

**Concept Paper
for the
Emergency Reuse of Wastewater Effluent
as a
Source for Direct Potable Reuse in Wichita Falls**



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Executive Summary

The City of Wichita Falls is currently in the second year of an extended drought, which has depleted its source water reservoirs to approximately 40% of their storage capacity. The City of Wichita Falls anticipates that if significant rainfall is not forthcoming, that its source water reservoirs will continue to drop, triggering more advanced stages of its Drought Plan. The City of Wichita Falls' current drought plan has an established goal of 10 MGD maximum daily production when its source water lakes drop below 30% of their combined storage capacity.

In an effort to extend the use of these source water lakes to a point that they receive enough rainfall runoff to raise their levels, the City of Wichita Falls is seeking approval from the Texas Commission on Environmental Quality to utilize a portion of the City's Wastewater Effluent to augment its source waters for drinking water.

The City of Wichita Falls proposes to initially divert 7.5 MGD of its Wastewater Effluent to its Microfiltration/Reverse Osmosis Plant located within its Cypress Water Treatment Facility, and then blend the produced 5.0 MGD of RO Permeate with 5.0 MGD of raw lake water and treat that blend through one of the conventional plants at Cypress.

The City of Wichita Falls has performed extensive monitoring of its wastewater effluent and has calculated that it will be able to comply with all

existing Federal regulations governing surface water treatment, as well as additional requirements that the TCEQ has proposed. The primary focus will be those constituents that would cause problems with short-term (4 to 6 months) consumption of water, such as waterborne pathogens.

The City recognizes the importance of the Wastewater Effluent as a valuable resource that can be utilized in a variety of ways. To that end, the City is also developing a long-term strategy for the permanent reuse of its Wastewater Effluent.

In conclusion, the City of Wichita Falls believes that it has demonstrated through monitoring, calculation, and the development of operational plans that the Wastewater Effluent can be safely and effectively utilized as a source of water for the direct potable reuse for drinking water.

I. Statement of Problem

The Current Drought

The City of Wichita Falls utilizes 3 lakes (Lake Kickapoo, Lake Arrowhead, and Lake Kemp) as its primary sources of water. All 3 of these lakes have been adversely impacted by the drought that began in 2011 and persisted through 2012. (Figure 1 & Figure 2).

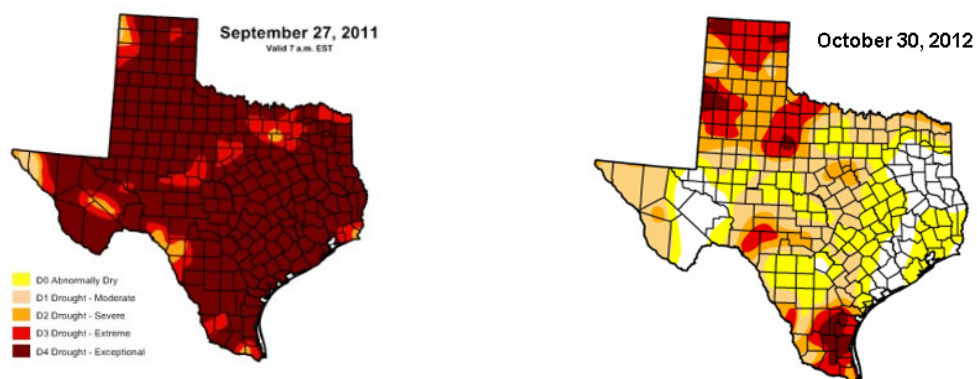


Figure 1: Overall Impact of Drought Throughout Texas

It can be seen that while the whole State of Texas was adversely impacted by the drought of 2011, recent rains have brought the vast majority of the State into a better condition by October 2012. Unfortunately, the Wichita Falls watersheds are still within the areas that are indicating Severe to Extreme Drought conditions as of October 30, 2012.

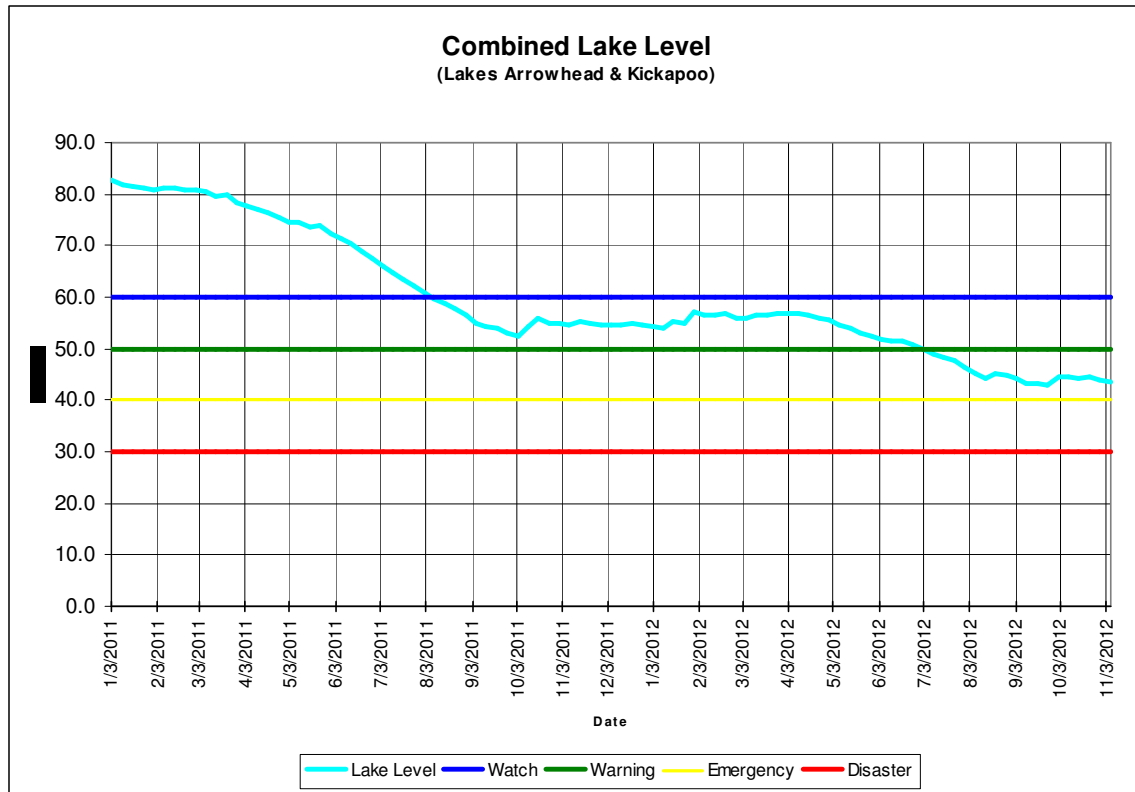


Figure 3: Wichita Falls Lake Combined Lake Levels (January 2011 to Present)

When Wichita Falls started the calendar year 2011, it had a combined lake level of 83.0 %. During the summer of 2011, Wichita Falls experienced over 100 days of temperatures over 100° F and high winds, all of which served to drop the combined lake levels to 55% by the end of the summer.

Wichita Falls started 2012 with a combined lake level of 54%. It did have what is considered an average summer as far as temperatures and rainfall but the combined lake level continued to decline and as of October 30, 2012 is at 43%.

As Wichita Falls attempts to predict the future of its water supplies for the next 6 – 12 months, it takes into account several sources of information. Of those, the two most important are presented below.

The U.S. Seasonal Drought Outlook, provided by the National Oceanic & Atmospheric Administration (NOAA) is predicting that the drought throughout the North Central Texas region to persist or intensify through January 31, 2013 (Figure 3)

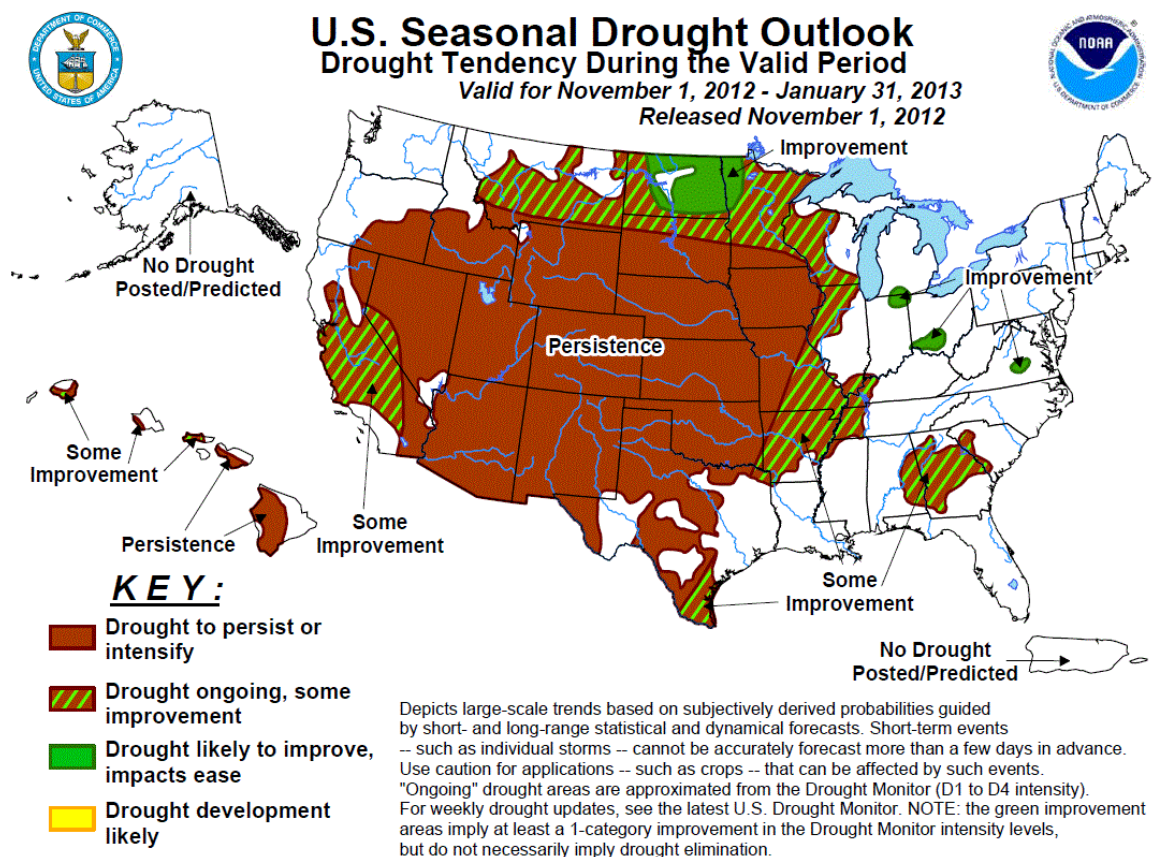


Figure 3: NOAA Drought Outlook through January 31, 2013.

The City of Wichita Falls is also projecting the lake level decline using data that provides for a worst case scenario for lake level decline (2011 Summer Data). This projection indicates that the City of Wichita Falls could trigger its Stage 3 Drought Emergency restrictions as soon as March 2013, followed by the declaration of a Stage 4 Drought Disaster as early as 3 months later, in June 2013. (Figure 4)

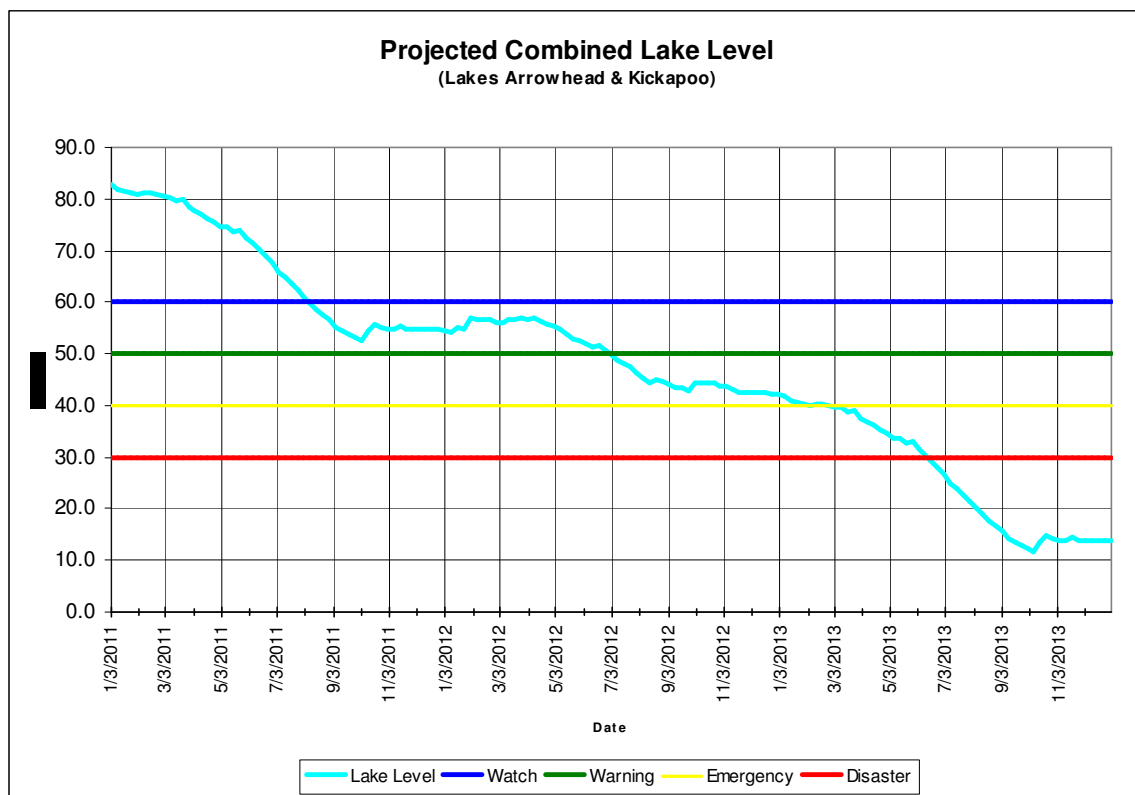


Figure 4: Wichita Falls Projected Lake Level Reduction

As Figure 4 demonstrates, without significant rainfall/runoff within the watershed boundaries of Lake Kickapoo and Lake Arrowhead the City of Wichita

Falls runs the risk of starting its 2013 Summer demand with a combined lake level of 30 % and rapidly declining into the teens before the end of the summer.

This situation not only poses a problem for the citizens of Wichita Falls and its wholesale potable water customers but also those communities that purchase raw water from the City of Wichita Falls. Several of them rely on the sources from Lake Kickapoo and Lake Arrowhead as a backup supply for their smaller sources of water. If these two lakes are not reinforced against a steep decline in their levels, then the City's of Archer City, Olney, Henrietta, and Windthorst run the very real risk of not having any drinking water at all.

Water Conservation / Drought Contingency

The City of Wichita Falls conducted a major revision of its Water Conservation / Drought Contingency Plan in 2008. It raised the trigger levels of the first 3 drought triggers by 10% (triggering them earlier than in the past) and created a new 4th trigger, Stage 4 Drought Disaster.

Wichita Falls triggered its Stage 1 Drought Watch during the summer of 2011. An aggressive conservation Public Education Program was launched, bringing to bear all resources that the City had at its disposal to get the word out to the public.

Within a year, the City triggered its Stage 2 Drought Warning (June 2011). During this stage, the City started issuing water violation citations that had substantial fines associated with them. To date, the City has issued just under

1300 water violation citations. In addition to the citations, the City implemented its surcharging program.

In anticipation of triggering its Stage 3 Drought Emergency, the City of Wichita Falls has coordinated with its Water Resources Committee on the further development of the Stage 3 restrictions, which encompass further restrictions of outside irrigation, increased surcharges, and the restriction of certain industries.

The Stage 4 Drought Disaster is the most restrictive of all the Drought stages in the City's Drought Plan. The stated production goal in the Stage 4 Drought Disaster is a maximum of 10 MGD. This value was derived from the demand flows that are exhibited in the months of January and February, i.e. the flows that are necessary to maintain health, sanitation, and safety of the citizens. The City anticipates that the Public Education message at this stage will be, "If you don't do it in January, Don't do it in July."

The Proposal

If the City's lake levels decline to predicted levels, then the City of Wichita Falls would enter the high demand / evaporation summer months of 2013 with dwindling raw water sources. The City, in an effort to continue to supply drinking water and by extension protect the public health, the City of Wichita Falls is seeking to augment its supply of source water to help see it through the high demand / evaporation summer of 2013.

After considering several options and the timing to achieve them, the City of Wichita Falls proposes to begin utilizing its Wastewater Effluent to augment its

supply of raw source water when it reaches a combined lake level of 30% or less (Stage 4 Drought Disaster declaration). The City is requesting that of the 10 MGD production goal established in its Stage 4 Drought Disaster, that 5 MGD (50%) of that total be Wastewater Effluent.

The City of Wichita Falls proposes to lay a temporary pipeline from its River Road Wastewater Treatment Plant (RRWWTP) to the Cypress Water Treatment Facility. There, it would treat the Wastewater Effluent through the existing Microfiltration/ Reverse Osmosis Plant. The RO Permeate would then be blended with raw lake water, at a 1:1 ratio, and treated through one of its conventional plants at Cypress.

The City anticipates that once the combined lake levels increased to a level that was over 40%, it would cease the use of its Wastewater Effluent under this Emergency configuration.

II. Conceptual Design

Introduction

As stated previously, the City of Wichita Falls proposes to bring the wastewater effluent from the River Road Wastewater Treatment Plant (RRWWTP) to the Cypress Water Treatment Facility. The water would be disinfected using Chloramines down the entire length of the pipeline.

Once at Cypress, the Wastewater Effluent would be treated first through the existing Microfiltration/ Reverse Osmosis Plant. This preliminary processing would entail:

- ◆ Treatment through the Microfiltration / Reverse Osmosis Clarifier with Chloramines and Ferric Sulfate
- ◆ Clarifier Supernatant passed through MF
- ◆ MF Permeate dechlorinated with Sodium Bisulfite and Stored in a Break Tank
- ◆ From the Break Tank the water is pumped through the Reverse Osmosis process.

The RO Permeate would then be placed in an existing Backwash Water Lagoon, where it can be blended with filter backwash water from the conventional plants at Cypress.

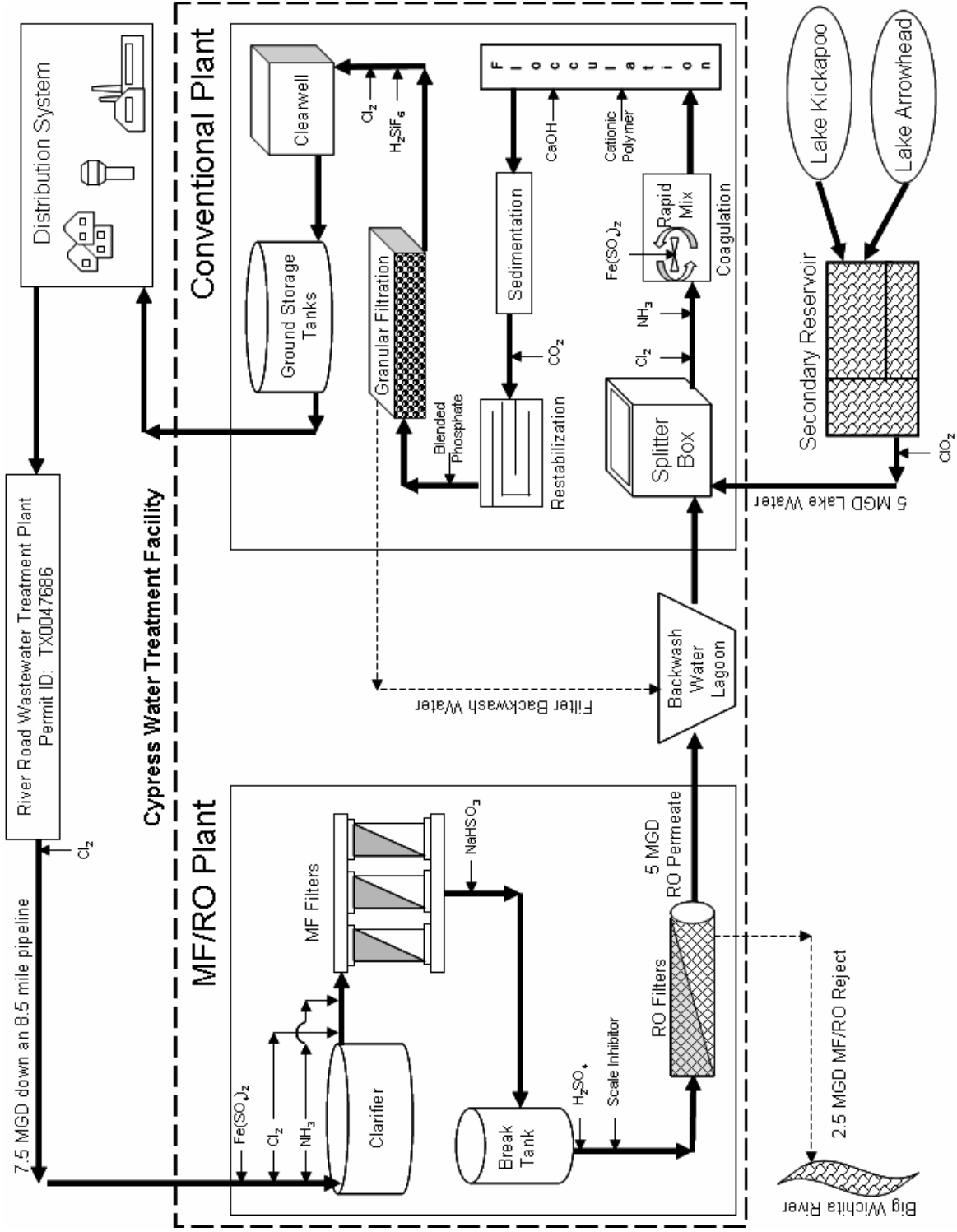
The water from the Backwash Water Lagoon would then be pumped to the Raw Water Splitter Box and blended with raw lake water before it is sent to the Conventional Plants for treatment. The City anticipates a 1:1 blending ratio.

The Conventional Treatment at Cypress consists of the following process:

- ◆ Disinfection with Chloramines starting at the Splitter Box
- ◆ Coagulation with Ferric Sulfate and Mechanical Rapid Mixing
- ◆ Flocculation with the addition of Cationic Polymer for Bridging and Calcium Hydroxide for Lime Softening.
- ◆ Sedimentation
- ◆ Restablization with Carbon Dioxide and the addition of a Blended Phosphate
- ◆ Filtration through Granular Media
- ◆ Storage in a Clearwell with the addition of Chloramines for Post-Disinfection and Hydrofluosilicic Acid for Fluoridation.

At this point, the water is stored in Ground Storage Tanks totaling 18 MG in capacity before it is pumped into the Distribution System.

A Flow Diagram of this conceptual design is provided below.



Issues

The use of Wastewater Effluent as a source of drinking water comes with some inherent risk, associated with the fact that the water has come into intimate contact with human fecal waste. Those risks can either be microbial, chemical, or radiological; and they can either cause problems with an acute exposure or require long-term, chronic exposure.

Since the City of Wichita Falls is only seeking to utilize this source on an Emergency basis, thereby requiring only a short duration of use (potentially 4 to 6 months), the City of Wichita Falls is particularly interested in eliminating those contaminants that would pose a threat upon an acute exposure in the drinking water. Examples of those contaminants would include:

- ◆ Microbials, such as Giardia, Cryptosporidium, and Viruses that would cause acute waterborne diseases
- ◆ Inorganics, such as Nitrate that would cause acute Methemoglobinemia,
- ◆ Organic Disinfection By-Products that would cause acute Neural Tube Defects in fetuses

The City has been analyzing the Wastewater Effluent for nearly a year for a parallel project (Permanent Wastewater Reuse) and feels that it has a very good understanding of the contaminants and their concentrations that would be present in the wastewater effluent stream (see Appendix A). The City of Wichita Falls is taking all of this data into consideration in this project, as it relates to the

degree of treatment that would be necessary to bring the Wastewater Effluent to drinking water standards.

Microbial

During preliminary discussions with the TCEQ, it has been stated that the TCEQ would seek the following levels of treatment to ensure that the public health was protected from certain microbial contaminants:

- ◆ 8 – log removal of Viruses
- ◆ 6 – log removal of Giardia cysts
- ◆ 5.5 – log removal of Cryptosporidium oocysts

The City of Wichita Falls has calculated the removal credits that could be expected through the existing treatment processes. In making these calculations, the City used the credits for removal that are allowed through existing Surface Water Treatment Rules, as well as Disinfection credit (CT) spreadsheets and other documentation that states approved removal credits from the TCEQ. The City of Wichita Falls has compiled all of this information into tables and requests the TCEQ approval of the cumulative credits.

Viruses (Need 8 – log Total)

Process	Agent		Log Removal
Pipeline from RRWWTP	Total Chlorine	30° C	4.27 ¹
		7° C	0.85 ¹
MF/RO Clarifier	Total Chlorine	30° C	7.76 ¹
		7° C	1.54 ¹
Microfilters	Total Chlorine	30° C	0.06 ¹
		7° C	0.01 ¹
Microfiltration	Physical Removal		2.0 ²
Reverse Osmosis	Physical Removal		0.0
Conventional Plant	Total Chlorine	30° C	27.5 ¹
		7° C	5.3 ¹
Conventional Plant	Physical Removal		2.0 ³
	Total	30° C	43.59
	Total	7° C	11.7

1 Calculated using the TCEQ software for CT calculations.

2 Applied based on TCEQ Letter dated April 30, 2012 from Ada Lichaa

3 Applied based on demonstration of Turbidity levels in accordance with Surface Water Treatment Rule

Giardia (Need 6 – log Total)

Process	Agent		Log Removal
Pipeline from RRWWTP	Total Chlorine	30° C	1.24 ¹
		7° C	0.47 ¹
MF/RO Clarifier	Total Chlorine	30° C	2.26 ¹
		7° C	0.86 ¹
Microfilters	Total Chlorine	30° C	0.02 ¹
		7° C	0.01 ¹
Microfiltration	Physical Removal		3.0 ²
Reverse Osmosis	Physical Removal		0.0
Conventional Plant	Total Chlorine	30° C	8.0 ¹
		7° C	3.0 ¹
Conventional Plant	Physical Removal		2.5 ³
	Total	30° C	17.02
	Total	7° C	9.84

1 Calculated using the TCEQ software for CT calculations.

2 Applied based on TCEQ Letter dated April 30, 2012 from Ada Lichaa

3 Applied based on demonstration of Turbidity levels in accordance with Surface Water Treatment Rule

Cryptosporidium (Need 5.5 – log Total)

Process	Agent		Log Removal
Pipeline from RRWWTP	Total Chlorine	30° C	0
		7° C	0
MF/RO Clarifier	Total Chlorine	30° C	0
		7° C	0
Microfilters	Total Chlorine	30° C	0
		7° C	0
Microfiltration	Physical Removal		2.0 ¹
Reverse Osmosis	Physical Removal		0.0
Conventional Plant	Total Chlorine	30° C	0
		7° C	0
Conventional Plant	Physical Removal		4.0 ²
	Total	30° C	6.0
	Total	7° C	6.0

1 Applied based on TCEQ Letter dated April 30, 2012 from Ada Lichaa

2 Applied based on demonstration of Turbidity levels in accordance with LT2 Enhanced Surface Water Treatment Rule (3-log plus additional 1.0 log for IFE and CFE credits for turbidities below 0.15 NTU 95% of the month)

Chemical

The City's analysis of the Wastewater Effluent (Appendix A) has indicated that several constituents will need to be addressed to bring this source into drinking water standards. Those constituents are pH, Chlorides, Nitrates and the Disinfection By-Products (Total Trihalomethanes and Haloacetic Acid 5's). Below is a synopsis of how the City of Wichita Falls plans on dealing with each of these constituents.

pH

The Wastewater Effluent has exhibited a pH of below 7.0. The City of Wichita Falls utilizes a Lime Softening process within its Conventional Treatment

Plant. This process will enable the City to bring the pH back to an acceptable level before it is used as drinking water.

Chloride

The Wastewater Effluent has an average Chloride (388 ppm) that is slightly over the Secondary Limit of 300 ppm for drinking water. The City's Reverse Osmosis plant is expected to reduce this amount by 90%, which would lower the RO Permeate to approximately 39 ppm. Blending the RO Permeate with the existing source water would help reduce the Chloride concentrations in the lake water which are expected to be elevated due to the continued drought.

Nitrate

It is anticipated that the City will accomplish approximately 70% to 90% reduction in Nitrate through its Reverse Osmosis process, with additional reduction being accomplished through blending with the raw lake water prior to conventional treatment. If the average amount of Nitrate that can be expected is 80 ppm, and an average reduction of 80% through the RO process, that would yield a Nitrate concentration of 16 ppm in the RO Permeate. If the RO permeate is blended with the existing Source water at a 1:1 ratio, then it can be expected that the 16 ppm will be further reduced to 8.0 ppm, which is below the regulatory MCL of 10.0 ppm. The City will continue to evaluate the current RO's performance in removing this constituent and apply that removal efficiency to future reports.

Disinfection By-Products

With an average Total Trihalomethane concentration of 106 ppb and an average Haloacetic Acid concentration of 68 ppb in the Wastewater Effluent, these concentrations will have to be reduced to comply with the Drinking Water regulations of 80 ppb and 60 ppb, respectively for TTHM and HAA5.

The City of Wichita Falls anticipates a low removal rate of TTHM & HAA5 through the Reverse Osmosis plant, on the order of 30% - 60%. Using an average removal rate of 50%, this would yield 53 ppb for TTHM and 34 ppb for HAA5 in the RO Permeate. Further blending with the existing Source Water in a 1:1 ratio would further reduce the TTHM value to 27 ppb and the HAA5 to 17 ppb. It is expected that the conventional disinfection process using Chloramines will add back to those concentrations an additional 20 ppb and 28 ppb, for TTHM and HAA5, respectively. That would yield a final TTHM concentration in the drinking water of 47.0 ppb, which is below the regulatory MCL of 80 ppb; and, 45 ppb for the HAA5's, which is below the regulatory MCL of 60ppb. The City will continue to evaluate the current RO's performance in removing these constituents and apply that removal efficiency to future reports.

Unregulated / Emerging Contaminants

Because the Unregulated / Emerging contaminants were an unknown, the City has submitted samples to laboratories to shed light on these constituents. Please refer to Appendix B for the average concentrations of those unregulated /

emerging contaminants that the City has detected, to date. As more data becomes available, the City will update this Table.

The City plans on evaluating these constituents using methodologies established by the Water Industry, the EPA and the State of California in an attempt to determine if there are any concerns with these levels of constituents in the source water, as well as their removal through the Reverse Osmosis plant.

The City would like to note that concomitant sampling of the City's source water lakes and its Tap water have found many of the same constituents already existing in these waters (see footnotes in Appendix B).

Operations and Monitoring

The City recognizes that the Wastewater Effluent is derived from a source that has had direct contact with human waste, and therefore has already begun to develop the Operational & Monitoring procedures that it feels would be necessary to implement a successful program and ensure the public's health.

The City currently has an established Water Quality Task Force that is comprised of members from the Public Works/Public Utilities staff and the Health Department. This group has established triggers that would activate a meeting and investigation by the Task Force.

On the Public Utilities side, triggers include but are not limited to;

- ◆ Failure of the Disinfection Process or Bacteriological Testing
- ◆ Failure of the Turbidity MCL

On the Health Department side, triggers include but are not limited to;

- ◆ Epidemiological increase of waterborne disease

Additionally, the Utilities Divisions of Water Purification and Wastewater Treatment have developed protocols for the monitoring of the entire treatment system. Those protocols include triggers that would shutdown the use of the wastewater effluent in the event that there was something of operational concern.

On the Wastewater side, shutdown triggers include:

- ◆ Failure in the Aeration Basins or Finals.
 - a) A low Dissolved Oxygen level for more than two hours in two or more Basins.
 - b) Rake failures in the Finals causing an increase in solids going over the weirs.
- ◆ A high dissolved oxygen demand in two or more of the Aeration Basins causing an increase in air consumption for more than four hours to maintain the DO set point under normal flow conditions.
- ◆ Any sign of soap or suds in the treatment process. Do not wait for it to appear at the out fall.
- ◆ Any abnormalities in the quality of the water whether raw or effluent.
- ◆ Elevated TSS / Turbidity levels (above average).
- ◆ Elevated CBOD levels (above average).
- ◆ Elevated E-Coli levels (above average).
- ◆ Elevated Phosphorus levels (above average).
- ◆ When any parameter as defined in the discharge permit exceeds maximum limits.
- ◆ Any indication that there is toxicity in the daily microscopic exam.
 - a) A microscopic exam will be done every eight hours while water is being sent to purification and before the start up of sending

water to purification.

- ◆ The CCB effluent Chlorine residual is below defined limits.
- ◆ Failure of the Chlorination system.
- ◆ The indicator fish at the outfall die.

On the Water Treatment side, shutdown triggers include:

- ◆ Blended Nitrate/Nitrite concentrations that will not meet MCL's.
- ◆ Blended TTHM or HAA5 concentrations that will not meet MCL's.
- ◆ Failure of the MF/RO to meet defined criteria on turbidity or removal percentages.
- ◆ TOC removal is being adversely affected and Alternative Compliance Criteria will not be sufficient to meet TOC removal regulations

III. Conclusion

The City has performed preliminary research into the viability of utilizing its existing Water Treatment Facilities to treat Wastewater Effluent for a source of drinking water. It has further performed analysis to characterize this source of water and has identified those constituents that would be of an immediate health concern if not removed in the treatment process.

Taking these considerations into account, the City believes that the existing quality of the Wastewater Effluent lends itself to be effectively treated to drinking water standards, by utilizing the existing treatment processes within the City and the application of existing Rules and Regulations that govern Drinking Water Treatment.

The City eagerly awaits the TCEQ's response to this Concept Paper and anticipates that, based off of the data presented here within; the TCEQ will request a Formal Engineering Report to advance the project.

The City of Wichita Falls looks forward to working with the TCEQ in an effort to protect the citizens of Wichita Falls from running out of drinking water, which would ultimately lower the sanitary conditions and reduce the City's abilities to protect the public's health.

Appendix A

Wastewater Effluent Monitoring

Appendix A Wastewater Effluent Monitoring

Inorganic Constituent	Unit of Measure	Regulatory Limit	Wastewater Effluent (avg)
pH		>7.0 ²	6.62
Temperature	C	N/A	27.0
Total Harness	ppm	N/A	130.0
Total Alkalinity	ppm	N/A	44.0
Turbidity	NTU	0.5 ¹	2.49
TSS	ppm	N/A	4.43
TDS	ppm	1000 ²	760.0
Conductivity	us/cm	N/A	1232.0
Fluoride	ppm	4.0 ¹	1.96
Chloride	ppm	300 ²	388.0
Bromide	ppm	N/A	0.6
Nitrite	ppm	1.0 ¹	0.09
Nitrate	ppm	10.0 ¹	78.0
Sulfate	ppm	300 ²	75.0
Aluminum	ppm	0.05 ²	0.022
Antimony	ppm	0.006 ¹	0.002
Arsenic	ppm	0.01 ¹	0.001
Barium	ppm	2.0 ¹	0.005
Beryllium	ppm	0.004 ¹	0.00002
Cadmium	ppm	0.005 ¹	0.003
Calcium	ppm	N/A	34.0
Chromium (total)	ppm	0.1 ¹	0.0006
Copper	ppm	1.3 ³	0.004
Iron	ppm	0.3	0.09
Lead	ppm	0.015 ³	0.0004
Magnesium	ppm	N/A	9.0
Manganese	ppm	0.05 ²	0.024
Mercury	ppm	0.002 ¹	<0.0001
Potassium	ppm	N/A	28.19
Selenium	ppm	0.05 ¹	0.0005
Silver	ppm	0.1 ²	0.002
Sodium	ppm	N/A	180.0
Thallium	ppm	0.002 ¹	0.0003
Zinc	ppm	5.0 ²	0.07
TOC	ppm	N/A	9.74

1 Primary Drinking Water Standard

2 Secondary Standard

3 Action Level

Organic Constituent	Unit of Measure	Regulatory Limit	Wastewater Effluent (avg)
Alachlor	ppm	0.002	ND
Atrazine	ppm	0.003	ND
Benzopyrene	ppm	0.0002	ND
Carbofuran	ppm	0.04	ND
Chlordane	ppm	0.002	ND
Dalapon	ppm	0.2	ND
Dibromochloropropane	ppm	0.0002	ND
Di(2-ethylhexy 1)adipate	ppm	0.4	ND
Di(2-ethylhexy 1)phthalate	ppm	0.006	0.004
Dinoseb	ppm	0.007	ND
Diquat	ppm	0.02	ND
Endothall	ppm	0.1	ND
Endrin	ppm	0.002	ND
Ethylene Dibromide	ppm	0.00005	ND
Glyphosate	ppm	0.7	ND
Heptachlor	ppm	0.0004	ND
Heptachlor epoxide	ppm	0.0002	ND
Hexachlobenzene	ppm	0.001	ND
Hexachlorocyclopentadiene	ppm	0.05	ND
Lindane	ppm	0.0002	ND
Methoxychlor	ppm	0.04	ND
Oxamyl (Vydate)	ppm	0.2	ND
Pentachlorophenol	ppm	0.001	ND
Picloram	ppm	0.5	ND
Polychlorinated Biphenyls	ppm	0.0005	ND
Simazine	ppm	0.004	0.0011
Toxaphene	ppm	0.003	ND
2,3,7,8 –TCDD (Dioxin)	ppm	3×10^{-8}	ND
2,4,5-TP	ppm	0.05	ND
2,4-D	ppm	0.07	ND
1,1-Dichloroethylene	ppm	0.007	ND
1,1,1-Trichloroethane	ppm	0.2	ND
1,1,2-Trichloroethane	ppm	0.005	ND
1,2-Dichloroethane	ppm	0.005	ND
1,2-Dichloropropane	ppm	0.005	ND
1,2,4-Trichlorobenzene	ppm	0.07	ND
Benzene	ppm	0.005	ND
Carbon Tetrachloride	ppm	0.005	ND
cis- 1,2-Dichloroethylene	ppm	0.07	ND
Dichloromethane	ppm	0.005	ND
Ethylbenzene	ppm	0.7	ND

Monochlorobenzene	ppm	0.1	ND
o-Dichlorobenzene	ppm	0.6	ND
para-Dichlorobenzene	ppm	0.075	ND
Styrene	ppm	0.1	ND
Tetrachloroethylene	ppm	0.005	ND
Toluene	ppm	1.0	ND
trans- 1,2-Dichloroethylene	ppm	0.1	ND
Trichloroethylene	ppm	0.005	ND
Vinyl Chloride	ppm	0.002	ND
Xylenes	ppm	10.0	ND
Total Trihalomethanes	ppm	0.08	0.106
Chloroform	ppm	0.07 ¹	0.0077
Dibromochloromethane	ppm	0.06 ¹	0.051
Dichlorobromomethane	ppm	0 ¹	0.029
Bromoform	ppm	0 ¹	0.025
Haloacetic Acid 5	ppm	0.06	0.064
Dichloroacetic Acid	ppm	0 ¹	0.015
Trichloroacetic Acid	ppm	0.02 ¹	0.011
Monochloroacetic Acid	ppm	0.07 ¹	0.0032
Bromoacetic Acid	ppm	N/A	0.021
Dibromoacetic Acid	ppm	N/A	0.026

¹ Maximum Contaminant Level Goal

Radiological Constituent	Unit of Measure	Regulatory Limit	Wastewater Effluent (avg)
Gross Alpha	pCi/L	15.0	-0.93 (± 0.90)
Gross Beta	pCi/L	N/A	20.6 (± 1.2)

Microbiological Constituent	Unit of Measure	Regulatory Limit	Wastewater Effluent (avg)
Cryptosporidium	oocysts/L	N/A	0.566
Giardia	cysts/L	N/A	8.56
Total Coliform	MPN/100mL	N/A	179.3
E. Coli	MPN/100mL	N/A	10.48
Total Culturable Virus	MPN/100mL	N/A	<0.387

Appendix B

Wastewater Effluent Monitoring

for

Unregulated / Emerging Constituents of Concern

Appendix B Wastewater Effluent Monitoring for Unregulated / Emerging Constituents of Concern

Constituent	Unit of Measure	Regulatory Limit	Wastewater Effluent (avg)
Perchlorate	ug/L	N/A	0.17
Sucralose	ug/L	N/A	43.0
Perfluorooctanoic Acid (PFOA)	ng/L	N/A	28.0
Acetaminophen	ug/L	N/A	0.008
Antipyrine	ug/L	N/A	0.004 ²
Atenolol	ug/L	N/A	0.128
Carbamazepine	ug/L	N/A	0.059
Cotinine	ug/L	N/A	0.025 ¹
DEET	ug/L	N/A	0.116 ^{1, 2}
Fluoxetine	ug/L	N/A	0.009
Meprobamate	ug/L	N/A	0.505
Nicotine	ug/L	N/A	0.019 ¹
Paraxanthine	ug/L	N/A	0.029
Primidone	ug/L	N/A	0.391
Sulfamethoxazole	ug/L	N/A	0.004
Theobromine	ug/L	N/A	0.465 ^{1, 2}
Dilantin	ug/L	N/A	0.279
Salicylic Acid	ug/L	N/A	0.18 ²
Theophylline	ug/L	N/A	0.040
Triclocarbon	ug/L	N/A	0.076 ¹
Galaxolide	ng/L	N/A	490.0
Tonalid	ng/L	N/A	71.0
Progesterone	ng/L	N/A	0.2 ²

¹ Detected in Current Lake Water also.

² Detected in Current Tap Water also.