



SECONDARY WATER QUALITY TREATMENT SYSTEM REQUEST

Spring Shores Well #2 Treatment

NC 01-49-138

WSF ID No: P02

AQUA NORTH CAROLINA

EXECUTIVE SUMMARY

The Spring Shores Master Water System is comprised of 2 approved and active wells, #1&2, and 2 single points of entry, P01 and P02 (POE). **The Mn concentrations from well #2 are consistently more than 0.3 mg/L (see Table 4 below) which makes it one of Aqua's Group 1 Priority Secondary Water Quality Projects as per the Water Quality Plan.** The Fe and Mn concentrations at Well #1 are below the sMCLs. Aqua proposes installing an Iron and Manganese removal system at Spring Shores Well #2 in order to provide a treated second source of supply since the number of active connections has surpassed 49. Based on studies performed by AWWA and other organizations, elevated concentrations of Mn are being linked to cause adverse health effects and there is a current EPA health advisory on Mn. Preliminary engineering studies indicate that an Fe/Mn treatment system is the most effective and permanent solution since it physically removes the contaminants.

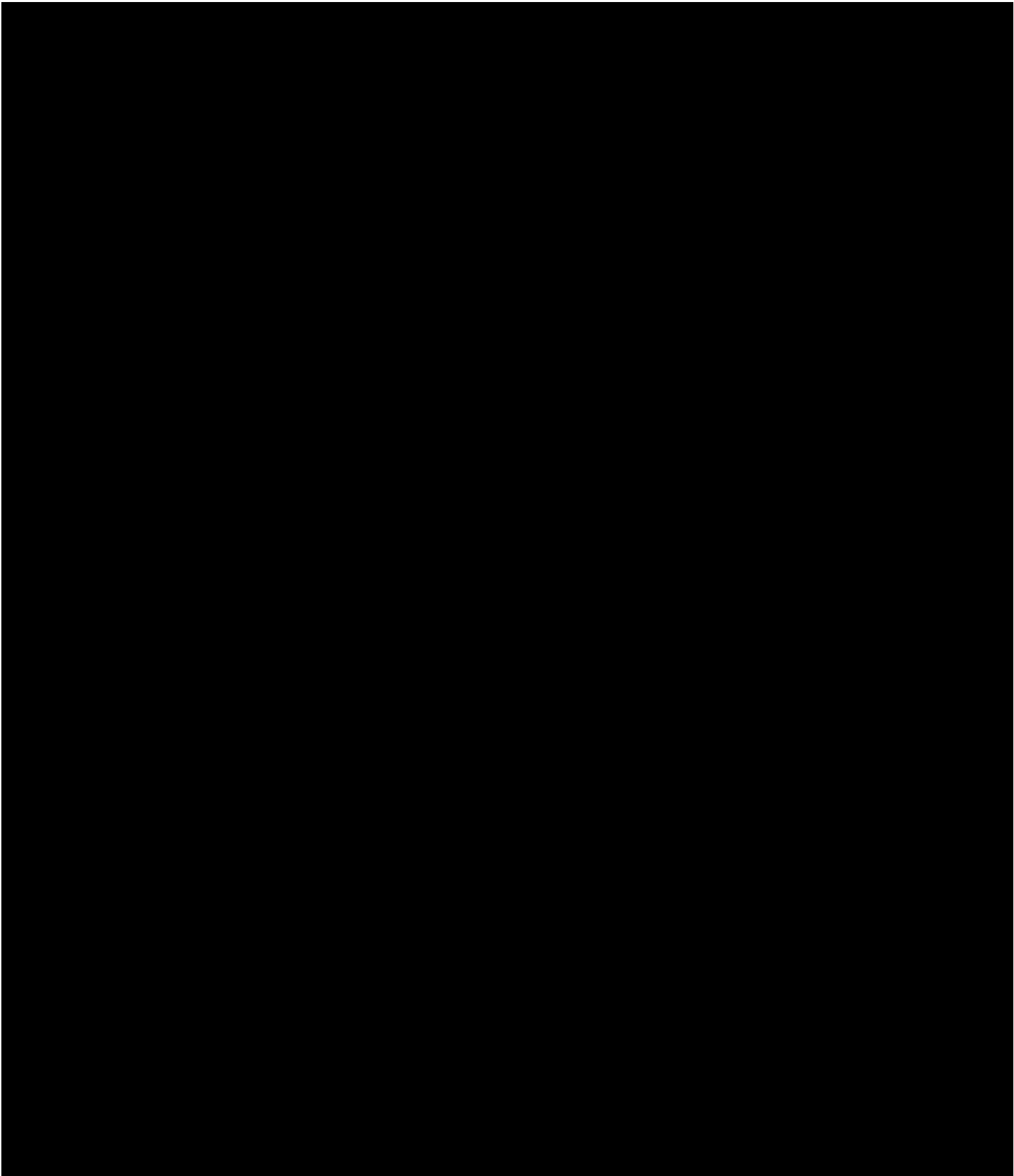
A. PROPOSED SYSTEM REQUIRING TREATMENT

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| 1. System Name: | <u>Spring Shores Well #2</u> |
| 2. PWS ID: | <u>NC 01-49-138</u> |
| 3. No. Total Active Residential Water Connections: | <u>50</u> |
| 4. No. Total Connections at Build Out: | <u>140</u> |
| 5. List of DEH/PWSS Approved Wells and Storage | |

TABLE 1: Approved and Active Wells in Proposed System**

Well Name and No.	Capacity (GPM)				Max, Avg., Min Pump Runtime from Past 12 Months (hrs./day)	Latest POE Inorganic Sampling Results						
	App.	Max, Avg., Min from Past 12 Months				Fe (mg/L)*	Mn (mg/L)	Fe/Mn Loading Rate (lbs./day)	Fe/Mn Loading Rate (lbs./yr.)	Average Fe/Mn Loading Rate Per Residential Customer (lbs./yr.)		
Spring Shores Well #1***	25	48	30	15	3	0.2	0.02	ND	ND	---	---	---
Spring Shores Well #2	50	38	31	8	24	7	3	0.506	0.410	0.1	37	0.3

*Raw samples are taken directly at the wellhead before chemical treatment and point of entry (POE) samples are taken after chemical injection and treatment but before the tank and distribution system.



**Interconnection with the Highlands @Lake Norman/Heronwood/Windemere water system is not cost effective because the systems are over 1 mile apart and the capital cost for interconnection would be comparable to installing filtration at Well #2.

TABLE 2: Existing Storage at Well Sites

Well Name and No.	Storage Description		Most Recent Cleaning Date	
	Type	Gallons	Tank	Dist. System
Spring Shores Well #1	Bladder Tank	500	Never	9/12/19
Spring Shores Well #2	Hydro Tank	5,400	Never	9/12/19

6. Past Three (3) Years Flushing Occurrences, list month/year:

Response: 9/12/19, 5/22/19, 5/23/18, 1/24/18, 9/20/17, 6/28/17, 2/15/17

7. Next Planned Distribution System Flushing Occurrence

Response: This water system will be flushed again in November 2019 and on an ongoing quarterly basis. Disclaimer: Flushing does not completely remove the mineral accumulation on distribution lines when utilizing water with exceptionally high levels of iron and manganese in the source.

8. List of chemicals being used:

TABLE 3: Existing Chemicals Used at Well Site

Well Name and No.	Chemical Description		
	Cl ₂	NaOH	Polyphosphate
Spring Shores Well #1	X	N/A	X
Spring Shores Well #2	X	N/A	X

9. Current description of the water treatment system for each well over the past three (3) years, including specific names of chemicals and dates of changes:

Response: Wells #1&2 are being treated with sodium hypochlorite and a polyphosphate. The system utilizes a polyphosphate to sequester the Fe and Mn and clean the distribution lines, as well as to prevent further mineral accumulation on the pipe walls. Wells #1 and #2 both have radium removal systems in the existing well houses that were installed in Jan. 2009 and Sept. 2014, respectively. Well #2 also has a cartridge filter that was installed in 2016.

10. Planned changes (if any) for chemical treatment within the next six (6) months:

Response: None.

11. Comments on Approved/Current Well Capacity.

Response: None.

B. CURRENT SECONDARY WATER QUALITY CONCERNS

1. How many wells require treatment? _____ 1*

*Well #2 has a sMCL violation for both Fe and Mn and it must be treated. The Mn concentrations are consistently above 0.3 mg/L. There are no other replacement wells available, or other feasible water supplies that can be utilized. Well #1 is below the sMCL for Fe/Mn and does not need to be treated.

2. Can system operate with single well offline? _____ Yes*

*The system can and does operate mainly on Well #2. The system demand cannot be met by well #1 alone (25 GPM/50 connections = 0.5 GPM/connection < the required minimum flow of 0.555 GPM/connection). Well #2 is required to meet system demand and the system is mainly supplied by this well (50 GPM / 50 connections = 1 GPM/connection) but requires treatment for high iron and manganese (see Table 4 below). As per State regulations, over 49 active connections require a second source of supply, requiring treatment at Well #2.

3. Are combined Fe/Mn concentrations above 1 mg/L? _____ No*

*The latest combined POE concentration at Well #2 is 0.92 mg/L (Fe+Mn), but the latest manganese result is 0.410 mg/L Mn.

4. Date of most recent POE Fe/Mn sampling results at Well #2: 3/25/2019

TABLE 4: Historical Fe/Mn Results

Spring Shores Well #1 POE Lab Results						
Date	Iron (Fe), mg/L			Manganese (Mn), mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
10/26/12	1.00	-	-	0.170	-	-
1/23/2013 (Raw)	0.515	0.220	0.295	0.012	0.012	ND
6/10/2014 (Raw)	1.70	1.03	0.67	0.148	0.146	0.002
10/12/2015	-	-	-	0.16	-	-
10/12/2017*	3.31	0.803	2.507	0.129	0.126	0.003
Well cleaning with SeaQuest and Chlorine						

10/19/2017*	0.946	0.217	0.729	0.163	0.144	0.019
11/27/2017	0.384	0.302	0.082	0.117	0.114	0.003
12/18/2017	0.288	0.0271	0.2609	0.113	0.106	0.007
1/16/2018	0.0247	-	-	0.00712	-	-
2/5/2018	ND	-	-	ND	-	-
3/20/2018	ND	-	-	0.00189	0.00162	-
4/17/2018	0.0244	ND	0.0244	0.00138	0.00132	0.0001
5/14/2018	ND	-	-	0.00174	ND	0.00174
6/18/2018	0.0238	ND	0.0238	0.00200	0.00188	0.0001
7/19/2018	ND	-	-	0.00227	0.00221	0.0001
8/16/2018	0.0298	ND	0.0298	0.00312	0.00296	0.0002
11/1/2018	ND	-	-	ND	-	-
Spring Shores Well #2 POE Lab Results						
Date	Iron (Fe), mg/L			Manganese (Mn), mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
10/23/2012	0.5	-	-	0.414	-	-
1/23/2013	0.560	0.192	0.368	0.451	0.420	0.031
10/12/2015	0.086	-	-	0.42	-	-
5/7/2018	0.206	-	-	0.421	-	-
11/1/2018	0.534	-	-	0.414	-	-
3/25/2019	0.506	ND	0.506	0.410	0.385	0.025

- Describe previous actions to improve secondary water quality and describe results (i.e.; installation of particulate filters and sequestering agents).

Response: There is a cartridge filter at Well #2 that was installed in 2016. In Oct. 2017, Well #1 was cleaned with SeaQuest and Chlorine treatments. The Fe decreased significantly but the Mn remained the same. Well #2 underwent a similar treatment in March 2019 with no significant reduction in Fe and Mn concentrations. Both wells are being treated with sodium hypochlorite and polyphosphate. The intent of the sequestering agent is to physically chelate or hold Fe and Mn in a soluble state, ideally decreasing the insoluble concentration and resolving water discoloration issues. Because Fe usually reaches the surface in mostly an insoluble state, it is very challenging to convert insoluble Fe back into a soluble state unless the chemical dose of the sequestering agent is increased heavily. Also, sufficiently long contact time is a necessary criterion to make this happen. Because sequestering does not physically remove Mn, Aqua is concerned that its efforts to reduce total Mn will not be effective without adding a Fe/Mn treatment system or equivalent treatment system such as those using solid phase Manganese Dioxide.

C. UTILITY COMMISSION REQUIRED INFORMATION

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| 1. Well Location Map | <u>Embedded in Executive Summary</u> |
| 2. DEH/PWS Approval Letter | <u>Attached</u> |
| 3. Original 24 hr. Pump Status Report | <u>Attached</u> |
| 4. Past 36 months of pump status reports | <u>Attached</u> |
| 5. Inorganic Analysis Report submitted to DEH for well approval | <u>Attached</u> |
| 6. Past 6 yrs. inorganic analysis from each wellhead | <u>Attached</u> |
| 7. Past 3 yrs. Fe/Mn analyses, both soluble and insoluble. | <u>See Table 4 Above</u> |

Note: For item (6) above, provide information on baseline (w/o treatment – raw samples taken at the well head) and point of entry (after treatment).

D. CUSTOMER COMPLAINT DATA

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| 1. Total number of customer complaints in past 6 months | <u>3</u> |
| 2. Total number of customer complaints in past 12 months | <u>3</u> |
| 3. For past 6 months, do customer secondary water complaints exceed 10% of the number of active customers? | <u>No</u> |
| 4. Provide 12-month list of all water quality complaints | <u>N/A</u> |
| 5. Provide 12-month list of all completed water quality work orders | <u>N/A</u> |
| 6. Describe most common customer complaint over the past 12-month period relating to secondary water quality, i.e.; discolored water, taste, or odor. | |

Response: Brown and yellow water complaints.

E. PROPOSED SECONDARY WATER QUALITY TREATMENT

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| 1. Proposed treatment recommendation: | <u>AdEdge Fe/Mn Filter System</u> |
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2. Proposed System Capitol Cost Estimate:

ENGINEERING COST ESTIMATE					
Spring Shores Well #2					
TASK	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
1	AdEdge Filtration Unit	1	LS	\$ 80,000.00	\$ 80,000.00
2	Sales Tax (6.75% combined sales tax for Iredell County, NC)	1	EACH	\$ 5,400.00	\$ 5,400.00
3	Freight (based on shipping costs of similar size filters)	1	EACH	\$ 5,000.00	\$ 5,000.00
4	Engineering Design, Permitting, Bidding, & CA/CO (based on design costs of similar size filters)	1	EACH	\$ 30,000.00	\$ 30,000.00
Construction					
5	Bonding, Mobilization and Demobilization	1	EACH	\$ 5,000.00	\$ 5,000.00
6	Site Clearing, Grubbing, Grading, and Gravel	1	EACH	\$ 15,000.00	\$ 15,000.00
7	Filter Equipment Installation-Including but not limited to all water piping, water treatment filter installation, and necessary appurtenances, within the existing filter building. Also includes all extension piping near filter building	1	EACH	\$ 20,000.00	\$ 20,000.00
8	Filter Building Construction-Including but not limited to concrete floor slab, well house erection, finishing, and necessary appurtenances	1	EACH	\$ 30,000.00	\$ 30,000.00
9	Yard Piping-Including but not limited to all underground pipe, fittings, and valves	1	EACH	\$ 15,000.00	\$ 15,000.00
10	Electrical/Controls-Including but not limited to all electrical power and controls wiring, conduit, panels, fixtures, electric heaters, thermostats, junction boxes, control equipment not provide by filter manufacturer, and miscellaneous appurtenances	1	EACH	\$ 20,000.00	\$ 20,000.00
11	Erosion and Sedimentation Control	1	EACH	\$ 5,000.00	\$ 5,000.00
12	Aqua Direct Cost @	5%			\$ 11,520.00
13	Contingencies @	5%			\$ 12,096.00
TOTAL CAPITAL COSTS:					\$ 254,016.00
14	AFUDC @	7%			\$ 17,781.12
TOTAL ESTIMATED PROJECT COSTS:					\$ 272,000

Note: The above information is for planning purposes only and is subject to change based on further engineering evaluations, water quality analyses, site conditions, and other site-specific discoveries and information

3. Comments:

The latest Mn concentration at Well #2 is greater than 0.3 mg/L, making this one of Aqua's Group 1 Priority Secondary Water Quality Projects as per the Water Quality Plan. As part of the filtration design process, a new 24-hour drawdown test will be performed on Well #2 to verify the originally approved capacity of 50 GPM. Aqua will be able to supply these results to the Public Staff upon request.

For these reasons, Aqua proposes installing an Iron and Manganese filter system at Spring Shores Well #2 in order to provide a treated second source of supply since the number of active connections has surpassed 49 and Mn concentrations are consistently above 0.3 mg/L.