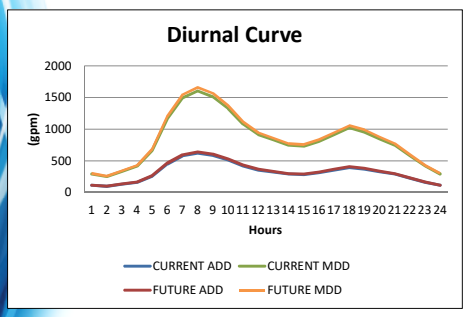
- Decommission Bolted Tank
- Level Controls
- Tank Mixer
- Weekly Flush (2hrs @ 1,000gpm)

Storage – New Tank

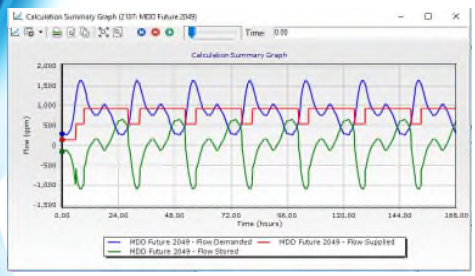


- Redundancy
- Higher Effective Capacity (710K)
- Lower Water Age (75 hrs)

System Modeling

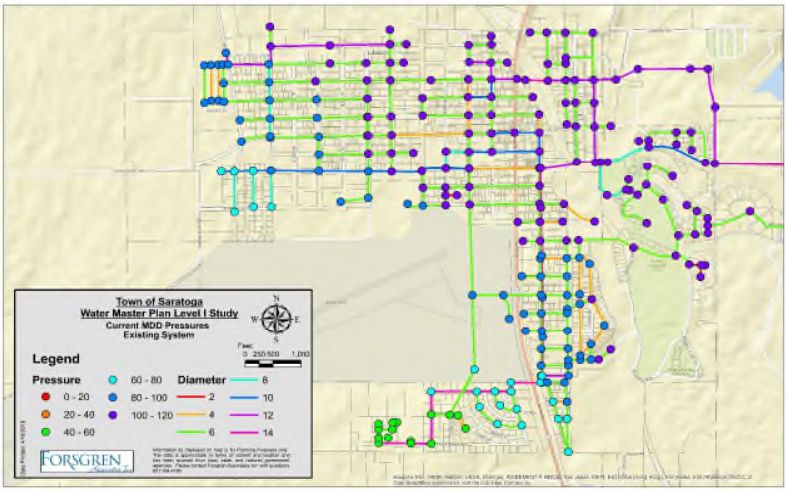


- ADD, MDD, PHD
- Existing System
- Recommendations
- EPS
- Water Age



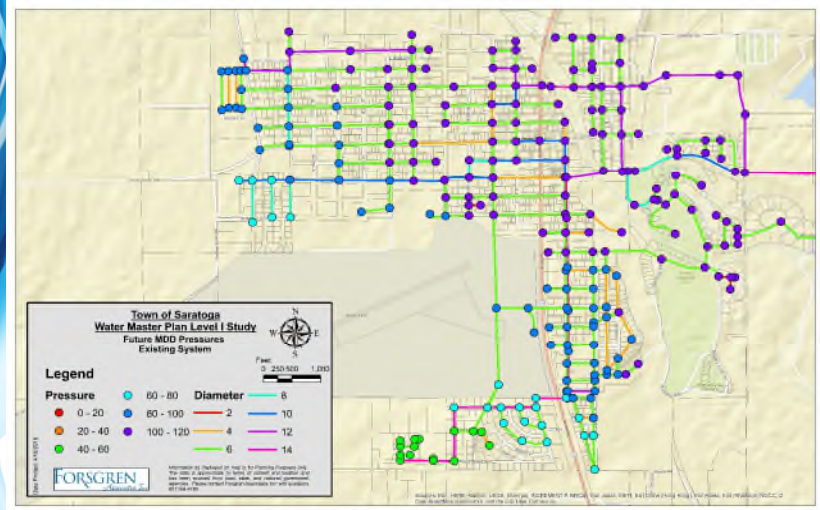
System Modeling cont..

Existing System Pressures

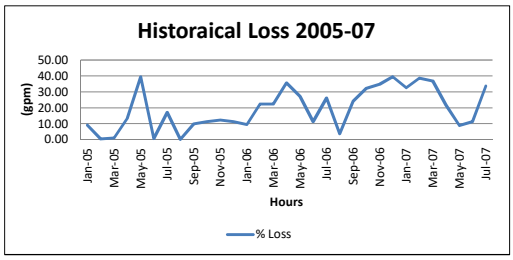


System Modeling cont..

Future System Pressures



Production vs. Metered



Year	Production	Metered Water	Estimated Non Metered	Total Accountable Water	Loss (Gallons)	Loss (%)	Accountable (%)
2016	165,096,475	132,528,000	3,500,000	136,028,000	29,068,475	17.61	82.39
2017	160,555,088	105,257,000	3,500,000	108,757,000	51,798,088	32.26	67.74
2018	151,481,818	107,257,000	3,500,000	110,757,000	40,724,818	26.88	73.12
Averages	159,044,460	115,014,000	3,500,000	118,514,000	40,530,460	25.58	74.42

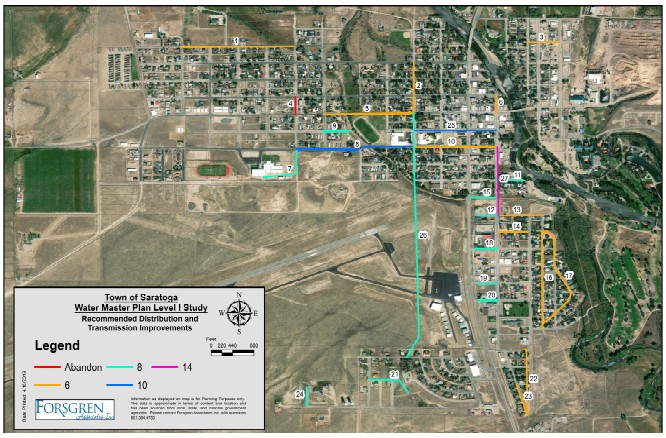
Production vs. Metered cont..

Water Loss Mitigation/Program

- Data Collection/Storage System of Identified Leaks & Causes
- Annual Meter Calibration
- Implement Accountability of non-metered connections
- Distribution System Replacement
- Testing
- Remedy Guidelines
- Etc.

Increase in Production
=
Loss In Revenue

Transmission & Distribution



- Operator Interviews
- Record Drawings
- DEQ Regulations
- Modeling
- Fire Hydrants
- Metering

Recommendations & Priorities

- Recommended Improvements

Priority	Description	Notes
1	Well Field Rehabilitation (7.1.12)	Rehabilitation of the Wells could significantly increase the capacity of the wells and result in more shallow pumping water levels, increased production capacity and less dewatering of well screens.
2	Decommission Bolted Steel 1.0 MG Standpipe and Install New 750K Tank along Transmission Line (7.1.1)	Bolted Steel Tank has leaking deficiencies. As noted above, the location of the existing tanks is less than desirable. By installing a new tank along the transmission line, the Town retains its redundancy with storage while also providing redundancy by having storage on both sides of the river.
3	Tank Mixers (7.1.2)	A tank mixer will help with the stagnation in the Town's Storage Tanks as well as stabilize overall water age.
4	System Flushing (7.1.3)	A 120,000 gallon weekly flush (2.0 hrs @ 1,000 gpm) will reduce the Town's water age in the Tanks.
5	SCADA Upgrades (7.1.5)	Upgrades/Updates the Town's SCADA System will provide better operational control of the system and a more useable control for the system.
6	Tank Operational Controls (7.1.4)	Allowing for a wider range of operational controls on the system's storage and pumping will allow for better control of water age.
7	Water Loss Program (7.1.10)	The Implementation of a water loss program will allow the Town to better understand loss in the system, maintain more accurate records and develop priorities for system replacement/repair.
8	Transmission Line Improvements (7.1.7)	Updating existing transmission lines will provide the Town with a more reliable conveyance of system delivery.
9	Distribution Line Improvements (7.1.6)	Updating existing distribution lines will provide the Town with a more reliable conveyance of system delivery, address the issues of an aging system, reduce water loss, etc.
10	Additional Metering (7.1.11)	The installation of additional metering, specifically at locations in which the system is unmetered (parks, municipal buildings, etc.), will allow for a better accounting of water use in the system.

Recommendations & Priorities

- Estimated Project Costs

Item No.	Description	Estimated Cost (inclusive of engineering and contingency)
1	Well Field Rehabilitation	$208,068.40
2	Decommission Bolted Steel 1.0 MG Standpipe and Install New 750K Tank along Transmission Line	$1,962,819.35
3	Tank Mixers	$72,621.71
4	SCADA Upgrades	$23,481.28
5	Transmission Line Improvements (WTP & Airport)	$2,085,724.56
6	Distribution Line Improvements	$6,129,448.87
7	Additional Metering	$233,252.42

- Estimated Operational Costs

Item No.	Description	Estimated Annual Operational Cost
1	Weekly Flush (120,000gal)	$13,728

Rate Impacts & Financial Capacity

- Project Rate Impact (WWDC Grant – Eligible & DWSRF Loan Non-Eligible)

Item #	Description	Estimated Project Cost	ASSUMED FUNDING SOURCE			Monthly Cost per Ratepayer (Based on 990 current users)
			WWDC Grant (67% new Eligible construction)	SRF Loan (2.5%, 20-year)	Annual Payment	
1	Well Field Rehabilitation	$208,068	$139,406	$68,406	$4,405	$0.37
2	Decommission Bolted Steel 1.0 MG Standpipe and Install New 750K Tank along Transmission Line	$1,962,819	$1,309,800	$653,019	$41,889	$3.53
3	Tank Mixers	$72,622	$0	$72,622	$4,658	$0.39
4	SCADA Upgrades	$23,481	$0	$23,481	$1,506	$0.13
5	Transmission Line Improvements (WTP & Airport)	$2,085,725	$1,397,435	$688,289	$44,152	$3.72
6	Distribution Line Improvements	$6,129,449	$0	$6,129,449	$393,169	$33.09
7	Additional Metering	$233,252	$0	$233,252	$14,962	$1.26
Monthly Cost per Ratepayer					Total	$42.49

Rate Impacts & Financial Capacity

- Expenditures vs. Revenues (2016-2018)

	Actual	Budget
Expenditures	$364,482.38	$538,053.33
Revenues	$511,446.98	$598,600.00
Gross Revenue	$146,964.60	$60,546.67

- Budget Recommendations

Project Funding

- WWDC (67% Grant & 33% Loan on Eligible Components)
- USDA Rural Development (RUS)
- State Revolving Fund (DWSRF)
- State Mineral Royalty Grants (MRG)
- Abandoned Mine Land (AML)
- Wyoming Business Council (CDBG)

"Ability to Pay" – Financial Planning

Questions?

Ryan Welling

From: Suzie <suzie@saratogawyo.org>
Sent: Wednesday, April 24, 2019 2:31 PM
To: Ryan Welling
Cc: 'Jon Winter'
Subject: FW:

This is the ad that went to the paper

Sincerely,

Suzie

Suzie Cox, Clerk
Town of Saratoga
PO Box 486
Saratoga, WY **82331**
307-326-8335
fax: 307-326-8941
suzie@saratogawyo.org
www.saratoga.govoffice2.com

"The highest courage is to be yourself in the face of adversity.
Choosing right over wrong, ethics over convenience, and truth over popularity...These are the choices that measure your life.
Travel the Path of Integrity without looking back, for there is never a wrong time to do the right thing."

From: Amanda Shepherd [mailto:sunnews@union-tel.com]
Sent: Wednesday, April 24, 2019 11:54 AM
To: Suzie
Subject: Re:

Hi Suzie,

Attached is the CCIJPB ad proof.
It is a 2x2, cost $34 and will run 5/1.
Let me know if you have any changes.

The Carbon County Impact Joint Powers Board

will hold a **Special Meeting**, prior to its regularly scheduled meeting, on **Wednesday May 8th at 5 pm** to discuss the **Draft Report of the Saratoga Water Master Plan Level I Study**.

The meeting will be held at the Saratoga Town Hall 110 E. Spring Avenue.

All residents and users of the Saratoga Water System are invited to attend.

Amanda Shepherd
Sales/Graphics
Saratoga Sun
sunnews@union-tel.com
307-326-8311

On Apr 24, 2019, at 7:49 AM, Suzie <suzie@saratogawyo.org> wrote:

Amanda
Please place the following in the paper on May 1st

The Carbon County Impact Joint Powers Board will hold a Special Meeting,
prior to its regularly scheduled meeting, on Wednesday May 8th at 5 o'clock PM
to discuss the Draft Report of the Saratoga Water Master Plan Level I Study.
The meeting will be held at the Saratoga Town Hall 110 E. Spring Avenue.
All residents and users of the Saratoga Water System are invited to attend.

Thank you Amanda

Sincerely,

Suzie

Suzie Cox, Clerk
Town of Saratoga
PO Box 486
Saratoga, WY **82331**
307-326-8335
fax: 307-326-8941
suzie@saratogawyo.org
www.saratoga.govoffice2.com
<image003.jpg>
"The highest courage is to be yourself in the face of adversity.
Choosing right over wrong, ethics over convenience, and truth over popularity…These are the choices that measure your life.
Travel the Path of Integrity without looking back, for there is never a wrong time to do the right thing."