



SECONDARY WATER QUALITY TREATMENT SYSTEM REQUEST

Carden's Creek Wells #1&2

NC 03-32-126

WSF ID No: P01 and P02

AQUA NORTH CAROLINA, INC.

A. EXECUTIVE SUMMARY

The Carden's Creek (CC) Master Water System is comprised of 2 approved and active wells, Carden's Creek #1 and #2, and two points of entry (POE), P01 and P02. **The latest Mn concentration from Carden's Creek Well #2 is 0.401 mg/L which makes it one of Aqua's Group 1 Priority Secondary Water Quality Projects as per the Water Quality Plan.** Carden's Creek Well #2 is a Group 2 Priority Secondary Water Quality Project, but its Fe/Mn loading rate to the system's 72 customers is close to the loading from Well #1 as seen in Table (1) below. Loading rates are normalized based on a 12-hour per day well runtime.

Aqua proposes Option (1) running a 2" raw water supply main from Well #2 to Well #1 and installing a combined oxidation-filtration system at Carden's Creek Well #1 in order to remove Fe/Mn below the sMCLs for both wells. At the max well #2 production of 42 GPM over the past 12 months, the velocity in the raw water main will be 4.3 feet per second, high enough to scour the main and prevent mineral accumulation over time. Aqua plans to chlorinate the combined flow at well #1 before entering the filtration system. Two clean sources of supply are required since the connections are over 49.

Option (2) entails filtering both wells separately with no interconnection.

Capex estimates for both options are given below in Section D.2.

PROPOSED SYSTEM REQUIRING TREATMENT

1. System Name: Carden's Creek Well #1&2
2. PWS ID: NC 03-32-126
3. No. Total Active Residential Water Connections: 72
4. No. Total Connections Permitted Residential Connections: 72
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				
	APPC**	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.)

Well #1	33	54	38	28	7	4	1	0.342	0.211	0.1	46	0.6
Well #2***	23	42	35	27	9	3	0.3	0.267	0.401	0.1	51	0.7

*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

**APPC = Approved Pumping Capacity

***Well #2 currently runs in operational lag mode and is only used in periods of peak demand

****Loading calculations based on 12-hour per day well runtime

TABLE 2: Existing Storage at Well Sites

Well Name and No.	Storage Description		Most Recent Cleaning Date
	Type	Gallons	Dist. System
Carden's Creek Well #1	Hydro	5,000	March 2020
Carden's Creek Well #2	Hydro	5,000	March 2020

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

Response: February 2017, April 2018, March 2020

7. Next Planned Distribution System Flushing Occurrence:

Response: This water system will be flushed again by Dec. 2021 and on an ongoing annual basis. Disclaimer: Flushing does not completely remove the mineral accumulation in the distribution mains when utilizing water with exceptionally high levels of iron and manganese in the source water.

8. List of chemicals being used:

TABLE 3: Existing Chemicals Used at Well Site

Well Name and No.	State Approved Treatment			
	Disinfectant	Caustic	Sequestrant	Fe/Mn Filter
Well #1	X	X	X	N/A
Well #2	X	N/A	X	N/A

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: Harmsco cartridge filter installed at P01 in May 2018 and installed at P02 in May 2018. Started feeding Seaquest at P01 in October 2015.

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

Response: None.

11. Comments on Approved/Current Well Capacity.

Response: There has been no significant deviation of the average well production from the APPC for both wells.

B. CURRENT SECONDARY WATER QUALITY CONCERNS

1. How many wells require treatment? 2
2. Can system operate with single well offline? No*

*Per attached capacity calculations, the system requires the permitted production from both wells to meet the State min design standard of 0.555 GPM/connection.

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

*The latest POE Mn concentration from P02 is over 0.3 mg/L (0.401 mg/L)

4. Date of most recent POE Fe/Mn sampling results 2/10/2021

TABLE 4: Past 3 Years Fe/Mn Analysis

Carden's Creek Well #1 Laboratory Analysis at POE						
Date	Iron (Fe), mg/L			Manganese (Mn), mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
8/20/2020	0.342	< 0.022	0.342	0.219	0.211	0.008
8/5/2020	0.3	< 0.022	0.3	0.163	0.16	0.003
3/4/2020	0.613	< 0.022	0.613	0.207	0.109	0.098
1/15/2020	0.149	-	-	0.129	-	-
Carden's Creek Well #2 Laboratory Analysis at POE						
Date	Iron (Fe), mg/L			Manganese (Mn), mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
2/10/2021	0.267	-	-	0.401	-	-
10/6/2020	0.258	< 0.022	0.258	0.513	0.508	0.005

8/20/2020	0.25	< 0.022	0.25	0.435	0.431	0.004
8/5/2020	0.504	< 0.022	0.504	0.423	0.418	0.005
3/4/2020	0.326	< 0.022	0.326	0.414	0.404	0.01
1/15/2020	0.152	-	-	0.423	-	-

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

Response: Aqua flushes the water mains annually in this system. Harmsco cartridge filter installed at P01 in May 2018 and installed at P02 in May 2018. Started feeding Seaquest at P01 in October 2015.

UTILITY COMMISSION REQUIRED INFORMATION

- Well Location Map Attached
- DEH/PWS Approval Letter Attached
- Original 24 hr. Pump Status Report Attached
- Past 36 months of pump status reports Attached
- Inorganic Analysis Report submitted to DEH for well approval Attached
- Past 6 yrs. inorganic analysis from each wellhead Attached
- Past 3 yrs. Fe/Mn analyses, both soluble and insoluble. See Table 4 Above

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).

C. CUSTOMER COMPLAINT DATA

- Total number of customer complaints in past 6 months 0
- Total number of customer complaints in past 12 months 1
- For past 6 months, do customer secondary water complaints exceed 10% of the number of active customers? No
- Provide 12-month list of all water quality complaints Attached
- Provide 12-month list of all completed water quality work orders Attached
- Describe most common customer complaint over the past 12-month period relating to secondary water quality, i.e.; discolored water, taste, or odor.

Response: Orange, yellow, brown dirty water.

D. PROPOSED SECONDARY WATER QUALITY TREATMENT

- Proposed treatment recommendation: Oxidation-Filtration Treatment System

2. System Capex Estimates for Option (1) and (2):

Option 1: Interconnect Carden's Creek #1&2 with 2" raw water main and install combined Fe/Mn filter at #1					
	Total design flow rate =	56	GPM		
TASK	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
1	Filter Equipment, no recycle, sludge management, or BW supply systems required	1	EACH	\$ 102,100	\$ 102,100
2	Freight (based on shipping costs of similar size filters)	1	EACH	\$ 3,000	\$ 3,000
3	Engineering Design, Permitting, Bidding, & CA/CO (based on design costs of similar size filters)	1	EACH	\$ 50,000	\$ 50,000
4	Construction Bonding, Mobilization and Demobilization	1	EACH	\$ 5,000	\$ 5,000
5	Site Clearing, Grubbing, Grading, Gravel, erosion control	1	EACH	\$ 25,000	\$ 25,000
6	Existing Well House Piping Modifications	1	EACH	\$ 3,500	\$ 3,500
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	\$ 20,000
8	Filter Building Construction-Including but not limited to concrete floor slab, well house erection, finishing, and necessary appurtenances	1	EACH	\$ 35,000	\$ 35,000
9	Yard Piping-Including but not limited to all underground pipe, fittings, and valve	1	EACH	\$ 15,000	\$ 15,000
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	\$ 15,000	\$ 15,000
11	Interconnection Construction Cost: Open cut with 2" Pipe	3300	per foot	\$ 45	\$ 148,500
12	Aqua Direct Cost (payroll, water quality sampling) @	3%			\$ 12,663
13	Contingencies @	5%			\$ 21,738
14	AFUDC @	2%			\$ 9,131
15		TOTAL CAPITAL COSTS:			\$ 465,632
TOTAL ESTIMATED PROJECT COSTS/GPM:					\$ 8,393
TOTAL ESTIMATED PROJECT COSTS:					\$ 470,000

Option 2: All Carden's Creek Wells Filtered Separately with no interconnection					
	Total design flow rate =	56	GPM		
TASK	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
1	Cardens Creek #1 Filter skid, no recycle, sludge management, or BW supply systems required (33gpm)	1	EACH	\$ 80,000	\$ 80,000
2	Cardens Creek #2 Filter skid, no recycle, sludge management, or BW supply systems required (23 gpm)	1	EACH	\$ 70,000	\$ 70,000
3	Freight (based on shipping costs of similar size filters)	2	EACH	\$ 2,000	\$ 4,000
4	Engineering Design, Permitting, Bidding, & CA/CO (based on design costs of similar size filters)	2	EACH	\$ 30,000	\$ 60,000
5	Construction Bonding, Mobilization and Demobilization	2	EACH	\$ 5,000	\$ 10,000
6	Site Clearing, Grubbing, Grading, Seeding, Gravel, Erosion Control	2	EACH	\$ 25,000	\$ 50,000
7	Existing Well House Piping Modifications	2	EACH	\$ 3,500	\$ 7,000
8	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	2	EACH	\$ 20,000	\$ 40,000
9	Filter Building Construction-Including but not limited to concrete floor slab, well house erection, finishing, and necessary appurtenances	2	EACH	\$ 35,000	\$ 70,000
10	Yard Piping-Including but not limited to all underground pipe, fittings, and valve	2	EACH	\$ 15,000	\$ 30,000
11	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	2	EACH	\$ 15,000	\$ 30,000
12	Aqua Direct Cost (payroll, water quality sampling) @	3%			\$ 13,530
13	Contingencies @	5%			\$ 23,227
14	AFUDC @	2%			\$ 9,756
15				TOTAL CAPITAL COSTS:	\$ 497,513
TOTAL ESTIMATED PROJECT COSTS/GPM:					\$ 8,929
TOTAL ESTIMATED PROJECT COSTS:					\$ 500,000

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. Opex Estimate for Option (1): \$9,000
4. Comments:

Aqua will use the total APPC of 56 GPM as the treatment system design (max) flow rate.
Aqua proposes running a raw water supply main from Well #2 to Well #1 and installing a
combined oxidation-filtration system at Carden's Creek Well #1.

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Mar 12 2021