Welcome!

Joint Engineer Training
Conference & Expo

2015

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Climate Change & Facility Management

CO-MODERATORS

- **Wendi Goldsmith**, Chief Innovation Officer, Pantheon Chemical, PG, MSAME

PANELISTS

- **John Wolfe**, Senior Associate, AHC Group
- **Dave Wegner**, Senior Consultant & Scientist, Jacobs
- **Ed Gauvreau**, Chief of Planning Branch, HQ USACE, AIA, MSAME
- **John Hickey**, PE, CEM, LEED AP BD&C, Jacobs
- **Steve Raney**, PE, USCG, Shore Infrastructure Logistics Center
Doing More with Less: Innovation, Management Trends, and Employment Imperatives on Carbon and Capital

John Wolfe
AHC Group, Inc.
Those that have shaped our view include major global firms competing in a smaller world of 7 billion consumers, all wanting more for less

**Corporate Affiliates**

- AECOM
- American Electric Power
- Amway
- Bayer CropScience
- BNSF Railway
- Canadian National
- Cenovus Energy
- CH2MHILL
- Chrysler
- Comcast NBCUniversal
- Cummins
- Don Finkell
- DTE Energy
- Energy Answers International
- Federal Express
- First Energy
- FMC Corporation
- Freeport-McMoRan
- Georgia Pacific
- Green Diamond Solutions
- IRBARIS
- Masco Corporation
- Monsanto
- Pirelli Tire
- Shell
- Shumaker, Loop & Kendrick, LLP
- Suncor Energy, Inc.
- The Greenbrier Companies
- Toyota
- Veolia North America
Energy, Prosperity, Climate are Linked

• Energy is a critical part of boosting prosperity and eradicating poverty.”
  
  Jim Yong Kim  
  President, World Bank Group

“It has become increasingly clear that climate change poses risks to society and ecosystems that are serious enough to warrant action – by individuals, by businesses, and by governments.”

Rex Tillerson  
CEO, Exxon Mobil Corporation
Four Ways to Reduce Greenhouse Gases

- Reduce Population
- Decrease Standard of Living
- Improve Efficiency
- Reduce Carbon Intensity
Why competition has changed as population has increased

- Two thirds of ecosystems are being degraded or used unsustainably
- Energy consumption is expected to increase 70% by 2030

MAKING SUSTAINABLE PROGRESS POSSIBLE

* courtesy of CAT
• CO₂ Emissions Plateau

Energy-Related CO₂ Emissions by Region (Billion Tonnes)

- North America
- Russia/Caspian
- Europe
- Latin America
- Middle East
- Africa
- Asia Pacific

Emissions per Capita (Tonnes / Person)

- OECD
- Non OECD

ExxonMobil 2015 Outlook for Energy
- Stabilization Requires Energy System Transformation

- Efficiency/Reduce Demand
- Decarbonize Energy System
- Negative GHG Emissions
Unprecedented Pace of Technology Deployment and Investment

Reducing GHGs 50% below 2005 by 2050 would require all steps below:

<table>
<thead>
<tr>
<th>Investment</th>
<th>Required Annual Additions, #</th>
<th>Annual Additions Since 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear plants, 1,000 MW</td>
<td>30</td>
<td>- 1</td>
</tr>
<tr>
<td>Coal and gas plants with CCS, 500 MW</td>
<td>55</td>
<td>None</td>
</tr>
<tr>
<td>Wind turbines, 4 MW</td>
<td>15,600</td>
<td>8,100</td>
</tr>
<tr>
<td>Solar PV, m² panels</td>
<td>325 million</td>
<td>115 million</td>
</tr>
</tbody>
</table>

*Source: IEA Energy Technology Perspectives 2010: Scenarios and Strategies to 2050*
NORTH AMERICAN PRODUCED CARBON WILL BE A MIX REQUIREMENT FOR THE FORESEEABLE FUTURE

Canada and the US are now poised to become net energy exporters.

The benefits for North American Energy security are obvious and game changing.

The question then becomes one of how do we exploit and utilize the resource in the most responsible manner.
CAT as an Exemplar of this New Business Model

Doing More With Less

“Our customers are being challenged to do their work more efficiently and with less impact on the environment. In a few cases, their very right to do that work is being questioned. **So only by making our customers more sustainable in their respective industries will our own business prosper.**”

- Doug Oberhelman, Caterpillar CEO, Chairman

In summary then:

1. This is the new approach to business growth and success
2. Doing more with less is the success
3. Making others in business look better is key to strategy in a hot crowded severe world!

* courtesy of CAT
Case study: Competing on Sustainability & Innovation
Caterpillar As Visual Example of What Military Engineers can Do

### Operational Goals
- Reduce absolute GHG emissions from existing facilities by 25%
- Increase Energy Efficiency by 25%
- Hold water consumption flat
- Design all new construction to meet Leadership in Energy and Environmental Design (LEED) or comparable green building criteria
- Eliminate waste by reducing waste generation and reusing or recycling all that remains
- Reduce recordable workplace injury rates to 0.6 and lost-time case rate due to injury to 0.15

### Products, Services & Solutions Goals
- Reduce customer GHG emissions by 20%
- Increase customer energy efficiency by 20%
- Increase customer material efficiency by 20%
- Provide leadership in the safety of people in, on and around our products
Sustainable Development: Your Competitive Advantage

Doing More With Less

- 50% less operator noise
- Easier to operate
  - no shifting
  - low-effort controls
- 10% lower lifetime operating costs
- 50% better steering performance
- Grade Control Ready
  - AccuGrade™ from the factory
- Less fluids used
- 35%-70% lower undercarriage operating costs
  - with SystemOne™
- 10% more
  - material moved per hour
- Up to 50% longer life
  - for the electric drive train
- 10%-30% less fuel consumed per hour
- 60% fewer moving parts
  - in the electric drive train
- 25% more
  - material moved per gallon of fuel
- Less down time

*courtesy of CAT
Can you map benefits around your products like CAT did with its universal tractor?
Do You Have the Managed Systems and Operational Discipline Culture In Your Organization and Supply Chain to Support Effective Execution Of Your Strategy? Are You Operationally Excellent?

- Organizations with robust ISO 9001, ISO 14001 – Health safety environmental quality management programs that also employ Six Sigma Lean management programs are the most successful
- Why?
- They understand their risks and opportunities
- They understand their processes – simple procedures, trained staff, the right metrics
- They empower their people
- They focus initially on waste, first time quality, energy efficiency – building a base for continual improvement
Operational Excellence – Areas of Importance

People

Recruit and retain sufficient, capable, motivated people and significantly improve the people productivity of our business

Personal and process safety management

Continue our Journey to Zero and significantly improve the integrity and performance of our assets

Environmental excellence and sustainability

Significantly improve the environmental performance of our business and go “beyond compliance” in key areas

Reliability

Significantly improve the reliability of our business
## Operational Excellence

### 1. Operational Excellence means:
- Running our base business well, through standard repeatable processes and tools
- Always looking for ways to improve

### 2. Operational Excellence is a philosophy of:
- Leadership
- Growth Delivery
- Cost management
- Risk management …

resulting in Continuous improvement

### 3. Operational Excellence is when every employee can see the flow of value and fix that flow before it breaks down – self healing

### 4. Operational Excellence is demonstrated by results not just by words. i.e. results that are:
- sustained improvement over time
- improvement in all areas of importance → OpsEx Strategy
- performance at a level that is at or better than best in class organizations
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People
- quality people
- high retention
- productive

Personnel and Process Safety
- Zero injuries
- high integrity of asset

Reliability
- High operating factors for assets
  - low T/A days
  - max production / throughput
- Achieve design rate

Environment
- significant improvement in:
  - Air Emissions
  - Water Consumption
  - Energy efficiency
  - Land reclamation

Reputation and $$ in the event of a catastrophic process safety incident

Reputation and $$ in the event of a catastrophic environmental incident

How we achieve OpsEx

Operational Excellence Pillars

This results in $$$

Measure the $ value of OpsEx through case study and “what if” analysis

$
Operational Excellence – Future

“What if” Suncor performance follows BP instead of Exxon

Since 2005, BP has had to refocus their strategic goals from growth/value creation to crisis management. The impact of this is reflected in their stock price which has underperformed operationally excellent company such as Exxon

- Since 2005 BP share price returned -19%
- Since 2005, XOM share price returned 71%
- Since 2005, Suncor share price returned 100% @ $33 / share

- Predicting next 5 years: 1) what if Suncor performance equivalent to BP
  2) what if Suncor performance equivalent to XOM

- The value proposition to Suncor between BP vs. XOM performance is $47 Billion

Source: Yahoo Finance
Why The Public Private Spheres Need to Align and Share:

COSIA: Canada’s Oil Sands Innovation Alliance

➢ COSIA was founded on the problems with innovation, carbon and energy trends.

➢ COSIA collectively redirected impact on air, water, land and greenhouse gases

➢ There are now over 250 intellectual property innovation exchanges

COSIA - an alliance of 13 Oil Sands Producers since 2012.

Member companies have shared 560 distinct technologies and innovations that cost over $900 million to develop. These numbers are increasing as the alliance matures and expands. Through this sharing of innovation and application of new technologies, members can accelerate the pace of environmental performance improvements.

* courtesy www.cosia.ca
The Purpose of Business and Government: The role of Innovation in a Carbon and Capital Constrained World

- There is an opportunity to **transform thinking and practice** about the role of the corporation in society.

- Shared value gives rise to **far broader opportunities** for economic value creation.

- Shared value thinking will drive the next wave of **innovation, productivity growth, and economic growth**.

- Shared value will reignite a whole new generation of **management** thinking.

- Businesses **acting as businesses**, not as charitable givers, are arguably the most powerful force for addressing many of the pressing issues facing our society.

- A transformation of business practice around shared value will give **purpose** to the corporation and represents our best chance to **legitimize business again**.

* Courtesy Michael Porter*
Thank You!

John Wolfe
AHC Group, Inc.
Climate Change and Implications for Operations, Maintenance and Planning of Water Management Features

David L. Wegner
Senior Consultant and Scientist
Jacobs Engineering
Water, Hydrology and Extreme Events

- We are now in a time of climate and hydrologic uncertainty
- Our traditional approaches to water infrastructure management now have a higher risk
- Water management needs to be strategic rather than reactive
Stationarity is Dead. Extreme Variability is the New Normal

- Historically we depended on the past to make predictions of the future.
- Historically we believed and designed around the concept of stationarity – that all would return to the mean and that variance and autocorrelations do not change over time
- We need to plan for variability – often extreme
Engineering Challenges – Beyond the Numbers

- Facing challenges that we have not had to address – it is the outliers, not the predictable
- Engineer “think” needs to expand to include “Strategic Engineering”
- Multi-discipline engineering and integration of multiple data streams
Strategy requires understanding the risks: The Pentagon already sees it.

• RELEASE: Military Leaders Agree with New Pentagon Roadmap: Climate Change an “Immediate Risk to National Security”

• Pentagon Report: U.S. Military Considers Climate Change a 'Threat Multiplier' That Could Exacerbate Terrorism
Military Presence and Sustainability

Expanding Pacific Presence

Arctic Ocean Expansion
Domestic Water Infrastructure and Needs

Traditional Roles
- Congress – WRDA legislation
- Agencies – policy direction
- Public
- States
- Other Nations

Expanding Roles
- Predicting rather than reacting
- Strategic placement and use of resources
- Response
- Public Private Partnerships
Extreme Weather Events
Rivers and Flood Management
Harbors and Shipping: multiple tasks and intermodal applications
Changing International Shipping Dynamics
Rivers and Commerce
Hydropower and Grid Security
Operation and Management of Dams

Low water management

High water management
River System Management – Based on the Past or the Future?

- Historically we have managed rivers based on past hydrology
- The future is clearly going to be more dynamic
- Hydrologic models need to be updated to reflect the future, not the past
SUMMARY

- Climate and resultant weather variability has changed the game.
- Risks to populations and critical infrastructure are increasing.
- Strategic thinking and planning and execution is necessary to be prepared and respond to events.
Thank you for your attention

David Wegner
Jacobs Engineering
Tucson, AZ

Dave.wegner@jacobs.com
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Ed Gauvreau, AIA, MSAME Planning Branch Chief, HQ USACE

Lessons Learned – Ed’s Perspective
Lessons Learned – Ed’s Perspective

• Best method of prevention – plan from the start!
  – Siting, Building Design, Construction
• If you think an event will not happen -- it will!
• Be penny-wise with maintenance
• Assure functionality in worst-case scenario
Greensburg, Kansas (2007)
Greensburg – Model Green Community
Fort Irwin, CA - Flooding
Thank you!

Ed Gauvreau, AIA, MSAME
Planning Branch Chief, HQ USACE
Climate Disruption
a Golden Opportunity in Facility Design & Management

John Hickey, PE, LEED AP BD&C, CEM
Jacobs Engineering
Hydro Power
Vulnerable to Drought – 5 MW/ft
Millstone Nuclear Power Plant
Illinois Power Plants

- 8 special exemptions
- Braidwood
Coal Fired Plants – extreme conditions for shipping and cooling water.
What if it had been hotter and more arid?

Where should we build the next plant?
Cyber threat
Grid infrastructure
Terrorism
Price
So if central power generation, transmission and distribution is subject to climate disruption, and other threats what should we do?
• Distributed Generation
• Reduce Consumption
• Renewable Energy

• Less than optimal
• Distributed Generation – stranded assets
• Efficiency - not enough
• Renewables – unfavorable load profile
  - unpredicatable
  - not resilient
• Net Zero Buildings & Bases
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- High Performance Buildings
- High Penetration Renewables
- Grid parity
- Energy Storage
- Smart Grid Controls
- Grid Friendly
Benefits

• Mission impacts
• More efficient
• Less fuel storage
• Resilient
• Reliable
• Reduced energy cost
• Interconnectable
• Market Participation $$
Resilient Design

• Reference the Future
• Choose the right Site
• Design for Passive Performance
• Address Multiple Problems for Multiple Stakeholders
Resilient Design Example – Building Envelope

- Safety
- Security
- Energy
- Durability
Results

• Sustainable by Design
• Durable by Design
• Resilient by Design
Back to that Golden Opportunity……...

• As engineers, architects, facility managers, consultants, contractors, etc….. You are more relevant than ever.

• Problems need solutions. You can solve them.

• Deploy multivalent solutions.
Thank you very much!

John Hickey

John.Hickey@jacobs.com

206.696.6680
CG Shore Energy Program Brief

- “A Call To Action”
- Resources
- Energy Projects
- Sustainable Buildings
- Resiliency
A Call to Action

“Our Commitment to Excellence demands that we hold ourselves to the highest standards of environmental compliance, sustainability and energy conservation in the conduct of all Coast Guard missions.”

“I charge every Coast Guard member to incorporate sustainability into all mission areas. Our shared duty to protect our natural resources and operate resourcefully is essential to sustained mission excellence.”

- Paul F. Zukunt, Admiral, US Coast Guard
  (Sustainability, Environmental & Energy Policy Statement)
### CG Facility Energy Costs – By the Numbers

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>FY2012</th>
<th>FY2013</th>
<th>FY2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cost</td>
<td>Usage</td>
<td>Cost</td>
</tr>
<tr>
<td>Electricity (kWh)</td>
<td>$36,466,256</td>
<td>388,308,276</td>
<td>$36,789,224</td>
</tr>
<tr>
<td>Natural Gas (DTh)</td>
<td>$4,834,400</td>
<td>602,976</td>
<td>$6,044,942</td>
</tr>
<tr>
<td>Propane (Gal)</td>
<td>$841,000</td>
<td>434,788</td>
<td>$1,022,960</td>
</tr>
<tr>
<td>Liquid Fuel - Shore (Gal)</td>
<td>$15,945,400</td>
<td>5,404,400</td>
<td>$6,841,704</td>
</tr>
<tr>
<td>Renewable Energy (MBTU)</td>
<td>$0</td>
<td>112,019</td>
<td>$0</td>
</tr>
<tr>
<td><strong>Total (MBTU)</strong></td>
<td><strong>$58,087,056</strong></td>
<td><strong>2,827,855</strong></td>
<td><strong>$50,698,830</strong></td>
</tr>
</tbody>
</table>
CG Facility Energy Costs – By the Numbers

Where
- Tactical
  - Boats: 5%
  - Aircraft: 30%
  - Cutters: 42%
- Shore
  - Mobile: 1%
  - Facilities: 23%

Type
- Tactical
  - Electricity: 5%
  - Liquid Fuels: 95%
- Shore
  - Renewable: 2%
  - Natural Gas/Propane: 30%
  - Liquid Fuel: 21%
  - Electricity: 46%
## CG Facility Energy Goals—By the Numbers

<table>
<thead>
<tr>
<th>Facility</th>
<th>FY14 Coast Guard Performance</th>
<th>FY14 Statutory Goal</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>35.6%</td>
<td>27%</td>
<td>The Coast Guard achieved a 35.6% reduction in facility energy intensity from baseline, exceeding the FY14 statutory goal by 8.6%.</td>
</tr>
<tr>
<td>Water</td>
<td>22.3%</td>
<td>14%</td>
<td>The Coast Guard achieved a 22.3% reduction in facility water intensity from baseline, exceeding the FY14 statutory goal by 8.3%.</td>
</tr>
<tr>
<td>Electricity</td>
<td>5.8%</td>
<td>7.5%</td>
<td>The Coast Guard used 5.8% of its total electricity from renewable sources.</td>
</tr>
<tr>
<td>Installation</td>
<td>100%</td>
<td>100%</td>
<td>The Coast Guard achieved 100% installation of advanced electricity meters, meeting the FY14 statutory requirement.</td>
</tr>
<tr>
<td>Building</td>
<td>100%</td>
<td>100%</td>
<td>Since 2007, all new Coast Guard building designs are 30% more energy-efficient than code. This achievement meets the FY14 statutory goal.</td>
</tr>
<tr>
<td>Scope 1-2 Emissions</td>
<td>32.1%</td>
<td>14%</td>
<td>The Coast Guard achieved a 32.1% reduction of Scope 1 and 2 Greenhouse Gas emissions from baseline, exceeding goals outlined for FY14 in the <em>Coast Guard Operational Sustainability Performance Plan</em> by 18.1%.</td>
</tr>
</tbody>
</table>
### CG Energy Projects – Past Alt. Financed

<table>
<thead>
<tr>
<th>Location</th>
<th>yr</th>
<th>Annual Savings (MBTU)</th>
<th>FY14 Use (MBTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG Academy D01/2</td>
<td>1998/2009</td>
<td>36,246</td>
<td>449,094</td>
</tr>
<tr>
<td>Base Kodiak DO1/2/3</td>
<td>1998-9/2007</td>
<td>122,437</td>
<td>697,875</td>
</tr>
<tr>
<td>Base Alameda</td>
<td>1999</td>
<td>6,241</td>
<td>29,172</td>
</tr>
<tr>
<td>Base E-City DO1/2/3</td>
<td>2000/7/15</td>
<td>23,027</td>
<td>330,132</td>
</tr>
<tr>
<td>Base Boston</td>
<td>2003</td>
<td>23,971</td>
<td>52,356</td>
</tr>
<tr>
<td>West Coast (9 Sites)</td>
<td>2007</td>
<td>28,158</td>
<td>&gt;94,627</td>
</tr>
<tr>
<td>CG Yard</td>
<td>2008</td>
<td>129,990</td>
<td>232,055</td>
</tr>
<tr>
<td>TRACEN Cape May TO1/2</td>
<td>2008-9</td>
<td>7,937</td>
<td>292,034</td>
</tr>
<tr>
<td>TRACEN Petaluma</td>
<td>2009/14</td>
<td>23,526</td>
<td>150,972</td>
</tr>
<tr>
<td>Sector NY</td>
<td>2010</td>
<td>31,279</td>
<td>&gt;44,215</td>
</tr>
<tr>
<td>TISCOM</td>
<td>2010</td>
<td>1,785</td>
<td>23,770</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>2011</td>
<td>31,208</td>
<td>78,108</td>
</tr>
<tr>
<td>Florida</td>
<td>2011</td>
<td>10,691</td>
<td>&gt;48,108</td>
</tr>
<tr>
<td>TRACEN Yorktown</td>
<td>2012</td>
<td>13,108</td>
<td>60,244</td>
</tr>
</tbody>
</table>
CG Energy Projects—Future Alt. Financed

- **Base Portsmouth UESC**
  - Target award Spring of 2015

- **CG Academy Performance Contract**
  - Kickoff in Spring 2015

- **Air Station Barbers Point**
  - Planning documents generated in FY14
  - FY16 funds earmarked

- **Base Cape Cod Solar Array**
  - Planning developed in FY14, but not signed

- **Squadron Level UESC**
  - Unsolicited Proposal submitted to DOE & FEMP in FY14
CG Energy Projects—Alt. Financed Clean-up

- CG Yard ESPC
  - Target award Summer of 2015

- CG Sector NY
  - Target award Winter of 2015
CG Energy Projects—Direct Financed

- $1.5M/yr Budget for ECM implementation
- ~$900K/yr Resource Efficiency Mgr Kt
- $2.5-$3.0M/yr Budget for RcX
- Utility Metering Initiative
CG Energy Projects—Metering/Utilities

- **Advanced Meter Initiative (AMI)**
  - $7.4M ARRA funded project awarded 9/2010 completed 9/2012
  - ~225 locations
  - ~270 Data Acquisition Servers
  - ~2,700 Acquisition Points, e.g. Meters

- **Lessons Learned**
  - Keys to Success
    - Connectivity
    - Data Management
    - Equipment Maint. Strategy
  - Plan, Plan, Plan
USCG Alameda Off Cycle Crew Building

- PLATINUM in 2015
- Roof mounted PV array
- Underground water collection – irrigation reuse
- 50% Water use reduction
- Window sun screens
USCG Station Fairport, OH

- SILVER in 2015
- Bio swales for runoff filtration
- 38% water use reduction
- 29% energy savings
- Daylighting opportunities
USCG Cleveland Boat Maintenance Annex

• GOLD in 2014
• Substantial Sustainable Sites & Indoor Environmental Quality Credits
• Water reduction & water efficient landscaping
Sea Level Rise – What’s the big deal?

[Sewells Point, VA] 4.44 +/- 0.27 mm/yr

Source: NOAA
Increased Sea Level = Increased Risk

• Hurricane Ike Tracker
  • Made Landfall Sep 13, 2008.
  • Coast Guard received $261M in Hurricane Supplemental Funding.

• Hurricane Katrina Tracker
  • Made Landfall Aug 29, 2005.
  • Coast Guard received $130M in Hurricane Supplemental Funding.
STA Marathon Housing

Station Marathon Family Housing

9 Units (3 Duplexes, 3 Single Units)

Pre-Cast Concrete Panels

Elevated above storm surge w/ Sacrificial Walls on the Ground Level

Impact Resistant Windows

Standing Seam Metal Roofs

Attained LEED Gold Certification
$16M - 26,000 square foot re-build of Station Gulfport, MS.

Station was completely destroyed by Hurricane Katrina
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- Hurricane Sandy Tracker
- Made Landfall Oct 29, 2012
- Coast Guard received $260.5M in Hurricane Supplemental Funding
- Affected 24 states

Based on damage assessment reports:
- Minor Damage
- Moderate Damage
- Severe Damage
Major flooding in almost all buildings, housing, and structures at DET Sandy Hook.

All electrical shore ties and associated cabling were compromised.

Severe loss of beach material & pavilion destroyed.

Entire waterfront left inoperable - all floating docks rose above the level of their piles and floated off.
STA Shark River (NJ) STA Bldg had 2+ feet of flooding in the multi-mission bldg, boathouse & housing.
Debris from the storm surge covered the parking lot.

Floating docks severely damaged and not attached to piles.

Waterfront completely compromised; no boat assets able to operate out of STA NY.

Bank erosion depicts how high water levels reached.
Reconstruction/Resiliency Strategies

- Hardening of shoreline erosion protection structures
- Critical infrastructure/spaces above 500-yr flood plain
- Relocatable components below 500-yr flood plain
- Taller guide piles for increased surge heights
- Structures designed to higher wind/flood velocity standards, etc. (break away walls, impact windows).
Questions?