

Full-Scale Verification Testing Protocol Minimum Monitoring and Reporting of Water Qualities and Flow Rates

Water quality monitoring for chemical and microbiological constituents and frequencies are listed and marked with a check (✓) in Table A below. These monitoring parameters have been selected so that the TCEQ can verify the continuous protection of public health by the removal or inactivation of chemical and microbiological contaminants through the different proposed treatment processes at the tested flow rates and operating parameters. The PWS should customize the sampling plan for the treatment provided and the raw water quality expected.

Continuous (5-minute, 15-minute, 2-hour and 4-hour), daily, and other monitoring frequencies less than once every 7 days are to be **conducted onsite**. Twice per week monitoring should be at conducted at a consist frequency no closer than three days apart.

Samples collected at weekly (once every 7 days) and at longer frequencies **should be submitted to an offsite NELAP accredited laboratory for drinking water analysis**. Analyses marked for both onsite and offsite monitoring are required for quality control to verify the accuracy of the onsite monitoring equipment.

Table A

	WWTP Effluent (prior to WW DZ 1 chlorine injection point)							
	Continuous, every				Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	2-hrs.	4-hrs.	Once per day			
Flow rate (gpm)		✓						
Turbidity (NTU)		✓						
Temperature (°C)		✓						
	Frequency to be based on hydraulic detention time between WWTP effluent and selected 2010 SWTP filter effluent 3.0-day interval using an onsite analytical method. Based on the reported hydraulic detention time of 4.160 minutes between the RR WWTP effluent pumps and the Cypress 2010 Conventional SWTP gravity media filters' effluent.							
<i>Escherichia coli</i> (<i>E. coli</i>) enumeration								✓

Comment [W1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

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	Continuous, every				Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	2-hrs.	4-hrs.				
<i>Giardia</i> (cysts/l)	Frequency to be based on hydraulic detention time between WWTP effluent and selected 2010 SWTP filter effluent 3.0-day interval using an onsite analytical method. Based on the reported hydraulic detention time of 4.169 minutes between the RR WWTP effluent pumps and the Cypress 2010 Conventional SWTP gravity media filters' effluent.							✓
<i>Cryptosporidium</i> (oocysts/l)	Frequency to be based on hydraulic detention time between WWTP effluent and selected 2010 SWTP filter effluent 3.0-day interval using an onsite analytical method. Based on the reported hydraulic detention time of 4.169 minutes between the RR WWTP effluent pumps and the Cypress 2010 Conventional SWTP gravity media filters' effluent.							✓
Total dissolved solids (TDS, mg/L)					✓			
Total suspended solids (TSS, mg/L)					✓			
Daily flow rate (gpd)		✓			✓			
Nitrate (mg/L)					✓			✓
Alkalinity (mg/L)					✓			
Total organic carbon (TOC, mg/L)					✓			
Dissolved organic carbon (DOC, mg/L)					✓			
5-day Carbonaceous biochemical oxygen demand (CBOD ₅ , mg/L)					✓			
Full metal scan (mg/L, arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, zinc)					✓			
Algae counts (CFU/l)								✓
Chemicals listed in §290.106(b) Inorganics Chemicals								✓
Chemicals listed in §290.107(b) Organic Chemicals								✓
Chemicals listed in §290.108(b)(1) Radium 226, radium 228, uranium, gross alpha activity								✓

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDI frequency.

Comment [JPK2]: Daniel had a question about this language: he wanted to confirm he understood that monitoring was required only at startup, every 30 days, and end, but that monitoring should be staggered with appropriate lag time in order to track a single molecule through the treatment process.

TCEQ Response: That is correct. Please note that samples are required to be collected and analyzed: (1) onsite and (2) at an off-site lab to validate on-site monitoring.

Comment [JW3]: Our response is wrong. Was to be two different sampling events.

1) at this frequency using an onsite analytical method (real time) and
2) Startup, every 30 days and end using an offsite lab, Method 1623.

First method allowed track of water moving through the treatment process based on HDIs as noted here and for onsite monitoring of E. coli, Giardia & Crypto at other locations.

Comment [JW4]: Duh! How did the rest of you miss me doping this in the first version? Daily flow rate monitored every 15 minutes.

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	Continuous, every				Once per day	Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	2-hrs.	4-hrs.					
Chemicals listed in §290.108(b)(2) & 40 CFR §141.66(d) (gross beta particle and photon radioactivity, tritium, strontium 90)									✓
Chemicals listed in §290.118(b) Secondary Chemicals									✓
Lead (ug/L)									✓
Total trihalomethanes (TTHM, chloroform, dichlorobromomethane, dibromochloromethane, bromoform) (ug/L)							WF		✓
Halocetic acids (group of 5) (HAA5, monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromooacetic acid, dibromooacetic acid) (ug/L)							WF		✓
Bromide							WF		✓
Enterovirus (CFU/L)									WF
Norovirus (CFU/L)									WF
Nitroso-dimethylamine (NDMA, ng/L)									WF
Nitroso-pyrolidine (NPYR, ng/L)									WF
Pharmaceuticals (ug/L)									WF
Hormones (ug/L)									WF
Personal Care Products (ng/L)									WF
Fluorinated Alkyl-Acids (PFOS, PFOA, PFNA, PFHxS, PFHpA, & PFBS; ng/L)									WF
Sulfolose (ug/L)									WF
Perchlorate (ug/L)									WF
Begin WW DZ 1									
(at chlorine injection into WWTP effluent transmission pipe)									
Free ammonia level prior to chlorine injection (mg/L)									✓
Free chlorine dosage (mg/L)									✓
Total chlorine residual after chlorine injection (mg/L)									✓
Monochloramine residual after chlorine injection (mg/L)									✓
Free chlorine residual after chlorine injection (mg/L)									✓
Free ammonia level after chlorine injection (mg/L)									✓
pH level at monochloramine residual monitoring tap.									✓
Water temperature at for monochloramine residual monitoring tap (°C)									✓

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW5]: Deleted this with breakpoint chlorination DZ so had to add back in. WF doesn't have.

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	Continuous, every					Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	1-hr.	4-hrs.	Once every 7 days		
Total trihalomethanes (TTHM, chloroform, dichlorobromomethane, dibromochloromethane, bromoform) (mg/L)					W		
Halocetic acids (group of 5) (HAA5- monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, dibromoacetic acid) (mg/L)					W		
Bromide					W-WF		
Quantity of chlorine used (pounds per day, ppd)					W		
End WW DZ 1							
(WWTP Effluent Transmission Line at 2008 MF/RO SWTP's Flow Control Vault)							
Total chlorine residual (mg/L)		✓					
Monochloramine residual (mg/L)		✓					
Free chlorine residual (mg/L)		✓					
Free ammonia level (mg/L)		✓					
pH level at monochloramine monitoring tap		✓					
Water temperature at monochloramine monitoring tap (°C)		W					
2008 MF/RO Membrane Static Mixers and Coagulant Addition							
Alkalinity level (mg/L)				✓			
Influent water temperature (°C)				✓			
Coagulant dosage (mg/L)				✓			
Quantity of coagulant used (gpd)				✓			
Begin WW DZ 2							
(at 2008 MF/RO radial flow clarifier's flocculator with chlorine and ammonia injection)							
Influent flow rate (gpm)		✓					
Free chlorine dosage (mg/L)				✓			
Ammonia dosage (mg/L)				✓			
Total chlorine residual, after ammonia injection (mg/L)				✓			
Monochloramine residual, after ammonia injection (mg/L)				✓			
Free chlorine residual, after ammonia injection (mg/L)				✓			
Free ammonia level, after ammonia injection (mg/L)				✓			
pH level at monochloramine residual monitoring tap				✓			
Water temperature at monochloramine residual monitoring tap (°C)				✓			
Quantity of chlorine used (ppd)				✓			

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW6]: I agree with WF that this is the same or at least similar to raw WWTP effluent monitored above. Not enough time for increase to occur

Comment [JW7]: I agree with WF that this is the same or at least similar to raw WWTP effluent monitored above. Not enough time for increase to occur.

Comment [JW8]: Do we want to keep since monitored prior to chlorine injections?

Comment [JPK9]: Question from Daniel: why the requirement for temp every 15 minutes?

TCEQ Response: This is needed to match temperature to 15-minute monochloramine residual readings for required CT. Additionally, if pH is measured every 15 minutes, temperature should be monitored too.

Please note that the recommended monitoring requirements in this table are for the full-scale verification test period. The results will allow us to set the frequency for routine operation.

Comment [JW10]: Moved from locations below to here. WF has with Clarifier Disinfection Zone.

Comment [JW11]: I think

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Quantity of ammonia used (ppd)	Continuous, every				Once per day	Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	2-hrs.	4-hrs.					
2008 MF/RO Membrane Clarifier (floculation & clarification)									
Calculated flocculator hydraulic detention time (Based on influent flow rate, mins.)				✓				✓	WF
Effluent flow rate (gpm)		✓							
Calculated surface overflow rate (gpm/sf)				✓				✓	WF
Effluent turbidity level (NTU)			WF						
Effluent pH level			✓						
Effluent TOC (mg/L)						✓			
Effluent DOC (mg/L)						✓			
End WW DZ 2 (at 2008 MF/RO Clarifier effluent pipe)									
Total chlorine residual (mg/L)		✓							
Monochloramine residual (mg/L)		✓							
Free chlorine residual (mg/L)		✓							
Free ammonia level (mg/L)		✓							
pH level at monochloramine monitoring tap		✓							
Water temperature (°C) at monochloramine monitoring tap		✓							
Begin WW DZ 3 (at pipe to MF membrane prefilterers and feed pumps)									
Free chlorine feed pump dosage rate (mg/L)				✓					
Ammonia feed pump dosage rate (mg/L)				✓					
Total chlorine residual, after ammonia injection (mg/L)		✓							
Monochloramine residual, after ammonia injection (mg/L)		✓							
Free chlorine residual, after ammonia injection (mg/L)		✓							
Free ammonia level, after ammonia injection (mg/L)		✓							
pH level at monochloramine residual monitoring tap		✓							
Water temperature at monochloramine residual monitoring tap (°C)		✓							
Selected Microfiltration Prefilter									
Flow rate (gpm)		✓						✓	
Calculated hydraulic loading rate (gpm/sf)				✓					

Comment [JW11]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW12]: WF only wanted to do once at startup.

Comment [JW13]: WF dropped because said same as influent. Flow rate may be or not be same as influent. Clarifier blowdown events will change. Also, since no break tank, vacuum MF pumps, the flow could change when a MF unit goes into backwash.

Comment [JW14]: WF only wanted to do once at startup.

Comment [JW15]: we said frequency based on hydraulic detention time of MF/RO Clarifier, they requested 2 hours.

Comment [JW16]: If they exist

Comment [JPK17]: Per Daniel, no prefilter for the MF membranes.

TCEQ Response: It would be unusual to not have any type of prefilter. A 200 or 500 micron screen would qualify as a prefilter.

Comment [JW18]: If they do not have them we need to delete.

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	Continuous, every				Once per day	Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	2-hrs.	4-hrs.					
Selected MF Membrane Unit Feed Water (at MF unit feed trough & tank)									
Flow rate (gpm)		✓							
Influent turbidity (NTU)		✓							
Pressure head on membranes (psi)		✓							
Influent silt density index (SDI)					✓				
Selected MF Membrane Unit Filtrate (after vacuum pump & prior to blending with other MF filtrate)									
Turbidity (mNTU)	✓								
Pressure vacuum (psi)		✓							
Flow rate (gpm)		✓							
Calculated transmembrane pressure (TMP, psi)				✓					
Calculated flux rate (gallons per square-foot per day, gfd)				✓					
Calculated specific flux rate (gfd/psi) at measured temperature				✓					
Calculated specific flux (gfd/psi) normalized to 20° C				✓					
	Frequency based on hydraulic detention time between WWTP effluent and selected MF membrane unit effluent; 5-day interval using an onsite analytical method. Based on the reported hydraulic detention time of 3,644 minutes between the RR WWTP effluent pumps and the Cypress 2008 MF/RO SWTP MF units effluent.								✓
<i>Escherichia coli</i> (<i>E. coli</i>) enumeration									
	Frequency based on hydraulic detention time between WWTP effluent and selected MF membrane unit effluent; 2.5-day interval using an onsite analytical method. Based on the reported hydraulic detention time of 3,644 minutes between the RR WWTP effluent pumps and the Cypress 2008 MF/RO SWTP MF units effluent.								✓
<i>Giardia</i> (cysts/L)									

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW19]: Says the same as Clarifier effluent. Only if no prefilter/screens.

Comment [JPK20]: Question from Daniel: Is SDI useful for MF membranes?

TCEQ Response: We want to see what SDI reduction is across MF membranes because this is feed water for RO. We do not have historical data on treating wastewater. Clarification and MF should be adequate, but these MF membranes are not new.

Comment [JW21]: They dropped because they said they could not measure the pressure since are submerged membranes. Wonder how they are going to ge the TMP???

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	5-min.	15-min.	2-hrs.	4-hrs.	Once per day				
<i>Cryptosporidium</i> (oocysts/L)	Frequency-based on hydraulic detention time between WWTP effluent and selected MF membrane unit-effluent 2.5-day interval using an onsite analytical method. Based on the reported hydraulic detention time of 3,644 minutes between the RR WWTP effluent pumps and the Cypress 2008 MF/RO SWTP MF units' effluent.								✓
Enterovirus (CFU/L)									WF
Norovirus (CFU/L)									WF
pH level					✓				
SDI					M				
Alkalinity (mg/L)						✓			
TOC (mg/L)						✓			
DOC (mg/L)						✓			
End WW DZ 3 (at selected MF membrane filtrate piping)									
Flow rate (gpm)		✓							
Total chlorine residual (mg/L)		✓							
Monochloramine residual (mg/L)		✓							
Free chlorine residual (mg/L)		✓							
Free ammonia level (mg/L)		✓							
pH level at monochloramine residual monitoring tap		✓							
Water temperature at monochloramine residual monitoring tap (°C)		M							
Sodium Bisulfite Feed									
Sodium bisulfite dosage (mg/L)					✓				
Quantity of sodium bisulfite used (ppd)					✓				
Break Tank									
(RO membrane feed water tank)									
Effluent flow rate (gpm)		✓							
Water level (feet)					✓				
Calculated hydraulic detention time (using effluent flow rate, mins.)					✓				
Effluent free chlorine residual (mg/L)					✓				

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW2]: WF deleted here and said added after Break Tank. I am okay with it.

Comment [JW23]: Agree same as above flow rate, if we are talking the same location.

Comment [JPK24]: Same comment re Temp every 15 minutes as before.
TCEQ response: same response as above.

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	Continuous, every				Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	2-hrs.	4-hrs.		
Effluent total chlorine residual (mg/L)				✓		
SDI				WF		
Sulfuric Acid Feed						
Sulfuric acid dosage (mg/L)			✓			
pH level after injection			✓			
Quantity of sulfuric acid used (gpd)			✓			
Antiscalant Feed						
Antiscalant dosage (mg/L)			✓			
Quantity of antiscalant used (gpd)			✓			
Selected RO Membrane Prefilter						
Flow rate (gpm)	✓					M
Hydraulic loading rate (gpm/sf)			✓			✓
Selected RO Membrane Unit Feed Water (after RO unit feed pump and prior to unit)						
Flow rate (gpm)		✓				
Turbidity (MNTU)		✓				
Inlet pressure (psi)			✓			
Temperature (°C)			✓			
Nitrate (mg/L)			✓			
TDS (mg/L)			✓	WF		✓
TSS (mg/L)			✓	WF		
SDI				M		
pH level				M		
Hardness as calcium carbonate (mg/L)				✓		
Alkalinity (mg/L)				✓		
TOC (mg/L)				✓		
DOC (mg/L)				✓		
Nitrite (mg/L)						✓
Silica (mg/L)						✓
First Stage RO Membranes						

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW25]: If they exist.

Comment [JW26]: WF said same as Break Tank. I disagree. WF flow rate into break tank, RO membrane vacuum pump flow rate out of tank.

Comment [JW27]: Needs to be at same time as calculation for HLR

Comment [JW28]: I changed to MNTU in lieu of NTU.

Comment [JW29]: WF says the same SDI as measured at the Break Tank. We didn't require at Break Tank. They added. However, the addition of the sulfuric acid and antiscalant could change level at this point. And there is still the question if the RO units have prefilter/screens.

Comment [JW30]: WF says pH same as after sulfuric acid injection. However, Antiscalant is injected after that point.

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	Continuous, every						Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	1-hr.	4-hrs.	Once per day	Once every 7 days		
Flow rate (gpm)					✓			
Calculated flux rate (gfd) at measured temperature					✓			
Calculated net driving pressure (psi)					✓			
Calculated specific flux rate (gfd/psi) normalized to 20° C					✓			
Second Stage RO Membranes								
Flow rate (gpm)					✓			
Calculated flux rate (gfd) at measured temperature					✓			
Calculated net driving pressure (psi)					✓			
Calculated specific flux rate (gfd/psi) normalized to 20° C					✓			
Selected RO Membrane Unit Reject Water (at concentrate piping)								
Flow rate (gpm)		✓						
Pressure (psi)		✓						
Temperature (°C)						✓		
TDS (mg/L)					✓			
pH level						✓		
Turbidity (NTU)						✓		
Free ammonia (mg/L)					✓			
Nitrate (mg/L)					✓			
CBOD ₅ (mg/L)						✓		
Full metal scan (mg/L, arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, zinc)						✓		
Selected RO Membrane Unit Permeate (at selected RO unit permeate piping and prior to blending with other RO units' permeate)								
Flow rate per unit (gpm)		✓						
TDS (mg/L)		✓						
Effluent pressure (psi)		✓						
Temperature (°C)					✓			
pH level					✓			
Maximum daily TDS (mg/L)					✓			
Calculated average flux rate (gfd) at measured temperature					✓			

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JPK31]: Question from Daniel: is pressure needed for the RO membrane reject?

TCEQ response: Pressure of the RO membrane unit reject is needed to calculate net driving pressure. See equation in EPA MFGM Eq. 2.17

Comment [JPK32]: Question from Daniel: why no requirement to monitor E. coli, crypto and giardia? The City plans on monitoring for these in the RO permeate.

TCEQ response: The City can monitor E. coli, crypto and giardia, but until we approve a method to grant pathogen-removal credit for RO membranes, monitoring data does not result in pathogen-removal credit.

Please use the same sample collection methods for E. coli, crypto and giardia as done elsewhere in the treatment process.

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	5-min.	15-min.	2-hrs.	4-hrs.	Once per day	Once every 7-days	Twice per week
Calculated net driving pressure (psi)				✓			
Calculated average specific flux rate (gfd/psi) normalized to 20° C					✓		
Nitrate (mg/L)					✓		✓
Nitrite (mg/L) <i>if nitrite is detected in RO membrane feed water</i>					✓		✓
Alkalinity (mg/L)					✓		
TOC (mg/L)					✓		
DOC (mg/L)					✓		
Chemical listed in §290.106(b) Inorganics Chemicals							✓
Chemicals listed in §290.107(b) Organic Chemicals							✓
Chemicals listed in §290.108(b)(1) and §290.108(b)(2) & 40 CFR §141.66(d)							✓
Chemicals listed in §290.118(b) Secondary Chemicals							
TTM (ug/L)					✓		
HAAs (ug/L)					✓		
Bromide (mg/L)					✓		
Enterovirus (CFU/L)							WF
Norovirus (CFU/L)							WF
Nitroso-dimethylamine (NDMA, ng/L)							WF
Notroso-pyrolidine (NPPYR, ng/L)							WF
Pharmaceuticals (ug/L)							WF
Hormones (ug/L)							WF
Personal Care Products (ug/L)							WF
Fluorinated Alkyl-Acids (PFOS, PFOA, PFNA, PFHxS, PFHpA, & PFBS; ng/L)							WF
Sulfolose (ug/L)							WF
Perchlorate (ug/L)							WF
Calculated % Removal							
(Based on RR WWTP effluent quality and RO unit's permeate quality prior to discharge to lagoon)							
Nitrate removal (%)					✓		✓
Nitrite removal (%) <i>if nitrite detected in RO feed water</i>					WF		
TDS removal (%)					M		

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDI frequency.

Comment [JW33]: Do we want NDP at same frequency as specific flux calculations? 1/day

Permeate pressure? Temp?

Comment [JW34]: Hard to do since nitrite is not monitored at the RR WWTP effluent.

Comment [JW35]: Problem here as we have TDS monitored 1/week at WWTP and every 15 minutes at RO membrane permeate. Do we need to match up or add something back up the line???

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	5-min.	15-min.	2-hrs.	4-hrs.				
TOC removal (%)								
DOC removal (%)					✓			
Removal of inorganics (%)								✓
Removal of organics (%)								✓
Removal of all radionuclides (%)								✓
Removal of secondary chemicals (%)					WF			✓
THM removal (%)					WF			✓
HAA5 removal (%)					WF			✓
Bromide removal (%)					WF			✓
RO Permeate Lagoon Effluent (at lagoon recycle pump station & before blending with Secondary Reservoir source water)								
Flow rate (gpm)		✓						
Turbidity (NTU)				✓				
pH level				✓				
Temperature (°C)				✓				
Nitrate (mg/L)					✓			✓
Free ammonia level (mg/L)					✓			
Alkalinity (mg/L)					✓			
TOC (mg/L)					✓			
DOC (mg/L)					✓			
Raw Secondary Reservoir Source Water (prior to chlorine dioxide injection)								
Flow rate (gpm)		✓						
Turbidity (NTU)			✓					
Temperature (°C)		✓						
Frequency based on hydrant detection time between Secondary Reservoir raw water pumps and splitter box effluent; 5-hour interval using an onsite analytical method. Based on the reported hydraulic detention time of 337 minutes between the Secondary Reservoir pumps and the Cypress facility's Splitter Box.								
<i>E. coli</i> enumeration								✓

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW36]: Okay we have THM, HAA5 only monitored at the WWTP effluent at startup, every 30 days and at the end. But are monitored 1/week at the RO permeate. So... we need to adjust this ?

Comment [JPK37]: Same questions as before.
 TCEQ response: This can be deleted.
 Comment [JW38]: They left in.

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		5- min.	15- min.	2- hrs.	4- hrs.				
	<i>Giardia</i> (cysts/L)	Frequency based on hydraulic detention time between Secondary Reservoir raw-water pumps and splitter-box effluent 5.5-hour interval using an onsite analytical method. Based on the reported hydraulic detention time of 337 minutes between the Secondary Reservoir pumps and the Cypress facility's Splitter Box.							✓
	<i>Cryptosporidium</i> (oocysts/L)	Frequency based on hydraulic detention time between Secondary Reservoir raw-water pumps and splitter-box 5.5-hour interval using an onsite analytical method. Based on the reported hydraulic detention time of 337 minutes between the Secondary Reservoir pumps and the Cypress facility's Splitter Box.							✓
	TDS (mg/L)					✓			
	TSS (mg/L)					✓			
	Daily flow rate (gpd)					✓			
	Nitrate (mg/L)					✓			✓
	Alkalinity (mg/L)					✓			
	TOC (mg/L)					✓			
	DOC (mg/L)					✓			
	Chemicals listed in §290.106(b) Inorganics Chemicals								✓
	Chemicals listed in §290.107(b) Organic Chemicals								✓
	Chemicals listed in §290.108(b) (1) and §290.108(b)(2) & 49 CFR §141.66(d)								✓
	Chemicals listed in §290.118(b), Secondary Chemicals								✓
	TTTHM (mg/L)					✓			
	HAA5 (mg/L)					✓			
	Bromide (mg/L)					✓			
	Enterovirus (CFU/L)								WF
	Norovirus (CFU/L)								WF
	Nitroso-dimethylamine (NDMA, ng/L)								WF

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW39]: WF said TTTHM and HAA5 should not exist in raw SW. "Therefore the City has elected to not monitor at this point." ACD & I talked about. I don't think there are any WW discharges into Secondary Reser.

Comment [JW40]: We have at startup, every 30 days and end for WWTP effluent. Should we change here or there?

Full-Scale Verification Testing Protocol **Minimum Monitoring and Reporting of Water Qualities and Flow Rates**

	Continuous, every				Once per day	Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	2-hrs.	4-hrs.					
Notroso pyroline (NPYR, ng/L)									WF
Pharmaceuticals (µg/L)									WF
Hormones (ng/L)									WF
Personal Are Products (ng/L)									WF
Fluorodated Alkyl-Acids (PFOS, PFOA, PFNA, PFHxS, PFHpA, & PFBS; ng/L)									WF
Sulcalose (ug/L)									WF
Perchlorate (ug/L)									WF
Begin RW DZ 1									
(at chlorine dioxide injection point on Secondary Reservoir raw water transmission pipe)									
Flow rate (gpm)		✓							
Chlorine dioxide dosage (mg/L)				✓					
pH level				✓					
Temperature (°C)				✓					
Quantity of chlorine dioxide used (gpd)				✓					
End RW DZ 1									
(at 1 st monitoring point on raw Secondary Reservoir transmission pipe 400 feet from chlorine dioxide injection point)									
Flow rate (gpm)		✓							
Chlorine dioxide residual (mg/L)				✓					
pH level				✓					
Temperature (°C)				✓					
End RW DZ 2									
(at 2 nd monitoring point on raw Secondary Reservoir transmission pipe 900 feet from chlorine dioxide injection point)									
Flow rate (gpm)		✓							
Chlorine dioxide residual (mg/L)				✓					
pH level				✓					
Temperature (°C)				✓					
End RW DZ 3									
(prior to tee for blending, RO Permeate Lagoon water at 3 rd monitoring point on raw Secondary Reservoir transmission pipe 6,500 feet from chlorine dioxide injection point)									
Flow rate (gpm)		✓							
Chlorine dioxide residual (mg/L)				✓					
pH level				✓					

Comment [W41]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [W41]: WF says will only monitor at end of RW DZ 3

Comment [W42]: Same as RW DZ 1 reading

Comment [W43]: WF says will only monitor at end of RW DZ 3

Comment [W44]: Same as RW DZ 1 reading

Comment [W45]: Same as RW DZ 1 reading

Full-Scale Verification Testing Protocol Minimum Monitoring and Reporting of Water Qualities and Flow Rates

	Continuous, every				Once per day	Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5- min.	15- min.	2- hrs.	4- hrs.					
Temperature (°C)				✓					
Turbidity (NTU)				WF					
Total Alkalinity (mg/L)				WF	WF				
Nitrate (mg/L)				WF	WF				
Raw-Secondary Reservoir Influent to Splitter Box									
Flow rate (gpm)		✓							
Turbidity (NTU)				✓					
Alkalinity (mg/L)				✓	✓				
Nitrate (mg/L)					✓				✓
Splitter Box Effluent									
(blended RO permeate from lagoon & Secondary Reservoir source water prior to chlorine & ammonia injection)									
Combined flow rate (gpm)				✓					
pH level				✓					
Temperature (°C)									
Turbidity (NTU)				✓					
E. coli enumeration	Frequency based on hydraulic detention time between Splitter box effluent and selected 2010 SWTP filter effluent 7-hour interval using an onsite analytical method. Based on the reported hydraulic detention time of 428 minutes between the Cypress facility's Splitter Box and the selected Conventional 2010 SWTP filter's effluent.								
	Frequency based on hydraulic detention time between Splitter box effluent and selected 2010 SWTP filter effluent 7-hour interval using an onsite analytical method. Based on the reported hydraulic detention time of 428 minutes between the Cypress facility's Splitter Box and the selected Conventional 2010 SWTP filter's effluent.								
Giardia (cysts/L)									

Comment [JW41]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW46]: This was supposed to be for blended RO Permeate and Secondary Reser. Therefore, same as Splitter box effluent.

Comment [JW47]: Monitored at Beginning of Blended DZ 4

Comment [JW48]: WF had listed in their Protocol, but no frequency marked. I think leave it out here and just include at the Begin Blended DZ 4 location as we had.

Comment [JPK49]: Question from Daniel: elsewhere in this document the monitoring requirement for flow, pH, and turbidity is once every 15 minutes. Is there a reason why it only required every 4 hours here?

TCEQ response: Monitoring requirements elsewhere are for membrane treatment. Here we have conventional SWTP processes.

Full-Scale Verification Testing Protocol **Minimum Monitoring and Reporting of Water Qualities and Flow Rates**

		Continuous, every				Once per day	Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
		5-min.	15-min.	2-hrs.	4-hrs.					
	<i>Cryptosporidium</i> (oocysts/L)	Frequency based on hydraulic detention time between Splitter box effluent and selected 2010 SWTP filter effluent 7-hour interval using an onsite analytical method. Based on the reported hydraulic detention time of 428 minutes between the Cypress facility's Splitter Box and the selected Conventional 2010 SWTP Filter's effluent.								✓
	Nitrate					✓				✓
	Water color					✓				
	Odor (threshold odor number)					✓				
	TOC (mg/L)						✓			
	DOC (mg/L)									
	THM (mg/L)									✓
	HAA5 (mg/L)									✓
	Bromide (mg/L)									✓
	Chemical listed in §290.106(b) Inorganics Chemicals									✓
	Chemicals listed in §290.107(b) Organic Chemicals									✓
	Chemicals listed in §290.108(b)(1) radionuclides									✓
	Chemicals listed in §290.108(b)(2) & 40 CFR §141.66(d) manmade radionuclides									✓
	Chemicals listed in §290.118(b) Secondary Chemicals									✓
	Enterovirus (CFU/L)									WTF
	Norovirus (CFU/L)									WTF
Calculated % Change in Water Quality (between RO membrane unit permeate, prior to discharging to lagoon, and the blended water quality)										
	Nitrate change as % reduction (-) or % increase (+)					✓				✓
	TOC change as % reduction (-) or % increase (+)									WTF
	DOC change as % reduction (-) or % increase (+)									
	THM change as % reduction (-) or % increase (+)									✓
	HAA5 change as % reduction (-) or % increase (+)									WTF
	Bromide change as % reduction (-) or % increase (+)									WTF
	Chloride change as % reduction (-) or % increase (+)									WTF

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JPK50]: Per Daniel, they do not plan to monitor for color or odor here.
 TCEQ response: The City needs to monitor for color and odor during full-scale verification. Color and odor are two significant concerns when treating WWTP effluent for potable water.

Comment [JPK51]: Question from Daniel: THMs and HAA5s are monitored elsewhere both upstream and downstream- is it necessary to monitor here?
 TCEQ response: Yes, we want to know what each treatment process is achieving during the full-scale verification testing so that we can determine monitoring and shutdown requirements for when the water is sent to the distribution.

Comment [JW52]: WF has % change in RO Permeate Lagoon effluent. I think we intended for it to be RO Permeate before the lagoon. So I amended to clarify this direction. Was I wrong.

Comment [JW53]: TOC only monitored 1wk.

Comment [JW54]: We deleted THM & HAA5 from Sec. Reser.

Comment [JW55]: We monitor 1wk at both locations.

Comment [JW56]: Not sure why WF added at this location. Chlorite not monitored at either water source location on their Protocol or ours.

Full-Scale Verification Testing Protocol Minimum Monitoring and Reporting of Water Qualities and Flow Rates

	Continuous, every							Startup, every 30 days & End
	5- min.	15- min.	1- hrs.	4- hrs.	Once per day	Once every 7- days	Twice per week	Once per day & anytime the effluent flow rate changes
Begin Blended DZ 4 (at chlorine & ammonia injection after Cypress facility Splitter Box and before 2010 Rapid Mix)								
Flow rate (gpm)		✓						
Free chlorine dosage (mg/L)				✓				
Ammonia dosage (mg/L)				✓				
Total chlorine residual, after ammonia injection (mg/L)				✓				
Monochloramine residual, after ammonia injection (mg/L)				✓				
Free chlorine residual, after ammonia injection (mg/L)				✓				
Free ammonia residual, after ammonia injection (mg/L)				✓				
pH level at monochloramine residual monitoring tap				✓				
Water temperature at monochloramine monitoring tap (°C)				✓				
Quantity of chlorine used (ppd)				✓				
Quantity of ammonia used (ppd)				✓				
Conventional 2010 SWTP Rapid Mix								
Influent pH level				✓				
Influent alkalinity level (mg/L)				✓				
Influent water temperature (°C)				✓				
Coagulant dosage (mg/L)				✓				
Quantity of coagulant used (gpd)				✓				
Conventional 2010 SWTP Flocculation & Clarification (Accelerator solids-contact clarification)								
Flow rate (gpm)		✓						
Calculated flocculator hydraulic detention time (mins.)				✓				WF
Lime feed rate (gpd)				✓				
Calculated clarifier surface overflow rate (gpm/sf)				✓				✓
Settled water turbidity (NTU)				WF				WF
Quantity of cationic polymer used (gpd)					✓			
Quantity of lime used (gpd)					✓			
Effluent TOC (mg/L)						✓		
Effluent DOC (mg/L)						✓		

Conventional 2010 SWTP Restabilization Basin

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW57]: Same as above for Splitter Box effluent flow rate.

Comment [JW58]: This is new listed location. Moved from below under its on heading in hopes to eliminate confusion.

Comment [JW59]: Only wanted to do at startup.

Comment [JW60]: Only wanted to do at startup.

Comment [JW61]: We had based on HDT, WF requested every 2 hrs.
I have no idea why we also said monitor settled water turbidity at this frequency in the table we sent them.

Full-Scale Verification Testing Protocol Minimum Monitoring and Reporting of Water Qualities and Flow Rates

	Continuous, every				Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	2-hrs.	4-hrs.				
Flow rate (gpm)		✓						
Carbon dioxide dosage (mg/L)					✓			
Effluent pH level					✓			
Quantity of carbon dioxide used (gpd)					✓			
Blended Phosphate Addition (after Conventional 2010 SWTP Restabilization Basin and prior to gravity media filters)								
Blended phosphate dosage (mg/L)					✓			
Quantity of blended phosphate used (gpd)					✓			
Selected Conventional 2010 SWTP Gravity Media Filter								
Filtered water turbidity level (NTU)		✓						
Selected individual filter flow rate (gpm)				WF				
Combined filtered water flow rate (gpm)				✓				
Calculated filter hydraulic loading rate (gpm/sf)				✓			✓	WF
End Blended DZ.4 (at effluent of Conventional 2010 SWTP filters)								
Flow rate		✓						
Total chlorine residual (mg/L)		✓						
Monochloramine residual (mg/L)		✓						
Free chlorine residual (mg/L)		✓						
Free ammonia level (mg/L)		✓						
pH level		✓						
Water temperature (°C)		✓						
Begin 2010 SWTP Clearwell DZ.5								
Fluoride Adjustment (after Conventional 2010 SWTP filters and prior to chlorine injection point)								
Fluoride level, pre-fluoridic injection (mg/L)					✓			
Fluoridic acid dosage (mg/L)					✓			
Quantity of fluoridic acid used (gpd)					✓			
Begin Blended DZ.5 (at chlorine injection prior to Conventional 2010 SWTP Clearwell)								
Total chlorine residual, pre chlorine injection (mg/L)		✓						
Free chlorine dosage (mg/L)				✓				

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JW62]: Not the same as Accelerator influent flow rate if clarifier blowing down.

Comment [JW63]: WF added

Comment [JW64]: WF wording added

Comment [JW65]: They only wanted to do once at startup.

Comment [JW66]: Same as combined filter flow rate above

Comment [JW67]: Relocated below after Fluoride adjustment to represent order of treatment. I hope.

Comment [JPK68]: Per Daniel, due to the proximity of the C12 injection point to the ammonia injection point, he says they cannot monitor for this.

TCEQ response: This is a nchloration point. The two chemicals need to be added simultaneously or ammonia needs to go in first. There should be no free chlorine present at the end of the filters... or, as noted previously, downstream of any ammonia injection point.

Red comment added: There is not any ammonia injection equipment at this location based on their App. G schematic.

Full-Scale Verification Testing Protocol Minimum Monitoring and Reporting of Water Qualities and Flow Rates

	Continuous, every				Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	1-hr.	4-hrs.				
Free ammonia residual, pre-chlorine injection (mg/L)				✓				
Free chlorine residual, after chlorine injection (mg/L)				✓				
Free ammonia level, after chlorine injection (mg/L)				✓				
Total chlorine residual, afterchlorine injection (mg/L)				✓				
Monochloramine residual, after chlorine injection (mg/L)				✓				
pH level at monochloramine residual monitoring tap				✓				
Water temperature at monochloramine residual monitoring tap (°C)				✓				
Quantity of chlorine used (ppd)				✓				
End Blended DZ 5								
(at Conventional 2010 SWTP Clearwell's transfer pumps)								
Total chlorine residual (mg/L)		✓						
Monochloramine residual (mg/L)		✓						
Free chlorine residual (mg/L)		✓						
Free ammonia level (mg/L)		✓						
pH level at monochloramine residual monitoring tap		✓						
Water temperature at monochloramine residual monitoring tap (°C)		✓						
Finished Water-Conventional 2010 SWTP Clearwell Water Quality								
(after clearwell transfer pumps and prior to GSTs)								
Flow rate (gpm)								
Turbidity (NTU)		✓						
Turbidity (mNTU)		✓						
Nitrate (mg/L)		✓			WF			✓
TDS (mg/L)		✓			WF			✓
Daily quantity of water treated (MGD)					✓			
Chlorine dioxide (mg/L)					✓			
Chlorite (mg/L)					✓			
Color (color units)					✓			
Odor (threshold odor number)					✓			
Fluoride (mg/L)					✓			✓
Alkalinity (mg/L)					✓			
Hardness as calcium carbonate (mg/L)					✓			

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [JPK69]: Daniel's same ques re 15-minute temp mon requirement.

TCEQ response: same response as above.
Comment [JW70]: Renamed since finished water would be after GSTs and DZ 6.
Also, had after filters and not CW/transfer pump station as Alicia pointed out.

Comment [JW71]: WF or us needs to select one or the other. Prefer mNTU.

Comment [JPK72]: Question from Daniel: Is it correct that we recommend monitoring for NO3 and TDS here every 15 minutes? Elsewhere the monitoring frequency is once per day.

TCEQ response: This is right before planned distribution for human consumption.

Full-Scale Verification Testing Protocol Minimum Monitoring and Reporting of Water Qualities and Flow Rates

	Continuous, every				Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5-min.	15-min.	2-hrs.	4-hrs.				
Calculated Langelier saturation index (LSI)					✓			
TTHM (ug/L)					✓			
HAA5 (ug/L)					✓			
Lead (mg/L)								✓
E. coli enumeration	Two sample sets: 1) WWTP effluent and 2010 Clearwell effluent 3.0-day interval using an onsite analytical method. Based on the reported hydraulic detention time of 4,208 minutes between the RR WWTP effluent pumps and the Cypress 2010 SWTP's clearwell effluent. 2) Secondary Reservoir raw water pumps and 2010 Clearwell effluent 13.4-hour interval using an onsite analytical method. Based on the reported hydraulic detention time of 804 minutes between the Secondary Reservoir pumps and the Cypress 2010 SWTP's clearwell effluent.							✓
	Two sample: 1) WWTP effluent and 2010 Clearwell effluent 3.0-day interval using an onsite analytical method. Based on the reported hydraulic detention time of 4,208 minutes between the RR WWTP effluent pumps and the Cypress 2010 SWTP's clearwell effluent. 2) Secondary Reservoir raw water pumps and 2010 Clearwell effluent 13.4-hour interval using an onsite analytical method. Based on the reported hydraulic detention time of 804 minutes between the Secondary Reservoir pumps and the Cypress 2010 SWTP's clearwell effluent.							✓
Giardia (cysts/L)								✓

Comment [JW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.

Comment [PK3]: Question from Daniel: this is the only recommended monitoring point for lead? Do we want it only here, or should it be monitored elsewhere? Should lead be monitored at all?
TCEQ response: We also require lead monitoring in raw WWTP effluent.

Full-Scale Verification Testing Protocol **Minimum Monitoring and Reporting of Water Qualities and Flow Rates**

	Continuous, every				Once every 7 days	Twice per week	Once per day & anytime the effluent flow rate changes	Startup, every 30 days & End
	5- min.	15- min.	2- hrs.	4- hrs.				
<i>Cryptosporidium</i> (oocysts/L)	Two sample sets: 1) ~~WWTP effluent and 2010 Clearwell effluent~~ 3-0-day interval using an onsite analytical method. Based on the reported hydraulic detention time of 4,208 minutes between the RR WWTP effluent pumps and the Cypress 2010 SWTP's clearwell effluent. 2) ~~Secondary Reservoir raw water pumps and 2010 Clearwell effluent~~ 3-4-hour interval using an onsite analytical method. Based on the reported hydraulic detention time of 804 minutes between the Secondary Reservoir pumps and the Cypress 2010 SWTP's clearwell effluent.							✓
Enterovirus (CFU/L)								WF
Norovirus (CFU/L)								WF
Nitroso-dimethylamine (NDMA, ng/L)								WF
Nitroso-pyrolidine (NPPYR, ng/L)								WF
Pharmaceuticals (ug/L)								WF
Hormones (ng/L)								WF
Personal Care Products (ng/L)								WF
Fluorinated Alkyl Acids (PFOS, PFOA, PFNA, PFHxS, PFHpA, & PFBS, ng/L)								WF
Sulfolose (ug/L)								WF
Perchlorate (ug/L)								WF
Begin Blended DZ 6								
(no disinfectant injection, includes 10.0-MG GST)								
NA during Full-Scale Verification Testing								
End Blended DZ 6								
(at high service pumps' discharge header)								
NA during Full-Scale Verification Testing								

* Either a Hach Model 1720E (or TCEQ approved equivalent) or Model 660 FilterTrak turbidimeter may be used for the 15-minute finished water turbidity level monitoring and reporting.

Comment [DW1]: WF requested for settled turbidity monitoring frequency. More frequent than our specified HDT frequency.