

***Category 5: Louisiana Coastal Protection &  
Restoration (LACPR)  
Workshop Transcripts  
February 13-14, 2006***



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# Table of Contents

<b>1. Executive Summary</b> .....	<b>3</b>
<b>2. Presentation Comments, Questions &amp; Answers</b> .....	<b>6</b>
Welcoming Remarks: Colonel Richard Wagenaar, Commander New Orleans District, Army Corps of .....	6
Category 5 Hurricane Threat: Vann Stutts .....	6
Multiple Lines of Defense: Dr. John Lopez.....	12
A Framework for Planning: Dr. Denise Reed.....	22
Integrating Storm Protection and Coastal Restoration for Louisiana: Tim Axtman.....	30
Assessment of Hurricane Protection Needs for Lower Louisiana: Carl Anderson .....	38
Coastal Protection and Restoration: Resource Agency Environmental Alternative Proposals: Bruce Baird .....	43
Preliminary Resource Agency Environmental Alternatives.....	44
Louisiana Hurricane Realities: Ivor van Heerden.....	52
Bring Back New Orleans Commission: Bruce Thompson.....	60
Greater New Orleans Area's East Gulf Portal: Dr. Sherwood Gagliano.....	71
A GulfNET Update: Dr. Anthony Cavell .....	73
The Sierra Club Perspective: Casey Roberts .....	75
Planning Principles: Mark Davis.....	76
Additional Discussion Themes .....	76
<b>3. Principle Prioritization</b> .....	<b>77</b>
<b>4. Structural Alternatives</b> .....	<b>81</b>
<b>5. Structural Alternatives</b> .....	<b>95</b>
<b>6. Team Recommendations, Options and Ideas</b> .....	<b>101</b>
New Orleans Options & Ideas 1 .....	102
New Orleans Options & Ideas 2 .....	105
New Orleans Options & Ideas 3.....	107
Coast Options & Ideas 1 .....	108
Coast Options & Ideas 2 .....	110
Coast Options & Ideas 3 .....	111
Sabine/Mermentau Ideas & Alternatives.....	118
Summary Discussion.....	119
<b>Appendix A: Workshop Attendance Roster</b> .....	<b>120</b>
February 13, 2006.....	120
February 14, 2006.....	123
<b>Appendix B: LACPR Workshop Presession Feedback</b> .....	<b>125</b>
<b>Appendix C: South Louisiana Hurricane Protection and Restoration Legislative Direction</b> .....	<b>133</b>

# 1. Executive Summary

## **Overview**

More than 100 south Louisiana stakeholders representing numerous agencies and support groups in Louisiana, met in Lafayette, LA for a 2-day workshop to review preliminary alternatives and planning criteria for the Louisiana Coastal Protection and Restoration Project. Participants were encouraged to respond to existing plans and planning principles and offer different alternatives that may achieve project goals.

## **Introduction**

Authorization and appropriation was in the Energy and Water Development Appropriations Act 2006 (P.L. 109-103). The Corps was provided \$8 M to develop a full range of flood control, coastal restoration and hurricane protection measures exclusive of normal policy considerations at full Federal expense. The Department of Defense Appropriations Act, 2006, (P.L. 109-148) provided another \$12 M, but this money is not available until the State of Louisiana establishes a single state entity to act as local sponsor for construction, operation and maintenance of all the hurricane, storm damage reduction and flood control projects in the greater New Orleans and southeast Louisiana area. A preliminary technical report for Category 5 protection will be submitted in June 2006 and a final technical report by December 2007. The analysis will be done in close coordination with the State of Louisiana (and also local interests, other Federal agencies, academic researchers and international managers and scientists).

A workshop was held in Vicksburg, MS in Dec. 2005 to estimate the maximum hurricane impact. The initial plan formulation meeting was held in Lafayette, LA in Feb. 2006 to develop a set of alternative alignments for model runs. Over 100 stakeholders attended and participated. A workshop on technical approaches to engineering and new innovations was held in Vicksburg, MS in March 2006. Public scoping meetings will be held at four sites in LA in March 2006.

## **The Process**

The first day began with a series of presentations from subject matter experts, questions and answers from the workshop participants and a facilitated discussion of each presentation. In addition to scheduled presentations, workshop participants were encouraged to offer their own plans or plan perspectives. A unique methodology was used to capture an initial round of comments on each plan. Participants were linked via a wireless network of PCs which enabled them to enter comments simultaneously and anonymously. Team members were able to view the comments of all session participants without knowing who entered them. This methodology enabled workshop members to focus more on specific ideas...and less on who was offering them.

Day two focused on team development and prioritization of consensus-based principles for Corps planners, applicable to a variety of planning scenarios. The team also developed a series of structural recommendations and offered an initial prioritization of this list.

Finally, a team of GIS specialists and facilitated discussion was used to capture real-time recommendations from workshop participants on specific regional planning recommendations.

## ***Major Recommendations***

The following major recommendations and recommendations emerged from these discussions:

Use recently gathered information and data about tidal surge and flooding within the South LA ecosystem to modify existing projects based on a people first priority schedule.

Flood control and coastal restoration are mutually inclusive strategies that must be properly blended for viable long-term success.

Start with existing, approved strategies for flood protection and natural resource enhancement relative to flooding, then modify those existing plans for quick implementation – don't start from scratch. Modify as necessary the inventory of existing projects.

Cost-benefit analysis; economic equity for impacted citizens, communities, and industries; sustainability; and restoration of natural ecosystems are priority principles that must be considered in any solution.

Sustainable solutions must include resource-based initiatives, recognizing that a 10-year land building effort is not a part of the 6 month proposal due to the lack of data points available for modeling this type of solution, but natural solutions must be part of the long-term solutions included in the 24-month plan.

Multiple Lines of Defense are crucial for sustainable protection of Southern Louisiana from flooding and storms.

Despite the rapid timeline mandated by Congress, maximize stakeholder participation opportunities or expect implementation delays.

The Corps will pursue rapid modeling of the options presented, without worrying about the exact siting and specific structural features, focusing instead on modeling results related to suppression of flooding risks, tidal surge, and other wind and water impacts.

Think outside the map – solutions will involve new thinking, new technologies, and materials and ideas from other places.

Subsidence cannot be over-emphasized in the planning. Combined with shoreline erosion, this issue will contribute to significant future challenges.

In addition to protecting significant populations and communities from Category 4 or 5 storm impacts, solutions such as ring levees and other localized protections for ameliorating the flooding impacts of lesser storms (top-able levees to slow down surge) may be included in planning options.

Apply lessons-learned from Dutch experiences. Avoid repeating the same mistakes, but *do plan on making new mistakes* specific to local conditions.

Over the years, inability to reach consensus or closure on proposed options, lack of funding, multiple competing political voices, and the inability of divergent interests to work together have led to the current situation of dangerously inadequate and deteriorating protections offered by man-made and natural "barriers".

Special emphasis is recommended on restoring, mimicking, and enhancing natural and historic ecosystem features to address flooding, surge and wind impacts.

Plan for expensive, ongoing maintenance for repair and modification of subsiding and eroding solutions/features.

The team recommended creation of an overall sediment budget for this project to ensure a readily available, ongoing source of sediment for the future.

Rapid time lines mandated by Congress may preclude “normal” public input processes necessitating planners to use the principles developed in the workshop as a lens for project planning and implementation.

It is time to set aside old arguments, ongoing debates and theoretical/philosophical disagreements and get to work implementing solutions before national funds and national attention turn elsewhere.

### ***Notes on Report Formatting***

Team generated input is indicated in normal typeface. The facilitation team summarized and captured key discussion themes. Italicized/asterisked team questions and discussion teams were captured by the facilitation team. Where possible, comments are identified by who offered them. This was not always possible as speakers sometimes did not identify themselves and discussions occasionally overlapped. This document is not a transcription, but a capture of key discussion themes.

## 2. Presentation Comments, Questions & Answers

### ***Welcoming Remarks: Colonel Richard Wagenaar, Commander New Orleans District, Army Corps of***

The workshop was opened by Colonel Richard Wagenaar, Commander, New Orleans District Army Corps of Engineers. Colonel Wagenaar stressed the urgency of the planning process and thanked each participant for their attendance. He introduced and clarified Edmond Russo's role as Project Manager representative of the Colonel.

### ***Category 5 Hurricane Threat: Vann Stutts***

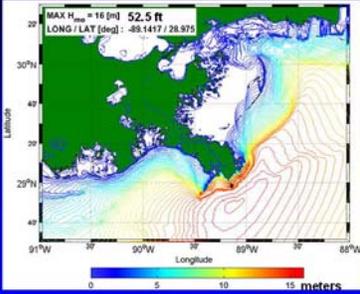
#### **Summary**

PL 109-103 provided \$8M for the Corps of Engineers to conduct a comprehensive hurricane protection study at full Federal expense to develop a full range of flood, coastal and hurricane protection measures for south LA. A Feasibility Study for short-term protection must be submitted within 6 months and a full report within 24 months. The report shall consider the equivalent to Category 5 protection. A workshop was held in Vicksburg MS on Dec 20-21, 2005 to discuss the winds of tropical cyclones, water levels and storm surge, waves including design wave heights and risk or frequency of occurrence. Representatives of National Center for Environmental Prediction, National Weather Service, ERDC, Delft University, Notre Dame University and a private contractor made presentations.



<p>3</p>	<p>Hurricane Rita Sept. 23, 1432 UTC Clouds: NOAA GOES Background: NASA/ODIS Image credit: NASA/GSFC</p> 	<p>4</p>	<p><b>Public Law 109-103</b> Energy and Water Development Appropriations Act, 2006</p> <p><b>DEPARTMENT OF THE ARMY</b></p> <p><b>Corps of Engineers--Civil</b></p> <p>The following appropriations shall be expended under the direction of the Secretary of the Army and the supervision of the Chief of Engineers for authorized civil functions of the Department of the Army pertaining to rivers and harbors, flood control, shore protection and storm damage reduction, aquatic ecosystem restoration, and related purposes.</p> <p><b>INVESTIGATIONS</b></p> <p>....That using \$8,000,000 of the funds provided herein, the Secretary of the Army, acting through the Chief of Engineers, is directed to conduct a comprehensive hurricane protection study at full Federal expense to develop and present a full range of flood, coastal and hurricane protection measures exclusive of normal policy considerations for south Louisiana and the Secretary shall submit a feasibility report for short-term protection within 6 months of enactment of this Act, interim protection within 12 months of enactment of this Act and long-term comprehensive protection within 24 months of enactment of this Act: <i>Provided further</i>, That the Secretary shall consider providing protection for a storm surge equivalent to a Category 5 hurricane within the project area and may submit reports on component areas of the larger protection program for authorization as soon as practicable: <i>Provided further</i>, That the analysis shall be conducted in close coordination with the State of Louisiana and its appropriate agencies.</p>															
<p>5</p>	<p>.....long-term comprehensive protection within 24 months of enactment of this Act: <i>Provided further</i>, That the Secretary shall consider providing protection for a storm surge equivalent to a Category 5 hurricane within the project area and may submit reports on component areas of the larger protection program for authorization as soon as practicable.....</p>	<p>6</p>	<p><b>Saffir-Simpson Scale</b></p> <table border="0"> <tr> <td>Category 1</td> <td>74 – 95</td> <td>mph winds</td> </tr> <tr> <td>Category 2</td> <td>96 – 110</td> <td>mph winds</td> </tr> <tr> <td>Category 3</td> <td>111 – 130</td> <td>mph winds</td> </tr> <tr> <td>Category 4</td> <td>131 – 155</td> <td>mph winds</td> </tr> <tr> <td>Category 5</td> <td>155+</td> <td>mph winds</td> </tr> </table>	Category 1	74 – 95	mph winds	Category 2	96 – 110	mph winds	Category 3	111 – 130	mph winds	Category 4	131 – 155	mph winds	Category 5	155+	mph winds
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<p>7</p>	<p><b>Category 5 Workshop 20-21 Dec 2005</b> <b>Engineering Development Research Center</b> <b>ERDC</b></p> <p>Winds - Tropical Cyclones</p> <p>Water Levels – Storm Surge</p> <p>Waves – Design Wave Heights</p> <p>Risk– Frequency of Occurrence</p>	<p>8</p>	 <p><b>Hurricane Intensity and Structure - Prediction and Importance</b></p> <p>JACK BEVEN TROPICAL PREDICTION CENTER</p> <p>WHERE AMERICA'S CLIMATE AND WEATHER SERVICES BEGIN</p>															

<p>9</p>	<p>The use of computational models in water control of The Netherlands Guus Stelling, Vicksburg, December 2005</p>  	<p>10</p>	 <p><b>Storm Surge Prediction in Southern Louisiana</b></p> <p>Joannes Westerink and Shintaro Bunya University of Notre Dame</p> <p>Rick Luetlich University of North Carolina – Chapel Hill</p> <p>Clint Dawson University of Texas - Austin</p> <p>ERDC Category 5 Hurricane Workshop December 20, 2005</p>
<p>11</p>	  <p><b>Hurricane Protection Design Workshop</b></p> <p>Vicksburg, MS Dec. 20-21, 2005</p> <p>Dr. Wilson (Will) Shaffer NATIONAL WEATHER SERVICE</p>	<p>12</p>	   <p><b>Hurricane Risk for the Northern Gulf Coast</b></p> <p>JACK BEVEN TROPICAL PREDICTION CENTER</p> <p>WHERE AMERICA'S CLIMATE AND WEATHER SERVICES BEGIN</p>
<p>13</p>	<p>Estimating Storm Frequency</p>  <p>Don Resio Coastal and Hydraulics Lab, ERDC, Vicksburg, MS</p> <p>Hurricane Protection Design Workshop December 20-21, 2005</p>	<p>14</p>	<p>EXPANDING THE REALM OF POSSIBILITY</p> <p><b>Assessing Hurricane Risk along the US Coastline</b></p> <p>Peter J Vickery Applied Research Associates 8540 Colonnade Center Drive Raleigh, NC, 27615</p>  <p>Applied Research Associates, Inc. An Employee-Owned Company</p> <p>ICC Conference February 2005</p>

<p>15</p> <p>Effect of waves and morphology on boundary conditions</p> <p>New Orleans Hurricane Protection Design Workshop, 20-21 December, 2005</p> <p>Prof. Dano Roelvink UNESCO-IHE, Delft Hydraulics and Delft University of Technology</p> 	<p>16</p> <h3>Wave Prediction in Southeast Louisiana</h3>  <p><b>J.M. Smith, R.E. Jensen, and A.R. Sherlock</b></p> <p>US Army Corps of Engineers Coastal and Hydraulics Laboratory - ERDC</p>				
<p>17</p> <p>A selection of Slides taken from the Workshop presentations follows:</p>	<p>18</p> <h3>Tropical Cyclone Intensity</h3> <ul style="list-style-type: none"> <li>• The intensity is the maximum sustained wind anywhere in the cyclone</li> <li>• These maximum sustained winds normally cover only a <u>limited</u> area near the center of the cyclone</li> <li>• Generally, the stronger the cyclone, the closer the maximum winds are to the center</li> </ul> <p>Beven</p>				
<p>19</p> <h3>Structure and Intensity Variability</h3> <table border="0"> <tr> <td data-bbox="180 1356 500 1692"> <p>930 mb</p>  <p>Hurricane Floyd September 14, 1998 @ 1244 UTC</p> </td> <td data-bbox="505 1356 821 1692"> <p>933 mb</p>  <p>Hurricane Andrew August 23, 1992 @ 1231 UTC</p> </td> </tr> <tr> <td>Maximum winds: 105 kt TS Force winds: 250 n mi</td> <td>Maximum winds: 145 kt TS Force winds: 75 n mi</td> </tr> </table> <p>Beven</p>	<p>930 mb</p>  <p>Hurricane Floyd September 14, 1998 @ 1244 UTC</p>	<p>933 mb</p>  <p>Hurricane Andrew August 23, 1992 @ 1231 UTC</p>	Maximum winds: 105 kt TS Force winds: 250 n mi	Maximum winds: 145 kt TS Force winds: 75 n mi	<p>20</p> <h3>Tropical Cyclone Structure</h3> <ul style="list-style-type: none"> <li>• Shows tremendous storm-to-storm variability</li> <li>• Can also show tremendous variability in any given storm</li> <li>• As a generality, tropical cyclones get larger with time, increasing intensity, and increasing latitude</li> <li>• Two important elements are the overall size of the wind field and the radius of maximum winds (RMW)</li> </ul> <p>Beven</p>
<p>930 mb</p>  <p>Hurricane Floyd September 14, 1998 @ 1244 UTC</p>	<p>933 mb</p>  <p>Hurricane Andrew August 23, 1992 @ 1231 UTC</p>				
Maximum winds: 105 kt TS Force winds: 250 n mi	Maximum winds: 145 kt TS Force winds: 75 n mi				

21	<h3 style="text-align: center;">Radius of Maximum Wind</h3> <ul style="list-style-type: none"> <li>• The distance of the maximum sustained winds from the center of the cyclone - usually just outside the eye of a hurricane</li> <li>• The TPC does not forecast the RMW quantitatively, and the qualitative forecast skill would be low</li> <li>• The TPC Sea-Lake and Overland Surge from Hurricanes (SLOSH) model is very sensitive to this parameter</li> <li>• While small storms will generally have relatively small RMW's, large storms can have a variety of RMW sizes ranging from very small to very large</li> </ul> <p style="text-align: right;">Beven</p>	<h3 style="text-align: center;">Same Strength, Different Sizes</h3> <p style="text-align: right;">Beven</p>
23	<h3 style="text-align: center;">Changes In The Eye of Wilma</h3> <p>Pinhole eye on 19 October      Larger eye after eyewall cycle      Pressure and eye size evolution</p> <p style="text-align: right;">Beven</p>	<h3 style="text-align: center;">Importance of Structure on Surge and Waves</h3> <ul style="list-style-type: none"> <li>• Generally, for storms of equal intensity the amount and aerial coverage of storm surge increases as the RMW gets larger</li> <li>• Generally, for storms of equal intensity the amount and aerial coverage of storm surge increases as the overall size increases</li> <li>• Larger RMW's and overall sizes generally mean larger fetch areas for wave generation</li> </ul> <p style="text-align: right;">Beven</p>

**Discussion Notes:**

**Denise Reed:** *It's important NOT to create the impression that experts know all there is to know in developing plans. There are huge Implications for climate change.*

**Stutts:** *Weather service updates address the probabilities of storm events. Cyclic nature of this activity vs. past decades and how this will be addressed. The highest intensity event is being defined that would produce the largest surge possible on the LA coast.*

**Denise Reed:** *Given what was discussed this morning, how are we incorporating global change into the planning process? There is plenty of debate on this in the scientific community.*

**Stutts:** *That answer is a great unknown. Our probabilistic projections are based on historic events, what's occurred.*

**All of the levee upraises described today taken together represent a huge volume of sediment...where will it come from?**

*Stutts: A: serious consideration on this is necessary. Where does borrow originate? Quality? At some point we know the time required to construct and the amount needed become excessive. These breakevens need to be identified and will be examined at the March 2/3 technical workshop.*

***CAT 3-4-5 refers to wind speed. How is this linked to storm surge? Can anyone explain this discrepancy?***

*Stutts: Although these are related, they may not be directly related. Probable max hurricane definitions are being developed to assist in the screening process. These will identify likely surge at specific locations and enable us to pinpoint storm frequency and likelihood of landfall.*

***Shelf slope explanation: how does this affect susceptibility to storm surge?***

*Dr: Risse: wind stress on surface builds a slope. The slope is a function of water depth. Longer distances tend to generate stronger surges up the coast.*

**Team Comments**

What occurs to these steep slopes when the recent earthquake not only near Baton Rouge happened, but just recently near these slopes spoken of today in the Gulf of Mexico's bottom floor?

Wouldn't unpredicted floor bottom earthquakes revise the theories shown?

It is obvious that a specific value (surge and design wave f.i.) is needed. The probability of those numbers requires special attention. As so many aspects of the hurricanes influence those design figures a model with known properties fed with parameters with known distributions is necessary.

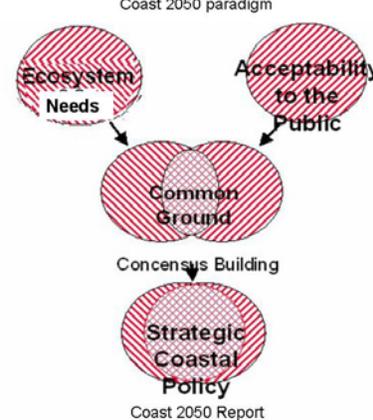
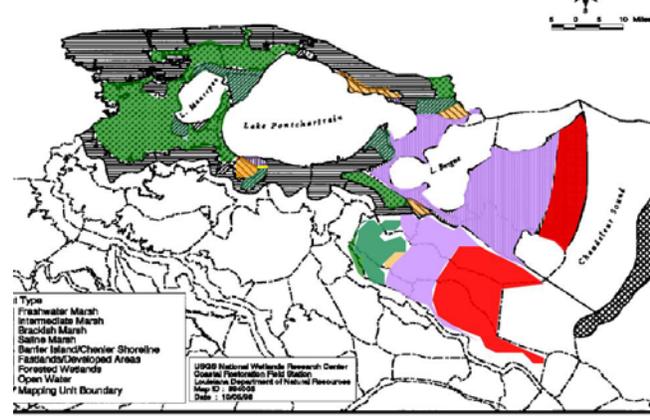
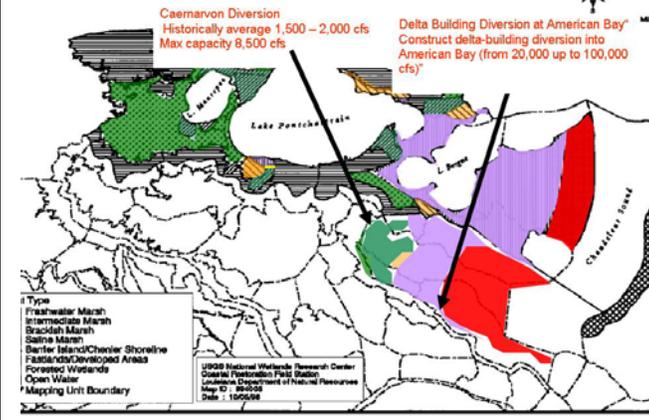
Tim Axtman showed a slide that showed 28 foot of surge off the Mississippi coast and only 11 feet in Lake Pont. Is that evidence that the landbridge (marsh) reduced storm surge, and if not, why not?

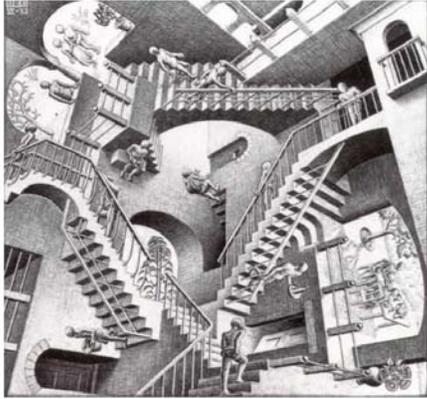
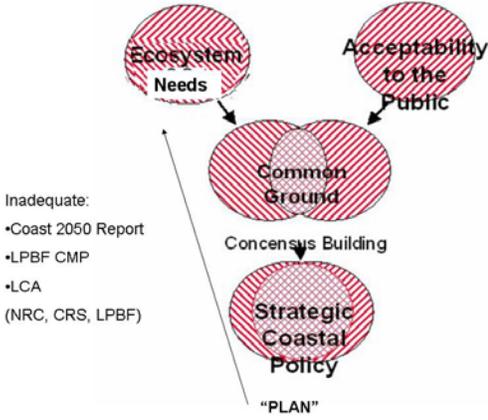
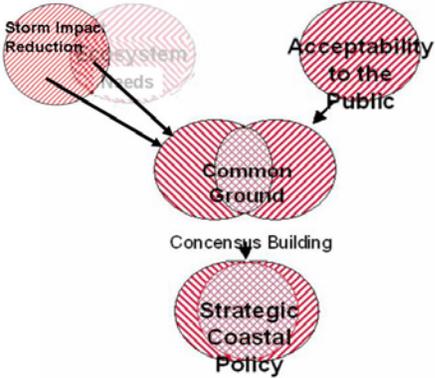
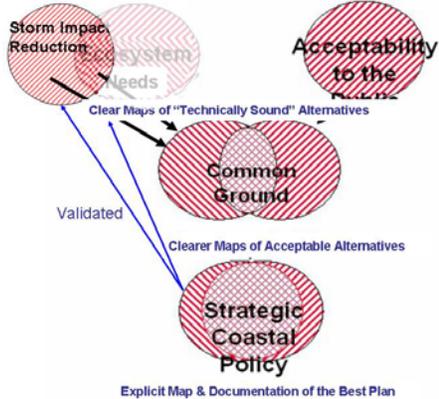
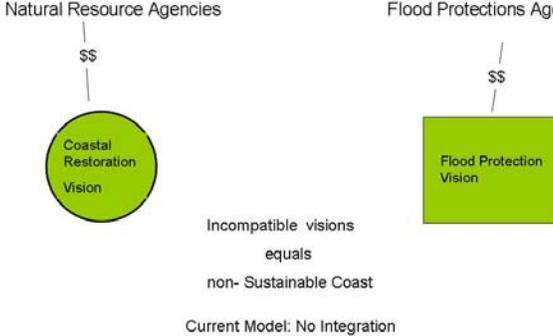
What about sloshing within the Lake and stacking of water from the Lake against the southern shore from a prolonged, extreme North wind? Some of the data suggest that most of the storm surge that compromised the canal levees was from this sloshing within the Lake and not new water entering the lake from a storm surge. This could be significant if we are designing to keep storm surge out of the Lake and anticipate this to resolve the surge issue along the southern shore of Lake. Pontchartrain.

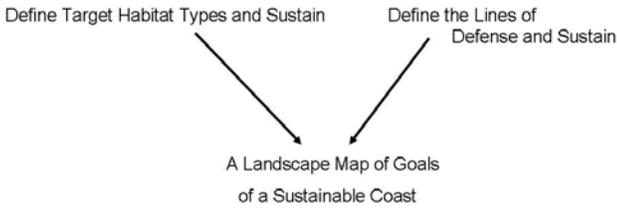
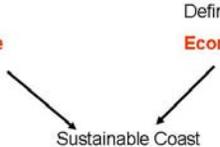
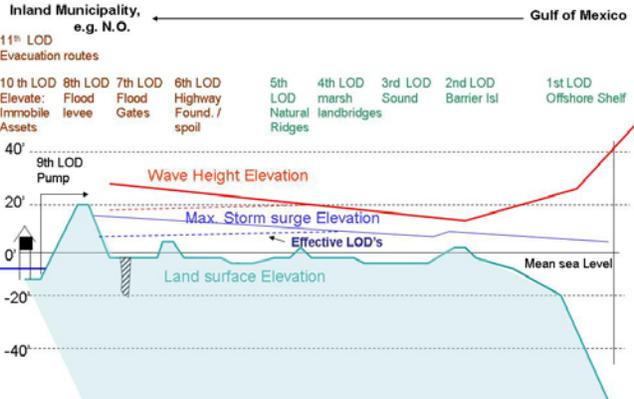
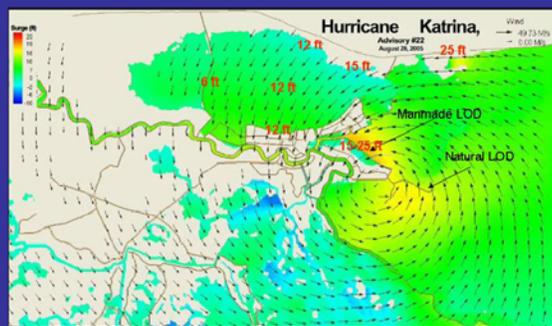
# Multiple Lines of Defense: Dr. John Lopez

## Summary

We must integrate coastal restoration and flood protection. This is best done by defining and sustaining target habitat types and lines of defense so a landscape map of a sustainable coast is developed. Target habitat types are vital because they force stakeholders to align their programs toward common goals. Lines of defense include the offshore shelf, barrier islands, sounds, marsh landbridges, natural ridges, highway and railroad foundations, flood gates, flood levees, elevation of immobile assets and evacuation routes. Dr. Lopez proposed 10 natural lines of defense projects for the Pontchartrain basin including a river reintroduction at Violet, restoration of the Chandeleur Islands, restoration of 6 marsh landbridges and one natural ridge (including restriction of MRGO to GIWW dimensions) and one fringe marsh. It is as important to restore function as form. Marsh landbridges should be survivor marsh. Quantitative hydrologic and ecologic models must be used to help define the map and guide toward sustainability. Adaptive management is a vital part of the program.

<p>1</p> <h3>The Multiple Lines of Defense Strategy to Sustain Coastal Louisiana</h3> <p>Lake Pontchartrain Basin Foundation Coastal Sustainability Program John Lopez, Ph.D. February 2006 LACPR workshop</p> <p>Supporting Documents The Multiple Lines of Defense Strategy to Sustain Coastal Louisiana, 2005 Comprehensive Habitat Management Plan for the Lake Pontchartrain Basin, 2006 Pontchartrain Coastal Lines of Defense Program, 2006</p> <p>see <a href="http://SAVEOURLAKE.org">SAVEOURLAKE.org</a> <b>SAVE OUR LAKE</b> LAKE PONTCHARTRAIN BASIN FOUNDATION</p>	<p>2</p>  <p>Coast 2050 paradigm</p> <p>Ecosystem Needs</p> <p>Acceptability to the Public</p> <p>Common Ground</p> <p>Consensus Building</p> <p>Strategic Coastal Policy</p> <p>Coast 2050 Report</p> <p>Source: Coast 2050 brochure</p>
<p>3</p> <h3>Coast 2050 Habitat Goals in the Pontchartrain Basin</h3>  <p>Type</p> <ul style="list-style-type: none"> <li>Freshwater Marsh</li> <li>Intermediate Marsh</li> <li>Brackish Marsh</li> <li>Saline Marsh</li> <li>Barrier Island/Chenier Shoreline</li> <li>Flooded/Developed Areas</li> <li>Forested Wetlands</li> <li>Open Water</li> <li>Mapping Unit Boundary</li> </ul> <p>USGS National Wetlands Research Center Coastal Wetlands Field Station Louisiana Department of Natural Resources Map ID : 800588 Date : 10/05/98</p>	<p>4</p> <h3>Coast 2050 Habitat Goals for the Pontchartrain Basin: Non-scientific &amp; Non-sustainable "Escher Map"</h3>  <p>Caemaron Diversion Historically average 1,500 – 2,000 cfs Max capacity 8,500 cfs</p> <p>Delta Building Diversion at American Bay* Construct delta-building diversion into American Bay (from 20,000 up to 100,000 cfs)*</p> <p>Type</p> <ul style="list-style-type: none"> <li>Freshwater Marsh</li> <li>Intermediate Marsh</li> <li>Brackish Marsh</li> <li>Saline Marsh</li> <li>Barrier Island/Chenier Shoreline</li> <li>Flooded/Developed Areas</li> <li>Forested Wetlands</li> <li>Open Water</li> <li>Mapping Unit Boundary</li> </ul> <p>USGS National Wetlands Research Center Coastal Wetlands Field Station Louisiana Department of Natural Resources Map ID : 800588 Date : 10/05/98</p>

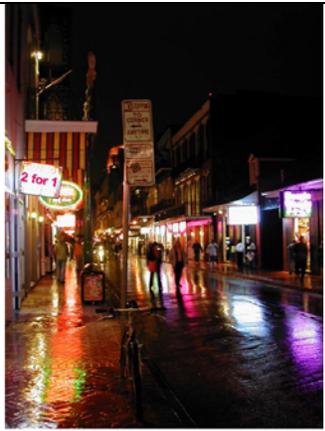
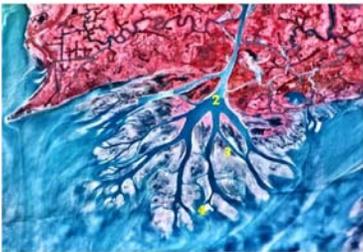
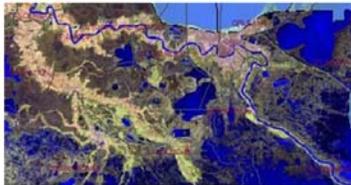
<p>5</p>	<p>M. C. Escher Drawing of Stairs</p> 	<p>6</p> <p>Pre-Katrina Paradigm</p>  <p>Inadequate:</p> <ul style="list-style-type: none"> <li>•Coast 2050 Report</li> <li>•LPBF CMP</li> <li>•LCA (NRC, CRS, LPBF)</li> </ul>
<p>7</p>	<p>Post - Katrina Paradigm</p> 	<p>8</p> <p>Post - Katrina Paradigm</p>  <p><i>"To Achieve this, the development of an explicit map of the future landscape of coastal Louisiana should be a priority as the implementation of the LCA study moves ahead." National Research Council 2005</i></p>
<p>9</p>	<p>10</p> <p><b>Maps <math>\neq</math> Panacea</b></p> <p><b>Maps are not:</b></p> <ul style="list-style-type: none"> <li>▪A replacement for basic science and engineering</li> <li>▪The sole product of a restoration plan</li> <li>▪The only medium for analysis</li> </ul> <p><b>Maps are:</b></p> <ul style="list-style-type: none"> <li>▪The best articulation of the landscape plan &amp; goals</li> <li>▪A dynamic medium that may be adjusted when and where appropriate</li> <li>▪Inadequate without a compliment of technical reports</li> </ul> <p style="color: red;">Inadequate maps are symptomatic of other challenges</p> <p><b>Traditional Model Addressing Coastal Restoration and Flood Protection</b></p>  <p>Natural Resource Agencies</p> <p>Flood Protections Agencies</p> <p>Coastal Restoration Vision</p> <p>Flood Protection Vision</p> <p>Incompatible visions equals non-Sustainable Coast</p> <p>Current Model: No Integration</p>	

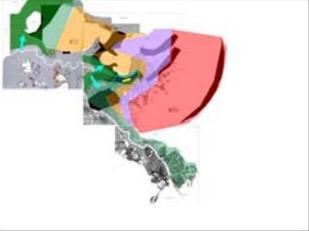
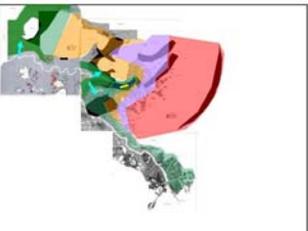
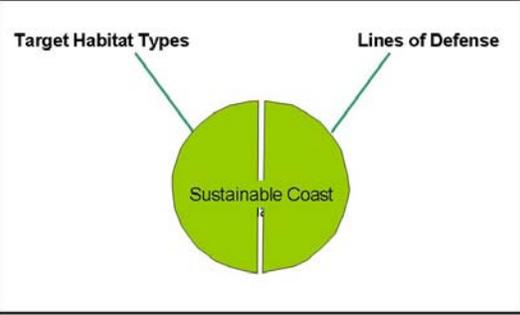
<p>11</p>	<p><b>The Future Model to Integrate of Coastal Restoration and Flood Protection</b></p> <p>Natural Resource Agencies      Flood Protection Agencies</p>  <p>Future Model: Common Vision</p>	<p>12</p> <p><b>How do you Technically Integrate Dual Goals?</b> <b>The Multiple Lines of Defense Strategy</b></p> <p>Define Target Habitat Types and Sustain      Define the Lines of Defense and Sustain</p>  <p>A Landscape Map of Goals of a Sustainable Coast</p>
<p>13</p>	<p><b>Integrate of Coastal Restoration and Flood Protection</b></p> <p>Define <b>Habitat Types</b>      Define the <b>Lines of Defense</b></p> <p><b>Ecologic Engine</b>      <b>Economic Engine</b></p>  <p>Sustainable Coast</p>	<p>14</p> <p><b>Lines of Defense (LOD) are definable geographic areas in which certain natural or manmade features or activities are promoted or implemented, resulting in the reduction of impacts by tropical weather systems in the Louisiana coast.</b></p> <p>(The order of LOD's derived from the physical location of the LOD's moving from the Gulf of Mexico inland. The order is not intended to indicate a relative significance, just relative physical position.)</p>
<p>15</p>	<p><b>Model of Multiple "Lines of Defense" (LOD) to Reduce the Impact of Tropical Weather Systems to the Louisiana coast (Scale is vertically exaggerated and approximate)</b></p> <p>Inland Municipality, e.g. N.O.      Gulf of Mexico</p> <p>11<sup>th</sup> LOD Evacuation routes</p> <p>10<sup>th</sup> LOD Elevate: Immobile Assets</p> <p>8<sup>th</sup> LOD Flood levee</p> <p>7<sup>th</sup> LOD Flood Gates</p> <p>6<sup>th</sup> LOD Highway Found./spoil</p> <p>5<sup>th</sup> LOD Natural Ridges</p> <p>4<sup>th</sup> LOD marsh landbridges</p> <p>3<sup>rd</sup> LOD Sound</p> <p>2<sup>nd</sup> LOD Barrier Isl</p> <p>1<sup>st</sup> LOD Offshore Shelf</p> 	<p>16</p>  <p><b>Hurricane Katrina, Advisory #22 August 26, 2005</b></p> <p>Model from the LSU Hurricane Center of a projected Hurricane Katrina track. Actual track was a few miles east. Colors indicate expected storm surge. Orange color east of St. Bernard along the MRGO indicate excess surge levels from the "funnel effect" near the westward convergence of the MRGO spoil bank with the flood levees along the Gulf Intracoastal Waterway. Note also Bayou la Loutre ridge impeding storm surge.</p> <p>Image courtesy of the LSU Hurricane Center</p>

<p>17</p>	<p><b>How do you Technically Integrate Dual Goals?</b> <b>The Multiple Lines of Defense Strategy</b></p> <p>Define Target Habitat Types and Sustain      Define the Lines of Defense and Sustain</p> <p>A Landscape Map of Goals of a Sustainable Coast</p>	<p>18</p> <p>CHMP – Figure 17 p 78</p>
<p>19</p>	<p><b>Why is the target habitat map essential?</b></p> <p>It is the "floor plan" for a functional estuary (defining the salinity regime, vegetation &amp; topography)</p> <p>It shifts the coast to a more riverine and sustainable condition</p> <p>It delineates the future natural landscape resources promoting the economy (including fur, fin and feather)</p> <p>It allows (and forces) all stakeholders to align their programs toward the goals</p> <p><i>The "flood-protection service" provided by the natural landscape requires more than just elevation, it requires biologic functionality.</i></p> <p><i>If was just about elevation, we would not have marsh creation projects and we would not have a functional estuary.</i></p>	<p>20</p> <p><b>The Nine Coastal Lines of Defense in the Pontchartrain Basin For Restoration</b></p> <p>Eleven Lines of Defense</p> <ol style="list-style-type: none"> <li>1) Offshore shelf</li> <li>2) Barrier Islands</li> <li>3) Sounds</li> <li>4) Marsh landbridges</li> <li>5) Natural ridges</li> <li>6) RR/Hwy Foundations</li> <li>7) Flood gates</li> <li>8) Flood levees</li> <li>9) Pump Capacity</li> <li>10) Elevate immobile assets</li> <li>11) Evacuation routes</li> </ol>
<p>21</p>	<p><b>How do you Align Natural Resource and Flood Protection Agencies?</b></p> <p>Define Target Habitat Types and Sustain      Define the Lines of Defense and Sustain</p> <p>Sustainable Coast</p> <p>Answer: Integrate of Coastal Restoration and Flood Protection using the Multiple Lines of Defense Strategy, which creates a unified vision of habitat goals and flood protection elements.</p>	<p>22</p> <p>Habitats      Lines of Defense</p> <p>A common Vision of a Sustainable Ecosystem and Economy</p>

<p>23</p>	
<p>24</p>	<p><b>Pontchartrain Coastal Lines of Defense Program</b></p> <ol style="list-style-type: none"> <li>1) Maintain the MRGO-Lake Borgne Landbridge</li> <li>2) Restore the Bayou la Loutre Ridge (includes construction of MRGO to GIWW dimensions)</li> <li>3) Restore the Chandeleur Barrier Islands</li> <li>4) Jefferson Parish Shoreline Restoration and Protection</li> <li>5) Mississippi R. Reintroduction at Violet, La. to maintain target habitats in Borgne-Biloxi estuary in LA and MS</li> <li>6) Maintain and restore the Biloxi Marsh Landbridge and reefs (South)</li> <li>7) Maintain and restore Breton Landbridge with the Caernarvon Diversion and marsh creation</li> <li>8) Maintain critical marsh shorelines and ridges of the East Orleans Landbridge</li> <li>9) Maintain and restore Biloxi Marsh Landbridge and barrier reefs (North)</li> <li>10) Maintain and enhance the Maurepas Landbridge with Maurepas Reintroduction &amp; Conservation</li> </ol>
<p>25</p>	<p><b>Integration of Development Corridors Routes into the LOD's</b></p> <p>Example Development Corridors</p>
<p>26</p>	<p><b>Pontchartrain Lines of Defense Program</b></p> <ul style="list-style-type: none"> <li>19 major coastal projects, included in 10/05 appropriation request</li> <li>Major Non- Lines of Defense Projects \$350M</li> <li>CHMP 100 recommendations       <ul style="list-style-type: none"> <li>Smaller Coastal Projects (not included in appropriation request)</li> <li>Non-coastal Projects (Upland forests and Riverine habitats)</li> </ul> </li> </ul>
<p>27</p>	<p><b>Pontchartrain Lines of Defense Program:</b></p> <p><b>Prioritized Projects Utilizing the Multiple Lines of Defense Strategy in the Pontchartrain Basin, i.e. providing dual benefits Current Funding Request</b></p> <ol style="list-style-type: none"> <li>1. Maintain the MRGO-Lake Borgne Landbridge LCA</li> <li>2. Restore the Bayou la Loutre Ridge (includes constriction of MRGO to ICW dimensions)</li> <li>3. Restore the Chandeleur Barrier Islands</li> <li>4. Construct the Jefferson Parish fringe marsh buffer</li> <li>5. Construct the Violet Reintroduction to maintain target salinity in LA and MS</li> <li>6. Maintain and restore the Biloxi Marsh Landbridge and reefs (South)</li> <li>7. Maintain and restore Breton Landbridge with Caernarvon and marsh creation</li> <li>8. Maintain critical marsh shorelines and ridges of the East Orleans Landbridge</li> <li>9. Maintain and restore Biloxi Marsh Landbridge and barrier reefs (North)</li> <li>10. Maintain and enhance the Maurepas Landbridge with Maurepas Reintroduction CWPBRA</li> </ol> <p><b>4% of the Pontchartrain Basin</b>  <b>7% of Pontchartrain Estuary</b>  <b>20% of Pontchartrain wetlands</b></p>
<p>28</p>	<p><b>Where:</b> MRGO-Borgne Land Bridge  <b>What:</b> Extensive Rock armoring, local marsh creation, Intermediate marsh  <b>Who:</b> Construction Team    US Army Corps of Engineers - Lead agency    EPA    LSU Hurricane Center    St. Bernard Parish    DNR    Lake Pontchartrain Basin Foundation  <b>Cost:</b> \$110,000,000</p> <p><b>Performance Goals</b></p> <p><b>Flood Protection:</b> Wetland buffer to St. Bernard levees and minimize encroachment of Lake Borgne into the MRGO</p> <p><b>Habitat Restoration:</b> Typical intermediate marsh nursery, recreational and commercial fishing</p>

<p>29</p>		<p>30</p> <p style="text-align: center;"><b>Suggested Integration Design Guidance For the Multiple Lines of Defense Strategy</b></p>
<p>31</p>	<p style="text-align: center;"><b>“Weakest Link”</b></p> <p>If coastal restoration is integral to our flood protection system,</p> <p>The twenty-year project/planning cycle for coastal restoration is too short and should be on-par with the project life of engineered lines of defense such as levees.</p> <p>Therefore, restoration of natural lines of defense must emphasize self-sustainability and cost-effectiveness to restore.</p>	<p style="text-align: center;"><b>“System Integrity”</b></p> <p>Natural coastal wetland habitats are positioned on the flood side of levees.</p> <p>Why:</p> <p>Better protection for levees due to wetland buffer</p> <p>Better to sustain habitats due to hydrology and reduced development impacts</p>
<p>33</p>	<p style="text-align: center;"><b>“Don’t throw good money after bad”</b></p> <p>Marsh landbridges should be defined as much as possible by existing “survivor marsh”</p> <p>Why?</p> <p>Historical precedent of sustainability</p>	<p>34</p> <p style="text-align: center;"><b>“Surge elevation benefit vs. wave energy reduction benefit”</b></p> <p>Exposed levees or infrastructure not buffered by a natural line of defense should have alternative buffers e.g. see below. Example sites Bayou Lafourche near Leeville, Jefferson Parish levee at Lake Pontchartrain, Hwy 90 at Lake Catherine, Mississippi River</p>

35	<p align="center"><b>“Don’t compromise coastal restoration for flood protection”</b></p> <p>Enhance coastal habitats and the flood protection service without compromising the ecological services.</p> <p>Why?</p> <p>Coastal restoration is expensive and ecological functionality promotes sustainability, i.e. reduces O&amp;M</p>	<p align="center"><b>“Restore Some Form &amp; All Function”</b></p> <p align="center">Don’t <u>just</u> rebuild barrier islands</p> <p>Rather rebuild restore the longshore sediment transport of the gulf shoreline including barrier islands and headlands</p> <p>For example:</p> <ul style="list-style-type: none"> <li>Minimize passes</li> <li>Minimize potential to breach</li> <li>Manage sand sinks and sources</li> </ul> <p> </p>
37	<p align="center"><b>The Multiple Lines of Defense Strategy to Save Louisiana’s Coast</b></p> <p>Define Habitat Types and Sustain      Define the Lines of Defense and Sustain</p> <p align="center"> </p> <p align="center">An integrated map of landscape goals <b>Does it define a Sustainable Coast?</b></p>	<p>38      <b>Efficient Use of Restoration or Flood Protection Funding</b></p> <p>focuses limited restoration funding on a limited number of features which together are a framework for the coastal estuaries and flood protection.</p> 
39	<p><b>Shifts Toward a More Stable &amp; Riverine Influenced Hydrology</b></p> <p>aligns all coastal resource managers, coastal restoration programs to a common natural habitat and resource architecture utilizing riverine resources</p>  <p align="center">Wax Lake delta: Lafayette Geological Society website</p>	<p>40      <b>Fundamental Economic Compatibility</b></p> <p>Bayou natural ridges are compatible with ecologic restoration while continuing to be economic corridors, evacuation routes etc.</p>  <p align="right">2000 Landsat imagery</p>

<p>41</p>	<p style="text-align: center;"><b>Invests in Survivor Marsh</b></p> <p>Marsh landbridges are largely the residual marsh and, in general, should have less potential to be loss due to processes of subsidence, faulting etc.</p>  <p style="text-align: center;">Potential marsh landbridge Lines of Defense</p>	<p>42</p> <p style="text-align: center;"><b>Adaptive Management</b></p> <p>Goals are definable and measurable allowing for feedback to ongoing coastal management</p> 
<p>43</p>	<p style="text-align: center;"><b>Adaptive Management</b></p> <p>Goals are definable and measurable allowing for feedback to ongoing coastal management</p> 	<p>44</p> <p style="text-align: center;"><b>Institutional Commitment &amp; Economic Viability</b></p> <p>Natural Lines of defense are designated with a commitment in perpetuity just as manmade lines of defense such as a levee</p> <div style="text-align: center;">  </div> <p>The economic viability of the region will be enhanced and available to maintain the lines of defense framework .</p>
<p>45</p>	<p style="text-align: center;"><b>Multiple Lines of Defense Strategy</b></p> 	<p>46</p>  <p style="text-align: center;"><b>SaveOurLake.org</b></p>

## **Discussion Notes**

***Bruce Baird: Was it clear if the presentation was presenting a position on barriers like those proposed in the Corps?***

*Lopez: Flood gates are presented as a line of defense, however, the question of gates on Rigolets and Cheff Pass are a different order of scale. We looked at gates as a last resort for protection. The reason this is a LR is 1. Environmental implications and 2. costs. I-10 alternative may be preferable for these reasons.*

*We aren't saying flood gates shouldn't be considered.*

***Are risk-based alternatives on civil engineering being developed for flood protection?***

*State of ecosystem considerations? Should alternative not be explored about end goals for the ecological state with various cost estimates?*

*Lopez: Absolutely! A do-nothing alternative for the coast means a much poorer long-range condition for the coast.*

***Comment: The domain is too small; doesn't include entire Pontchartrain basin.***

***It downplays the role of historic distributaries - especially Bayou Lafourche but also Bayou Manchac. These are state owned conveyance channels that have enormous potential value to nourish wetlands over a very large area with clays, nutrients and iron. Bayou Lafourche reconnection also has enormous multiple value of drinking water for 300k people.***

## **Team Comments**

Storm surge is a volume of water moving inland and elevation of the surge is influenced by the shallowness of the bay or coastal system it is moving over.

Coastal wetlands submerged by surge levels of 2-3 feet will not influence the movement of surge as it moves to and across the shoreline. As surge moves inland and gets higher, storm waves will increase as well (as net water depth increases) and increase the amount of storm energy (with wind energy during the storm) impacting a shoreline or coastal population.

Any significant waterway through wetlands areas will convey storm surge through the area and to the back shoreline areas very effectively. This was seen by Hurricane Lili and other storms (even Tropical Storm Matthew) as surge traveled through the intracoastal waterway and impacted coastal populations well north of the shoreline.

Good example of attempt to formalize method and theory for coastal restoration.

Using some past condition as a target for restoration is not practical. We should be looking at sustainable sub-ecosystems, based on current conditions, or conditions that can be achieved through implementation of storm protection and restoration features.

Modification of natural ridges will have high impact on prehistoric and historic cultural resources.

Some difficult decisions will need to be made. For example, should we be more concerned with preserving cultural resources, or protecting our current population and infrastructure from storm impacts?

The "Multiple Lines of Defense" approach captures the need for a sustainable coast, which should be the overarching consideration. Great concept!!!! It takes a holistic approach to correcting the problems that we face in the Lake Ponchartrain Basin.

A study combining the two interests (ecology and safety) is needed to give more insight in the possibilities. Safety will always come first, but incorporation of a good ecological sound and sustainable coastline could possibly benefit all interests.

An important note is that the coastal landscape is not static. Most coastal parishes in southeast Louisiana have significant land areas at or below sea level today. Even parishes like Vermilion and Cameron have elevations today that are very close to sea level.

As the coastal elevations move downward in the future, storm surge penetration and flood inundation will increase with future storms. Even small tropical storms are inundating significant areas of coastal parishes at this time.

The idea of identifying or agreeing to a landscape template as a target or goal is sensible and make complete sense. Another approach to doing this would be to use imagery from a past, agreed-upon time period as a target. Agreeing to a previous time period enables us to use a natural template rather than a human-made template. Once the time period for the template is chosen and then adjusted to meet what is possible, then various techniques (the tools) can be used to build according to the template. Target templates also allow us to address issues and to deal with them. If we know what we are going to rebuild and where, then we can deal with such things as oyster issues before encountering insurmountable barriers.

I concur with multiple lines of ecological defense. Care should be taken from eliminating restoration alternatives that reestablish environmental gradients to also achieve habitat mapping diversity. Specifically, some areas of historic high land loss should not be eliminated for restoration. Design and cost effectiveness analysis would help prioritize restoration in those areas in comparison to others. If effective, this would allow another line of ecological defense in many basins.

Great idea about using the historical landscape as a template. It would effectively address the areas experiencing the highest rates of land loss (including the Barataria and Terrebonne Basin) which have been greatly overlooked at times.

The framework for planning coastal restoration must include global warming. Sea level rise is predicted to be upwards of 40 inches over the next 100 years, not 8 inches that is used in the LCA plan. In addition, the number of Category 4 and 5 hurricanes will become more frequent as the Gulf warms. How will our restoration efforts be impacted by that?

40 inches? Not much need to plan anything below Baton Rouge.

Are multiple lines of defense more expensive and feasible than one large line of defense?

Can we please have some consideration of reality? Come up with a minimalist plan that protects the most important areas only.

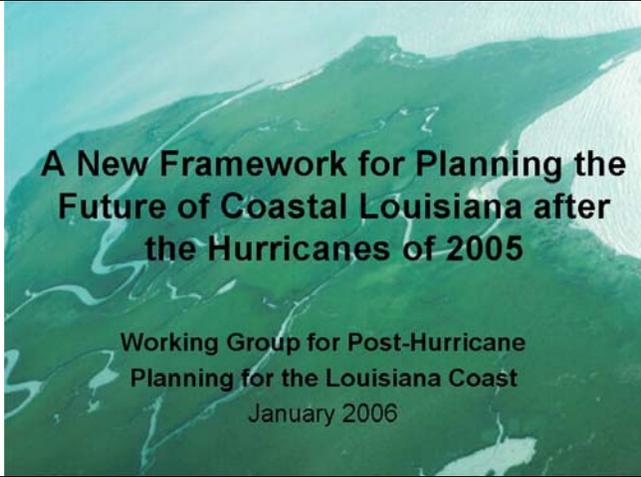
Does this response also apply to a closure structure of some type in Seabrook? Seabrook was part of the original Lake Pontchartrain barrier plan.

What benefits do barrier islands in their current positions (e.g. Chandeleurs & Timbaliers) have in regards to hurricane protection? And do we have data or evidence to support?

## A Framework for Planning: Dr. Denise Reed

### Summary

Dr. Reed presented the results of a report with the above title, written by a group of coastal scientists led by Dr. Don Boesch. Storm damage reduction should be achieved through a combination of stronger inner defenses around large population centers; broader, self-sustaining wetland landscapes; restrictions along artificial channels and barrier islands. Planning for all of the above must be integrated under a new framework so that each proposed project takes advantage of synergies and avoids and mitigates conflicts among purposes. System-level analysis should be used to achieve this. Governments should engage scientists, economists, engineers, communities and stakeholders to develop a spatially explicit vision of Louisiana's future coast. Large-scale introduction of freshwater and sediment should occur in the Deltaic Plain and improved water management in the Chenier Plain.

1	 <p><b>A New Framework for Planning the Future of Coastal Louisiana after the Hurricanes of 2005</b></p> <p>Working Group for Post-Hurricane Planning for the Louisiana Coast January 2006</p>	2	<p><b>Who?</b></p> <ul style="list-style-type: none"> <li>• Don Boesch, Univ. Maryland – Chair</li> <li>• Len Shabman, RFF – Vice Chair</li> <li>• 19 scientists</li> <li>• Ecologists, geologists, coastal and river engineers, modelers, social scientists</li> <li>• Most with a record of engagement on restoration in coastal Louisiana or other coastal management issues</li> </ul>
3	<p><b>How?</b></p> <ul style="list-style-type: none"> <li>• Independently convened</li> <li>• Support from USACE-IWR and NRC to hold a meeting in December, 2005</li> <li>• Input from USACE and State</li> <li>• Report produced in &lt; 8 weeks</li> <li>• Briefed to USACE-HQ &amp; ASA prior to release, subsequently to State, Governor's Commission</li> </ul>	4	<p><b>Principal Messages - Protection</b></p> <ul style="list-style-type: none"> <li>• In the long term, hurricane protection for larger population centers, including the New Orleans region, can only be secured with a combination of levees and a sustainable coastal landscape.</li> <li>• Storm damage reduction should be achieved through a combination of stronger inner defenses around larger population centers; broader, self-sustaining wetland landscapes that reduce storm surge and wave fetch; restrictions along artificial channels to limit storm surge propagation; and maintaining barrier islands along selected areas of the coast.</li> </ul>

5	<p>Principal Messages - Restoration</p> <ul style="list-style-type: none"> <li>• With presently observed subsidence rates and anticipated acceleration of sea-level rise, most—although not all—of the <i>coastal landscape could be maintained through the 21st century</i>. And with efficient management of the river's resources, this landscape could be expanded in some places.</li> <li>• The near-term critical restoration features selected by Louisiana Coastal Area Ecosystem Restoration Study <i>should be reexamined and prioritized</i> to assure that they provide environmentally and economically sustainable approaches that advance both ecosystem restoration goals and support storm damage reduction.</li> </ul>	6	<p>Principal Messages – Unified Approach</p> <ul style="list-style-type: none"> <li>• Federal and State governments should engage scientists, economists, engineers, government officials, communities and stakeholders to develop a <i>spatially explicit vision of a future coastal Louisiana</i> that incorporates longterm challenges, opportunities and overarching goals.</li> <li>• No longer can coastal ecosystem management and restoration, flood protection, and navigation be planned, executed and maintained independently. We must <i>integrate planning, investment and management decisions under a new framework</i> in order to secure these multiple purposes</li> </ul>
7	<p>Principal Messages – Integrated Process</p> <ul style="list-style-type: none"> <li>• Future integrated planning and decision making should recognize, account for and mitigate the <i>disruption of coastal landscape dynamics</i> when formulating and evaluating <i>navigation channel expansion, maintenance or abandonment</i>.</li> <li>• Project planning should rely on <i>innovative decision-support analyses</i> that engage stakeholders and responsible agencies in resolution of conflicts and in identifying and synergies among projects.</li> </ul>	8	<p>Principal Messages - Organization</p> <ul style="list-style-type: none"> <li>• A joint Federal-State body should be given the responsibility and organizational and fiscal support for guiding the program. Authorization and financing should be separated from the WRDA process.</li> </ul> <p>The Concept of Foundation Features</p> <p>Future planning must embrace protection, restoration and navigation</p>
9	 <ul style="list-style-type: none"> <li>• Subprovince 1 <ul style="list-style-type: none"> <li>– a large, land building diversion into Lake Borgne that uses a shallower, decommissioned MRGO and Bayou LaLoutre as a means of distributing freshwater and sediment to nourish the Biloxi marshes.</li> </ul> </li> <li>• Subprovince 2 <ul style="list-style-type: none"> <li>– large-scale reintroduction of riverine freshwater and sediments to rebuild extensive wetlands to both sustain the ecosystem and provide storm damage reduction</li> </ul> </li> </ul>	10	 <ul style="list-style-type: none"> <li>• Subprovince 3 <ul style="list-style-type: none"> <li>– more effective use of freshwater and sediment resources of the Atchafalaya that can support sustainable coastal landscapes.</li> </ul> </li> <li>• Subprovince 4 <ul style="list-style-type: none"> <li>– improved water management, e.g., structures on major navigation channels, improved use of seasonally available freshwater supplies and existing waterways</li> </ul> </li> </ul>

11

## Integrated coastal planning

Avoid unintended consequences  
Maximize synergies among projects

- Identify environmental consequences and opportunities associated with flood protection plans
- Strategically place restoration features so that they contribute to the protection of vulnerable areas

12

Measure	Affects Large Area of Ecosystem	Affects Tidal Processes	Other Considerations
Rigolets/Chef Menteur Pass flood gates	Yes	Yes, if they affect x-section	Potential improved freshwater management
Heightened levees around Greater NO communities	No	None	Footprint impact
Outer defense barrier in St. Bernard-Orleans Parish	Moderate	Yes, unless permeable	Opportunity for treated sewage effluents to promote swamp in interior
Hwy 90 barrier in Barataria basin	Yes	Yes	Could be designed to improve exchange
GIWW alignment Barataria basin	Yes	Yes	Multiple exchange points & overflows required, decreased tidal exchange over extensive interior wetlands
Morganza-to-Gulf in Terrebonne basin	Yes	No	Operation of environmental structures needs definition
Houma Canal lock	Yes	Yes	Potential for fresh water distribution
Houma-Morgan City barrier	No	Minor	Follows existing barrier
GIWW barrier west of Wax Lake Outlet	No	Minor	Must provide exchange to contained wetland areas and streams

13

Feature	Decreases water depth over large area	Limits fetch (e.g., ridge)	Buffers wind-wave (e.g., forest)	Location re. important infrastructure	Other considerations
<b>Near-Term Critical Ecosystem Restoration Features Included in Plan Authorization</b>					
Small Bayou Lafourche reintroduction	Only in isolated areas	No	No	Distant	Net wetland benefits are minor and distributed
MRGO environmental restoration	For a small area	No	No	Greater New Orleans	Stopping the breach to Lake Borgne would not significantly affect storm surge.
Small diversion at Hope Canal	No	No	Potentially	Distant and up-estuary	Depends on diversion size
Barataria basin shoreline restoration	No	Yes	No	Plaquemines and Westbank	Only one section proposed
Medium diversion at Myrtle Grove	Yes	No	No	Plaquemines and Westbank	Depends on diversion size and operation

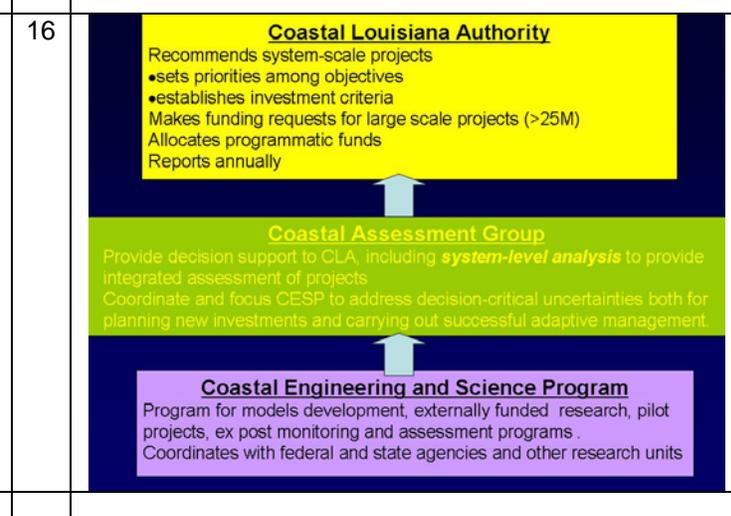
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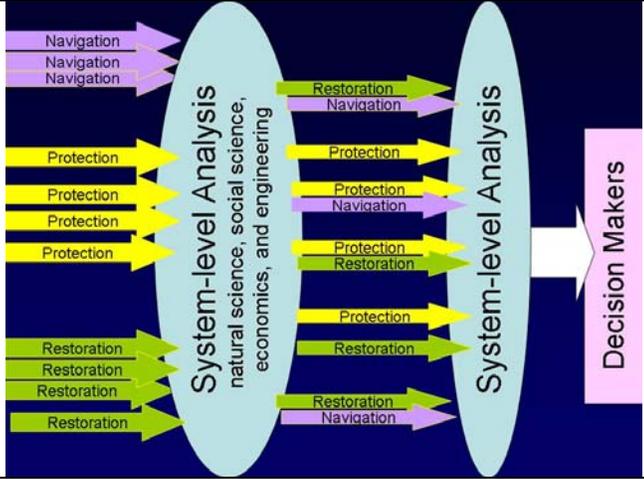
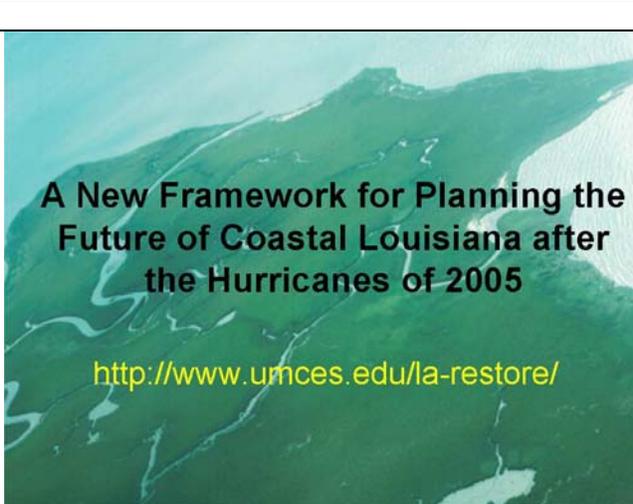
Feature	Dec. water depth	Limits fetch	Buffers wind-wave	Location re. infrastructure	Other considerations
<b>Additional Near-Term Restoration Features for Further Investigation</b>					
Multi-purpose HNC lock					Primarily for flood protection
Terrebonne basin barrier-shoreline	No	Yes	No	Terrebonne	
Landbridge at Caillou Lake	Moderate area	No	No	Distant from Terrebonne pop.	Seaward of existing marshes
Small diversion at Convent	No	No	Possibly	Distant and up-estuary	Depends on div. size
Amite River diversion canal	No	No	Possibly	Distant and up-estuary	Depends on div. size
Medium diversion at White's Ditch	Yes	No	No	Greater New Orleans	
Shoreline at Point au Fer	No	No	No	Distant	
Modification of Caernarvon	Yes	No	No	Greater New Orleans	Depends on diversion size and operation
Modification of Davis Pond	Yes	No	No	Westbank	Depends on diversion size and operation

15

## Towards Integrated Planning

- Conduct integrated assessment to assure that each proposed project investment in storm protection, navigation and coastal restoration takes advantage of synergies and avoids and mitigates conflicts among purposes.
- Based on natural science, social science, economics, and engineering
- Coastal Assessment Group & Coastal Engineering and Science Program



17		18	
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**Discussion Notes**

***Proposals for large scale diversions seem to take a long time to show benefits. If there was a diversion in Lake Borgne, how long would it take to build 500-100 acres?***

*Reed: These were conceptual recommendations, not a detailed analysis. Our report recognizes benefit from protection as the water becomes shallower. We don't have to wait for land creation to derive storm protection benefits. Many scientific panelists believe that self-organization in ecosystem restoration is an important benefit. AS YET we don't have any examples of large-scale land building.*

***There was little discussion of wave effect in the first line marshes. Why?***

*Reed: There are two ways this can provide protection, via restriction of fetch and buffering of the wind waves. Landscape features will reduce wave activity. Where that should be located was unspecified. We focused on forested systems as principles.*

**Sue Hawes: I have concerns on the total emphasis on diversions and prefer to have a combination of marsh AND structure.**

Shallow water benefits cited. Report details the influence of water depth on storm surge elevation. Details are embedded in how the answer generates the surge across the landscape.

Reed: The Wax Lake studies should be circulated. We have some knowledge here.

The report/panel is not specifically against this approach. Several measures were mentioned that include this principle. Ridges/barriers are needed and difficult to build with diversions. There is no contradiction here.

Natural resource agencies plan definitely includes pipeline sediment delivery with diversions to maintain them.

There is discussion of using a variety of restoration techniques depending on the final objective sought.

**Introduction of sediments are a huge need. This has to be done sooner rather than later.**

Infrastructure pipelines for delivering sediment from MS or Atchafalaya rivers are supported. The beauty of this approach is the flexibility to move material where it's needed most and knowing what you'll have to deal with. This can be done with enough water to move it through the pipe. This is done all over the world. Sediments can be transported great distances. This is a big advantage in Terrebonne and other locations that don't have easy access to sediment.

A DNR-sponsored study will be released soon underscoring the viability of this technique and that it costs less than many believe.

John Lopez: We're all looking at sediments from an external perspective. The first completed CWPR project was accomplished with this. 300 acres/3months/\$3million dollars. This is a promising way to move sediment where it's needed.

**Why the segment that follows the GIWW chosen here?** There is opposition to this (ecological damage to Barataria ecosystem). Why was this selected across BT estuary? When will we see a map showing the State recommendation?

Bruce showed the resource agency proposals. The line was chosen during assessment for Secretary of Army. We picked the shortest alignment, not restricting coastal flow. This is AN ALIGNMENT, one of several possibilities offered for discussion.

**Bruce Thompson on Barrier plan's effect on large area tides: If the design didn't affect tidal flow, are there other considerations?**

Reed: The biggest affect was similarities to the Dutch experience. This had a measurable/significant effect on top/bottoms of tides, eliminating whole habitats. We must examine and learn from this.

**If you can maintain a nominal tidal exchange are the considerations/concerns as great?**

Reed: We'd have to examine this.

**Len Barr: Was there discussion about the limitation of the domain restoration? Seems like some barriers and flows weren't considered. Was water quality discussed?**

Reed: A number of our team members were very concerned about water quality. Our focus was more on systems than specifics. Fully understanding the fate of nutrients was a part of the report.

**Joop Weigers: . Please take advantage of the Dutch experience and learnings:** *We adjusted for mistakes as we went along. Complex situations will result in continuous learnings. Not all plans will be successful. Planning and engineering teams must maintain a focus on the long-term. Make new mistakes...don't duplicate those of the past. A focus on adaptive management will serve you well.*

*Has there been any consideration of construction of rock break waters along the coast similar to the ones West of Holly Beach?*

**John Lopez:** *This issue of sustainability is great, but there are some short-term problems. The biggest is MRGO and it's effect on habitat restoration. Are there no specific recommendation in the report on MRGO?*

*Reed: Modeling data on the role of MRGO as a deep channel and its influence on storm surge elevations was just coming to light. We discussed it and recommended further study.*

**Woody G:** *One of the last slides emphasized multiple use: ecosystem/socio-political, etc. Isn't this a plea for re-involvement of the NEPA/legal process? In Coast 2050 report our goal statement covered multiple use, but we never achieved it. Is that what you're recommending?*

*Reed: There are certainly parallels. Nobody was suggesting this had been completed under NEPA in the past. NEPA calls for these activities to be done. It may be the right vehicle for getting this done.*

**Sue Hawes:** *System leveling analysis: computer model?*

*Reed: Analytical model is what we've used. A potential approach is Rand Corp's low-resolution modeling. This combines landscape drivers/policy regimes to see how outcomes are generated.*

*Computer modeling would be the way to go.*

### **Team Comments**

A spatially explicit vision is critical to all of our planning efforts. This must be unified and comprehensive in order to get to an overall goal of a sustainable coast.

Future planning needs to consider protection, restoration, and navigation, but also other user groups, such as fisheries (fish, shrimp, oysters) and oil & gas.

The integration of all interest in the planning stage is the best way to keep everybody on board and constructive. The product could then possibly be the best program in terms of synergy and probably the most cost effective solution in the long run.

Subprovince 1, could have riverine water intro through a spillway at Violet, - there is approx 1/2 mile of uninhabited river front back to the forty arpent levee.

Need to consider fisheries interests in Lake Borgne area when discussing freshwater diversions through Violet.

As mentioned by both Lopez and Reed, synergistic and best-use of existing landscape features should be key to any new plan. Start with our existing landscape and build on it.

There is always a question of whether or not the science is there, so this report is very important.

A large land building diversion in the Lake Borgne area is inconsistent with the nature of the marginal delta basin that occupies this area. Introduction of nutrient-rich Mississippi River water into this area would be beneficial to the marshes in St. Bernard Parish as well as to the ecology of Lake Borgne and Mississippi Sound, but a large delta-building project in this area would be counter-productive.

Are there significant policy issues that will need to be considered (at the legislative level) that could prohibit some of these considerations? Let's also not forget about landowners and land rights issues.

Has a plan been discussed using maintenance dredge material as land building projects? Currently, the material removed from the Atchafalaya River is not being utilized in this potential project.

Sub province 1 should be looking at riverine introduction farther upstream than violet. Introducing near Bayou Manchac/Reserve gives a benefit to the Maurepas and Pontchartrain fringe wetlands which provides some storm water protection for the north shore parishes.

Adding a marsh buffer in the Lake Borgne area through a delta-building diversion might provide additional protection to levees bordering the Chalmette area.

Has anyone considered using wood debris for restoration?

Davis Pond and Caernarvon's operational plans should be modified ASAP to mitigate the impact after the hurricanes.

The CIAC authorized a more aggressive operation plan for Caernarvon for 2006. It has been operating under this new plan for the past month.

Utilizing all construction demolition of concrete pieces by LDOTD can help on reef building or levee building along coast.

An integral approach is never finished. It is learning by doing that is something that was learned in the Netherlands. It is a constant adjusting and refitting of the system. A good analysis of what the "care" the system needs and who will do that is important. It is a process toward a sustainable coastline and perhaps a self-sustaining coastline. In this last aspect the synergy can be found. It is not reached overnight.

Marsh building and buffers to coastal levee structures and along navigation channels (with some shoreline structure protecting the wetland from wave wash erosion from the navigation channel, is noteworthy as these structures all become more exposed to open water conditions and more open exposure to unattenuated storm conditions.

Isn't "System Level Analysis" simply the application of the NEPA planning methodology? Let's use NEPA for social-economic-environmental balancing the way that it was intended.

MRGO channel could be a channel for the transfer of nutrients. Didn't examine any single project in great detail. Our mission was creating a conceptual framework.

The important issue is to determine the critical exposure to existing coastal parishes to flooding and storm impact today and apply that to the balance of restoration and protection efforts for each coastal area.

The use of navigation channels for delivery systems also needs to recognize the functioning of the same channel to transmit storm surge back into a shoreline and coastal population. How you control

the waterway and flow of water, while allowing for continuous navigation through the waterway is a key issue.

This could be addressed with flood gates that could be closed to prevent storm surges from moving inland, while operating for navigation during normal times.

Recommendations for restoration techniques must include stakeholder agreement. Agreement is absolutely paramount to a successful restoration program. Unfortunately, stakeholder involvement is usually implemented in restoration discussions as an afterthought (if at all). Large-scale water diversions into the lower systems would not be viewed as desirable to the estuarine fisheries users. Also, it is questionable that there are enough suspended sediments in the river columns to meet the land building needs of the system. Thought should be given to the strategic placement of enriched sediment harvested from riverine and offshore sources. Agreement of how to restore our system and what it should look like must, absolutely must be paramount.

It is important to couch the presentation of various alternatives in terms of long term tradeoffs. for large river diversions, the users have to understand that failure to move forward could result in adverse impacts to their resources also. Specifically, the no action alternative would adversely impact marine fishery species also.

Although all stakeholders may not view large water diversions as desirable, they are certainly necessary for the long term sustainability.

The sustainability issue is critical. Presently, the coastal system is collapsing. This threatens coastal communities such that protection features are rendered inadequate over time. Diversions would use natural processes to maintain portions of the coastal ecosystem and maintain a certain level of storm surge protection. Given the high costs of system maintenance, usage of such free natural processes will be very advantageous in containing high costs.

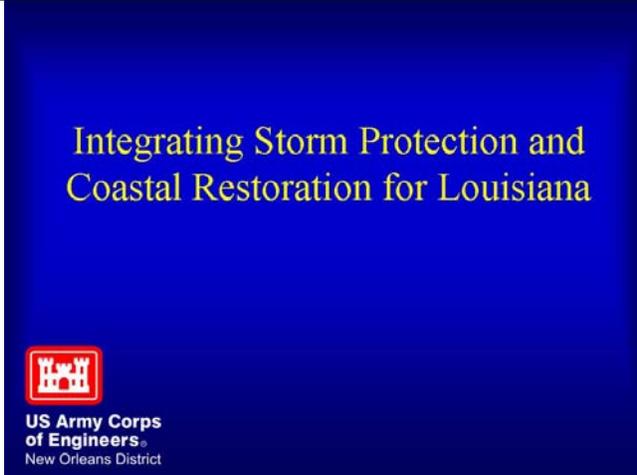
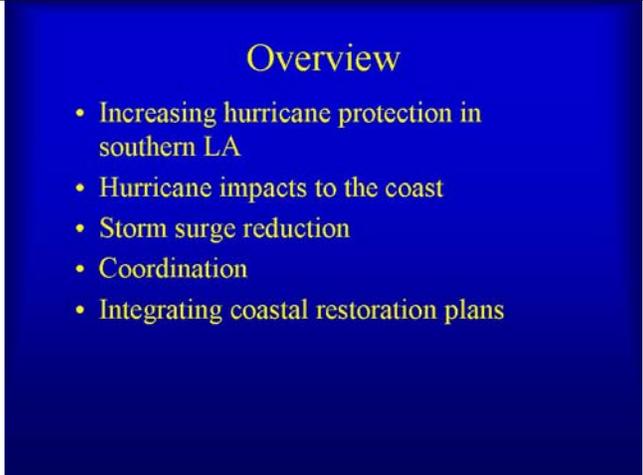
Denise's talk did not really endorse mechanical marsh creation but instead emphasized large scale diversions, which can create land, but over a very long time frame. We need a combination of marsh creation by pipeline sediment delivery, to produce land in a short time because we need that marsh land now. Diversions are needed to maintain natural and man-made marshes.

## ***Integrating Storm Protection and Coastal Restoration for Louisiana: Tim Axtman***

### **Summary**

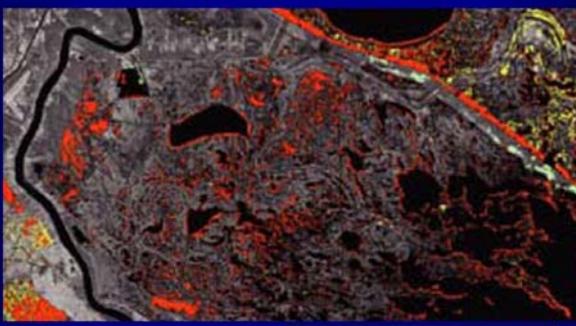
Mr. Axtman described the proposed Barrier Plan including control structures in the Chef, Rigolets and MRGO with a new levee connecting them and extending north, foreshore protection of the Jefferson Parish Lakefront Levee, new pumping stations at the mouths of Orleans Parish canals and a floodgate on the Industrial Canal at Seabrook. In Plaquemines Parish, the river levees and hurricane protection levees were only strengthened as far south as Port Sulphur. In southwest LA, there were alternative alignments along the Chenier's, the GIWW and north of the GIWW.

Restoration of the coastal wetlands is a vital part of hurricane protection because each 2.7 miles of wetland can provide one foot of storm surge reduction. Barrier islands also reduce storm surge. These lines of defense are more important in lower intensity storms. The 15 Near-term projects in the LCA Ecosystem Restoration must be prioritized, as should the projects in the original LCA Plan. The hurricanes of 2005 destroyed 133 square miles of marsh southwest of New Orleans. The restoration projects must be coordinated and integrated with hurricane protection plans. Restoration that involves beneficial use of dredged material, modification of existing structures and restoration of historic hydrology and geomorphic structure is vital because these projects provide additional lines of defense.

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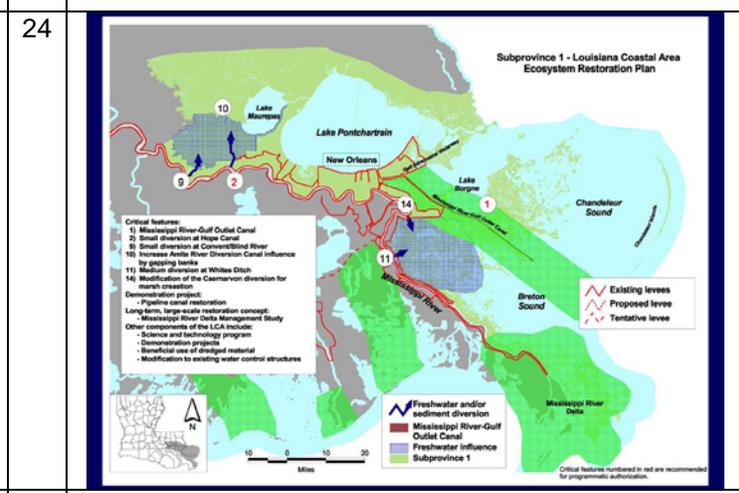
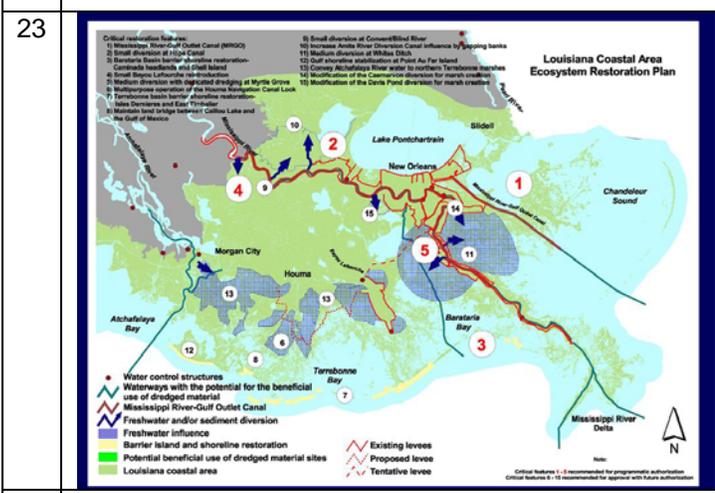


15	<h3 style="text-align: center;">Historic and Projected Landloss in the Vicinity of the Caernarvon Diversion</h3>  <div style="text-align: right; margin-top: 10px;"> <span style="color: red;">■</span> Historic loss (1932-2000)  <span style="color: yellow;">■</span> Projected loss (2000-2050)         </div>	<h3 style="text-align: center;">Landsat Thematic Mapper 5 Hurricane Katrina Comparison Images Upper Breton Sound Area</h3> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>April 16, 2004</p>  </div> <div style="text-align: center;"> <p>September 7, 2005</p>  </div> </div> <p style="font-size: small; margin-top: 5px;">Source: USGS NWRC Landsat Thematic Mapper Satellite Imagery provided by EO2 Data Center Band 4 (near-IR), 5 (mid-IR), and 3 (visible red) displayed Draft Sept. 28, 2005</p> 
17	<h2 style="font-size: 2em;">Storm Surge Reduction</h2>	<h3 style="text-align: center;">Strategic Natural Lines of Defense</h3> 
19	<h3 style="text-align: center;">Coastal Lines of Defense</h3> <ul style="list-style-type: none"> <li>• Wetlands provide flood water storage</li> <li>• Natural habitat features (forested ridges, marsh and islands) buffer the coastal area from storms and provide other ecosystem benefits</li> <li>• LA coast wetlands restoration supports coastal protection and recovery</li> <li>• Surge reduction benefits more important in lower intensity storm events with more frequent return intervals</li> </ul>	<h3 style="text-align: center;">Storm Surge Reduction</h3> <ul style="list-style-type: none"> <li>• The concept of natural lines of storm surge defense is based on the hydraulic principle that surge elevation is effectively reduced by the friction of flowing over a vegetated land mass.</li> <li>• Historically an engineering “rule of thumb” has been used for estimating potential storm surge reduction in LA.</li> <li>• The engineering “rule of thumb” for the effect of coastal wetlands in reducing storm surge elevation provides for an estimated one foot of surge reduction for each 2.7 miles of wetlands over which the surge must flow.</li> </ul>



22

# LA Coastal Restoration Plan



- 25
- ## Prioritization
- The N-T Plan and all larger plans provide restoration below the existing or proposed storm protection
  - The critical features provide benefit to lines of defense
  - Requires increased priority and development:
    - Beneficial Use of Dredged Material
    - Modifications to Existing Structures
    - Restoration of historic hydrology and geomorphic-structure



## Discussion Notes

**Denise Reed: Most alignments focus on protecting large areas of populations. Important national infrastructures (ports/pipelines) aren't always close by. How will this be considered in the plan?**

*Axtman: This didn't mean waterfront access. Pipeline corridors should be considered along with environmental features. When economic assessments are conducted as to what is at risk these will be included.*

**EPA: Plan must consider storm surge, flooding and coastal restoration. Will there be an all-structural plan, or will the plan include all 3 elements?**

*We will provide a protection system that consists of all 3 elements. The alternatives will consist of all 3 items. Addressing the value of these must be considered.*

*Congress requires we submit a report for the entire coastal area. Intent will be to break the project into reaches. Priorities will be based on risks/probabilities and consequences of inundation. At-risk areas will be focused on first.*

*There will be an economic dimension of the report that will consider including/excluding communities. We haven't heard from western stakeholders to feel like we understand their expectations.*

*One factor that will be considered are the resources (protection components) and alternatives (break levees or CAT5 + lesser levels of protection and how they're tied together).*

**What's the reality of a "great wall" levee across the state?** *As we get started do we expect to take a minimalist approach as to where the levees are MOST needed across the state. Risk of losing important communities based on cost. The fit didn't seem quite as good on the first 5 on the map I saw (LSU). Hard to see how the other protections would fit well. What are our criteria for saying we have a fit?*

*Axtman: The actual areas of affect are not at the actual diversions, they're downstream. Barrier islands between gulf shoreline and headlines would have direct affects on Fouchon. Stabilizing shorelines of MRGO are critical.*

**Follow Up: We'll have to accept that restorations may not be perfectly aligned with post-Katrina needs.**

*Axtman: All of these environmental features may not be directly related to storm surges.*

## Team Comments

How do we protect the areas that most need protection without bankrupting the treasury?

Caernarvon was not authorized for marsh creation. It was "authorized" for salinity reduction. It will have to be reauthorized congressionally to be able to operate for sediment introduction and/or marsh creation.

Its use can be maximized for wetland restoration purposes. Recently the overseeing committee approved its maximum use during high river stages when sediment supply is greatest in the river.

Experienced researchers on the ground in Breton Sound think loss post-Katrina has been overblown. I see reason to believe that recovery will occur during growing season.

Similar impacts in Cote Blanche area caused by Andrew did not recover.

Isn't storm surge salinity? No need for another study report.

Recovery might be dependent on flushing salinity out of pore water.

What is the sediment volume required to place 3-6 inches of sediment across a open water area (created by Hurricane Katrina) of the 25,000 acres impacted by the hurricane? What is the available sediment delivery that the Caernarvon Diversion can deliver annually? What time period would be required to place the sediment volume to repair the Katrina damage?

I agree with the comments summarized in Denise's report. I'm unsure these don't give us the best long-term fit.

Storm surge physically compresses marsh against higher features.

Reauthorization would be well worth any effort. Science is also on our side- the diversions modifications were a recommendation of the science working group to the Governor's Commission.

The December meetings held in Vicksburg included discussion that showed marsh areas having little impedance to surge once water levels in the surge event overtop the wetland areas by a surge of 2 feet or more.

The LCA near term plan needs to be reviewed to re-emphasize the points made in the report presented by Denise. A lot of components in the near term plan wouldn't do much either for restoration or hurricane protection.

Storm surge does not necessarily compress marsh. It depends upon how solid and connected the soils are to the layers below the upper root zone.

Has anybody overlaid the protection features and critical areas of protection (i.e., landbridges) with existing or planned CWPPRA restoration project boundaries and features? How might this new Master Plan affect existing CWPPRA projects?

How has this process recognized the surge effects that were seen in Lafourche, Terrebonne and Vermilion Parishes from Hurricane Rita in which surge levels were seen to have not been reduced as they traveled past the barrier islands and through the bays into the parishes?

Hurricanes Katrina and Rita identified serious conceptual flaws in the LCA Near Term Plan. The plan should not be implemented without serious revision.

In development of multiple lines of defense, the orientation of the defense effort needs to be altered to form the first lines of defense at the coastal populations and inner shoreline and then to work out to more open water areas. Coastal parishes and the flooding of major populations and large number of homes and businesses are now focused on population protection more than ever.

Caernarvon was optimized for fresh water, however a dredge pipeline could be threaded down the middle directly into the marsh to maximize the amount of rebuilding in the damaged marsh.

Will COE under the review process then decide if a coastal area or population will not receive hurricane protection if environmental reviews are not resolvable? Will coastal parishes have a significant role in the review process to represent their coastal constituents?

In any flow, boundary effects are near the boundary. When the storm surge is low, the water surface is near the marsh vegetation, which in this case has a significant effect. If the storm surge is high, away from the marsh vegetation, the marshland has little mitigating effect on the surge.

The Coast 2050 Plan is better than the LCA plan. The Coast 2050 Plan should be re-visited.





**How much pile support would it have?**

*Anderson: About 50 ft down. This is one idea that is being explored...where some of the cost figures were derived.*

**Jefferson Parish: When we discussed offshore levees with our stakeholder groups there were concerns about levees holding storm surges INSIDE after storms passed. Has there been any exploration on this?**

*Anderson: Our designs aim to have differential patterns balanced.*

**Sue Hawes Is a structure considered for MRGO? Anderson: yes**

**Team Comments**

This alignment flies in the face of a lot of the recommendations in the report summarized by Denise Reed.

Isn't there a lot of opposition to the Larose to Lafitte levee alignment? I was getting the impressions that people were not seriously considering that alignment a viable option due to the impacts of cutting off the upper part of the estuary.

We need to also consider the Mississippi River levees. The river backed up from 4ft at New Orleans before Katrina to 17ft during the storm. If the River had been higher, the city could have flooded from the River side. The River levees (and flooding risks from the river) should not be forgotten...

Note that the depicted alignment is not correct for the Morganza to the Gulf Project. Specifically, the preferred alternative under the PEIS for Morganza does not include the Mandalay marshes in the vicinity of Lake Theriot. The preferred alignment identified in the PEIS follows the Bayou Du Large ridge up to the Gulf Intracoastal Waterway.

We need to examine the premise that a continuous wall is needed and appropriate for all coastal locations. Nonstructural alternatives should receive equal considerations.

From Golden Meadow West to Atchafalaya River levee and structure construction time frame to protect people?

We should be comparing the costs, benefits, impacts for these alignments. I suspect we will find that a series of ring levees around the most heavily developed areas is the best thing to do.

The levee alignments south of Houma, particularly in the Montegut area, will create the same dangerous conditions that caused loss of life in the New Orleans, St. Bernard and Plaquemines areas during Katrina. These alignments must be re-examined.

Did navigation concerns enter into the study especially east of Houma? Locks?

This has been referred to as the "great wall approach." Are there assessments that are tying this to habitat assessments? Do we have the funding to make this happen? Is this the way to go?

What is the alignment south of GIWW?

What about the secondary impacts of this alignment; namely the increased development pressure placed on the functional wetlands left inside of the protection area? Are we simply writing these areas off or are we going to bring permitting age?

An alignment along the south side of the GIWW in western LA will further impede water flow from the upland side towards the coast, thus compounding our hydrology problems.

After development of more ring levees how will all these pump stations survive?

Walls..structures...alone will not protect our area. You must consider other forms of protection in addition to the "structures."

An alignment along the south side of the GIWW will further compound our hydrology problems in the western part of the state.

Ring levees are to be used. How will this be dealt with from pump station survival financially and the physical aspects of hurricane forces?

No levee protection south of GIWW is necessary.

The "Great Wall" approach taken by the Hurricane Barrier Plan raises several critical questions:

1) Is it compatible with deltaic restoration? Does it work at cross purposes with the coastal restoration plan?

2) Is it the most realistic plan to ensure sustainability of the coast?

Ring levees combined with restoration would work. Make it a sustainable wetland and size the levees for the modeled Cat 5 storm.

Besides levees, has there been any discussions of restoration of clam shell reef systems west of the Atchafalaya River which were removed by dredging operations in the 70's & 80's? Rabbit Island, Shell Keys, etc.?

I think one of the most important things Anderson did not highlight enough is that Morganza is not authorized; therefore, the entire population of Terrebonne plus is unprotected. After Rita flooded 10,000 structures after landfall 200 miles away, its authorization and implementation should be made a priority.

The shortest alignment will likely be the least costly to construct, have the smallest overall foot print direct impacts, and lowest O&M cost, as well as providing the largest area of protection.

I would hope that we continue to look at the southern (Larose to Lafitte) alignment of the Donaldsonville to the Gulf levee. With sufficient consideration for structures to allow flow in a manner considered in the Morganza to the Gulf, the Donaldsonville to the Gulf southern alignment would not "cut off" the upper part of the estuary and might instead protect the upper part of the levee from the fate of areas to the south.

Existing levees/pump stations (E. Wax Lake) constructed by the US Corp in the '50-60's need to be reviewed and updated for protection from storms but also from flood waters in the spring. Updated soil sampling in these levees needs to be done at the same time in areas of concern along the lower Atchafalaya River and ICWW.

Good principles...we will need them.

There exists some voids along the Atchafalaya of minor stage that is noted, however, borings would prove to be vital to the floodwalls future.

The restoration strategy suggested is eclectic by using different restoration techniques. There is no silver bullet with restoration so this approach is practical.

A foundation of concrete piling can create a construction that is very sensitive to piping. This solution can be very dangerous because of that. The solutions to avoid these piping problems can be very expensive. Looking into other concepts may be very cost effective.

## ***Coastal Protection and Restoration: Resource Agency Environmental Alternative Proposals: Bruce Baird***

### **Summary**

A team consisting of representatives from US Fish and Wildlife Service, National Marine Fisheries Service, Environmental Protection Agency, Natural Resources Conservation Service and Louisiana Department of Natural Resources developed these alternatives. They offered the following recommendations: Unavoidable wetland impacts should be offset by compensatory mitigation in-kind and in the same basin. Existing levee alignments should be used and new levees should be on upland side of wetlands. Minimize (and undo) disruption of natural hydrology. No mitigation credit should be provided for enclosed wetlands. Restoration measures must maximize hurricane protection. Anticipate and accommodate river reintroductions. Use external sources of sediment such as offshore deposits or two rivers. Adaptive management must occur. Non-structural alternatives have to be fully evaluated. Public involvement is important.

Pontchartrain/Breton Basin restoration includes restoration of several landbridges and natural ridges, several river reintroductions, extensive marsh creation and barrier island restoration. Levee Alternative 1 includes gates at Rigolets and Chef Menteur Passes near Highway 90, a gate in the MRGO/GIWW near Paris Road, raising the 40-Arpent levee in St. Bernard Parish, and a hurricane levee down to Pointe a la Hache. Alternative 2 includes a gated structure just east of I-10, a levee along the lakefront and Maxent Canal in New Orleans East and the same alignment as Alternative 1 after the gate in the GIWW/MRGO. Restoration in the Barataria Basin includes several small diversions into the swamps with hydrologic restoration and easements, large reintroductions at Myrtle Grove and Boothville, marsh creation and barrier island restoration. Levee alternative 1 extends from West Pointe a la Hache northwestward along the wetland/non-wetland interface and follows the developed land of B. Lafourche southward to below Golden Meadow. Levee Alternative 2 essentially follows Highway 90, except it includes Bayou Gauche, and then the Larose to Golden Meadow alignment. Restoration in Terrebonne Basin includes ridge and shoreline restoration, extensive marsh creation, especially on landbridges, reintroduction at B. Schaffer and the Houma Navigation Canal and barrier island restoration. Terrebonne Basin Levee Alternative 1 follows US Highway 90 after ringing Morgan City to just west of Houma where it follows the Morganza to the Gulf of Mexico alignment. Alternative 2 is similar to Alt. 1, but it goes no further south than the Falgout Canal. Alternative 3 is similar to Alt. 2, except it essentially rings Point au Chene. Alternative 4 is similar to Alt 3, but encloses even less of the Point au Chene ridge. In the Atchafalaya and Teche-Vermilion Basin restoration includes reef restoration in Atchafalaya Bay, diversion of more water down the WLO and west in the GIWW, marsh creation and improvement of the LAR delta. The one levee alternative rings the Patterson area, follows the GIWW to the west side of the B. Sale Ridge and thence along the wetland/non-wetland interface to Leland Bowman Lock. Restoration in the Sabine and Mermentau Basins includes salinity control structures at the mouth of the Calcasieu Ship Channel (CSC) the Sabine/Neches Waterway, shoreline and chenier restoration and marsh creation on several landbrides. The major levee alignment follows the GIWW from Leland Bowman Lock to the CSC and thence northwestward. There are several short alternative alignments both north and south of the GIWW.

## Preliminary Resource Agency Environmental Alternatives

The following presentation is based on input from staff of various Louisiana state and federal resource agencies, but does not reflect the official position of any of the agencies involved.

### Agreed upon principles

No levee construction without concomitant habitat restoration commensurate with the scale of levee construction.

Restoration measures designed to maximize the dual purpose (hurricane protection/environmental benefit).

Proposed features to be reviewed and modified as info becomes available on effectiveness.

Avoid and Minimize Impacts.

Use existing levee alignments.

New alignments on the upland side of the upland/wetland interface.

Avoid enclosing wetlands.

Minimize (and undo) the disruption of natural hydrology.

### **Restoration Strategy**

Large scale creation of wetland and ridge barriers for storm surge protection, and maintain with diversions.

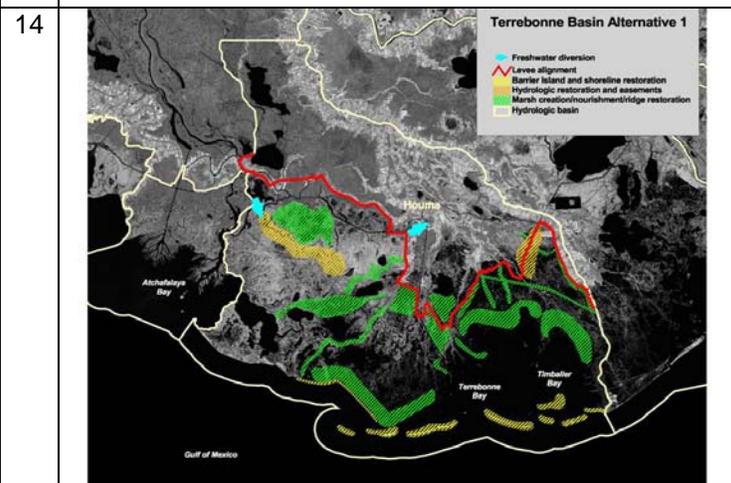
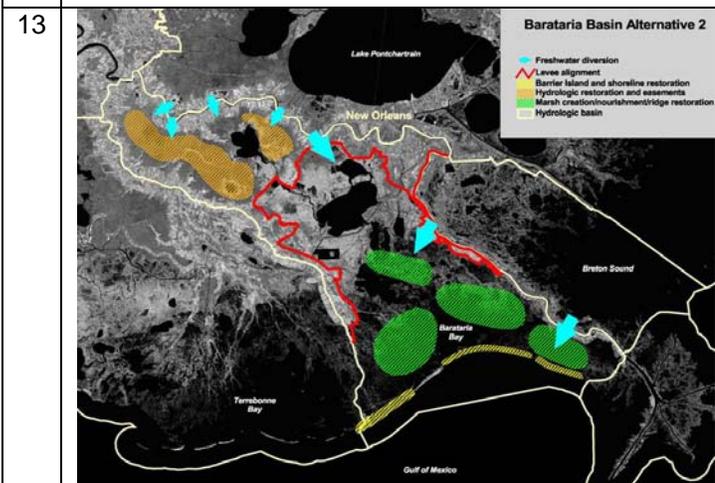
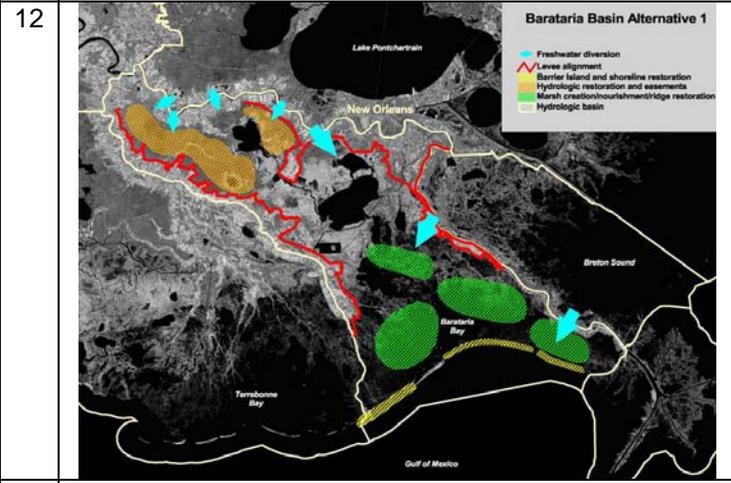
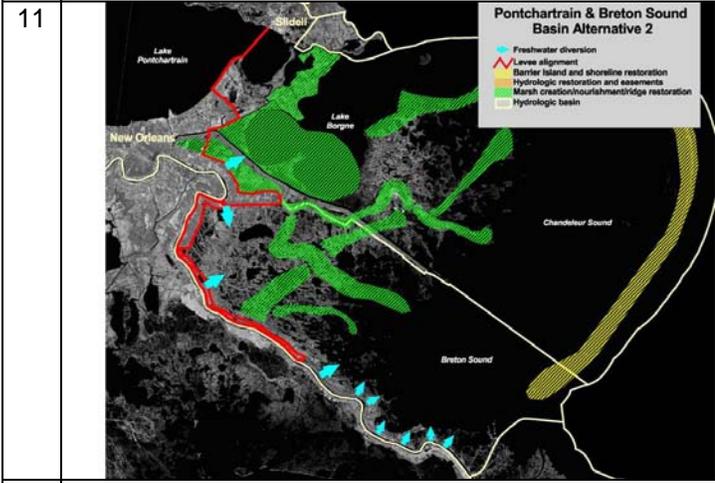
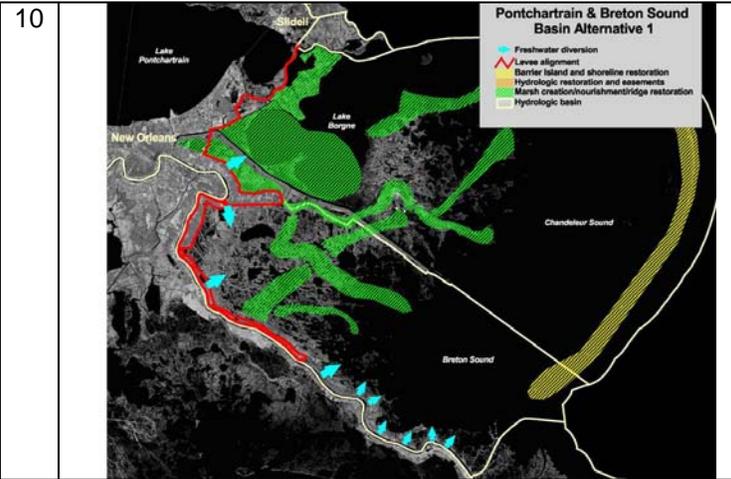
### **Programmatic Sediment Sources**

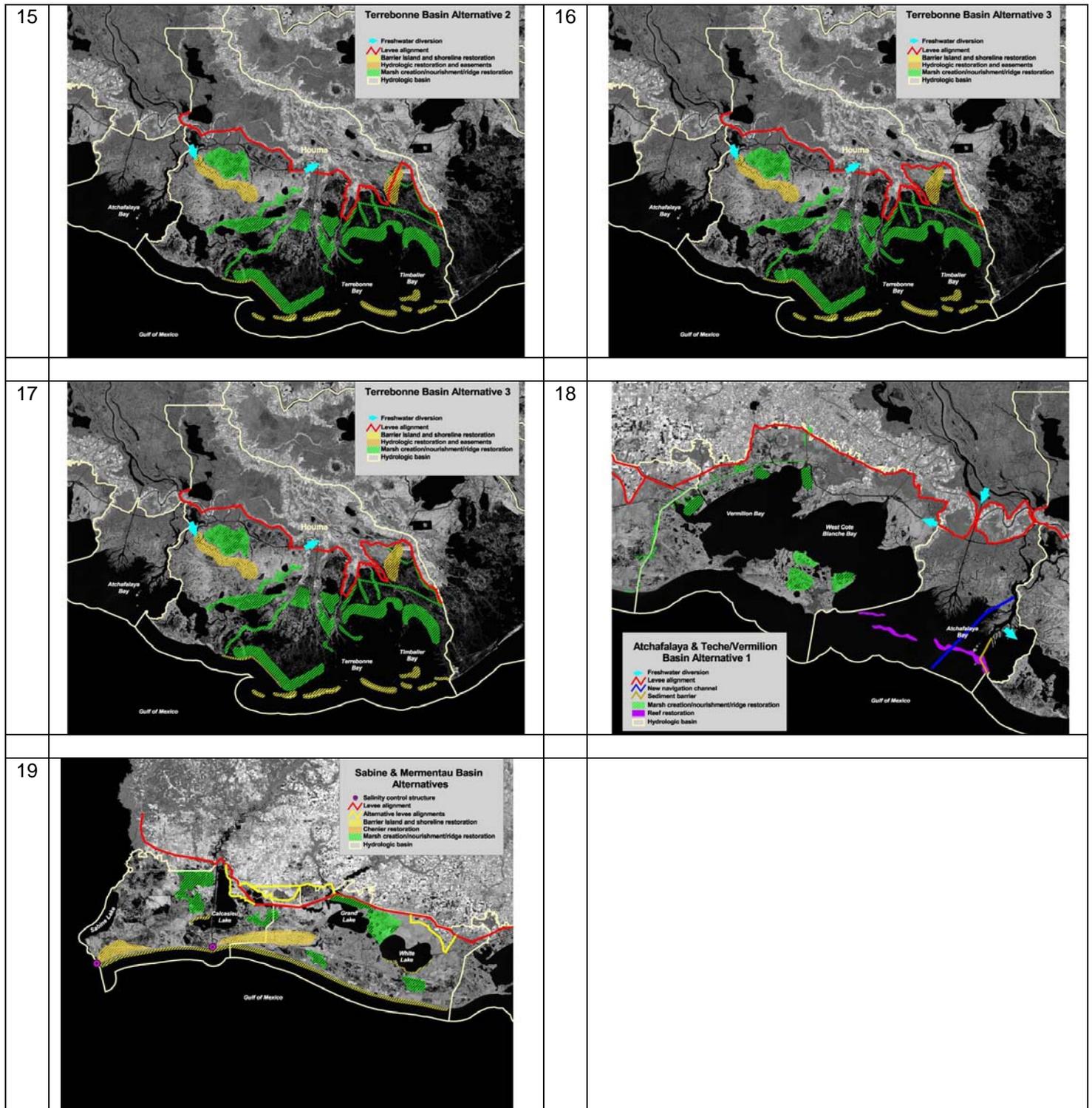
- Massive amounts are needed.
- Use external sources.
- Avoid historical piecemeal approach, which results in adjacent borrow in wetlands.
- Large-scale, such as offshore deposits, 2 rivers.
- Pipeline delivery.
- Economy of scale.

1	<p>The following presentation is based on input from staff of various Louisiana state and federal resource agencies, but does not reflect the official position of any of the agencies involved.</p>	2	<p>Louisiana Coastal Protection and Restoration</p> <p>Preliminary Resource Agency Environmental Alternatives</p>
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3	<h3 style="text-align: center;">Agreed upon principles</h3> <ul style="list-style-type: none"> <li>• No levee construction w/o concomitant habitat restoration commensurate with the <u>scale of levee const</u></li> <li>• Restoration measures designed to maximize the dual purpose (hurricane prot./env. ben)</li> <li>• Proposed features to be reviewed and modified as info becomes available on effectiveness</li> </ul>	4	<ul style="list-style-type: none"> <li>• Fully evaluate non-structural alternatives</li> <li>• Hurricane protection should not come at the expense of the coastal environment</li> <li>• Involve the public</li> <li>• Plan for effects of features on <u>hydrology</u></li> </ul>
5	<h3 style="text-align: center;">Avoid and Minimize Impacts</h3> <ul style="list-style-type: none"> <li>• Use existing levee alignments</li> <li>• New alignments on the upland side of the upland/wetland interface *</li> <li>• Avoid enclosing wetlands</li> <li>• Minimize (and undo) the disruption of natural hydrology</li> </ul>	6	<ul style="list-style-type: none"> <li>• Unavoidable impacts to wetlands should be offset by compensatory mitigation measures</li> <li>• Mitigation should be in-kind, same basin</li> <li>• No mitigation credit for benefits to enclosed wetlands</li> </ul>
7	<ul style="list-style-type: none"> <li>• Anticipate and accommodate river reintroduction projects</li> <li>• Use Miss. and Atchafalaya Rivers for restoration and storm protection</li> </ul>	8	<h3 style="text-align: center;">Restoration Strategy</h3> <ul style="list-style-type: none"> <li>• Large scale creation of wetland and ridge barriers for storm surge protection, and maintain with diversions</li> </ul>

- 9
- ## Programmatic Sediment Sources
- Massive amounts needed
  - Use external sources
  - Avoid historical piecemeal approach, which results in adjacent borrow in wetlands
  - Large-scale, such as offshore deposits, 2 rivers
  - Pipeline delivery
  - Economy of scale





## **Discussion Notes**

**Denise Reed: Do you envisage NEPA process including system level analysis in a numerical/analytical framework? How are you going to do it?**

*Baird: View all significant resources, involve the public and work with a broad cross section of subject matter experts. Include all stakeholders that will be included in the evaluation.*

**Will this be an "expert" process or a computer modeling? It sounds like this will be much more of an expert assessment.**

*Baird: Correct.*

*A peer-reviewed report supporting the "rule of thumb" would be nice.*

**Hassan: From an NGA perspective, we had a Category 3 hurricane with a 28 ft surge. With a 25 ft surge, how do you propose to stop it? What is the protection for this level of surge?**

*Baird: Wetlands, bridges and other structures outside of the barriers are the most logical approach: multiple lines of defense.*

*Comment: The "expert" vs. computer process comparison is meaningless. You should mean qualitative vs. quantitative (i.e. Monte Carlo) process, or something in-between that takes key features from both to accelerate the process.*

*NOAA: This raises several issues: surge events really don't get buffered with low-lying structures. In a 20-25 foot surge there will not be a great deal of reduction by features that are 1-3 foot in elevation. The National Hurricane center/NOAA can help provide models to review the capabilities of these features. Defending as far up interior and layering defense lines toward barrier islands seems like a good way to link partners. Work from interior out to maintain a defense line we've established.*

**Tulane: Levee height of 30 ft?**

*Baird: This was preliminary based on our assessment.*

**OK, if the Corps was funded today, how much would this cost to build and maintain?**

*Baird. We examined the Southeastern portion of LA in Nov. Construction/contract models were run assuming no limits on funding. The result was 12 years. None of this will be completed overnight. We have to examine the broad spectrum and address priority risks as quickly as possible.*

*Follow-up on subsidence to sustain a 30 ft. This will take more than 12 years.*

*Al Naomi, Corps: Multiple lifts will be addressed in our next technical workshop in March. We recognize this is a tall order, but believe there are some novel/creative approaches.*

*Wetlands/Storm surge reduction comments. If there's any, it's probably very little. The role of wetlands should include consideration of the entire ecosystem, the natural system of ridges, live oak forests? We can agree that wetlands can offer some benefits in CAT 5 protection.*

*Ridge restoration is a crucial component of our planning.*

*Category 5 storms are infrequent, but we get many weaker storms. 5-6 feet of surge are effectively addressed with improved wetlands. Distance from the coast is an important aspect as well as placement of storm barriers that make people feel secure enough to build/re-build.*

*Higher ground instead of marshes have to play a part.*

**Denise Reed: Numerical experimentation n surges: removal of Biloxi marshes/controlled experiment. Without wetlands the surge would have been an additional meter higher.**

*Baird: It doesn't have to be marsh. Shallow water can also play a beneficial role.*

**What about the lock as a component of the plan? If the Morganza alignment went below Houma would this still be a factor?**

*Baird: This is not a question of what I think, this is a combination of what the workgroup came up with. We examined possible diversions. With a closed MRGO these could be a lot more effective. The floodgate at Bayou Buff/Amelia is particularly contentious. It was impossible to address all the hot issues the team uncovered.*

*Hydrological modeling will be a critical element of our review.*

**Len Barr: In the haste to develop CAT 5 protection was coast wide evacuation considered? Have ring levees been considered for communities vs. total protection of inland areas**

*Baird: Everything is on the table; nothing has been left out. We will be reviewing evacuation. Our intent is to show you what we've reviewed to date.*

**Warren Paul, Washington Group: I'm concerned about terminology used for some system wide evaluations: expert vs. computer. This implies only experts were involved. Consider qualitative/quantitative analysis. There is plenty of precedent for including stakeholders in both processes. This should be considered.**

*Baird: Involvement/oversight from peer review and stakeholder groups is anticipated. We need it from agencies and stakeholders. 24 months to complete an EIS is an extremely tight schedule. We need a draft by 2/07. The rest of the year will be devoted to review and edits. We need public involvement, but it needs to be done effectively, on a timely basis that supports the plan development.*

*University of New Orleans: We recognize this isn't a blank sheet. As a sociologist, you'll need to respond to the challenge of stakeholder concerns and merging them into the process. They need to be considered in advance of the final plan. Delays of overlooking this will far outweigh any time gains.*

*There will be some conflicting concerns in this process. We can't let this gridlock the process. We will do the best we can with the mandate Congress has given us.*

### **Team Comments**

Coastal restoration provides only limited surge reduction, and very little for storms with large surges.

Adjacent borrow sites would create another navigation channel across the State. Huge secondary impact aside from the direct footprint.

How can one tell the difference between interested and disinterested "displaced" public?

How are you going to ensure that you get input from the displaced public?

If we have storm surge protection independent of coastal restoration, there will be no coastal ecosystem left in a very short period of time. The loss of the coast means the loss of the resources, the benefits, and the people and the communities which live in and depend upon this coast every day.

A levee provides very little ecosystem function. We need to develop a truly integrated plan that provides storm surge protection that allows ecosystem function.

It would seem that borrow areas are only implicated where native soils are appropriate for "wall building."

Levees should be as far away from population as possible in order to provide the most protection.

Barge from Illinois? Have you considered a feasibility study to determine the impact?

In response to the comment above ("levees should be as far away from population as possible to provide the most protection"), we need to remember what the sustainable protection arrangement for LA has to be: levees behind extensive coastal wetlands. Without those wetlands as a buffer, we're trying to build a dyke that will stand against the direct force of the Gulf. It's not likely that is affordable. In this situation you want levees to protect the population centers, not enclosing extensive areas of wetlands in the interior.

I think CRD has put some significant thought into the Illinois sediment option. I don't know what they decided, but they are looking at demos.

Construction of large levees way out in the marsh may be very difficult due to soil quality. Those large levees may have to be located closer to communities to take advantage of higher quality soils. The further inland the levee, the smaller they should be. Use natural features to dampen surge so that the levee size could be further reduced.

The habitats in the region we in Louisiana refer to as "the coast" include a system of cypress swamps, freshwater, brackish, and saline marshes, natural Chenier ridges, and barrier islands do indeed provide storm surge mitigating benefits. It may be debatable how much storm benefit would be realized during a Cat 5 storm surge, however, those Cat 5 storms are not the norm. Most tropical systems experienced in Louisiana are far below Cat 5. There is no doubt that south LA. is experiencing increased incidence of infrastructure flooding in association with tropical systems and periods of sustained southerly winds.

How will the plan reflect the reality that the Chandeliers has been significantly damaged to nearly reduced to a series or broken shoals with some small land forms? With the present level of degradation and likely additional loss of land area with even this winter season, this may alter the consideration of the priority of addressing this feature if at all.

What about abandoning the bird's foot delta while maintaining SW Pass as a slack water navigation channel? This would provide a new barrier shoreline of great importance to both flood protection and environmental enhancement.

Large scale marsh recreation must be sustained long-term to be effective, at a large cost. Who and how will it be funded?

On Illinois sediments: The ILDNR has provided the data on soil particle size, contaminants, chemistry and potential seed sources in their dredged materials. Any other impacts would essentially be the same as any other dedicated dredged material creation or restoration. The big difference is the distance of transport and associated costs, which are not as bad as people typically believe.

Considering cost/benefit is a wise thing. Considering and considering it some more will reduce costs as the areas of benefit shrink.

Besides the Atchafalaya River & Wax Lake Outlet, land creation is also occurring at the discharge of the Chariton Drainage Canal (the "Jaws") at Cote Blanche Bay. Could this be used as a small diversion project for that area?

Whatever decisions, the public will need to understand their risk and vulnerability to living in certain areas so that they can plan accordingly.

The timelines envisioned in this planning and implementation effort are so long that the frequency of storm events impacting the coastline will likely see very substantial changes to the shoreline and barrier islands and coastal bay systems and additional flooding and damage to coastal communities.

The LDNR will soon have a finalized report that has preliminary cost estimates and possible locations for an infrastructure of pipelines from the Miss. and Atchafalaya Rivers that could result in meaningful rebuilding of lost wetland systems. This should provide somewhat of a head start at a serious look at the pipeline slurry strategy.

Can we define rules of triage by which choosing the "right" project(s) may be made?

Regarding maintenance of marsh creation areas - this should be done through river diversion where possible. Otherwise, sediment would have to be piped in for mechanical maintenance. Existing wetlands also need to be maintained through diversions to protect more inland communities. Is distance inland more relevant to surge or to cutting off the source of energy (warm water)?

Ridge and Chenier restoration could also involve reforestation to increase friction effects on surge propagation.

What combination of protection would this area need if we are to survive "back to back" storms like FL sustained in 2004?

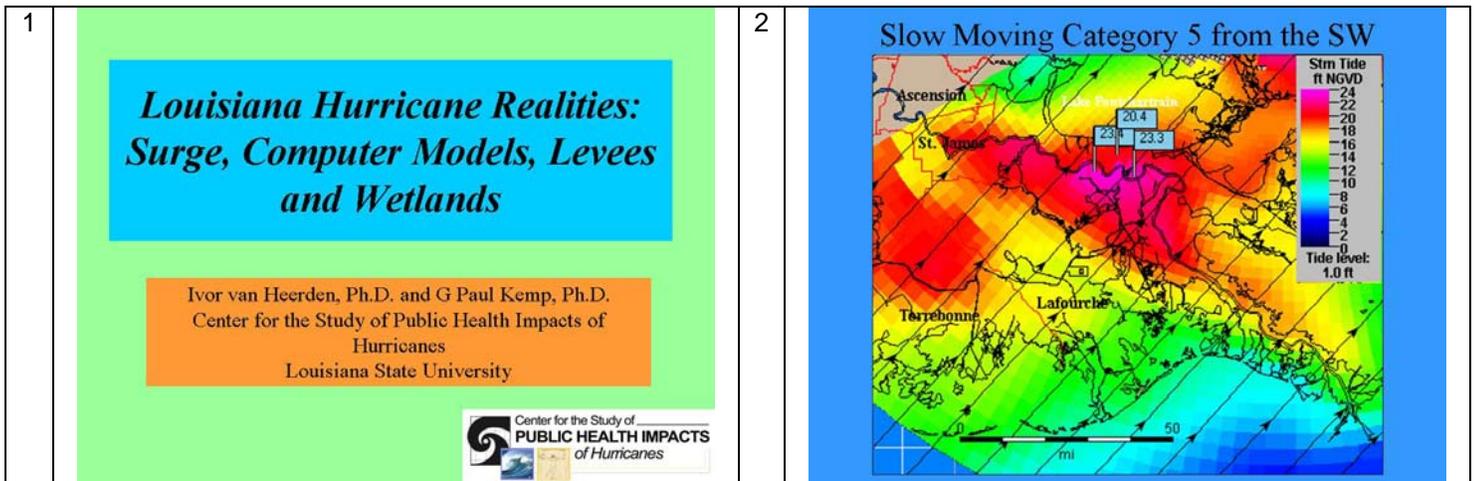
This conceptual plan assumes a stable base. Feasibility and sustainability of each feature of the plan depends on subsidence rate. Has differential subsidence been considered?

## Louisiana Hurricane Realities: Ivor van Heerden

### Summary

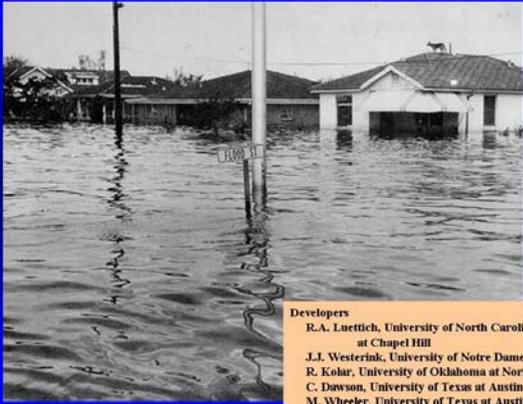
The first part of the presentation described the “Funnel Effect” caused by the levee to the west of MRGO and the levees along the GIWW. The authors claimed that 92% of the volume of St. Bernard Parish flooding was caused by this effect. To solve this problem, they proposed a gate in the Rigolets Pass at Highway 90, one in Chef Menteur Pass just north of the GIWW, a gate in the GIWW and a new levee along the extreme northwest shore of Lake Borgne and a gate in the MRGO at B. Dupre. This would effectively close the mouth of the funnel.

Later, the presentation described a totally different coastal restoration and hurricane protection plan proposed by LSU, La. Geological Survey and the LSU Center for the Study of Public Health Impacts of Hurricanes. The plan consisted of a levee starting in Slidell, a sea wall with 2 small navigation gates just east of I—10, a levee across NO East, a butterfly gate in the GIWW just east of the MRGO, a new levee along the 40-Arpent levee in St. Bernard Parish to Braithwaite, a levee parallel to the GIWW from Jesuit Bend to the Lower Atchafalaya River (LAR), and a ring levee around the Patterson area. Gated structures would be placed in the levee at Bayou Baratavia, Bayou Lafourche, Bayou Terrebonne, the Houma Navigation Canal (HNC) and the LAR. For restoration, diversions were proposed from the Mississippi at Violet, Caernarvon, Naomi and W. Point a la Hache. A Fourth Delta was proposed to be created by a major diversion into California Bay. A new Mississippi River Navigation Channel would proceed south from Empire with a lock in the river. There are no levees proposed in Plaquemines Parish and the existing Birdsfoot Delta would be abandoned. A major diversion is proposed from the LAR through Lake Palourde into Terrebonne Parish. Smaller diversions are proposed from the GIWW at the HNC and B. Terrebonne. All existing barrier island chains would be restored, but significantly inland from their present position.



**3**

### ADCIRC Storm Surge Modeling



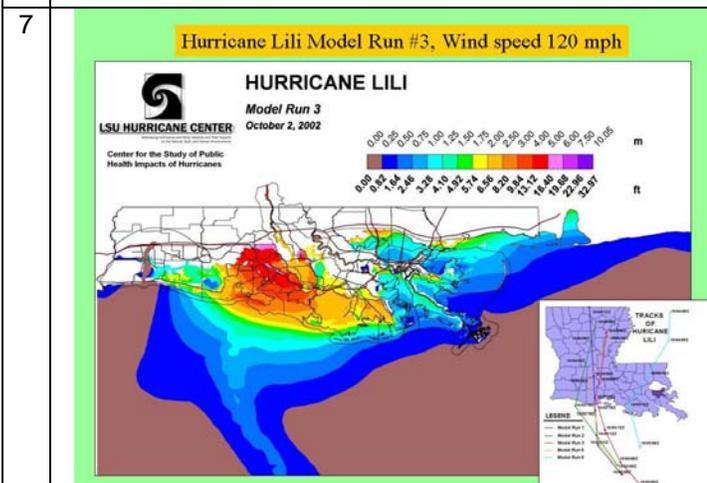
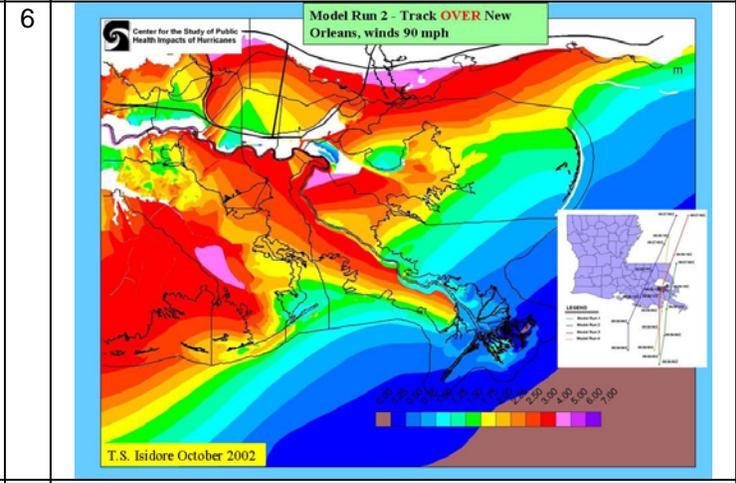
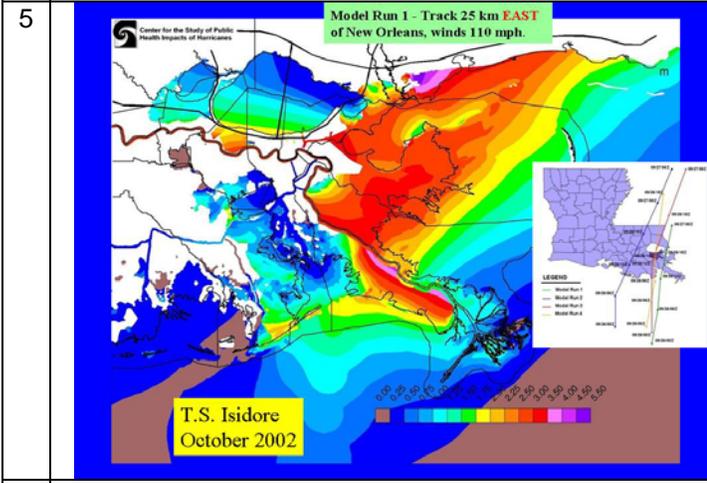
**Developers**  
 R.A. Luetlich, University of North Carolina at Chapel Hill  
 J.J. Westerink, University of Notre Dame  
 R. Kolar, University of Oklahoma at Norman  
 C. Dawson, University of Texas at Austin  
 M. Wheeler, University of Texas at Austin  
 W.G. Gray, University of Notre Dame

Hurricane Betsy 1965 and a flooded New Orleans

**4**

### ADCIRC Surge Forecast Accuracy as Katrina Approached

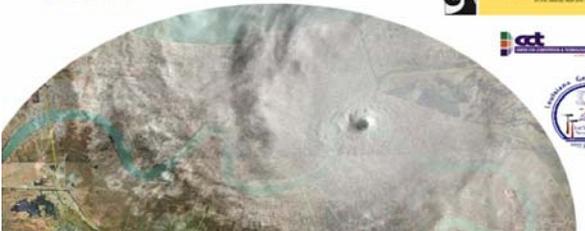
Zone	No. Obs.	HWM (SE)	Forecasts: Hours to Louisiana Landfall						
			51	45	39	24	9	(-27)	
West to East									
Lake West	5	2.20 (0.48)	2.16	1.66	2.30	2.24	1.94	2.71	
		RMSB	0.34	0.62	0.37	0.30	0.38	0.66	
		% Error	15	20	15	15	17	12	
Jefferson	4	2.45 (1.02)	2.49	2.10	2.94	3.14	2.60	3.73	
		RMSB	0.37	0.34	0.28	0.23	0.26	0.34	
		% Error	15	14	12	9	11	14	
Orleans Metro	20	3.63 (0.43)	1.99	2.28	2.73	3.40	2.77	3.49	
		RMSB	1.69	1.39	0.99	0.35	0.92	0.33	
		% Error	47	38	27	10	25	9	
East Orleans	9	4.18 (0.50)	2.76	2.90	3.43	4.06	3.35	4.18	
		RMSB	1.57	1.41	0.99	0.45	1.02	0.63	
		% Error	38	34	24	11	24	15	



**8**

Center for the Study of PUBLIC HEALTH IMPACTS of Hurricanes

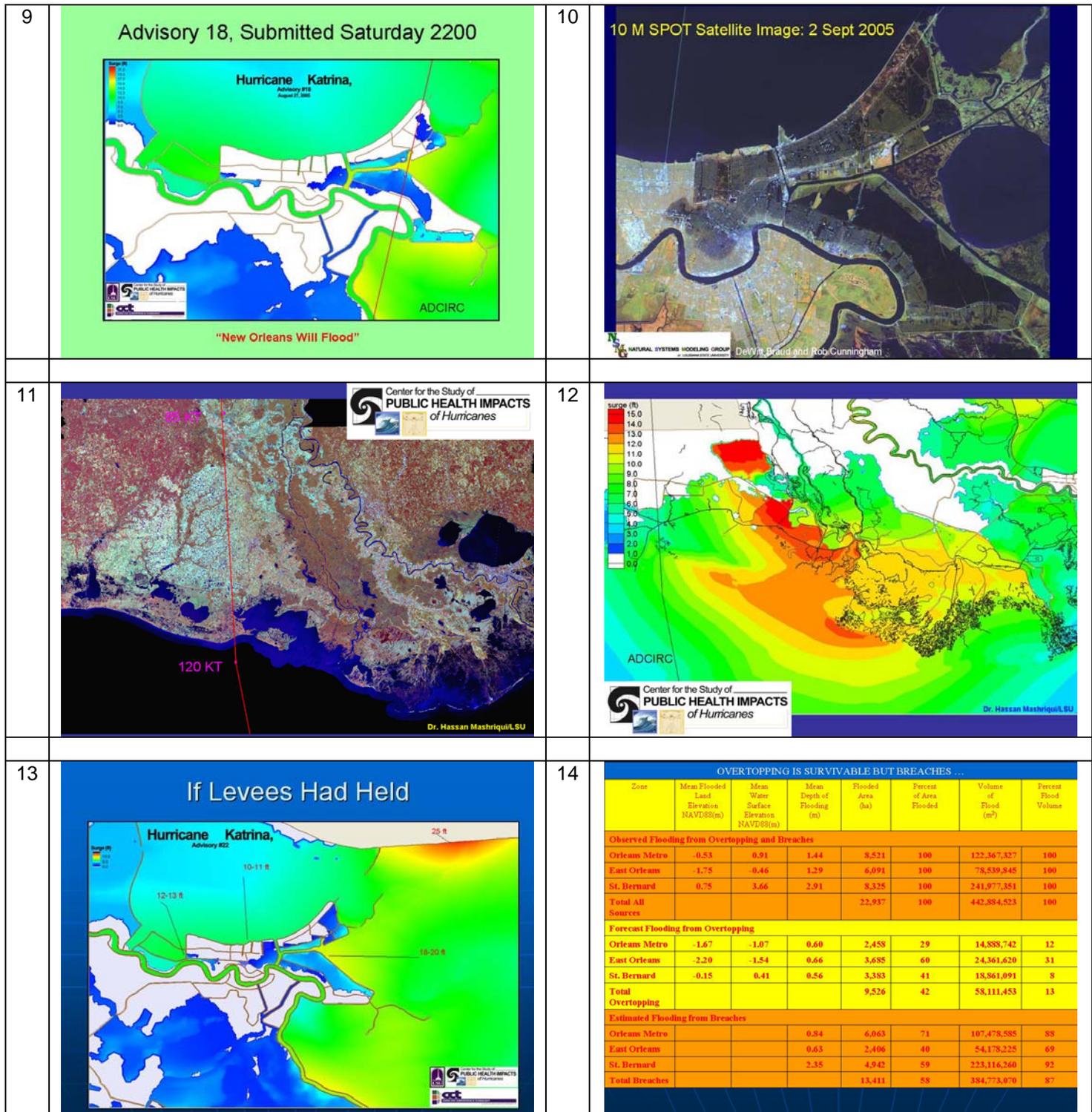
ADCIRC Simulation

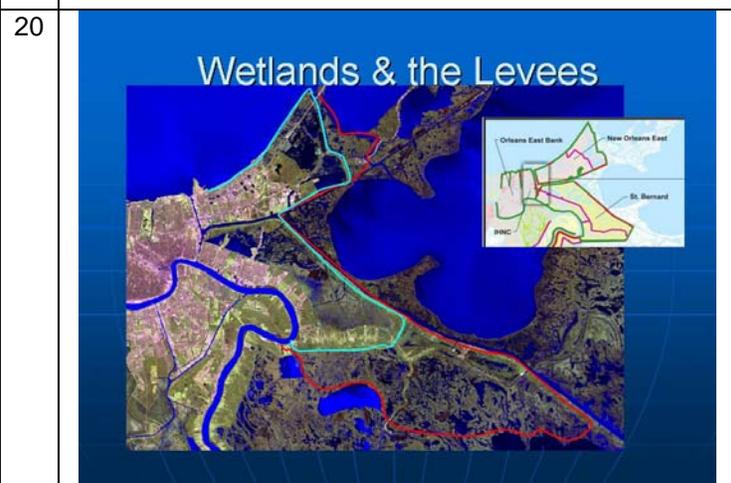
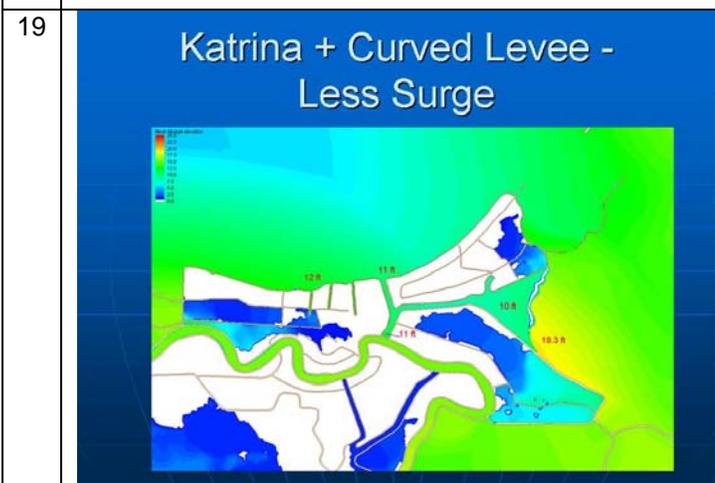
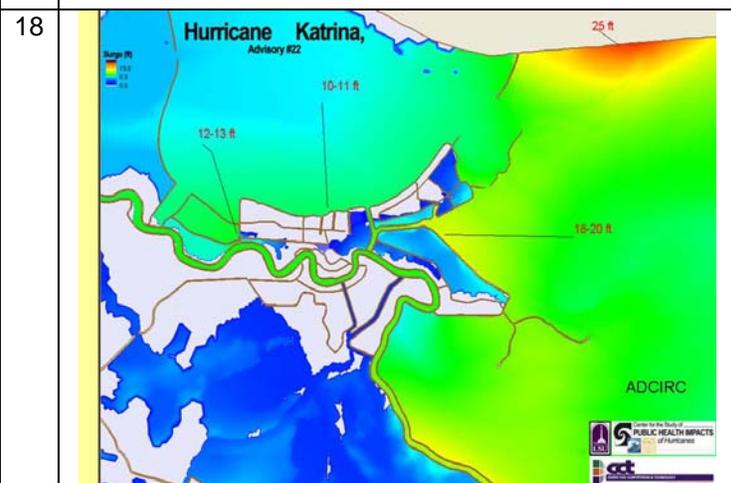
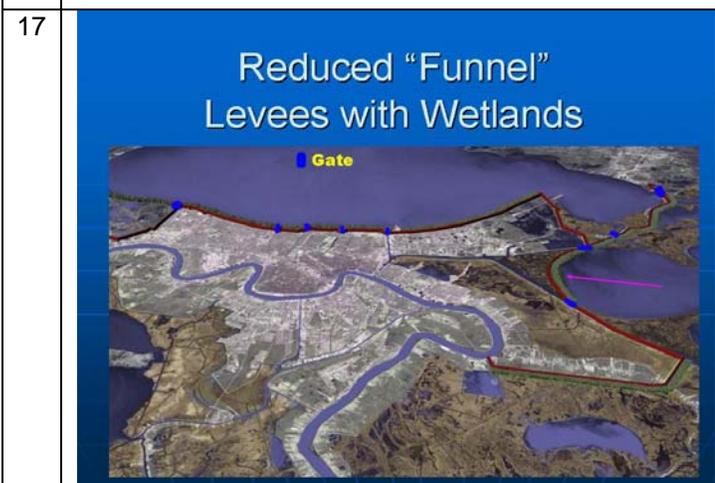
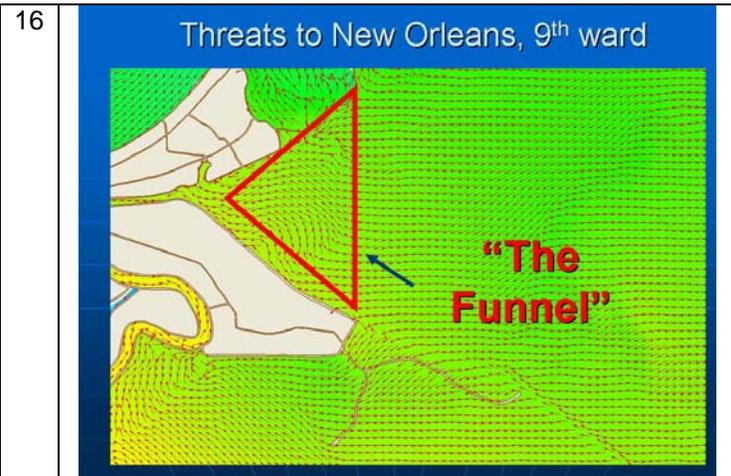


LSU HURRICANE CENTER

ct

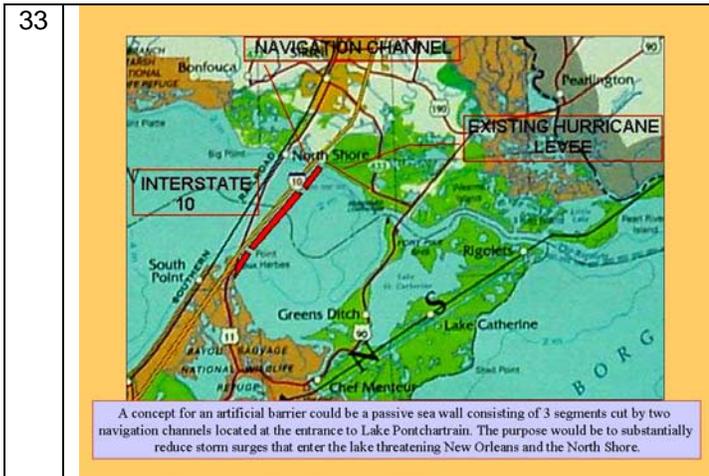
This research has been supported by the Louisiana Board of Regents through the Millennium Trust Health Excellence Fund Contract HEF (2001-06)-01





21	<p>The Difference Between This...</p> 	22	<p>And This...</p> 
23	<p>Propose a barrier levee – wetland – barrier island solution</p> <ul style="list-style-type: none"> <li>• Barrier levee located across coast such that significant wetlands seaward, pathway crosses reasonable soils</li> <li>• Barrier levee leaky, navigation and sediment delivery channels</li> <li>• Barrier levee backed by service/navigation channel, extension of GIWW</li> <li>• Barrier levee such that evacuations not needed.</li> </ul> <ul style="list-style-type: none"> <li>• Wetland creation, focus on large scale diversions</li> <li>• Reconnection of Bayou Lafourche</li> <li>• Large-scale diversion from Atchafalaya River into Terrebonne marshes</li> <li>• Wetland creation to be mitigation for barrier levee</li> </ul> <p>Barrier Island creation by mining offshore shoals and near shore sand deposits</p>	24	
25		26	





36

Conclusions

- The Netherlands surge protection system is an excellent model for Louisiana
- We need to act now, need to be bold, need to assume some risk
- ADCIRC surge model a great planning tool, need for ecological assessment models amongst others. Models are extremely valuable planning tool.
- Choose some short-term big picture projects and move on these – expediate the implementation process. Take info from Lake Pontchartrain Levee, Morganza to the Gulf, lower Atchafalaya Evaluation studies and integrate. Do not fall into trap of studing to death.- We know enough to act now.

**Discussion Notes**

**Sue Hawes:** Funnel visualization on MRGO questioned, but there is no levee to the East.  
**Van Heerden:** Hydrographs illustrate how this works.

**What about those outside the lines on the map?**  
 Much has been gathered, but these are a starting point. We're certain some of these will be drawn. There is not necessarily a conclusion that those outside the lines are to be abandoned. The gap in the Corp's lines is 360 miles. This one is 120. There is a big difference in getting it approved/funded.

The cost/benefit of the net value of property of communities outside the lines will have to be examined. These will be hard/difficult questions.

**John Lopez:** Large scale diversions have been covered in several presentations. The river isn't what it once was. Sediment loads have been altered. It Seems like there are large gaps between now and when they will actually create land 20-30 years in the future.

**Van Heerden:** Even shallow water bodies have a benefit. Once the Atchafalaya basin reached a full state we saw rapid growth in this. Wax Lake an excellent example.

*Wax Lake took 20 years. I stand by my 20-year window.*

*Barataria Restoration Program: Stakeholder involvement will be crucial here. This will be delayed beyond anyone's expectations if we fail to pay careful attention to it. Consideration/mitigation must be thought through on any of these plans.*

*Stakeholder agreements are in place. We keep rethinking/re-doing them. Implementing what we build will be impossible if stakeholders have not bought into plan recommendations. We need to consider what will be acceptable to the stakeholders. There are some alternatives that are acceptable: fisheries, estuaries, ecosystem preservation, cultural aspects. Some change is acceptable, but there is a limit to what stakeholders will go along with.*

### **Team Comments**

What is mitigation of a levee?

What happens to those communities south of levee system?

Eva north.

What about oil and gas hubs like Fourchon?

Turn valves off and head north!

Moving the barrier islands to a position farther north is not acceptable to the communities that depend on surface water sources for drinking purposes. Salinity regimes would also move northward and would cause drinking water sources to become too saline for to be used for drinking source.

Does the Third Branch Delta have a place in this plan?

What about those communities in West Louisiana that flooded in Rita?

The line in the sand, smooth levee alignment through the Barataria/Terrebonne area is understandable as a means to minimize the funnel effect, but how do you address the existing levees that interrupt that alignment? Unless you move the line to the seaward extent of the existing alignments, you will still experience some sort of funnel in areas across the coast.

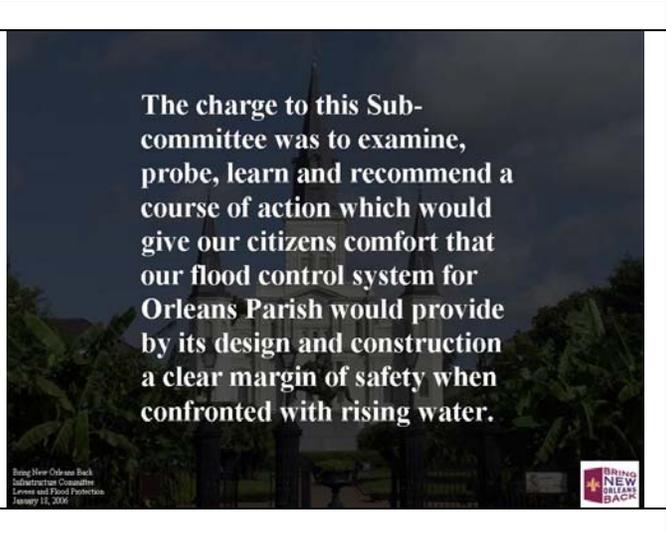
Has anyone calculated the amount of openings in the discussed levee systems that are open to the tidal exchange? It seems that regardless of where or which opening, there is a significant reduction in tidal flow.

River diversions have long range potential. Shorter term solutions are needed.

## ***Bring Back New Orleans Commission: Bruce Thompson***

### **Summary**

The Committee's Vision is to ensure that New Orleans citizens, their families and property, are secure from intrusion by and damage from water, whether river, rain or sea. They believe that flood control requires a coordinated system of levees, pumps, locks, dams, weirs, flood gates, dredging, siphons and other forms of coastal restoration. They support the current Corps plan for higher armored levees and flood control structures in the Chef and Rigolets Passes. They strongly suggest some fast-track, add-on projects: jetties and temporary barge/thruster pumps at the mouths of the 17<sup>th</sup> Street, London Avenue and Orleans Avenue Canals, a dam at the mouth of the Industrial Canal, and a weir with a barge gate in the GIWW/MRGO at Paris Road. Other suggested add-ons to the Corps plan are modification of the railroad tracks that run from west to east across the city to be a line of defense and a weir/barge gate in the MRGO at the La Loutre Ridge. They also desire permanent pumping stations with gates at the mouths of the three canals and a flood control structure in the GIWW south of the Hero Canal on the West Bank.

<p>1</p> <p><b>Bring New Orleans Back Infrastructure Committee Levees and Flood Protection</b></p> 	<p>2</p> <p><b>Vision Statement</b></p> <p><b>To ensure that our citizens, their families and property, are secure from intrusion by and damage from water, whether river, rain or sea.</b></p> 
<p>3</p> <p><b>Flood control is not simply accomplished by raising levees, but requires a coordinated system of levees, pumps, locks, dams, weirs, flood gates, dredging, siphons and other forms of coastal restoration.</b></p> 	<p>4</p> <p><b>The charge to this Subcommittee was to examine, probe, learn and recommend a course of action which would give our citizens comfort that our flood control system for Orleans Parish would provide by its design and construction a clear margin of safety when confronted with rising water.</b></p> 

5

**•Feasible**

**•Affordable**

Bring New Orleans Back  
Infrastructure Committee  
Levees and Flood Protection  
January 11, 2006

6

**Many Have Contributed To This Report**

Bruce Thompson	TECO
Billy Marchal	Engineer
Boyan Bollinger	Bollinger Shipyards / Dock Board
Jim Bras	Peak Dredging
Mark Schumler	LSU Agricultural Center
John Kallenborn	Chase Bank / Dock Board
John Barry	Author
Charles Nelson	Waldemar S. Nelson and Company
Janmy Kottmayer	Kottmayer Construction
Robert Boh	Boh Bros. Construction
Mircha St. Martin	Sewerage & Water Board of New Orleans
Toby Roster	Levee Guard
Allan Odley	Duguy Storage
Rene Cross	Louisiana Recovery Authority
David Vorhies	Louisiana Recovery Authority
Joe Sullivan	Sewerage & Water Board of New Orleans
Tim Ashton	U.S. Corps of Engineers
Cynthia Frombertz	FEMA
Erik L. Johnson	International Engineering
Walter E. Searcy	U.S. Corps of Engineers
Randy Evans	Levee Guard
Ralph Lehmann	Koerner Capital
Jaron Lehmann	DNO
Jay Laporte	Latham / Business Council
King Milling	American's Wetlands
Frank Nicholas	NY Architects
Bill Montalozze	L. B. Beach Wetlands
John Lopez	Lolo Potchchartrain
Greg Miller	U.S. Corps of Engineers
Joseph Becker	Sewerage & Water Board of New Orleans
Walter Beckler	Dean Engineering, Inc.
Maj. Hugh Darville	U.S. Corps of Engineers
Col. Lewis Setliff	U.S. Corps of Engineers
	Timor Pagnone
	National Geographic

Bring New Orleans Back  
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Levees and Flood Protection  
January 11, 2006

**Many Others Contributed to This Work in Addition to Those Listed**

7

**What Happened ?**

Bring New Orleans Back  
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8

**Katrina's Tidal Surge**

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9

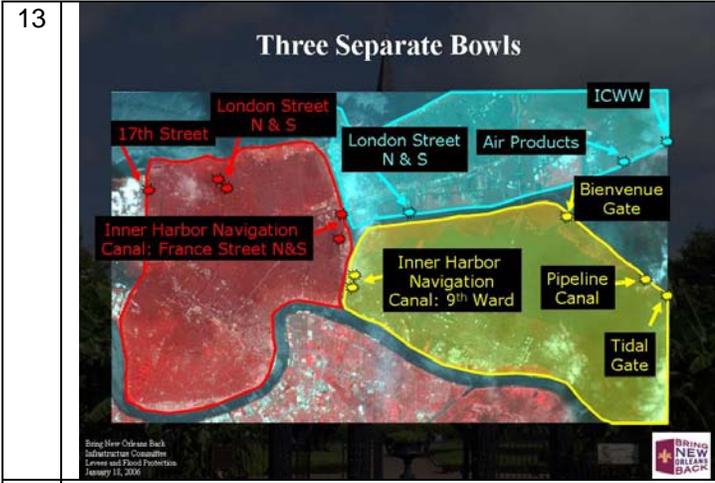
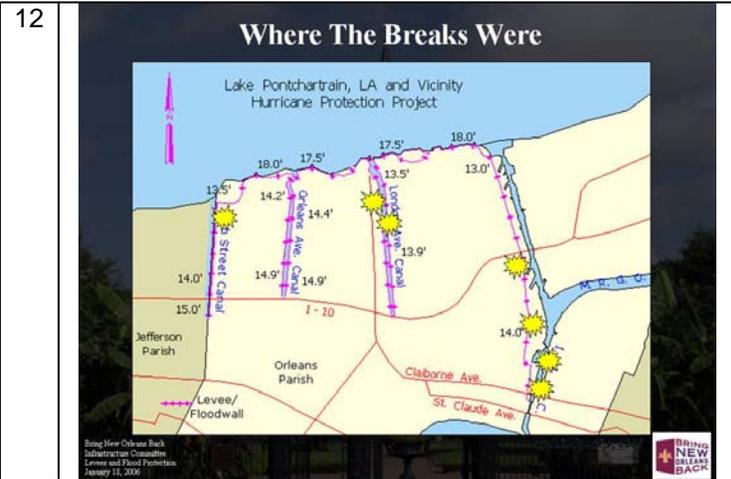
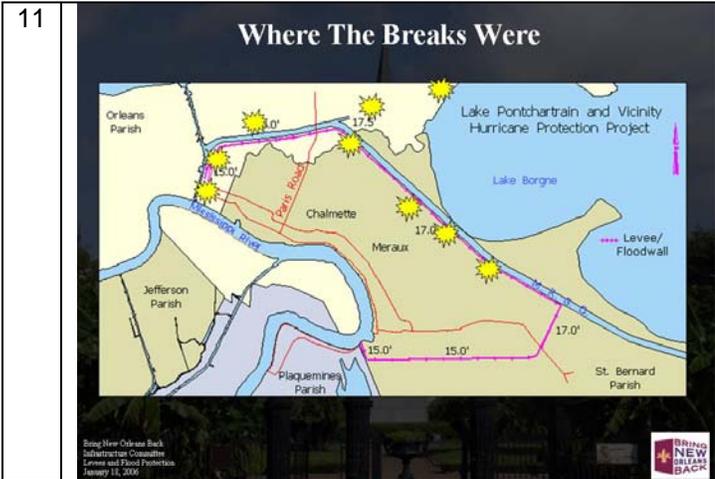
**Funnel Effect**

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10

**Swollen Lake Pontchartrain**

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17

## A Good Flood Strategy Relies on Layers of Protection

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## Backtracking

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## Assume That East Bank of Orleans Parish Is Protected From The South & West

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## East Jefferson

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21

## Holes in the Levee

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## Orleans Canals Open to the Lake

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23

### Jefferson Parish has Jetties Across the Mouth

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### Add Jetties at the Mouth of Each Canal

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25

### Pumping Station at the Mouth of Canal

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26

### Move Pumping Stations to the Mouth of Each Canal

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27

### Sheet Piles at 17<sup>th</sup> Street Canal for Rita

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28

### Sheet Piles at 17<sup>th</sup> Street Canal Today

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29

### I-10 Pumping Station

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30

### 17<sup>th</sup> Street Canal Pump Barge

LAKE PONTCHARTRAIN

EL. +5.00' T.O. Barge  
EL. 0.00' Water Line  
EL. -15.00' S.O. Barge

METAIRIE ← → NEW ORLEANS

**Nelson** WALDEMAR S. NELSON AND COMPANY  
INCORPORATED  
ENGINEERS AND ARCHITECTS  
1200 ST. CHARLES AVE. NEW ORLEANS, LA.

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31

### Industrial Canal

Old Pumping Stations

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32

### Dam at Seabrook

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33

### Groups Impacted

- Barges
- Fisherman
- Shrimpers
- Boaters
- Repair Yards

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34

### Groups Favorably Disposed

- Environmentalists
- Neighborhoods Near Canal

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35

# Closing the Four Holes in the Levee Creates a Solid Front to the North, From Hwy. 11 to the St. Charles Parish Line

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36

## Funnel Effect

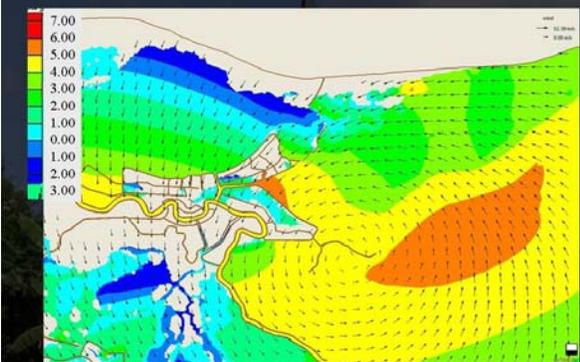


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37

## Funnel Effect



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38

## Funnel Effect



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39

## Weir Across the MRGO/GIWW at Paris Road

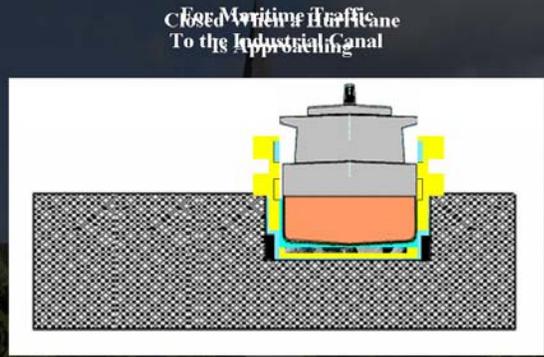


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40

## Weir Across the MRGO at Paris Road



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41

### The Dam and Weir Combination Would Isolate the Industrial Canal System From Flood Waters

Image © 2005 MOA EarthSat  
Image © 2005 DigitalGlobe

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42

### Weir Across the MRGO at the LaLoutre Ridge

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43

### Lake Pontchartrain Barrier Plan

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44

### STOPPING THE SURGE

Although still working on the final plan, the Army Corps of Engineers said it probably will use a system of high levees and floodgates in building a Category 5 hurricane protection system for the New Orleans metro area. Here are some of the possible tools expected to be used:

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January 11, 2006

45

### STOPPING THE SURGE

Although still working on the final plan, the Army Corps of Engineers said it probably will use a system of high levees and floodgates in building a Category 5 hurricane protection system for the New Orleans metro area. Here are some of the possible tools expected to be used:

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46

### Flood Control Structures in the Chef and Rigolets

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47

## STOPPING THE SURGE

Although still working on the final plan, the Army Corps of Engineers said it probably will use a system of high levees and floodgates to build a Category 3 hurricane protection system for the New Orleans metro area. Here are some of the possible tools expected to be used:

**Slidell to Rigolets**

**Slidell to Rigolets (Includes Gates at Rig.)**

**Chef Island and Gates at Chef Menteur**

**Venetian Isles / FT. McComb to MRGO**

**South of MRGO thru Chalmette**

**Engineering and Design**

**Supervision and Admin**

**\$2.035 Billion**

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48

## Times Picayune Estimate of Component Cost

Slidell to Rigolets (Includes Gates at Rig.) \$926.5 Million

Chef Island and Gates at Chef Menteur 336.6

Venetian Isles / FT. McComb to MRGO 168.5

South of MRGO thru Chalmette 170.5

Engineering and Design 240.3

Supervision and Admin 192.3

**\$2.035 Billion**

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49

## Primary Barrier With Our Current Levees and Containment Strategy Gives Triple Protection

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50

## Add-Ons to Current Corps Plans

Jetties

Dam

Flood Control Structure

Pump Barge

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51

**Note:**

Four Suggestions/Recommendation Can Be Fast Tracked

- \* Jetties
- \* Barge/Thruster
- \* Dam
- \* Weir

These Suggestions Do Not Interfere With Any Ongoing Corps Work

These are Add-Ons Which Complement and Augment Current Projects

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52

## Fast Track Projects Cost Ranges – Best Estimate

3 Jetties	\$15-25 Million
1 Barge/Thruster – 17st.	10-20
2 Barge/Thrusters-Orleans & London	15-30
1 Dam	10-15
1 Weir and Barge Gate	<u>50-80</u>
	\$100-170 Million

**A Good Nights Sleep Priceless**

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### **Discussion Notes**

**John Lopez: Weir on MRGO: depth deeper than parish road...Why?**

*Thompson: I believe I said HEIGHT. Under I510 it would have to tie into an adjacent structure. At La Loutre landbride this would be 4 ft.*

*The navigation channel agreed to would be a 28 ft draft. We are not tied to this level.*

**What's your sense of acceptability of the dam on the lake, especially from navigation?**

*Thompson: It's very acceptable, boatyards and shell dredging are/were the main users of the lake.*

**Denise Reed: BBNO structure unfamiliarity: Were nonstructural alternatives examined? Were these done by another group?**

*Thompson: There were 17 commissioners. Ours was under infrastructure. There were no considerations for coastal restoration in our study as our emphasis was protecting the citizens of our parishes and coastal restoration work was being done elsewhere.*

*The sustainability subcommittee did discuss wetlands protection in another venue.*

### **Team Comments**

These are interesting suggestions but what would have happened if Katrina had been a little further west?

Why wouldn't you place a lock in the inter harbor canal instead of a dam. It is the only navigation canal between the Barataria and Pontchartrain Basin.

The GIWW would have to be higher in order to support lock structure.

Isn't there a flood gate being built on the Harvey Canal near Cousins Pumping Station?

What is the effect in the north east portion (Lacombe to Slidell) of Lake Pontchartrain from a swollen lake? There are no lake levees on north shore. Are those communities getting an effect from water that sloshes around inside an enclosed lake?

The North Shore communities have not expressed an interest in lakefront levees, but they have a strong interest in the Lake Pontchartrain Barrier Plan because it will prevent the Lake from filling up. If the winds from Katrina had come out of the south after the Lake filled, the North Shore would still be bailing out as they had to do several years ago when we had the two back to back storms.

As a point of information, storm surges from Katrina of 20 plus feet were reported in eastern portions of Slidell.

We're already putting a lock on Harvey Canal south of Lapaico. Why put another one?

The flood gate (not lock) on the Harvey Canal at Lapalco will still leave approximately 30 miles of levees susceptible to failure or overtopping. The 0.3 mile long Hero Canal flood control structure would remove this 30 miles of levees from a primary role and make them secondary internal levees.

BNOB Sub-Committee also recommended specific wetland restoration projects as well as four projects with beneficial use of dredged material.

The full report of the subcommittee on Flood Protection and Drainage including text and copies of all slides are on the BNOB website--bringneworleansback.org. Click on 'Final Report - Levees' for the PDF file.

Specific restoration projects recommended by the BNOB include

- 1 Restore the LaLoutre landbride.
- 2 Add sediment to the Caernarvon diversion using a dredge in the river.
- 3 Utilize the Violet Canal as a diversion with sediment.
- 4 Utilize the Industrial Canal / Miss. river locks as a fresh water diversion (combined with a flood control structure at the Canal and Lake Pontchartrain) to freshen the Lake Borgne area using the Intracoastal Waterway and MRGO as distribution channels.
- 5 Implement the Barataria Landbride Project.
- 6 Implement river reintroduction with sediment at Myrtle Grove and LaRoussette/West Point a la Hache.
- 7 Increase the Hope Canal project capacity enhancing the Manchac and New Orleans landbridges.

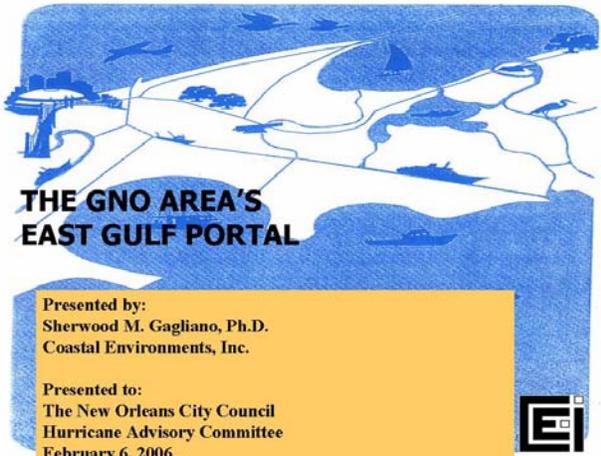
BNOB has also recommended the requirement of a "Levee School" for all levee board members statewide. The program would include all manner of man-made structures as well as marsh restoration projects and methodology. This proposal is currently being considered by LSU's administration at the highest levels.

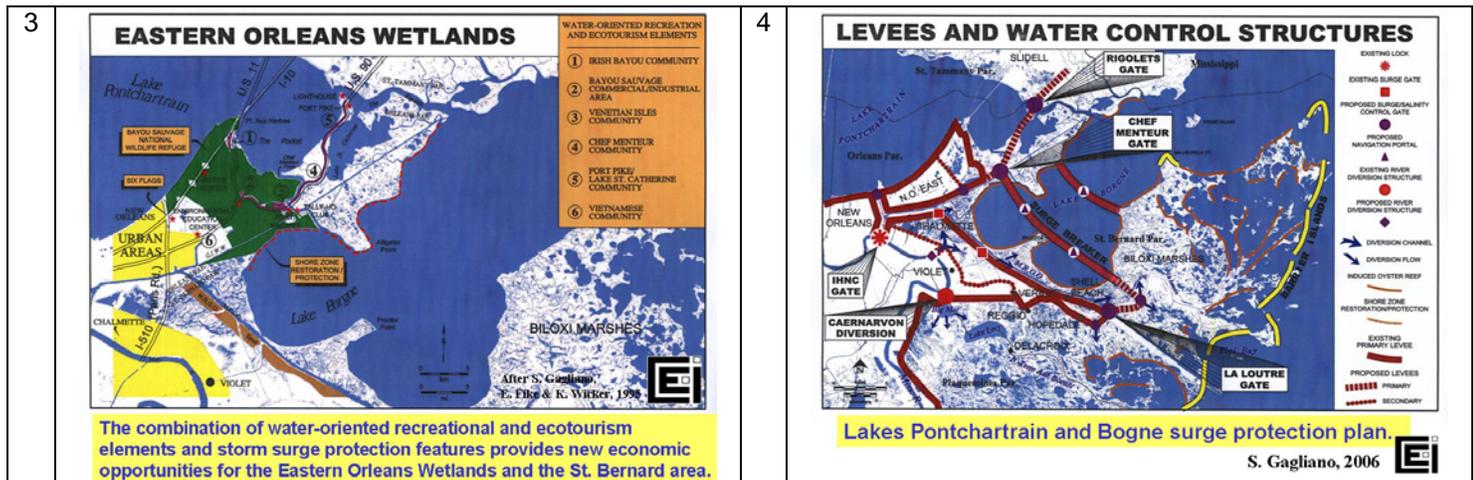
## Greater New Orleans Area's East Gulf Portal: Dr. Sherwood Gagliano

### Summary

Dr. Gagliano proposes the following structures to protect New Orleans from the east:

1) -Surge/salinity control gates at Chef Menteur and Rigolets Passes with a new primary levee connecting them and extending northeast to the Prairie Terrace; 2) - Existing Lake Pontchartrain and Vicinity HP levees; 3) - Two "surge-breakers" with navigation portals extending from northwest to southeast across Lake Borgne. The inner of these connects to the Chef Menteur Gate, to a navigation portal in Bayou La Loutre at B. St. Malo and thence to a surge/salinity control gate in the MRGO at the La Loutre ridge; 4) - A line of "interior" barrier islands around the edge of the Biloxi Marshes; 5) - A secondary levee along the 40-Arpent Line in St. Bernard Parish and along the Maxent Canal in NO East; 6) – a diversion at Violet whose waters are directed to B. Bienvenue, the MRGO, east and west in B. La Loutre to the gate near B. St. Malo and another near Hopedale Lagoon. Water would flow north and/or south from these; 7 – induced oyster reefs in the Biloxi Marshes and Lakes Jean Louis Robin, Coquille and Calabasse; 8) – shore restoration and protection along the north shore of Lake Borgne and 9) – water oriented recreation and ecotourism promoted in the various communities of New Orleans East.

<p>1</p>  <p><b>THE GNO AREA'S EAST GULF PORTAL</b></p> <p>Presented by: Sherwood M. Gagliano, Ph.D. Coastal Environments, Inc.</p> <p>Presented to: The New Orleans City Council Hurricane Advisory Committee February 6, 2006</p> 	<p>2</p> <p>DISCLAIMERS and COPYRIGHT</p> <p>The interpretations, findings and opinions presented in this paper are those of the author and are subject to revision upon completion of further research. They may or may not represent positions or views of sponsoring clients.</p> <p>The content of this presentation entitled <i>The GNO Area's East Gulf Portal</i> are copyrighted and are the property of Sherwood M. Gagliano. They are not to be reproduced in any form without written permission of the author.</p>
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**Discussion Notes**

*I have concerns about our approach to building perimeter protection. It's almost a self-fulfilling prophecy as protected areas will continue to lower over time. We'll tend to believe these are "safe" areas. Difficulty of evacuating population must be considered. We have to figure out how to build up ridges over time.*

*Gagliano: This is a 200-300 year plan. Holes get deeper. Levees need to get higher.*

*Once we build a wall with wetlands and low-lying areas behind them, what policies are in place to keep people from moving into them? How will we prevent people from moving into those low-lying buffer zones?*

*Gagliano: The Corps is looking at barriers. There is nothing to prevent these barriers from enabling overtopping. These should buy us time. This gives the surge someplace to go AND it also prevents these areas from being developed. Easements may provide additional assurances against development in these areas.*

*Bend, not break zones seem like the way to go.*

**Corps agrees to easements that would prevent development in vulnerable areas?**

*Dr. Gagliano: I don't see how anticipated overtopping accommodates development in these areas.*

*Overflow areas need to be fleshed/framed out quickly to outline assumptions of these zones.*

**Team Comments**

A state wide building code defining those areas AI Naomi mentioned could address the level of development within a specific barrier.

It would seem to be more the responsibility of the state and local government to define those codes. The Corps would need to ID them for the authorities. and then the public would be educated that knowledge reinforced through enforcement of the codes.

## ***A GulfNET Update: Dr. Anthony Cavell***

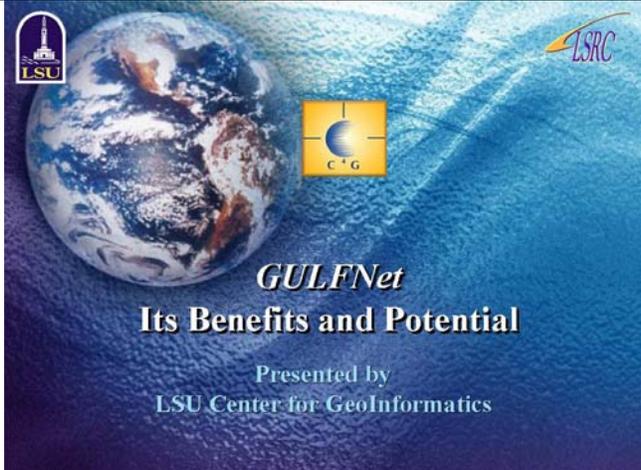
### **Summary**

Dr. Cavell from LSU's Center for Geoinformatics, described the benefits and potential of GULFnet for establishing reliable positioning data in a variable and changing landscape. Due to subsidence, Louisiana is becoming more vulnerable to destruction by coastal storms and erosion. The impacts of subsidence on wetlands, the population, and coastal roads and industries in Louisiana are of major concern.

GULFnet is a network of GPS Continuously Operating Reference Stations (CORS) operated by the LSU Center for Geoinformatics. Dr. Cavell described the growing problem establishing reliable horizontal and vertical positioning data in lieu of outdated and unreliable benchmarks. GULFnet is helping to provide the required vertical datum information for addressing Louisiana coastal subsidence

GULFnet's CORS' positions are NOAA-NGS verified and the data is freely available via Internet, resulting in savings of hundreds of dollars per download. The system is under constant development

GULFnet is especially well-suited to the requirements of real-time surveys, especially beneficial to hurricane recovery and flooding mitigation along Gulf Coast. CORS station sensors proved to be much more survivable than traditional sensors during Hurricane Katrina.

<p>1</p>  <p><b><i>GULFNet</i></b> <b>Its Benefits and Potential</b> Presented by LSU Center for GeoInformatics</p>	<p>2</p>  <p><b><i>GULFNet</i></b></p> <ul style="list-style-type: none"><li>• <i>GULFNet</i> is a network of GPS CORS operated by LSU C<sup>4</sup>G, 24/7</li><li>• CORS' positions NOAA-NGS verified</li><li>• Data freely available via Internet, savings worth \$hundreds/download.</li><li>• Supports academic research into subsidence and other phenomena</li><li>• Enables positioning in lieu of unreliable benchmarks</li></ul> <p>LSU C<sup>4</sup>G 2006</p>
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<p>3</p>	<h3 style="text-align: center;">GULFNet Availability</h3> <ul style="list-style-type: none"> <li>• From existing <i>GULFNet</i> CORS</li> <li>• From additional FBN CORS (80 km)</li> <li>• From future Networked RTK</li> </ul>	<p>4</p> <h3 style="text-align: center;">Existing <i>GULFNet</i> CORS</h3> <ul style="list-style-type: none"> <li>• Data available free of charge through NOAA</li> <li>• Station quality verified daily by NOAA</li> <li>• System fully operational, now</li> <li>• Fits requirements of control surveys, OPUS users and post-processed mapping</li> </ul>
<p>5</p>	<h3 style="text-align: center;">Additional FBN CORS (80 km)</h3> <ul style="list-style-type: none"> <li>• Data available free of charge</li> <li>• System under constant development</li> <li>• Stations will complete 80 km spacing desired by NOAA for FBN</li> <li>• New CORS available upon verification by NOAA</li> <li>• Fits requirements of control surveys, OPUS users and post-processed mapping</li> </ul>	<p>6</p> <h3 style="text-align: center;">Anticipated Network RTK Facility</h3> <ul style="list-style-type: none"> <li>• RTK Correctors provided as a free service during emergency recovery period</li> <li>• <u>Fits requirements of real-time surveys, especially beneficial to hurricane recovery and flooding mitigation along Gulf Coast.</u></li> <li>• System requires additional hardware for closer CORS spacing (50 km).</li> <li>• System requires special software to enable delivery of service</li> <li>• New CORS will extend NSPS</li> </ul>
<p>7</p>	<h3 style="text-align: center;">LSU Center for GeoInformatics</h3> <ul style="list-style-type: none"> <li>• LSU C<sup>4</sup>G Integrates science, geospatial &amp; professional technologies to gain new knowledge about the Earth, how it changes and how man can best fit into his place on it.</li> <li>• In Louisiana, "Elevation is our salvation from inundation"</li> </ul>	

## **Discussion Notes**

### ***Can you address instrument viability following a storm?***

*Cavell: We had 20 stations running pre-hurricane. 5 were lost to internet/power interruptions. 1 was lost when it was blown off it's mast. All stations are running presently with the exception of Leesville. Hardened cores are being developed to improve survivability/sustainability.*

*LA subsidence rates over the next 50 years coupled with sea level rises need to be considered. This is far greater than expected rises in sea levels over the same period.*

*Interior-engineered features that enable the natural landscape to sustain itself should be high priorities.*

## ***The Sierra Club Perspective: Casey Roberts***

### **Summary**

Casey Roberts of the Sierra Club inquired about the long-term implications of climate change and global warming and how these are being considered in the planning process.

### **Discussion Notes**

#### ***Casey Roberts: My questions center on two areas:***

*How much sea level rise is being anticipated in our planning? It appears there are some gaps in our thinking/planning.*

*How is planning considering/compensating for the apparent rise in more powerful hurricanes that appear to be occurring more often?*

*Historical levels of sea level rise are being used. This may not be an accurate measurement. Some global climatologists believe this is not a linear trend. I recommend consideration/adoption of trends showing this accelerating.*

*Joop Wiejers: Netherlands example cited on sea water levels. 30 year trends do not show significant changes here. Several inches of change are the maximum we anticipate.*

*Allow for a few extra inches. In a century this will be more of a factor.*

*That margin for error in Louisiana may not be appropriate. The consequences here are much more pronounced.*

*Climate change projections and sea level projections include these in NL. 50 year planning horizons are used.*

## **Planning Principles: Mark Davis**

### **Summary**

Mark Davis presented a recommended planning framework to the team.

### **Discussion Notes**

*Len Barr: I have one addition recommended: consider the changing climate of energy availability. We're going to building something over the next 30 years that is likely to be affected by increasing scarcity of petroleum. If we're going to move sediments, perhaps we should be doing more of this sooner rather than later.*

## **Additional Discussion Themes**

### ***A confusing array of plans is being presented. How will we turn this into a plan?***

*We will be developing a series of fundamental planning principles. There are several plans with coastal reach and a city-wide plan. These will be examined today and tomorrow.*

### ***There are many questions about getting the interested Stakeholders/constituents together. I'd like to observe how many people are here from the public. Frequently the public doesn't respond to these requests or show up.***

*John Lopez: Often these meetings need to be a place where intense technical conversations can take place. Public meetings aren't always the best forum for this. There is a certain weariness of the public that we, as planners, haven't produced more that's meaningful.*

*We need to present coherent plans to the public that are easily understood to increase acceptance.*

*John Boyle, FEMA: We've been working hard with S LA parish planning. I've been disappointed with the turnouts. We can't wait for them to come to us...we have to bring our plan to them. We can't hope that they'll show up at our events. I strongly recommend we take more of this approach in the future.*

### **Where's the door prize? OK this is a little facetious, but we need to give people a REASON to show.**

*The intimidation factor of being proven unknowledgeable can be scary. We each have constituencies...it's our obligation to communicate what's been learned to each one of them*  
*John Lopez: The planning process is planning to include evacuation routes, elevated housing. We need to be considering these elements of a plan in our discussions.*

### ***Please make sure that Environmental Justice concerns are taken into consideration and included in your planning process!***

*Several parishes have environmental justice communities (Orleans, St. Bernard, Jefferson, Terrebonne and others).*

**What input is being received from coastal parish government on the level and alignment of hurricane protection levees?** *Some parishes are likely wanting a Cat 3 level of hurricane protection if is it more feasible and likely to become a reality. Additionally, some alignments exclude important coastal population centers that can be of real impact to the State and the individual parish economy.*

### 3. Principle Prioritization

10-Point Scale (Allow bypass)

Number of ballot items: 45

Total number of voters: 32

Number of Votes

Participants generated a list of principles that should be applied to future plans and alignments. Following a clarifying discussion, the team rated the list using the following scale:

10	Mission Critical
9-8	Very Important
7-6	Important
5	OK
4	No, but willing to consider alternations
3-2	Unimportant
1	No way!

The following distribution resulted:

Principle Alternative	Mean	10	9	8	7	6	5	4	3	2	1	Total	STD	n
1. Maximize dual-purpose (hurricane protection and environmental benefits)	8.65	10	9	8	1	1	2	0	0	0	0	268	1.4	31
2. Active Stakeholder participation must be included even in accelerated planning processes. (Ignoring this will delay implementation). Be sure this group is defined and inclusive	8.53	13	8	4	3	0	3	0	1	0	0	273	1.85	32
3. Build barriers to mimic natural structures (i.e. barrier islands, cypress forests and ridges)	8.25	8	9	6	6	1	1	0	0	1	0	264	1.74	32
4. The plan must be adaptable to change	8.06	5	6	13	4	2	0	0	0	1	0	250	1.57	31
5. Restoration projects should protect people, businesses and infrastructure	8.06	15	2	4	4	0	4	2	0	1	0	258	2.34	32
6. Establish measures that maintain the health of the ecosystem	8	8	9	4	3	3	4	1	0	0	0	256	1.87	32
7. Where gates and structures are used, there should be clear criteria established regarding when and or how long such structures are closed	8	9	5	5	5	3	2	0	0	1	0	240	1.97	30
8. Maximize synergies, flood protection coastal restoration and navigation	7.97	12	3	7	1	3	3	0	1	0	1	247	2.34	31

Principle Alternative	Mean	10	9	8	7	6	5	4	3	2	1	Total	STD	n
9. Use sediment retrieval and pipeline slurry technique where needed or necessary	7.91	10	2	7	7	3	2	0	0	1	0	253	1.92	32
10. Sensitivity, fairness and compensation must be shown to those whose homes, lands, livelihoods, and ways of life may be adversely affected by the implementation of any selected alternatives.	7.72	6	6	8	7	1	2	0	0	2	0	247	2.04	32
11. Socio-economic impacts must be included in the plan	7.72	8	7	5	4	2	4	0	0	2	0	247	2.25	32
12. Subsidence needs to be understood and included in all planning (especially speed of construction)	7.69	7	6	10	1	2	2	2	1	1	0	246	2.21	32
13. Include local zoning and evacuation routes in planning	7.68	3	5	9	9	3	2	0	0	0	0	238	1.33	31
14. Proposed features need to be reviewed and modified as new information becomes available on plan effectiveness	7.68	5	4	10	5	4	2	0	1	0	0	238	1.68	31
15. Coordinate design with projects currently underway (LCA and others)	7.61	8	7	2	4	3	5	1	0	1	0	236	2.22	31
16. Encourage the settlement of population in safe zones (discourage development behind newly-created levees)	7.59	11	4	3	5	3	2	1	1	1	1	243	2.56	32
17. Anticipate and accommodate river reintroduction projects	7.57	8	3	8	4	1	2	2	0	2	0	227	2.34	30
18. Plan alternatives must include measures that can be implemented in the near term and, provide some immediate benefits to the ecosystem.	7.44	9	3	3	9	1	3	2	1	1	0	238	2.29	32
19. Identify project implementation priorities clearly	7.33	4	6	7	3	2	6	1	1	0	0	220	1.99	30
20. Include easements and outright purchase critical properties	7.3	6	3	4	8	4	2	2	0	1	0	219	2.05	30
21. Develop a programmatic sediment source	7.3	7	1	8	4	5	2	1	0	2	0	219	2.23	30
22. Reexamine and prioritize LCA near-term restoration features	7.3	6	5	5	5	1	4	2	1	1	0	219	2.29	30
23. Avoid enclosing wetlands to the maximum extent practical	7.28	6	7	8	2	1	3	1	1	1	2	233	2.68	32
24. Project design should promote conditions that route riverine waters through estuarine basins and minimize sediment and nutrient export to shelf waters	7.25	8	1	8	2	5	6	0	1	1	0	232	2.21	32

Principle Alternative	Mean	10	9	8	7	6	5	4	3	2	1	Total	STD	n
25. Seek ecosystem sustainability and diversity while providing interchange and linkages among habitats	7.22	7	5	5	3	3	5	2	0	2	0	231	2.39	32
26. Secure input/support from local agencies that will supply long-term matching funds	7.19	3	5	7	8	1	3	3	1	0	0	223	1.9	31
27. Encourage innovative/different approaches that might work better	7.19	7	1	9	3	2	4	4	1	0	0	223	2.2	31
28. Establish a coastal sediment that identifies sources and quantities (quality) of available material	7.16	4	4	5	8	4	2	4	0	0	0	222	1.86	31
29. Solutions should provide long-term appreciation of the natural dynamism of the coastal system	7.16	5	7	5	4	1	7	0	1	2	0	229	2.36	32
30. Think big in our planning scope	7.13	9	3	3	3	4	3	2	0	2	1	214	2.73	30
31. Evaluate the economic implications of all alternatives	7.13	7	3	4	5	4	5	1	0	2	0	221	2.32	31
32. Consider the implications of rising sea levels, subsidence and climate change in planning	6.91	6	5	5	4	3	4	1	1	0	3	221	2.73	32
33. Make a special effort to include navigation interests in outreach	6.81	3	1	12	2	4	6	0	2	1	0	211	2.06	31
34. The plan must include effective monitoring and evaluation that reduces scientific uncertainty, assesses plan success and supports adaptive management of implementation.	6.72	3	3	6	8	2	7	0	1	2	0	215	2.11	32
35. Low-cost, long-term sustainable systems are preferable (use natural materials to re-build)	6.69	3	5	3	9	4	2	2	2	2	0	214	2.26	32
36. No levee construction without concomitant habitat restoration commensurate with the SCALE of levee construction	6.65	10	3	2	5	0	1	2	1	5	2	206	3.34	31
37. Minimize hydrologic changes and restore natural flows where possible	6.63	6	3	4	4	3	4	6	0	1	1	212	2.54	32
38. Emphasize nonstructural barriers first	6.58	2	6	3	3	7	6	2	1	1	0	204	2.08	31
39. Mimic natural processes and rely on natural cycles and processes for their operation and maintenance	6.56	2	4	9	2	7	4	0	0	2	2	210	2.42	32
40. Restrictions on artificial channels	6.39	3	3	4	6	5	3	3	2	2	0	198	2.29	31
41. Utilize public affairs officers to communicate with displaced stakeholders	6.16	3	2	7	3	2	6	3	2	3	0	191	2.45	31

<b>Principle Alternative</b>	<b>Mean</b>	<b>10</b>	<b>9</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>Total</b>	<b>STD</b>	<b>n</b>
42. Blend the best of qualitative AND quantitative analysis	6.16	3	2	3	7	3	9	0	3	2	0	197	2.22	32
43. Upgrade or change methods for water pumping; use this water beneficially	6.1	3	1	3	5	3	11	0	4	0	0	183	2.04	30
44. Coordinate plan implementation with other state and federal programs that addresses invasive/exotic species	5.84	2	4	3	3	4	7	3	3	3	0	187	2.38	32
45. Establish greater consensus on what is meant by subsistence terminology/impact	4.87	1	2	1	2	1	11	6	2	5	0	151	2.11	31

## 4. Structural Alternatives

The team was asked to consider and build a list of potential structural alternatives. This exercise enabled team members to add new alternatives and project items to the list and attach related comments. Ideas presented here are shown in the order they were input, not in any indication of relative priority.

### Team Comments.

#### **1. Implement Barataria Landbridge Project.**

#### **2. Implement river reintroduction at Myrtle Grove and LaRosusette with river sediment.**

#### **3. Implement Lake Ponchartrain Barrier Plan.**

#### **4. Ring Levees around population centers.**

Re-route Mississippi River to maximize sediment deposition on coastal shelf, thereby maximizing land building/maintaining capacity of the system (requires abandoning birds foot delta).

Reclaim private property.

Provide alternative means of protection to outlying communities (raised structures, etc.), reducing levee construction costs and improving ability to sustain wetlands.

Ring levees provide the most sensible approach. In vulnerable areas, development should be the "out of place" element, not the natural coastal landscape.

Think outside the ring levee as well as inside.

This needs to be addressed for areas like Cameron Parish. However, ring levees are guaranteed to strand communities and trap coastal populations inside an area that will be flooded throughout the rest of the area. Need to consider a Morganza type of levee system which does not create a ring effect on small communities.

#### **5. Large surge structures on MRGO/Rigolets.**

Include surge barricades or barriers across Lake Borgne.

If, and only if, there are no adverse impacts to the Ponchartrain estuary.

Define operation - e.g. Open during low tide in anticipation of a storm event in order to lower lake level, then closed during and just prior to event and open as soon as differential after event permits.

Or consider pumping and "drawing down" water levels after closing the gates, in advance of the storm.

Only if these can be done without impeding sediment distribution (MRGO may be a great conduit for water/sediment/nutrient distribution to that marsh).

#### **6. Fund Short term projects which can be completed for the '07 hurricane season.**

#### **7. Match the natural soils blending the best soils and ridgeline combinations.**

#### **8. Open several needles of the Bonnet Carre until Hope Canal Project comes on line.**

**9. Flood Control Structure on Industrial Canal at Lake Ponchartrain.**

**10. Develop inventory including profile of Levees - Fed, State, Parish, Local, Private.**

**11. "Harden" existing pumping stations in SE LA so that they can be manned or automated during hurricane conditions.**

**12. Increase Hope Canal project capacity to enhance Manchac Landbridge.**

Good idea - swamps are not sustainable and their loss may increase flood threat to local communities.

**13. Start "levee school" at Louisiana University ( e.g., LSU Hurricane Center) required for Levee commissioners state coordinated with Corps for 4-5 days.**

**14. Navigation weirs on Mississippi River Gulf Outlet.**

Navigation Weirs presented by BNOB as I understand were multi purpose - salt water reduction - barriers during storm events and allowing navigation.

Or navigation gates/water control structures on MRGO.

**15. Reauthorize IHNC at Miss River to act a diversion of river water into the New Orleans Landbridge and down MRGO in conjunction with the flood control structure at lake Ponchartrain.**

**16. Develop Ridges (natural and man-made).**

**17. Reconfigure MRGO to reduce salt water intrusion, while allowing commerce and recreation and storm surge reduction as well.**

**18. Armor the barrier islands.**

This is in conflict with the natural processes that govern how islands are formed and how they change over time. While it might have some positive effective when viewed from a very narrow and short term perspective, it is doomed to fail in the long run.

This is not sustainable - we can use existing sediment in sound to build marsh or barrier island marsh.

It would be better to spend the money over time maintaining the barrier islands with sand, ultimately creating a more sustainable defense, because the sand will continue to nourish the down drift islands.

This has proven to be counter-productive.

**19. Move barrier islands inward.**

Nature is doing this. Identify a line where barriers can be sustained.

Or consider a second line of barrier islands landward of existing islands.

**20. More pipelines to move sediment**

What does this mean???

**21. Armor all levee in high population area to prevent failure if overtopped - e.g., MRGO levee behind St Bernard.**

**22. Barge fill from the Midwest.**

Filled with what?

Is moving the limestone and fill material found in Kentucky by barge to completely reclaim the Louisiana coast a cost-effective alternative?

Create tax incentives for private entities to encourage barging from Midwestern states. The Midwest has more fill than they can handle and are interested in "giving" it away.

Why KY or MO? What is the significance of from whence it is obtained? Let's get cost effective fill from where ever it is now!

The state of IL created a brochure that informs the public that they have fill that they are willing to "give" away. (not for free)

Is it more cost effective to suspend it in the river and let nature carry it down here?

### **23. Maximize use and transfer of Atchafalaya Basin sediment.**

The only sediment loss is through the Lower Atchafalaya Navigation Channel. Sediment is already entering the Penchant Marshes. No additional channel through Lake Verret is needed.

This should include maximizing use and transfer of all Mississippi River sediment.

### **24. Enhance drainage from Barataria**

What does this mean? Upper Barataria Basin? Sluggish drainage in upper basin is due to subsidence.

### **25. Close MRGO.**

Define what MRGO "closure" means.

Change wording to "Develop Plan for Reconfiguration of MRGO."

MRGO can be reconfigured to obtain ongoing benefits without filling the channel with concrete.

When you close MRGO relocate the companies upstream.

A controlled MRGO will provide both environmental and economic benefits.

Complete closure may be too expensive, and may preclude its use for environmental benefits such as freshwater and sediment conveyance; consider reduction in cross-section &/or allowing it to silt in.

MRGO can be used as a Freshwater and Sediment conveyance channel to the benefit of the Biloxi marsh area and Breton Sound.

LPBF has a closure/restoration plan of 3 developments 1) Reduce channel at Bayou la Loutre 2) Rebuild Bayou la Loutre ridge 3) Violet reintroduction to manage the Biloxi marsh.

### **26. Accelerate marsh building.**

Thread Caernarvon Diversion with a dredge pipe to add sediment directly into the marsh.

Pipeline sediment delivery, large scale.

Marsh building priority on critical landbridges.

**27. Construct survivable overtoppable levees.**

Why would anyone want to do this? Don't they mean levees that won't breach?

I think we are doing that already.

We can get the plans from the NOD. Use the 17th street canal as our model.

This will not work in today's world. All levees today are designed to be breached. "Construction" therefore is not necessary.

**28. Structures that protect against CAT 1-3 (most common/most likely) vs. CAT 4-5.**

Our goal for the urban centers must be protection against Cat 5 storms.

**29. 3 lines of defense (in-water structure, marsh & ridges, levees).**

Agree.

Very good proposal. The line of defense needs to start at the northern most line and work south. Flooding of coastal areas needs immediate attention and then layers of defenses as you move farther out.

**30. Install effective storm surge control structures on navigation channels in the coastal zone.**

**31. Poll private and public land owners to solicit participation in land reclamation and marsh restoration projects. The Port of Lake Charles has initiated such an effort. Consider statewide polling. The aggregate of such beneficial use of dredged material might significantly help the flood protection and hurricane mitigation effort.**

**32. No levees where possible.**

or use existing levee alignments to the maximum extent possible.

Please clarify.

Levee protection is not only needed but critical to the survival of most coastal parishes in southeast Louisiana today. Are the 10,000 homes and businesses and residents in south Terrebonne Parish not going to be provided the same chance at flood protection as south Lafourche Parish, Jefferson Parish, or Plaquemines Parish? Is Vermilion Parish, with over 6,000 flooded homes or Cameron Parish with most homes and communities in the southern half of the Parish destroyed not going to be included in the state's efforts of long-term coastal protection?

Even Baton Rouge today is protected by levees that keep many areas of the city from flooding.

Levees are the most critical need to provide the protection mandated by Congress. Anything less will not be accepted by the public or Congress.

Category 5 levee protection without encouraging evacuation will give the public a false sense of security.

Levees from Freshwater Bayou west would likely enclose vast acreage of wetlands while protecting very few homes and businesses.

**33. Minimize total levee length (Van Heerden plan)**

Not acceptable.

This could result in enclosing large areas of wetland, which would accelerate wetlands loss and ecosystem decline.

The Barataria swamps might be enclosed, but assuming that drainage would not be impacted, it might not be bad as those swamps are not regenerating now and hence are not sustainable. This concept might greatly reduce total wetland footprint impacts compared to alignments up and down each ridge.

This must include sustainable wetland basins inside of levees. Levees must include large surge gates as in the Netherlands Ostescheldt.

The problem with this proposal is that it does not consider existing projects that are necessary to the survival of many local communities, i.e., Terrebonne and Lafourche Parishes.

Could be designed to protect lots of wetland by assuming water level control.

**34. Develop tax incentives to get the fill to the area.**

You mean like the land reclamation act of the late 1800's?

**35. Use GIWW as levee alignment coast wide.**

Why GIWW? Why not population and industrial considerations?

Disagree. Local needs should dictate.

This alignment is the best practical location that meets the needs of LA and the scope of this project.

This is an environmentally-unacceptable option. Regardless of efforts to allow for natural hydrology, there would be hydrologic modifications to wetlands inside and outside of the system. These changes would result in reduced sedimentation, increased impoundment, and generally move the system away from a more natural self-sustaining condition. This option would also promote development in high-risk areas. In short, this option is in conflict with coastal restoration efforts.

This needs to be considered as a high priority issue. Construction of a levee system for long-term operation and function needs to look at the area of the coast that has long term viability. The GIWW actually disrupted the natural hydrology a long time ago. The GIWW is also a major storm surge conveyance for most coastal parishes that lead to flooding of many of the parishes in the past year.

Encloses thousands of acres of wetlands.

Could protect thousand of acres of wetland?

Enclosing wetlands does not protect them!!!!

**36. Establish - encourage development of trees & substantial vegetation(more than just grasses) in coastal barriers.**

Use appropriate vegetation and other stabilizers.

Mangroves helped mitigate the tsunami's effect and oaks helped deter Katrina's storm surge in some areas.

Mangrove are not sustainable, we are actually too far north, They are subject to freezing.

**37. Reconfigure MRGO.**

How?

**38. Incorporate and build upon existing projects LCA, Morganza etc.**

CWPPRA has several projects that have completed engineering and design. Those projects are ready to go to construction, but cannot because of limited funding. It is good to use the structure already created by the CWPPRA organization when possible.

Should be used to get protection to the region ASAP.

**39. Surge breakwaters across Lake Borgne.**

No way. This would seriously disrupt the hydrology and hence, the ecology of the ecosystem..

**40. Rebuild Bayou Perot/Rigolets landbridge.**

This concept may not be as important as a diversion at Myrtle Grove which would protect the rapidly deteriorating system to the south.

**41. Identify the ratio of the length of the proposed levees to the length of the hydrological openings (gates).**

**42. Barrier islands represent sand rivers. Armoring them doesn't work.**

I agree. Islands are dynamic and should not be armored.

This depends on your definition of armoring. Appropriate use of hard structures to protect barrier islands should not be eliminated. Structures that promote sediment accretion can sometimes prolong the presence of an island, particularly during storm events. Consider the Raccoon Island example.

In some instances (i.e. Raccoon Island and West Timbalier) rocks have worked well. Had Raccoon Island not been rocked, it would not exist today. The rocks withstood both major hurricanes of 2005 and sand is currently reforming between the breakwaters and beach.

Armoring might be OK if periodic nourishment was done.

**43. Re-create lost reefs using both natural and artificial materials.**

Very important!

**44. Utilize/enhance existing landscape and landscape features for coastal protection.**

**45. Rebuild natural ridges of Barataria and Terrebonne regions to 1955 landscape.**

**We cannot look at a specific time in the past and restore features to match that time. We must decide what can be sustained given the current patterns of settlement and the financial restrictions we face, and then commit to implementing and maintaining those.**

**46. Non structural measures in Donaldsonville basin.**

This option cannot provide the needed protection.

**47. Consider outermost barrier consisting of enhanced barrier islands with hydraulic and navigational control structures.**

**48. Use the existing levees and levee alignments (Morganza-Gulf, Donaldsonville-Gulf, etc.) as much as possible.**

Because the ideas for these systems were developed many years ago, they don't benefit from what we've learned about hurricanes and coastal restoration science. They also were not developed as part of a comprehensive coastal restoration/protection system. They need to be re-thought and redesigned based on what we know now. For instance, the "v" shapes in the MtG need to be eliminated (storm surge amplification) and we need to re-think stretching the levee that far down into the marsh. The whole system may work better if we protect those communities by alternative means (structure elevation, ring levees, etc.)

I disagree if you would look at project awaiting federal authorization, you will see that it will allow for adaptive management and accommodate proposed coastal restoration/protection projects while serving a very critical function which protect the lives and infrastructure for 200,000 people within and around Terrebonne and Lafourche parishes.

**49. Rebuild barrier islands to 1955 geomorphology.**

It is a great mistake to think we can recreate the coastal morphology of the past when we don't have the same physical drivers as formed those geomorphic elements. We must reach agreement on what can be sustained and commit to implement and maintain that.

I think 1954 geomorphology is better.

But I think pre 1918 is truly the best.

**50. Maintain the chef, Seabrook, Rigolets, and Bayou Boeuf open as possible except during storms.**

**51. Nonstructural alternatives, such as elevation of structures, relocation (individuals and communities), and evacuation.**

**52. Investigate features of Plans that were presented on Monday for areas of overlap and consistency to use as a starting point.**

**53. A ring acts as a trap. The security offered by a ring should be very high,**

We shouldn't consider just rings, but also a layered layout of levees with levees within levees for multiple protection and back-up.

Un-ringed areas may allow more reservoir for surge to fill and may be safer from surge overtopping than the great wall approach.

I have 2 concerns about levees:

1. Water being trapped inside and not able to be pumped out quickly enough.
2. Interference with natural hydrological processes of the surrounding areas. Will this lead to islands ringed by levees?

**54. Multiple lines of natural defense with restoration.**

This is the only way to go.

I fully agree!

**55. Armor levees.**

**56. Propagate and plant live oaks and other woody plants on restored ridges.**

This will require sufficient elevation to get roots out of saltwater inundation.

**57. Navigation gates/water control structures on MRGO.**

**58. Armoring of barrier islands should only be done rarely since it disrupts natural shoreline transport.**

**59. ADCIRC modeling showed effectiveness of marsh creation within the "funnel."**

**60. Rebuild the New Orleans Landbridge.**

**61. Use a uniform LA Spatial Reference Frame to support all projects construction.**

We need to know how high anything is before we can assess its usefulness or propriety.

LA has most dynamic geology so this is a requirement.

**62. Restore cypress forests.**

I would recommend we change this to restore and protect cypress swamps.

**63. Construct major diversions on the Mississippi River and Atchafalaya River**

Implement the Third Branch Delta as proposed in Coast 2050.

Management of the river (levee construction) has gotten us in the un-sustainable situation we are in where communities are increasingly threatened by surges. We have to restore riverine inputs in a big way to maintain the ecosystem. Diversion could be adaptively managed to provide only seasonal inputs and operated to reduce inflows for several years to accommodate estuarine-marine fisheries.

**64. Greatly expand plant materials production, (public and private growers) to ramp up the capacity for vegetative plantings.**

**65. Purchase privately owned barrier shoreline habitats for public use and protection (Elmer's Island).**

**66. Locate offsite borrow material that can be used in levee construction and marsh creation site other than adjacent borrow canals.**

**67. Swamp alignment then the HWY90 alignments should be considered higher than the GIWW alignment.**

**68. River diversions should meet specified habitat goals.**

The need to adaptively manage may make such goals difficult to obtain and maintain. The goal should be more related to maintenance of the coastal ecosystem.

**69. Enact a state easement/purchase program to ensure protection of natural areas and their hurricane buffering capacity while avoiding (at least in some cases) property rights issues.**

**70. Levees should be built on the wetland no wetland interface.**

That will be one hell of a circuitous levee.

It will be about 20,000 miles long.

**71. Specifically endorse storm barriers in Chef and Rigolets (with no reduction in cross section in passes)**

Structures alone will not work. Water will simply go around if there isn't a land barrier as well to contain water movement. This implies the need for levees of equal or greater height to achieve the barrier's intent.

**72. 3 lines of defense (barrier islands & marsh, major barrier, existing levees).**

**73. Use Morganza to the Gulf Alignment currently under construction and remaining portions to be authorized.**

Per Van Heerdon yesterday, this alignment needs to be revisited. It may not represent the best design to protect the populace and conserve natural resources.

It creates funnels and the soil may be too poor for the high levees that would be needed

**74. Generate revenue by creating dive sites that use artificial reefs (airplanes, automobiles). The area gets revenues from a new tourism sector and the citizens get a reduction in storm surge**

It is ludicrous to allow state and Gulf waters to become repositories for everybody's trash. This is not a viable plan for development of a tourism industry or any other kind of industry except trash disposal.

But, these methods are used in other areas, such as Florida, to create artificial reefs.

**75. Include NA**

**76. Prioritize restoration projects above other public works projects until the coast is protected.**

OK, How long the people of new Orleans, St. Barnard, etc. should wait before flood protection levees are built to protect their communities ??? 10, 20, 50 years ??? That is unacceptable.

**77. Streamlining the review and permit process is a critical component of any successful effort.**

What's up with this one?

I think this is the best idea yet.

The time factor is so critical to any protection or restoration effort. Streamlining the review and permit process is an important part of this effort.

For Coastal Parishes, the one very good effort seen along the coast in the state is the initiative and leadership of coastal parish government in spearheading the coastal recovery effort and in supporting coastal protection and restoration efforts. State and Federal efforts have, in many cases, not been even close to as effective as some parish efforts.

Streamlining the permit process is industry speak for "get out of our way." Unless the streamlining results in a quick "NO" for inappropriate proposals, the delay of the permit process is good. It serves as the only disincentive to rampant and aimless coastal development.

**78. Include navigation interests in planning process.**

**79. Enhance sediment delivery of river diversions.**

Sediment is the critical resource in this subsiding coastal area.

**80. Design and implement a comprehensive GIS data system to include complete inventory of all levees with profile grade, pump stations, locks, gates and other features with elevation (finished grad), latitude /longitude, cross section, and other appropriate design elements, if possible. This should be made available to your partners first, and eventually posted on COE web page.**

This should be required in the Corps plan

**81. Any structural plan must be coupled with a regulatory change.**

Permitting processes must take into account the inability of local governments to provide adequate infrastructure and services to many vulnerable areas. Investment in coastal restoration and flood protection means nothing if in 50 years, we have developed outside the system and have to do this all over again.

So, I think that means parishes must begin to take responsibility for planning the future of their communities.

I agree. The only problem is that local authorities are often too close to the situation to see coastal development in its proper context. There is too much pressure on local government to fund itself, and personal relationships often cloud better judgment. Not necessarily corruption, just too much personal interest in local issues. Regional regulations, state regulations, or federal regulations are more appropriate in this area. States should create the slate onto which local governments draw their community.

Some local officials are okay with regulation, as long as they have a federal or state agency to blame for restricted development. My experience is that local officials appreciate being able to point to regulation from above. It accomplishes the sensible goal, without putting the local officials in the position of having to explain to their cousin's brother-in-law why they can't do what they want to do.

**82. Use recon and modified recon for Morganza to the Gulf reaches in Terrebonne.**

Why?

Minimize footprint impacts to wetlands, minimizes the amount of wetlands enclosed in comparison to the previously selected alignment that had a slightly higher B/C ratio based on assumed benefits to the enclosed wetlands that have yet to be demonstrated

**83. Maintain landbridges.**

Also restore old deteriorated bridges.

**84. Control structure at Gum Bayou.**

Great idea!!

**85. Relocate communities or how communities are rebuilt. Establish guidelines that will ensure structure will be above the expected surge height (Cat 3 or Cat 5?) if rebuilding in the low laying areas.**

Dictating how private citizens build shouldn't be a role of government. Only let citizens know the risk of living where they choose.

I agree, but why do they ask the government for help when destruction happens?

Exactly! If they rebuild outside of the set guidelines, the government should not be expected to help them.

**86. GIWW alignment only to be used in the lakes sub basin.**

**87. Large-scale marsh creation and ridge restoration using a dedicated infrastructure of pipelines for sediment delivery, then nourish marshes with small freshwater diversions and plant ridges with woody species.**

Because of difficulty of building such hi levees, such features in front to reduce surges may be the most practical solution.

**88. Prevent loss of large forested areas by purchasing for mitigation.**

**89. Consider using existing navigation channels (GIWW, MRGO, etc) for freshwater and sediment conveyance. Atchafalaya FW and sediment could be transported into Terrebonne Basin for beneficial use.**

Any such opportunities such be used

**90. Move everybody north of I-10.**

Unrealistic.

**91. Elevate and relocate infrastructure rather than levees.**

This should seriously be considered as part of the plan. It may be more reasonable in some areas.

And more cost effective and better for the environment in the long run.

**92. Maintain navigation channels at no more than authorized widths.**

**93. All dredged material from navigation channels should be used beneficially.**

I agree. The Corps is limited by budget constraints and continually faced with greater disposal distances and ample marsh creation opportunities are being wasted.

**94. Use shoreline wave breaks in large open bodies of water, i.e. lakes and bays.**

Might develop oyster reefs in suitable salinity zones to do this - but it would need LDWF regulations to protect from leasing and harvest.

**95. Protection of existing natural resources (through regulatory programs, voluntary measures, financial incentives, and other tools) must be the highest priority.**

**96. There needs to be serious consideration to which areas we will try to save and which we can no longer support.**

Sad, but true!

**97. Need a larger strategic plan that acknowledges our time and financial limitations.**

**98. Restrict passes between barrier islands**

Excellent. We need to restore function of long shore transport.

Wouldn't this accelerate erosion between the islands?

**99. Build the lock complex on the HNC.**

This is a great idea.

All Morganza features need to compliment freshwater management opportunities, but environmental restoration is not presently being viewed as a major project goal. This should be changed!

**100. Design barriers to allow overtopping.**

This pertains to the dual levee concept. Natural barriers in front of protection levees should be overtopped.

**101. Develop measures of effectiveness for all layered coastal defense features.**

**102. Use local zoning to establish growth corridors in protected areas and prohibit development in buffer and conservation areas.**

**103. Get serious about marsh restoration and build a spillway thru Violet for a 1/2 mile width and get water and sediment into area east of St Bernard and flow through LaLoutre Caernarvon FW diversion is closer to Bayou la Loutre and could provide more water than the bayou could handle.**

**104. Investigate augmenting energy needs by placing turbines in River siphons.**

**105. include adequate number of environmental water control structures to remain open except storms for drainage and fisheries as determined by stakeholders.**

Definitely a concern - lack of drainage because of levees.

**106. Mississippi river spillways(for surge relief and river diversions.**

These would also improve wetland health through freshwater introductions.

**107. Re-route Mississippi River to maximize sediment deposition on coastal shelf, thereby maximizing land building and land-sustaining capacity of the system.**

This will require abandoning the birdsfoot delta, which is necessary if we are to have any chance at a sustainable coast.

Navigation must be sustained and salt water intrusion considered before large scale river diversions.

This only produces long term benefits. What do we do in the interim?

**108. Navigation channels need to have rock armoring. The Corps has an authorized bottom width. This would establish a top width that the Corps would be responsible for maintaining. It would provide areas behind the rock as marsh creation sites increasing protection.**

**109. Use academic and research institutions to help develop structures plans that will accomplish protection and conservation goals. Some critical review of these ideas is required.**

**110. Raise gasoline tax to discourage automobile use and help fund restoration projects, expand regional public transportation, use rail.**

**111. Use alternative means of protecting outlying communities, reducing levee construction cost and improving ability to sustain wetlands.**

**112. No discussion of community relocation should occur without the involvement of community leaders.**

**113. Build Levee and connect with Flood Control structure across Barataria waterway at the Hero Canal and V-Levee connect. This has minimal impact (5 acres) on marsh and has maximum protection by removing 30 miles of levees into a secondary protection role.**

**114. Create sediment traps in the Mississippi/Atchafalaya to serve as renewable sources for pipeline sediment delivery infrastructure.**

**115. Design and implement a comprehensive data system, say GIS, to include levees with finished grade, say every 100 ft , latitude and longitude and make the data available first to your partners with ID and password and eventually to be posted on Corp's web page.**

**116. Restoration projects, strategies, etc. should not interfere with critical water uses (drinking water sources).**

**117. Use lower, armored levees, combined with ability to evacuate after overtopping, in favor of higher (Cat.-5) levees. This may be a more economical approach.**

**118. Do not relocate barrier islands farther northward.**

Barrier islands should be rebuilt in their historic locations as much as possible, the overriding considerations re-establishment of the long shore drift to minimize sand loss to the gulf shoreline.

Barrier islands should only be rebuilt in locations that can support their sustainability.

**119. What about the use of earthen terraces, which may break down during a storm but are relatively easy to create and will add structure to the coast and resistance to hurricane surge?**

**120. Utilize sediment conveyance (through pipelines or other mechanism) to build marshes in landbridge areas to maintain buffers.**

Good idea.

**121. Restoration should be firmly based on scientific principles, but should not be dictated by scientists alone.**

**122. Remove Mississippi Levee south of Point la Hache.**

**123. There needs to be coordination between scientists, engineers, NGO's, government agencies and the private sector (business) in all phases of planning and implementation of restoration and protection work.**

**124. Implement the Third Branch Delta Building Channel as included in Coast 2050 Plan**

This would provide long term protection for much of the Jefferson, Lafourche and Terrebonne area.

Land building could be accelerated with pipeline delivery of slurried sediment.

This would ultimately be a self-sustaining natural system.

This project has both flood protection, environmental and economic benefits.

We should not sacrifice existing wetland forest for this project.

Self sustaining? How many years would it take to offset the construction impacts?

The project will build more wetland forests than required for the channel-levee footprint.

**125. Restoration should begin with and be firmly based on scientific principals, then passed through the filter of public acceptability.**

**126. Ensure that any diversion structures or spillways can be closed in the future if necessary. No open, uncontrolled diversions or spillways.**

**127. Endorse structures in Calcasieu and Sabine ship channels to protect and maintain the Cal/Sabine Basin marshes.**

**128. Create green spaces in high flood risk areas of New Orleans for storm water retention, etc.**

**129. Protection of the LA citizens, life, critical economic resources must not be delayed or restricted environmental concerns. Hurricane protection must be built with the environmental issues addressed.**

When you make a choice between a human life and an environmental or habitat concern, you make a false dichotomy. Don't streamline at the expense of environmental concerns.

**130. Define exactly what it is we are trying to protect against before we design protection features.**

**131. Unrealistic suggestions for restoring our coast are only delaying progress.**

**132. Apply the multiple lines of defense strategy to the entire coast.**

**133. Consider dual purpose structures which could produce energy and which might be sold back to the grid to fund future projects.**

## 5. Structural Alternatives

Multiple Selection (maximum choices = 20)

Number of ballot items: 137

Total number of voters (N): 36

Participants were asked to select 20 of the most promising alternatives from the list that had been created. The list below shows the number of times each alternative was selected by workshop participants.

Team Selections	Structural Alternative
18	Large-scale marsh creation and ridge restoration using a dedicated infrastructure of pipelines for sediment delivery, then nourish marshes with small freshwater diversions and plant ridges with woody species
17	More pipelines to move sediment
17	All dredged material from navigation channels should be used beneficially.
13	Utilize Sediment Conveyance (through pipelines or other mechanism) to build marshes in landbridge areas to maintain buffers.
13	Consider using existing navigation channels (GIWW, MRGO, etc) for freshwater and sediment conveyance. Atchafalaya FW and sediment could be transported into Terrebonne Basin for beneficial use.
12	Ring Levees around population centers
12	Restore cypress forests
12	Rebuild the New Orleans Landbridge
12	Develop Ridges (natural and man-made)
11	Accelerate marsh building
11	Re-route Mississippi River to maximize sediment deposition on coastal shelf, thereby maximizing land building and land-sustaining capacity of the system
11	Construct major diversions on the Mississippi River and Atchafalaya River
11	Create sediment traps in the Mississippi/Atchafalaya to serve as renewable sources for pipeline sediment delivery infrastructure
11	"Harden" existing pumping stations in SE LA so that they can be manned or automated during hurricane conditions
11	3 lines of defense (in-water structure, marsh & ridges, levees)
11	Multiple lines of natural defense with restoration
10	Build the lock complex on the HNC
10	Implement Barataria Landbridge Project
9	Enhance sediment delivery of river diversions
9	Maintain landbridges
9	Apply the multiple lines of defense strategy to the entire coast
9	Navigation weirs on MRGO
9	Use the existing levees and levee alignments(Morganza-Gulf, Donaldsonville-Gulf, etc.) as much as possible
8	Rebuild Bayou Perot / Rigolets landbridge
8	Minimize total levee length (Van Heerden plan)
8	Re-create lost reefs using both natural and artificial materials

Team Selections	Structural Alternative
8	Install effective storm surge control structures on navigation channels in the coastal zone.
8	Close MRGO
8	3 lines of defense (barrier islands & marsh, major barrier, existing levees)
8	Flood Control Structure on Industrial Canal at Lake Ponchartrain
8	Locate offsite borrow material that can be used in levee construction and marsh creation site other than adjacent borrow canals.
8	Levees should be built on the wetland nonwetland interface.
7	Nonstructural alternatives, such as elevation of structures, relocation (individuals and communities), and evacuation.
7	Rebuild natural ridges of Barataria and Terrebonne regions to 1955 landscape
7	Propagate and plant live oaks and other woody plants on restored ridges.
7	Utilize/enhance existing landscape and landscape features for coastal protection
7	Relocate communities or how communities are rebuilt. Establish guidelines that will ensure structure will be above the expected surge height (cat 3 or cat 5?) if rebuilding in the low laying areas.
7	Implement river reintroduction at Myrtle Grove and LaRosusette with river sediment
7	Enact a state easement/purchase program to ensure protection of natural areas and their hurricane buffering capacity while avoiding (at least in some cases) property rights issues
7	Implement Lake Ponchartrain Barrier Plan
7	Fund Short term projects which can be completed for '07 hurricane season
7	Remove Mississippi Levee south of Point la Hache.
7	Develop inventory including profile of Levees - Fed, State, Parish, Local, Private.
6	Incorporate and build upon existing projects LCA, Morganza etc.
6	Mississippi river spillways(for surge relief and river diversions)
6	No levees where possible
6	Include navigation interests in planning process
6	Open Several needles of the Bonnet Carre until Hope Canal Project comes on line
6	Maximize use and transfer of Atchafalaya Basin sediment
6	Armor levees
6	Increase Hope Canal project capacity to enhance Manchac Landbridge
5	Endorse structures in Calcasieu and Sabine ship channels to protect and maintain the Calcasieu/Sabine Basin marshes
5	Use Morganza to the Gulf Alignment currently under construction and remaining portions to be authorized
5	Large surge structures on MRGO/Rigolets
5	Establish - encourage development of trees & substantial vegetation(more than just grasses) in coastal barriers
5	Start "levee school" at Louisiana University ( e.g., LSU Hurricane Center) required for Levee commissioners state coordinated with Corps - 4-5 day

Team Selections	Structural Alternative
5	Protection of the La citizens, life, critical economic resources must not be delayed or restricted environmental concerns. Hurricane protection must be built with the environmental issues addressed
5	Prevent loss of large forested areas by purchasing for mitigation
5	Armor all levee in high population area to prevent failure if overtopped - e.g., MRGO levee behind St Bernard
5	Barge fill from the Midwest
5	Implement the Third Branch Delta Building Channel as included in Coast 2050 Plan
5	Maintain the chef, Seabrook, Rigolets, and Bayou Boeuf open as possible except during storms
5	Use local zoning to establish growth corridors in protected areas and prohibit development in buffer and conservation areas
5	Structures that protect against CAT 1-3 (most common/most likely) vs. CAT 4-5
5	What about the use of earthen terraces, which may break down during a storm but are relatively easy to create and will add structure to the coast and resistance to hurricane surge?
5	Use lower, armored levees, combined with ability to evacuate after overtopping, in favor of higher (cat.-5) levees. This may be a more economical approach.
4	There needs to be coordination between scientists, engineers, NGO's, government agencies and the private sector (business) in all phases of planning and implementation of restoration and protection work.
4	Design barriers to allow overtopping.
4	Design and implement a comprehensive GIS data system to include complete inventory of all levees with profile grade, pump stations, locks, gates and other features with elevation (finished grad),latitude /longitude, cross section, and other appropriate design elements, if possible. This should be made available to your partners first, and eventually posted on COE web page.
4	Get serious about marsh restoration and build a spillway thru Violet for a 1/2 mile width and get water and sediment into area east of St Bernard and flow thru LaLoutre
4	Use alternative means of protecting outlying communities, reducing levee construction cost and improving ability to sustain wetlands.
4	Investigate features of Plans that were presented on Monday for areas of overlap and consistency to use as a starting point.
4	Use GIWW as levee alignment coast wide Poll private and public land owners to solicit participation in land reclamation and marsh restoration projects. The Port of Lake Charles has initiated such an effort. Consider statewide polling. The aggregate of such beneficial use of dredged material might significantly help the flood protection and hurricane mitigation effort
4	Reconfigure MRGO
4	Uniform La. Spatial Reference Frame to support all projects construction.

Team Selections	Structural Alternative
4	Reauthorize IHNC at Miss River to act a diversion of river water into the New Orleans Landbridge and down MRGO in conjunction with the flood control structure at lake Ponchartrain
4	Non structural measures in Donaldsonville basin
4	Rebuild barrier islands to 1955 geomorphology.
4	Greatly expand plant materials production, (public and private growers) to ramp up the capacity for vegetative plantings
4	Construct survivable overtoppable levees
3	Do not relocate barrier islands farther northward
3	Prioritize restoration projects above other public works projects until the coast is protected
3	River diversions should meet specified habitat goals
3	Purchase privately owned barrier shoreline habitats for public use and protection (Elmer's Island)
3	Restoration should begin with and be firmly based on scientific principals, then passed through the filter of public acceptability.
3	Armor the barrier islands
3	Planning is easy, implementation is what's needed
3	Specifically endorse storm barriers in Chef and Rigolets (with no reduction in cross section in passes)
3	Navigation gates/water control structures on MRGO.
3	Reconfigure MRGO to reduce salt water intrusion, while allowing commerce and recreation and storm surge reduction as well
3	Elevate and relocate infrastructure rather than levees
3	Create green spaces in high flood risk areas of N.O. for storm water retention, etc.
3	Navigation channels need to have rock armoring. The Corps has an authorized bottom width, this would establish a top width that the Corps would be responsible for maintaining. It would provided areas behind the rock as marsh creation sites increasing protection.
3	Restrict passes between barrier islands
3	There needs to be serious consideration to which areas we will try to save and which we can no longer support
3	Develop measures of effectiveness for all layered coastal defense features.
3	Protection of existing natural resources (through regulatory programs, voluntary measures, financial incentives, and other tools) must be the highest priority.
3	Barrier islands represent sand rivers, armoring them doesn't work
2	Move barrier islands inward
2	Restoration should be firmly based on scientific principles, but should not be dictated by scientists alone.
2	Ensure that any diversion structures or spillways can be closed in the future if necessary. No open, uncontrolled diversions or spillways.
2	Can we promise to start implementing and stop this endless planning?
2	Consider outermost barrier consisting of enhanced barrier islands with hydraulic and navigational control structures.

Team Selections	Structural Alternative
2	Unrealistic suggestions for restoring our coast are only delaying progress.
2	Define exactly what it is we are trying to protect against before we design protection features.
2	Use shoreline wave breaks in large open bodies of water, i.e. lakes and bays
2	ADCIRC modeling showed effectiveness of marsh creation within the "funnel"
2	Any structural plan must be coupled with a regulatory change.
2	Swamp alignment then the HWY90 alignments should be considered higher than the GIWW alignment
2	Streamlining the review and permit process is a critical component of any successful effort
2	Develop tax incentives to get the fill to the area
2	Restoration projects, strategies, etc. should not interfere with critical water uses (drinking water sources)
2	No discussion of community relocation should occur without the involvement of community leaders.
2	Surge breakwaters across Lake Borgne
2	Use academic and research institutions to help develop structures plans that will accomplish protection and conservation goals. Some critical review of these ideas is required.
2	Identify the ratio of the length of the proposed levees to the length of the hydrological openings (gates)
1	Need a larger strategic plan that acknowledges our time and financial limitations.
1	Ask Santa to bring us a 1925 Coastline
1	Maintain navigation channels at no more than authorized widths
1	Move everybody north of I-10
1	Control structure at Gum Bayou
1	Use recon and modified recon for Morganza to the Gulf reaches in Terrebonne
1	Generate revenue by creating dive sites that use artificial reefs (airplanes, automobiles) . The area gets revenues from a new tourism sector and the citizens get a reduction in storm surge
1	Enhance drainage from Barataria
1	Design and implement a comprehensive data system, say GIS, to include levees with finished grade, say every 100 ft , latitude and longitude and make the data available first to your partners with ID and password and eventually to be posted on COE's web page.
1	Raise gasoline tax to discourage automobile use and help fund restoration projects, expand regional public transportation, use rail.
1	128. amalgamate the repetitive ideas into a reasonable number of choices
1	Include adequate number of environmental water control structures to remain open except storms for drainage and fisheries as determined by stakeholders
0	Match the natural soils blending the best soils and ridgeline combinations
0	Consider dual purpose structures which could produce energy and which might be sold back to the grid to fund future projects.

**Team  
Selections**

**Structural Alternative**

0	Armoring of barrier islands should only be done rarely since it disrupts natural shoreline transport
0	Build Levee and connect with Flood Control structure across Barataria waterway at the Hero Canal and V=Levee connect - this has minimal impact (5 acres) on marsh and has maximum protection by removing 30 miles of levees into a secondary protection role
0	Investigate augmenting energy needs by placing turbines in River siphons
0	A ring acts as a trap. The security offered by a ring should be very high,
0	GIWW alignment only to be used in the lakes sub basin
0	Include NA

## 6. Team Recommendations, Options and Ideas

Using a series of aerial maps a team from the Corps of engineers worked with the workshop participants to capture specific recommendations to planners. Diagrams and discussion notes from each segment follow. Discussion themes from this segment follow.

*Facilitator:* We'll be developing a conceptual Piece for today: these won't all be perfect. They will be starting points.

*John Lopez:* We discussed Issues of timing and restoration and flood protection this morning. I'd like to present a model that might help clarify discussion. No endorsement of any specific geographic plan is intended.

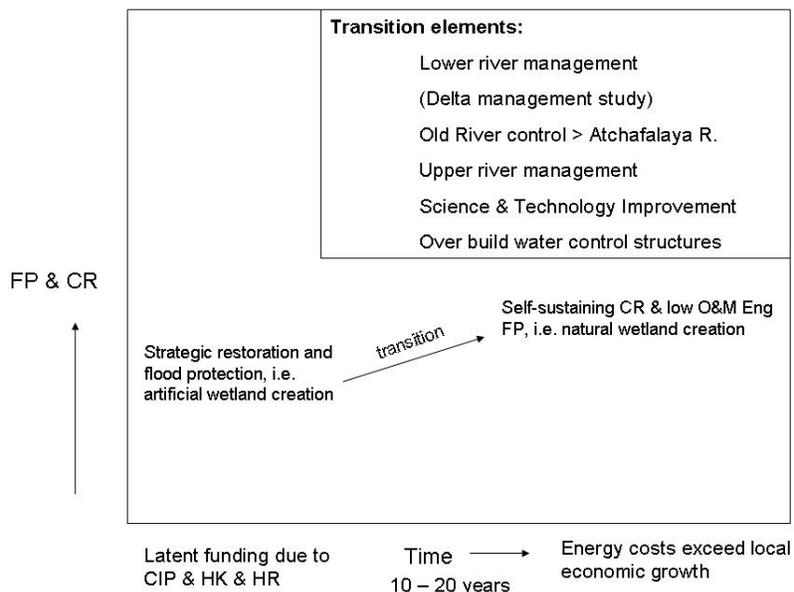
It's been suggested that rising energy costs may make some restoration cost-prohibitive as energy costs may exceed local economic growth. Because of this we may be trying to do things we won't be able to do in the future.

*Increasing flood control and coastal restoration...artificial wetland creation*

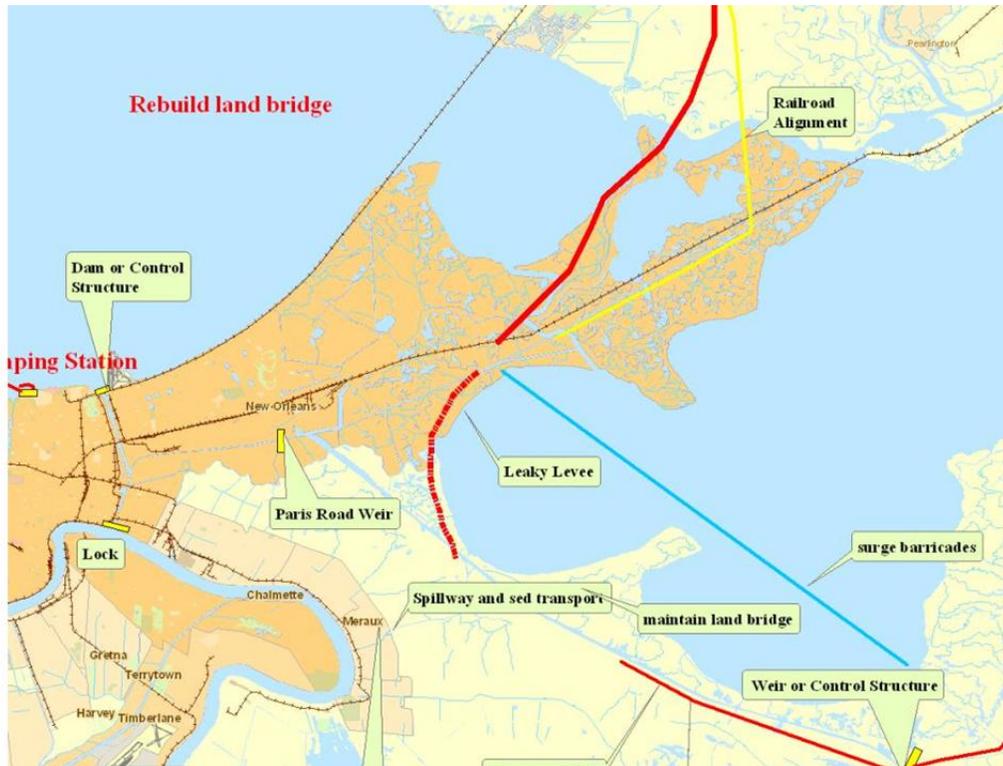
*We need to transition to a more self-sustaining model, that's more natural. We should be thinking about these strategic options now, even though the benefits may not kick in for 10 or 20 years.*

*It's hard to know what this will be in the future, but we can consider some of the transitions. These would include lower river management, the delta management study, Old River control on the Atchafalaya River, Upper river management, Science and technology improvement and over-building water control structures.*

*This might help guide short and long-term transitional thinking. We don't know all the answers for the future.*



## New Orleans Options and Ideas 1



Facilitator: Starting at the Mississippi border: what should go on this map? **We talked yesterday about a large surge structure. What options should be discussed on the Rigolets and on that side?**

**The Lake Pontchartrain barrier plan calls for a structure starting at Lake Kitchen on Highway 90 Southeast to Slidell continuing to a flood control structure at Rigolets down the land bridge to the Cheff and down to what is shown as the red flood control structure. This flood control structure on the west coast of Lake Bourne would have “leaky levee.” This would be a fixed structure that has openings to enable allow water passage.**

At the pass, include a flood control structure across the Rigolets, another sluice gate that would not restrict tidal flow.

Summary: There are 3 components:

- **Rigolets surge structure.**
- **A surge structure at Cheff.**
- **Leaky Levee to the back of Slidell.**

Al Naomi and Gregg Miller met with the citizens at Lake Catherine on the land bridge who have concerns. **Their views are the alignment needs to be along the railroad tracks headed toward the Mississippi then turn northerly toward higher ground. The exact route of this is uncertain.** Some of it will impact wetlands) and there may be problems with this alternative as well. They’re asking us to look at different alignments than what is being shown here.

**Include a Lake Catherine railroad option for the leaky levee.**

Doug Daigle, Mississippi River Basin Alliance: I'm suspicious that we'll arrive at the plan that was presented yesterday. We're looking at this exposed area of Slidell where building took place that shouldn't have, and now we're going to ask for funding to build levee systems. This may displace surge to the southwest which means we'll just have to continue building to accommodate it, or else channel it into wetlands. What's a coherent way to deal with this? Just go from one end of the coast to the other and come up with a bunch of ideas? What's the option? Do nothing? A massive structure is being proposed. Lake Catherine and those spits of land are very exposed areas. Much is involved that we won't be able to capture. **Should we armor the shoreline and abandon areas?**

**Facilitator: We're just looking for options.** We need to assume a huge part of this may never be funded...there just isn't sufficient money and some prioritization will need to take place.

Al Naomi: The idea isn't to trap anybody. We need to model something and begin planning some action. If you aren't prepared to make a commitment, fine. But we need to put something in the model that will give us some results. This is what we're going to present to Congress. **Now is the time to get these ideas on the table. We can't wait. We're moving ahead.**

Bruce Thompson: My understanding is there are 3 key landowners at Lake Catherine. One is a railroad itself, another is a corporation that leases to about 320 camps and the third is a small number of people who own their own camps. **Certainly one option would be to buy all of those properties as a mitigation.**

Facilitator: This discussion is not a debate. It is search for options. There is no assumption any of them will ever happen. **We are just searching for potential alternatives.**

Dr. Gagliano: The key point is not protection of the wetland properties, **the purpose of this barrier system is to prevent water buildup in Lake Pontchartrain which affects every Parish west of the lake.** The basic question is do we need protection with surge gates across that land bridge?

**What is the support for surge protection for Lake Pontchartrain?**  
**The groups indicated very strong (75+%) via a quick show of hands.**

**Add an option to rebuild the land bridge.**

**John Lopez: It's easy to draw lines on a map, but difficult to depict nonstructural alternatives. Wetland restoration, ridge work and barrier island restoration are important components of this plan.** Elevating homes should always be considered as an alternative. Somehow we have to have these on the map.

Facilitator: These are being captured as options.

Consider using the existing footprints of the highways and railroads to raise the elevation of these features without building any gates across the passes. **This could include Highway 11, Highway 90 and the CSX railroad. Raised highways (10 ft.) would improve evacuation routes.**

**Add control structures at Cheff and Rigolets.**

Sue Hawes: What about the plan the City of New Orleans had to divide the city along the railroad tracks? **This isn't shown here. A city option to use the railroad tracks as an internal levee barriers needs to be shown.**

**Move down the map to "the funnel" flood control structures or areas in front of it.**

Dr. Gagliano: We'd like to see barriers across Lake Bourne included as an option that has been endorsed by the planning Committee in St. Bernard's Parish. **There are several potential alignment across the lake to serve as surge barricades. The New Orleans plan refers to this in greater detail.** Dr. Gagliano's plan includes two of them.

There are 2 other key features:

**1. The existing storm protection feature along MRGO, which is to be restored to at least project conditions as soon as possible.** St. Bernard Parish recommended extending this levee.

**2. What is shown as a weir here as part of their levee protection system. The nature of the structure at Bayou La Loutre is still under debate. It's the keystone of the whole future of the MRGO channel.** St. Bernard favors some type of control structure here as opposed to a weir. A weir won't provide the type of storm protection needed during storms, nor will it allow control of inflow and outflow of tidal water which is beneficial.

The New Orleans plan includes a "sinkable" weir. The navigation notch proposed in the New Orleans presentation can be closed during storms. There are options about what this weir might look like. Further clarification is needed.

Dr. Gagliano: Reinforcement and buildup of an existing levee includes two other features:

**1. The existing levee along the 40 Auburn Canal is now being viewed as the primary levee. Even though it's an outer levee. This is where we're going to draw a line in the sand and raise the levee to Category 5 conditions. The idea is a series of stepwise reductions in surge before it gets to urban areas.**

**2. Another point is the freshwater introduction feature in the vicinity of Island Canal that would have a control structure on the river and conveyance channel leading to wetlands and to the MRGO.**

Use Violet, or New spillway off of MRGO, to get some freshwater into the nearby wetlands to refresh the marshes with freshwater and sediment.

John Lopez: Two options we'd like to see are complete closure of the MRGO at Bayou La Loutre and rebuilding Bayou La Loutre Ridge east of the MRGO.

Include options for the weir or control structure.

Sue Hawes: **Include the Agency plan for marsh creation in Lake Bourne.**

John Lopez: **Maintain the narrow piece of marsh land that is the MRGO-Lake Bourne land bridge. Don't let it break.**

Dr. Gagliano: We haven't provided protection for the urban areas on the southern plain. **Southern levees need to be upgraded to at least Category 4 or Category 5 levels.**



Facilitator: Are we OK calling this a control structure? **(Yes).**

Bruce Thompson: The issue of time ties all these together.

Does this include reauthorization of the canal and the lock at the bottom?

At Lake Pontchartrain, the dam/control structure was authorized as a flood control structure in 1965. **The lock at the bottom of the industrial canal at the river exists as a lock. It does not exist as a freshwater diversion so we need to modify the authorization to have it serve a dual purpose. The timing is such you would have to have the control structure at the lake. Using the lock as a freshwater diversion is not going to work unless you have the control structure at the lake.**

So the deauthorization that was mentioned is for RE-authorization?

Bruce Thompson: The words I used were “deauthorization of this channel as a navigable waterway.” **AI said it’s a lot easier to change this into a control structure. Legally this can be done a lot faster and easier.**

How does this compare to the historical project that’s been subject to so much debate over the past several years involving the canal?

Billy Marchal, Bring Back New Orleans: Right now the inner harbor navigation locks, or the Holy Cross Locks, as I call it at the river, is on standby. The Corps has acquired all the land necessary for the new locks, but the funding is on hold. The objections to the locks from the population of the lower 9<sup>th</sup> ward have diminished as a lot of those people are no longer in the city, however, I think the economic benefit of those locks is probably going to be revisited before they are actually built. **From a practical standpoint, if you put those new locks in, any objections to closing MRGO from industry disappears overnight.**

MRGO has been held hostage for years over this very issue, so it’s concerned a lot of folks. I realize that many of them are now gone. This was another tragedy of the storm along with what happened in St. Bernard. A lot of folks, and even some people on the hill were wondering what the \$800 million for the lock had to do with coastal restoration. I see the freshwater aspects are being emphasized, but it’s going to get a lot scrutiny and I want to be clear on it.

Facilitator: Anything else on the New Orleans Plan? There is more to the Southwest. Remember, we’re looking for options.

### New Orleans 3: Options & Ideas 3



**The Hero levee and canal structure runs from Highway 23 on the Mississippi River levee to Barataria Seaway. That levee is currently a 9-foot level and it's 3 miles long. The distance from the Barataria Seaway to the Barataria levee system is 3/10s of a mile. By placing a control structure across Barataria and lengthening this 3 mile levee with no new right-of-way you impact only 5 acres of marsh and tie that into the entire west bank which protects the Naval Air Station. This takes out 30 miles of very low-level levees and protects Algiers, Harvey, and the entire west bank of the metropolitan area.**

**Heather Warner, LADNR: There is no doubt we need a water control structure somewhere. There is already a proposal to put one in a little further to the north, but I think putting it there is not the best place. It is the 404c area of Bayou Carpes which is the only 404c area under the Clean Water Act. We would like to recommend that the GIWW alignment as proposed in Dawsonville to the Gulf project which includes two water control structures, one at Bayou Pirou and the other Bayou Barataria.**

**Add a water control structure with a levee alignment along the southern edge of the GIWW.**

**John Ettinger, EPA: 404c is a no-go zone for the discharge of any material. I believe this land is owned by the Department of Justice. Going there would present significant administrative and legal barriers. This is not to say this is impossible. If it's the least environmentally-damaging alternative we could open up that can of worms. Only 11 of these actions have been taken nationwide since the CWA was enacted. The result of a 404c is a prohibition on placing any fill material in that area. Potentially, this could be a huge legal barrier.**

There may be a mitigation opportunity in this area. The Department of Justice owns 2 parcels of land. This is a very nice cypress swamp. It is about to be incorporated into the Jean Lafitte National Wildlife Refuge. **By purchasing the middle parcel that is currently privately-owned this entire tract of cypress could be tied together.**

Cindy Brown, The Nature Conservancy: So far 95% of the comments have included structural measures. I don't want to lose sight of yesterday's discussions on the importance of wetlands building. **We don't want to see wetlands building taking a back seat to other options.**

**Resorting land bridge between Bayou Pirou and Rigolets would be an excellent restoration tool that would be linked to storm surge into Lake Salvador. The proximity to the Mississippi River would make this a good candidate for pipeline sediment.**

One potential problem with dual control structures is the funnel effect.

Marny Winter: At the Jefferson pump stations we want to see strong houses/safe houses and look at Category 4 or 5 levees along the lake. **Increase the quality and integrity of the pump houses along the way. Wave breaks along the length of the shore (as shown in Carl's plan) are also needed.**

## Coast Options & Ideas 1



Sue Hawes: *Where are the green lines from Bruce's Maps?*

Facilitator: *We weren't able to capture the shading from Bruce's Agency recommendations on the maps that are being displayed, but please assume they will be in the minutes.*

Sue Hawes: *From Chandeleur Islands move in some structure toward the marsh that would replicate the impact of the islands. **We need to consider the alternative of leaving the islands where they are and consider rebuilding them using the current footprint.***

**Examine John Lopez' recommendations on multiple coastal lines of defense. Include those in the minutes.**

#### **Options**

- **Restore the outer barrier islands**
- **Create a new set of inner barrier islands, closer to the coast**
- **Do both**

Bruce Thompson: *Creating a barrier structure might be a more accurate description than saying we're moving the islands.*

**Create new barrier island structures.**

**Dr. Gagliano: Induced oyster reefs and planted beds should be included in the St. Bernard Marshes**

*Woody's recommendations on induced reefs should be strongly supported. To be effective though, they would have to be elevated, three-dimensional structures. It might be necessary to keep from having the developing reef harvested. Getting legislation passed to protect them might be necessary.*

*Consider causeways that would enable some of the surge to pass through. **These causeways could be used to divert river flow at certain times. We need to demonstrate the feasibility this actually works. Include some openings in the causeways.** Should they be full-time or storm-only? This is to be decided.*

**Provide islands of Category 5 ring levee protection, particularly around the populated areas like Venice.**

**Use 100% of the sediment that is going out which means re-routing the river.** *This may result in the abandonment of certain existing structures that could be re-used for fill structure elsewhere.*

**Move the river so sediments, nutrients and water are deposited on the shelf instead of off the shelf.**

**The land bridge on the south shore of Mississippi Sound. ridge restoration needs to be extended. Follow the old ridge blueprint along that restoration area.**

*On White's Ditch: The proposed diversion structure that would augment flow into the Breton Sound Basin. **The White's Ditch diversion might overlap with the spillway Van discussed.***

**Enhance the east bank spillway overflow for marsh building.**

**Reroute the river to use sediment more effectively**

**Add an American Bay diversion site.**

**Include sediment diversion along Myrtle Grove**

**Build a Lower Pontchartrain Structure Flood Control Structure: "leaky Levee"**  
*Begins in Slidell to West coast of Lake Bourne*

**Construct a sluice gate that wouldn't restrict tidal flow.**

## **Coast Options & Ideas 2**



*Marny Winter: Focus on barrier Island restoration.*

**Restore Gulf sediment transport along the Gulf shoreline to help sustain the islands.**

**Use pipelines through Wilkerson and Newport canals to transfer sediment to rebuild ridges.**

**Rebuild ridges with pipeline or offshore sediment as available and appropriate.**

**Plant propagation: use appropriate wooded plants on ridges.**

**Dr. Gagliano: Include the 3<sup>rd</sup> branch conveyance channel project highlighted in 2050 and part of long-term LCA program involving a conveyance channel from the river with 2 delta lobes, 1 in the vicinity of Little Lake, the other on the west side of Bayou Lafouche.**

**Progress could be accelerated by the use of slurried material introduced by dredging.** Major environmental and hurricane buffering benefits are possible with this, but it is a long-term, 20-year process.

**Restore the estuary functionality to reduce the tidal prism.**

**Reestablish marshes with the help of transferred material.**

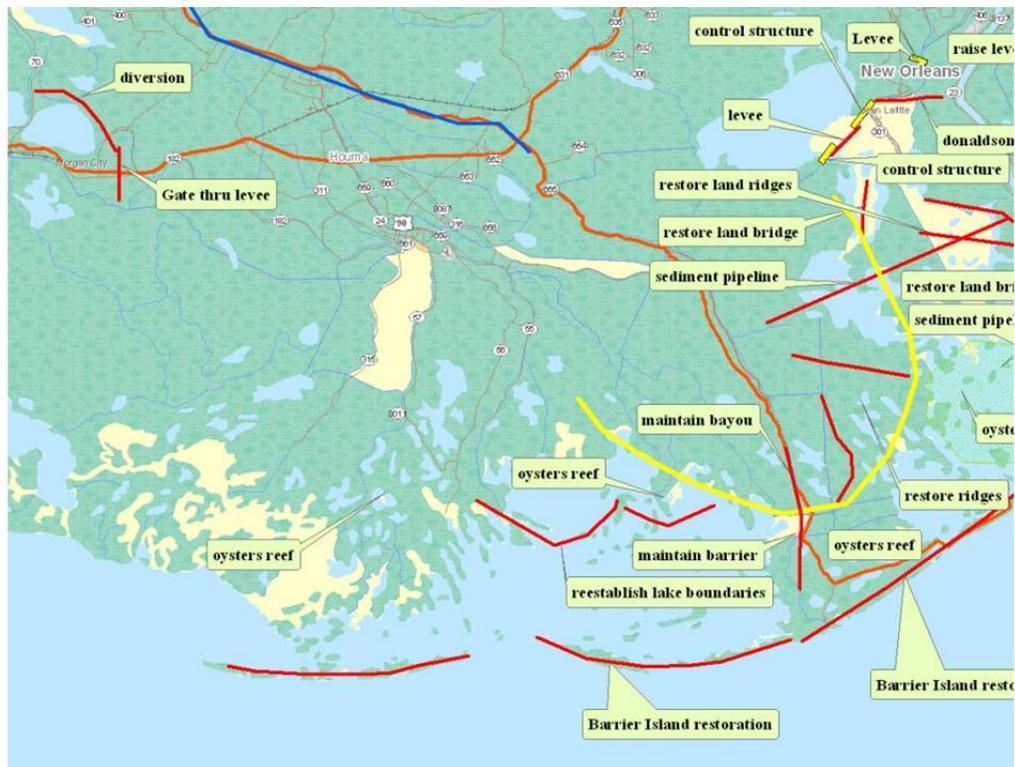
**Address levee subsidence.**

**Enhanced diversion via the conveyance channel.** This is a massive project. An interim step is the LCA. Reconnect Bayou Lafouche at a smaller volume than originally proposed in the LCA plan. The State owns the water bottom. Enhance a diversion in this area. No other diversion project of it's type has ever been attempted.

**John Lopez:** There are two land bridges in Barataria. 1 is the Barataria land bridge extending from Bayou Lafouche to the Mississippi River, The second is between Little Lake and Barataria Bay. These have two important ridges at Bayou Barataria and Bayou DuPont. If restored, sediment could be held behind both and you could protect the bay.

Restrict (size, depth, width) the passes between the ridges at the barrier islands.

### Coast Options & Ideas 3



*Dr. Gagliano:* We need to show some oyster reefs south of the yellow line, both planted and induced reefs around all 3 sides of the bay.

These are the alternatives we're considering. How will these be determined? **At a minimum the existing Morganza line needs to move forward for consideration.**

Al Naomi: This was being modeled even before the storm. The only thing we have to do is see what the Category 5 impacts will be. The question is what else might be modeled that will show any significant difference in the area. **It's important to remember that as many data points are being evaluated, it's dependent on the physical features that are on the ground when we run the model. Things that can be represented very easily with data points will show differences in surge elevations, but moving alignments up to half a mile really isn't going to make a whole lot of difference from a modeler's perspective.** From the results of what we get out of the model, those decision would have to be based on other considerations, but we're just looking initially to get some storm surge elevations, get an idea of the heights of the structures we need to talk about, and what wetlands would be beneficial to lower the surges, things like that. When we try to get into too minute of detail, the model just won't pick it up.

**Testing concepts here:**

No action

The great wall, full-on purely structural

100% coastal restoration

A hybrid approach (levees with active marsh creation)

Understand the wall and certain biases. **Many environmental assumptions and adaptations have been included in the Morganza plan. It isn't accurate to characterize it as 100% structural.**

Terrebonne Parish is helping NOAA maintain elevation standards in the USA. Recently we re-set the elevations of coastal LA where we lowered elevations from what was being measured 10 years ago. As a running mean, we lowered coastal LA between six inches and a foot from what they were 10 years ago. This means in a lot of ways a 25% reduction in our assumptions. Actually, we've lost closer to 50%. With a 1 foot tide range....Terrebonne parish has taken 450 marks to be monitored annually. Once they've dropped 4-5" we'll reset all the elevations in the Parish. What's most important with AI and the Corps is when you have a land area that is dropping half an inch or more a year, our decision making must be extremely flexible and how we design flood protection and restoration. **We have a dynamic landscape that's constantly moving at different rates. In general they're all moving down.**

It's a bad position for us to take the position that it's an either-or with structural solutions or coastal restoration. **We need to focus on integrating these efforts and collaboration that will meet all goals.**

Jerome may be a levee manager, but he's one of the most active advocates of coastal restoration in the state. He has strong family connection's to Louisiana conservation. His parish has a legacy of 10,000 homes and structures that have been destroyed and come June 1, it may happen all over again.

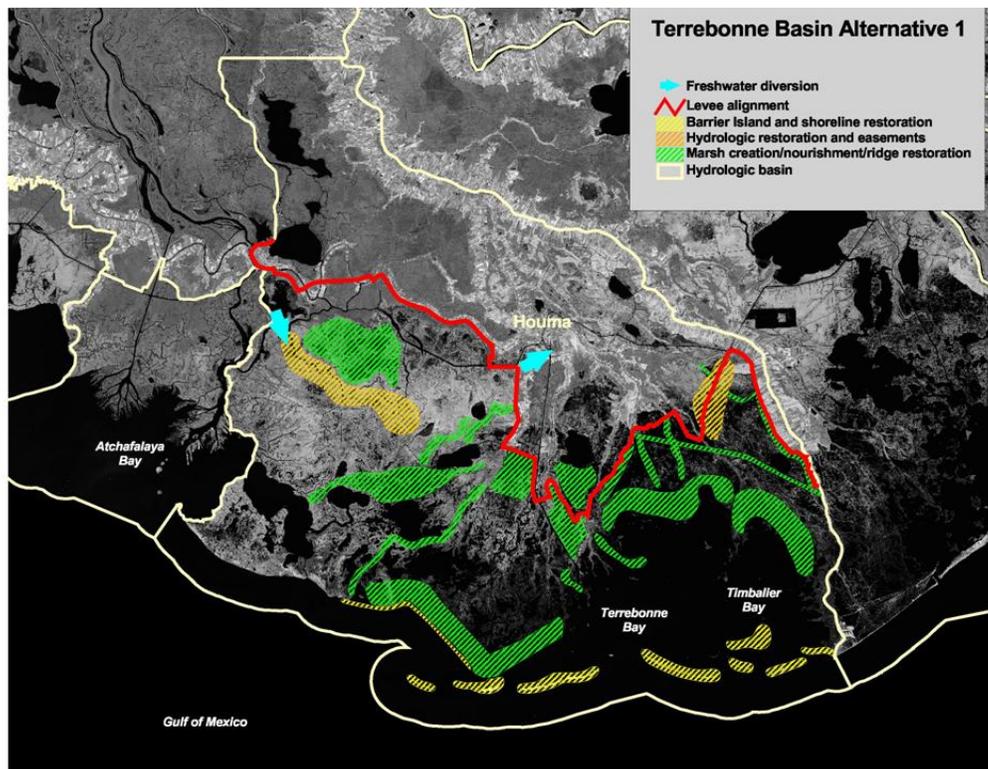
I suspect if you presented the 3 options to Congress, they'd pick the middle one. **We need to simplify our presentations.**

**Look at maintaining the integrity of the lower segment of Bayou Lafouche.** Maintain the hydrologic barrier that Bayou Lafouche provides between the basins on either side.

Assume we would continue the barrier island restoration discussed further east here? Are there specifics?

Not armoring. **Restoring.**

Reestablish the historic lower rims of Lake Felicity and Lake Barry with reefs and marsh area. **Include wide swaths of marsh to reduce the fetch length in the bay. This is covered in Resource Agency Alternatives.**



**Shoreline protection of fragile marshes within the barrier islands.** Bruce Baird: Blue arrow indicates enhancing the flow of Atchafalaya River water to the east.

**Include Paul Kemp's proposed 3<sup>rd</sup> outlet to the Atchafalaya River outlet alternative.** This is a multi-purpose project that would have dramatic environmental benefits in terms of the marshes. It would have flood protection benefits for Morgan City, protecting it from surges from the Gulf. Also would take some of the high-stage flood risk from the Atchafalaya River. Designed to take 50% of the Mississippi River flow under rare and extraordinary circumstances (500 year flood).

Wax Lake and Lower Atchafalaya are the only two outlets. There is always a question of the Lower Atchafalaya capturing more of the flows.

**Add a new outlet North of Morgan City including a gate.** This would be very compatible with the Morganza alternative.

Facilitator Summarizes: Add a diversion around, with a gate through the levee linking to Morganza-Gulf strategy. This proposal was given to the Governor's commission last week.

Tim Osborn: Structural considerations: This separation between Barataria and Timbalier and Terrebonne Bay system is really only being maintained marginally by a thin strip of land supporting LA State Highway 1. This will soon be replaced by a causeway that DOT is building. Once the causeway is in place that thin barrier between the 2 bay systems is going to be abandoned. Right now the exchange between the system under the Leeville Bridge and the Timbalier Bay system is exchanging enormous amounts of water. Bayou Lafouche under Leeville Bridge is 50-60 feet deep. **We need to consider some continuation of maintaining this historic barrier between the 2 bays.** Once they converge, the amount of water that is exchanged and the amount of fetch that's going to be behind those islands will be huge. Maintaining that integrated with the outer barrier system will be a key issue. Unless we incorporate this now, this entire geographic area will erode. This won't take long: 5-10 years until there is significant breaching and merging of those two bay systems.

### 3 Questions from Mark Slussny, Times-Picayune.

- a. Is there any idea of an effort to protect humans in the immediate aftermath of a hurricane other than the pump operators? In Bangladesh, about 1,000 refuge structures have been put up along the coast line. These are fairly cheap structures that allow people to survive close to their homes.
- b. What will be done tomorrow with the information gathered? How do you move from the information that's been gathered to planning? What does tomorrow give you at the end of the day?
- c. Public access to this information. I need to explain this immediately to my readers. The maps that are being produced are not going to be available for a day or two. It becomes difficult to get this information back to the public with the speed that's needed.

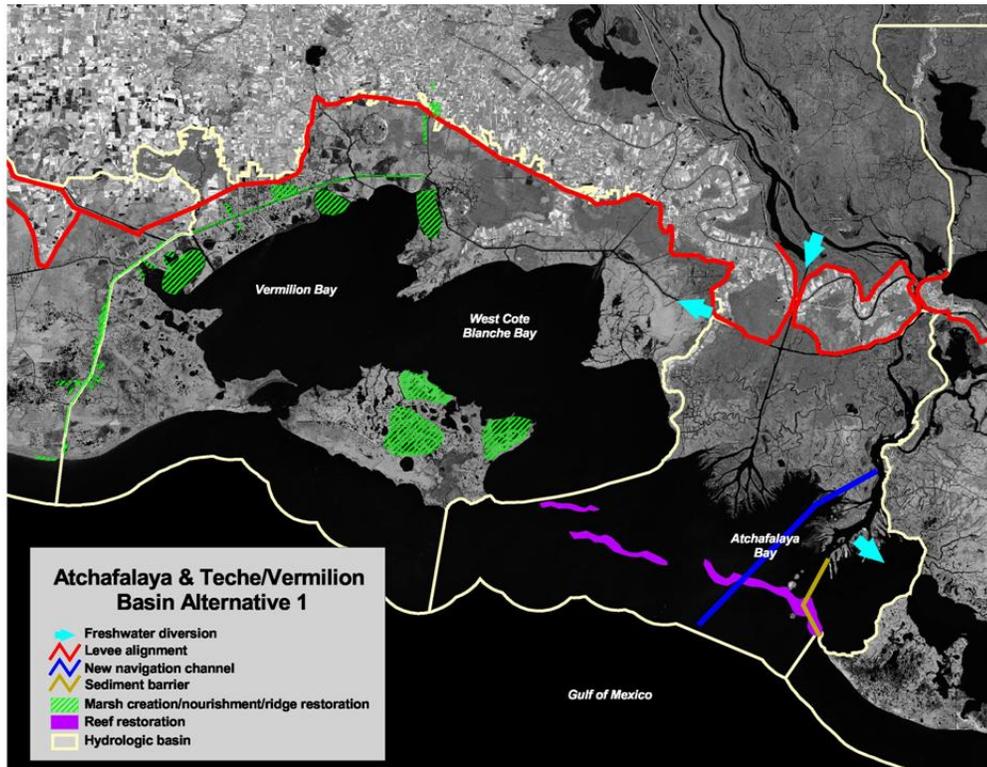
Bangladesh lost 300,000 lives in 1970, in 1991 the lost 100,000 people. Their structures are capable of housing about 1,200 people each. **We believe we can get people out and don't want to encourage them to stay in low-lying areas. The New Orleans area is a different issue. This idea may have more application here.**

That theory was tested and if failed dramatically during Katrina. We had 1,300 people who died because they had no place to go to immediately within their neighborhoods to escape the winds and water.

St. Bernard's, New Orleans and Plaquemine's parish. Our pushback in Terrebonne is to get people to high ground so the storm surge can not reach them. **We agree that in the New Orleans area this idea has merit. If we could afford it in less-populated areas it would be a good thing.**

In the lower area of Bayou Lafouche below Leeville there has been serious discussion between LA and Illinois on sharing sediments from the Illinois River. John Marlin, the IL point of contact recently visited here to examine potential sites for this. **This alone won't save south LA, but it's a great way to dramatize sediment imbalances: our deficit, their surplus and addressing 2 problems at the same time.**

We're looking for sites with **barge accessibility, areas of critical need, and public visibility. These should be places people will see and be able to identify marsh re-creation.**



Tim Osborn: Identify readily available sediment sources for dredging both for restoration projects and for supporting flood protection projects. **We'll be providing to the State and the Corps 8-month survey results from last year off the Atchafalaya delta. In this, we found the 12-ft depth contour had moved almost 8 miles out along a 20 mile front representing a massive build out of sediment, not in the Bay, but in the offshore area that serves as a potentially-useful sediment source.**

**There is both good news and bad news on this.**

**Advantages include a local supply of billions of cubic yards of material.**

**Disadvantages are the 30 foot contour which the Corps and the program of channel maintenance has been moved out an additional 10 miles.**

*Altering the navigation channel to an alignment that would fall outside of the sediment outfall might be very useful. At the same time this could be used this as an opportunity to consider what this new hydrography is doing in the way of acting in lieu of the kind of reef projects that are being proposed here.*

*Unfortunately these barrier islands weren't lost naturally. They were dredged for a supply or road base materials. But this whole bay system, which used to be sheltered and had a controlled water flow from these huge reefs is now wide open. One of the problems is even though there are massive barrier island complexes and a restricted entrance into Vermilion Bay, Hurricane Rita took the surge through the larger opening in the bay unabated.*

***We need to do a great deal more testing, more inventorying of sediment supply and look at the hydrology to determine if the barrier islands are doing anything to function in lieu of the offshore reefs.***

***Disenfranchise the sediment flow from the navigation of the river in the Atchafalaya Basin.***

***John Lopez: Maintain the opening on the Southwest Pass. At least keep it where it is.***

***The reef complex is not limited to the 3 purple lines. There was a lot of oyster reef development in this system. This water is too fresh to support oysters as-is. Further west, this could be accomplished. If more Atchafalaya River water is taken from the east, that's going to increase salinity in this area, which could be very helpful to oyster reef production.***

***A good alignment might be between Point Chervil and Marsh Island to help break up that free flow. Ann Walker at LSU probably is the leading expert on the oceanography of this area.***

*When this reef was intact, fishermen could go out under strong south/southeast winds and fish comfortably. It has changed dramatically. One of the worst decisions the State ever made was dredging those reefs away.*

*Somewhere along the indicated white lines, investigate reestablishing some oyster reefs. **Place this wherever the natural salinity point lies.***

***Heather Winter: Maintenance of Marsh Island as a barrier should be a priority.***



*Tim Osborn: The freshwater bayou area is also a shoreline area that needs significant stabilization. It appears fairly continuous, but this whole area is incredibly dynamic.*

*Marsh Island is one of the few remaining barrier islands that functions beautifully. It's being shortcut by this large bay system behind it. If you examine the Southwest Pass, you'll find water depths in excess of 100 ft. deep. This shows massive exchange of waters with the tidal prism going back and forth.*

*The Southwest Pass is dynamic. The shoreline connecting or coming close together is actually being worked very hard. This continues all along the fresh water bayou area. **We'll need more effort to try to stabilize this shoreline to the west.** Once that shoreline starts becoming breached, the elevations and land areas behind it are very fragile. The increasing water bodies inside are one of our biggest challenges as we move west.*

### **Stabilize shoreline**

## Sabine/Mermentau Ideas & Alternatives



***A water control/salinity control structure is recommended at both the mouth of the Calcasieu and Sabine.***

***Troy Malleck NRCS: We had looked at some marsh creation sites. One of the areas we want to include is along this shoreline. We had also talked about some terracing. This needs to be included.***

***More marsh creation is needed.***

***Terracing, using beneficial use of dredge material from the ship channel.***

***Jim Robinson, Port of Lake Charles: There are actually numerous marsh creation proposals that the Refuge Complex Manager has requested.***

*Oyster Lake Area*

*Protecting Highway 27*

*Black Lake (There are private properties on the east side of Black Lake that would like to be reclaimed)*

*Southeast shoreline of Black Lake already has a dike that needs to be restored*

## Summary Discussion

### **Next Steps from Corps modeling: Van Stuttz**

*We'll meet tomorrow to determine which alignments will require modeling. Those decisions will be made by the modelers to test big concepts. In certain places there will be multiple options.*

*The 3 Rigolets options will probably be handled as one model. This is not to say each option will not be considered in terms of developing cost options. We will be attempting to define how high our structures need to be to prevent overtopping in a Category 5 event.*

*There will be a bias toward short-term deliverables for our 6 month efforts. 24 months will enable more refinement. A no-levee option will be included in the base condition model, which will take into account the \$3.1 mil of restoration work represents the base case for starting this effort.*

### **Wouldn't it make sense to consider with extreme sideboards that included:**

- **100% structural option**
- **No levees restoration option**
- **Hybrid option**

*Yes, this will be looked at during the 24-month planning effort. For many of the restoration options presented today we intend to initiate development of the grids that will enable us to simulate them in our modeling.*

### **What is the significance of the colors on the maps?**

*None. There were no preferences shown on colors.*

*John Lopez: I sympathize with the 6-month deadline, but it's smart because it allows you to check in with Congress to see if you're on the right track. I understand that you can't model too many alternatives before then, but it might be useful to go to Congress to say we're considering in the future looking at these types of alternatives. One which might be just levees and structures, one that might be a hybrid and one that involves pure coastal restoration. This would allow you to check in with Congress and have them respond to whether or not you should even pursue any of those alternatives, or which ones you should focus on. **You might take advantage of this 6-month window by getting some early feedback from Congress.***

### **Final thoughts**

*We'll post this for public access*

*Talk with Van about the studies that have been summarized*

**Bob: on the voting numbers. Is there a way you can track the Corps people and remove them?**

*Facilitator: No...we chose not to enable that option*

*Facilitator: We'll turn this around within a week.*

**So if a City or NGO wanted to link to this on their sites, are you OK with that?**

*Facilitator: absolutely. Thanks everybody..a lot of ground was covered here.*

## Appendix A: Workshop Attendance Roster

February 13, 2006

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## Appendix B: LACPR Workshop Pre-session Feedback

### ***What resources in your area justify Category 5 hurricane surge protection?***

Refineries. Housing. 185,000 people. Schools
Lafourche is the only corridor in all of southeast La. that provides road access to the Gulf of Mexico.
This access is critical in support of this state's seafood industry and this country's energy interest. This corridor must be sustained for access to the Gulf.
Port Fourchon is now so significant to this country's energy supply that it warrants cat. 5 protection as well as the 17mi. stretch between the port and South Lafourche Levee system which must also be upgraded.
Heavy Oil and Gas related industries Fabrication facilities Boat companies Helicopter companies Shipyards Airport
Two ports
Numerous oil & gas pipelines coming onshore into plants for further processing and transportation, three carbon black plants, one power generation plant, large portion of parish is agricultural industry with two sugar mills,
U. S. Hwy 90/Future I-49 is a primary evacuation route.
Inland Communities should receive appropriate surge protection.
Human life, port and energy infrastructure, unwillingness of the Federal Government to respond adequately if a "category 5" would strike. Therefore, the only real hope that the Greater New Orleans area has is to get the protection "upfront".
Major oil refineries, homeowners, businesses and human lives
Communities and business entities in Cameron and Calcasieu Parishes warrant such protection.
The Calcasieu River Waterway (Lake Charles, Louisiana and vicinity) is ranked among National ports of significance warranting priority justification for required periodic maintenance dredging to ensure Congressionally authorized ship channel dimensions.
Approximately \$17,000,000 is required annually to maintain the Nation's longest dredged approach channel and waterway to authorized dimensions of 400' wide shoreward and 800' wide offshore, with 40' minimum depth. The waterway enables transit of over 55,000,000 tons of cargo annually. A 70% forecasted increase in ship traffic by 2011 is on the near-term horizon.
The Calcasieu River Waterway continues to support and lead the Nation in liquefied natural gas (LNG) imports.
Expansion of Trunk line LNG and FERC-approved construction of a new two-berth Sempra Energy, Cameron LNG, LLC terminal and contemplated construction of a third LNG
Chenier Creole Trail terminal near Cameron, Louisiana, and planned expansion of major refineries operated by CITGO and ConocoPhillips especially justify special efforts to afford high priority to fully maintain Congressionally authorized ship channel parameters. Chemical and other manufacturing, shipyard activity and Intermodal cargo handling by other waterway reliant industries such as PPG, W.R. Grace, Alcoa, Firestone, Lyondell, Westlake Styrene, Omega Protein, Global Industries, Bollinger Calcasieu LLC, Texas Butylene, Venco, Dunham Price, Port Aggregates, and the Lake Charles Harbor & Terminal District depend on an adequately maintained Calcasieu River Waterway.
The waterway also serves military-essential mobilization activities, the commercial fishing industry, outer continental shelf offshore oil and gas production, and essential oil spill response readiness capabilities of the Marine Spill Response Corporation. Critical U.S. Department of Agriculture food programs rely on services of the Lake Charles Harbor & Terminal District and waterway efficacy. The waterway, with its ninety-foot deep hole in the Cameron vicinity, is capable of supporting one of only two available protected heavy-lift vessel operation locations on the Gulf Coast. The Federal Strategic Petroleum Reserve (SPR)

facility is adjacent to the waterway. Recreational facilities (casino vessels), which rely on the safety of the adjacent waterway, entertain soon-to-be over seven million patrons annually.

Greater New Orleans

My house, place of business, and way of life.

Cities, oil refineries, and human habitation

People, homes, businesses, schools, infrastructure

- 1) Communities and related infrastructure;
- 2) Agriculture and livestock;
- 3) Fisheries; and
- 4) Oil and gas production, transportation, and refining.

Our levees protect: \$270 billion in residential, commercial and public property, 257,230 residents in East Jefferson, The Louis Armstrong International airport, 7 drainage pump stations, 4 hospitals (the only ones functional not in metropolitan New Orleans) and the 5 major evacuation routes of over 1 million residents of the surrounding parishes.

## ***What components would make up this Category 5 hurricane surge protection in your area?***

Levees/pumps
Open up the intracoastal waterway to let storm surge down waterway
Ordinances that restricted development in surge areas
Master drainage plan
Barrier Island and beachhead protection at the coast, an elevated highway between the port and existing hurricane protection system and cat. 5 upgrade of SL Levee System.
Additional "speed bumps" should be constructed in the lower basins to lower storm impact.
Engineered flood protection and the natural coastal landscape
N/A, but in the coast, we would encourage wetland restoration, forest conservation and improved levees.
Storm surge in excess of 3 feet has a significant effect on all coastal parishes in Louisiana today.
Movement of water through surge significant distances inland with even small storms is not unusual.
Flood protection through levees and flood gates to stop the movement of water impacting a coastal population is seen for all coastal parishes today (and enhancement of existing structures).
Storm wave on top of surge also needs to be added to vertical height of water movement against the coastal areas and used in the development of future storm surge barriers. In large scale storms, surge and wave heights can exceed 20-25 feet vertical against the coast.
Floodwalls, Levees, flood gates, locks, pump stations, bridges.
Category 5 surge protection is not possible with levees alone.
Necessary landscape components are restored barrier islands, saline, brackish, and fresh marsh systems, restored natural Chenier ridges (with restored oak and woody plant forests) and cypress swamps.
Ecologically friendly gates (as much as possible) on the Rigolets and Chef Pass,
Vigorously restored wetland east and west of New Orleans,
Addressing navigation channel threats (MRGO, Intracoastal, etc.)
Bring hurricane protection levee up to 13 feet within St. Charles Parish
Floodgates, levees, structural barriers, and ridge and wetland creation.
Lake Pontchartrain Barrier Plan
Ecosystem restoration, Floodwalls and floodgates.
Levees, flood gates, and coastal marshes.
Floodgates in Chef and Rigolettes and IHNC that are continually open (except during hurricanes) and whose opening does not reduce the cross-section of the passes or canal. Levees and floodwalls around the metro area as necessary.
Pumping stations at the lake for all canals.
A combination of shoreline protection, wetland creation, restoration, protection, and maintenance, and potentially earthen levees.
Earthen levees, flood walls, gates, shoreline (rock) protection, breakwaters, pump stations (Parish responsibility) with 100% of closure structure at Rigolets to prevent Lake from rising from Gulf storm surges.

***What role do coastal wetlands play in reducing impacts of hurricanes in your area? Please give specific site examples and references if you can.***

Intracoastal waterway at Black Bayou/ Calcasieu Parish had gates closed Many of the structures that flooded wouldn't have been built with legislation prohibiting construction in storm surge areas or would have been built to higher standards

Extremely important, but they are so decimated in the lower Terrebonne & Barataria Basins that natural ridge restorations are the best bang for buck in lower basin.

A prime example is the performance of Port Fourchon's Maritime Forest Ridge Project during Hurricane Katrina. It clearly afforded protection from hurricane force north winds and provided protection and storm reducing friction for the Port's Northern Expansion Development.

The wetlands and other landforms in the Pontchartrain Basin make the difference between a LA type surge (15-20) feet and a Mississippi type surge (20-30 feet).

Wetlands suppress tidal surge and break the wind impacts therefore even lessening impacts even in Baton Rouge, but really help the coastal communities.

Wetlands buffering storm wave energy against hurricane protection levees is very important. Storm wave and even normal daily wind fetch derived water motion against levees, coastal shorelines, roads and other coastal infrastructure have serious impacts to the integrity of structures and changing shoreline.

Since the Atchafalaya River and the Wax Lake Outlet are building delta/coastal wetlands in St. Mary Parish, which provides a buffer.

Coastal maritime forests and natural ridges provide critical storm surge reducing benefits. these benefits are increased when the ridge itself supports live oaks and other woody plants. Additional height and therefore drag is added by these living surge reduction components. The maritime forest ridge being built at Port Fourchon was credited by the Port Director as providing some level of protection to the port from Katrina surge. The east side of Grand Isle where maritime forests still exist received less catastrophic damage from surge than did the western side of Grand Isle where there are no maritime forests.

Wetlands immediately in front of MRGO levees prevented levee disintegration. Storm surge gulf side of New Orleans "Landbridge" much higher than in Lake Pontchartrain.

Tree lines and breaker walls play major part in slowing down tidal surge, etc.

Flood protection, absent barrier islands.

They at least buffer wave energy against levees, and may buffer storm surge.

Wetlands do not play a very large part in protecting New Orleans east of the Miss. River but do help St. Bernard and lower 9th Ward.

Storm surge is reduced about 1 foot/2.75 miles of perpendicular coast according to a 1965 Corps report

There appears to be considerable assumptions about the effects of marshes on storm surge, but limited scientific data.

I would think that different types of wetlands (Marsh versus forested swamp) would have differing effects on storm surge. Surge would also be influenced by the location of the wetland and storm track. Different types of wetlands also have varying effects on waves and erosive forces on storm protection infrastructure.

In Andrew, in Terrebonne Parish, every approximately 4 miles of wetlands reduced the storm surge by one foot(Coast 2050).

Coastal wetlands are the first line of defense against storm surge in my area. According to a report submitted by the Corps of Engineers (USACE 1965), every 2.7 miles of wetland will reduce a storm surge by approximately 1 foot.

The LaBranch wetlands protects our West return levee at St. Charles Parish line.

Shoreline protection in Lake Pontchartrain is not a high priority. In 1965 when the Lake Pontchartrain Project was authorized our shoreline was much further from our levees. We have lost 175 acres since 1947 and 675 feet in depth in some areas!!

Pretty soon the lake shoreline will consume our levees.

***What measures are needed to protect and restore wetlands along the coast? Please give specific site examples and references if you can.***

In lieu of letting northern states flood from the Mississippi and bring the silt down we should replenish the marshes in some form maybe by letting more of the dredged materials in the marsh.

Stop all new oilfield canal construction and require many of the old ones to be filled in.

We need a 3 tier defense system.

Substantial Barrier Islands with a minimum of 10 ft. elevation. then a middle basin ridge re-creation system that will add friction to damper storms and tidal surge, then a cat 5 levee system south of the populated areas.

- 1) Land water ratio of landbridges
- 2) Total productivity of the estuary
- 3) Total fisheries harvest of the estuary
- 4) Attainment of habitat goals
- 5) eEcology of shellfish

We need to increase sediment input and freshen saltier areas, especially to upper Breton sound and myrtle grove.

There needs to be a sensible combination of levees and restored wetland habitats. Wetlands restoration is and always been part of flood protection. this is not a new concept. the role wetlands play in storm surge remediation was explained in the earliest materials produced by the BTNEP. Certainly this was well known within the La. scientific community before the BTNEP ever existed. Katrina and Rita have merely underscored that restoration attention needs to go well beyond protecting the wetland systems we have left. Attention to ALL of our coastal habitats is essential. There must be a holistic view that is inserted into the restoration effort. Spartina marshes are important, but so are barrier islands and freshwater and brackish marshes, so are the system of natural ridges and cypress swamps.

The tendency of some to support their "favorite" habitats must move towards a consensus support for supporting all of the habitats between our communities and the Gulf of Mexico.

Restore historic isohaline lines (Lake Pontchartrain Basin) to reverse losses of forested wetlands in St. Charles and the Maurepas/Pontchartrain landbridge. Shaeffer et al. Hope Canal Environmental assessment. Lake Pontchartrain Basin Comprehensive Management Plan, 2006

Utilize existing structures like Bonnet Carre to reach these reduced salinity goals while we are building "over wetland" structures and fixing other hydrological wrongs.

Bring new sediments via pipeline to these "landbridge" areas east and west of the Mississippi River to rebuild these vital backbones of the coast.

Need to build breaker walls along tree lines to protect existing trees.

In cooperation with the U.S. Army Corps of Engineers, the State of Louisiana, and the Coalition to Restore Coastal Louisiana, the Lake Charles Harbor & Terminal District supports beneficial use of dredged material to enhance public and private properties toward maintaining the continued availability of a fully maintained Calcasieu River Waterway.

Ship channel dredging activities, which are so essential to the economic health of the Southwest Louisiana region, also hold the beneficial-use dual prospect of providing for storm protection and enhancing the Federal Wildlife Refuge Complex and participating owners' properties through land Reclamation and creation of productive marshland in open water coastal areas which have suffered from the well documented loss of "America's Wetland." (ref: <http://www.lca.gov/>)

Remaining availability of confined dredged material placement sites along the Calcasieu River Waterway is scarce. Projections by the U.S. Army Corps of Engineers' Engineering Research & Development Center reveal that the available capacity for merely stacking dredged material near the channel to technically comply with the "federal standard" will be exhausted within three years. Production of a 20-year Dredged Material Management Plan (DMMP) is underway. Over seventy brainstormed proposals are under consideration. Most proposals involve some form of beneficial use. Current U.S. Army Corps of Engineers policy and governance, according to the USACE New Orleans District staff, precludes beneficial use of dredged material due to additional costs of transporting dredged material to sites more remote than those waning availabilities in traditional placement areas. Specific enabling legislation may be necessary to authorize federal assistance, specifically by the U.S. Army Corps of Engineers, to require or lend priority to needed beneficial use of dredged material.

Large scale marsh creation using pipelines to deliver sediment from the Mississippi River

Enlarge Caernarvon diversion and add sediment with a dredge in river, use Violet Canal to introduce fresh water and sediment.

As a bold step, put a spillway across St. Bernard about 1/2 mile below the Violet Canal for a major diversion project. Two roads would have to be elevated as a causeway and only two structures relocated.

Barrier Islands, Ridges (with trees), and plenty of good solid marsh.

Levees, flood gates, and coastal marshes.

Sediment pumping from the Mississippi and Atchafalaya rivers will quickly build marsh. Small river diversions adjacent to this new marsh will nourish it. Shore protection to prevent bays and lakes from breaking through into important wetlands. Hydrologic restoration to restore "natural water flow in the marsh. Barrier island restoration References: Coast 2050, LCA (pre-Bush).

First, we must maintain and expand the existing wetlands using the best science available.

Second, we must create and nourish wetlands using natural systems, where available, and the beneficial use of dredge/sediment in appropriate areas. Third, construct and operate freshwater diversions where appropriate, and lastly, it is important to restore/backfill many of the canals dredged into the marshes. Those canals increase erosion by increasing the exposed surface area and alter hydrology.

More sediment delivered to the coast and possibly some wave height reduction at the coast or off the coast (i.e. barrier islands).

La Branch wetlands needs to be rebuilt to protect us. Also wetlands in the Lake beyond our shoreline would act as a wave break.

## ***Where should priority emphasis be placed for newer or stronger levees in your area?***

Depends on a cost benefit analysis

In Calcasieu Parish the best place would be on the north side of the Intracoastal Canal but this would do nothing for Cameron Parish. If Calcasieu Parish would get levees for storm surge protection this must be carefully combined with a flood protection program or the levees could cause flooding in non hurricane floods or even keep the rainwater from the hurricane from getting out which would cause flooding. We had as much flooding caused by the rainwater immediately after the storm which couldn't get out due to the storm surge as we did from the storm surge itself.

A comprehensive flood protection system must be developed that combines Morganza and Donaldsonville to the Gulf projects, with the SL Levee system as the backbone.

Levees should be close to population centers and where wetlands and other natural habitats provide protection to the levees on their flood side.

Any population area and coastal parish impacted by storm surge in the last 5 years is a good indicator of where flood and surge protection is needed.

Repairing the breaches in levees is certainly important. In some cases, repairing breaches along with restoring the lost wetland systems in "front" of the levee will need to take place at the same time. Repeating what was said earlier, in most cases newer and stronger levees alone will not protect our communities. Stronger levees are important, but the strongest of levees will not withstand the full force of Cat 5 surge. There must be wetland systems between the levees and the Gulf.

A line from St. Tammany, across and connecting Rigolets and Chef Pass gates, and down along the La Loutre ridge and the St. Bernard levees.

St. Charles Protection Levee and Orleans Area.

Between the MRGO and Slidell.

New Orleans East, Industrial Canal, and MRGO/GIWW along Michoud.

West Bank New Orleans and Houma.

The magnitude of each protection component should vary across the coast based on the amount of infrastructure and population to protect.

All around the New Orleans metro area.

At the marsh/upland interface with allowances for hydrology into the marsh.

We are asking for 10 foot crowns on our lake levees (not 7 foot) and shallower slopes so we can ride on them during storms high water and maintain them easier.

## ***Other thoughts/comments for the planning team for a more effective workshop?***

We must throw the book of flood protection of the past out the window and re-think how we deal with this huge problem that transcends coastal protection & restoration, critical infrastructure needs and viability of the region. There is simply no reason why we can't have it all.

Use the "multiple Lines of Defense Strategy" to add depth and redundancy to our flood protection, and to sustain habitats.

Close MRGO and keep committed to restoration of the coastal wetlands.

Look forward to a productive and good meeting.

If the restoration movement in Louisiana has a chance of succeeding, there needs to be clear understanding that AGREEMENT of what needs to be done must be reached. We will never succeed if we simply have scientists and engineers discussing what is possible or how to mimic what the river systems did 300 years ago. This is a waste of the time we don't have. These discussions are necessary, but there must be another step of filtering the "what is possible" discussion through a discussion of what can we actually do that is acceptable to our population.

Failure to do this has absolutely stalled our restoration efforts. Planning is really the easy part. Our people are tired of planning. I'm tired of planning. We are all tired of planning. It's really very simple. Find the points of agreement and implement projects in accordance with the agreement. In regions where there is no agreement...get one and stick to it.

To the nay-sayers who claim that the river is "not the same river"... it is. We can not afford to wait another 50 years for nitrogen levels to come down to these folks "acceptable" levels. Besides, these nutrients are actually very powerful restoration tools to maintain and grow wetland plants. Have big posters of dead cypress trees all around the room, and point to them everything someone says the word "algae" or "eutrophication", stating "nutrients didn't kill these trees, salt did". Ask for specific fisheries expertise from anyone saying that we don't want to "over-freshen" a basin. These folks are way off base, and couldn't tell a brown shrimp from a white shrimp, much less know the history or biology of these critters in Louisiana or the evolution of the fishery. Our salinity goal should be to push oyster production back to the historic reefs in the lower part of the basin; the rest of the fisheries will adjust accordingly AND be sustainable. Please don't let a few fear mongers rule the day or control the process.

Take a look at areas that were hit the hardest and see what can be learned and what could have been done better.

Submitted: James L. Robinson Director of Navigation & Security Lake Charles Harbor & Terminal District

Plan for protecting the most people in the shortest amount of time.

Coastal restoration can not be an afterthought. It needs to be an integral an important part of the plan.

Need to ensure that terminology is clearly understood. In this survey we use the term components in Q2 and measures in Q4. How are they different? How specific should particular locations be? Can we show on a map of 1:24000?

You have set an impossible task for Tues. No way you can get down to three alternatives for Eng. Structures. There are at least 2 valid alternative alignments in each of the 9 Hydrologic Basins. You may want to breakout into small groups sometime to get these alternatives.

Good time management by the session leaders.

## Appendix C: South Louisiana Hurricane Protection and Restoration Legislative Direction

Section 5009, The Department of Defense Appropriations Act, 2006 (P.L. 109-148) 30 December 2005

“SEC. 5009. Public Law 109–103 is amended under the heading “Corps of Engineers—Civil, Investigations”, by striking “*Provided further, That using \$8,000,000*” and all that follows to the end of the paragraph, and inserting in lieu thereof, “*Provided further, That using \$8,000,000 of the funds provided herein, the Secretary of the Army, acting through the Chief of Engineers, is directed to conduct a comprehensive hurricane protection analysis and design at full federal expense to develop and present a full range of flood control, coastal restoration, and hurricane protection measures exclusive of normal policy considerations for South Louisiana and the Secretary shall submit a preliminary technical report for comprehensive Category 5 protection within 6 months of enactment of this Act and a final technical report for Category 5 protection within 24 months of enactment of this Act: Provided further, That the Secretary shall consider providing protection for a storm surge equivalent to a Category 5 hurricane within the project area and may submit reports on component areas of the larger protection program for authorization as soon as practicable: Provided further, That the analysis shall be conducted in close coordination with the State of Louisiana and its appropriate agencies.*”.”

Chapter 3, The Department of Defense Appropriations Act, 2006 (P.L. 109-148) 30 December 2005

“*Provided further, That none of the \$12,000,000 provided herein for the Louisiana Hurricane Protection Study shall be available for expenditure until the State of Louisiana establishes a single state or quasi-state entity to act as local sponsor for construction, operation and maintenance of all of the hurricane, storm damage reduction and flood control projects in the greater New Orleans and southeast Louisiana area*”