EXPERT PANEL ON DIVERSION PLANNING AND IMPLEMENTATION

Report #1

February 2014

Submitted to:
Coastal Protection and Restoration Authority

EXECUTIVE SUMMARY

The first meeting of the Expert Panel on Diversion Planning and Implementation focused on uncertainty and the ways in which scientific and engineering uncertainty could be understood and reduced to the maximum extent possible. Discussions centered around six themes: (1) the importance of data, (2) the absence of analogs, (3) uncertainty in ecological outcomes, (4) uncertainty in social and economic outcomes, (5) design and operational uncertainties, and (6) framing expectations in light of uncertainties. Panel recommendations covered methods by which biophysical data should be collected and disseminated, social data that should be incorporated and linked to biophysical data, models that should be developed and used as an ensemble, coordination and communication that should be undertaken, and types of additional simulations and experiments that should be conducted.

1.0 INTRODUCTION

The Expert Panel on Diversion Planning and Implementation (the Panel) held its inaugural meeting in Baton Rouge on January 8-9, 2014. The Panel was established to provide expert advice and guidance on key issues that pertain to river diversions, recognizing that diversions are an essential restoration tool in coastal Louisiana. Indeed, Louisiana's 2012 Comprehensive Master Plan states (p. 106) that "…sustainable restoration of our coast without sediment diversions is not possible." The Panel's official charge was therefore to provide technical input, review, and guidance as plans are refined on diverting freshwater and sediment from the Mississippi and Atchafalaya rivers into adjacent estuarine basins to build, maintain, and sustain coastal wetlands.

The Panel, convened by The Water Institute of the Gulf (the Institute), is comprised of 12 members with backgrounds in a broad range of physical and biological sciences, social science, and engineering. The extensive experience of Panel members in other restoration programs, together with the particular blend of Panel expertise, was considered important for advancing the understanding of river diversions. The Panel recognizes that there is an expectation that they remain independent and objective, and that their role is advisory in nature. As such, the Panel is not in a position to make policy or implement decisions. More information on the panel, including the list of members and their professional expertise, is included in Appendix 1.

The primary issues that the Panel will address over the next three years include: (1) evaluation of critical scientific and technical uncertainties, (2) identification of research that will be needed to reduce uncertainties, and (3) review and comment on technical reports, model outputs, and other aspects of project development identified by the Panel or by the Coastal Restoration and Protection Authority (CPRA). The Panel anticipates that topics for consideration will vary from meeting to meeting and that the Panel will continue to be engaged in these topics between each of the formal meetings. Some of the topics will be discussed in further detail at future meetings and we anticipate that additional recommendations on specific topics will also be offered in future reports. The agenda for the first day of the meeting is given in Appendix 2. The second day of the meeting was not open to the public and the focus of those discussions is summarized below.

2.0 FOCUS OF MEETING #1

Prior to the first meeting, the Institute and the Panel Chair agreed that the initial focus would be on the topic of uncertainty. Uncertainty can be broadly classified in terms of natural variability and knowledge limitations. Given the complexity of the science and engineering associated with the design and operation of major freshwater and sediment diversions, and that there are no analogs of existing sediment diversions at an appropriate scale, it became clear that uncertainty was a highly relevant and pressing topic for consideration. Several questions guided the Panel's discussions: (1) are the approaches for river modeling and assessing uncertainty appropriate? (2) how can uncertainty be quantified in diversion receiving basins where validation data do not exist? (3) can uncertainty in physical and biological effects be linked? and, (4) what are best practices for communicating uncertainty to a broad range of stakeholders?

There was strong agreement among Panel members that addressing uncertainty at the planning and design stages of diversions was the correct approach. Addressing uncertainty in impact assessments and building uncertainty into model outcomes is necessary not only for determining the potential effectiveness of diversions, but also for developing operational strategies and managing expectations in the future. The Panel agreed that there is no clear uniform standard of practice for evaluating and reducing uncertainty, but that the work on river modeling and the approach to addressing uncertainty in the Mississippi River is significantly advancing our understanding.

3.0 DISCUSSION, FINDINGS, AND RECOMMENDATIONS

The Panel identified and discussed at length six broad areas in which uncertainty must be framed and understood. These are listed below, along with a set of recommendations for each topic. Recommendations are categorized as: (1) near-term needs to support planning, (2) on-going needs that are necessary for effective communication, and (3) project-specific needs that are tied to pre- or post-construction of individual projects. Six of the near-term needs and one of the on-going needs are identified as being of the highest priority.

3.1 Reducing Uncertainty in Project Outcome: The Importance of Data

Successful restoration of the Mississippi River Delta and, more broadly, the Louisiana Coast, depends on effective data collection, analysis, and management. The degree to which appropriate data are available to evaluate diversion design options and forecast outcomes will greatly influence the uncertainty in predicted outcomes. Collection of baseline data should begin well before the construction phase of individual projects so that progress may later be assessed. Using the same ecosystem parameters to monitor areas after construction and during project operations provides accountability, the ability to measure success, and important feedback for adaptive management. Examining response variables in a BACI (Before, After, Control, Impact) design is a classic experimental approach used to assess ecological impacts. A test case such as the Mid-Barataria Bay sediment diversion would be ideal. Comparable monitoring should be conducted in a control system that will not be affected by the diversion. All measurements must be clearly linked to project goals.

Baseline and monitoring data are particularly valuable because they serve as support for extended analysis and the creation of improved ecological and hydrologic models. In the Everglades, for example, data have informed adaptive management and fueled scientific discoveries related to hydrology, geomorphology, biology, and important biogeochemical processes such as anthropogenic influences on mercury and phosphorous cycling. Substantial data are currently available for the hydrology and geomorphology of the Mississippi River, as well as descriptive data for surficial material, landuse, and land cover in the up-stream watersheds. Water quality in the river is also well known. By contrast, relatively little is known about the potential receiving basins for sediment diversions. This knowledge gap needs to be filled as soon as possible (see sections 3.2 and 3.3). Bathymetric data collection in the receiving basins is a high priority; in many areas, the most recent bathymetric data were collected in the 1930s.

Ideally, ecosystem measurements for specific projects should begin two or more years prior to construction and continue for an indefinite period after construction. In an effort to restore salt marshes at a site in the northeastern U.S., project managers for the Public Electric Service and Gas of New Jersey began monitoring several years before construction, and monitoring has continued for more than 15 years up to the present. A comprehensive list of data required to assess the success of land-building objectives needs to be developed and reviewed by experts. Examples of data that should be part of a monitoring program include chemical gradients in the receiving basin (e.g., salinity, nutrients), subaerial and subaqueous measures of new land, changes in particle size of surficial materials, types of vegetation cover and new and old organic material in monitored plots, and effects on fauna, particularly focused on management endpoints (e.g., commercial and recreational fisheries, shellfish beds, spread of invasive species).

To be most effective, data for projects serve two primary purposes: one is for scientific analysis, and the other is to inform the general public. Data should be easily and freely accessible to interested citizens, and be presented with an explanation of how the data contributes to project goals. In the case of the Grand Canyon-Glen Canyon restoration project, managers established a single location (Grand Canyon Monitoring and Research Center) for all data related to the entire project. The site is available on the internet and includes an explanation of how the data support the Grand Canyon restoration project through hydrologic controls.

Recommendations:

1. **Project-specific.** Review data requirements for determining project success, assessing environmental impacts, and developing models. Start project data collection at least two years before project construction, and develop recommendations for the frequency and duration of data collection during the operation of the projects after infrastructure construction is complete.
2. **On-going.** Establish a centralized internet location for baseline and monitoring data that is accessible to all. The maintenance of such a data warehouse should be considered to be an integral part of the restoration and be fully supported by restoration funds.

3.2 Uncertainty due to the Absence of Land-Building Analogs

Analogs for controlled sediment diversions do not exist as local factors (e.g., hydrodynamics, subsidence, or marsh habitat) are unique for each location. However, knowledge of the results at one diversion would provide a partial analog for future diversions. Numerous natural crevasse-splay deltas, similar to what is expected to be achieved by controlled diversions, have already been built in the Mississippi Delta and elsewhere, demonstrating that land can be constructed by reconnecting the river to the coastal system. However, we lack the knowledge to predict how much land will be built, how quickly, and what secondary effects—positive and negative—one can expect on management endpoints of concern (e.g., habitat for fish, birds, shellfish). Studying natural analogs is thus essential for setting expectations for success.

The land-building capacity of a diversion is not only dependent on the sediment supplied from the river but is also a function of processes in the receiving basin, which either limit sediment retention rates (i.e., waves and currents) or increase the accommodation space (i.e., sea-level rise, compaction, subsidence), and thus require proportionally larger sediment extractions from the river. Assuming that these key factors can be measured or modeled, controlled diversions should perform at least as effectively as natural ones. Furthermore, while natural processes that lead to land building are stochastic (involving chance or probability), controlled diversions can be optimized through informed engineering design and operation.

Data collection and modeling have already led to an advanced state-of-the-art understanding of the river; similarly planned efforts for the receiving basins would be expected to have a similar impact, assuming that appropriate data would be available to inform model development. At a minimum, collection of physical data should include new bathymetry, detailed local subsidence and compaction maps, and wave data measurements that would inform the sophisticated modeling tools that are already employed. Geological reconstructions and geotechnical studies of natural realizations of land building (e.g., Cubit's Gap and older crevasse deltas of the Belize lobe) can provide a range of land building and subsidence rates that can help to set expectations for controlled diversions. Data collection and modeling should also address the fate of fine-grained suspended sediment after diversion implementation as it constitutes the bulk of the sediment transported by the Mississippi River (~90%) and maximizing its retention is key in the delta building processes.

Recommendations:

3. **Project-specific.** Choose a diversion site, collect baseline data, develop comprehensive monitoring and research protocols to evaluate project success, inform adaptive management of the diversion, and reduce uncertainty in future diversions. Establish expectations for success with field data, modeling, and best professional judgment.
4. **Near-term.** Start broad-based monitoring now to collect physical data. Examples of these data types include bathymetry (e.g., multibeam) and subsidence (e.g., InSAR) data for areas that are anticipated diversion sites as well as natural analog (reference) sites. Convene workshops to identify the categories of data needed and how they would be used.
5. **Near-term.** Measure past rates of land building and other indicators of landscape and habitat change using sediment core-based proxies and subsurface imaging techniques to reconstruct timescales of natural crevasse delta construction. Model past crevasse delta development to hindcast style and rates of land building for informing model parameterization. Where data from analog sites cannot be measured or is otherwise insufficient, use expert judgment to define plausible ranges of outcomes.

3.3 Uncertainties in Ecological Outcomes

Building wetlands through sediment diversions promises important ecological benefits. In addition to the expectation of land building, diverting large quantities of fresh, cold, and nutrient-rich river water into shallow Louisiana estuaries is likely to have impacts on plant and animal communities, some of which may be adverse and counter to the overarching restoration goals of diversions. Determining the nature and extent of these effects is a major challenge because of the high degree of uncertainty, and is likely greater than in assessments of the physical processes that govern land building from sediments.

Uncertainty surrounding biological responses to diversions is high because the scale of potential impact is large, natural variability in biological responses is high, and there are many sampling challenges to be addressed.

An example of this uncertainty is the factors that control spatial and temporal marsh extent following sediment diversion. Project success depends not only on land creation, but also on the survival of existing and newly created land. Recent freshwater diversions suggest that there are potential risks associated with water diversion; for example, large water discharges can erode land, and nutrients can weaken soil strength, and thus the efficacy of land building, by encouraging shallow rooting and microbial decomposition of organic material. Moreover, there are uncertain effects of water quality on ecosystem health that extend beyond marsh soils. Can nutrients and toxins be effectively filtered by vegetation and sediment in receiving basins, or will they lead to local and far-field algal blooms and altered food webs? How will rates of nutrient and toxin assimilation change in ecosystems rapidly responding to diversions and land building? While previous diversions were not designed to create land or maximize sediment transport, they do highlight uncertainty associated with biophysical factors controlling marshland extent through time.

Floating marshes are also common in freshwater portions of the Delta. Studies indicate that these communities may be more sensitive than emergent marsh to pulses of high nutrients and are more likely to degrade and convert to open water. Vegetation models and on-the-ground assessments and experiments are needed that differentiate between floating and attached marshes and account for potentially different responses to diversions. Submerged aquatic vegetation (SAV) is also an important habitat as it affects many juvenile nekton, waterfowl, and sea turtles. The footprint of diversion impacts on SAV coverage is likely to be larger than for emergent marsh species. While enhanced dispersal opportunities may favor SAV expansion, reduced salinity and suspended sediments may drive shifts in the composition of SAV communities.

Monitoring data used to examine impacts of an initial sediment diversion also are required to parameterize the biological models needed to provide a broader mechanism for predicting ecological impacts of sediment diversions. Modeling will also be necessary to examine potential effects of different operation scenarios for diversion structures. A variety of models will be required from conceptual to holistic ecosystem models. The comprehensive approach used to examine uncertainty in the physical modeling of river dynamics needs to be extended to biological models. However, uncertainty in biological modeling is likely to be greater because of the wide array of species and their individual responses to spatiotemporal changes in the physical environment associated with diversions. Modeling is necessary in receiving basins of diversions to examine salinity, flooding, and nutrient effects on abundance, productivity, and species composition of emergent vegetation. These models should incorporate a dispersal module to assess recruitment potential of emergent marsh species in newly formed deltaic sediments. Colonization of receiving basins that are relatively isolated and degraded is likely to be slower than in vegetated basins with ample propagule sources.

Modeling of animal communities and fishery production is a necessity, and these models need to address potential interactions with other ecosystem impacts in coastal Louisiana (e.g., Deepwater Horizon oil spill, climate change, and other restoration projects). Uncertainty in these models can be addressed, but the challenge is likely to be even more difficult than in modeling vegetation dynamics because of the diversity of organisms involved and variability in responses to environmental drivers and trophic interactions. The responses of animals to newly developed emergent marsh are currently unpredictable. A major concern regarding diversion impacts is related to far-field changes in salinity and temperature. These environmental factors have been shown to affect the distribution and productivity of juvenile and adult fishery species. In addition, potential impacts on a variety of wildlife organisms (e.g., alligators, sea turtles, waterfowl, and marine mammals) needs to be examined.

Recommendations:

6. **Near-term (high priority).** Convene a session at a future Panel meeting to identify specific biophysical variables that should be targeted for monitoring. The goal of this effort would be to address questions about the spatial and temporal resolution required in a sampling program, expected power of statistical analyses, and gear efficiency.
7. **Near-term (high priority).** Propose the biophysical modeling framework that will be used to analyze scenarios and forecast ecological outcomes. Summarize all ecological models available to examine impacts of diversions and begin development of a variety of new models. In addition to specific response models, ecosystem models are needed that are spatially articulate and include trophic interactions. A model ensemble approach is recommended, because all models fail to represent reality but in different ways, and complementarity in model results can provide confidence in conclusions.
8. **On-going.** Develop a decision-making framework to complement monitoring efforts. This framework should explicitly specify how monitoring data will be analyzed and how the results will be used to guide adaptive management decisions.
9. **Near-term.** Investigate water driven erosion through numerical modeling of receiving basins (Delft3D or other) with different configurations of intertidal land. Manipulate flooding frequencies and nutrient loads in flooding water in an intermediate scale experiment (~10,000–100,000 m2) to assess biological and geomorphological impacts.
10. **Near-term.** Add simulations of sediment deposition across vegetated marshes to numerical modeling currently being conducted on sediment transport to receiving basins.
11. **Near-term (high priority).** Convene a Panel session devoted to water quality including speakers to present what is known and expected. This effort should include contrasting views on nutrient impacts, but be wider in scope than simply the nutrient-marsh stability issue.

3.4 Uncertainty in Social and Economic Outcomes: Complex System Interactions

Large-scale river diversions affect both biophysical and social outcomes. Therefore, it is imperative that river diversion planning and analysis capture linkages between social and biophysical systems. River diversions by design will change the character of natural resources (e.g., land mass, water quality, flood risks, species abundance) and social resources (e.g., fishing, hunting, navigation, agriculture, community structure, property value). Social and political outcomes are an important lens through which to view the performance of diversion projects. Ecosystem Services analysis is an approach that relates policy and management interventions—including diversions—to changed biophysical outcomes and then corresponding changes in social impacts, expressed as human health, financial, employment, and community welfare outcomes).

Social factors are also important drivers of diversion performance and constraints on operation. For example, sediment diversions require adequate sediment volumes and water flows for their delivery. Sediment volumes are a function of runoff affected by farming, construction, and urban practices throughout the Mississippi watershed. These practices are social phenomena that are influenced by regulations, technological innovation, and demographic changes. Projections of future navigation needs, in terms of water depth and timing, are also related to economic activity throughout the Mississippi River basin, and it is important that these are identified as a source of uncertainty.

The Panel acknowledges that linking biophysical outcomes to social outcomes complicates the interpretation of the success of diversion projects, but social outcomes cannot be ignored. Political conflict associated with unanticipated social outcomes is a potential barrier to implementation, progress, and learning. Analyses that illuminate social consequences will help address some potential political conflicts. In short, social analysis cannot be conducted independently from biophysical modeling and measurement. Social outcome analysis must be explicitly linked to those biophysical models that describe a diversion's effect on natural resource conditions, and must be addressed early on rather than as an afterthought.

Biophysical systems are associated with nonlinear and threshold outcome relationships, meaning that extrapolation from one study or result cannot usually be simply multiplied in order to predict what will happen in a larger system. Social outcomes present analogous challenges. The social and economic value of any given biophysical improvement (or loss) is highly dependent on the location of that change in the social landscape. A flood-pulse reduction may decrease flood damage as measured by reduced mortality and preserved property value. This is a function of location. This means that fine-scale economic analyses of ecosystem service benefits cannot be "multiplied by area" in order to scale up or be applied easily to other locations in the landscape.

Recommendations:

12. **Near-term (high priority).** Ensure that diversion assessments (models, data, outcomes, and monitoring) include both biophysical and socioeconomic elements. Incorporate the role of upstream social and economic factors, including other diversions and restoration projects, into diversion project performance assessment.
13. **On-going (high priority).** Communicate regularly with affected communities to exchange and incorporate social data into planning and implementation.
14. **Near-term (high priority).** Acknowledge the difficulties and uncertainties associated with non-linear biophysical and social outcome relationships. Ideally, diversion modeling—particularly of biotic phenomena—would explicitly incorporate conservation science designed to capture these nonlinear effects.

3.5 Design and Operational Uncertainties

Decisions about the design and construction of diversions must deal with significant challenges posed by a complex socioecological system that is dynamic and highly uncertain, as only limited knowledge exists on how the coupled system works. Adaptive management is well suited for dealing with these challenges. An adaptive management framework for diversions should be based on scenarios that project alternative future system conditions, flexible strategies for system-wide projects and individual diversion project design that account for a range of possible scenarios, and a monitoring program to track diversion project performance and required adaptive adjustments in project design and operation to deal with uncertainty and realistic expectations.

Factors that lead to uncertainties in the design of diversion structures include the level of political will, financial investments, and engineering design decisions that must consider variations in rates of sea-level rise, change in climate, the hydrology of the basin, and in hurricane intensity and frequency. Another factor is variation in the diversion systems that are built (single-project expectations vs.

multiproject expectations). Strategies in the design and construction of projects should consider multiple future system scenarios that vary in degree of project biophysical changes due to land building and subsequent social impacts influenced by biophysical changes. It is important to evaluate the cost of alternative levels of protection (e.g., account for uncertainty in sea-level rise, degree of life safety issues related to downstream flooding).

Once built, maximization of successful outcomes requires that a range of operating possibilities should be considered. Management strategies for operating the structures should address, for example, low and high flow periods, or unique combinations of events, such as a major flood combined with operational failure. A data program must be developed to track and adaptively manage the performance of the diversion structure with regard to the achievement of original objectives, such as expected land creation, biophysical changes, and resulting social impacts. Analyses of the monitoring data must take place to determine the performance of the system of diversions, required adjustments to strategies in light of actual trends, and increase scientific knowledge of system dynamics.

It is clear that diversion operational strategies may change through different stages of land creation and maintenance. Construction and operation strategies currently focus on maximizing the concentration of sediment in a given volume of diverted water. However, the desired grain size of sediment that is transported is also an important consideration, and may change over time. For example, coarse particles (sand) are beneficial in land building since they are less prone to compaction and resuspension. However, wetlands are largely maintained by finer particles (silt) since dense vegetation and low flow velocities preclude transport of larger particles across an established marsh. Grain size also influences transport distance into the receiving basins, so that it may be beneficial to deliver sand during the early stages of land creation (near the diversion structure) and silt during later stages of land creation (farther from the diversion structure). The uncertain ability of diversions to maintain created land requires more knowledge on how diversion operation may change through time.

Recommendations:

15. **Near-term (high priority).** Account for a range of scenarios that convey uncertainty and realistic expectations of performance. Experts should involve stakeholders (e.g., public agencies, private sector, and nongovernment groups) and the public in the development of scenarios and decisions regarding the design of diversions.
16. **Project-specific.** Report trends in performance of the diversion structures on a regular basis (e.g., annual report card), and communicate these to the public.
17. **Project-specific.** Develop real-time coordination and communication systems among organizations with responsibilities to manage and make adjustments in response to varying impacts of diversions. For example, a decision to construct a diversion that periodically releases floodwaters requires coordination with emergency managers responsible for downstream flood warnings, with a transportation agency that has the authority to change the operation of critical infrastructure, and with environmental managers charged with restoration of wetlands.

3.6 Framing Expectations in Light of Uncertainties

In previous sections, the Panel highlighted five major areas of uncertainty that are important for framing expectations: (1) availability of data to support analysis of project success, (2) analogs, (3) ecological outcomes, (4) social outcomes, and (5) design and operation. Complexities in the interactions among these biophysical and social elements produce uncertainties in outcomes that are greater than the sum of the parts; we must acknowledge that limitations exist in our ability to quantify this uncertainty. Communicating this uncertainty to stakeholders is a critical step in determining what level of risk is acceptable in project design and implementation. While science may help determine the odds of project success, social decisions that judge whether the level of certainty is appropriate are ultimately made by politicians and stakeholders rather than scientists. Thus a great deal of attention must be paid to appropriately setting expectations for project outcomes and carefully considering how to communicate potential outcomes and associated uncertainty.

Indicators of project success may depend on the timescale of observation, and stakeholders must be informed of this temporal uncertainty. For example, diversions may result in short-term land loss before any new land is created. Net land loss may still occur even if diversions successfully slow land loss relative to the no-action alternative. Communicating these potential outcomes, and their temporal and spatial uncertainty, is critical to framing reasonable stakeholder expectations. Current best practices across scientific disciplines include presenting the average most likely result, together with spatial and temporal variability. Developing an annual restoration report card should build public awareness. However, conveying this information is critical to the success of the restoration, and trained experts in the field of science communication should be retained throughout the restoration plan. We think these experts—rather than the Panel—could offer better advice on how to effectively communicate spatial and temporal uncertainty in a complex, constantly adjusting system.

Recommendations:

18. **On-going.** Develop a communications plan that links decision framework outcomes to key elements of communication to stakeholders, policymakers, and politicians.

Appendix 1:

ABOUT THE EXPERT PANEL ON DIVERSION PLANNING AND IMPLEMENTATION

The Expert Panel on Diversion Planning and Implementation was established to provide independent advice as plans for implementing sediment diversion projects along the Mississippi and Atchafalaya rivers that support coastal restoration are refined.

This independent panel is expected to meet approximately three times per year. It will identify critical scientific and technical uncertainties, suggest specific research to reduce uncertainty, and review and comment on technical reports, model outputs, and other aspects of project development. Given the issues surrounding the complexity of the design and operation of a major sediment diversion, the panel's recommendations will be in an adaptive management context. Meetings of the panel will be structured to ensure key input is received from a variety of local experts, stakeholders, and citizens. Panel reports will be presented at meetings of the CPRA Board.

The Expert Panel was formed at the request of the Coastal Protection and Restoration Authority (CPRA), which is also funding the effort. The Water Institute of the Gulf provides staff and logistical support to the panel.

MEMBERS

Member	Affiliation	Expertise
Dr. John T. Wells	Virginia Institute of Marine Science (Panel Chair)	Deltaic Processes
Dr. Loretta Battaglia	Southern Illinois University	Restoration Ecology and Climate Change
Dr. Philip Berke	Texas A&M University	Urban Land Use and Environmental Planning
Dr. James Boyd	Resources for the Future	Economics and Environmental Policy
Dr. Linda Deegan	Marine Biological Laboratory	Fish Ecology, Biogeochemical Cycling and Nutrient Delivery
Dr. William Espey Jr	Espey Consultants Inc	Civil/Coastal Engineering and Water Resources
Dr. Liviu Giosan	Woods Hole Oceanographic Institution	Morphodynamics and Sedimentation
Dr. William Graf	University of South Carolina (Emeritus)	Rivers and Water Resources Management
Dr. Matt Kirwan	Virginia Institute of Marine Science	Coastal Landscapes and Sea Level Change
Dr. Tom Minello	NOAA Southeast Fisheries Science Center	Fisheries Ecology
Dr. Martha Sutula	Southern California Coastal Water Research Project Authority	Water Quality Management, Systems Ecology
Dr. John Teal	Woods Hole Oceanographic Institution (Emeritus)	Coastal Wetlands Ecology

Appendix 2:
MEETING #1 AGENDA

January 8, 2014
Capitol Park Welcome Center, 702 North River Road, Baton Rouge, LA

8:30	**Welcome and Panel Introductions**	**Dr. John Wells (Panel Chair),** Virginia Institute of Marine Sciences
9:00	**Purpose of the Panel/Charge to the Panel**	**Dr. Chip Groat,** The Water Institute of the Gulf
9:15	**Diversions: Our Path Forward**	**Mr. Kyle Graham,** Coastal Protection and Restoration Authority
10:15	**Break**	
10:30	**USACE Perspective of Diversions**	**Brig. Gen. Peter A. "Duke" DeLuca,** U.S. Army Corps of Engineers
11:10	**Background on Diversions as a Restoration Tool**	**Mr. Jim Tripp,** Environmental Defense Fund **Mr. Michael Massimi,** Barataria-Terrebonne National Estuary Program
12:00	**Lunch**	
1:15	**Further Discussion of Charge for Meeting**	
1:30	**Model Assessment Approach**	**Dr. Ehab Meselhe,** The Water Institute of the Gulf
2:10	**Approaches in Everglades Planning**	**Dr. Alaa Ali,** South Florida Water Management District
2:40	**Break**	
2:50	**Agency Panel:** **Perspectives on Uncertainty in Long-Term Planning**	**Mr. John Ettinger,** Environmental Protection Agency **Mr. Ronny Paille,** Fish and Wildlife Services **Mr. Mark Wingate & Mr. Martin Mayer,** U.S. Army Corps of Engineers
4:00	**Public Comment Period**	Comments received from: Mr. George Rey, COTS Technology Mr. George Ricks, Save Louisiana Coalition Mr. Scott Eustis, Gulf Restoration Network Mr. Matt Rota, Gulf Restoration Network Mr. David Muth, National Wildlife Federation Mr. Doug Daigle, Louisiana Hypoxia Working Group Dr. Paul Kemp, G.P. Kemp and Assoc. LLC Mr. Charles Caillouet, Friends of the Atchafalaya
5:00	**Adjourn**	

Appendix 3

READ AHEAD MATERIAL PROVIDED TO PANEL PRIOR TO MEETING #1

Adamack, A. T., Stow, C. A., Mason, D. M., Rozas, L. P., & Minello, T. J. (2012). Predicting the effects of freshwater diversions on juvenile brown shrimp growth and production: A Bayesian-based approach. *Marine Ecology Progress Series*, *444*, 155–173. doi:10.3354/meps09431

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Day, J. W., Bailey, C., Batker, D., Bentley, S., Cable, J., Costanza, R., … Willson, C. S. (2012). *Answering 10 fundamental questions about the Mississippi River Delta* (p. 42). Mississippi River Delta Science and Engineering Speical Team. Retrieved from http://www.mississippiriverdelta.org/restore-the-delta/science/answering-10-fundamental-questions-about-the-mississippi-river-delta/

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