

Scope of Services

Cooperative Endeavor Agreement (CEA) between the Department of Natural Resources (DNR) And The Nature Conservancy (TNC)

Overview:

One of the main goals of the Atchafalaya Basin Program (ABP) is to improve water quality and manage sediment by restoring the natural hydrology of the Atchafalaya Basin. Meeting this goal requires management on a landscape scale, and in the past, such efforts have been hindered by land/water ownership issues.

The Atchafalaya Basin Program has worked with its Technical Advisory Group (TAG) from 2010 to present to design a complete and specific plan to address water quality and sedimentation in the East Grand Lake Water Management Unit (WMU) by modifying water flow patterns and managing sediment. This plan has not been implemented to date, because many key restoration features are on private property, and negotiations with landowners for easements have been unsuccessful.

Recent acquisition of property by The Nature Conservancy (TNC) in strategic locations has reinvigorated the East Grand Lake project, and this Cooperative Endeavor Agreement is designed to support the implementation of this plan through a partnership with TNC to construct and monitor water management features and to support construction of a science and restoration center in the project area. TNC intends to apply for matching funds from other sources; however, the scope of services shall remain the same whether or not matching funds are obtained.

Deliverables

This CEA supports engineering, design, and construction of water management features as well as science and restoration center structures. It requires monitoring of water management features and recommendations for adaptive management. In addition to the above items, the CEA allows for the purchase of equipment required for construction, maintenance, and monitoring of water management features.

Plans and designs for all features and structures shall be submitted to the ABP for approval, and the ABP will coordinate with the TAG and the public to provide feedback to TNC before projects are approved for construction.

FRED MILLS, JR.
State Senator
District 22
Parishes of:
Iberia, St. Martin, St. Landry, Lafayette

COMMITTEES
Health and Welfare, Chairman
Judiciary C
Local and Municipal Affairs

SENATE
STATE OF LOUISIANA

October 13, 2016

The Honorable John Bel Edwards
Post Office Box 94004
Baton Rouge, LA 70804

Dear Governor Edwards,

Thank you for your service to our state and to our citizens.

I am writing to you in support of the Atchafalaya Basinkeeper, Louisiana Crawfish Producers Association-West and Delta Chapter of the Sierra Club and their efforts to protect the Atchafalaya Basin from the East Grand Lake Project which has the potential to become detrimental to Louisiana.

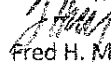
As you know, the Atchafalaya Basin is an area of wetlands that is of tremendous economic, ecological, cultural, and recreational value to the residents of Louisiana and the people of the United States. The biggest river swamp left in North America, it provides the largest harvest of wild crawfish in the world; critical for both migratory birds and our swamp-related part of our Louisiana Cajun culture. As important as the Atchafalaya Basin is for ecological values, we cannot forget that the Basin is also a Spillway that is critical for flood control.

The Atchafalaya Basin Program is moving forward with projects to increase river water inputs into the back swamps, lakes, and bayous of the Atchafalaya Basin, despite strong opposition from commercial fisherman and Louisiana's non-governmental entities that have been at the forefront of protecting the Atchafalaya Basin for years. It is feared that these projects are being implemented without a scientifically based plan to manage sediments away from open water and swamps which will greatly diminish the ability of the Spillway to handle future floods. In addition, projects to enlarge or create new cuts to increase river water diversions will most likely silt-up again in a short period of time.

I urge the State of Louisiana to halt the development or implementation of any restoration projects which introduce more river water into swamps, lakes, and bayous until sediment control measures are put in place to guarantee the integrity of those ecosystems. Additionally, all stakeholders should be included in developments of future projects that affect the Atchafalaya Basin, including Atchafalaya Basinkeeper, Louisiana Crawfish Producers Association - West, and the Delta Chapter of the Sierra Club.

Thank you for your consideration and your leadership.

Sincerely,


Fred H. Mills, Jr.

State Senator - District 22

cc: Department of Natural Resources



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JOHN BEL EDWARDS
GOVERNOR



THOMAS F. HARRIS
SECRETARY

State of Louisiana
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF THE SECRETARY

December 7, 2016

Fred H. Mills, Jr.
State Senator – District 22
1010 Martin Street
Parks, LA 70582

Dear Senator Mills,

Please accept this letter as a response to the October 13, 2016 letter you sent to Governor John Bel Edwards regarding the Atchafalaya Basin Program's East Grand Lake (EGL) Project.

The Atchafalaya Basin Program (ABP) has partnered with The Nature Conservancy (TNC) to move this project forward since TNC acquisition in 2015 of approximately 5400 acres in the project area. TNC's Atchafalaya Basin Preserve consists of 5 tracts, 3 of which are bound on the north by Bayou Sorrel. This construction project was nominated in the ABP's 2012 Annual Plan process, which followed the East Grand Lake Study that was completed through the 2010 Annual Plan and recommended restoration of North-to-South historical swamp sheet flow. This Annual Plan process is a requirement of Act 606 of the 2008 Legislature.

During the 2012 Annual Plan process, the ABP Technical Advisory Group (state and federal resource agency scientists) evaluated the study and approved the construction project for inclusion in the plan. Six public hearings were held during the Plan comment period. Two comments were received and noted in opposition to the project. The ABP Research and Promotion Board (parish presidents and state resource agency heads) approved the project to be included in the final version of the 2012 Annual Plan, which was then presented as HCR 34 in the 2011 Regular Session of the Legislature. In the House Natural Resources and Environment Committee hearing on May 18, 2011, no objections to the Annual Plan were made, and no cards of opposition were submitted. Cards of support were submitted by the Friends of the Atchafalaya, The Nature Conservancy, Audubon, LEAN, and the Delta Chapter of the Sierra Club.

The Atchafalaya River Basin (ARB) Initiative is TNC's vision for conservation and restoration of this great American wetland. Their vision is closely compatible with the ABP's mission to conserve, restore, and enhance the natural habitat of the Atchafalaya Basin. TNC's goal is to set the ARB on a path for a sustainable future through successful partnerships and habitat restoration. In order to achieve that goal, the ARB Initiative is multi-disciplinary; 2) addresses both conservation and restoration; 3) is science-based at the core; and 4) develops transparent stakeholder relations with local communities, crawfishermen, private landowners, public agencies, and others. The Initiative will also provide outreach and education opportunities that will result in mutually beneficial knowledge and appreciation for the Atchafalaya for the public at large.

In place of a limited number of water inputs that currently direct water and sediment into only a few locations, the project will redirect water and sediment more evenly throughout the area south of Bayou Sorrel to re-establish a more natural hydrologic regime that will provide nutrients for the forest and offset the naturally occurring subsidence that has been documented in this part of south Louisiana.

Mr. Lynn Greenwalt, former director of the US Fish and Wildlife Service, pointed out several significant points regarding the Atchafalaya Basin:

- Protection of the Atchafalaya may be the next big land issue following on the heels of the Redwoods and Alaska.
- There is no clear position of the environment/conservation community on how to preserve the Basin.
- There is no viable "do nothing" alternative.
- Something must be done soon.

Mr. Greenwalt's comments were made in 1980. Thirty-six years later, these points are still valid. Much work remains to be done; however, we finally have the opportunity to move beyond the status quo toward restoration of the Atchafalaya Basin.

The ABP is required by Act 606 of the 2008 Legislature to expend 75% of Capital Outlay funds available for the program on water quality / water access projects. Improving water quality in the Basin will always involve concerns about sediment. It is the intention of the Atchafalaya Basin Program to extend the life of the naturally-filling swamps by responsible adaptive management.

Thank you for your time to consider these comments. Please contact Don Haydel, Director, of the Atchafalaya Basin Program at (225) 342-8953 or at don.haydel@la.gov if you have any questions or concerns.

Sincerely,

A handwritten signature in dark ink, appearing to read 'T. F. Harris', written in a cursive style.

Thomas F. Harris
Secretary

cc: John Bel Edwards, Governor of Louisiana

Louisiana

The Atchafalaya River Basin Initiative

At almost a million acres, the Atchafalaya River Basin is North America's largest floodplain swamp.

The Nature Conservancy in Louisiana has identified the Atchafalaya River Basin as one of the state's most important natural habitats.

And now, working with landowners and other partners, we're able to work to protect this unique landscape for people and nature for the first time in its history.

This one-million acre wetland is one of the few relatively intact major river basins in North America, and contains the only actively building delta system in the Gulf of Mexico.

The Atchafalaya contains an especially high variety of plants and wildlife that is not only important for nature's sake, but also to the people who make their living from the Atchafalaya's lands and waters. In fact, the value of the Basin's natural services (flood control, carbon storage, navigation, oil and gas resources, forest, fish and wildlife resources, and nutrient reduction) is valued at billions of dollars annually.

But the future of the Atchafalaya is at risk and has spurred an initiative to conserve and restore its resources.

Conservation and restoration in the Basin will require a combination of approaches, and the Conservancy has created the *Atchafalaya River Basin Initiative* to engage our strengths in partnership building, science, and land protection to ensure that it remains a magnificent American landscape.

- **First**, we have worked with partners to develop and maintain a strong scientific baseline for conservation and restoration.
- **Next**, we are working with the state, partners and stakeholders to develop a decision making process that fully engages stakeholders in designing the future Atchafalaya, places landowner vision at the forefront, and promotes science-based decisions.

- **Lastly**, we will launch a comprehensive land-protection and restoration program for the Atchafalaya River Basin by acquiring initial tracts of forested wetland to serve as the foundation for a new Atchafalaya Basin Preserve.

This platform preserve builds on our previous work and establishes a place from which we can work with landowners, agencies, universities, the oil and gas industry, barge industry and others to implement key strategies for restoration and protection. This preserve and our comprehensive *Atchafalaya River Basin Initiative* will help protect a vitally important freshwater system that provides flood protection for millions of Americans, livelihoods and recreation for countless Louisianans, critical habitat for hundreds of fish and wildlife species, a source of drinking water, and the heartbeat of a unique American heritage and culture.

INITIAL COMMENTS ON THE NATURE CONSERVANCY PROJECT IN EAST GRAND LAKE, ATCHAFALAYA FLOODWAY

By

Ivor van Heerden, Ph.D.

Agulhas Ventures, Inc.

260 Captains Way

Reedville, VA 22539

For Atchafalaya Basinkeeper.

August 2017

BACKGROUND

Unique Swamp Basin

The Atchafalaya basin is the largest swamp wilderness in the US. The swamps of the Atchafalaya Basin are one of the most productive wetlands in the world, critical amongst many other values; a haven for migratory birds. They also have a very important and crucial public safety function as part of the Corps of Engineers M R @ T flood control system. The swamps and associated cultural/socioeconomic activities makes the Atchafalaya Basin are one of the most unique ecosystems in the world. Louisiana, as the steward of these incredible forested wetlands, has an obligation to do what it can to preserve them for generations to come.

Current sediment accretion levels in the Basin are not natural and are destroying one of the most unique ecosystems in the world.

The Atchafalaya Basin, formed in a cypress swamp depression between the levee systems of two former courses of the Mississippi River, offered a shorter course to the sea such that the Atchafalaya River started to capture Mississippi flows in the mid 1500's. The federal government then constrained the Atchafalaya distributary by building a structure at the point of diversion from the Mississippi, and also constructing guide levees to contain Atchafalaya Floods within a Floodway basically cutting the size of the receiving basin by 50%. As a consequence sedimentation rates within the Floodway increased significantly, something the federal government had not taken into consideration. Cut the receiving basin area by half suggests that the average annual sediment accretion rate would double. If your interest is in preserving and maintaining this incredible swamp wilderness then you want to keep the sediment out as much as possible. Swampland is rare especially on the scale of this Basin; bottomland hardwoods are far more common and definitely less ecologically diverse.

Coupled with the M R @ T floodway alterations has being the construction of numerous pipelines with associated channels and spoil banks; that have severely impacted the natural hydrology and circulation resulting in some areas of stagnation due to low dissolved oxygen content, and some areas of enhanced sedimentation and conversion of swamp to hardwood forests. Both these actions severely stress the natural productivity of the swamp land and hence commercial crawfish harvesting, amongst other activities. The bottom line is once a swamp is filled-in it is no longer a swamp, and pretty much lost as such forever.

East Grand Lake Project

Based on the ABP 2017 Annual Plan the funding of this project along with others in the Upper Region is the first step in developing the plan to realign water flow patterns and strategically redirect sediment in the EGL Project area. My initial review of the project leads me to believe it will enhance sedimentation in the swamps. Accretion in the project area will make cypress regeneration even less likely because it promotes the growth of water elm, swamp privot and vines (ladies eardrop, Brunnichia Ovata) will eventually cover everything.

In initial opinion is that the project will accelerate the infilling of the East Grand Lake project area. I suggest a full scientific review before moving forward. Once a swamp is filled in – it is gone forever. We owe it to future generations not to destroy this unique ecosystem.



**Atchafalaya River Basin Monitoring Program
for East Grand Lake Restoration Activities**

Annual Report
December 2017
DNR Contract NO. ABFP-17-03
LaGov NO. 4400013244

Prepared by:

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The Nature Conservancy

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Introduction

The Atchafalaya Basin Program's East Grand Lake Project (EGL) is the state of Louisiana's restoration plan for an 81,918 hectare portion of the Atchafalaya Basin bound by Bayou Sorrel, the Atchafalaya River, and the East Atchafalaya Guide Levee (LDNR 2012). The project area is partitioned into three main regions: Upper Region, Lower Region and Western Region. These regions were then subdivided into smaller Assessment Units (AU) to aid in the planning and implementation of project features. The Nature Conservancy's Atchafalaya Basin Preserve falls within the Upper Region and spans a portion of AUs 1, 2, 3, 5, and 6 (Figure 1).

The main strategy of the EGL Project is to improve the north to south flow of water through the area during moderate river stages (i.e., 3.0-3.6 m at Butte La Rose) to improve water quality and ecosystem health. The swamps in this area suffer from poor water quality due to historic hydrologic alterations. Currently, Atchafalaya River water tends to stay confined within the banks of distributary channels and does not flood the backswamps until extremely high-water levels occur with high river flow. For example, water entering Bayou Sorrel heads south through School Board Canal, Indigo Bayou, Salt Mine Bayou, and the GIWW, but tends to pass through those channels with little to no communication with adjacent swamps until water levels are high (LDNR 2012). Significant overbank flow into those AUs from Bayou Sorrel does not happen until the Butte La Rose gauge is greater than 5.5 m. Below this stage, inflow is limited to point source locations including input from the Florida gas pipeline along the southern border. The EGL project consists of hundreds of separate project features, but within the Upper Region there are two major types of features: those that increase the flow of river water from channels into the backswamps at the north end of AU's and those that increase drainage of water at the southern end of AU's. To date, there has been no work done on an AU that incorporates both types of features.

The goal of this monitoring program is to evaluate the effectiveness of hydrologic restoration done as part of the EGL Project. This project has many restoration features, and it will be necessary to assess the effectiveness of selected individual project features, as well as the combined effects of multiple project features. By providing a network of stations across the area, we can assess not only the areas affected by project features, but also the ecological condition of areas not being restored (i.e., reference sites). Therefore, a small network of stations, similar to that employed by the Coastwide Reference Monitoring System (CRMS) has been deployed throughout the study area (CRMS 2014).

Methods

Site Description

The Nature Conservancy's Atchafalaya Basin Preserve was established in 2015 in the vicinity of Bayou Sorrel. The Preserve consists of five distinct tracts that are surrounded by a mix of private and State Lands (Figure 1). The habitat is predominantly baldcypress/water tupelo swamp, with bottomland hardwoods dominating the higher ground along channels and canals.

Seven monitoring stations were setup in the Atchafalaya Basin Preserve and adjacent State Lands (Figure 1). Each station consists of a fixed wooden structure with a 4" perforated PVC pipe that houses a YSI Exo2 multiparameter sonde. Each sonde is equipped with sensors to measure water level, dissolved oxygen, turbidity, specific conductance, and temperature. The sondes are also equipped with a central wiper which cleaned the sensors twice an hour to prevent biofouling. The sondes collected data every hour, and data were then binned to give daily averages for analysis.

Sondes were deployed throughout the year except for periods of regular maintenance and calibration. Additionally, low water levels during the fall and winter months prevented sonde deployment and data collection.

To date, no restoration has been conducted in the area, so all data presented within this report can be considered pre-restoration monitoring.

Results

There was a small rise in water levels during February, which was followed by a short period of low water in March (Figure 2). Water began to rise in the spring with the highest water levels of the year occurring in early June. The water levels at each monitoring station during the flood pulse (April to July) mimicked the overall rise and fall of the Atchafalaya River at Butte La Rose (Figure 3). The peak water level at Butte La Rose 5.85 m on 05/31/17 corresponded to peak water levels at the monitoring stations on 06/01/17. Peak water depths at the monitoring stations varied from 1.7 m to 2 m depending on local topography. When water levels at Butte La Rose reached 5.5 m water began to flow over the banks of Bayou Sorrel, while a Butte La Rose level of approximately 5.2 m led to overbank flow along Little Tensas Bayou (Figure 4).

During the passage of the flood pulse dissolved oxygen levels increased at all sites, but the magnitude and duration of that response varied from site to site (Figures 5a and 5b). For example, Site AU2N had a short duration peak in dissolved oxygen that corresponded to overbank flooding along Bayou Sorrel, while site AU2SW had two peaks on dissolved oxygen. The first peak occurred when water came over the bank of the Florida Gas canal and water moved south to north. The second peak occurred after water came overbank along Bayou Sorrel. This overbank flooding also changed conditions at site AU6 (Figure 5b). Sites AU1 and AU5 had a similar dissolved oxygen response from the flood pulse (Figure 5a). Both sites exhibited low dissolved oxygen before and after the flood, but the flood boosted dissolved oxygen at these sites for almost one month when water was coming over the bank. The only site that didn't see an ecologically

significant increase in dissolved oxygen from the flood pulse was site T3, which is on the north side of Bayou Sorrel. There was a small increase in dissolved oxygen at this site, however it barely reached 2 mg/l which is the threshold for hypoxia. The passage frontal systems also had brief impacts on the dissolved oxygen concentrations at the sites. For example, the small dissolved oxygen peaks on May 3rd and June 29th corresponded with precipitation events and reduced air temperatures as frontal systems passed through the area.

Turbidity at all sites was also impacted by the flood pulse, but again the magnitude and duration of that response varied from site to site (Figures 5a and 5b). For example, increases in turbidity mirrored increases in dissolved oxygen at sites AU3, AU5, and AU2SW, but sites AU2N, AU6, and AU1 had increases in turbidity that began before there was a corresponding increase in dissolved oxygen. The outlier, again, was site T3 on the north side of Bayou Sorrel which had short duration increase in turbidity that was smaller in magnitude than the other sites.

Discussion

Dissolved oxygen and turbidity proved to be good tracers of the presence of river water at the backswamp monitoring stations. The overbank flooding along Bayou Sorrel and Little Tensas Bayou during the 2017 high water event allowed us to document an on-the-ground water quality improvement from increased river connectivity. We also saw how quickly water quality (i.e., dissolved oxygen) declined once the sites became disconnected from river water after the flood pulse subsided.

References

- CRMS 2014. TM Folse, LA Sharp, JL West, MK Hymel, JP Troutman, TE McGinnis, D Weifenbach, WM Boshart, LB Rodrigue, DC Richardi, WB Wood, and CM Miller. 2008, revised 2014. A Standard Operating Procedures Manual for the Coastwide Reference Monitoring System-Wetlands: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control. Louisiana Coastal Protection and Restoration Authority. Baton Rouge, LA. 228 pp.
- Louisiana Department of Natural Resources. 2012. East Grand Lake Phase 1: Initial Project Development Assistance Report. Atchafalaya Basin Program DNR ABP Project 201006.

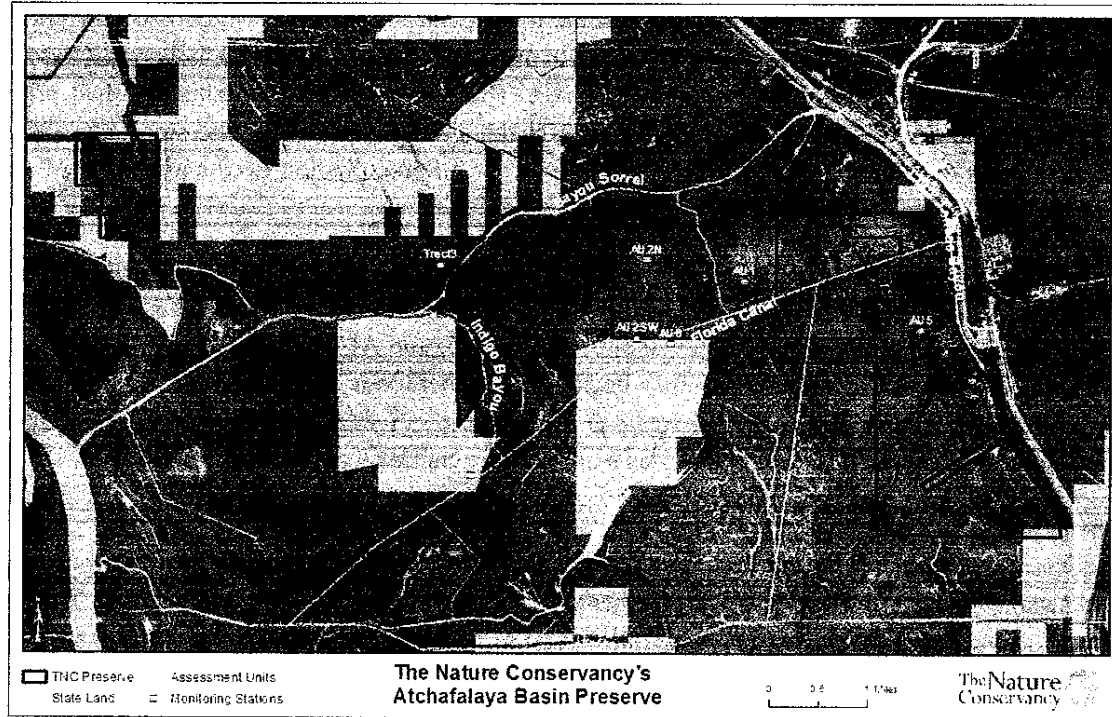


Figure 1. Monitoring stations on TNC's Atchafalaya Basin Preserve and State Lands.

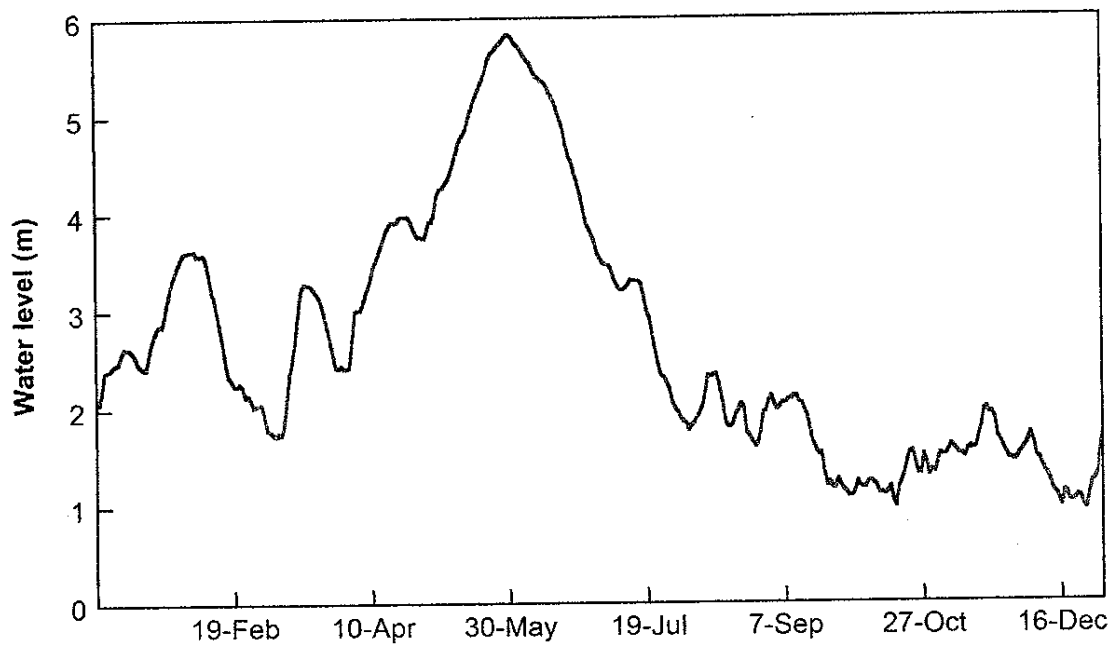


Figure 2. Daily mean water levels at Butte La Rose during 2017. Preliminary data from USGS gage 07381515 Atchafalaya River at Butte La Rose, LA.

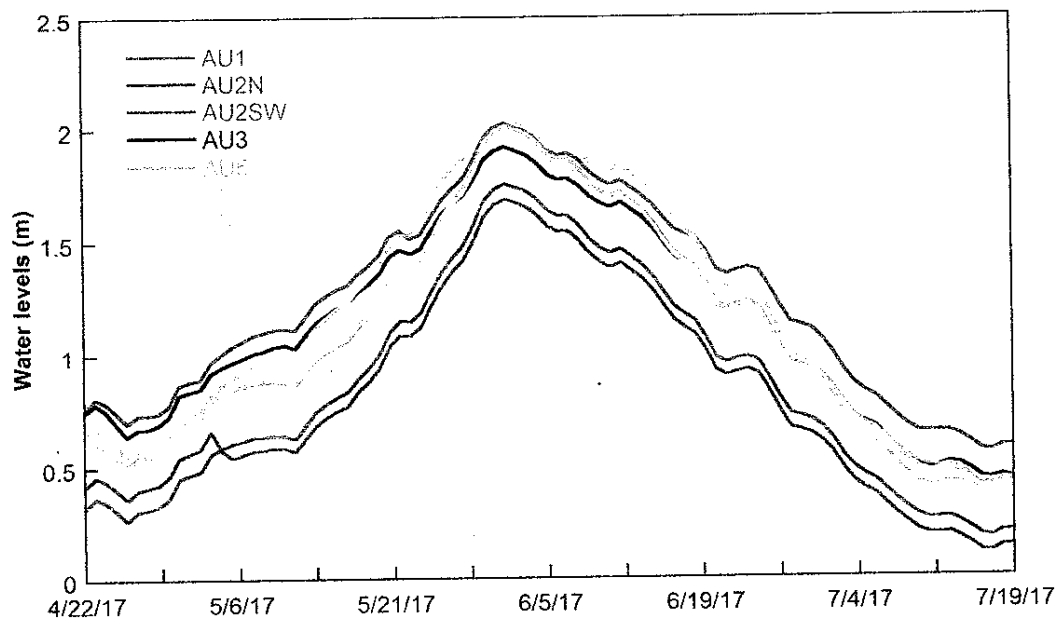


Figure 3. Daily mean water levels during the 2017 flood pulse at the seven monitoring sites.



Figure 4. Overbank flooding along Bayou Sorrel on June 2, 2017.

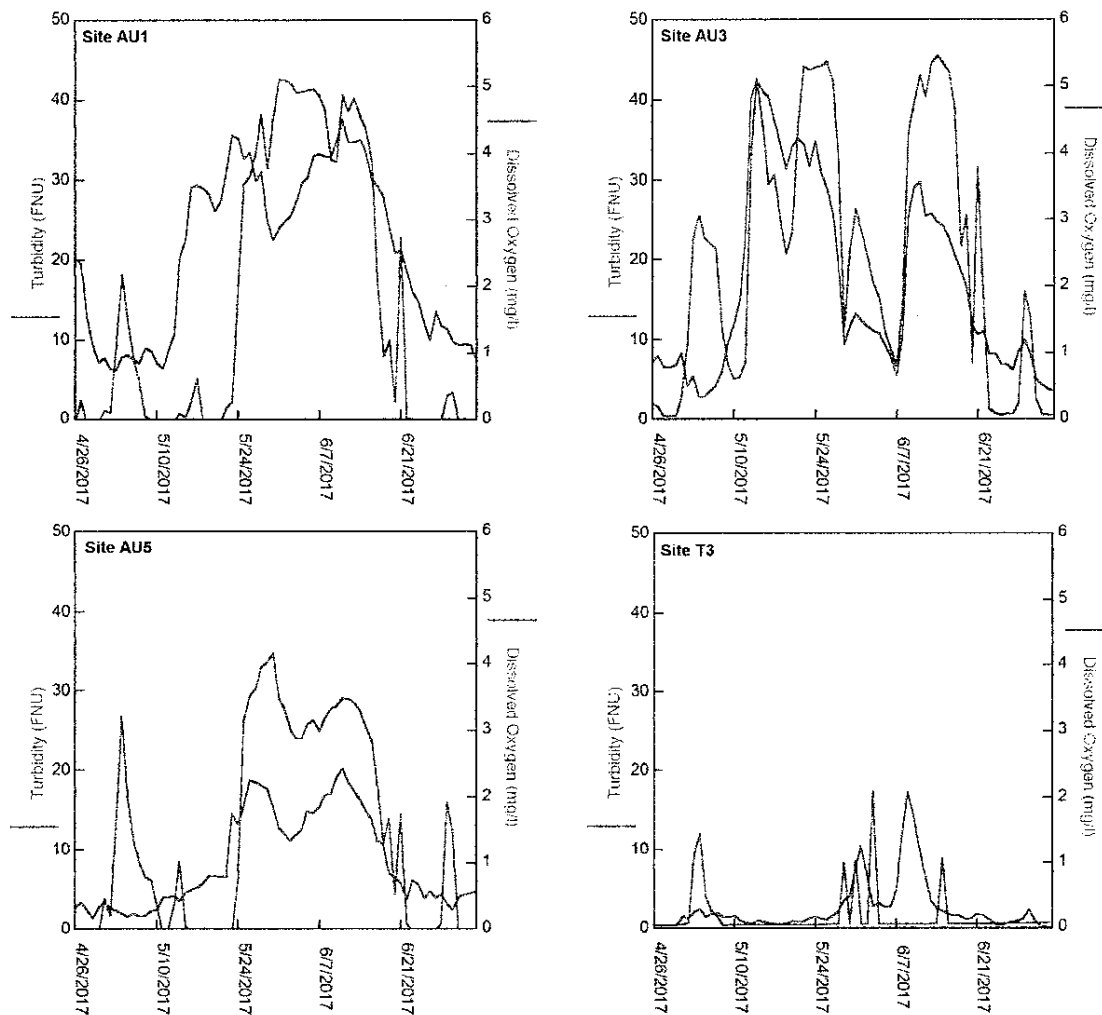


Figure 5a. Turbidity and dissolved oxygen from April to July 2017.

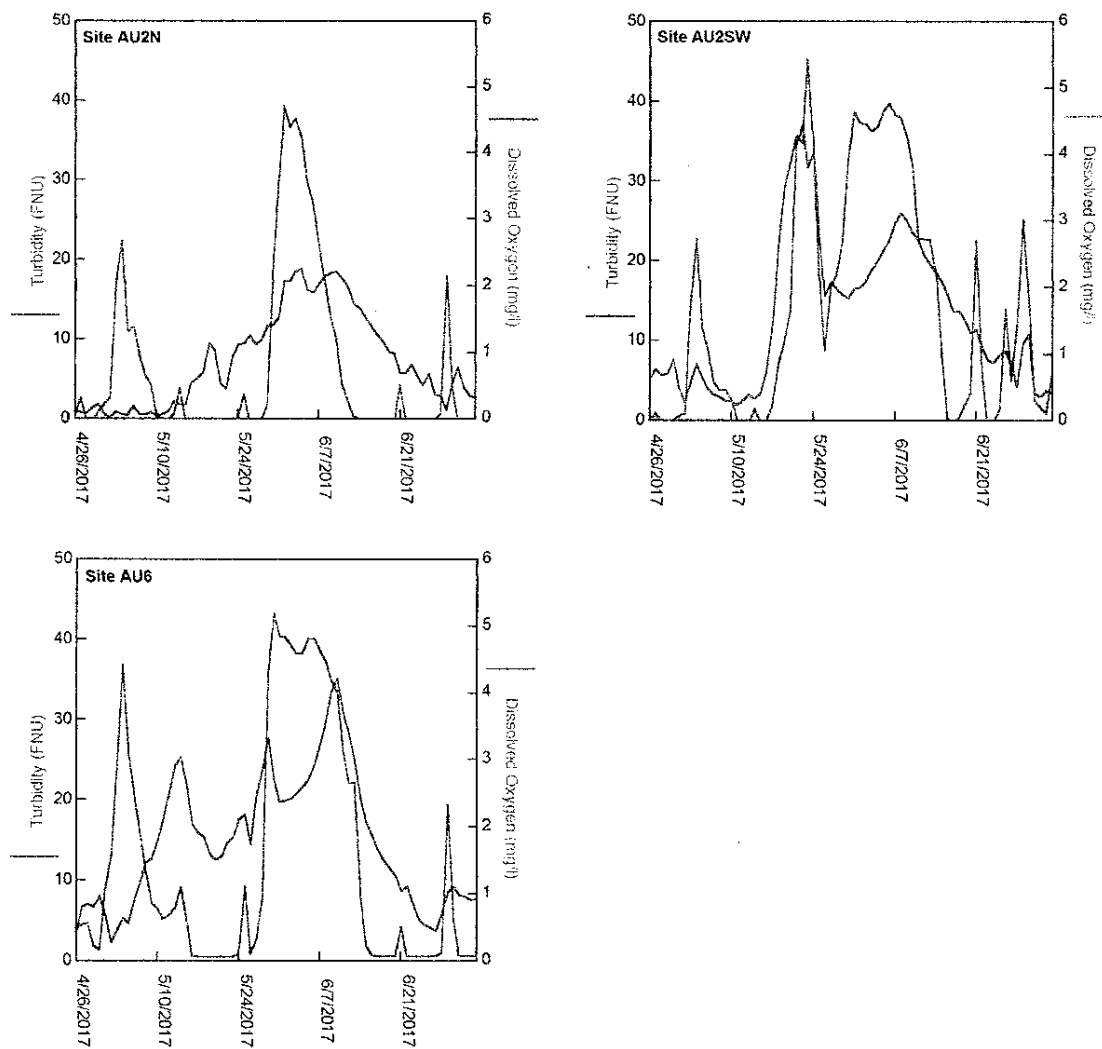


Figure 5b. Turbidity and dissolved oxygen from April to July 2017.

Appendix

Table 1. Daily summary of sonde data.

Date	Site	Water level (m)	Temperature (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (µS/cm)	Turbidity (FNU)
4/22/2017	AU1	0.76	22.8	0.01	466	20.3
4/23/2017	AU1	0.81	22.2	0.55	442	13.3
4/24/2017	AU1	0.79	20.3	0.38	439	13.4
4/25/2017	AU1	0.75	20.2	0.51	435	14.5
4/26/2017	AU1	0.70	20.6	0.00	443	20.4
4/27/2017	AU1	0.73	21.2	0.28	441	19.6
4/28/2017	AU1	0.74	21.5	0.00	456	12.7
4/29/2017	AU1	0.74	21.8	0.00	425	9.3
4/30/2017	AU1	0.78	21.9	0.00	459	7.2
5/1/2017	AU1	0.86	21.9	0.13	434	7.8
5/2/2017	AU1	0.88	21.6	0.10	420	6.4
5/3/2017	AU1	0.89	21.3	1.09	401	6.2
5/4/2017	AU1	0.97	20.2	2.18	365	7.9
5/5/2017	AU1	1.01	19.2	1.49	362	8.1
5/6/2017	AU1	1.04	19.2	0.91	365	7.7
5/7/2017	AU1	1.06	19.4	0.57	362	7.1
5/8/2017	AU1	1.09	19.8	0.04	366	9.0
5/9/2017	AU1	1.10	20.1	0.00	373	8.6
5/10/2017	AU1	1.11	20.4	0.00	376	7.2
5/11/2017	AU1	1.12	20.7	0.00	387	6.4
5/12/2017	AU1	1.11	20.9	0.00	394	8.6
5/13/2017	AU1	1.17	21.0	0.00	401	10.7
5/14/2017	AU1	1.23	20.8	0.08	356	20.2
5/15/2017	AU1	1.26	20.7	0.03	341	22.6
5/16/2017	AU1	1.29	20.7	0.25	323	29.1
5/17/2017	AU1	1.31	20.7	0.61	315	29.4
5/18/2017	AU1	1.36	20.7	0.00	323	29.0
5/19/2017	AU1	1.40	20.8	0.00	325	28.3
5/20/2017	AU1	1.44	21.0	0.00	331	26.2
5/21/2017	AU1	1.52	21.3	0.00	332	27.3
5/22/2017	AU1	1.55	21.6	0.18	323	31.2
5/23/2017	AU1	1.51	21.8	0.25	325	35.7
5/24/2017	AU1	1.53	22.0	2.01	321	35.3
5/25/2017	AU1	1.61	21.8	3.54	323	32.7
5/26/2017	AU1	1.68	22.1	3.66	325	33.5
5/27/2017	AU1	1.73	22.7	4.02	328	29.9
5/28/2017	AU1	1.78	23.2	4.59	334	31.0
5/29/2017	AU1	1.86	23.4	3.78	334	24.8
5/30/2017	AU1	1.96	23.2	4.49	328	22.5
5/31/2017	AU1	2.00	23.4	5.11	332	23.9
6/1/2017	AU1	2.02	23.7	5.10	332	24.8
6/2/2017	AU1	2.01	24.1	5.06	327	25.5
6/3/2017	AU1	1.99	24.3	4.91	322	27.3
6/4/2017	AU1	1.96	24.5	4.93	321	29.7

6/5/2017	AU1	1.91	24.3	4.95	317	30.3
6/6/2017	AU1	1.88	24.2	4.97	317	33.0
6/7/2017	AU1	1.89	24.3	4.86	321	33.3
6/8/2017	AU1	1.87	24.1	4.65	330	32.9
6/9/2017	AU1	1.81	24.1	3.91	331	32.9
6/10/2017	AU1	1.78	24.5	3.88	326	35.0
6/11/2017	AU1	1.75	24.9	4.87	326	37.6
6/12/2017	AU1	1.77	25.1	4.64	338	34.7
6/13/2017	AU1	1.74	25.3	4.82	355	34.7
6/14/2017	AU1	1.70	25.4	4.55	362	35.1
6/15/2017	AU1	1.66	25.7	4.37	373	33.4
6/16/2017	AU1	1.60	25.9	3.88	375	30.2
6/17/2017	AU1	1.55	25.9	2.04	381	29.3
6/18/2017	AU1	1.53	26.0	0.95	389	27.9
6/19/2017	AU1	1.52	25.9	1.20	389	24.2
6/20/2017	AU1	1.46	25.9	0.26	397	20.9
6/21/2017	AU1	1.37	25.7	2.73	371	21.2
6/22/2017	AU1	1.35	25.4	0.02	381	18.6
6/23/2017	AU1	1.37	25.4	0.00	390	16.0
6/24/2017	AU1	1.38	25.5	0.00	398	14.7
6/25/2017	AU1	1.37	25.6	0.00	423	11.9
6/26/2017	AU1	1.29	25.8	0.00	417	10.0
6/27/2017	AU1	1.21	25.9	0.00	411	13.5
6/28/2017	AU1	1.14	25.8	0.00	425	11.8
6/29/2017	AU1	1.12	25.6	0.35	401	11.3
6/30/2017	AU1	1.11	25.3	0.40	376	9.8
7/1/2017	AU1	1.06	25.3	0.00	393	9.3
7/2/2017	AU1	1.00	25.5	0.00	401	9.5
7/3/2017	AU1	0.92	25.8	0.00	405	9.4
7/4/2017	AU1	0.86	26.0	0.00	414	7.5
7/5/2017	AU1	0.83	26.3	0.00	417	9.0
7/6/2017	AU1	0.80	26.5	0.00	421	8.2
7/7/2017	AU1	0.76	26.7	0.00	421	7.6
7/8/2017	AU1	0.72	26.9	0.00	418	8.7
7/9/2017	AU1	0.68	26.9	0.00	395	9.7
7/10/2017	AU1	0.65	26.7	0.19	380	12.5
7/11/2017	AU1	0.65	26.1	0.23	368	11.6
7/12/2017	AU1	0.65	25.9	0.13	357	10.3
7/13/2017	AU1	0.65	26.1	0.00	372	10.1
7/14/2017	AU1	0.63	26.3	0.00	373	9.7
7/15/2017	AU1	0.60	26.4	0.02	371	9.2
7/16/2017	AU1	0.57	26.4	0.00	371	8.8
7/17/2017	AU1	0.56	26.4	0.00	379	8.5
7/18/2017	AU1	0.58	26.4	0.00	378	7.7
7/19/2017	AU1	0.58	26.4	0.00	379	7.8

Date	Site	Water level (m)	Temperature (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (µS/cm)	Turbidity (FNU)
4/22/2017	AU2N	0.33	22.6	0.18	458	1.4

4/23/2017	AU2N	0.37	21.6	0.45	436	0.8
4/24/2017	AU2N	0.35	19.9	0.12	429	1.1
4/25/2017	AU2N	0.31	19.6	0.40	418	0.9
4/26/2017	AU2N	0.27	20.3	0.07	423	0.8
4/27/2017	AU2N	0.31	21.0	0.31	412	0.8
4/28/2017	AU2N	0.32	21.5	0.00	414	0.6
4/29/2017	AU2N	0.33	22.1	0.00	426	1.3
4/30/2017	AU2N	0.37	22.6	0.11	418	1.8
5/1/2017	AU2N	0.45	21.6	0.21	388	0.6
5/2/2017	AU2N	0.47	21.1	0.31	388	0.0
5/3/2017	AU2N	0.48	20.7	2.04	367	0.8
5/4/2017	AU2N	0.56	19.7	2.66	339	0.6
5/5/2017	AU2N	0.59	18.7	1.31	332	0.4
5/6/2017	AU2N	0.61	18.7	1.37	331	1.6
5/7/2017	AU2N	0.62	19.0	0.97	335	0.5
5/8/2017	AU2N	0.64	19.4	0.65	339	0.4
5/9/2017	AU2N	0.64	19.8	0.50	344	0.8
5/10/2017	AU2N	0.65	20.1	0.06	346	0.4
5/11/2017	AU2N	0.64	20.5	0.00	348	0.5
5/12/2017	AU2N	0.63	20.8	0.00	350	0.8
5/13/2017	AU2N	0.69	21.0	0.08	348	2.1
5/14/2017	AU2N	0.75	20.9	0.45	342	1.8
5/15/2017	AU2N	0.78	21.0	0.00	348	1.7
5/16/2017	AU2N	0.81	21.1	0.00	345	4.5
5/17/2017	AU2N	0.83	21.3	0.00	344	5.0
5/18/2017	AU2N	0.89	21.4	0.00	336	5.7
5/19/2017	AU2N	0.94	21.5	0.00	321	9.4
5/20/2017	AU2N	1.00	21.7	0.00	326	8.5
5/21/2017	AU2N	1.10	21.9	0.00	346	4.4
5/22/2017	AU2N	1.15	22.1	0.00	361	3.7
5/23/2017	AU2N	1.14	22.1	0.00	344	7.6
5/24/2017	AU2N	1.19	22.1	0.00	307	9.2
5/25/2017	AU2N	1.28	21.8	0.36	305	9.4
5/26/2017	AU2N	1.36	21.6	0.00	313	10.3
5/27/2017	AU2N	1.43	21.7	0.00	316	9.3
5/28/2017	AU2N	1.48	22.1	0.00	326	9.8
5/29/2017	AU2N	1.56	22.7	0.21	332	11.5
5/30/2017	AU2N	1.68	22.8	2.23	324	11.7
5/31/2017	AU2N	1.73	22.9	3.56	319	12.6
6/1/2017	AU2N	1.76	23.5	4.71	328	17.2
6/2/2017	AU2N	1.74	23.7	4.38	324	17.3
6/3/2017	AU2N	1.72	24.1	4.52	319	18.5
6/4/2017	AU2N	1.69	24.2	4.20	318	18.8
6/5/2017	AU2N	1.64	24.0	3.57	315	16.1
6/6/2017	AU2N	1.61	23.9	3.21	303	15.7
6/7/2017	AU2N	1.61	23.8	2.63	317	16.9
6/8/2017	AU2N	1.57	23.6	2.04	326	17.8
6/9/2017	AU2N	1.51	23.5	1.52	329	18.3
6/10/2017	AU2N	1.47	23.6	1.18	328	18.4

6/11/2017	AU2N	1.45	23.9	0.53	327	17.6
6/12/2017	AU2N	1.47	24.2	0.25	326	16.3
6/13/2017	AU2N	1.43	24.4	0.04	333	14.3
6/14/2017	AU2N	1.39	24.6	0.00	347	13.7
6/15/2017	AU2N	1.34	24.7	0.00	356	12.6
6/16/2017	AU2N	1.27	24.9	0.00	365	11.5
6/17/2017	AU2N	1.21	25.1	0.00	373	10.5
6/18/2017	AU2N	1.17	25.2	0.00	377	9.7
6/19/2017	AU2N	1.14	25.4	0.00	376	8.4
6/20/2017	AU2N	1.07	25.2	0.00	374	8.2
6/21/2017	AU2N	0.98	25.1	0.50	367	5.7
6/22/2017	AU2N	0.96	24.9	0.00	364	5.8
6/23/2017	AU2N	0.98	24.9	0.00	366	6.8
6/24/2017	AU2N	0.99	25.1	0.00	372	5.3
6/25/2017	AU2N	0.97	25.3	0.00	374	4.2
6/26/2017	AU2N	0.89	25.5	0.00	369	5.6
6/27/2017	AU2N	0.80	25.6	0.00	367	2.9
6/28/2017	AU2N	0.73	25.6	0.08	366	2.9
6/29/2017	AU2N	0.72	25.2	2.15	347	1.0
6/30/2017	AU2N	0.70	24.7	0.47	322	4.4
7/1/2017	AU2N	0.67	25.0	0.00	319	6.4
7/2/2017	AU2N	0.62	25.5	0.00	325	3.9
7/3/2017	AU2N	0.55	25.9	0.00	333	2.8
7/4/2017	AU2N	0.49	26.2	0.00	339	2.6
7/5/2017	AU2N	0.46	26.5	0.00	341	3.2
7/6/2017	AU2N	0.43	26.7	0.03	342	1.8
7/7/2017	AU2N	0.39	26.8	0.40	342	1.1
7/8/2017	AU2N	0.35	26.8	0.43	342	0.8
7/9/2017	AU2N	0.31	26.4	0.43	nd	0.0
7/10/2017	AU2N	0.28	25.9	0.71	336	0.4
7/11/2017	AU2N	0.26	25.3	0.82	330	0.4
7/12/2017	AU2N	0.26	25.1	0.96	320	0.3
7/13/2017	AU2N	0.27	25.6	0.92	316	0.9
7/14/2017	AU2N	0.25	25.6	1.23	312	0.7
7/15/2017	AU2N	0.22	25.5	1.26	311	0.4
7/16/2017	AU2N	0.18	25.6	1.08	311	0.3
7/17/2017	AU2N	0.18	25.7	1.16	311	0.1
7/18/2017	AU2N	0.20	25.7	0.93	310	0.2
7/19/2017	AU2N	0.21	25.8	0.78	310	0.2

Date	Site	Water level (m)	Temperature (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (µS/cm)	Turbidity (FNU)
4/22/2017	AU2SW	0.42	22.0	0.02	444	8.1
4/23/2017	AU2SW	0.46	21.1	0.14	414	4.9
4/24/2017	AU2SW	0.44	19.2	0.14	421	5.0
4/25/2017	AU2SW	0.40	19.1	0.42	415	5.1
4/26/2017	AU2SW	0.36	19.8	0.00	423	5.2
4/27/2017	AU2SW	0.40	20.5	0.11	415	6.4
4/28/2017	AU2SW	0.41	21.0	0.00	432	5.6

4/29/2017	AU2SW	0.42	21.5	0.00	437	5.8
4/30/2017	AU2SW	0.46	22.1	0.00	427	7.6
5/1/2017	AU2SW	0.55	21.2	0.06	392	4.0
5/2/2017	AU2SW	0.57	20.8	0.11	394	2.2
5/3/2017	AU2SW	0.59	20.4	1.76	370	4.6
5/4/2017	AU2SW	0.66	19.4	2.72	323	7.0
5/5/2017	AU2SW	0.58	18.3	1.36	319	5.4
5/6/2017	AU2SW	0.55	18.4	1.06	324	3.9
5/7/2017	AU2SW	0.56	18.8	0.57	326	3.2
5/8/2017	AU2SW	0.58	19.3	0.44	330	2.9
5/9/2017	AU2SW	0.58	19.7	0.46	332	2.4
5/10/2017	AU2SW	0.59	20.1	0.31	332	2.3
5/11/2017	AU2SW	0.59	20.4	0.01	332	1.9
5/12/2017	AU2SW	0.57	20.7	0.00	333	2.5
5/13/2017	AU2SW	0.63	20.8	0.00	342	3.1
5/14/2017	AU2SW	0.69	20.7	0.17	348	2.6
5/15/2017	AU2SW	0.72	20.7	0.00	349	3.4
5/16/2017	AU2SW	0.75	20.8	0.00	330	6.0
5/17/2017	AU2SW	0.77	20.9	0.23	325	12.0
5/18/2017	AU2SW	0.83	21.0	0.84	310	21.7
5/19/2017	AU2SW	0.88	21.1	1.17	300	29.2
5/20/2017	AU2SW	0.94	21.5	1.63	300	32.5
5/21/2017	AU2SW	1.04	21.9	4.12	302	35.7
5/22/2017	AU2SW	1.09	21.9	4.42	305	34.6
5/23/2017	AU2SW	1.08	22.1	3.80	309	45.1
5/24/2017	AU2SW	1.12	34.7	4.02	301	33.6
5/25/2017	AU2SW	1.22	21.7	2.18	318	23.4
5/26/2017	AU2SW	1.30	21.8	1.04	320	15.5
5/27/2017	AU2SW	1.36	22.3	2.01	321	17.3
5/28/2017	AU2SW	1.41	22.8	2.19	324	16.4
5/29/2017	AU2SW	1.50	23.3	2.68	329	15.6
5/30/2017	AU2SW	1.61	23.2	3.95	326	15.2
5/31/2017	AU2SW	1.66	23.2	4.62	325	16.4
6/1/2017	AU2SW	1.69	23.6	4.46	329	16.6
6/2/2017	AU2SW	1.67	23.9	4.45	326	17.4
6/3/2017	AU2SW	1.65	24.3	4.33	321	18.7
6/4/2017	AU2SW	1.62	24.4	4.40	318	19.9
6/5/2017	AU2SW	1.57	24.3	4.62	313	21.2
6/6/2017	AU2SW	1.54	24.2	4.77	311	22.4
6/7/2017	AU2SW	1.54	24.3	4.58	317	24.6
6/8/2017	AU2SW	1.51	24.2	4.55	324	25.9
6/9/2017	AU2SW	1.45	24.2	4.23	327	24.9
6/10/2017	AU2SW	1.41	24.4	3.83	325	23.6
6/11/2017	AU2SW	1.38	24.6	2.73	322	22.5
6/12/2017	AU2SW	1.40	24.8	2.72	321	20.8
6/13/2017	AU2SW	1.37	25.0	2.70	332	19.6
6/14/2017	AU2SW	1.33	25.2	2.20	346	18.5
6/15/2017	AU2SW	1.28	25.2	1.05	355	17.3
6/16/2017	AU2SW	1.21	25.2	0.03	361	15.6

6/17/2017	AU2SW	1.15	25.3	0.00	368	13.5
6/18/2017	AU2SW	1.11	25.5	0.02	374	13.6
6/19/2017	AU2SW	1.09	25.8	0.21	378	12.5
6/20/2017	AU2SW	1.02	26.0	0.40	381	10.9
6/21/2017	AU2SW	0.92	25.7	2.70	366	11.4
6/22/2017	AU2SW	0.90	25.6	0.72	366	9.2
6/23/2017	AU2SW	0.92	25.8	0.00	377	7.6
6/24/2017	AU2SW	0.93	26.0	0.00	382	7.2
6/25/2017	AU2SW	0.91	26.3	0.15	390	8.2
6/26/2017	AU2SW	0.83	26.2	1.66	398	8.7
6/27/2017	AU2SW	0.74	26.2	0.60	408	7.2
6/28/2017	AU2SW	0.67	26.0	1.42	401	4.2
6/29/2017	AU2SW	0.66	25.3	3.00	373	9.7
6/30/2017	AU2SW	0.64	25.1	1.83	348	10.7
7/1/2017	AU2SW	0.61	25.7	0.30	364	3.4
7/2/2017	AU2SW	0.56	26.3	0.19	375	2.9
7/3/2017	AU2SW	0.48	26.6	0.10	379	3.7
7/4/2017	AU2SW	0.43	26.9	0.72	376	3.3
7/5/2017	AU2SW	0.40	27.1	1.06	375	3.1
7/6/2017	AU2SW	0.37	27.3	0.89	376	3.0
7/7/2017	AU2SW	0.33	27.3	1.29	375	2.2
7/8/2017	AU2SW	0.28	27.2	1.24	376	1.9
7/9/2017	AU2SW	0.24	26.8	1.11	377	2.1
7/10/2017	AU2SW	0.21	26.2	1.32	376	2.0
7/11/2017	AU2SW	0.19	25.6	0.88	374	2.4
7/12/2017	AU2SW	0.19	25.6	1.02	375	2.8
7/13/2017	AU2SW	0.20	26.2	1.00	376	2.0
7/14/2017	AU2SW	0.18	26.3	0.82	379	2.1
7/15/2017	AU2SW	0.15	26.3	0.81	380	2.2
7/16/2017	AU2SW	0.11	26.3	0.82	386	3.5
7/17/2017	AU2SW	0.11	26.4	0.89	383	3.0
7/18/2017	AU2SW	0.14	26.4	0.88	392	3.9
7/19/2017	AU2SW	0.14	26.4	0.71	388	2.8

Date	Site	Water level (m)	Temperature (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (µS/cm)	Turbidity (FNU)
4/22/2017	AU3	0.75	19.8	0.07	376	18.9
4/23/2017	AU3	0.78	20.2	0.44	374	15.9
4/24/2017	AU3	0.75	19.6	1.35	372	5.8
4/25/2017	AU3	0.70	19.6	1.40	372	6.8
4/26/2017	AU3	0.64	19.7	0.24	372	7.2
4/27/2017	AU3	0.67	19.9	0.18	369	8.0
4/28/2017	AU3	0.68	20.0	0.05	371	6.5
4/29/2017	AU3	0.69	20.2	0.04	375	6.5
4/30/2017	AU3	0.73	20.4	0.04	379	6.8
5/1/2017	AU3	0.82	20.7	0.32	374	8.3
5/2/2017	AU3	0.84	20.7	1.20	364	4.1
5/3/2017	AU3	0.85	20.5	2.70	346	5.4
5/4/2017	AU3	0.92	19.9	3.06	323	2.8

5/5/2017	AU3	0.95	19.1	2.72	326	2.7
5/6/2017	AU3	0.97	19.0	2.64	332	3.5
5/7/2017	AU3	0.99	19.1	2.56	333	4.2
5/8/2017	AU3	1.01	19.3	1.36	338	5.9
5/9/2017	AU3	1.02	19.5	0.81	349	9.8
5/10/2017	AU3	1.04	19.6	0.61	360	11.7
5/11/2017	AU3	1.05	19.8	0.63	362	14.9
5/12/2017	AU3	1.03	20.0	0.86	356	22.1
5/13/2017	AU3	1.09	20.0	3.98	317	40.3
5/14/2017	AU3	1.14	19.9	5.11	298	42.2
5/15/2017	AU3	1.17	20.0	4.43	298	41.0
5/16/2017	AU3	1.21	20.2	3.54	298	40.4
5/17/2017	AU3	1.23	20.4	3.68	293	37.5
5/18/2017	AU3	1.28	20.6	2.97	293	34.3
5/19/2017	AU3	1.31	20.9	2.48	297	31.3
5/20/2017	AU3	1.36	21.4	2.80	300	34.1
5/21/2017	AU3	1.44	21.9	4.29	302	35.2
5/22/2017	AU3	1.46	22.1	5.30	303	34.5
5/23/2017	AU3	1.45	22.3	5.25	308	31.7
5/24/2017	AU3	1.47	22.3	5.28	315	34.7
5/25/2017	AU3	1.55	22.2	5.31	320	31.0
5/26/2017	AU3	1.62	22.5	5.36	321	28.9
5/27/2017	AU3	1.66	22.8	5.07	325	25.8
5/28/2017	AU3	1.70	23.3	3.92	325	19.4
5/29/2017	AU3	1.77	23.5	1.37	317	9.4
5/30/2017	AU3	1.86	23.5	2.52	323	11.7
5/31/2017	AU3	1.90	23.2	3.16	320	13.2
6/1/2017	AU3	1.92	23.4	2.83	319	12.3
6/2/2017	AU3	1.90	23.6	2.45	326	11.6
6/3/2017	AU3	1.89	23.9	2.05	332	11.1
6/4/2017	AU3	1.85	24.2	1.81	329	10.7
6/5/2017	AU3	1.80	24.3	1.33	324	9.3
6/6/2017	AU3	1.78	24.3	1.05	317	7.9
6/7/2017	AU3	1.78	24.2	0.80	316	5.5
6/8/2017	AU3	1.75	24.1	1.75	317	10.5
6/9/2017	AU3	1.70	24.3	4.29	325	25.3
6/10/2017	AU3	1.67	24.6	4.72	320	29.0
6/11/2017	AU3	1.65	24.9	5.17	323	29.7
6/12/2017	AU3	1.67	25.0	4.84	331	25.4
6/13/2017	AU3	1.64	25.4	5.35	352	25.7
6/14/2017	AU3	1.60	25.6	5.45	359	24.6
6/15/2017	AU3	1.56	26.0	5.35	370	24.2
6/16/2017	AU3	1.49	26.1	5.20	368	22.7
6/17/2017	AU3	1.43	26.3	4.66	372	20.6
6/18/2017	AU3	1.40	26.2	2.60	377	18.6
6/19/2017	AU3	1.38	26.2	3.06	377	16.5
6/20/2017	AU3	1.31	25.9	0.84	384	11.7
6/21/2017	AU3	1.22	40.7	3.79	358	10.6
6/22/2017	AU3	1.20	25.6	1.65	372	11.1

6/23/2017	AU3	1.22	25.5	0.15	376	8.2
6/24/2017	AU3	1.22	25.6	0.08	376	8.3
6/25/2017	AU3	1.20	25.6	0.06	380	6.9
6/26/2017	AU3	1.12	25.8	0.07	387	6.9
6/27/2017	AU3	1.03	25.8	0.07	393	6.2
6/28/2017	AU3	0.96	25.9	0.24	405	8.5
6/29/2017	AU3	0.95	25.6	1.92	393	10.0
6/30/2017	AU3	0.93	25.4	1.54	376	8.3
7/1/2017	AU3	0.89	25.5	0.30	380	5.0
7/2/2017	AU3	0.84	25.6	0.07	381	4.3
7/3/2017	AU3	0.77	25.8	0.06	384	3.8
7/4/2017	AU3	0.72	26.0	0.05	385	3.5
7/5/2017	AU3	0.69	26.3	0.05	388	3.1
7/6/2017	AU3	0.67	26.5	0.05	389	3.9
7/7/2017	AU3	0.62	26.7	0.06	378	5.0
7/8/2017	AU3	0.57	26.8	0.12	375	4.9
7/9/2017	AU3	0.53	26.7	0.67	371	4.8
7/10/2017	AU3	0.50	26.4	1.32	376	4.1
7/11/2017	AU3	0.49	25.9	1.43	383	4.2
7/12/2017	AU3	0.50	25.9	1.65	390	5.1
7/13/2017	AU3	0.51	26.1	1.50	387	5.5
7/14/2017	AU3	0.50	26.2	1.56	410	6.2
7/15/2017	AU3	0.48	26.2	1.87	445	6.0
7/16/2017	AU3	0.44	26.2	1.62	480	5.7
7/17/2017	AU3	0.44	26.3	1.36	493	5.6
7/18/2017	AU3	0.45	26.3	1.28	454	8.2
7/19/2017	AU3	0.44	26.3	0.86	417	8.6

Date	Site	Water level (m)	Temperature (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (µS/cm)	Turbidity (FNU)
4/22/2017	AU5	0.56	22.5	0.13	323	2.7
4/23/2017	AU5	0.60	21.9	0.40	311	2.0
4/24/2017	AU5	0.59	20.1	0.43	307	2.6
4/25/2017	AU5	0.55	19.9	0.16	303	2.9
4/26/2017	AU5	0.51	20.2	0.00	313	2.7
4/27/2017	AU5	0.55	20.7	0.00	327	3.3
4/28/2017	AU5	0.56	21.0	0.00	329	2.4
4/29/2017	AU5	0.57	21.4	0.00	342	1.3
4/30/2017	AU5	0.61	22.0	0.00	338	2.7
5/1/2017	AU5	0.69	21.7	0.44	306	3.2
5/2/2017	AU5	0.71	21.3	0.20	306	2.6
5/3/2017	AU5	0.72	21.0	1.50	308	2.3
5/4/2017	AU5	0.80	20.2	3.21	318	1.9
5/5/2017	AU5	0.83	19.2	2.02	319	1.4
5/6/2017	AU5	0.85	19.2	1.35	325	1.9
5/7/2017	AU5	0.86	19.4	1.03	331	1.5
5/8/2017	AU5	0.87	19.8	0.79	337	1.6
5/9/2017	AU5	0.88	20.2	0.74	348	2.2
5/10/2017	AU5	0.88	20.5	0.36	359	2.4

5/11/2017	AU5	0.88	20.8	0.00	367	3.9
5/12/2017	AU5	0.86	21.2	0.00	365	3.9
5/13/2017	AU5	0.92	21.4	0.35	352	4.2
5/14/2017	AU5	0.98	21.3	1.01	348	3.5
5/15/2017	AU5	1.01	21.4	0.04	342	4.6
5/16/2017	AU5	1.04	21.5	0.00	338	4.9
5/17/2017	AU5	1.06	21.7	0.00	334	5.2
5/18/2017	AU5	1.12	21.8	0.00	328	5.8
5/19/2017	AU5	1.17	21.9	0.00	324	6.6
5/20/2017	AU5	1.23	22.1	0.00	324	6.7
5/21/2017	AU5	1.33	22.1	0.00	330	6.6
5/22/2017	AU5	1.38	22.2	0.00	330	6.6
5/23/2017	AU5	1.38	22.2	0.00	322	14.5
5/24/2017	AU5	1.42	22.4	0.76	297	13.1
5/25/2017	AU5	1.51	22.1	3.11	301	15.4
5/26/2017	AU5	1.60	22.3	3.51	309	18.8
5/27/2017	AU5	1.67	22.8	3.63	311	18.5
5/28/2017	AU5	1.73	23.3	3.94	314	18.2
5/29/2017	AU5	1.82	23.3	4.02	313	17.7
5/30/2017	AU5	1.93	23.2	4.15	307	15.7
5/31/2017	AU5	1.98	23.3	3.49	308	12.8
6/1/2017	AU5	2.01	23.6	3.33	305	12.0
6/2/2017	AU5	2.00	23.8	3.01	303	11.2
6/3/2017	AU5	1.98	24.1	2.86	301	11.9
6/4/2017	AU5	1.94	24.3	2.87	300	12.5
6/5/2017	AU5	1.89	24.2	3.08	299	14.9
6/6/2017	AU5	1.87	24.2	3.15	298	14.6
6/7/2017	AU5	1.87	24.3	2.98	299	15.4
6/8/2017	AU5	1.83	24.3	3.18	303	16.9
6/9/2017	AU5	1.77	24.4	3.33	304	17.2
6/10/2017	AU5	1.73	24.6	3.37	302	19.1
6/11/2017	AU5	1.70	24.8	3.48	304	20.1
6/12/2017	AU5	1.72	24.9	3.48	311	18.6
6/13/2017	AU5	1.68	25.1	3.42	319	17.4
6/14/2017	AU5	1.64	25.3	3.29	324	16.3
6/15/2017	AU5	1.59	25.6	3.05	330	15.0
6/16/2017	AU5	1.52	25.8	2.84	334	13.7
6/17/2017	AU5	1.45	26.0	2.18	335	11.2
6/18/2017	AU5	1.42	26.0	1.30	338	10.7
6/19/2017	AU5	1.39	25.9	1.66	339	7.1
6/20/2017	AU5	1.32	25.9	0.52	341	6.4
6/21/2017	AU5	1.22	25.5	1.73	334	5.8
6/22/2017	AU5	1.20	25.5	0.08	336	3.6
6/23/2017	AU5	1.22	25.5	0.00	339	6.1
6/24/2017	AU5	1.23	25.6	0.00	346	5.6
6/25/2017	AU5	1.20	25.7	0.00	348	3.9
6/26/2017	AU5	1.12	25.8	0.00	343	4.8
6/27/2017	AU5	1.03	25.8	0.00	338	3.9
6/28/2017	AU5	0.96	25.8	0.08	337	4.3

6/29/2017	AU5	0.95	25.6	1.91	329	3.1
6/30/2017	AU5	0.94	25.4	1.46	325	2.4
7/1/2017	AU5	0.90	25.5	0.00	320	4.0
7/2/2017	AU5	0.85	25.8	0.00	324	4.4
7/3/2017	AU5	0.78	26.1	0.00	326	4.5
7/4/2017	AU5	0.72	26.4	0.00	331	4.7
7/5/2017	AU5	0.69	26.6	0.00	335	5.8
7/6/2017	AU5	0.66	26.9	0.00	334	6.7
7/7/2017	AU5	0.62	27.1	0.08	330	7.0
7/8/2017	AU5	0.58	27.2	0.10	322	5.9
7/9/2017	AU5	0.54	26.9	0.47	321	2.9
7/10/2017	AU5	0.51	26.3	1.41	315	1.8
7/11/2017	AU5	0.50	25.7	1.88	294	2.0
7/12/2017	AU5	0.49	25.5	1.19	280	3.6
7/13/2017	AU5	0.50	25.9	0.79	283	2.4
7/14/2017	AU5	0.48	26.0	0.77	284	2.7
7/15/2017	AU5	0.45	26.0	0.78	283	3.0
7/16/2017	AU5	0.41	25.9	0.76	275	2.5
7/17/2017	AU5	0.41	26.0	0.22	279	3.6
7/18/2017	AU5	0.43	26.1	0.36	278	2.8
7/19/2017	AU5	0.44	26.2	0.19	276	2.8

Date	Site	Water level (m)	Temperature (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (µS/cm)	Turbidity (FNU)
4/22/2017	AU6	0.56	19.9	0.98	411	14.8
4/23/2017	AU6	0.60	19.8	2.21	407	8.1
4/24/2017	AU6	0.58	18.7	1.78	404	4.3
4/25/2017	AU6	0.55	18.5	1.94	403	4.2
4/26/2017	AU6	0.50	18.9	0.49	407	3.5
4/27/2017	AU6	0.54	19.5	0.53	410	6.6
4/28/2017	AU6	0.55	19.8	0.55	413	7.0
4/29/2017	AU6	0.56	20.2	0.22	416	6.6
4/30/2017	AU6	0.60	20.6	0.16	423	8.0
5/1/2017	AU6	0.69	20.6	1.08	404	5.7
5/2/2017	AU6	0.71	20.2	1.56	397	2.2
5/3/2017	AU6	0.72	20.0	2.84	386	3.6
5/4/2017	AU6	0.81	19.3	4.40	350	5.2
5/5/2017	AU6	0.83	18.3	3.11	336	4.6
5/6/2017	AU6	0.85	18.4	2.45	347	7.6
5/7/2017	AU6	0.87	18.6	1.86	357	10.0
5/8/2017	AU6	0.88	18.9	1.28	368	12.2
5/9/2017	AU6	0.89	19.1	0.85	371	12.7
5/10/2017	AU6	0.89	19.3	0.78	372	14.8
5/11/2017	AU6	0.89	19.5	0.61	369	17.3
5/12/2017	AU6	0.87	19.6	0.68	362	20.7
5/13/2017	AU6	0.93	19.8	0.79	349	24.1
5/14/2017	AU6	0.99	19.8	1.09	330	25.2
5/15/2017	AU6	1.02	19.7	0.59	323	21.8
5/16/2017	AU6	1.05	19.8	0.06	330	16.9

5/17/2017	AU6	1.07	19.9	0.06	334	15.8
5/18/2017	AU6	1.13	20.0	0.05	338	15.4
5/19/2017	AU6	1.18	20.2	0.05	345	13.2
5/20/2017	AU6	1.24	20.4	0.06	350	12.5
5/21/2017	AU6	1.34	20.7	0.06	351	12.9
5/22/2017	AU6	1.38	20.9	0.06	352	14.6
5/23/2017	AU6	1.38	21.1	0.06	349	15.3
5/24/2017	AU6	1.42	21.3	0.10	342	17.5
5/25/2017	AU6	1.51	21.3	1.10	331	18.0
5/26/2017	AU6	1.60	21.4	0.10	333	14.5
5/27/2017	AU6	1.66	21.8	0.32	329	20.6
5/28/2017	AU6	1.71	22.4	0.94	332	23.6
5/29/2017	AU6	1.80	23.0	4.32	331	27.5
5/30/2017	AU6	1.91	23.1	5.19	326	22.6
5/31/2017	AU6	1.96	23.3	4.83	331	19.7
6/1/2017	AU6	1.98	23.6	4.84	330	19.8
6/2/2017	AU6	1.97	23.9	4.71	326	20.1
6/3/2017	AU6	1.95	24.2	4.58	320	20.7
6/4/2017	AU6	1.92	24.3	4.59	319	21.6
6/5/2017	AU6	1.87	24.2	4.80	312	22.3
6/6/2017	AU6	1.84	24.1	4.81	314	24.1
6/7/2017	AU6	1.84	24.2	4.64	320	26.6
6/8/2017	AU6	1.81	24.1	4.46	327	29.7
6/9/2017	AU6	1.75	24.2	4.18	325	33.4
6/10/2017	AU6	1.71	24.5	4.00	319	35.0
6/11/2017	AU6	1.68	24.6	3.13	325	31.1
6/12/2017	AU6	1.70	24.8	2.64	337	28.0
6/13/2017	AU6	1.67	24.9	2.65	352	24.8
6/14/2017	AU6	1.63	24.9	0.93	361	20.2
6/15/2017	AU6	1.58	24.9	0.22	370	17.2
6/16/2017	AU6	1.51	25.0	0.08	376	15.4
6/17/2017	AU6	1.44	25.1	0.06	382	13.7
6/18/2017	AU6	1.40	25.2	0.06	387	12.4
6/19/2017	AU6	1.37	25.2	0.08	395	11.5
6/20/2017	AU6	1.30	25.2	0.07	391	10.5
6/21/2017	AU6	1.21	25.2	0.49	378	8.6
6/22/2017	AU6	1.19	24.9	0.06	377	9.2
6/23/2017	AU6	1.21	25.0	0.06	382	7.1
6/24/2017	AU6	1.21	25.0	0.06	386	5.1
6/25/2017	AU6	1.19	25.2	0.07	390	4.4
6/26/2017	AU6	1.11	25.4	0.07	391	4.1
6/27/2017	AU6	1.02	25.5	0.07	389	3.7
6/28/2017	AU6	0.95	25.5	0.11	391	5.8
6/29/2017	AU6	0.94	25.4	2.32	387	8.5
6/30/2017	AU6	0.93	25.1	0.62	366	9.1
7/1/2017	AU6	0.89	25.2	0.08	378	8.2
7/2/2017	AU6	0.84	25.4	0.07	384	7.9
7/3/2017	AU6	0.76	25.6	0.07	391	7.5
7/4/2017	AU6	0.71	25.9	0.07	395	7.7

7/5/2017	AU6	0.67	26.1	0.07	395	8.8
7/6/2017	AU6	0.65	26.3	0.07	395	8.7
7/7/2017	AU6	0.60	26.4	0.12	390	9.6
7/8/2017	AU6	0.56	26.4	0.08	389	7.6
7/9/2017	AU6	0.52	26.3	0.43	386	7.4
7/10/2017	AU6	0.49	26.0	1.39	387	3.7
7/11/2017	AU6	0.47	25.4	1.33	385	1.9
7/12/2017	AU6	0.48	25.3	1.41	386	2.6
7/13/2017	AU6	0.48	25.4	0.14	396	4.4
7/14/2017	AU6	0.46	25.5	0.37	411	4.6
7/15/2017	AU6	0.43	25.6	0.71	424	4.2
7/16/2017	AU6	0.40	25.5	0.54	417	5.8
7/17/2017	AU6	0.39	25.6	0.09	418	8.7
7/18/2017	AU6	0.42	25.6	0.12	413	7.9
7/19/2017	AU6	0.42	25.6	0.07	418	7.0

Date	Site	Water level (m)	Temperature (°C)	Dissolved Oxygen (mg/l)	Specific Conductance (µS/cm)	Turbidity (FNU)
4/22/2017	T3	0.64	21.8	0.04	308	1.3
4/23/2017	T3	0.68	21.6	0.08	292	1.2
4/24/2017	T3	0.65	20.2	0.03	294	0.8
4/25/2017	T3	0.60	20.0	0.03	298	0.7
4/26/2017	T3	0.55	20.2	0.03	303	0.4
4/27/2017	T3	0.58	20.5	0.03	308	0.3
4/28/2017	T3	0.58	20.7	0.03	316	0.4
4/29/2017	T3	0.59	21.0	0.04	318	0.2
4/30/2017	T3	0.63	21.3	0.04	319	0.2
5/1/2017	T3	0.72	21.3	0.05	308	1.5
5/2/2017	T3	0.74	21.1	0.07	300	1.2
5/3/2017	T3	0.74	20.8	1.14	289	2.0
5/4/2017	T3	0.82	20.0	1.44	265	2.3
5/5/2017	T3	0.86	19.0	0.48	262	1.4
5/6/2017	T3	0.90	18.9	0.26	266	1.7
5/7/2017	T3	0.92	19.1	0.17	269	1.8
5/8/2017	T3	0.95	19.4	0.04	281	1.4
5/9/2017	T3	0.96	19.6	0.04	281	1.3
5/10/2017	T3	0.98	19.8	0.04	282	1.5
5/11/2017	T3	0.99	19.9	0.04	286	0.9
5/12/2017	T3	0.99	20.0	0.04	286	0.7
5/13/2017	T3	1.06	20.2	0.04	283	0.5
5/14/2017	T3	1.12	20.3	0.04	282	0.8
5/15/2017	T3	1.16	20.4	0.04	285	0.7
5/16/2017	T3	1.20	20.5	0.04	287	0.6
5/17/2017	T3	1.23	20.6	0.04	286	0.4
5/18/2017	T3	1.29	20.6	0.04	285	0.4
5/19/2017	T3	1.33	20.7	0.04	288	0.6
5/20/2017	T3	1.38	20.8	0.04	291	0.8
5/21/2017	T3	1.48	20.8	0.04	295	0.7
5/22/2017	T3	1.53	20.9	0.04	302	0.8

5/23/2017	T3	1.53	21.0	0.04	309	1.2
5/24/2017	T3	1.58	21.2	0.04	308	1.3
5/25/2017	T3	1.68	21.3	0.05	310	1.1
5/26/2017	T3	1.77	21.4	0.05	312	1.0
5/27/2017	T3	1.82	21.5	0.05	314	1.5
5/28/2017	T3	1.86	21.6	0.05	317	2.1
5/29/2017	T3	1.93	34.6	0.99	303	3.4
5/30/2017	T3	2.01	21.7	0.05	319	4.0
5/31/2017	T3	2.04	34.9	1.01	308	7.7
6/1/2017	T3	2.05	22.2	0.05	322	10.4
6/2/2017	T3	2.03	22.3	0.05	322	6.4
6/3/2017	T3	2.00	49.7	2.08	292	2.7
6/4/2017	T3	1.98	22.4	0.05	322	3.2
6/5/2017	T3	1.93	22.5	0.05	324	2.6
6/6/2017	T3	1.90	22.7	0.05	328	2.7
6/7/2017	T3	1.92	22.9	0.05	326	4.7
6/8/2017	T3	1.90	23.2	0.05	316	11.1
6/9/2017	T3	1.86	23.2	0.06	321	17.3
6/10/2017	T3	1.83	23.1	0.05	320	14.6
6/11/2017	T3	1.82	23.1	0.05	319	10.4
6/12/2017	T3	1.84	23.1	0.05	318	6.8
6/13/2017	T3	1.80	23.1	0.06	318	3.4
6/14/2017	T3	1.77	23.1	0.06	321	2.5
6/15/2017	T3	1.72	36.4	1.07	307	2.1
6/16/2017	T3	1.65	23.2	0.06	322	1.7
6/17/2017	T3	1.59	23.3	0.06	324	1.5
6/18/2017	T3	1.55	23.4	0.06	329	1.5
6/19/2017	T3	1.51	23.5	0.06	330	1.1
6/20/2017	T3	1.44	23.6	0.06	331	1.2
6/21/2017	T3	1.33	23.8	0.06	330	1.7
6/22/2017	T3	1.29	23.9	0.06	316	1.6
6/23/2017	T3	1.29	23.9	0.06	303	1.1
6/24/2017	T3	1.29	24.0	0.06	300	0.6
6/25/2017	T3	1.28	24.0	0.06	301	0.2
6/26/2017	T3	1.19	24.2	0.07	302	0.5
6/27/2017	T3	1.08	24.3	0.07	301	0.6
6/28/2017	T3	0.99	24.4	0.07	302	0.9
6/29/2017	T3	0.97	24.4	0.06	304	1.1
6/30/2017	T3	0.94	24.4	0.06	288	2.2
7/1/2017	T3	0.88	24.4	0.07	285	1.0
7/2/2017	T3	0.81	24.5	0.07	279	0.2
7/3/2017	T3	0.73	24.7	0.07	272	0.1
7/4/2017	T3	0.67	24.8	0.07	270	0.0
7/5/2017	T3	0.64	25.0	0.07	269	0.1
7/6/2017	T3	0.61	25.2	0.07	269	0.3
7/7/2017	T3	0.56	35.9	1.18	257	0.6
7/8/2017	T3	0.51	25.5	0.07	268	0.8
7/9/2017	T3	0.46	25.6	0.07	264	1.3
7/10/2017	T3	0.42	25.5	0.07	258	1.0

7/11/2017	T3	0.41	25.2	0.07	256	0.8
7/12/2017	T3	0.41	25.1	0.07	256	1.5
7/13/2017	T3	0.42	25.2	0.07	256	0.8
7/14/2017	T3	0.42	25.3	0.07	254	0.9
7/15/2017	T3	0.40	25.3	0.07	252	1.7
7/16/2017	T3	0.37	25.3	0.07	253	1.3
7/17/2017	T3	0.36	25.3	0.07	255	1.2
7/18/2017	T3	0.37	25.4	0.07	258	1.2
7/19/2017	T3	0.34	25.5	0.07	254	0.9

Atchafalaya Basinkeeper
P.O. Box 410
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December 21, 2017

The Nature Conservancy of Louisiana
Atchafalaya River Basin Initiative
Attention: Custodian of Public Records
P.O. Box 4125
Baton Rouge, Louisiana 70821
lafo@tnc.org

New Orleans Office
320 Hammond Highway, Suite 404
Metairie, Louisiana 70005
Via Email and Regular Mail

*Re: Request for Public Records regarding the Nature Conservancy's Atchafalaya
Basin Preserve and the Louisiana Department of Natural Resources, Atchafalaya
Basin Program's East Grand Lake Project (201006)*

Dear Custodian of Public Records,

On behalf of Atchafalaya Basinkeeper ("Basinkeeper"), and in accordance with the Louisiana Public Records Act, La. Rev. Stat. § 44:1 *et seq.*, Basinkeeper requests access to the following records in the possession or control of the The Nature Conservancy ("TNC") and/or TNC's Atchafalaya River Basin Initiative. Basinkeeper requests access to records relating to the "public-private partnership between TNC and the Louisiana Department of Natural Resources and their Atchafalaya Basin Program"¹ regarding the ABP's proposed East Grand Lake project, also referred to as TNC's Atchafalaya River Basin Initiative's Atchafalaya Basin Preserve in the Bayou Sorrel region of the Atchafalaya River Basin.

¹ See News Release, *The Nature Conservancy Launches Atchafalaya River Basin Initiative: Project will protect and conserve more than 5,000 acres of American's great swamp forest*, available at <https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/louisiana/explore/atchafalaya-acq-press-release-06-2015.pdf>.

Basinkeeper requests the following:

Any and all records related to the Louisiana Department of Natural Resources, Atchafalaya Basin Program's East Grand Lake project (201006)/TNC's Atchafalaya Basin Preserve in the Bayou Sorrel region in Iberville Parish (the "project"), including but not limited to:

- (a) Documents pertaining to the acquisition of real property upon which the project will be performed, including tracts acquired by The Nature Conservancy in pursuit of the project and its partnership with A. Wilbert's Sons LLC of Plaquemine;**
- (b) Modifications and amendments to the project since TNC's revival thereof;**
- (c) All research conducted by TNC, LDNR and/or affiliates, including results, data and information gathered pursuant to ABP's monitoring program, initiated by TNC, including but not limited to data concerning water quality, habitat, forest health, accretion, crawfish health, biodiversity and carbon and nutrient sequestration during flood and drainage events in the project area;**
- (d) Committed and future sources of funding for the project, included but not limited to funding supplied by Shell Pipeline Company, LP; and**
- (e) Any and all email correspondence and communications between TNC, and/or other employees or agents of TNC, and officials, employees or agents of stakeholder groups, landowners, federal, state, parish, city or town officials and/or individuals in the private sector as pertains to the private-public partnership project, the Atchafalaya Basin Preserve project.**

For the purposes of this request, the term "records" includes all written, printed, recorded or electronic materials, communications, emails, correspondence, memoranda, notations, copies, diagrams, charts, maps, photographs, tables, spreadsheets, formulas, directives, observations, impressions, contracts, letters, comments, messages and mail in the possession or control of TNC.

To the extent TNC has partnered with LDNR's Atchafalaya Basin Program to propose and implement the "East Grand Lake Project" and/or the "Atchafalaya Basin Preserve," with the support of the state,² TNC is subject to Louisiana Public Records Act pursuant to La. R.S. § 44:1(A)(1), wherein "public body" includes "a public or quasi-public nonprofit corporation designated as an entity to perform a governmental or proprietary function . . ."

² See News Release, *supra* note 1.

Basinkeeper requests a fee waiver for this request because it is a 501(c)(3) nonprofit organization dedicated to the protection and restoration of the Atchafalaya Basin. This request is made in the public interest as the information requested would primarily benefit the general public. Atchafalaya Basinkeeper will use this information to educate the public and promote discussion and dissemination of information pertaining the permitting process, including communications with stakeholders and the development of the East Grand Lake/Atchafalaya Basin Preserve project.

The requested information will not be used for the financial or commercial benefit of Atchafalaya Basinkeeper or its members. If our fee waiver request is denied and this request for information cannot be sent free of charge, we request immediate notification of the reasons for denial and an estimate of costs to fulfill the request prior to any copying. Nothing in this letter will constitute a waiver of Atchafalaya Basinkeeper's right to seek administrative or judicial review of any denial of its fee waiver request.

If you intend to deny access to any of the above-mentioned records, we request a written determination within three (3) days of receipt of this request, stating the reasons for your denial. La. Rev. Stat. Ann. § 44:32(D). If an exemption is claimed as to some records, we request that all segregable, non-exempt parts of the documents be provided. If it is your contention that any of the requested records are not in your custody or control, we request that you promptly detail in writing the reason for the absence of the record, its location, what person has custody of the record and the time, manner and method in which it was taken from your custody.

If it is your contention that any of the requested documents are exempt from disclosure under the Louisiana Public Records Act based on any claim of privilege or confidentiality, please provide the following: the title of the document as to which the privilege or confidentiality is claimed; the nature of the document (e.g., interoffice memorandum, correspondence, report, etc.); the author or sender; the date of the document; the name of each person to whom an original or copy was shown or circulated; the basis upon which confidentiality is claimed; the facts upon which you rely to support the claim of confidentiality and a summary of the subject matter of the document in sufficient detail to permit the court to rule on the propriety of the claim of confidentiality. If possible, Atchafalaya Basinkeeper would prefer that your response to this request be in electronic form, or in the form of a compact disc. Please respond to this request within five (5) business days as required by La. Rev. Stat. Ann. § 44:35(A).

Thank you for your time and prompt attention to this matter. If you have any questions or concerns regarding this request, please contact Misha Mitchell at (225) 692-1133, or by email at basinkeeperlegal@gmail.com.

Best Regards,



Misha Mitchell, SBN: 37506
Atchafalaya Basinkeeper, *Staff Attorney*
P.O. Box 410
Plaquemine, LA 70765
Phone: (225) 692-1133
Email: Basinkeeperlegal@gmail.com
Counsel for Atchafalaya Basinkeeper

Cc: Dean Wilson, Executive Director
Atchafalaya Basinkeeper

BARRASSO · USDIN · KUPPERMAN
— FREEMAN & SARVER, L.L.C. —

ANDREA M. PRICE
DIRECT DIAL: (504) 589-9766
E-MAIL: aprice@barrassousdin.com

OUR FILE NO.
0027-0118

January 4, 2018

Misha Mitchell, Esq.
Atchafalaya Basinkeeper
P.O. Box 410
Plaquemine, LA 70765

Re: Response to Request for Public Records regarding The Nature Conservancy's Atchafalaya Basin Preserve and the Louisiana Department of Natural Resources, Atchafalaya Basin Program's East Grand Lake Project (201006) (the "Project") dated December 21, 2017.

Dear Ms. Mitchell:

I am responding on behalf of The Nature Conservancy (the "Conservancy") to the above-referenced public records request. The Conservancy is a private non-profit, 501(c)(3) organization whose mission is to conserve the lands and waters on which all life depends. While we understand that, under certain circumstances, private non-profit organizations may be treated as "public bodies" for purposes of the Louisiana Public Records Act, La. R.S. 44:1, *et. seq.*, (the "Statute") we do not believe that the Conservancy may be treated so in this case.

The Statute defines "public body" as "any branch, department, office, agency, board, commission, district, governing authority, political subdivision, or any committee, subcommittee, advisory board, or task force thereof, ***any other instrumentality of state, parish, or municipal government, including a public or quasi-public nonprofit corporation designated as an entity to perform a governmental or proprietary function.*** . . ." La. R.S. 44:1 (emphasis added). As the Louisiana Supreme Court has recognized, this definition includes "quasi-public nonprofit corporation[s]" only when acting as an "instrumentality of the state" and when "designated as an entity to perform governmental or proprietary functions." *New Orleans Bulldog Society v. Louisiana Society for the Prevention of Cruelty to Animals*, 16-1809, *8 (La. 5/3/17); 222 So.3d 679, 685. In the *Bulldog* case, the only case of which we are aware where a private entity was found to have a duty to respond to a public records request under the Statute, the Louisiana SPCA ("LASPCA") performed animal control services on behalf of the City of New Orleans, acting under the color of authority of the City "through its enforcement of Chapter 18 infractions, issuance of citations, and appearance in court on related matters of animal control." *Id.* Not only did the City provide LASPCA with vehicles for use in its duties, including investigating and enforcing municipal violations relating to animal control, it also

provided ongoing maintenance and fuel for the vehicles, as well as a \$153,870 monthly budget to carry out those activities on behalf of the city. *Id.* at 685-86; *8-9.

Here, the Conservancy is not acting as an “instrumentality of the state,” nor has it been designated to perform governmental or proprietary functions. While the Conservancy has, very recently, entered into an agreement with the Louisiana Department of Natural Resources (“LADNR”) to perform some monitoring in the Atchafalaya Basin, this activity does not rise to the level that the *Bulldog* decision found transformed the SPCA’s activities into that of a “quasi-public nonprofit corporation.” Even if it did, which we dispute, your requests seek documents and information far removed from this limited monitoring activity. *See* 2016-1809 (La. 5/3/17), 222 So. 3d 679, 688 (“[I]n terms of documents to be released under the Public Records Law in this case, we also limit this holding to *only those documents which pertain to the LSPCA’s functions, duties, and responsibilities to enforce Chapter 18 of the Municipal Code*, as outlined in the CEA with the City of New Orleans.”)(emphasis added).

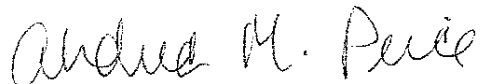
Based on the above, the Conservancy is not obligated to provide any records in response to the Basinkeeper’s request. In response to your specific requests, we provide the following information:

- a. The Conservancy’s land acquisition activities are not subject to the Statute. These activities were neither contracted for nor funded by the State of Louisiana or any other Louisiana governmental entity.
- b. The Conservancy did not participate in any modifications or amendments to the Project as an instrumentality of the State of Louisiana or any other governmental entity of Louisiana. The Conservancy has received no funding from the State of Louisiana or any other Louisiana government entity for any related activities.
- c. While the Conservancy recently entered into a contract to provide certain Project implementation support and monitoring information to the Louisiana Department of Natural Resources, all resulting data will be provided to LADNR in accordance with the terms of the Contract and is directly available from LADNR.
- d. The Conservancy is a private non-profit organization. The Conservancy’s records relating to its donors are not subject to disclosure under the Statute. Additionally, even if the Conservancy was deemed subject to the Statute in any manner, information relating to donors is proprietary and is not subject to disclosure.

Misha Mitchell, Esq.
January 4, 2018
Page 3

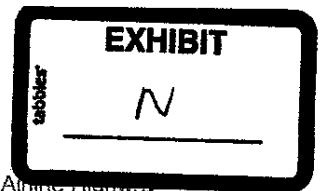
- e. For the reasons stated above, the email correspondence and communications requested in subsection (e) of the request are not subject to the Statute. Additionally, this request is so broad as to be unreasonably burdensome.

Sincerely,

A handwritten signature in cursive script that reads "Andrea M. Price".

Andrea M. Price
OF BARRASSO USDIN KUPPERMAN
FREEMAN & SARVER, L.L.C.

AMP/cr



10305 Airline Highway
Baton Rouge, LA 70816
Phone (225) 298-0800
Fax (225) 208-1699
www.sigmacg.com

February 19, 2018

Mr. John Herman
Chief, Central Evaluation Section
Regulatory Branch
Corps of Engineers, New Orleans District
Post Office Box 60267
New Orleans, LA 70160-0267

Ms. Elizabeth Hill
LA DEQ, Water Permits Division
Registrations and Certifications Section -
Water
Office of Environmental Services
602 N. Fifth Street
Baton Rouge, LA 70802

Mr. Rick Dugas
CPRA – Flood Protection Division
CPRArequest@la.gov
P.O. Box 44027
Baton Rouge, LA 70804-4027

**RE: PERMIT APPLICATION
REQUEST FOR USACE SECTION 404 PERMIT – MVN 2016-01163-CY,
DEQ WATER QUALITY CERTIFICATION (WQC)
CPRA LETTER OF NO OBJECTION
East Grand Lake Ecological Enhancement
Atchafalaya River Basin
Bayou Sorrel, Louisiana
Project No. 11-431-99-01 Part 83
WBS F.11000077**

Dear Ladies and Gentlemen:

On behalf of the Atchafalaya Basin Program, Sigma Consulting Group, Inc. is submitting a permit application for the East Grand Lake Ecological Enhancement Project. This project is located in Iberville Parish, LA outside of the LA Coastal Zone; therefore, it is being transmitted to the US Army Corps of Engineers – New Orleans District for processing (USACE-NOD). This letter, together with the attached documents, serves as an application for Section 10 and 404 U.S. Army Corps of Engineers Permits; Water Quality Certification by the Louisiana Department of Environmental Quality, and a request for a Letter of No Objection from the Louisiana Coastal Protection and Restoration Authority.

A pre-application meeting was held on December 11, 2017 at the USACE-NOD office. A copy of the meeting minutes are attached for your reference.

Permit Application
February 19, 2018

East Grand Lake Ecological Enhancement Project
Atchafalaya River Basin
Bayou Sorrel, LA
FP&C No. 11-431-99-01 Part 83
WBS F.11000077

The project description is as follows:

The Atchafalaya Basin Program's East Grand Lake Ecological Enhancement Project is the State of Louisiana's restoration plan for a 202,424 acre portion of the Atchafalaya Basin bound by Bayou Sorrel, the Atchafalaya River, and the East Atchafalaya Guide Levee. The main strategy of the East Grand Lake Ecological Enhancement Project is to increase the north to south flow of water through the Bayou Sorrel area during moderate river stages in order to improve circulation and ecological function directly to 5,560 acres of the back swamp. This will be achieved by shaving and dredging existing spoil banks along the Gulf Intracoastal Waterway right descending bank (Elements 1, 2, 3 and 4), Florida Pipeline Canal north and south banks (Elements 5, 6, 7, 8, 9, 10 and 11), and the south bank of Bayou Sorrel (Elements 12 and 13). Dredging will be performed to a +6.0 elevation (NAVD88). Dredge widths are 25' wide for Elements 1-4 and 12-13 and are 100' wide for Elements 5-11. This includes clearing and snagging of each element along the dredge length shown in the attached plats. Additional 25' wide clearing and snagging for positive water conveyance along the existing +6.0' contour is proposed for Elements 1-4 and 12 and covers 2.40 acres. All cleared and snagged vegetation will be removed from the site and transported to a certified disposal site outside of the Atchafalaya Basin. Spoil is proposed to be placed in designated areas adjacent to the dredge areas and stacked to a maximum height of 6 feet. The spoil mounds will then be planted with trees of similar species found in the area, such as oaks, swamp hickory, and bald cypress. Approximately 25,535 cubic yards of in-situ material covering 8.31 acres of existing bottomland hardwood swamp will be dredge and placed on-site. Disposal areas totaling 5.80 acres with a capacity of 33,119 cubic yards are located adjacent to the dredged areas.

To the best of my knowledge, the dredge/fill material will be free of contaminants. To the best of my knowledge, the Best Management Practices will be utilized during construction to minimize erosion. Also, to the best of my knowledge, a Stormwater Discharge Permit will be obtained, if required. Exposed soils will be stabilized by the use of Best Management Practices such as reseeding and revegetating the exposed areas to prevent erosion.

In lieu of requesting a formal jurisdictional determination, non-wet areas are conceded as wetlands.

**Permit Application
February 19, 2018**

East Grand Lake Ecological Enhancement Project
Atchafalaya River Basin
Bayou Sorrel, LA
FP&C No. 11-431-99-01 Part 83
WBS F.11000077

Included in support of the permit application are the following:

- A. ENG FORM 4345 with 1 additional sheet
- B. Project Justification Report
- C. Pre-Application Meeting Minutes (for reference)
- D. One (1) set of letter size permit figures (29 sheets) showing project details

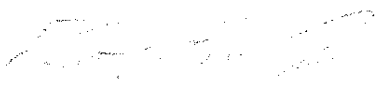
After your review of this documentation, if you require any additional information, please contact me at rlear@sigmacg.com or (225) 298-0800.

Sincerely,

SIGMA CONSULTING GROUP, INC.

On Behalf of the:

ATCHAFALAYA BASIN PROGRAM



Robert J. Lear, Jr. PE, LSI
Authorized Agent

Attached: as stated

CC: Charles Reulet, Sara Krupa - LDNR
Joseph Baustian, Jim Bergan, Bryan Piazza – The Nature Conservancy
Chuck Armbruster - LOSCO

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17. DIRECTIONS TO THE SITE

The project is located in the Atchafalaya Basin near the town of Bayou Sorrel in Iberville Parish, LA. The project elements are accessed from water via the Bayou Sorrel landing on Bayou Sorrel Road. Elements 1-4 are south of the launch on the west bank; Element 1 - 1.1 miles, Element 2 - 1.6 miles, Element 3 - 1.9 miles, Element 4 - 4.0 miles. Elements 5-11 are located on the Florida Pipeline Canal which is approximately 1.1 miles south of the Bayou Sorrel Public Boat Launch on the west bank. From this point, Elements 5 & 9 are 2.9 miles west, Elements 6 & 10 are 3.3 miles west, Elements 7 & 11 are 3.5 miles west, and Element 8 is 3.7 miles west. Elements 12 and 13 are located on the south bank of Bayou Sorrel, which is approximately 0.9 miles north of the Bayou Sorrel Public Launch along the GIWW. From this point, Element 12 is 1.8 miles west and Element 13 is 2.3 miles west.

18. Nature of Activity (Description of project, include all features)

The main strategy of the East Grand Lake Ecological Enhancement Project is to increase the north to south flow of water through the Bayou Sorrel area during moderate river stages in order to improve circulation and ecological function throughout the backswamp. This will be achieved by shaving and dredging existing spoil banks along the Gulf Intracoastal Waterway right descending bank (Elements 1, 2, 3 and 4), Florida Pipeline Canal north and south banks (Elements 5, 6, 7, 8, 9, 10 and 11), and the south bank of Bayou Sorrel (Elements 12 and 13). Dredging will be performed to a +6.0 elevation (NAVD88). Dredge widths are 25' wide for Elements 1-4 and 12-13 and are 100' wide for Elements 5-11. This includes clearing and snagging of each element along the dredge length shown in the attached plats. Additional 25' wide clearing and snagging for positive water conveyance along the existing +6.0' contour is proposed for Elements 1-4 and 12. Spoil is proposed to be placed in designated areas adjacent to the dredge areas and stacked to a maximum height of 6 feet. The spoil mounds will then be planted with trees of similar species found in the area, such as oaks, swamp hickory, and bald cypress.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

The main strategy of the East Grand Lake Ecological Enhancement Project is to increase the north to south flow of water through the Bayou Sorrel area during moderate river stages in order to improve circulation and ecological function throughout the backswamp. Existing flow is restricted by spoil banks. Restoring flow will benefit the ecological habitats of the back swamp.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED**20. Reason(s) for Discharge**

Excavation of existing spoil banks to restore and promote north-south flow of water from the Bayou Sorrel area during moderate river stages in order to improve circulation and ecological function throughout the back swamp.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards
-------------------------------	-------------------------------	-------------------------------

In-Situ Soil Placed On-Site / 25,535 CY

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres 5.8
or
Linear Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

Over 100 element locations were evaluated in the East Grand Lake. The elements included in this project were selected based on maximizing flow distributions to the back swamp while minimizing dredge lengths. Returning flow to the back swamp benefits 5,560 acres while the entire project footprint impacts 16.51 of predominately bottomland hardwood forest. The entire 16.51 acres impacted are conceded as wetlands in lieu of a formal jurisdictional determination.

24. Is Any Portion of the Work Already Complete? ☐ Yes ☒ No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list)

a. Address- A. Wilbert's Sons, LLC. 58020 Bayou Road

City - Plaquemine State - LA Zip - 70764

b. Address- Baist Individual Owners 27620 Intracoastal Road

City - Plaquemine State - LA Zip - 70764

c. Address- Schwing Management, LLC 9422 Common Street, Suite 2

City - Baton Rouge State - LA Zip - 70809

d. Address- Jeanerette Lumber & Shingle Co., LLC 228 St. Charles Avenue, Suite 1424

City - New Orleans State - LA Zip - 70130

e. Address- Iberville Parish School Board 58030 Plaquemine Street

City - Plaquemine State - LA Zip - 70764

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT

DATE

SIGNATURE OF AGENT

DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than \$10,000 or imprisoned not more than five years or both.

**Application MVN 2016-01163-CY
East Grand Lake Ecological Enhancement
ENG Form 4345 Additional Information**

Block 25

- f. Mildred G. Norman, et al
P.O. Box 52228
New Orleans, LA 70152
- g. Wilbert Funeral Home, Inc.
24120 Railroad Avenue
Plaquemine, LA 70764

EXPERT REPORT ON PROPOSED EAST GRAND LAKE PROJECT (EGL)

Ivor L. van Heerden, Ph.D.

INTRODUCTION

The EGL project consist of 13 sites where altering the environment is proposed, generally to increase the flow of suspended sediment-laden waters from channels into cypress swamps (Figure 1), to their long-term detriment.

This document consists of two Sections. The first discusses the proposed EGL project directly; the second details some of the fundamental ecological/geomorphological concepts related to the Basin; relevant background.

The Atchafalaya Basin, South Central Louisiana, is truly one of the ecological wonders of the Earth. Man is trying to manage the Basin as a Mississippi River major flood "overflow" or pressure release valve (cutting its original area in half by flood control levees) and as a natural swamp. Unfortunately, and therefore, the Basin is undergoing dramatic physical changes due to sediment input and infilling with attendant environmental and ecological stress. Cypress swamp is being converted to bottomland hardwoods. Once this process is started the latter much faster growing bottomland trees including invasive species eventually shade out the cypress trees and the original very productive and unique swamp is lost. Given this serious stress on the natural system because of the Corps management plan, it is incumbent on them to ensure that all projects they permit do not stress the system beyond that associated with the Corps present flood control management plan. Oil and gas pipelines significantly add to this stress as does any project that enhances suspended sediment deposition in the Basin.

Sediments originally from the Atchafalaya River move along man-made canals and channels in suspended sediment mode – they are well mixed through the water column - and if the channel is confined can travel tens of miles in suspension. Wherever the channel goes from a confined to an unconfined state sedimentation is very rapid forming delta like deposits (See Figure 1). During Atchafalaya River Flood stages (late winter, spring, early summer) these suspended sediment laden waters also overflow the banks and suspended sediment deposition leads to levee aggradation. Thus, in one flood season suspended sediments using these linear intrabasin connections can be deposited over large areas and lead to significant shallowing and physical change. Any channel/canal with lateral cuts is a very efficient conduit to transport sediment into the interior locations of the Basin. Any cut made through a levee, whether man-made or natural, enhances suspended sediment deposition in the cypress swamps.

Even if a channel is blocked off from the main river, once the Atchafalaya River starts to overtop its banks with a rising flood, these flood waters will preferentially flow towards the channel and use it; the channel offering an efficient linear low friction pathway for flood waters to flow into interior portions of the cypress swamp.

THE PROPOSED EGL PROJECT

The Louisiana Department of Natural Resources, c/o Sigma Consulting Group, Inc. seeks permits and certification for its proposed swamp enhancement project in the Bayou Sorrel area of the Atchafalaya Basin, hereinafter referred to as the “East Grand Lake” or “EGL” project. The character of work for which the applicant seeks permits from the Corps and DEQ, as described in the March 19, 2018 Joint Public Notice, is to clear, grade, excavate, dredge, and place fill within the Atchafalaya Basin, to include Bayou Sorrel, the Gulf Intracoastal Waterway and the Florida Pipeline Canal. The work will include shaving and dredging existing spoil banks, clearing, snagging, excavation, dredging and placement of spoils in designated areas. The Notice provides that 25,535 yards of native material will be excavated and re-deposited to complete the project, and that 2.4 acres of jurisdictional wetlands will be directly impacted by clearing and conversion to open water, that approximately 8.3 acres of jurisdictional forested wetlands will be cleared and excavated to become open water, and approximately 5.8 acres of jurisdictional forested wetlands will be cleared and filled. The Permit Application concedes that the project footprint will impact 16.51 acres of wetlands. See ENG FORM 4345, Application for Department of the Army Permit, MVN 2016-01163-CY, Feb. 19, 2018, at 2, para. 23.

The purported purpose of the project is “to improve the north to south hydrologic flow in Bayou Sorrel during moderate river stages to improve the circulation and ecological function through the back swamp of the East Grand Lake Area of the Atchafalaya Basin.” The Notice suggests that the area that stands to benefit from the proposed activity’s “hydrologic restoration” in EGL includes “approximately 5,560 acres of swamp habitat” and that the project will “enhance and improve existing forested wetlands.” Joint Public Notice, March 19, 2018.

The EGL project consist of 13 sites where altering the environment is proposed, generally to increase the flow of suspended sediment-laden from channels into backwater swamp locations (Figure 1).

SECTION 1. THE EGL PROJECT AND ITS CONSEQUENCES - WHY ARE CUT CHANNELS SO HARMFUL?

In reviewing this Application, I relied upon field trips in September 2017 and again in January 2018, my many previous visits to the area over the last 40 years and research, the Joint Public Notice (March 19, 2018) and the scientific literature. In terms of the Joint Public Notice I could not find any documentation as to the scientific reasoning for the assumed benefits, no apparent understanding of the impacts of the suspended sediment and its transport mechanisms. Engineering design diagrams are not science.

Cypress swamps are fragile, require very unique conditions of hydrology, geomorphology and sedimentation to germinate, sprout and grow. If the environment is kept pristine in that the

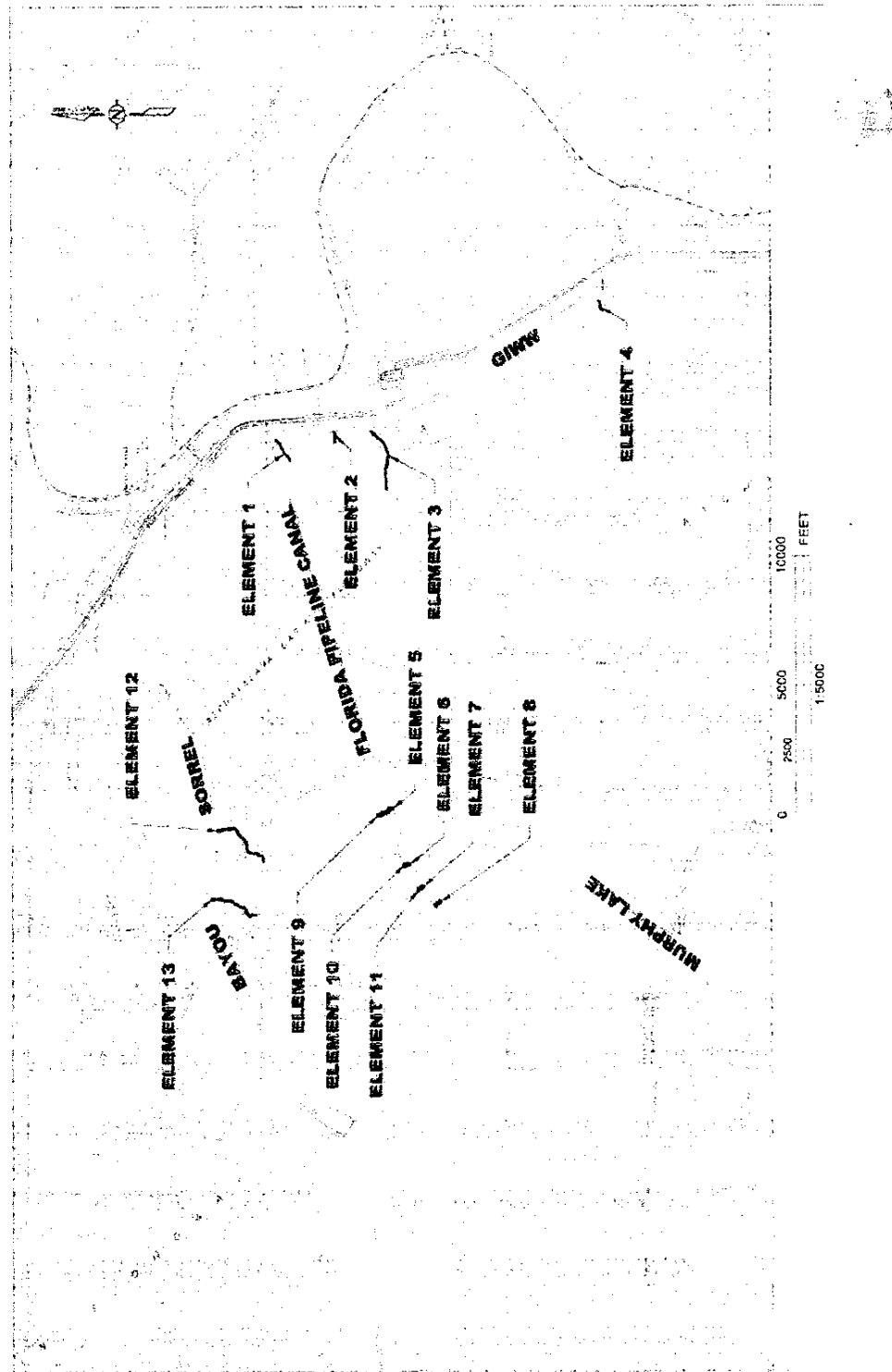


Figure 1. Location of EGL project in Atchafalaya Basin

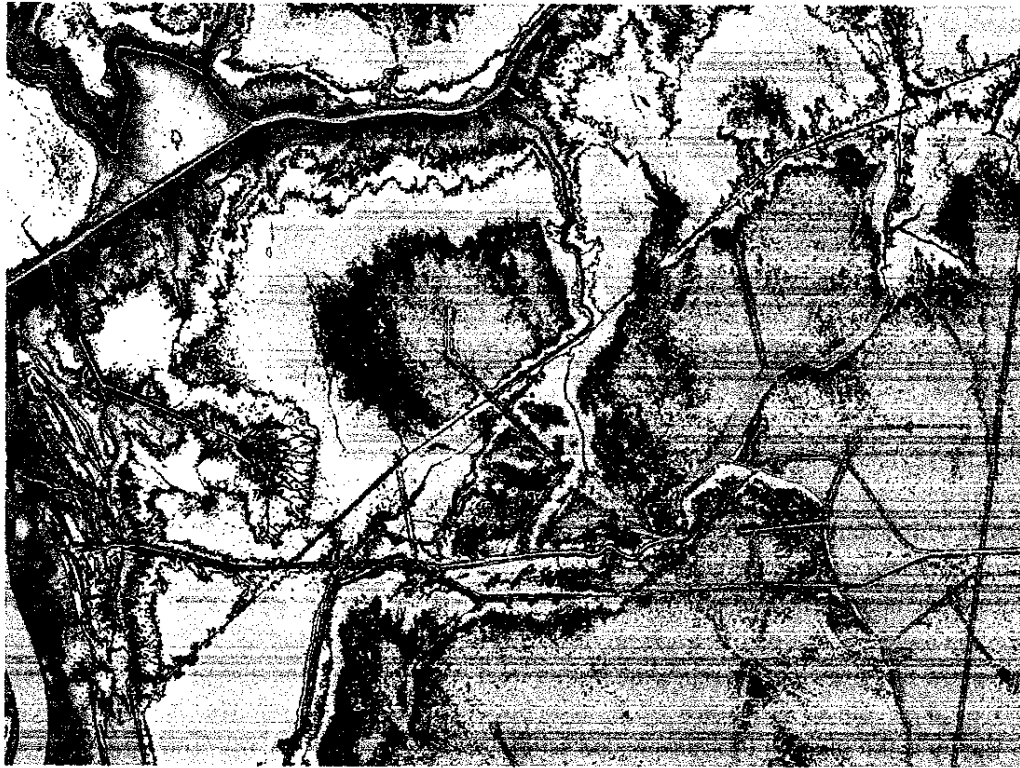


Figure 2. LiDAR image of Atchafalaya Basin centered on the Florida Pipeline Canal. Note the higher elevations spreading out from channels and canals (light blue to yellow to brown).

physics do not change then these swamps can survive for thousands of years. Louisiana was blessed with millions of acres of these biological wonders, but man, through altering the physics and the physical environment, has destroyed most of these swamps. The Atchafalaya Swamps are under direct threat as the physics of the environment undergoes dramatic changes. These swamps survived by limited over bank (levee) flows during periods of high river stages where the suspended sediment was deposited on the natural basin levees and some fine-grained clays, organic matter and nutrients would, through overbank flow, enter the Basin and slowly drain out at its seaward ends, maintaining the health and integrity of the system. Hydrology and circulation is aided by the 60 plus inches of rain that falls in the Basin each year. So over 5 feet everywhere. A North to South flow existed reflecting the natural slope of the Basin. That is not the case today as will be discussed below.

In excavating channels, whether 100 yards or many miles in length, cypress trees some over 1500 years old and mostly more than 100 years old are shredded, the mulch created adding to the organic load of the system enhancing the capacity for anoxic low oxygen (hypoxia) conditions to form. The result of just removing the trees is a major reduction in friction along the 'channel' enhancing the ability of suspended sediment laden flow to use this treeless conduit to reach interior portions of the swamp. Generally, a canal is excavated with spoil placed on either one side or both sides of the channel and a deep straight conduit will result with the capacity to transport many miles any suspended sediment load that enters the channel. Removing a linear pathway of trees and then excavating a channel complement each other (Figure2). Many times,

“blame” is just placed on the excavated channel, and little or any consideration is given to creating of the treeless conduit, which becomes very functional during periods of high River stages when the water level exceeds base level. As presented in Section 2, we know that 100% of the sediment that moves down cuts, channels, canals in the Basin moves in the suspended mode, especially in high River stages. The probability of transport of tons of suspended sediment with the Atchafalaya River now on the rising part of its hydrograph cycle is very high. Thus, any channel or canal, is a very efficient conduit, will transport large volumes of sediment into interior portions of the Basin enhancing the infilling of the swamp and its rapid demise. Typically, spoil is not colonized by cypress trees; rather willows, sycamores and other invasive trees that detrimentally impact native organisms will take root. The impacts of this EGL project will be permanent.

THE LiDAR SAYS IT ALL.

LiDAR, which stands for Light Detection and Ranging, is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth. It is very accurate and is now the tool of choice in mapping and producing elevation maps of the Earth. Figure 3a covers a section of the Basin from Bayou Sorrel including the Florida Pipeline Canal. The yellow and brown areas represent higher land always on either side of canals/channels. The wider or more robust high areas are all associated with Bayou Sorrel. This is to be expected as this Bayou is the source of the suspended sediments that enter the Bayou from the Atchafalaya River/Whiskey Bay Pilot Channel. The mechanisms for suspended sediment movement and the



Figure 2. A typical channel after excavation and cypress tree removal. A low friction conduit.

role the misaligned Bayou Sorrel plays in capturing tons of suspended sediment from the River are discussed in detail in Section 2. Suffice to say one can see ample evidence of these sediment fingers stretching into and delivering sediment to inner parts of the swamp (Figure 3a – brown, yellow, light blue pixels). Wherever there is a channel/canal connecting to the Bayou’s sediment

laden waters; these function to divert flow downgradient into the swamps. This is the real curse of the way the Basin has been managed. While the realignment and opening up of Bayou Sorrel was originally claimed to be a water quality project it was in fact a sediment introduction project (See Section 2.) Where channels connecting to the Bayou have some cross section mini delta lobes have formed (Figure 3a, lower mid of image).

The lower left part of Figure 3b shows a basin delta that has formed at the end of a pipeline canal that is connected to Bayou Sorrel very close to the take off point the COE excavated in the outer bend of an Atchafalaya River meander. It is a text book example of such a basin delta or delta lobe and exhibits bifurcating channels and crevasse splay type channels upstream of the delta. To the west of this pipeline channel are three similar channel deposits but because of their smaller size are not elongating as deltas by as sinuous channels but never-the-less elongating into the Basin.

The bottom line; you create a sediment conduit by both removing trees and excavating a channel and the suspended sediment will take advantage and deposits will elongate into the Basin. The sad fact is that the Atchafalaya Basin is geological and geomorphological unique, we will never make another. The sediment introduction is permanent and irreparable.

Figure 3c is a close up of the junction of Salt Mine and Florida Pipeline Canal. It represents an area getting sediment from Bayou Sorrel via Salt Mine and the GIWW via Florida Pipeline Canal. Note the sediment fingers extending in three directions and the significant sedimentation that has occurred on both banks of Salt Mine. This is again direct proof that Salt Mine connected to Bayou Sorrel, and Florida Pipeline Canal connected to GIWW, are very significant transporters of suspended sediment from their source channels into the interior swamps; swamps that are now lost forever. This is again ample evidence that if you interfere with natural processes there will be drastic physical results. The negative impacts of these canals whether Bayou Sorrel, the GIWW, or Salt Mine, or Florida Pipeline Canal, is that these will only enhance the negative impacts of allowing suspended sediment flows to enter interior portions of the swamps. Excavate or build them and there will be negative consequences for the Basin.

Figure 3d is the end of the navigable western end of the Florida Pipeline Channel. Note how the suspended sediment flows have taken advantage of any opening to create sinuous basin directed delivery systems. The LIDAR imagery does not lie, allow any connection to the River and its extremely high suspended sediment load, create the efficient transport conduits, and you will add to the rapid deposition and loss of the swamps.

POTENTIAL SUSPENDED SEDIMENT LOADING OF INTERIOR SWAMPS AS A CONSEQUENCE OF EGL PROJECT.

This discussion is based on data principally collected by the US Geological Survey and is a first cut at determining the depositional impacts of the EGL project, deposition of sediment that is in interior swamps. Welch, etal (2014) present data on suspended sediments, Nitrogen and Phosphorus, amongst others during the 2011 Mississippi River flood which occurred from April



Figure 3a. LiDAR image that extends from Bayou Sorrel in the North southwards with the Florida Pipeline Canal crossing from NE to SW. Image orientated with North to left.



Figure 3b. LiDAR image of the western portion of Figure 3a. North to the Sediment sources to the area come from the Atchafalaya River/Whiskey Bay Pilot Channel. It includes Bayou Sorrel down to the GIWW (Gulf Intracoastal Waterway).

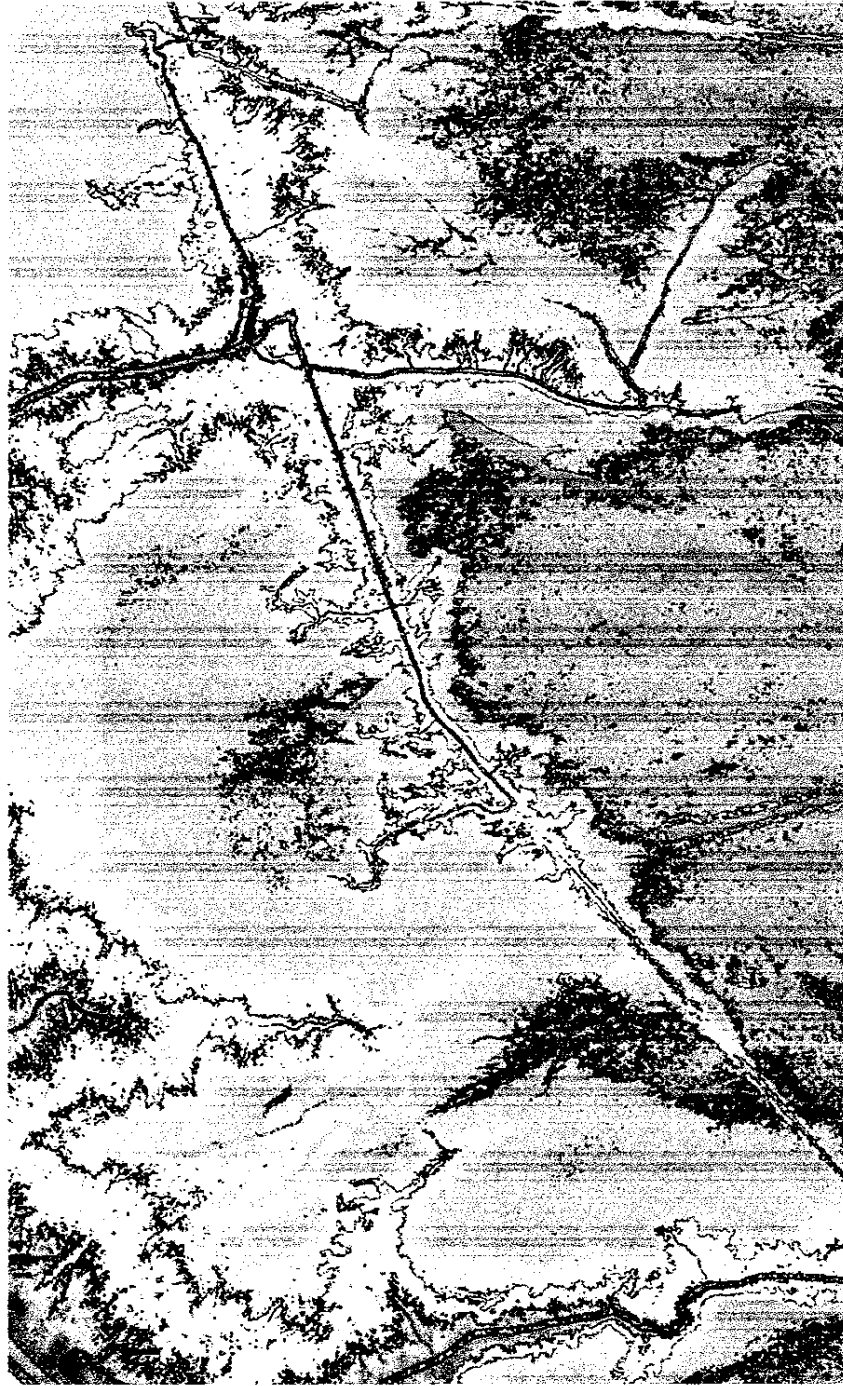


Figure 3c, Intersection of Salt Mine and Florida Pipeline Channel, Note the sediment fingers extending in three directions and the significant sedimentation that has occurred on both banks of Salt Mine. North to left.



Figure 3d. LiDAR image of a section of Florida Pipeline Canal. Note the many sinuous sediment delivery conduits into the swamps.

through July of that year. They reveal that the mean suspended sediment concentration in the Lower Atchafalaya River at Morgan City for this flood event was 133 microgram/liter (mg/l) and for Wax Lake at Calumet was 143 mg/l, and these numbers are similar to lower Mississippi River concentrations. For the basis of the following calculations I will use a median of 138 mg/l suspended sediment concentrations for the Atchafalaya Basin. The Median percent suspended sand was about 22% (Table 1). We will now go through the process to determine what the sediment loading, or in other words how much sedimentation, could have entered the swamp from the 13 proposed cuts (dredge sections – Figure 1) taken from the Joint Public Notice; during a flood such as the 2011 flood.

First assuming an average flood velocity in the cuts of 1 m/sec, which is common in these sized channels, one can calculate that for every square meter of cross sections of a channel; in one second 138,000 milligrams/sec of suspended sediment moved towards the swamp. Thus, the Mass of sediment moved is 138 grams/m²/sec. As we are going to be looking at volumes of sediment deposited we need to convert this Mass to a Volume. Density equals Mass/Volume and we know from years of study that the density of suspended sediment is 1602 kg/m³.

Doing the math gives us that the volume of suspended sediment per square meter of channel cross section in 1 second is 8.621×10^{-5} cubic meters. So how much suspended sediment by volume moves through our 1 square meter of channel in a 24 hour day ($24 \times 60 \times 60 = 86,400$ seconds); thus, the volume is 8.621×10^{-5} multiplied by 86,400 = 7.43 cubic meters per 24 hour day per square meter of channel.

For a 120 day (four-month flood) the volume of sediment flowing through 1 square meter of channel is 7.43 multiply by 120 = 897 cubic meters of sediment. So, what happens to this sediment? Well there is ample research and as discussed in Section 2, and as evident from the LiDAR imagery, it gets deposited as it goes from the confined main channel to the unconfirmed open waters (swamp). It gets deposited rapidly. So, if we assume these 897 cubic meters of

suspended sediment is equally deposited over the basin off the channel mouth as a layer 10 centimeters thick (4 Inches) then how big an area (horizontal bottom) will be covered by this sediment moving through 1 square meter of channel cross section in a four month period? Calculating this number and then dividing by 4046, being the number of horizontal square meters in an acre, gives a result of 2.22 acres of swamp bottom with be covered by sediment 10 cm/4 inches thick this for our four-month flood; per square meter of channel cut.

In reviewing the Dredge Sections as presented in the Joint Public Notice we see that 6 Elements (1, 2, 3,4,12,13) have an average width of about 39 feet (10 meter) while 7 Elements (5, 6, 7, 8, 9, 10, 11) have an average width of about 108 feet (30 meter). If we are conservative and assume 2.0 m of flow depth on average then the combined cross section of all these channels, 6 at $10 \times 2 = 20$ square meters; and, 7 at $30 \times 2 = 60$ square meters means the total combined cross section of the EGL elements is $120 + 420 = 540$ square meters. Thus, in the four months flood these channels combined deliver enough sediment to cover the bottom, an even 4 inches thick, over an area of $540 \times 2.22 = 1188$ acres.

So, this EGL project, in just a four-month flood based on 2011 data (Welch et al, 2014) **covers 1188 acres with at least 4 inches of sediment, and this is a very conservative estimate.** If you review Table 3 (Stations 10 and 11) you will see that the suspended sediment loads measured during the 2011 flood were well below the median of the historical data. Welch et al (2014) account for this lower than normal suspended sediment concentrations because most of the flood water was coming from the Ohio River that contained lower concentrations of suspended sediment, pesticides, and nutrients that water from the Mississippi River. They go on to state that the 4-month flood of 2011 contributed about 50% of the estimated annual suspended sediment, nitrate, and total phosphorous fluxes in 2011. What about the rest of the year? Discharges are lower, but the period is twice as long (8-months) and in that 8-month period the suspended sediment flux is the same as the 4-month flood. Without going into the math, one could conclude that the 13 dredge elements of the EGL project in one year could cover 2400 acres of swamp bottom with 4 inches of sediment or 1200 acres with 8 inches and so on. This is a very significant alteration, modification of the natural environment and will force habitat and hence ecological changes especially if you follow these numbers out 10 years. The LiDAR data is very, very clear. Allow suspended sediment out of the River and you will destroy this swamp, something that is happening right now, and this Project will exacerbate the loss of this swamp.

The lack of science in trying to justify this project is glaring. I have seen some data but there is no indication of the conditions that samples were taken, for instance was it raining, was it windy, what about the day, or week before and so on.

In summary, elements 1,2,3,4, will enhance sediment delivery into the adjacent swamps sources being Grande River and Bayou Sorrel.

Element 12 and 13 will introduce River water directly from a sediment source, Bayou Sorrel, into back swamps, creating deltas and sinus conduits filling in those wetlands with clays, silts and fine sand.

Elements 5,6,7,8,9,10 and 11 will introduce River water laden with suspended sediment coming down from Bayou Sorrel down Salt Mine and/or along the Florida Pipeline Canal pipeline into the back swamps, creating deltas and rapidly infilling in wetlands with clays, silt and fine sand.

It is very important to note again that linear channels in a setting such as the Atchafalaya Basin are very efficient at transporting suspended sediments long distances with a real threat to surrounding cypress swamps (See also Section 2). The impacts of the EGL project excavations and channel once in place will not be temporary. The cuts whether channels or bank shavings will have the capacity to transport significant amounts of suspended sediments especially during floods – sediment that would never be there if it weren’t for the channel! Flood waters overtopping the Atchafalaya River seek out linear efficient flow pathways such as pipeline canals and channels to flow downhill from the river. Flow through vegetated areas, especially trees, is greatly reduced due to the friction the trees and brush offer to flow. In some ways the trees are like a ‘wall’ and ‘steer’ the flood discharge towards the canal or channel.

If contaminated sediment is excavated this would have to be physically removed from the area. We know that oil and gas production have occurred in the Basin for many years and there have been oil spills and the release of drilling mud and brine/produced waters. We don’t know everywhere these have occurred. I don’t see any discussion of how this removal of contaminated sediment or material would be achieved or how testing will be undertaken.

Figure 1. Map of the lower Mississippi-Atchafalaya River subbasin showing the locations of the water-quality stations sampled during the 2011 flood. The map includes the following information:

- Water quality station number:** A list of 15 stations, numbered 1 through 15, located along the river.
- USGS station name:** The name of the USGS station for each numbered location.
- USGS station number:** The official USGS station number for each location.
- Drainage area (mi²):** The drainage area for each station.
- Suspended sediment concentration:** Statistics for suspended sediment concentration (H, M, Max, Med) for each station.
- Percent sand:** Statistics for percent sand (H, M, Max, Med) for each station.

Water quality station number	USGS station name	USGS station number	Drainage area (mi ²)	Suspended sediment concentration				Percent sand			
				H	M	Max	Med	H	M	Max	Med
1	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
2	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
3	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
4	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
5	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
6	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
7	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
8	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
9	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
10	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
11	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
12	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
13	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
14	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12
15	Atchafalaya River at Bayou Sorrel	06500000	1,200	100	150	200	120	10	15	20	12

Table 1. Water-quality stations sampled in the lower Mississippi-Atchafalaya River subbasin during the 2011 flood, April through July, and summary statistics for suspended sediment and percent sand (Welch et al, 2014).

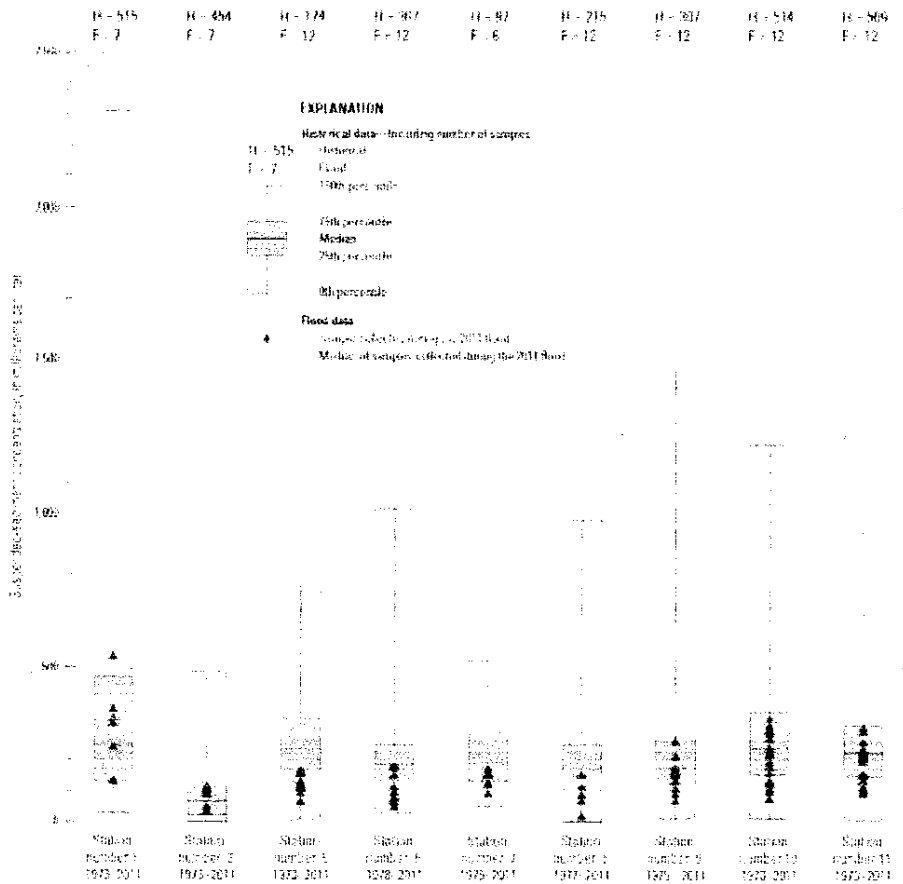


Figure 4. Concentrations of suspended sediment measured during the 2011 flood compared to concentrations measured at these stations in the lower Mississippi-Atchafalaya River subbasin for the period of record (Welch et al, 2014).

NUTRIENT LOADING DUE TO CHANNEL CUTS

Welch et al (2014) present data related to nutrient loading of the Basin during the 2011 flood, data that has to be considered in evaluating the impacts of the EGL project. It is important to note they only sampled main river channels and not any swamp sites. They point out that Nitrate composed about 70% of the total Nitrogen Flux and that there were no substantial losses or gains in the Atchafalaya or Lower Mississippi Rivers. But what happens to the nitrogen when it enters the still water of an interior swamp? It has nowhere to go so nitrogen loading of the swamp takes place – a cause of hypoxia. Welch et al (2014) point out that when suspended sediment fluxes increase, agricultural chemicals attached to sediment can be readily transported downstream and may further exacerbate water quality problems in receiving surface-water bodies. So, if you increase the discharge of suspended sediments into interior swamps you are going to exacerbate water quality problems. Horowitz (2010) concludes that suspended sediments delivers about 85% of the annual phosphorous flux and 30% of the annual Nitrogen flux to the region.

Welch et al (2014) point out that as streamflow was decreasing in the 2011 flood in the Lower Mississippi River - Atchafalaya River sub basin, orthophosphate composed an increasing percentage of the total phosphorous concentration, probably because of return of waters low in oxygen concentration from areas such as inundated lands, backwater streams, and floodways. These poorly oxygenated waters promote the release of sediment-bound phosphorous into the more readily available dissolved form. So, the data collected by the USGS during the 2011 flood reveal that Atchafalaya River water entering a swamp had a low oxygen concentration that promoted the release of phosphorous. This is a double whammy – the waters that would have enter the interior swamps from the 13 EGL elements would have had low oxygen concentrations, and in addition, this condition would have enhanced the release of a nutrient, phosphorous. So instead of improving water quality, we are enhancing hypoxia! It is incredibly important that before one messes with the natural environment that one understand the consequences. For every action there is a reaction.

I am aware that there have been some who have advocated that to reduce the hypoxia in the northern Gulf of Mexico we should try to capture the nutrients before such exit the Atchafalaya and Mississippi Rivers. One thought has been that projects such as the EGL project will lead to capture of these nutrients and help the Gulf. However, if one really wants to capture the nutrients one needs to attack them at their source – upcountry farmlands. The political will does not seem to be there to achieve this so instead we should concentrate on building as many Atchafalaya and Wax Lake deltas along our coast to try to reduce or stem coastal land loss (so necessary for coastal Louisiana's future) and tie up the nutrients here where they will stimulate marsh growth, instead of filling up the Atchafalaya Basin with suspended sediments. The Basin once lost will never be returned or restored. It will be lost forever.

In the past, discharges in the Grand River channel have been almost 10% of the Atchafalaya flow with stages of at least +11 feet (as is evidenced by the levees depicted in Figure 12b – Section 2). This year NOAA is predicting wetter than normal conditions for a large part of the Mississippi Valley. We have already seen this winter that changes in the Jet Stream are causing weather features such as cold fronts to move much slower than normal. There is a high probability of major flooding on the Mississippi and hence Atchafalaya Rivers this season.

Cypress swamps are fragile, require very unique conditions of hydrology, geomorphology and sedimentation to germinate, sprout and grow. If the environment is kept pristine in that the physics do not change then these swamps can survive for thousands of years. Louisiana was blessed with hundreds of thousands of acres of these biological wonders, but man through altering the physics and the physical environment has destroyed most of these swamps. The Atchafalaya Swamps are under direct threat as the physics of the environment undergoes dramatic changes. These swamps survived by limited suspended sediment being deposited on the natural Basin levees and some fine-grained clays, organic matter and nutrients would through overbank flow enter the basin and slowly drain out at its seaward ends, maintaining the health and integrity of the system. Sixty plus inches of rain p.a. aided the natural hydrology.

That is not the case today.

The Corps of Engineers' management of the Basin discussed in greater detail in Section 2 is accelerating the physical change due to significantly enhancing sedimentation rates within the Basin. This is the death knell of cypress swamps – it is also developing a substantial public safety issue as we fill the “tank” that is supposed to hold Mississippi and Atchafalaya flood waters – the Floodways purpose – that is being accelerated by rapidly rising sea levels off the Louisiana coast. All decreasing the functionality of the Floodway each year—a looming public safety issue.

So, change the physics, change the physical environment and the biology will change. Can we really afford to lose this American Gem?

CONCLUSIONS

It is my opinion that the EGL project will have the following negative consequences for the Atchafalaya River Swamp: -

1. Long term and very significant suspended sediment loading will occur in an area of thousands of acres of swamp converting these to less productive bottomland hardwoods.
2. There will be a dramatic and permanent loss of productive swamp habitat with resultant loss in productivity and ecological value.
3. Loss of productivity and water bottoms will severely curtail the traditional and cultural harvest of wild crawfish, amongst other species.
4. There will be an attendant loss in recreational income for the region as the swamps become bottom land hardwoods.
5. The LiDAR and other data reveal just how much mis directed suspended sediments have led to swamp loss, thousands and thousands of acres.
6. There is a high probability that this project will lead to greater water quality problems and increased hypoxia events, especially after major flooding events.
7. There is no recognition that in these shallow still water areas with a thick submerged carpet of organic matter that hypoxia will occur from time to time due to events such as storms, wind outbursts, and human interference sometimes as simple as boat wash or wakes; subsurface faulting and so on. Hypoxia events are a part of the natural landscape.

My suggestion moving forwards is to develop a long-term science-based management plan with a focus of reducing sediment input, reconnecting former waterways with gated structures if necessary, minimize the impacts of existing pipeline channels; and similar projects. Such a planning effort would recognize that the River sediment is needed at the coast, not infilling a floodway basin, a looming public safety problem.

SECTION 2. SOME PERTINENT ECOLOGICAL/GEOMORPHOLOGICAL/ HYDRODYNAMIC PRINCIPALS; RELEVANT BACKGROUND

To understand the potential irreparable harm of this project on the Basin, one needs a basic understanding of how an aquatic environment such as a mature cypress intertributary basin swamp responds to changes in the physical environment whether sedimentation of and from pipeline excavations, man-made canals, or from levee cuts.

1. The biology is mostly a response to the physical environment.

If I set up a fish tank of only water with no sediment on the bottom with an inflow of 100 gallons a day and a similar outflow I can support 'open water' aquatic species that depend upon sunlight and nutrients introduced by the 100 gallons of inflow to support the lower forms of life such as algae and plankton that in turn form the food base to nourish all upper forms of aquatic life. The fact that there is no sediment on the bottom means that these organisms in total have evolved to live in this open water environment and breed, mature, survive and so on.

Now if I set up a second tank with a different physical environment by filling half the tank with sediment so the surface is half water and half subaerial 'land' with the subaerial part of the surface but a few inches above the water level and with the 100 gallons in and 100 gallons out; in this fish tank, I now can support some but not all the open water species from Tank 1, and a new suite of organisms that utilize the sediment in addition to sunlight and nutrients to breed, mature, survive and so on. Additionally, a wetland will develop on this low-lying land with all the benefits that wetlands bring to the food chain including nutrients and the host of organisms that will thrive in the wetland. So, the biology responds to the change in the physical environment; in this case, adding sediment to the tank. This different set of organisms will utilize this different environment to breed, mature, survive and so on. If my want is to protect open water species, obviously the physical change due to the sediment has killed that goal or objective.

Now if I set up a third tank that is half filled with sediment but now elevated many feet, still 100 gallons in and 100 gallons out, I have a different biology. No more wetland plants, instead trees and grass so the 'land' biology will be dominated by upland species that survive in such. The aquatic species will be diminished some because of the lack of wetland and a different suite of organisms will inhabit the aquatic environment. If my want is to protect open water species, obviously the physical change due to the sediment has killed that goal or objective. Similarly, if my objective was wetlands and aquatic species the elevated sediment (land) has consequently put an end to that desire or goal.

Now if I set up a fourth tank that is filled with sediment and supports only upland species but has a stream flowing through with 100 gallons in and 100 gallons out I end up with no wetland and a very limited stream bank aquatic species. The change means I cannot achieve my goals for any of the previous three tank setups.

This rather simplistic depiction very strongly reveals how the biology is a direct response to the physical. Change the physical environment and you will alter the biology. Other than extreme hurricanes, major earth quakes, and volcanoes, man is the most effective force in changing the physical landscape of this planet. Just recognize what one day's work with a bull dozer can do to

a landscape. What the Lord created over thousands and thousands of years can be changed almost in an instant.

2. Suspended sediment versus Bedload sediment.

As sediment, or too much thereof, is the death knell of a cypress swamp, we need to better understand the sediment regime of the Basin as a background to assessing the impacts of channels, pipelines canals and excavations. The **suspended** load of a flow of fluid, such as a river, is the portion of its sediment uplifted by the fluid's flow in the process of **sediment** transportation. It is kept suspended by the fluid's turbulence. The **suspended** load generally consists of smaller particles, like Clay, Silt, and fine Sands.

The term **bedload** describes particles in a flowing fluid (usually water) that are transported along the bed. **Bedload** is complementary to suspended load and wash load. **Bedload** moves by rolling, sliding, and/or saltating (hopping). In other words, sand (medium or coarse), gravel, boulders, or other debris is transported by rolling or sliding along the bottom of a stream.

The always brown color of the Mississippi and Atchafalaya Rivers is made up of suspended sediment that is well mixed up throughout the water column; there being virtually no bedload in the Mississippi and Atchafalaya Rivers other than waterlogged vegetation. Below the Old River Control Structure what bedload is in the Mississippi River does not get past the sill into the Atchafalaya River, but continues down the Mississippi. Numerous studies have reached this conclusion (van Heerden, 1983.) This is a crucial point in understanding sediment deposition in Louisiana, how our deltas grow and why we have these huge intertributary basin swamps such as the Atchafalaya, Maurepas and others including the huge cypress swamp that used to protect New Orleans from hurricane surges until saltwater destroyed it after the Corp constructed the ill-advised MRGO (van Heerden and Bryan, 2006, van Heerden, 2007).

An important difference between the two types of sediments is that bedload requires a lot of velocity in the bottom waters of a river to move. Rivers dominated by bedload do not have natural levees. Just think of most of the rivers you see outside of coastal areas like Louisiana. Louisiana coastal rivers and bayous all have natural levees – this is because the latter carry suspended sediment and the mechanism under which the sediment is deposited. Suspended sediment as the definition above describes requires turbulence to stay in suspension as the water moves along. However, once the sediment is in suspension it does not require a lot of current and hence flow to stay in suspension. Suspended sediment thus confined in any sort of channel can be transported a long way. This ability to travel a long distance is one of the reasons that we have seen such dramatic changes in the Atchafalaya Basin within the confines of the artificial flood control levees due to man-made channels and cuts. More on that to follow. Additionally, the suspended sediment loads are very high when the rivers are in flood, pushed by connections to the Mississippi River as it floods each year after the snow melts inland, as well of course by storm rainfall-induced floods. The Atchafalaya River does get a sediment contribution from the Red River which has decreased because of the locks and dams that have been built on the Red River in recent years.

For suspended sediments to be deposited, for them to drop out of the water column requires friction. Friction kills turbulence. The central portions of most Louisiana channels do not have enough friction for the suspended sediment, mostly silts and fine sands, to be deposited and that

is why most channels have dark brown to black clay bottoms. Notably, the clays are mostly deposited in the low water months. Look at your anchor next time you anchor in a Louisiana coastal channel. The maximum friction is along the sides of the channel especially the natural levees. As the river flow starts to reach up the levees and especially when the levees are overtopped suspended sediment deposition can be very rapid. In areas like the Atchafalaya Delta one flood can cause up to three feet of deposition (van Heerden, 1983). Here as the water shallows the friction effects of the side of the channel dramatically reduce turbulence. Each deposition cycle has a distinct morphology, the base being fine sand that is then covered with silts and finally a clay top. Geomorphologists refer to the as "Upward fining flood cycles." In my research in the Atchafalaya Delta starting in 1977 (van Heerden, 1983, 1994) we were able to map out individual flood deposits for each year, thickness generally relating to the size and longevity of the flood. Figure 5 is an example of such upward fining cycles from the levee inside the floodway along the channel fed from the Grand Bayou take off from the Atchafalaya River many miles upstream. This is one key component of understanding how channels infill the Basin.

So, during floods, the friction along the bank reduces flow turbulence and the suspended sediment is preferentially deposited on the sides and top and overbank of the natural levee systems. This is the origin of all our natural levee systems. If not for the fact that suspended load can be transported hundreds of miles in a confined channel, if not for our low-lying wetlands that are excellent sites for levees to form, as there is a slope gradient in the wetland away from the channel; if not for the subsequent reduction in turbulence, there would be no levees and very little colonization of coastal Louisiana.

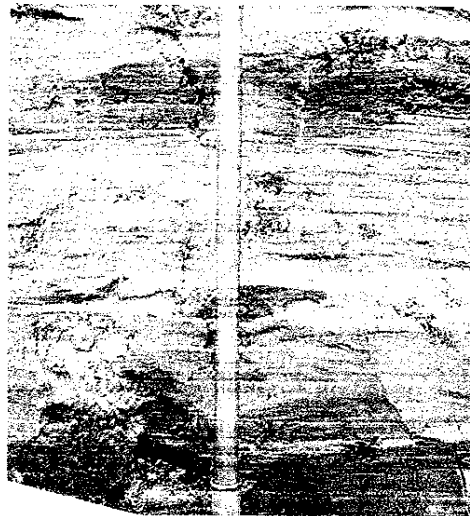


Figure 5. Suspended sediment deposits in the levee along the Bayou Sorrel channel within floodway showing different sedimentation cycles. Spade handle for scale.

When you go from a deeper confined channel into an open generally shallower bay with no confinement, the river flow can spread laterally sometimes through an arc of more than 180 degrees. This then becomes an ideal situation for suspended sediment deposition and that is the origin of all our deltas, whether large scale features such as the Mississippi or Atchafalaya or the Wax lake deltas; or small deltas off channels or bank cuts 10's of feet wide (Figures 3a, 3b, 3c,

3d). Wherever suspended sediment flow goes from the confined to the unconfined, rapid deposition results. This is the second key component of understanding how channels (in this case with cuts) can lead to deposition in the Basin. The reason that the rapid deposition does not choke off and seal the channel is that due to minor subsurface undulations, secondary delta channels form (van Heerden, 1983 amongst others). This is partially related to something called the “Bernoulli’s Effect.” I don’t want to get into too much detail here as it will mean exploring some math. Basically, this is the principal that defines an aircraft wing. As the air flow is compressed on the wing it accelerates and creates lift. So, as the flow lines are compressed in a delta (from deep to shallow) they speed up maintaining some level of turbulence which results in the finger like spread of distributary channels at mouths of deltas and means that these deltas keep growing seaward or into the basin they occupy. Thus, a delta is not a plug, it is rather a very efficient mechanism of spreading sediment over a large area as the distributary delivery channels maintain themselves. Deposition is thus very different between a confined versus a non-confined channel. The former builds levees with minor sedimentation in the interior swamps due to the sheet flow into bays or swamp basins (van Heerden, 1983). Where the levees are vegetated, the lateral flow into the basins is minimal, as the vegetation adds a whole lot more friction and suspended deposition that is mostly confined to the levee itself.

Going from confined to unconfined flow means delta growth and deposition spread over a wide area. As the whole suspended load is involved, not just that portion along a levee, deposition can be very significant, and the system has an in-built mechanism to keep growing outwards due to Bernoulli’s effect and delta channel development.

Confined channels can transport suspend load great distances; but moving from a confined to an unconfined situation results in deposition of most of the suspend sediment load near the opening/spreading of the flow—a delta (See LiDAR imagery figures 3a-d).

Sediments originally from the Atchafalaya River move along man-made canals and channels in suspended sediment mode – they are well mixed through the water column - and as long as the channel is confined can travel tens of miles in suspension. Wherever the channel goes from a confined to an unconfined state sedimentation is very rapid forming delta like deposits. Thus, in one flood season suspended sediments using these linear intrabasin connections can be deposited over large areas and lead to significant shallowing and physical change. Pipeline and similar cuts **are** very efficient conduits to transport sediment into the interior locations of Basins.

Even if the canal or channel is blocked off from the main river, once the River starts to overtop its banks with a rising flood, these flood waters will preferentially flow towards the channel and use it; the channel being treeless offering an efficient linear low friction pathway for flood waters to flow into interior portions of the cypress swamp.

It goes without saying that the higher the velocity the higher the turbulence, the higher the potential sediment load. This gets us to our next principal.

3. Discharge, velocity, and sediment concentration in a meandering channel such as the Atchafalaya.

As is shown in Figure 6 (below) the velocity distribution in a straight channel (Section A-A’) distant from a river meander is uniform across channel with the highest velocities, and hence

sediment load, in the central portion of the channel. This is very typical as determined in hundreds of velocity profiles taken across rivers over the years. However, the distribution of flow velocity and sediment load is very different in a meander. When in a car taking a sharp turn your body (mass) is pulled to the outside of the curve basically due to centrifugal force; in a minuscule way too, the outer edge of your body is moving faster than the inner edge of your body as the former must go through a longer curve. In a similar way, the same thing happens in a meander channel. Sediment moving say from point A to B in Figure 6 below has a longer curve (way) to move that sediment from point A' to B'. It thus speeds up and along with the centrifugal force means that strongest velocities and hence most of the sediment is now concentrated in the outer portion of the bend as shown in Sections B - B' and C - C'. So, if you want to divert water from the Atchafalaya River, and have the lowest sediment load possible, then you would take the flow from the edge of a straight channel such as A - A'. Taking it from the outside of a meander channel would be the worst-case scenario; it would enhance sediment transport out of the main river channel. We will come back to this in a moment.

Meandering Channels

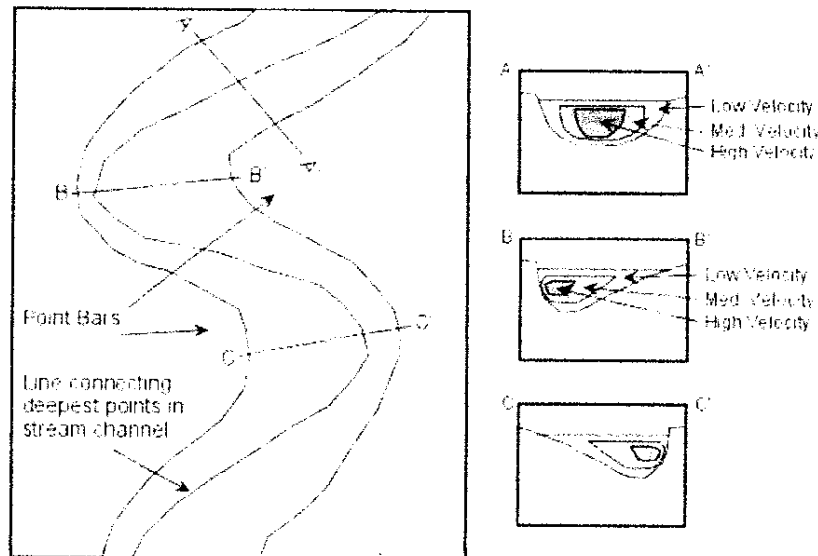


Figure 6. Typical velocity sections across a river including a river meander.

4. Mismanagement of the Atchafalaya by the US Army Corps of Engineers exacerbates pipeline and other channel-like impacts

The Atchafalaya River runs through an inland basin of swampland and lakes with the edges of the original Basin, pre-M R & T levees, being defined by the alluvial ridges formed from two abandoned distributaries of the Mississippi River, the Teche-Mississippi ridge to the west and south, as well as the younger, modern Mississippi and the Lafourche ridges to the east (Figure 7). Geomorphologically it is a classic delta interdistributary swamp basin. The surface lies at an approximate elevation of 42ft above mean sea level near Krotz Springs in the northern end of the Basin and slopes seaward, reaching sea level near the southern termination of Grand Lake.

In the mid-1500s, the Atchafalaya River started to capture flow from the Mississippi River due to a distinct gradient advantage because of a shorter course to the Gulf. With capture of Mississippi flow came Mississippi sediment and the Basin started to slowly fill with sediments from the north. By the early 1960's the Atchafalaya had captured 30% of the Mississippi flow creating concerns about how long New Orleans could operate as a port. The federal government then constrained the Atchafalaya distributary by building a structure at the point of diversion from the Mississippi in 1963, artificially controlling the flow down the Atchafalaya at 30% of the Mississippi. They also constructed guide levees to contain Atchafalaya Floods within a Floodway basically cutting the size of the receiving Basin by 50% (Figure 7).

The Atchafalaya Basin, preconstruction of the Atchafalaya flood control levees (the so-called M R & T guide levees), was almost twice its present size. As depicted in Figure 7, the guide levees crossed open water and swamp. Basically, it would appear that two lines were drawn on a map, each being a guide levee, without any consideration of the environmental and ecological impacts. Thus, construction of the control structure at Old River and the flood control 'role' given the Basin has meant that the sediment load of the Atchafalaya River has now only half the area it used to have to be 'spread out,' thus significantly enhancing the average annual sediment deposition rate in the Basin. Half the area with the same load as before means twice the potential sedimentation rate across the Basin. The Corps very effectively altered the physics setting up a change in the physical environment with its attendant biological responses. It is also filling in the Flood Way Basin, reducing its capacity, decreasing the efficiency and potential for the floodway to hold flood waters – a real public safety issue.

The Corps' two main functions are to control river flooding and aid commercial navigation. In the Atchafalaya system this required the M R & T artificial levees and the Atchafalaya Floodway. The navigation component requires keeping the various navigation channels in the Basin open and making sure there is a deep connection from the Morgan City/Berwick industrial hub to the Gulf of Mexico. The latter involves dredging and maintaining a channel through the Atchafalaya Delta. As pointed out previously deltas are net deposition sites for suspended sediment with a series of shallow finger channels feeding the sediment load to each channel's natural levees as well as to its most bayward edges. It is a very efficient system at moving sediment; that is why they keep growing. Typically, these finger channels or distributaries are no more than 6 ft. deep and about 2000 feet wide—a distinct difference from the Atchafalaya River Mouth which is some 90 feet deep and about 6 miles wide (Figure 8).

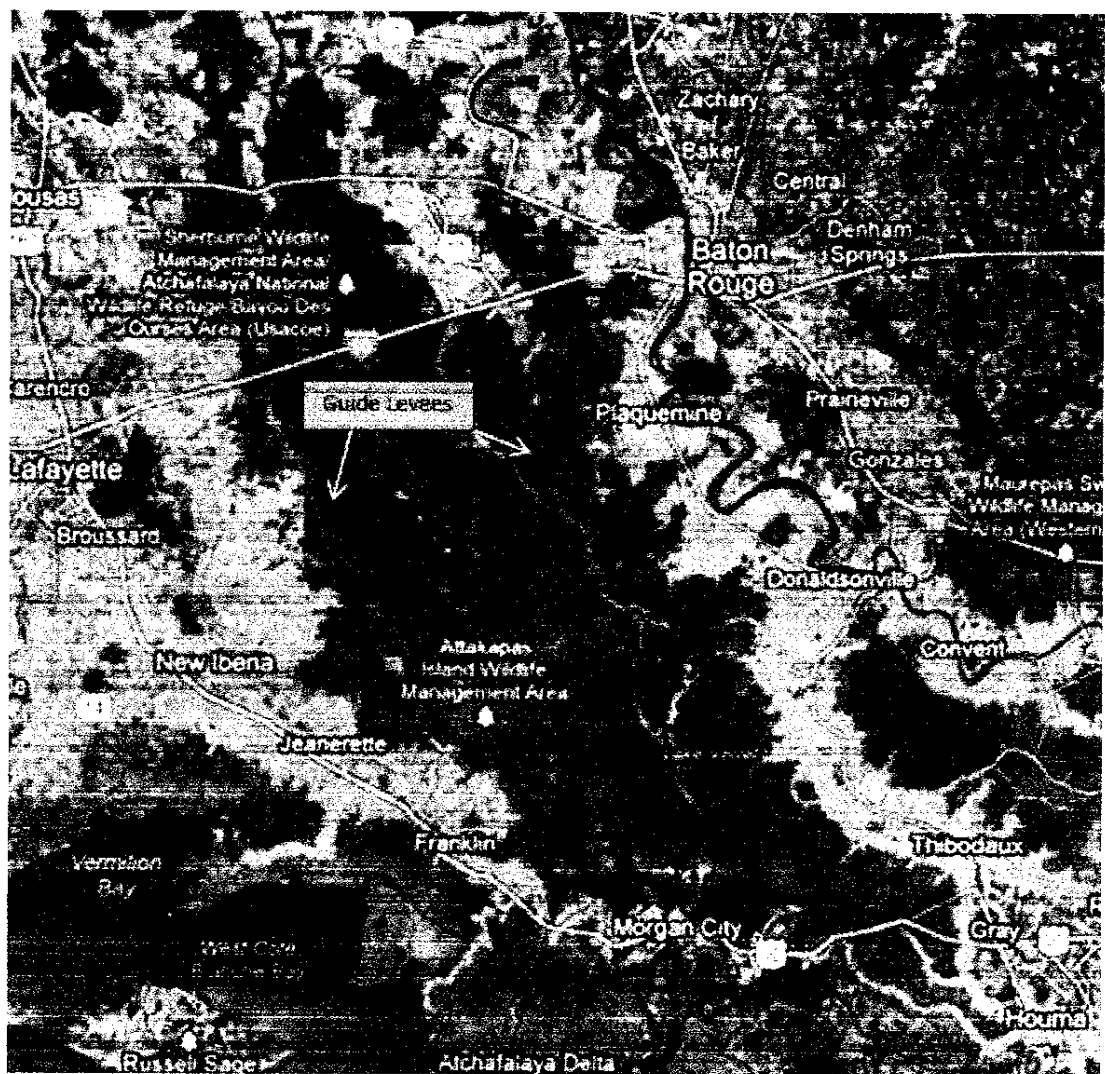


Figure 7. Atchafalaya Basin, south central Louisiana. Note the large area of swampland outside the M R & T guide levees.

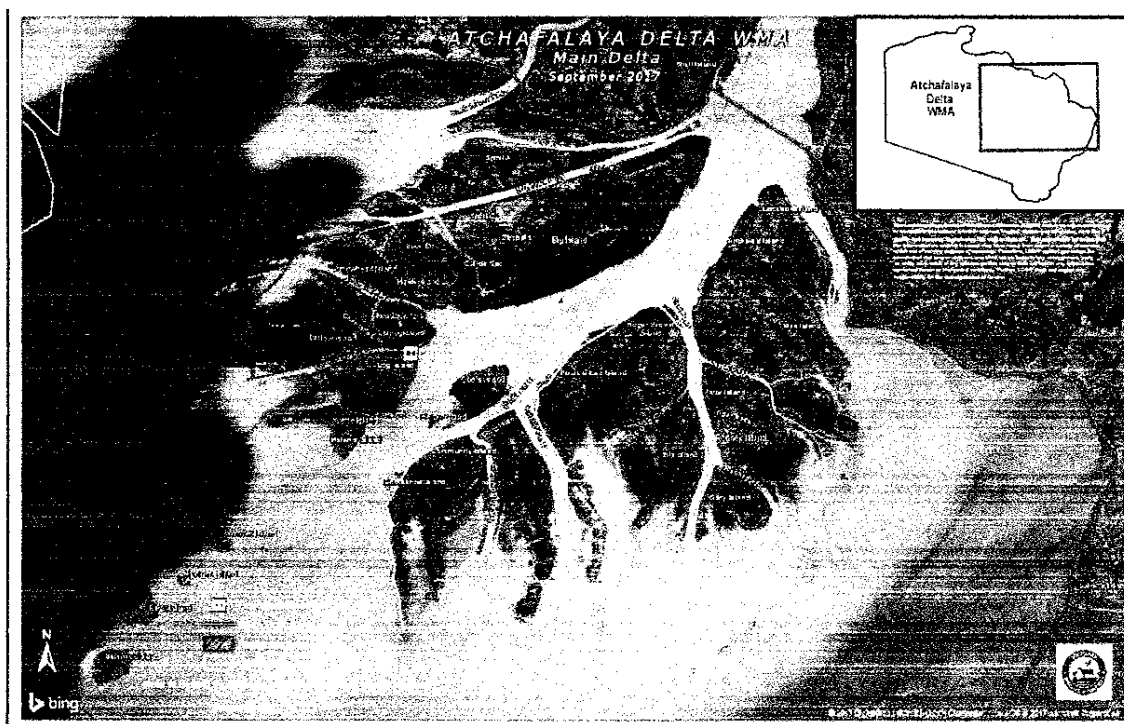


Figure 8. Mouth of Atchafalaya River (top of figure) and the Atchafalaya Delta. Note the narrow shallow finger distributary channels and the wide deep main channel cutting through the delta. The latter is a dredged feature.

The Corps of Engineers must regularly dredge millions of cubic yards of suspended sediment that has been deposited in the deep navigation channel and place in spoil piles. Basically, the natural system wants a shallow bay and each time the Corps digs a hole, the navigation channel, nature tries to fill it up. This Atchafalaya River Navigation channel is conceptually directly opposite to delta building, and it is very expensive to maintain. Thus, whatever the Corps can do to reduce the sediment deposited in its delta navigation channel the Corps will try. So, it looks at the Atchafalaya Basin, and manages the Basin as not only a floodway but also as a sediment trap for retention of suspended load sediments that it would have to dredge if they made their way to the river mouth.

5. Water diversions or really sediment diversions?

Over the last fifty years the Corps has opened and dredged channels from the main stem of the Atchafalaya River into the Basin. The stated aim was to enhance fresh water flows into the Basin while reducing sedimentation in the swamps.

The two principal cuts into our area of concern are the Grand River diversion in the north and the Bayou Sorrel connection in the south. Pipeline and other channels intersects these, and these two channels are what connects the total EGL project to the river. Each will be discussed separately but the reader's attention is drawn to the section above discussing sediment movement in meander channels.

6. Grand River cut and sediment diversion.

This cut and associated dredged channel were proposed to divert fresh water from the Atchafalaya River into the upper eastern portions of the Atchafalaya Basin (Figure 9).



Figure 9. Grand River cut, the 'reopening' of Little Tensas Bayou.

If you note the original Little Tensas Bayou connection (from SE to NW on right) was in a straight section of the Atchafalaya River (Figure 9) where the maximum flows and hence sediment load would have been confined to the central parts of the channel as depicted in Figure 6 Section A – A'. Additionally, the channel had a reverse takeoff, that is the connection had a northerly or 'upstream' bend at the connection. This Bayou as it was connected would have carried flows mostly year-round that had very little sediment loads and most of the suspended sediment would have been deposited on the natural levees of the Little Tensas Bayou. Instead the Corps created a new connection further upstream but most importantly on the outer bend of a meander, a situation such as Section C – C' in Figure 6. Such a location would place the diversion or takeoff point right adjacent to the maximum flows and sediment load, ensuring that a much greater sediment load now entered the system in what is now called Grand River, enhancing sedimentation into the basin. The Corps dredged a straight connection to the old bayou with an upstream facing or scoop connection. This configuration only enhances sediment capture and diversions down the new bayou – Grand River – perhaps aptly named. Below we will show evidence of the enhanced sedimentation associated with the very efficient connection to the Basin. This river diversion connects to the GIWW.

However, the COE also needed a 'sediment diversion' in the lower half of the Basin – Bayou Sorrel.

7. Bayou Sorrel cut and 'sediment diversion'.

The original Bayou Sorrel (Figure 10) was in the upper right part of figure and was a rather sinuous channel that originally headed off in a south easterly direction. Its takeoff point was along a straight section of the Atchafalaya River thus predominantly capturing low sediment load discharge such as depicted in Figure 6, Section A – A'. The suspended load would mostly have been deposited on its natural levees with fresh water and nutrients flowing to the Basin on each side during period of high river flows.

Instead the Corps cut was made somewhat downstream on the outer bend of a meander, cutting off a long sinuous section of Bayou Sorrel, in a situation similar to the Grand River cut (See Figure 6, Section C - C'), enhancing sediment diversion through the cut. A straight efficient connection was then dredged between the new cut and Bayou Sorrel – a very efficient sediment transport connection.

Thus, the Corps, through these two actions, set the stage for rapid infilling of parts of the Basin while achieving their goal of reducing potential sediment deposition in the Atchafalaya Delta Navigation Channel. This sediment loading is enhancing in many areas the loss of cypress swamp. The late 1980's Corps Design Memorandum mentions the loss or modification of 21,000 acres of wetland aquatic habitat because of these projects. Again, change the physics and the biology will respond.

The Corps of Engineers has created a situation whereby the impacts of oil and gas pipeline canals are enhanced because of the very real use of the canals as sediment conduits during flood periods; confined conduits carrying suspended sediments to portions of the Basin far removed from the source, the Atchafalaya River—to the detriment of the delicate natural balance that ensures cypress swamps can flourish. Excavation of these 13 EGL sediment delivery channels and levee height shavings just enhance the sedimentation into the cypress swamps.

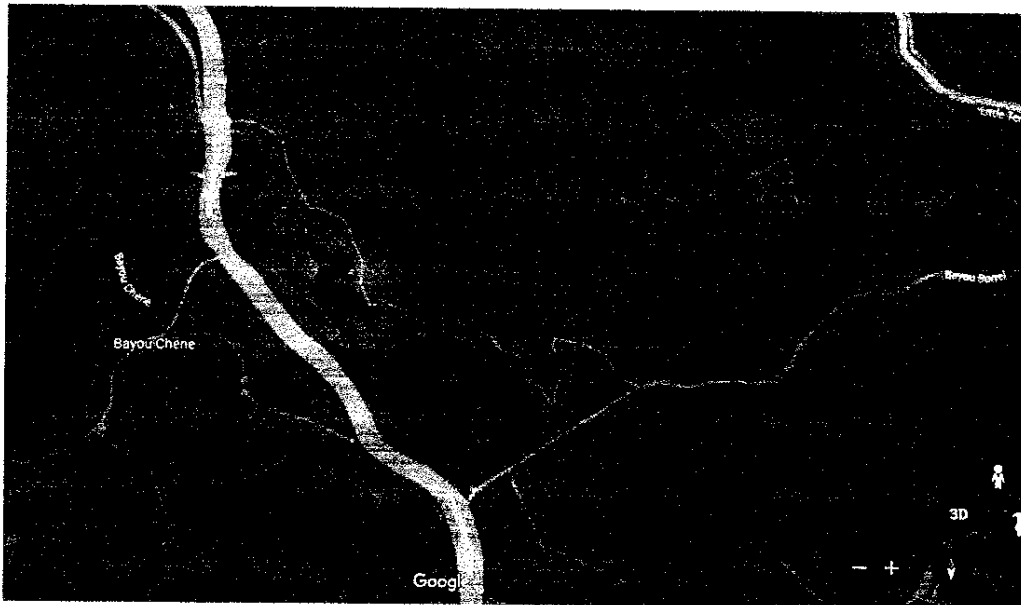


Figure 10. The Bayou Sorrel realignment and new diversion cut. Original Bayou sinuous feature on right from NE to SW on right. New linear diversion channel in lower portion of figure right.

Sedimentation in the Basin as a result of Man's Actions.

Figure 11 below indicates that in the central portion of the Basin, over a 71-year period, 23 feet of sediment have accumulated in the Basin – strong evidence of physical change. I have not been able to date to get data to give me a better timeline of how much the average annual sediment deposition rate has changed over time, but strong physical evidence points to key levels of change.

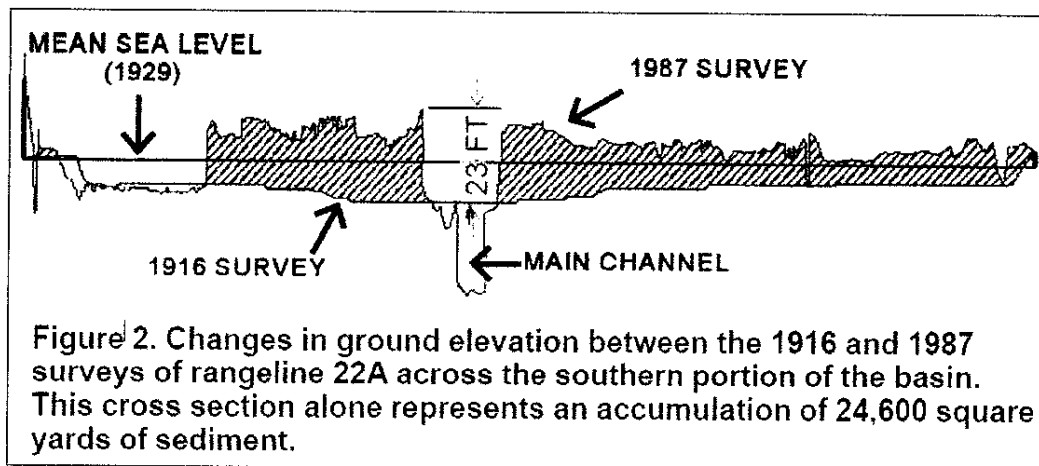


Figure 11. Cross-section of southern past of Basin showing sediment accumulation.

The reader is asked to again review the LiDAR images presented earlier!

Figures 12a and 12b were taken within an hour of each other on a field investigation undertaken 7th January 2017, at almost the same latitude in the Basin. Figure 12a was taken outside the Basin, in that area outside the flood way along the bank of Bayou Sorrel, the water stage was +4.8 feet. The natural levees with annual sediment deposition rates reminiscent of in the past were only 1.5 feet above the water level, so at a crest elevation of + 6.3 foot. (The M R & T levee cut off a section of the original Bayou Sorrel, so some of original bayou in and some outside the Floodway.)

Figure 12b is a photo of the Bayou Sorrel channel inside of the Basin, in an area receiving suspended sediments directly through the cut and distribution channel shown in Figure 6b; the stage was +4.0 feet and the levees were 7.0 feet on average above the water level, so a crest elevation of + 11.0 foot. This is a very significant observation and directly reveals just how much suspended sediment load the Corps' sediment diversion cut at Bayou Sorrel is delivering to locations far removed in the Basin. Suffice to say at the latter location there were no cypress trees, the canopy dominated by willows and sycamores.

Bayou Sorrel discharge ends up in the GIWW.



Figure 12a. Photograph of the natural levees along Bayou Sorrel outside of the Atchafalaya Floodway. Bayou stage was +4.8 feet on 7th January 2018 and levees about 1.5 feet above stage. Note abundance of cypress trees. Approximately same latitude as Figure 12b.

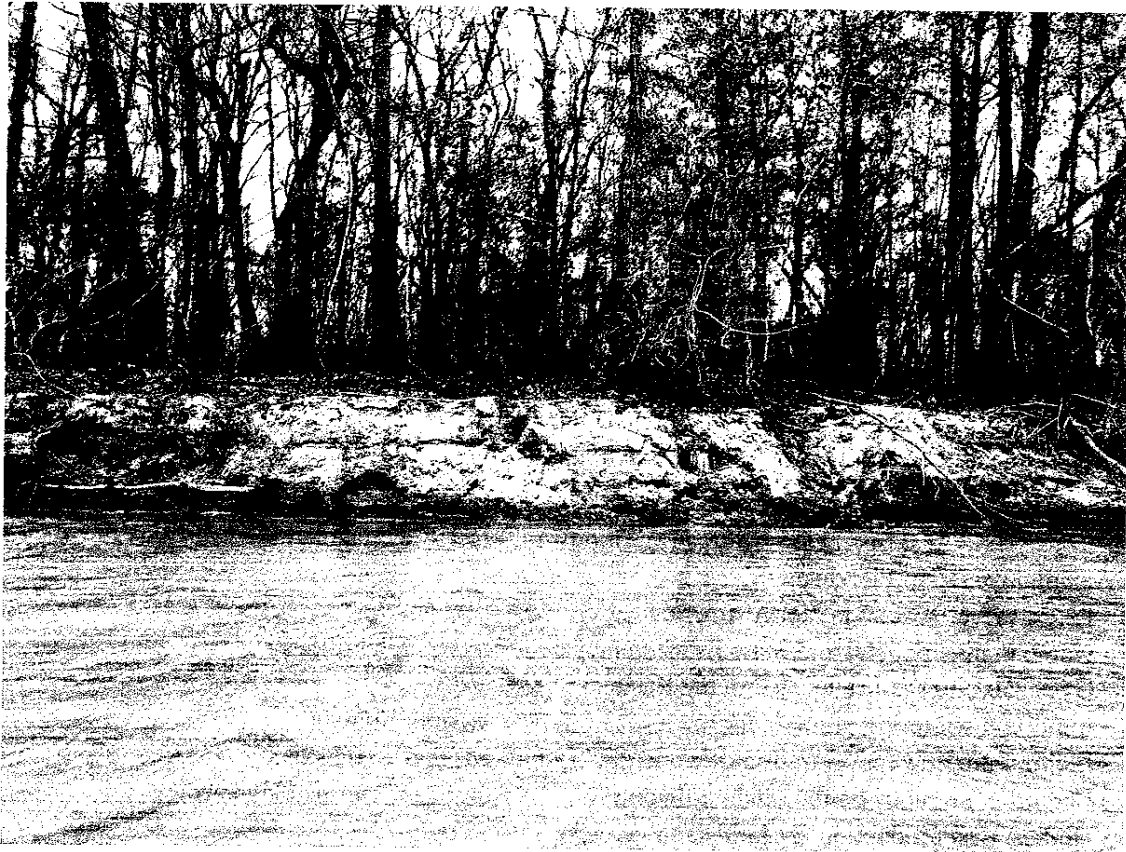


Figure 12b. Photograph of the levees along Bayou Sorrel Diversion Channel inside of the Atchafalaya Floodway. Bayou stage was +4.0 feet on 7th January 2018 and levees about 7.0 feet above stage. Approximately same latitude as Figure 12a.

5. The Beauty of the Basin.

In dealing with the Atchafalaya System there is sometimes confusing use of the term 'basin.' For this report the term Basin is used to represent the full original size of the Basin before levee systems were constructed. The term Atchafalaya Floodway is used to represent those areas of the Basin within the confining flood protection levees associated with the Mississippi River and Tributaries Flood Control system (M R & T). Both the Basin and the Floodway include the deltas developing at the coast, Atchafalaya and Wax Lake, as these are an integral part of the dynamics of the whole Atchafalaya system.

The Atchafalaya Basin Swamp, is the largest river swamp (in excess of 1 million acres) in the United States. Located in South Central Louisiana, the Basin is made up of a combination of wetlands and river delta area where the Atchafalaya River and the Gulf of Mexico converge. The Atchafalaya Floodway bounded by the M R & T system levees within the Basin encompasses approximately 512,000 acres of fresh marsh, bottomland hardwoods, cypress swamps, and open water and contains the largest contiguous tract of coastal fresh marsh in the state, combined a valuable national resource. An American-Indian word, "Atchafalaya" (ah-CHA-fa-LIE-ah) means *long river*.

Established in 2006, the Atchafalaya National Heritage Area stretches across 14 parishes in south-central Louisiana. It is among the most culturally rich and ecologically varied regions in the United States, home to the widely recognized Cajun culture as well as a diverse population of people of European, African, Caribbean and Native-American descent.

The Atchafalaya Basin is one of the last great wildernesses remaining in the continental United States as identified by the United States Corps of Engineers (USACE). The Basin includes the largest contiguous wetlands in the Mississippi River Valley and includes 10 distinct aquatic & terrestrial habitats ranging from large rivers to backwater swamps. The Basin is most noted for its Cypress-Tupelo Gum swamp habitat and its Cajun heritage.

A Short Fact Sheet

- Located between Baton Rouge, Louisiana to the east and Lafayette, Louisiana to the west
- More than 1 million acres in size, comprising the largest floodway in North America
- Consists of three floodways: Morganza Floodway, West Atchafalaya Floodway and Atchafalaya Basin Floodway
- Largest river swamp in North America
- Home to nine Federal and State listed endangered/threatened wildlife species
- Over 250 bird species located in the Basin
- Important wintering grounds for the birds of the Mississippi Flyway
- Major wintering concentration of wood ducks, mallards and woodcocks
- Largest contiguous bottomland hardwood forest for forest interior nesting species
- Highest nest production for Louisiana species
- Home to six endangered/threatened species of birds and 29 rookeries
- Diversity of wetlands, 500,000 acres of hydric soils, provide habitat for 14 wading bird rookeries
- Home to numerous bald eagle nests
- More than 50 mammalian species
- More than 40 reptilian and 20 amphibian species
- More than 100 species of fin fish and shellfish
- The Atchafalaya River is one of the top five rivers in terms of discharge in the United States; average annual flow is 180,000 cubic feet per second
- Important component of the USACE M R & T Flood Control Project. At times that the full basin is used as a Floodway, the maximum projected flood flow is 1.5 million cubic feet per second
- Most active growing delta (land accretion) in the continental United States
- Produces over \$123 million annually from recreational activities
- Nature study averages 49,000 hours per year
- Produces \$5 – \$6 million annually from commercial fishing & crawfishing
- Produces more than 1000 pounds of fin fish per acre in certain water bodies in the lower Basin – greater than any reservoir in the Southeastern United States
- More than 500,000 user days of sport fishing recreational activity each year – over 8000 hours per month in just a 17-square mile area which is only 2% of the Basin
- More than 164,000 user days of hunting activity each year

- Deer hunters on the Sherburne Wildlife Management Area/Atchafalaya National Wildlife Refuge contributed over \$1 million to the state's economy
- 25% of Louisiana's commercial forest lands and 51% of the state's hardwood forest are located in the basin
- Oil & gas pipelines cross the basin
- More than 300 active oil & gas wells are located in the Basin
- Atchafalaya River is a vital port for the oil & gas industries in the Gulf of Mexico
- More vessels pass Morgan City annually than Baton Rouge, the sixth largest port in the country
 - Important in the development of unique cultures of Acadians & Native Americans
- Location of several hundred archeological sites, including several prehistoric sites.

From January to June 2015, landings of wild crawfish in the Atchafalaya Basin equaled 2,412,183 pounds with a dockside value of \$3,148,755, according to a preliminary analysis of trip ticket data by the LA Dept. of Wildlife and Fisheries.

Total Travel Expenditures in the Eight Atchafalaya Basin Parishes: 2008: \$ 451 million 2009: \$ 435 million 2010: \$ 450 million 2011: \$ 468 million 2012: \$ 464 million 2013: \$ 470 million 2014: \$ 483 million. Tourism in the Atchafalaya Basin Visitors to Atchafalaya Welcome Center June 2004- July 2015: 1.3 million people Visitors to Lake Fausse Pointe State Park FY 2004 - FY 2015: 890,770.

Although this river-swamp system is an integral part of Louisiana's history and natural resource heritage, changes in the Basin due to human activity during the last century are rapidly eroding the natural beauty, biotic diversity, and wildlife and fisheries productivity of this unique ecosystem (Kelso et al., 1997).

REFERENCES

- Horowitz, A.J., 2010, A quarter century of declining suspended sediment fluxes in the Mississippi River and the effect of the 1993 flood: *Hydrological Processes*, v. 24, p. 13–34.
- Kelso, E., Rutherford, C., and Hale, L., 1997. The Atchafalaya basin: An Ecosystem in Peril. *Louisiana Agriculture*, Vol. 40, No. 3, Summer 1997.
- van Heerden, I. LL, 1983. Deltaic sedimentation in eastern Atchafalaya Bay, Louisiana. Special Grant Publication. Baton Rouge, LA.: Center for Wetland Resources, Louisiana State University.
- van Heerden, I. Ll., 1994. A long-term, comprehensive management plan for coastal Louisiana to ensure sustainable biological productivity, economic growth, and the continued existence of its unique culture and heritage. NSMEP, Center for Coastal, Energy, and Environmental Resources, Louisiana State University, Baton Rouge, LA, 45 pp. <http://www.worldcat.org/title/longterm-comprehensive-management-plan-for-coastal-louisiana-to-ensure-sustainable-biologicalproductivity-economic-growth-and-the-continued-existence-of-its-unique-culture-andheritage/oclc/30617836>
- van Heerden, I. L. 2007. The Failure of the New Orleans Levee System Following Hurricane Katrina and the Pathw3ay Forward. Public Administration review, Supp. to Vol.67, Dec 2007.

van Heerden, I.L. and M. Bryan, 2006. The Storm - What Went Wrong and Why during Hurricane Katrina - the Inside Story from One Louisiana Scientist Publ. Penguin/Viking, New York, New York, 308pp.

Welch, H. L., R. H. Coupe, and B. T. Aulenbach, 2014. Concentrations and Transport of Suspended Sediment, Nutrients, and Pesticides in the Lower Mississippi Atchafalaya River Subbasin During the 2011 Mississippi River Flood, April Through July. Scientific Investigations Report 2014-5100, U.S. Department of the Interior U.S. Geological Survey.

1 second. I said, well, you know, I wish
2 somebody like me from Alaska a hundred
3 years ago had come down to lobby Congress
4 then to save the cypress trees so I could
5 have --
6 (Audience applauding)
7 MR. BOWMAN: Thirty seconds.
8 AUDIENCE MEMBER: It really makes
9 a difference. Your job is to protect the
10 state for our future and for our children
11 and us. Please do it. Thank you.
12 MR. BOWMAN: Thank you.
13 AUDIENCE MEMBER: My name is
14 Suzanne Cohen. I live in Mandeville,
15 70094, Nancy Road. I was born and raised
16 in Louisiana. I been sitting here tonight
17 hearing person after person come up here
18 and say how the pipeline is the safest
19 way to transport the oil and I'm not
20 buying it. If you look at the way water
21 moves and how much water's out there, and
22 the rivers and everything that are going
23 to be crossed by this thing, if the oil
24 goes everywhere, we've seen the floods and
25 everything, if the oil gets in there it

1 side of the river. However, they are not
2 there for the Buffalo Cove Water
3 Management Unit, the Beaux Bayou Water
4 Management Union, or the Cocodrie Swamp
5 Area. However, if anybody would like to
6 talk to me, or any of the other agencies,
7 I'm sure we would be able to help in
8 designing some kind of plans, help with
9 the stagnancy and water quality issues
10 associated with the spoil come years from
11 now. Thank you.
12 MR. BOWMAN: Thank you sir. At
13 this time, it's 9:50. We're going to go
14 ahead and take a brief ten minute recess
15 and reconvene at 10:00 sharp.
16 (Off the record)
17 (Recess taken at 9:50 p.m.)
18 (Back on the record at 10:00 p.m.)
19 MR. BOWMAN: Next up we have
20 Heywood Martin, followed by Megan
21 Sorenson, and Sarah Ball. Heywood Martin.
22 AUDIENCE MEMBER: Yes. For the
23 record, I'm Heywood Martin, also known as
24 Woody. 400 Glynnedale Avenue, Lafayette,
25 Louisiana. I have been in the

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1 goes everywhere. It goes in the rivers,
2 it goes everywhere, so I ain't buying it.
3 I don't think it is the safest way when
4 you think with the environmental impact. I
5 think everything else has been said
6 already.
7 MR. BOWMAN: Thank you.
8 AUDIENCE MEMBER: Good evening.
9 I'm Dan Crows of the U.S. Geological
10 Survey. We neither oppose nor support
11 this pipeline. However, we have concerns
12 about the spoil banks associated with this
13 pipeline. My address is 3952 One Court,
14 Baton Rouge. From studies we've done, and
15 remote sensing, we've noticed that this
16 pipeline is an obstruction flow against
17 the flood plain on the east side of the
18 river and the Buffalo Cove Water
19 Management Unit and the Beaux Bayou Water
20 Management System.
21 There are plans, multi-agency
22 plans on the books and in the Atchafalaya
23 Basin plans to alleviate these conditions.
24 They have not been constructed yet.
25 However, the plans are there for the east

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1 environmental field pretty much my whole
2 professional and retired life, been doing
3 different programs and in my professional
4 field doing water quality enforcement and,
5 uh, regulatory programs having to do with
6 discharge permits from industrial and
7 domestic wastewater treatment facilities.
8 I learned a lot about water quality
9 through those years and, kind of, kept me
10 in touch with environmental issues, coming
11 down here with talking to you folks this
12 evening. I appreciate the opportunity.
13 I'm in opposition to the pipeline
14 speaking for myself. The first and most
15 obvious problem with the pipeline is it
16 represents a large investment in continued
17 high rates of consumption of fossil fuels.
18 Such projects continue to receive
19 subsidies of public funds, tax breaks, all
20 sorts of stuff. They require the
21 sacrifice of our natural resources that
22 belong to all of us.
23 Energy Transfer Partners is
24 asking us, the public, for our permission
25 to go through, under, over our waterways

