PLACE: Dobbs Building, Raleigh, North Carolina

DATE: Tuesday, September 18, 2018

TIME: 10:30 a.m. - 12:52 p.m.

DOCKET NO.: W-218, Sub 497

BEFORE: Commissioner ToNola D. Brown-Bland, Presiding
Chairman Edward S. Finley, Jr.
Commissioner Jerry C. Dockham
Commissioner James G. Patterson
Commissioner Lyons Gray
Commissioner Daniel G. Clodfelter
Commissioner Charlotte A. Mitchell

IN THE MATTER OF:

Application by Aqua North Carolina, Inc.,
202 MacKenan Court, Cary, North Carolina 27511,
for Authority to Adjust and Increase Rates
for Water and Sewer Utility Service in
All Service Areas in North Carolina.

VOLUME: 7

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COMMISSIONER BROWN-BLAND: Good morning. Welcome back. Let's come to order and go on the record.

We're here to resume the evidentiary hearing in the Aqua general rate increase case. And that's Docket W-218, Sub 497. Before we get started, I'm aware of some housekeeping matters. We were trying to get out ahead of Hurricane Florence and neglected to clean up a couple of things, and one of those is the rebuttal testimony, as corrected by the witness, Dylan W. D'Ascendis. There being no objection that I hear from anyone, that testimony will be received into the record as if given orally from the witness stand.

(Whereupon, the prefiled rebuttal testimony of Dylan W. D'Ascendis, as corrected, was copied into the record as if given orally from the stand.)

I. INTRODUCTION

A. Witness Identification

Q. Please state your name and business address.

A. My name is Dylan W. D'Ascendis. My business address is 3000 Atrium Way, Suite 241, Mount Laurel, NJ 08054.

Q. By whom are you employed and in what capacity?

A. I am a Director at ScottMadden, Inc.

Q. Are you the same Dylan W. D'Ascendis that provided direct testimony in this proceeding?

A. Yes, I am.

II. PURPOSE OF TESTIMONY

Q. What is the purpose of your rebuttal testimony in this proceeding?

A. My rebuttal testimony responds to the direct testimony of John R. Hinton, witness for the North Carolina Utilities Commission – Public Staff ("Public Staff") concerning the investor required return on common equity ("ROE") of Aqua North Carolina, Inc. ("Aqua North Carolina" or the "Company").

Q. Have you prepared an exhibit in support of your rebuttal testimony?

A. Yes. I have prepared D'Ascendis Rebuttal Exhibit No. 1, which consists of Schedules DWD-1R through DWD-10R.

III. SUMMARY

Q. What conclusions do you reach?

A. Aqua North Carolina's proposed ROE should not be reduced as Mr. Hinton recommends. In particular, I respond to Mr. Hinton's estimation of the Company's ROE using the Discounted Cash Flow Model ("DCF") and Risk Premium Model ("RPM") and explain the shortcomings of their applications, including:

- His misapplication of the DCF;
- His misapplication of the RPM;
- His failure to account for size-specific risks; and
- His opinion that the Company's Water and Sewer Improvement Charge Mechanisms and Acquisition Incentive Adjustments are unique to the Company.

Corrections and additions to Mr. Hinton's analysis result in an indicated ROE of 10.57%, before any adjustment due to the Company's small size compared with the proxy group. In addition, I will address Mr. Hinton's opinions regarding current capital markets.

IV. CURRENT CAPITAL MARKETS

Q. Please summarize Mr. Hinton's summary of current capital markets.

A. Mr. Hinton provided the Moody's A-rated public utility bond yield as of January 2014, when the last Aqua North Carolina case was stipulated, which was 4.63% and the current Moody's A-rated public utility bond as of July 2018, which is 4.27%. Mr. Hinton expresses the drop in yield as a sign

of lower capital costs.[1] Mr. Hinton then presents a chart showing the current flattening yield curve as compared with the yield curves in January 2014 and in November 2011, the approximate dates of Aqua North Carolina's last two rate cases.[2] Despite the graph showing increased short-term interest rates, Mr. Hinton recommends the use of current bond yields in his ROE analysis while only "reviewing" forecasted interest rates. Mr. Hinton claims that current interest rates are inherently forward-looking, as they reflect investor expectations of current and future returns.[3]

Q. **Do you have any comment on Mr. Hinton's opinions regarding current market conditions?**

A. Yes. While the yield on long-term Moody's A-rated utility bonds have decreased since Aqua North Carolina's last rate case in 2014, general market conditions have changed as shown in Mr. Hinton's chart. Since the last rate case, the Federal Reserve Bank ("Fed") has raised the Federal funds rate ("Fed funds rate") seven times, from a target range of 0.00% - 0.25% to a target range of 1.75% - 2.00% after its Quantitative Easing Initiative was completed in October 2014 and began the process of rate normalization.[4] While the long-term Treasury yields have not yet caught up with short-term Treasury yields, this has more to do with Fed policy rather than market fundamentals. As the Fed continues to unwind its balance

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1 Hinton Direct Testimony, at 14.
2 *Ibid.*, at 15.
3 *Ibid.*, at 16-17.
4 *See* Federal Reserve Press Release (December 16, 2015).

sheet by not reinvesting after their Treasury securities have matured,[5] shorter-term notes will mature faster than long-term notes, which will effectively lower demand for those replacement notes (as the Fed is no longer reinvesting), which will lower prices, and raise yields faster on long-term notes. As the unwinding of the Fed balance sheet continues, the remaining longer-term notes will mature, and the yields for the long-term Treasury securities will also increase.

Q. **Have conditions changed for Mr. Hinton's proxy group since Aqua North Carolina's last rate case?**

A. Yes. As shown in Table 1, below, the average beta of Mr. Hinton's proxy group has risen from 0.66 in January 2014 to 0.77 in July 2018. Since the prices of the proxy group have increased substantially, price to earnings ratios ("P/E") have increased from 22.03 to 30.85, and dividend yields decreased from 3.02% to 2.08%, while prospects of growth in earnings per share ("EPS") have grown from 7.17% to 8.33%.

Table 1: Comparison of Value Line Data for Hinton Proxy Group[6]

	Beta	Dividend Yield	P/E Ratio	Proj EPS Growth
Hinton Proxy Group 2014	0.66	3.02%	22.03	7.17%
Hinton Proxy Group 2018	0.77	2.08%	30.85	8.33%

[5] The current monthly maturities of Treasury securities are $30 billion per month. Starting in Q4 2018, maturities will be $50 billion per month.

[6] Value Line Investment Survey, January 17, 2014 and July 13, 2018.

Q. **Do you believe that current interest rates are appropriate for the estimation of the cost of common equity in this proceeding?**

A. No. Failing to use projected measures, such as interest rates, is inappropriate for cost of capital and ratemaking purposes because they are both prospective in nature. The cost of capital, including the cost rate of common equity, is expectational in that it reflects investors' expectations of future capital markets, including an expectation of interest rate levels, as well as future risks. Ratemaking is prospective in that rates set in this proceeding will be in effect for a period in the future.

Even though Mr. Hinton relies, in part, on projected growth rates in his DCF analyses, he fails to apply that same logic to selecting an appropriate interest rate in his RPM analysis.

Whether Mr. Hinton believes those forecasts will prove to be accurate is irrelevant to estimating the market-required cost of common equity. Published industry forecasts, such as *Blue Chip Financial Forecasts* ("*Blue Chip*") consensus interest rate projections, reflect industry expectations. Additionally, it is incorrect to view investors' expectations as improper inputs to cost of common equity estimation models simply because prior projections were not proven correct in hindsight. As FERC noted in Opinion No. 531, "the cost of common equity to a regulated enterprise depends upon what the market expects, not upon what ultimately happens."[7] Because our analyses are predicated on market expectations,

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7 Opinion No. 531, 150 FERC ¶ 61,165 at P 88.

the expected increase in bond yields is a measurable and relevant data point that should be reflected in Mr. Hinton's analysis.

V. RESPONSE TO MR. HINTON

Q. What does Mr. Hinton recommend in his direct testimony?

A. Mr. Hinton recommends that the Commission establish an allowed ROE of 9.20% based on the average of the midpoint of his DCF range (8.70%)[8] and the result of his RPM (9.69%).[9]

Q. Do you have any general comments on Mr. Hinton's recommended ROE?

A. Yes. Mr. Hinton only relies on two models, the DCF and the RPM in his ROE analysis, when in Docket No. W-218, Sub 319, Mr. Hinton used both the Capital Asset Pricing Model ("CAPM") and the Comparable Earnings Model ("CEM") in conjunction with the DCF to arrive at his recommended ROE.[10] As discussed previously,[11] the use of multiple models adds reliability and accuracy to the estimation of the common equity cost rate. Moreover, the prudence of using multiple cost of common equity models is supported in both the financial literature and by regulatory precedent. Therefore, Mr. Hinton should have included the CAPM and CEM in his analysis.

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8 Mr. Hinton's DCF results range from 8.20% to 9.20%.
9 Hinton Direct Testimony, at 32.
10 Docket No. W-218, Sub 319, Direct Testimony of John R. Hinton, at 21-22.
11 D'Ascendis Direct Testimony, at 37.

Q. **Can you provide examples from the financial literature which support the use of multiple cost of common equity models in determining the investor-required return?**

A. Yes. In one example, Morin states:

> Each methodology requires the exercise of considerable judgment on the reasonableness of the assumptions underlying the methodology and on the reasonableness of the proxies used to validate a theory. The inability of the DCF model to account for changes in relative market valuation, discussed below, is a vivid example of the potential shortcomings of the DCF model when applied to a given company. Similarly, the inability of the CAPM to account for variables that affect security returns other than beta tarnishes its use.
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> **No one individual method provides the necessary level of precision for determining a fair return, but each method provides useful evidence to facilitate the exercise of an informed judgment.** Reliance on any single method or preset formula is inappropriate when dealing with investor expectations because of possible measurement difficulties and vagaries in individual companies' market data. (emphasis added)
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> * * *
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> The financial literature supports the use of multiple methods. Professor Eugene Brigham, a widely respected scholar and finance academician, asserts (footnote omitted):
>
> Three methods typically are used: (1) the Capital Asset Pricing Model (CAPM), (2) the discounted cash flow (DCF) method, and (3) the bond-yield-plus-risk-premium approach. **These methods are not mutually exclusive – no method dominates the others**, and all are subject to error when used in practice. Therefore, when faced with the task of estimating a company's cost of equity, we generally use all three methods and then choose among them on the basis of our confidence in the data used for each in the specific case at hand. (emphasis added)

Another prominent finance scholar, Professor Stewart Myers, in an early pioneering article on regulatory finance, stated(footnote omitted):

> Use more than one model when you can. Because estimating the opportunity cost of capital is difficult, **only a fool throws away useful information**. That means you should not use any one model or measure mechanically and exclusively. Beta is helpful as one tool in a kit, to be used in parallel with DCF models or other techniques for interpreting capital market data. (emphasis added)
>
> Reliance on multiple tests recognizes that no single methodology produces a precise definitive estimate of the cost of equity. As stated in Bonbright, Danielsen, and Kamerschen (1988), 'no single or group test or technique is conclusive.' Only a fool discards relevant evidence. (italics in original) (emphasis added)
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> * * *
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> While it is certainly appropriate to use the DCF methodology to estimate the cost of equity, there is no proof that the DCF produces a more accurate estimate of the cost of equity than other methodologies. Sole reliance on the DCF model ignores the capital market evidence and financial theory formalized in the CAPM and other risk premium methods. **The DCF model is one of many tools to be employed in conjunction with other methods to estimate the cost of equity.** It is not a superior methodology that supplants other financial theory and market evidence. The broad usage of the DCF methodology in regulatory proceedings in contrast to its virtual disappearance in academic textbooks does not make it superior to other methods. The same is true of the Risk Premium and CAPM methodologies. (emphasis added) [12]

Finally, Brigham and Gapenski note:

> In practical work, *it is often best to use all three methods* – CAPM, bond yield plus risk premium, and DCF – and then apply judgment when the methods produce different results. People experienced in estimating equity capital costs recognize that both careful analysis and some very fine judgments are required. It would be nice to pretend that these

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12 Roger A. Morin, New Regulatory Finance, Public Utilities Reports, Inc., 2006, at 428-431. ("Morin")

> judgments are unnecessary and to specify an easy, precise way of determining the exact cost of equity capital. Unfortunately, this is not possible. Finance is in large part a matter of judgment, and we simply must face this fact. (italics in original) [13]

In the academic literature cited above, three methods are consistently mentioned: the DCF, CAPM, and the RPM, all of which I used in my analyses.

Q. **Can you also provide specific examples where this Commission has considered multiple cost of common equity models?**

A. Yes. The Commission in Docket E-2, Sub 1142, concerning Duke Energy Progress, LLC, stated:

> "Thus, the Commission finds and concludes that the Stipulation, along with the expert testimony of witnesses Hevert (risk premium analysis), O'Donnell (comparable earnings), and Parcell (comparable earnings), are credible and substantial evidence of the appropriate rate of return on equity and are entitled to substantial weight in the Commission's determination of this issue."

Also, in Docket E-7, Sub 1026, concerning Duke Energy Carolinas, LLC, the Commission stated the following:

> "In summary, the Commission finds and concludes, for purposes of this case and after thoroughly and independently reviewing all of the evidence, that Company witness Hevert's DCF analysis, particularly on the basis of mean growth rates, is credible and deserving of substantial weight, and that witness Johnson's comparable earnings analysis provides

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13 Eugene F. Brigham and Louis C. Gapenski, Financial Management – Theory and Practice, 4th Ed. (The Dryden Press, 1985) at 256. ("Brigham and Gapenski")

independent corroboration for the results of that analysis and is also credible and deserving of substantial weight,"

In the Commission Orders cited above, there is clear language that this Commission considers multiple cost of equity models in its determination of ROE. It is also my interpretation of these Orders that the Commission correctly observes capital market conditions and their effect on the model results in determining a ROE for utility companies. This, in addition to the academic literature cited above, justifies the use of the DCF, CAPM, RPM, and CEM in this proceeding.

Q. **Have you performed a CAPM and CEM analysis for Mr. Hinton's proxy group consistent with his DCF spot date of August 17, 2018?**

A. Yes, I have. The CAPM analysis is presented on Schedule DWD-1 and the selection criteria and CEM analysis is presented on Schedule DWD-2.[14] The results of the CAPM applied to Mr. Hinton's proxy group average 10.89%, with a median of 11.15%. The results of the DCF, RPM, and CAPM applied to the non-regulated proxy group, similar in total risk to Mr. Hinton's proxy group is 13.27%, 12.17%, and 11.41%, respectively. The average result is 12.28%, while the median is 12.17%.

[14] The selection criteria for the non-regulated proxy group is identical as described at pages 33 through 35 of my direct testimony.

Q. **Have you applied the CAPM and the CEM differently to Mr. Hinton's water proxy group than when you applied them to your proxy group in your direct testimony?**

A. Yes. In the CAPM for Mr. Hinton's water proxy group and the non-regulated group, I only used Value Line betas instead of both Value Line and Bloomberg Betas, since Mr. Hinton only relies on Value Line Betas for his risk measures on Hinton Exhibit #2. Also, in the CAPM for both groups, I gave equal weight to all six measures of the market risk premium ("MRP"), instead of averaging the MRPs by source (*i.e.* Ibbotson, Value Line, and Bloomberg) and then averaging them together.

In the application of the DCF model for the non-regulated group, I calculated the prospective dividend yield as Mr. Hinton described in his direct testimony at pages 27 and 28. I then added the prospective dividend yield to the average prospective EPS growth rate from Value Line and Yahoo Finance. I only include expected EPS growth rates for use in the DCF, as will be explained in detail, below.

A. <u>Discounted Cash Flow Model</u>

Q. **Please summarize Mr. Hinton's DCF analysis.**

A. Mr. Hinton calculated his dividend yield by using the Value Line estimate of dividends to be declared over the next 12 months divided by the price of the stock as reported in the Value Line Summary and Index for 13 weeks ended August 17, 2018.[15] He then added the expected dividend yield of 2.1% to

[15] Hinton Direct Testimony, at 27-28.

a range of growth rates from 6.1% to 7.1%[16] to arrive at his range of results from 8.2% to 9.2%.

Q. **Please comment on Mr. Hinton's growth rate analysis in his application of the DCF Model.**

A. Mr. Hinton states on page 28 of his direct testimony that he employed EPS, dividends per share ("DPS"), and book value of equity per share ("BVPS") growth rates as reported in Value Line, both five- and ten-year historical and forecasted, and five-year projected EPS growth rate as reported by Yahoo Finance. Thus, he includes both historical and forecasted growth rates, "because it is reasonable to expect that investors consider both sets of data in deriving their expectations". After reviewing the array of growth rates, Mr. Hinton determined a range of expected growth rates between 6.1% and 7.1%. Notwithstanding this statement, it is unclear exactly how much weight Mr. Hinton gave to each of the projected and historical growth rates in arriving at his high and low growth rate estimates for his proxy group, because his range of growth rates bears no logical relationship to the array of growth rates he evaluated.

Moreover, there is a significant body of empirical evidence supporting the superiority of using analysts' EPS growth rates in a DCF analysis, indicating that analysts' forecasts of earnings remain the best predictor of growth to use in the DCF model. Such ample evidence of the

[16] Mr. Hinton reviewed 10 and 5-year historical growth rates in EPS, DPS, and BVPS as well as 3-5 year projected growth in EPS, DPS and BVPS from Value Line and 5-year projections of EPS growth from Yahoo Finance.

proven reliability and superiority of analysts' forecasts of EPS should not be dismissed by Mr. Hinton. As will be discussed below, Mr. Hinton should have relied exclusively on EPS growth rate projections in his DCF analysis.

Q. **Please describe some of the empirical evidence supporting the reliability and superiority of analysts' EPS growth rates in a DCF analysis.**

A. As discussed previously,[17] over the long run, there can be no growth in DPS without growth in EPS. Security analysts' earnings expectations have a more significant, but not the only, influence on market prices than dividend expectations. Thus, the use of projected earnings growth rates in a DCF analysis provides a better match between investors' market price appreciation expectations and the growth rate component of the DCF, because they have a significant influence on market prices and the appreciation or "growth" experienced by investors.[18] This should be evident even to relatively unsophisticated investors just by listening to financial news reports on radio, TV, or by reading the newspapers.

In addition, Myron Gordon, the "father" of the standard regulatory version of the DCF model widely utilized throughout the United States in rate base/rate of return regulation, has recognized the significance of analysts' forecasts of growth in EPS in a speech he gave in March 1990

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17 D'Ascendis Direct Testimony, at 16.
18 Morin, at 298-303.

before the Institute for Quantitative Research and Finance[19], stating on page 12:

> We have seen that earnings and growth estimates by security analysts were found by Malkiel and Cragg to be superior to data obtained from financial statements for the explanation of variation in price among common stocks... estimates by security analysts available from sources such as IBES are far superior to the data available to Malkiel and Cragg.
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> * * *
>
> Eq (7) is not as elegant as Eq (4), but it has a good deal more intuitive appeal. It says that investors buy earnings, but what they will pay for a dollar of earnings increases with the extent to which the earnings are reflected in the dividend or in appreciation through growth.

Professor Gordon recognized that the total return is largely affected by the terminal price, which is mostly affected by earnings (hence price/earnings multiples).

Studies performed by Cragg and Malkiel[20] demonstrate that analysts' forecasts are superior to historical growth rate extrapolations. While some question the accuracy of analysts' forecasts of EPS growth, the level of accuracy of those analysts' forecasts well after the fact does not really matter. What is important is the forecasts reflect widely-held expectations influencing investors at the time they make their pricing decisions and hence the market prices they pay.

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19 Gordon, Myron J., "*The Pricing of Common Stock*", Presented before the Spring 1990 Seminar, March 27, 1990 of the Institute for Quantitative Research in Finance, Palm Beach, FL.

20 Cragg, John G. and Malkiel, Burton G., Expectations and the Structure of Share Prices (University of Chicago Press, 1982) Chapter 4.

In addition, Jeremy J. Siegel[21] also supports the use of security analysts' EPS growth forecasts when he states:

> For the equity holder, the source of future cash flows is the earnings of firms. (p. 90)
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> * * *
>
> Some people argue that shareholders most value stocks' cash dividends. But this is not necessarily true. (p. 91)
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> * * *
>
> Since the price of a stock depends primarily on the present discounted value of all expected future dividends, it appears that dividend policy is crucial to determining the value of the stock. However, this is not generally true. (p. 92)
>
> * * *
>
> Since stock prices are the present value of future dividends, it would seem natural to assume that economic growth would be an important factor influencing future dividends and hence stock prices. However, this is not necessarily so. The determinants of stock prices are earnings and dividends on a *per-share* basis. Although economic growth may influence *aggregate* earnings and dividends favorably, economic growth does not necessarily increase the growth of per-share earnings of dividends. It is earnings per share (EPS) that is important to Wall Street because per-share data, not aggregate earnings or dividends, are the basis of investor returns. (italics in original) (pp. 93-94)

Therefore, given the overwhelming academic and empirical support regarding the superiority of security analysts' EPS growth rate forecasts,

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[21] Jeremy J. Siegel, Stocks for the Long Run – The Definitive Guide to Financial Market Returns and Long-Term Investment Strategies, McGraw-Hill 2002, pp. 90-94.

such EPS growth rate projections should have been relied on exclusively by Mr. Hinton in his DCF analysis.

Q. **What would Mr. Hinton's DCF result be had he only relied on EPS growth forecasts?**

A. As shown on Schedule DWD-3R, the mean DCF derived cost rate based on EPS growth forecasts is 9.10%. This result should be viewed with caution, however, as the DCF model is currently understating the investor required return.

Q. **Why is it your opinion that the DCF model is currently understating the investor-required return?**

A. Traditional rate base/rate of return regulation, where a market-based common equity cost rate is applied to a book value rate base, presumes that market-to-book ("M/B") ratios are at unity or 1.00. However, that is rarely the case. Morin states:

> The third and perhaps most important reason for caution and skepticism is that application of the DCF model produces estimates of common equity cost that are consistent with investors' expected return only when stock price and book value are reasonably similar, that is, when the M/B is close to unity. As shown below, application of the standard DCF model to utility stocks understates the investor's expected return when the market-to-book (M/B) ratio of a given stock exceeds unity. This was particularly relevant in the capital market environment of the 1990s and 2000s where utility stocks were trading at M/B ratios well above unity and have been for nearly two decades. The converse is also true, that is, the DCF model overstates that investor's return when the stock's M/B ratio is less than unity. The reason for the distortion is that the DCF market return is applied to a book

> value rate base by the regulator, that is, a utility's earnings are limited to earnings on a book value rate base.[22]

As Morin explains, a "simplified" DCF model, like that used by Mr. Hinton, assumes an M/B ratio of 1.0 and therefore under- or over-states investors' required return when market value exceeds or is less than book value, respectively. It does so because equity investors evaluate and receive their returns on the market value of a utility's common equity, whereas regulators authorize returns on the book value of that common equity. This means that the market-based DCF will produce the total annual dollar return expected by investors only when market and book values of common equity are equal, a very rare and unlikely situation.

Q. **Why do market and book values diverge?**

A. Market values can diverge from book values for a myriad of reasons including, but not limited to, EPS and DPS expectations, merger/acquisition expectations, interest rates, etc. As noted by Phillips:

> Many question the assumption that market price should equal book value, believing that 'the earnings of utilities should be sufficiently high to achieve market-to-book ratios which are consistent with those prevailing for stocks of unregulated companies.[23]

In addition, Bonbright states:

> In the first place, commissions cannot forecast, except within wide limits, the effect their rate orders will have on the market prices of the stocks of the companies they regulate. In the second place, *whatever the initial market prices may be, they are sure to change not only with the changing prospects for earnings, but with the changing outlook of an inherently*

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22 Morin, at 434.

23 Charles F. Phillips, The Regulation of Public Utilities, Public Utilities Reports, Inc., 1993, p. 395.

> *volatile stock market*. In short, market prices are beyond the control, though not beyond the influence of rate regulation. Moreover, even if a commission did possess the power of control, any attempt to exercise it ... would result in harmful, uneconomic shifts in public utility rate levels. (italics added)[24]

Q. **Can the under- or over-statement of investors' required return by the DCF model be demonstrated mathematically?**

A. Yes, it can. Schedule DWD-4R demonstrates how a market-based DCF cost rate of 8.70%,[25] when applied to a book value substantially below market value, will understate the investors' required return on market value. As shown, there is no realistic opportunity to earn the expected market-based rate of return on book value. In Column [A], investors expect an 8.70% return on an average market price of $48.83 for Mr. Hinton's proxy group of water utility companies. Column [B] shows that when Mr. Hinton's 8.70% return rate is applied to a book value of $15.56,[26] the total annual return opportunity is $1.354. After subtracting dividends of $1.025, the investor only has the opportunity for $0.329 in market appreciation, or 0.67%. The magnitude of the understatement of investors' required return on market value using Mr. Hinton's 8.70% cost rate is 5.93%, which is calculated by subtracting the market appreciation based on book value of 0.67% from Mr. Hinton's expected growth rate of 6.60%.

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24 James C. Bonbright, Albert L. Danielsen and David R. Kamerschen, Principles of Public Utility Rates (Public Utilities Reports, Inc., 1988), p. 334.

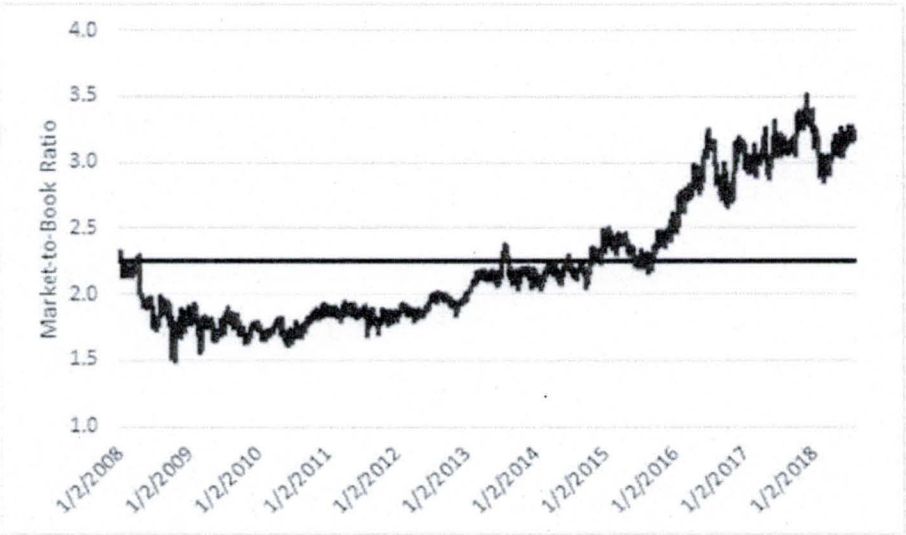
25 Mr. Hinton's DCF cost rate as shown in Hinton Exhibit #3.

26 Representing a market-to-book ratio of 313.76%.

Q. **HOW DO THE M/B RATIOS OF THE WATER PROXY GROUP COMPARE WITH THEIR TEN-YEAR AVERAGE?**

A. The M/B ratios of the water proxy group are currently extraordinarily high compared with their ten-year average. As shown in Chart 1, below, since early 2016, the M/B ratios of the water proxy group are currently dramatically higher than their ten-year average M/B ratio of approximately 2.10 times.

Chart 1: M/B Ratios Compared with Ten-Year Average[27]



It is significant that although the ten-year average M/B ratio has always been greater than 1.0x, the current M/B ratio is even further removed from 1.0x, which further distorts DCF results.

[27] Source: Bloomberg Financial Services.

Q. HOW CAN ONE QUANTIFY THE INACCURACY OF THE DCF MODEL WHEN THE M/B RATIOS ARE DIFFERENT THAN UNITY?

A. One can quantify the inaccuracy of the DCF model when M/B ratios are not at unity by estimated the implied cost of equity using the market-value DCF results (based on a market-value capital structure) to reflect a book-value capital structure.

Q. HOW CAN THE INACCURACY OF THE DCF MODEL BE QUANTIFIED BY SUCH A LEVERAGE ADJUSTMENT?

A. The inaccuracy of the DCF model, when market values diverge from book values, can be measured by first calculating the market value of each proxy company's capital structure, which consists of the market value of the company's common equity (shares outstanding multiplied by price) and the fair value of the company's long-term debt and preferred stock. All of these measures, except for price, are available in each company's SEC Form 10-K.

Second, one must de-leverage the implied cost of common equity based on the DCF. This is accomplished using the Modigliani / Miller equation as illustrated in Schedule DWD-5R and shown below:

$$ku = ke - (((ku - i)(1 - t))\ D/E) - (ku - d)\ P/E \quad \text{[Equation 1]}$$

Where:

ku	=	Unlevered (i.e., 100% equity) cost of common equity;
ke	=	Market determined cost of common equity;
i	=	Cost of debt;

t = Income tax rate;
D = Debt ratio;
E = Equity ratio;
d = Cost of preferred stock; and
P = Preferred equity ratio.

Using average proxy group-specific data, the equation becomes:

ku = 8.70% - (((ku – 4.63%)(1 - 21%)) 22.30% / 77.65%) - (ku – 0.00%) 0.05% / 77.65%

Solving for ku results in an unlevered cost of common equity of 7.94%.

Next, one must re-leverage those costs of common equity by relating them to each proxy group's average book capital structure as shown below:

ke = ku + (((ku – i)(1 – t)) D/E) + (ku – d) P/E [Equation 2]

Once again, using average proxy group-specific data, the equation becomes:

ke = 7.94%+(((7.94% - 4.63%)(1 - 21%))45.27%/54.61%)+(7.94%-0.00%)0.12%/54.61%

Solving for ke results in a 10.13% indicated cost of common equity relative to the book capital structure of the proxy group, which is an increase of 143 basis points over Mr. Hinton's average indicated DCF result of 8.70%.

Q. ARE YOU ADVOCATING A SPECIFIC ADJUSTMENT TO THE DCF RESULTS TO CORRECT FOR ITS MIS-SPECIFICATION OF THE INVESTOR-REQUIRED RETURN?

A. No. The goal of this discussion is to demonstrate that, like all cost of common equity models, the DCF has its limitations. The use of multiple cost of common equity models, in conjunction with informed expert judgment, provides a clearer picture of the investor-required ROE.

B. Application of the Risk Premium Model

Q. **Please summarize Mr. Hinton's RPM.**

A. Mr. Hinton's RPM explores the relationship between average allowed equity returns for water utility companies published by Regulatory Research Associates, Inc. ("RRA") and annual average Moody's A-rated utility bond yields. Using data from the years 2006 through 2018, Mr. Hinton conducts a regression analysis, which he then combines with recent monthly yields on Moody's A-rated public utility bonds to develop his risk premium estimate of 5.53% and a corresponding cost of equity of 9.69%.

Q. **Please comment on Mr. Hinton's application of the RPM.**

A. As previously addressed, it is inappropriate to use current bond yields to determine an expected ROE. In addition, instead of using yearly average authorized returns and Moody's A-rated public utility bond yields, it is preferable to use the authorized returns and Moody's A-rated public utility bond yields on a case by case basis.

Q. **What is the corrected result of the RPM after reflecting a prospective Moody's A-rated public utility bond yield and using individual rate case data in place of annual rate case data?**

A. As shown on page 1 of Schedule DWD-6R, the analysis is based on a regression of 169 rate cases for water utility companies from August 24, 2006 through May 2, 2018. It shows the implicit equity risk premium relative

to the yields on Moody's A-rated public utility bonds immediately prior to the issuance of each regulatory decision.[28]

I determined the appropriate prospective Moody's A-rated public utility yield by relying on a consensus forecast of about 50 economists of the expected yield on Moody's Aaa-rated corporate bonds for the six calendar quarters ending with the fourth calendar quarter of 2019, and *Blue Chip's* long-term projections for 2020 to 2024, and 2025 to 2029.[29] As described on note 1 of Schedule DWD-6R, the average expected yield on Moody's Aaa-rated corporate bonds is 4.76%. I then derived an expected yield on Moody's A2-rated public utility bonds, by making upward adjustment of 0.33%, which represents a recent spread between Moody's Aaa-rated corporate bonds and Moody's A2-rated public utility bonds.[30] Adding the recent 0.33% spread to the expected Moody's Aaa-rated corporate bond yield of 4.76% results in an expected Moody's A2-rated public utility bond yield of 5.09%.

I then used the regression results to estimate the equity risk premium applicable to the projected yield on Moody's A2-rated public utility bonds of 5.09%. Given the expected Moody's A-rated utility bond yield of 5.09%, the indicated equity risk premium is 4.85%, which results in an indicated ROE of 9.94%, as shown on Schedule DWD-6R.

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28 If the Order was in the first half of the month, the Moody's A rated utility bond from two months prior would be used. If the Order was in the second half of the month, the Moody's A rated public utility bond from the last prior month was used.

29 *Blue Chip*, August 1, 2018, at 2, June 1, 2018, at 14.

30 As explained in note 1 of Schedule DWD-6R.

Q. **What are the results of Mr. Hinton's ROE models after making the adjustments described above and including the CAPM and CEM.**

As discussed above, my adjustments to Mr. Hinton's DCF and RPM result in ROEs of 9.10% and 9.94%, respectively. After the inclusion of the CAPM (11.02%) and CEM (12.23%) results,[31] Mr. Hinton's average result is 10.57%. The average result of 10.57% still does not reflect the cost of common equity for Aqua North Carolina, as it has not been adjusted for the Company's greater risk relative to the proxy group based on its small size.

Q. **Mr. Hinton justifies his recommended ROE of 9.20% by reviewing the interest coverage ratio and confirming that his ROE would allow the Company a single "A" rating.[32] Does one measure of financial risk such as pre-tax interest coverage underpin a credit rating?**

A. No. While I do not take issue with Mr. Hinton's inputs or calculations in determining Aqua North Carolina's pre-tax interest coverage ratio, I note that the ratios of pre-tax coverage needed to qualify for a single "A" rating range from 3.0 to 6.0. As can be seen in my Schedule DWD-7R, ROE's ranging from 7.10% to as high as 17.74% all allow Aqua North Carolina to qualify for a single "A" rating based on its pre-tax coverage ratio. Clearly these results indicate that simply relying on one measure, out of a multitude of measures, to determine a bond's rating is misleading and without significance.

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31 Average of mean and median results as shown on Schedules DWD-1R and DWD-2R.
32 Hinton Direct Testimony, at 33.

C. Failure to Reflect Aqua North Carolina's Greater Relative Risk Due to its Small Size

Q. **Does Mr. Hinton make a specific adjustment to reflect the smaller size of Aqua North Carolina relative to the proxy group?**

A. No. As previously discussed previously,[33] relative company size is a significant element of business risk for which investors expect to be compensated through greater returns. Smaller companies are simply less able to cope with significant events which affect sales, revenues and earnings. For example, smaller companies face more exposure to business cycles and economic conditions, both nationally and locally. Additionally, the loss of revenues from a few large customers would have a far greater effect on a small company than on a larger company with a more diverse customer base. Finally, smaller companies are generally less diverse in their operations and have less financial flexibility. Consistent with the financial principle of risk and return previously,[34] such increased risk due to small size must be taken into account in the allowed rate of return on common equity.

Q. **Is there another empirical study in addition to the empirical analysis you performed in your direct testimony that evaluates the effect of size on the cost of equity?**

A. Yes. Duff & Phelps' ("D&P") 2018 Valuation Handbook ("D&P 2018") presents a Size Study based on the relationship of various measures of

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33 D'Ascendis Direct Testimony, at 38-40.
34 *Ibid.*, at 8.

size and return. Relative to the relationship between average annual return and the various measures of size, D&P state:

> **The size of a company is one of the most important risk elements to consider when developing cost of equity estimates for use in valuing** a firm. Traditionally, researchers have used market value of equity (*i.e.*, "market capitalization" or "market cap") as a measure of size in conducting historical rate of return research. For example, the Center for Research in Security Prices (CRSP) "deciles" are developed by sorting U.S. companies by market capitalization. Another example is the Fama-French "Small Minus Big" (SMB) series, which is the difference in return of "small" stocks minus "big" (*i.e.*, large) stocks, as defined by market capitalization. (emphasis added) [35]

The Size Study uses the following eight measures of size, all of which have empirically shown that over the long-term, the smaller the company, the higher the risk:

- Market Value of Common Equity (or total capital if no debt / equity);
- Book Value of Common Equity;
- Net Income (five-year average);
- Market Value of Invested Capital;
- Total Assets (Invested Capital);
- Earnings Before Interest, Taxes, Depreciation & Amortization ("EBITDA") (five-year average);
- Sales / Operating Revenues; and
- Number of Employees.

I used the D&P Size Study to determine the approximate magnitude of any necessary risk premium due to the size of Aqua North Carolina

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[35] Duff & Phelps, 2018 Valuation Handbook Guide to Cost of Capital – Market Results through 2017, at 10-1. ("D&P 2018")

relative to the water proxy group. Schedule DWD-8R shows the relative size of Aqua North Carolina compared with the water proxy group. Indicated size adjustments based on these relative measures range from 0.84% to 2.12%, averaging 1.34%. From these results, it is clear that Aqua North Carolina is riskier than the water proxy group due to its small size, and that my proposed size adjustment of 20 basis points for Aqua North Carolina is conservative.

Q. **Mr. Hinton says that since Aqua North Carolina is a part of Aqua America, Inc., it should not receive a size adjustment. Please comment.**

A. The fact that Aqua North Carolina is a subsidiary of Aqua America, Inc. ("Aqua America" or "the Parent"), is irrelevant for ratemaking purposes, because it is the rate base of Aqua North Carolina to which the overall rate of return set in this proceeding will be applied, which is consistent with the stand-alone nature of ratemaking. To not reflect the Company's greater risk due to its small size would be discriminatory, confiscatory, and inaccurate. It is also a basic financial precept that the use of the funds invested give rise to the risk of the investment. As Brealey and Myers state:

> The true cost of capital depends on the use to which the capital is put.

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> ***Each project should be evaluated at its own opportunity cost of capital; the true cost of capital depends on the use to which the capital is put.*** (italics and bold in original) [36]

Morin confirms Brealey and Myers when he states:

> Financial theory clearly establishes that the cost of equity is the risk-adjusted opportunity cost of the investors and not the cost of the specific capital sources employed by the investors. The true cost of capital depends on the use to which the capital is put and not on its source. The *Hope* and *Bluefield* doctrines have made clear that the relevant considerations in calculating a company's cost of capital are the alternatives available to investors and the returns and risks associated with those alternatives.(italics in original)[37]

Additionally, Levy and Sarnat state:

> The firm's cost of capital is the discount rate employed to discount the firm's average cash flow, hence obtaining the value of the firm. It is also the weighted average cost of capital, as we shall see below. The weighted average cost of capital should be employed for project evaluation...only in cases where the risk profile of the new projects is a "carbon copy" of the risk profile of the firm.[38]

Although Levy and Sarnat discuss a project's cost of capital relative to a firm's cost of capital, these principles apply equally to a proxy group-based cost of capital. Each company must be viewed on its own merits, regardless of the source of its equity capital. As *Bluefield* clearly states:

> A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same general part of the country

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36 Richard A. Brealey and Stewart C. Myers, Principles of Corporate Finance, McGraw-Hill, Inc., 1988, at pp. 173, 198.

37 Morin, at p. 523.

38 Haim Levy & Marshall Sarnat, Capital Investment and Financial Decisions, Prentice/Hall International, 1986, p. 465.

> on investments in other business undertakings which are attended by corresponding risks and uncertainties.[39]

In other words, it is the "risks and uncertainties" surrounding the property employed for the "convenience of the public" which determines the appropriate level of rates. In this proceeding, the property employed "for the convenience of the public" is the rate base of Aqua North Carolina. Thus, it is only the risk of investment in Aqua North Carolina's rate base that is relevant to the determination of the cost of common equity to be applied to the common equity-financed portion of that rate base, not its relationship to its parent, Aqua America.

In addition, Fama and French proposed that their three-factor model include the SMB (Small Minus Big) factor, which indicates that small capitalization firms are more risky than large capitalization firms, confirming that size is a risk factor which must be taken into account in estimating the cost of common equity.[40]

Q. **Mr. Hinton cites a study by Dr. Annie Wong for the proposition that there is no size premium for utilities. Does this study establish that contention?**

A. No. Dr. Wong's study is flawed because she attempts to relate a change in size to beta coefficients, which accounts for only a small percentage of diversifiable company-specific risk. Size is company-specific and therefore

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39 Bluefield Water Works Improvement Co. v. Public Serv. Comm'n, 262 U.S. 679 (1922). ("Bluefield")

40 Eugene F. Fama and Kenneth R. French, "The Capital Asset Pricing Model: Theory and Evidence," Journal of Economic Perspectives, Summer 2004, Vol. 18, Issue 3, pp. 25-46.

diversifiable. For example, the average R-squared, or coefficient of determination for the water proxy group, is 0.1257 as shown on Schedule DWD-9R. An R-squared of 0.1257 means that approximately 12.60% of total risk is explained by beta, leaving 87.40% unexplained by beta.

Q. **Is there also a published response to Dr. Wong's article?**

A. Yes, there is. In response to Professor Wong's article, *The Quarterly Review of Economics and Finance* published an article in 2003, authored by Thomas M. Zepp, which commented on the Annie Wong article cited by Mr. Hinton. Relative to Ms. Wong's results, Dr. Zepp concluded in the Abstract on page 1 of his article: "Her weak results, however, do not rule out the possibility of a small firm effect for utilities."[41] Dr. Zepp also noted on page 582 that: "Two other studies discussed here support a conclusion that smaller water utility stocks are more risky than larger ones. To the extent that water utilities are representative of all utilities, there is support for smaller utilities being more risky than larger ones."[42] Finally, I note that Professor Wong's study, while relying on a large group of gas and electric utilities, used no water utilities.

Q. **Are you aware of any other academic literature relating to the applicability of a size premium?**

A. Yes. An article by Michael A. Paschall, ASA, CFA, and George B. Hawkins ASA, CFA, also supports the applicability of a size premium. As the article

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41 Thomas M. Zepp, Thomas M. "Utility Stocks and the Size Effect --- Revisited", The Quarterly Review of Economics and Finance, 43 (2003) at 578-582.

42 *Ibid, at 578-582*

makes clear, all else equal, size is a risk factor which must be taken into account when setting the cost of capital or capitalization (discount) rate. Paschall and Hawkins state in their conclusion as follows:

> The current challenge to traditional thinking about a small stock premium is a very real and potentially troublesome issue. The challenge comes from bright and articulate people and has already been incorporated into some court cases, providing further ammunition for the IRS. Failing to consider the additional risk associated with most smaller companies, however, is to fail to acknowledge reality. Measured properly, small company stocks have proven to be more risky over a long period of time than have larger company stocks. This makes sense due to the various advantages that larger companies have over smaller companies. Investors looking to purchase a riskier company will require a greater return on investment to compensate for that risk. There are numerous other risks affecting a particular company, yet the use of a size premium is one way to quantify the risk associated with smaller companies.[43]

Hence, Paschall and Hawkins corroborate the need for a small size adjustment, all else equal. Consistent with the financial principle of risk and return discussed previously and the stand-alone nature of ratemaking, an upward adjustment must be applied to the indicated cost of common equity derived from the cost of equity models of the water proxy group used in this proceeding.

D. Consideration of Adjustment Mechanisms in Place for Aqua North Carolina

Q. **Mr. Hinton discusses several mechanism's that he claims to impact risk for Aqua North Carolina.[44] Is his claim valid?**

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43 Michael A. Paschall, ASA, CFA and George B. Hawkins ASA, CFA, "Do Smaller Companies Warrant a Higher Discount Rate for Risk?", CCH Business Valuation Alert, Vol. 1, Issue No. 2, December 1999.

44 Hinton Direct Testimony, at 34.

A. No. The cost of capital is a comparative exercise, so if the mechanism is common throughout the companies of similar risk on which one bases that analyses, the comparative risk is zero because any impact of the perceived reduced risk due to the mechanism(s) by investors would be reflected in the market data of those companies of similar risk. To that point, as shown on Schedule DWD-10R, every single one of the proxy companies has a Distribution Service Improvement Charge or comparable Water Revenue Adjustment Mechanism in at least one of their jurisdictions.

VI. CONCLUSION

Q. **Has Mr. Hinton persuaded you to amend your originally recommended ROE of 10.90?**

A. Yes. Given his argument regarding flotation costs,[45] I have conceded the 11 basis point adjustment for flotation costs. I conclude that an appropriate cost of common equity for the Company is 10.80% as a result.

Q. **Does this conclude your rebuttal testimony?**

A. Yes, it does.

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45 Hinton Direct Testimony, at 39-40.

COMMISSIONER BROWN-BLAND: And also, just out of an abundance of caution, the exhibit was received in evidence, but I want to make it clear that it is identified as it was marked when prefiled.

(D'Ascendis Rebuttal Exhibit Number 1 was marked for identification having previously been admitted in Volume 6.)

COMMISSIONER BROWN-BLAND: On the second matter, there were two requests for a late-filed exhibit. Counsel and I have discussed one of them up here before going on the record. I understand that the Company is still working on that and will be providing something later. And the second one -- we talked about both of them. The second one was also the communications with DEQ, which Aqua is also working on. So they have not been lost sight of; is that correct?

Is there anything else that needs to be dealt with before we call the next witness?

MS. SANFORD: Commissioner Brown-Bland, we owe the Commission and are prepared very shortly to file a response to the Public Staff's motion with respect to confidential document, so that we

filed this morning.

COMMISSIONER BROWN-BLAND: All right. Thank you, Ms. Sanford. With that, no one else has anything. Ms. Sanford, I believe the direct case is still with you this morning?

MS. SANFORD: Yes. Thank you. We're calling Dr. Chris Crockett.

CHRISTOPHER CROCKETT

having first been duly sworn, was examined and testified as follows:

DIRECT EXAMINATION BY MS. SANFORD:

Q. Good morning, Dr. Crockett.

A. Good morning.

Q. Would you state your name, business address, and occupation?

COMMISSIONER BROWN-BLAND: Dr. Crockett, would you pull that microphone real close?

COMMISSIONER GRAY: Thank you. Some of us are a little hard of hearing.

THE WITNESS: The chair doesn't move forward.

COMMISSIONER GRAY: The microphone does.

BY MS. SANFORD:

Q. So you might even move it closer. It needs

to be pretty close for people to hear, in my experience. So let's try this again.

Would you please state for the record, your name, business address, and occupation?

A. Sure. My name is Christopher S. Crockett, and I am the chief environmental officer for Aqua America, located at 762 West Lancaster Avenue, Bryn Mawr, Pennsylvania 19010.

Q. And have you prepared for this proceeding and prefiled rebuttal testimony consisting of 15 pages and one exhibit?

A. Yes, I did.

Q. And your exhibit is captioned "The Water Quality Plan"; is that correct?

A. Yes, it is.

Q. Do you have any changes to make to your testimony?

A. No, I do not.

MS. SANFORD: Commissioner Brown-Bland, we would move that his testimony be identified and moved into the record as if given orally from the stand.

COMMISSIONER BROWN-BLAND: Ms. Sanford, that motion will be allowed. I just want to be

clear for labeling purposes, is this his direct or his rebuttal?

MS. SANFORD: This is his direct. He's here on rebuttal day, and I've got my mind on rebuttal. So this has nothing to do with the witness and everything to do with his attorney. Sorry. I'm trying to rebut and move on.

COMMISSIONER BROWN-BLAND: That motion will be allowed, and his prefiled testimony will be received into evidence as if given orally from the witness stand. And the exhibits will be marked as they -- or identified as they were marked when prefiled.

MS. SANFORD: Thank you very much.

(Crockett Exhibits A and B were marked for identification.)

(Whereupon, the prefiled direct testimony of Christopher Crockett was copied into the record as if given orally from the stand.)

STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. W-218, SUB 497

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

IN THE MATTER OF
APPLICATION BY AQUA NORTH CAROLINA, INC.,
202 MACKENAN COURT, CARY, NORTH CAROLINA 27511,
FOR AUTHORITY TO ADJUST AND INCREASE RATES FOR WATER
AND SEWER UTILITY SERVICE IN ALL SERVICE AREAS IN
NORTH CAROLINA

PREFILED DIRECT TESTIMONY OF
DR. CHRISTOPHER CROCKETT
ON BEHALF OF
AQUA NORTH CAROLINA, INC.

July 27, 2018

Q. PLEASE STATE YOUR NAME, YOUR POSITION WITH AQUA AMERICA AND YOUR BUSINESS ADDRESS.

A. My name is Christopher Crockett. I am Chief Environmental Officer for Aqua America and work for its service company. My business address is 762 West Lancaster Avenue, Bryn Mawr, Pennsylvania 19010. My responsibilities include oversight of environmental compliance within the Aqua America footprint, including North Carolina.

Q. PLEASE PROVIDE YOUR BACKGROUND AND EXPERIENCE.

A. I have been employed by Aqua America since 2016. Prior to that, I was employed by the Philadelphia Water Department where I held progressively responsible positions. My last position at the Philadelphia Water Department was Deputy Water Commissioner and my duties included overseeing drinking water quality and laboratory services, infrastructure planning, research, watershed protection, and environmental compliance. I graduated from Drexel University in 1993, 1995, and 2004 with degrees in Civil Engineering, Environmental Engineering, and Environmental Engineering, respectively. I am a licensed Professional Civil Engineer in Pennsylvania.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. My testimony will address water and wastewater compliance for Aqua North Carolina, Inc. ("Aqua" or "Company") with a focus on secondary water quality. I will discuss Aqua's North Carolina Water Quality Plan and our

goal to expedite infrastructure improvements to address secondary water quality issues for our customers.

BACKGROUND ON PRIMARY AND SECONDARY WATER QUALITY STANDARDS

Q. PLEASE DESCRIBE THE DIFFERENCE BETWEEN PRIMARY AND SECONDARY WATER QUALITY.

A. Primary water quality is discussed in terms of mandatory water quality standards for drinking water contaminants, as promulgated by the EPA's *National Primary Drinking Water Regulations.* Primary water quality is focused on contaminants that pose a risk to public health and is measured by legally enforceable standards called Maximum Containment Levels or "MCLs". Secondary water quality is discussed in terms of non-mandatory water quality standards, per the EPA's *National Secondary Drinking Water Regulations.* In most jurisdictions, secondary water quality is measured by Secondary Maximum Containment Levels or "sMCLs". Unlike MCLs, sMCLs are not legally enforceable by EPA, and are generally concerned with aesthetic attributes such as taste, color, and odor.

Q. IS AQUA NORTH CAROLINA IN COMPLIANCE WITH ALL PRIMARY DRINKING WATER STANDARDS? IF NOT, PLEASE EXPLAIN WHERE THOSE ISSUES ARE.

A. We are currently in compliance with all primary drinking water standards except in one system, which is the Chapel Ridge system. In the first quarter

of 2018, the system exceeded the disinfection by-products Maximum Contaminant Level for Total Trihalomethanes. This system purchases water from the Town of Pittsboro and the water was not in compliance when it was delivered to our system. We are currently working with the Town to improve the quality of water being received and evaluating ways Aqua can prevent this condition from occurring moving forward.

Q. WHY IS IT IMPORTANT TO CONSIDER SECONDARY WATER QUALITY CONCERNS?

A. Aqua believes that water should be both safe (primary water quality) and aesthetically pleasing (secondary water quality). While not a threat to public health, secondary water quality factors are critical to achieving customer confidence in a water system.

MANGANESE AND IRON IN NORTH CAROLINA

Q. PLEASE COMMENT ON THE PRESENCE OF IRON AND MANGANESE IN NORTH CAROLINA.

A. Iron and manganese are naturally occurring minerals that can be found in rocks and soil. Iron is one of the most abundant of all elements in nature and comprises 5% of the earth's crust. Both iron and manganese are found in groundwater throughout North Carolina due to the presence of these minerals in the aquifers in the state.

Q. PLEASE PROVIDE AN OVERVIEW OF WHAT HAPPENS TO GROUNDWATER THAT IS LOCATED IN AQUIFERS CONTAINING NATURALLY OCCURRING IRON AND MANGANESE.

A. When these minerals are present in materials that compose an aquifer, they can become dissolved in the groundwater that is produced from that aquifer. While these minerals remain soluble in the oxygen-depleted environment of an aquifer or well, they are oxidized when pumped to the surface (where oxygen is more abundant) and become insoluble. Insoluble iron presents as solid, rust-colored particles while insoluble manganese presents as solid, brownish-black particles. Both minerals in their insoluble forms cause discoloration of the water and could stain laundry, porcelain, dishes or other household items.

Q. WHAT TYPES OF CUSTOMERS ISSUES ARISE IF A WELL OR AQUIFER HAS HIGHER IRON AND MANGANESE?

A. Often, we will hear and see pictures from customers that the water coming out of their tap is discolored, feels "hard", or has particles in it. Iron and manganese can have a variety of impacts on customers ranging from plumbing problems, staining of fixtures, and staining of clothes during washing. Other potential impacts can occur if the manganese levels are too high. The U.S. EPA has a lifetime health advisory of 0.3 mg/L for manganese health effects. The EPA Health Advisory suggests levels greater than 0.3 mg/L have the potential to impact the health of children.

Q. WHAT ARE DIFFERENT WAYS TO ADDRESS THIS OUTCOME?

A. Iron and manganese can be treated to make them non-objectionable to customers in several ways. The most direct way is either: 1) removal from the water through a filter or 2) by sequestration. Removal from water can be performed by several processes, including sedimentation and filtration, filtration alone, aeration followed by filtration, and by ion exchange. Manganese greensand is effective for the removal of both iron and manganese to very low levels. The chemical sequestration process transforms the iron and manganese from a particulate form to a dissolved form. Sequestration keeps the iron and manganese in their soluble liquid forms which will not cause staining or produce visible particles.

Other remedies include:

- Flushing the water system, which Aqua does from the street;
- Flushing the water tank;
- Filtration installed on the customer's premises---either on a whole-house or individual appliance basis;
- Homeowner runs water to allow buildup in internal plumbing to drain.

Q. PLEASE FURTHER ADDRESS THE PRESENCE OF NATURALLY OCCURING IRON AND MANGANESE IN THE GROUNDWATER SUPPLY WHICH AQUA ACCESSES IN MANY AREAS TO PROVIDE SERVICE.

A. Aqua understands the concerns expressed by affected customers, and I will address the scope of the issue, compliance standards, available remedies, and cost of remediation.

Iron and manganese characterize ground water across the state and impact the water drawn from public as well as private wells. Of Aqua's 1,312 Entry Points in this state, approximately 80 draw from groundwater that has appreciable amounts of iron and manganese (Fe + Mn > 1 or Mn > 0.3 mg/L). Whether the wells were drilled by a developer, an Aqua contractor, or purchased from legacy utility providers, the source of the issue is the underlying groundwater, the causes of which have been previously discussed.

Q. PLEASE DESCRIBE RECENT ACTIONS BY THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY ("NCDEQ") REGARDING SECONDARY WATER LIMITS FOR IRON AND MANGANESE.

A. In February of 2016, NCDEQ began issuing Notice of Deficiencies ("NODs") for exceeding sMCLs for iron ("Fe") and manganese ("Mn") in the Raleigh region. These NODs were categorized in three tiers:

- Tier 1 NODs: Fe + Mn > 1 mg/L and no treatment (8 NODs received)
- Tier 2 NODs: Fe or Mn > their respective sMCL and no treatment (13 NODs received)

- Tier 3 NODs: Fe + Mn > 1 and sequestration (47 NODs received)

A total of 68 NODs were received for all three of these tiers. Prior to February 2016, Aqua had only received Notice of Deficiencies for exceeding sMCLs for iron and manganese 5 times since 2011.

Q. WHAT WAS AQUA'S RESPONSE TO THIS CHANGE IN POLICY?

A. Aqua has a longstanding commitment to its customers and has been working on this issue for many years. Aqua was a leader in the industry in North Carolina working to get an infrastructure mechanism in place that would allow the Company to accelerate treatment improvements to address this issue. Legislation was passed in 2013 which authorized a system improvement charge; this has established a method by which solutions can be more readily achieved, while maintaining strict regulatory oversight of the expenditures and rate recovery.

Q. WHAT ELSE HAS AQUA DONE IN RESPONSE TO THIS SHIFT IN POLICY FROM NCDEQ?

A. Aqua has had a number of meetings with NCDEQ and Public Staff. Aqua's goal at these meetings was to form a consensus with our environmental and economic regulators on how and when certain sets of criteria would trigger the need for treatment of iron and manganese issues. These were productive meetings that ultimately lead to the Water Quality Plan, which I describe in more detail below.

Q. PLEASE REVIEW THE CURRENT AVAILABLE REMEDIES TO REMEDIATE WATER THAT IS RICH IN IRON AND MANGANESE.

A. These include:

- Removing the minerals via sedimentation and filtration, filtration alone, aeration followed by filtration, and by ion exchange
- Converting the insoluble minerals to soluble form via sequestration
- Flushing the water system (Aqua)
- Flushing internal plumbing (Homeowner)
- Filtration installed on the customer's premises---either on a whole-house or individual appliance basis

Q. PLEASE DISCUSS THE VARYING COSTS OF THE REMEDIATION METHODS LISTED ABOVE.

A. The levels of effectiveness, cost, and relative responsibility for these corrective measures vary. Additionally, costs can be measured both in dollars and in terms of inconvenience.

- Customer-initiated treatment---whether by draining buildup in lines by flushing and running water, or by one or more of the modes of home filtration---imposes inconvenience and cost directly on the homeowner.

- Utility-initiated flushing imposes the cost of water used in flushing on all customers as well as an inconvenience to individual homeowners who bear intermittent discoloration that may result from flushing activities.
- Central filtration, installed at the well, is the most expensive, but most effective treatment. The current capital cost to install central filtration at a well is approximately $350,000, but varies based on many factors. The estimated monthly rate impact to Aqua water customers based on this capital cost is approximately $.06 per water customer per each filter installed. By contrast, the approximate monthly costs for sequestration and cartridge filters per site is estimated to be less than $.01 per customer. It is important to note that high levels of iron and manganese render the much more inexpensive sequestration and cartridge filter solutions ineffective and, thus, require a central filtration system.

WATER QUALITY OPERATIONS PLAN

Q. PLEASE PROVIDE A GENERAL OVERVIEW OF THE WATER QUALITY PLAN.

A. Aqua is utilizing a combination of increased capital and operational process improvement to address secondary water quality issues within our Water Quality Plan. The Company's plan identifies capital and process needs to address each system's water quality issues, and establishes a prioritization

methodology. Examples of capital and process improvement needs include (but are not limited to) treatment options or filtration along with tank cleaning and flushing. This plan works to develop a common framework to address secondary water quality issues with NCDEQ support, thereby collaboratively engaging regulatory stakeholders. The plan estimates the installation of 10-15 greensand filter systems annually and would potentially require an estimated $28 million investment in greensand filtration systems over the next seven years.

Q. PLEASE EXPLAIN THE PRIORITIZATION PROCESS REFERENCED ABOVE.

A. Aqua's Water Quality Plan prioritizes sites and addresses water quality issues based on three points:

1) Notice of deficiencies

2) Scientific, engineering, and health data

3) Customer complaints

These factors were analyzed to sort Aqua's systems into groups associated with water quality needs and anticipated remediation methods were determined for each grouping.

Q. WHAT IS THE RESULT OF THE PREVIOUSLY EXPLAINED WATER QUALITY PRIORITIZATION PLAN?

A. The water quality plan focuses on four groupings:

- Group 1 Sites: Fe + Mn > 1 or Mn > 0.3 mg/L

- Group 2 Sites: Fe > 0.6 or Mn > 0.1 mg/L
- Group 3 Sites: Fe > 0.3 or Mn > 0.05 mg/L
- Group 4 Sites: Under sMCLs for Fe and Mn

Group 1 Sites are prioritized for public health protection. The EPA's health advisory for Mn in drinking water begins at 0.3 mg/L. As such, manganese measured at this level or higher is considered an acute issue and is anticipated to be treated with greensand filtration, flushing, and tank cleaning. Sites that meet the Group 1 criteria then go through further feasibility analysis to include their overall contribution to a system's needed capacity and its mineral load, along with an assessment of potential alternative sources, before final recommendation for a greensand filter system is made. Group 2 sites are focused on water aesthetics and home plumbing protection. These sites must be continually assessed and tested to determine whether filtration may be required (and if so, what type) or if sequestration is effective and appropriate. Regular flushing will be conducted in the interim. Group 3 sites are continuously reviewed to maximize sequestration and operational treatment with the aim to improve the water's aesthetics. Group 4 sites are flushed as needed to maintain Fe and Mn below sMCLs. The current Water Quality Plan aims to address secondary water quality issues in Group 1 sites within the next seven (7) years, and includes a tank cleaning program, flushing program, and filtration implementation plan.

Q. IS THERE A SUMMARY DOCUMENT THAT GIVES AN OVERVIEW OF THE PLAN?

A. Yes, see Crocket Exhibit A - Water Quality Plan Summary.

Q. PLEASE DESCRIBE HOW OPERATIONS IS INCLUDED IN THE WATER QUALITY PLAN.

A. Routine flushing and tank cleaning is a key part of the plan to remove legacy sediments and mineral build-up in a system prior to the installation of filtration treatment. Systems that use other types of treatment, or are waiting for filtration to be installed, will be subject to scheduled flushing to limit the build-up of minerals in the distribution system and improve water quality.

CUSTOMER COMMUNICATIONS PLAN

Q. PLEASE DISCUSS THE CUSTOMER COMMUNICATIONS PLAN LINKED TO THE WATER QUALITY PLAN.

A. Coinciding with our operational plan, Aqua developed a communications plan so that the water quality remediation efforts, timing, and education on the subject could be effectively conveyed to our customers. Educating our customers on this topic is high priority and the Company takes this effort very seriously. Aqua surveyed residential customers to better understand their concerns, understand their general awareness regarding water quality issues, and to identify preferred communication methods.

In February 2018, Aqua rolled out a project website for customers to learn more about the program and Aqua's actions (www.ncwaterquality.com). The building website features a sign-up page that allows the Company to build an email list, which is used to share ongoing updates about progress using the most preferred medium of outreach, per the survey results. Aqua is also using direct letters, postcards and bill inserts to reach customers, all driving them to view the project website and sign up to receive updates. The ultimate goal is to educate and provide more information to customers. An example of this customer education material is attached to my testimony as Crockett Exhibit B - Customer Education Information.

Q. PLEASE DESCRIBE ADDITIONAL ACTIONS TAKEN TO EDUCATE AND COMMUNICATE WITH CUSTOMERS.

A. As mentioned above, Aqua has developed a site on its website specifically designed to focus on its water quality plan and educate customers on this issue.

Working collaboratively with our state regulators, we have developed a plan for carrying out our water quality improvement program. For customers, it is important to explain our long-term plan to address water quality. The plan on the site outlines:

- For systems with high levels of iron and manganese, new filtration treatment will be installed. Our goal is to install new filtration treatment within a reasonable timeline. The wells that need it most

will see filtration within the next three to five years; installations will be prioritized based on the number of compounds in the water;

- Areas with moderate levels will be treated with a process to improve overall water aesthetics; and
- Systems with little to no iron and manganese will be monitored and treated as needed.

The site explains that all systems will be monitored on an ongoing basis to help ensure safety and overall quality of the water source. It further explains that Aqua also employs an aggressive water quality operation plan to help make sure water consistently flows clear. That will mean an increase in scheduled system flushing in many communities and a robust tank-cleaning program that spans our operation across the state.

In addition to addressing the naturally occurring iron and manganese, the rates our customers pay also go toward other water and wastewater system improvements to prevent service interruptions and prevent sewage backups into customers' homes and businesses.

We are committed to ongoing system enhancements to improve both the quality of water and reliability of service and will update customers on the progress of the plan.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

BY MS. SANFORD:

Q. Do you have a summary, Dr. Crockett?

A. Yes, I do.

Q. Would you read it, please?

A. With permission.

My name is Christopher Crockett, I'm the chief environmental officer for Aqua America, and I'm employed by its service company. I have been employed there since 2016, and I'm responsible for the oversight of environment compliance within the Aqua America footprint, including North Carolina. Prior to Aqua America, I held progressively responsible positions at the Philadelphia Water Department, ending as deputy water commissioner, for 21 years.

I graduated from Drexel University with a bachelor's in science and civil engineering, a master's of science in environmental engineering, and a Ph.D. in environmental engineering, and I'm a registered professional engineer in the state of Pennsylvania.

The purpose of my testimony is really to talk about our water quality compliance plan and North Carolina, with our focus on secondary water quality. I will discuss North Carolina's water quality plan, our goal to expedite our infrastructure

improvements and address our secondary water quality issues to our customers in relating communications plan.

Water quality standards are classified in two categories, primary and secondary. Primary water quality standards are standards -- or contaminants that pose a risk to public health and are measured by legally-enforceable standards called maximum contaminate levels. The secondary water quality standards are discussed in terms of nonmandatory, typically nonenforceable standards called secondary maximum contaminant levels, and are really associated with aesthetic attributes, such as taste, color, and odor. While not a threat to health in general, secondary water quality factors are critical to achieving customer confidence in a water system.

North Carolina's secondary water quality focuses on the presence of iron and manganese in groundwater throughout the state. Naturally occurring iron and manganese are found in the groundwater throughout North Carolina and can cause secondary water quality concerns in the form of discolored water, hard water, or water containing particles. The presence of these minerals can have a variety of impacts on

customers ranging from plumbing problems to staining of fixtures and staining of clothes during washing. These treatment options that we have available include removing the minerals from the water through a filter, or through a chemical means called sequestration.

In February of 2016, the North Carolina Department of Environmental Quality began issuing notices of deficiencies for exceeding secondary MCLs for iron and manganese. Aqua's had a long-standing commitment to its water quality and to its customers on this issue for years prior to this requirement and formal action of these notices of deficiency. We were a leader in the industry working to get the infrastructure mechanisms in place to allow the Company to accelerate improvement to address these issues. Aqua has also held several meetings with the North Carolina Department of Environmental Quality and the Public Staff to gain a consensus on how and when certain sets of criteria would trigger the need for treatment of iron and manganese issues.

Those meetings ultimately led to the development of Aqua's North Carolina water quality -- Aqua North Carolina's water quality plan, which utilizes a combination of increased capital of

operational process improvements to address secondary water quality issues. This plan identifies capital and process needs to address each system's water quality issues and establish it as a prioritization methodology, which is fully detailed in the text of my testimony, including the exhibit.

The effect of this plan is develop a framework to address secondary water quality issues with North Carolina DEQ support, thereby collaboratively gauging regulatory stakeholders. The plan estimates about 10 to 15 greensand filter systems would need to be installed annually and would potentially require an additional $20 million investment in greensand filtration systems over the next seven years.

Coinciding with the operational plan, Aqua has developed a communications plan so that water quality remediation efforts, timing, and education on the subject could be effectively conveyed to our customers. In February of 2018, Aqua rolled out its website for customers to learn more about this program and Aqua's actions at www.ncwaterquality.com.

The Company is using direct letters, postcards, and bill inserts to reach customers, all

driving them towards this new website, encouraging them to sign up to receive regular updates regarding progress with the water quality plan. The ultimate goal is to educate and provide more information to customers.

This concludes my summary.

Q. Thank you, Dr. Crockett.

MS. SANFORD: The witness is available for cross.

CROSS EXAMINATION BY MS. TOWNSEND:

Q. Good morning, Dr. Crockett. My name is Terry Townsend. I'm with the Department of Justice, the Attorney General's Office.

As the chief environmental officer of Aqua America, do your duties include all of Aqua America subsidiaries?

A. Yes, ma'am.

Q. Do your oversight responsibilities include the history of compliance with Aqua North Carolina since it first came to North Carolina?

A. It involves reporting, tracking, and improving the compliance of Aqua, North Carolina.

Q. From the date it arrived in North Carolina; is that correct?

A. Well, when it arrived in North Carolina, that predated my existence.

Q. Okay. So you only have information since 2016; is that correct?

A. We have some historical information, but not all.

Q. Okay. You state -- and you stated that iron and manganese are naturally-occurring minerals found in groundwater throughout North Carolina, correct?

A. Yes.

Q. You also state, on page 4, lines 10 to 11, that these minerals are, quote, not a threat to public health, correct?

A. Iron is not a threat to public health. However, manganese, recently and in recent studies, have been shown to have potential for public health issues above a certain dosage. That has been founded in a lifetime health advisory limit issued by EPA for manganese of 0.3 milligrams per liter.

Q. Thank you. To your knowledge, has any of the Aqua North Carolina water quality systems ever reached a level of concentration for manganese of 0.3 milligrams per liter or more?

A. Yes. That is the purpose of the plan.

Q. Do you know which systems have reached that level or beyond?

A. I do not have that number and names off the top of my head.

Q. Do you know approximately how many?

A. If we -- I would have to go back and consult our spreadsheet of the Group One systems that are -- the ones over 0.3.

Q. And what has Aqua North Carolina's response been when such levels were discovered?

A. Typically, the response has been flushing. We have investigated treatment and filtration. And again, it's a lifetime health advisory limit, not an acute standard. It's something that is akin to other contaminants out there, so it doesn't require an immediate shut-down of a well or anything like that. But we've investigated treatment, we've investigated options for chemical sequestration, we've investigated options for flushing and other approaches, including looking at different well sources and other water sources.

Q. Have you ever advised -- or has Aqua ever advised its customers regarding health issues in areas serviced by a water quality system that has manganese

over 0.3?

A. Other than our general communication in our customer -- we have a consumer confidence report, it's called water quality report, it's required by EPA. In that, we post information about the manganese levels, and that's communicated to our customers.

Q. But not to any individual customers of certain water systems that might have and that do have concentrations of 0.3; is that correct?

A. I'm not aware of it at this time.

Q. Okay. In North Carolina, you're aware that the maximum concentration level for iron is 0.3, and for manganese is actually 0.05 milligrams per liter, correct?

A. Yes.

Q. Okay. Significantly lower than the 0.3 suggested by the EPA's advisory, correct?

A. That number is set based on aesthetic standards for black water and staining.

Q. On page 7, lines 5 through 8 of your testimony, you state there are approximately 80 points of entry that draw from groundwater with appreciable amounts of iron and manganese, correct?

A. The testimony states that, yes; that's

correct.

Q. All right. And my understanding of appreciable amounts of iron and manganese are when iron and manganese together total more than 1 milligram per liter or manganese more than 0.3 milligrams per liter; is that correct?

A. It would also -- yes.

Q. Okay. You were referencing 80 points of entry, not 80 water quality systems; am I understanding that correctly?

A. That's correct. Some systems have multiple points of entry because there's multiple wells servicing an area.

Q. Can you explain what you mean by "points of entry"?

A. So point of entry is the official designation by a regulatory agency for the Safe Drinking Water Act where compliance needs to be measured and met in terms of meeting drinking water quality standards. You can have -- imagine this room as your neighborhood. You could have a well over in this corner, a well over in that corner, and a well over in this corner. Each one of those could combine together into one place and then go out to the distribution system, which would be an

entry point, or they could all individually go into the distribution system to the customers, and those would each individually be entry points.

Q. So it could be three points of entry or it could be one point of entry --

A. Depending on the system's --

Q. -- depending on how it's flowing?

A. Depending on the system's arrangement, yes.

Q. Okay. In your testimony, on page 10, lines 12 through 15, you state that high levels of iron and manganese render sequestration and cartridge filter solutions ineffective, and only a central filtration system would do; is that correct?

A. Yes, that's correct.

Q. Okay. Does that mean that all of these 80 points of entries that you indicated would require a central filtration system to be effective in eliminating problems regarding iron and manganese?

A. I would qualify that. There are 80 points that we originally identified, and so part of the process involves going back and resampling to verify that that wasn't a mistake or some kind of strange result that could happen. And then once we verify if those levels are there, then we have to look at the

flow. We have to look at how much flow is coming out of that system.

If it's a very, very, very small flow, we may end up shifting to using another source or something else. And then after we look at those options, if the levels are still that high, then you would need to go to some kind of filtration system. Specifically at those high levels, a greensand filter system would be the way to do it. The cartridge filters would clog almost immediately. You wouldn't be able to maintain them. And sequestration just moves it from the particulate form that you can see to a dissolvent form. It does not get rid of the chemical -- of the minerals.

Q. At this point, to your knowledge, what percentage have been able to use something other than the greensand and be effective?

A. I don't have that number off the top of my head. It's something we're still working on.

Q. And you mentioned, in your summary, and also in your testimony, that Aqua would install 10 to 15 greensand systems annually over seven years; is that the plan?

A. Right now, that is the estimated plan. As we go through and go through the framework, and maybe it

will be less depending -- or maybe it will be more depending on the results we find.

Q. That comes out to about 70 to 105 filters over that seven-year period, correct?

A. It comes out to -- hold on. I have a number in my -- if -- in the seven-year plan? The five-year plan or seven?

Q. Seven years.

A. Seven years. I have roughly 92 locations that were eligible to be investigated for greensand filtration.

Q. Okay. And do you know if those 92 include all 80 points of entry that you discussed earlier?

A. It should include all 80 of those. They use the same criteria.

Q. All right. And you propose -- or Aqua proposes four groupings in its water quality operations plan, correct?

A. That's correct.

Q. And you further state that the Group One sites are prioritized for, quote, public health protection, end quote; is that correct?

A. Yes.

Q. All right. And you again reference EPA's

health advisory about the 0.3 milligrams per liter for manganese, correct?

A. Yes.

Q. And how many Aqua wells are currently measuring at that level of manganese or higher?

A. I'm sorry, repeat the question.

Q. How many Aqua wells are currently measuring at that level of manganese, 0.3 or higher?

A. I don't have that number off the top of my head.

Q. An approximate number?

A. I wouldn't guess without looking at the spreadsheet.

Q. Okay. Do you know if there is a certain area where these wells tend to be located?

A. It really depends on the geology, and it really depends on the results. So the whole state of North Carolina, because of its geology, tends to have higher levels of iron and manganese. So there isn't a particular cluster, other than where we have the wells that would have it. So I don't think so.

Q. So you don't know if there is more in Wake County than there are in Buncombe County?

A. Well, that would be a factor not just based

on the geology, but if we have more wells in one county than another, it would bias it anyways. So that's not necessarily a picture of the whole state. The whole state has high levels of iron and manganese throughout the whole state.

Q. Is it possible to actually provide that information in some kind of a spreadsheet to explain where these wells are located?

A. We can -- I think one of the requests that we're working on right now is actually providing that list of those systems and where they are.

Q. And you state, on page 12, lines 19 through 22, that Aqua aims to address secondary water quality issues at these Group One sites within the next seven years and would include a tank cleaning program, a flushing program, and a filtration implementation plan, correct?

A. Yes.

Q. Okay. If my understanding is correct, then this tank cleaning and flushing program are precursors to the installation of a greensand filter; is that correct?

A. They are initially precursors, and then we would need to see if it's required after that. But if

the filtration system is working, it shouldn't be required.

Q. So are they -- once a greensand filter has been approved, do you go through the process of tank cleaning, flushing, and getting the filter ready?

A. Tank cleaning and flushing happened anyways in systems. And as a precursor to -- and it's something that we're going to be doing anyways for the systems while we're waiting to build a greensand filtration. It's something that we will do, obviously, before a filter is installed to get all the stuff out of the system so it doesn't reside in it anymore, but you have to do it constantly, because until you put the filtration system in, you're constantly getting those minerals in the system.

Q. Once you get to the point you're going to put in the greensand filter, how long does it take for you to do the process of the tank cleaning and flushing?

A. It depends on the size of the system, but it can be done from -- it can be done in days. And it really depends on, again, the size of the system, the locations, the pressure of the geology buildup.

Q. Okay. And what about -- is each filter designed specifically for a specific well?

A. Yeah. Filters are -- there's a general design framework to them, but they're typically designed for each well, because you have to look at the water chemistry, because each well is slightly different, which involves looking at the pH or the acidity of the water. And also making sure that when you produce the water coming out the other side, that it's not just dealing with iron and manganese, but it also makes sure that there isn't any other issues that would effect corrosivity, or the lead and copper, or anything else in the home.

Q. Now, is that done contemporaneously with the tank cleaning and the flushing, when you're getting ready to put that filter on?

A. The studies of the design are done in parallel while everything else is happening. The operational work is happening in parallel -- the flushing and operational work is happening in parallel to the design construction.

Q. Who actually engineers the design? Is it designed by somebody from Aqua, or is there a third party involved?

A. Aqua typically hires an engineering firm that designs these for many organizations, many water

companies. It's a relatively standard thing to design, you just got to make sure you do your homework when you design it.

Q. And who actually installs the filters; is that also the third party?

A. Yeah. We would hire a contractor to install. Sometimes it's the vendor that actually makes the proprietary product, sometimes it's the contractor.

Q. And how are the filters maintained once they're installed?

A. Typically, you develop a maintenance plan based on the manufacturer or the vendor of the technology that's selected. They have a series of recommended maintenance programs where you have to backwash it based on certain criteria to make sure that it's maintained. You have to make sure that certain pumps and electrical equipment are checked and any other chemical dosages are checked. So it really depends on the individual filter and its needs and its size. Some may need to be more routinely maintained than others, depending on what's happening.

Q. And who actually maintains them, your employees?

A. Our operations staff would operate and

maintain them.

Q. And what qualifications do they have to operate these filters?

A. Well, first they would be given training, but second, they are licensed operators in the state. So they're required to understand how you do this. It's not a very complicated process, operating the greensand filter.

Q. And my understanding from Mr. Becker's testimony earlier was that the training for greensands is a little bit more complicated and takes a little bit more time.

Is that --

A. It's more complicated than running a basic well where you're just running a pump, but it is something that an operator could be trained to do. And if -- if necessary, a third party can help bridge that gap until the operator is up to speed. There's ways to deal with that issue.

Q. And who does the training; is that done by Aqua, or is that done by a third party?

A. Typically, it's done by a third party. Typically, the manufacturer of the actual greensand filter technology.

Q. And which positions -- or which employees, actually, then are qualified to install; what are their position names, if you would?

A. I would have to let Shannon describe those position titles, but my general term for them is the operators of well systems.

Q. Okay. And what is the life expectancy of these filters?

A. It depends on the actual nature of the geology and the mineral content, but, typically, these things can operate for more than a decade, upwards of two decades. Twenty years is pretty much an expected service life, and that's typically before all the other equipment starts to -- it's not necessarily the filter, it's all the other equipment around it that would need repair and replace. But it's really a very general number.

Q. So for accounting purposes, would they be depreciated?

A. They would definitely have to be depreciated over that period of time. Fifteen to twenty years is typical. And also, if they lose efficiency, you may want to replace it with a more efficient system down the road.

Q. And how is that determined, whether or not --
A. The efficiency is depending on how often are you replacing media, how often does it clog, how often is it backwashing. You know, different things like that. So if it looks like the equipment isn't -- is requiring more, and more, and more, and more maintenance, and more, and more replacement, things need replace more frequently or updated, then you make a decision based on lifecycle analysis if it's time to replace it or not.
Q. How many greensand filters are currently in place in North Carolina?
A. If -- off the top of my head, I don't have the exact number, but I know that we've installed over 10 in the last several years in different systems that we have.
Q. And have all those worked properly?
A. I don't have data to say that they are not working properly. All I know is that we've installed them, and I have not heard any issues.
Q. Okay. You weren't here for Mr. Becker's testimony, but I think he indicated that there was at least one greensand filter dealing with a waterfall area that had some problems, and he didn't know if it

was a mechanical failure, or backwash issues, or even the poor operation of the operator.

Could that -- could it be one of those things, if there is a problem with the filter?

A. There could be a problem with any water filtration system ever designed and built anywhere in the United States for any one of those three reasons.

Q. And does Aqua America utilize greensand filters throughout its -- for all of its subsidiaries?

A. We do have a -- sand filters -- a -- greensand filters in systems that we have in Ohio and some in PA. It's a very standard technology used in the water industry for groundwater systems high in iron and manganese.

Q. Okay. Have any of them experienced any problems, to your knowledge?

A. Not on top of my head, but operating a system is just like your car. You know, your car runs well and eventually, you know, something may break and you need to fix it, and then it works again. So those are just the same things that happen.

Q. And you state, on page 7 of your testimony, on line 16, that DEQ, North Carolina's Department of Environmental Quality, began issuing notices of

deficiencies to Aqua North Carolina in February of 2016, and you also state in your summary; is that correct?

A. Yes.

Q. However, you later note, on page 8, lines 3 through 4, that Aqua North Carolina had received notices of deficiency at least five times since 2011, right?

A. Yes. Only five. But in 2016, we had received 68.

Q. Okay. But it wasn't a new occurrence to have a notice of deficiency?

A. It was a somewhat very limited occurrence.

Q. Okay.

A. Which the change in 68 was a change in policy and enforcement by the DEQ.

Q. To your knowledge?

A. It's pretty clear, based on the numbers, it was a change.

Q. As chief environmental officer of Aqua America, how do you receive these notice that Aqua North Carolina received 68 notices of deficiency in February 2016?

A. Any time that -- there's a number of

different frameworks we have for reporting of violations. So there is our normal quarterly calls, where we go through all the compliance with every state and detail, on-site meetings, monthly phone calls. And then, of course, any time a notice of violation comes in, we're immediately notified at headquarters from whatever it is, wherever it is, in any state. And then we put it on our list of things to track and make sure it gets resolved and identify what the issues are.

Q. What about notices of deficiency?

A. A notice of deficiency is the same in our mind as a violation. It's a regulatory agency sending you a letter saying this is something that is not -- not at their liking, and therefore, we need to address it and resolve it.

Q. And does that require someone from Aqua America to come to Aqua North Carolina to check out what's happening?

A. Depends on the nature, and the amount, and the severity of the issue. For this one, we did come down, and we did go through -- work together on a number of the data points. You know, looking at the well is not really going to change its water quality, it's really about working through what to do and what

the criteria are. So we spend our time working with Public Staff and DEQ on what our criteria and our options are for addressing these contaminants.

Q. Okay. You indicated that you also received the notice of violations.

Do you know if any notice of violations have come to your attention from Aqua North Carolina since you took off -- took your position in 2016?

A. Yes.

Q. And how many have those been?

A. I don't have the number off the top of my head. We track it all in spreadsheets and report on it.

Q. Do you know if it was less than 10, more than 10?

A. Are you asking the drinking water side of all of Aqua North Carolina or the wastewater side?

Q. All of North Carolina.

A. There's been more than 10.

Q. And who would have that information about the other notices of violations?

A. All those were tracked by the state -- our state compliance manager, Ms. Owens.

Q. Do you know if all of these -- I believe you

indicate there were 68 notices of deficiency in 2016 in February.

Were they all related to the 80 points of entry you mentioned in your testimony?

A. If they were iron and manganese over 1 is typically where they did them, so it would include most of the ones that are in the 80 there.

Q. Okay. Are all of them, then, related to Group One facilities?

A. They -- yes.

Q. Okay. Do you know if all of the 68 notices of deficiencies given in February of 2016, have they been resolved?

A. Some have, as we've either changed sources or adjusted the system, but not all have been resolved yet.

Q. For those that have been resolved, how have they been resolved?

A. I would best leave that to Mr. Becker to go through the details of all the resolutions. I don't have the details of all that off the top of my head. I would have to go back and reacquaint myself with it.

Q. Do you know how the expenses for their resolution have been treated on North Carolina Aqua's

books?

A. No, I do not.

Q. Do you know how many notices of deficiency are still outstanding?

A. No, I do not.

Q. As a condition of the notice of deficiency for each facility that was given back in February 2016, Aqua North Carolina was required to provide updates to DEQ on a quarterly basis; is that your understanding?

A. It depends on the actual system and what DEQ required, but that was the general intent, yes.

MS. TOWNSEND: Okay. Madam Chairman, if we may, we have an exhibit that we would like to present at this time. Madam Chairman, we would like to move to mark this exhibit as Attorney General Crockett Cross Exhibit 1, which is Aqua North Carolina's summary of its second quarter, 2018 quarterly update to DEQ, as well as a sample update from the Bayleaf Master System provided with that letter.

MS. SANFORD: Madam Chair, if I might, one clarification. I don't see a date on this. Does the attorney general have a date --

MS. TOWNSEND: There is a date. If you

look on page 4 --

MS. SANFORD: Okay.

MS. TOWNSEND: If you look on page 4. The cover letter didn't have one for some reason, but the later to Bayleaf -- I believe it's page 4. It's not marked as page 4, so if you go one --

COMMISSIONER BROWN-BLAND: Mine is marked page 4, and it's there --

MS. TOWNSEND: -- two, three, four, five. June 27, 2018.

COMMISSIONER BROWN-BLAND: And it's also on page 2. Well, actually, it's on the first cover letter. It's on the cover letter of the letter under Aqua.

MS. SANFORD: Okay. Thank you.

COMMISSIONER BROWN-BLAND: All right. It will be so identified as Attorney General Crockett Cross Examination Exhibit 1.

MS. TOWNSEND: Thank you.

(Attorney General Crockett Cross Examination Exhibit Number 1 was marked for identification.)

BY MS. TOWNSEND:

Q. Dr. Crockett, have you seen these documents

before?

A. No. I have not had a chance to review these documents.

Q. Do you receive the actual notices of deficiency at your office?

A. I get a copy of notices of deficiency at our office. We don't get copied on every communication back and forth between the regulatory agencies and their submissions.

Q. Okay. So you don't get the updates -- the quarterly updates that are actually submitted to DEQ, correct?

A. No.

Q. Okay. If you would go ahead and review it, and let me know when you feel comfortable to discuss.

A. (Witness peruses document.)

Q. We can go through it together very quickly. The first one, two, three pages are actually a cover letter. It's referencing a notice of deficiency quarterly update, iron and manganese concentration, and it was directed to the public water supply section, correct?

A. Correct.

Q. And the first line of the letter to Mr. Hardy

says:

"Attached you will find Aqua's Q2," quarter two, or second quarter, "2018 responses and updates for the current notice of deficiency water systems."

Correct?

A. Yes.

Q. And then they provide you a concise summary of everything that they are providing, correct?

A. Yes.

Q. All right. And after you -- after that first cover sheet, then you'll see that there is actually a June 27, 2018, sample of what they sent for a Bayleaf Master System on that date, June 27, 2018, again to Mr. Hardy at the public water supply section, correct?

A. Yes.

Q. All right. And that is approximately -- I think that's 15 pages long, correct?

A. I'm still counting.

Q. Okay.

A. (Witness peruses document.)

Yes.

Q. Okay.

COMMISSIONER BROWN-BLAND: Ms. Townsend,

just keep your voice up, please.

MS. TOWNSEND: Sorry. I thought I did it.

BY MS. TOWNSEND:

Q. Okay. Let's go just to the summary page first. And if you'll look at the second paragraph of the cover letter, it identifies six wells that Aqua believes should be removed from the quarterly reporting requirement, because Aqua North Carolina considers the reason for the issuance of the notice of deficiency resolved; is that correct?

A. Yes.

Q. All right. And if we go to the third paragraph, it identifies four notice of deficiency wells that Aqua North Carolina has submitted to the Public Staff for approval of a greensand filtration.

Is that your understanding?

A. Yes.

Q. Okay. To your knowledge, are these four wells, The Barony, Woodvalley, Georges Grant, and Upchurch part of the 80 points of entry?

A. I wouldn't know off the top of my head. Again, I don't have the list in front of me.

Q. Okay. Do you know if they're part of Group

One of the water --

A. Again, I haven't memorized all 179 or 3,000 well results we have, so I would need to have the list in front of me.

Q. All right. Let's go to paragraph 4.

Aqua identifies two notice of deficiency wells that have been approved by Public Staff for greensand filtration, and at that time, being engineered for installation; is that correct?

A. I'm sorry, could you repeat which place?

Q. Absolutely. We're on the fourth paragraph, the last paragraph on the front page.

A. Okay.

Q. And there's two wells identified there that have been approved by Public Staff for greensand filtration; and at that time, they were being engineered for installation, correct?

A. Yes.

Q. All right. Do you know if they've been installed since this date?

A. No, I do not.

Q. Okay. On the second page of the letter, Aqua identifies 24 wells, subject to check, if you would like to count them, for which is has determined require

greensand filtration; is that correct?

A. Yes.

Q. And are these wells part of the 80 points of entry?

A. Again, I don't have the list in front of me, but I do recognize some of the ones in that 24 that were in the original Group One list that we developed.

Q. But you do have a list of what the 80 points of entry are; do you not, somewhere?

A. It's maintained at our state, yes.

Q. Okay. And that could be provided?

A. That's what I thought they were working on.

Q. Okay. All right. Going to the second paragraph on the second page. Again, there are four wells: Tyndrum, Eagle Creek, Glendale, and Hugh Grove well.

And it indicates that they are doing investigation to determine how to deal with these particular wells; is that correct?

A. Yes.

Q. And you had indicated earlier that there were certain things that are done to determine, you know, what's the next step.

Are these the four things that are normally

done to determine what the next step is?

A. Those four items mentioned are steps that they are taking in addition to other actions. These are very specific substeps.

Q. Okay. And so if we count -- let's go back to -- if we count all of the wells addressed in the cover letter that are currently subject to a notice of deficiency, there appear to be 42 that are still under that notice of deficiency; is that correct?

A. At one point, I note it reached into the 40s, I didn't know if it was 42 or 49.

Q. Okay. And subject to check, these 42 wells represent 26 water systems; do they not?

A. I don't have that information in front of me. I can't confirm that.

Q. But subject to check, would you agree with me?

A. I'll agree with you once I check it.

Q. Okay. Again, subject to check, those 26 water systems with outstanding notices of deficiency as of June 27, 2018, were -- and I'm going to list those for you and see if you recall any of them -- Avocet subdivision; do you know or not know?

A. Yes.

Q. Okay. The Bayleaf Master System?
A. Yes.
Q. The Belle Ridge subdivision?
A. I can't remember them.
Q. Okay. Branston subdivision?
A. I can't remember it.
Q. Brayton Park subdivision?
A. Yes.
Q. The Briarwood/Kildaire subdivision?
A. Yes.
Q. Cotesworth Down, Kensington Manor subdivision?
A. Yes.
Q. Duncan Ridge subdivision?
A. Can't remember.
Q. Eagle Creek?
A. Don't recall.
Q. Forest Glen?
A. Yes.
Q. Galloway?
A. Yes.
Q. Glendale?
A. Yes.
Q. Hampton Park?

A. Do not recall.
Q. High Grove?
A. Do not recall.
Q. High Meadows?
A. Yes.
Q. Middle Creek?
A. I'm sorry, repeat that one.
Q. Middle Creek Acres subdivision?
A. Do not recall.
Q. Okay. Northgate subdivision?
A. Do not recall.
Q. Old South Trace subdivision?
A. Yes.
Q. River Oaks subdivision?
A. Yes.
Q. The Saddle Run?
A. Yes.
Q. Saddleridge subdivision?
A. Yes.
Q. The Southwood Surrey subdivision?
A. Do not recall.
Q. Okay. And the Trapper's Creek subdivision?
A. Don't recall.
Q. Tyndrum subdivision?

A. Don't recall.
Q. Upchurch Place subdivision?
A. Yes.
Q. And the Wakefield Plantation subdivision?
A. Yes.
Q. Okay. Subject to check, most of these water systems that we just discussed have one well subject to a notice of deficiency with the exception of Bayleaf Master System, which has 12 wells, correct? Or to the best of -- subject to check?
A. I wouldn't comment on how many wells are in the Bayleaf Master System how are you're defining it versus how we look at it.
Q. Okay. All right. The Forest Glen subdivision has two, Glendale Master System with three, and Southwood Surrey with two, subject to check. Okay.
In addition to these outstanding notices of deficiency, there have been -- putting -- you said there were 68, correct?
A. There were originally 68 notices of deficiency in 2016.
Q. Right. So -- and if we subtract the 42 that are outstanding, then there are 26.
Did I do that right? 42 from 68, yes. 26

others?

A. That were removed.

Q. Okay. And those have all been resolved, to your knowledge?

A. I -- again, subject to check, but that would be the expectation based on the reading of the report.

Q. And again, subject to check, the reporting submitted by Aqua North Carolina for each of the 26 systems identified that we just discussed took the same format as the sample provided for Bayleaf that we have provided here in Exhibit 1; is that correct?

A. I'm sorry, could you repeat that again.

Q. Sure. The other -- this is -- Bayleaf's Master System, which is part of Exhibit 1, is simply one of the 41 -- I'm sorry, of the 26 systems that we just indicated that provided the same similar format for their quarterly update to DEQ?

A. I'm not tracking your numbers with the 26. You're starting to --

Q. Okay.

A. Bayleaf Master is one of the systems that was reported on the NODs in the quarterly report.

Q. Right. Right. Okay. We'll start with that.

And on that, in the first page of that

document, this is where they indicate which wells are being reviewed and updated for DEQ, correct?

A. Again, repeat this again. I'm trying to read your document and then answer your questions here, so.

Q. No. I apologize if I'm -- I want you to be able to take your time, and I don't want to -- I want to make sure you understand the question.

What I'm asking is, this front page, this first page of the document for Bayleaf, gives a summary of which wells are being updated for DEQ, correct?

A. Yes. It gives a summary of the wells that are being updated in the Bayleaf Master System that had NODs.

Q. These are the wells that were subject to the notices of deficiency, correct?

A. Yes. Of the 122 wells, those had NODs.

Q. Okay. And it would appear, if we look at the second bullet and we count the numbers, P12, 16, et cetera, that there are 12 of those; is that correct?

A. Yes.

Q. Okay. And if we look on the next pages, I just want to show, basically, what is included in the update. And it would appear that, for each well -- or sometimes there's a combination of wells, as you leaf

through the pages -- that it shows us the well name or names, the completed activities since the last -- since the beginning, and then the planned activities, and comments from Aqua indicating the current status; is that correct?

A. Yes.

Q. All right. And that, as I said, is for each well.

So we go through page 9, and then we have Mr. Krueger, who is the area manager who has signed off on this document; is that correct?

A. Yes.

Q. Do you know Mr. Krueger?

A. Yes.

Q. Okay. And then if we go to the page after his signature, you will find that there are a number of pages where the actual sample data for each well and/or combination of wells is included, correct?

A. Yes.

Q. All right. And if we look at the very first six, if we look at the fifth row from the right, it says:

"Solids manganese points of entry"; correct?

A. You mean the fifth column from the right?

Q. Yes, I --
A. I'm sorry.
Q. Do you see?
A. That's soluble manganese.
Q. That's what I meant. I'm sorry. Thank you.
And if you look at that mand if you go to the very last entry, it shows it's 0.47, correct?
A. Yes.
Q. And then if we go to the one under it, it's 0.306 for that same column, the same last line?
A. Yes.
Q. All right. And if we go to the next sampling, it shows it's 0.486, correct?
A. Yes.
Q. And then 0.376?
A. Yes.
Q. And then we have 0.46?
A. Yes.
Q. And then 0.469?
A. Yes.
Q. All right. And then the others are those that related to the ones that they believe should be off the list because they are now below 0.3; I believe it's 0.25 and 0.12, correct?

A. 0.24 and 0.11.

Q. Okay. Now, those wells that we talked about that would be above 0.3 would all qualify for Group One status; is that correct?

A. Yes.

Q. Okay. And with that, I have no further questions. Thank you, Dr. Crockett.

A. Thank you.

COMMISSIONER BROWN-BLAND: Public Staff?

CROSS EXAMINATION BY MS. JOST:

Q. Good morning, Dr. Crockett. My name is Megan Jost. I'm with the Public Staff legal division. So you indicated, in response to Ms. Townsend, that approximately 80 of Aqua's entry points in the state draw from groundwater -- I'm sorry, draw groundwater from wells that exceed a combined 1 milligram per liter of iron and manganese or 0.3 milligrams per liter of manganese, correct?

A. Yes.

Q. And you state that in your testimony as well; is that correct?

A. Yes.

Q. Do you know if any of these entry points are actively being utilized by Aqua to provide drinking

water to customers?

A. If we are reporting on them, they are actively providing drinking water. I don't have the latest update of which wells have been shut down and which wells were not, I'm not privy to the day-to-day operation numbers.

Q. All right. So just -- we were going to use a similar exhibit to the Attorney General's, and for ease of use and to save time, we'll just go ahead and I'd like you to once again look at the Attorney General Crockett Cross Exhibit 1.

A. Okay.

Q. And I would like to direct you to -- it would be the eleventh page of that exhibit. It doesn't have a page number, but this is the table two. It's the second table two, and the name of the well at the top of the page is Hawthorne Number 1 and 2; do you see that?

A. Yes.

Q. All right. So do you agree that the dates listed here in the column labeled "date" represent the dates that samples were taken from these wells?

A. Yes.

Q. Okay. And would you agree that those dates

appear to range over a two-year period with the last date being May 2nd of 2018?

A. Yes.

Q. And do you agree that the numbers indicated in the column which reads "average sample week run time" indicate the hours per day that water was pumped from these wells?

A. I don't have the -- it doesn't say hours or minutes, but you could assume it's hours, but I wouldn't unless I checked.

Q. Okay. Subject to check, then.

Do you agree that -- I'd like to direct you to the column for total manganese POE, that is the sixth column from the right.

So would you agree that, for the samples taken May 19, 2016; September 28, 2017; October 6, 2017; October 23, 2017; December 14, 2018 [sic], January 22, 2018; February 26, 2018; March 28, 2018; April 5, 2018; and May 2, 2018, those highlighted values or -- I'm sorry, I have them highlighted -- but those values appearing in that column represent exceedances of the EPA lifetime health advisory of 0.3 milligrams per liter of manganese?

A. Yes. And I would like to qualify that EPA's

health advisory limits, if you talk to EPA about what they are, they are nonenforceable standards that they set. They are only guidelines and recommendations.

Q. But that is the limit, nonetheless, that they have set?

A. It is not a regulatory limit, it is an advisory limit.

Q. So this indicates that, as of May 2, 2018, this well was providing water which was in excess of that limit?

A. Yes.

Q. Thank you. All right. If you could turn to page 9 of your testimony. On that page, you described some of the remedies that are available to address water that is rich in iron and manganese, including, and I quote:

"Filtration installed on the customer's premises either on a whole house or individual appliance basis":

Is that correct?

A. I'm just making sure I'm reading -- line 6? Page 9, line 6?

Q. I didn't -- I didn't indicate a line.

MS. TOWNSEND: 11 and 12.

BY MS. JOST:

Q. 11 -- lines 11 and 12, thank you.

A. Okay. My printout isn't matching up with your printout. It's under the varying -- the question was?

Q. Is the bullet -- are you on page 9?

A. My printout of 9 might be different --

Q. Okay. I'm sorry.

A. -- because it's larger text.

Q. This is under the prompt, "please review the current available remedies" --

A. Okay.

Q. -- "to remediate water."

A. Okay. I got you.

Q. And it's the last bullet point there.

A. Yes, I see that.

Q. Could you tell us what an average cost of a whole-house filter would be?

A. I couldn't give you that estimate, because it depends on the type of system that they're trying to install, and it also depends on the concentrations that they'd have to remove and how much water they use in the home. So it depends on the size of the system, you know, whether it's one person or a six-person house.

It depends on if they are just doing it for their refrigerator or if they're doing it for every faucet in their house.

Q. Right. And so I was asking about a whole-house filter.

Can you provide -- if somebody is looking to remove iron and manganese from the water --

A. I wouldn't speculate on that number. I would get a direct quote from a vendor.

Q. All right. Would this cost potentially be $1,000, $2,000? Can you give me a rough estimate?

A. Installation of a home system, again, I would ask a vendor to give you a price on that. And it depends on the needs, but it definitely is -- exceeds a $500 price.

Q. Okay. And so once that filter is installed -- and so there's the cost of the filter, itself, there's the cost of installation.

Are there additional ongoing costs to operate that filter?

A. It depends on the design of the system. It could be anything from replacing the filter, a cartridge filter, every so often, to -- depending on the level of system that they have operating there,

could use -- could require chemicals to be added or changed.

Q. Do you think customers should be expected to bear the costs associated with the installation and maintenance of in-home filtration systems when the water that's supplied to them by Aqua exceeds secondary maximum contaminant levels?

A. I think what we're doing is trying to address, through the plan that we have, providing filtration for systems that do exceed the secondary maximum contaminant level.

Q. But you do indicate, in your testimony, that this is one means of addressing this -- these secondary water quality issues, correct?

A. There are individual customers that may choose to have a different standard or a different level of water quality, and that's their choice.

Q. All right. In your testimony, you also discuss sequestration and central filtration installed at the well as a means of addressing iron-and-manganese-related secondary water quality issues, correct?

A. Yes.

Q. And on page 10 of your testimony, at lines 8

through 10, you state that the estimated monthly rate impact to customers, based on the capital cost to install central filtration, is approximately $0.06 per customer per filter, correct?

A. $0.06 per customer for the entire plan, not per filter.

Q. If you could look at lines 8 through 10, and do you agree that --

A. I'm sorry. My -- it's $0.06 per water customer for each filter installed.

Q. Okay. Thank you.

Does the rate impact that you calculated here for central filtration include operation and maintenance costs?

A. Typically, what we added in was we added in an operation and maintenance cost in addition to the capital to provide a rough estimate of what that would be. And it's typically a conservative number.

Q. Okay. And what would go into that cost?

A. Typically, it's, you know, from prior experience and talking to vendors, you know, how much they expect to see equipment replaced, media replaced. It's typically cost of media, typical equipment, pumps, or other things that break over time, wear and tear.

Q. Okay.

A. Chemicals, if you need chemicals.

Q. Thank you. On that same page, at lines 10 through 12, you estimate that the monthly rate impact for sequestration and cartridge filters is less than $0.01 per customer, correct?

A. Yes.

Q. How did you calculate these estimates, this estimate and your previous estimate regarding the central filtration?

A. So the central filtration was based on a range of about 3 to $350,000 in capital costs, plus there was an assumed operating cost that came from that, typically at the planning level. Again, you could use anywhere from 10 to 20 percent operating cost as the cost of the capital cost. In the $0.01 per customer, we looked at the cost of what we typically spend on sequestration for wells that we have sequestration at, as well as what cartridge filters cost typically to install.

And again, these are tools in a toolbox. Not every tool is the right tool for the situation, because as I state later on in my testimony, that a cartridge filter -- if you have very high levels of iron and

manganese, a cartridge filter is going to clog immediately within a day or even sooner than that. And you could -- it's not an operable solution, even though it may be the cheapest solution.

Q. Okay. So you indicated that the monthly rate impact for sequestration and cartridge filters, you estimate it at less than $0.01 per customer.

Would you say that the monthly rate impact for sequestration is closer to $0.01 or closer to 1/100 of a cent?

A. I don't have that off the top of my head. I'd have to go back and check the calcs.

Q. Could the difference in impact on rates of central filtration versus sequestration and cartridge filters be greater than six times the cost, as your testimony seems to indicate?

A. I don't have the calculation for sequestration on the top of my head. I'd have to go back and check that.

Q. Once a greensand-type filter has been installed, can you tell us what additional costs would be associated with operating that filter?

A. Typically, the power involved for any additional electrical equipment, if there is any

chemicals that are required to adjust the pH for the system, and those are typically relatively minor operating costs, and switching out media, if you need to switch out media. Those are typically the main components of operating costs, or any wear and tear on any pumps or other equipment that you need for backwashing.

Q. Okay. Would sludge hauling be an additional cost?

A. Yes. That's also an additional cost, depending on the type of system, and how it's set up, and what you're allowed to do with the backwash.

Q. You indicated, in response to one of Ms. Townsend's questions, that your operators would be trained to operate the greensand filters, and these are licensed operators, correct?

A. Yes.

Q. Is -- do you know whether greensand filter operation is covered by the North Carolina C-Well and B-Well certification exams?

A. No. But we would always review that before, making sure that the operator has the proper certification to operate that system.

Q. On page 10 of your testimony, you begin

discussing Aqua's water quality operations plan and the manner in which Aqua intends to prioritize its sites under that plan, correct?

A. Yes.

Q. And on page 12, lines 13 through 14, you indicate that the sites that have been designated as Group Two must, and I quote, continually -- must be, quote, continually assessed and tested, close quote, to determine whether filtration should be implemented; is that right?

A. Yes.

Q. Can you please explain what you mean by "continually" in this context?

A. Well, we would need to establish a benchmark as well as an ongoing, at least -- at least annually if not more frequent testing of those wells to determine if the levels of iron and manganese are changing, are they going up or going down, do we need to think about an additional type of treatment, or is it that the water quality is improving.

So it's something that we would want to do because they're close -- they're at a higher level, and we want to make sure we keep an eye on it. So you would at least want to do annual monitoring,

potentially quarterly. In some of the work we've done, we've embarked on quarterly monitoring.

Q. Thank you. If you could now please turn to page 13 of your testimony.

And on this page, you discuss the operational aspects of Aqua's water quality plan, correct?

A. Yes.

Q. And beginning on line 6, you state, and I quote:

"Routine flushing and tank cleaning is a key part of the plan to remove legacy sediments and mineral buildup in a system prior to the installation of filtration treatment";

Is that correct?

A. Yes.

Q. Can you please explain what would cause, quote, legacy sediments and mineral buildup to be present in a system?

A. Yes. So typically, iron and manganese, when they come out of the ground, there's a large amount of it that is in the dissolved form, because when it's in the ground, it doesn't have any oxygen, so therefore, it doesn't oxidize. When it comes out of the ground and is exposed to oxygen in the treatment -- in the

pumping process and moving it into a tank, that iron and manganese will move sometimes from the soluble form, which you don't see, to the particulate form, which turns into orange rust or black water.

In a tank or in a pipe, over time, if a system has high levels of iron and manganese, it can build up those minerals in the piping system or in the tanks. And so, therefore, if you want to make sure that the system is delivering everything that it needs to deliver once the filtration is put in, you want to get rid of, potentially, anything that may have been potentially stored in there from that process.

It's not uncommon, throughout the United States, when somebody opens up a hydrant or opens up a line and flushes a pipe that you're going to get some kind of buildup, or rust, or anything in there to flush out. So, in systems like this where we have higher levels of iron and manganese, it's not uncommon to see that happen in the system.

Q. Okay. So if a system were not flushed for an extended period of time, you would expect to see some buildup of those minerals you just mentioned?

A. It would really depend on the system. It would depend on how high the levels are and how the

system is configured. You could have systems where the majority of the system doesn't have any buildup at all, but you get to a dead-end spot where there's not a lot of water use, and then you might have stuff settle out there. So it's really specific to the actual system and all the characteristics of those systems, even within from block to block.

Q. All right. Can you tell us whether Aqua conducted routine flushing during the period from 2006 through 2012 prior to the initiation of the water quality plan?

A. I don't have any knowledge or do not have that information.

Q. Okay. And then, on page 13, you -- of your testimony, you describe Aqua's customer communications plan.

Does that plan include communications about conservation of water?

A. I can't tell you off the top of my head if it includes conservation. I do know, from the water quality website, it really focuses on telling people about iron and manganese and how to address it, and how we are addressing iron and manganese, and where we're building systems and the progress on those. I'm not

familiar with the conservation language.

Q. Okay. Would a decrease in consumption or an offsetting of peak usage potentially avoid the need to utilize some of the wells and the systems and, in turn, avoid costs associated with filtration, testing and chemical treatment of those wells?

A. It depends on the system you're at, and that's something that we are going to look at, is capacity in our system so that we can avoid having to build a filtration system. We are looking at can we change the capacity in the system to not have to build a filter. So it's one of the options we look at prior to going to filtration.

Another item that we have to balance out with that is also making sure that we maintain enough flow and enough pressure in the system in order to meet all the other regulations that we have out there. So we cannot just take a well off because of water quality and not meet other requirements as well.

Q. But if you could reduce the demand on the system, that would help you to potentially take some of those wells off-line; is that correct?

A. In theory, yes. But typically what we find is, with customers, getting them to willfully not water

their lawn when they want to, even with a notice, is something that they're reluctant to back off on.

Q. Okay.

A. And we wouldn't want to depend on individual customer behavior to make our product.

Q. All right.

MS. JOST: I don't have any further questions of this witness.

COMMISSIONER BROWN-BLAND: All right. Redirect?

MS. SANFORD: Thank you.

REDIRECT EXAMINATION BY MS. SANFORD:

Q. Dr. Crockett, assuming, as I believe we do and as you have testified, that we have iron and manganese in the water in a large number of places in this state, so let me ask you, should we assume that? Should we understand that to be the case?

A. The geology in North Carolina is such that, throughout the entire state, you're subject to having iron and manganese, it's -- to some extent. And actually, looking on a national basis, you have a lot of the geology for having higher levels compared to the rest of the country.

Q. And in certain parts of Aqua's service

territory, you're experiencing problems associated with iron and manganese and the resultant customer concerns; is that correct?

A. Yes.

Q. EPA has become more attentive to iron and manganese levels, correct?

A. Yes.

Q. But not to the point of rules or regulations, simply issuing guidelines?

A. That's correct. They have only set a health advisory limit, which is a nonenforceable, nonregulatory guideline. They have not set a primary maximum contaminant level.

Q. Right. And DEQ has become more attentive to this, since 2016 particularly?

A. That is correct.

Q. Aqua has become more attentive to it; is that correct?

A. Yes.

Q. Would one of the manifestations of Aqua's concerns be having hired you?

A. Yes.

Q. Would another be their participation in -- under the WSIC statute, and I will just say spending a

lot of money and doing a lot of work for secondary water quality?

A. Yes.

Q. And that's why you have developed the water quality plan; is that correct?

A. Yes.

Q. This is an ongoing plan?

A. Yes.

Q. In terms -- but it costs money to remove the iron and manganese; isn't that correct?

A. Yes.

Q. You have to either spend money on finding alternative sources, or sequestration, or flushing, or filtration at various levels; is that correct?

A. That's correct. Filtration -- think of it this way: Flushing is like when you have -- it addresses a symptom. You just get it out of the system and then it comes back tomorrow. It's like taking Tylenol for a fever, right? It makes the pain or the fever go away, but the infection is still there.

Sequestration is, again, another way of addressing the symptom, but it doesn't necessarily completely provide a cure.

Filtration deals with the problem at the

source and provides a cure.

Q. So you have multiple tools to employ; is that correct?

A. Yes.

Q. You have to coordinate among them, correct?

A. Yes.

Q. And you attempt to employ them with a balance towards the least cost and the efficiency of the measure that you take to solve the problem; is that correct?

A. Yes.

Q. Are you aware that, in the Public Staff's scrutiny of the secondary water quality projects, that a great deal of attention is paid to the cost, particularly of the greensand filters?

A. Yes.

Q. That's appropriate, isn't it, because they can be expensive?

A. Yes.

Q. And they can range from -- can you give me a range of the costs?

A. A greensand filter system can be in the range of 300 to $350,000, depending on the requirements for how you deal with the backwash.

Q. Can be more than that, can it?

A. It can, depending on the size, flow, and delivery systems.

Q. And so as you attempt to manage this issue and to address these issues with the range of tools that we've just discussed, the Public Staff raised another one which had to do with deployment of your wells, adjustment of capacity; is that correct?

A. Yes. Yes.

Q. And that's complicated, isn't it?

A. Yes. Because when you adjust capacity and you adjust flow, it's like a -- imagine in your body adjusting how the blood flows through your body. You have to be very careful how you do that. And balancing out how the hydraulics of the system can not only lead to reductions in pressure, it can lead to reductions in fire flow, it could lead to a number of others. And so we have to be very careful when we mess with the hydraulics of any system.

Q. And so there is no one-size-fits-all solution for this iron and manganese issue, is there?

A. No. As I said earlier, there -- we have to customize every solution to every community to every system, because it's dependent on the characteristics

of that system and those communities.

Q. And there is no way to treat it without expenditures of capital; is that correct?

A. That's correct.

Q. By the Company?

A. Yes.

Q. Which the Company seeks to recover in rate cases; is that correct?

A. Yes.

Q. Let's turn to the Attorney General's exhibit for just a minute, if we could. And I simply want to try to -- it's almost a matter of housekeeping here.

The first two pages, front and back, represent a letter from Mr. -- no. The Hardy letter, I'll call it; is that correct?

A. Yes.

Q. The portion of this document that begins with Aqua's letterhead dated June 27th and to Allen Hardy deals just with the Bayleaf Master System; is that correct?

A. Yes.

Q. And the first two pages, what I'll call the Hardy letter, the one without a letterhead, does not just deal with the Bayleaf Master System; is that

correct?

A. Yes, you're correct.

Q. I am correct. Okay. I just wanted to clarify that.

It deals with all of your systems; is that correct?

A. It deals with systems that are not part of Bayleaf.

Q. That are not part of Bayleaf Master.

MS. SANFORD: I have no other questions. Thank you.

COMMISSIONER BROWN-BLAND: Questions from the Commission?

COMMISSIONER CLODFELTER: I have a couple.

COMMISSIONER BROWN-BLAND: commissioner Clodfelter?

EXAMINATION BY COMMISSIONER CLODFELTER:

Q. Dr. Crockett, I want to ask you some questions just to get an understanding of the relationship between the Company's response to DEQ; the NODs from DEQ, which we have been talking about; Attorney General Cross Exhibit 1, which sort of summarizes where you are in that process; and then your

three-year WSIC/SSIC plan. I know you don't have that in front of you probably, but it's in the Company's application, and I assume you have a general familiarity with it. I'm not going to try to ask you detailed questions about it, but what I'm trying to focus on with my questions will be the relationship between those two things.

So the three-year WSIC/SSIC plan references -- has a section referencing secondary drinking water, quality capital investments.

Do you have that? Are you --

A. I do not have the WSIC/SSIC plan in front of me.

Q. As I say, I'm not going to ask you detailed questions about it. I'm more interested in the relationship overall. And it says that the initiative that's established in that three-year plan has been adopted as the Company's secondary water quality plan for that three-year period of time.

So the document says that's your secondary water quality plan for the next three years. And that's where you get the priority -- prioritization -- Group One, Group Two, Group Three prioritizations for your capital projects.

You're familiar with that?

A. Yes.

Q. And so the investment over the next three years is focused in the three-year plan on the Group One projects that either have NODs outstanding or they don't have an NOD outstanding but they have something called greater than 10 lab D, which I understand is a measure of discoloration of the water; is that correct?

A. Actually, yeah. So can I just --

Q. Yes. Help me out.

A. So Group One --

Q. Right.

A. -- has to have iron and manganese --

Q. Right.

A. -- over 1 --

Q. Right.

A. -- or manganese over 0.3.

Q. Right.

A. And then the two groups you mentioned, one has a notice of deficiency and the other is -- what we call lab Ds are basically discolored water calls to our system -- for that system. So more than 10 in a year, you know, says we need to -- there's obviously a water quality issue here. But we also have true water

quality data to back up that need.

Q. Got it. Thank you for that clarification.

What I've got in the three-year plan, then, is an exhibit that gives me the listing of projects that are the Group One projects for the next three years that meet those criteria for being a Group One project. They either have an NOD, Bayleaf or non-Bayleaf NODs when they have greater than 10 lab D characteristics.

And what -- here's -- here's -- now we're sort of focusing on the question -- is when I look at the Cross Examination Exhibit Number 1, which is the Company's response and plan of action in response to the NODs, and I look at the summary letter, which is the first two pages that summarizes those projects, in a quick scan of this, in comparison of the two, I've got projects on the NOD response list that are not in the three-year plan. And I'm just -- what I'm looking for is guidance about why, for example, Upchurch 1 and 4 and Ridgebrook Bluffs/Westbury Number 1, you're investigating for greensand filtration, or you've submitted for approval, or you've gotten approval for engineering and installation of greensand, but they -- those projects don't show up on your three-year

WSIC/SSIC plan for secondary water quality.

That's the question. Help me understand that.

A. And Mr. Becker may be able to clarify this a little more too, but the submission of the WSIC/SSIC plan was a -- is a snapshot in time.

Q. All right.

A. And this process with the NODs is an ongoing process where we go through the framework that we worked out with the Public Staff, with the DEQ where we collect more data and go in and look at can we take a well off-line instead of installing filtration. And if that -- and if that one drops off, we have another one that probably moves onto the list.

So that -- that's why this list -- this conversation and the WSIC/SSIC list may not necessarily be in sync, because there's a -- it's changing as we get information and as we work through it.

Q. The WSIC/SSIC three-year plan is dated in April, and this is the end of second quarter 2018, so that -- you're telling me that projects may have appeared and gone on the list since the WSIC/SSIC plan?

A. We may have shuffled the prioritization of those, depending on the data we've gotten, even within

the month of that period between there.

Q. Well --

A. Because there's results from May in this quarterly report.

Q. Okay. I think I'm following you, but I need to then ask a follow-up.

The three-year plan that you filed in April, then, doesn't include all of the NOD sites? Because you got some here that you're dealing with in June that are NOD sites that are not in the April list.

A. It -- the three-year plan should -- and I'm not exactly how it's laid out in detail with each project by name identified by well or if it's by grouping, so that might be part of the problem. So I'd have to look at that three-year plan sheet. I don't -- I can't remember it off the top of my head.

Q. You don't have it in front of you, and I know --

A. If I could see it, I could probably explain it.

Q. I understand.

A. But right now, when we have a Group One site with an NOD or that other -- or greater than 10 that meets the water quality criteria set forth by DEQ and

the Public Staff, those are supposed to be in that three-year plan.

And so if there is something with an NOD -- you can have -- so let me clarify one other thing. We have had sites where we have had an NOD, and I can't tell you off the top of my head, where they weren't necessarily greater than 1 or 0.3. They've -- it was just over the secondary MCL. And it depended on the region of DEQ we were dealing with.

So not in every case were the NODs always issued perfectly based on greater than 1, and we've had to go back and resolve that with them.

Q. So it's possible that you have some NODs on your updated compliance report that didn't meet the criteria that you established for Group One --

A. Right.

Q. -- in your WSIC/SSIC plan?

A. It's possible.

Q. I got it.

Well, then, even so, though, you're looking at greensand filters for some of those projects that aren't --

A. If we're looking at greensand filters, it always has to meet those water quality criteria of

greater than 1 for iron and manganese or greater than 0.3 for manganese.

Q. Okay. I'm going to leave you alone on this because, in fairness to you, you don't have the three-year plan in front of you. But I'm going to leave the question pending, and maybe your counsel can work to get an answer to it, because, again, let's take -- let me focus on one specifically, and that will help focus the question for them to go off and figure out how to get me an answer.

On your Attorney General Crockett Cross Examination Exhibit 1, first page, the Company has submitted to Public Staff for approval of greensand filtration, which, according to you, as I understand it, that should mean it meets the Group One priority classification. Upchurch Number 1 and Number 4, the Company thinks they may need greensand filtration. And then I look down the list in the April WSIC/SSIC plan, and Upchurch 1 and 4 aren't on that list for project expenditures. So I just want someone to help me sort of track that through.

And again, at the end of the day, what I'm trying to get to here for our decision-making purposes is we're trying to get a sense of what capital dollars

the Company is going to be expending in the next three years in order to help us decide what the level of rate should be to cover those capital expenditures.

A. And we appreciate --

Q. That's the purpose of all the questions. Okay?

A. And we appreciate the request. But I do want to state --

Q. Yeah.

A. -- we would not be looking to do filtration if it did not meet those concentrations of criteria. So it's got to be over 0.3 for manganese or over 1 for iron and manganese.

Q. I hear you loud and clear. If that's the case, then maybe the $9,075,000 number in the WSIC/SSIC plan might need an adjustment. And that would be another point that -- again, that's the point I'm trying to get at is, what's the capital spend that this Commission is looking at trying to fit within a rate design or rate structure for the next three years to cover the projects that you're actually going to be doing. And if that has changed since the three-year plan filed in April, that's really where I'm driving -- that's what I'm trying to understand.

Has it changed? If so, how and why? Okay? I'll leave it -- I'll leave you alone on that for now, but I think your counsel knows where I want to go. I've got one other question for you, and then I'll be done.

I know you're not a lawyer, but would you agree with me that this Commission has authority to establish water quality standards that are not limited to or restricted by what the EPA has established?

A. I'm not a lawyer. I don't know the legal authority of the Commission. I apologize.

Q. That's fair enough. I'll leave the question hanging.

COMMISSIONER CLODFELTER: That's all I have.

COMMISSIONER BROWN-BLAND: Commissioner Mitchell?

EXAMINATION BY COMMISSIONER MITCHELL:

Q. Good morning, Dr. Crockett. Just a few questions for you. In response to questions from the Attorney General and the Public Staff, you've mentioned changing sources and taking a source off-line, which I understood to mean taking a well off-line, shutting a well down.

Is taking a well off-line, taking it out of use, is that one solution to an iron and manganese problem within a system?

A. Commissioner, that's a good question. So we're talking about a lot of different things happening at once, and I apologize if I wasn't clear enough.

When we look at the sources that we have supplying that water, as we mentioned, there could be multiple wells supplying a community. Say the community needs 100 gallons a minute, and that well that had the really high level is only producing 8 gallons a minute, we may try to find another way to make up that 8 gallons a minute somewhere else with the wells that we have and avoid having to use that well, because that source -- and that's a typical standard procedure in the water industry. You always try to go with your best sources first, just like your best players -- your first-string plays on the football team, then go to your back-ups. Same thing here. You know, we're always going to put our first-string first and try to make our sources that are not as good in a back-up situation.

Q. Okay. So if you look a well off-line, you might have to increase the capacity of the wells that

remain online?

A. May have to do that, or may have to look at different -- other options. For example, you could do storage in a system to make up for immediate production capacity. There's a variety of approaches that we have to look at and consider, but it is one of the things that you have to consider.

Q. Okay. And so that -- so making changes to the sources, and by that I mean taking a well off-line, increasing the capacity of those that remain online, the Company would consider that alternative before going to some sort of expenditure like a filter?

A. Yeah. In my mind, it's something that is just part of the conversation. When we think about before we build a filter, we would -- we would have to consider those things. It's just part of second nature to do that. Do we take it off-line; can we drill a new well; can we, you know, get water another way; can we make a connection to one of our other systems? You know, there's all those kinds of different ways that we would look at that and compare those costs.

Q. Are you familiar with any instances of drilling a new well in any of the systems -- any of the Aqua North Carolina systems that have appreciable

levels of iron and manganese?

A. Actually, that's something we're looking at now is, can we drill some wells to replace other wells, and would we get the same water quality or not. We're looking at that through the hydrogeology right now.

Q. Okay. The way I understand the three-year water quality plan, you all are projecting your expenditures for the next seven years, but this is -- the plan is live or the plan is a sort of three-year projection of longer-term spend. And you -- this three-year plan -- and I know you don't have it in front of you, but I just was sort of hoping you are familiar enough with it to answer the question that follows this -- but the three-year plan looks at or contemplates the installation of filtration for certain systems in the Group One category in the next two years and then also in the next two to three years. So there are certain levels, I guess, within that Group One, as you've discussed with Commissioner Clodfelter already.

For those Group One systems that obviously have been prioritized by nature of the fact that they're in Group One, that will not have filtration installed for some time, for two to three more years, I mean, what is Aqua going to do to ensure that the water

quality is adequate in those systems until that point in time which the filtration is or will be installed?

A. Commissioner, that's a really good question. What was laid out in Exhibit A, and I probably didn't cover it enough, is, in parallel to the capital effort to build filtration where it's needed, we're also looking at operational changes that could be made to potentially improve the situation. Albeit temporarily in the interim until those systems are aligned. Which includes looking at a variety of different flushing techniques to keep the system clear, trying to improve whatever sequestration we have. And also, as we mentioned sources, can we take a well and seasonally -- only use it seasonally and take it out of production for several months out of the year to limit that water quality impact. Put it into back-up status, so to speak, and use it less.

So all those things are being looked at and being considered and implemented in the meantime for those Group One systems through our operations team.

Q. Okay. Okay. You -- I believe it was in reference to a question from the Attorney General, you mentioned that Aqua had installed greensand filters in Ohio and Pennsylvania.

Do you recall that question and answer?

A. Yes.

Q. Okay. And were those greensand filters installed because of appreciable levels of iron and/or manganese in those particular systems?

A. I do have a correction to that. Virginia also has quite a few of these as well.

Q. Okay.

A. And yes, that's typically due to appreciable levels of iron and/or manganese. Those areas typically had considerable amounts of iron and manganese, depending on the situation. I can't tell you exactly off the top of my head every single one.

Q. Okay. And so can you tell me, just very generally, has Aqua gone through the same process in those locations; in Ohio, and Virginia, and Pennsylvania; of identifying how to adequately treat those systems?

A. Yeah. We did go through a less universal framework, like we are in North Carolina, because North Carolina has so many wells and it has such a pervasive issue with iron and manganese in the groundwater, we need to have a uniform framework. In those areas, they were kind of the -- they were outside

the norm, and so we had to go through each one of those individually and work through the solutions.

Q. Okay. Okay. We've heard some about the 68 notices of deficiency that were issued to the Company in 2016, and I believe, in your testimony, you testified that prior to 2016, I think since 2011, the Company had been issued only five NODs.

And I assume that's five NODs for iron and manganese?

A. That's correct.

Q. Okay. Deficiencies. So can you help us understand -- I mean, obviously, that's a pretty significant disparity, I mean, to go from 11 -- from 5 to 68 is a significant jump.

What happened during that time frame, whether it's a change in law, or a change in policy, or a change in circumstances of the systems? I mean, what happened to result in 68 NODs being issued by the State?

A. Our belief is that the State changed its policy on how it was looking at secondary contaminant levels and chose to take a different stance and enforce them differently.

Q. So did the State establish a different

guideline or standard that it was using or --

A. There was no prior communication on that change in position or stance. Whatever that change in policy was at the state level, it was not communicated to the water industry or to us in advance. We only knew about it when we literally received a stack of NODs in the mail.

COMMISSIONER MITCHELL: Okay. I have nothing further.

COMMISSIONER BROWN-BLAND: Commissioner Gray?

EXAMINATION BY COMMISSIONER GRAY:

Q. Dr. Crockett, on page 10, we were talking about the current capital cost of -- your direct testimony, sir -- capital cost of greensand filters being 300, $350,000. And then it goes on to say the capital cost monthly impact is $0.06 per water customer per each filter installed.

Now, is that customer the North Carolina customer or the total of Aqua America customer? And how do I figure out how much is going to be added to my bill, if I'm an Aqua customer and you install a greensand filter on this well system that services my home?

A. That's a good question, Commissioner Gray. First, the number is over Aqua North Carolina customers, not over all of Aqua, the company. Second, the detailed impact for each system on the cost of your bill, Mr. Becker is -- has testified on that and can explain that further, how they go about developing the actual final bill impact for you in detail. This was a planning-level estimate.

Q. That's helpful. Thank you.

EXAMINATION BY COMMISSIONER BROWN-BLAND:

Q. Dr. Crockett, you agree with your counsel that one of the ways the Company has expressed its concern and its needing to do something about the iron and manganese was hiring you.

And so my first question is, have you seen, in other parts of Aqua America, these same iron and manganese issues that you see in the -- North Carolina?

A. Commissioner, the issue in North Carolina is actually -- with the water quality from iron and manganese is actually probably the most widespread I've seen. We do have some in Virginia where we do have some similar geology, but not quite to the levels and extent we have here in North Carolina. And in pockets of small -- places in Ohio and Pennsylvania. But,

definitely, North Carolina has a very unique situation, in terms of challenging groundwater situations, not just for iron and manganese, but for a lot of other things.

Q. And in those other states, Virginia, Ohio, and Pennsylvania, have you seen the kind of outcry -- are you familiar with the outcry that we've seen from our North Carolina customers?

A. Yes. It's -- even in places in other states, when someone gets brown water, it doesn't matter -- rusty water, doesn't matter where you're at, even in Pennsylvania, you're going to get people calling and complaining.

Q. And so when there's elevated levels of the iron and manganese, what has Aqua done in the other locations; is it similar to the same plan here?

A. Yeah. The approach is pretty much the same. It's just we had to create a larger framework due to the sheer number of wells and locations and all the different customer situations in North Carolina. But, generally, the process is the same.

Q. You have not seen anything or tried anything different that you might try here?

A. Not that I'm aware of. We generally would

like to try to solve this the most effectively and cost efficiently as possible.

Q. Now -- and you may have exhausted this with Commissioner Mitchell, but in addition to the capital part of the quality plan, and then the operational part, and the flushing and the tank cleaning, that kind of thing, is there anything else that you hadn't already told us about that you think the Company might consider or has considered to do in the short term until you can reach maybe that seven-year period when the filtration is fully executed or implemented?

A. At this moment, Commissioner, no, but we are always open to any new idea, or technology, or technique that comes out there. So if somebody sees something, we're always looking for it. Or even any one of our regulators or other colleagues see something, you know, we're going to -- we'll happily copy that approach if it's an efficient and effective approach. We tend to try new things to see if they work to try to make it work. So if we see something better out there that comes along or a new idea that comes along, we're going give it a try.

Q. And the question I had asked earlier, I think Mr. Becker, but Ms. Jost was asking you about the cost

of filtration, in-home filtration that the customers get.

Is there -- one thing that might be considered to look into and see the benefits and the cost would be if there was any way the Company was able to help lessen the cost of that home filtration where you see larger numbers of people in the system trying to achieve that. And that is, I'm referring to being able to use economy scale, help those customers negotiate some kind of deal, or anything along those lines that you might be able to do.

Is that anything that you have considered before?

A. It has been -- there's been conversations from time to time about what can be done for those homeowners and approaches. It really is not a technical issue that would involve me. It's typically a legal and rate issue and a liability issue for those systems. So usually across the board, whether it's iron and manganese or any other type of contaminant, lead, you name it, installation and utilities working to install point-of-use devices becomes a very tricky, complicated, legal, financial issue that usually ends up not working out to due to all the barriers.

Q. These kinds of things might be temporary, is what I'm getting at, until a more permanent solution or better solution is attained.

A. Well, we'll definitely bring it back to our team and they're here to hear that.

Q. Does Aqua check for discoloration, what you call the lab Ds? Do you do any independent checking, or you only learn of that when you receive complaints? Specifically, I mean Aqua North Carolina.

A. In Aqua North Carolina, we normally have our standard water quality testing that we have to do as regulated or required or for performance reasons in the entry point or in the distribution system. Other than that, then we would -- if we don't detect anything there, we typically would have a customer complaint, lab D, as you mentioned, where we would go out and investigate the discolored water in that home and take samples specifically for that.

Q. The tests that you mentioned, though, do they include discoloration? Would you discover discoloration from those tests?

A. Typically, we're always -- when we're doing our testing, we're looking at the samples to see if there is discolor or if there's an issue, because we

want to address it if there's a possibility. It doesn't always pick up every issue. As I mentioned previously, in some parts of the distribution system, you could have what we call dead-ends, where the water doesn't necessarily move. And we may not know that because one owner lives there and doesn't use a lot of water, and then a new member moves in, and they have a family of five, and they're turning on everything, and suddenly water turns brown from inside the system.

So there is a variety of factors that would cause a discolored water. A lot of our discolored water complaints that we run into sometimes are due to construction or even just routine flushing that's occurring in the community where somebody wasn't aware there was construction and a pipe was disturbed, or a valve was opened, or a hydrant was opened, and it stirs up the system. So there is a variety of reasons why we would see those calls.

Q. Are you aware, with respect to any of the customer complaints, any of the exhibits that customers have either filed with us or come to testify about, bring and show us, are you aware of any reason on the Company's part to doubt the accuracy or authenticity of what we see?

A. I haven't had a chance to delve into each of the exhibits in each of the individual claims. Personally, I've been involved in looking at hundreds of individual issues with water quality throughout eight states and throughout just an old city like Philadelphia, and what I find is that, in many cases, there is extenuating circumstances that lead up to that situation, and it's not the norm that it's portrayed to be. And in other cases, there is truly an issue on the end of the utility that needs to be addressed. And also we tend to find a lot of individual home plumbing problems where the individual's home plumbing has something wrong with it, that it wasn't properly maintained or operated, and we have to help them fix it.

Q. Has the Company discovered any reason to cast doubt on the customers' testimonies as to their experiences with the water?

A. I have -- Commissioner, I have not reviewed those specific claims, so I wouldn't be able to provide an opinion on that.

Q. Just for my understanding, you mentioned, with regard to the manganese level, the EPA is an advisory level the EPA has set at 0.3.

It has to be less than 0.3 milligrams per liter?

A. Commissioner, the EPA has a health advisory limit, which is not a primary drinking water standard or enforceable drinking water standard. It is a health-based recommendation that they have. And they produce these for a variety of different chemicals where, above that limit, it's a guideline they recommend that --

Q. It needs to stay at 0.3 or below?

A. 0.3 milligrams per liter or higher is the level at which they recommend -- they have a guideline where they recommend that some action should be taken to address it.

Q. So when it exceeds that number. And my question is, with regard to sequestration, now that this health advisory is in effect and you, in fact, put these kinds of -- when you find these exceedances, they go into your Group One, as I understand it?

A. Yes, ma'am.

Q. So sequestration would no longer be appropriate once you found that you were at 0.3 or above; is that correct?

A. Yes. Because it's the total dosage of

manganese that you would be exposed to. So, in a soluble -- when you sequester it, it just moves from particulate solid form to dissolved form.

Q. So if it was over, if it was 0.4, it's going to still be 0.4 --

A. Still be 0.4.

Q. -- you just won't see it. All right. And I think you were asked how many wells were at that level or higher.

Is that what -- do you think that number we will see in what the Company's looking to provide to us in an exhibit now?

A. Yes.

Q. And also, Ms. Townsend asked you about NOVs, and you gave a number. She revised her question to indicate on the water and the sewer side, all the NOVs.

Do you have an estimate of NOVs pertaining just to the water?

A. Other than the notices of deficiency, there are no systems that are in violation of any primary drinking water standards in North Carolina, with the exception of -- in my testimony, I mentioned the Chapel Ridge system where we buy water from the town of Pittsboro, which exceeds the disinfection byproducts

limits, which we're working to resolve right now.

Q. Were there any NOVs prior -- that's the current status.

Have there been any NOVs on the water side since you've been with the Company?

A. I couldn't track the number -- give you a number off the top of my head if there's a specific NOV. But even if we don't receive an NOV, if we exceed any standard, we track that ourselves and work to resolve it so that there is not an NOV issued.

Q. Now, in your testimony, and I think just a minute ago you indicated that the secondary water quality issues are not a threat to public health.

But isn't it true that that's not the only reasonable concern that customers would have?

A. I'm sorry.

Q. Would it be a customer health concern? Wouldn't customers be -- have -- be reasonable to have other concerns, in addition to the health concerns when it comes to their water?

A. Customers typically have concerns when they have water that's discolored or doesn't smell or taste well, and that is the customers' prerogative to have that stance. Our goal, the way we are told to operate

under the laws and regulations that we operate under, are to meet the standards of the EPA and the Department of Environmental Quality. Aesthetics have always been, throughout the industry and for the -- since the beginning of the Safe Drinking Water Act, they've always been considered nonenforceable.

It does not mean that the concerns are not real about discolored water. It just means that, under that regulatory framework, they're nonenforceable.

Q. But in practical terms, if that water is so discolored that it looked like iced tea, is that water drinkable and usable by the average customer?

A. It depends on -- you're giving me a theoretical here, so it's hard for me to answer a hypothetical. But just because water is discolored does not mean it's not safe to drink. It may be objectionable from an aesthetics point of view, but it does not represent a health issue.

Q. An objection is real and reasonable, wouldn't you say?

A. I'm not the person to define what that objection is.

Q. You would agree that there are many naturally-occurring elements or minerals that you would

not want to be present in your household water, wouldn't you?

A. Correct.

Q. And am I right to assume that you would not want to drink that kind of groundwater that I described or that you see on these exhibits?

A. I did not see the pictures in the exhibits.

Q. Well, if it looks like brown tea, iced tea, hot tea, for that matter, but tea, brown -- brown or black?

A. Typically, you would want to drink water that is not brown.

Q. And so if you had that problem and you were these customers, just what steps would you take to have your concerns addressed? And I would say first, if it was your own individual well that was -- that you owned and were responsible for and it was in your back yard, what would you do?

A. Typically, what most people with individual private wells do is, if they have a higher iron and manganese, they typically install a treatment system in their home to address it. That's a pretty common approach. Because you can't really drill another well, so that's typically what they do.

Q. You say you can't drill another well.
Isn't that sometimes what they do?
A. It is quite expensive and difficult to drill wells, and being involved in that, it doesn't always guarantee you are going to find water. So, typically, your residential homeowner will debate whether or not to install a treatment system or try to drill another well. But given the situation in a lot of these aquifers, if you can't move very far, especially down to another area or up or over, you're going to have to put in a treatment system.
Q. All right. Fair enough. And on page 7 of your testimony, line 5, you -- lines 4 and 5, it says:
"Iron and manganese characterize groundwater across the state and impact the water drawn from public as well as private wells."
What did you mean by "public" in that sentence?
A. Public wells are -- I meant regulated public water systems in the state of North Carolina.
Q. You mentioned, on page 6 of your direct, one of the options -- one of the options for improving the water is a process called sedimentation and filtration.
What's the sediment -- what does that mean,

sedimentation and filtration?

A. Typically, it's a process that's used on surface water or streams and rivers. Basically, you have the water come into a big pool, and in that pool, all the heavy stuff settles out. And then the cleaner water goes over a weir into another area onto a filter, and then goes through that filter and is filtered. It's a traditional water treatment system that's used in most rivers and streams.

Q. All right. And these conditions that we see with the levels of iron and manganese, is that effective on the age of the well; do we know?

A. It's something that we're embarking on a program to look at. Because of the levels of iron and manganese, they do cause clogging. And there are a variety of techniques to keep those wells in production. And the concern is always losing capacity over time from the iron and manganese in that well.

Q. And so have you found -- if you were to find that some age is problematic and that's when you see more and more of the problems, would one -- I know you talked about having to maintain a balance of the capacity and so forth, but would one option be to bring on new wells?

A. Yes. That's one of the options that we are looking at is, can we find other sources in the areas where we're at, and would they be available and how -- and would they be any better, or is there a different solution.

Q. And some of these subdivisions and systems that we're dealing with, they've been growing and expanding.

Does growth play a role in worsening conditions when it comes to these secondary water quality issues?

A. Growth really plays a role in how many straws are in the glass. So the more wells you have, the more straws in that glass. And these wells are very limited to the area they draw. They're not part of a huge aquifer. They're very localized. The groundwater is very localized. And so the more straws you have in that glass, the less water, and that can affect -- and if you draw down the water table, that can affect potentially the iron and manganese levels.

Q. So a possible option that might help in the future could be additional wells to assist them; is that a fair --

A. There's -- that's a good question. So you're

thinking like -- are you an engineer?

Q. No. I just pretend.

A. So you're thinking like an engineer. We're always looking at different ways to reconfigure the system. So one of the things would be, can we get rid of three sources, replace it with one bigger one that's more efficient to operate? Would we be able to find that? Can we change how the well's operating? Can we change the configuration of that system? That's exactly some of things that we're looking at now in this way, because we -- you know, filtration is really our last step after we have exhausted all of our other options.

Q. On the bottom of page 7 of your direct, I think I had not completely understood, and I had some questions to ask. But I think Ms. Townsend and others -- well, I think Ms. Townsend helped you out by saying that -- on line 16, it says, in February 2016, DEQ began issuing notices of deficiency. And she added to Aqua.

But that's what you meant here in this testimony, it wasn't -- or did you mean it was broadly to other companies in the industry, or this was specifically to Aqua?

A. Commissioner, this is just to Aqua. Thank you for the clarification.

Q. So -- and then when you say there was a policy change, is the policy change actually the bullets here? Did they -- were these new categorizations and standards here? Is that what the policy change is, or is it just a policy change to be more vigilant and enforceable?

A. We've never had a clear document provided to us from DEQ explaining the policy guidelines for procedures behind the different tiers of NODs that were sent to us and why the change, nor were we given notice in advance. We were just given those, and those tiers were not explained. We were told to comply.

Q. And we may be able to determine this from what's already in the record or been filed with us, but do you know offhand how much of the WSIC charges have gone to the secondary water quality?

A. Not off the top of my head, no, ma'am.

Q. Any kind of guess, percentage-wise maybe?

A. I wouldn't guess at this point.

Q. That's fair. That's fair. And on page 10 of your direct, around lines 12 and 15, there's a discussion there about high levels of iron and

manganese. And that when there's high level requires central filtration.

Does -- does the Public Staff, when you're working with them about who can get the greensand filters, require sequestration and other less costly methods prior to moving to filtration even when the Company has identified what they find to be those high levels?

A. There is a process with the Public Staff where we take them through the systems that we think need filtration. And there is a due diligence conversation where they ask, "Did you look at this? Did you look at this? Did you go through this? Try this option. Try this option," to make sure that we looked at all of our options and basically tried everything before going to filtration.

Q. I think my question, based on your testimony, unless I'm drawing the wrong inferences, though, is, do you even need to bother with those if there's that high level that you say requires central filtration because nothing else is effective? Are we -- so in other words, are we taking too long to get to what we know we need to do?

A. I wouldn't be able to comment on the time

period of the process. We just know that the Public Staff is following through their due diligence to make sure that we're doing the right thing and that we've exhausted all our options first.

Q. I understand that. But would the Company rather ask the Commission to -- there might be a need to dispense with that, because that, in itself -- if you're spending money on something you know is not going work, money or time, and customers are still suffering in the meantime and there's a quicker way to get to the solution, do you need any assistance to move on to the solution that will work?

A. Commissioner, that's a great suggestion, and we would love to try anything to expedite this process as fast as possible to get filtration with the systems that need it in the proper way, making sure that we're doing it appropriately.

Q. But is that a part of your testimony? Is that a fair inference that, at a certain level -- at a certain high level, you already know for a fact, or is that not true, that other methods may work or have some benefit, or do you need filtration?

A. Once we've looked at changing source options or abandoning that well, once we're past looking at

different sources or changing that source, sequestration and cartridge filtration for a high volume, high rate system is not appropriate. It'll clog, it won't work. And we should just go directly to filtration is the right choice and saves a lot of time, yes.

Q. Do you know if there's a -- has there been any discussion or thought on the Company's part that we do take too long move to the filtration stage?

A. I think we've been working with the Public Staff to come to a much clearer agreement, because this is new and we did -- you know, to defend the Public Staff, we did actually feed them a large number of tables with a large amount of data and systems, and they had to get comfortable with it. But we would love to get a faster process and come to a clearer agreement to streamline it as soon as possible.

Q. If there's a choice between an increase in the rates and clear, usable water, do you have -- does the Company have any feedback that lets it know what its customers want as between those two?

A. Well, the communications plan, as was mentioned in my testimony, has started. We've already been surveying -- you know, we've done surveys of

customers in the past. And one of the things that we get feedback directly on is our discolored water complaints. And so we're seeing those. Last year we saw 1,443 discolored water complaints over a 12-month period, and that was included in this analysis. And so we want to -- we track to see those numbers go down and we want those numbers to go down. So we want that input.

Q. When we hear from the customers, we're aware that we're not hearing from the majority of them, yet and still, those that we hear from, particularly with Aqua, we hear a fair number every time one of these cases come up say, "Of course we don't want an increase, but if we got -- if the result would be clear water or a higher quality water, we would be willing to pay more." Don't discuss how much more, but they say they're willing to pay more.

There's a letter in this file, customer's statement of position, we call it, from a Ms. Perry, and I believe she said, you know, if it would result in the highest quality of water, and if you would install generators, as I recall, those were her two qualifiers, but she said, "I'm all for it."

So I guess I'm just throwing out there and

asking to find an effective way to get that customer feedback so that we, as part of our balancing, we can take into account the customer's needs and what can be done to make the situation better.

I've heard it said that the Company's already spent millions on the filters and on secondary water qualities that aren't required, and so there was the suggestion made or the question whether we want to -- whether we'd want to spend more as if that was just unheard of. But the reality is the answer might be yes. But it requires a balance, as your counsel has already said previously. So we just want to be sure we've considered the whole picture.

Is that -- do you follow what I'm saying? Is that a reasonable approach?

A. Yes. Our goal is to make sure that, just like you, we don't want unhappy customers, we don't want people coming to complain about discolored water. The people that come to work every day really take this personally. They view it as their personal mission, the operators and others to provide safe water for not only the communities but their families they live in. And we do not want to have discolored water. We want to produce that water as clear and as clean as possible

for the most reasonable cost that we can provide to the customers.

Unfortunately, North Carolina is not blessed with many high quality groundwater sources, and we start with a handicap that is the same for everybody across the state, and it has to be addressed.

Q. The Company's messaging that I saw in your Exhibit A to your testimony speaks to that the manganese and iron is naturally occurring, affects taste, odor and color. But it also -- it does other things, does it not, like damage to property and so forth?

So can't -- can't that -- I guess I'm asking, does that packaging of that message lull us all into not looking for the creative solution, but saying it's naturally occurring in your state, so there's little we could do about it?

A. That's a fair point and something we're going to have to take back to our communications people, to emphasize more about the potential for plumbing damage and other things that are important to the homeowner.

Q. Now, in the water quality plan, many -- my question is, how many systems are addressed every year, or in a year by the 10 to 15 greensand filters that's

in the water quality plan for the next -- is that 7 years?

A. The 10 to 15 greensand filters that we're anticipating right now per year, there's about 80 points of entry that we have identified that need that. And that would address anything in Group One. There is numbers of sites versus systems, so it's hard for me to tell you how many exact systems would be addressed. But if I'm not mistaken, just within the Bayleaf Master System alone, there was over two dozen sites that needed addressed. Even though only a handful had an NOD, there are a few sites in there that are -- quite a few sites in there that are Group One that need to be addressed.

So there may be a number of -- if there's a large number of wells, we may have, you know, more systems in one system than another. But once you move out of the Bayleaf Master System, then it's typically -- you know, every filter covers one system, typically.

Q. As I understand your testimony, the Group One sites should be addressed or remediated in seven-year time period; but I also, am I wrong, understood the Group One sites are prioritized for the public health

protection; is that right?

A. Yes, ma'am.

Q. So is the seven years too long to wait?

A. If I could wave a magic wand, we would love to have them installed today. But there's a process we have to go through to make sure that we're installing the right ones in the right places and we've exhausted all of our other options and that we have identified the right treatment process. We also do need to go back and sample these sites and verify that the results are real and that we're not jumping at a shadow and that it's a false read.

Q. And Group One, though, it does address health concerns; it's not just property or discoloration, it's a real health concern?

A. Group One systems that are over 0.3 milligrams per liter of manganese exceed that EPA recommended limit, and we want to make sure that our systems don't exceed that EPA recommended limit.

Q. And my last question is, when you say sites there, Group One sites -- you usually use the word sites, as I recall -- is that -- what is sites to you? Is that the same as wells? Systems? Site?

A. Sites typically mean entry points. It's a

little complicated and, you know, we even struggle ourselves with the terminology, because we have wells, and some of them all have an individual entry point, some of them combined to one entry point. And we have thousands of these, so coordinating the information makes it difficult. So we try to bring it down to the actual entry point or well level.

When I say "sites," I mean actual sites where we have measurements at an entry point or a well.

Q. All right. Thank you.

COMMISSIONER BROWN-BLAND: And we're overdue for a break, but we're going to go to lunch when you are done, but right now I'm going to finish up with you if I can.

Any questions on the Commission's questions?

MS. TOWNSEND: Yes.

RECROSS EXAMINATION BY MS. TOWNSEND:

Q. Dr. Crockett, Commissioner Clodfelter asked you about Upchurch and indicated he wanted to know why that wasn't included in what he saw as your three-year plan; is that correct?

A. Yes.

Q. All right. Just as a refresher, and subject

to change, I have the updated status report for Upchurch as I did for all the others. So the comments on that updated quarterly status report dated June 27, 2018, says:

"Well Number 1" -- there's two wells, 1 and 4 -- "Well Number 1, which has the lesser levels of iron and manganese concentrations, is currently supplying all the water to the system at this time. Aqua limits the run time at Well Number 4 to limit the amount of mineral concentrations entering the distribution system. Two smart pumps have been installed to better regulate sequestration dosing. However, laboratory results show that sequest still does not adequately solve the problems of iron and manganese in the system. Some of total iron and total manganese is consistently greater than 1."

MS. SANFORD: Objection -- excuse me, what are you reading? And may we ask what --

COMMISSIONER CLODFELTER: I was just going to ask the same question. I don't see that in the exhibit.

MS. TOWNSEND: No, it's not. I have a copy, and would be happy to provide to the Commissioners, all of the summary updated reports. I just had a sample for Bayleaf, but I also have Upchurch's, and I wanted to help Commissioner Clodfelter, since I had the document with me. But I would be happy to provide all of them to everyone at some point in time.

MS. SANFORD: I will object until when and unless the witness gets to look at it.

MS. TOWNSEND: Sure.

COMMISSIONER BROWN-BLAND: Ms. Townsend, how much time does everybody anticipate on follow-up to Commission's questions? Can we complete him before 1:00?

MS. JOST: Yes.

COMMISSIONER BROWN-BLAND: If people think we can't, we'll take a break for lunch.

MS. SANFORD: I think I have five minutes, maybe not that.

COMMISSIONER BROWN-BLAND: Let's go ahead, then.

THE WITNESS: (Witness peruses document.)

BY MS. TOWNSEND:

Q. You've had a chance to review this page?

A. Yes, briefly.

Q. Okay. And it is the June 27, 2018, Upchurch subdivision quarterly update, correct?

A. Yes.

Q. All right. And as I was saying -- we'll go to where I stopped.

"The sum of iron -- total iron and manganese is consistently greater than 1. Although Public Staff originally denied the installation of greensand filtration, Aqua has requested the Public Staff of North Carolina Utilities Commission re-evaluate their decision. Aqua is currently awaiting the final decision and will update DEQ as soon as we are notified"; Is that correct?

A. That's what's written.

Q. Okay. Does that help refresh your recollection as to the status of the Upchurch wells?

A. No, ma'am. There's hundreds of wells that we have in our system.

MS. TOWNSEND: All right. No further

questions.

RECROSS EXAMINATION BY MS. JOST:

Q. I just have one question. Commissioner Brown-Bland asked you questions about the lifetime health advisory for manganese.

Would you agree that, in its drinking water health advisory for manganese published in 2004, the EPA advised that, for infants younger than six months, the lifetime health advisory of 0.3 milligrams per liter should be used for even acute exposures of 10 days?

A. Your question is?

Q. Would you agree that the EPA has advised that that health advisory of 0.3 milligrams per liter, which is a lifetime health advisory for others, should be used for exposures as short as 10 days for infants?

A. I don't have that language right in front of me from the 2004 document, so I can't verify that. It's subject to check.

Q. Subject to check. Okay. Thank you.

REDIRECT EXAMINATION BY MS. SANFORD:

Q. Dr. Crockett, I want to move as quickly as we can, but I want to move through several topics. And the first topic is with respect to discolored water and

your conversation with Commissioner Brown-Bland.

Just to clarify, is it correct to say nobody wants this water to be discolored?

A. That's correct.

Q. And Aqua is working to provide water that is not only safe but that is also clear; is that correct?

A. That's correct.

Q. And for all the reasons we've discussed this morning, it takes time and it takes money; is that correct?

A. That's correct.

Q. But I just wanted to be clear that there is -- optimally, there is a zero tolerance for brown water on the part of the provider, on the part of Aqua?

A. Yes. That's our goal.

Q. And did you say or is it your position that the incidence of discolored water is generally not -- and I don't want to put words in your mouth, but is it a constant phenomenon, in your experience, or is it an intermittent phenomenon?

A. It really depends. It depends. There could be a system where, because of the well, because of the situation, it's a constant phenomenon for that customer. And there could be come where the well is

fine for years and then suddenly you start getting iron and manganese and discolored water. It really depends. We've seen all kinds of varieties of that.

Q. And it is sometimes for customers, is it not, the situation in which their water will be fine in terms of the color but then intermittently will be discolored and -- is that correct?

A. Right. And intermittent discoloration could have nothing to do with the well, it could have -- somebody could open a hydrant, you know, something could cause a surge in the system, or somebody could strike a line.

Q. And though I realize people don't like to do this, just flushing -- customers can just manually flush themselves by opening their spigot; is that right?

A. That's correct.

Q. Let's look at -- with respect to Commissioner Clodfelter's questions -- and we realize we have more work to do here -- but I want to ask you about Upchurch, which is one of the wells that has been discussed this morning, including by Commissioner Clodfelter.

Are you aware that Aqua made an application

for a greensand filter for Upchurch two years ago?

A. No.

Q. Would you accept, subject to check, that that's the case?

A. Yes.

Q. Do you know what the Public Staff's position was on that Upchurch upgrade?

A. No.

Q. Are you aware that the Public Staff has put that -- has moved forward or has made a positive indication with respect to that recently?

A. No.

Q. Okay. Sounds like you're not the one to ask. Give me one second.

With respect to the interaction between Aqua and the Public Staff, as you develop these plans, have you been involved in some of that?

A. Yes.

Q. You have. You have. And if the Commission -- and it's a multi-party engagement; it's the Company and the Public Staff, correct?

A. Yes.

Q. And then I guess there's some DEQ involvement, at least on the periphery?

A. Yes.

Q. And so would it be reasonable to ask the Public Staff, with respect to their view about this balancing of costs and benefits?

A. Yes.

Q. Okay. My last question is this:

Are you aware that Aqua -- and this is to a Commissioner Clodfelter question -- are you aware that Aqua is required once a year to file this three-year WSIC plan?

A. Yes.

Q. And it was filed -- are you aware that it was file in this docket on April 2nd?

A. No.

Q. Is it correct that this is a dynamic kind of document? I've forgotten how you described it. I don't know if it was as a snapshot.

A. Capital planning, when you're involved in a framework and a process like this of prioritizing dozens of wells for work, going through and doing your due diligence and checking, sites will -- a well or a location will suddenly have a solution and go off the list, that doesn't require a filter. And another well may need -- you may find it needs filtration and go on

the list.

So whenever you look at those lists, it's as of the day you have that information, because not every well has been -- has been completely evaluated by the Public Staff and gone through the whole process.

Q. And so we shouldn't expect that a document or a forecast filed once a year is going to be determinative of actions or decisions made even within a month, two months after it's filed; is that correct?

A. Yes.

MS. SANFORD: Thank you. That's all I have.

COMMISSIONER BROWN-BLAND: Well, I hate to do this, but there's one burning -- you're done? All right. So we can stop there. All right.

COMMISSIONER GRAY: I got to her.

COMMISSIONER BROWN-BLAND: So do you have something for me, Ms. Sanford?

MS. SANFORD: Let's see.

COMMISSIONER BROWN-BLAND: The exhibits?

MS. SANFORD: Yes. I would like to move as exhibit into evidence --

COMMISSIONER BROWN-BLAND: There are two of them. But there being no objection, the

exhibits filed with Dr. Crockett's prefiled testimony will be received into evidence.

(Whereupon, Crockett Exhibits A and B were admitted into evidence.)

MS. TOWNSEND: And the Attorney General would like Crockett Exhibit Number 1 -- Cross Exam Exhibit Number 1 to be put into evidence.

COMMISSIONER BROWN-BLAND: All right. That motion will be allowed.

(Whereupon, Attorney General Crockett Cross Examination Exhibit Number 1 was admitted into evidence.)

MS. SANFORD: Madam Chair, this is the close of Aqua's direct case, and if this is the appropriate time, I'd like to move some things into evidence and then to request if we may excuse Dr. Crockett so he can fly back to Pennsylvania.

COMMISSIONER BROWN-BLAND: Unless you need Dr. Crockett right now, you are excused.

THE WITNESS: Thank you, Commissioner.

COMMISSIONER BROWN-BLAND: Thank you.

MS. SANFORD: If I may, I would like to move into evidence, the -- I lost my notes. The application; the water quality -- the WSIC/SSIC

three-year plan, which was filed in this docket, and in the Sub 363 docket on April 2nd; the Company's reports on the customer public hearings. There were four public hearings, we filed three reports: Mocksville, Gastonia, Raleigh, and Wilmington, and we combined Gastonia and Mocksville. And I believe that's it.

COMMISSIONER BROWN-BLAND: All right. I believe the application is already in, but out of an abundance of caution, I will note that it is received into evidence, as well as the Company's reports filed in the public hearings, there were three of them. And what was the other?

MS. SANFORD: The three-year plan.

COMMISSIONER BROWN-BLAND: The three-year plan is also received into evidence.

MS. SANFORD: Thank you.

(Whereupon, the Application, the WSIC/SSIC Three-Year Plan, and the Company's Reports on the Customer Public Hearings in Mocksville/Gastonia, Raleigh, and Wilmington were identified and admitted into evidence.)

COMMISSIONER BROWN-BLAND: That being

said, let's see if we can be back at 2:15. We are out for a lunch break.

(The hearing was adjourned at 12:52 p.m. and set to reconvene at 2:15 p.m. on Tuesday, September 18, 2018.)

CERTIFICATE OF REPORTER

STATE OF NORTH CAROLINA)
COUNTY OF WAKE)

I, Joann Bunze, RPR, the officer before whom the foregoing hearing was taken, do hereby certify that the witnesses whose testimony appears in the foregoing hearing were duly sworn; that the testimony of said witnesses was taken by me to the best of my ability and thereafter reduced to typewriting under my direction; that I am neither counsel for, related to, nor employed by any of the parties to this; and further, that I am not a relative or employee of any attorney or counsel employed by the parties thereto, nor financially or otherwise interested in the outcome of the action.

This the 20th day of September, 2018.

JOANN BUNZE, RPR
Notary Public #200707300112