



SECONDARY WATER QUALITY TREATMENT SYSTEM REQUEST

High Meadows Well #2 NC 03-92-334

WSF ID No: TM1

AQUA NORTH CAROLINA

A. EXECUTIVE SUMMARY

Aqua proposes installing an AdEdge Iron (Fe) and Manganese (Mn) filter system to treat water at the combined point of entry (POE) at High Meadows Well #2, TM1. The High Meadows Master System is comprised of two (2) active wells (#2 and 3) and one combined point of entry (POE) at Well #2, identified as TM1. **NC DEQ issued a Notice of Deficiency in July 2016 due to Fe and Mn levels exceeding the secondary limits. Combined Fe and Mn levels at this well are consistently greater than 1 mg/L which makes it one of Aqua's Group 1 Priority Secondary Water Quality Projects as per the 2018 Water Quality Plan.** The average raw Mn concentration at Well #2 is 0.21 mg/L. Based on studies performed by AWWA and other organizations, elevated concentrations of Mn are being linked to cause adverse health effects. Preliminary engineering studies indicate that an Fe/Mn treatment system is the most effective and permanent solution since it physically removes the Fe and Mn.

B. PROPOSED SYSTEM REQUIRING TREATMENT

1. System Name: High Meadows Well #2, TM1
2. PWS ID: NC 03-92-334
3. No. Total Water Connections: 133
4. No. Total Connections at Build Out: 149
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 (hrs./day)	Average Raw 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.)		
Well #2, TM1	64	83	59	41	9	4	2	1.35	0.21	~0.18	~68	~0.19
Well #3, Comb. With 2	20	27	26	26	9	4	2	ND	0.01	---	---	---

*In terms of interconnection and consolidated treatment, the closest other well is Rolling Ridge Well #2 (See attached system map).

- Distance apart ~1,500 ft.
- Approximate cost to construct interconnection = \$150,000 (at \$100/ft.)
- The interconnection would need to travel under Highway 401
- Aqua has investigated the possibility of interconnecting High Meadows Well #2 with Rolling Ridge, but the overall determining factor is that the blended results would not get the water quality below the sMCL for Fe/Mn. That, in addition to the infeasibility of obtaining the required easements make this alternative neither sensible nor practical.
- Thus, Aqua does not plan to pursue interconnection with Rolling Ridge Well #2.

There are no other wells close enough to Well #2 to consider for possible interconnection and consolidated treatment.

**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.

TABLE 2: Existing Storage at Well Sites

Well Name and No.	Storage Description		Most Recent Cleaning Date	
	Type	Gallons	Tank	Dist. System
High Meadows Well #2, TM1	Hydro	10,000	Mar. 2018	June 2018
High Meadows Well #3, Combined with #2	N/A	N/A	N/A	

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

Response: Apr. 2016, Apr. 2017, June 2018.

7. Next Planned Distribution System Flushing Occurrence

Response: Apr. 2019.

8. List of chemicals being used:

TABLE 3: Existing Chemicals Used at Well Site

Well Name and No.	Chemical Description			
	Cl ₂	OP-37	NaOH	SeaQuest
High Meadows Well #2, TP1	X	N/A	N/A	X
High Meadows Well #3, Combined with #2	X	N/A	N/A	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: The system switched from OP 37 to SeaQuest in October 2013 to sequester the Fe and Mn and clean the distribution lines, as well as to prevent further mineral accumulation on the pipe walls. Aqua installed a Harmsco particulate cartridge filter at Well #2 in September 2014 and it is still online. Started distribution and POE total and soluble sampling in September 2017; Started raw total and soluble sampling and testing in Dec. 2017. The last pump and motor replacement at Well #2 was in July 2013 and in January 2013 for Well #3. Aqua will continue to flush distribution system annually and maintain cartridge filter.

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

Response: None.

11. Comments on Approved/Current Well Capacity.

Response: Both wells operate near the State approved capacity as seen in Table 1.

C. CURRENT SECONDARY WATER QUALITY CONCERNS

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

* Based on the historical demands from the system, Well #2 and #3 are both required to meet the minimum system demand of 400 GPD/connection and two sources of supply are required since there are greater than 49 connections. See attached system demand and pump supply calculations.

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

*The average raw concentration at Well #2 is ~1.56 mg/L (Fe+Mn).

4. Date of most recent POE Fe/Mn sampling results 10/5/2018

TABLE 4: Most Recent Fe/Mn Inorganic Analysis at the Combined POE

High Meadows Laboratory Analysis						
Date	Iron (Fe) POE, mg/L			Manganese (Mn) POE, mg/L		
	Tot.	Sol.	Insol.	Tot.	Sol.	Insol.
1/8/2018	0.592	0.0426	0.5494	0.132	0.0855	0.0465
2/20/2018	0.986	0.0809	0.9051	0.216	0.0895	0.1265
3/19/2018	1.06	0.0421	1.0179	0.193	0.135	0.058
4/25/2018	0.704	0.00975	0.69425	0.146	0.0818	0.0642
8/17/2018	0.487	0.0747	0.4123	0.139	0.11	0.029

9/18/2018	0.706	0.238	0.468	0.131	0.118	0.013
10/5/2018	0.811	0.126	0.685	0.174	0.122	0.052

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

Response: The system switched from OP 37 to SeaQuest in October 2013 to sequester the Fe and Mn. Flushed distribution system annually since Apr. 2016 and will continue to flush water mains annually. Aqua began collecting and testing POE total and soluble sampling in Sept. 2017 and the most recent results are noted in Table 4 above. 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. Aqua installed a Harmsco particulate cartridge filter in Sept. 2014 but no real reduction in total or insoluble Fe and Mn has been observed. 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 a those using solid phase Manganese Dioxide.

D. UTILITY COMMISSION REQUIRED INFORMATION

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|---|-----------------|
| 1. Well Location Map | <u>Attached</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>Attached</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).

E. CUSTOMER COMPLAINT DATA

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|---|-----------------|
| 1. Total number of customer complaints in past 6 months | <u>1</u> |
| 2. Total number of customer complaints in past 12 months | <u>1</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>Attached</u> |
| 5. Provide 12-month list of all completed water quality work orders | <u>Attached</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 water complaint. Even though there was only 1 customer complaint in the past 12 months, the adverse health effects and public health issues resulting from elevated Mn make removal by Fe/Mn treatment system the most prudent and responsible step moving forward.

F. PROPOSED SECONDARY WATER QUALITY TREATMENT

1. Proposed treatment recommendation: AdEdge Water Technologies Treatment system
2. Proposed System Cost: \$350,000.00
(Includes vendor, consulting engineer, and contractor costs)
3. Estimated annual operating and maintenance expenses: \$1,000.00
4. Comments: The water quality at this well has resulted in a NOD from NCDEQ since July 2016. The elevated level of Mn also poses a health risk to customers that must be addressed. Aqua will use 84 GPM (the combined approved flows of Wells #2 and #3) as the treatment system design (max) flow rate.

For these reasons, Aqua proposes an AdEdge treatment system for Fe and Mn removal to be installed at the combined POE at High Meadows Well #2 with no interconnection and consolidated treatment to outside systems (See footnote in Section B. above).