



MISSISSIPPI STATE DEPARTMENT OF HEALTH

REPORT OF INSPECTION OF DRINKING WATER SUPPLY

PWS: 0250008 **Class:** A

An inspection of the CITY OF JACKSON water supply in HINDS county was made on 11/17/2017. Present at the time of inspection was CYNTHIA H HILL, OPERATOR; WRITER. Official TERRY WILLIAMSON Address P O BOX 17 JACKSON MS 39205 W.W. Operator CYNTHIA H HILL Address P O BOX 285 TOUGALOO MS 39174 No. Connections 77050 No. Meters Population Served 192547 Field Chemical Analysis: pH Cl2(free) Cl2(total) H2S N/A Iron Fluoride Point of Sampling DISTRIBUTION Water Rates

COMMENTS

Technical: 3 Managerial: 4 Financial: 4

OVERALL CAPACITY RATING: 3.7 / 5.0

1. All elevated tanks, wells, and booster stations were inspected on November 13 and in attendance were Terence Byrd and James Perry. The Fewell & OB Curtis plants were inspected on November 14, 2016. City personnel in attendance were Cynthia Hill, Terence Byrd, James Perry, Chris Ward, Lenore Hicks, Hubert Russell, and Colleen Cook from MSDH. Records were reviewed on November 17. Present during the records review were Bill Miley and Cynthia Hill.
2. It is vital that both O.B. Curtis and J.H. Fewell be fully staffed with licensed Class A water operators and capable maintenance staff. The City's water treatment is not a simple undertaking and involves complex processes that require 24/7 monitoring and adjustment. These operators are necessary to keep everything running smoothly and ensuring all Federal Safe Drinking Water Act Standards are met.
3. The conventional operations at both plants are meeting the requirements of the Long Term 2 Enhanced Surface Water Treatment Rule.

4. As a reminder, UV disinfection at both plants must be operated at all times that the filters/service pumps are online. Credit can be given for 3.0 log removal for the conventional filtration plants if they maintain filter effluent turbidities of <0.3 NTU 95% of the time. However, the remaining 2.5 log inactivation of Crypto must be achieved with the UV and membranes. No disinfection credit will be given for Crypto using free chlorine or chloramines, therefore properly operating UV and membranes units will be essential.
5. It is important that anytime a UV unit is taken offline, and the corresponding filter or high service pump remains online, the City is able to demonstrate that the appropriate free chlorine concentration is maintained between the point of chlorine injection and the point of ammonia injection in order to inactivate viruses. Calculations should be kept in the plant records showing that the appropriate CT is maintained anytime a service pump remains online with a UV unit down at either plant. Alternatively, the high service pump can be taken offline when its UV is down.
6. We recommend following up on the results of the 2017 pump tests as you can.

CAPACITY ASSESSMENT COMMENTS

7. Updated target for pH is 9.0 or greater and updated target for alkalinity is 35 mg/L or greater. At the time of inspection, both plans were meeting these specific goals.
8. The City is under a State issued Compliance Plan to resolve Lead and Copper problems. As of the time of inspection, soda ash had been online at the O.B. Curtis plant for 3 weeks. The City and their consultants are still finalizing the conversion of the second silo from lime to soda ash, as well as getting ready to convert J.H. Fewell over to soda ash.
9. Credit for T2-1 was not given due to the fact that not all of the membranes at O.B. Curtis were passing the MIT. There has been a huge amount of work done on the membrane system over the past year. Mrs. Hill reported that the City will be getting trains 1 and 5 by November 2018 and they will pursue getting trains 3 and 4 replaced through the City's SRF project.
10. Credit for M3 was not given due to the City exceeding the action level for lead during sample period ending December 2016. It should be noted that the December 2016 sampling period was the last time the City exceeded the lead action level. The two sampling events in 2017 have resulted in the City being below the lead action level.
11. Credit was not given for T5-1 because the system does not have the ability to provide water during a prolonged power outage. In order to get credit next year, the City will need to obtain generators capable of keeping pressure in the system during a prolonged power outage.
12. Credit for F3 was not given as the City has not been cutting off. Mr. Miley reported that 87-92% of the meters are being read monthly. The City has upgraded the quality of the signal repeaters, resulting in greater accuracy in the readings. He reported that a public announcement will be made in January/February 2018 as to when they will begin following their cut-off policy.

*** FEWELL PLANT COMMENTS ***

13. The turbidities of all online filters were less than 0.3 NTU at the time of inspection. Turbidity readings are automatically saved every 5 minutes.

14. The following analyses were completed on the finished water from the plant and the results were as follows: Turbidity = 0.17; pH = 9.4; Total Chlorine Residual = 3.7 mg/L; Free Chlorine Residual = 0.1 mg/L; Color = 8; Manganese = 0.29 mg/L; Fluoride = 1.0 mg/L; Free ammonia = 0.31 mg/l; Monochloramine = 3.24 mg/l; Alkalinity = 42 mg/L; Hardness = 75 mg/L; Iron = 0.01 mg/L. The total plant output was 10.0 MGD.

*** O.B. PLANT COMMENTS***

15. The turbidities of all online filters and online membrane trains were less than 0.3 NTU at the time of inspection.

16. As stated above, not all membrane trains were passing the membrane integrity testing. Therefore, we cannot give any log removal credit for the membranes. This a serious issue and must be corrected before the membrane treatment must be taken offline. The lifespan of the membranes is greatly shortened due to them not being protected from the weather. The membranes that are designed to last 10 years are only lasting a third of that due to the lack of cover. Each of the 6 membrane trains need new fibers in the form of individual cassettes or full modules. Both the cover to protect the membrane treatment train AND new fibers PLUS repairs to operational valving are all needed in equal measure to ensure properly treated water is created through this treatment process. With the membrane treatment train offline, the plant will not make enough water to meet the demands of the City.

17. Fluoride should be added to both treatment trains. At the time of inspection, it was only being added to the conventional side.

18. To improve the effectiveness of filter backwashing, it is recommended that all filters have a functioning surface wash system.

19. The average flow rate was 15.3 MGD from the conventional side and 11.5 MGD from the membrane side.

20. The following analyses were completed on the finished water from High Service 1, which is predominantly water from the conventional side: Turbidity = 0.079; pH = 9.4; Total Chlorine Residual = 3.4 mg/L; Free Chlorine Residual = 0.1 mg/L; Alkalinity = 42 mg/L; Hardness = 16 mg/l; Iron = 0.01 mg/L; Manganese = 0.008 mg/L; Free ammonia = 0.55 mg/l; Monochloramine = 2.47 mg/l; Color = 6 units; Fluoride = 0.9 mg/L.

21. The following analyses were completed on the finished water from High Service 2, which is predominantly water from the membrane side: Turbidity = 0.086; pH = 9.4; Total Chlorine Residual = 3.2 mg/L; Free Chlorine Residual = 0.1 mg/L; Alkalinity = 35 mg/L; Hardness = 16 mg/l; Iron = 0.01 mg/L; Manganese = 0.015 mg/L; Fluoride = 0.04 mg/L; Free ammonia = 0.41 mg/l; Monochloramine = 2.11 mg/l; Color = 2 units.

*** GENERAL REMINDER COMMENTS ***

22. When repairs are made on the distribution system, all lines affected should be properly chlorinated and flushed before they are placed back in service.

23. Whenever system pressure is lost, even for brief periods of time, contaminants may be introduced to the system through back-siphonage and/or back flow. When this occurs, system officials should notify all customers in the affected area to boil their drinking water vigorously for one minute. This boil water notice should remain in effect until clear bacteriological samples have been obtained.

Completed by Amy L. McLeod, E.I. on 12/21/2017.

Reviewed by Greg Caraway, P.E. on 01/08/2018.

If you have any questions, please call (601)576-7518.

pc:

TERRY WILLIAMSON, OFFICIAL
CYNTHIA H HILL, OPERATOR



Mississippi Department of Health Bureau of Public Water Supply

STANDARD FORM

FY 2018 Public Water System Capacity Assessment Form

NOTE: This form must be completed whenever a routine sanitary survey of a public water system is conducted by a regional engineer of the Bureau of Public Water Supply

PWS ID#: 0250008 Class: A Survey Date: 11-17-2017 County: HINDS

Public Water System: CITY OF JACKSON Conn: 77050

Certified Waterworks Operator: CYNTHIA H HILL Pop: 192547

CAPACITY RATING DETERMINATION

Technical (T) Capacity Rating: [3] Managerial (M) Capacity Rating [4] Financial (F) Capacity Rating [4]

$$\text{Capacity Rating} = \frac{T+M+F}{3} = \frac{11}{3} = 3.7$$

Overall Capacity Rating = 3.7

Completed by Amy L. McLeod, E.I. on 12/19/2017

Reviewed by Greg Caraway, P.E. on 01/08/2018

Comments: _____

Technical Capacity Assessment	Point Scale	Point Award
[T1] Does the water system have any significant deficiencies? [<u>Y</u> <u>(N)</u>]	N - 1pt. Y - 0pt.	1
[T2] 1) Was the water treatment process functioning properly? [<u>Y</u> <u>(N)</u>] (i.e. Is pH, iron, chlorine, fluoride, etc. within acceptable range?) 2) Was needed water system equipment in place and functioning properly at the time of survey? [<u>Y</u> <u>(N)</u>] (NOTE: Equipment deficiencies must be identified in survey report.) 3) Were records available to the regional engineer clearly showing that all water storage tanks have been inspected and cleaned or painted (if needed) within the past 5 years? [<u>Y</u> <u>(N)</u> <u>NA</u>] (NOTE: All YESs required to receive point)	All Y - 1 pt. Else - 0 pt.	0
[T3] 1) Was the certified waterworks operator or his/her authorized representative present for the survey? [<u>Y</u> <u>(N)</u>] 2) Was log book up to date and properly maintained? [<u>Y</u> <u>(N)</u>] (Are minimum days being met based on system classification) 3) Was the water system properly maintained at the time of survey? [<u>Y</u> <u>(N)</u>] 4) Did operator/system personnel satisfactorily demonstrate to the regional engineer that he/she could fully perform all water quality tests required to properly operate this water system? [<u>Y</u> <u>(N)</u>] (NOTE: All YESs required to receive point)	All Y - 1 pt. Else - 0 pt.	1
[T4] 1) Does water system routinely track water loss and were acceptable record available for review? [<u>Y</u> <u>(N)</u>] 2) Is water system overloaded? (i.e. serving customers in excess of MSDH approved design capacity)? [<u>Y</u> <u>(N)</u>] 3) Was there any indication that the water system is/has been experiencing pressure problems in any part(s) of the distribution system? [<u>Y</u> <u>(N)</u>] (based on operator information, customer complaints, MSDH records, other information) 4) Are well pumping tests performed routinely? [<u>Y</u> <u>(N)</u> <u>NA</u>] (NOTE: YES FOR #1 & YES OR N/A FOR #4 AND NOs FOR #2 & #3 required to receive point)	1)Y - pt. 2)N - pt. 3)N - pt. 4)Y - pt.	1
[T5] 1) Does the water system have the ability to provide water during power outages? (i.e. generator, emergency tie-ins, etc.) [<u>Y</u> <u>(N)</u>] 2) Does the water system have a usable backup source of water? [<u>Y</u> <u>(N)</u>] (NOTE: Must be documented on survey report)	All Y - 1 pt. Else - 0 pt.	0
TECHNICAL CAPACITY RATING = [<u>3</u>] (Total Points)		

Managerial Capacity Assessment	Point Scale	Point Award
[M1] Were all SDWA required records maintained in a logical and orderly manner and available for review by the regional engineer during the survey? <input checked="" type="radio"/> Y <input type="radio"/> N]	Y - 1pt. N - 0pt.	1
[M2] 1) Have acceptable written policies and procedures for operating this water system been formally adopted and were these policies available for review during the survey? <input checked="" type="radio"/> Y <input type="radio"/> N] 2) Have all board members (in office more than 12 months) completed Board Member Training? <input checked="" type="radio"/> Y <input type="radio"/> N <input type="radio"/> NA] 3) Does the Board of Directors meet monthly and were minutes of Board meetings available for review during the survey? <input checked="" type="radio"/> Y <input type="radio"/> N <input type="radio"/> NA] (NOTE: Quarterly meetings allowed if system has an officially designated full time manager) <input checked="" type="radio"/> Y <input type="radio"/> N <input type="radio"/> NA] (NOTE: ALL YESs or NAs required to receive point. NA - Not Applicable)	All Y - 1 pt. Else - 0 pt.	1
[M3] Has the water system had any SDWA violations since the last Capacity Assessment? <input checked="" type="radio"/> Y <input type="radio"/> N]	N - 1pt. Y - 0pt.	0
[M4] Has the water system developed a long range improvements plan and was this plan available for review during the survey? <input checked="" type="radio"/> Y <input type="radio"/> N]	Y - 1pt. N - 0pt.	1
[M5] 1) Does the water system have an effective cross connection control program in compliance with MSDH regulations? <input checked="" type="radio"/> Y <input type="radio"/> N] 2) Was a copy of the MSDH approved bacti site plan and lead/copper site plan available for review during the survey and do the bacti results clearly show that this approved plan is being followed? <input checked="" type="radio"/> Y <input type="radio"/> N] (NOTE: All YESs required to receive point)	All Y - 1 pt. Else - 0 pt.	1
MANAGERIAL CAPACITY RATING = [<u>4</u>] (Total Points)		

Financial Capacity Assessment	Point Scale	Point Award
[F1] Has the water system raised water rates in the past 5 years? <input checked="" type="radio"/> Y <input type="radio"/> N] (NOTE: Point may be awarded if the water system provides acceptable financial documentation clearly showing that a rate increase is not needed, i.e. revenue has consistently exceeded expenditures by at least 10%, etc.)	Y - 1pt. N - 0pt.	1
[F2] Does the water system have an officially adopted policy requiring that water rates be routinely reviewed and adjusted as appropriate and was this policy available for review during the survey? <input checked="" type="radio"/> Y <input type="radio"/> N]	Y - 1pt. N - 0pt.	1
[F3] Does the water system have an officially adopted cut-off policy for customers who do not pay their water bills, was a copy of this policy available for review by the regional engineer, and do system records (cut-off lists, etc.) clearly show that the water system effectively implements this cut-off policy? <input checked="" type="radio"/> Y <input type="radio"/> N]	Y - 1pt. N - 0pt.	0
[F4] Was a copy of the water system's officially adopted annual budget available for review by the regional engineer and does the water system's financial accounting system clearly and accurately track the expenditure and receipt of funds? <input checked="" type="radio"/> Y <input type="radio"/> N]	Y - 1pt. N - 0pt.	1
[F5 - Municipal Systems] 1) Was a copy of the latest audit report available for review at the time of the survey? <input checked="" type="radio"/> Y <input type="radio"/> N] 2) Does this audit report clearly show that water and sewer fund account(s) are maintained separately from all other municipal accounts? <input checked="" type="radio"/> Y <input type="radio"/> N] (NOTE: Yes answer to all questions required to receive point.)	All Y - 1 pt. Else - 0 pt.	1
[F5 - Rural Systems] 1) Was the latest financial report / audit report available for review? <input checked="" type="radio"/> Y <input type="radio"/> N] 2) Does the latest financial report show that receipts exceeded expenditures? <input checked="" type="radio"/> Y <input type="radio"/> N] (NOTE: Yes answer to both questions required to receive point)	All Y - 1 pt. Else - 0 pt.	1
FINANCIAL CAPACITY RATING = [<u>4</u>] (Total Points)		

**MISSISSIPPI DEPARTMENT OF HEALTH
BUREAU OF PUBLIC WATER SUPPLY
DESIGN CAPACITY SHEET**

System: **CITY OF JACKSON**
ID: **0250008** Class: **A** County: **HINDS**

Date Completed: **03/12/2020**
Connections - Actual: **71486** Equivalent: **76008**
Design Capacity: **178350** Percent Design Capacity: **76008/178350 = 42.6%**

** REVISED DESIGN CAPACITY TO REFLECT THE CHANGE FROM BIN 4 TO BIN 2 **

J H FEWELL WATER TREATMENT PLANT

**** CT calculations for FEWELL ****

There are four disinfection segments at Fewell, and the contact time must be determined for each segment to achieve 4-log inactivation of viruses, 3-log inactivation of Giardia, and 3.5-log inactivation of Crypto.

Fewell is required to achieve 0.3 turbidity units 95% of the time to comply with the SWTR. If this treatment is achieved, credit can be given for 2-log removal of viruses & Crypto and 2.5-log removal of Giardia. Free chlorine, chloramination, and UV disinfection must then attain the remaining 2-log inactivation of viruses, 0.5-log inactivation of Giardia, and 1.5-log of Crypto.

Book values:

CT required for 0.5-log inactivation of giardia at 10C and pH at 6.5 = 19 mg/L min

CT required for 2-log inactivation of viruses at 10C and pH at 6.5 = 3 mg/L min

The first segment is free chlorine contact between the point of chlorine injection (at the head of the outlet pipe from the sedimentation basin) and the point of ammonia injection (at the end of the outlet pipe just prior to ammonia injection).

The second is the contact time of free chlorine in the filters during normal filter operation.

The third is the contact time in the clearwell.

The fourth is the UV disinfection.

BASED ON THE PAST FOUR MONTHS OF TURBIDITY FILTER DATA SUBMITTED ON MONTHLY OPERATING REPORTS, MSDH IS SETTING A MAXIMUM TREATMENT CAPACITY OF 20 MGD. THE 7/13 MGD SPLIT BETWEEN BASINS IS BASED ON STANDARD OPERATION WHEN 20 MGD IS BEING TREATED.

CHLORINE RESIDUALS UPDATED TO REFLECT WHAT THE PLANT WAS TREATING ON 3/5/20

CT SEGMENT 1 (pipes between sed basins and ammonia injection):

The free chlorine is measured by chlorine analyzers which communicate with the ammonia feed system. The concentration of free chlorine in the pipe between Sed Basin #3 and the filters was 2.1 mg/L. The concentration of free chlorine in the pipe between Sed Basin #4 and the filters was 3.0 mg/L.

Calculating the free chlorine contact time between chlorine injection and ammonia injection (at maximum design flows):

Sed basin #3: Pipe dimensions: Length = 351 ft; Diameter = 42 in = 3.5 ft.

Volume in pipe = $0.785 \times 3.5 \times 3.5 \times 351 \times 7.48 = 25,247$ gallons

Estimated flow through Sed basin #3 train: 7 MGD

Contact time = $25,247 \text{ gallons} / 7,000,000 \text{ gal/day} \times 1440 \text{ min/day} = 5.19 \text{ min}$

Sed basin #4: Pipe dimensions: Length = 357 ft; Diameter = 48 in = 4 ft.

Volume = 33,540 gallons

Estimated flow through Sed basin #4 train: 13 MGD

Contact time = $33,540 / 13,000,000 \times 1440 = 3.72 \text{ min}$

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CT SEGMENT 1 (using shortest contact time of 3.72 min) = $3.0 \text{ mg/L} \times 3.72 \text{ min}$
= 11.2 mg/L min

(Note: Virus inactivation is achieved in Segment 1; 11.2 mg/L min > 3 mg/L min)

SEGMENT 1 LOG INACTIVATION = $11.2 \text{ mg/L min} / 19 \text{ mg/L min} \times (0.5 \text{ log}) = 0.29 \text{ log}$

CT SEGMENT 2 (Disinfection in filters):

Disinfectant contact time between filters and clearwell/storage outlet:

Calculate volume of water in filters and estimated residence time:

Volume = L X W X D (where D = depth of water above filter media)
= $(20 \text{ ft} \times 10 \text{ ft} \times 1.5 \text{ ft}) \times 7.48 \text{ gal/cu.ft.} \times 12 \text{ filters} +$
 $(25 \text{ ft} \times 28 \text{ ft} \times 3 \text{ ft}) \times 7.48 \text{ gal/cu.ft.} \times 3 \text{ filters}$
= 26,928 gallons + 47,124 gallons
= 74,052 gallons

Residence time = $(74,052 \text{ gallons} / 20,000,000 \text{ gallons/day}) \times 1440 \text{ min/day}$

Residence time = 5.33 minutes

CT SEGMENT 2 (assuming chlorine concentration = finished water chlorine concentration = 0.3 mg/L)

CT SEGMENT 2 = $0.3 \text{ mg/L} \times 5.33 \text{ minutes} = 1.6 \text{ mg/L min}$

SEGMENT 2 LOG INACTIVATION = $1.6 \text{ mg/L min} / 19 \text{ mg/L min} \times (0.5 \text{ log}) = 0.042 \text{ log}$

CT SEGMENT 3 (Disinfection in the clearwell):

Using the clearwell volume of 3.8 MG and a pre-determined baffling factor of 0.233:

Contact time = $3.8 \text{ MG} / 20 \text{ MGD} \times 1440 \text{ minutes/day} \times 0.233 = 63.7 \text{ minutes}$

Free chlorine measured in finished water = 0.3 mg/L

CT SEGMENT 3 = $63.7 \text{ minutes} \times 0.3 \text{ mg/L} = 19.1 \text{ mg/L min}$

SEGMENT 3 LOG INACTIVATION = $19.1 \text{ mg/L min} / 19 \text{ mg/L min} \times (0.5 \text{ log}) = 0.50 \text{ log}$

Total CT using free chlorine = $(11.2 + 1.6 + 19.1) \text{ mg/L min} = 31.9 \text{ mg/L min}$

Total LOG INACTIVATION using free chlorine = SEGMENT 1 + SEGMENT 2 + SEGMENT 3

Total LOG INACTIVATION using free chlorine = $0.29 + 0.042 + 0.50 = 0.832 \text{ log}$

CT SEGMENT 4 (UV Disinfection):

At the time of the inspection, Pump 2 was pumping 10 MGD and dosing 28.2 mJ/sq.cm.

According to 40 CFR 141.720 (d)(1), a dose of 3.9 mJ/sq.cm. will achieve a 1.5 log inactivation of Crypto and 1.5-log inactivation of Giardia. Therefore, the UV disinfection more than adequately achieves the remaining inactivation of Giardia & Crypto.

NOTE: Any time that the UV disinfection is offline on any service pump, that service pump MUST be taken offline as free chlorine is not enough to achieve the log credit removal for Crypto.

*** FEWELL DESIGN CAPACITY ****

Rated treatment capacity of plant = 20 MGD (limiting factor)

Clearwell volume = 3.8 MG

2 additional ground storage tanks @ 5MG each = 10 MG

Total storage located at the plant = 3.8 MG + 10 MG = 13.8 MG

Usable storage (volume filled in 6 hours) = $20 \text{ MGD} / 24 \text{ hrs/day} \times 6 \text{ hrs} = 5 \text{ MG}$

Plant capacity = rated treatment capacity of plant + usable storage/200 minutes

Plant capacity = $20 \text{ MGD} + (5 \text{ MG} / 200 \text{ min} \times 1440 \text{ min/day}) = 56 \text{ MGD}$

Service pump capacity = $(9+9+9+7) = 34 \text{ MGD}$

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FEWELL DESIGN CAPACITY = 20,000,000 gal/day/1440 min/day = 13,889 GPM

O B CURTIS WATER TREATMENT PLANT

**** CT calculations for OB Curtis ****

This plant must meet 4-log inactivation of viruses, 3-log inactivation of Giardia, and 3.5-log inactivation of Crypto.

The conventional side is required to achieve 0.3 turbidity units 95% of the time to comply with the SWTR, so credit can be given by default for 2-log removal of viruses & Crypto and 2.5-log removal of Giardia. Free chlorine, chloramination, and UV disinfection must then attain the remaining 2-log inactivation of viruses, 0.5-log inactivation of Giardia, and 1.5-log of Crypto.

The membrane system is required to achieve <0.15 turbidity units 95% of the time to comply with the SWTR, so credit can be given by default for 2-log removal of viruses, 3-log inactivation of Giardia, and 2-log inactivation of Crypto. Free chlorine must achieve the remaining 2-log of viruses. Maintaining membrane integrity must achieve the remaining 1.5-log inactivation of Crypto.

****MEMBRANE INTEGRITY TESTING (MIT) MUST BE COMPLETED EVERY 24 HOURS. IF THE TRAIN FAILS MIT, IT MUST BE TAKEN OFFLINE UNTIL IT PASSES. IF TRAIN TURBIDITIES EXCEED 0.15 NTU, THAT TRAIN *MUST* BE TAKEN OFFLINE UNTIL IT PASSES MIT.****

Book values:

CT required for 0.5-log inactivation of giardia at 10C and pH at 6.5 = 19 mg/L min

CT required for 2-log inactivation of viruses at 10C and pH at 6.5 = 3 mg/L min

The clearwell is divided into two separate zones based on their baffling. The conventional and membrane treatment trains feed mirror image clearwells, so the T and CT values below apply to each treatment process.

Zone 1:

Volume = 1.989 MG; BF = 0.7

$T = [(1.989 \text{ MG} / 25 \text{ MGD}) * 0.7] * 1440 \text{ min/day} = 80.2 \text{ min @ } 25 \text{ MGD}$

Zone 2:

Volume = 1.658 MG; BF = 0.3

$T = [(1.658 / 25 \text{ MGD}) * 0.3] * 1440 \text{ min/day} = 28.7 \text{ min @ } 25 \text{ MGD}$

Total T = 80.2 + 28.7 = 108.9 min

The free chlorine residual measured from High Service 1 (conventional side) finished water = 0.1 mg/L

$Ct_{25} = 0.1 \text{ mg/l} * 108.9 \text{ minutes} = 10.89 \text{ mg/L min}$

Virus inactivation achieved at 0.1 mg/L free chlorine at 25 MGD;
10.89 mg/L min > 3 mg/L min

Giardia log inactivation = 10.89 mg/L min / 19 mg/L min * (0.5) = 0.29 log
Remaining 0.5-log Giardia inactivation not achieved by free chlorine contact time in clearwell.

UV disinfection - UV unit attached to each filter

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Each UV unit must be dosing a minimum of 4 mJ/sq.cm. to achieve the final 1.5-log removal of Crypto and the remaining 0.21-log removal of Giardia.

IF AT ANY TIME A UV UNIT IS OUT OF SERVICE, THE CORRESPONDING FILTER MUST BE TAKEN OUT OF SERVICE. CRYPTO AND GIARDIA REMOVAL IS NOT ACHIEVED WITHOUT UV DISINFECTION

Full credit for the conventional side treatment capacity of 25.0 MGD can be given.

The free chlorine residual measured from High Service 2 (membrane side) finished water = 0.3 mg/L.

Using this minimum concentration throughout the clearwell and flow rate of 25 MGD, the contact time is:

T = 108.9 min

CT = 0.3 mg/L * 108.9 minutes = 32.67 mg/L min

Virus inactivation achieved at 0.3 mg/L free chlorine at 25 MGD;
32.67 mg/L min > 3 mg/L min

Giardia & Crypto log inactivation achieved by maintaining turbidities <0.15 NTU 95% of the time. Any time turbidities exceed 0.15 NTU, that train must be taken offline.

Full credit for the membrane side treatment capacity of 25 MGD can be given.

Treatment capacity is not limited on either side by CT.

TOTAL TREATMENT CAPACITY AT OB CURTIS = Conventional (25 MGD) + Membrane (25 MGD) = 50 MGD

*** OB CURTIS DESIGN CAPACITY ***

Raw water pump capacity = (9+8+9+8+8+17+8+17) MGD = 84 MGD

Rated treatment capacity of plant = 50 MGD (limiting factor)

Service pump capacity = (8+8+12+12+12+16+16+22+22) = 128 MGD

Total storage located at the plant (clearwell capacity) = 10 MG

Usable storage (volume filled in 6 hours) = 50 MGD/24 hrs/day x 6 hrs = 12.5 MG (This is greater than 10 MG, so 10 MG = usable storage)

Total plant capacity = rated treatment capacity of plant + usable storage/200 minutes

Total plant capacity = 50 MGD + (10 MG/200min * 1440 min/day) = 122 MGD

This exceeds the service pump capacity of 128 MGD, so:

OB CURTIS DESIGN CAPACITY = 122 MGD

TOTAL SYSTEM DESIGN CAPACITY

TOTAL CAPACITY OF FEWELL AND OB CURTIS PLANTS = 20 MGD + 122 MGD = 142 MGD

142,000,000 gpd / 1440 min/day = 98,611 CONNECTIONS + 3739 (WELLS) = 102,350 CONNECTIONS

TOTAL ELEVATED STORAGE ON SYSTEM:

0.5 MG + 0.2 + 1.0 + 0.5 + 1.5 + 1.0 + 1.0 + 0.5 + 1.0 + 1.0 + 0.25 + 1.5 + 0.25 + 3.0 + 2.0 = 15.2 MG

FINAL DESIGN CAPACITY FOR ENTIRE SYSTEM:

Final design capacity = 102,350 + (15,200,000 gal/200 min) = 178,350 CONNECTIONS

EQUIVALENT CONNECTIONS CALCULATIONS:

COMMERCIAL/INDUSTRIAL USAGE FACTOR CALCULATIONS:

Ciu = Average total CI use(gal)/avg total use (gal)

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The Ciu factor calculated from 2014 data = 0.28
Number of Actual Connections = 54,679
Apartment Adjusted = # Units X 2/3 = 17,992 x 2/3 = 11,995
Total Adjusted Connections = Actual + Apartment Adjusted
= 54,679 + 11,995 = 66,674

Eq. connections = # of adjusted conn + (# of adjusted conn x Ciu factor x 0.5)
= 66,674 + (66,674 x 0.28 x 0.5)
= 76,008

Total final equivalent connections = 76,008

THEREFORE THIS SYSTEM IS CURRENTLY AT 76,008/178,350 = 43% CAPACITY.