Augusta’s Provisionally Accredited Levee Process

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Identifying and Managing the Risk

✓ The Flood Insurance Maps provide information on Flood Control Structures including Levees, Floodwalls, and Seawalls.

✓ The purpose is to show the risk and allow the public to manage the risk in areas impacted by levees.

✓ Residual Risk always exist.
Levee Rules

• In recognizing the importance of accurate risk assessment to the thousands of miles of levee systems across the United States, FEMA established detailed requirements in the Code of Federal Regulations, Title 44, Chapter 1, Section 65.10, to guide the evaluation of levee systems and the mapping of levee impacted areas on the NFIP flood maps in 1986.
Levee Rules

44 CFR 65.10 levee criteria:

- Freeboard
- Closures
- Embankment Protection
- Embankment and Foundation Stability
- Interior Drainage
- Operation and Maintenance Plan
Map Modernization and Levee Guidance

• To assure standard levee evaluation and mapping practices, FEMA issued levee mapping guidance to its mapping partners and contractors.

• The guidance is provided in Appendix H of the comprehensive Guidelines and Specifications for Flood Hazard Mapping Partners dated April 2003.
The Katrina Factor

- The devastation caused by Hurricane Katrina and Rita brought the issues of levee systems policy, flood hazard management, and flood insurance to the forefront of public debate and discussion.

- On August 22, 2005, FEMA issued Procedure Memorandum 34 (PM 34), Interim Guidance for Studies including Levees. PM 34 re-emphasized FEMA’s 20-year old levee system evaluation and regulation policy, and provided additional guidance to levee owners to meet NFIP standards.
Levee Policy and Accreditation Process

The following policies define the accreditation process:

• Procedure Memorandum 34; Aug 22, 2005
• Procedure Memorandum 43; Mar 16, 2007
• Procedure Memorandum 45; May 12, 2008
PM 34-Interim Guidance for Studies including Levees

- FEMA identifies flood hazard and Levee-impacted areas through engineering and mapping projects, including mapping updates and the map modernization efforts.

- FEMA notifies levee owners and requests information to demonstrate that the Levee can be recognized as providing protection against the 100-year flood event based on 44 CFR 65.10.
If the levee meets 65.10 criteria and can be certified:

- the levee is accredited and mapped,
- area behind the levee is mapped as moderate risk area (zone X),
- FEMA encourages flood insurance protection against other flooding events or residual risks.
If the levee does not meet 65.10:

- the Levee is de-accredited if shown on the effective maps,
- the area behind the levee is mapped as high risk area (zone AE or A), and
- flood insurance policies will be required for properties with federally backed, or insured mortgages.
The PAL policy was initiated to allow levee owners to prepare and submit information and data related to design, analysis, and construction plans and reports leading to levee certification by a professional engineer.
PAL is applicable to the following previously accredited and mapped levees and levees that can be potentially certified:

- USACE and other federally owned levees
- Community owned or privately owned levees.

PAL is applicable to levees that are non-maintenance deficient.

PAL allows 12 months deficiency corrections for maintenance deficient levees before it can be applied.
The PAL process:
• A letter is forwarded to the levee owner
• The letter is to be signed in 90 days
• A 24 months of provisional accreditation is giving to the levee.
• The levee is mapped as provisionally accredited. Area behind the levee is shown as shaded Zone X, except residual risk areas including ponding are shown as high risk Zone A or AE
• When the levee is accredited, the notation is changed from provisionally accredited to accredited levee.
PM45-Revisions to Accredited Levees and Provisionally Accredited levee Notation

- The PAL allows the public to be notified of the flood hazard and any new information related to the modernized maps - the maps will be issued while the levee data is being gathered and evaluated.

- PM 45 provides revised notations for provisionally and accredited levee under which the language advises of potential risk of failure and overtopping.
What is post levee accreditation?

- Levee Safety Act
- Levee Safety funding?
- Accreditation status change?
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Formerly: Map Modernization Program Manager
Dept of Natural Resources

Currently: Atlantic Energy and Engineering LLC
President
(770) 883-8026
Levee Compliance Determination

Augusta’s PAL Process

*In Augusta the results of not complying would affect over 4000 properties, and cost about $1.2 million in insurance premiums annually.*

- August 2007  FEMA letter requiring levee certification
- October 2007 City began working with Corps of Engineers toward certification
- December 28, 2007 Provisionally Accredited Levee (PAL) agreement
- December 28, 2009 Deadline for certification
- January 5, 2008 The Jolt: Obstacles to Corps Certification arise
  - Stafford Act compliance – 4 months delay, minimum
  - Local funding waiver – 6 months delay
  - Cost and time to complete the study

The Problem: Not Enough Time to Meet PAL Deadline
Levee Compliance Determination

The Solution: Hire a qualified engineering firm

- Already engaged in FERC dam safety studies of the Augusta Canal
- Amended an existing contract under emergency conditions
- Started work on the Levee March 20, 2009
Levee Compliance Determination

The Engineering Team

– Cranston Engineering Group, P.C. – Engineer of Record
– S&ME, Inc. -- Geotechnical Investigations
– Matrix Engineering Group, Inc. – Geophysical Investigations
Levee Compliance Determination

- Augusta City Levee Overview
Levee Compliance Determination

Study Approach and Methodology

• Supporting Technical Information
• Surveys
• Geotechnical -- Subsurface Investigations
• Geophysical -- Multi-channel Analysis of Surface Waves
• Field Investigations
• Structural Investigations
• Potential Failure Mode Analysis
• Evaluation and Findings
• Conclusions and Recommendations
Levee Compliance Determination

• **Supporting Technical Information**
  – Project works and drawings
  – Construction history
  – O&M Procedures
  – Historical geotechnical investigations
  – Hydrology & hydraulics
    • Base flood (1% chance) = 138,000 cfs
    • Flood Insurance Study 9/25/09
    • Levee Design Flood – 550,000 cfs
Levee Compliance Determination

Savannah River Flooding History

- Not depicted
- Actual Peak Floods
- Normal Flow
- % Watershed Forestation
Levee Compliance Determination

Savannah River Flooding History (cont’d)

![Graph showing flood history with different flow levels and years marked.]
### 1994 Savannah River Base Flood Revisions

**NFIP Base Flood (100 Year) (cfs)**

<table>
<thead>
<tr>
<th>Reservoir Effect</th>
<th>Before 1994</th>
<th>After 1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unregulated</td>
<td>350,000</td>
<td>277,000</td>
</tr>
<tr>
<td>Regulated</td>
<td>250,000</td>
<td>138,000</td>
</tr>
</tbody>
</table>
Levee Compliance Determination

SAVANNAH RIVER VALLEY
1736-1844

SOUTH CAROLINA
GEORGIA

SAVANNAH RIVER CHANNEL

1796
Levee Compliance Determination

SAVANNAH RIVER VALLEY
1845-1911

1888

SAVANNAH RIVER CHANNEL

AUGUSTA CANAL THIRD LEVEL
Levee Compliance Determination

- **Surveys**
  - Base mapping - photogrammetry
    - 1000 ft wide corridor
    - 11 1/2 miles long

- As-built Surveys
  - Embankments
  - Structures

Pipe Location

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- **Geotechnical Investigations – Subsurface Borings**
  - 75 Borings
  - Laboratory Analysis
  - Stability Analyses
  - Seepage Analyses

Boring Cross Section

Geotechnical Boring
Levee Compliance Determination
Levee Compliance Determination
Levee Compliance Determination

UNDER-SEEPAGE W/ BERM & RELIEF WELLS

LEVEE

BERM

RELIEF WALL

SEMI-PERVIOUS TOP STRATUM

PERVIOUS SAND OR GRAVEL STRATUM

BEDROCK OR IMPERVIOUS STRATUM

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- **Geophysical** –
  Multi-channel Analysis of Surface Waves (MASW)
  - New technology to levees
  - Correlation to boring logs
  - ASCE paper
Levee Compliance Determination

- **Field Investigations**
  - Inspections
    - Pedestrian
    - Boat

Gates from River

Levee Ground Inspection
Levee Compliance Determination

- **Field Investigations**
  - 8 Breach Closure Exercises
  - 9 Gate Operations

*East Boundary Breach Closure Exercise*

*Butler Creek Gate Closure Exercise*
Levee Compliance Determination

• **Structural Investigations**
  – 28 Features
    • Gates
    • Breaches
    • Walls
  – Conditions
    • Steady seepage
    • Sudden drawdown

Levee Breach

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- **Potential Failure Mode Analysis**
  - Determines most probable modes to focus on.
  - Maintenance/Construction
  - Overtopping
  - Piping/Seepage
  - Slope Instability
  - Structure Instability
  - Pipeline Penetrations
  - Embankment Undercut
Levee Compliance Determination

• Evaluation and Findings – FEMA Criteria
  – Freeboard
  – Closures
  – Embankment Protection
  – Embankment and Foundation Stability
  – Settlement
  – Interior Drainage
  – Operations Plan & Maintenance Plan
  – Additional Elements Assessment
Levee Compliance Determination

Evaluation and Findings - Freeboard

REQUIRED
3.0 FT.
1.0 FT. EXTRA • STRUCTURES
0.5 FT. EXTRA • UPSTREAM END

FREEBOARD

BASE FLOOD

FINDING
4.1 FT. TO 35.0 FT.

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Levee Compliance Determination

Evaluation and Findings – Closures

- Required: Openings with operational closures, designed according to sound engineering practice.

- Findings:
  - 8 Breach Closure Exercises
    - Time: 36 min to 124 min
  - 9 Gate Closure Exercises
    - Time: 44 min to 272 min
  - No Major Structural Deficiencies
Levee Compliance Determination

Evaluation and Findings - Embankment Protection

- **Required:** No appreciable erosion from currents or waves

- **Findings:**
  - River velocities: 3.23 to 10.28 feet/sec
  - Overbank Velocities: 0 to 2.78 feet/sec
  - Protection: Bank paving, sheet pile walls, retaining walls, and lateral distance from river
  - No appreciable erosion

Bank Paving

River Walk Marina
Levee Compliance Determination

• Evaluation and Findings - Embankment and Foundation Stability
  – Required: Slope Stability
    • Steady State F.S. > 1.4
    • Rapid Drawdown F.S. > 1.0
  – Findings:
    • Steady State > 1.4
    • Rapid Drawdown 1.26 to 2.20
Levee Compliance Determination

Evaluation and Findings - Embankment and Foundation Stability

– Required: Under-seepage
  • Uplift Gradient $< 0.5^*$

– Findings:
  • Uplift Gradient 0.06 to 0.63

* For new levee; existing levee may be higher
Levee Compliance Determination

Evaluation and Findings – Settlement

– Required: Settlement will not result in loss of freeboard
– Finding:
  • Not likely to settle further after more than 60 years
Levee Compliance Determination

Evaluation and Findings - Interior Drainage

– Required: Adequate ability to evacuate interior flood waters

– Finding:
  • Phinizy Swamp provides a natural storm water detention basin of 9 ½ square miles
  • Recognized in present NFIP flood maps
Levee Compliance Determination

Evaluation and Findings - Operations Plan & Maintenance Plan

– Required:
  • Formal plans for operations assignments, training, inspection, repairs, etc.
  • Formal plans for continued maintenance

– Finding:
  • 1984 Operations and Maintenance Manual needs to be updated
Levee Compliance Determination

Evaluation and Findings – Additional Elements Assessment

• Required: No FEMA Requirement
  – Vegetation - Natural and man-placed
    • Findings: Lie in overbuilt areas due to excess freeboard for 100 year flood
  – Structural Encroachments - Retaining walls, crossings, buildings, etc.
    • Finding: No major deficiencies
Levee Compliance Determination

• Conclusions and Recommendations
  – Augusta City Levee is generally compliant with FEMA criteria
  – Operations and Maintenance manual needed updating
Levee Compliance Determination

• **Results**
  – Reports: Four volumes, 600 pages, 75 drawings, aerial photographs, 550 ground photographs
  – Compliance Determination: 2 pages, 2 signatures
  – Submitted to FEMA: October 20, 2009; Approved by FEMA: December 4, 2009
Levee Compliance Determination

Levee Accredited by FEMA:
January 22, 2010
Levee Compliance Determination

• **Summing Up …**
  – Levee safety is a nationally important issue that will get more attention.
  – Start early on levee compliance determinations.
  – The answer is simple; the supporting data is not.
  – What is under a levee is as important as what is in the levee itself.
  – Operational preparedness improves flood-fighting success.
  – Continued levee accreditation requires on-going maintenance.
  – You can always get a flood bigger than what you figured on!
  – Buy flood insurance when in or near a flood plain.
Levee Compliance Determination

• Panel Discussions - Questions & Answers

• Panelists
Ban Yousif, PE, President
Atlantic Energy and Engineering, LLC
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