Greater New Orleans
Hurricane and Storm Damage
Risk Reduction System

Mike Park
Chief
Task Force Hope
Mississippi Valley Division
U.S. Army Corps of Engineers

April 1, 2011
New Orleans Area
Hurricane and Storm Damage Risk Reduction System

5 Parishes
350 Miles of Levee/Floodwall
78 Pumping Stations (Fed & Non-Fed)
4 Gated Outlets

Legend
- Federal
- Federal Non-COE
- Non-Federal
New Orleans Topography

From Canal St. at Mississippi River to the Lakefront at U.N.O.

City of New Orleans Ground Elevations

- Floodwall Along Mississippi River
- London Avenue Canal Floodwall
- Hurricane Levee / Floodwall (14.0 Feet)
- London Avenue Canal Floodwall

Elevations in Feet NGVD

-10
-20
0
10
20
30
23 FT
Hurricane Katrina
Aug 29, 2005

- One of America’s largest natural disasters
- Cat 5 less than 12 hrs before landfall
- 127 MPH wind at Louisiana landfall
- Maximum surge of 28 to 30 feet along Mississippi coast
- 80 percent of the city of New Orleans flooded

Hurricane Rita
Sep 24, 2005

- Cat 4 less than 12 hrs before landfall
- 175 MPH max sustained winds in Gulf of Mexico
- 120 MPH max sustained winds at landfall
- Cat 3 strength at landfall
New Orleans
Maximum Flooding Depth

- Design Failure Breach Locations
- 8 to 15 feet
- 10 to 13 feet
- 12 to 15 feet
- 9 to 11 feet

Max Flood Depth
High: 15 Ft.
Low: 0 Ft.
HSDRRS: Our Mission and Commitment

- Repair the damages, making what was there before whole again.

- By 1 June 2011, strengthen and improve the system and provide 100-year level of risk reduction capable of withstanding the effects of a storm having a 1% chance of occurring each year.

- Current funding level $14.48 B (fully funded).

- Study and recommend solutions to provide higher levels of protection; restore and protect coastal wetlands (LACPR).
Cost Estimate Process

“STATE OF THE ART”
Repeatable & Sustainable

- Design Material Quantities
- Crew Production Rates
- System Cost Estimate
- Schedule
- Risk Analysis

- Validation of Unit Prices
- Material & Labor Cost Variables
- Risk Impacts

Market Analysis

External Independent Technical Review
Market and Risk Analysis

- Performed by World Class industry experts
- Analyzed key materials, equipment and labor
- Researched market prices
- Projected future costs
- Assessed potential for supply constraints
- Cost & quantity uncertainties captured and analyzed
- Developed Risk Register (cost & schedule risk)
- Risk items linked to specific affected activities
**HSDRRS Funding Breakdown**

**TOTAL APPROPRIATED FUNDS: $14.48 B**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>$ (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELA (Interior Drainage)</td>
<td>1,253</td>
</tr>
<tr>
<td>WBV 100-year Level of Protection</td>
<td>1,605</td>
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<tr>
<td>LPV 100-year Level of Protection</td>
<td>1,997</td>
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<tr>
<td>Repair Existing System</td>
<td>1,491</td>
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<tr>
<td>Restore to Design Height</td>
<td>1,116</td>
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<tr>
<td>Complete Authorized System</td>
<td>1,619</td>
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<tr>
<td>Permanent Pump Stations</td>
<td>804</td>
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<tr>
<td>IHNC</td>
<td>1,743</td>
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<tr>
<td>Selective Armoring</td>
<td>89</td>
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<tr>
<td>Storm-proof Existing Pump Stations</td>
<td>340</td>
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<tr>
<td>Incorporate non-Fed Levees in Plaquemines Parish</td>
<td>671</td>
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<tr>
<td>Reinforce or Replace Floodwalls</td>
<td>1,626</td>
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<tr>
<td>Other</td>
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## Construction Contract Status

<table>
<thead>
<tr>
<th></th>
<th>Total Contracts</th>
<th>100-Year Contracts</th>
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<tbody>
<tr>
<td><strong>TOTAL</strong></td>
<td>392</td>
<td>109</td>
</tr>
<tr>
<td>Awarded to date</td>
<td>314</td>
<td>103</td>
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<tr>
<td>Complete</td>
<td>197</td>
<td>42</td>
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<tr>
<td>Under Construction</td>
<td>117</td>
<td>61</td>
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<tr>
<td>Remaining Awards</td>
<td>78</td>
<td>6</td>
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</table>

*as of 30 Mar 11*
## HSDRRS Remaining Awards

<table>
<thead>
<tr>
<th>Project</th>
<th>CY11</th>
<th>CY12</th>
<th>CY13</th>
<th>CY14</th>
<th>CY15</th>
<th>Estimated Construction Completion Date</th>
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<tbody>
<tr>
<td>WBV / LPV 100-yr</td>
<td>~24</td>
<td>26</td>
<td>10</td>
<td>8</td>
<td>1</td>
<td>December 2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2 WBV, 4 MRL EAM)</td>
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<tr>
<td>SELA</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td></td>
<td>November 2017</td>
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<tr>
<td>Storm Proofing</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>October 2012</td>
</tr>
<tr>
<td>NOV / NFL</td>
<td></td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>September 2016</td>
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<tr>
<td>MRL Resilient Features</td>
<td></td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td>December 2014</td>
</tr>
<tr>
<td>LGM</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>June 2012</td>
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<tr>
<td>Perm Pumps</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>October 2014</td>
</tr>
<tr>
<td>Environmental Mitigation</td>
<td>1</td>
<td>1</td>
<td></td>
<td>5</td>
<td></td>
<td>August 2014</td>
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<tr>
<td>Grand Isle</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>January 2014</td>
</tr>
<tr>
<td>Armoring</td>
<td></td>
<td>~3</td>
<td></td>
<td></td>
<td></td>
<td>October 2012</td>
</tr>
</tbody>
</table>

*SELA 28 scheduled to be awarded in early 2017*

As of 30 Mar 11
Current Program Status

- **Total Program**: $9.7 B Obligated
  - $7.2 B Expended

- **100-yr System**:
  - Design about **99%** complete
  - All 100-yr NEPA Compliance/Project Description Documents complete
  - Lake Borgne Surge Barrier 84% construction complete
  - Seabrook Surge Barrier 26% construction complete
  - West Closure Complex 72% construction complete
  - LPV – 63 of 63 100-yr contracts awarded
  - WBV – 39 of 45 100-yr contracts awarded
    - MRL scheduled to award in March (4 Contracts pending ROE)
  - SELA – 13 of 35 contracts awarded
  - Pump Station Repair complete
  - Storm Proofing 46% construction complete
  - Armoring – Alternatives being developed, select alternative in May
  - HSDRRS Environmental Mitigation – scoping ongoing
  - HSDRRS Accreditation
1 June 2011 Status:

- A perimeter system capable of defending against a 100-year storm surge where:
  - 97% of the system perimeter will be constructed to 100-year design criteria
  - 2% of the system will have Engineered Interim Structures in place
  - 1% of the system will have Engineered Construction Closures on site to close gaps should a hurricane threaten the area
## 100-yr Contracts Where Final Structure Is Projected Beyond 1 June 2011

<table>
<thead>
<tr>
<th>100-yr Contract</th>
<th>Award Date</th>
<th>Interim 100-yr</th>
<th>Final 100-yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>IHNC-01 Seabrook Surge Barrier</td>
<td>15-Feb-10</td>
<td>30-May-11</td>
<td>30-Dec-11</td>
</tr>
<tr>
<td>PCCP-01 Permanent Canal Closures</td>
<td>21-Apr-11</td>
<td>1-Jun-06</td>
<td>Oct-14</td>
</tr>
<tr>
<td>LPV-17.2 Bridge abutment and Floodwall Tie-ins at Causeway Bridge - Phase 2</td>
<td>24-Aug-10</td>
<td>Closure</td>
<td>13-Jan-12</td>
</tr>
<tr>
<td>LPV-09.2 PS's #1, #2, #3 and #4 Mods, Fronting Protection, Positive Cutoff and Floodwall Tie-ins</td>
<td>15-Apr-10</td>
<td>15-May-11</td>
<td>01-Oct-11</td>
</tr>
<tr>
<td>LPV-03.2B West Return Floodwall (Northern Segment) - Phase 2</td>
<td>15-Jul-10</td>
<td>1-May-11</td>
<td>09-Dec-11</td>
</tr>
<tr>
<td>LPV-03.2A West Return Floodwall (Southern Segment) - Phase 2</td>
<td>30-Jul-10</td>
<td>1-May-11</td>
<td>06-Sep-11</td>
</tr>
<tr>
<td>LPV-3d.2 Airport Runway 10 Levee Phase 2</td>
<td>15-Sep-10</td>
<td>Closure</td>
<td>15-Aug-11</td>
</tr>
<tr>
<td>WBV-77 Western Tie-In_UP_Railroad Crossing</td>
<td>1-May-11</td>
<td>Closure</td>
<td>2-Jan-12</td>
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<tr>
<td>WBV-75 Western Tie-In_BNSF_Railroad Crossing</td>
<td>17-Apr-11</td>
<td>Closure</td>
<td>2-Oct-11</td>
</tr>
<tr>
<td>WBV-74 Western Tie-In Closure Structure</td>
<td>30-Apr-10</td>
<td>30-May-11</td>
<td>26-Jun-11</td>
</tr>
<tr>
<td>WBV-73 Western Tie-In Highway Crossing</td>
<td>06-Jul-10</td>
<td>Closure</td>
<td>17-Dec-11</td>
</tr>
<tr>
<td>WBV-15a.2 Lake Cataouche Pump Station to Segnette State Park</td>
<td>15-Feb-10</td>
<td>Closure</td>
<td>5-Aug-11</td>
</tr>
<tr>
<td>WBV-16b Segnette PS fronting protection and modifications</td>
<td>15-Jan-10</td>
<td>Closure</td>
<td>18-Dec-11</td>
</tr>
<tr>
<td>WBV-16.2 Bayou Segnette Complex</td>
<td>10-Feb-10</td>
<td>Closure</td>
<td>14-Jul-11</td>
</tr>
<tr>
<td>WBV-24 Segnette State Park Floodwall</td>
<td>23-Dec-09</td>
<td>Closure</td>
<td>27-Jul-11</td>
</tr>
<tr>
<td>WBV-37 Ames / Mt. Kennedy Pump Stations</td>
<td>23-Jun-10</td>
<td>1-May-11</td>
<td>17-Sep-11</td>
</tr>
<tr>
<td>WBV-90 GIWW - West Closure Complex</td>
<td>17-Apr-09</td>
<td>1-Jun-11</td>
<td>16-Aug-11</td>
</tr>
<tr>
<td>WBV-12 Hero Canal Reach 1, 2nd Enlargement</td>
<td>15-Apr-10</td>
<td>Closure</td>
<td>17-Jun-11</td>
</tr>
<tr>
<td>WBV-09b Hero Canal to Oakville - Structures</td>
<td>14-May-10</td>
<td>Closure</td>
<td>21-Jul-11</td>
</tr>
<tr>
<td>WBV-09a Hero Canal to Oakville - Levees</td>
<td>21-Jun-10</td>
<td>Closure</td>
<td>17-Jun-11</td>
</tr>
<tr>
<td>WBV-09c Hero Canal to Oakville - Highway Structures</td>
<td>09-Jul-10</td>
<td>Closure</td>
<td>02-Jul-11</td>
</tr>
</tbody>
</table>

*Engineered Interim Structures

*Engineered Construction Closure*

Unawarded contracts are in bold / underline

*deployed as needed prior to tropical events
Definitions

**Engineered Alternative Measures**
- Meet hydraulic and structural/geotechnical design criteria
- Meet criteria for Accreditation
- Do not meet full HSDRRS design criteria
- Example: MRL Co-located phase 1 levees

**Engineered Interim Structures**
- Meet 100-yr hydraulic and structural/geotechnical design criteria
- Temporary in nature – to be replaced by permanent features for Accreditation
- Example: Cofferdams at Seabrook Surge Barrier, ICS at Outfall Canals

**Engineered Construction Closures**
- Rapidly deployed measures
- Used to close discrete access points, railroad / highway crossings under construction
- Does not meet criteria for Accreditation
- Example: HESCO Bastions / Temporary sheet pile
Deliver the Greater New Orleans HSDRRS Mission

Challenges
- Mandate to deliver $14.6B construction program within budget and on schedule
- Form design criteria, program cost estimate, acquire funding
- Intense scrutiny / oversight
- New governances
- NEPA compliance
- Deliver a comprehensive system

Enablers
- Administration / Congressional commitment
- Fully funded program
- National/Regional Corps capabilities
- Local partners and stakeholders capabilities
- NEPA Alternate Arrangements
- Full host of acquisition strategies
- Favorable bidding climate
Best Practices:
System Program Management

- **Acquisition Strategy**
  - Design Build / Cost Plus Contracts
  - Best Value Source Selection
  - Early Contractor Involvement (ECI)
  - Program Management Support Contract

- **Construction Materials**
  - Government Furnished Borrow
  - Supply Contracts for Sheet Piles and Borrow

- **Improved Techniques**
  - Value Engineering – systems study complete
  - Pile Load Tests – in advance of contract award
  - Press Pile, Spiral welded piles
  - Deep soil mixing, sand blanket and wick drains

- **Earned Value Management System (EVMS)**

- **Leverage National & Regional Resources**
Integrated Systems Approach

- Navigation
- Flood Damage Risk Reduction
- Ecosystem Restoration
The Big Picture

Central Wetlands Cypress Re-forestation

MRGO Closure

New Orleans

St. Bernard Parish

IHNC

Surge Barrier

Orleans Parish

Lake Borgne Marsh Restoration

GIWW
Old 100-yr system: 200 miles
New 100-yr system: 130 miles
→ 30% less perimeter to defend
Lake Borgne Surge Barrier
Lake Borgne Surge Barrier Gates

GI WW Barge Gate

GI WW Sector Gate
Lake Borgne Surge Barrier
Lake Borgne Surge Barrier
Lake Borgne Surge Barrier Barge Gate
New Orleans East Levee

Bayou Sauvage National Wildlife Refuge

Over 1 Superdome of Clay (4.9 mil cy) Required
New Orleans East

Surge Barrier Tie-In

New Floodwall

Old Floodwall
New Orleans East

Tie-In Floodwall
Seabrook Surge Barrier

Conceptual
Seabrook Surge Barrier
Orleans Parish
2011 Interim Closure Structures

<table>
<thead>
<tr>
<th>Seabrook (IHNC)</th>
<th>London Ave. Canal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete March 2011</td>
<td>Completed June 2006</td>
</tr>
<tr>
<td>17th St. Canal</td>
<td>Orleans Ave. Canal</td>
</tr>
<tr>
<td>Completed June 2006</td>
<td>Completed June 2006</td>
</tr>
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</table>

Provides interim 100-year level of risk reduction
West Closure Complex

- The WCC removed 26 miles of levees and floodwalls from the first line of defense.
West Closure Complex
West Closure Complex

Pump Station
Pump Station Repairs

Repair $102.7 M Program

Repairs for all 61 pump stations are complete.

Motor at Orleans Drive Pump Station

Vertical Drive Pump – Elaine Pump Station
## Pump Station Storm Proofing

<table>
<thead>
<tr>
<th>Contract Status</th>
<th>Orleans Parish</th>
<th>Jefferson Parish</th>
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<tbody>
<tr>
<td>TOTAL</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>In Design</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Awarded</td>
<td>7</td>
<td>8</td>
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<tr>
<td>Complete</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Pending</td>
<td>8</td>
<td>2</td>
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## SELA Interior Drainage

<table>
<thead>
<tr>
<th>Contract Status</th>
<th>Orleans Parish</th>
<th>Jefferson Parish</th>
</tr>
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<tbody>
<tr>
<td>TOTAL</td>
<td>11</td>
<td>24</td>
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<tr>
<td>In Design</td>
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<td>Awarded</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Complete</td>
<td>0</td>
<td>9</td>
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</table>
Questions / Discussion