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Use of Surplus Water from Reduction in Steam Electric Power Generation for Environmental Restoration

An Investigation into the Opportunities in the Big Cypress Watershed of the Cypress River Basin

For the Caddo Lake Institute

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EXECUTIVE SUMMARY

As Texas moves away from the traditional sources of electric power, the amount of water needed for the generation of electricity is dropping significantly. This in turn creates opportunities for the use of all or some of the surplus water to help restore and maintain the health of Texas rivers, streams, bays and estuaries.

For example, some such surplus water could be purchased and stored in the reservoir that had been used to store the water for steam electric power generation (SEPG) at the closed power plant. Then the water could be released to provide the type of environmental flows needed downstream.

But there will likely be competition for such surplus water. Cities, industries and agricultural interests may seek the surplus water for their future needs. Some new uses of the surplus SEPG water could result in even greater damage to the Texas environment than are caused by the diversion and use of the water for SEPG. For example, the transfer of surplus SEPG water to another river basin could leave the basin of origin with less water for environmental needs, since most SEPG facilities return some of the water they use to rivers downstream.

While the amount of water consumed for cooling and other consumptive uses for SEPG represents only three to five percent of all of the water that is consumed in Texas, it is still hundreds of thousands of acre-feet of water per year. The diversion of the water has significant impacts at the location of the diversion and downstream.

Moreover, a far greater amount of water is diverted from Texas rivers and lakes for SEPG but is not consumed. The non-consumptive uses include maintenance of water levels in the lakes above intake structures to allow the pumping of the water to where it is used for cooling and other SEPG uses. The non-consumptive water often also serves as the heat sinks to lower the temperature of the water used for cooling and returned to the cooling water lake. Estimates of the percentage of water diverted for SEPG but not consumed are much higher than the amounts consumed - up to ten times the amount of water consumed for some SEPG facilities.

For those working to restore or sustain the health of Texas rivers and bays for fish and wildlife, recreational use, or for their cultural or economic value, the closing of SEPG facilities creates significant opportunities. Given that the closings can also create new risks, there are multiple reasons for evaluating the potential opportunities and the risks resulting from the reductions in SEPG.

This report is the result of an investigation of the opportunities and risks for the Cypress River Basin in northeast Texas. This Basin was selected because it has a high concentration of coal and gas-fired power plants. Some of the coal and gas-fired units at such facilities have recently been closed. In addition, significant work has been done in the Basin to identify the environmental water needs and to develop strategies for meeting those needs. Some of these strategies and others identified in this investigation may be able to take advantage of the surplus water from closed SEPG facilities.

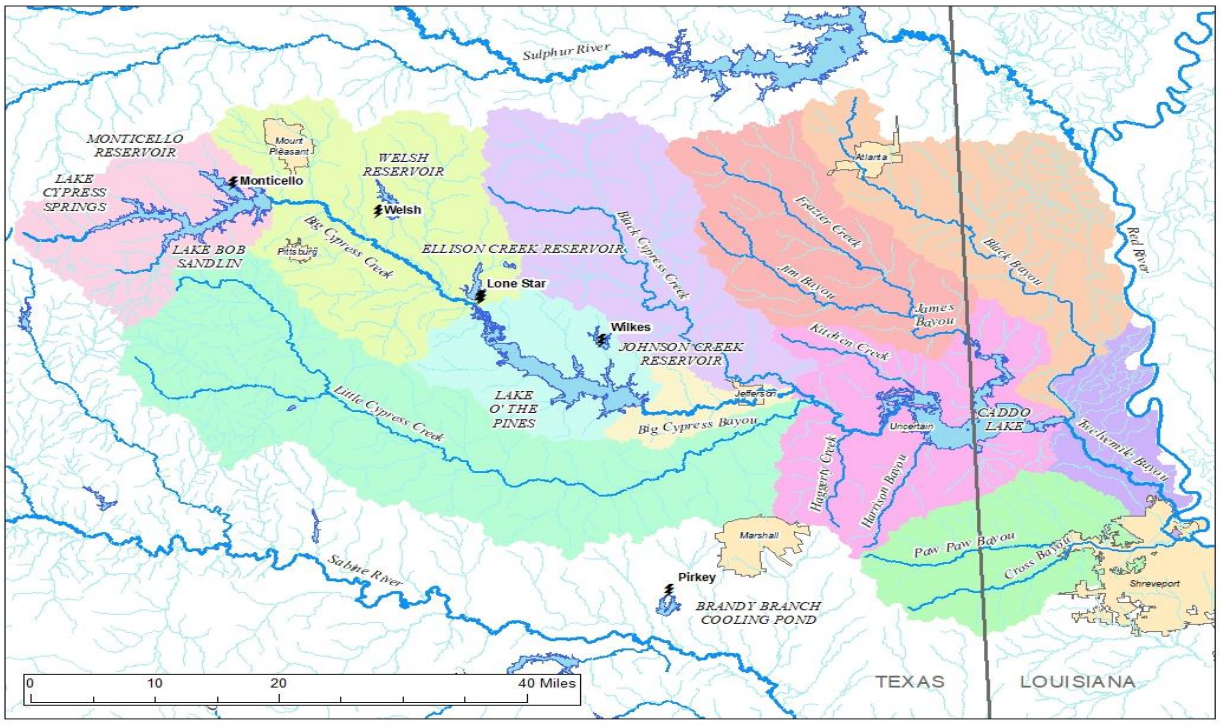

Figure ES 1: The Cypress River Basin and the coal and gas-fired SEPG facilities authorized to use water from the reservoirs in the Big Cypress watershed in Texas.

The investigation identified some significant complications to developing and implementing the possible strategies to take advantage of these opportunities and to reduce risks to the Basin. For example, the actual amount of water diverted for SEPG facilities in Texas is not well documented, as collection of accurate figures by operators of SEPG facilities for the amounts of water diverted, consumed or returned have not been required. Nor have such figures been collected by the state or federal agencies. Recent efforts by the Texas Water Development Board to use its water use survey authority to gain better data should result in improved accuracy over time.

Also, in the Big Cypress watershed, like many other watersheds, there are separate agreements between major water right owners on how water rights will be distributed and used. These agreements are often outside of the state water right system and not easily identified in state records. Those working on issues of water availability and impacts of closure of SEPG in the Cypress River Basin could easily make erroneous assumptions about ownership and use of water if the state's official water right files were the only records reviewed.

This investigation considered a number of strategies that might be used to take advantage of the opportunities to use surplus SEPG water. For example, in some areas of Texas, there should be opportunities for partnerships with downstream cities, industries or farms that will want to buy the surplus SEPG water for their future needs. Conservation interests may be able to work with such an entity, possibly helping with the purchase of the water, to reach an agreement on the pattern of release of the water from the upstream cooling water reservoir. The timing and amount of water released could be set to provide environmental benefits in the segment of the river between the

reservoir and new diversion. Moreover, until the water is needed, such a partner may be willing to agree to releases that help fill environmental needs further downstream, even down to Texas bays.

That approach of partnering with a downstream user is not, however, likely in the Cypress River Basin. There are no significant municipal, industrial or agriculture needs projected downstream of the current SEPG reservoirs in the Cypress River Basin.

Of course, purchase of surplus SEPG water could be an option. However, no likely source of funds for the purchase of significant amounts of surplus SEPG water rights for environmental water needs was identified in this investigation. The cost per acre-foot of a water right could be in the $1,000 range, possibly more. With such a price, the cost of the surplus SEPG water freed up by the recent closure of Luminant's Monticello coal-fired power plant could be $30 million.

Therefore, more creative strategies were considered, and several appear to have merit. For example, one approach discussed is the use of partnerships with the cities and industries that are upstream of Lake O' the Pines and close to the closed Monticello facility. With financial assistance or other incentives, such cities or industries might be convinced to purchase some of the surplus SEPG water from Luminant or the water supplier with the water rights for Luminant's cooling water to meet their future needs. This could then limit these cities and industries need to reuse their own treated wastewaters, the discharge of which helps assure water in the rivers and streams below the city or industries. The economics need to be evaluated further, but this approach could help in the entire Big Cypress watershed. Retaining surplus SEPG water in the Cypress River Basin in this fashion not only would assure future releases of return flows to rivers and streams in the watershed, it would limit the amount of water that could be sold to cities or industries outside the Cypress River Basin.

In the short term, there are additional opportunities in the upper Big Cypress watershed. With Luminant's closure of its facilities, power plant and lignite mines, the water no longer needed is available for environmental benefits, until it is sold or used for other purposes.

Much of the water Luminant was using, possibly 40,000 acre-feet per year, is now flowing downstream and helping restore Big Cypress Creek, where historic low flows and pollution have degraded the Creek and its floodplain. The surplus water then flows to Lake O' the Pines where it adds to the water available for release downstream to Big Cypress Bayou and Caddo Lake to provide the environmental flows below Lake O' the Pines.

While the current flow of the surplus water provides some ecological benefits, It could provide even more, if one developed agreements with the owners of the reservoirs that have been used to store Luminant's water to release the surplus water in ways that best help restore Big Cypress Creek above Lake O' the Pines.

Even if the full amount of surplus SEPG water were only available for a few years, its use could provide some significant environmental benefits. The strategies of assuring the continued discharge of return flows from cities and industries for the long-term could help maintain some of the ecological values that have been restored and prevent further degradation of the watershed.

For the Big Cypress watershed downstream of Lake O' the Pines, this investigation focused on different strategies to address instream flow needs and SEPG facilities. The recommendation is to develop a partnership with Southwest Electric Power Company (SWEPCO), the owner of several SEPG facilities using water from Lake O' the Pines. It has closed one of its SEPG units and other SWEPCO coal and gas-fired units will likely be closed in the next decade.

While this closure has not created significant surplus water, any additional closures could, if there is water no longer needed by SWEPCO, there will be opportunities for use of the water for environmental needs. The cities and industries downstream of Lake O' the Pines apparently have sufficient water for their current and future needs. They are not likely to compete for any surplus SEPG water left in Lake O' the Pines.

Until there are more significant opportunities for converting unneeded SEPG water, there is a related strategy to provide additional flows downstream for environmental and other instream uses. A current proposal to raise the water levels in Lake O' the Pines would help protect the water supplies needed by SWEPCO, while providing more water for release downstream or environmental and other t needs.

This report recommends that further work be done in both the upper and lower Big Cypress watershed of the Cypress River Basin. There are both opportunities to supply current environmental water needs and reduce the risks of the sale of significant amounts of water out of the Cypress River Basin.

As SEPG is reduced in other river basins, the work in the Cypress River Basin could also be a model for other river basins in Texas and around the country.

INTRODUCTION

Across Texas, steam electric power generation facilities are closing or reducing the amount of power produced due to the changing mix of electricity generation. As the facilities are closing or reducing generation, large amounts of water are freed up and potentially available to benefit river basins and bays systems.

For example, the Cypress River Basin is now benefiting annually from thousands of acre-feet of water that is no longer needed for Luminant's Monticello coal-fired power plant. This surplus water comes at a time when there are significant efforts underway to identify strategies to help meet environmental water needs in the Cypress Basin and others basins across the state.

However, surplus water from reductions in steam electric power generation (SEPG) could serve more than environmental needs. Many cities, industries, farmers and others could see this water as a source to fill their future water needs. There will be competition for much of the surplus SEPG water. Competition could also create opportunities partnerships that benefit these competitors and the environment.

General evaluations of the opportunities to use surplus SEPG water across Texas are covered in reports of two prior projects of the Texas Center for Policy Studies (TCPS).[1] To date, the state water planning process and work done under a 2007 law to protect environmental flows have failed to recognize such opportunities to restore and protect our surface water bodies.

The previous TCPS reports explain in detail why there are significant problems with the lack of accurate data on actual use of water for SEPG and on the projected water demands. The state water planning process has historically over-estimated the amount of water needed for SEPG.

With a recent change in the approach by the TWDB for the planning process, the state's 2018 projection for future water needs for SEPG by coal, nuclear and gas-fired power plants is less than half of those projected in the 2017 State Water Plan. Still, the projections for SEPG demands are inflated, and such projections are discouraging a process to add environmental water needs to the state water planning.

This report focuses on the surplus water that is presently available and that which will be available in the future with the reductions in SEPG in Texas. That surplus will be made up of water no longer needed for SEPG and the additional supplies that have been held for the projected growth of SEPG.

There is and will continue to be surplus water resulting from the changes in generation of electricity, which will create significant opportunities to redirect some of the water to the environmental and other instream needs. Some of those needs were, of course, created when water rights were issued for SEPG, especially for those

[1] See "Learning from the Drought, The Next Generation of Water Planning for Texas," and "Blue Skies – Healthy Rivers: Opportunities for Reallocation of Surplus Waters from Reduced Steam Electric Power Generation to Texas Rivers and Bays" both of which are available at TCPS's website: http://www.texascenter.org/.

rights issued before 1981, when the first significant law for the consideration of the impacts of diversions of water on rivers and bays systems was passed by the Texas Legislature. Many of the water rights for SEPGs were issued well before 1980.

This report summarizes the investigation made in 2017 of the opportunities that have arisen or may arise from the reductions in SEPG in the Cypress River Basin. The investigation looked specifically at the Big Cypress watershed of the Cypress River Basin. This watershed includes Lake Bob Sandlin, Lake O' the Pines (LOP), Caddo Lake, and several other major reservoirs. It is home to half a dozen major power plants that have used or are using coal or natural gas. The watershed has separately been subject to one of the most comprehensive evaluations of environmental water needs in the state.

Finding ways to use the surplus water for environmental needs will not be easy. It will require some significant work in coordination with public and private interests. And there will inevitably be competition for the water by others with projected future water needs.

For example, in this watershed, Luminant has operated three coal-fired SEPG units at its Monticello power plant. Over the past few years, Luminant started reducing its power generation, with only limited operations in summer months. With the more recent closure of the entire operation,[2] more than 40,000 acre-feet of water per year should now be available for other uses. Most of that water is surface water, owned by the State of Texas in trust for the public. However, Texas no longer seeks to reclaim its water, even though it was originally provided through water rights for specific purposes. The water remains state water, with water right owners allowed to use the water for authorized purposes. But, Texas has moved to a water marketing approach, which allows the sale of water rights, rather than return of the rights to the state for redistribution.[3] Thus, any efforts to return some of the water no longer needed for Luminant's SEPG for rivers and bay systems will face competition from others who could purchase the surplus SEPG water.

This investigation evaluated a number of strategies that could be used to take advantage of the surplus SEPG water from the closure of facilities owned by Luminant and Southwest Electric Power Company (SWEPCO). Water is taken from the Big Cypress watershed for five SEPG facilities owned by these companies.

The investigation not only confirmed that there are opportunities for use of SEPG water in the Big Cypress watershed, it also identified some significant risks to the watershed. The existence of surplus water from the reduction in SEPG, together with other surplus water in watershed reservoirs, is likely to interest those cities and industries outside of the Cypress River Basin that are looking for water for their projected needs.

Thus, even if there were no realistic opportunities to use surplus SEPG water to enhance instream needs, the risk of further ecological harm from the transfer of surplus SEPG water out of the Cypress

[2] Luminant is now a subsidiary of Vistra Energy. Full closure of this Monticello power plant was recently announced. See https://www.dallasnews.com/opinion/editorials/2017/10/09/texas-monticello-power-plant-closes-signaling-undeniable-shift-natural-gas-renewable-energy.

[3] Unlike most other states to allow marketing, Texas even permits the sale of the entire water right, regardless of whether the total amount has never been "perfected" through beneficial use.

Basin is reason enough to evaluate the impacts of the reductions in SEPG in the Basin.

The work of this investigation was done with the assistance of a number of experts and stakeholders. The assistance of the Northeast Texas Municipal Water District, the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the Texas Parks and Wildlife Department and the Caddo Lake Institute were especially important to the work.

While the entire Big Cypress watershed could benefit from any successful strategy to use surplus water from reductions in SEPG, the investigation looked separately at the upper section of the watershed, i.e. Big Cypress Creek which flows into LOP, and the lower section, i.e. Big Cypress Bayou which runs from LOP to Caddo Lake. The strategies evaluated for the upper watershed are focused on the surplus water from the closure of Luminant's coal-fired plants. The strategies evaluated for the lower watershed are focused on the closure and operations of SWEPCO's three gas-fired power plants that take water from LOP.

BIG CYPRESS WATERSHED AND SURPLUS SEPG WATER

A. The Cypress River Basin and Big Cypress Watershed

As shown in Figure 1, the Big Cypress watershed begins above Lake Cypress Springs. The river flows east as "Big Cypress Creek" through several lakes into LOP. Downstream of that lake it is named "Big Cypress Bayou" and flows into Caddo Lake, which is shared by Texas and Louisiana.

In Louisiana, as it comes out of Caddo Lake, its name changes to Twelve Mile Bayou, and it flows into the Red River in Shreveport. The watershed that feeds the Big Cypress river system includes all of the Cypress River Basin with the exception of two small watersheds, one in the most northeastern areas, shown above in brown, and one if the most southeastern areas, shown in green. Those watersheds flows into Twelve Mile Bayou in Louisiana near Shreveport.

There are nine major reservoirs with capacities of 10,000 acre-feet or more in the Cypress River Basin, eight of which are shown on Figure 1.

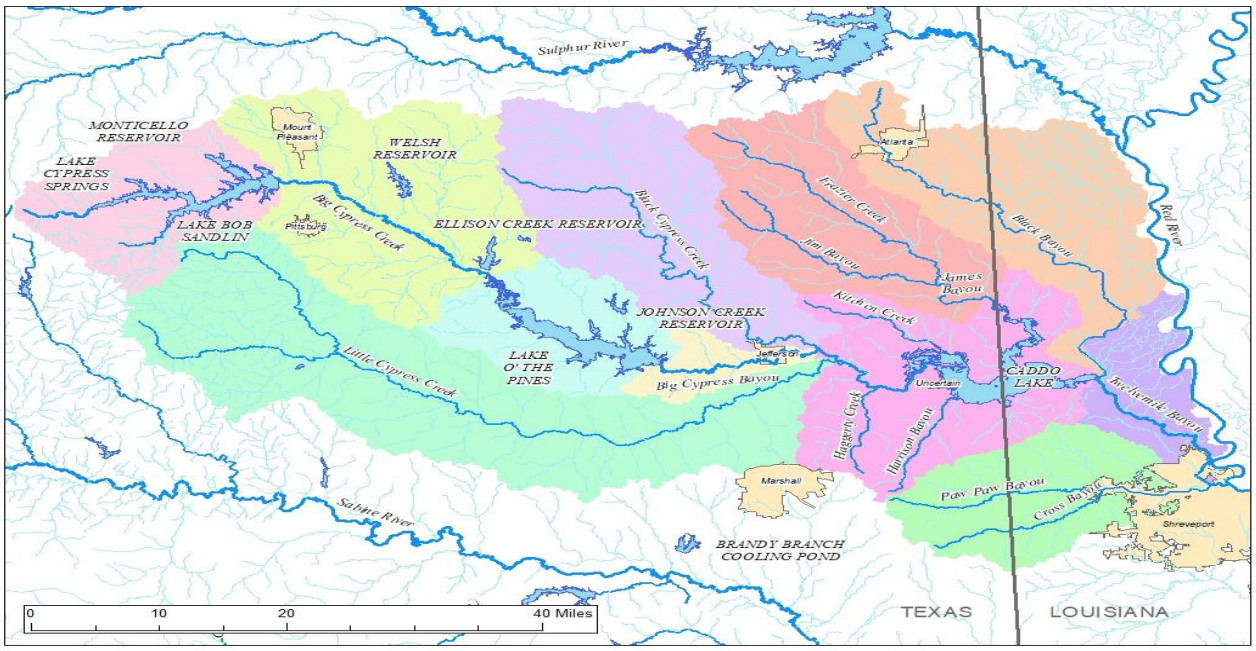

Figure 1. Map of the Cypress River Basin

The ninth, Lake Gilmer, is in the Little Cypress watershed, which joins with the Big Cypress watershed just above Caddo Lake. Lake Gilmer and Caddo Lake do not provide water to any SEPG facility in Texas, and they not are included as potential sources of water for environmental needs in this report.

The other seven lakes are on the main stem of Big Cypress or on tributaries to it. All seven could serve as water sources to protect environmental flows in Big Cypress Watershed down to Caddo Lake. Four of these reservoirs were constructed specifically as cooling water reservoirs for SEPG. The other three were built for multiple uses, including water supplies cooling water at power plants in the watershed. Water from LOP is also pumped into the Sabine River Basin to the Brandy Branch cooling pond for an SWEPCO SEPG facility in that river basin.

Diversions of water for SEPG, as with diversions for other consumptive uses, can have major impacts on the downstream conditions. Figure 1 shows the relationship of LOP, Caddo Lake, and Big Cypress Bayou. Figure 2 shows the historic flows in the Big Cypress downstream of LOP before and after the lake was constructed in 1960.

While the construction of the LOP has provided benefits, including flood control and water supply, it has also resulted in major changes downstream to Big Cypress Bayou and Caddo Lake, especially to the wetland and other riparian habitat.

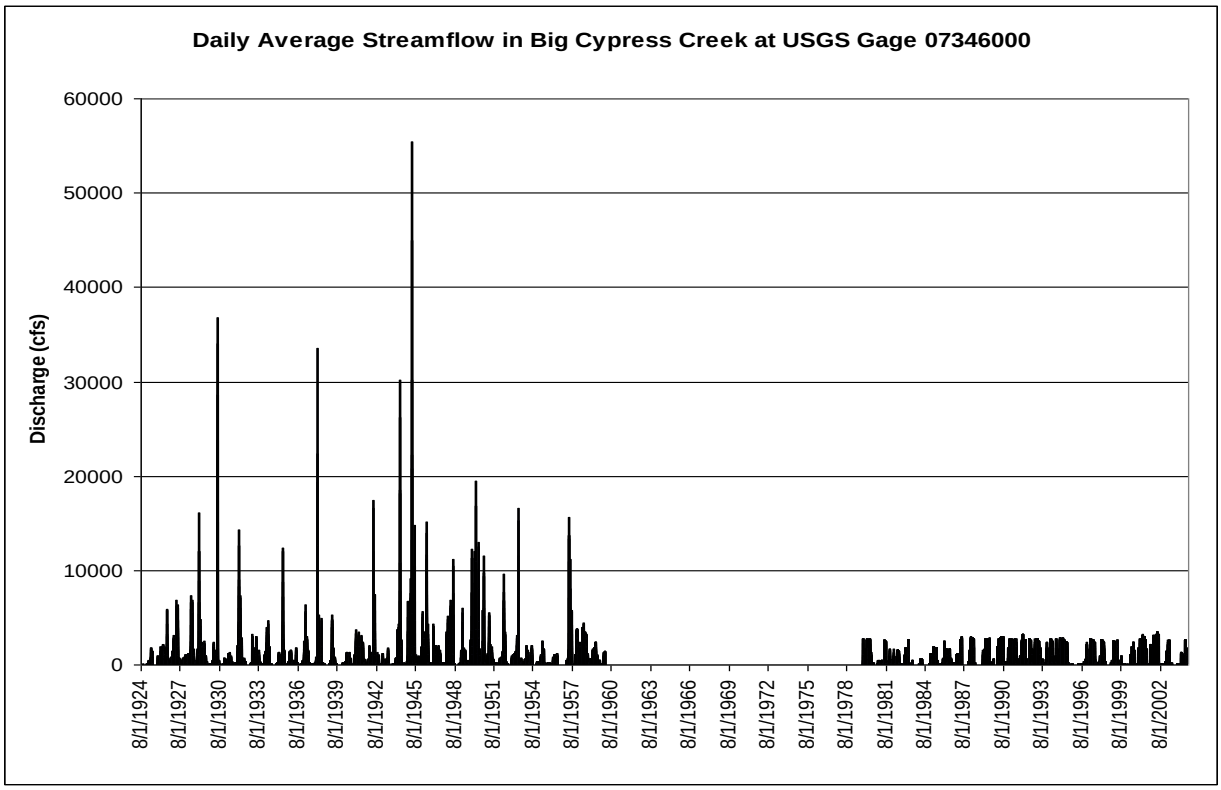

Figure 2. Graph of the range of flows before and after the construction of the dam at Lake O' the Pines in 1960. The maximum releases from the dam to Big Cypress since then is 3,000 cfs. There was no gage between 1960 and 1980

B. The Availability of Surplus Cooling Water from SEPG Facilities

There are or have been five steam electric power generation facilities with capacities over 50 megawatts that take water for cooling from reservoirs in the Big Cypress watershed in Texas.[4] Luminant's power plant, with its three coal-fired units, was recently closed.

Owner	*Power Plant*	*County*	*Generation*	*Fuel*
U.S. Steel & AEP/SWEPCO	*Lone Star*	*Morris*	*70MW*	*Nat Gas*
AEP/SWEPCO	*Wilkes*	*Marion*	*882MW*	*Nat Gas & Fuel Oil*
AEP/SWEPCO	*Welsh*	*Titus*	*1674MW*	*Coal*
AEP/SWEPCO	*Pirkey*	*Harrison*	*721MW*	*Coal*
Luminant Generation	*Monticello*	*Titus*	*1980MW*	*Coal*

Table 1. SEGP facilities using water from the Big Cypress watershed

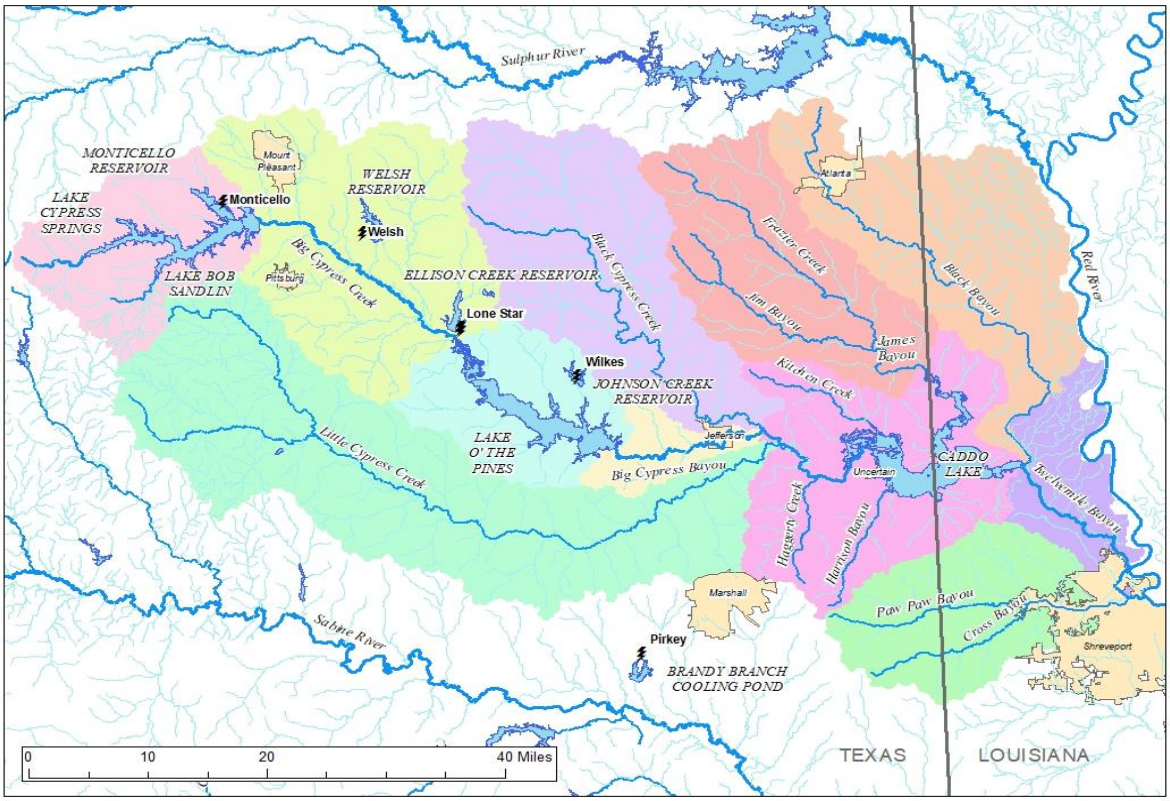

Figure 3. Map of the SEPG facilities using water from the reservoirs in the Big Cypress watershed

Prior to its closure and the closure of one of SWEPCO's units, the Texas Water Development Board (TWDB) figures suggest that the five SEPG facilities consumed, through evaporative cooling,

[4] The Pirkey plant is in Harrison County, and outside the Cypress River Basin. It obtains most of its water from Lake O' the Pines and, thus, is included in the evaluation here.

50,000 to 55,000 acre-feet of water per year from 2010 to 2015. Table 2 shows the historic use estimates and two sets of projections of the TWDB for all SEPG in Region D, which is the Northeast Texas Region for water planning purposes. Some of the SEPG in Region D is outside of the Cypress River Basin with water for cooling coming from other river basins. Region D includes parts of the Red, Sulphur and Sabine Rivers. Thus, the Region D totals for historic use future demands are somewhat greater than the amounts for the Cypress River Basin and more specifically the Big Cypress watershed.

Table 2 shows the dramatic changes now proposed from the past forecasts for water demands for SEPG in the region. In the 2017 state water plan, the projections cooling water demands for 2070 were over 220,000 acre-feet. Those projections were essentially the same as they had been in the 2007 and 2012 state water plans.

Now, the projected demand of the Texas Water Development Board (TWDB) for use in the next planning cycle and the 2022 state water plan is down from 96,574 to less than 75,000 acre-feet per year for 2020. Then, the projected demands remain the same from the 2020 decade through the 2070 decade. The current projected 2070 demand is one-third of the projected demand for water for SEPG in 2017.

This change is, of course, driven by the change in how electricity is produced in Texas. The recent closure of three large coal-fired power plants and several gas-fired plants, together with the shift to wind and solar power, means much less cooling water will be in the future.

Still, the new projected demands of 75,000 acre-feet for the next 5 decades are too high. First, Figure 2 shows historic water use for SEPG in Region D at less than 60,000 acre-feet per year, even during the major droughts period from 2010 to 2012. There are no projections for new SEPG in the region, and there is no reason to assume that there will be a 15,000 acre-feet increase in water use for SEPG in 2020 or beyond.

Second, the 75,000 acre-feet projection does not take into account the closure of the Luminant plant, the largest water using power plant. That SEPG facility could have easily been responsible for 50% of the estimate of 60,000 acre feet per year for the historic use.

Thus, future SEPG demands in Region D could be less than 50% of the current projections. That means, not only that less water will be needed for SEPG than in the past, but that the supplies now being held for the past, large projected demands for SEPG will also be available for other uses.

This situation is not only true in Region D, but across the state. TWDB's estimates of use and future demands for all 16 regions in the 2017 and current water planning process are shown in Table 3. While the 2070 projections for Region D were reduced by two thirds, those for the state were only reduced by 50%

There is on other major issue with accuracy of the historic use figures in Table 2 and 3. They are based largely on TWDB's surveys of owners of SEPG facilities. Those surveys however, are often inaccurate, as some utilities reported the amount of water diverted as the amount consumed. Much of the diverted water is not consumed, but used to make the water needed for cooling available.

2021 RWP Draft Water Demand Projections - Steam-electric Power (in acre-feet)

	Historical Use Estimates						2017 SWP Projections						2021 RWP Draft Projections					
County	2010	2011	2012	2013	2014	2015	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
Gregg	825	940	916	767	412	362	978	1,143	1,345	1,591	1,890	2,094	940	940	940	940	940	940
Harrison	12,193	17,739	14,980	16,750	15,884	14,286	19,838	23,193	27,283	32,268	38,345	46,625	20,055	20,055	20,055	20,055	20,055	20,055
Hopkins	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hunt	343	373	299	207	303	218	12,436	14,539	17,102	20,228	24,038	28,564	373	373	373	373	373	373
Lamar	336	364	360	272	415	5,511	8,503	9,941	11,694	13,831	16,435	19,529	5,451	5,451	5,451	5,451	5,451	5,451
Marion	2,659	2,291	4,257	2,378	1,661	2,310	1,852	2,165	2,547	3,012	3,580	3,967	4,257	4,257	4,257	4,257	4,257	4,257
Morris	2,830	2	2	2	2	1	43	50	59	69	82	91	2,830	2,830	2,830	2,830	2,830	2,830
Rains	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red River	-	-	-	-	-	-	489	572	673	796	946	1,048	-	-	-	-	-	-
Smith	-	-	-	-	-	-	12	14	16	19	23	27	-	-	-	-	-	-
Titus	40,331	30,773	35,123	36,705	37,501	37,160	52,423	61,288	72,096	85,270	101,329	120,703	40,331	40,331	40,331	40,331	40,331	40,331
Region D Total	59,517	52,482	55,937	57,081	56,178	59,848	96,574	112,905	132,815	157,084	186,668	222,648	**74,237**	**74,237**	**74,237**	**74,237**	**74,237**	**74,237**

Table 2. Excerpts from TWDB figures for historic use and projected needs for water SEPG in Region D[5]

	Historical Use Estimates						2017 SWP Projections						2021 RWP Draft Projections					
Region	2010	2011	2012	2013	2014	2015	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
A	14,409	16,969	22,496	15,615	14,424	13,620	26,996	28,916	30,707	32,963	37,202	40,989	28,302	28,302	28,302	28,302	28,302	28,302
B	4,982	5,838	6,029	7,735	6,074	3,886	10,360	10,360	10,360	10,360	10,360	10,360	7,742	7,742	7,742	7,742	7,742	7,742
C	25,144	41,798	31,479	29,638	31,003	34,361	71,452	94,176	106,033	113,641	124,001	135,443	61,512	65,303	65,303	65,303	65,303	65,303
D	59,517	52,482	55,937	57,081	56,178	59,848	96,574	112,905	132,815	157,084	186,668	222,648	74,237	74,237	74,237	74,237	74,237	74,237
E	5,643	5,967	7,949	7,307	7,333	6,804	6,937	8,111	9,541	11,284	13,410	15,937	10,545	10,545	10,545	10,545	10,545	10,545
F	6,069	3,567	3,747	3,600	3,573	3,183	19,085	21,315	24,071	27,472	31,657	36,125	18,092	18,092	18,092	18,092	18,092	18,092
G	115,303	132,272	158,589	170,130	147,631	147,228	239,299	272,711	288,696	322,702	341,364	362,386	232,894	232,894	232,894	232,894	232,894	232,894
H	69,056	68,089	56,925	32,800	54,813	89,565	103,629	121,153	142,518	168,559	200,304	238,800	112,355	112,355	112,355	112,355	112,355	112,355
I	25,997	38,471	45,878	31,863	21,746	23,877	82,018	95,544	112,035	132,137	156,640	184,714	66,811	66,811	66,811	66,811	66,811	66,811
J	0	0	0	0	0	0	0	0	0	0	0	0	444	444	444	444	444	444
K	70,013	70,337	106,997	78,437	63,172	88,839	178,453	185,235	187,410	194,802	200,413	207,319	161,917	161,917	161,917	161,917	161,917	161,917
L	68,809	78,561	66,588	47,705	44,631	57,344	59,901	89,807	101,070	122,845	146,639	152,702	103,691	103,691	103,691	103,691	103,691	103,691
M	233	453	453	388	733	7,955	16,972	19,842	23,340	27,605	32,806	38,916	15,240	15,240	15,240	15,240	15,240	15,240
N	388	394	342	407	398	2,059	15,038	17,582	20,681	24,461	29,067	34,541	3,996	3,996	3,996	3,996	3,996	3,996
O	17,338	17,275	16,766	18,016	13,279	13,306	25,981	30,376	35,732	42,261	50,221	58,976	20,943	20,943	20,943	20,943	20,943	20,943
P	0	0	0	0	0	0	0	0	0	0	0	0	4,496	4,496	4,496	4,496	4,496	4,496
Region Totals	482,901	532,473	580,175	500,722	464,988	551,875	952,695	1,108,033	1,225,009	1,388,176	1,560,752	1,739,856	923,217	927,008	927,008	927,008	927,008	927,008

Table 3. Excerpts from TWDB figures for historic use and projected needs for water for SEPG in all sixteen regions

[5] See, http://www.twdb.texas.gov/waterplanning/data/projections/2021/draft.asp.

Likewise, the water use reports that are required to be filed with the Texas Commission on Environmental Quality (TCEQ) do not appear to be any more accurate or helpful. One major problem with reporting may be the lack of metering or other ways to determine accurately the amount of water diverted or consumed.

These problems are further complicated by inconsistencies and assumptions in the state's water rights accounting and modeling systems. The problems will be different in each river basin, but in the Cypress River Basin, they arise from language found in water rights and contacts, as is explained in the memorandum on Issues with "WAM Representation in LOP and Related Water Rights," attached as Appendix 1.

Certainly, it is wise for the water planning process to make conservative estimates, especially given the accuracy of the historic use data. Still, the changes being made in electric power generation are so significant that a harder look at what is being used and what will be needed for SEPG in the next decade or two should be justified. In any case, there will be significant opportunities to move water from SEPG to other uses.

And there will be even more water to move to instream uses or other uses than TWDB and the water planning process consider. That process focuses on consumptive uses, which consists mainly of water that is evaporated as part of cooling for SEPG. There are also significant non-consumptive uses for SEPG, i.e. water diverted to reservoirs but not consumed through evaporation or other consumptive uses.

Non-consumptive uses of water can make up the largest amounts of water diverted to or captured in reservoirs and they make it possible for the utilities to have the water needed for cooling and other purposes. The water serves as heat sinks which allow recirculating and cooling of the hot water that is the result of the cooling processes.

Other water is diverted to help maintain water levels high enough in reservoirs to stay above the level of the intake structures that are used to pump the cooling water from water supply lakes to cooling ponds or from cooling ponds to the power plant. Such intake structures are generally not located in the bottom of reservoirs for a number of reasons, including the fact that the quality of the water at the bottom of reservoirs often requires significant treatment before it can be used or discharged back into the reservoir or to downstream rivers and streams.

The amount of water required to be diverted to or captured in a reservoir to assure that a SEPG facility will have 10,000 acre-feet needed for cooling could be over 100,000 acre-feet periodically. That estimate is based national averages for such diversions for consumptive and non-consumptive use for SEPG. For example, in a 2010 report, USGS estimated that Texas diverted on average 12 million acre-feet per year for what TWDB's estimates was just under 500,000 acre-feet of water consumed for SEPG that year in all of Texas. TWDB's estimates of diversions were even higher than USGS. [6]

The "once-through" cooling water process requires much more diversion of non-consumed water than other cooling systems. More water efficient cooling

[6] "Estimated Use of water in the United States in 2010," U.S. Geological Survey, table 12, available at http://pubs.usgs.gov/circ/2004/circ1268/htdocs/table12.html TWDB estimated that total of diverted water at 8 to 19 million acre-feet per year. Table 3.3, page 137, 2012 Texas water plan available at http://www.twdb.texas.gov/waterplanning/swp/2012/index.asp. The estimate of average water consumed for SEPG in Texas during this period was less than 50,000 acre-feet per year.

water systems can rely upon diversions of only a fraction of what is needed for once-through cooling.[7]

SWEPCO reported for its Wilkes facility that it diverted and consumed just 4,562 acre-feet in a recent year. While, the diversion and consumption rates for the Wilkes facility are not likely to be accurate and certainly not equal, its cooling process does use far less water than Luminant's process. SWEPCO may not actually measure both the amount diverted and the amount consumed, but assumed they were close to the same in reporting their usage.

There are significant complications in determining how much water will no longer be needed with the closure of a SEPG facility or for future SEPG needs. In watersheds like Big Cypress, just the 30,000 acre feet per year of cooling water no longer needed for Luminant's power plant is enough to make the effort to evaluate options for instream uses worth the effort.

Evaluating the total amounts of water and thus the opportunities for use instream involves at least one more complication. The water used for many SEPG facilities is not from water rights owned by the utilities. Many of the owners of power plants purchase water from others who own water rights and sell water under contracts.

In the Big Cypress watershed, the owners of SEPG facilities have or have had significant contracts for water from water rights of NETMWD and the Titus County Fresh Water Supply District No. 1 (TCFWSD). These entities store their water in LOP and Lake Bob Sandlin. In fact, the amounts of water purchased by Luminant and SWEPCO from these two entities has been far greater than the amounts of water available to them in their own water rights.

For example, Luminant has a relatively small water right, approximately 5,000 acre-feet per year, which allows it to capture water flowing into Lake Monticello from upstream creeks. It had another 50,000 acre-feet per year of water available to it under contracts with NETMWD and TCFWSD.[8] Both of these water suppliers have water rights for water that can be stored in Lake Bob Sandlin. NETMWD also has rights for storage of much more water in LOP.[9]

The total water available to Luminant, about 55,000 acre-feet per year, was the figure before Luminant recently revised its contract with TCFWSD. As Luminant reduced its electricity generation at its Monticello power plant, closing two of its three coal-fired units and operating the third at peak electric use times, it renegotiated its contract with TCFWSD from 38,000 acre-feet of water per year to 10,000 acre-feet per year.[10] Luminant retained its contract with NETMED for about 12,000 acre-feet per year.[11]

With the recent permanent closure of all three units, the total of the 55,000 acre-feet per year once for use by Luminant is likely surplus. Most is owned by, and presumably available for purchase from TCFWSD and NETMWD. Until it is purchased, possibly even after it is purchased, most, if not all, of the water remains in the watershed to help maintain reservoir levels and add to the amounts of

[7] Id, USGS report table 13.

[8] TCEQ's Water right database is available at https://www.tceq.texas.gov/permitting/water_rights/wr-permitting/wrwud/.

[9] See the discussion of water rights in Appendix 1.

[10] Phone conversation with Daryl Grubbs, Executive Director of the Titus County Fresh Water Supply District No. 1, 6/23/2015.

[11] Phone conversation with Walt Sears, Executive Director of the Northeast Texas Municipal Water District, 9/5/2017.

water that is released from the reservoirs when they are full.

The situation with SWEPCO's plants is more complex. This investigation assumed that the closure of one of its units would create a surplus of water that could help with a strategy to project environmental flows in Big Cypress Bayou below LOP. The assumption turned out to be incorrect or premature.

Like Luminant, SWEPCO has small water rights to capture flows in several creeks on which its cooling reservoirs were constructed. And like Luminant, the company also buys much larger quantities of water for its three SEPG facilities from others, NETMWD in particular. SWEPCO has contracts with NETMWD to use about 37,000 acre-feet per year for its Welch, Wilkes and Pirkey power plants.[12]

As discussed above, the total consumption of water by SWEPCO is not easy to determine, because some of the water under SWEPCO's water rights and some water purchased from NETMWD is used for non-consumptive uses. In addition, the figures SWEPCO has reported to the TWDB for its diversions and use suggests that there is some confusion by the power plant operators about how to report the two use figures.

There is one more complication. SWEPCO's agreements with NETMWD allow SWEPCO to take water under a contract for one power plant and use it at another plant. Thus, it has some flexibility on how it uses the water it has under contract, depending upon the level of power generation at each facility and water levels in LOP.

In fact, the recent closure of one of its SEPG unit at the Welch SEPG facility may not have resulted in reductions in the level of SWEPCO's water use. SWEPCO has retained its contracts for the full 37,000 acre-feet per year of water that it had with NETMWD before the closure of the unit. Having some surplus water may give SWEPCO more flexibility in its operations.

Further closings of units at SWEPCO's plants are anticipated and could help with the current supplies for environmental needs downstream. Currently, NETMWD has more water in its water rights that it has committed in contracts. NETMWD water is some of the water that is currently being released downstream to help with the restoration and protection of Big Cypress Bayou and Caddo Lake. Any water no longer needed by SWEPCO, could add to the surplus now available for such releases.

Moreover, SWEPCO has an incentive to help keep water levels high in LOP, where at least one of its intakes for its power plants is located so high that it limits how much water NETMWD can release or could sell in the future. SWEPCO should be an important partner in implementing the strategy discussed below to raise water levels in the lake and provide additional water for environmental needs downstream, especially in no drought periods.

There is an additional set of SEPG units near the city of Lone Star, in Morris County, operated by SWEPCO and U.S Steel. These units apparently have not been in operation since 2010 as can be seen by the lack of use shown TWDB's historic use figures in Table 2 above. Use is reported to have dropped from 2,830 acre-feet that year to almost no water use after 2010.

Due to its pipe manufacturing near the power plants, U.S. Steel is one of the three largest water users in

[12] Id. Also see "2016 Regional Water Plan," Vol. 1, page 4-26, available at http://www.twdb.texas.gov/waterplanning/rwp/plans/2016/D/Region_D_2016_RWPV1.pdf?d=2748.905.

Region D [13] and the largest in the Big Cypress watershed. It uses almost all of the water for manufacturing in Morris County.

It currently has access to about 55,000 acre-feet per year of water from its water rights and contracts with others. About 32,000 acre-feet per year of the total is based on a contract with NETMWD. [14] But U.S. Steel uses less than 55,000 acre-feet per year.

U.S. Steel's future water needs for manufacturing could be as high as that 55,000 acre-feet figure, although the current projections for the entire region for manufacturing are at about half that figure for the period from 2020 to 2070. As with the projections for SEPG, the 2017 regional water plan projected much higher demands, growth to almost 100,000 acre feet per year by 2070.

Even though the current projections suggest some significant surplus water, any future surplus, like the current surplus, will help maintain water levels in LOP. The Lone Star reservoir used by U.S. Steel is just upstream of LOP and any flows from the reservoir go to LOP. There they help maintain LOP water levels and, thus, help provide releases for the environmental water needs downstream in Big Cypress Bayou and Caddo Lake.

Thus, any reductions in SEPG at the Lone Star power plant and any existing surplus water for manufacturing there can be part of the strategy to provide timed releases from LOP in the amount needed to provide the recommended environmental flow downstream. The water available to U.S. Steel and SWEPCO for the power plant at Lone Star and for related manufacturing is not, however, addressed further in this report.

C. The Availability of Other Water from SEPG Facilities

There are other sources of water from or related to SEPG operations that are or will be available to help with environmental water needs. For example, there is wastewater and storm water released from SWEPCO's SEPG facilities. Neither is recycled to cooling ponds. Other water has been stored in ponds created by Luminant's mining activities at Luminant's lignite mines adjacent to Lake Monticello. Some of these types of water could be used to fill environment water needs. In fact, Luminant has several large mine ponds that may have to be reclaimed and restored to more natural conditions unless water right permits are obtained for the use of the ponds and water for other purposes.

As will be discussed below, other return flows, including the discharge of treated wastewater from cities and other industries, could also be included in strategies to develop sources of water for environmental needs. In fact, such return flows from cities, industries and SEPG facilities currently make up much of the water in some river segments and streams in the Cypress River Basin. Keeping these return flows in the river may depend on the availability of surplus water from the closed SEPG facilities that could be used in place of the reuse of return flows to meet the long-term needs of these cities and industries. One of the strategies discussed below focuses on such an approach to using Luminant's surplus SEPG water and leaving return flows in the upper Big Cypress watershed.

D. Ownership of Water from SEPG Facilities

[13] "2016 Regional Water Plan," Vol. 1, page ES-6, available at http://www.twdb.texas.gov/waterplanning/rwp/plans/2016/D/Region_D_2016_RWPV1.pdf?d=2748.905.

[14] "2016 Regional Water Plan," Vol. 1, page 4-26, available at http://www.twdb.texas.gov/waterplanning/rwp/plans/2016/D/Region_D_2016_RWPV1.pdf?d=2748.905.

Most of the water used for SEPG, consumed or not, is the state's water. There is some use of groundwater, which is privately owned, but the vast majority of water used for SEPG is surface water. That is water owned by the state, essentially in trust for the public good.

Thus, water rights for such surface water uses authorize the use but do not grant ownership of the water. Texas could reclaim its water that is not needed for the purposes identified in water rights.[15] The state did some such recapture of water not needed by those with water rights in the state's water right adjudication process under a 1977 law.[16] A number of water rights were reduced significantly to reflect historic uses and more accurate projections of future demands.

With state action to recapture surplus water rights from operators of SEPG facilities, significant quantiles water could be made available for other uses, including environmental water needs without the costs of purchasing the rights. However, the actions by the state over the last 30 years to allow water right holders, especially farmers, to market their water rights to cities and others, make the option of reclaiming all or even part of unneeded surface water rights for SEPG difficult politically.

Thus, the development of a strategy to ask the state to reclaim the Luminant water rights for it the Monticello power plant was not pursued and is not recommended. A statewide effort would likely be required to revise or clarify Texas law to allow the recapture of some or all of the water rights owned by the owner of the closed SEPG facility to allow the water to be converted to environmental needs. This investigation, therefore, looks to other strategies.

RISKS OF NOT PURSUING SURPLUS SEPG WATER FOR ENVIRONMENT NEEDS

While there are opportunities to use surplus water from SEPG facilities for environmental needs, there are also risks that come with the closing of SEPG facilities. Those risks include the use of water for other purposes in a way that is even more harmful to the environment and instream uses.

Surplus SEPG water could be used to support the construction of new reservoirs or to supplement existing reservoirs both in and out of the Cypress River Basin. Figure 4 below shows three proposed reservoirs in the Basin. While none are under current public discussion, all remain options for future development. Two of the three were considered likely water supply reservoirs when Texas and the other three states using water from the Red River Basin divided up rights to water in that Basin.[17]

Neither of the two watersheds with the three proposed reservoirs, i.e. Black Cypress and Little Cypress, have SEPG facilities. However, surplus SEPG water could be transferred by pipeline from the Big Cypress Watershed to help supply water to these proposed reservoirs, just as water is currently transported to several of SWEPCO's cooling water lakes.

[15] Texas law allows TCEQ to cancel water rights for non-use, although it makes it harder to do that for municipal uses than other uses. See Subchapter E, Chapter 11, Texas Water Code.

[16] See Subchapter G, Chapter 11, Texas Water Code.

[17] The Red River Compact that limits some reservoir development. The Compact divides the surface water in the Red River Basin between Texas, Oklahoma, Arkansas and Louisiana. The compact allows Texas to build any of these three reservoirs capture water for use in Texas. (See, Settemeyer, Herman, "Red River Compact Analysis - Cypress River Basin", available from TCPS.

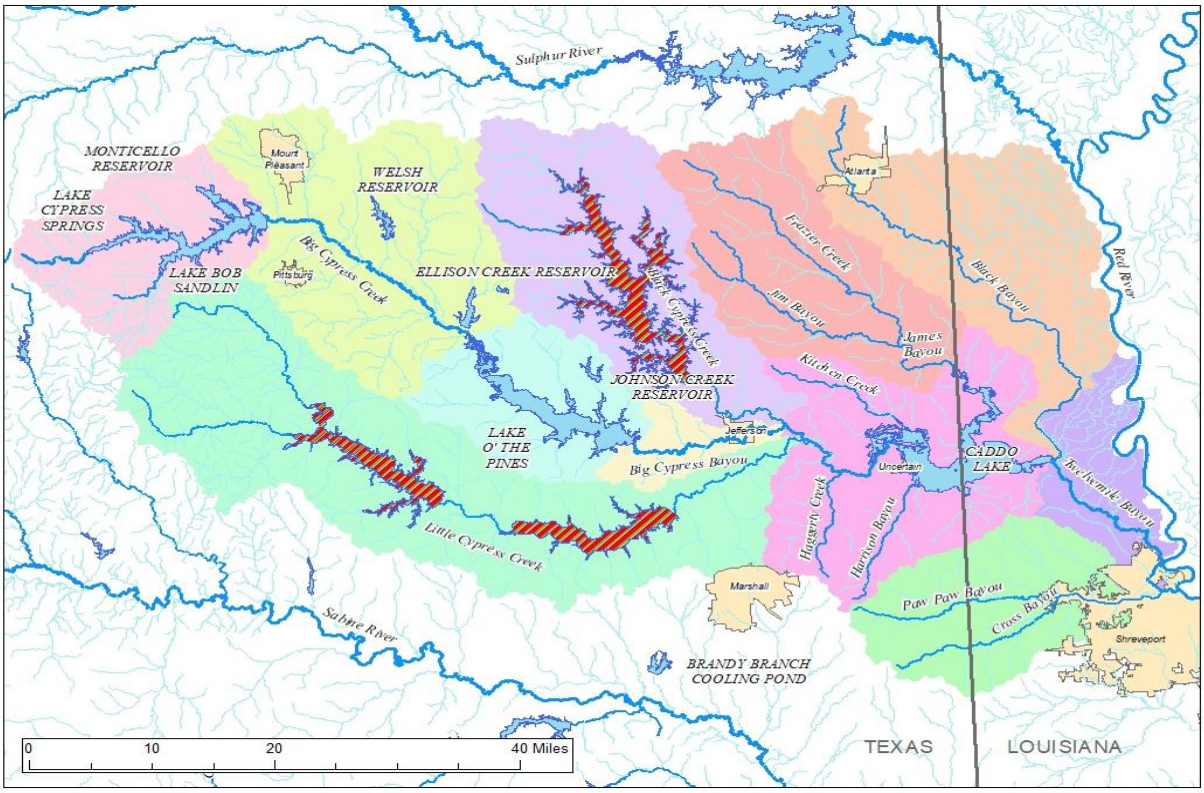

Figure 4. Map of the Caddo Lake watershed with reservoirs that have been proposed in red

There is also the risk of a interbasin transfer out of the Cypress River Basin south to the Sabine River Basin or west to the Trinity River Basin. Such transfers are currently occurring to the Sabine Basin, to SWEPCO's Pirkey Power Plant and to the cities of Longview and Marshall. At least one water supplier in the Dallas Fort Worth area has expressed interests in water from the Big Cypress watershed.

Moving water out of the Big Cypress watershed for new reservoirs in the Cypress River Basin or to supplement water supplies for reservoirs out of the Basin would likely have some significant adverse impacts on environmental and other instream uses. If any of the three proposed reservoirs were built, there could be significant impacts on the downstream rivers, similar to the significant loss of flow in the Big Cypress downstream of LOP after that lake was constructed, as shown in Figure 2 above. Moreover, if any of these or other reservoirs were used to export water from the Basin, the system could lose much of the water it currently has for environmental water needs.

The risks of interbasin transfers out of the Cypress River Basin is significant. Currently about 30,000 acre-feet per year from LOP is transferred out of the Basin into the Sabine River Basin for water supplies for Longview and Marshall. In both cases, the resulting wastewater return flows are discharged in the Sabine River Basin, resulting in a loss of the water for the Cypress River Basin.

While proposals for additional out-of-basin sales have been raised by Longview and water supplies in the Dallas-Fort Worth region, they are apparently not now under discussion. This may be true for several reasons. First, the exaggerated water demands projected in past regional and state water plans for the Cypress River Basin may be have discouraged users in other basins from seeking water from the Cypress Basin. Those projected

demands have been reduced significantly in the recent TWDB figures, suggesting a significant surplus of water in the Basin.

Second, the focus of areas such as the Dallas-Fort Worth metroplex has been on major new reservoirs in the Sulphur and Red River Basins. Several have been authorized, and the focus of addition water supplies for that area could now be shifted to the Cypress River Basin. The projected demands for water in the Dallas-Fort Worth area continue to exceed the projected supplies, even with the new reservoirs approved in the Sulphur and Red River Basins. As new pipelines are proposed or constructed to move water from the Sabine, Sulphur and Red River Basin to the Dallas-Fort Worth area, the options of adding water from the Cypress River Basin will likely receive more attention.

In addition, the resolution of a dispute between Dallas and the Sabine River Authority over the price that Dallas pays for water from Lake Fort is also likely to create an opening for new evaluations of moving more water from East Texas to Dallas.

Both NETMWD and TCFWSD have water available to sell in addition to the surplus SEPG cooling waters. Depending upon the approach used to calculate NETMWD available water under its water right, it could have 50,000 to 100,000 acre-feet of water per year to sell. As discussed above, it appears that TCFWSD has at least the 28,000 acre-feet per year of water rights or water to sell. It will likely have 38,000 acre-feet to sell soon. There are other suppliers with surplus water.

And there is also surplus water in "return flows;" the water not consumed by cities or industries, discharged back into the lakes, rivers and streams in the Basin. There are significant quantities of such return flows discharged by cities such as Pittsburg and Mount Pleasant, and industries such as Pilgrim's Pride and U.S. Steel. Discharges of wastewater into the upper segments of the Big Cypress watershed, above LOP, total about 25,000 acre-feet per year, and some or all of that water could also be sold for interbasin transfers.

The closure of Luminant's Monticello power plant, together with the fact that the Cypress River Basin has other sources of surplus water has likely increased the risk of purchases and interbasin transfers out of the Basin. When such interest in water from the Cypress River Basin might lead to specific proposals is hard to predict, but it could be soon, possibly within the next few years.

NETMWD has expressed its interests in determining the instream needs in the Cypress River Basin before entering into discussions for sales out of the Basin.[18] Nevertheless, those seeking opportunities to use surplus water in the Big Cypress watershed for environmental needs could see both competition and significant risks to the watershed in the near future.

ENVIRONMENTAL WATER NEEDS IN THE CYPRESS RIVER BASIN

Because of the interest in protecting Caddo Lake and its watershed, the Caddo Lake Institute (CLI), the Nature Conservancy (TNC), the NETMWD, the U.S. Army Corps of Engineers (Corps) and others began a project in 2004 to work on restoration and protection of instream flows in the streams and

[18] In 2008, NETMWD released a "notice of available water and opportunity to express interest." NETMWD apparently wanted to know the level of interest in future purchases of its surplus water. NETMWD received positive responses from Longview and at least one water supplier in the Dallas-Fort Worth area.

rivers and to lakes in the Cypress River Basin.[19] The major focus of the initial work of this Flows Project was on Big Cypress Bayou downstream of LOP to Caddo Lake, and on the ecological, recreational and other benefits of healthy rivers and lakes.

CLI looked to TNC and the Corps of Engineers for the process they use in other parts of the country in their Sustainable Rivers Program.[20] The process brings together scientists and stakeholders to develop consensus recommendations for the flow regimes for river basins or watersheds. The work of the scientists and stakeholders in the Cypress River Basin was done over a number of years and in a series of meetings. The process is similar to that recommended in a report by the National Academy of Sciences for State of Texas.[21]

One such approach was adopted, with some revisions, was the methodology for identifying environmental flow needs in most Texas rivers under a 2007 Texas law, known as Senate Bill 3. That law required several state agencies to work with local interests to develop environmental flow regimes for all river basins in Texas with flow to the Gulf of Mexico in Texas. Thus, the Cypress, Sulphur, Red and Canadian river basins were excluded. No effort to develop environmental flow needs under SB 3 for these river basins has been pursued by state agencies.

Unlike the approach developed by TNC, the one used under the Senate Bill 3 process requires the scientists to meet first to develop their recommendations on what the rivers and streams need. Then, stakeholders meet to revise those recommendations based on other factors, such as risks of flooding and projections for future water needs and supplies.

The Senate Bill 3 process is also somewhat different from that used in the Cypress River Basin because it was initially a short process focused on developing a quick set of flow regimes which the state could then consider in issuing new water rights. The Flows Project for the Cypress River Basin, on the other hand, was designed as a multi-year process. It allowed for testing of proposed flow regimes and for time to revise those regimes as better understanding of the environmental needs was developed. The process also included the explicit goal of identifying and developing strategies to meet the water needs for the flow regimes.

As with the work under Senate Bill 3, the efforts in the Cypress River Basin were not intended to restore historic flows patterns. No one proposed steps such as taking down dams. The goal was to develop flow regimes that would mimic natural patterns using the amount of water and timing of flows that the experts and stakeholders agreed are sufficient to assure the basic ecological health of the rivers and streams of the Basin, while protecting the local economy of the region.

A consensus on such flow regimes for the major rivers in the Cypress River Basin was reached by experts and stakeholders involved in the Flows Project in 2011. The flow regimes, also referred to as the "building blocks," that were recommended for the Big Cypress downstream of LOP, are shown in Figure 5 below. These were based on a process allowing revising flow regimes, as field work and experiments to test the values of those regimes

[19] The work on this Cypress Flows Project can be found at https://caddolakeinstitute.org/documents/#other

[20] See, https://www.nature.org/ourinitiatives/habitats/riverslakes/sustainable-rivers-project.xml.

[21] See, https://www.tceq.texas.gov/assets/public/permitting/watersupply/water_rights/eflows/resourcesscienceofinstreamflows.pdf.

proceeded. As a result, in 2011, the Corps and NETMWD agreed to a five-year experiment to help test the value of these consensus flow regimes and determine the extent that current water supplies, including flood flows captured in LOP, could help meet the flow targets.

The Corps and NETMWD worked together to release water from LOP in way that could provide the recommended environmental flows. The releases were, however, subject to the availability of flood and other waters in LOP that were not needed by cities, utilities and industries.

The releases were also subject to other constraints on releases of water from the lake, such as downstream flood risks. Under the federal law authorizing LOP, the minimum release from the reservoir for downstream flows was set at 5 cfs.

Historically, higher releases had been made. NETMWD and the Corps tried to assure that at least 25 cfs was released downstream, in part, because of a contract for the purchase of NETWMD water downstream of the dam by SWEPCO. In addition, because of the need to release flood water, much higher releases were made at times, up to 3,000 cfs, which is what the Corps then considered its maximum safe release.

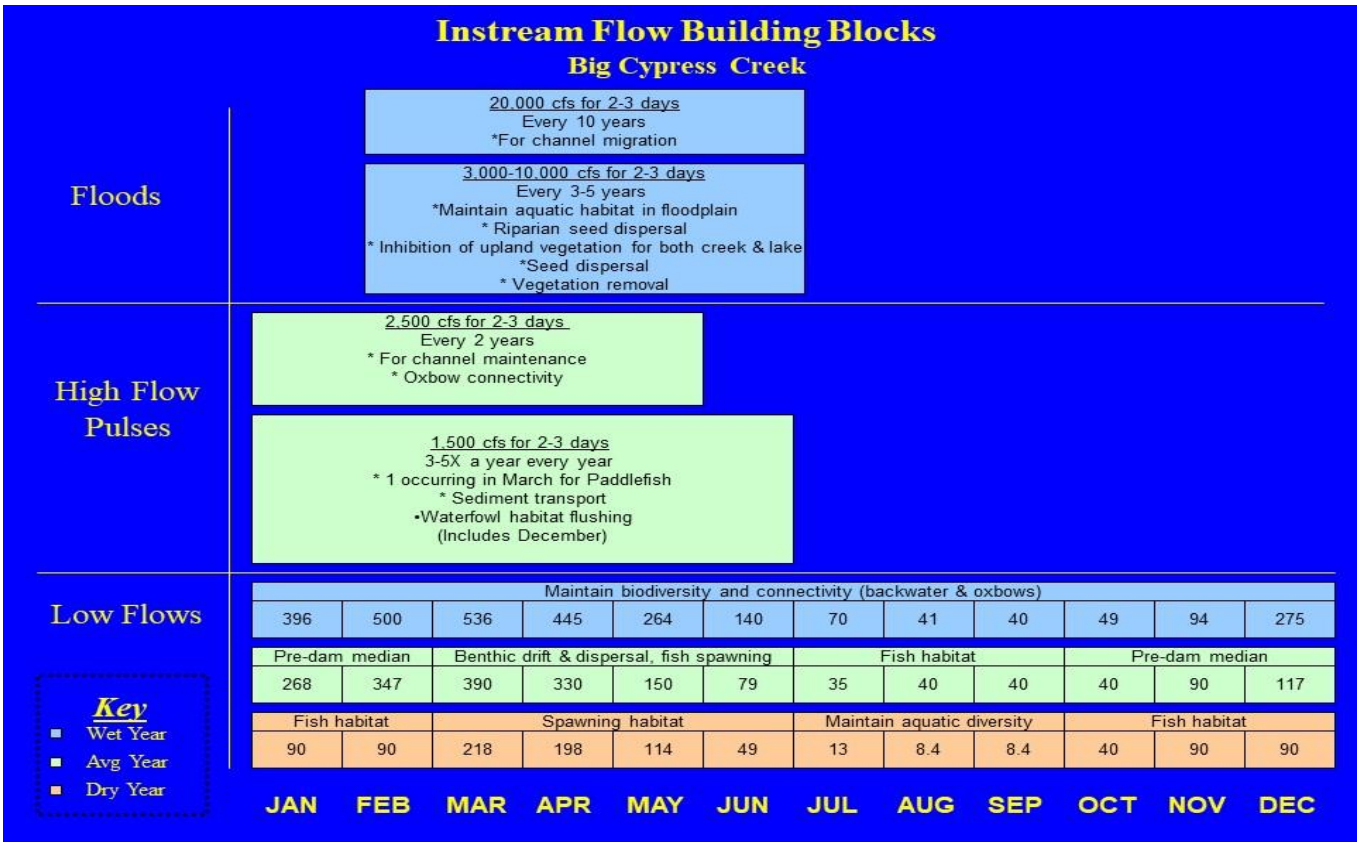

Figure 5. Environmental flow regime for Big Cypress. Flows in cubic feet per second (cfs) [22]

[22] This building block and the ones developed for other rivers can be found in "Summary of Development of Building Blocks and Other Work on the Cypress River Basin" 2015 at https://caddolakeinstitute.org/documents/#major.

In addition to helping to determine if there is sufficient water, under different weather conditions, to provide the releases needed to meet the flow regimes, the experiment also allowed the Flows Project to evaluate the responses in Big Cypress Bayou to the new release pattern.

While the five year time frame was not sufficient to determine if new flow regimes will restore and protect the ecological values of Big Cypress Bayou and Caddo Lake, the experiment allowed for some initial assessments that the new flow regimes would provide predicted benefits.

The experiment allowed the Flows Project to develop evidence that changing operations of LOP can have some beneficial effects. For example, the Flows Project had recommended a 1500 cfs pulse flow timed in the spring to help provide conditions needed for fish, such as the American Paddlefish. (This flow target is shown in Figure 5). With that pulse flow and other work, an experimental release of the Paddlefish was begun in 2014. Due to its initial success, the effort was converted to a full scale reintroduction effort. [23] Paddlefish had not been seen in this watershed for 50 years before 2014, but those that were released appear to have adapted to the watershed, with its new flow regime.

The experiment also showed that the LOP releases that could be made would not be provide the flows recommended under all weather conditions. Additional water or strategies would be needed.

Nevertheless, the success of the five-year experiment allowed the Corps and NETMWD to make the release program for environmental flows a permanent part of the official water management plan for LOP, when water is available. In effect, a fourth goal—environmental restoration and protection—was added to operations of the lake to compliment the other three goals: water supply, recreation and flood prevention.

In addition, in 2016, the recommended flow regimes for the Cypress River Basin were adopted as the goals for the environmental water needs in the regional water plan for the northeast Texas region of Texas, Region D. That plan was then approved by the TWDB to become part of the 2017 State Water Plan.[24]

These types of environmental water needs have only been included in one regional water plan, that for Region D. All other regional plans have limited themselves to identifying water needs and strategies for cities, industries, agriculture, SEPG and a few other consumptive water uses.

Now with the consensus on flow regimes and environmental needs in Big Cypress Bayou, additional strategies, such as those discussed below can be pursued.

The level of work done for the Big Cypress watershed downstream of LOP has not been done for the watershed upstream of LOP. There are similarities, but work on the upstream segment will require additional work to develop the environmental flow regimes needed to restore and maintain the ecology of that segment of the watershed. That can be done while the types of strategies discussed below for that segment are further developed.

[23] See, https://www.fws.gov/southwest/fisheries/txfwco/documents/Big_Cypress_Bayou_Paddlefish_Reintroduction_Assessment_2014-2015.pdf.

[24] See, http://www.twdb.texas.gov/waterplanning/rwp/plans/index.asp.

STRATEGIES FOR USING SURPLUS SEPG WATER

There are a number of opportunities for using the surplus SEPG water that is currently available from the closure of Luminant's Monticello SEPG facilities for environmental water needs in the Cypress River Basin, both in short-term and long-term. This surplus water could benefit the Big Cypress Basin, both upstream and downstream of LOP.

It is likely, however, that much of that surplus SEPG water will only be available in the short term, as significant amounts of the water will likely be purchased for other uses over time. Still, during the short-term, some significant restoration work could be done in the Big Cypress watershed above LOP, the segment of Big Cypress that is the most degraded in the Cypress River Basin. The quantity of water flowing down to LOP from the Monticello area could also help maintain water levels in LOP to allow the flow regimes downstream to be met more often than they could in the past.

In the long-term, maintaining some of the surplus SEPG water would help protect the ecology of Big Cypress upstream of LOP. Others strategies will be needed to help meet the flow regimes downstream to Caddo Lake.

A. Strategies Below Lake O' the Pines

As discussed in the prior section, changing the operations of LOP cannot, by itself, provide sufficient water to meet the environmental flow regimes in Big Cypress Bayou below the lake. Additional sales of water by NETMWD from the lake could further limit the ability of the lake to provide sufficient releases.

The one strategy that has been considered in the Flows Project to help meet the environmental water needs below LOP is to increase the amount of water stored in LOP. With more water captured in LOP, more water could be released downstream in ways that help meet the flow regime for Big Cypress down to Caddo Lake.

Obtaining more water for LOP could be accomplished in at least two ways. First, water no longer needed by SWEPCO for its SEPG could remain in LOP for releases downstream. The increase in water for release for downstream environmental flow regimes could also result from raising the level of water stored in LOP with the capture and retention of more water flowing into the flood pool of the lake.

Because the closure of one unit at a SWEPCO power plant has not likely resulted in any significant additional water being available in LOP and because the timing of further closures of SWEPCO's units is uncertain, this investigation did not look at the option of using SWEPCO's water. It should be a viable option in the future. Much of SWEPCO's water is purchased from the NETMWD, and unless sold to someone else, should remain in LOP once SWEPCO no longer needs to divert it for cooling.

In addition, as mentioned above, some of the surplus water flowing downstream from the Monticello area or return flows from cities and industries should help maintain higher water levels in LOP, but those benefit will be tied to the strategies that are developed for Big Cypress upstream of LOP.

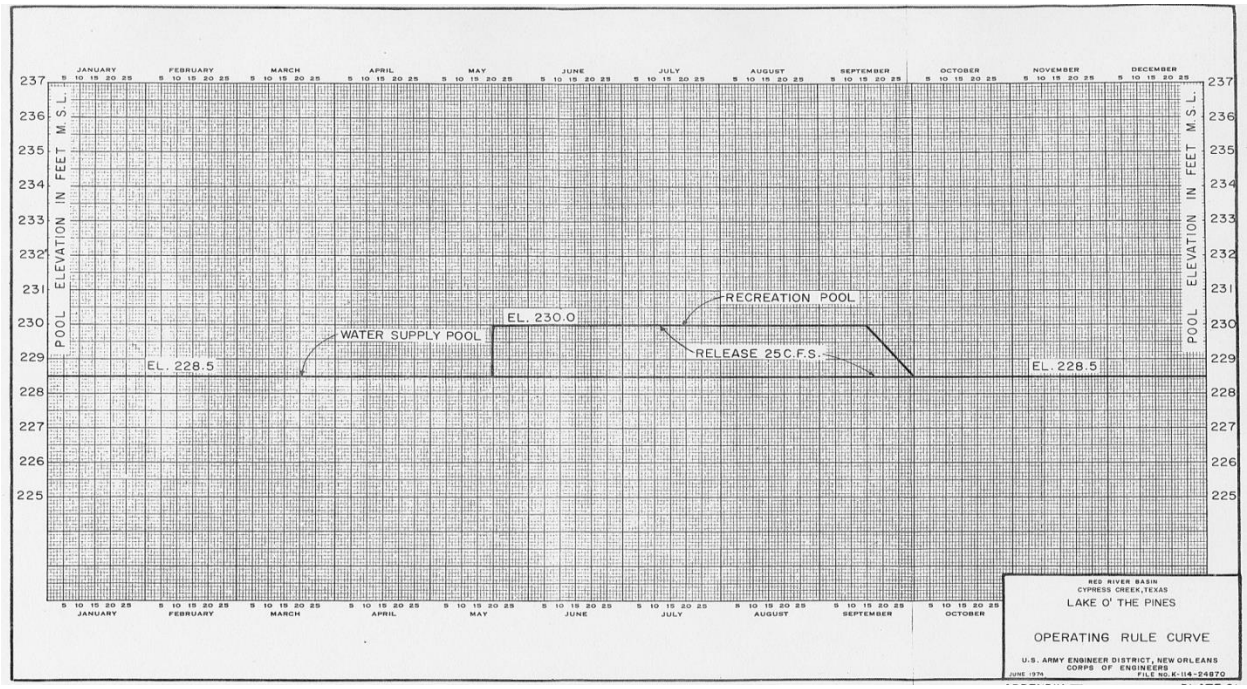

Figure 6. Operating rule curve for the operations of Lake O' the Pines

Increasing the amount of water that can be captured and stored in the flood pool of LOP is the strategy that could bring the most benefit for environmental water needs downstream of LOP.

Figure 6, shows the water levels in LOP under the current conditions. The water supply or conservation pool, in which NETMWD stores its water, is limited to the Lake below 228.5 feet msl. Above that level, the water is in the flood pool and is managed by the Corps for flood control. The water level in the flood pool is normally dropped to 228.5 msl to make room for the next rain event. However, from mid-May until the end of September, the Corps is authorized to maintain that flood pool at a level higher than 228.5msl. When the water is available, the Corps retains storm water in the flood pool at 230 feet msl to provide additional water during peak times of recreation.

Based on more than fifty years of experience in operating LOP, the staff of the Corps' Fort Worth office have suggested that LOP could be managed all year at the level of this seasonal or recreational pool. The Corps has not conducted the modeling needed to assure that such year-round operations would not increase the extent or frequency of flooding up or downstream. Nor have the appropriate models been run to determine the frequency of having sufficient water to maintain the lake at 230 feet msl. This modeling work is planned for 2018-2020.

Still, extending the timing of the seasonal pool for any period of time would provide the Corps more flexibility for releasing flood water downstream for environmental flows at the times needed. Extending the seasonal pool could also provide greater certainty to NETMWD that it will have access to its full water rights.

Given the 20,000-acre surface area of LOP and a 1.5 increase in water level for the full year, an additional 20,000 acre-feet of water per year could be stored for release downstream, possibly more depending upon reservoir operations. Such additional water stored in LOP could then be released downstream to meet the recommended environmental flow

regimes and other instream uses. Louisiana water users and recreational users in Caddo Lake would also benefit from these additional releases, as the flows would also help maintain water levels in Caddo Lake.

The water in Caddo Lake is allocated between Texas and Louisiana under the Red River Compact.[25] Five (5) cities and SWEPCO take water from the Louisiana side of Caddo Lake for their water needs in Louisiana. As with SWEPCO's intake structures in LOP, those for these cities and SWEPCO in Caddo Lake could also be better protected with more inflows to Caddo Lake.

Significantly, providing the additional water in LOP would also help solve the problem of SWECPCO high intake structure in LOP, which is used for transfer of LOP water to SWEPCO's cooling lake for its Pirkey SEPG plant. The increased storage in the flood pool should reduce the risk that water levels in LOP drop to or below that intake structure during periods of dry weather.

There could be some adverse, environmental, cultural and economic impacts with extending the seasonal pool to 12 months. There are marinas that could be affected. There may be native American sites around the lake that need to be protected. Holding more water in LOP during the spring could increase the risks of flooding around the lake and downstream. Nevertheless, there appears to be a consensus that those potential issues will not create significant barriers to extending the seasonal pool.

Moreover, the 1.5 feet increase in the flood pool is not enough to require congressional approval. The Corps has the flexibility in its current authorization for LOP. The strategy for obtaining additional water for release downstream, be the water from surplus SEPG supplies or other sources, appears very possible.

There is, however, one unresolved legal issue with capturing water and extending the timing of the seasonal pool. In late 2016, the staff of the Texas Commission on Environmental Quality (TCEQ) indicated that a new water right might be required for the water captured and held to extend time for the seasonal pool.

The agency staff apparently sees the current seasonal pool as within the Corps' flexibility for managing its flood waters. No water right has been required by TCEQ. Thus, storage of the water is subject to the discretion of the Corps and the Corps decides when the water should be released, at what release rate, and for how long. The Corps must balance the risks of flooding upstream and downstream.

However, TCEQ staff is concerned that extending that pool to 12 months for use for environmental needs would require approval by TCEQ through a water right under Texas law. The matter has not been taken to the Commissioners of TCEQ who have the ultimate agency decision. The commissioners may decide that the water in an extended seasonal pool is simply flood water and read Texas law as allowing the Corps to maintain a longer seasonal pool without a water right, possibly for a time less than 12 months.

If, however, TCEQ determines that a water right is required for water stored in LOP at levels above 228.5 feet msl outside the September through May

[25] Settemeyer, Herman "Red River Compact Analysis - Cypress River Basin," which states: The Compact provides Texas the unrestricted right to the use of all water above Lake O' the Pines, . . . Thus, any changes to the operation of Lake O' the Pines reservoir release, both in amount and timing, would not be in conflict with the Compact or require any Commission action. Available in the Background Information and Reports at http://www.caddolakeinstitute.us/flowsworkshop16.html.

period, there will be a number of complications and new costs that will need to be addressed. First, anyone who would seek a new water right for this water would have to go through a resource-intensive state process, which would include paying a significant application fee, possibly $50,000.

Second, if the right is obtained, the owner would then likely have to pay the annual TCEQ water use assessment fees for the water right.[26] Third, the Corps could charge a fee for use of LOP for storage of the water in the lake, probably as a percentage of the Corps' annual maintenance fees.

The first two of those costs could be reduced or eliminated if water from existing water rights were stored in the lake to provide the extended seasonal pool. There could be costs associated with adding a storage right or adding instream flows to an existing water right. Neither should be a significant problem, as Texas allows "stacking" of uses and storage of water rights in reservoirs owned by others. Thus, a holder of water rights for either consumptive or non-consumptive use could amend the right to add instream uses and storage rights.

However, assuming that SWEPCO needs all of its water rights and the amount of water it purchases from NETMWD, SWEPCO is not a likely candidate for storing its water in an extended seasonal pool. Again, that could change with closure of more of its SEPG units. However, most of SWEPCO water is purchased from NETMWD. SWEPCO water needs are meet with small water rights it owns. Its rights which could not provide the 20,000 acre feet that could be stored in the extended seasonal pool.

The water no longer diverted by Luminant for SEPG becomes state water once it passes through Luminant's diversion points. That water would be available for storage in the extended seasonal pool of LOP, but a new water right for its use and storage would be required.

NETMWD has significant water rights, which it stores in LOP and in Lake Bob Sandlin. It pays the Corps for storage of its water in LOP. Since NETWMD has surplus water it can sell, it is not likely to seek any additional water right. It might not support issuance of water rights to others who might compete with it for sales of water from LOP.

Organizations, such as the Caddo Lake Institute, will not be able to obtain a new non-consumptive water right for instream or environmental flows to store in the extended seasonal pool under Texas law.[27] Texas law prohibits TCEQ from approving such new water rights. The organizations could, in theory, buy existing water rights and convert it to instream uses, which is permitted under Texas law. The cost of such a purchase is probably much too great to make that option possible. The cost per acre-foot of water rights could run to $1,000, possibly more. There have been only a few sales of very limited water rights in this area of Texas.

There are also two major water right holders with water that flow through LOP and downstream to Caddo Lake. Either could obtain storage rights for LOP and stack instream uses for environmental benefits to their water rights.

The City of Marshall has 16,000 acre-feet of "run of the river" water rights, currently with no storage rights in Caddo Lake or LOP. The City's diversion

[26] Currently $0.385 per acre-foot of water right authorized for consumptive use and $0.021 per acre-foot of water right authorized for non-consumptive use.

[27] Texas law prohibits TCEQ from issuing a new water right for "instream flows dedicated to environmental needs or inflows to the state's bay and estuary systems; or (2) other similar beneficial uses. Texas Water Code, Section 11.0235(d).

point is in the upper end of Caddo Lake. Marshall might be convinced to seek an amendment to add instream uses to its water right and to allow it to store the water in LOP, especially if there were some financial assistance for the costs of such amendments and storage. Still, the City will need some of its water rights and, even if 16,000 acre-feet per year were available, it is not sufficient to provide the full benefit of extending the seasonal pool.

The U.S. Fish and Wildlife Service is the second major water rights holder. It has water rights for its Caddo Lake National Wildlife Refuge on the shores of Caddo Lake. The Service currently has water rights for about 29,600 acre-feet per year, all but about 1,000 acre-feet being non-consumptive and for instream uses. It will obtain an additional 10,000 acre-feet of water rights, again some for consumptive use, when the U.S. Army transfers its remaining land and water rights to the Service for that National Wildlife Refuge.[28]

Some staff of the Service have expressed support for use of the Service's water right as a significant component of the water needed for protection of habitat in Big Cypress Bayou downstream of LOP and in Caddo Lake.[29] They appear to support the storage of the Service's water in LOP for the extended seasonal pool.

There would still be a number of issues to resolve if TCEQ does require a water right with storage rights in LOP for the extended seasonal pool. Whether the Services 30,000 to 40,000 acre-feet of water per year in Caddo Lake translates into the 20,000 acre-feet needed for the extension of the seasonal pool at LOP will need to be determined. Whether the Service's water rights are subject to TCEQ's use assessment fee is currently in dispute. What the Corps might charge the Service for storage is also not resolved.

The Service would not, however, have to to pursue a new water right and deal with the time and costs of the state's water right process. Thus, while the costs for the use and storage of the Service's water rights is not known, the option of using the Service's water right is the likely best option if TCEQ decides that it must require a water right for all or some of the storage required for extending the seasonal pool.

Findings and Recommendation

Extending the seasonal pool in LOP appears to be the best strategy for assuring additional water is available to meet the environmental water needs down stream of LOP and into Caddo Lake. This strategy could allow the Corps to capture more flood flows and use any surplus SEPG water that is currently available or that will become available in the future with reductions in SEPG in the watershed by Luminant or SWEPCO.

If TCEQ requires a water right for the storage required to extend the seasonal pool or for use of the water in the pool for downstream environmental water needs, the use of water rights of the Fish and Wildlife Service would appear to be a good option.

Thus, additional work on the strategy to extend the seasonal pool at LOP should continue, while resolution of the water right issue is pursued. The work by the Corps to model and evaluate the

[28] The refuge is on land previously owned by the Army for its Longhorn Army Ammunition Plant. As the land and ground water is being cleaned up, the Army is transferring title to the land and water rights to the Service.

[29] Telephone conversation with Juaquin Baca, US Fish and Wildlife Service, Albuquerque NM, September 2017.

impacts of extending the seasonal pool is likely to take several years and should be encouraged.

B. Needs and Strategies Above Lake O' the Pines

There is a greater opportunity to use surplus water from SEPG facilities for filling environmental water needs in Big Cypress Creek upstream of LOP. Two strategies were investigated, direct use of the surplus SEPG water and indirect use, where the surplus water would be in place of return flows from cities and industries, allowing those flows to remain in the streams and rivers to assist with filling the environmental water needs.

Big Cypress Creek between Lake Bob Sandlin and LOP has suffered from a lack of water and high levels of pollutants in wastewater discharged to the streams in the watershed. Obtaining additional water to restore Big Cypress Creek and to maintain the ecological health of that segment may be possible by using water freed up from the closure of SEPG units and mining operations, especially in the short term.

The ecology of Big Cypress Creek has suffered for two main reasons. The first is the lack of releases from Lake Bob Sandlin during many of the last 14 years. While some water was released from Lake Bob Sandlin to Big Cypress from its construction in 1978 until 2004, there are no release requirements for the reservoir. Almost no water was released downstream to Big Cypress Creek in 2005, 2006, or from 2011 to 2014[30] due to drought and demands for diversions of water from Lake Bob Sandlin for SEPG use and for use by cities and industries.

As a result, Big Cypress Creek downstream of Lake Bob Sandlin, especially through lands owned by the Titus County Fresh Water Supply District No 1 (TCFWSD) immediately downstream of the dam, received little, if any, water from Lake Bob Sandlin for a number of years. There are several tributaries that enter Big Cypress Creek downstream of Lake Bob Sandlin that provided some flows in Big Cypress Creek. The flows in those tributaries were, however, dominated by wastewater discharges from cities such as Mount Pleasant and industries such as Pilgrim's Pride chicken processing plant.

Discharges of wastewater are the second reason the ecology of Big Cypress Creek downstream of Lake Bob Sandlin and the ecology of the upper reaches of LOP were significantly degraded. Run off from agricultural activities are likely to have added to the pollutant loads in these tributaries and in Big Cypress Creek, but discharges from Pilgrims Pride's operations has apparently been the largest single source of pollutants and impacts on aquatic species in the watershed.

Samples of water quality conditions in this segment of Big Cypress has shown statistically significant upward trends of pollutants in the Big Cypress over much of the last 10 to 20 years.[31] Thus, the Big Cypress watershed below Lake Bob Sandlin, the main stem and several of the tributaries to it, have been listed as "impaired," or not meeting state water quality standards since the 1990s. The pollutants of concern have mainly been bacteria and nutrients.

In 2000, the upper end of LOP was also identified as impaired, suffering low dissolved oxygen levels that were later blamed on high phosphorous levels in the

[30] 2016 Cypress Creek Basin Highlights Report, page 9, available at http://netmwd.com/images/2016BHR_final_5-4-2016.pdf.

[31] The annual Cypress Creek Basin reports, such as the 2016 highlights report cites above provide a good history of the conditions.

water coming into the lake from Big Cypress Creek. Fish kills occurred because of the low dissolved oxygen levels.

A study of the problem led to the development of a program under rules of EPA and TCEQ to require wastewater treatment plants, especially for the one operated by Pilgrim's Pride, to reduce the level of phosphorous in the wastewater it discharged.[32] Local agricultural operations were also encouraged to reduce the run-off of phosphorous laden fertilizers.

In 2008, an implementation plan for reductions of phosphorous was developed. It was initially implemented in 2016. Progress is being made on the problem, but it is too soon to determine if the effort will solve the problem of low dissolved oxygen levels in Big Cypress and LOP resulting from discharges and runoff of water with phosphorous.

Moreover, because of high levels of bacteria in several tributaries to Big Cypress Creek above LOP, a separate study was started in 2009 with the goal of identifying the sources of the bacteria.[33] The results showed continued pollution problems from bacteria, but the studies could not distinguish between human and some animal sources. Thus, the effort did not lead to strategies to address the bacteria problems.[34] Instead, the study led to an effort that loosens the levels of bacteria allowed in some of the tributaries to Big Cypress, thus, eliminating the impairment without solving the pollution problem.

Recent studies for the state sponsored Texas Clean Rivers Program show mixed results. There continue to be high levels of phosphorous and bacteria at times, although not as high as in the past. There is also a new problem, higher levels of sulfates, possibly a result of the phosphorous removal process used at Pilgrim's Pride's wastewater plant in Mount Pleasant.

Still, with the progress being made, the increased releases of water from Lake Bob Sandlin resulting from the closure of Luminant's Monticello mining and SEPG power plants are likely to help restore Big Cypress and the upper end of Lake O' the Pines. There is no restoration plan at this time, and the sale of the water that had been used by Luminant would reduce the likelihood of the type of restoration effort that could be done.

If TCFWSD and others were willing to pursue some significant restoration efforts for Big Cypress Creek, now is the time. Just allowing the surplus water to flow downstream when Lake Bob Sandlin is full will help. However, if the release of water from Lake Bob Sandlin was done to mimic the historic natural flows, the surplus water could do much more to help and restore the habitat in and along Big Cypress Creek.

There are some significant differences in the upper and lower Big Cypress watersheds that would need to be addressed. First, while there is clearly some interest in restoration of the river below Lake Bob Sandlin, there is currently no effort to create the partnerships with stakeholders that will be needed.

[32] Descriptions of the problem, the resulting evaluation, the report on the total maximum daily load that should be allowed in Big Cypress and the implementation plan to achieved this maximum load for phosphorous are available on TCEQ's website at https://www.tceq.texas.gov/waterquality/tmdl/nav/19-lakepines.

[33] A description of the project is available at http://bcc.tamu.edu/media/1094/monitoringapproach.pdf.

[34] See http://netmwd.com/images/FY12_Cypress_BHR_Final_Report.pdf.

Certainly NETMWD has an interest in restoration efforts, given that it supplies water out of LOP to a number of its member cities and to power plants and industries. These cities also have economic interests in the recreational opportunities on LOP that help support the local economy. NETMWD owns a significant amount of the water stored in Lake Bob Sandlin.

There has been a recent effort by two private landowners working with the Texas Parks and Wildlife Department in the watershed to restore habitat along several tributaries to Big Cypress Creek.[35] These landowners and others along Big Cypress are likely to support additional restoration of Big Cypress Creek if approached. In fact, the major landowner on Big Cypress is TCFWSD. It owns the land immediately below the dam at Lake Bob Sandlin and would be a critical partner in any restoration effort. It also owns the majority of the water in Lake Bob Sandlin.

With any short-term restoration effort, there would also need to be a long-term plan to assure that the restoration can be maintained. If no short-term effort were made, the long-term strategy to meet some of the environmental water needs in this watershed could be even more important. Thus, strategies for both the short and long-terms were evaluated based on a simple assessment of the environmental water needs.

The Environmental Water Needs

The effort by the Flows Project to develop environmental flow regimes in the Cypress River Basin resulted in recommending regimes for several river segments, including Big Cypress downstream of LOP, as is shown in Figure 5. This level of work has not begun on the segment of Big Cypress between Lake Bob Sandlin and LOP.

However, the approach used in that Project provides a sound basis for developing basic flow regime for Big Cypress Creek above LOP. Figure 7 shows the results of one approach, with the different base flow regimes for dry, normal and wet years. The regimes are based on the average historic flows for the 25th, 50th, and 75th percentages of flows. Similar estimates can be made for the size and timing of the pulse flows.

These initial estimates for base and pulse flows would need to be evaluated by a number of different types of experts based on the ecological goals. It would be important to have access to information on historic fish and mussel populations, water quality, conditions of floodplain vegetation and habitat, and other factors. The opinions of experts will be needed to determine how the flow regimes in Figure 7 and any historic pulse flow information should be revised to help restore and protect the ecological values of the Big Cypress Creek with the water that could be available.

The goals of stakeholders would then need to be considered. Ideally the experts and stakeholders, would work together to find a consensus for the flow regimes that would determine the strategies needed to meet appropriate environmental water needs. While there are different stakeholders and issues in this segment of the Big Cypress watershed, many of the stakeholders in this segment have experience working with the Flows Project. Many

[35] Notes from meeting with one landowner and representatives of Texas Parks & Wildlife Department May 11, 2017.

of the same experts might also be willing to provide advice and time for this effort.

While this investigation has begun to pull some of the information that will be needed to develop a plan for restoration and long-term maintenance of the segment, there is more research that must be done. Certainly, any plans Luminant may have for its mine and power plants would be important to understand.

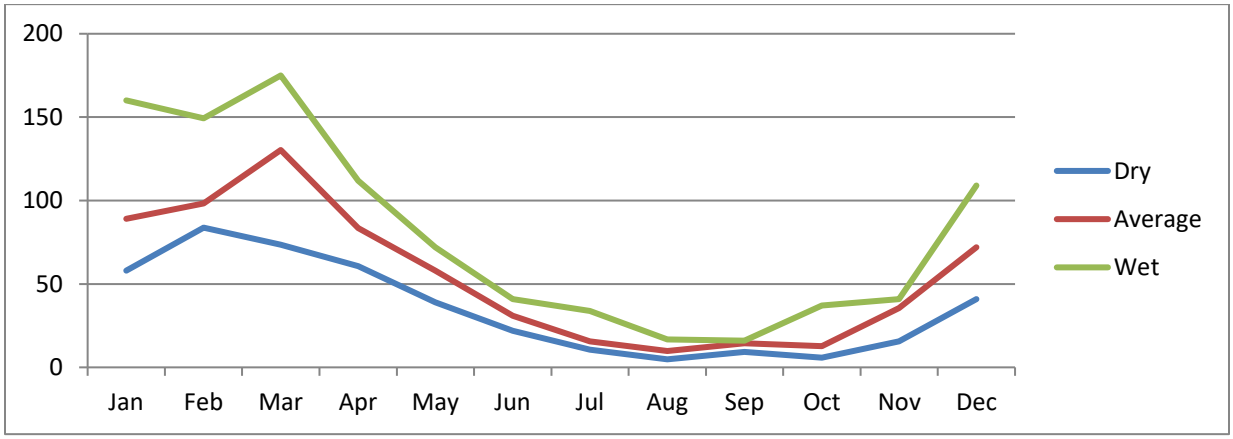

Figure 7. Base flow regimes determined using the Indicators of Hydrologic Alterations (IHA) methodology. Flows are in in cubic feet per second (cfs)

The likely sale of surplus water in or out of the watershed would be important to assess. Nevertheless, even without the surplus SEPG water, efforts to understand the environmental water needs of Big Cypress and develop strategies to provide the water should be pursued.

Direct use of Surplus Water from Closure of Luminant's Operations

The water that Luminant no longer needs for its mining and power generation activities may be 40,000 acre-feet per year, possibly more. This amount includes water no longer consumed for cooling, water not consumed but had been used to maintain water levels and a heat sink in Lake Monticello, the water that had been consumed in mining, such as dust suppression, and the water captured in some mine ponds and excavations.

The water for cooling, for lake level maintenance and some other consumptive uses is now being released to or retained in Lake Bob Sandlin, where it is then released to Big Cypress Creek when Lake Bob Sandlin is full or in flood stage. These releases of the surplus water should be helping to restore the aquatic and floodplain habitat downstream. The releases could be of greater benefit if it were made in ways that best help with such restoration.

These releases and the opportunity to make some significant restoration efforts may, however, only last until the water is sold for other purposes. There is little protection in Texas law to assure that any of the surplus water has to be release for ecological or other instream uses.

Moreover, the ponds created by the lignite mining near the power plants apparently capture and hold significant amounts of water that could be used to provide water to nearby tributaries to Big Cypress. The water in those ponds is likely a combination of surface and ground water. If those ponds are reclaimed, as generally required by the surface

mining laws, that water source would be lost. But there are exceptions to reclamation for such ponds, if approval by the Railroad Commission of Texas.[36] With the cooperation of Luminant, such ponds could be maintained, possibly saving Luminant some significant restoration costs.

The presence of Lake Monticello and some significant ponds in the mining area create a number of opportunities for storage of water for timed releases and for restoring and maintaining the ecological values of Big Cypress Creek and some of the tributaries to it.

A plan for timed release of the water from Lake Bob Sandlin to restore and maintain the ecology of Big Cypress Creek, as long as significant quantities of the surplus water is available, is more complex than it is with LOP.

The basic problem with Lake Bob Sandlin is the lack of significant flood storage. Operators of Lake Bob Sandlin do not have the type of flexibility to capture flood flows and time the releases downstream. The conservation pool at Lake Bob Sandlin has a maximum elevation of 337.5 feet msl at which its surface area is 8,700 acres and the capacity of the lake is about 200,000 acre-feet. The top of the flood gate is at 339 feet msl which would, in theory, provide for as much as 20,000 acre-feet of additional storage at flood stage. However, the lake cannot be maintained at that level and still have room to capture additional rainfall events.[37]

In contract, the conservation pool at LOP is at 228.5 feet msl with the flood pool at 249.5 feet msl, providing up to 350,000 acre-feet of storage for flood waters, although the reservoir would not be operated at that top level. Thus LOP can more easily be operated at a foot or two above the conservation pool level to provide significant additional water for releases downstream.

This limitation does not mean that the surplus water from Luminant's operations could not be used to help restore and maintain the Big Cypress. Lake Bob Sandlin will "spill" or release water when there are significant rain events, essentially passing the pulses, if the lake is full. The surplus water from Luminant will help keep Lake Bob Sandlin full or fuller. Releases in quantities and timing to meet the base flow regimes downstream could be provided more often also through controlled releases of water in the flood pool and conservation pool, as long as there is water in excess of what TCFWSD is committed to provide or expects to need.

There are also two reservoirs just upstream of Lake Bob Sandlin that could be operated in coordination with Lake Bob Sandlin to provide the needed storage for releases to Big Cypress Creek. Lake Monticello and Lake Cypress Springs have some flood storage capacity that could be used to assist with providing water to Big Cypress Creek when needed. Lake Cypress Springs has its conservation pool at 378 feet msl, with a capacity of 67,000 acre-feet. While it has no significant flood pool and has to release water to lower levels to its conservation pool quickly, it has some flexibility to hold flood water and release water from its conservation pool to make room for future rain events.

Lake Monticello, however, offers the best option to supplement storage for releases from Lake Bob Sandlin for environmental water needs. It is currently being maintained well below its conservation pool level of 340 feet msl, and, while it

[36] See for example, rules of the Texas Railroad Commission at 16 TAC §12.147.

[37] Figures for lakes capacities and other aspects of the reservoirs and dams in Texas can be found at https://waterdatafortexas.org.

has a total capacity of only 35,000 acre-feet, it could be operated its capacity to supplement storage for Bob Sandlin.

Because of their close proximity, the three reservoirs could be operated in ways that provide significant storage for releases to Big Cypress. The amount that could be safely stored during wet, normal or dry years have not been determined, and there are some legal and economic issues regarding the use of these reservoirs for storage and release, as there are for such activities at LOP.

Still, there appears to be significant opportunities to use the water no longer needed for mining and SEPG at the Monticello mine and power plant for ecological purposes in Big Cypress. Any barriers to such use do not seem too high, assuming the owners of the water and the reservoirs are willing to assist. Again, however, in the long-term, sales of the surplus water will likely limit its use for ecological and other instream uses.

Of course, such coordinated operations could also increase the likelihood that there is a more reliable source of water in the upper reaches of Big Cypress Creek for sale, possibly out of the Basin to the west. That condition is, however, likely known already by those looking to supplement their water supplies.

There will need to be some significant work if a strategy for using the surplus SEPG and mining water in this part of the Cypress River Basin is to be used in the long-term for environmental needs.

And as part of that effort, or as a separate effort, the opportunity to use water captured in ponds at the mine could be pursued. If there is sufficient water in one or more of these excavations, the water could be pumped or released to Lake Monticello or to Tankersley Creek, a nearby tributary of Big Cypress Creek. Tankersley is one of the tributaries that has suffered significantly from the releases of high phosphorous levels in the wastewater released by Pilgrim's Pride. It should be one of the priority streams for restoration and protection in the Big Cypress watershed, and the efforts by Pilgrim's Pride to improve its discharges could lead to an opportunity for a partnership with the company for restoration.

Thus, the opportunities for direct use of water freed up by the closure of the mine and SEPG facilities at Monticello are significant. The development of the strategies will not be easy without some significant work and leadership in the watershed. Partnerships with the water suppliers, landowner and industries will be critical.

Indirect Use of Surplus Water from Closure of Luminant's Operations

Another strategy for the long-term use of Luminant's surplus water that could be pursued is using this water to substitute for other water supplies that are likely to be developed. Then those other sources of supplies, return flows from cities and industries, could be used for environmental benefits in the watershed.

The cities and industries such as Mount Pleasant and Pilgrim's Pride, treat their wastewater and discharge it into the creeks in the watershed. These "return flows" have provided much of the water in the tributaries to Big Cypress Creek and for flows to LOP. The return flows have been especially important to the Creek when no water was being released from Lake Bob Sandlin. Maintaining these return flows could be a goal independent of the type of strategies discussed above for direct use of Luminant's surplus waters.

The major discharges that were evaluated here are shown on Figure 8. There are a number of other return flow discharges, mostly from cities, which are listed with flow levels and discharge in Appendix 4.

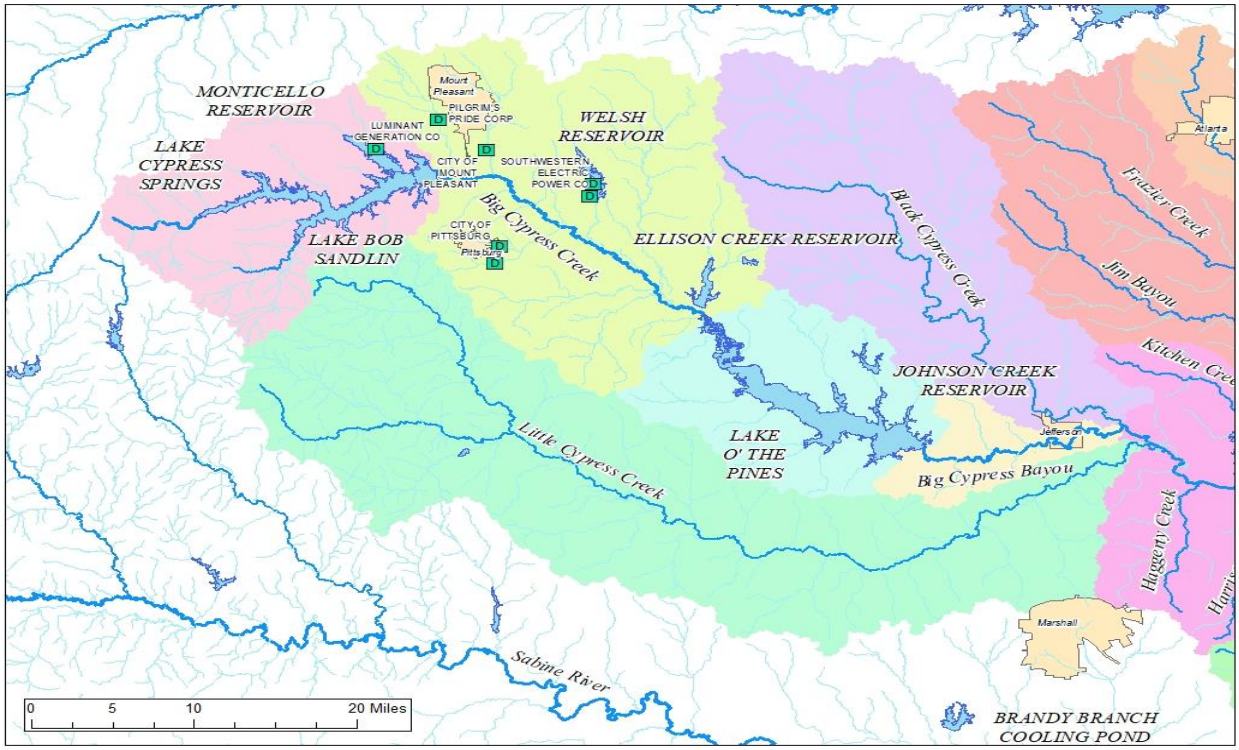

Figure 8. Map showing seven major discharges of wastewater to the Big Cypress Creek above Lake O' the Pines

In many parts of Texas, treated wastewater, discharged to lakes, rivers and streams, are being reused, some by diverting the wastewater downstream of where it is discharged. Such "indirect reuse" allows the wastewater to be diluted and pulled back out for additional uses. In some cases, this water can be sold to others. In some cases, it is pumped back to the cities or industries for further treatment and use.

Historically, when wastewater, which is the result of diversion of surface water for municipal or industrial use, was discharged into a river, stream or lake, the water became state water again. Any such water could then be subject to appropriation in a new water right by others. Discharges of wastewater derived from use of groundwater for the initial water supply is not necessarily water of the state, and ownership can remain with the uses of the groundwater.

Under more recent Texas law, this indirect reuse can be authorized by TCEQ, which allows the quantity of the water discharged as wastewater to be diverted downstream for reuse or sale.[38] With TCEQ approval, the original water right owner can retain right to use the quantity of water discharged, even though it is different water. The diversion downstream results in dilution of the contaminants

[38] Until recently, exactly how such approvals might be provided by TCEQ was not clear. In its 2016 decision involving an application for indirect reuse by the Brazos River Authority (BRA), the TCEQ Commissioners interpreted the law to create two ways such reuse of surface water could be approved. The Brazos River Authority sought to divert and reuse both the wastewater it returns to the river and the wastewater discharged by others. The agency ruled that BRA could apply for an "authorization" to divert and reuse its own return flows. BRA could obtain a new water right, for the return flows of others. TCEQ, however, added a cancellation provision to the latter approval. If the original discharger obtains its own indirect use authorization for return flows, that new authorization cancels BRA's water rights for such waters. TCEQ's decision in this case is on appeal, so its interpretation may not be the final word on the law.

and makes it easier to treat for additional uses than treating the wastewater before discharge.

Direct reuse, or use or sale of wastewater, without discharge or diversion downstream, is also allowed under Texas law. For example, Longview sold much of its treated wastewater to Entergy Power Venters for cooling water at its Harrison County Power Project.

There are efforts to dedicate return flows for ecological purposes. The City of San Antonio is currently seeking authorization from TCEQ to dedicate some of its return flows of treated wastewater to instream flows below the City all the way to a Texas coastal bay. With the approval of TCEQ, no one else would then be able to obtain a water right to divert those return flows.

Because of the large quantities in diversions and use of surface water in Texas, return flows from cities and industries are often a significant amount of the flow in many streams and rivers. Even with the pollutants in these wastewaters, they can help maintain the ecologic values and instream uses of the receiving water bodies. With efforts to reuse wastewater as a new water supply, return flows and, thus, flows in rivers and streams are being reduced.

In the Big Cypress watershed above LOP, both ground and surface waters are used for water supplies by industries and cities. Determining the amount of the resulting wastewater that is from surface water and, thus subject to reuse, is difficult. However, for purposes here of identifying strategies to keep wastewater in the Big Cypress watershed and not sold outside the Cypress Basin, the distinction between surface and groundwater derived wastewater is not significant.

For example, the wastewater from the City of Mount Pleasant is discharged into Hart Creek, a tributary to Big Cypress Creek. The City may want to reuse or sell its wastewater in the future. In either case, the water would likely have to be pumped some distance for any indirect reuse. Direct reuse of wastewater would require greater treatment.

Given the City's location, the cost of purchasing water rights or water under a contract from Luminant, TCFWSD or NETMWD might be less expensive than the cost of pumping and reusing its own wastewaters. The water from Lake Bob Sandlin would also likely be cheaper to treat for drinking water.

If the City could be convinced to consider the purchase of water from Lake Bob Sandlin for its future needs and dedicate its return flows for environmental needs downstream, this approach should provide protection for the environment for the long term. It could help protect Hart Creek, Big Cypress Creek and flows to LOP and beyond. Thus, it should make sense for those seeking such dedication for environmental purposes to create incentives for such an arrangement, good publicity, financial assistance, or such.

A similar approach could be tried with other cities in the upper reaches of Big Cypress watershed and industries such as Pilgrim's Pride. The benefits would include assuring water for instream uses, and limiting the amount of water sold and transferred outside the Basin.

Even if such cities and industries were only willing to develop partnerships for dedication of their wastewater for some interim period, there could be benefits.

What will likely be needed in the upper segments of the Big Cypress watershed is the initiation of a collaborative effort by those with interests in developing strategies to restore and protect the watershed. Leadership for such an effort could come from those who have already developed good

working relations on providing environmental water needs downstream of LOP. Certainly, those entities would benefit from assuring good environmental flows in the watersheds upstream of LOP and to Caddo Lake.

Since the laws governing return flows were just being developed as the investigation was beginning, a full evaluation of the opportunities to work with cities and industries on their return flows has not yet been pursued. It now appears to be the time to start in the upper Big Cypress watershed.

While any strategy of assuring that return flows remain in the watershed is not likely to provide the types of additional flows needed to meet a number of the environmental water needs, such as pulse flows, any such strategy could help assure water for the base flows. It may even be possible to work with cities and industries on the timing and quantity of return flows to better meet those base flows and small pulses.

Findings and Recommendation:

The closure of the Luminant SEPG facilities and its lignite mine at Monticello creates significant opportunities for developing strategies to use some, possibly much, of the resulting surplus water to restore and maintain the ecological values of Big Cypress Creek, its watershed and LOP. It would also help with efforts to protect the Big Cypress watershed below LOP, down to Caddo Lake.

The closure of the facilities and mine also create risks that the surplus water could be sold and transferred out of the watershed, leaving Big Cypress, LOP and Caddo Lake with less water, and more environmental water needs.

Efforts to take advantage of the opportunities and reduce the risks have not begun in any significant way. Work on such issues for the Big Cypress watershed, below LOP should provide a road map for the efforts upstream of that lake.

Significant work would, however, be needed to develop the relationship with TCFESD, Luminant, cities and industries in the watershed for the work. And while this investigation and report provides some the basic information that will be needed for this effort, significant work to determine the environmental water needs and the best combination of strategies to meet those needs will be required. Only some of the possible strategies have been explored here.

It is recommended that such work be started in the near future, as the opportunities to develop the strategies may be reduced with future sales of the surplus waters. The priority should be on using the current surplus through releases from Lake Bob Sandlin to help restore Big Cypress Creek and the upper end of LOP. Strategies for the long-term needs for reliable base and pulse flows could take longer to develop, but should also be part of any effort to restore or protect the watershed.

As with the work in the lower Big Cypress Watershed, the process will take time. Building the relationships early in the process is recommended as the first step.

CONCLUSION

The goal of this investigation was to identify potential strategies to take advantage of these opportunities and provide some basic information to move the effort forward. This report summarizes opportunities that take advantage of the reduction in SEPG in the Cypress River Basin and to reduce the risks of the sale of the surplus water out of the Basin.

There clearly are some significant opportunities. While there are also some potential barriers and

complexities, there are also likely some significant allies and partners who would participate, given the success of the efforts of the Flows Project in addressing environmental water needs below Lake O' the Pines.

It appears likely that the effort to extend the seasonal pool at Lake O' the Pines will succeed given the partners involved, including NETMWD, USFWS, TPWD, the Corps, TNC, CLI and SWEPCO. That effort could be all that is needed to assure the recommended environmental flow regimes are meet well into the future.

The effort in the Big Cypress watershed above LOP will be more complex, as there is not the history of the partnerships that there is below LOP. The closure of Luminant's power plants and mines there do offer a unique opportunity, possibly the only opportunity to do significant restoration and protection work in that upper watershed. Thus, work on building relations and support for determining what is needed and what is possible should be started.

This type of work should also be pursued in other river basins in Texas and around the country with the reductions in SEPG at coal and gas-fired facilities and nuclear power plant. A network of persons and organizations interested in such work across the state or the country could make such efforts easier.

And the benefits would not just be to the ecology of the rivers, streams, bays and estuaries. Protecting instream flows in and to such water bodies can provide significant recreational and economic value to the local communities. With expanding population such recreational and economic opportunities are even more important.

The biggest barrier to success, however, is likely the competition for the surplus water. Unfortunately, the types of exaggerated forecasts of demands for water for cities, industries, and agriculture that have been part of the water planning processes in Texas and elsewhere, help to drive that competition. The failure of Texas and other states to set a priority for restoration of their rivers, streams, and bay systems, also makes the efforts proposed here more difficult.

There are not, however, many opportunities for restoration of these water bodies. When they arise, they should be used.

APPENDIX 1

Robert J. Brandes Consulting

MEMORANDUM

To: Kathy Alexander, Ph.D., Technical Specialist
Office of Water, Water Availability Division
Texas Commission on Environmental Quality

From: Bob Brandes
Kirk Kennedy

Subject: Issues with WAM Representation of Lake o' the Pines and Associated Water Rights

Date: May 21, 2015

As we have discussed on several occasions, the proper representation of the Lake o' the Pines and Lake Bob Sandlin water rights and other water rights associated with Lake o' the Pines in the water availability model (WAM) for the Cypress Creek Basin is somewhat confusing because of certain language in the permits and certificates of adjudication that authorize these water rights, and is further complicated by the Cypress Basin Operating Agreement and other agreements that the Northeast Texas Municipal Water District (NETMWD) has entered into with other water rights owners and reservoir operators in the basin. The goal of this memo is to lay out an approach for structuring the WAM that effectively protects all water rights in the Cypress Creek Basin pursuant to the prior appropriation doctrine, yet recognizes to the extent necessary certain provisions of the Cypress Basin Operating Agreement and its amendments.

Following is a summary of the authorizations contained in the certificates of adjudication for Lake o' the Pines and Lake Bob Sandlin:

Lake o' the Pines Certificate of Adjudication No. 04-4590, as amended

Owner:	Northeast Texas Municipal Water District
Watercourse:	Cypress Creek, Cypress Creek Basin
Reservoir:	Lake o' the Pines
Storage Capacity:	251,000 acre-feet
Diversions:	42,000 acre-feet/year for municipal and domestic purposes, of which not more than 1,930 acre-feet/year may be diverted from Lake Bob Sandlin
	161,800 acre-feet/year for industrial purposes, of which not more than 10,000 acre-feet/year may be diverted from Lake Bob Sandlin
Interbasin Transfers:	18,000 acre-feet/year to Sabine River Basin for SWEPCO
	20,000 acre-feet/year to Sabine River Basin to City of Longview (Amend. A)
	9,000 acre-feet/year to Sabine River Basin for City of Marshall (Amend. B)
Priority Date:	September 16, 1957

Lake Bob Sandlin Certificate of Adjudication No. 04-4564, as amended

Owner:	Titus County Fresh Water Supply District No. 1 (TCFWSD)
Watercourse:	Cypress Creek, Cypress Creek Basin
Reservoir:	Lake Bob Sandlin
Storage Capacity:	213,350 acre-feet

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Diversions:	10,000 acre-feet/year for municipal and domestic purposes 38,500 acre-feet/year for industrial purposes
Priority Dates:	December 20, 1971 for the reservoir, for diversion of 10,000 acre-feet/year for municipal and domestic purposes, and for diversion of 18,900 acre-feet/year for industrial purposes March 13, 1978 for diversion of 19,600 acre-feet/year for industrial purposes

Both of these certificates of adjudication include a special condition in Section 5.C that states:

Owner's rights hereunder are subject to an agreement for reservoir operations on Cypress Creek between the Texas Water Development Board, the Titus County Fresh Water Supply District No. 1, the Franklin County Water District, the Northeast Texas Municipal Water district and the Lone Star Steel Company, dated January 1, 1973 and to subsequent amendments to that agreement or basin operation orders issued by the Commission.

The above agreement is referred to as the Cypress Basin Operating Agreement, and it was actually entered into by the parties on July 17, 1972, not the January 1, 1973 date erroneously stated in the above special condition. This Operating Agreement contains rules and procedures that allow for the storage and subsequent release of inflows to TCFWSD's Lake Bob Sandlin and Franklin County Water District's (FCWD) Lake Cypress Springs by all parties to the agreement, with releases from these upstream reservoirs by NETMWD and the Lone Star Steel Company (LSS) subject to drawdown conditions in downstream Lake o' the Pines and Ellison Creek Reservoir, respectively. Special provisions are included in the agreement that provide protection for the senior-priority water supplies of NETMWD in Lake o' the Pines and LSS in Ellison Creek Reservoir under conditions of water shortage.

A subsequent but related agreement entered into on January 23, 1978, by NETMWD, TCFWSD, and the City of Pittsburg and referred to as the Trilateral Agreement contains provisions that:

1) eliminated NETMWD's storage account in Lake Bob Sandlin that was originally created under the 1972 Cypress Basin Operating Agreement;
2) recognized that the elimination of NETMWD's storage account in Lake Bob Sandlin caused the yield of Lake o' the Pines to be reduced by 12,600 acre-feet/year and subsequently required that the Lake o' the Pines Permit No. 1897 be amended to reduce its authorized annual diversion by this amount;
3) recognized that the elimination of NETMWD's storage account in Lake Bob Sandlin caused the yield of Lake Bob Sandlin to be increased by 16,430 acre-feet/year, with this amount of additional supply in Lake Bob Sandlin allocated to NETMWD (11,930 acre-feet/year) under its Lake o' the Pines Permit No. 1897 and TCFWSD (4,500 acre-feet/year) under its Lake Bob Sandlin Permit No. 2794;
4) assigned 1,930 acre-feet/year of NETMWD's authorized diversion from Lake Bob Sandlin to the City of Pittsburg, with the balance of 10,000 acre-feet/year assigned to Texas Utilities Generating Company (TUGCO).

As a side note, it is important to recognize that since the inception of the Cypress Basin Operating Agreement in 1972 and the Trilateral Agreement in 1978, and their subsequent amendments, the basic provisions of these agreements have never been implemented in practice by the parties, and there is no reservoir storage and release accounting system in place as required under these agreements. Instead, the subject reservoirs have continued to be operated without regard to water rights priorities, apparently with historical demands able to be fully satisfied due to ample streamflows throughout the Cypress Creek Basin.

It is clear from closely reading the Cypress Basin Operating Agreement and the Trilateral Agreement that the intent of these agreements was to allow upstream junior-priority reservoirs, namely Lake Cypress Springs and Lake Bob Sandlin, to capture and store inflows that downstream senior-priority reservoirs, namely Ellison Creek Reservoir and Lake o' the Pines, would have been entitled to, subject to specific provisions for protecting these downstream senior-priority reservoirs and their water users from adverse impacts during periods of water shortage. In these agreements there is no legal transfer or exchange of existing water rights between the parties, and there is no legal subordination of the rights of the downstream senior-priority reservoirs to the upstream junior-priority reservoirs. As stated in the introductory language of the Cypress Basin Operating Agreement,

WHEREAS, ... This agreement consists of governing rules for division of water resources of the basin through an exchange of storage between Franklin County Reservoir, Titus County Reservoir, Lake o' the Pines and Ellison Creek Reservoir without impairment of existing water rights .....

WHEREAS, this agreement will:

a. *Allow Franklin and Titus Reservoirs to impound portions of their natural inflows which may in fact be covered by prior downstream rights.*

b. *Provide rules which insure that waters covered by prior downstream rights, if impounded in the upper reservoirs, will be released when necessary to avoid adverse effects on the downstream rights.*

Provisions of the Cypress Basin Operating Agreement and the Trilateral Agreement, which apparently were entered into by the parties in lieu of attempting to enforce the prior appropriation doctrine in the absence of a watermaster, merely provide for an accounting system whereby the effects of out-of-priority storage in upstream reservoirs on the available supply of downstream senior-priority reservoirs are offset and mitigated to avoid adverse impacts. In other words, the basic end result of the complicated reservoir storage and release accounting system agreed to under the Cypress Basin Operating Agreement and the Trilateral Agreement very likely can be fully accomplished within the WAM through the WAM's normal prior appropriation simulation procedures taking into account the actual priority dates for the water rights involved. Essentially, if all of the detailed components of the complicated accounting procedures stipulated in the Cypress Basin Operating Agreement and the Trilateral Agreement were to be incorporated into the WAM, it is likely that the results in terms of water availability for the different parties' water rights would not be appreciably different, if at all, from those derived with the WAM using strict application of the prior appropriation doctrine. For this reason, for the water rights permitting purposes of the Texas Commission on Environmental Quality (TCEQ), the development a Run 3 version of the WAM that incorporates all of the detailed components of the complicated storage and release accounting procedures that are included in the Cypress Basin Operating Agreement and the Trilateral Agreement does not appear to be necessary.

There is, however, one aspect of the provisions in the Cypress Basin Operating Agreement and the Trilateral Agreement that does require some special consideration as to how it should be properly accounted for in a WAM simulation. This provision relates to the authorization, which now is included in NETMWD's Certificate of Adjudication No. 04-4590, that allows NETMWD to divert up to 11,930 acre-feet of water per year from Lake Bob Sandlin for NETMWD's use, with these diversions charged to the Lake o' the Pines water right. The fact that the priority date for diversions under NETMWD's Certificate of Adjudication No. 04-4590 is September 16, 1957, and the priority date for impoundment in and for diversion of 28,900 acre-feet/year from Lake Bob Sandlin is December 20, 1971, with 19,600 acre-feet/year of additional diversions authorized at a priority date of March 13, 1978, presents complications regarding

how this NETMWD diversion of up to 11,930 acre-feet of water per year from Lake Bob Sandlin and the subsequent refilling of any storage used to back up this diversion should be modeled. In other words, should they be modeled at Lake o' the Pines' 1957 senior priority date or Lake Bob Sandlin's 1971 or 1978 junior priority dates or some combination thereof?

There is language in the 1978 Trilateral Agreement that sheds some light on this issue. Paragraph 4 under Section No. 5, General Conditions, of the Trilateral Agreement states that the priority date of the additional diversions attributable to the increase in the firm yield of Lake Bob Sandlin resulting from the elimination of NETMWD's storage account *shall date from and after November 20, 1972*[1]*, the "date of issuance" of* Permit No. 2794 that authorized Lake Bob Sandlin. This would suggest that the NETMWD's authorized diversion amount of 11,930 acre-feet/year cannot be diverted from Lake Bob Sandlin until after the portion of the TCFWSD's authorized diversion with a 1971 priority date (28,900 acre-feet/year) has been satisfied.

At this point, it is informative to consider the firm yield of Lake Bob Sandlin as determined with the WAM with the demand on Lake o' the Pines set equal to NETMWD's currently authorized diversion amount of 191,870 acre-feet/year, which excludes the 11,930 acre-feet/year that NETMWD is authorized to divert from Lake Bob Sandlin. This firm yield value for Lake Bob Sandlin has been determined to be 36,230 acre-feet/year. At this level of firm yield, the relative priority requirement stipulated in Paragraph 4 of Section No. 5 of the Trilateral Agreement would make TCFWSD's authorized diversion of 28,900 acre-feet/year with a November 20, 1971 priority date 100% fully reliable and NETMWD's authorized diversion of 11,930 acre-feet/year with a priority date immediately junior to November 20, 1971 only partially reliable, with the TCFWSD's 1978 authorized diversion of 19,600 acre-feet/year considerably less reliable.

As an alternative approach, since the effect of the elimination of NETMWD's storage account in Lake Bob Sandlin under the Cypress Basin Operating Agreement, in reality, resulted in only a shift of diversion authority for NETMWD from Lake o' the Pines (reduction of 12,600 acre-feet/year) to Lake Bob Sandlin (increase of 11,930 acre-feet/year), there is a reasonable argument that NETMWD's diversion from Lake o' the Pines should be modeled in the WAM under the prior appropriation doctrine with the Lake o' the Pines 1957 senior priority date and not either of the junior priority dates of Lake Bob Sandlin. This would appear to be necessary in order for the Lake o' the Pines water right to be maintained whole, and it certainly would result in a higher reliability for NETMWD's diversions from Lake Bob Sandlin.

Considering both positions regarding the priority to be used in the WAM for NETMWD's diversion of 11,930 acre-feet/year from Lake Bob Sandlin, a reasonable compromise would be to allow TCFWSD's authorized senior-priority diversion of 28,900 acre-feet/year to be diverted from Lake Bob Sandlin at the December 20, 1971 priority date and NETMWD's authorized diversion of 11,930 acre-feet/year to be diverted at a priority date immediately junior to December 20, 1971, with both diversions having access to storage in Lake Bob Sandlin to back up any demand shortages during each time step of a WAM simulation. Modeling these two diversions in this way would make the reliability of the TCFWSD's diversion amount slightly greater than the reliability of the NETMWD's diversion amount, and it would eliminate further consternation as to how these diversions should be represented in the WAM. This compromised approach would fully commit the available firm yield of Lake Bob Sandlin proportionally to both of these diversions with essentially the same reliability[2], and, by necessity, it would limit the access of TCFWSD's junior-priority diversion of 19,600 acre-feet/year to only the available streamflows in Cypress Creek at the March

[1] The actual priority date for Lake Bob Sandlin, as stated in Certificate of Adjudication No. 04-4564, is November 20, 1971, so the year in the priority date noted in the Trilateral Agreement is likely in error.

[2] As noted, the reliability of TCFWSD's diversion of 28,900 acre-feet/year would be slightly greater than the reliability of NETMWD's diversion of 11,930 acre-feet/year.

13, 1978 priority date, without any back up from storage in Lake Bob Sandlin for satisfying demand shortages. If any storage in Lake Bob Sandlin was allowed to be used to back up shortages in the TCFWSD's 1978 junior-priority diversion, then the reliability of the TCFWSD's and NETMWD's 1971 senior-priority diversions would be significantly reduced, which is not appropriate nor allowed under the prior appropriation doctrine.

Structuring the WAM in accordance with this compromised approach for representing NETMWD's diversion from Lake Bob Sandlin has produced the following reliabilities for the diversions from Lake Bob Sandlin and from Lake o' the Pines:

Lake Bob Sandlin

TCFWSD's 1971 Diversion of 28,900 acre-feet/year	98.3%
NETMWD's 1971 Diversion of 11,930 acre-feet/year	98.1%
TCFWSD's 1978 Diversion of 19,600 acre-feet/year	8.2%

Lake o' the Pines

NETMWD's 1957 Diversion of 191,870 acre-feet/year	99.3%

Considering all of the above, the following approach is considered the most appropriate and has been implemented in the Run 3 version of the WAM for modeling the Lake o' the Pines and Lake Bob Sandlin water rights, taking into consideration all water rights' priorities and the prior appropriation doctrine, while acknowledging certain stipulations in the Cypress Basin Operating Agreement and the Trilateral Agreement:

Lake o' the Pines

1) At a priority date of September 16, 1957, divert 40,070 acre-feet/year for municipal and domestic use by NETMWD from available streamflows, back up any demand shortage with storage, and refill storage in the reservoir up to 251,000 acre-feet
2) At a priority date of September 16, 1957, divert 151,800 acre-feet/year for industrial use by NETMWD from available streamflows, back up any demand shortage with storage, and refill storage in the reservoir up to 251,000 acre-feet

Lake Bob Sandlin

1) At a priority date of December 20, 1971, divert 10,000 acre-feet/year for municipal and domestic use by TCFWSD from available streamflows, back up any demand shortage with storage, and refill storage in the reservoir up to 213,350 acre-feet
2) At a priority date of December 20, 1971, divert 18,900 acre-feet/year for industrial use by TCFWSD from available streamflows, back up any demand shortage with storage, and refill storage in the reservoir up to 213,350 acre-feet
3) At a priority date immediately junior to December 20, 1971, divert 1,930 acre-feet/year for municipal and domestic use by NETMWD (City of Pittsburg) from available streamflows, back up any demand shortage with storage, and refill storage in the reservoir up to 213,350 acre-feet

4) At a priority date immediately junior to December 20, 1971, divert 10,000 acre-feet/year for industrial use by NETMWD (TUGCO) from available streamflows, back up any demand shortage with storage, and refill storage in the reservoir up to 213,350 acre-feet

5) At a priority date of March 13, 1978, divert 19,600 acre-feet/year for industrial use by TCFWSD from available streamflows, with no back up of any demand shortage from storage

Finally, it should be noted that pursuant to review of the Final Determination of All Claims of Water Rights in the Cypress Creek Basin (dated May 21, 1985), it was observed that the 10,000 acre-feet/year of diversion from Lake Bob Sandlin as described in Item 1 above and as authorized under TCFWSD's Certification of Adjudication No. 04-4564 was clearly identified in the Conclusions section of the Final Determination document as having a priority date of March 13, 1978, instead of December 20, 1971. Assuming the more junior 1978 priority date stipulated in the Final Determination document is correct, then the 1971 priority date specified in TCFWSD's Certification of Adjudication No. 04-4564 appears to be an error. If so, then the reliability of the remaining diversions from Lake Bob Sandlin authorized at a priority date of December 20, 1971, which would total 30,830 acre-feet/year (18,900 acre-feet/year for industrial use by TCFWSD, 1,930 acre-feet/year for municipal and domestic use by NETMWD, and 10,000 acre-feet/year for industrial use by NETMWD), would be 100% firm based on the calculated firm yield of the reservoir (36,230 acre-feet/year). With part of the firm yield remaining, there would also be some amount of storage in Lake Bob Sandlin available to back up the 1978 junior-priority diversions from the reservoir, which then would total 29,600 acre-feet/year. These changes related to the priority date of the 10,000 acre-feet/year diversion from Lake Bob Sandlin have not been made in the WAM, as they would likely require authorization in the form of some type of legal action by the TCEQ.

ATTACHMENT

SUMMARY OF KEY ELEMENTS OF CYPRESS BASIN OPERATING AGREEMENT AND TRILATERAL AGREEMENT WITH REGARD TO LAKE O' THE PINES

Original Cypress Basin Operating Agreement

1) Agreement between Northeast Texas Municipal Water District (NETMWD), Titus County Fresh Water Supply District No. 1 (TCFWSD), Franklin County Water District (FCWD), Lone Star Steel Company (LSS), and Texas Water Development Board (TWDB) for storing, passing and releasing inflows to Lake Bob Sandlin and Lake Cypress Springs, subject to drawdown conditions in Lake o' the Pines and Ellison Reservoir, *without violating senior water rights priorities*.

LSS and NETMWD Storage Accounts

2) Implements an accounting plan that creates storage accounts in Lake Bob Sandlin and Lake Cypress Springs for LSS and NETMWD with prescribed procedures for calculating and allocating, *in accordance with priority order*, daily inflows to these reservoirs, first to the LSS storage accounts, with limitations related to LSS's Cypress Creek diversions, and then the balance to the NETMWD storage accounts.

3) At all times, limits the combined storage in LSS's storage accounts in Lake Bob Sandlin and Lake Cypress Springs to the volume of empty storage space in LSS's Ellison Reservoir, with any excess water transferred to the NETMWD storage accounts.

4) At all times, limits the combined storage in NETMWD's storage accounts in Lake Bob Sandlin and Lake Cypress Springs to the volume of empty storage space in NETMWD's Lake o' the Pines, with any excess water transferred to the TCFWSD, FCWD and TWDB storage accounts.

5) Authorizes LSS to retain title to water stored in its storage accounts in Lake Bob Sandlin and Lake Cypress Springs until such time LSS's Ellison Reservoir spills, thereby causing storage in LSS's storage accounts to be set to zero.

6) Authorizes NETMWD to retain title to water stored in its storage accounts in Lake Bob Sandlin and Lake Cypress Springs until such time NETMWD's Lake o' the Pines spills, thereby causing storage in NETMWD's storage accounts to be set to zero.

7) Allows releases from the storage accounts of LSS at any time and in any amount, provided that the level of LSS's Ellison Reservoir is three feet or more below normal.

8) Allows releases from the storage accounts of NETMWD at any time with the release amount limited to the available storage in NETMWD's storage accounts in excess of prescribed volumes related to the drawdown in NETMWD's Lake o' the Pines, with unlimited releases allowed when the drawdown in Lake o' the Pines equals or exceeds 7.0 feet below the normal pool level at 228.5 feet msl.

TCFWSD, FCWD and TWDB Storage Accounts

9) Implements an accounting plan that creates storage accounts in Lake Bob Sandlin and Lake Cypress Springs for TCFWSD and FCWD with prescribed procedures for

calculating and allocating, in accordance with reservoir storage ownership, the net inflows to these reservoirs, *taking into consideration corresponding changes in the LSS and NETMWD storage accounts which effectively makes the TCFWSD and FCWD storage accounts junior to the LSS and NETMWD storage accounts.*

10) Establishes storage accounts for the TWDB in Lake Bob Sandlin and Lake Cypress Springs equal to the conservation storage capacity of these reservoirs less the storage amounts credited to LSS, NETMWD, TCFWSD and FCWD, *which effectively makes the TWDB storage accounts junior to the LSS, NETMWD, TCFWSD and FCWD storage accounts.*

11) Limits the use of water in the storage accounts for TCFWSD, FCWD and TWDB to the amount of water stored in their respective storage accounts and to their respective appropriative rights.

Trilateral Agreement

12) Agreement between NETMWD, TCFWSD, and City of Pittsburg that eliminates the storage account for NETMWD in Lake Bob Sandlin, reallocates the changes in firm yield of Lake o' the Pines and Lake Bob Sandlin caused by elimination of NETMWD's storage account in Lake Bob Sandlin, and recognizes authority for the NETMWD and the City of Pittsburg to divert specified annual quantities of water from Lake Bob Sandlin.

13) Stipulates that the elimination of the NETMWD's storage account in Lake Bob Sandlin and the subsequent capture and diversion of additional water by Lake Bob Sandlin under natural priority operations results in a reduction of 12,600 acre-feet/year in the firm yield of Lake o' the Pines and an increase of 16,430 acre-feet/year in the firm yield of Lake Bob Sandlin.

14) Allocates the additional firm yield in Lake Bob Sandlin caused by the elimination of the NETMWD's storage account in Lake Bob Sandlin and the subsequent capture and diversion of water by Lake Bob Sandlin under natural priority operations as follows:

- 4,500 acre-feet/year to TCFWSD
- 10,000 acre-feet/year to NETMWD
- 1,930 acre-feet/year to City of Pittsburg

15) Stipulates that the priority date of the additional diversions from Lake Bob Sandlin as allocated above *shall be junior in priority to November 20, 1972*[1], the "date of issuance" of Permit No. 2794 that authorizes Lake Bob Sandlin.

16) Provides the consent of TCFWSD for the diversion of 10,000 acre-feet/year from Lake Bob Sandlin by NETMWD and for the diversion of 1,930 acre-feet/year by the City of Pittsburg.

[1] The actual priority date for Lake Bob Sandlin, as stated in Certificate of Adjudication No. 04-4564, is November 20, 1971, so the year in the priority date noted in the Trilateral Agreement is likely in error.

17) Conditions the additional diversion of 4,500 acre-feet/year by TCFWSD from Lake Bob Sandlin on the approval by the State of Texas of an amendment to TCFWSD's Permit No. 2794 to increase the appropriative rights available to TCFWSD by 4,500 acre-feet/year.

18) Conditions the additional diversions of 10,000 acre-feet/year by NETMWD and 1,930 acre-feet/year by the City of Pittsburg from Lake Bob Sandlin on the approval by the State of Texas of an amendment to NETMWD's Permit No. 1897 to decrease NETMWD's authorized diversions from Lake o' the Pines by 12,600 acre-feet/year and to authorize NETMWD to divert 11,930 acre-feet/year from Lake Bob Sandlin.

Second Amendment of Cypress Basin Operating Agreement[2]

19) Amendment of Cypress Basin Operating Agreement between NETMWD, TCFWSD, FCWD, LSS, and TWDB that implements changes necessary as a result of the Trilateral Agreement.

20) Eliminates the storage account for NETMWD in Lake Bob Sandlin, and cancels and extinguishes all rights of NETMWD regarding a storage account in Lake Bob Sandlin.

21) Reaffirms NETMWD's right to maintain a storage account in Lake Cypress Springs and to pass releases from Lake Cypress Springs through Lake Bob Sandlin to Lake o' the Pines.

22) At all times, limits the storage in NETMWD's storage account in Lake Cypress Springs to three-eighths of the volume of empty storage space in NETMWD's Lake o' the Pines, with any excess water transferred to the FCWD and TWDB storage accounts.

23) Stipulates that if the level of Lake o' the Pines exceeds elevation 227.0 feet msl, then all water in NETMWD's storage account in Lake Cypress Springs shall be transferred to the storage accounts of FCWD and TWDB.

24) Allows releases from the storage account of NETMWD in Lake Cypress Springs at any time with the release amount limited to the available storage in NETMWD's storage account in excess of prescribed volumes related to the drawdown in NETMWD's Lake o' the Pines, with unlimited releases allowed when the drawdown in Lake o' the Pines equals or exceeds 7.0 feet below the normal pool level at 228.5 feet msl.

25) Authorizes the unconditional right of NETMWD to furnish water from Lake Bob Sandlin to the City of Pittsburg as authorized under NETMWD's amended Permit No. 1897.

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[2] Other than this Second Amendment, it should be noted that the Cypress Basin Operating Agreement has been amended several times, with these other amendments involving matters that are now moot or that pertain to metering and reporting requirements of the parties.

APPENDIX 2

Excerpts from USGS's Use Figures for SEPG Facilities Taking Water from the Big Cypress Watershed.[1]

PLANT NAME	COUNTY	NAME OF WATER SOURCE	WATER SOURCE CODE	WATER TYPE CODE	MODEL TYPE	Estimated Annual Withdrawal (Mgal/d)	Estimated Annual Consumption (Mgal/d)	Estimated Annual Maximum Withdrawal (Mgal/d)	Estimated Annual Minimum Consumption (Mgal/d)	Estimated Annual Maximum Consumption (Mgal/d)	Total EIA-reported Net Generation (MWh)
Pirkey	Harrison	Brandy Branch Reservoir	Surface Water	Fresh Water	RECIRCU-LATING POND	9.23	9.23	10.20	8.20	10.20	4,847,270
Wilkes	Marion	Johnson Creek Reservoir	Surface Water	Fresh Water	COMPLEX	4.07	4.07	5.19	3.66	5.19	1,542,313
Lone Star	Morris	Ellison Creek Reservoir	Surface Water	No Report	ONCE-THROUGH LAKE	2.56	0.03	18.70	0.02	0.04	17,147
Welsh	Titus	Swauano Creek Reservoir	Surface Water	Fresh Water	COMPLEX	757.00	11.30	6960.00	8.45	17.40	10,831,561
Monticello	Titus	Monticello Reservoir	Surface Water	Fresh Water	ONCE-THROUGH POND	1180.00	13.30	8720.00	10.40	16.30	13,447,287

[1] U.S. Geological Survey, "Withdrawal and Consumption of Water by Thermoelectric Power Plants in the United States," 2010, Scientific Investigations Report 2014–5184, http://pubs.usgs.gov/sir/2014/5184/

APPENDIX 3

WR #	Type	Permit #	Owner Name	AF/Yr	Use	Priority	Reservoir Name	Site Name	County
237	9		SOUTHWESTERN ELECTRIC POWER C	17543	2	9/7/1975		WELSH POWER PLANT	Marion
259	9		TEXAS UTILITIES ELECTRIC CO	38500	2	1/1/1977	LAKE SANDLIN	MONTICELLO STEAM ELECTRIC STATIO	Titus
269	9		CITY OF MOUNT PLEASANT	7000	1	1/1/1977	LK CHEROKEE TRAIL		Titus
454	9		SOUTHWEST ELEC POWER CO	18000	2	11/28/1978	LAKE O THE PINES	PIRKEY POWER PLANT	Marion
1219	9		CITY OF WINNSBORO	4000	1		LAKE CYPRESS SPRINGS		Franklin
1278	9		SOUTHWESTERN ELECTRIC POWER C	6668	2	5/15/1960	LAKE OF THE PINES	WILKES POWER PLANT	Marion
1598	9		CYPRESS SPRINGS WSC	2500	1	1/14/1985	LK CYPRESS SPRINGS		Franklin
1599	9		CITY OF MOUNT VERNON	3000	1	7/10/1984	LAKE CYPRESS SPRINGS		Franklin
1736	9		CITY OF PITTSBURG	1930	1	8/15/1989	LK BOB SANDLIN		Marion
2448	9		CITY OF LONGVIEW	20000	1		LAKE O' THE PINES		Marion
2509	9		NORTHEAST TEXAS MWD	169	1		LAKE O' THE PINES		Marion
4334	1	3997	T R & HAZEL C DENVER		7	2/22/1983			Wood
4349	1	4005	LONGHORN ARMY AMMUNITION PLANT	586	1	4/18/1983		LONGHORN DIV	Harrison
4349	1	4005	LONGHORN ARMY AMMUNITION PLANT	9295	2	4/18/1983			Harrison
4349	1	4005	US DEPARTMENT OF THE INTERIOR	1757	1	4/18/1983			Harrison
4349	1	4005	US DEPARTMENT OF THE INTERIOR	27885	2	4/18/1983			Harrison
4522	1	4199	CARROLL SHELBY		7	11/27/1984			Camp
4559	6		J MCDONALD WILLIAMS		7	12/15/1975			Franklin
4560	6		FRANKLIN CO WATER DIST	11500	1	1/31/1966	LAKE CYPRESS SPRINGS		Franklin
4560	6		FRANKLIN CO WATER DIST	210	3	1/31/1966			Franklin
4560	6		CITY OF MOUNT PLEASANT	3590	2	1/31/1966			Franklin
4561	6		LOYD DAILY ET UX	12	3	8/31/1963			Camp
4562	6		G M SCOTT	24	3	8/1/1963			Titus
4563	6		TXU GENERATION COMPANY LP	15300	2	4/6/1970	LAKE MONTICELLO	MONTICELLO STEAM ELECTRIC STATIO	Titus
4563	6		TXU GENERATION COMPANY LP	1000	2	6/4/1973	LAKE MONTICELLO	MONTICELLO STEAM ELECTRIC STATIO	Titus
4563	6		TXU GENERATION COMPANY LP		4	6/4/1973	LAKE MONTICELLO	MONTICELLO STEAM ELECTRIC STATIO	Titus
4564	6		TITUS CO FWSD 1	10000	1	12/20/1971	LAKE BOB SANDLIN		Titus
4564	6		TITUS CO FWSD 1	38500	2	12/20/1971	LAKE BOB SANDLIN		Titus
4564	6		TITUS CO FWSD 1		7	12/20/1971	LAKE BOB SANDLIN		Titus
4565	6		CITY OF MOUNT PLEASANT	1680	1	8/22/1955	LAKE TANKERSLEY		Titus
4565	6		CITY OF MOUNT PLEASANT	550	2	8/22/1955	LAKE TANKERSLEY		Titus
4565	6		CITY OF MOUNT PLEASANT		7	8/22/1955	LAKE TANKERSLEY		Titus
4566	6		WILLIAM DEAN PRIEFERT	21	3	12/31/1959			Titus
4567	6		WILLIAM DEAN PRIEFERT	6	3	12/31/1956			Titus
4568	6		BILLY JACK MAXTON	8	3	12/31/1963			Titus
4569	6		CITY OF MOUNT PLEASANT	400	1	3/17/1938	NEW CITY LAKE		Titus
4570	6		CITY OF MOUNT PLEASANT	144	1	1/20/1975	OLD CITY LAKE		Titus
4571	6		R J PORTER ESTATE	4	3	12/31/1963			Titus
4572	6		GLEN K ANDERSON ET UX	4	3	12/31/1963			Titus
4573	1	4254	SNIDER INDUSTRIES INC	16084	2	6/4/1985		MARSHALL PLANT	Harrison
4573	6		EDITH A SANDERS ET AL	11	3	12/31/1955			Titus
4574	6		PRINCEDALE COUNTRY CLUB	1	3	12/31/1951			Camp
4575	6		BEAVER CLUB LAKE		7	4/30/1973			Camp
4576	6		SOUTHWESTERN ELECTRIC POWER C	17000	2	9/10/1973	WELSH LAKE DAM	WELSH POWER PLANT	Titus
4576	6		SOUTHWESTERN ELECTRIC POWER CO		7	9/10/1973	WELSH LAKE DAM	WELSH POWER PLANT	Titus
4577	6		ADRON JUSTISS	124	3	9/30/1950			Morris
4578	6		ADRON JUSTISS	6	3	12/31/1952			Morris
4579	6		ADRON JUSTISS	75	3	12/31/1953			Morris
4580	6		SAM L DALE	2	3	12/31/1958			Morris
4581	6		TEXAS PARKS & WILDLIFE DEPT		7	9/22/1969		DAINGERFIELD ST PARK	Morris
4582	6		LONE STAR STEEL CO	21000	2	11/30/1942	ELLISON CR RES		Morris
4582	6		LONE STAR STEEL CO		2	11/30/1942	RES ON CYPRESS CRK		Morris
4582	6		LONE STAR STEEL CO	2000	1	5/8/1972			Morris
4582	6		LONE STAR STEEL CO		8	11/30/1942	RES ON CYPRESS CRK		Morris
4583	6		JFS TIMBER PARTNERS LTD	38	3	7/31/1962			Upshur
4584	6		EDWIN LACY ESTATE ET AL	14	3	9/30/1948			Upshur
4585	6		GASTON W DEBERRY	1	3	3/31/1955			Upshur
4586	6		DOUGLAS NEWSOM	1	3	12/31/1964			Upshur
4587	6		EAGLE LANDING HOMEOWNERS ASSN	150	3	12/31/1956			Cass
4588	6		SOUTHWESTERN ELECTRIC POWER C	6668	2	5/4/1960	JOHNSON CR RES	WILKES POWER PLANT	Marion
4589	6		LAKE DEERWOOD OWNERS ASSN		7	12/8/1975			Harrison
4590	6		NORTHEAST TEXAS MWD	40070	1	9/16/1957	LAKE O' THE PINES		Marion
4590	6		NORTHEAST TEXAS MWD	2E+05	2	9/16/1957	LAKE O' THE PINES		Marion
4590	6		NORTHEAST TEXAS MWD		7	9/16/1957	LAKE O' THE PINES		Marion
4591	6		H. ZEKE GROGAN	8	3	4/30/1967			Marion
4592	6		DAVID R & E M KEY	97	3	9/30/1969			Marion
4593	6		GEORGE D GROGAN	85	3	5/31/1962			Marion
4594	6		BILLIE J ELLIS ET UX	1080	3	1/3/1955			Marion
4594	6		RANCHO GUADALUPE INC		3	1/3/1955			Marion
4595	6		JEFFERSON WATER & SEWER DIST	2000	1	2/18/1963			Marion
4596	6		DAVID R KEY ESTATE	80	3	3/19/1957			Marion
4597	6		LLOYD JUSTISS FARMS INC	25	3	6/21/1976			Morris
4598	6		JIMMY H. WAKEFIELD	10	2	1/26/1970			Cass
4599	6		DELWIN YOUNG	47	3	7/31/1953			Cass
4601	6		ANITA G SAFADY		7	11/21/1946			Upshur
4613	6		FAIR OIL LC	165	4	2/24/1969			Harrison
4614	6		CITY OF MARSHALL	7558	1	4/18/1947			Harrison
4614	6		CITY OF MARSHALL	8442	1	11/27/1956			Harrison
4614	6		CITY OF MARSHALL		2	4/18/1947			Harrison
4614	6		CITY OF MARSHALL		2	11/27/1956			Harrison
4615	6		MARSHALL LAKESIDE COUNTRY CLUB	10	3	12/15/1975			Harrison
5080	1	5080	HAROLD W NIX		7	7/29/1986			Morris
5112	1	5112	FERN LAKE HUNT & FISH CLUB INC		7	11/25/1986			Harrison
5251	1	5251	ALAN H ROBERTS		11	8/10/1989			Camp

APPENDIX 4

Dischargers	Permit Number	County	Status as of July 2017	Outfall Location	Flow (MGD): daily ave/ daily max or 2 hr peak	CBOD or BOD (mg/l): Daily Avg. / Daily Max.	TSS (mg/l): Daily Avg. / Daily Max.	NH3-N (mg/l): Daily Avg. / Daily Max.	Bacteria (mg/l): Daily Avg. /Daily Max.	PH Level Range	Phos-phorus (lbs/yr)
Chapel Hill ISD	WQ0013821001	Titus	Issued 2/25/2011 Renewed 11/21/14 Expires 2/1/2018	Williams Creek to - Big Cypress Creek below Lake Bob Sandlin	before expansion .016/ 33, after .032/67	BOD: before expansion: 20 / 45, after: 20 (5.3)/45	before expansion: 20 /45, after: 20 /45	n/a	126 / 399	6.0-9.0	n/a
Daingerfield (City)	WQ0010499001	Morris	Issued 2/3/2011 Renewed 2/19/2016 Expires 2/1/2021	Bruton's Creek to Ellison Creek Reservoir to - Big Cypress Creek	.70 / 1,090	CBOD: 10 / 25	15 /40	3(18) / 10	126 / 399	6.0-9.0	n/a
Mount Pleasant (City) Southside Facility	WQ0010575004	Titus	Issued 3/3/2009 Renewed 2/24/2016 Expires 2/1/2018	Hart Creek to Big Cypress Creek	2.91 / 4,646	CBOD: 7 (170) / 17	15/40	2 (49) / 10 (for April to October) 3(73) / 10 (for November to March	126 / 399	6.0-9.0	n/a
Omaha (City)	WQ0010239001	Morris	Issued 6/16/2011 Renewed 4/27/2016 Expires 2/1/2021	Okry Creek to Boggy Creek to Big Cypress Creek	.2 / 417	CBOD: 10 (17) / 25	15/40	3(5) / 10	126 / 399	6.0-9.0	n/a
Pilgrim's Pride	W00003017000	Titus	Expired May 25, 2015. Limits are for 2016 draft permit	Tankersley Creek; to Big Cypress Creek	3.5/5.0	BOD: before expansion 7.5/15, after 5/10	15/30	Apr-Oct 1/2, Nov-Mar 8/16	126/394	6.0 max	44,650
Pittsburg (City of) Sparks Branch	WQ0010250001	Camp	Issued 7/19/2006 Renewed 2/3/2011 Expired 2/1/2016	Sparks Branch to Dry Creek to Big Cypress Creek	2 / 4,167	CBOD: 10 (167) / 25	15 (250) / 40	3 (50) / 6	126 / 394	6.0-9.0	n/a
Pittsburg (City) Dry Creek	WQ0010250002	Camp	Issued 2/3/2011 Renewed 3/7/2016 Expires 2/1/2021	Dry Creek to Big Cypress Creek	.2 / n/a	CBOD: 30 (50) / 70	90 (150) / n/a	5 (8.34) / n/a	126 / 399	6.0-9.0	n/a
Winfield (City)	WQ0012146001	Titus	Issued 5/24/2011 Renewed 3/14/2016 Expires 2/1/2021	Smtih Creek to Lake Monticello to Lake Bob Sandlin	.084 / 149	BOD: 20 (14) / 45	20 (14) / 45	n/a	126 / 399	6.0-9.0	n/a
Southwest Electric Power Company Lone Star Power Plant	WQ0001464000(Outfall 001)	Morris	Issued 5/16/2011 Renewed 2/24/2016 Expires 2/1/2021	Ellison Creek Reservoir - Big Cypress Creek	80 / 83	n/a	n/a	n/a	n/a	n/a	n/a
Southwest Electric Power Company Lone Star Power Plant	WQ0001464000(Outfall 101)	Morris	Issued 5/16/2011 Renewed 2/24/2016 Expires 2/1/2021	Ellison Creek Reservoir - Big Cypress Creek	Report	n/a	30 MDG / 100 MDG	n/a	n/a	6.0-9.0	n/a

Northeast Texas Community College	WQ0013948001	Titus	Issued 10/30/2012 Renewed 02/05/2016 Expires 02/01/2021	Williamson Creek to Big Cypress Creek	.03 / 42	CBOD: 20 (5) / 45	20 (5) / 45	n/a	126 / 399	6.0-9.0	n/a
Town of Miller Cove	WQ0011750001	Titus	Issued 9/9/2011 Renewed 2/8/2016 Expires 2/1/2021	Blundell Creek to Lake Monticello to Lake Bob Sandlin	.038 / 53	BOD: 20 (6.3) / 45	20 (6.3) / 45	n/a	126 / 399	6.0 - 9.0	n/a
Southwest Electric Power Company Welsh Power Plant	WQ00018110000utfall 001	Titus	Issued 8/20/2007 Renewed 4/26/2012 Expired 2/1/2016	Welsh Reservoir to Swauano Creek to Big Cypress Creek	20 / 60	n/a	3,811 (30) / 11,883 (50)	n/a	n/a	6.0 - 9.0	n/a
Southwest Electric Power Company Welsh Power Plant	WQ00018110000utfall 003	Titus	Issued 8/20/2007 Renewed 4/26/2012 Expired 2/1/2016	Welsh Reservoir to Swauano Creek to Big Cypress Creek	1,425 / 1,425	n/a	n/a	n/a	n/a	6.0 - 9.0	n/a
Southwest Electric Power Company Welsh Power Plant	WQ00018110000utfall 101	Titus	Issued 8/20/2007 Renewed 4/26/2012 Expired 2/1/2016	Welsh Reservoir to-Swauano Creek to Big Cypress Creek	Report	n/a	30 / 100	n/a	n/a	n/a	n/a
Southwest Electric Power Company Welsh Power Plant	WQ00018110000utfall 103	Titus	Issued 8/20/2007 Renewed 4/26/2012 Expired 2/1/2016	Welsh Reservoir to Swauano Creek to Big Cypress Creek	.016 / .02	BOD: 2.7(20)/7.5(45)	2.7 (20) / 7.5 (45)	n/a	n/a	6.0 - 9.0	n/a