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Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

June 27, 2014

Mr. Russell Schreiber, P.E., Director of Public Works
City of Wichita Falls
P.O. Box 1431
Wichita Falls, Texas 76307-1431

Re: City of Wichita Falls – PWS ID No. 2430001
Conditional Approval of Full-Scale Operation of the Temporary Direct Potable Reuse Project for a Six-Month Duration
Wichita County, Texas
RN 600129316 | CN 105598759

Dear Mr. Schreiber,

On June 20, 2014, the Texas Commission on Environmental Quality (TCEQ) received your submittal dated June 18, 2014 entitled the "Full Scale Verification Test #2 Report for the Temporary Direct Potable Reuse Project" for the City of Wichita Falls (City). The submittal presents the results of the second full-scale verification test (FSVT2) of the direct potable reuse water treatment plant (DPR WTP) and requests approval to begin sending effluent from the City's River Road Wastewater Treatment Plant (RRWWTP) that has been treated through the temporary DPR WTP to the City's drinking water distribution system. We have organized our response to your submittal and discussion of other issues related to the operation of the Temporary DPR Project into the sections below.

Project Description

Because of the ongoing drought, the City proposes to supplement its water supply with the temporary reuse of wastewater effluent from the City's RRWWTP as source water for the DPR WTP for a period of six months. The project proposes to utilize the existing Cypress Surface Water Treatment Plants (SWTPs) as a part of the Temporary DPR Project.

The treated wastewater from the RRWWTP will be delivered to the 2008 SWTP via a temporary pump skid located at the RRWWTP. From the temporary pump station, the treated wastewater will then be delivered to the Cypress site through approximately 12 miles of high density polyethylene temporary above-ground transmission line. The effluent will enter the Cypress treatment process through an existing flow control vault located prior to the 2008 SWTP microfiltration/reverse osmosis (MF/RO) clarifier. The 2008 MF/RO SWTP will treat the RRWWTP effluent. The treated water from the 2008 MF/RO SWTP will be blended with raw water from the Secondary Reservoir, which contains untreated surface water from Lake Arrowhead and Lake Kickapoo. A maximum of five (5.0) million gallons per day (MGD) partially-treated RRWWTP effluent from the 2008 MF/RO SWTP will be blended with the raw surface water from the Secondary Reservoir at a location upstream of the existing Cypress SWTP splitter box. The waters will be blended with a ratio of 50.00-percent or lower partially treated

RRWWTP effluent to Lake Arrowhead and Lake Kickapoo surface water. The blended water will then be treated through the existing conventional 2010 SWTP prior to entering the distribution system.

Review of FSVT2 Report

As documented in TCEQ's May 1, 2014 letter, due to significant deficiencies with the first full scale verification test (FSVT1), the TCEQ required the City to restart the verification test and demonstrate proper operation of the DPR WTP facility for 30 consecutive days. The City responded in a letter dated May 28, 2014. The City conducted the FSVT2 from May 16 to June 15, 2014. TCEQ staff provided on-site assistance to the City prior to the start of FVST2, and also were on site for the first 18 days of the test.

TCEQ staff have completed review of the FSVT2 Report. A discussion of findings for which the TCEQ has specific comments is provided in Enclosure I. The information and data provided in the report support **conditional temporary approval of full-scale operation (FSO) of the Temporary DPR Project for a period not to exceed six months from the date of this letter**.

Conditional Approval of Full-Scale Operation of the Temporary DPR Project

The TCEQ **conditionally approves** FSO of the Temporary DPR Project for **a period not to exceed six months from the date of this letter**. This conditional approval is dependent on compliance with the requirements in Enclosure A. Failure to meet the requirements in Enclosure A will result in revision or revocation of this Temporary DPR Project conditional approval.

This conditional approval includes construction approval for reconnection of the Cypress facilities to the City's distribution system by reconnecting the 2010 SWTP transfer pumps to the 10 million gallon (MG) ground storage tank (GST).

Duration of the Temporary DPR Project

You have presented this project as a temporary, emergency response measure due to the extreme drought conditions that the City faces. The TCEQ evaluated this project as a temporary, emergency project, with a maximum duration of six months. However, information recently provided by the City indicates that you may wish to operate the Temporary DPR Project for more than six months.

In order for the TCEQ to consider approval of long-term use of the DPR Project (i.e. more than six months), the same standards will be applied to the City and the DPR Project as for other public water systems and DPR projects. These standards include installation of the water line carrying water from the RRWWTP to the Cypress SWTP to be below the ground surface per Title 30 of the Texas Administrative Code (30 TAC) Chapter 217.54. A standard for other DPR projects in Texas is the installation of ultraviolet (UV) light disinfection. Therefore, if this project is operated more than six months, UV light disinfection providing at least 3.0-log inactivation of *Cryptosporidium* must be approved and installed. Due to the amount of time required to plan for burying the pipeline and approval and installation of a UV light disinfection system, the TCEQ recommends that the City begin preparing for these measures now.

Current DPR WTP Regulatory Monitoring Locations, Frequency, and Action Levels

With this letter as Enclosure B is the current, updated figure depicting the TCEQ-required regulatory monitoring locations, frequency, and action levels for the Temporary DPR Project.

Revised CT Studies

Enclosed with this letter are two CT study approval letters for the 2010 SWTP and the temporary DPR WTP as Enclosures C and D. The City submitted a revision to the 2010 SWTP disinfection protocol because the plant is being used as part of the treatment sequence for the City's temporary DPR WTP and has been isolated from the 1961 and 1987 SWTPs at the Cypress site. The City submitted a proposed disinfection protocol for the temporary DPR WTP. The City must follow all requirements included in the CT study approval letters.

Revised Direct Integrity Test

Enclosed with this letter is a revised direct integrity test (DIT) approval letter for the parameters to be used for integrity testing of the MF membranes at the DPR WTP. A revision of the DIT approval was required due to a change in the surface area of the membrane modules discovered during review. The City must conduct DIT calculations in accordance with the requirements stated in the letter contained in Enclosure E.

Updated Use of Chloramines Exception

With this letter in Enclosure F is an updated exception approval for the use of chloramines. The TCEQ has made changes to the monitoring requirements for systems using chloramines, and in order to ensure consistency with current requirements, is providing this letter to the City. The City must follow all requirements included in the exception approval letter. Please note that the most significant changes in the updated exception are requirements for nitrate and nitrite distribution monitoring and for developing a nitrification action plan.

Industrial Contributions to the RR WWTP

In TCEQ's September 5, 2013 letter several suggestions about the industrial pretreatment program at the City was discussed. These suggestions have been placed in Enclosure H for your convenience.

Replacement of Reverse Osmosis Membrane Elements

On June 17, 2014, the TCEQ received your letter dated June 17, 2014, notifying us of the City's intent to replace the RO membrane elements in five RO trains. Because you propose to use membrane elements that are the same models as have been previously approved, the City will not be required to submit plans and specifications for the RO replacement project. Per discussion with City staff, the timeframe for replacement is summer 2014.

Replacement of Microfiltration Membrane Elements

On February 5, 2014, the TCEQ received your letter dated January 30, 2014 notifying us that the City had replaced the MF membrane elements in two MF units. The TCEQ received the challenge study for these MF membrane elements and has approved the study. The City will not be required to submit plans and specifications for the MF replacement project. In order to avoid future violations, please note the City is required by 30 Texas Administrative Code Chapter

§290.39(j) requires notification of the TCEQ prior to making significant changes including membrane replacement.

If you have any questions regarding this letter, please contact Joel Klumpp at (512) 239-4453 or by e-mail at joel.klumpp@tceq.texas.gov or Vera Poe at (512) 239-6988 or by e-mail at vera.poe@tceq.texas.gov.

Sincerely,

Joel Klumpp, Team Leader
Technical Review and Oversight Team
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

for Vera Poe, P.E., Team Leader
Utilities Technical Review Team
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

Linda Brookins, Director
Water Supply Division
Office of Water
Texas Commission on Environmental Quality

LB/JPK/VP/dfs

Enclosures

Enclosure A:	List of Conditions for the Temporary DPR WTP
Enclosure B:	Current DPR WTP Regulatory Monitoring Locations, Frequency, and Action Levels
Enclosure C:	CT Study Letter for the Cypress 2010 Water Treatment Plant
Enclosure D:	CT Study Letter for the Cypress Temporary DPR Water Treatment Plant
Enclosure E:	Revised Direct Integrity Test Letter
Enclosure F:	Updated Use of Chloramines Exception Letter
Enclosure G:	Unregulated Contaminants of Concern
Enclosure H:	Industrial Contributions to the RR WWTP
Enclosure I:	FSVT2 Discussion
Enclosure J:	Cypress WTP 10 Million Gallon Ground Storage Tank Sample Analysis

cc: Honorable Glenn Barham, Mayor, City of Wichita Falls, P.O. Box 1431, Wichita Falls, TX 76307-1431
Mr. Darron Leiker, City Manager, 1300 7th Street, Wichita Falls, TX 76301
City of Wichita Falls - Attn.: Daniel K. Nix, Utilities Operations Manager, P.O. Box 1431, Wichita Falls, Texas 76307-1431

Enclosure A: List of Conditions for the Temporary DPR WTP

Enclosure A
List of Conditions, June 27, 2014
City of Wichita Falls - PWS 2430001
Temporary Direct Potable Reuse WTP - 410791

Due to the ongoing drought, the City of Wichita Falls (City) proposes to augment its water supply with the temporary reuse of wastewater effluent from the City of Wichita Falls River Road Wastewater Treatment Plant (RRWWTP) as source water for the Temporary Direct Potable Reuse (DPR) Water Treatment Plant (WTP) for a period of six months. The project proposes to utilize the existing Cypress Surface Water Treatment Plants (SWTPs) as a part of the temporary DPR WTP project.

As stated in TCEQ's May 1, 2014 letter, if the City determines that the temporary DPR WTP will be needed for longer than six months; the burial of the above ground pipeline and approval, installation, and use of additional treatment barriers will be required. The maximum duration the project can be operated is six months unless UV disinfection providing at least 3.0-log inactivation of *Cryptosporidium* is approved and installed.

EXCEPTIONS

1. The proposed use of RRWWTP effluent as a raw water source and the associated treatment processes for a DPR WTP require exceptions to Title 30 of the Texas Administrative Code (30 TAC) Chapter 290, Subchapter D regulations. The TCEQ staff review requests for exceptions to ensure that a public water system will provide a safe quality and adequate quantity of drinking water to their customers as required by the Texas Health and Safety Code (THSC) §341.0315(a).

   The conditional granting of the temporary exceptions is **valid for a period of 6 months from the date of this letter.** Below are listed the City's temporary exceptions granted for 6 months of temporary DPR WTP use to produce potable drinking water for public user:

   a. The use of RRWWTP effluent in lieu of groundwater or surface water as a source of water for a public water system [30 TAC §290.41];

   b. The use of the temporary DPR WTP equipment and piping in the proposed configuration which includes common walls between areas carrying water in prior stages of treatment [30 TAC §290.42(d)(2)];

   c. The use of pre-formed chloramines as a pre-disinfectant [30 TAC §290.42(e)(3)(G)];

   d. The use of chloramines for inactivation credit [30 TAC §290.42(e)(3)(G)];

   e. Micro Filtration (MF) membranes for removal of pathogens [30 TAC §290.42(g)(3)];

   f. Reverse Osmosis (RO) membranes for the removal of primary and secondary drinking water chemical contaminants [30 TAC §290.42(g)]; and

   g. Post-RO membrane pH adjustment [30 TAC §290.42(g)].

2. Please be aware that these conditionally granted temporary exceptions, and any exceptions granted in the future, **are subject to TCEQ revision or revocation if**:

   a. Monitoring results, on-site alarms, or other data indicate that the temporary DPR WTP is producing a finished water quality—after all removal, chemical treatment and blending—that is a potential risk to public health;

   b. The U.S. Environmental Protection Agency (EPA) revises the allowable maximum contaminant levels (MCLs) for existing regulated contaminants or establishes maximum contaminant levels or treatment technique requirements for chemical or microbiological contaminants that are currently unregulated;

   c. Substantiated data becomes available establishing a public health risk for one or more unregulated contaminants at a specified concentration level in drinking water;

   d. The City fails to comply with one or more of the conditions of the temporarily granted exceptions.

3. All of the TCEQ's and EPA's regulations that apply to surface water treatment plants also apply to the City's temporary DPR WTP. In addition to the TCEQ and EPA drinking water regulations, **this enclosure includes the minimum site-specific requirements for the granted exceptions for the proposed temporary DPR WTP to use RRWWTP effluent as source water** meant for human consumption. The following conditions are TCEQ site-specific minimum operation, design, reporting, calibration, and record keeping requirements for the temporary DPR WTP facility which will produce drinking water and are based on the full scale verification study data supplied by the City.

OPERATIONAL REQUIREMENTS WITH SHUTDOWN CONDITIONS

4. The City's temporary DPR WTP may only discharge water into the City's distribution system when all of the following conditions have been met. These conditions are in addition to the EPA and TCEQ public drinking water or other rules and are **the minimum site-specific requirements for the granted exceptions for the proposed temporary DPR WTP to use RRWWTP effluent as source for water**. If any of the conditions are not met, the plant or unit must be shut down until all the conditions are met.

   The conditions are:

   a. The City's temporary DPR WTP must provide at least a total 9.0-log removal and/or inactivation of viruses; a total 8.0-log removal and/or inactivation (including at least 2.0-log of inactivation) of *Giardia*; and a total 5.5-log removal and/or inactivation of *Cryptosporidium*. If the disinfection or removal barriers do not meet the required parameter(s), resulting in the plant providing less treatment than required, the plant must be taken off line, corrective actions taken, and the temporary DPR WTP must not be returned to service until the failed parameter(s) is within the appropriate range.

   b. All of the RRWWTP influent must pass through each of the treatment units, including the entire RRWWTP process, sedimentation, MF, RO, blending with raw

surface water, second sedimentation, conventional filters and disinfection. If water is bypassed around a unit process, the entire temporary DPR WTP must be shut down until the bypass is corrected, and TCEQ has approved the corrective action.

c. The RRWWTP effluent turbidity must remain below 24 Nephelometric Turbidity Units (NTU) at all times. If the RRWWTP effluent turbidity level is at or above 24 NTU, the water from the RRWWTP must not enter the pipeline leading to the temporary DPR WTP until corrective action is taken, and the turbidity is below 24 NTU.

d. The RRWWTP effluent monochloramine residual must be 1.0 milligrams per liter (mg/L) or greater when temperatures are above 16°C and 1.5 mg/L or greater when the temperature is at or below 16°C. If the RRWWTP effluent monochloramine residual is below 1.0 mg/L when temperatures are above 16°C and below 1.5 mg/L when the temperature is at or below 16°C, the water from the RRWWTP must not enter the pipeline leading to the temporary DPR WTP until corrective action is taken, and the residual is above the action level.

e. The *Giardia*, *Cryptosporidium* and virus concentrations in the RRWWTP effluent must not exceed 700 cysts/L, 9.5 oocysts/L, and 22 viruses/L, respectively. If the RRWWTP effluent exceeds the concentrations above (when the results are received), the RRWWTP effluent must stop entering the pipeline leading to the temporary DPR WTP, and the entire temporary DPR WTP must be shut down until TCEQ provides approval to continue.

f. The *Escherichia coli* (*E. coli)* concentrations in the RRWWTP effluent (after the chlorine contact basin) must be no greater than 75 most probable number (MPN)/100 mL. If the RRWWTP *E. coli* effluent concentration is above 75 MPN/100 mL (when the results are received), the RRWWTP effluent must stop entering the pipeline leading to the temporary DPR WTP and the entire temporary DPR WTP must be shut down until corrective action is taken and the *E. coli* levels return to below 75 MPN/100 mL.

g. A direct integrity test (DIT) must be performed on **each membrane unit** at a frequency of **no less than once each day** that the unit is in operation. All DITs must be conducted using a sensitivity of 2.8-log and a resolution capable of detecting a 3.0 micron breach using the parameters approved by TCEQ in Enclosure E. If a MF membrane unit fails a DIT, it must be taken off line immediately, inspected and, if necessary, repaired. The MF membrane unit cannot be returned to service until the inspection and any needed maintenance have been performed and the unit passes a subsequent DIT.

h. If salt rejection [(total dissolved solids (TDS)-feed - TDS-product) / (TDS-Feed) x 100] for a single RO unit decreases by more than 10% over the unit's acceptable daily salt rejection average from the previous day, then the RO unit must be removed from service. The unit must have any problems repaired and retested until the salt rejection returns to less than 10% of the unit's acceptable daily salt rejection total from the previous day before the RO unit can resume discharging to the next stage of treatment. The monthly average of the unit's salt rejection must not decrease 5% or more from the previous month's average of acceptable daily salt rejection levels.

i. The nitrate levels of each RO unit's permeate must be below 10 mg/L. If any of the 8-hour sample results show the nitrate level to be at or above 10 mg/L then the unit must be taken off line, inspected, and, if necessary, repaired. The unit cannot be returned to service until the level of nitrate is below 10 mg/L

j. The ratio of the partially treated RRWWTP effluent from Waste Lagoon No. 3 to the Secondary Reservoir raw surface water must be no greater than 50.00%. No single instantaneous 15-minute reading may be above 55.00% and the 2-hour averages of 15-minute readings must be below 50.00%. The 2-hour averages begin at midnight and continue every 8 readings (i.e. 12 am to 1:45 am, 2:00 am to 3:45 am, etc.). If the instantaneous or averaged ratios are above the threshold then the water from the lagoon to the splitter box or the water from the secondary reservoir must be adjusted to establish a ratio below 50.00%.

k. The weekly nitrate and nitrite levels at the entry point to the distribution system from the City's temporary DPR WTP must be below 10.0 mg/L and 1.0 mg/L, respectively. If the sample results show the nitrate level to be above 10.0 mg/L or the nitrite level to be more than 1.0 mg/L then the facility must be taken off line, inspected, and, if necessary, repaired. The City can only return the plant to service when the nitrate or nitrite levels are below the MCLs.

l. The weekly *E. coli* concentration levels at the entry point to the distribution system from the DPR WTP must be zero (0) Colony Forming Units/Liter (CFU/L). If *E. coli* is present at the entry point, the facility must be shut down, inspected and, if necessary, repaired. The City must resample *E. coli* and receive a zero CFU/L concentration before the City's temporary DPR WTP can be returned to service.

m. The twice monthly *Cryptosporidium*, *Giardia* and virus concentration levels at the entry point to the distribution system from the temporary DPR WTP must be non-detect based on a sample volume of at least 15 L and a “fast response” requested for the laboratory. If upon verbal notification from the laboratory, *Cryptosporidium*, *Giardia* or viruses are present at the entry point to distribution, the facility must be shut down, inspected and, if necessary, repaired. The City must resample *Cryptosporidium*, *Giardia* or virus and receive a non-detected concentration in 15 L of water and the Water Quality Task Force shall be convened to discuss the implications regarding community impacts. The Water Quality Task Force must recommend to TCEQ a return to service and TCEQ must also approve the recommendation before a return to service of the temporary DPR WTP.

NOTIFICATIONS

5. The City must notify the Technical Review and Oversight Team (MC-159) in writing when the City's temporary DPR WTP begins distributing treated water at:

   Technical Review & Oversight Team (MC 159)
   Texas Commission on Environmental Quality
   P.O. Box 13087
   Austin, Texas 78711-3087

6. Item No. 4, above, contains the conditions under which the City's temporary DPR WTP, or a particular treatment process, must be shut down. Table 1, below, shows the

conditions under which the City must notify their customers, their wholesale water customers, and the TCEQ of a plant or process shut down, or lack of shut down, due to noncompliance with an item in No.4. When the City notifies the TCEQ, the TCEQ may determine that the retail and/or wholesale customers need notification, even if that notification is not shown on Table 1.

TABLE 1: CITY TEMPORARY DPR WTP NOTIFICATION REQUIREMENT

Condition	Shutdown Requirement	Notify		
		Retail Customers	Wholesale Customers (PWSs)	TCEQ
4a. Treatment total below *Crypto* 5.5-log, *Giardia* 8-log, and virus 9- log	Entire Plant			✓*
4b. Water bypasses a treatment unit	Entire Plant	✓	✓	✓
4c. Turbidity higher than 24 NTU at RRWWTP and no diversion of WW effluent	Water from RRWWTP	✓	✓	✓
4d. Monochloramine too low at RRWWTP and no diversion of WW effluent	Water from RRWWTP	✓	✓	✓
4e. *Crypto*, *Giardia*, virus above limits at RRWWTP	Entire Plant			✓*
4f. *E. coli* at RRWWTP above 75 MFN/100 mL	Entire Plant			✓*
4g. Failing a DIT and continuing to produce water	MF Unit	✓	✓	✓
4h. Having too little salt rejection on a RO unit and continuing to produce water	RO Unit	✓	✓	✓
4i. Nitrate above 10 mg/L at a RO unit effluent and continuing to produce water	RO Unit	✓	✓	✓
4j. Ratio above 55% for one reading or with a 2-hour average greater than 50.00%	Adjust pumps			✓*
4k. Nitrate and nitrite above MCLs at entry point.	Entire Plant	✓	✓	✓
4l. *E. coli* above zero CFU/L at entry point	Entire Plant			✓*
4m. *Crypto*, *Giardia*, virus above zero or non-detect at entry point	Entire Plant	✓	✓	✓

* When the City notifies the TCEQ, the TCEQ may determine that the retail and/or wholesale customers need notification, even if that notification is not shown above.

7. Public notice is required for specific situations as described in 30 TAC §290.122
8. If notification is required by Table 1, the TCEQ and the City's retail and wholesale customers must be contacted within 24 hours. The TCEQ shall be contacted by telephone at 1-888-777-3186 or by e-mail at PDWS@tceq.state.tx.us. Within five working days, the City must submit written notification to:

   Technical Review and Oversight Team (MC 159)
   Texas Commission on Environmental Quality
   P.O. Box 13087
   Austin, TX 78711-3087

   The written notification to TCEQ must include:

   a. A detailed description of the problem that required:
      i. The RRWWTP effluent to be diverted from the temporary DPR WTP; or
      ii. The City's temporary DPR WTP, or a particular treatment process, to be taken out of service;
   b. The corrective actions taken; and
   c. The quantity and duration of any unacceptable water discharged to the retail and wholesale customers.

OPERATIONAL REQUIREMENTS WITHOUT SHUTDOWN CONDITIONS

9. The City has chosen to achieve removal credits for *Cryptosporidium* and *Giardia* through the optimization of the granular media filters. To achieve the 1.0-log removal credit the facility must maintain the turbidity under the conditions set in 30 TAC §290.111(g)(1)(IFE readings less than or equal to 0.15 NTU) and §290.111(g)(2) (CFE readings less than or equal to 0.15 NTU). If the conditions of §290.111(g)(1) are not met then the facility cannot receive the additional 1.0-log removal credit for enhanced individual filter performance for the month. If the conditions of §290.111(g)(1) are not met, but those in §290.111(g)(2) are met, then the facility can receive 0.5-log of additional removal credit for enhanced combined filter effluent credit.
10. The City must provide an additional 1.0-log viral inactivation when using pre-formed chloramines (ammonia before chlorine) as a pre-disinfectant. Based on consultation with EPA Region 6 staff, the TCEQ has concluded that 1.0-log of additional viral inactivation will provide an equivalent safety factor to that provided when chlorination precedes ammonia addition. Therefore, using pre-formed chloramines will require at least 9.0-log of total viral removal and inactivation through the temporary DPR WTP.
11. The City must conduct conductivity measurements on individual RO pressure vessel to identify pressure vessels which should be investigated on an 8-hour basis. If necessary, based upon the conductivity readings being 20% over the daily average of the entire unit, the individual vessels must be repaired or replaced. No shutdown of units is necessary for this process control parameter.

12. The City has elected to use a Water Quality Task Force to communicate with health officials during the operation of the temporary DPR WTP. The Water Quality Task Force must be convened when the triggers for convening the Water Quality Task Force are reached. These triggers are described in section 11 of the City's final engineering report submitted to TCEQ on December 11, 2013 and the Alarm and Shut Down Triggers document submitted as part of the full scale verification test-2 report.

13. If the *E. coli* levels at the RRWWTP before the chlorine contact basin are above 15,000 CFU/100 mL, a sample of *Cryptosporidium* and *Giardia* must be collected and analyzed.

14. If the *E. coli* levels at the RRWWTP before the chlorine contact basin are above 30,000 CFU/100 mL the Water Quality Task Force shall convene to discuss the situation.

15. To assure the pipeline from the RRWWTP to the temporary DPR WTP is intact, the City shall inspect the pipeline for leaks or illegal taps at least once a day. If a leak or illegal tap is found, the leak or tap must be investigated and repaired/removed as necessary.

16. Because of concerns regarding the potential introduction of contamination into the Lake Kemp/Headquarters Road Reservoir raw water line, the 1961 SWTP and 1987 SWTP treatment equipment and associated clearwells and piping, the following conditions must be met:

    a. The 2008 SWTP flow control vault's valve located on the Lake Kemp/Headquarters Road Reservoir pipeline must continue to remain closed at all times during the six-month temporary project. The City must take the following actions:

        i. The valve and flow meter after the valve and before the tee must be inspected at least once during each eight-hour shift;

        ii. If leaking of the RRWWTP effluent back into the Headquarters Road transmission pipeline is noted, immediate corrective actions must be taken to stop the leaking and prevent the exposure of the pipeline to the RRWWTP effluent; and

        iii. The results of the eight-hour visual inspections and any corrective actions must be recorded, kept onsite, and made available to the TCEQ upon request.

    b. The weir gates in the Cypress Splitter Box to the 1961 and 1987 SWTPs must be maintained closed and:

        i. Visually inspected at least once during each eight-hour shift for leakage;

        ii. If leaking from either of these two weir gates is noted, immediate corrective actions must be taken to stop the leaking and prevent the exposure of the 1961 and 1987 SWTPs' pretreatment facilities to the partially treated RRWWTP effluent;

        iii. As proposed by the City in your July 29, 2013 email, the drain valve in the 1961 SWTP settling basin must be maintained open during the proposed six-month temporary project;

iv. The drain valve in the 1987 SWTP Parshall flume must be maintained open during the proposed six-month temporary project; and

v. The results of the eight-hour visual inspections and any corrective actions must be recorded, kept onsite, and made available to the TCEQ upon request.

17. Operators having both a water and wastewater license may work in the temporary DPR WTP and the RRWWTP, but not during the same shift, to prevent the introduction of contaminants.

18. The temporary DPR WTP must have a Class B or higher Surface Water operator onsite when CIP procedures are being conducted on the MF and RO membrane units. A Class B operator must be available to respond to alarms and shut-downs caused by the automated control system.

19. A plant operations manual that meets the requirements of 30 TAC §290.42(l) must be kept on site and must be made available to TCEQ staff upon request. The manual shall include the procedures and contact information for the TCEQ and the receiving PWSs.

20. The Texas Pollutant Discharge Elimination System (TPDES) permit and 30 TAC Chapter 210 authorization of the City's RRWWTP must be current. For assistance, please contact TCEQ's Wastewater Permitting Section (MC 148) for information at (512) 239-2369.

START- UP REQUIREMENTS

21. The disinfection and start up plan for the 3, 5 and 10-MG ground storage tanks (GST) submitted to TCEQ on June 25, 2014 is generally acceptable. To place the 10 MG tank in service, the plan states that total coliform samples must be negative, chloramine levels must be adequate and other chemical/physical analysis performed on the water in the GST must be within normal ranges. In addition, TCEQ requested that the water in the 10-MG tank be tested for nitrate, nitrite, free ammonia, and monochloramine. The City provided TCEQ with the laboratory results of the bacteriological test and the chemical/physical analysis, and the results are included in Enclosure J. The laboratory results show the water in the 10-MG tank to meet all applicable standards and the water can be released to the distribution system.

22. The City must completely isolate the 10 MG, 5 MG, and 3 MG ground storage tanks (GSTs) at the Cypress WTP site by closing all of the 28 butterfly valves located that:

    a. connect the 3 MG and 5 MG GSTs to the suction line for the Cypress 2010 high service pump station;

    b. would allow water to flow back and forth between the three GSTs; and

    c. connect the 2010 Clearwell to the Cypress 1961 or Cypress 1987 plants.

    The 3 and 5 MG tanks will be isolated during full scale operations and the disinfectant residual of the water in the tanks will be monitored periodically.

23. The City must contact each of the City's retail customers and wholesale public water systems (PWSs) that can receive the water from the City's temporary DPR WTP to

notify them of the new source water. The City has provided TCEQ a copy of the notice sent to customers.

MONITORING

24. The City must monitor and record the following for the temporary DPR WTP:

a. All of the data and other information needed to complete the monthly reports for the temporary DPR WTP (Surface Water Monthly Operating Report (SWMOR)-Alt) and the Cypress 2010 plant (SWMOR).

b. The *E. coli* concentration must be monitored immediately before the chlorine contact basin at the RRWWTP daily.

c. Continuous turbidity monitoring of the RRWWTP effluent turbidity must be recorded every 15 minutes. The turbidity will be monitored before the chlorine contact basin.

d. Continuous monochloramine residual monitoring of the RRWWTP effluent must be recorded at least every 15 minutes. The residual will be monitored before the chlorine contact basin.

e. *E. coli* must be sampled each day in the RRWWTP effluent at the end of the chlorine contact basin, but before the transmission pipeline from the RRWWTP to the temporary DPR WTP.

f. The City must conduct a DIT on each MF membrane unit to verify that the integrity of the MF membranes has not been compromised and the approved 2.8-log removal credit for *Cryptosporidium* oocysts and *Giardia* cysts is being continuously achieved. A DIT must be conducted on a MF membrane unit:

   i. Once each calendar day for each unit in operation for any period of time during that day;

   ii. If any MF membrane unit produces filtered water with a turbidity level above 0.100 NTU in two consecutive 5-minute readings;

   iii. Before returning a MF membrane unit to service after failing an initial DIT and being repaired; and

   iv. After each clean-in-place (CIP) procedure.

g. Each DIT must meet the TCEQ requirements contained in its temporary DPR WTP DIT approval letter shown in Enclosure E.

h. Continuous indirect integrity monitoring of each MF membrane unit's filtrate turbidity levels must be conducted using the Hach Model FilterTrak method 10133, or an approved alternative acceptable to the TCEQ. The results must be recorded every five minutes.

i. The nitrate levels must be measured and recorded every eight hours at the effluent of each active RO unit.

j. The performance of the on-line RO units shall be monitored three times a day by a conductivity or TDS meter. The feed and permeate conductivity or TDS shall be

monitored three times a day. The average of the three salt rejections found for each RO unit shall be calculated each day that the RO unit is used.

k. The performance of the individual pressure vessels in the RO units shall be monitored for conductivity once per eight-hour shift.

l. The ratio of the partially treated RRWWTP effluent from Waste Lagoon No. 3 to the Secondary Reservoir raw surface water must be determined and recorded every 15 minutes. The highest instantaneous 15-minute ratio for the day must be reported each month. The two-hour averages must also be reported if the maximum daily 15-minute instantaneous ratio is above 50.00%.

m. The percent of the total capacity of the Cypress 10 million gallon (MG) storage tank must be recorded every two hours. Any percentage less than 50% full, and the duration, must be reported monthly.

n. The nitrate and nitrite levels must be measured and recorded weekly at the entry point to the distribution system from the City's temporary DPR WTP.

o. The *E. coli* concentration must be monitored weekly at the entry point to the distribution system from the temporary DPR WTP.

p. *Cryptosporidium* and *Giardia* sampling must be performed once a month (normal turn-around) at the RRWWTP effluent and two times per month (Fast Response) at the entry point to the distribution system from the temporary DPR WTP using EPA method 1623. *Cryptosporidium* analysis must be performed by a laboratory approved by EPA for *Cryptosporidium* analysis. One entry point sample per month must be collected and must be delayed by the approximate detention time that it takes the water to travel to the entry point sampling location from the RRWWTP effluent sampling plant. This delay will help to be able to establish the removal efficiency provided by the temporary DPR WTP.

q. Virus sampling must be performed once a month at the RRWWTP effluent and two times per month at the entry point to the distribution system from the temporary DPR WTP using EPA method 1615. One entry point sample per month must be collected and must be delayed by the approximate detention time that it takes the water to travel to the entry point sampling location from the RRWWTP effluent sampling plant. This delay will help to be able to establish the removal efficiency provided by the temporary DPR WTP. Please note that during the verification testing process a subset of the EPA 1615 method was required, specifically total culturable viruses. During full scale operation, all of the results generated through EPA 1615 must be determined and submitted.

25. All monitoring required as a condition of this exception must be conducted using methods that conform to the requirements of 30 TAC §290.119. If alternative methods are preferred, reasonable field methods can be approved by the TCEQ.

26. The City must continue using the approved amperometric method to measure the chlorine dioxide residuals at the disinfection zone D1A, D1B, D1C sampling points of the 2010 Cypress SWTP as well as at the entry point to the distribution system. However,

chlorine dioxide samples collected in the distribution system, if necessary, may be analyzed using the colorimetric method and a colorimeter in the field

27. To obtain inactivation credit for the disinfection in the temporary DPR WTP, the operators must monitor specific disinfectants.
    a. The operators must continue to measure and use monochloramine, instead of total chlorine, residuals at the end of disinfection zones D1, D2, and D3 at the temporary DPR WTP; and
    b. The operators must also continue to measure total chlorine residuals in disinfection zones D4 and D5 of the temporary DPR WTP using an approved total chlorine method.
28. The free ammonia, total chlorine and monochloramine levels must be monitored at each chloramine injection point, the end of each disinfection zone, and the entry point to the distribution system from the temporary DPR WTP one time per week. See Enclosure F: Updated Use of Chloramines Exception Letter for more details.
29. The TCEQ has received chemical analytical results from the temporary DPR WTP's verification testing. Based on these results, the TCEQ will require quarterly sampling for all regulated compounds in 30 TAC 290 Subchapter F for the life of the temporary DPR WTP.
30. The City must monitor for cyanide quarterly at the entry point to the distribution system.
31. The TCEQ recommends that the City monitor the RRWWTP's effluent and the entry point to the distribution system from the City's temporary DPR WTP for the potential chemical and microbiological contaminants of concern contained in Enclosure G: Unregulated Contaminants of Concern on a quarterly basis.
32. The City must provide the results of any sampling performed under the EPA's Unregulated Contaminant Monitoring Rule –3 (UCMR3) to the TCEQ within two weeks of receiving those results.
33. Before water from the temporary DPR WTP enters the distribution system, all shut-down controls and alarms for summoning the operators must be tested. The testing must be repeated every three months. Documentation of the testing procedure and results shall be kept on site to be reviewed by TCEQ staff during site visits. The alarms and shut down controls are for taking:
    a. the RRWWTP effluent transfer pumps (to the Cypress facility) out of service when the effluent exceeds 24 NTU;
    b. the RRWWTP effluent transfer pumps (to the Cypress facility) out of service when the effluent has inadequate monochloramine residual(below 1.0 mg/L when temperatures are above 16°C and below 1.5 mg/L when the temperature is at or below 16°C);
    c. a MF membrane unit out of service when its filtrate turbidity level is greater than 0.100 NTU for two consecutive five-minute readings;

d. action to reduce the output of the permeate transfer pumps at Waste Lagoon No. 3 when the flow rate from Lagoon No. 3 is greater than the Secondary Reservoir's raw surface water flow rate to the Cypress Splitter Box; and

e. a gravity media filter out of service when the individual filter effluent turbidity level exceeds 0.3 NTU for two consecutive 15-minute readings.

DESIGN REQUIREMENTS

34. The following temporary piping modifications at the Cypress Water Treatment Plant that were approved for construction in TCEQ's letter dated January 22, 2014 and as-built modifications approved by TCEQ's letter dated May 12, 2014 to eliminate common walls and cross connections as indicated below must remain as part of the City's temporary DPR WTP:

a. Connection No. 1- modifications included cutting and removing a portion of pipe to provide an air gap on the connection from Lagoon No. 2 to the reuse Pump Station and include modifications at the Filter-to-Waste Pump Station with the removal of the Flange Coupling Adaptor and modifications at the Reuse Pump Station with the removal of a portion of pipe to provide an air gap at the 12-inch filter-to- waste waterline connection;

b. Connections No. 2 and No. 3- approximately 3,800 linear feet (l.f) of proposed temporary 36-inch above-ground high density polyethylene (HDPE) waterline to divert the 2008 SWTP RO permeate to existing storage Lagoon No. 3 with a nine-inch vertical separation between the bottom of the pipe and the top of the lagoon's berm; this includes the blind flange of the existing 36" line;

c. Connections No. 8 and No. 9- approximately 2,100 linear feet of a temporary 18-inch HDPE above-ground waterline from the Lagoon Valve Vault, located north of Lagoon No. 2 to an existing 20-inch brine line that ultimately discharges to the Wichita River; and

d. Connection No. 6- modifications at the Backwash Valve Vault with the removal of the Flange Coupling Adaptor and closing of the 24-inch valve to isolate the 1961/1987 backwash lines.

35. The following temporary piping modifications are approved for construction for the City's temporary DPR WTP:

a. Connections No. 4 and No. 5-reconnection of the 2010 transfer pumps to the 10-MG ground storage tank (GST) and backwash supply to the high service pumps; and

b. To close the valves as indicated on map supplied by the City to TCEQ on June 26, 2014 to isolate the 3.0-MG, 5.0-MG GSTs from the 10-MG ground storage tank (GST) and the high service pumps.

36. The City must notify TCEQ prior to making any change in water source, (increase or decrease) in production, treatment, and storage facilities, disinfection (disinfectant method/type used, application points, or monitoring points), replacement of membranes (MF or RO), blending ratio, or any additional treatment processes as described in 30 TAC §290.39(j).

37. All waste discharge must be in accordance with federal and state requirements as described in 30 TAC §290.42(i). You may contact TCEQ's Wastewater Permitting Section (MC 148) regarding information required for the proper disposal of generated waste (such as RO membrane reject, clean in place (CIP) cleaning solutions, etc.) and any required discharge permit at (512) 239-2369.

38. The City must continue to use the MF membrane system with Siemens Memcor (previously distributed by USFilter) S10V MF membrane modules for which an exception was previously granted and for which the City received TCEQ approval to construct on August 19, 2004. This system has the following design and operating requirements:

    a. A feed-side surface area of 300 square-feet (sf);
    b. A nominal pore size of 0.2-micron;
    c. Maximum transmembrane pressure (TMP) of -12 pounds per square-inch (psi);
    d. Water temperature range of 1o to 40o °C;
    e. pH tolerance range of 2 to 12;
    f. Five tanks containing 504 submerged MF membrane elements;
    g. A maximum instantaneous flux rate of 19.6 gallons per square-foot per day (gfd) at 20 °C;
    h. A three-minute backwash duration (nine minutes out of service) once every 30 minutes of run-time;
    i. A 32-minute maintenance clean (45 minutes out of service) once per 24 hours of run-time; and
    j. A CIP procedure once every 720 hours of run-time.

39. The 2.8-log removal credits for the MF membrane units that were approved in the TCEQ letter dated November 6, 2013 are approved for the duration of the temporary DPR project.

40. The temporary exception to use RO membranes for the removal of chemical contaminants is only for the eight-inch diameter by 40-inch long Hydranautics RO elements currently installed, which previously received an exception and approval to construct, based on:

    a. Six RO units/skids with two-stages per unit; and
    b. Operated at a maximum permeate flux rate of 14.9 gfd (average of the two stages flux rates).

41. The City may not recycle sludge blowdown, spent backwash water, or other recycle streams without the prior written approval of the TCEQ. If recycle return is desired in the future, please contact the TCEQ Technical Review & Oversight Team (MC 159) at the following address:

    TCEQ Technical Review & Oversight Team (MC 159)
    Texas Commission on Environmental Quality

P.O. Box 13087
Austin, Texas 78711-3087

42. All treatment chemicals and media used in the full-scale facility must conform to American National Standard Institute/National Sanitation Foundation (ANSI/NSF) Standard 60 for direct additives and ANSI/NSF Standard 61 for indirect additives and must be certified by an organization accredited by ANSI as described in 30 TAC §290.42(j). This includes dechlorination compounds, disinfectants, anti-scalants, anti-foulants, acids, caustics, other membrane cleaning chemicals, and all other compounds used to treat the RRWWTP effluent.

43. Flow measuring devices will be required on the RRWWTP effluent transmission line, the feed to each HF MF membrane unit, the HF MF membrane backwash supply, the combined HF MF membrane filtrate, RO concentrate, in addition to those described in 30 TAC §290.42(d)(5).

44. The City's temporary DPR WTP must be designed to conduct and record continuous turbidity monitoring of the RRWWTP effluent.

45. The RO membrane system must be designed to measure and record conductivity or TDS on each RO membrane unit's feed and permeate lines.

46. The MF and RO membrane systems must be designed so that the membrane units' feed water, filtrate, backwash supply, waste, and chemical cleaning piping shall have cross-connection protection to prevent chemicals from all chemical cleaning processes from contaminating other membrane units' filtrate and permeate in other modes of operations. This may be accomplished by the installation of a double block and bleed valve arrangement, a removable spool system, or other alternative method approved by the TCEQ.

47. The City's temporary DPR WTP source water must receive the same pretreatment, at a minimum, under full-scale operation as received during the full scale verification study. The treatment is provided at the RRWWTP and is as follows: Raw wastewater is first screened and de-gritted, then flows to a primary clarification. Primary effluent then proceeds to aeration basins for biological treatment. The contents of the aeration basins flow to the final clarifiers, where the active biomass settled from the treated effluent is returned to the aeration basin. The effluent is then chlorinated and after sufficient detention time, the effluent containing a monochloramine residual is the source water for the temporary DPR WTP.

48. An adequately equipped laboratory must be available so that daily tests and all other tests required by the conditions of this letter may be performed.

CALIBRATION

49. Conductivity meters used to monitor the RO membrane units' permeate shall be calibrated with solutions of known concentrations at least once every 90 days.

50. Flow measuring devices and rate-of-flow controllers shall be calibrated at least once every 12 months. The accuracy of magnetic flow meters shall be verified at least once every 12 months and calibrated if needed.

51. Pressure monitors used for DIT measurements shall be calibrated or verified at least once every 12 months.

52. Instruments used to monitor nitrate and nitrite shall be calibrated or verified at least once every 12 months.

REPORTING

53. The City's temporary DPR WTP must submit the completed SWMOR and SWMOR-Alt report and other reports listed in the reporting section of this enclosure to the TCEQ by the tenth day of the month following the end of the reporting period. Send the reports to:

    TCEQ Drinking Water Quality Team, (MC-155)
    Texas Commission on Environmental Quality
    P.O. Box 13087
    Austin, Texas 78711-3087

54. To accurately describe the treatment processes at the temporary DPR WTP, please use the Demonstration of Performance fields on the LT2- Summary page of the SWMOR-alt to allow the plant to gain a 0.5 log removal credit for the second flocculation and clarification unit process.

55. An addendum to the SWMORs containing the following information must be submitted at the same time.
    a. The highest daily turbidity level in the RRWWTP effluent;
    b. If water is diverted from the temporary DPR WTP pipeline due to high turbidity, the amount (in gallons) and duration (in minutes) of the diversion;
    c. The lowest daily monochloramine level in the RRWWTP effluent (before the chlorine contact basin);
    d. If water is diverted from the temporary DPR WTP pipeline due to low monochloramine levels, the amount (in gallons) and duration (in minutes) of the diversion;
    e. The *Giardia*, *Cryptosporidium* and virus results from the monthly sampling at the RRWWTP effluent;
    f. The daily *E. coli* results from the RRWWTP effluent;
    g. If any of the pathogen concentrations in items 55e and 55f are over the action limits, then also provide a report indicating the time the plant was shut down, the corrective action taken, and the samples that showed the facility could produce safe water again;
    h. The date that any CIP that had been performed on a RO membrane unit;
    i. The total daily flow to each of the RO membrane units;

j. Both the average daily and monthly average salt rejection for each active RO membrane unit;

k. If any RO unit does not meet the salt rejection action levels, then also report, the duration of time the RO unit was out of service, the corrective actions taken and the results of the lab tests that show the unit can be returned to service;

l. The highest nitrate results found in each of the active RO unit effluent each day;

m. The action taken if the nitrate results were higher than the action level;.

n. The highest daily 15-minute instantaneous maximum ratio of partially treated RRWWTP effluent to lake water;

o. If the highest daily 15-minute instantaneous maximum ratio is greater than 50.00% also include the 2-hour averages of the ratio. For example, the averages from 12:01 am to 2:00 am; 2:01 am to 4:00 am, etc.;

p. If the average ratios were over 50.oo%, or the instantaneous ratio was over 55.00% then the duration the membrane and RO plant were off-line, the corrective actions taken and the ratio that was achieved when the plant was put back on line;

q. The minimum operational level each day of the Cypress 10 MG Storage Tank expressed as percentage full;

r. The nitrate and nitrite results found at the entry point to the distribution system from the temporary DPR WTP effluent each week;

s. If the nitrate or nitrite concentrations at the entry point to the distribution system from the temporary DPR WTP are above the MCLs, then report the duration the temporary DPR WTP was off-line, the corrective actions taken and the nitrate and/or nitrite results found before the plant was put back on line;

t. The weekly *E. coli* concentration at the entry point to the distribution system from the temporary DPR WTP;

u. The twice monthly *Cryptosporidium*, *Giardia*, and virus sample results at the entry point to the distribution system from the temporary DPR WTP; and

v. If any of the pathogens in items in 55t and 55u are detected, then also report the time the plant was shut down, the corrective action taken, and the samples that showed the facility could produce safe water again;

56. The City shall record the daily and monthly data required in the reporting section of this Enclosure using the customized, site-specific version of the Surface Water Monthly Operating Report (SWMOR-Alt, form number 00102D) that the TCEQ created for the temporary DPR project.

57. The TCEQ will require the reclaimed wastewater to be identified as a raw water source on the Consumer Confidence Report (CCR) for this and any wholesale customer using water from the temporary DPR WTP.

58. The City must report to TCEQ as described in Table 1. If required, the City must contact the TCEQ within 24 hours by telephone at 1-888-777-3186 or by e-mail at pdws@tceq.state.tx.us, and immediately notify all retail customers and wholesale PWS customers. Within five working days, submit written notification to the address below

regarding the problem that required the City's temporary DPR WTP, or part of the WTP, to be taken out of service, the corrective actions taken, and the quantity of any unacceptable water discharged:

TCEQ Technical Review and Oversight Team (MC 159)
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

RECORD RETENTION

59. The City must retain this letter while the exception is valid and subsequently for at least five years after the exception is no longer valid.

60. The following records must be retained for at least ten years:

    a. A copy of the submitted SWMORs for the temporary DPR WTP and the 2010 Cypress plant;

    b. The highest daily confirmed turbidity level in the wastewater effluent;

    c. The lowest daily monochloramine level in the RRWWTP effluent (before the chlorine contact basin);

    d. The *Giardia*, *Cryptosporidium* and virus results from the monthly sampling at the RRWWTP effluent;

    e. The daily *E. coli* results from the RRWWTP effluent;

    f. Any CIP that has been performed on a RO membrane unit;

    g. The total daily flow to each of the RO membrane units;

    h. The average daily and monthly average salt rejection for each RO membrane unit;

    i. The nitrate results found in each of the active RO unit effluent each day;

    j. The highest daily 15-minute instantaneous maximum ratio of partially treated RRWWTP effluent to lake water;

    k. If the daily 15-minute instantaneous maximum ratio is greater than 50.00% also include the 2-hour averages of the ratio. For example 12:01 am to 2:00 am; 2:01 am to 4:00 am, etc.;

    l. The daily minimum operation level in the Cypress 10 MG Storage Tank expressed as percentage;

    m. The nitrate and nitrite results found at the entry point to the distribution system from the temporary DPR WTP each week;

    n. The weekly *E. coli* concentration at the entry point to the distribution system from the City's temporary DPR WTP;

    o. The twice monthly *Cryptosporidium* or *Giardia* sample results at the entry point to the distribution system from the City's temporary DPR WTP;

    p. The highest daily confirmed conductivity or total dissolved solids for each RO membrane unit; and

q. The results of all chemical analyses.

MF MEMBRANE FORMULA

61. The following formula shall be used to determine filtrate flux:

$$\text{filtrate flux}_{\text{at feed water temperature}} = \frac{(\text{filtrate flux}_{\text{at 20 C}})}{[1.784-(0.0757 * T)+(0.0011 * T^2)-(10^{-5} * T^3)]}$$

Where T is the HF MF membranes' feed water temperature in degrees centigrade, and filtrate flux at 20°C is 19.6 gfd.

DECOMMISSIONING OR MODIFYING THE TEMPORARY DPR WTP

62. After the temporary DPR WTP is no longer treating RRWWTP effluent, the City may not return the Cypress 2008 MF/RO WTP and the Cypress 2010 WTP to their traditional source waters and operational practices without the prior written approval of the TCEQ.

63. The City may not change the source water for the temporary DPR WTP or the Cypress 2010 WTP plants without prior written approval of the TCEQ.

64. At least 30 days before the conclusion of the temporary DPR project, the City must prepare and submit a sealed engineering report describing the plan for converting the plants back to untreated surface water. The proposal must describe in detail how the City will:

a. decommission the temporary wastewater effluent line from the RRWWTP;

b. flush and disinfect the raw water line from Lake Kemp;

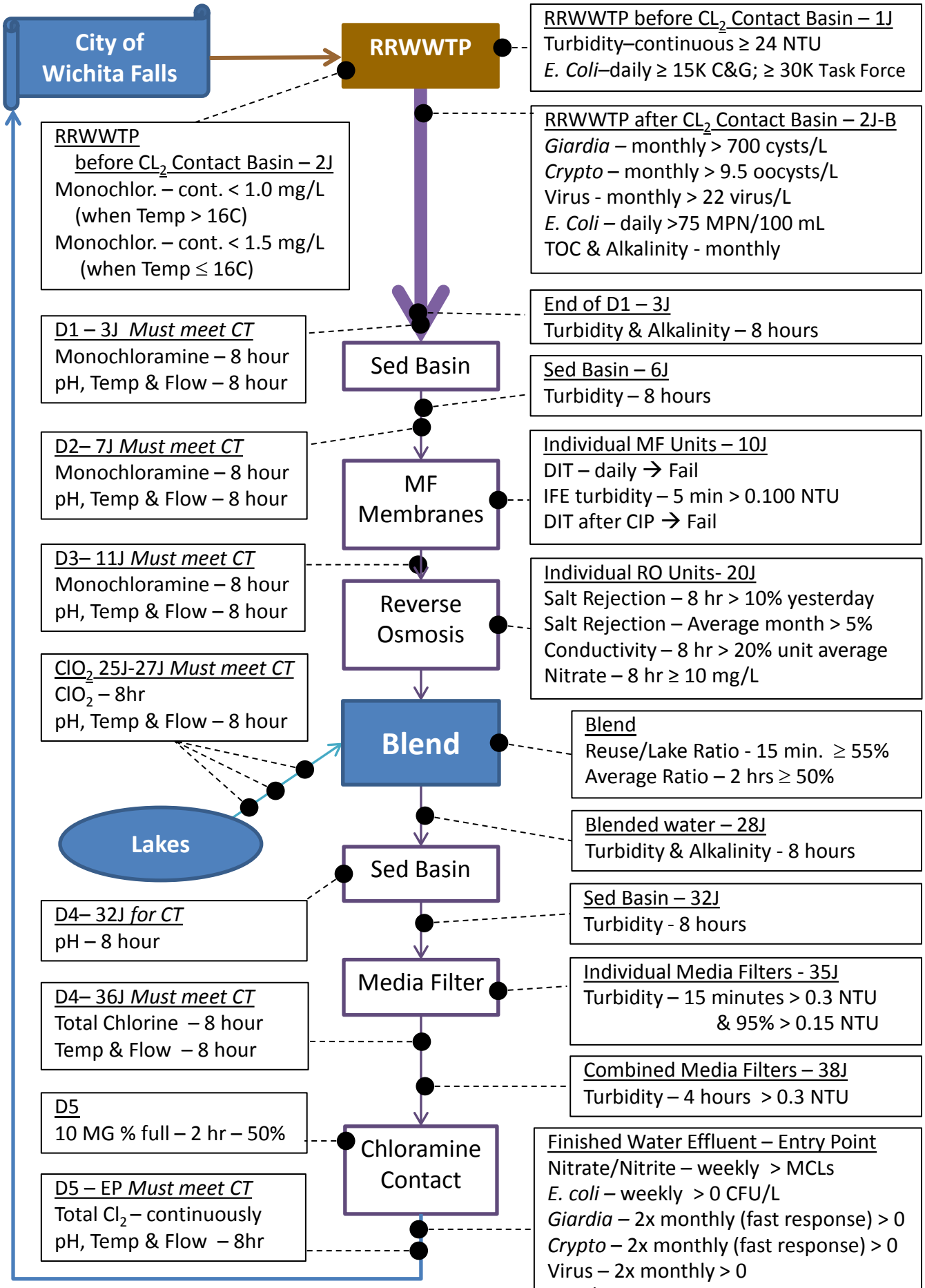
c. ensure that all of the treatment units and equipment at the two plants have been cleaned, disinfected, and show no evidence of contamination by RRWWTP effluent;

d. transition back to the original piping configurations at the Cypress 2010 WTP; and

e. prepare to reactivate the facilities at the Cypress 1961 and the Cypress 1987 WTPs.

Enclosure B: Current DPR WTP Regulatory Monitoring Locations, Frequency, and Action Levels

Enclosure B: City of Wichita Falls Temporary DPR WTP Monitoring Locations, Frequency, and Action Levels



Enclosure C: CT Study Letter for the Cypress 2010 Water Treatment Plant

Bryan W. Shaw, Ph.D, P.E., *Chairman*
Toby Baker, *Commissioner*
Zak Covar, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

PWS_2430001_CO_20140627_CTSTUDY

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

June 27, 2014

Mr. Mark Southard
Water Source/Purification Superintendent
City of Wichita Falls
4801 Big Ed Neal Drive
Wichita Falls, Texas 76310

Subject: Public Drinking Water System Contact Time Study
City of Wichita Falls - PWS ID No. 2430001
Cypress 2010 Water Treatment Plant, TCEQ Plant ID No. TP410071
Wichita County, Texas

CN600129316 RN105598759

Dear Mr. Southard:

The Texas Commission on Environmental Quality (TCEQ) Technical Review and Oversight Team (TROT) has completed the review of the revised CT Study for the 2010 Cypress Water Treatment Plant (2010 WTP) which was submitted on April 25, 2014. The revision was submitted because the plant is being used as part of the treatment sequence for the City's temporary Direct Potable Reuse Project (DPR Project) and has been isolated from the 1961 and 1987 plants at the Cypress WTP site. The revision is submitted for the full scale operation of the treatment scheme. Based on the information provided, we are approving the proposed revisions. The information in this letter supersedes and does not supplement any previous CT study correspondence for the Cypress

Please note this letter does not waive any of the conditions required in the TCEQ's exception letter dated June 27, 2014 and applies when the temporary DPR Project is in operation. As you are aware, the City will need to submit another CT Study update at the conclusion of the temporary DPR Project.

During the temporary DPR Project, the raw water for the 2010 Cypress WTP will be a blend of surface water pumped from the Secondary Reservoir and RO permeate pumped from the RO Lagoon. The source of the water in the Secondary Reservoir is Lake Kickapoo and Lake Arrowhead and the source of the water in the RO Lagoon is the RO permeate produced by the 2008 Cypress Microfiltration/Reverse Osmosis Water Treatment Plant (2008 Cypress MF/RO WTP) which is treating the effluent from the River Road Waste Water Treatment Plant.

For the duration of the temporary DPR Project, the 2010 WTP will include a splitter box (which, under normal, non-emergency DPR operating conditions, distributes water between the 1961, 1987, and 2010 plants); a mechanical rapid mix; a Parshall Flume meter; a solids contact, slurry recirculation clarifier; a recarbonation basin; five dual-media gravity filters; the small 2010 Clearwell and filtered water transfer pump station; and the 10 million gallon (MG) 2010 Ground Storage Tank (GST) that has been isolated from the rest of the GSTs at the Cypress site; and the 2010 High Service Pump Station (HSPS) that discharges to the distribution system.

During the temporary DPR Project, the proposed disinfection protocol at the 2010 Cypress WTP involves the injection of chlorine dioxide (ClO_2) at the Secondary Reservoir raw water transfer pumps, followed by the injection of chlorine (Cl_2) and ammonia (NH_3) at the outlet of the splitter box. There are also standby/secondary Cl_2 and NH_3 injection points at the 2010 Clearwell and the HSPS. Disinfectant residual monitoring can be performed at three designated sample sites on the Secondary Reservoir transmission line, and upstream of the rechloramination points at the 2010 Clearwell and HSPS.

A disinfection zone is a segment of the treatment process which begins at a disinfectant application point and ends at a subsequent disinfectant application or residual sampling point. Hence, each disinfectant application point regardless of the frequency of use represents the beginning of a separate disinfection zone. Similarly, a plant may have only one disinfectant point, but may also choose to monitor disinfection residuals at more than one point, thus creating multiple disinfection zones.

Based on the proposal you submitted, we concur that there are three disinfection zones at the 2010 Cypress WTP. The first disinfection zone, D1, consists of the three parallel trains that represent the three sampling location on the raw water line; Zone D1A represents the monitoring point located 400 feet downstream of the injection point, Zone D1B represents the monitoring point located 900 feet downstream of the injection point, and Zone D1C represents the monitoring point located 6,500 feet downstream of the injection point. The second disinfection zone, D2, contains the rapid mix, clarifier, recarbonation basin, granular media filters, and associated piping. The last disinfection zone, D3, incorporates the 2010 Clearwell and 2010 GST and the associated piping.

Contact Time (CT) calculations are used to evaluate the disinfection process. The time that the disinfectant is in contact with water in the disinfection segment must be determined on a daily basis to complete the CT calculations. This contact time, measured as T_{10}, is determined based on the peak hourly flow rate occurring during the 24-hour period and the detention time that is equaled or exceeded by 90 percent of the water passing through the basin. Since T_{10} values are required to calculate the CT for the treatment process, Table 1 was developed for the 2010 WTP while it is operating as part of the DPR treatment process. The T_{10} values are based on the information provided in the CT Study template you submitted on April 25, 2014.

TABLE 1: T_{10} TABLE FOR THE 2010 CYPRESS WATER TREATMENT PLANT (TP410071) DURING THE TEMPORARY DIRECT POTABLE REUSE PROJECT

DISINFECTION ZONE	TREATMENT UNIT	VOLUME (GAL)	FLOW RATE (MGD)	BAFFLING FACTOR	T_{10} (MIN)	
					Unit	Sum
D1A	Segment 1 of the raw water line from the Secondary Reservoir	28,800[1]	5.0[11]	1.0[14]	8.3	8.3
D1B	Segments 1 and 2 of the raw water line	64,800[2]		1.0[14]	18.7	18.7
D1C	All three segments of the raw water line	467,900[3]		1.0[14]	134.7	134.7
D2	Piping	14,800[4]	10.0[12]	1.0[14]	2.1	67.1
	Rapid Mix	4,850[5]		0.1[15]	0.1	
	Clarifier	926,500[6]		0.3[16]	40.0	
	Recarbonation Basin	183,000[7]		0.5[17]	13.2	
	Granular Media Filters	29,100[8]	2.5[13]	0.7[18]	11.7	
D3	2010 Clearwell	109,100[9]	10.0[12]	0.5[17]	7.9	223.3
	2010 Ground Storage Tank	4,987,000[10]		0.3[19]	215.5	

Notes:

1. Based on a 42-inch diameter pipe with 400 feet between the injection point and the D1A sample tap.
2. Based on a 42-inch diameter pipe with 900 feet between the injection point and the D1B sample tap.
3. Based on a 42-inch diameter pipe with 6,500 feet between the injection point and the D1C sample tap.
4. Based on cumulative volume in 220 linear feet of 36-inch piping between the splitter box to the rapid mix and 85 linear feet of 30-inch piping from the rapid mix to the 2010 clarifier.
5. Based on a basin that is 27 feet long and 6 feet wide with a water depth of 4 feet.
6. Based on a 90-foot diameter clarifier with a side water depth of 18.9 feet and a center water depth of 20.6 feet.
7. Based on a basin that is 45.5 feet long and 32 feet wide and has a 16.8-foot side water depth.
8. Based on one dual-media gravity filter that is 24 feet long and 15 feet wide, contains 6 feet of gravel and media, and a 1-foot underdrain system. The minimum water depth over the media was reported to be 6.8 feet and a 50% porosity of the filter media is assumed.
9. Based on a clearwell that is 98.4 feet long and 26 feet wide. The maximum water depth and minimum operating levels in the clearwell are 11.3 feet and 5.7 feet, respectively.
10. Based on a tank that has a 206-foot diameter, a 40-foot maximum water depth, and a 20-foot minimum operating level.
11. Based on the design capacity of the DPR Project and the assumption that 50% of the source water for the 2010 Cypress WTP will be obtained from the raw water transfer pumps at the Secondary Reservoir.
12. Based on the design capacity of the DPR Project.
13. Based on the design capacity of the DPR Project. Assumes equal flow divided between identical units and that four filters will always be in operation.
14. Assumes that the flow conditions that exist in long pipeline segments will virtually eliminate the possibility of short-circuiting and create "perfect" baffling characteristics.
15. Assumes the rapid mix completely mixes the water within the unit and results in an "unbaffled" baffling characteristic within the basin.
16. Assumes that the mixing zone within the solids contact clarifier results in sufficient short-circuiting that the overall baffling characteristic of the clarifier will be "poor".
17. Assumes that "average" baffling conditions will occur in a tank that contains multiple baffle walls that create a contactor with an effective length:width ratio greater than 20:1 but less than 50:1.
18. Assumes that the hydraulic conditions that exist in a gravity filter will create "superior" baffling characteristics.
19. Assumes that a tank with two inlets, three internal baffle walls, and a single outlet will exhibit some short-circuiting and demonstrate "poor" baffling characteristics.

We have prepared a Disinfection Process Parameters table to help the operators complete their Surface Water Monthly Operating Report (SWMOR). In Table 2, we have characterized the T_{10} available in each of the disinfection zones based on the flow rate through the unit(s) that contributes most to the disinfection process within that zone. We have also provided the operators with the disinfection requirements that the 2010 Cypress WTP must meet on a continuous basis.

TABLE 2: DISINFECTION PROCESS PARAMETERS FOR THE 2010 CYPRESS WATER TREATMENT PLANT (TP410071) DURING THE TEMPORARY DIRECT POTABLE REUSE PROJECT

APPROVED CT STUDY PARAMETERS						PERFORMANCE STANDARDS	
Parameters	Disinfection Zones					Log Inactivation	
	D1A	D1B	D1C	D2	D3	Giardia	Viruses
Flow Rate (MGD)	5.00	5.00	5.00	10.00	10.00	0.5	2.0
T_{10} (minutes)	8.3	18.7	134.7	67.1	223.3		

As you are aware, zone D2 includes the 2010 clarifier, recarbonation basin, and filters. As we have discussed, this grouping of treatment processes results in some constraints on the manner in which the plant can be operated and monitored. Specifically:

- **The operators must monitor the pH in disinfection zone D2 at the outlet of the 2010 clarifier.** Historically, the plant has practiced full lime softening and, therefore, the clarifier has operated at a higher pH range in order to achieve greater hardness reductions and improved total organic carbon removal. During the temporary DPR project, the 2010 Cypress WTP expects to meet these two treatment objectives by blending the surface water (from Lake Kickapoo and Lake Arrowhead) with RO permeate produced by the 2008 Cypress MF/RO WTP plant. However, the City would like to retain the flexibility to practice partial lime softening when conditions warrant.

  This desired level of flexibility is understandable. However, the US Environmental Protection Agency's CT Tables for chloramine only apply at pH levels between 6 and 9, i.e, from 5.5 through 9.49. Because zone D2 includes both the clarification and recarbonation processes and recarbonation lowers pH, the pH in zone D2 must be measured before recarbonation. Consequently, the operators must monitor the pH for disinfection zone D2 at the outlet of the clarifiers rather than at the typical site located at the end of the disinfection zone. The alternate location will ensure that the 2010 Cypress WTP plant does not overestimate disinfection levels when the clarifier pH reaches 9.5.

- **The operators must have at least four filters in operations whenever the plant is treating water.** This operational constraint is needed because zone D2 contains both the plant's gravity filters and the disinfection contact time within the zone depends on the flow rate of the water and the total volume of water contained in the treatment units. Consequently, the CT calculations will overestimate the level of viral inactivation achieved if fewer than four filters are on line whenever the plant is treating water.

Please be aware that the plant staff must continue using the approved amperometric method to measure the chlorine dioxide residuals at the disinfection zone D1A, D1B, D1C sampling points as well as at the entry point to the distribution system. However, chlorine dioxide samples collected in the distribution system, if necessary, may be analyzed using the colorimetric method and a colorimeter in the field.

It is also important to note that this approved CT study is only applicable for the duration of the temporary DPR Project and only if the plant adheres to the operational constraints identified above. **Therefore, you must submit another revised CT study when the plant returns to its traditional source water and operational practices.**

If you have any questions concerning our evaluation or if we may be of other assistance, please contact Mr. Joel Klumpp at (512) 239-4453, by e-mail at joel.klumpp@tceq.texas.gov, or by correspondence at:

Technical Review and Oversight Team (MC-159)
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

Sincerely,

Joel Klumpp, Team Leader
Technical Review and Oversight Team
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

Cindy Haynie, CT Study Program Manager
Technical Review and Oversight Team
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

JPK/jcs

Enclosure: CT Study Template

cc w/ enclosure: Mr. Daniel K. Nix,
Operations Manager, Public Utilities
City of Wichita Falls

CT Study for the 2010 Cypress WTP

CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

Description Worksheet

PUBLIC WATER SYSTEM NAME:	**City of Wichita Falls**	**PWS ID No.:**	**2430001**
PLANT NAME OR NUMBER:	**2010 Cypress Water Treatment Plant**	**Month:**	**April**
		Day:	**25**
		Year:	**2014**

Enter a detailed narrative description of the plant treatment processes and disinfection protocol.

The City of Wichita Falls Cypress Water Treatment Plant (CWF CWTP) Temporary Reuse Project will combine the use of the Micro-filtration/Reverse Osmosis (MF/RO) treatment facilities with the conventional 2010 CWTP. This CT study takes into account the treated water pumped from the CWF River Road Waste Water Treatment Plant (RRWWTP) to the CWTP through a 30 inch raw water pipe at a flow of 7.5 million gallons per day (MGD), through the MF/RO treatment facility to a raw water lagoon where 5.0 MG will then be mixed with 5.0 MG raw surface water and treated through the conventional 2010 CWTP. The treatment process includes clarification prior to micro-filtration, reverse osmosis where the 5.0 MG permeate will be sent to a raw water lagoon, pumped back the the splitter basin and mixed with 5.0 MG of raw surface water prior to the 2010 CWTP.

The 2010 CWTP consists of a rapid mix basin, a 90-foot diameter (dia.) clarifier, a re-carbonation basin, five multi-media gravity filters, a 0.20-million gallon (MG) clearwell and pump station and a 10-MG ground storage tank. Total capacity through the 2010 CWTP is 10 MGD.

The treatment processes for the water from Lake Arrowhead and Lake Kicapoo through the CWF's Secondary Reservoir must achieve a 2.0-log removal or inactivation of Cryptosporidium, a 3.0-log removal or inactivation of Giardia, and a 4.0-log removal or inactivation of viruses before water is distributed to the customers. Based on the combination of treatment processes that will be used at 2010 CWTP, the disinfection process must be able to achieve a 0.5-log inactivation of Giardia and a 2.0-log inactivation of viruses before treated water enters the distribution system.

However, it should be noted that higher levels of inactivation may be required at the 2010 CWTP so that the reuse water from the RRWWTP, which will be passing through the CWTP treatment processes, will be adequately disinfected before treatment is complete and it enters the distribution system.

The proposed disinfection protocol involves the injection of chlorine dioxide (ClO2) downstream of the secondary reservoir, and chlorine (Cl2) and liquid ammonia gas (NH4) at the outlet of the splitter basin and upstream of the 0.20-MG clearwell and transfer pump station. Chlorine dioxide residual can be measured at three locations along the 42-inch raw water pipe at 400, 900 and 6500 linear feed downstream of the reservoir pump station, prior to entering the splitter basin. Since Cl2 and NH4 are added at the same location at the splitter basin, a measurable ClO2 residual must be maintained at the 400 ft sample tap. Chloramine residual is monitored downstream of the five multi-media gravity filters and downstream of the Cypress high service pumps, prior to entering the distribution system.

Submitted by: **Mark Southard, Water Source/Purification Superintendent**

Contact Information: **mark.southard@wichitafallstx.gov** **Reviewed by Jack C. Schulze, P.E.**
940-691-1153, 940-691-4121 Fax

Detailed narrative description of the plant treatment processes and disinfection protocol (cont)

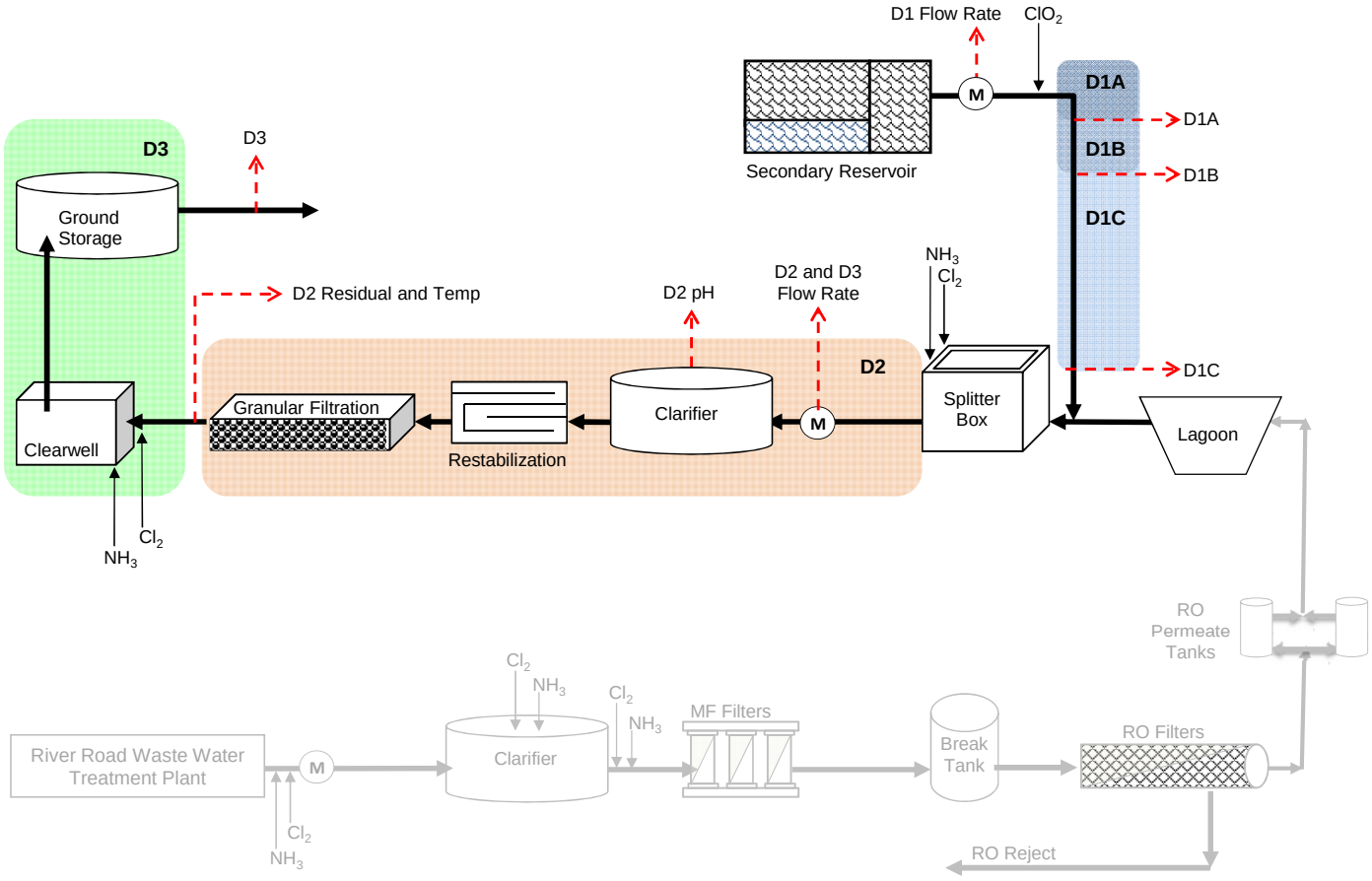
The disinfection process will utilize three disinfection zones which are summarized as follows:
D1A: The segment of the raw water pipeline from the chlorine dioxide injection point to the first monitoring point
D1B: The segment of the raw water pipeline from the chlorine dioxide injection point to the second chlorine dioxide monitoring point
D1C: The segment of the raw water pipeline from the chlorine dioxide injection point to the third chlorine dioxide monitoring point
D2: The 2010 clarfier, recarbonation basin,multi-media gravity filters, and associated piping
D3: The 2010 SWTP 0.20-MG clearwell and 10-MG ground storage tank

CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)
Schematic Worksheet

PUBLIC WATER SYSTEM NAME:	City of Wichita Falls	**PLANT NAME OR NUMBER:**	2010 Cypress Water Treatment Plant
PWS ID No.:	2430001	**Date:**	April 25, 2014

Use this worksheet to create your plant schematic with the Microsoft Drawing Tools.
If you are not familiar with the drawing tools, you may create your schematic using any other suitable medium.
Please refer to Section 3.3 of the Guidance Manual for instructions and guidance.



CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

T10 Details Worksheet

PUBLIC WATER SYSTEM NAME: City of Wichita Falls **PWS ID No.:** 2430001

PLANT NAME OR NUMBER: 2010 Cypress Water Treatment Plant **Date:** April 25, 2014

Treatment Plant Capacity 10.000 mgd
6,944 gpm

Based on the combined flow rate from the MF/RO facilities and the secondary reservoir containing the raw water from Lake Arrowhead and Lake Kicakpoo through the Secondary Reservoir.

Disinfection Zone: D1A **Disinfectant:** Chlorine Dioxide

Unit - 1 Type: Piping Shape: Pipe

Further Description: 42 Inch Raw Water Line From Secondary Reservoir to Cypress WTP

Characteristic			Comments
Number of Units	1		From Secondary Reservoir to first sample tap or raw water pipeline.
Diameter	42	in	As per CT Submittal Dated April 4, 201
Length	400	ft	As per CT Submittal Dated April 4, 201
Volume (each)	28,792	gal	
Flow Rate (each)	3,472	gpm	Based on a 5 MGD Flow Rate of raw water fron Lake Arrowhead
Detention Time	8.3	min	
Baffling Factor	1.0		Typical Baffling Factor for Pipe
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**8.3**	**min**	

D1A FLOW RATE	**5.000**	**mgd**
T10 SUM FOR D1A	**8.3**	**min**

CT Study for the 2010 Cypress WTP
T10 Details Worksheet

Disinfection Zone: **D1B** **Disinfectant:** **Chlorine Dioxide**

Unit - 1 Type: **Piping** Shape: **Pipe**

Further Description: 42 Inch Raw Water Line From Secondary Reservoir to Cypress WTP

Characteristic			Comments
Number of Units	1		
Diameter	42	in	As per CT Submittal Dated April 4, 201
Length	900	ft	As per CT Submittal Dated April 4, 201
Volume (each)	64,782	gal	
Flow Rate (each)	3,472	gpm	Based on a 5 MGD Flow Rate of raw water fron Lake Arrowhead
Detention Time	18.7	min	
Baffling Factor	1.0		Typical Baffling Factor for Pipe
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**18.7**	**min**	
D1B FLOW RATE	**5.000**	**mgd**	
T10 SUM FOR D1B	**18.7**	**min**	

Disinfection Zone: **D1C** **Disinfectant:** **Chlorine Dioxide**

Unit - 1 Type: **Piping** Shape: **Pipe**

Further Description: 42 Inch Raw Water Line From Secondary Reservoir to Cypress WTP

Characteristic			Comments
Number of Units	1		
Diameter	42	in	As per CT Submittal Dated April 4, 201
Length	6500	ft	As per CT Submittal Dated April 4, 201
Volume (each)	467,873	gal	
Flow Rate (each)	3,472	gpm	Based on a 5 MGD Flow Rate of raw water fron Lake Arrowhead
Detention Time	134.7	min	
Baffling Factor	1.0		Typical Baffling Factor for Pipe
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**134.7**	**min**	
D1C FLOW RATE	**5.000**	**mgd**	
T10 SUM FOR D1C	**134.7**	**min**	

CT Study for the 2010 Cypress WTP
T10 Details Worksheet

Disinfection Zone: **D2** **Disinfectant:** **Chloramines**

Unit - 1 Type: **Piping** Shape: **Pipe**

Further Description: Raw Water Pipe from Splitter Box to Rapid Mix

Characteristic			Comments
Number of Units	1		Splitter box to rapid mi
Diameter	36	in	As per CT Submittal Dated April 4, 201
Length	220	ft	As per CT Submittal Dated April 4, 201
Volume (each)	11,634	gal	
Flow Rate (each)	6,944	gpm	10 MGD, the combined flow rate from the MF/RO facilities and the Secondary Reservoir containing raw water from Lake Arrowhead
Detention Time	1.7	min	
Baffling Factor	1.0		Typical Baffling Factor for Pip
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**1.7**	**min**	

Unit - 2 Type: **Rapid Mix** Shape: **Rectangular**

Further Description: Rapid Mix Basin

Characteristic			Comments
Number of Units	1		
Length	27	ft	As per CT Submittal Dated April 4, 201
Width	6	ft	As per CT Submittal Dated April 4, 201
Side Water Depth	4	ft	As per CT Submittal Dated April 4, 201
Volume (each)	4,848	gal	
Flow Rate (each)	6,944	gpm	Based on a total 10 MGD flow through the conventional 2010 CWTP facilities.
Detention Time	0.7	min	
Baffling Factor	0.1		Typical baffling factor for an "Unbaffled" basin
			Baffling Characteristics: Unbaffled
			Approved Baffling Factor:
T_{10}	**0.1**	**min**	

Unit - 3 Type: **Piping** Shape: **Pipe**

Further Description: 30 Inch Pipe from Rapid Mix to Clarifier

Characteristic			Comments
Number of Units	1		Rapid Mix to Clarifie
Diameter	30	in	As per CT Submittal Dated April 4, 201
Length	85	ft	As per CT Submittal Dated April 4, 201
Volume (each)	3,122	gal	
Flow Rate (each)	6,944	gpm	10 MGD Flow
Detention Time	0.4	min	
Baffling Factor	1.0		Typical baffling factor for pipe
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**0.4**	**min**	

CT Study for the 2010 Cypress WTP
T10 Details Worksheet

Unit - 4 Type: **Clarifier** Shape: **Circular**

Further Description: 2010 Plant Clarifier

Characteristic			Comments
Number of Units	1		
Diameter	90	ft	As per CT Submittal Dated April 4, 201
Side Water Depth	18.9	ft	As per CT Submittal Dated April 4, 201
Center Water Depth	20.6	ft	As per CT Submittal Dated April 4, 201
Volume (each)	926,521	gal	
Flow Rate (each)	6,944	gpm	Based on the rated capacity of the temporary DPR WTP. At this flow rate, the SOR = 1.09 gpm/ft2 and the HDT = 133.42 min.
Detention Time	133.4	min	
Baffling Factor	0.3		Typical baffling factor for clarifiers
			Baffling Characteristics: Poor
			Approved Baffling Factor:
T_{10}	**40.0**	**min**	

Unit - 5 Type: **Other** Shape: **Rectangular**

Further Description: Recarbonation Basin

Characteristic			Comments
Number of Units	1		
Length	45.5	ft	As per CT Submittal Dated April 4, 201
Width	32	ft	As per CT Submittal Dated April 4, 201
Side Water Depth	16.8	ft	As per CT Submittal Dated April 4, 201
Volume (each)	183,003	gal	
Flow Rate (each)	6,944	gpm	10 MGD Flow
Detention Time	26.4	min	
Baffling Factor	0.5		Typical baffling factor for basins with 4 interna baffles and length to width (40:1)
			Baffling Characteristics: Average
			Approved Baffling Factor:
T_{10}	**13.2**	**min**	

CT Study for the 2010 Cypress WTP
T10 Details Worksheet

Unit - 6 Type: **Filter** Shape: **Rectangular**

Further Description: 2010 Plant Gravity Filters

Characteristic			Comments
Number of Units	4		To represent the City's operation with four filters always in service and the fifth filter on standby for when one of the filters goes into backwash.
Length	24	ft	As per CT Submittal Dated April 4, 201
Width	15	ft	As per CT Submittal Dated April 4, 201
Media Depth	6	ft	As per CT Submittal Dated April 4, 201
Underdrain Depth	1	ft	As per CT Submittal Dated April 4, 201
Minimum Water Depth Over Media	6.8	ft	As per CT Submittal Dated April 4, 201
Average Porosity	50	%	
Volume (each)	29,088	gal	
Flow Rate (each)	1,736	gpm	10 MGD flow divided equally between four filters. Each filter is rated at 2.5 MGD. Four filters must always be operated together at equal flow rates.
Detention Time	16.8	min	
Baffling Factor	0.7		Typical baffling factor for filters
			Baffling Characteristics: Superior
			Approved Baffling Factor:
T_{10}	**11.7**	**min**	
D2 FLOW RATE	**10.000**	**mgd**	
T10 SUM FOR D2	**67.1**	**min**	

Disinfection Zone: **D3** **Disinfectant:** **Chloramines**

Unit - 1 Type: **Clearwell** Shape: **Rectangular**

Further Description: 2010 Clearwell/Transfer Pump Station

Characteristic			Comments
Number of Units	1		
Length	98.4	ft	As per CT Submittal Dated April 4, 201
Width	26	ft	As per CT Submittal Dated April 4, 201
Side Water Depth	11.3	ft	As per CT Submittal Dated April 4, 201
Maximum Volume (each)	216,290	gal	
Minimum Operating Level	5.7	ft	50 % of total volume
Worst Case Volume (each)	109,102	gal	
Percent of Maximum Volume	50	%	
Worst Case Volume (each)	109,102	gal	
Flow Rate (each)	6,944	gpm	10 MGD flow
Detention Time	15.7	min	
Baffling Factor	0.5		Typical baffling factor for basins with two interna baffles with length to width (30:1)
			Baffling Characteristics: Average
			Approved Baffling Factor:
T_{10}	**7.9**	**min**	

CT Study for the 2010 Cypress WTP
T10 Details Worksheet

Unit - 2 Type: **Clearwell** Shape: **Circular**

Further Description: 10 MG Ground Storage Tank

Characteristic			Comments
Number of Units	1		
Diameter	206	ft	As per CT Submittal Dated April 4, 201
Side Water Depth	40	ft	As per CT Submittal Dated April 4, 201
Center Water Depth	40	ft	As per CT Submittal Dated April 4, 201
Maximum Volume (each)	9,974,083	gal	
Minimum Operating Level	20	ft	Assumes "Worst Case" operating leve
Worst Case Volume (each)	4,987,042	gal	
Percent of Maximum Volume	50	%	
Worst Case Volume (each)	4,987,042	gal	
Flow Rate (each)	6,944	gpm	100 % of 10 MGD max at Cypress. All water produced during the DPR Full Scale Operation will pass through the 10 MG GST
Detention Time	718.1	min	
Baffling Factor	0.3		Typical baffling factor for basins having 2 inlets, 1 outlet and 3 interior baffles.
			Baffling Characteristics: Poor
			Approved Baffling Factor:
T_{10}	**215.4**	**min**	

D3 FLOW RATE	**10.000**	**mgd**
T10 SUM FOR D3	**223.3**	**min**

Disinfection Zone: **D4** **Disinfectant:**

Disinfection Zone: **D5** **Disinfectant:**

Disinfection Zone: **D6** **Disinfectant:**

Disinfection Zone: **D7** **Disinfectant:**

Disinfection Zone: **D8** **Disinfectant:**

CT Study for the 2010 Cypress WTP

CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)
Summary Worksheet

PUBLIC WATER SYSTEM NAME: **City of Wichita Falls** **PWS ID No.:** **2430001**

PLANT NAME OR NUMBER: **2010 Cypress Water Treatment Plant** **Date:** **April 25, 2014**

Disinfection Zone	Treatment Unit	Volume* (each) (gal)	Flow Rate* (each) (MGD)	Baffling Factor*	T_{10}* (min) Unit	T_{10}* (min) Zone
D1A	Raw Water Line From Secondary Reservoir to Cypress	28,792	5.000	1	8.292	8.29
D1B	Raw Water Line From Secondary Reservoir to Cypress	64,782	5.000	1	18.657	18.66
D1C	Raw Water Line From Secondary Reservoir to Cypress	467,873	5.000	1	134.747	134.75
D2	Raw Water Pipe from Splitter Box to Rapid Mix (1)	11,634	10.000	1	1.675	67.12
	Rapid Mix Basin (1)	4,848	10.000	0.1	0.070	
	30 Inch Pipe from Rapid Mix to Clarifier (1)	3,122	10.000	1	0.450	
	2010 Plant Clarifier (1)	926,521	10.000	0.3	40.026	
	Recarbonation Basin (1)	183,003	10.000	0.5	13.176	
	2010 Plant Gravity Filters (4)	29,088	2.500	0.7	11.728	
D3	2010 Clearwell/Transfer Pump Station (1)	109,102	10.000	0.5	7.855	223.30
	10 MG Ground Storage Tank (1)	4,987,042	10.000	0.3	215.440	

* These values are calculated on the T10 Details Sheet

TCEQ - (05-01-13) **CT STUDY**

CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)
CT Calculator Worksheet

PUBLIC WATER SYSTEM NAME:	City of Wichita Falls	**PLANT NAME OR NUMBER:**	2010 Cypress Water Treatment Plant
PWS ID No.:	2430001	**Date:**	April 25, 2014

DISINFECTION PROCESS PARAMETERS

APPROVED CT STUDY PARAMETERS						PERFORMANCE STANDARDS	
Parameters	Disinfection Zones					Log Inactivations	
	D1A	D1B	D1C	D2	D3	Giardia lamblia Cysts	Viruses
Flow Rate (MGD)	5.000	5.000	5.000	10.000	10.000	0.5	2.0
T_{10} (minutes)	8.3	18.7	134.7	67.1	223.3		

DISINFECTION PROCESS DATA

INDIVIDUAL DISINFECTION ZONES											PLANT TOTAL		
Disinfectant		C (mg/L)	Flow (MGD)	Temp (^oC)	pH	CT_{CALC}	Giardia CT_{REQD}	Virus CT_{REQD}	Giardia Log	Virus Log	Giardia Log	Virus Log	Inact. Ratio
CLO2	*D1A*	0.05	5.000	5.0	8.2	0.4	4.5	5.7	0.05	0.14			
NA	*D1B*					NA	NA	NA	NA	NA			
NA	*D1C*					NA	NA	NA	NA	NA	1.56	2.67	1.34
CLA	*D2*	3.50	10.000	5.0	9.0	234.9	357.5	857.0	0.33	0.55			(V)
CLA	*D3*	3.80	10.000	5.0	8.9	848.5	357.5	857.0	1.19	1.98			

SUBMITTED BY: _____ **Certificate No. and Grade:** _____ **Date:** _____

TCEQ - (05-01-13) **CT STUDY**

Enclosure D: CT Study Letter for the Cypress Temporary DPR Water Treatment Plant

Bryan W. Shaw, Ph.D, P.E., *Chairman*
Toby Baker, *Commissioner*
Zak Covar, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

PWS_2430001_CO_20140627_CTSTUDY

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

June 27, 2014

Mr. Mark Southard
Water Source/Purification Superintendent
City of Wichita Falls
4801 Big Ed Neal Drive
Wichita Falls, Texas 76310

Subject: Public Drinking Water System Contact Time Study
City of Wichita Falls - PWS ID No. 2430001
Cypress Temporary Direct Potable Reuse Water Treatment Plant,
TCEQ Plant ID No. TP410791
Wichita County, Texas

CN600129316 RN105598759

Dear Mr. Southard:

The Texas Commission on Environmental Quality (TCEQ) Technical Review and Oversight Team (TROT) has completed the review of the CT Study for the full-scale Direct Potable Reuse Water Treatment Plant (Temporary DPR WTP) which was submitted on April 25, 2014. Based on the information provided, we are approving the proposed disinfection protocol.

Please note this letter does not waive any of the conditions required in the TCEQ's exception letter dated June 27, 2014 and applies when the temporary DPR Project is in operation. As you are aware, the City will need to submit another CT Study update at that time.

During the temporary DPR Project, the raw water for the Temporary DPR WTP will be supplied by a transmission line that delivers treated effluent from the River Road Waste Water Treatment Plant (RR WWTP). For the duration of the Project, the DPR WTP will include:

- all of the treatment units at the 2008 Cypress Microfiltration/Reverse Osmosis Water Treatment Plant (2008 Cypress MF/RO WTP), which includes a Flocc-Clarifier; five MF filters; and six two-stage RO units;
- all of the treatment units at 2010 Cypress WTP, which includes a splitter box that, under normal (non-DPR) operating conditions, distributes water between the 1961, 1987, and 2010 plants; a mechanical rapid mix; a Parshall Flume meter; a solids contact, slurry recirculation clarifier; a recarbonation basin; five dual-media gravity filters; and the small 2010 Clearwell and filtered water transfer pump station;
- a 10 million gallon (MG) 2010 Ground Storage Tank (GST) that has been isolated from the rest of the GSTs at the Cypress site; and
- the 2010 High Service Pump Station (HSPS) that discharges to the distribution system.

The proposed disinfection protocol at the DPR WTP involves the injection of chlorine at the RR WWTP chlorine contact chamber and the injection of chlorine (Cl_2) and ammonia (NH_3) at the outlet of the splitter box. There is also a standby liquid ammonium sulfate (LAS) injection point

at the RR WWTP chlorine contact chamber, standby/secondary Cl_2 and LAS injection points at the 2008 clarifier, and standby/secondary Cl_2 and NH_3 injection points at the 2010 Clearwell and the HSPS. Disinfectant residual monitoring can be performed at three designated sample sites on the Secondary Reservoir transmission line, and upstream of the rechloramination points at the 2010 Clearwell and HSPS.

A disinfection zone is a segment of the treatment process which begins at a disinfectant application point and ends at a subsequent disinfectant application or residual sampling point. Hence, each disinfectant application point, regardless of the frequency of use, represents the beginning of a separate disinfection zone. Similarly, a plant may have only one disinfectant point, but may also choose to monitor disinfection residuals at more than one point, thus creating multiple disinfection zones.

Based on your proposal, we concur that there are five disinfection zones at the DPR WTP. The first disinfection zone, D1, consists of the treated effluent water line from the RR WWTP. The second disinfection zone, D2, consists of the Clari-flocculator in the 2008 MF/RO WTP and the third disinfection zone, D3, includes the MF cells and their inlet channel and associated piping. The fourth zone, D4, contains the rapid mix, clarifier, recarbonation basin, granular media filters, and associated piping at the 2010 Cypress WTP. The last disinfection zone, D5, incorporates the 2010 Clearwell and 2010 GST and the associated piping.

Contact Time (CT) calculations are used to evaluate the disinfection process. The time that the disinfectant is in contact with water in the disinfection segment must be determined on a daily basis to complete the CT calculations. This contact time, measured as T_{10}, is determined based on the peak hourly flow rate occurring during the 24-hour period and the detention time that is equaled or exceeded by 90 percent of the water passing through the basin. Since T_{10} values are required to calculate the CT for the treatment process, Table 1 was developed for the DPR WTP. The T_{10} values are based on the information provided the CT Study template you submitted on April 25, 2014.

TABLE 1: T_{10} TABLE FOR THE TEMPORARY DIRECT POTABLE REUSE WATER TREATMENT PLANT (TP410791)

DISINFECTION ZONE	TREATMENT UNIT	VOLUME (GAL)	FLOW RATE (MGD)	BAFFLING FACTOR	T_{10} (MIN)	
					Unit	Sum
D1	Treated Effluent Transmission Line	1,859,200(1)	7.5(13)	1.0(17)	357.0	357.0
D2	2008 Flocc-Clarifier	3,875,600(2)		0.3(18)	223.2	223.2
D3	Piping	13,200(3)		1.0(17)	2.5	5.9
	Microfiltration Inlet Trough	5,500(4)		0.1(19)	0.1	
	Microfiltration Cells	9,650(5)	3.0(14)	0.7(20)	3.2	
D4	Piping	14,800(6)	10.0(15)	1.0(17)	2.1	67.1
	Rapid Mix	4,850(7)		0.1(21)	0.1	
	2010 Clarifier	926,500(8)		0.3(22)	40.0	
	Recarbonation Basin	183,000(9)		0.5(23)	13.2	
	Granular Media Filters	29,100(10)	2.5(16)	0.7(24)	11.7	
D5	2010 Clearwell	109,100(11)	10.0(15)	0.5(25)	7.9	223.3
	2010 Ground Storage Tank	4,987,000(12)		0.3(26)	215.4	

Notes: (see following page)

Table 1 Notes:

1. Based on a 27-inch diameter pipe that is 62,500 feet long.
2. Based on a flocculation clarification unit that has a 155-foot diameter, a 25.3-foot side water depth, and a 31.76-foot center water depth.
3. Based on a 36-inch diameter pipe that is 250 feet long.
4. Based on the section of the influent trough from the trough inlet to the closest of the microfiltration cells. This section of the trough is 25.16 feet long and 11 feet wide and has a 2.66-foot side water depth.
5. Based on the volume of water contained in a single filter cell containing 504 submerged microfiltration membrane modules.
6. Based on cumulative volume in 220 linear feet of 36-inch piping between the splitter box to the rapid mix and 85 linear feet of 30-inch piping from the rapid mix to the 2010 clarifier.
7. Based on a basin that is 27 feet long and 6 feet wide with a water depth of 4 feet.
8. Based on a basin that has a 90-foot diameter, an 18.9-foot side water depth, and a 20.6-foot center water depth.
9. Based on a basin that is 45.5 feet long and 32 feet wide and has a 16.8 foot side water depth.
10. Based on one dual-media gravity filter that is 24 feet long and 15 feet wide, contains 6 feet of gravel and media, and an underdrain system that is 1 foot tall. The minimum water depth over the media was reported to be 6.8 feet and a 50% porosity of the filter media is assumed.
11. Based on a clearwell that is 98.4 feet long and 26 feet wide. The maximum water depth and minimum operating levels in the clearwell are 11.3 feet and 5.7 feet, respectively.
12. Based on a tank that has a 206-foot diameter, a 40-foot maximum water depth, and a 20-foot minimum operating level.
13. Based on the maximum anticipated flow rate of treated effluent from the RRWTP.
14. Based on the rated capacity of 504 submerged membrane modules with a total surface area of 334.9 square feet per module and a TCEQ-approved flux rate of 19.6 gallons per square foot per day.
15. Based on the design capacity of the DPR Project and the assumption that 50% of the source water for the 2010 Cypress WTP will be obtained from the raw water transfer pumps at the Secondary Reservoir.
16. Based on the design capacity of the DPR Project and the assumption that flow will be evenly distributed between four of the five filters.
17. Assumes that the flow conditions that exist in long pipeline segments will virtually eliminate the possibility of short-circuiting and create “perfect” baffling characteristics.
18. Assumes that a Flocc-Clarifier with a central, single-stage flocculation chamber and a single baffle wall between the flocculation and settling zones will result in some short-circuiting and an overall “poor” baffling characteristic within the unit.
19. Assumes that the signification hydraulic short-circuiting occurring in a trough with a single inlet and a 2.5:1 length to width ratio will result in an “unbaffled” baffling characteristic within the basin.
20. Assumes that the hydraulic conditions that exist in a filter cell with 504 membrane unit will create “superior” baffling characteristics within the cell.
21. Assumes the rapid mix completely mixes the water within the unit and results in an “unbaffled” baffling characteristic within the basin.
22. Assumes that the mixing zone within the solids contact clarifier results in sufficient short-circuiting that the overall baffling characteristic of the clarifier will be “poor”.
23. Assumes that “average” baffling conditions will occur in a tank that contains multiple baffle walls that create a contactor with an effective length:width ratio greater than 20:1 but less than 50:1.
24. Assumes that the hydraulic conditions that exist in a gravity filter will create “superior” baffling characteristics within the filter.
25. Assumes that a tank with two inlets, three internal baffle walls, and a single outlet will exhibit some short-circuiting and demonstrate “poor” baffling characteristics.

We have prepared a Disinfection Process Parameters table to help the operators complete their Surface Water Monthly Operating Report (SWMOR). In Table 2, we have characterized the T_{10} available in each of the disinfection zones based on the flow rate through the unit(s) that contributes most to the disinfection process within that zone. We have also provided the operators with the disinfection requirements that the Temporary Direct Potable Reuse WTP must meet on a continuous basis.

TABLE 2: DISINFECTION PROCESS PARAMETERS FOR THE TEMPORARY DIRECT POTABLE REUSE WATER TREATMENT PLANT (TP410791)

APPROVED CT STUDY PARAMETERS						PERFORMANCE STANDARDS	
Parameters	Disinfection Zones					Log Inactivation	
	D1	D2	D3	D4	D5	Giardia	Viruses
Flow Rate (MGD)	7.50	7.50	3.308	10.00	10.00	2.0	5.0
T_{10} (minutes)	357.0	223.2	5.6	67.1	223.3		

As you are aware, zone D4 includes the 2010 clarifier, recarbonation basin, and conventional filters. As we have discussed, this grouping of treatment processes results in some constraints on the manner in which the plant must be operated and monitored. Specifically:

- **The operators must monitor the pH in disinfection zone D4 at the outlet of the 2010 clarifier.** Historically, the 2010 Cypress WTP has practiced full lime softening and, therefore, the clarifier has operated at a higher pH range in order to achieve greater hardness reductions and improved total organic carbon removal. During the temporary DPR project, the Temporary DPR WTP expects to meet these two treatment objectives by blending the surface water (from Lake Kickapoo and Lake Arrowhead) with RO permeate produced by the 2008 Cypress MF/RO WTP plant. However, the City would like to retain the flexibility to practice partial lime softening when conditions warrant.

  This desired level of flexibility is understandable. However, the US Environmental Protection Agency's CT Tables for chloramine only apply when pH levels are between 6 and 9, i.e., from 5.5 through 9.49. Because zone D4 includes both the clarification and recarbonation processes and recarbonation lowers pH, the pH in zone D4 must be measured before recarbonation. Consequently, the operators must monitor the pH for disinfection zone D4 at the outlet of the clarifiers rather than at the typical site located at end of the disinfection zone. The alternate location will ensure that the Temporary DPR WTP does not overestimate disinfection levels when the pH in the 2010 Clarifier reaches 9.5.

- **The operators must have at least four filters in operations whenever the plant is treating water.** This operational constraint is needed because zone D4 contains both the plant's gravity filters and the disinfection contact time within the zone depends on the flow rate of the water and the total volume of water contained in the treatment units. Consequently, the CT calculations will underestimate the level of viral inactivation achieved if fewer than four filters are on line whenever the plant is treating water.

During the duration of the temporary DPR process, the operators must continue to measure monochloramine, as opposed to total chlorine, residuals at the end of disinfection zones D1, D2, and D3. Because the source water for the Temporary DPR WTP is the treated effluent from the River Road WWTP, there is a possibility that the water in these three disinfection zones will contain significant amounts of organic chloramines and other chemical compounds that can be detected by the total chlorine test methods. Since the effectiveness of these chemicals as a disinfectant has not been studied, measuring monochloramine levels will reduce the potential for significantly overestimating the level of disinfection in these zones if elevated levels of these other chemicals are present. On the other hand, the operators must continue to measure total chlorine residuals in zones D4 and D5 using an approved total chlorine method since the water is dechlorinated at the end of disinfection zone D3.

Please note that this approved CT study is only applicable for the duration of the temporary DPR Project and only if the plant adheres to the operational constraints identified above. **Therefore, you must submit another revised CT study when the plant returns to its traditional source water and operational practices.**

If you have any questions concerning our evaluation or if we may be of other assistance, please contact Mr. Joel Klumpp at (512) 239-4453, by e-mail at joel.klumpp@tceq.texas.gov, or by correspondence at:

Technical Review and Oversight Team (MC-159)
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

Sincerely,

Joel Klumpp, Team Leader
Technical Review and Oversight Team
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

Cindy Hayme, CT Study Program Manager
Technical Review and Oversight Team
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

JPK/jcs

Enclosure: CT Study Worksheet

cc w/ enclosure: Mr. Daniel K. Nix,
Operations Manager, Public Utilities
City of Wichita Falls

CT Study for the Wichita Falls Temporary DPR WTP

CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

Description Worksheet

PUBLIC WATER SYSTEM NAME:	**City of Wichita Falls**	**PWS ID No.:**	**2430001**
PLANT NAME OR NUMBER:	**Temporary Direct Potable Reuse Water Treatment Plant**	**Month:**	**April**
		Day:	**25**
		Year:	**2014**

Enter a detailed narrative description of the plant treatment processes and disinfection protocol.

The City of Wichita Falls Cypress Water Treatment Plant (CWF CWTP) Temporary Reuse Project will combine the use of the Micro-filtration/Reverse Osmosis (MF/RO) treatment facilities with the conventional 2010 CWTP. This CT study takes into account the treated water pumped from the CWF River Road Waste Water Treatment Plant (RRWWTP) to the CWTP through a 32-inch outside diameter (O.D.) HDPE raw water pipe (with a 27-inch inside diameter, I.D.) at a flow of 7.5 million gallons per day (MGD), through the MF/RO treatment facility to a raw water lagoon where 5 MG will then be mixed with 5 MG raw surface water and treated through the conventional 2010 CWTP.

The treatment process includes clarification prior to micro-filtration, reverse osmosis where the 5 MG permeate will be sent to a raw water lagoon, pumped back the the splitter basin and mixed with 5 MG of raw surface water prior to the 2010 CWTP. The 2010 CWTP consists of a rapid mix basin, a 90 foot diameter (dia.) clarifier, a re-carbonation basin, five multi-media gravity filters, a 0.20 million gallon (MG) clearwell and pump station and a 10.0-MG ground storage tank. Total capacity through the 2010 CWTP is 10.0-MGD.

The treatment processes for the water from the RRWWTP must achieve a 5.5-log removal or inactivation of Cryptosporidium, an 8.0-log removal or inactivation of Giardia, and a 9.0-log removal or inactivation of viruses before water is distributed to the customers. Based on the combination of treatment processes that will be used at the MF/RO facilities and 2010 CWTP, the disinfection process must be able to achieve a 2.0-log inactivation of Giardia and a 5.0-log inactivation of viruses before treated water enters the distribution system.

The proposed disinfection protocol involves the injection of chlorine (Cl2) at the RRWWTP chlorine contact basin to create "per-formed chloramines" as a disinfectant (i,e, not adding enough Cl2 to reach breakpoint) before being pumped to the CWTP through the 32-inch O.D. raw water pipe to. In the micro-filtration clarifier, chlorine (Cl2) and liquid ammonium sulfate (LAS) are injected in the mix zone to form chloramines. Chlorine (Cl2) and liquid ammonium sulfate are again added at the clarifier effluent to form chloramines through the micro-filtration trough and cells. Once the reverse osmosis permeate is mixed with the raw surface water in the splitter basin, chlorine (Cl2) and liquid ammonia gas (NH4) are added in the splitter box and again just upstream of the CWTP's 0.20 MG clearwell and transfer pump station.

Chloramine residuals are monitored in the raw water vault, prior to the micro-filtration clarifier, in the mix zone of the clarifier, at the effluent collection box of the carifier, in the micro-filtration feed trough and cell filtrate. Chloramine residuals are also monitored downstream of the five multi-media gravity filters, downstream of the 0.20 MG clearwell and transfer pump station and downstream of the 10 MG ground storage tank, prior to entering the distribution system.

Submitted by: **Mark Southard, Water Source/Purification Superintendent**

Contact Information: mark.southard@wichitafallstx.gov 940-691-1153, 940-691-4121 Fax

Reviewed by Jack C. Schulze, P.E.

Detailed narrative description of the plant treatment processes and disinfection protocol (cont)

The disinfection process with utilize five disinfection zones which are summarized as follows:

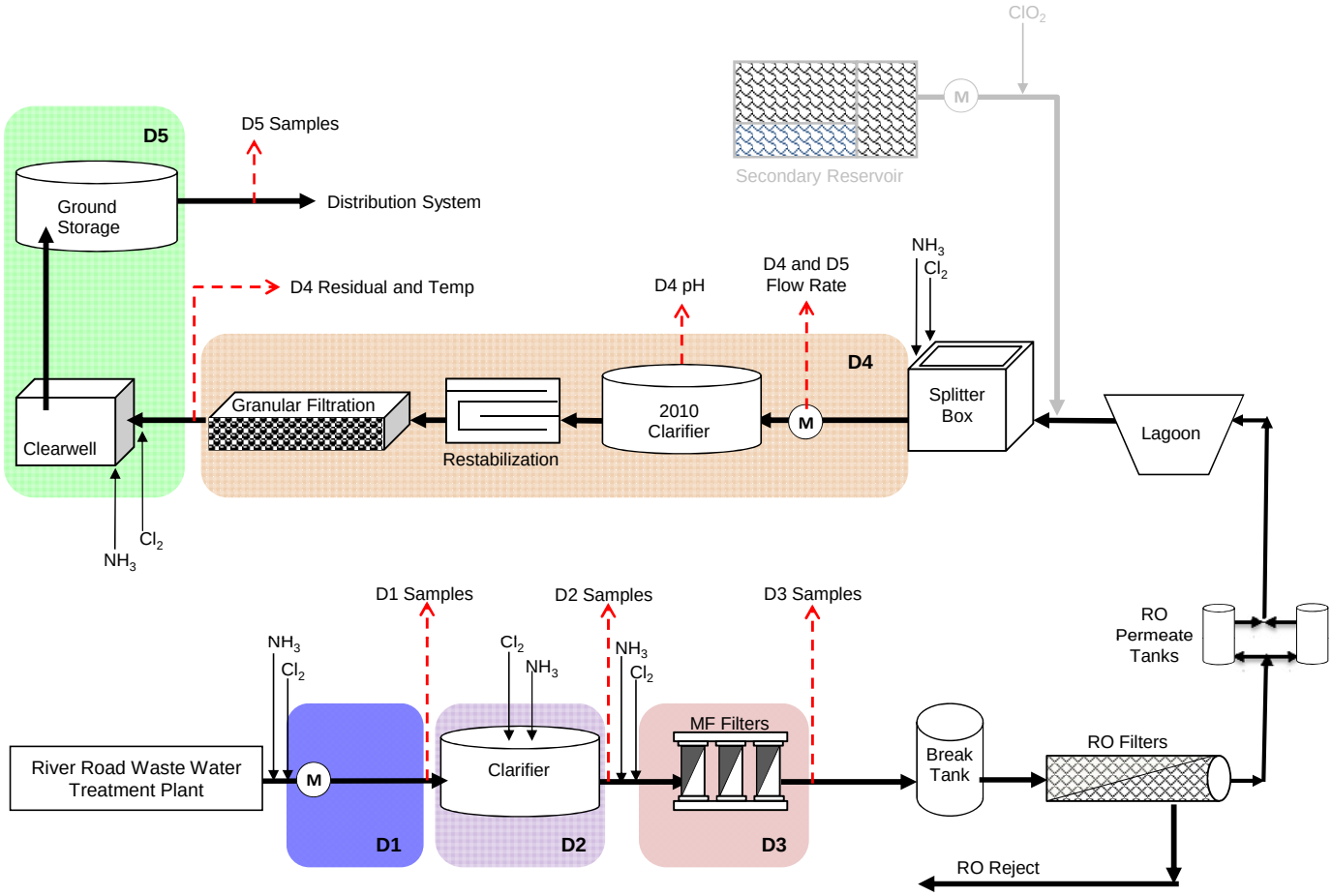
D1: 32-inch O.D. HDPE raw water pipeline from the River Road WWTP to the Cypress WTP
D2: 2008 SWTP's clarification unit at the MF/RO treatment facility
D3: 2008 SWTP's MF treatment units and associated piping
D4: 2010 SWTP's clarfier, recarbonation basin, filters, and associated piping
D5: 2010 SWTP's 0.20-MG clearwell and Cypress 10-MG ground storage tank

CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)
Schematic Worksheet

PUBLIC WATER SYSTEM NAME:	City of Wichita Falls	**PLANT NAME OR NUMBER:**	mporary Direct Potable Reuse Water Treatment Pl
PWS ID No.:	2430001	**Date:**	April 25, 2014

Use this worksheet to create your plant schematic with the Microsoft Drawing Tools.
If you are not familiar with the drawing tools, you may create your schematic using any other suitable medium.
Please refer to Section 3.3 of the Guidance Manual for instructions and guidance.



CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)
T10 Details Worksheet

PUBLIC WATER SYSTEM NAME: City of Wichita Falls **PWS ID No.:** 2430001

PLANT NAME OR NUMBER: emporary Direct Potable Reuse Water Treatment Pla **Date:** April 25, 2014

Treatment Plant Capacity 10.000 mgd
6,944 gpm

The peak flow rate through the MF/RO facilities will be 7.5 MGD but the peak flow rate throught the rest of the 2010 CWTP will be 10 MGD, which is the combined flow rate from the MF/RO facilities and the secondary reservoir containing

Disinfection Zone: D1 **Disinfectant:** Chloramines

Unit - 1 Type: Piping Shape: Pipe

Further Description: 13 Mile Pipe from RRWWTP to Cypress WTP

Characteristic			Comments
Number of Units	1		Pipe from RRWWTP to CWTP
Diameter	27	in	32" O.D. HDPE with a 27" I.D. per K. Maroney 8/29/2013 email
Length	62500	ft	8/15/2013 email
Volume (each)	1,859,189	gal	
Flow Rate (each)	5,208	gpm	7.5 MGD Flow
Detention Time	357.0	min	
Baffling Factor	1.0		Typical Baffling Factor for Pipe
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**357.0**	**min**	
D1 FLOW RATE	**7.500**	**mgd**	
T10 SUM FOR D1	**357.0**	**min**	

CT Study for the Wichita Falls Temporary DPR WTP

Disinfection Zone: **D2** **Disinfectant:** **Chloramines**

Unit - 1 Type: **Clarifier** Shape: **Circular**

Further Description: MF/RO Flocc-Clarifier

Characteristic			Comments
Number of Units	1		
Diameter	155	ft	Based on two engineer drawings for the clarifier structure (the CH2MHill DWG 4A-S-2, dated 2002 and the USFilter DWG 40507-101, dated 2004)
Side Water Depth	25.3	ft	" " "
Center Water Depth	31.76	ft	" " "
Volume (each)	3,875,583	gal	
Flow Rate (each)	5,208	gpm	7.5 MGD Flow
Detention Time	744.1	min	
Baffling Factor	0.3		Based on a concentric cylindrical baffle wall with a diameter of approximately 50 ft that extends 10 ft into the basin and settled water launder along the perimeter of the basin
			Baffling Characteristics: Poor
			Approved Baffling Factor:
T_{10}	**223.2**	**min**	
D2 FLOW RATE	**7.500**	**mgd**	
T10 SUM FOR D2	**223.2**	**min**	

Disinfection Zone: **D3** **Disinfectant:** **Chloramines**

Unit - 1 Type: **Piping** Shape: **Pipe**

Further Description: 36 Inch Raw Water Pipe

Characteristic			Comments
Number of Units	1		Clarifier to Micro-filtation Trough
Diameter	36	in	8/15/2013
Length	250	ft	8/15/2013
Volume (each)	13,221	gal	
Flow Rate (each)	5,208	gpm	7.5 MGD Flow
Detention Time	2.5	min	
Baffling Factor	1.0		Typical Baffling Factor for Pipe
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**2.5**	**min**	

CT Study for the Wichita Falls Temporary DPR WTP

Unit - 2 Type: **Other** Shape: **Rectangular**

Further Description: Micro-filtration Trough

Characteristic			Comments
Number of Units	1		
Length	25.16	ft	Based on CH2MHill DWG 4-S-10 dated 2002, and the length of the channel from the inlet to the center of the first pair of filter cells
Width	11	ft	Based on DWG 4-S-10
Side Water Depth	2.66	ft	Based on CH2MHill DWG 4-S-10 and DWG 4-S-11, both dated 2002
Volume (each)	5,508	gal	
Flow Rate (each)	5,208	gpm	Based on the total flow to the first diversion point
Detention Time	1.1	min	
Baffling Factor	0.1		
			Baffling Characteristics: Unbaffled
			Approved Baffling Factor:
T_{10}	**0.1**	**min**	

Unit - 3 Type: **Other** Shape: **Other**

Further Description: Micro-filtration Cells

Characteristic			Comments
Number of Units	1		The flow rate through each individual MF tank must be monitored and the highest flow rate entered on the Calculator Worksheet.
Volume (each)	9,557	gal	Based on CH2MHill DWG 4-S-10 and DWG 4-S-11, both dated 2002
Volume (each)	9,557	gal	
Flow Rate (each)	2,060	gpm	Based on 504 modules with a total surface area of 300.3 ft2 per module and an approved flux rate of 19.6 gfd.
Detention Time	4.6	min	
Baffling Factor	0.7		Based on the configuration of the filter cell and the submerged membrane units
			Baffling Characteristics: Superior
			Approved Baffling Factor:
T_{10}	**3.2**	**min**	

D3 FLOW RATE	**2.966**	**mgd**
T10 SUM FOR D3	**5.9**	**min**

CT Study for the Wichita Falls Temporary DPR WTP

Disinfection Zone: **D4** **Disinfectant:** **Chloramines**

Unit - 1 Type: **Piping** Shape: **Pipe**

Further Description: 36 Inch Raw Water Pipe

Characteristic			Comments
Number of Units	1		Splitter Box to Rapid Mix
Diameter	36	in	As per CT Submittal Dated April 4, 2011
Length	220	ft	As per CT Submittal Dated April 4, 2011
Volume (each)	11,634	gal	
Flow Rate (each)	6,944	gpm	based on a total 10 MGD flow through the conventional 2010 CWTP facilities
Detention Time	1.7	min	
Baffling Factor	1.0		Typical Baffling Factor for Pipe
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**1.7**	**min**	

Unit - 2 Type: **Rapid Mix** Shape: **Rectangular**

Further Description: Rapid Mix Basin

Characteristic			Comments
Number of Units	1		
Length	27	ft	As per CT Submittal Dated April 4, 2011
Width	6	ft	As per CT Submittal Dated April 4, 2011
Side Water Depth	4	ft	As per CT Submittal Dated April 4, 2011
Volume (each)	4,848	gal	
Flow Rate (each)	6,944	gpm	10 MGD Flow
Detention Time	0.7	min	
Baffling Factor	0.1		Typical Baffling Factor for an "Unbaffled" Basin
			Baffling Characteristics: Unbaffled
			Approved Baffling Factor:
T_{10}	**0.1**	**min**	

Unit - 3 Type: **Piping** Shape: **Pipe**

Further Description: 30 Inch Raw Water Pipe

Characteristic			Comments
Number of Units	1		Rapid Mix to Clarifier
Diameter	30	in	As per CT Submittal Dated April 4, 2011
Length	85	ft	As per CT Submittal Dated April 4, 2011
Volume (each)	3,122	gal	
Flow Rate (each)	6,944	gpm	10 MGD Flow
Detention Time	0.4	min	
Baffling Factor	1.0		Typical Baffling Factor for Pipe
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**0.4**	**min**	

CT Study for the Wichita Falls Temporary DPR WTP

Unit - 4 Type: **Clarifier** Shape: **Circular**

Further Description: 2010 Clarifier

Characteristic			Comments
Number of Units	1		
Diameter	90	ft	As per CT Submittal Dated April 4, 2011
Side Water Depth	18.9	ft	As per CT Submittal Dated April 4, 2011
Center Water Depth	20.6	ft	As per CT Submittal Dated April 4, 2011
Volume (each)	926,521	gal	
Flow Rate (each)	6,944	gpm	Based on the rated capacity of the temporary DPR WTP. At this flow rate, the SOR = 1.09 gpm/ft2 and the HDT = 133.42 min.
Detention Time	133.4	min	
Baffling Factor	0.3		Typical Baffling Factor for Clarifiers
			Baffling Characteristics: Poor
			Approved Baffling Factor:
T_{10}	**40.0**	**min**	

Unit - 5 Type: **Other** Shape: **Rectangular**

Further Description: Recarbonation Basin

Characteristic			Comments
Number of Units	1		
Length	45.5	ft	As per CT Submittal Dated April 4, 2011
Width	32	ft	As per CT Submittal Dated April 4, 2011
Side Water Depth	16.8	ft	As per CT Submittal Dated April 4, 2011
Volume (each)	183,003	gal	
Flow Rate (each)	6,944	gpm	10 MGD Flow
Detention Time	26.4	min	
Baffling Factor	0.5		Typical Baffling Factor for Basins with 4 Internal Baffles and Length to Width (40:1)
			Baffling Characteristics: Average
			Approved Baffling Factor:
T_{10}	**13.2**	**min**	

CT Study for the Wichita Falls Temporary DPR WTP

Unit - 6 Type: **Filter** Shape: **Rectangular**

Further Description: Gravity Filters

Characteristic			Comments
Number of Units	4		To represent the City's operation with four filters always in service and the fifth filter on standby for when one the filters goes into backwash.
Length	24	ft	As per CT Submittal Dated April 4, 2011
Width	15	ft	As per CT Submittal Dated April 4, 2011
Media Depth	6	ft	As per CT Submittal Dated April 4, 2011
Underdrain Depth	1	ft	As per CT Submittal Dated April 4, 2011
Minimum Water Depth Over Media	6.8	ft	As per CT Submittal Dated April 4, 2011
Average Porosity	50	%	
Volume (each)	29,088	gal	
Flow Rate (each)	1,736	gpm	10 MGD Flow Divided Equally Between Four Filters (Filters Rated at 2.5 MGD Flow Each). Four filters must always be operated together at equal flow rates.
Detention Time	16.8	min	
Baffling Factor	0.7		Typical Baffling Factor for Filters
			Baffling Characteristics: Superior
			Approved Baffling Factor:
T_{10}	**11.7**	**min**	
D4 FLOW RATE	**10.000**	**mgd**	
T10 SUM FOR D4	**67.1**	**min**	

Disinfection Zone: **D5** **Disinfectant:** **Chloramines**

Unit - 1 Type: **Clearwell** Shape: **Rectangular**

Further Description: Clearwell/Transfer Pump Station

Characteristic			Comments
Number of Units	1		
Length	98.4	ft	As per CT Submittal Dated April 4, 2011
Width	26	ft	As per CT Submittal Dated April 4, 2011
Side Water Depth	11.3	ft	As per CT Submittal Dated April 4, 2011
Maximum Volume (each)	216,290	gal	
Minimum Operating Level	5.7	ft	
Worst Case Volume (each)	109,102	gal	
Percent of Maximum Volume	50	%	Based on the clearwell's minimum operating level, i.e., 50% of Total Volume
Worst Case Volume (each)	109,102	gal	
Flow Rate (each)	6,944	gpm	10 MGD Flow
Detention Time	15.7	min	
Baffling Factor	0.5		Typical Baffling Factor for Basins with Two Internal Baffles Lenth to Width (30:1)
			Baffling Characteristics: Average
			Approved Baffling Factor:
T_{10}	**7.9**	**min**	

CT Study for the Wichita Falls Temporary DPR WTP

Unit - 2 Type: **Clearwell** Shape: **Circular**

Further Description: 10 MG Ground Storage Tank

Characteristic			Comments
Number of Units	1		
Diameter	206	ft	As per CT Submittal Dated April 4, 2011
Side Water Depth	40	ft	As per CT Submittal Dated April 4, 2011
Center Water Depth	40	ft	As per CT Submittal Dated April 4, 2011
Maximum Volume (each)	9,974,083	gal	
Minimum Operating Level	20	ft	Assumes a "Worst Case" operating level that is 50% of the maximum water depth
Worst Case Volume (each)	4,987,042	gal	
Percent of Maximum Volume	50	%	
Worst Case Volume (each)	4,987,042	gal	
Flow Rate (each)	6,944	gpm	100% of 10 MGD Max at Cypress. All water produced will pass through the 10 MG GST for the DPR full scale operation.
Detention Time	718.1	min	
Baffling Factor	0.3		Typical Baffling Factor for Basins Having 2 Inlets, 1 Outlet and 3 Interior Baffles
			Baffling Characteristics: Poor
			Approved Baffling Factor:
T_{10}	**215.4**	**min**	
D5 FLOW RATE	**10.000**	**mgd**	
T10 SUM FOR D5	**223.3**	**min**	

Disinfection Zone: **D6** **Disinfectant:**

Disinfection Zone: **D7** **Disinfectant:**

Disinfection Zone: **D8** **Disinfectant:**

Disinfection Zone: **D9** **Disinfectant:**

Disinfection Zone: **D10** **Disinfectant:**

CT Study for the Wichita Falls Temporary DPR WTP

CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)
Summary Worksheet

PUBLIC WATER SYSTEM NAME: City of Wichita Falls **PWS ID No.:** 2430001

PLANT NAME OR NUMBER: Temporary Direct Potable Reuse Water Treatment Plant **Date:** April 25, 2014

Disinfection Zone	Treatment Unit	Volume* (each) (gal)	Flow Rate* (each) (MGD)	Baffling Factor*	T_{10}* (min) Unit	T_{10}* (min) Zone
D1	13 Mile Pipe from RRWWTP to Cypress WTP (1)	1,859,189	7.500	1	356.964	356.96
D2	MF/RO Flocc-Clarifier (1)	3,875,583	7.500	0.3	223.234	223.23
D3	36 Inch Raw Water Pipe (1)	13,221	7.500	1	2.538	5.89
	Micro-filtration Trough (1)	5,508	7.500	0.1	0.106	
	Micro-filtration Cells (1)	9,557	2.966	0.7	3.247	
D4	36 Inch Raw Water Pipe (1)	11,634	10.000	1	1.675	67.12
	Rapid Mix Basin (1)	4,848	10.000	0.1	0.070	
	30 Inch Raw Water Pipe (1)	3,122	10.000	1	0.450	
	2010 Clarifier (1)	926,521	10.000	0.3	40.026	
	Recarbonation Basin (1)	183,003	10.000	0.5	13.176	
	Gravity Filters (4)	29,088	2.500	0.7	11.728	
D5	Clearwell/Transfer Pump Station (1)	109,102	10.000	0.5	7.855	223.30
	10 MG Ground Storage Tank (1)	4,987,042	10.000	0.3	215.440	

* These values are calculated on the T10 Details Sheet

TCEQ - (05-01-13) **CT STUDY**

CT STUDY TEMPLATE

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

CT Calculator Worksheet

PUBLIC WATER SYSTEM NAME:	City of Wichita Falls	**PLANT NAME OR NUMBER:**	mporary Direct Potable Reuse Water Treatment Pl
PWS ID No.:	2430001	**Date:**	April 25, 2014

DISINFECTION PROCESS PARAMETERS

APPROVED CT STUDY PARAMETERS						PERFORMANCE STANDARDS	
Parameters	Disinfection Zones					Log Inactivations	
	D1	D2	D3	D4	D5	Giardia lamblia Cysts	Viruses
Flow Rate (MGD)	7.500	7.500	2.966	10.000	10.000	2.0	5.0
T_{10} (minutes)	357.0	223.2	5.9	67.1	223.3		

DISINFECTION PROCESS DATA

INDIVIDUAL DISINFECTION ZONES										PLANT TOTAL		
Disinfectant	C (mg/L)	Flow (MGD)	Temp (^oC)	pH	CT_{CALC}	Giardia CT_{REQD}	Virus CT_{REQD}	Giardia Log	Virus Log	Giardia Log	Virus Log	Inact. Ratio
CLA *D1*	1.0	7.500	12.0	7.5	357.0	1108.0	1604.5	0.64	1.11			
CLA *D2*	1.0	7.500	12.0	7.5	223.2	1108.0	1604.5	0.40	0.70			
CLA *D3*	1.0	2.966	12.0	7.5	5.9	1108.0	1604.5	0.01	0.02	3.01	5.20	1.04
CLA *D4*	3.5	10.000	12.0	9.0	234.9	1108.0	1604.5	0.42	0.73			(V)
CLA *D5*	3.8	10.000	12.0	8.9	848.5	1108.0	1604.5	1.53	2.64			

SUBMITTED BY: _____ **Certificate No. and Grade:** _____ **Date:** _____

TCEQ - (05-01-13) **CT STUDY**

Enclosure E: Revised Direct Integrity Test Letter

Bryan W. Shaw, Ph.D, P.E., *Chairman*
Toby Baker, *Commissioner*
Zak Covar, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

June 27, 2014

Mr. Mark Southard, Purification Superintendent
City of Wichita Falls
P.O. Box 1431
Wichita Falls, Texas 76307

Subject: Public Drinking Water System Direct Integrity Test
City of Wichita Falls - PWS ID No. 2430001
Cypress Temporary Direct Potable Reuse Water Treatment Plant,
TCEQ Plant ID No. TP410791
Wichita County, Texas

CN600129316 RN105598759

Dear Mr. Southard:

The Texas Commission on Environmental Quality (TCEQ) Technical Review and Oversight Team (TROT) reviewed its April 30, 2012 letter that approved the Direct Integrity Test (DIT) calculations for the City of Wichita Falls 2008 Cypress Microfiltration/Reverse Osmosis Water Treatment Plant (2008 Cypress MF/RO WTP). This review was conducted as part of the overall review process for the City's proposed temporary Direct Potable Reuse (DPR) Project.

During the temporary DPR Project, the raw water for the 2008 Cypress MF/RO WTP will be supplied by a transmission line that delivers treated effluent from the River Road Wastewater Treatment Plant (RR WWTP) rather than by a raw water line from the Lake Kemp Headquarters Road Pump Station. Furthermore, the MF/RO WTP will discharge permeate to an RO Lagoon rather than directly to the 2010 Cypress WTP clearwell. The water from the RO Lagoon will then be blended with raw surface water from the Secondary Reservoir, which is supplied by water from Lake Kickapoo and Lake Arrowhead, at a location just upstream of the Cypress WTP splitter box. The blended water will be used as the raw water source for the 2010 Cypress WTP.

Essentially, the 2008 Cypress MF/RO WTP will become part of a Temporary Direct Potable Reuse Water Treatment Plant (Temporary DPR WTP) that will include:

- all of the treatment units at the 2008 Cypress MF/RO WTP, which includes a Flocc-Clarifier; five MF filters; and six two-stage RO units;
- all of the treatment units at 2010 Cypress WTP, which includes a splitter box that, under normal (non-DPR) operating conditions, distributes water between the 1961, 1987, and 2010 plants; a mechanical rapid mix; a Parshall Flume meter; a solids contact, slurry recirculation clarifier; a recarbonation basin; five dual-media gravity filters; and the small 2010 Clearwell and filtered water transfer pump station;
- a 10 million gallon (MG) 2010 Ground Storage Tank (GST) that has been isolated from the rest of the GSTs at the Cypress site; and
- the 2010 High Service Pump Station (HSPS) that discharges to the distribution system.

Direct Integrity Test Parameters

To comply with TCEQ rules and federal requirements, water treatment plants that use membranes for pathogen removal credit must submit a Surface Water Monthly Operating Report for Plants using Alternative Technologies (SWMOR-Alt) each month. This form, TCEQ Form 0102D, is an Excel® spreadsheet that must be customized based on site-specific design and operational conditions. When they create the customized SWMOR-Alt for the Temporary DPR WTP, the operators will need to enter the approved DIT parameters. The spreadsheet will use this information to compare the actual test conditions with the approved conditions and determine if the membrane units are continuing to meet minimum performance requirements.

To help the operators customize their SWMOR-Alt, we have prepared Table 1 which shows the approved minimum initial test pressure (P_{test}, or $P_{initial}$); the Upper Control Limit (UCL), which is the maximum allowable pressure decay rate allowed during a DIT; and the Log Removal Credit (LRC) that TCEQ has approved for the membrane units at the plant.

TABLE 1: DIRECT INTEGRITY TEST PARAMETERS FOR THE TEMPORARY DIRECT POTABLE REUSE WATER TREATMENT PLANT *(1)*

Initial Test Pressure (P_{test}) (psi)	Upper Control Limit (UCL) (psi/min)	Log Removal Credit (LRC) (log)
16.5	1.56	2.8

(1) Based on the data and calculations shown in Attachments 1 and 2.

Please note that the approved UCL for full-scale operation of the Temporary DPR WTP is slightly lower than that approved during the full-scale verification tests (FSVTs). The change in the UCL is the result of new information received during FSVT2 concerning the total surface area of the fibers in each of the membrane modules.

Because the water source for the Temporary DPR WTP is treated effluent from the RR WWTP, the source has been classified as a Bin 4 source with respect to state and federal monitoring requirements. **Consequently, the operators must conduct a DIT on each membrane unit at least once each day that it is used to treat water.**

If you have additional questions or comments concerning this letter, or if we may be of further assistance, please contact Mr. Joel Klumpp at (512) 239-4453, by e-mail at joel.klumpp@tceq.texas.gov, or by correspondence at:

Technical Review and Oversight Team (MC-159)
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

Sincerely,

Joel Klumpp, Team Leader
Technical Review and Oversight Team
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

Marlo Wanielista Berg, P.E.
Technical Review and Oversight Team
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

JPK/jcs

Enclosures: Attachment 1: Direct Integrity Test Parameter Calculations
Attachment 2: DIT Worksheet

cc w/ enclosure: Mr. Daniel K. Nix,
Operations Manager, Public Utilities
City of Wichita Falls

Attachment 1: Direct Integrity Test Parameter Calculations

City Of Wichita Falls
Cypress Temporary Direct Potable Reuse Water Treatment Plant

Direct Integrity Test (DIT) Resolution and Sensitivity Calculations:
Title 30 of Texas Administrative Code (TAC) §290.42(G)(3)(B) was amended in January 2008 to require removal credit awarded to a membrane filtration system to be based on the lower of either the log removal value (LRV) proven by a direct integrity test (LRV_{DIT}) or the log removal value proven by a challenge study ($LRV_{C\text{-}Test}$). The regulations describe the resolution and sensitivity requirements for the Direct Integrity Test (DIT). The values used in these calculations are required for the TCEQ to approve removal credits for the Cypress Temporary Direct Potable Reuse Water Treatment Plant (Temporary DPR WTP), which includes a Siemens Memcor S10V membranes system consisting of five microfiltration cells containing 504 modules each.

In accordance with the requirements in 30 TAC §290.42(G)(3)(B), detailed descriptions of the calculation methods and values for the DIT performed during the pilot study were provided. All formulas and methods of calculation are from the US EPA *Membrane Filtration Guidance Manual* (Guidance Manual) and are in accordance with the DIT requirements of 40 Code of Federal Regulations (CFR) §141.719(b)(3). To receive removal credit for *Cryptosporidium parvum* removal, the DIT procedure must be conducted at a pressure high enough to detect a 3-micron breach in the membrane. **Based on our review of the calculations and data submitted for the 2008 Cypress Microfiltration/Reverse Osmosis Water Treatment Plant and information provided during the FSVT2, TCEQ accepts the following values for DITs performed on the membrane system at the Temporary DPR WTP.**

Approved Initial Test Pressure (P_{test} or $P_{initial}$) for the Temporary DPR WTP membranes

1. **The TCEQ accepts 16.5 psi as the Minimum Test Pressure (P_{test}).**
   The approved minimum P_{test} is based on the following equation:

   Equation 4.1 (for a 3.0 micron defect): $P_{test} = (0.193 * \kappa * \sigma * \cos(\theta) + BP_{max})$

   where: κ = the membrane specific pore shape correction factor
   = 1.0;
   σ = the surface tension at the air-liquid interface
   = 74.9 dynes/centimeter;
   Θ = the liquid-membrane contact angle
   = 0 degrees; and
   BP_{max} = the maximum back pressure on the system
   = 2.0 pounds per square inch (psi).

   The TCEQ accepts the use of the most conservative values for κ, σ, and θ (as described above) and the $BP_{(max)}$ provided by the membrane vendor.

   Please note that the plant may conduct its DIT's at any pressure that is greater than or equal to the approved minimum test pressure shown above.

<u>Approved Upper Control Limit (UCL) for the Temporary DPR WTP membranes</u>

2. **The TCEQ approves the use of an upper control limit (UCL) of 0.98 psi/min.**
   The approved UCL is maximum allowable pressure decay rate during a DIT and based on the following equation from the Guidance Manual:

   Equation 4.17: Upper control limit (UCL) = $(Q_p \times ALCR \times P_{atm}) / (10^{LRC} \times V_{sys} \times VCF)$

   where: Q_p = the design capacity filtrate flow, calculated as shown below
   = 7,798 liters per minute (L/min);
   ALCR = the air-liquid conversion ratio, calculated as shown below
   = 40.23;
   P_{atm} = the absolute atmospheric pressure
   = 14.7 psia;
   LRC = the log removal credit demonstrated by the DIT
   = 2.8;
   V_{sys} = the volume of pressurized air in the system during a DIT, as discussed below
   = 3,122 L; and
   VCF = the volumetric concentration factor, as discussed below
   = 1.5

   a. **The TCEQ accepts 7,798 L/min as the Q_p.**
   The approved Q_p is based on information provided by the approved TCEQ pilot study dated August 5, 2002, and on the following equation.

   Maximum flow rate $(Q_p) = j \times A_m \times N$

   where: j = maximum approved flux, based on the approved pilot study
   = 19.60 gallons per day per square foot (gpd/ft^2);
   A_m = the total surface area of the membrane fibers in each membrane module, per the manufacturer specifications
   = 300.3 ft^2;
   N = number of membrane modules in a single membrane unit, or cell, based on the approved pilot study
   = 504;

   b. **The TCEQ accepts the use of 40.23 as the ALCR;**
   The approved minimum ACLR is based on the Darcy Pipe Flow Model assuming turbulent flow such as from a broken hollow fiber (as defined in the Guidance Manual) and the following equation from the Guidance Manual:

   Equation C.4: $ALCR = 170 \times Y \times \{(P_{test} - BP) \times (P_{test} + P_{atm}) / (460 + T) \times TMP\}^{1/2}$

   where: Y = Net expansion factor for compressible flow through pipe to a larger area
   = 0.910 (from Appendix C, Equation C.5 in the Membrane Filtration Guidance Manual)
   P_{test} = minimum initial test pressure for the DIT
   = 16.5 psi;
   P_{atm} = 14.7 psia;
   BP = 2.0 psi;
   T = Temperature
   = 95°F (35°C);
   TMP = Transmembrane pressure
   = 12.0 psi maximum (per manufacturer)

c. **The TCEQ accepts 3,122 L as the V_{sys}.**
The approved V_{sys} is based on the value provided by the membrane manufacturer.

d. **The TCEQ is approving a VCF of 1.5.**
Although the submerged membrane system operates in a particle deposition mode, site-specific investigations have demonstrated that VCF values for the submerged tanks vary with time and position. In lieu of a site-specific VCF study at the Temporary DPR WTP, the TCEQ will accept a VCF of 1.5 as a sufficiently conservative estimate.

<u>Approved Log Removal Credit for Temporary DPR WTP membranes</u>

3. **The TCEQ approves the use of 2.8 as the log removal credit for the membranes**
As noted previously, *the* LRC for a membrane filtration system is based on the lower of either the log removal value proven by a direct integrity test (LRV_{DIT}) or the log removal value proven by a challenge study ($LRV_{C\text{-}Test}$). The 2.8-log removal credit is based on this state and federal requirement and the information provided below.

a. **The TCEQ accepts the use of 2.8 as the LRV_{DIT}.**
The approved LRC_{DIT} is based on the following equation from the Guidance Manual:

Equation 4.9: $LRV_{DIT} = \log [(Q_p \times ALCR \times P_{atm}) \div (\Delta P_{test} \times V_{sys} \times VCF)]$

where: Q_p = the design capacity filtrate flow, as previously calculated
= 7,798 liters per minute (L/min);
ALCR = the air-liquid conversion ratio, as previously calculated
= 40.23;
P_{atm} = the absolute atmospheric pressure
= 14.7 psia;
ΔP_{test} = the maximum allowable pressure decay rate during the DIT
= the upper control limit (UCL), which was previously calculated
= 1.56 psi/min
V_{sys} = the volume of pressurized air in the system during a DIT, as previously discussed
= 3,122 L; and
VCF = the volumetric concentration factor, as previously discussed
= 1.5

b. **The TCEQ accepts the use of 2.8 as the log removal credit demonstrated by a challenge study test ($LRV_{C\text{-}test}$).**
The approved $LRV_{c\text{-}test}$ is based on the log removal credits for the Temporary DPR WTP which were approved in TCEQ's letter of November 6, 2013.

<u>Membrane Replacements</u>

4. **Prior to any membrane replacement at the Temporary DPR WTP, the City must submit, for review and approval by the TCEQ, the membrane's Challenge Test Log Removal Value ($LRV_{C\text{-}test}$), Non-Destructive Performance Testing (NDPT) method, and corresponding Quality Control Release Value (QCRV), as well as any proposed changes to the Direct Integrity Test Log Removal Value (LRV_{DIT}) calculations.**
Based on the requirements of the US EPA's Long Term 2 Enhanced Surface Water Treatment Rule (LT2) and TCEQ's 2008 revised rules, each Texas public water system installing or replacing membranes that are used for microbiological treatment **after April 1, 2012**, can only continue to receive removal credit for *Cryptosporidium* oocysts and *Giardia lamblia* cysts if they meet the specifications in 30 TAC §290.42(g)(3)(A) and §290.111.

Attachment 2: DIT Worksheet

City of Wichita Falls - PWS 2430001
Cypress Temporary Direct Potable Reuse Water Treatment Plant - TCEQ Plant ID TP410791

U.S. Filters/Memcor Model 540 S10V Membrane

P_{test} (psi)	ALCR	LRV_{DIT}	UCL psi/min
16.5	**40.23**	**2.80**	**1.56**

Flux rate (gal/sf-day)*	sf**	modules*	# of Units
19.60	300.3	504	5

*from pilot study

** per the manufacturer

Q_p (L/min)	V_{sys} (L)	VCF
7798.16	3122.00	1.5

P_{test} Minimum Pressure Test (Equation 4.1)	**P_{test}** (psi)	κ Pore Shape Correction Factor	Σ Surface Tension	cos θ liquid--membrane contact angle	BP_{max} maximum backpressure (psi)
$P_{test} = (0.193 * \kappa * \sigma * \cos\theta) + BP_{max}$	**16.5**	1	74.9	0	2

ALCR Turbulent Flow (Equation C.4)	**ALCR**	Y	P_{atm} (psia)	T (^oF)	BP_{max} (psi)	TMP (psi)
$ALCR = 170 * Y * Sqrt[((P_{test} - BP) * (P_{test} + P_{atm})) / ((460+T)*TMP)]$	**40.23**	0.910	14.7	95	2	12

UCL (Equation 4.17)	**UCL**	Q_p L/min	P_{atm} (psia)	LRC	V_{sys} (L)	VCF
$UCL = (Q_p * ALCR * P_{atm}) / (10^{LRC} * V_{sys} * VCF)$	**1.56**	7798.16	14.7	2.8	3122.00	1.5

LRV_{DIT} Sensitivity (Equation 4.9)	**LRV_{DIT}**	Q_p L/min	P_{atm} (psia)	ΔP_{test} (psi/min)	V_{sys} (L)	VCF
$LRV_{DIT} = \log((Q_p * ALCR * P_{atm}) / (\Delta P_{test} * V_{sys} * VCF))$	**2.80**	7798.16	14.7	1.56	3122.00	1.5

	L/gal	**min/day**
Conversion Factors	3.78541	1440

Note: Per the manufacturer, the smallest verifiable pressure decay rate (ΔP_{test}) is 0.1 psi/min, which corresponds to a maximum calculated DIT_{LRV} of 3.99-log.

Enclosure F: Updated Use of Chloramines Exception Letter

Bryan W. Shaw, Ph.D., P.E, *Chairman*
Toby Baker, *Commissioner*
Zak Covar, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

June 27, 2014

Mr. Russell Schreiber, P.E., Director of Public Works
City of Wichita Falls
P.O. Box 1431
Wichita Falls, Texas 76307-1431

Re: City of Wichita Falls – PWS ID No. 2430001
Revised Approval for Use of Chloramines
Wichita County, Texas
RN 600129316 | CN 105598759

Dear Mr. Schreiber,

On May 31, 2012, the Texas Commission on Environmental Quality (TCEQ) issued the City of Wichita Falls (City) public water system the most recent exception to use chloramines as a disinfectant in accordance with the requirements specified in Title 30 of the Texas Administrative Code (30 TAC) §290.42(e)(3)(G). The TCEQ has updated the monitoring requirements for public water systems that distribute chloraminated water. As part of our review of the City's proposed direct potable reuse project, we are **granting** approval to continue the use of chloramines as a disinfectant under the following updated conditions:

1) **Notification:** We note that the City has been distributing chloraminated water for many years. Consequently, public notice of the use of chloramines will be required only for new customers. Each of the City's new customers, both retail and wholesale, must be notified of the use of chloramine disinfectant at least 14 days prior to providing this treated water to the customers. This notification must contain the exact wording included in Enclosure 1 of this letter: *Sample Language for Notification Upon Changing from Free Chlorine to Chloramines*.

2) **Distribution Residual:** Please note the minimum distribution residual shall be maintained at 0.5 milligrams per liter (mg/L) chloramine residual (measured as total chlorine). When using chloramines, maintain a total chlorine residual of at least 0.5 mg/L (measured as total chlorine) throughout the distribution system, including the far reaches of the distribution system, at all times, as specified in 30 TAC §290.110. When using free chlorine to shock the system, maintain a free chlorine residual of at least 0.2 mg/L.

3) **Periodic testing:** Monochloramine, total chlorine, free ammonia and nitrite/nitrate levels need to be tested periodically to ensure that an adequate disinfectant residual is being maintained and nitrification is not occurring in the distribution system. Nitrification can result in loss of residual, regrowth of bacteria, odor problems, and elevated nitrate/nitrite levels that may exceed the safe levels, putting infants at risk. Consequently, systems using chloramines must meet the following requirements as a condition of the exception:

The plant must obtain a test kit(s) or use a laboratory procedure that can measure the following:

a) Free Ammonia—Acceptable analytical methods are EPA 350.1 and SM 4500-NH_3-G.
b) Monochloramine—The kit or procedure must have the ability to distinguish between monochloramine and other forms of total chlorine using methods SM4500-Cl-D, -F, and -G.
c) Total Chlorine—See 30 TAC §290.110(d)(2), effective November 8, 2012 for acceptable analytical methods.
d) Free Chlorine—The water system must have the ability to measure free chlorine when the water system switches from chloramines to free chlorine during a "burnout." See 30 TAC §290.110(d)(1), effective November 8, 2012 for acceptable analytical methods.
e) Nitrite/Nitrate—You must either obtain a kit for measuring nitrite and nitrate OR identify a laboratory that can perform nitrite and nitrate analysis and can provide you with results within 48 hours of sample delivery. Acceptable analytical methods are EPA 300.0, 300.1 and SM 4110 B.

The water system must, at a minimum, measure and record the following[a]:

	At **Entry Point(s)** to the Distribution System	In the **Distribution System**	Downstream of any Chlorine or Ammonia **Injection Points**
Free Ammonia	Weekly	At least monthly [c]	Weekly and before and after adjusting the chlorine or ammonia feed rate
Mono-chloramine	Weekly	At least monthly [c]	Weekly and before and after adjusting the chlorine or ammonia feed rate
Total Chlorine	Weekly	Daily [d]	Weekly and before and after adjusting the chlorine or ammonia feed rate
Nitrite and Nitrate	As needed to set baseline, then quarterly [b]	At least quarterly, and in response to action level triggers	Routine sampling not required [b]

a. *If levels are below disinfectant Action Levels, or over nitrite/nitrate or other Base Line levels, more frequent monitoring will be needed.*
b. *Different requirements apply to the City's Direct Potable Reuse Water Treatment Plant (DPR WTP). For DPR WTP requirements, see the approval letters specifically for that plant. However, when the City is no longer treating wastewater effluent at the Cypress Water Treatment Plant, these requirements will apply to that facility.*
c. *When collecting a routine sample such as a bacteriological or disinfectant residual sample. The free ammonia and monochloramine should be measured at the same time.*
d. *Total chlorine must be collected daily (based upon the size of the system and source of water) at locations representing the entire distribution system in accordance with 30 TAC §290.110.*

4) **Nitrification action plan:** You must set system-specific action levels to detect and prevent nitrification. If concentrations are inconsistent with system-specific action levels, corrective action shall be taken. For examples of corrective actions, please see Enclosure 2: *Monitoring Plan Alert and Action Levels*. You must document in writing the system-specific plan for monitoring free ammonia, monochloramine, total chlorine, and nitrite/nitrate; and the levels for taking corrective action. This information shall be maintained as a part of the systems

monitoring plan [30 TAC §290.121] and provided to operators and to the TCEQ upon request.

Additional information is available on the TCEQ web page, ***Controlling Nitrification in Chloraminating Water Systems:***

www.tceq.texas.gov/drinkingwater/disinfection/nitrification.html

5) **Record retention:** Records of monochloramine, total chlorine, ammonia, nitrite, and nitrate monitoring described above must be maintained with the system's disinfectant records for a period of three years and made available to the TCEQ staff upon request as specified in 30 TAC §290.46(f)(3)(B).

6) **Notification of reversion to free chlorine:** The TCEQ monitors disinfection byproduct (DBP) levels at all public water systems. The City may find that it needs to revert back to free chlorine periodically to control the levels of nitrifying bacteria in its distribution system. This reversion process, if accomplished in a month or less, does not reflect normal operating conditions and may result in temporary increases in DBP levels. Consequently, the TCEQ may adjust a system's DBP monitoring schedule during these events. To ensure that DBP samples are not collected under abnormal operating conditions, you must notify us of any temporary reversion back to free chlorine. These notices should be issued in the following manner:

   a) The notice should state the date that the system will begin distributing water with a free chlorine residual as well as the anticipated duration of the event.

   b) The notice to TCEQ should be sent via email to DBP@tceq.texas.gov, fax to (512) 239-6050, phone at (512) 239-4691, or correspondence to:

      Drinking Water Quality Team (MC 155)
      Texas Commission on Environmental Quality
      P.O. Box 13087
      Austin, Texas 78711-3087

   Public water systems that wholesale chloraminated water are required to notify wholesale customers in writing or via fax that they are temporarily switching to free chlorine at least 14 days before the reversion begins.

7) **Chlorine and Ammonia Feed Points**: In order for chloramines to provide a stable disinfectant residual, the manner in which they are injected should allow adequate mixing. Chlorine is normally fed prior to ammonia in order to allow inactivation of viruses and to avoid production of N-nitroso-dimethylamine (NDMA), a disinfection byproduct. After chlorine injection, mixing should occur prior to ammonia injection. This may be accomplished by a static in-line mixer, or by at least five minutes of detention time in turbulent flow. A sampling location should be provided after chlorine injection and mixing, but prior to ammonia injection. A sampling location should be provided after ammonia injection and mixing to represent the fully-formed chloramine levels. The TCEQ understands that the City's DPR WTP is subject to special monitoring and reporting conditions related to the use of pre-formed chloramines established through the DPR WTP exception approval letter. For DPR WTP requirements, see the approval letters specifically for that plant. However, when the City is no longer directly treating wastewater effluent at the Cypress Water Treatment Plant, these requirements for addition of chlorine prior to ammonia will apply.

All liquid chemicals must have approved containment, all chemical injection solutions must be absent of any cross connections or potential for back flow, and the system must have documentation that the TCEQ has either approved the disinfection facilities, or allowed those facilities to be constructed without written approval. Additionally, all chemical storage and feed facilities must comply with 30 TAC §290.42(f)(2). All chemicals used must be certified under American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 60. This is consistent with the requirement that all chemicals used in treatment of water supplied by public water systems must conform to ANSI/NSF Standard 60 for direct additives. Conformance with these standards must be obtained by certification of the product by an organization accredited by ANSI as specified in 30 TAC §290.42(j).

All exceptions are subject to periodic review and may be revoked or amended if warranted. A copy of this letter and all related monitoring data must be maintained with the water system's records for as long as this exception is in effect. These records must be made available to TCEQ staff upon request.

Please note that this exception is not intended to waive compliance with any other TCEQ requirement in 30 TAC Chapter 290. This exception cannot be used as a defense in any enforcement action resulting from noncompliance with any other requirement of 30 TAC Chapter 290.

If you have questions concerning this letter, or if we can be of additional assistance, please contact Mr. David Simons, P.E., by e-mail at david.simons@tceq.texas.gov, or by telephone at (512) 239-3154, or by correspondence at the following address:

Technical Review & Oversight Team (MC 159)
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Sincerely,

Joel Klumpp, Team Leader
Technical Review & Oversight Team
Plan and Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

JPK/dfs

Enclosures
Enclosure 1: Public Notice Materials
Enclosure 2: Monitoring Plan Alert and Action Levels

cc: Honorable Glenn Barham, Mayor, City of Wichita Falls, P.O. Box 1431, Wichita Falls, TX 76307-1431

Enclosure 1: Public Notice Materials

A public water system (PWS) must notify its customers, in writing, at least 14 days prior to commencing the use of chloramines. This notification must contain the Sample Language for Notification Upon Changing from Free Chlorine to Chloramines included below. The notification should be provided to the news media, renal disease facilities, dialysis clinics, hospitals, physicians, local health departments, etc.

Sample Language for Notification Upon Changing from Free Chlorine to Chloramines

*"On **<Date>**, the **<Water System Name>** will be changing the disinfectant that we use from chlorine to chloramines. This change is intended to benefit our customers by reducing the levels of disinfection byproducts (DBPs) in the system, while still providing protection from waterborne disease.*

However, the change to chloramines can cause problems to persons dependent on dialysis machines. A condition known as hemolytic anemia can occur if the disinfectant is not completely removed from the water that is used for the dialysate. Consequently, the pretreatment scheme used for the dialysis units must include some means, such as a charcoal filter, for removing the chloramine prior to this date. Medical facilities should also determine if additional precautions are required for other medical equipment. In addition, chloraminated water may be toxic to fish. If you have a fish tank, please make sure that the chemicals or filters that you are using are designed for use in water that has been treated with chloramines. You may also need to change the type of filter that you use for fish tanks."

OPTIONAL: "*When the chloraminated water first flushes out the chlorinated water there may be a slight taste and odor, and possibly discoloration for a short period of time. This will not compromise the safety of the water."*

Spanish Language for Notification Upon Changing from Free Chlorine to Chloramines

*"El **<Date>**, el **<Water System Name>** cambiará el desinfectante de cloro que usamos a otro de cloramina. El propósito de este cambio es beneficiar a nuestros clientes reduciendo los niveles de los productos secundarios relacionados a la desinfección (DBPs) en el sistema, proporcionando al mismo tiempo la protección contra las enfermedades originadas por los gérmenes del agua.*

No obstante, el cambio a cloramina puede causar problemas a las personas cuya vida depende de las máquinas de diálisis. Si el desinfectante no es completamente eliminado del agua que se usa para la diálisis, puede conducir a una anemia hemolítica. Por lo tanto, el esquema de tratamiento previo usado por las unidades de diálisis debe incluir algunos medios, tales como filtros de carbón, para eliminar la cloramina antes de esta fecha. Las instituciones médicas deben determinar si otros equipos médicos también pueden requerir precauciones adicionales. Además, el agua con cloramina podría ser tóxica para los peces. Si tiene un tanque para peces, asegúrese de que los filtros o los productos químicos que están siendo usados están diseñados para ser usados en agua que ha sido tratado con cloramina. También puede ser necesario cambiar el tipo de filtro que usa para el tanque."

OPCIONAL: *"Al tiempo de la primera aspesión del agua cloraminada, se puede percibir por periodos cortos de tiempo algún sabor, olor y posiblemente alguna pérdida del color del agua. Esto no compromete la seguridad del agua."*

Important notes:

1. The PWS may not begin using chloramines prior to the date shown in the notice.
2. The TCEQ does not currently require the PWS to include the name or contact number of a PWS employee that the customers can contract if they have questions. However, several systems have included this additional information as a courtesy to its consumers.

Some PWSs find it beneficial to periodically convert back to free chlorine for 21-28 days once or twice each year. This procedure can minimize the growth of nitrifying bacteria and make it easier to maintain an adequate chloramine residual during the rest of the year. If the PWS wishes to use this procedure, it must notify the TCEQ and any wholesale customer prior to making this type of temporary switch. The TCEQ also suggests that the PWS notify its customers just days before making the temporary change because this procedure occasionally results in slight changes in the taste and odor of the water. However, it does not have to reissue the public notice described above.

Texas Commission on Environmental Quality
CERTIFICATION of DELIVERY of PUBLIC NOTICE to CUSTOMERS

Public Water System (PWS) Name: _____

PWS I.D. (7-digit number required): _____

Date of Change to Chloramines: _____

I,_____, certify that the following information is true and accurate: (signature)

- The public water system named above has distributed the Public Notice (PN) for changing the disinfectant to chloramines at least 14 days prior to the change by mail or direct delivery to bill-paying customers; **and**
- The information contained in this public notification is correct and complies with required public notification condition in the letter authorizing the public water system to use chloramines; **and**
- The above system has made an adequate good-faith effort to reach non-bill-paying consumers by appropriate methods as follows (check all that apply):

_____ Posting the PN on the Internet at www._____

_____ Mailing the PN to postal patrons within the service area that do not receive a bill

_____ Advertising the PN in news media

_____ Publication of PN in local newspaper

_____ Posting the PN in public places

_____ Delivery of multiple copies to single bill addresses serving several persons

_____ Delivery to community organizations

Date of Delivery to Customers: _____

Certified by: Name (print): _____

Title: _____

Phone No: _____ Date: _____

Signature: _____

Send one copy of this completed form and one copy of the Public Notification that you delivered to your customers to:

Plan and Technical Review Section - Mail Code 159
Texas Commission on Environmental Quality
P. O. Box 13087
Austin, Texas 78711-3087

Enclosure 2: Monitoring Plan Alert and Action Levels

Note: *This is intended to help you develop a system-specific flow chart for your system. You need to set system specific baseline and action levels and responses. If you don't understand the reason for a change or corrective action recommended by this flow chart, review your training and/or contact the TCEQ to request on-site assistance.*

Setting Baseline & Action Levels

Monitor daily/weekly at sites representative of distribution system (in milligrams per liter (mg/L)) for disinfectants and ammonia:

- Total Available Chlorine (**TAC** or "combined" chlorine)
- Monochloramine ("**Mono**")
- Free Available Ammonia (**FAA**)

Set **Action Levels (ALs)** for each disinfection chemical:

▶**AL-1:** Normal operating level.
Exceeding an AL-1 triggers follow up with additional sampling and possibly dose change.

▶**AL-2:** Moderately off-spec water.
Exceeding the AL-2 triggers additional sampling and moderate corrective action such as flushing or changing chemical feed.

▶**AL-3:** Potential risk, potential violation.
Exceeding the AL-3 triggers immediate corrective action, additional sampling, and potential notification of customers

Monitor weekly/monthly at entry point and representative distribution site(s):

- Nitrite (**NO2**) (& Nitrate (**NO3**)) *(Labs do these tests together)*
- Heterotrophic Plate Count (on R2A agar) (**HPC**) measured in colony-forming units per milliliter (cfu/mL) *(Recommendation, not requirement)*

Determine **Baselines (BLs)—**the system-specific background level for naturally occurring nitrate, nitrite and HPC. The BL will be the level one trigger (like AL-1) for nitrite, nitrate, and HPC.

▶**BL:** Baseline. The normal, naturally occurring level of a constituent.
▶**AL-2:** Moderately off-spec water. Triggers moderate action.
▶**AL-3:** Potential risk, potential violation. Triggers immediate correction

EXAMPLE Chloramine Alert and Action Levels

Parameter	Target at EP	Target in Distribution	AL-1: Alert	AL-2: Action Needed	AL-3: Violation Possible
TAC (mg/L)	≥ 2 mg/L	≥ 1.6 mg/L	1.4 mg/L	1 mg/L	0.5 mg/L
NO2 (mg/L)	At baseline	At baseline	0.1 mg/L over baseline	0.2 mg/L over baseline	0.4 mg/L over baseline
FAA (mg/L)	~0.1 mg/L	~ 0.3 mg/L	0.5 mg/L	1 mg/L	2 mg/L
HPC (mg/L)*	< 100 cfu/mL	< 100 cfu/mL	> 100 cfu/mL	> 200 cfu/mL	> 500 cfu/mL

* HPC is recommended, but not required. HPC varies a great deal between systems.

This is an example. You must develop system-specific levels and procedures.

Monitor:
- TAC,
- Mono,
- FAA,
- NO2,
- HPC

Desired conditions:
- TAC ≥ AL-1
- TAC ≈ Mono
- FAA ≤ AL-1
- NO2 ≤ BL
- HPC ≤ BL

Check:
- Is TAC ≥ **AL 1 ?**
- Is TAC ≈ Mono **?**
- Is FAA ≤ **AL 1 ?**
- Is NO2 ≤ **BL ?**
- Is HPC ≤ **BL ?**

YES → No change

NO → Perform appropriate Level **1**, Level **2**, or Level **3** response

Level 1 Conditions — **Level 1 Responses**

- TAC < **AL-1** → Increase **both** chlorine and ammonia
- FAA > **AL-1** → Either increase chlorine **or** decrease ammonia
- TAC > Mono → Either increase ammonia **or** decrease chlorine
- NO2 > **BL** → Check for area of increased NO2. Check NO3 and
- HPC > **BL** →

Are levels back to normal? If so, done. If not, repeat / increase

Level 2 Conditions — **Level 2 Responses**

- TAC < **AL-2** But otherwise ok →
- FAA > **AL-2** →
- NO2 **> AL-2** →
- HPC **> AL-2** →

Perform Level 2 Responses
- Check and adjust chemicals like with Level 1.
- Continue monitoring and communication. Increase monitoring close to the sample site that shows the AL-2 issue. Identify the area in the distribution system that is impacted.
- Reduce water age. Sample tanks. Deep-cycle tanks. Operate storage at lower levels.
- Flush impacted areas distribution system.

Level 3 Conditions — **Level 3 Responses**

- TAC < **AL-3** →
- FAA > **AL-3** →
- NO2 **> AL-3** →
- HPC **> AL-3** →

Perform Level 3 Responses
- Check and adjust chemicals like with Level 1.
- Identify the area in the distribution system that is impacted like with Level 2. Sample tanks.
- Drain storage tanks. Reduce water age. Deep-cycle tanks. Operate storage at lower levels.
- Flush distribution system. Use unidirectional flushing (UDF)
- Determine if reversion to free chlorine is needed; implement if necessary. Notify customers if so.
- Perform system-wide “burn out” with free chlorine.

The following table is provided for your convenience, to record your site-specific Alert, Action, and Base Line levels:

BLANK Chloramine Alert and Action Levels

Parameter	Target at EP	Target in Distribution	AL-1: Alert	AL-2: Action Needed	AL-3: Violation Possible
TAC (mg/L)					0.5 mg/L
NO2 (mg/L)					
FAA (mg/L)					
HPC (mg/L)*					

* Remember, HPC is recommended, but not required. HPC varies a great deal between systems.
** You can use this blank table to document your system-specific levels.

Table 1. Critical Control Parameters for Chloramination

Parameter	Level or ratio	Reason
Total chlorine (TAC)	0.5 mg/L	Minimum regulatory limit.
Ratio of total chlorine to Monochloramine (TAC:Mono)	Plus or minus 10%	If most of the chlorine is present as monochloramine (as desired), the levels of total chlorine and monochloramine should be almost equal—within 10% is good.
Ratio of total chlorine to Free ammonia (TAC:FAA)	2 to 3 times	If the total chlorine is 2 to 3 times the free ammonia, it means there is an effective disinfectant residual present to help control potential nitrifying organisms.
Free available ammonia (as nitrogen) (FAA)	Low	Industry recommendations range from 0 to 0.3 mg/L free ammonia. Some systems operate with as much as 0.5 mg/L. The more ammonia that is present, the more 'food' available for nitrifying organisms. **NOTE:** Most test equipment can only measure up to 0.55 mg/L. If you measure 0.55 mg/L, you must dilute the sample and calculate the actual concentration.
	Present	When there is a little bit of free ammonia present, it indicates that monochloramine is the dominant species, as desired.
Free chlorine (FCL)	Very low/ absent	Most methods show a very small amount of free chlorine in every test—a "drop." The level should not be over about 0.1 mg/L, or it is recommended that the method be checked for accuracy. Letting a sample sit--for example to allow bubbles to dissipate--can give falsely high free chlorine readings
Nitrite (NO2-)	Equal to baseline	Most source water contains trace amounts of nitrite or nitrate, or both. Low levels are not of concern, but if levels within the distribution system are greater than the baseline levels, it can indicate either nitrification or intrusion of fecal matter. A change of 0.1 to 0.2 or 15% should be followed up on with additional sampling to verify whether nitrification is occurring.
Nitrate (NO3-)		

Entry Point Nitrite/Nitrate Data

The TCEQ requires periodic nitrite and nitrate monitoring for all public water systems. You may be able to use the entry point nitrite and nitrate levels from this compliance monitoring as your Base Line levels, particularly if the entry point represents a single well.

If your entry point(s) represent water from more than one well, you will need to do monitoring determine the contribution of nitrite and nitrate from each source. Then, if you have an unusual nitrite or nitrate reading in the distribution system, you will be able to tell if it is due to a particular well or other source.

The TCEQ's data for your system is available on-line on our Drinking Water Watch web site at:

dww.tceq.state.tx.us/DWW/

Data management

At a minimum, you must record the measured distribution system levels by hand and keep those data sheets. A blank example of a chloramine data sheet is provided below:

Blank Example of a Chloramine Data Sheet

PWS Name _____ **Operator name _____**

(Target Free Chlorine = ____ mg/L) **Date_____**

Location Address	Total Chlorine	Mono-chlor-amine	Free Ammo-nia	Free Chlor-ine	Mono: Total %	Trigger Exceeded? Y/N	Nitrite/Nitrate (if triggered, note date and time of collection)	
							Nitrite	Nitrate

Note – this data sheet may work better if you format it in "landscape" instead of "portrait."

You may be able to track the data better and optimize your system by recording it in a computer spreadsheet program like Microsoft Excel or Corel QuattroPro. The benefit of those programs is that they can be used to do calculations of the percent of monochloramine, the ratio of total chlorine to ammonia, and other useful calculations.

Record retention

You must retain your distribution monitoring for at least three years, and have it available for the TCEQ's Regional Investigators to look at during their visits. If you use an electronic record keeping system, you should be able to provide printouts to the TCEQ upon request. Other considerations for electronic recordkeeping include:

- Back up. You should routinely back up your data. Computer glitches can lose your data.
- Organization: You should give files unique names that clearly specify the data they contain, like the specific month and year. A good example of a file name is "2014-March-ChloramineData.xlsx." An example of a bad file name is "data.xlsx."

Enclosure G: Unregulated Contaminants of Concern

Enclosure G
Unregulated Contaminants of Concern
City of Wichita Falls - PWS 2430001
June 27, 2014

Tables G-1 and G-2 contain are currently unregulated chemical and microbiological contaminants of concern that the TCEQ recommends the system monitor quarterly.

The City must provide the results of any sampling performed under the EPA's Unregulated Contaminant Monitoring Rule –3 (UCMR3) to the TCEQ within two weeks of receiving those results.

For monitoring of unregulated contaminants — Table G-1: Microbials and Table G-2: Chemicals—the system should identify the analytical methods that they wish to use, and propose those to the TCEQ. If you have any questions concerning this enclosure, please contact Dr. Alicia Diehl by e-mail at Alicia.Diehl @tceq.texas.gov or by telephone at (210) 403-4053.

Table G-1: Microbals

MICROBIALS	Analytical Methods[1]	Regulated
Viruses[2]		
Rotavirus	1	No[2]
Poliovirus	1	No[2]
Echoviruses	1	No[2]
Coxsackie viruses group A and B	1	No[2]
Adenovirus	1	No[2]
Hepatitis A	1	No[2]
Protozoans		
Naegleria fowleri	4	No
Cyclospora	4	No
Microsporidia (fungus)	4	No
Bacteria		
Enterococci	1600, 1106	No
Salmonella (and / or Shigella, Campylobacter, Pseudomonas[5])	1200	No
Aeromonas	1605	No
Heterotrophic plate count (indicator)	9215	No

* Highly recommended for sampling
1 Method listed is an EPA method unless otherwise noted. List of methods is not exhaustive, but is included for reference only. If a method is not listed, the City will need to research and propose a method to TCEQ.
2 Viruses are regulated as a group through treatment technique requirements at treatment plants for the EPA's Surface Water Treatment Rules and Ground Water Rule
3 UCMR 3. Regulations cover distribution levels and removal requirements. Regulatory monitoring required, but no health-based standard set.
4 Methods are in development.

Table G-2: Chemicals

CHEMICALS	Method[1]	Regulated
Disinfection byproducts		
*Nitroso-dimethylamine (NDMA)	521	UCMR3[3]
*Nitroso-pyrolidine (NPYR)		
Organic chemicals		
***Pharmaceutical indicators:** 17-α-ethynylestradiol (ethinyl estradiol), 16-α-hydroxyestradiol (estriol), equilin, estrone, testosterone, 4-androstene-3,17-dione	539	UCMR3[3]
***Chemicals of human origin:** Perfluorooctanesulfonic sulfonate (PFOS), perfluorooctanoic acid (PFOA) perfluorononanoic acid (PFNA) perfluorohexanesulfonic acid (PFHxS) perfluoroheptanoic acid (PFHpA) perfluorobutanesulfonic acid (PFBS)	537	UCMR3[3]
*Sucralose	[2]	No
1,4 dioxane	522	No
Caffeine	1694	No
N,N-Diethyl-meta-toluamide (DEET)	633	No
Gemfibrozil	1694	No
Iopromide	1694	No
Inorganic chemicals		
Perchlorate[4]	314	UCMR2[3]

* Highly recommended for sampling.
1 Method listed is an EPA method unless otherwise noted. List of methods is not exhaustive, but is included for reference only.
2 Acceptable methods exist but have not yet been approved by the EPA. The City should propose the method they plan to use.
3 Regulatory monitoring required, but not a health-based standard set.
4 The EPA has indicated that a maximum contaminant level will be promulgated for perchlorate. EPA will be working with stakeholders to develop a maximum contaminant level.

Enclosure H: Industrial Contributions to the RR WWTP

Enclosure H
Industrial Contributions to the RR WWTP
City of Wichita Falls - PWS 2430001
June 27, 2014

There is a concern regarding the variability and unpredictability of certain industrial discharges into the headworks of the RRWWTP during the operation of the temporary DPR WTP. In order to increase the pretreatment measures in place to protect the supply of drinking water, human health, and the environment, the TCEQ recommends that the City take the following actions related to industrial discharges into the RRWWTP:

1. Do not accept hauled waste at the RRWWTP during the operation of the temporary DPR WTP.
2. Do not accept Underground Storage Tank (UST) clean-up waste at the RRWWTP during the operation of the temporary DPR WTP.
3. Either do not accept waste streams from the Liquid Waste Processing (LWP) Facility at the RRWWTP during the operation of the DPR WTP or implement additional precautions, such as follows.
   a. Require additional monitoring at the facility to determine compliance with local limits;
   b. Require additional safeguards to prevent untreated waste from being discharged to the RRWWTP;
   c. Require the facility to submit copies of manifests of every load of waste delivered to the facility;
   d. Increase sampling frequency for biochemical oxygen demand (BOD) and require the facility to sample for fats, oils, and grease (FOG);
   e. Increase inspection frequency of the facility;
   f. Require the LWP facility to perform a comprehensive evaluation of each waste stream source for existing waste streams and evaluate how such waste streams impact the LWP's treatment process and its ability to comply with local limits;
   g. Require the LWP facility to inform the city of the results of the evaluation and obtain written approval from the city prior to accepting new waste streams. The city should verify the categorical determination of LWP and revise the industrial discharge permit as necessary to reflect accurate categorization, effluent permit limit limits, and other conditions or requirements; and
   h. The city should pay close attention to the definition of centralized waste treatment (CWT) wastewater and CWT wastewater sources.
4. Minimize any new users discharging to the RRWWTP during the operation of the temporary direct potable reuse facility. All new industrial contributions, if any, must complete a Baseline Monitoring Report of their wastewater and be evaluated for their ability to meet the City's technology-based effluent limits (TBLLs). The City should

require additional pretreatment facilities at the industry, as necessary, to comply with those limits. If the Baseline Monitoring Report shows that compliance with TBLLs cannot be met, new industries shall not be allowed to enter the RRWWTP collection system.

5. Require all Significant Industrial Users (SIUs) to notify the City in advance of any planned action to substantially increase the volume or change the characteristic of their discharges to the RRWWTP. The City must carefully evaluate these notifications and determine whether the proposed changes may cause problems. In such cases, these changes should be denied.

6. Demonstrate how the current TBLLs are still protective of the RRWWTP and receiving streams before the beginning of the diversion of the effluent to be used as a supply source for the DPR WTP.

7. Continue to inspect, on a regular basis, the Sheppard Air Force Base (SAFB) to be aware of all the waste streams in each building including those operated by any tenants located at SAFB. Please pay close attention to any medical operations. Coordinate the investigation with the TCEQ Pretreatment Compliance Investigator of TCEQ's Region 4 Office. Please provide copies of inspection reports to TCEQ that include all the waste streams in each building that discharge and how each waste stream is or will be managed before the end of the full scale verification study.

8. Continue to require the facilities permitted and regulated under the Metal Finishing Point Source Category (40 CFR Part 433) to submit and implement a Toxic Organics Management Plan (TOMP) on an annual basis and obtain written approval from the city. The City should also continue to inspect these facilities for the absence or presence of toxic organic chemicals. The industries shall provide required certifications each month during the operation of the temporary DPR WTP. The TOMP will aide to manage toxic organics and prevent their discharge to the sanitary sewer system. During the inspections of these types of industries, the City should also conduct a thorough review of chemicals used to ensure that no chemicals are being used or stored at the facilities that contain any TTOs and verify procedures stated in the TOMP are adequate and are being followed. The City needs to require the industry to make any modifications necessary in order to ensure that toxic organics will not be introduced into the sanitary sewer system. Modifications to the TOMP need to be reviewed and approved by the City before the industries make the changes to their operations.

9. Continue to require all permitted SIUs to develop and implement a Slug Discharge Control Plan (SDCP) that includes detailed accidental spill cleanup and notification requirements. For facilities that currently have an approved SDCP, evaluate its effectiveness and require modifications as needed to ensure that slug loads will be prevented and that adequate procedures exist to respond to worst-case accidental spills and notification procedures to the City's pretreatment program and RRWWTP personnel if a slug discharge or accidental spill occurs. The city shall approve all SDCPs and revisions to them in writing.

10. Continue to require a Spill Prevention, Control, and Countermeasures (SPCC) Plan of every industry permitted by the City.
11. Notify all permitted or regulated industrial users (IUs) of the project, reinforce the need to comply with all the pretreatment regulations, and make them aware of potential implications that changes in their process could impact the City's ability to use wastewater effluent as a source of water. The City shall keep documentation of notifications to each regulated IU.
12. Encourage all permitted or regulated IUs to seek ways to minimize waste, reduce use of raw materials by increasing the efficiency of their production activities (e.g., maximizing product yield and minimizing by-products), improve the efficiency of their wastewater treatment system, substitute less-toxic chemicals, and implement any other pollution prevention activities that will reduce the volume and concentration of pollutants discharged to the sanitary sewer system. Continue to encourage pollution prevention measures and best management practices in all industrial permits.

Enclosure I: FSVT2 Discussion

Enclosure I
Full Scale Verification Test 2 (FSVT 2) Discussion
City of Wichita Falls - PWS 2430001
June 27, 2014

TCEQ staff reviewed the Full Scale Verification Test 2 (FSVT2) Report. The Report shows that the City's Temporary Direct Potable Reuse (DPR) Project meets the requirements for approval. However, the TCEQ has the following comments and recommendations:

Please note the following report comments:

1. Page 5, Table 2.2 "Microfiltration DIT Pressure Drop (psi)": There was a significant rise in the pressure drop in microfiltration cell #2 between Days 26 and 27. During daily telephone conversations between the City and the TCEQ, it was reported that the City was pinning defective membrane fibers on Day 27.

   The TCEQ recommends that the City continue to document the status of pinning in order to have this information available upon request.

2. Page 19, 2nd paragraph: The increase in the observed nitrate concentrations in the reverse osmosis permeate is attributed to the injection of liquid ammonium sulfate (LAS) at the River Road Wastewater Treatement Plant (RRWWTP) to help control the formation of monochloramines. In the TCEQ staff's experience, production of nitrates does not occur as a result of chloramination unless free ammonia concentrations are relatively high and disinfectant residual concentrations are low which promotes the growth of nitrifying bacteria. These conditions did not appear to occur during FSVT2.

   The TCEQ recommends that the City determine the source of the increased nitrate through additional process control monitoring and special studies.

3. Pages 21-22 "Correlation between *E. coli* and *Giardia*/*Cryptosporidium*": Although we do not expect there to be a correlation between *Giardia*/*Cryptosporidium* and *E. coli*, four samples is not an adequate sample set to establish correlation or lack thereof. The TCEQ requires the City to use *E. coli* as an indicator for potential outbreaks because of the relative speed and low cost of *E. coli* tests compared to the *Giardia* and *Cryptosporidium* tests.

   As additional sample data is acquired, we recommend that the City continue to review and analyze the trends, variability, and correlation. For example, the trends of microbial concentration through the treatment process may provide useful information over time.

4. Appendix A, SWMOR Page 3: The maximum individual filter effluent (IFE) turbidity for Filter 5 on Day 3 was reported incorrectly. The maximum value was 0.78 NTU, not 0.52 NTU. This determination is based on the concept of 'confirmation' for readings that are considered continuous—that is, 15-minute or 5-minute readings.

   In this specific instance, the discrepancy had no impact on regulatory compliance because the City correctly reported that it had a confirmed IFE reading above 0.3 NTU when it completed the rest of the SWMOR. However, that may not always be the case. We recommend that plant staff review the TCEQ's guidance on reporting IFE data because the requirements for the Filter Data and Enhanced IFE worksheets differ.

5. Appendix F, TCEQ-35J and TCEQ-38J Data Summaries: The average and 95th-percentile combined filter effluent (CFE) turbidities from the conventional granular media filters were significantly higher (nearly double) those of the IFE turbidities. While these values are not expected or required to be identical because of monitoring frequency and analytical differences, this is an issue that the City should address to ensure that they provide the most accurate data and receive all the appropriate removal credit.

We recommend that the City continue to review and analyze these data, and perform additional sampling if needed to identify the cause of this observation.

Enclosure J: Laboratory Results for 10 MG GST

Cypress WTP 10 MG GST Sample Analysis

Date Collected: 6/26/14

Analyst: B. Ramon

Chemical Analysis

pH	8.9	
Temperature	17.3	^{o}C
Conductivity	784	us/cm
Total Chlorine	2.1	ppm
Monochloramine	2.0	ppm
Free Chlorine	0.0	ppm
Free Ammonia	0.3	ppm
Total Hardness	99	ppm
Calcium Hardness	67	ppm
Magnesium Hardness	32	ppm
Total Alkalinity	67	ppm
Phenol Alkalinity	1	ppm
Carbonates	2	ppm
Bicarbonates	65	ppm

Calcium	26.81	ppm
Chlorate	0.33	ppm
Chlorite	0.55	ppm
Fluoride	0.5	ppm
Magnesium	0.91	ppm
Nitrate - N	<0.10	ppm
Nitrite - N	<0.10	ppm
Potassium	16.48	ppm
Sodium	114.25	ppm
Sulfate	35.60	ppm

Microbiological Analysis (MPN)

Total Coliform 0

Fecal Coliform 0

City of Wichita Falls Water Purification Laboratory
Microbiological / Bacteriological Testing Section

Water Bacteriological Testing Report
System Identification Number: 2430001
Texas Commission on Environmental Quality Laboratory ID Number: 48180-2006A

Sample Number: **27195**

System Name: City of Wichita Falls **County:** Wichita

Collection Point: 10 MGD Storage
Collection Date / Time: 6/25/14 / 8:45 **AM / PM**
Collected By: BR **Total Chlorine Residual:** 2.12 **mg/L**

Type of System: Public
Type of Sample:

Distribution:		**Raw:**	
Repeat:		**Special:**	✓
Upstream:		**Const:**	
Downstream:			

Water Sources: Lakes Arrowhead, Kickapoo, and Kemp.

For Laboratory Use Only

Water of Satisfactory Bacteriological Quality Must Be Free Of All Coliform Organisms

Date / Time Sample Inoculated: 6-25-14 / 10:00 **AM / PM**
Date / Time Incubated: 6-25-14 / 10:05 **AM / PM**
Received By: BR

Test Method: Colilert 24 with Quantitray Colilert 18 with Quantitray

None Found (Negative): ✓ **Found** (Positive):
Read By: NA **Total Coliform:** / **MPN**
Date / Time Read: 06/26/14 / 10:30A **E.Coli:** / **MPN**

Sample Unsuitable (Reason):
TCEQ Notified of Positive Samples By:

Name of Contact Person:
Date and Time Contacted: / **AM / PM**