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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

May 13, 2015

Mr. David W. Sloan, P.E.
Freese & Nichols, Inc.
4055 International Plaza, Suite 200
Fort Worth, TX 76109-4895

Re: City of Wichita Falls - Public Water System ID No. 2430001
Conditional Approval of the Temporary Direct Potable Reuse Project Water Treatment
Plant with Modifications Using Lake Kemp Water as an Additional Source
Plan Review Log No P-04232015-159
Wichita County, Texas

CN600129316; RN105598759

Dear Mr. Sloan:

On March 13, 2015, the Texas Commission on Environmental Quality (TCEQ) received planning materials with your letter dated March 10, 2015 for the proposed Temporary direct potable reuse (DPR) water treatment plant (WTP) operational modifications. The City of Wichita Falls (City) proposes to blend and concurrently treat the wastewater effluent from the City's River Road Wastewater Treatment Plant (RRWWTP) and Lake Kemp water through the City's Temporary DPR WTP before the microfiltration/reverse osmosis (MF/RO) membrane units, and credit the Lake Kemp blending as a substitute for all or a portion of the current Secondary Reservoir (Lake Arrowhead and Lake Kickapoo) blending. Total finished water from the Temporary DPR WTP derived from RRWWTP effluent will remain at or below 50.00%.

On April 1, 2015, TCEQ received ultraviolet light (UV) disinfection system Standard Operating Procedures (SOPs) followed by an additional SOP and alarm & shutdowns conditions for Full Scale Operations Version 5.4 on April 23, 2015. This material was submitted to satisfy requirements 5 and 6 of the TCEQ letter dated March 10, 2015 concerning final approval of the UV system. The material submitted is satisfactory and all conditions of the TCEQ letter dated March 10, 2015 have been met. The UV system is **approved for use**.

The conditional granting of these temporary exceptions is **valid for the duration of the Kemp water phase-in for Phases 1 and 2A or until February 29, 2016, whichever comes first.**

The conditional approval package for Full-Scale Operation of the Temporary Direct Potable Reuse Project dated August 5, 2014 is replaced with this letter and enclosures except that the following enclosures from the August 5, 2014 letter remain unchanged and remain in effect:

Enclosure C: CT Study Letter for the Cypress 2010 WTP
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 RRWWTP
Enclosure I: Full Scale Verification Test (FSVT) 2 Discussion
Enclosure J: Cypress 2010 WTP 10 Million Gallon Ground Storage Tank Sample Analysis

Project Description

Because of the ongoing drought, the City has been supplementing its water supply with the temporary reuse of wastewater effluent from the City's RRWWTP as source water for the Temporary DPR WTP. The project uses the existing Cypress 2008 WTP, Cypress 2010 WTP, and the 2010 10 million gallon ground storage tank at the Cypress facility in series to create the Temporary DPR WTP.

The treated wastewater from the RRWWTP is delivered to the Temporary DPR WTP via a temporary pump skid located at the RRWWTP. From the temporary pump station, the treated wastewater is delivered through approximately 12 miles of high-density polyethylene above-ground temporary transmission line. The effluent enters the Temporary DPR WTP through an existing flow control valve vault located prior to the Cypress 2008 WTP clarifier at the Cypress facility. The proposed modifications include introducing Lake Kemp water to be blended and mixed with the RRWWTP effluent in the existing flow control valve vault.

The Temporary DPR WTP will treat the blended RRWWTP effluent and Lake Kemp water using MF/RO. The treated water from the MF and RO membrane units will pass through the recently installed UV disinfection system before it is further blended with untreated surface water from the Secondary Reservoir at a location upstream of the existing Cypress 2010 WTP splitter box. The blended water will then be treated through the existing conventional Cypress 2010 WTP prior to entering the distribution system. The finished blend of water distributed from the Temporary DPR WTP will include less than 50.00% treated wastewater effluent from the City's RRWWTP, with the remaining source water from Lake Kemp and the Secondary Reservoir sources.

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

Enclosure A lists the City's temporary exceptions granted for the Temporary DPR WTP with the approval conditions. Changes to the enclosure are highlighted in grey. Enclosure B of this letter is the updated figure depicting the TCEQ-required regulatory monitoring locations, frequency, and action levels for the modified Temporary DPR Project. Please submit a copy of the City's revised Monitoring Plan for the Temporary DPR WTP for our records.

Revised CT Study

The City submitted a proposed disinfection protocol for the modified Temporary DPR WTP. Enclosure D of this letter is the revised contact time (CT) study approval letter for the Temporary DPR WTP. The City must follow all requirements included in both CT study approval letters.

Phased Approach and Blending Plan

The approved blending plan consists of multiple phases:

Phase 1

Phase 1 must be conducted for a period of **30 days**. This phase will verify continued consistent operation of membrane, UV and conventional treatment processes and involves blending 3 million gallons per day (MGD) of wastewater effluent from the City's RRWWTP and 3 MGD of Lake Kemp raw water. This blend is expected to yield 4 MGD of permeate to the backwash lagoon. The permeate will be combined with an equal or greater amount (4 MGD or more) of raw water from the Secondary Reservoir. Initially the City proposed using 4 MGD of Secondary Reservoir water, but based on conversations after the April 30th conference call, the City has expressed it may want to utilize more than 4 MGD of Secondary Reservoir water. This blend will be treated using the existing conventional Cypress 2010 WTP prior to entering the distribution system. **If any shutdown conditions are encountered, TCEQ must be immediately notified to discuss whether the phase can be continued.**

After two weeks of Phase 1, *Crypto*, *Giardia*, and viruses must be sampled at both the RRWWTP and the Entry Point. The results should be provided to TCEQ after the City has received, reviewed, and compiled the results into a submittal. The TCEQ acknowledges that the virus results will be provided at a later date than the other results due to longer laboratory analytical requirements. The system **must notify** TCEQ, but **may continue to Phase 2A after 30 days of run time.**

Phase 2A

Phase 2A must be conducted for a minimum of **30 days**. **If any shutdown conditions are encountered, TCEQ must be immediately notified to discuss whether the phase can be continued.** In Phase 2A, the flows from Lake Kemp and the RRWWTP can increase to 3.75 MGD each, which is approximately the current flow of the MF and RO membrane units and UV reactors. Permeate from the MF and RO membrane units and UV reactors is expected to stabilize at approximately 5 MGD, which will be blended with an equal amount of water from the Secondary Reservoir. This blend will be treated using the existing conventional Cypress 2010 WTP prior to entering the distribution system. **After two weeks of Phase 2A, *Crypto*, *Giardia*, and viruses must be sampled at both the RRWWTP and the Entry Point.** The results should be provided to TCEQ after the City has received, reviewed, and compiled the results into a submittal. The TCEQ acknowledges that the virus results will be provided at a later date than the other results due to longer laboratory analytical requirements. At the end of the 30-day duration of Phase 2A, all available sampling data required in the Enclosure A Reporting section must be submitted for TCEQ's review including the items detailed in the bullet list on the next page (under 'Reporting Requirements'). The system **cannot start Phase 2B** until all data generated during Phases 1 and 2A are submitted by the City and reviewed and approved by the TCEQ. **The TCEQ has not approved the continuation to Phase 2B at this time.**

Phase 2B

Per discussion with you and the City on April 30, 2015 and as documented in your email of the same date, you requested to modify your original submittal by adding an additional phase. You requested that the City be allowed to maintain flow from Lake Kemp at 3.75 MGD but increase flow from the RRWWTP to 7.5 MGD, producing up to 7.5 MGD of RO permeate with UV disinfection. This would be blended with at least 2.5 MGD of water from the Secondary Reservoir. The finished blend of water to distribution from the Temporary DPR WTP would include less than 50.00% treated wastewater effluent from the City's RRWWTP and 50.00% or more treated water from Lake Kemp and the Secondary Reservoir sources.

Phase 3

Phase 3 will gradually substitute contribution from the Secondary Reservoir with additional intake from Lake Kemp to be treated at the Temporary DPR WTP. The finished blend of water to distribution from the Cypress facility will include less than 50.00% treated wastewater effluent from the City's RRWWTP and 50.00% or more treated water from Lake Kemp and the Secondary Reservoir sources. **The TCEQ has not approved the continuation to Phase 3 at this time.**

Phase 1 and 2A Reporting Requirements

Weekly Reporting Requirements:

During Phase 1 and 2A, the City must submit by email the following data weekly on Mondays by noon:

- Calculated chemical and UV log inactivation credits for both the Temporary DPR WTP and the Cypress 2010 WTP once every 8 hours;
- Microfilters - Daily DIT results, 5-minute turbidity readings with max turbidity noted for all microfilters;
- Conventional Filters – IFE: 15-minute readings with max turbidity noted for each filter, CFE: 15-minute readings with max turbidity reading noted, IFE and CFE credit awarded;
- UV – UVT, flow, lamp status, and validated UV dose – 15-minute readings with Max and Min reading for each day;
- The surface water monthly operating reports (SWMORs) for the week; and
- All required reporting in Enclosure A, No. 57 – Addendum to the SWMOR.

Please send the emails to:

- Jennelle Crane at Jennelle.Crane@tceq.texas.gov and
- Joel Klumpp at Joel.Klumpp@tceq.texas.gov.

Monthly Reporting Requirements – based on start date:

At the end of the 30-day duration of Phases 1 and 2A (at days 30 and 60), please submit to TCEQ:

- All sampling results indicated in Enclosure A - Reporting Section;
- A graph of each MF unit's performance showing temperature adjusted flux, transmembrane pressure, filtrate turbidity, and indicating any clean-in-places performed;
- Graphs of each RO unit's performance showing flux, temperature, net driving pressure, filtrate total dissolved solids, filtrate nitrate levels, and an indication of any clean-in-places performed;
- Calculated resistance for the MF units; and
- A list of any pinning activity for the MF units, which directly shows the integrity of the membranes in lieu of a bulk measure such as flow per pressure applied

Please submit this information to:

Plan and Technical Review Section MC-159
Attn: Wichita Falls Project Team
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Monthly Reporting Requirements – SWMOR and Addendum:

By the tenth day of the month following the end of the normal reporting period submit to TCEQ:

- The SWMORs; and
- The required supplemental DPR monthly information.

Please submit the SWMORs and supplemental information to the usual address for SWMOR submittals.

Phase 2B and 3 Reporting Requirements

Reporting requirements for Phases 2B and 3 will be determined after complete review of Phase 1 and 2A information.

Mr. David W. Sloan, P.E.
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If you have any questions regarding this letter or need further assistance, please contact Mr. 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,



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



Joel Klumpp, Manager
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality



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

LB/JPK/VP/cas/mew

Enclosures:

- Enclosure A: Revised List of Conditions for the Temporary DPR WTP
- Enclosure B: Revised Current DPR WTP Regulatory Monitoring Locations, Frequency, and Action Levels
- Enclosure D: Revised CT Study Letter for the Temporary DPR Water Treatment Plant

cc: City of Wichita Falls, Attn: Honorable Glenn Barham, P.O. Box, 1431 Wichita Falls, TX 76307-1431
City of Wichita Falls, Attn: 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, May 13, 2015
City of Wichita Falls - PWS 2430001
Temporary Direct Potable Reuse WTP - 410791

Due to the ongoing drought, the City of Wichita Falls (City) will 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). The project utilizes the existing Cypress 2008 and Cypress 2010 Water Treatment Plants (WTPs) and 2010 10 million gallon ground storage tank located at the Cypress facility to create the Temporary DPR WTP.

EXCEPTIONS

1. The 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 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 these temporary exceptions **is valid for the duration of the Kemp water phase-in for Phases 1 and 2A or until February 29, 2016, whichever comes first.** Listed below are the City's temporary exceptions granted for the Temporary DPR WTP used to produce potable drinking water for distribution:

- 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)];
 - g. Post-RO membrane pH adjustment [30 TAC §290.42(g)]; and
 - h. The use of ultraviolet light (UV) for pathogen removal [30 TAC §290.42(g)(5)];
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 MCLs 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; or
 - 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 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 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, UV, blending with raw surface water, secondary sedimentation, conventional filtration, and disinfection. If water bypasses 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 22.2 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 colony forming units (CFU)/100 mL. If the RRWWTP *E. coli* effluent concentration is above 75 CFU/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 CFU/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 $[(\text{total dissolved solids (TDS)}_{\text{-Feed}} - \text{TDS}_{\text{-Product}}) / (\text{TDS}_{\text{-Feed}}) \times 100]$ 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 **within** 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 percentage of finished water from the Cypress Temporary WTP originating as RRWWTP effluent must be no greater than 50.00%. This calculation shall consider the impact of surface water, Lake Kemp, blending occurring prior to the MF/RO treatment process as well as the blending of surface water from the secondary reservoir with RO permeate. 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 WTP 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 Temporary DPR WTP must be zero (0) most probable number/Liter (MPN/L). If *E. coli* is present at the entry point, the WTP must be shut down, inspected and, if necessary, repaired. The City must resample *E. coli* and receive a zero MPN/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-detectable 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 WTP must be shut down, inspected and, if necessary, repaired. The City must resample *Cryptosporidium*, *Giardia* or virus and receive a non-detectable 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 the Temporary DPR WTP may be returned to service.
- n. The City must provide at least a 3.0-log inactivation of *Cryptosporidium* through the use of UV. If the City produces off-spec water for more than four (4) consecutive hours during a day or for more than 5% of the water produced during a month, the reactor must be taken off-line and the reactors must be inspected and, if necessary, repaired. The UV unit is considered to be operating off-spec when:
 - (1) The validated dose falls below the dose needed to achieve 3.0-log inactivation of *Cryptosporidium*;

- (2) the reactor operates at a flow rate that exceeds 25.6 MGD;
- (3) the UV transmittance of the water falls below 70%; or
- (4) one or more of the lamps is inoperable.

NOTIFICATIONS

5. The City must have notified the Technical Review and Oversight Team (MC-159) in writing when the City's Temporary DPR WTP began distributing treated water.
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 retail 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 <i>Crypto</i> 5.5-log, <i>Giardia</i> 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. <i>Crypto</i> , <i>Giardia</i> , virus above limits at RRWWTP	Entire Plant			✓ *
4f. <i>E. coli</i> 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	✓	✓	✓

Condition	Shutdown Requirement	Notify		
		Retail Customers	Wholesale Customers (PWSs)	TCEQ
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. <i>E. coli</i> above zero MPN/L at entry point	Entire Plant			✓ *
4m. <i>Crypto</i> , <i>Giardia</i> , virus above zero or non-detect at entry point	Entire Plant	✓	✓	✓
4n. UV produces off-spec water for over 4 hours or for more than 5% of water in a month	UV Unit			✓ *

* 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 WTP must maintain the turbidity under the conditions set in 30 TAC

- §290.111(g)(1) (for Individual Filter Effluent (IFE)) and §290.111(g)(2) (for Combined Filter Effluent (CFE)). If the conditions of §290.111(g)(1) are not met then the WTP 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 WTP 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 vessels 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 (FSVT2) report.
 13. If the *E. coli* levels at the RRWWTP before the chlorine contact basin are above 15,000 CFU/100 mL, the historical sample that was collected at the same time as the *E. coli* sample yielding the high *E. coli* results will be sent for analysis of *Cryptosporidium* and *Giardia* within 24 hours of the high *E. coli* sample.
 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 Cypress 1961 WTP and 1987 WTP treatment equipment and associated clearwells and piping, the following conditions must be met:
 - a. The Cypress 2008 WTP flow-control vault's valve located on the Lake Kemp/Headquarters Road Reservoir pipeline must continue to remain closed at all

- times during Temporary DPR project when Lake Kemp is not being used as a source of water for the Temporary DPR WTP.
- b. The weir gates in the Cypress Splitter Box to the Cypress 1961 and 1987 WTPs must be maintained closed and:
 - i. Be visually inspected daily for leakage;
 - ii. If leaking from either of these two weir gates is noted, the extent of leakage must be noted for disinfection activities prior to resuming normal operation;
 - iii. As proposed by the City in your July 29, 2013 email, the drain valve in the Cypress 1961 WTP settling basin must be maintained open during the proposed temporary project;
 - iv. The drain valve in the 1987 WTP Parshall flume must be maintained open during the proposed temporary project; and
 - v. The results of the daily inspections and any follow-up inspections 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 (SW) operator onsite when CIP procedures are being conducted on the MF and RO membrane units. A Class B SW 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 City must maintain up-to-date standard operating procedures that include actions to be taken when any of the triggers in this enclosure are reached.
 21. The operators must have a method to verify that the proper control algorithms and coefficients are being used for each UV unit in operation. The operators must be able to demonstrate the method upon request by TCEQ.
 22. 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.
 23. The City must completely isolate the Cypress 10-million gallon (MG), 5-MG, and 3-MG ground storage tanks (GSTs) at the Cypress facility 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 WTP high service pump station;
 - b. would allow water to flow back and forth between the three GSTs; and

- c. connect the Cypress 2010 WTP clearwell to the Cypress 1961 or 1987 WTPs.

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

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 for Alternative Treatment (SWMOR-Alt)) and the Cypress 2010 WTP (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 percentage of RRWWTP effluent water in the total finished 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%. Flow metering of the following streams will be used to determine the percentage of finished water originating as RRWWTP effluent.
 - 1. RRWWTP effluent (MGD)
 - 2. Lake Kemp raw water (MGD)
 - 3. Water pumped from Waste Lagoon No. 3 (MGD)
 - 4. Secondary Reservoir raw water (MGD)

The calculation used to determine the percent of flow that originated as RRWWTP effluent is as follows:

RRWWTP effluent % of permeate

$$= \frac{\text{RRWWTP effluent (1)}}{[\text{RRWWTP effluent (1)} + \text{Kemp raw flow (2)}]} * 100\%$$

RRWWTP effluent share of permeate (MGD)

$$= \text{RRWWTP effluent \% of permeate} * [\text{Lagoon (3)}]$$

$$\text{RRWWTP effluent \% of total} = \frac{\text{RRWWTP effluent share of permeate}}{[\text{Lagoon (3)} + \text{Secondary Reservoir (4)}]} * 100\%$$

- m. The percent of the total capacity of the Cypress 10-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. Total Culturable 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.
 - r. The UV intensities as measured by the UV sensors, lamp status, flow rate through the unit, UV transmittance (UVT), and lamp power must be monitored continuously and the results recorded every 15 minutes in accordance with 30 TAC §290.111(d)(2)(A).
 - 1. If the reactor is operated at flow rates below 1.0 MGD, the calculated validated dose (D_{val}) value must be based on 1.0 MGD or higher.
 - 2. If the UVT of the water being treated by the UV reactor exceeds 98%, the D_{val} value must be based on 98% or lower.
 - s. The D_{val} for the UV system calculated must be recorded at least every 15 minutes.
 - t. The total amount of water treated by each UV unit each month must be recorded.
 - u. The total amount of water produced each month when the UV unit is not operating within validated conditions (off-spec) in accordance with 30 TAC §290.111(d)(3)(B) must be recorded.
 - v. The continuous time each day that the UV unit is not operating with validated conditions (off-spec) must be recorded.
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, and D1C sampling points of the Cypress 2010 WTP and 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.
- Please note for items No. 29 and No. 30, if the sampling contractor notifies the City of the date that samples will be collected and the City's Temporary DPR WTP is not producing water on that date, the City is responsible for contacting the sampling contractor and scheduling the sampling for another date, which is within sampling period. For example, if the samplers call and schedule a visit for February 28th, and the plant is not operating that day, then it is the City's responsibility to work with the sampling contractor to choose another date before the end of the calendar quarter, March 31st.
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 percent of RRWWTP effluent in the total finished water exceeds 50.00%;
- e. action to correct the UV unit(s) if off-spec water is produced; and
- f. 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 Temporary DPR WTP 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 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 Cypress 2010 WTP transfer pumps to the Cypress 2010 10-MG GST and backwash supply to the high service pumps; and
 - b. To close the valves as indicated on the 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 GST and the high service pumps.
36. The City must notify TCEQ prior to making any significant 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).

For further clarification, some examples of changes which would require notification include any proposed change to the raw water sources, proposed treatment design modifications at the RRWWTP or the Cypress facility, or any proposed changes to the waste stream management practices. Some examples of changes which are considered non-significant and which would not require notification include operational practices at the RRWWTP and the Cypress facility, such as aeration rates or chemical dose adjustments

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, 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 **Evoqua (formerly Siemens Memcor 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 10 to 40°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 must use the Trojan UVSwift 8L24-2L UV system for which an exception was previously granted on January 13, 2015 and for which the City received TCEQ temporary plan approval on March 10, 2015, and April 24, 2015 and final approval on May, 13, 2015. The City must operate as approved in the exception letters and use the formulas provided in the most recent validation study approval letter for the unit.
- 42. 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
- 43. All treatment chemicals and media used in the full-scale WTP must conform to American National Standard Institute/NSF International (ANSI/NSF) Standard 60 for Drinking Water Treatment Chemicals and ANSI/NSF Standard 61 for Drinking Water Treatment Components 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.
- 44. Flow-measuring devices will be required on the RRWWTP effluent transmission line, the effluent from each MF membrane unit, the MF membrane backwash supply, the combined MF membrane filtrate, RO concentrate, in addition to those described in 30 TAC §290.42(d)(5).
- 45. The City's Temporary DPR WTP must be designed to conduct and record continuous turbidity monitoring of the RRWWTP effluent.
- 46. The RO membrane system must be designed to measure and record conductivity or total dissolved solids (TDS) on each RO membrane unit's feed and permeate lines.
- 47. 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 operation. 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.
- 48. 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.

49. 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

50. Conductivity meters used to monitor the RO membrane units' permeate shall be calibrated with solutions of known concentrations at least once every 90 days.
51. 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.
52. Pressure monitors used for DIT measurements shall be calibrated or verified at least once every 12 months.
53. Instruments used to monitor nitrate and nitrite shall be calibrated or verified at least once every 12 months.
54. UV light sensors and UVT analyzers must be properly calibrated as required by 30 TAC §290.46(s)(2)(D).

REPORTING

55. The City's Temporary DPR WTP must submit the completed SWMOR and SWMOR-Alt, report (including UV pages) 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

56. 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.
57. 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 No. 57e and No. 57f are over the action limits, then also provide a report indicating the time the plant was shut down, the corrective action taken, and the subsequent samples that showed the plant 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 units' 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 50.00%, 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 2010 10-MG GST 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 No. 57t and No. 57u are detected, then also report the time the plant was shut down, the corrective action taken, and the samples that showed the WTP could produce safe water again.
58. 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 SWMOR-Alt (form number 00102D) that the TCEQ created for the Temporary DPR WTP.
59. 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.
60. 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 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 it, 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

61. 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.
62. The Trojan UVSwift 8L24-2L validation report must be kept on-site for the Temporary DPR WTP operators and TCEQ staff to verify the proper control algorithms and coefficients are being used for each UV unit for as long as the reactors are included as a treatment unit at the Temporary DPR WTP.
63. The following records must be retained for at least ten years:
- a. A copy of the submitted SWMORs for the Temporary DPR WTP, including the UV pages, and the Cypress 2010 WTP;
 - 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 2010 10-MG GST 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

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

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

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

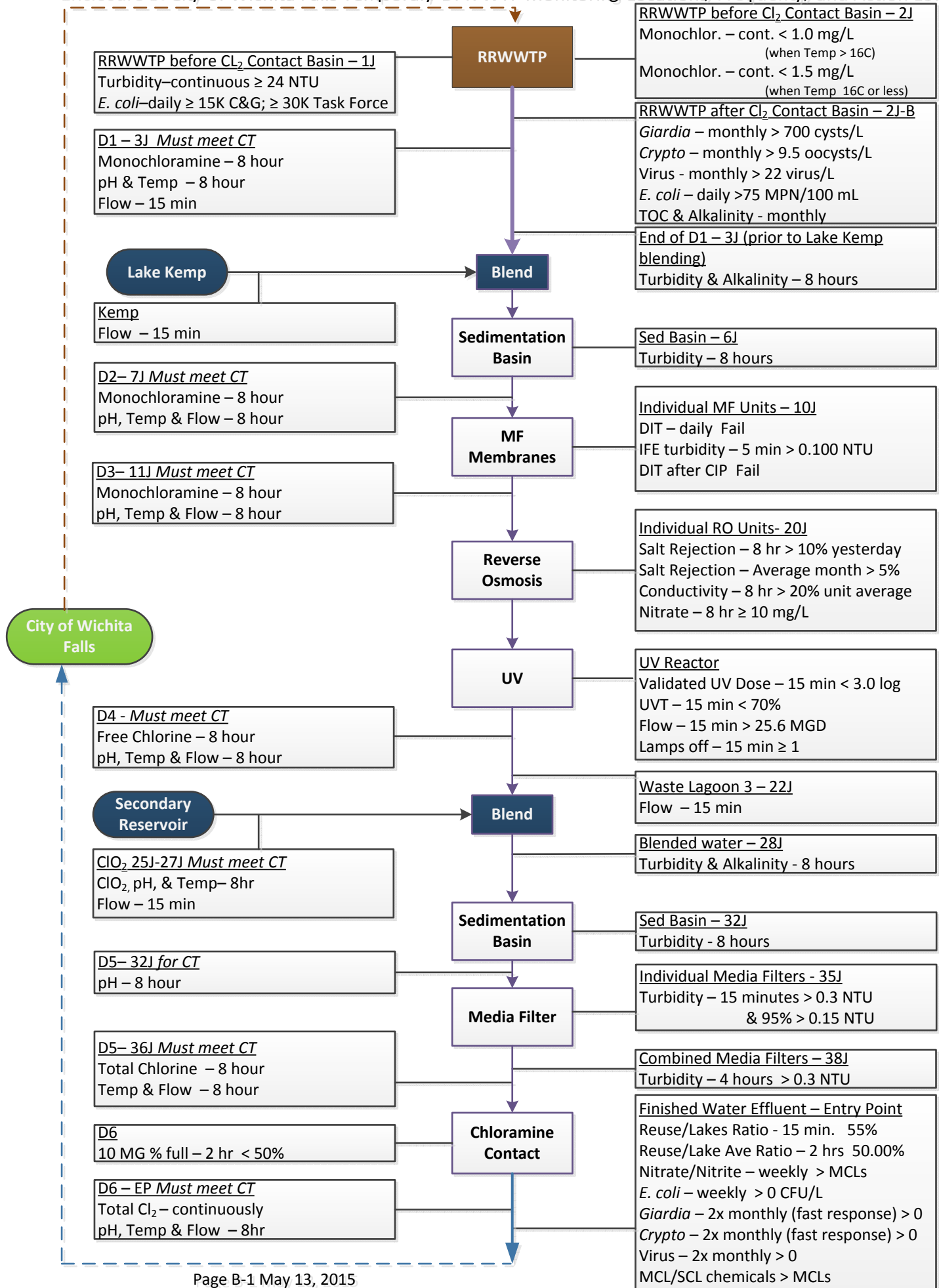
DECOMMISSIONING OR MODIFYING THE TEMPORARY DPR WTP

- 65. After the Temporary DPR WTP is no longer treating RRWWTP effluent, the City may not return the Cypress 2008 WTP and the Cypress 2010 WTP to their traditional source waters and operational practices without the prior written approval of the TCEQ.
- 66. The City must receive prior written approval from TCEQ before adding any other source water to the Temporary DPR WTP beyond Lake Kickapoo, Lake Kemp, Lake Arrowhead, and RRWWTP effluent.
- 67. 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. 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;
- c. transition back to the original piping configurations at the Cypress 2010 WTP; and
- d. prepare to reactivate the facilities at the Cypress 1961 and Cypress 1987 WTPs.

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



Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

May 13, 2015

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
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 reviewed the Engineering Report dated March 3, 2015 submitted by Mr. David W. Sloan, P.E., Freese and Nichols for the City of Wichita Falls (City). The report included a revised Contact Time (CT) Study for the Temporary Direct Potable Reuse Water Treatment Plant (DPR WTP). A revised CT Study is necessary to include installation of two (2) Trojan Swift™ 8L24-SL Ultraviolet Light (UV) reactors and piping after the Microfiltration (MF) and Reverse Osmosis (RO) at the Temporary DPR WTP. 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 current exception letter and enclosures and applies when the Temporary DPR Project is in operation. **The information in this letter supersedes and does not supplement any previous CT study correspondence for the Temporary DPR WTP. As seen in Condition No. 67 of TCEQ's May 13, 2015 Enclosure A, the City will need to submit an engineering report describing the plan for converting the Cypress facility back to treating only surface water when the Temporary DPR project is complete.**

The Temporary DPR WTP may use a blend of raw water from several sources:

- treated effluent supplied through a transmission line from the River Road Waste Water Treatment Plant (RRWWTP) pretreated with chlorine (Cl₂) and ammonia (NH₃);
- raw water from Lake Kemp through a transmission line from the Headquarters Road Pump Station (HQRdPS) pretreated with chlorine dioxide (ClO₂); and/or
- raw water from Lake Kickapoo and/or Lake Arrowhead through a transmission line from the Secondary Reservoir pretreated with ClO₂.

For the duration of the Project, the Temporary DPR WTP will include:

- approximately twelve (12) miles of 27-inch raw water line from the RR WWTP to the Temporary DPR WTP;
- All the treatment units at the Cypress 2008 WTP during normal (non-DPR) operating conditions, which includes a static mixer, a Floc-Clarifier; five (5) Memcor® S10V hollow fiber (HF) MF filters; a break tank and six (6) two-stage RO units and RO permeate tanks;
- all of the treatment units at the UV disinfection unit and the RO Permeate lagoon;
- all of the treatment units at the Cypress 2010 WTP during normal (non-DPR) operating conditions, which includes a splitter box that, under normal (non-DPR) operating conditions, distributes water between the Cypress 1961, 1987, and 2010 WTPs; a mechanical rapid mix; a Parshall Flume meter; a solids contact, slurry recirculation clarifier; a re-carbonation basin; and five (5) dual-media gravity filters;
- a small Cypress 2010 Clearwell and filtered water transfer pump station; a 10 million gallon (MG) Cypress 2010 Ground Storage Tank (GST) that has been isolated from the rest of the GSTs at the Cypress site; and
- the Cypress 2010 High Service Pump Station (HSPS) that discharges to the distribution system.

During the Temporary DPR Project, when Lake Kemp is used as a source water it will be blended with the RRWWTP effluent and treated through the MF and RO membranes, and UV units prior to being pumped to the Cypress 2010 WTP for further treatment. Raw water for the Cypress 2010 WTP will be RO permeate (with UV treatment) with a possible blend of surface water pumped from the Secondary Reservoir (Lake Kickapoo and Lake Arrowhead). The MF and RO units have a maximum treatment capacity of 15 million gallons per day (MGD) with the maximum treatment capacity for the UV unit and the Cypress 2010 WTP being 10 MGD.

The proposed disinfection protocol during the Temporary DPR Project includes injection of chlorine (Cl_2) and ammonia (NH_3) in the piping from the RRWWTP. Once at the Temporary DPR WTP, Cl_2 and liquid ammonium sulfate (LAS) are injected in the mix zone of the MF clarifier. Cl_2 and LAS are again added at the clarifier effluent to form chloramines through the MF trough and cells. Sodium hypochlorite is added to the downstream side of the RO permeate tanks, prior to the UV reactor to form free chlorine residual through the RO permeate piping to the lagoon. The disinfection protocol continues with the injection of Cl_2 and LAS at the outlet of the splitter box. There are also standby/secondary Cl_2 and LAS injection points at the Cypress 2010 Clearwell and the 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.

During the Temporary DPR Project, there are six (6) disinfection zones at the Temporary DPR WTP. The first disinfection zone, D1, consists of the 12 miles of treated effluent water line from the RRWWTP. The second disinfection zone, D2, consists of the Clari-flocculator

before the MF units and the third disinfection zone, D3, includes the MF cells and their inlet channel and associated piping. The fourth zone, D4, contains the piping through the UV reactor disinfection unit to the upstream side of the RO permeate lagoon. The fifth zone, D5, contains the rapid mix, clarifier, re-carbonation basin, granular media filters, and associated piping at the Cypress 2010 WTP. The last disinfection zone, D6, incorporates the Cypress 2010 Clearwell, Cypress 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 Temporary DPR WTP. The T_{10} values are based on the information provided in the CT Study template you submitted on March 3, 2015 and the most recent TCEQ approved CT Study dated August 5, 2014.

TABLE 1: T_{10} Table for the Temporary Direct Potable Reuse Water Treatment Plant, TCEQ Plant ID No. TP410791

DISINFECTION ZONE	TREATMENT UNIT	VOLUME (GAL)	FLOW RATE (MGD)	BAFFLING FACTOR	T_{10} (MIN)	
					Unit	Sum
D1	Treated Effluent Transmission Line	1,860,000 ⁽¹⁾	7.5 ⁽¹⁴⁾	1.0 ⁽¹⁸⁾	357.0	357.0
D2	Cypress 2008 MF/RO Floc-Clarifier	3,876,000 ⁽²⁾	15.0 ⁽¹⁵⁾	0.3 ⁽¹⁹⁾	111.6	111.6
D3	Piping	13,200 ⁽³⁾	15.0 ⁽¹⁵⁾	1.0 ⁽¹⁸⁾	1.3	4.6
	Microfiltration Inlet Trough	5,510 ⁽⁴⁾		0.1 ⁽²⁰⁾	0.1	
	Microfiltration Cells (5)	9,560 ⁽⁵⁾	3.0 ⁽¹⁶⁾	0.7 ⁽²¹⁾	3.2	
D4	Permeate Piping through UV Disinfection Area	7,500 ⁽⁶⁾	10.0 ⁽¹⁷⁾	1.0 ⁽¹⁸⁾	0.42	2.4
	HPDE Diversion Piping	13,500 ⁽⁷⁾			2.0	
D5	Piping	14,600 ⁽⁸⁾	10.0 ⁽¹⁷⁾	1.0 ⁽¹⁸⁾	2.2	67.1
	Cypress 2010 Clarifier	926,500 ⁽⁹⁾		0.3 ⁽²²⁾	40.0	
	Re-carbonation Basin	183,000 ⁽¹⁰⁾	2.5 ⁽¹⁸⁾	0.5 ⁽²³⁾	13.2	
	Granular Media Filters (4)	29,100 ⁽¹¹⁾		0.7 ⁽²⁴⁾	11.7	
D6	Cypress 2010 Clearwell	109,100 ⁽¹²⁾	10.0 ⁽¹⁷⁾	0.5 ⁽²⁵⁾	7.9	223.3
	Cypress 2010 Ground Storage Tank	4,987,000 ⁽¹³⁾		0.3 ⁽²⁶⁾	215.4	

Notes:

1. Based on a 27-inch diameter pipe that is 62,500 feet long River Road WWTP.
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 Siemens Memcor® S10V microfiltration membrane modules.
6. Based on cumulative volume of 104 LF of 24-inch and 32 LF of 20-inch diameter pipe.

7. Based on cumulative volume of 114 LF of 36-inch and 320 LF of 24-inch diameter pipe.
8. Based on cumulative volume in 220 LF of 36-inch piping between the splitter box to the rapid mix and 85 LF of 30-inch piping from the rapid mix to the Cypress 2010 clarifier.
9. 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.
10. Based on a basin that is 45.5 feet long and 32 feet wide and has a 16.8-foot side water depth.
11. 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.
12. 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.
13. Based on a tank that has a 206-foot diameter, a 40-foot maximum water depth, and a 20-foot minimum operating level.
14. Based on the pump capacity of DPR water from RRWWTP.
15. Based on the design capacity of the 2008 WTP.
16. Based on the design capacity of the 2008 WTP. Assumes equal flow divided between five racks of Siemens Memcor® S10V.
17. Based on the design capacity of the Cypress 2010 WTP.
18. Assumes equal flow split between like filters.
19. Assumes that the flow conditions that exist in long pipeline segments will virtually eliminate the possibility of short-circuiting and create "perfect" baffling characteristics.
20. 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".
21. Assumes "unbaffled" for basin with no baffle walls.
22. Assumes "superior" baffling condition based on the configuration of the filter cell and the submerged membrane units.
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.
25. Assumes that a tank with two internal baffles and a length to width ratio of 30:1 will create "average" baffling characteristics.
26. 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.

The treatment of water from the RRWWTP must achieve a 5.5-log removal or inactivation of *Cryptosporidium*, a 8.0-log removal or inactivation of *Giardia* and a 9.0-log removal or inactivation of viruses before the treated water can be distributed to the customers. The proposed UV system has been sized to provide a 3.0-log inactivation of both *Cryptosporidium* and *Giardia*. The Cypress WTP installation will consist of a 24-inch Trojan UVSwift™ 8L24-2L reactor with 2 lamps. The 8L24-2L reactor will operate at flow rates of up to 10.0 MGD, with a second 8L24-2L reactor serving as the stand-by reactor. The maximum approved disinfection credits for the reactor and operating condition are described in the table below.

Trojan UVSwift™ 8L24-2L UV Disinfection Design Criteria

Design Criteria	Type of Unit	Design Value
Flow Rate	MGD	1.0 - 10.0
<i>Cryptosporidium</i> disinfection	Log inactivation	3.0
<i>Giardia</i> disinfection	Log inactivation	3.0

Based on the combination of treatment processes that will be used at the Temporary DPR WTP, the **City of Wichita Falls Temporary DPR WTP must**, for compliance with minimum

treatment technique requirements, **provide at least a 2.0-log inactivation of Giardia and 5.0-log inactivation of viruses through the disinfection process.** We have prepared a Disinfection Process Parameters table to help the operators complete their Surface Water Monthly Operating Report-for Alternative Technologies (SWMOR-Alt). 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 DPR WTP** must meet on a continuous basis.

TABLE 2: Disinfection Process Parameters Table for the Temporary Direct Potable Reuse Water Treatment Plant, TCEQ Plant ID No. TP410791

APPROVED CT STUDY PARAMETERS						PERFORMANCE STANDARDS	
Parameters	Disinfection Zones					Log Inactivation	
	D1	D2	D3	D4	D5	Giardia	Viruses
Flow Rate (MGD)	7.50	15.00	3.00	10.00	10.00	2.0	5.0
T_{10} (minutes)	357.0	111.6	4.6	2.4	67.1		

APPROVED CT STUDY PARAMETERS						PERFORMANCE STANDARDS	
Parameters	Disinfection Zones					Log Inactivation	
	D6	D7	D8	D9	D10	Giardia	Viruses
Flow Rate (MGD)	10.00	na	na	na	na	2.0	5.0
T_{10} (minutes)	223.3	na	na	na	na		

As you are aware, zone D5 includes the Cypress 2010 clarifier, re-carbonation 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 **when using Lake Kickapoo and Lake Arrowhead** raw water. Specifically:

- **The operators must monitor the pH in disinfection zone D5 at the outlet of the Cypress 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 Temporary DPR WTP expects to meet these two treatment objectives when blending the surface water (from Lake Kickapoo and Lake Arrowhead) with RO permeate. 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 chloramines only apply at pH levels between 6 and 9, i.e., from 5.5 through 9.49. Because zone D5 includes both the clarification and re-carbonation processes and re-carbonation lowers pH, the pH in zone D5 must be measured before re-carbonation. Consequently, the operators must monitor the pH for disinfection zone D5 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 Cypress 2010 WTP plant does not overestimate disinfection levels when the clarifier pH reaches 9.5.

Mr. Mark Southard
Page D-6 of D-6
May 13, 2015

- **The operators must have at least four filters in operations whenever the plant is treating water.** This operational constraint is needed because zone D5 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.

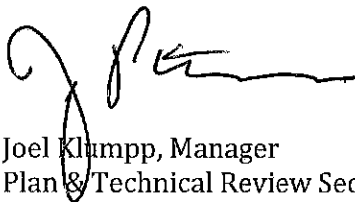
As mentioned above, when the raw water for the Temporary DPR WTP can be a blend of surface water pumped from the Headquarters Road Pump Station (HQRdPS) (Lake Kemp) and the River Road WWTP (RRWWTP) effluent, the combined raw waters are treated through the sedimentation basin, MF and RO membranes units, and UV disinfection units before being pumped to the Cypress 2010 WTP for further treatment. Approximately 12,000 linear feet of raw water transmission line from Lake Kemp is pretreated with chlorine dioxide prior to blending with the RRWWTP water. Because the Lake Kemp water, after blending with RRWWTP effluent, then receives adequate treatment for surface water through the Temporary DPR WTP, the City and TCEQ have agreed that no separate disinfection zone is necessary for the chlorine dioxide applied to the Lake Kemp water.

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.

If you have any questions concerning our evaluation or if we may be of other assistance, please contact Ms. Sylvana (Sam) Turner at (903) 535-6152, by e-mail at sylvana.turner@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, Manager
Plan & Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

JPK/JCS/SAT

Enclosure: CT Study Template

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

Mr. David W. Sloan, P. E.
Freese & Nichols, Inc.
4005 International Plaza, STE 200
Fort Worth, TX 76109

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: TP410791 Temporary DPR WTP Month: March
Day: 27
Year: 2015

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

The City of Wichita Falls (CWF) Temporary Direct Potable Reuse Water Treatment Plant (DPR WTP) Project will combine the use of the 2008 Cypress WTP Micro-filtration / Reverse Osmosis (MF/RO) treatment facilities and Ultraviolet (UV) Light disinfection with the conventional Cypress 2010 CWTP. This CT study takes into account the treated water pumped from the CWF River Road Waste Water Treatment Plant (RRWWTP) to the Cypress 2008 WTP through a 32-inch outside diameter (O.D.) raw water pipe (with a 27-inch inside diameter (I.D.) at a flow of 7.5 million gallons per day (MGD) and mixed with 7.5 MGD raw water from the Headquarters Rd Pump Station (Lake Kemp) prior to treatment in the MF/RO treatment and UV disinfection facilities, then sent to a raw water lagoon where 10 MGD will then be treated through the conventional Cypress 2010 WTP.

The treatment process includes clarification prior to micro-filtration, reverse osmosis and UV disinfection where the 10 MGD permeate will be sent to a raw water lagoon, pumped to the splitter basin and sent through the Cypress 2010 WTP. The Cypress 2010 WTP consists of a rapid mix basin, a 90-foot diameter clarifier, a re-carbonation basin, five dual-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 Cypress 2010 WTP is 10.0 MGD.

The treatment processes for the water from the RRWWTP must achieve a 5.5-log removal or inactivation of *Cryptosporidium*, a 6.0-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, UV and Cypress 2010 WTP facilities, the disinfection process must be able to achieve a 2.0-log inactivation of *Giardia* and a 5.0-log disinfection of viruses before this water enters the distribution system.

The proposed disinfection protocol involves the injection of chlorine (Cl₂) and liquid ammonium sulfate (LAS) at the RRWWTP chlorine contact basin to create "pre-formed chloramines" as a disinfectant (i.e. not adding enough Cl₂ to reach breakpoint) before being pumped to the Cypress 2008 WTP through the 32-inch O.D. raw water pipe. In the Cypress 2008 MF clarifier, chlorine (Cl₂) and liquid ammonium sulfate (LAS) are injected in the mix zone to form chloramines. Cl₂ and LAS are again added at the clarifier effluent to form chloramines through the MF trough and cells. Sodium hypochlorite is added to form a free chlorine residual through the RO permeate piping to the lagoon. Once the RO permeate is sent to the splitter basin, Cl₂ and liquid ammonia gas (NH₃) are added in the splitter box and again just upstream of the Cypress 2010 WTP's 0.20 MG clearwell and transfer pump station.

Monochloramine residuals are monitored in the raw water vault, prior to the Cypress 2008 clarifier, in the mix zone of the Cypress 2008 clarifier, at the effluent collection box of the Cypress 2008 clarifier; in the MF feed trough and cell filtrate. Free chlorine residuals are monitored at the RO permeate lagoon influent. Chloramine residuals are monitored downstream of the five multi-media gravity filters,

Submitted by: David W. Sloan, P.E., Freese & Nichols Reviewed by Sam Turner, TCEQ, TROT

Contact

Information: 817-735-7492 David.Sloan@freese.com

CT Study for the Wichita Falls Temporary DPR WTP

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

he RRWWTP to Cypress 2010 WTP through Cypress 2008 WTP has six (6) disinfection zones:

D1: 32-inch O.D. HDPE raw water pipeline from the RRWWTP to the Cypress WTP

D2: Cypress 2008 WTP's clarification unit at the MF/RO treatment facility

D3: Cypress 2008 WTP's MF treatment units and associated piping

D4: UV and RO permeate piping to lagoon

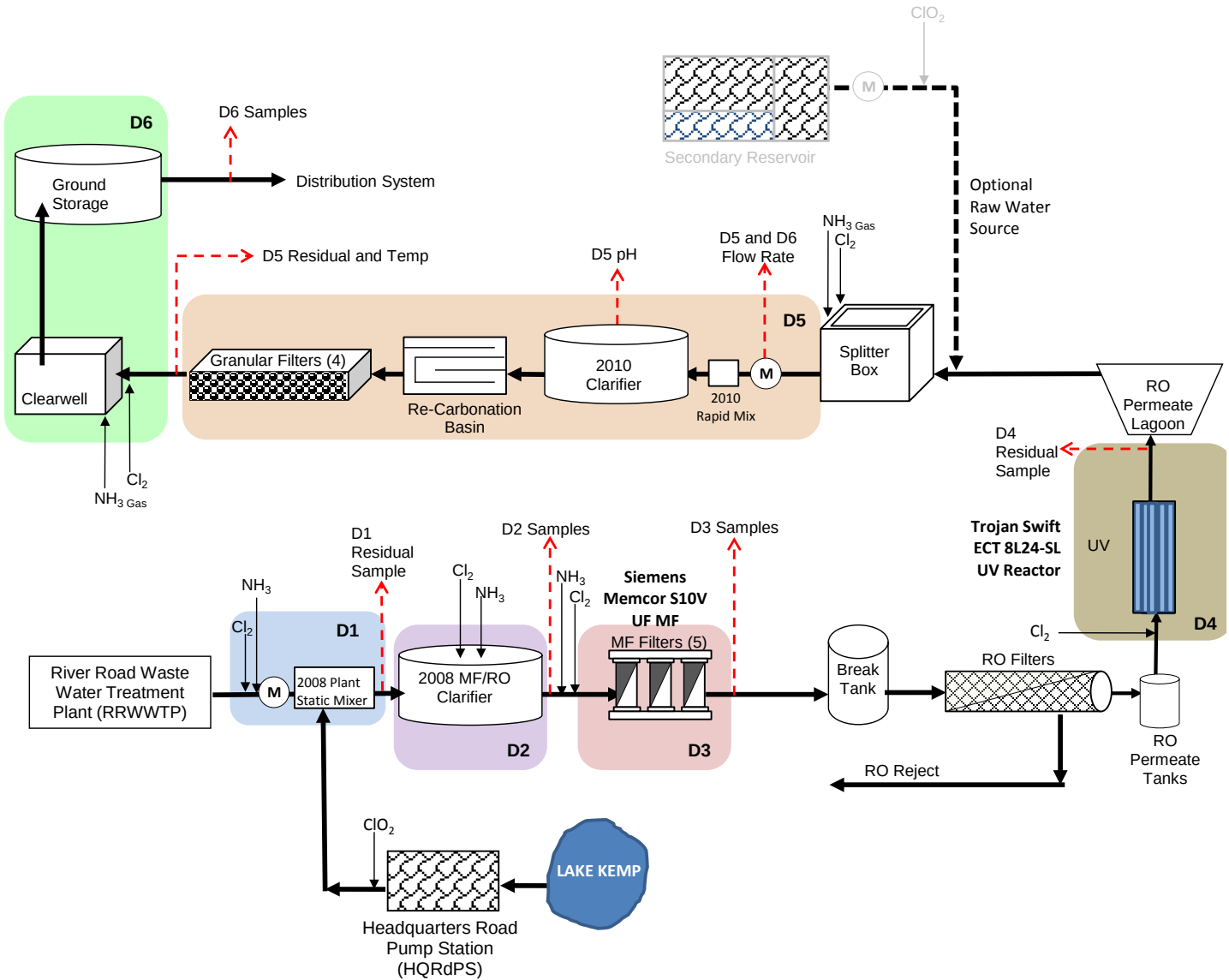
D5: Cypress 2010 WTP's clarifier, re-carbonation basin, gravity filters, and associated piping

D6: Cypress 2010 WTP'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

March 27, 2015

Please refer to Section 3.3 of the Guidance Manual for instructions and guidance.



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.)
T10 Details Worksheet

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

PLANT NAME
OR NUMBER: TP410791 Temporary DPR WTP Date: March 27, 2015

Treatment Plant Capacity 10.000 mgd
6,944 gpm

The peak flow rate through the MF/RO facilities will be 15.0 MGD. There is a potential that 100% of the water being treated through the 2010 Conventional Plant will be from the MF/RO Plant. The peak flow rate through the 2010

Disinfection Zone: D1 Disinfectant: Chloramines

Unit - 1 Type: Piping Shape: Pipe

Further Description: 13 Mile Pipe from RRWWTP to 2008 Cypress Plant

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Diameter	27 in	32" O.D. HDPE with 27" I.D. based on CT
Length	62500 ft	Submittal Mr. David W. Sloan, P.E., Freese & Nichols, 3/3/15.
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	
		Baffling Characteristics: <u>Perfect</u>
		Approved Baffling Factor: <u></u>
T ₁₀	357.0 min	

D1 FLOW RATE	7.500 mgd
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T10 SUM FOR D1	357.0 min
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CT Study for the Wichita Falls Temporary DPR WTP

Disinfection Zone: D2 Disinfectant: Chloramines

Unit - 1 Type: Clarifier Shape: Circular

Further Description: 2008 MF/RO Floc-Clarifier

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
		Based on TCEQ approved CT Study dated 6/27/2014.
Diameter	155 ft	
Side Water Depth	25.3 ft	
Center Water Depth	31.76 ft	
Volume (each)	3,875,583 gal	
Flow Rate (each)	10,417 gpm	15.0 MGD (7.5 MGD from RRWWTP and 7.5 MGD from HQRDPS-Lake Kemp)
Detention Time	372.0 min	
Baffling Factor	0.3	Based on concentric cylindrical baffle wall with a diameter of approximately 50 ft. that extends 10 ft into the basin and settled water launder along with perimeter of the basin
		Baffling Characteristics: <u> Poor </u>
		Approved Baffling Factor: <u> </u>
T ₁₀	111.6 min	
D2 FLOW RATE 15.000 mgd		
T10 SUM FOR D2 111.6 min		

Disinfection Zone: D3 Disinfectant: Chloramines

Unit - 1 Type: Piping Shape: Pipe

Further Description: 36-inch Raw Water Pipe

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
		Based on TCEQ approved CT Study dated 6/27/2014.
Diameter	36 in	
Length	250 ft	
Volume (each)	13,221 gal	
Flow Rate (each)	10,417 gpm	15 MGD Flow
Detention Time	1.3 min	
Baffling Factor	1.0	
		Baffling Characteristics: <u> Perfect </u>
		Approved Baffling Factor: <u> </u>
T ₁₀	1.3 min	

CT Study for the Wichita Falls Temporary DPR WTP

Unit - 2 Type: Other Shape: Rectangular

Further Description: Microfiltration Trough

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Length	25.16 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Width	11 ft	
Side Water Depth	2.66 ft	
Volume (each)	5,508 gal	
Flow Rate (each)	10,417 gpm	
Detention Time	0.5 min	
Baffling Factor	0.1	
		Baffling Characteristics: <u>Unbaffled</u>
		Approved Baffling Factor: <u></u>
T ₁₀	0.1 min	

Unit - 3 Type: Other Shape: Other

Further Description: Microfiltration Cells

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Volume (each)	9,557 gal	The flow rate through each individual MF tank must be monitored and the highest flow rate entered on the SWMOR
Volume (each)	9,557 gal	Based on TCEQ approved CT Study dated 6/27/2014.
Flow Rate (each)	2,060 gpm	
Detention Time	4.6 min	Based on 5 Racks of Siemens Memcor S10V 504 modules with a total surface area of 334.9 ft2 per module and an approved flux rate of 19.6 gfd.
Baffling Factor	0.7	
		Based on the configuration of the filter cell and the submerged membrane units
		Baffling Characteristics: <u>Superior</u>
		Approved Baffling Factor: <u></u>
T ₁₀	3.2 min	

D3 FLOW RATE	2.966 mgd
T10 SUM FOR D3	4.6 min

CT Study for the Wichita Falls Temporary DPR WTP

Disinfection Zone: D4 Disinfectant: Free Chlorine

Unit - 1 Type: Piping Shape: Pipe

Further Description: 24-inch Permeate piping through UV disinfection area

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Diameter	24 in	Based on CT template submitted by Mr. David W. Sloan, P.E. Freese & Nichols, 3/3/2015
Length	104 ft	
Volume (each)	2,444 gal	
Flow Rate (each)	6,945 gpm	10 MGD
Detention Time	0.4 min	
Baffling Factor	1.0	
		Baffling Characteristics: <u>Perfect</u>
		Approved Baffling Factor: <u></u>
T ₁₀	0.4 min	

Unit - 2 Type: Piping Shape: Pipe

Further Description: 20-inch permeate piping through meter vault

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Diameter	20 in	Based on CT template submitted by Mr. David W. Sloan, P.E. Freese & Nichols, 3/3/2015
Length	32 ft	
Volume (each)	522 gal	
Flow Rate (each)	6,945 gpm	10 MGD
Detention Time	0.1 min	
Baffling Factor	1.0	
		Baffling Characteristics: <u>Perfect</u>
		Approved Baffling Factor: <u></u>
T ₁₀	0.1 min	

Unit - 3 Type: Piping Shape: Pipe

Further Description: 36-inch permeate piping to diversion point

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Diameter	36 in	Based on CT template submitted by Mr. David W. Sloan, P.E. Freese & Nichols, 3/3/2015
Length	114 ft	
Volume (each)	6,029 gal	
Flow Rate (each)	6,945 gpm	10 MGD
Detention Time	0.9 min	
Baffling Factor	1.0	
		Baffling Characteristics: <u>Perfect</u>
		Approved Baffling Factor: <u></u>
T ₁₀	0.9 min	

CT Study for the Wichita Falls Temporary DPR WTP

Unit - 4

Type: Piping

Shape: Pipe

Further Description: 24-inch HDPE diversion to Lagoon

Characteristic

Comments

Number of Units

1

Diameter

24 in

Length

320 ft

Based on CT template submitted by Mr. David
W. Sloan, P.E. Freese & Nichols, 3/3/2015

Volume (each)

7,521 gal

Flow Rate (each)

6,945 gpm

Detention Time

1.1 min

10 MGD

Baffling Factor

1.0

Baffling Characteristics: Perfect

Approved Baffling Factor:

T₁₀

1.1 min

CT Study for the Wichita Falls Temporary DPR WTP

D4 FLOW RATE	10.000 mgd
T10 SUM FOR D4	2.4 min

Disinfection Zone: D5
Disinfectant: Chloramines
Unit - 1
Type: Piping
Shape: Pipe

Further Description: 30-inch Raw Water Pipe

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Diameter	36 in	Based on TCEQ approved CT Study dated
Length	220 ft	6/27/2014.
Volume (each)	11,634 gal	
Flow Rate (each)	6,945 gpm	10 MGD
Detention Time	1.7 min	
Baffling Factor	1.0	
		Baffling Characteristics: <u> Perfect </u>
		Approved Baffling Factor: <u> </u>
T₁₀	1.7 min	

CT Study for the Wichita Falls Temporary DPR WTP

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

Further Description: 2010 Rapid Mix Basin

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Length	27 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Width	6 ft	
Side Water Depth	4 ft	
Volume (each)	4,848 gal	
Flow Rate (each)	6,945 gpm	10 MGD
Detention Time	0.7 min	
Baffling Factor	0.1	
		Baffling Characteristics: <u>Unbaffled</u>
		Approved Baffling Factor: <u></u>
T₁₀	0.1 min	

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

Further Description: 30-inch Raw Water Pipe

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Diameter	30 in	Based on TCEQ approved CT Study dated 6/27/2014.
Length	85 ft	
Volume (each)	3,122 gal	
Flow Rate (each)	6,945 gpm	10 MGD
Detention Time	0.4 min	
Baffling Factor	1.0	
		Baffling Characteristics: <u>Perfect</u>
		Approved Baffling Factor: <u></u>
T₁₀	0.4 min	

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

Further Description: 2010 Clarifier

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Diameter	90 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Side Water Depth	18.9 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Center Water Depth	20.6 ft	
Volume (each)	926,521 gal	
Flow Rate (each)	6,945 gpm	10 MGD
Detention Time	133.4 min	
Baffling Factor	0.3	
		Baffling Characteristics: <u>Poor</u>
		Approved Baffling Factor: <u></u>
T₁₀	40.0 min	

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

Further Description: 2010 Re-carbonation Basin

CT Study for the Wichita Falls Temporary DPR WTP

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Length	45.5 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Width	32 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Side Water Depth	16.8 ft	
Volume (each)	183,003 gal	
Flow Rate (each)	6,945 gpm	10 MGD
Detention Time	26.4 min	
Baffling Factor	0.5	Typcal 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	

Unit - 6 Type: Filter Shape: Rectangular

Further Description: 2010 Gravity Filters

<u>Characteristic</u>		<u>Comments</u>
Number of Units	4	
Length	24 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Width	15 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Media Depth	6 ft	
Underdrain Depth	1 ft	
Minimum Water Depth Over Media	6.8 ft	
Average Porosity	50 %	Assume
Volume (each)	29,088 gal	
Flow Rate (each)	1,736 gpm	Flow split between like units
Detention Time	16.8 min	
Baffling Factor	0.7	
		Baffling Characteristics: Superior
		Approved Baffling Factor:
T ₁₀	11.7 min	

D5 FLOW RATE	10.000 mgd
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T10 SUM FOR D5	67.1 min
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Disinfection Zone: D6 **Disinfectant:** Chloramines

Unit - 1 Type: Clearwell Shape: Rectangular

Further Description: 0.2-MG Clearwell/Transfer Pump Station

<u>Characteristic</u>		<u>Comments</u>
Number of Units	1	
Length	98.4 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Width	26 ft	Based on TCEQ approved CT Study dated 6/27/2014.
Side Water Depth	11.3 ft	
Maximum Volume (each)	216,290 gal	

CT Study for the Wichita Falls Temporary DPR WTP

Minimum Operating Level	5.7	ft	Based on minimum operating level, i.e., 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)	6,945	gpm	10 MGD
Detention Time	15.7	min	

Baffling Factor	0.5		baffling factor for basins with two internal baffles, length to width (30:1)
			Baffling Characteristics: Average
			Approved Baffling Factor:

T₁₀ **7.9 min**

Unit - 2 Type: Clearwell Shape: Circular

Further Description: 10 MG Ground Storage Tank

<u>Characteristic</u>			<u>Comments</u>
Number of Units	1		
Diameter	206	ft	Based on TCEQ approved CT Study dated 6/27/2014.
Side Water Depth	40	ft	Based on TCEQ approved CT Study dated 6/27/2014.
Center Water Depth	40	ft	
Maximum Volume (each)	9,974,083	gal	
Minimum Operating Level	20	ft	Based on minimum operating level, i.e., 50% of total volume.
Worst Case Volume (each)	4,987,042	gal	
Percent of Maximum Volume	50	%	
Worst Case Volume (each)	4,987,042	gal	
Flow Rate (each)	6,945	gpm	100 % of 10 MGD max at 2010 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		Basin with 2 inlets, 1 outlet and 3 interior baffles.
			Baffling Characteristics: Poor
			Approved Baffling Factor:
T₁₀	215.4	min	

D6 FLOW RATE	10.000	mgd
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T10 SUM FOR D6	223.3	min
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Disinfection Zone:	D7	Disinfectant:	
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Disinfection Zone:	D8	Disinfectant:	
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Disinfection Zone:	D9	Disinfectant:	
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Disinfection Zone:	D10	Disinfectant:	
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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: TP410791 Temporary DPR WTP Date: March 27, 2015

Disinfection Zone	Treatment Unit	Volume* (each) (gal)	Flow Rate* (each) (MGD)	Baffling Factor*	T ₁₀ * (min)	
					Unit	Zone
D1	3 Mile Pipe from RRWWTP to 2008 Cypress Plant (1)	1,859,189	7.500	1	356.964	356.96
D2	2008 MF/RO Floc-Clarifier (1)	3,875,583	15.000	0.3	111.613	111.61
D3	36-inch Raw Water Pipe (1)	13,221	15.000	1	1.269	4.57
	Microfiltration Trough (1)	5,508	15.000	0.1	0.053	
	Microfiltration Cells (1)	9,557	2.966	0.7	3.248	
D4	4-inch Permeate piping through UV disinfection area (1)	2,444	10.000	1	0.352	2.38
	20-inch permeate piping through meter vault (1)	522	10.000	1	0.075	
	36-inch permeate piping to diversion point (1)	6,029	10.000	1	0.868	
	24-inch HDPE diversion to Lagoon (1)	7,521	10.000	1	1.083	
D5	30-inch Raw Water Pipe (1)	11,634	10.000	1	1.675	67.12
	2010 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	40.025	
	2010 Re-carbonation Basin (1)	183,003	10.000	0.5	13.176	
	2010 Gravity Filters (4)	29,088	2.500	0.7	11.728	
D6	0.2-MG Clearwell/Transfer Pump Station (1)	109,102	10.000	0.5	7.855	223.29
	10 MG Ground Storage Tank (1)	4,987,042	10.000	0.3	215.438	

* These values are calculated on the T10 Details Sheet

TCEQ - (05-01-13)

CT STUDY

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.)
CT Calculator Worksheet

PUBLIC WATER SYSTEM NAME: City of Wichita Falls PLANT NAME OR NUMBER: TP410791 Temporary DPR WTP
PWS ID No.: 2430001 Date: March 27, 2015

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	15.000	2.966	10.000	10.000	2.0		5.0		
T ₁₀ (minutes)	357.0	111.6	4.6	2.4	67.1					

DISINFECTION PROCESS DATA												
INDIVIDUAL DISINFECTION ZONES										PLANT TOTAL		
Disinfectant	C (mg/L)	Flow (MGD)	Temp (°C)	pH	CT _{CALC}	Giardia CT _{REQD}	Virus CT _{REQD}	Giardia Log	Virus Log	Giardia Log	Virus Log	Inact. Ratio
CLA D1	3.0	7.500	7.0	7.0	1070.9	1338.0	2269.1	1.60	2.36			
CLA D2	3.0	15.000	7.0	7.0	334.8	1338.0	2269.1	0.50	0.74			
CLA D3	3.0	2.966	7.0	7.0	13.7	1338.0	2269.1	0.02	0.03	2.96	8.55	1.48
FCL D4	3.0	10.000	7.0	7.0	7.1	105.7	8.3	0.13	4.29			(6)
CLA D5	3.0	10.000	7.0	9.0	201.4	1338.0	2269.1	0.30	0.44			

SUBMITTED BY: _____

Certificate No. _____ and Grade: _____ Date: _____

TCEQ - (05-01-13)

CT STUDY

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.)
CT Calculator Worksheet

PUBLIC WATER SYSTEM NAME: _____ City of Wichita Falls _____ PLANT NAME OR NUMBER: _____ TP410791 Temporary DPR WTP _____

PWS ID No.: _____ 2430001 _____ Date: _____ March 27, 2015 _____

DISINFECTION PROCESS PARAMETERS									
APPROVED CT STUDY PARAMETERS						PERFORMANCE STANDARDS			
Parameters	Disinfection Zones					Log Inactivations			
	D6	D7	D8	D9	D10	Giardia lamblia Cysts		Viruses	
Flow Rate (MGD)	10.000					2.0		5.0	
T ₁₀ (minutes)	223.3								

DISINFECTION PROCESS DATA												
INDIVIDUAL DISINFECTION ZONES										PLANT TOTAL		
Disinfectant	C (mg/L)	Flow (MGD)	Temp (°C)	pH	CT _{CALC}	Giardia CT _{REQD}	Virus CT _{REQD}	Giardia Log	Virus Log	Giardia Log	Virus Log	Inact. Ratio
CLA D6	1.0	10.000	12.0	9.0	223.3	1108.0	1604.5	0.40	0.70			
D7												
D8										SEE	PAGE	1
D9												
D10												

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

TCEQ - (05-01-13)

CT STUDY