PROTECTING VULNERABLE UTILITIES FROM MAJOR STORM EVENTS ALONG WATERWAYS

Patti Sexton, PE, CFM
Climate Change – What Happens?

IPCC – Intergovernmental Panel on Climate Change

1. Precipitation intensity increased
2. Precipitation events will occur less frequently

Result – increase in number of extreme events
Climate Change
What does it mean along waterways?

- Flooding
  - Depth of water

- Erosion
  - Change from water
Flooding
Fenton Sewer Plant – Fenton, MO
Flooding
Fenton Sewer Plant – Fenton, MO
Flooding
Southwest Wastewater Plant – Houston, TX
Flooding
Southwest Wastewater Plant – Houston, TX
Erosion
Santa Ana River Intercept Line – Yorba Linda, CA
Erosion
Santa Ana River Intercept Line – Yorba Linda, CA
Erosion
Tijeras Creek – Rancho Santa Margarita, CA
Erosion
Tijeras Creek – Rancho Santa Margarita, CA
# Ways to Protect Vulnerable Utilities

## Location
- [ ] Horizontal
- [x] Vertical

## Capacity
- [ ] Increase Capacity
- [x] Maintain Capacity

## Scour Protection
- [ ] At Utilities
- [ ] Within Stream

### Types of Actions
- [ ] Planning
- [ ] Non-Structural Measures
- [ ] Structural Measures
- [ ] O&M
**Ways to Protect Vulnerable Utilities**

### Flood Damage Reduction

**US Army Corps of Engineers**

**National Nonstructural/Flood Proofing Committee**

August 2015

#### Flood Damage Reduction Matrix

<table>
<thead>
<tr>
<th>Nonstructural Mitigation Measures</th>
<th>Structural Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation on Foundation Walls</td>
<td>NFIP</td>
</tr>
<tr>
<td>Elevation on Piers</td>
<td></td>
</tr>
<tr>
<td>Elevation on Columns</td>
<td></td>
</tr>
<tr>
<td>Elevation on Piles</td>
<td></td>
</tr>
<tr>
<td>Relocation</td>
<td></td>
</tr>
<tr>
<td>Buyout/Acquisition</td>
<td></td>
</tr>
<tr>
<td>Floodwalls &amp; Levees w/ Closures</td>
<td></td>
</tr>
<tr>
<td>Dry Flood Proofing</td>
<td></td>
</tr>
<tr>
<td>Wet Flood Proofing</td>
<td></td>
</tr>
<tr>
<td>Flood Warning Program Readiness</td>
<td></td>
</tr>
<tr>
<td>Flood Plain Regulation</td>
<td></td>
</tr>
<tr>
<td>Flood Insurance</td>
<td></td>
</tr>
<tr>
<td>Flood Mitigation 2</td>
<td></td>
</tr>
<tr>
<td>Channel</td>
<td></td>
</tr>
<tr>
<td>Levee/Wall</td>
<td></td>
</tr>
<tr>
<td>Dams</td>
<td></td>
</tr>
<tr>
<td>Dikes</td>
<td></td>
</tr>
</tbody>
</table>

---

**TETRA TECH**
Ways to Protect Vulnerable Utilities
Wall → Height → mitigate flooding

Floodwall – Mill Creek (San Bernardino)

Floodwall – San Luis Rey (Oceanside)
Ways to Protect Vulnerable Utilities

Wall → mitigate erosion

San Juan Creek Sheetpile Installation

Combi-Wall Section Santa Maria Levee
Ways to Protect Vulnerable Utilities

Bank Protection → erosion

Loose rock (riprap) - Santa Ana River (Orange County)
Ways to Protect Vulnerable Utilities
Bank Protection ➔ erosion

Grouted Bank - San Luis Rey (Oceanside)
Ways to Protect Vulnerable Utilities

Bank Protection \( \rightarrow \) erosion

Soil cement – Santa Ana River (Orange County)
QUESTIONS?

PATTI SEXTON
949-809-5099
PATTI.SEXTON@TETRATECH.COM