A New PIANC Standard of Practice for Managing Environmental Risks of Navigation Infrastructure Projects

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34th PIANC World Congress
Panama City, Panama
May 2018

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PIANC WG 175: A Practical Guide to Environmental Risk Management (ERM) for Navigation Infrastructure Projects

Members:

- **Burton Suedel (US): Research Biologist**
- **Kevin Kane (AU): Senior Manager, Environment**
- **David Moore (US): Research Biologist**
- **Rebecca Gardner (NO; Representing CEDA): Principle Engineer**
- **John Lally (US): Coastal Engineer**
- **Captain Kevin Allen (IE): Belfast Harbor Master**
- **Miran Vanwonterghem (BE): Project Engineer**
- **Amy Parry (UK) (YP): Marine Scientist**

Objectives

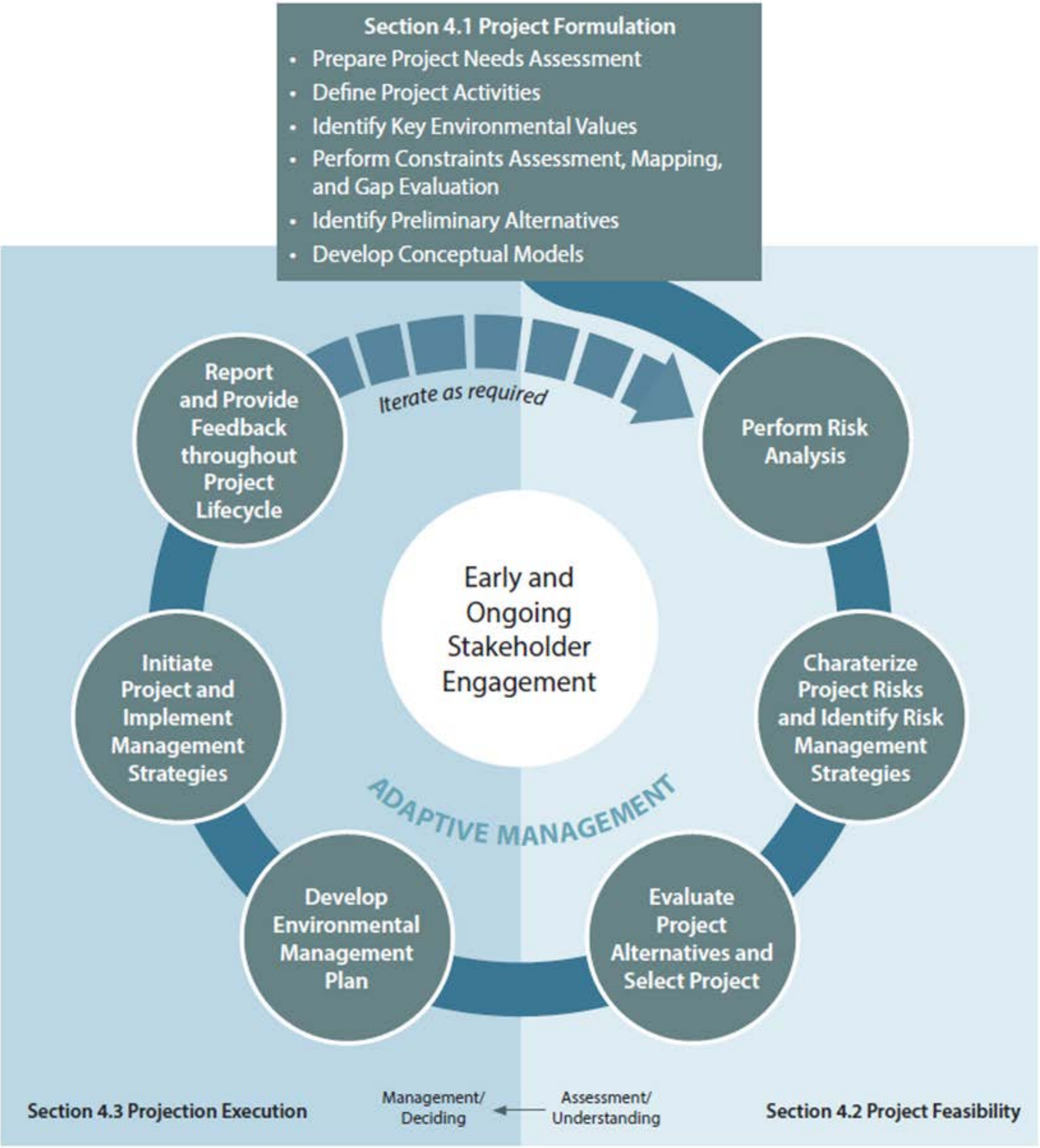
- Provide technical information to decision makers regarding the risk management process for waterborne infrastructure
- Provide a methodology to inform risk management decisions for the comprehensive range of environmental risks pertinent to waterborne infrastructure
- Provide a practical approach for managing effects of project components in the context of natural change in time and space, and the ability of environmental resources to recover from or compensate for damage
- Provide recent case studies
- Incorporate PIANC's Working with Nature philosophy

Environmental Risk Management

"The process of identifying, evaluating, selecting, and implementing actions to reduce risk to human health and to ecosystems. The goal of risk management is scientifically sound, cost-effective, integrated actions that reduce or prevent risks while taking into account social, cultural, ethical, political, and legal considerations."

Presidential/Congressional Commission
on Risk Assessment and Risk Management
(Omenn et al. 1997)

- Formulate project
- Perform risk assessments
- Characterize risks & identify risk management strategies
- Evaluate alternatives & select project
- Develop environmental management plan
- Initiate project and implement management strategies
- Reporting and feedback



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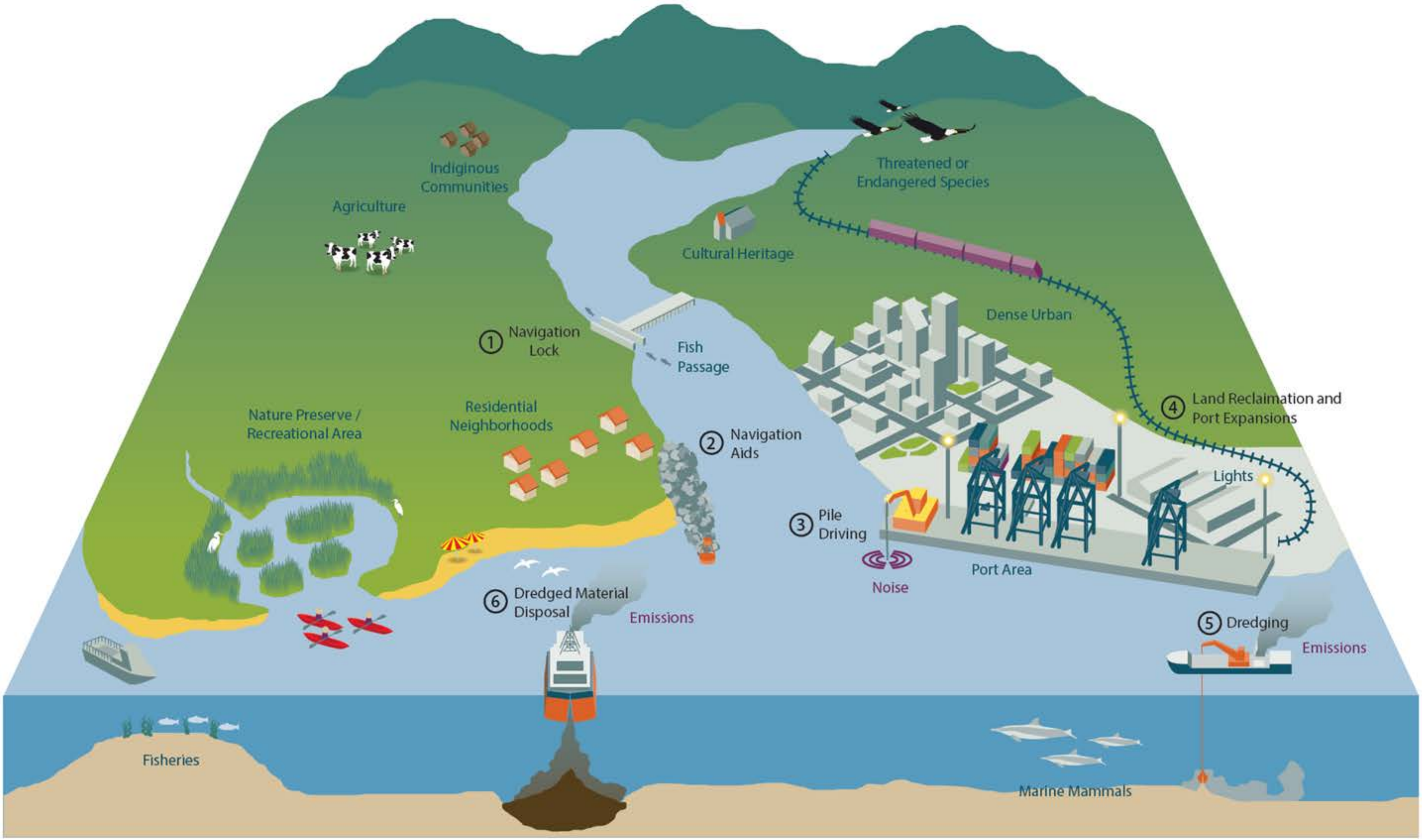
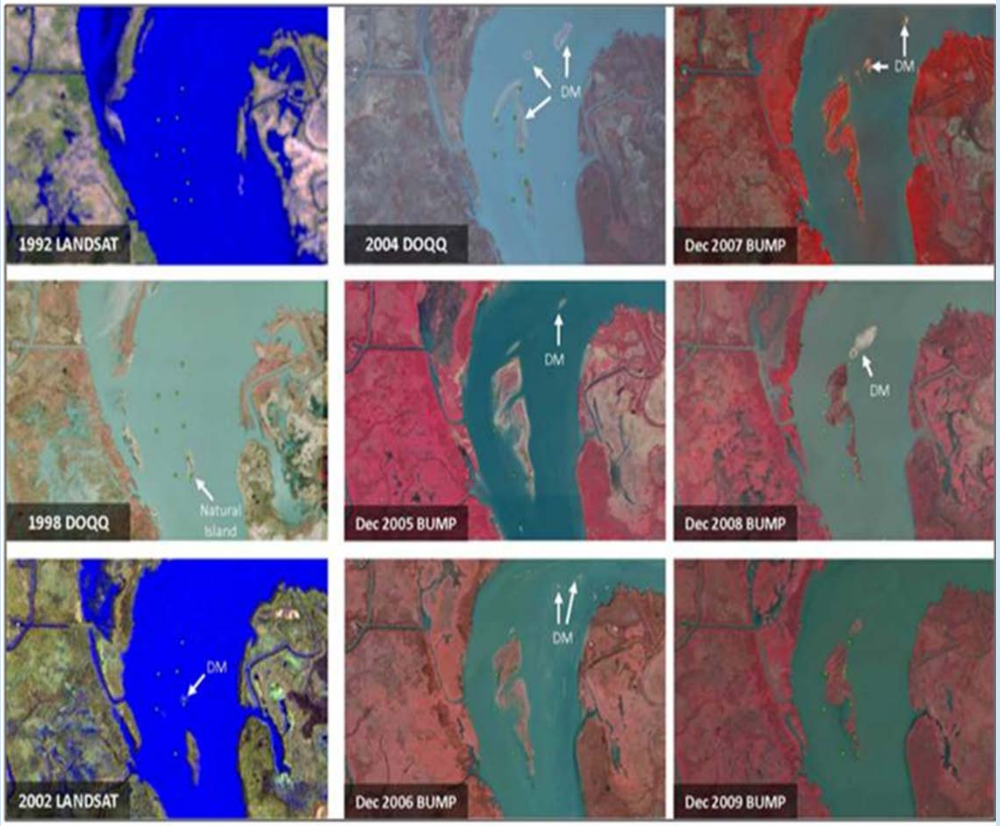
Conceptual Models



Working With Nature

- Promotes an integrated planning and design process
- Seeks to utilize the hydrodynamics of the ecosystem to produce desired effects
- Focuses on environmental aspects of the system to support project goals



The river island at Horseshoe Bend on the lower Atchafalaya River, Louisiana has self-designed by dredged sediment strategically placed upriver, allowing the river's energy to disperse the sediment, contributing to the island's growth, creating environmental and other benefits.

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Stakeholders

When managing environmental risks adaptively, engaging stakeholders early in the risk management process is crucial to achieving a common understanding of project uncertainties and opportunities, so that adjustments to project operating processes can be developed

Port of Long Beach, CA

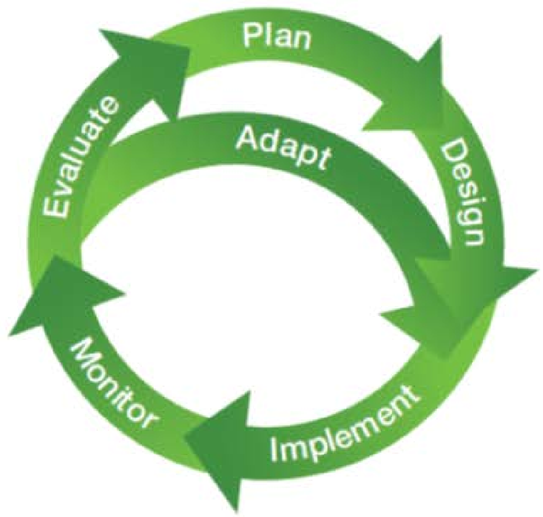
Uncertainty and Climate Change

Maritime navigation infrastructure may need to adapt to:	**Inland navigation infrastructure may need to adapt to:**
Increases in the frequency or severity of flooding	Increases in the frequency or severity of flooding or low flows/drought
Increased frequency of extreme wind, wave or storm conditions potentially exacerbated by sea level rise	Variations in estuarial or river current strengths
Changes in sediment transport, erosion and accretion	Changes in sediment transport, erosion and accretion
Potential for changes in fog characteristics or other visibility issues	Changes in seasonal precipitation
Increases in air and water temperature or changes in ocean chemistry	Increasing air and water temperatures
Changes in ice cover	Changes in icing and snowmelt characteristics

PIANC Navigating a Changing Climate: Action Plan of the PIANC Think Climate Coalition, November 2015; http://navclimate.pianc.org/about/action-plan

Adaptive Management

- AM enables a project with uncertainties relating to environmental impacts to proceed with a pre-negotiated monitoring and management plan to evaluate and mitigate actual effects on receptors, rather than design of a project with strict environmental thresholds



1. **Plan**: Defining the desired goals and objectives, evaluating alternative actions and selecting a preferred strategy with recognition of sources of uncertainty;
2. **Design**: Identifying or designing a flexible management action to address the challenge;
3. **Implement**: Implementing the selected action according to its design;
4. **Monitor**: Monitoring the results or outcomes of the management action;
5. **Evaluate**: Evaluating the system response in relation to specified goals and objectives; and
6. **Adapt**: Adapting (adjusting upward or downward) the action if necessary to achieve the stated goals and objectives.

CEDA 2015

Evaluation of Project Alternatives

- Multicriteria decision analysis
- Socio-economic cost benefit analysis
- Cost Efficiency Analysis
- Structured decision making
- Bayesian Networks

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Case Studies

Description of case studies communicating risk management principles and best practices addressing, for example resuspended sediments, the Working with Nature concept, climate change, and beneficial use of dredged material

- Dalrymple Bay Coal Terminal (DBCT), Queensland, Australia ‘Environmental Risk Management Measures’
- Port of Brisbane ‘Environmental Design for Land Reclamation Project Promoting Seagrass Growth’


DBCT, Queensland, AUS

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External Communications

WODCON XXI

June 2016, Miami, FL USA

ECO Magazine

June 2016

Case Study Example: River Training Structures

Blunt Nosed Chevrons at Miss. River Mile 266
USACE St. Louis District, Applied River Engineering Center

Problem

- Navigation channel alignment and sedimentation can be problematic to maintaining inland waterways
- River training structures (i.e., dikes) used to modify the hydraulic flow and sediment response to improve and/or restore the river for human and environmental benefit
- Dikes installed perpendicular to the bank line to help alleviate such issues
- Dikes created self maintaining navigation channels, but sedimentation occurred behind them, decreasing habitat diversity

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Stakeholder Engagement

- Multi-stakeholder team assembled to develop a robust site conceptual model to inform design, selection and construction of viable alternatives
- Representatives from navigation industry, local landowners, scientists and engineers from relevant regulatory and resource agencies
- Supported developing data collection program (e.g., high resolution multi-beam bathymetric surveys, acoustic doppler current profiles, fish collection, etc.) to inform conceptual site model, establish performance criteria and parameterize physical models for evaluation of proposed design alternatives.

A WwN Solution

Blunt Nosed Chevrons

- Reduce a continuous need to dredge
- Alleviate dangerous navigation conditions through several bridge crossings
- Support local facilities with shoaling problems
- Increase habitat diversity and support species restoration

Blunt Nose Chevron

Center section of chevron at lower elevation (e.g., notched)

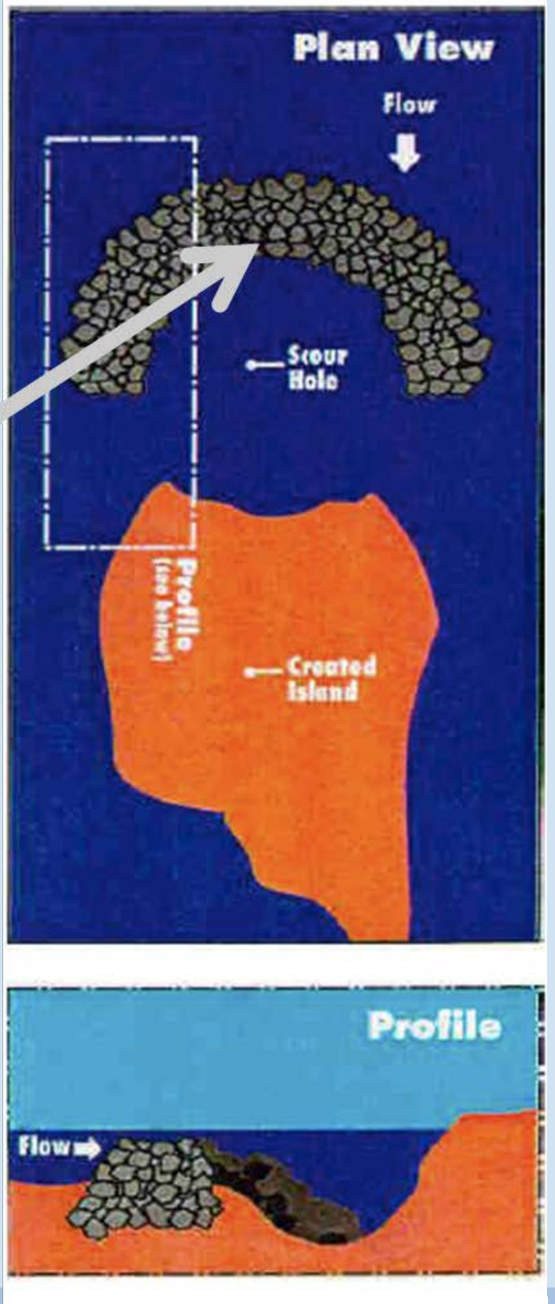

Figure 5.10. Blunt Nosed Chevron

Constructed Chevron Examples

Aerial view (looking upstream) of three chevrons at St. Louis Harbor. Note sand bar island, a habitat used by many wildlife species, created downstream from the middle and nearest chevron structures.

Aerial view of chevrons at Bolters Bar. Note sand bar islands created downstream from the chevron structures.

Aerial view of chevrons at Gilbert. Note sand bar islands created downstream from the chevron structures.

1998 DOQQ

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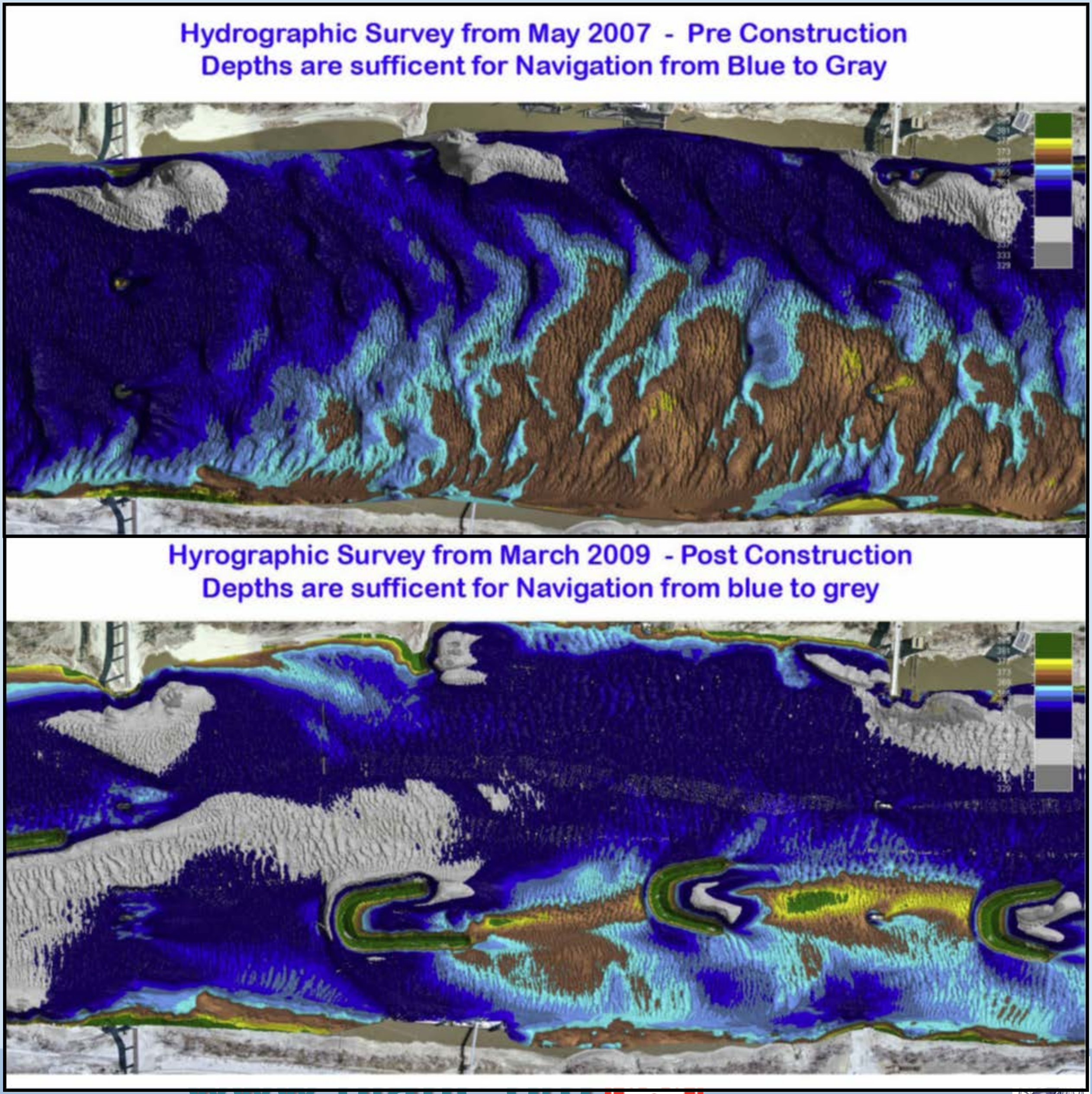
(All photos courtesy of USACE St. Louis District).

Blunt Nosed Chevrons at St. Louis Harbor

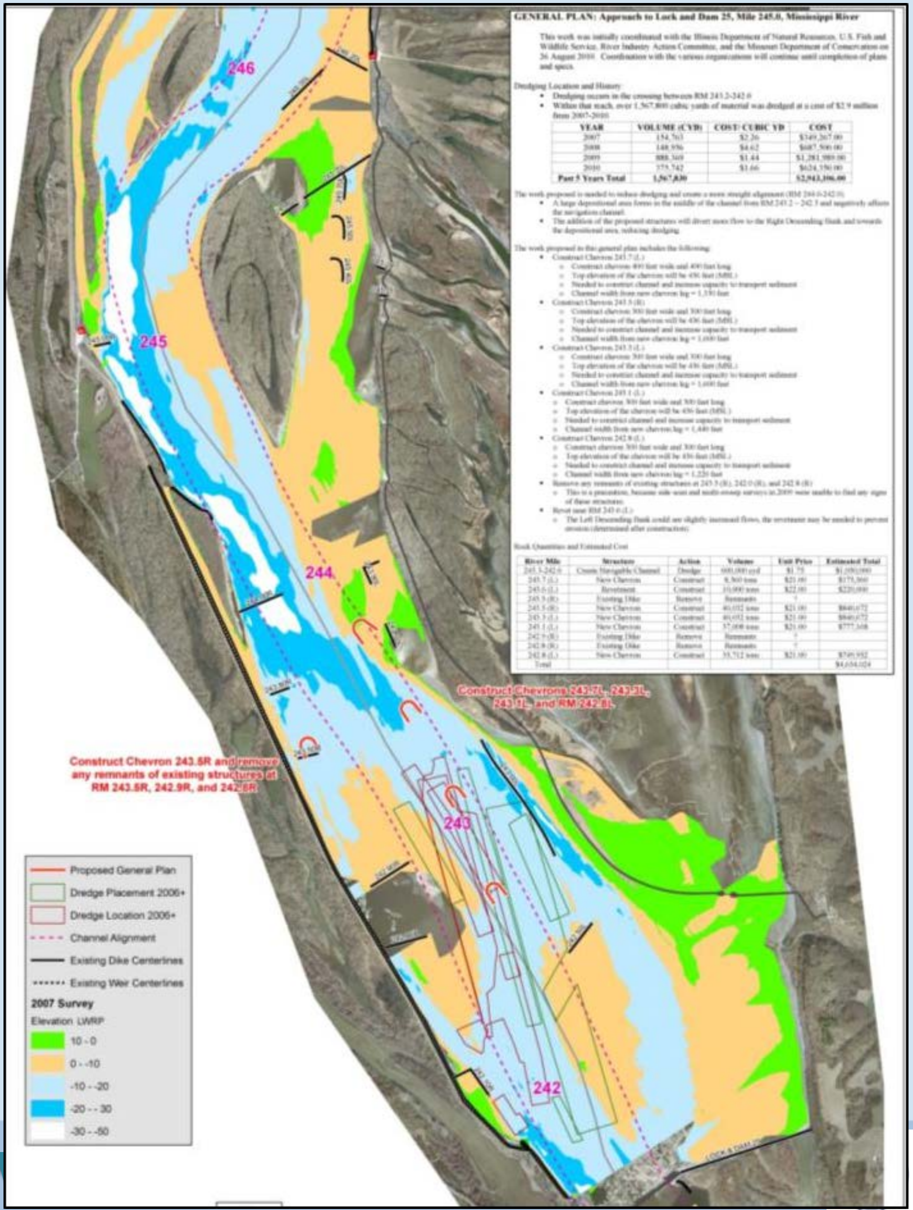
- Hydrographic Survey images from May 2007 before chevron construction and March 2009 after chevron construction
- By splitting the flow, deposition problems were greatly reduced in main channel and along bankline
- Due to the enhanced diversity of the river bed and increased habitat types created, number of species retrieved post-construction more than doubled pre-construction



USACE St. Louis District

Miss. River Lock & Dam 25 Approach

- Five LD 25 Approach Structures
  - Four Chevrons on LDB
  - One Chevron on RDB
- Constructed in FY13 for $3.2M
- Reduced repetitive dredging location
- Provided better alignment to the entrance of the lock chamber



Training Structures Benefits Summary

- Navigation: Improved channel
  - Decrease side channel conveyance
  - Increase main channel conveyance
- Economic: Reduced dredging requirements – lowered dredging costs
- Environmental: Created diverse riverine habitat
  - Invertebrates and fish
- Reduced navigation risk
  - Increased navigation safety

Take Away Points

- Effective waterways management practices are being implemented as part of maintenance dredging and navigation projects, consistent with WwN principles
- Communication essential to promote these good practices
- Lessons learned so innovative approaches can be more broadly applied
- Utilize nature's energy to achieve multiple benefits

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QUESTIONS?

Port of Oakland, CA