

## **St Tammany Parish comments on the *Pearl River Basin, Mississippi Section 211 Feasibility Study - Integrated Draft Feasibility and Environmental Impact Statement***

St. Tammany Parish is providing items that we believe should be included in the soon to be released document, *Pearl River Basin, Mississippi Section 211 Feasibility Study - Integrated Draft Feasibility and Environmental Impact Statement*. Recommendations are made on 1) technical inadequacies, 2) types of analyses that should be provided, 3) expanding the modeling domain/impact area and 4) necessary clarifications based on review of the public meeting notes and draft Feasibility & EIS Report (6/2018).

The four conceptual alternatives presented in the draft Study are listed below, with the alternative preferred by the Rankin Hinds Pearl River Flood & Drainage Control District being the “Levees with Lake”:

- No Action
- Non-Structural Measures (elevations & relocations)
- Structural Measures/Levees and Floodwalls
- **Lake Development – Excavate inside and outside of River channel (Locally Preferred Alternative C)**

### **Overview of the Preferred Alternative C: Lake Development**

The locally preferred alternative (per the EIS) consists of a 1900 surface acre impoundment with a weir forming a dam at the lower end. The Pearl River will be widened from about 300 feet to between 1,000 and 2,000 feet. Dredge spoil from the widening will be deposited around the proposed lake’s perimeter, presumably to elevate the land. All spoil is proposed to be deposited within 1,000 feet of the centerline of the River, much of which is currently wetlands. There will be habitat impacts for two species that are indigenous to the Pearl River and are protected by the Endangered Species Act.

St. Tammany Parish objects to the Alternative C “Lake Development” and the “Levees and Floodwalls” options due to the hydrologic changes and impacts from each. Development in the form of levees and impoundments in the Pearl River Watershed upstream of St. Tammany Parish could have significant adverse impacts on a wide range of concerns, including:

- Water Quantity & Quality
- Business & Industrial Activity
- Population Growth
- Recreation Resources
- Groundwater & Salt Water Intrusion
- Threatened & Endangered Species
- Aquatic & Wildlife Resources
- Community Cohesion, Cultural & Socioeconomic Resources
- Recreational & Commercial Fisheries

The underlined subjects are discussed in more detail, below.

## Water Quantity

Throughout this discussion, the concept of “low-flow” and “high flow” will be discussed. There are multiple ways to present these concepts for stream baseflow:

- The 7Q10 is the minimum low-flow for seven (7) consecutive days in 10 years (established by USGS for a specific period of record).
- The 5<sup>th</sup> percentile is the minimum stream baseflow used by EPA and MSDEQ to establish permits when the 7Q10 is not available.
- The 10<sup>th</sup> percentile minimum stream baseflow used by many hydrologists as a surrogate for "critical low flow".

In summary, 7Q10 < 5<sup>th</sup> percentile < 10<sup>th</sup> percentile; thus, the most conservative of the low-flow surrogates, 10<sup>th</sup> percentile, will be utilized throughout the discussion below. For high-flow, the 90<sup>th</sup> percentile will be used for comparisons of pre- versus post- construction of the Ross Barnett (RB) Reservoir.

The period of record is also critical to any pre- vs post- RB comparison. St. Tammany considers the correct period-of-record for comparisons to be pre-Ross Barnett (1938-1960) and post-Ross Barnett (1965-present). Figure 1 is a map of the Pearl River Basin indicating areas of concern and providing analyses at these locations.

### USGS 02486000 (Pearl River at Jackson, MS)

Construction of the Ross Barnett Reservoir (RB) began in 1960 and was completed in 1963. The 33,000 surface acre lake reached “full-pool” capacity in 1965<sup>1</sup>. Following construction of the Ross Barnett Reservoir near Jackson, MS. Minimum Mean Daily Discharges have remained approximately the same, from 45 cfs (10/5/1956) to 47 cfs (6/14/1984) for pre-RB versus post-RB, respectively (Figure 2).

Extreme low-flows at Jackson were approximated using historic Minimum Mean Daily Discharge by Month at the gage USGS 02486000 Pearl River at Jackson, MS for the post-RB period of record (1965-2018). Minimum Mean Daily Discharges by month indicate flows will not meet the minimum 227 cfs required for Savannah St. WWTP, except during high-flow events in February and March (Table 1).

Comparing Average Monthly Discharges for the Pre- and Post-RB periods of record, it can be seen that during the low-flow months, May – November, flows from the RB Reservoir were fairly homogenous and somewhat higher than pre-RB. However, during the critically low- flow months of July and August, flows from the Ross Barnett are lower post- than pre-RB (Table 2). Average Monthly Discharge values are not detailed enough to quantify the low-flow incidences that may cause significant harm to the downstream NPDES permittees and the environment.

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<sup>1</sup> Engineer provided date of Ross Barnett “full pool” for the Rankin-Hinds Pearl River Flood and Drainage Control District during a public meeting held in Slidell, LA on 8/16/2018.

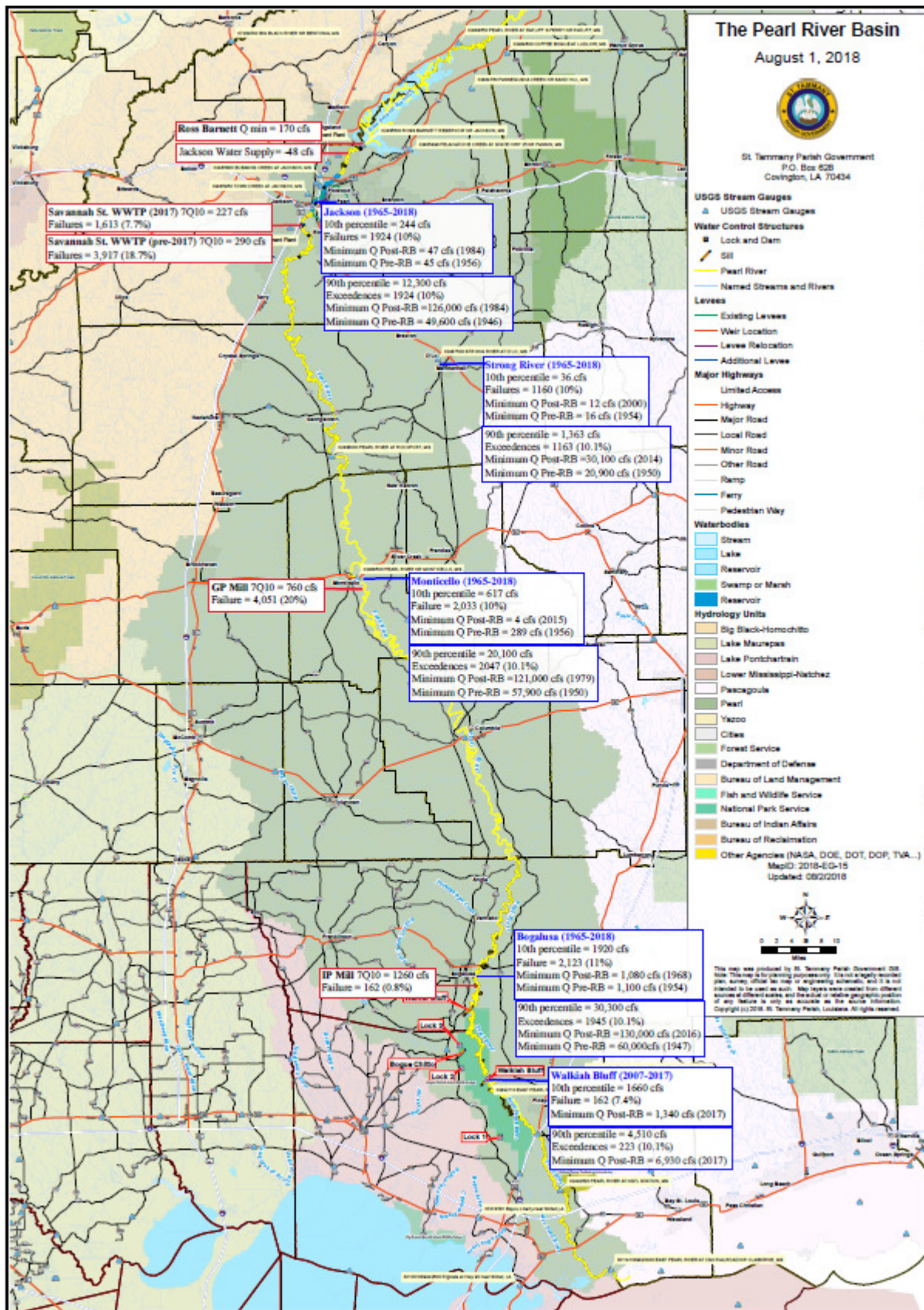
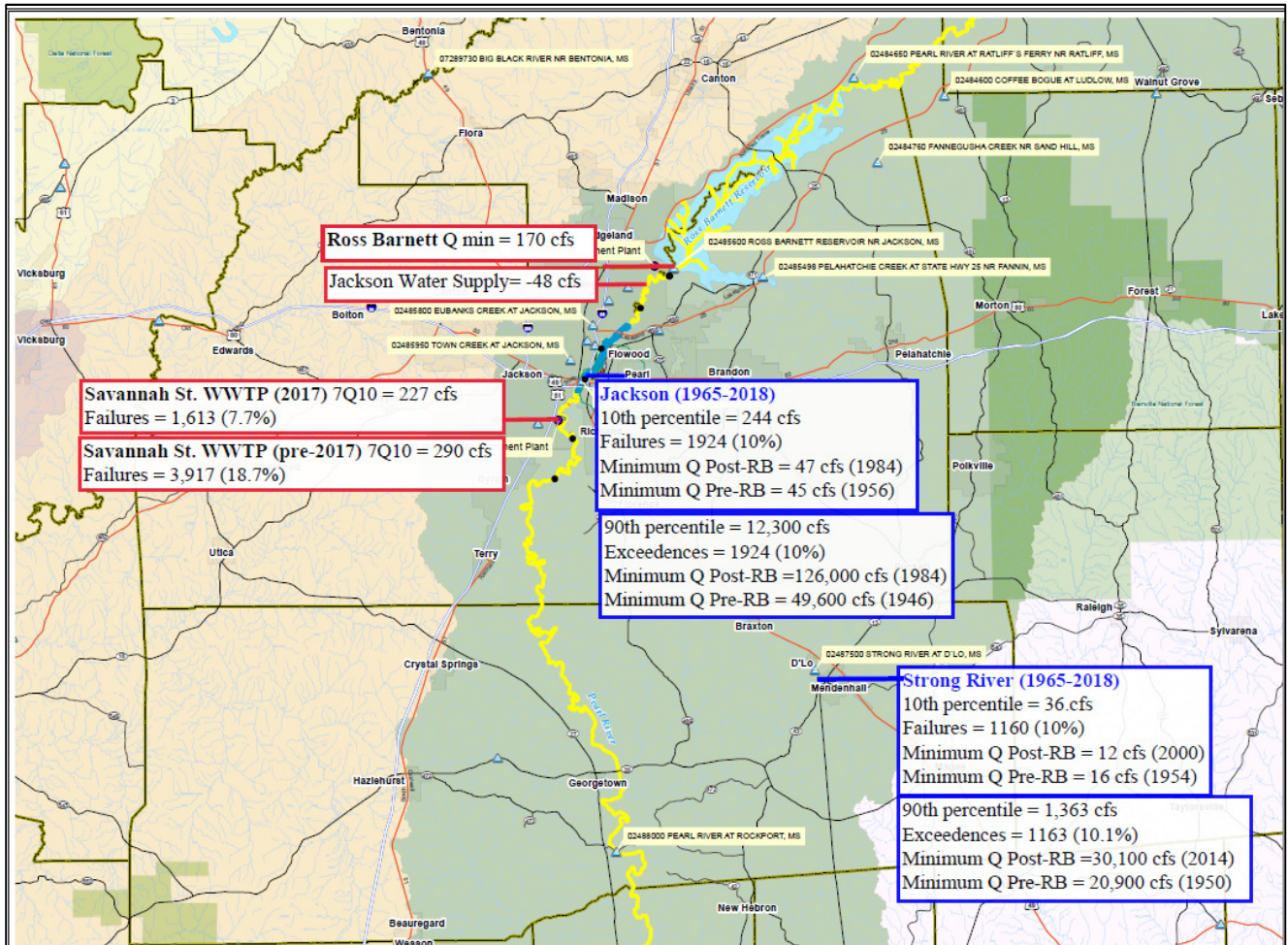


Figure 1. Pearl River Basin Locations of Concern





**Figure 2. Pearl River Reach near Proposed Alt. C Impoundment with Flow Characteristics**

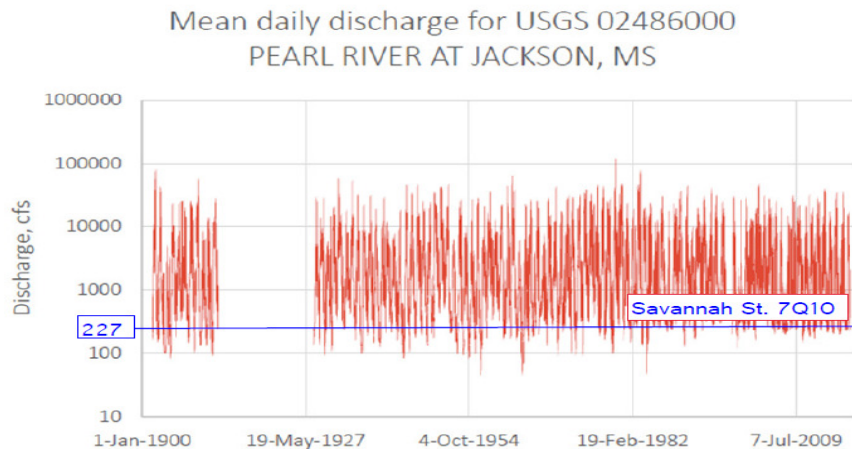
**Table 1. Minimum Mean Daily Flows by Month for USGS 02486000 Pearl River at Jackson, MS**

<b>USGS 02486000 Pearl River at Jackson, MS Minimum Mean Daily Discharges by Month (1968-2018)</b>		
<b>Month</b>	<b>Pre-RB (1938-1960)</b>	<b>Post-RB (1965-2018)</b>
	<b>Minimum Discharge, cfs</b>	<b>Minimum Discharge, cfs</b>
January	276	218
February	590	298
March	806	262
April	707	213
May	350	192
June	270	47
July	151	92
August	103	91
September	79	88
October	45	100
November	85	92
December	131	154
<b>Months in which flows Post-TB &lt; Pre-RB</b>		

**Table 2. Average Monthly Discharges by Month for USGS 02486000 Pearl River at Jackson, MS**

<b>USGS 02486000 Pearl River at Jackson, MS Average Monthly Discharges (1968-2018)</b>		
<b>Month</b>	<b>Pre-RB (1938-1960)</b>	<b>Post-RB (1965-2018)</b>
	<b>Average Monthly Discharge, cfs</b>	<b>Average Monthly Discharge, cfs</b>
January	5,757	7,643
February	9,488	9,208
March	8,725	9,015
April	7,719	8,610
May	1,715	4,153
June	1,640	1,713
July	1,819	1,124
August	1,028	956
September	507	1,124
October	461	1,252
November	1,128	2,000
December	2,588	5,013
<b>Months in which stream baseflows &lt; 227 cfs required for Savannah St. WWTP permit</b>		

A 7Q10 of 227 cfs is the minimum stream baseflow measured on the USGS gage at Jackson required by MSDEQ for the most recent permit renewal (2017) for the 46 MGD City of Jackson Savannah St. WWTP discharge. Post-RB, there were 1,613 failures (7.7%) to meet this minimum flowrate (Figure 1). Mean Daily Discharge on the gage at Jackson show many measurements that are lower than the required 227 cfs for City of Jackson, Savannah St. Wastewater Treatment Plant (WWTP), as seen on the hydrograph in Figure 3.



**Figure 3. Mean Daily Discharge for USGS 02486000 (Pearl River at Jackson, MS) for the period of record**

The previous NPDES permit for the Savannah St. WWTP set the stream baseflow at 290 cfs for which there were 3,917 failures (18.7%). It seems counter intuitive that the permit should have been issued with a lower stream baseflow, with the River’s history of not attaining adequate flow. A TMDL for Nutrients<sup>2</sup> was implemented by EPA and MSDEQ in 2015 for the Pearl River from Ross Barnett to the Strong River. It seems plausible that inadequate stream baseflow at the Jackson gage during summer-critical conditions may be contributing to the lack of assimilative capacity at this location in the River incurring the TMDL.

The EIS authors stated in a public meeting that Richland Creek discharges into the Pearl River between the USGS gage 02486000 Pearl River at Jackson, MS and the Savannah St. WW TP discharge, contributing to the stream baseflow (Figure 1) that would augment the facility’s permit requirements.

- Richland Creek has a 7Q10 of 0.9 cfs<sup>3</sup>, which is inadequate for substantive flow augmentation for the WWTP (USGS 1991).

<sup>2</sup> Total Maximum Daily Load Total Nitrogen and Total Phosphorous for the Pearl River from Ross Barnett Reservoir to the Strong River (Hinds, Rankin, Simpson and Copiah Counties) Pearl River Basin. MSDEQ. MSDEQ, Office of Pollution Control, Modeling and TMDL Branch. 2015.

<sup>3</sup> USGS. 1991. *Low-Flow and Flow-Duration Characteristics of Mississippi Streams*. USGS Water Resources Investigations Report 90-4087. Table 2. Low-Flow characteristics for partial-record stations. Page 153.

Another approach to quantify low-flow is to use a 10<sup>th</sup> percentile comparison. Pre-RB 10<sup>th</sup> percentile stream baseflow at the Jackson gage was 192 cfs with 828 gage measurements (10%) failing to reach that flow rate. Post-RB 10<sup>th</sup> percentile stream baseflow is 244 cfs, but with a larger number of measurements <10<sup>th</sup> percentile (1,924) failing to meet the flowrate.

Finally, using the 10<sup>th</sup> percentile approach and comparing pre- and post- RB for the USGS gage at Jackson, Table 3 quantifies the differences in pre- and post-RB. Many of the 10<sup>th</sup> percentile critical low-flows are lower post-RB and do not satisfy the minimum stream baseflow required for the Savannah St. WWTP 7Q10. It is apparent that flow control at the RB Reservoir is making the stream baseflow lower at least during July and August, summer-critical months for NPDES dischargers, water quality, habitat, recreation, navigation and coastal interests.

- It is strongly suggested that the Ross Barnett Reservoir minimum discharges be increased.

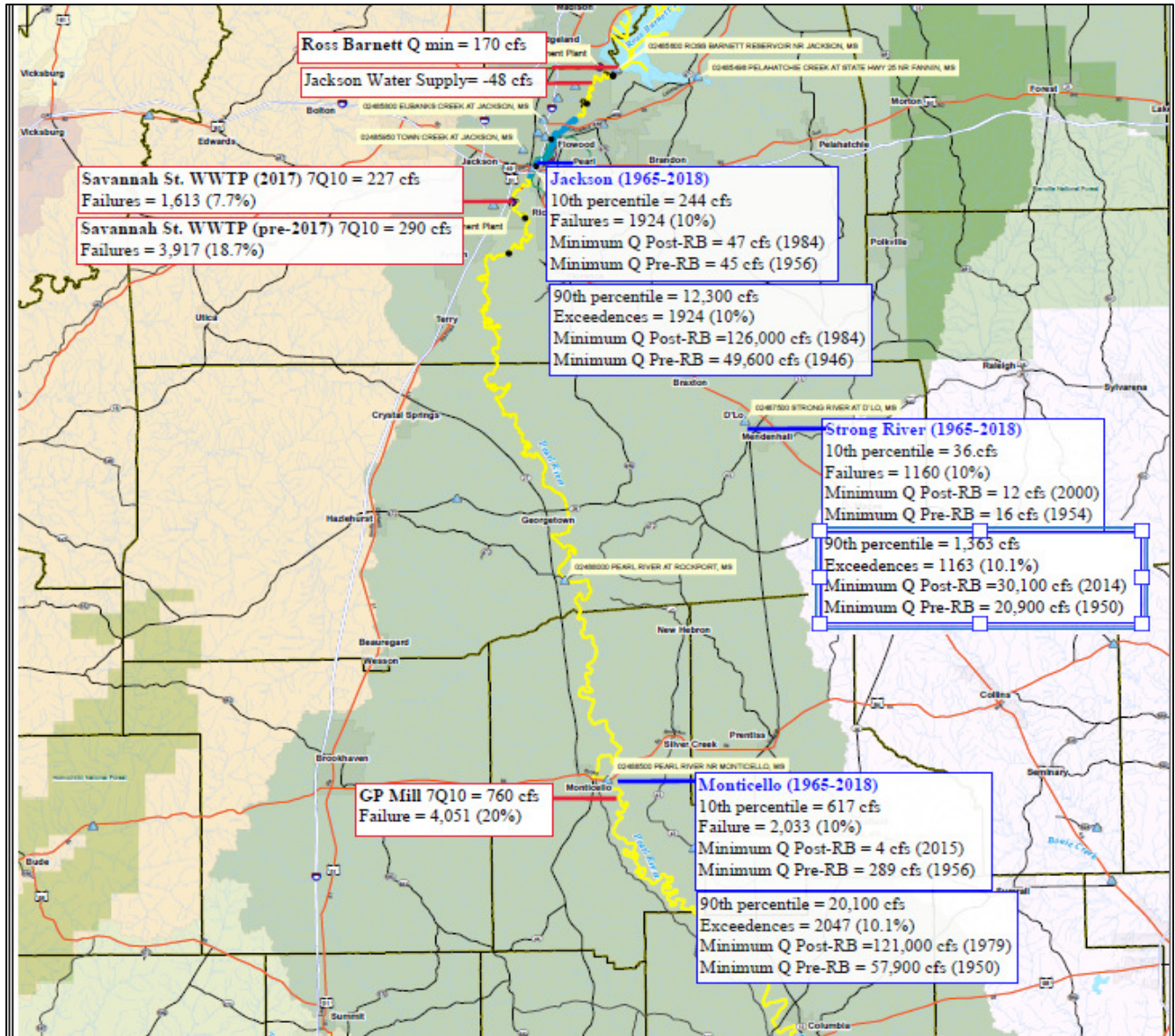
**Table 3. 10<sup>th</sup> Percentile Monthly Mean Daily Flows for USGS 02486000 Pearl River at Jackson, MS**

<b>Monthly Mean Daily Flows</b>		
<b>Gage Data USGS 02486000 Pearl River @ Jackson, MS</b>		
<b>Month</b>	<b>Pre- Ross Barnett (1938-1960)</b>	<b>Post- Ross Barnett (1965-2018)</b>
	<b>10th percentile Monthly Average Discharge, cfs</b>	<b>10th percentile Monthly Average Discharge, cfs</b>
<b>January</b>	<b>955</b>	<b>781</b>
<b>February</b>	<b>1960</b>	<b>1625</b>
<b>March</b>	<b>2763</b>	<b>1711</b>
<b>April</b>	<b>1870</b>	<b>232</b>
<b>May</b>	<b>588</b>	<b>274</b>
<b>June</b>	<b>350</b>	<b>239</b>
<b>July</b>	<b>238</b>	<b>232</b>
<b>August</b>	<b>222</b>	<b>214</b>
<b>September</b>	<b>141</b>	<b>212</b>
<b>October</b>	<b>99</b>	<b>206</b>
<b>November</b>	<b>123</b>	<b>223</b>
<b>December</b>	<b>205</b>	<b>293</b>
<b>Values are &lt;227 cfs required by MSDEQ to satisfy Savannah St WWTP (2017)</b>		
<b>[1] Evap losses, EIS Appendix C, Table 5-1, pg 10.</b>		



**USGS 02488500 (Pearl River at Monticello, MS)**

Monticello, MS is the location of a large NPDES discharger, Georgia Pacific (GP) Paper Mill (Figure 4). The 10<sup>th</sup> percentile flow post-RB is 512 cfs measured at the gage USGS 02488500 Pearl River at Monticello, MS, of which there were 854 measurements that failed to meet the 10<sup>th</sup> percentile (11%). The historic minimum flow at that location is 4.02 cfs. Residents along the River relay stories that the water was so low at that time that one could walk across to the other bank.



**Figure 4. Pearl River Reach near Monticello, MS with Flow Characteristics**



The 7Q10 for the 26.04 MGD (40.3 cfs) GP facility requires a stream baseflow of 760 cfs. There were 4,051 Daily Mean Discharge measurements (20%) that failed to meet that minimum. The Strong River, upstream of the Monticello gage, augments flow at this location (Figure 1); however, the post-RB 10<sup>th</sup> percentile for the Strong is 36 cfs measured at USGS 02487500 Strong River at D'Lo, MS. 1,160 Daily Mean Discharges failed to meet the 10<sup>th</sup> percentile (10%). The historic minimum was 12 cfs (8/31/2000).

- Clearly, stream baseflow, even with augmentation from the Strong River, is inadequate to meet the permit needs for this facility.

### USGS 02489500 (Pearl River at Bogalusa, LA)

Bogalusa, LA is the location of a large NPDES discharger, International Paper (IP) Mill (Figure 5). The 10<sup>th</sup> percentile flow post-RB is 1,920 cfs, of which there were 2123 Daily Mean Discharges that failed to meet the 10<sup>th</sup> percentile (11%). The historic post-RB minimum flow at that location is 1,080 cfs. The 7Q10 for the 16 MGD (24.8 cfs) IP facility requires a stream baseflow of 1,260 cfs. There were 162 post-RB Daily Average Discharge measurements (0.8%) that failed to meet that minimum. While the minimum stream baseflow for this facility was well determined for the permit, there is little margin of safety in the stream baseflow, potentially incurring in-stream water quality violations during summer-critical conditions.

- There is a need for additional stream baseflow augmentation at this location in the Pearl River.

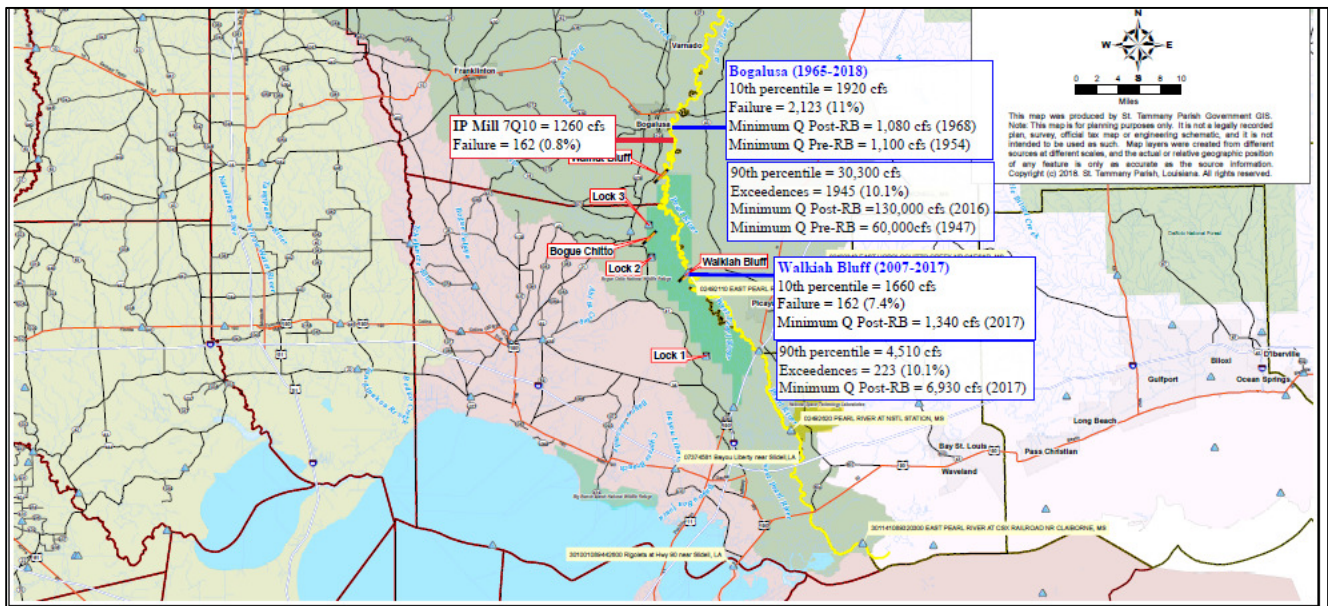


Figure 5. Pearl River Reach near Bogalusa, LA with Flow Characteristics

### USGS 2492110 (East Pearl River ab Wilson Slough at Walkiah Bluff)

This site is of particular interest to oyster culture in coastal MS and LA (Figure 5). Adequate freshwater during summer critical conditions is necessary to mitigate the effects of saltwater intrusion and survivability of oysters in Lake Pontchartrain and the Mississippi Sound. Walkiah Bluff was constructed by the USACE to divert freshwater to the East Peal River during low-flow conditions. The 10<sup>th</sup> percentile Daily Mean Discharge measured at this gage is 1,660 cfs, of which 162 measurements <10<sup>th</sup> percentile (2007-2018). The historic minimum flow was 1,340 cfs (10/15/2007). A significant amount of debris is reportedly blocking the structure’s weir lessening the amount of fresh water being diverted.

- It is suggested that the USACE conduct maintenance on the Walkiah Bluff structure to restore its capacity.

### Combined Impacts of Additional Impoundment with an Already Dammed Pearl River

Even without the addition of the proposed impoundment in Alt. C, it can be summarized that the Ross Barnett Reservoir has changed the flow patterns and Daily Mean Discharges throughout the Pearl River Watershed (Table 4). 10<sup>th</sup> percentile discharges are lowered in low-flow, summer-critical conditions and are increased during 90<sup>th</sup> percentile high-flow events. The latter will be discussed in another section.

**Table 4. Select USGS Gages in Pearl River Basin, Low Flow Summary**

USGS Gage Number	Description	7Q10, cfs	LOW-FLOW							
			PRE-Ross Barnett (1938--1960)				POST-Ross Barnett (1965-2018)			
			10th Percentile, cfs	Number Events ≤10th Percentile % Events ≤10th Percentile	Minimum Discharge, cfs	Date	10th Percentile, cfs	Number Events ≤10th Percentile % Events ≤10th Percentile	Minimum Discharge, cfs	Date
2485601	Pearl River @ Ross Barnett Reservoir	170 (post-1965)	-	-	-	-	-	-	-	-
2486000	Pearl River @ Jackson, MS	103 (1939-1960)	192	828 10.1 %	45	10/5/1956	244	1,924 10.0 %	47	6/14/1984
2486300	Richland Creek nr Jackson, MS	0.9	-	-	-	-	-	-	-	-
2487500	Strong River at D'Lo, MS	19 (1929-1970)	32	850 10.1 %	16	9/2/1954	36	1,160 10 %	12	8/31/2000
2488500	Pearl River @ Monticello, MS	359 (1939-1960)	512	854 11 %	289	9/28/1956	617	2,033 10 %	4	10/18/2015
2489500	Pearl River near Bogaulsa, LA	1,400 (1939-1960)	1,620	827 10.20 %	1,100	9/15/1954	1,920	2,123 11.0 %	1,080	10/26/1968
2492110	East Pearl River ab Wilson Slough @ Walkiah Bluff	(2007-2017)	-	-	-	-	1,660	162 7.40 %	1,340	10/15/2007

The EIS proposes to create an additional impoundment approximately 7.5 miles downstream of the Ross Barnett Reservoir. The EIS authors have provided the Monthly Mean Discharges for the Pearl River at Jackson for the entire period of record (Figure 3). Because the RB is essentially the new headwater for this reach of the Pearl River, beginning in 1965 when it reached “full pool”, St. Tammany Parish objects to the use of pre-RB data in determining flow impacts from the proposed impoundment. St. Tammany provided the Monthly Mean Discharges by Month for the Jackson gage pre- and post-RB previously in Table 2.

- Monthly Mean Discharges should be calculated using ONLY post-RB data when determining flow impacts from the proposed impoundment.

### Evaporative Losses

The EIS authors calculated evaporative losses from the proposed 1900 surface acre.

- Evaporative losses subtracted from either the Minimum Daily Mean Discharges by Month (Figure 6) or the 10<sup>th</sup> percentile of Mean Daily Discharges (Table 5) indicate the already-impacted Pearl River will be further compromised.

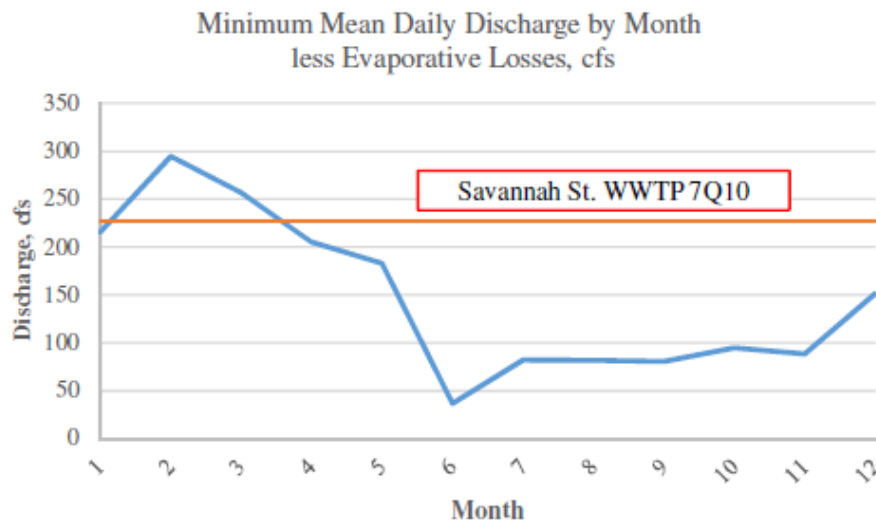


Figure 6. Minimum Mean Daily Flows by Month minus proposed evaporative losses

### Seepage Losses

Seepage losses/gains in the proposed impoundment were not addressed in the EIS. Losses would require an increased minimum discharge from the Ross Barnett Reservoir in order to maintain adequate downstream flows during low-flow events.

- A geotechnical investigation is needed in order to determine whether there will be gains or losses in the proposed impoundment due to groundwater effects.



**Table 5. 10<sup>th</sup> Percentile of Mean Daily Discharges for USGS 02486000 Pearl River at Jackson, MS**

Monthly Mean Daily Discharges				
Gage Data USGS 02486000 Pearl River @ Jackson, MS				
Month	Pre- Ross Barnett (1938-1960)	Post-Ross Barnett (1965-2018)		
	10th percentile Monthly Average Discharge, cfs	10th percentile Monthly Average Discharge, cfs	Evap. loss, cfs [1]	10th percentile Monthly Average Discharge less Proposed Evap. loss, cfs
January	955	781	2.5	779
February	1960	1625	3.4	1622
March	2763	1711	5.3	1706
April	1870	232	7.7	224
May	588	274	9.2	265
June	350	239	10.1	229
July	238	232	9.9	222
August	222	214	9.1	205
September	141	212	7.5	205
October	99	206	5.2	201
November	123	223	3.6	219
December	205	293	2.6	291

[1] Evap losses, EIS Appendix C, Table 5-1, pg 10.

Values are <227 cfs required by MSDEQ to satisfy Savannah St WWTP (2017)

**High Flow Impacts from the Combined Impoundments (Ross Barnett & Alt. C)**

The current proposal, Alt. C in the *Pearl River Basin, Mississippi Section 211 Feasibility Study – Integrated Draft Feasibility and Environmental Impact Statement*, is expected to demonstrate a reduction of flooding in the Jackson, MS area due to lowering the tailwater condition, thereby speeding up flows. This increase in flow due to loss of floodplain storage needs to be mitigated by a volume of storage created downstream, which is proposed Alt. C impoundment.

In Louisiana, both flood height and duration cause issues on a yearly basis during high flow events. Further, at all Pearl River gage stations and tributaries assessed, the 90<sup>th</sup> percentile discharges increased post-Ross Barnett, as did the maximum flows (Table 5). Table 5 also provides insight as to how many Daily Mean Discharges were greater than the 90<sup>th</sup> percentile; in most cases this was in excess of 10%.

These “slugs” of water from Ross Barnett cause bank erosion and excessive sediment transport to downstream reaches. St. Tammany Parish is concerned with how the proposed impoundment will compensate for the “slugs” from the Ross Barnett.

- An unsteady model showing both maximum flooding and duration of flooding needs to be run for all conceptual alternatives over the entire model domain (Ross Barnett Reservoir to Lake Pontchartrain and the Mississippi Sound).
- As with low-flow considerations, the high-flow operational plan must be detailed in the EIS.
- Sediment transport should be included in the modeling effort in the EIS.

**Table 4. Select USGS Gages in Pearl River Basin, High Flow Summary**

USGS Gage Number	Description	HIGH-FLOW							
		PRE-Ross Barnett (1938--1960)				POST-Ross Barnett (1965-2018)			
		90th Percentile, cfs	Number Events <90th Percentile % Events <90th Percentile	Maxium Discharge, cfs	Date	90th Percentile, cfs	Number Events <90th Percentile % Events <10th Percentile	Maxium Discharge, cfs	Date
2485601	Pearl River @ Ross Barnett Reservoir	-	-	-	-	-	-	-	-
2486000	Pearl River @ Jackson, MS	10,300	833 10.1 %	49,600	2/17/1944	12,300	1924 10 %	126,000	4/17/1979
2486300	Richland Creek nr Jackson, MS	-	-	-	-	-	-	-	-
2487500	Strong River at D'Lo, MS	1,500	844 10 %	20,900	1/7/1950	1,363	1163 10.1 %	30,100	4/8/2014
2488500	Pearl River @ Monticello, MS	17,700	782 10.1 %	57,900	1/7/1950	20,100	2047 10.1 %	121,000	4/20/1979
2489500	Pearl River near Bogaulsa, LA	23,700	1390 17.1 %	60,000	1/26/1947	30,300	1945 10.0 %	130,000	3/12/2016
2492110	East Pearl River ab Wilson Slough @ Walkiah Bluff	-	- -	-	-	4,510	223 10.1 %	6,930	8/4/2017

### Summary Water Quantity Comments

In summary, the headwater flow from the Ross Barnett Reservoir minimum discharge (170 cfs), less the withdrawal for the City of Jackson Water Supply (-48 cfs) and adding the minimal input from tributaries in the project area (most of which have 7Q10 = 0 cfs) is reflected in the USGS stream gage at Jackson. The Jackson gage reflects that for much of the year, flow is inadequate to provide the minimal stream baseflow required for the Savannah St, WWTP (227 cfs) during summer critical conditions. Further, the lack of adequate flow may have contributed to the water quality impairments and promulgated TMDL in the area, due to lack of assimilative capacity. The location of the proposed additional impoundment is critical for flow management. Additional stream baseflow is required even without the additional losses incurred by Alt. C.

- It is suggested that the Ross Barnett Reservoir should be encouraged to discharge a minimum flow > 170 cfs required by the MS Board of Commissioners in 1956.

- A minimum flow release must be specified in the EIS and included in the reservoir operational plan for Alt. C.
- In the operational plan, the tandem operations of the two gates from the respective reservoirs must be detailed.
- The minimum flows from both reservoirs should be formalized through an MOU between Ross Barnett and proposed Alt. C impoundment for flow management and with the States of Mississippi and Louisiana.

## Water Quality

Currently the Pearl River and its distributaries are suffering from inadequate low flow that is impacting water quality (from reduced assimilative capacity), discharge limits for effluent dischargers (such as International Paper), recreation (due to shallow draft limitations), fish populations (due to low dissolved oxygen concentrations), aesthetics (impacting swamp tours in St. Tammany Parish), and saltwater intrusion (affecting drinking water wells, habitat, and coastal marshes) in the lower portion of the Pearl River.

Significant environmental impacts exist that are partially attributable to the Ross Barnett Reservoir discharging inadequate volumes during low flow months. Without adequate flow from Jackson, the assimilative capacity of the Pearl River will continue to be compromised and the River subsegments will remain impaired. In fact, EPA has promulgated 21 Total Maximum Daily Loads (TMDL) for subsegments of the Pearl River in Louisiana and 49 in Mississippi for various pollutants. Failure to improve the water quality in these stream segments may result in a reduction of development in the watershed, due to permit denials.

A number of TMDLs have been promulgated for the Alt. C reach of the Pearl River (Figure 7). The 2015 EPA Nutrient TMDL<sup>4</sup> (Ross Barnett to the Strong River) is a major concern to all downstream stakeholders. The Pearl River in that extensive reach is impaired for low dissolved oxygen (DO) due to nutrients from NPDES dischargers and from nonpoint sources (NPS) from nine (9) Multiple Separate Storm Sewer System (MS4) communities in the project area. The TMDL calls for a 70% reduction in Total Phosphorous, much of which must be from reductions in NPS loading from the nine (9) MS4s.

These tributaries are a major source of pollutants into the Pearl during rainfall events and will discharge into the proposed impoundment. Without significant water quality improvements from aggressive MS4 and Ross Barnett activities, the water quality in the proposed impoundment will certainly be eutrophic, incur algae blooms and dissolved oxygen collapse, and potentially exceed CWA standards.

- Discharges from the proposed Alt. C impoundment will compromise the downstream reaches even more than the Ross Barnett currently does.

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<sup>4</sup> *Total Maximum Daily Load for Total Nitrogen and Total Phosphorous for the Pearl River from Ross Barnett Reservoir to the Strong River, Hinds, Rankin, Simpson, and Copiah Counties, Pearl River Basin.* Prepared by MDEQ, Office of Pollution Control, Modeling and TMDL Branch. April 2015.



Table 3.1. Summary of TMDLs for waterbodies within the Study Area.

Waterbody	TMDL Pollutant	TMDL Approved	Recommended Reduction
Hanging Moss Creek	Total Biochemical Oxygen Demand	June 2009	43.9% reduction of total phosphorus
	Total Nitrogen		
	Total Phosphorus		
Pearl River	Total Nitrogen	June 2009	56.0% reduction of total phosphorus
	Total Phosphorus		
	DDT	January 2007	-
	Toxaphene		
Hanging Moss Creek Pearl River Richland Creek	Sediment	March 2009	-
Richland Creek	Total Biochemical Oxygen Demand	December 2008	49.8% reduction of total phosphorus
	Total Nitrogen		
	Total Phosphorus		
Pearl River from Ross Barnett Reservoir to the Strong River	Total Nitrogen	April 2015	70% reduction of total phosphorus
	Total Phosphorus		

Figure 7. EIS Table 3.1 presenting TMDLs in the Study Area

The West Pearl River in St. Tammany Parish already experiences many environmental consequences resulting from reduced flow being released from the Ross Barnett, specifically: Quiescence, water quality degradation, eutrophication and invasive aquatic macrophytes, shoaling, navigation impediments, saltwater intrusion into the River and shallow drinking water wells, loss of habitat, loss of commercial fisheries and risk from wasteload allocation (WLA) excursions from the International Paper (IP) Mill<sup>5</sup> in Bogalusa.

- As discussed previously, all vulnerabilities result from lack of volume and reduced velocity from the headwaters during critical low-flow months. Thus, any additional headwater reductions are environmentally unacceptable.

<sup>5</sup> Permit limits for the IP Mill were determined from the LDEQ modeling effort published 12/03/2013. Results of the *Final - Evaluation of Biochemical Oxygen Demand Loading from the International Paper – Bogalusa Paperboard Mill (AI# 38936, LPDES# LA0007901) into the Pearl River (Subsegments 090101 & 090107)* were utilized to verify permit limits for the discharger.

## **Sediment Loading downstream of the proposed impoundment**

It was pointed out during a public meeting by a resident in Slidell, LA that the shape of the proposed weir is stated to reduce maintenance; presumably, this will reduce dredging needs in the proposed impoundment. The resident was concerned that the 12'x12' gates would be opened to release slugs of sediment that will travel downstream. Some sediment is necessary to maintain bank stability, but an excess will add to the over-burdened lower Pearl River.

- St. Tammany Parish would like the EIS to include a discussion of the maintenance procedures to maintain Alt. C storage capacity and to minimize downstream sediment loading.

Stakeholders are assured in the EIS that since 96% of the water into the proposed impoundment will be from the Ross Barnett Reservoir, water quality in the proposed lake will be similar to that in Ross Barnett Reservoir (EIS Appendix D, Environmental, pg.135):

**Most of the water entering the project reach originates upstream of the Ross Barnett Reservoir. The reservoir functions as a settling basin for the downstream study reach. Water quality of the reservoir is a good indicator of water quality in the proposed impoundment.**

However, the water quality of the RB was determined to be impaired for nutrients and temperature. Following the draft TMDL for Nutrients (MSDEQ 2009), a Water Quality Management Plan was developed for the Ross Barnett Reservoir (EIS Appendix D, Water Quality, Pg.11):

The water quality of the Ross Barnett Reservoir will have a significant influence on the water quality within the proposed project. In 2011, MDEQ in conjunction with the Pearl River Valley Water Supply District developed a *Comprehensive Protection & Restoration Plan for the Ross Barnett Reservoir Watershed, Mississippi*. This plan serves, "as the framework for long-term, coordinated multi agency efforts to protect and restore water quality in the Reservoir and its watershed."

The plan identified, within the Reservoir and its watershed, six priority issues along with management strategies for reducing and controlling them. Those issues include the following:

1. Sediments and turbid water,
2. Nutrient enrichment and algae growth,
3. Bacteria and other pathogens,
4. Invasive aquatic plant species,
5. Pesticides (currently used herbicides and insecticides), and
6. Trash dumping and littering in and around the Reservoir and its shoreline.

Further, this plan identifies areas where targeted watershed protection and restoration efforts will be focused. This plan identified the most prevalent pollutant source in the Reservoir and its tributaries to be nonpoint sources.

Water quality sampling was conducted by the EIS team in July 2014 (EIS Appendix D, Water Quality, pg.26) presumably to verify “current summer-critical conditions,” and/or to gauge the progress from the RB SW Management Plan (above). Sampling locations included two on the Pearl River (downstream of the Ross Barnett Reservoir, upstream of the Jackson water supply intakes) and at three of the tributaries that will discharge into the proposed impoundment. As seen in Figure 8 (EIS Appendix D, Water Quality, Pg.43), there were significant failures of DO criteria at two Pearl River sites (Ross Barnett and Jackson water supply), and failure of temperature standard at three Pearl River sites and one tributary that discharges into the proposed impoundment.

Table 3.15. Comparison of measurements from July 2014 water quality study with numeric criteria.

Parameters Measured with Criteria	Station	Number of Exceedances	Criterion not met	Percent of measurements
DO, instantaneous	PR1	4	4 mg/L	<1%
	PR2	6		1.3%
DO, day average	PR1	1	5 mg/L	7.7%
	PR2	2		18.2%
Temperature	PR1	2	90°F	<1%
	PR2	3		<1%
	PR3	3		<1%
	RT3	1		50%
pH	-	0	-	-
Conductivity	-	0	-	-
Ammonia	-	0	-	-

Figure 8. Sample Comparison to Water Quality Standards, July 2014

Further, water quality in the tributaries discharging into the proposed impoundment is dominated by NPS from the nine MS4s on those tribs. The EIS authors are certain that the 2011 Stormwater Master Plan enacted to improve water quality from the MS4s will provide relatively “clean” water to the impoundment. The TMDLs listed in Figure 5 indicate that one of the tribs. (Hanging Moss Creek) has its own TMDL for BOD, Nutrients and Sediment (2009).

**The watershed of the proposed channel improvements within the Project Area, is primarily urban. Storm water runoff from localized storms impacts the water quality in the Pearl River. Implementation of the existing storm water management plans for adjacent and nearby municipalities should improve the quality of this runoff.**

- The EIS must address whether WQ improvements have been achieved in the MS4s and the Ross Barnett discharges in the seven (7) years since the Stormwater Master Plan and TMDL were promulgated.
- Does the proposed impoundment have a plan to improve water quality prior to release?



## Water Quality Modeling

The modeling effort utilized a 1-D, steady-state approach. While this may be effective when developing a “snapshot” of “worst case” conditions, as with a TMDL, it is not appropriate for average advective conditions where many tributaries and distributaries confluence in the main stem of the Pearl River. Further, the model domain only extends to River Mile 279 below Richland Creek. The EIS authors has made the statement in a public meeting and in the EIS that the Ross Barnett discharge rate contributes minimally to that of the mouth outfalls.

- St. Tammany Parish is concerned that with the known low-flow (and high-flow) concerns of downstream communities and NPDES dischargers, an unsteady-state model should be developed with its modeling domain extending to the Mouth of the West and East Pearl Rivers at Lake Pontchartrain and the MS Sound, respectively. This would provide a more accurate method of quantifying downstream flow impacts.

The geographic boundary of the hydraulic and hydrologic (H&H) model domain should include the Pearl River watershed from the Ross Barnett Reservoir to the Mississippi Sound and the Biloxi Marshes of Louisiana. Further, due to the dynamic system downstream, an unsteady model should be developed that will allow modeling of the entire impacted Pearl River system (Jackson to Lake Pontchartrain and Mississippi Sound).

- St. Tammany Parish requests that the Rankin Hinds Pearl River Flood & Drainage Control District produce a defensible, robust unsteady model of the current conditions and projections for all of the conceptual alternatives.

Using data from the July 2014 sampling event, the EIS team developed a model to predict the impact of the proposed impoundment. Figure 9 (EIS Appendix D, Water Quality, pg.119) presents model output of dissolved oxygen (DO) for two scenarios: 1) “No Action” (current conditions) and 2) Alternative C scenario. In the “No action” scenario, DO is significantly higher than the Alt. C scenario; however, EIS reviewers are assured that the DO in the Alt. C scenario will remain above the CWA criteria of 5.0 mg/L. Reviewers are asked to believe that the flow rates, pollutant concentrations, temperatures and decay coefficients used in the model are also correct. Assuming the 10<sup>th</sup> percentile flow rates were to be used, it is doubtful that the DO would maintain CWA DO minimums.

- St. Tammany Parish requests that a modeling scenario be conducted using “worse-case conditions” of 10<sup>th</sup> percentile flow rates and 32<sup>o</sup>C temperatures, with a minimum 20% increased loadings to represent a margin of safety for growth.

Further, DO appears to FAIL EPA anti-degradation criteria for dissolved oxygen (< 0.2 mg/L) with Alt. C impoundment. LDEQ’s water quality standards define degradation as “a lowering of water quality, as demonstrated by data analysis, water quality models, or other scientifically defensible method.” So, a lowering of the dissolved oxygen content, as predicted by a model, is considered degradation. Per LAC 33: IX, Chapter 15 (Water Quality Certification Procedures), LDEQ has the responsibility to certify that federal permits or licenses will not violate water quality standards, so the application of the antidegradation policy is not limited to industrial discharges.

- In reviewing the discharge from the proposed Alt. C impoundment, MSDEQ and USACE are encouraged to require compliance with the CWA anti-degradation standard upon submittal of the final EIS and again at the USACE permit application.

Figure 4.52. Predicted DO at PR1 for No Action and Alternative C (July 2014 flows)

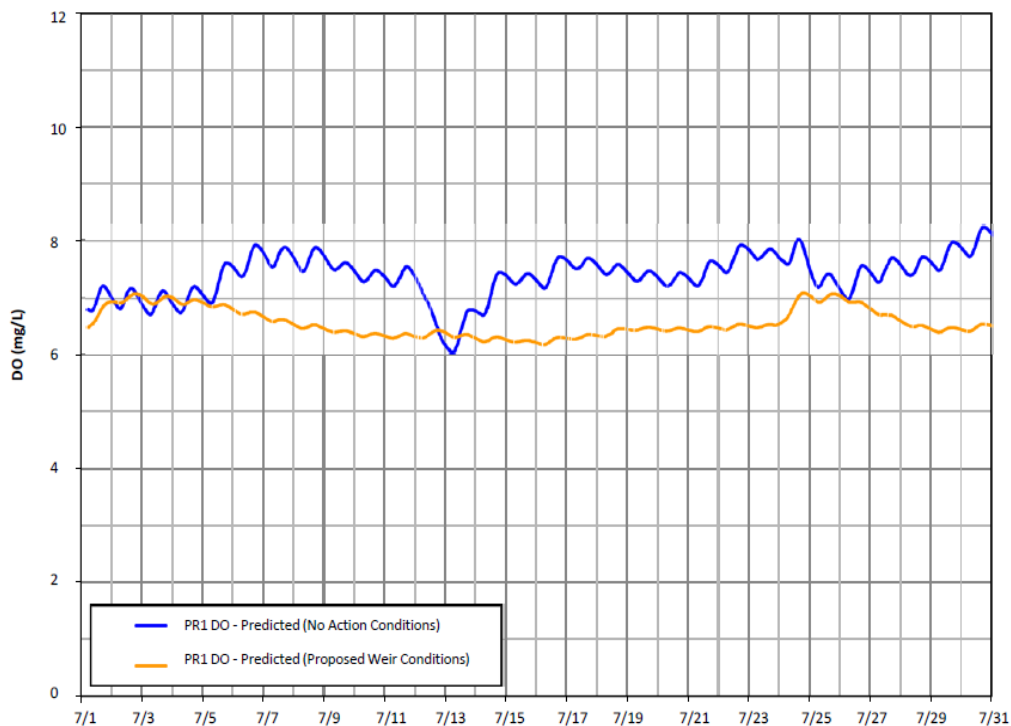


Figure 9. Predicted DO vs Observed DO at Sample Location downstream of the Ross Barnett gates

### Future Major NPDES Dischargers in the Area

An additional new domestic wastewater treatment facility is forecast to be constructed across the Pearl River from the Savannah St. facility and downstream of the proposed Alt. C impoundment weir. The new facility is accounted for in the 2015 TMDL, but indicates that additional development is anticipated. Future growth is not discussed in the EIS or accounted for in the flows and loads in the model.

- Although additional wastewater is accommodated in the 2015 Nutrient TMDL (EPA 2015), it is recommend that a growth factor be included in the EIS model that includes additional stormwater runoff and water supply needs to assure that minimum flow needs and CWA standards are met.

### Summary of Water Quality Concerns

In summary, documentation in the sampling events and the 2015 TMDL demonstrate that water quality from the Ross Barnett Reservoir is currently impaired with excess nutrients (eutrophic) and exceeds EPA Clean Water Act (CWA) criteria for temperature. The proposed additional lake will certainly exacerbate these environmental impacts unless the Alt. C inflows demonstrate considerable improvement.

- The Ross Barnett Reservoir operational plan should be modified to address its water quality issues and the MS4s should be compelled through regulatory audits to improve water quality from their respective stormwater outfalls.

As discussed previously, a minimum discharge from the Reservoir and the proposed lake is required to provide adequate stream baseflow in order to minimize environmental impacts.

- A minimum discharge must be determined from a large-scale modeling effort that satisfies stream baseflow necessary for downstream dischargers, public health, habitat and ecosystem needs. This minimum discharge from Ross Barnett and the proposed lake development should be specified in each operational plan and be strengthened by an MOU with the States of Mississippi and Louisiana.
- Further, St. Tammany Parish would like the Ross Barnett operations plan to be reviewed to see if stream baseflow could be augmented when needed to address the environmental impacts in Louisiana resulting from low flow events.

## **Business & Industrial Activity**

Construction of the Ross Barnett Reservoir began in 1960 and was completed in 1963. The 33,000 surface acre lake reached “full-pool” capacity in 1965<sup>6</sup>. Following construction of the Ross Barnett Reservoir near Jackson, MS, historical low flow discharge rates measured at the USGS stream gauge Pearl River @ Bogalusa have decreased from 1100 cfs<sup>7</sup> down to 1020 cfs<sup>8</sup>. It appears that the controlled discharges from the Ross Barnett Reservoir have contributed to the reduced historic low flows in the West Pearl River @ Bogalusa.

Regulatory compliance for the International Paper Mill on the Pearl River near Bogalusa, LA is dependent upon a minimum flow of 1260 cfs in the Pearl River measured at the stream gauge USGS 02489500 (Pearl River near Bogalusa, LA). During the August 2011 excursion (black liquor release), the critical low flow was an historic 1160 cfs. This reduction in flow (coupled with permit exceedances at the Mill, resulted in egregious environmental damage to approximately 60 river miles of the Lower Pearl River.

- A minimum flow release must be quantified in the EIS and included in the reservoir operational plan. Further, the minimum flow should be formalized through an MOU with the states of Mississippi and Louisiana.

Further, the additional 1900<sup>9</sup> surface acre impoundment proposed by the Rankin Hinds Pearl River Flood & Drainage Control District may further reduce the flow by as much as 10.1 cfs (per the EIS) due to evaporative losses in the proposed impoundment.

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<sup>6</sup> Engineer provided date of Ross Barnett “full pool” for the Rankin-Hinds Pearl River Flood and Drainage Control District during a public meeting held in Slidell, LA on 8/16/2018.

<sup>7</sup> 1100 cfs (daily mean discharge) for 9/15/1954 pre-construction.

<sup>8</sup> 1020 cfs (daily mean discharge) 10/29/1963 post-construction.

<sup>9</sup> Surface acreage of the proposed lake will be enlarged from the existing 300 ft. stream profile.



## Population Growth

Apparently, the minimum flowrate for discharges released from the Ross Barnett Reservoir is based upon regulatory compliance to accommodate the Wasteload Allocation (WLA) for Jackson, MS Wastewater Treatment Plant (WWTP). Providing a growth factor with consequent discharge and load estimates assures that assimilative capacity and dissolved oxygen are preserved in the stream segments downstream of this discharger.

- The State of Mississippi should assure that a growth factor is built into this release.

## Recreation Resources

Boating for recreation and navigation are currently compromised due to reduced flow & velocity during critical low-flow events. Inadequate stream baseflow effects increased siltation, debris accumulation and nuisance rooted macrophyte establishment.

- Minimum flow agreements between the two reservoirs, along with Best Management Practices throughout the highly erosional upper Pearl River watershed, will help reduce further sedimentation in the lower watershed.

## Groundwater & Salt Water Intrusion

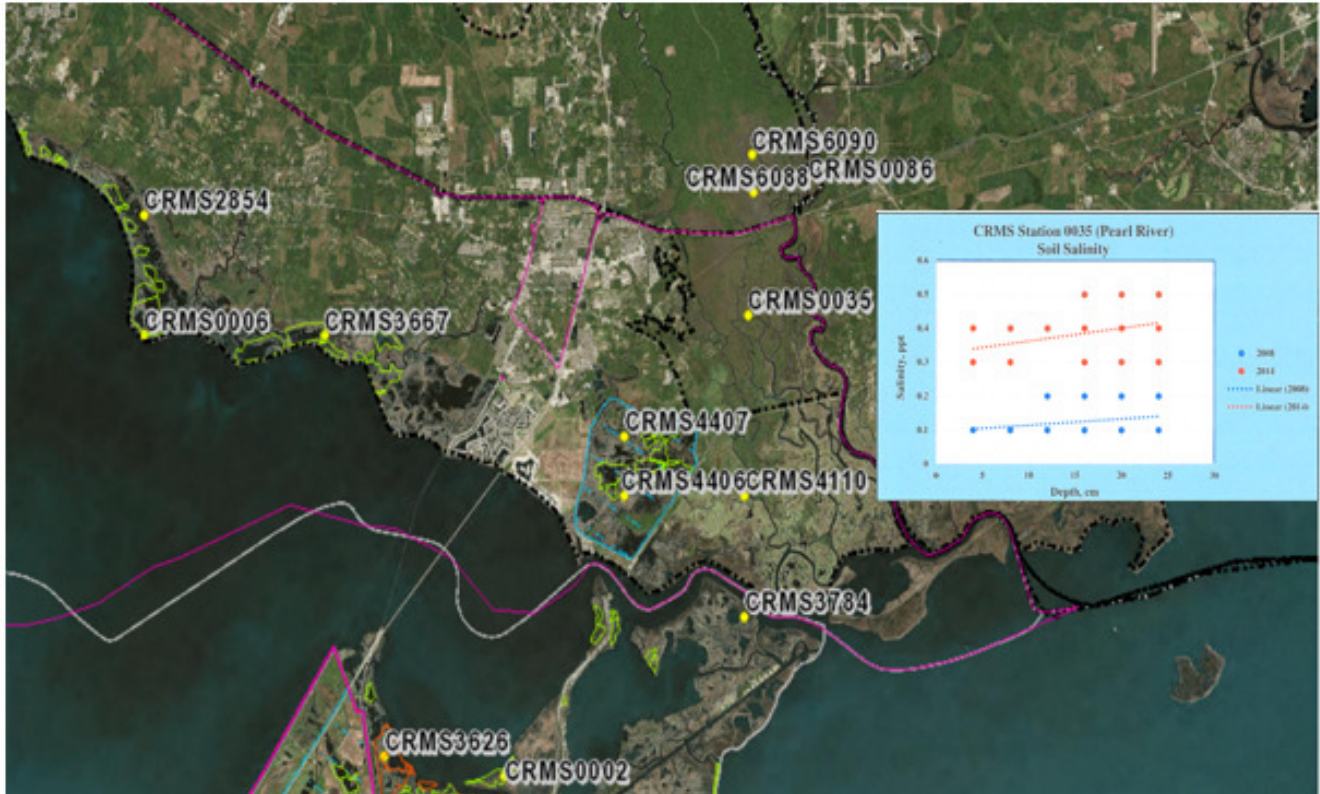
Private drinking water wells in STP were inventoried in 2011; there were determined to be 114 wells within ¼ mile of the West Pearl River in STP that are registered with Louisiana Department of Natural Resources; many of which are considered to be shallow (<75' deep). These shallow wells are extremely vulnerable to saltwater intrusion. With increased population pressure in the Pearl River Basin, the cone of depression will draw saltwater up into the wells. With less fresh water available, the number of well failures is expected to increase, impacting development and public health.

- Base flow augmentation in the Pearl River from the reservoirs should be studied to determine minimum stream baseflows needed to relieve salt water intrusion impacts in downstream drinking water wells and coastal marshes.

Since 2006, the Louisiana Coastal Protection and Restoration Authority (CPRA) and the US Geological Survey (USGS) have developed and maintained a Coastwide Reference Monitoring System (CRMS) for wetland restoration efforts. There are three CRMS sites in the vicinity of coastal Pearl River and a number of coastal restoration projects that are in the construction or engineering/development phase (Figure 10). These projects are vital to the restoration and resiliency of the Louisiana coastline and provide surge protection to inland communities.

The CRMS site houses monitoring datasets of hydrogeomorphological parameters that characterize coastal habitats in Louisiana. Some of the parameters that are monitored include water level, soil porewater salinity, percent organic content and surface elevation/accretion. The CRMS site link is: <http://www.lacoast.gov/crms2/Home.aspx>. All CRMS indicate increased saline concentration in porewater, perhaps attributable to less fresh water flowing down the Pearl River in low flow months.

- St. Tammany Parish recommends that monitoring at the CRMS sites continue, particularly to monitor for salt water intrusion.



**Figure 10. Locations of Coastal Restoration Projects and CRMS sites in the Pearl River vicinity**

The Pearl River in Louisiana is considered to be a national treasure. It is designated by LDEQ as an Outstanding Natural Resource Water (ONRW) and by LDWF as a Scenic River and is subject to higher WQ standards. In 2013, the LDEQ conducted a 33.5 mile intensive survey and water modeling effort to test the proposed permit limits for the IP Mill in Bogalusa, LA. Dissolved oxygen (DO) was modeled for the Pearl River from the Mississippi state line, upstream of Bogalusa, LA (RKm 137), to just downstream of Walkiah Bluff, MS (RKm 84.3)<sup>10</sup>. Permit limits for the IP Mill outfalls were dependent upon a minimum Pearl River discharge of 1260 cfs at Bogalusa.

- Any reduction in Pearl River baseflow, particularly in low-flow events, is unacceptable. Advective flows provide reaeration that is critical to assimilation of pollutants from permitted dischargers to assure the health of the River and the ecosystem.

<sup>10</sup> Final – Evaluation of Biochemical Oxygen Demand Loading from the International Paper – Bogalusa Paperboard Mill (AI# 38036, LPDES# LA0007901) into the Pearl River (Subsegments 090101 & 090107) December 3, 2013.

## Threatened & Endangered Species

The Louisiana Department of Wildlife and Fisheries may be assuming jurisdiction over the property in and near the Pearl River owned by the USACE (Pearl River Navigation Channel). The LDWF plans to restore habitat for Gulf Sturgeon and other endangered species with projects such as removing weirs. The primary intent is to restore Sturgeon spawning grounds and population in the Pearl River from Lake Pontchartrain up to the Ross Barnett Reservoir. The hope is to eliminate the endangered / threatened status of this fish.

- Any project implemented downstream of the Ross Barnett Reservoir needs to address minimum stream baseflow and structures that impede habitat and spawning should be identified and mitigations offered.

## Additional Alternatives to the Proposed “Levees with Lake”

St. Tammany Parish also objects to the current “Levees with Lake” proposal for the problems listed above. It also does not appear to be optimized for environmental impacts or cost. St. Tammany Parish also objects to the “Levees Only” options due to increases in downstream flooding.

As discussed in the November 20, 2013 Public Meeting, there are other project alternatives that should be considered. Not included in the Feasibility study to reduce Jackson area flooding were nonstructural alternatives (elevations, not just buy-outs), better management of the Ross Barnett Reservoir, and development of better local stormwater management plans.

A nonstructural option that was not discussed in the study or the public meeting was modification to the operation of the existing Ross Barnett Reservoir. This alternative may have the least environmental impact and financial costs. The reservoir appears to have the storage capacity to handle local recreational and water needs while serving at least a limited flood protection role.

- St. Tammany Parish suggests that the Ross Barnett Reservoir be optimized to include some modicum of floodplain storage as an undiscussed nonstructural option.

Finally, local stormwater management is essential to a community’s resilience. For instance, New Orleans has collaborated with international leaders in stormwater management to produce the “Greater New Orleans Urban Water Plan” that allows the area to manage its water resources. Responsible development and redevelopment through local zoning and development regulations is an essential part of “Living with Water” (<http://livingwithwater.com/>).

- St. Tammany suggests that the stormwater management plans for Jackson, Flowood and vicinity be thoroughly evaluated for opportunities to reduce runoff at the source.

Comments above are also supported by St. Tammany Parish Council Resolutions (2008, 2013 and 2018).

## EXHIBIT

### Summary of St. Tammany Parish Concerns and Recommendations

#### Low-Flow Concerns:

Flows at the Jackson gage are inadequate to provide the minimal stream baseflow required for the Savannah St, WWTP (227 cfs) during summer critical conditions. Further, the lack of adequate flow may have contributed to the water quality impairments and promulgated TMDL in the area. Additional stream baseflow is required even without the additional losses incurred by the Alt. C impoundment.

- Ross Barnett Reservoir should be encouraged to discharge a minimum flow > 170 cfs required by the MS Board of Commissioners in 1956.
  - Base flow augmentation in the Pearl River from the reservoirs should be studied to determine minimum stream baseflows needed to relieve salt water intrusion impacts in downstream drinking water wells and coastal marshes.
  - Any project implemented downstream of the Ross Barnett Reservoir needs to address minimum stream baseflow and structures that impede habitat and spawning should be identified and mitigations offered.
- A minimum flow release, must be specified in the EIS and included in the reservoir operational plan for Alt. C. to satisfy the needs of NPDES dischargers, water quality, habitat, recreation, navigation and coastal interests,
- The minimum flows from both reservoirs should be formalized through an MOU between Ross Barnett and proposed Alt. C impoundment for flow management and with the States of Mississippi and Louisiana.
- In the Alt. C operational plan, the tandem operations of the two gates from the respective reservoirs must be detailed.
- Ross Barnett operations plan should be reviewed to see if stream baseflow could be augmented when needed to address the environmental impacts in Louisiana resulting from low flow events.
- Salinity monitoring of the CRMS sites in the Lower Pearl River Basin should be continued.
  - Additionally, funding to sample representative community wells would be a benefit to determining long-term impacts of freshwater flow to offset salt water intrusion.
- Ross Barnett Reservoir should be optimized to include some modicum of floodplain storage as a nonstructural option not discussed in the EIS.

Losses during low-flow conditions must be more critically calculated:

- Evaporative losses subtracted from either the Minimum Daily Mean Discharges by Month (Figure 6) or the 10<sup>th</sup> percentile of Mean Daily Discharges (Table 5) indicate the already-impacted Pearl River will be further compromised.
- Seepage losses/gains in the proposed impoundment were not addressed in the EIS. Losses would require an increased minimum discharge from the Ross Barnett Reservoir in order to maintain adequate downstream flows during low-flow events.



- A geotechnical investigation is needed in order to determine whether there will be gains or losses in the proposed impoundment due to groundwater effects.

### **High-Flow Concerns:**

“Slugs” of water from Ross Barnett Reservoir during high-flow events cause bank erosion and excessive sediment transport to downstream reaches. St. Tammany Parish is concerned with how the proposed impoundment will compensate for the “slugs” from the Ross Barnett.

- As with low-flow considerations, the high-flow operational plan must be detailed in the EIS.
- Sediment transport should be included in the modeling effort in the EIS.

Some sediment is necessary to maintain bank stability, but an excess will add to the over-burdened lower Pearl River.

- St. Tammany Parish would like the EIS to include a discussion of the maintenance procedures to maintain Alt. C storage capacity and to minimize downstream sediment loading.

### **Water Quality:**

Water quality in the tributaries discharging into the proposed impoundment is dominated by NPS from the nine MS4s on those tributaries:

- The EIS must address whether WQ improvements have been achieved in the MS4s and the Ross Barnett discharges in the seven (7) years since the Stormwater Master Plan and TMDL were promulgated.
- Does the proposed impoundment have a plan to improve water quality prior to release?
- In reviewing the discharge from the proposed Alt. C impoundment, MSDEQ and USACE are encouraged to require compliance with the CWA anti-degradation standard upon submittal of the final EIS and again at the USACE permit application.
- Although additional wastewater is accommodated in the 2015 Nutrient TMDL (EPA 2015), it is recommend that a growth factor be included in the EIS model that includes additional stormwater runoff and water supply needs to assure that minimum flow needs and CWA standards are met.
- Although additional wastewater is accommodated in the 2015 Nutrient TMDL (EPA 2015), it is recommend that a growth factor be included in the EIS model that includes additional stormwater runoff and water supply needs to assure that minimum flow needs and CWA standards are met.
- The Ross Barnett Reservoir operational plan should be modified to address its water quality issues and the MS4s should be compelled through regulatory audits to improve water quality from their respective stormwater outfalls.
- St. Tammany suggests that the stormwater management plans for Jackson, Flowood and vicinity be thoroughly evaluated for opportunities to reduce runoff at the source.

## Modeling Requirements:

The EIS authors state that the Ross Barnett discharge rate contributes minimally to that of the mouth outfalls.

- Rankin Hinds Pearl River Flood & Drainage Control District should produce a defensible, robust unsteady model of the current conditions and projections for all of the conceptual alternatives.
- The geographic boundary of the hydraulic and hydrologic (H&H) model domain should include the Pearl River watershed from the Ross Barnett Reservoir to the Mississippi Sound and the Biloxi Marshes of Louisiana to provide a more accurate method of quantifying downstream flow impacts.
- A modeling scenario should be conducted using “worse-case conditions” of 10<sup>th</sup> percentile flow rates and 32<sup>o</sup>C temperatures, with a minimum 20% increased loadings to represent a margin of safety for growth.
- A minimum discharge from the Ross Barnett Reservoir and the proposed lake is required to provide adequate stream baseflow in order to minimize environmental impacts.
  - A minimum discharge must be determined from a large-scale modeling effort that satisfies stream baseflow necessary for downstream dischargers, public health, habitat and ecosystem needs.
- An unsteady model showing both maximum flooding and duration of flooding needs to be run for all conceptual alternatives over the entire model domain (Ross Barnett Reservoir to Lake Pontchartrain and the Mississippi Sound).
- Providing a growth factor with consequent discharge and load estimates assures that assimilative capacity and dissolved oxygen are preserved in the stream segments downstream of this discharger.
  - The State of Mississippi should assure that a growth factor is built into this release.
- A Water Budget should be developed for LA from Lake Pontchartrain to LS-MS state line to determine water needs for the Lower Pearl River Basin

## Maintenance of existing structures:

A significant amount of debris is reportedly blocking the structure’s weir lessening the amount of fresh water being diverted.

- It is suggested that the USACE conduct maintenance on the Walkiah Bluff structure to assure adequate freshwater to East Pearl during critical low-flow conditions