

# CLEAN & RESILIENT MARINA GUIDEBOOK

## VOLUME I



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## **ACKNOWLEDGEMENTS:**

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The *Clean and Resilient Marina Initiative* Task Force Members included representatives from the following State agencies: Florida Department of Environmental Protection; Florida Sea Grant Program; University of Florida - Department of Family, Youth and Community Sciences; Mississippi/Alabama Sea Grant Program; Auburn University's Marine Extension & Research Center; Mississippi Department of Marine Resources; Louisiana Department of Natural Resources; Louisiana Sea Grant Law & Policy Program; and Texas Sea Grant Program. The Working Task Force Members were instrumental in the success of the development of the *Clean and Resilient Marina Initiative* deliverables and provided their guidance, review and outreach throughout the project. The Working Task Force Members included: Rhonda Price, Brenda Leonard, Mike Spranger, Christian Miller, Tracie Sempier, Dewayne Hollin, Logan Respess, Linda Pace, Jon Truxillo and Melissa Daigle. Appreciation for the Eco-Systems, Inc. (Eco-Systems) project team is also expressed. Eco-Systems' team members include Melissa Pringle, Jay Estes, Kimberly Miller, Courtney Vanderschaaf, and Paul Lanning.

Finally, we want to thank the marina owners and operators who participated in the initial survey and helped us understand how to write this guidebook to contribute to a safer marina operation prepared to prosper in good times but also ready to meet the challenging environment of our beautiful Gulf of Mexico.

# INTRODUCTION



Louisiana Clean Marina  
South Shore Harbor Marina  
6701 Stars and Stripes Blvd.  
New Orleans, LA 70126

# I.0

## INTRODUCTION TO THE GULF OF MEXICO ALLIANCE'S CLEAN & RESILIENT MARINA GUIDEBOOK

Resilience is the capacity of humans and natural systems to adapt to and recover from change. For marinas on the Gulf of Mexico directly exposed to tropical storms, flooding and land loss, being resilient means being able to reduce damage and resume business even in the face of many hazards. This *Clean and Resilient Marina Guidebook* is a project of the Gulf of Mexico Alliance (GOMA), who made it a priority to help the marine and boating businesses in the five Gulf States survive even in harsh conditions. Although the geographic and environmental conditions in each state are unique, the Gulf of Mexico States share the common concern of providing marina operators and owners with new strategies to design, develop and manage marinas that can resume operations quickly after a storm.

### 1.1 BACKGROUND

GOMA is a multi-state partnership between Alabama, Florida, Louisiana, Mississippi, and Texas. GOMA was established to increase regional collaboration on the ecological and economic health of the Gulf of Mexico. To that end, GOMA created six Priority Issue Teams (PITs) to address regionally significant issues and involve local, state, and federal stakeholders. The Teams are as follows:

- o Coastal Community Resilience,
- o Water Quality,
- o Habitat Conservation and Restoration,
- o Ecosystem Integration and Assessment,
- o Nutrients & Nutrient Impacts, and
- o Environmental Education.

The Clean and Resilient Marina Initiative was born from the Coastal Community Resilience Team and became part the Gulf of Mexico Alliance's Governors' Action Plan. The initiative calls for the "promotion and expansion of resilient and environmentally responsible operations and best management practices at marinas". This guidebook builds on existing Clean Marina Programs in all five states to promote marinas that can bounce back quickly from both natural and man-made disasters. Marinas that are already certified Clean Marinas can follow the checklist and resources in this Guidebook to become certified as Clean and Resilient Marinas.

### 1.2 GOAL OF RESILIENT MARINA GUIDEBOOK

The goal of the *Clean and Resilient Marina Guidebook* is to provide uniform standards for the resiliency of marinas across the Gulf's coastal States and to complement existing Clean Marina Programs in these states. A Resilient Marina Task Force was developed with members representing State coastal zone management programs as well as Sea Grant universities from each of the participating GOMA states. The task force members served diligently to develop a guidebook for new, developing, or redeveloping marinas to reference to achieve an extra level of resiliency, sustainability, and environmental responsibility.

The *Clean and Resilient Marina Guidebook* focuses on the following key issues facing marinas: 1) Marina Design and Siting, 2) Emergency Preparedness, 3) Marina Evacuations, 4) Stormwater Management and Erosion Control, 5) Climate Adaptation, and 6) Education and Outreach. In addition, an example Hurricane Preparedness Plan is provided.

## **1.3** INVALUABLE INPUT FROM MARINA OPERATORS

The Resilient Marina Task Force made it a priority to gather information from marina operators and owners who will use this *Clean and Resilient Marina Guidebook*. A survey was created and distributed to marina operators and owners across the five Gulf of Mexico States. The information gathered was invaluable in creating this guidebook and guided the Task Force in the topics included. For the survey response summary, please see the **Appendix A** section located in *Volume II of this guidebook*.

## **1.4** EXISTING CLEAN MARINA PROGRAMS IN EACH OF THE FIVE GOMA STATES

### Alabama

Alabama's Clean Marina Program is closely tied with Mississippi's and managed through the Mississippi- Alabama Sea Grant. There are five certified clean marinas registered in the program. Maps depicting these clean marinas and all other marinas in Alabama, as well as the checklist for certification, are provided in the **Appendix A** located in *Volume II of this guidebook*. In addition, other documents such as the *Clean Marina Guidebook* for Mississippi and Alabama can be found at <http://www.masgc.org>.

### Florida

Florida's Department of Environmental Protection maintains approximately 250 designated Clean Marinas, 38 Clean Boatyards and 16 Clean Retailers throughout the state. The Florida Clean Marina Program boasts a manual, strategies and techniques to promote Clean Marinas, boatyards and retailers, as well as promotion of clean boating practices. Maps depicting Florida's marinas and a Marina Checklist for Florida can be found in the **Appendix A** located in *Volume II of this guidebook*. Other useful Florida resources can be found at <http://www.dep.state.fl.us/cleanmarina>.

### Louisiana

Louisiana's Clean Marina Program is managed by the Department of Natural Resource's (DNR's), Office of Coastal Management. Currently, the state has 12 certified Clean Marinas (maps depicting location of marinas is provided in the Introduction Appendix located in Volume II). The Louisiana Clean Marina Program maintains a checklist (See **Appendix A** in *Volume II of this guidebook*) and other useful information such as a guidebook, action plan, and recognition program. Details can be found at <http://dnr.louisiana.gov>, and DNR cooperates closely with Louisiana State University (LSU) Sea Grant to maintain standards for the program.

## **Mississippi**

The Mississippi Department of Marine Resources (DMR) in conjunction with Alabama-Mississippi Sea Grant, manages the Clean Marina Program in Mississippi. Approximately 90% of the state's coastal marinas were lost during Hurricane Katrina, and many were certified Clean Marinas. Currently, six marinas pledged to enroll in the program (a map depicting location of marinas is provided in the **Appendix A** located in *Volume II*). The DMR utilizes a Clean Marina checklist (provided in the **Appendix A** located in *Volume II*) and maintains a guidance manual and other useful resources (<http://www.masgc.org/cleanmarinas/resources.htm>). The DMR also has a well-developed GIS marina database with GPS coordinates, and they also track the location of all pump-out stations. The program has successfully tied Clean Marina certification to funding sources and has found this a successful strategy to encourage participation.

## **Texas**

The Texas Clean Marina program was established in 2000 and is managed with the cooperation of the Marina Association of Texas, Texas Sea Grant College Program, Texas Commission on Environmental Quality, and Texas Parks and Wildlife Department. There are currently 25 coastal marinas certified as "Clean Marinas" and 9 pledges from marinas interested in being certified. A map depicting locations of marinas is provided in the **Appendix A** located in *Volume II of this guidebook*. Program materials can be found at <http://cleanmarinas.org> and include a guidance manual, pledge form, testimonials, vessel maintenance information, and stormwater management information applicable at the state and federal levels. In addition, the state utilizes a Clean Marina Checklist which can also be found in the **Appendix A** located in *Volume II of this guidebook*.

## **1.5 APPENDICES TO THE GUIDEBOOK PROVIDED AS VOLUME II**

The Appendices have been developed and provided to complement the *Clean and Resilient Marina Guidebook*. The Appendices are located in *Volume II* of the *Clean and Resilient Marina Guidebook* and structured in the same order as the chapters in the *Clean and Resilient Marina Guidebook*. The references and resources provided in *Volume II* include the following:

- Appendix A: Introduction
- Appendix B: Marina Design and Siting
- Appendix C: Emergency Preparedness
- Appendix D: Evacuation Procedures
- Appendix E: Stormwater Management and Erosion Controls
- Appendix F: Climate Adaptation and Sea Level Rise
- Appendix G: Outreach and Education for Marina Operators and Boaters

# MARINA DESIGN & SITING



## 2.0 MARINA DESIGN & SITING

Marinas are some of the Gulf Coast region's most at-risk facilities because of their location on the water. They are vulnerable to high winds of hurricanes and tornados, as well as storm surge and coastal erosion. With sound siting, design and construction methods, owners and operators can minimize damage to onshore facilities, docks and boats harbored at the marina. Design and construction of even the smallest marina is complex, and requires in-depth knowledge of the planned site, and long-term data about the area's climate and geography. Licensed design professionals experienced in marina planning, design, and construction should be involved in engineering and design to ensure the marina and its tenants are resilient to the stresses of high winds and water. The combined natural forces acting upon a marina during heavy storms and on a daily basis depend heavily on a number of factors addressed in this section. Design solutions should draw upon history at the site, but with the onset of more severe storms of damaging force, the need for guidance in marina design has never been greater.<sup>(1)</sup>

The goal of design standards employed at a Resilient Marina should be to:

1. Protect Human Life & Safety,
2. Reduce the Exposure of Landside and Waterside Facilities from Damage,
3. Minimize Damage to Property That Cannot Be Relocated, and
4. Seek To Restore Normal Operations As Quickly As Possible.

### 2.1 RISKS TO RESILIENCE

There are a number of structural threats posed by hurricanes and tropical storms that affect how resilient a marina will be to a major event.

- Hurricane and tropical storm-prone areas are subject to storm surge and marinas must be designed to withstand maximum projected structural stresses. Materials selected for docks and permanent structures should be both sturdy and flood resistant.<sup>(2)</sup>
- Storm surge raises the water level far above normal high tide, cutting off roads, forcing evacuation, submerging docks, and lifting boats above their docks and pilings.
- Hurricanes also create the potential for extreme wind conditions. As wind speed doubles, wind pressure quadruples.
- Improperly secured boats in wet and dry docks can break free from their moorings, causing additional damage to other boats, docks and landside structures.
- Boats may sink when deck drains and bilge pumps are overwhelmed by high volumes of water.
- Wave heights are elevated during a hurricane due to wind and storm surge. As the surge submerges natural and man-made protective barriers, it extends the fetch, or the distance over which wind can generate waves.

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1. Hurricane Preparedness Guidelines for Marinas. (FEMA for the Coastal Soil and Water Conservation District and the Coastal Georgia Resource Conservation and Development Council. June 2002.)

2. BoatU.S. Marine Insurance Damage Avoidance Program. p 2

## 2.2 CHALLENGES TO ADDRESS

### 2.2.1 LOCATION AND SITING

Small craft marinas should be located in a sheltered harbor whenever possible. The following considerations apply for planning a new facility's location.

- Protection from Winds, Waves and Currents,
- Sufficient Land and Water Area,
- Proximity to Upland Portion of Marina,
- Adequate Water Depths,
- Limited Exposure to Sedimentation and Shoaling, and
- Few Potential Environmental Concerns.

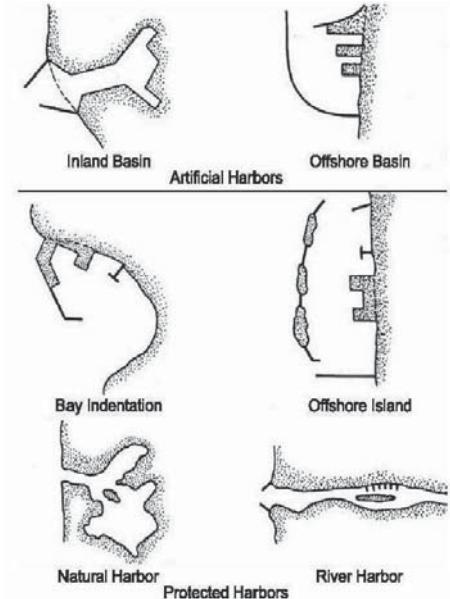
In addition to providing shelter, the most desirable sites are those requiring minimal excavation, dredge, fill, breakwater construction and disturbance of sensitive habitats.<sup>(3)</sup> Additional consideration with respect to location and siting of new facilities are as follows:

- Since locations can vary significantly along the coastal region, there is no "one-size fits all" answer to design and construction.
- A soil stability, or geotechnical, assessment of the marina site should be conducted before selecting layout design.
- Availability of appropriate sites for new marina construction is limited and hazard safety should play a major factor in site selection.
- Sites that require minimal dredging to maintain the navigational channel should be given top priority.
- Infrastructure such as roads, electricity and plumbing must be available or easily connected to the site.
- Marshland, wetland and natural habitats can blunt the effects of storm surge and flooding, but only if the operator takes care to minimize erosion and the runoff of polluted stormwater on these natural resources.
- Armoring the shoreline with hardened bulkheads provides protection, but may cause erosion downstream, either at the facility or on nearby properties.<sup>(4)</sup>

### 2.2.2 DESIGN STANDARDS FOR WATER- AND LAND-BASED STRUCTURES

Whether constructing a new marina or retrofitting an existing facility for greater resiliency, registered engineers with marine experience should be directly involved in the design process. While the dock manufacturers' literature provides useful information about specifications, it is too frequently used as the primary resource to predict the impact of a hazard event on a specific marina. For existing marinas, structure age of berthing and on-land facilities are the most likely determinant of the facility's ability to withstand storm forces.

The following design challenges<sup>(5)</sup> should be considered during the original process of harbor



*Small Site Harbor Classifications*

Source: U.S. DOD - Small craft Berthing Facilities

3. U.S. Department of Defense. UNIFIED FACILITIES CRITERIA (UFC) DESIGN: SMALL CRAFT BERTHING FACILITIES. UFC-4-152-07, 14 JULY 2009 – Modified September 1, 2012 (Chaps 3,4,6) - [http://www.wbdg.org/ccb/DOD/UFC/ufc\\_4\\_152\\_07.pdf](http://www.wbdg.org/ccb/DOD/UFC/ufc_4_152_07.pdf)

4. Hurricane Preparedness Guidelines for Marinas. p 16

5. Hurricane Preparedness Guidelines for Marinas. p 16

design, berthing system siting and layout, and land-based structure design as well as during any improvements to promote greater resiliency.

- Water and land-based structures are regulated by different standards, entities and permitting processes.
- Harbor and berthing entrance channels require ample room for entrance and maneuvering of vessels, while also considering wind direction and prevailing currents.
- The dimensions of internal navigation channels and berths will vary based on anticipated craft size and length.
- Wind loads on wet and dry storage facilities will vary by day and by season, with maximum winds during hurricanes.
- Wave force will vary by day and by season, with maximum wave frequency and force during hurricanes.
- Sediment transport patterns affect the need for dredging and long-term economic and environmental viability.<sup>(6)</sup>
- The design should provide for periodic repair and maintenance of facility and channel.
- Low-lying structures may need to be removed or rebuilt in the event of heavy storm surge or permanent elevation in sea levels.<sup>(7)</sup>

Marinas can ensure continued resiliency by planning structural upgrades based upon the expected useful life of pilings, decking and other materials.

## 2.2.3 MATERIALS SELECTION

There are many structures that make up a marina, on land and in the water. Water-based facilities include berthing docks, walkways and perhaps boat repair and refueling facilities; while landside facilities may offer a combination of marina stores and offices, bait shops and restaurants. Materials with the highest demonstrated resistance to environmental stresses should be chosen for all structures, whether on water or on land. Selecting the appropriate materials to meet a marina's needs is challenging process and should take into account the following factors:

- Soil type and stability provide a good indicator of the most appropriate materials for structural support.
- Many commonly used construction materials are unsuitable at marinas. For example, untreated wood pilings and deck surfaces are quick to decay, and metal surfaces without proper coatings may rust when exposed to water and salt spray.<sup>(8)</sup>
- Storm surge may submerge water and land-based structures several times over the course of their useful life, Materials must be able to withstand prolonged exposure to water.
- Structural supports may be required to be flexible in some circumstances, where rigid materials are preferable for other locations.<sup>(9)</sup>



Pensacola Florida - Bayou Chico Marina



San Diego, California Chula Vista Marina

6. U.S. Department of Defense. UNIFIED FACILITIES CRITERIA (UFC) DESIGN: SMALL CRAFT BERTHING FACILITIES.

7. Belize Department of the Environment. National Environmental Guidelines for Marinas, <http://www.doe.gov.bz/documents/Marina%20Guidelines.pdf> , Accessed 9/4/12

8. FEMA Technical Bulletin 2-93

9. U.S. Department of Defense. UNIFIED FACILITIES CRITERIA (UFC) DESIGN: SMALL CRAFT BERTHING FACILITIES.

The anticipated resilience and life span of materials for water and land-based construction will be discussed in greater detail later in this section.

#### **2.2.4 BOAT STORAGE**

Many marinas on the Gulf Coast offer boaters a combination of both wet and dry slip storage. While some dry storage facilities are exposed racks, others are enclosed structures designed to increase a boat's resiliency in the event of a hurricane. Points to consider include:

- Wet slips are not the ideal location for storage during a major storm, and often fail to meet the location's wind speed and wave forces.
- Some boats in wet slips will remain in the harbor regardless of evacuation policy.
- Adequate facilities for tie-downs and anchoring should exist at each wet slip.
- Generally, older framing and support structures are less resilient.
- Many older dry storage racks may not have been designed for high wind velocity.
- Heavy structural loads in dry boat storage require suitable foundations for anchoring.

#### **2.2.5 PROTECTING SENSITIVE AREAS**

The loss of habitat and vegetation in coastal areas is not only harmful to the environment; it can also result in damages to the marina itself. Marsh and wetlands provide natural shelter from coastal wave forces. Erosion resulting from the loss of natural habitat can also undermine the strength and resiliency of docks, anchoring mechanisms and other facilities. Some challenges to maintaining an active marina operation while protecting the environment are listed below.

- Where possible, avoid a dock system layout that casts shadow over the water, which could result in lower quality habitat for grasses and marine life
- Follow United States Corps of Engineers (USACE) procedures for National Oceanic and Atmospheric Administration (NOAA) managed marine sanctuaries, marine monuments, and National Estuarine Research Reserves.
- Discharges of dredged or fill material must take place in a designated site to prevent environmental damage.<sup>(10)</sup>
- Protect marshland habitats from vegetation loss.
- Natural shoreline protection procedures may require more maintenance, but often have fewer side effects than a hard shoreline.<sup>(11)</sup>

Landscaping strategies that use aquatic plants to reduce erosion and filter stormwater pollution, also known as Living Shorelines, are discussed in greater depth in the Stormwater Management Section.

### **2.3 BEST MANAGEMENT PRACTICES**

After experiencing the devastating hurricanes of the last decade, many Gulf Coast marinas have upgraded to promote greater resiliency in the face of higher levels of risk. Other marinas built after hurricanes Katrina, Rita and Gustav engineered their facilities to withstand these landmark storms or an even higher standard. Best management practices are available from a number of

10. U.S. Army Corps of Engineers. Nationwide Permit, 2012.

11. Warren Pinnacle Consulting for GOMA. Application of the Sea Level Affecting Marshes Model (SLAMM 6) to the Mississippi Sand Hill Crane NWR.

## SITING & DESIGN PROFILE: PELICAN'S REST MARINA

### Galveston, Texas, Offsets Bayou

After Hurricane Ike struck the Texas Gulf Coast in 2008, the designers of Pelican's Bayou employed several lessons learned at this marina. The first phase was completed in 2011, and offers 33 wet slips and lay-tos for up to 40 boats. Site selection considered the marina's sheltered location behind the seawall, deep water access that offers up to an 18 foot draft for larger boats and relatively modest needs for regular dredging.

Pelican's Rest offers a floating dock system composed of concrete panels. The material was selected because it will not bend when exposed to heavy surge and winds. Panels are cabled together, and the marina is surrounded by a floating breakwater system of the same modules used for the docks. Engineers worked closely with FEMA to determine piling height based on calculations of maximum storm surge. They added in two additional feet of freeboard for unexpected events. The City of Galveston was very involved in layout and design and issued building permits for sanitary facilities, parking and landscaping.

The marina is currently obtaining a permit for a restaurant and office on the land side, with the lower level designed as breakaway structure that can collapse during storm surge to preserve the elevated foundation. A second phase is planned to include an additional 70 boats.

*Source: Interview with Marcus Michna, President, Shelmark Engineering & Design Engineer for Pelican's Rest Bayou*

sources. Federal agencies like FEMA, the Department of Defense and the Army Corps of Engineers provide design guidance on increasing resiliency. At the regional and state level, the Gulf of Mexico Alliance, Coastal Zone Management agencies, and State Sea Grant Programs provide references on challenges faced by the marinas they serve. National boating organizations such as BoatUS offer valuable industry perspectives on risk prevention and materials and practices that perform under pressure. For marinas wishing to pursue improvements under their original plan without an expansion of the area or slip count, the Army Corps of Engineers offers two options under their nationwide permit (NWP): Modifications of Existing Marinas and Maintenance Dredging of Existing Basins.<sup>(12)</sup> Best practices at individual marinas are also valuable sources of information, such as the hurricane adaptation strategy adopted by Long Beach, Mississippi, that includes making the marina's bait shop transportable so that it can be relocated when storms approach.<sup>(13)</sup>

### 2.3.1 LOCATION AND SITING

- When possible, select areas for marina construction with a protected harbor.
- Focus landside construction in upland areas that are less prone to flooding.
- Follow natural navigation channels.
- Ensure the harbor entrance is aligned with the channel to provide the shortest path from the harbor to open water.
- Align the channel to account for prevailing winds, waves, and currents.
- Design the marina and its protective structures so as to minimize the need for dredging.<sup>(14)</sup>
- Examine the particulars of the marina's location, elevation and available equipment to determine if boats need to be moved to a safe harbor during storms.
- Locate marinas in coves or a bay when possible or behind reefs and natural breakwaters to offer natural protection from breaking seas.<sup>(15)</sup>

12. U.S. Army Corps of Engineers. Nationwide Permit, 2012.

13. Conversation with William Angley, Harbor Master Long Beach, Mississippi Marina

14. U.S. Department of Defense. UNIFIED FACILITIES CRITERIA (UFC) DESIGN: SMALL CRAFT BERTHING FACILITIES.

15. Hurricane Preparedness Guidelines for Marinas.

## 2.3.2 DESIGN STANDARDS FOR WATER- AND LAND-BASED STRUCTURES

The first step to determining the best design and materials is knowing the specifics about the soil type and stability of the marina location, as well as the maximum potential forces of wind and water (including wave force) on the marina's water and land facilities. More specific guidance about calculating these forces is found in the *Volume II Appendices* to this guidebook. Any new design or upgrade to existing facilities should also take into account the impact of past storms at the marina location. This information which can be found at NOAA's National Climatic Data Center. Some advantages of floating versus fixed docks are discussed below. Construction of structures on land will benefit from consulting FEMA's Informational Bulletins, also referenced below. Regardless of the berthing system and landside layout of the marina, a licensed design professional with extensive marine industry experience should review and stamp all drawings and specifications.

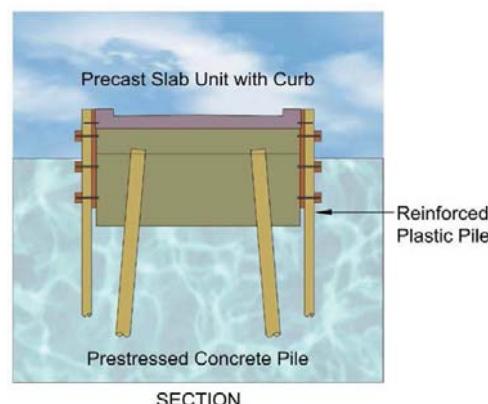
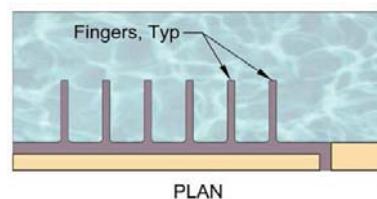
### 2.3.2.1 PRE-DESIGN OR UPGRADE CONSIDERATION

- Wind and wave protection are the most critical elements from an engineering standpoint.
- Calculate fetch at the site, remember the larger the fetch window, the greater the wave exposure.
- Plan land or water structures to withstand normal water pressure as well as increased pressure expected during storm events. (see *Volume II Appendices* for more information on calculating pressure on structures)
  - $Ph=wH$ ,
  - Where  $Ph$  = pressure in pounds per square foot,
  - $w$  = specific weight of water, 62.4 pounds per cubic foot, and
  - $H$  = depth from the surface of the water to the location in question.<sup>(16)</sup>

### 2.3.2.2 BERTHING FACILITIES

Fixed docks are susceptible to vertical and lateral forces from wind and wave. Marinas should consider the following:

- Provide wide slips wherever possible as boats in narrow slips are more vulnerable than boats in wider slips due to proximity of pilings, and
- Use longer tie-down lines to accommodate rise and fall of boats.



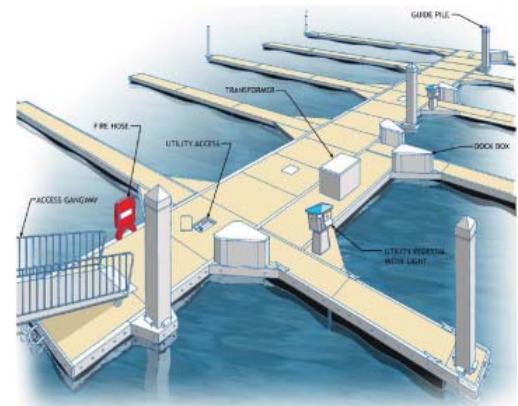
Typical Fixed Finger Pier

Source: DOD - Small craft Berthing Facilities

16. FEMA. FIA TECHNICAL BULLETIN 1-93.

Floating docks are susceptible to horizontal forces of wind, waves, and the weight of boats. Marinas should consider the following:

- Size pilings to accommodate potential storm surge associated with past tropical storms and hurricanes at the location (as much as 16-18 feet above sea level, depending on historical storm surge elevation).
- Floating docks may cost substantially more than wooden docks.



*Floating Dock System*

*Source: DOD - Small craft Berthing Facilities*

### 2.3.2.3 LANDSIDE FACILITIES

Marinas should consider the following for landside facilities:

- Construct all structures to International Building Code standards for Hurricane Resistance
- Buildings not built to withstand hurricane force winds or prolonged exposure to floodwater should be removed during hurricanes and tropical storms
- Elevate buildings such as offices and bait shops based on FEMA's base flood elevation.
- Utilize flood-resistant building materials (outlined in FEMA's Technical Bulletin 2-93).

### 2.3.3 MATERIALS SELECTION

Marina construction materials can include steel, concrete, aluminum, timber, fiberglass, or a combination of the above. For maximum resiliency, selection factors should prioritize strength and durability. If the most durable materials cannot be used because of cost concerns, a long-term maintenance and replacement plan can improve the resiliency of the marina facility. Landside construction should also consider the flood resistance of materials used in interiors and in roofing. FEMA provides additional information on floodproof materials<sup>(17)</sup>, floodproofing and breakaway walls for landside structures in Technical Advisory Bulletins FIA TB-3-4/93<sup>(18)</sup>, and FIA TB-9-9/99, which can be found in *Volume II Appendices*.<sup>(19)</sup> Materials highlights are as follows:

- Wood is susceptible to lateral and vertical stresses as floating docks rise.
- Concrete has a 30-50 year life span.
- Spun Concrete is 20% stronger than conventional concrete.
- Steel has a 30-50 year life span requires some maintenance.
- Fiberglass can last up to 300 years.
- All hardware in a marina environment should be hot dip galvanized or stainless steel.

### 2.3.4 BOAT STORAGE

There are a number of different options for storing boats during a hurricane. Generally, evacuation is considered the most resilient practice. However, there are several structural and

17. FEMA. FIA TB-1

18. FEMA. Non-Residential Floodproofing — Requirements and Certification for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program. FIA TB-3 4/93.

19. FEMA. Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings In accordance with the National Flood Insurance Program. FIA TB-9, 9/99.

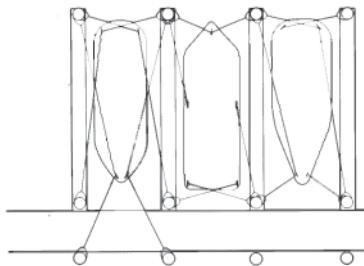
operational strategies for storage on water or land that may reduce damages during a major storm. The Texas Sea Grant Program's document, Protecting Your Boat against Severe Weather, is a helpful resource included in the *Volume II Appendices* to this guidebook. The document provides information on ways to limit damage and business interruption and highlights the importance of marina owners having an effective program to communicate their expectations about bad weather boat storage to staff and boaters. Suggestions for stronger structures and good emergency preparation materials are included below.

### 2.3.4.1 MOORING & TIE DOWNS IN WET SLIPS

Marinas should consider the following for mooring and tie down in wet slips:

- Educate staff on appropriate tie down methods.
- Double all lines.
- Attach lines high on pilings to allow for tidal rise or surge.
- Make sure lines will not slip off pilings.
- Inspect pilings and choose those that seem strongest and tallest and are properly installed.
- Cover all lines at rough points to prevent chafing. Wrap with tape, rags and rubber hoses, etc.
- Install fenders to protect the boat from rubbing against the pier, pilings and other boats.
- Monitor the tide and storm, if possible, and adjust lines as circumstances change. Make allowances for rising and falling tides.<sup>(20)</sup>
- Longer Nylon lines stretch and absorb shock and work best for boats in the water.<sup>(21)</sup>
- Have a plan in place for abandoned boats.

**Figure 5**



**STORM MOORING EXAMPLES**  
Four lines plus four spring lines is the best method. Mooring lines should span as far as possible. Lines may span to piling on other slip provided your neighbor does the same. Spider web method will work only if all boats use the same method. Use chaffing gear.

### 2.3.4.2 SECURING BOATS ASHORE

Marinas should consider the following for securing boats ashore:

- Helical Anchors: Four-foot anchors with round eyes that screw into the ground. Effectiveness is dependent on strength/density of soil. They are easily installed, inexpensive, and strong, but in heavy rains may lose holding power.
- Eyes Embedded in Concrete Pavement: Tremendous holding power, but expensive if not pouring concrete foundation from scratch.
- Chain and Eyes Embedded in Concrete Runners:
  - o Anchor boats ashore using long concrete runners (2') wide set into dirt, sand, or gravel parking lot.
  - o Anchored with two-inch nylon straps, boats secured to lengths of  $\frac{1}{2}$ -inch chains embedded

20. Dewayne Hollin for Texas Sea Grant College Program, Texas A&M University. Protecting Your Boat Against Severe Weather. TAMU-SG-84-511(r) 3M April 2006. NA16RG1078. A/F-4. <http://texas-sea-grant.tamu.edu>

21. BoatU.S. Marine Insurance Damage Avoidance Program. The Boater's Guide to Preparing Boats & Marinas For Hurricanes. <http://www.boatus.com/hurricanes/assets/pdf/Hurricane Warning.pdf>

- in concrete.
- o Quicker to install and less expensive than concrete pavement, and tremendous holding power.
- o Keel blocking may sink in mud causing the boat to shift, but can be corrected with gravel supports beneath the keel.
- On shore, a tie-down at mid-ship is preferred.
- Polyester line does not stretch and has a higher breaking strength, making it the preferred material for on-shore anchoring.
- Dry storage racks should be designed for highest potential wind storm loads.
- For enclosed structures, strengthen building framework with thick walls, doors, and reinforced structural patterns.
- Ensure proper anchoring and tie-down techniques are understood by staff and boat owners.<sup>(22)</sup>

### 2.3.5 PROTECTING SENSITIVE AREAS

Marinas should consider the following to protect sensitive areas:

- Limit shaded areas over the water by limiting the number of covered slips.
- Minimize the use of paved surfaces for roads, parking lots and foundations where possible.
- Locate landside facilities toward upland and inland areas.
- Expand new landside facilities vertically where possible but keep in mind a higher vertical structure may be more susceptible to wind damage during tropical events.
- Employ Nonstructural Shore Erosion Control Measures
  - o Vegetation plantings (marsh, submerged aquatic vegetation, dune grasses),
  - o Coir fiber logs or other natural materials, or
  - o Beach nourishment.
- Employ hybrid measures such as combining low-profile rock, rubble, oyster reefs, or wood structures with vegetative planting.
- Employ soft stabilization techniques
  - o Marsh plantings with stone containment groins,
  - o Beach replenishment, and
  - o Segmented sills with marsh plantings.
- Employ beach replenishment with living breakwater (low profile breakwater made with marine limestone rock set with oysters).
- Protect wetlands and sensitive habitats such as
  - o Submerged aquatic vegetation,
  - o Emergent wetland vegetation,
  - o Shellfish beds/reefs,
  - o Artificial reefs,
  - o Shell middens,
  - o Salt pannes,
  - o Natural reefs, and
  - o Hard banks containing reef building organisms.

- Practice Water-wise Landscaping. Water-wise landscaping is a set of landscaping principles encouraging responsible plant selection, landscape design and maintenance. This practice results in landscapes that will conserve water.



*Planting plan using water-wise landscaping techniques.*

### 2.3.5.1 EXAMPLES OF NONSTRUCTURAL SHORELINE CONTROL MEASURES

Oyster Restoration and Marsh Plantings are used to Stabilize an Eroding Shoreline



Hybrid Stabilization Combines low Rock Sills with Marsh Restoration



Dune Grasses



Salt Pannes



Coir Fiber Logs



Artificial Reefs



# EMERGENCY PREPAREDNESS



# 3.0 EMERGENCY PREPAREDNESS FOR NATURAL DISASTER

Because disasters, both natural and man-made, are unpredictable, it is important to define the steps marina operators and boat owners need to take well in advance of a disaster. In a coastal setting, tropical storms, hurricanes and the associated storm surge, wind, rainfall and tornados are the natural disasters most likely to occur. Oil and chemical spills either in or outside the facility are also a threat. Emergency Preparedness Plans should have four primary goals:

1. Protecting Human Life & Safety,
2. Reducing the Exposure of Property to Damage,
3. Minimizing Damage to Property that cannot be Relocated, and
4. Restoring Normal Operations as Quickly as Possible.

A comprehensive Emergency Management Plan will establish a Disaster Response Team. It should also be part of the marina's normal schedule of maintenance. This would include emergency response drills to respond to different disaster scenarios. Just a few unprepared boats and unsecured facilities can inflict a significant amount of damage. An illustrated plan with clear diagrams of the location of facilities and illustrated techniques for securing boats can speed the response of employees and boaters in an actual disaster.<sup>(23)</sup>

Emergency planning and preparedness are already part of the Gulf Coast States' Clean Marina Programs. Each of the programs require regular emergency training and drills for staff. Most also require a written emergency response plan for likely threats. A Resilient Marina Program would expand the range of threats the program addresses, which are now largely based on spills of fuel, hazardous materials and sewage, to focus more explicitly on the dangers posed by natural hazards including tropical storms, tornados/waterspouts and hurricanes that are outside of the marina operators' and boaters' control. This document describes the nature of these additional hazards and the potential damage they may cause. It also includes questions that might help a marina evaluate its own preparedness and how current operations help meet the four goals described above. Particular operational and technical challenges to creating a resilient marina are outlined and best management practices are put forth to make participating marinas more resilient to the high winds and waters that accompany these events.

## 3.1 HAZARDS AFFECTING RESILIENCE

### 3.1.1 TROPICAL STORMS:

The National Weather Service (NWS) defines tropical storms as tropical cyclones originating offshore in which the maximum sustained surface wind speed ranges from 34 kt (39 mph) to 63 kt (73 mph). These storms, or tropical depressions, lack the intensity of a hurricane but may have similar impacts in terms of rainfall, flooding, and potential for spin-off tornados. They are relatively common in the Gulf of Mexico coastal region and have a tendency to be slow moving and prolonged. For marinas, which are located at sea level, tropical storms increase the potential for localized and wide-spread flooding associated with more extreme tidal effects. Their frequent association with tornados represents a heightened probability of property damage and

<sup>23</sup> Hurricane Preparedness Guidelines for Marinas. FEMA for the Coastal Soil and Water Conservation District and the Coastal Georgia Resource Conservation and Development Council. June 2002.

casualties.

### **3.1.2 HURRICANES:**

Atlantic hurricanes are tropical cyclones that form over the warm waters of the Atlantic Ocean, Caribbean Sea, or Gulf of Mexico generally from mid-summer to late fall although the official Atlantic hurricane season runs from June 1 through November 30. Because hurricanes are often very large in size, they have potential to cause widespread damage long before the center of the storm moves over land; after which, hurricanes tend to rapidly lose strength. Threats posed to a marina by hurricanes include storm surge ranging from 3 to more than 20 feet that may worsen with tidal influence, prolonged rainfall, and wind damage to boats, docks and land-based structures. Hurricane severity is rated by the Saffir-Simpson Scale that establishes severity or intensity by a rating of Category 1 through Category 5. Hurricanes categories are based on both maximum sustained winds and minimum central barometric pressure. The table below provides an overview of the Saffir-Simpson Scale, with wind categories and potential damages associated with each category.<sup>(24)</sup> Marinas located at the coastline of the Gulf of Mexico are extremely prone to occurrences of hurricanes and tropical storms.

#### **SAFFIR-SIMPSON SCALE**

SAFFIR-SIMPSON CATEGORY	MAXIMUM SUSTAINED WIND SPEEDS		MINIMUM CENTRAL PRESSURE	STORM SURGE	TYPICAL DAMAGES
	MPH	KTS			
1	74-95	64-82	>980	3-5	Damage to vegetation and tree foliage; no real structural damage; low-lying areas potentially inundated.
2	96-110	83-95	979-965	6-8	Considerable damage to vegetation and tree foliage; some trees blown down; major damage to exposed mobile homes; some damage to building roofs; no major structural damage; low-lying areas inundated; considerable damage to piers
3	111-130	96-113	964-945	9-12	Large trees blown down; damage to roofing, doors, and windows; some structural damage to small buildings; serious flooding in coastal zones; flat terrain 5' or less above sea level potentially flooded 8 miles or more inland.
4	131-155	114-135	944-920	13-18	Trees blown down; signs destroyed; extensive damage to roofs, windows, and doors; complete failure of roofs on many small buildings; major damage to lower floors of structures near shore; major erosion of beaches; flat terrain 10' or less above sea level potentially flooded 10 miles or more inland.
5	156+	136+	<920	19+	Trees blown down; considerable damage to roofs of all buildings; severe and extensive damage to windows and doors; complete failure of roofs on many residences and industrial buildings; some complete building failure; small buildings overturned or blown away.

24. NATIONAL WEATHER SERVICE INSTRUCTION 10-604 JUNE 15, 2011 Operations and Services Tropical Cyclone Weather Services Program, NWSPD 10-6 TROPICAL CYCLONE DEFINITIONS. <http://www.nws.noaa.gov/directives/sym/pd01006004curr.pdf>

### 3.1.3 TORNADOS AND WATERSPOUTS:

Tornados and waterspouts often develop from severe thunderstorms or hurricanes. A tornado appears as a rotating funnel cloud that extends from a thunderstorm to the ground and can generate winds in excess of 300 MPH with damage paths in excess of a mile wide and fifty miles long. Waterspouts are similar to tornados over water and generally fall into two categories: fair weather waterspouts and tornadic waterspouts. Fair weather waterspouts are typically less dangerous. Tornadic waterspouts are simply tornados that form over water and have the same characteristics as a land-based tornado. Generally, the most active time of year for tornados is during the spring months, although they may occur at any time of year. A tornado's wind speed and corresponding damage potential is measured using the Fujita Scale, as illustrated in the table below.

#### FUJITA SCALE

	INTENSITY PHASE	WIND SPEED/MPH
F0	Gale Tornado	45-78
F1	Moderate Tornado	79-117
F2	Significant Tornado	118-161
F3	Severe Tornado	162-209
F4	Devastating Tornado	210-261
F5	Incredible Tornado	262-317

Damage potential to buildings based on their construction type is described in the Enhanced Fujita Scale. In addition to docks, wetslips and dry slips, most marinas also have land-based structures used for retail sales and marina management operations. Unreinforced metal sheds found at many marinas will offer very limited protection from a wind or flooding event. Many marinas have invested in sturdier facilities with the following construction features:

- Flat, hip, gable, mansard, or monoslope roof,
- Asphalt shingles, metal panels, slate, tile, single-ply, or BUR roof covering
- Plywood/OSB roof decking,
- Wood or metal roof structure consisting of trusses or rafters and joists,
- Wood or metal stud walls,
- Large areas of window glass and double entry doors,
- Canopies, covered walkways, or porches, and
- Wood, brick veneer, metal/vinyl siding, concrete block, stucco wall cladding.

An estimate of the potential damage levels for these types of structures is described in the table below, at each increment in the Fujita Scale.

## **ESTIMATED TORNADO DAMAGE TO SMALL RETAIL BUILDINGS BY WIND SPEED**

DOD*	DAMAGE DESCRIPTION	WIND SPEED (IN MPH)		
		EXPECTED	LOWER BOUND	UPPER BOUND
1	Threshold of visible damage	65	54	81
2	Loss of roof covering (<20%)	78	65	98
3	Broken glass in windows and doors	86	72	103
4	Uplift of roof decking; significant loss of roof covering (>20%)	98	81	119
5	Canopies or covered walkways destroyed	98	83	114
6	Uplift or collapse of entire roof structure	119	101	140
7	Collapse of exterior walls; closely spaced interior walls remain standing	138	120	159
8	Total destruction of entire building	167	143	193

\*Degree of Damage

## **3.2 CHALLENGES TO ADDRESS**

As previously mentioned, a Marina's Emergency Preparedness Plan should have the following four goals at its heart:

1. Protecting Human Life & Safety,
2. Reducing the Exposure of Property to Damage,
3. Minimizing Damage to Property that cannot be Relocated, and
4. Restoring Normal Operations as Quickly as Possible.

For all four goals to be reached, emergency preparedness must be a year-round endeavor that involves regular maintenance of facilities, employee training and a clear delineation of expectations for owners of the boats using the marina as their home base. There must also be an open flow of communication among all parties involved to ensure the marina and its tenants can adequately respond to an emergency when it arises.

Accordingly, some of the specific challenges and procedures that a comprehensive Emergency Preparedness Plan should address include:

- Securing Boats In Wet & Dry Slips,
- Evacuation,
- Employee Safety,
- Boater Safety,
- Property Protection,
- Emergency Assistance,
- Communication Plan,
- Damage To Surrounding Properties, and
- Post-Disaster Clean-Up.

## **3.3 BEST MANAGEMENT PRACTICES**

### **Establish an Emergency Preparedness Leadership Team.**

An Emergency Preparedness Team should include the following representatives.

1. Marina Manager/Owner - Hurricane Response Team (HRT) Chairman,
2. Marina Secretary - Communications Coordinator,
3. Office Manager,
4. Dry Storage Manager,
5. Wet Slip Manager,
6. Ship's Store Manager,
7. Restaurant Manager,
8. Repair Service Manager,
9. Boat Club Commodore, and
10. Two Boat Owners Each from Wet Slips and Dry Racks.

### **Evaluating Facility Resistance & Preparing for the Worst**

The initial planning phase must occur prior to the threat of a natural disaster. Preparing a marina for an approaching weather event is a formidable task and will be performed under duress. In order to be prepared before major storms arrive, the following tasks are required:

- Evaluate the Marina's Protective Characteristics and Damage Potential,
- Evaluate the Marina Fleet (Number, Size, Age and Purpose Of Vessels),
- Evaluate and Define the Marina Employee Instruction Program,
- Define Boat Owner Contract Requirements and Owner Instruction Program,
- Evaluate Hurricane Preparedness Kit, and
- Conduct a Full Facility Housekeeping.

### **Encourage Boat Owners to Conduct their Own Emergency Plans**

To encourage participation of boat owners, marinas should provide a "Boat Owner's Hurricane Readiness Questionnaire" outlining storm preparation requirements by the marina and how the boat owner plans to comply. Include provisions for absentee owners, permission to relocate boats if necessary, a contact list, and removal of gear from the boats or dock boxes, etc. This will establish the boat owner's responsibility toward the marina's own plans in case of an emergency.<sup>(25)</sup>

### **Determine an Evacuation Procedure (More will be discussed on this topic in the Evacuation Section)**

#### ***Wet Slip Evacuation***

Damage to the marina could affect the availability of docking location and the future cost of slip rentals. The boats and the marina will suffer more damage if boats are left tied to docks during a hurricane. However, lessons learned from hurricane disasters in other states clearly indicate total mandatory evacuation is nearly impossible. Also, mandatory evacuation requirements can lead to human safety issues.

#### ***Dry Stack Evacuation***

Evacuation of dry racks by trailer is the safest course of action for boats. Hurricane history indicates unloaded racks systems fare better. If boats are left in the racks, they should be tied down – although conditions or circumstances may prevent doing so. Tie-down procedures should only be conducted by authorized marina personnel. Any attempt to tie down boats must be completed before foul weather. Boat owners must be aware there will be an announced cut-off time after which loading trailers will cease in order to complete the tie-down process.

25. Hurricane Preparedness Guidelines for Marinas. FEMA for the Coastal Soil and Water Conservation District and the Coastal Georgia Resource Conservation and Development Council. June 2002.

### ***Evacuation of Personnel***

To avoid injury, marinas should conclude activities to secure boats and other property within 24-hours of a hurricane making landfall and should be prepared to evacuate at a moment's notice. Boat owners should not be allowed on the premises after the tie-down procedures have concluded.

# EVACUATION PROCEDURES



# 4.0 MARINA EVACUATIONS

Marinas can protect property from excessive damage, reduce personal injury and minimize liability to their tenants by clearly outlining a marina evacuation procedure to be followed when tropical storms and hurricanes are threatening. Employees should be knowledgeable of and trained to execute the Marina's Evacuation Plan. Each boater sheltering at the marina should review the plan, fill out the proper paperwork, and commit to carry out their assigned responsibilities as a part of their lease agreement. The goal of evacuation procedures should be to:

1. Protect Human Life,
2. Seek to Prevent or Minimize Personal Injury,
3. Reduce the Exposure of Property to Damage,
4. Minimize Damage to Property that cannot be Relocated, and
5. Seek to Restore Normal Operations as Quickly as Possible.

Each marina's evacuation procedures will be unique to that marina due to

- Differences in site location,
- Elevation,
- Natural barriers that provide protection,
- Quality of construction of docks, pilings and dry docks,
- State specific procedures,
- Distance to inland safe harbors,
- Size and number of boats at the marina, and
- Other site specific considerations.

## 4.1 RISKS TO RESILIENCE

There are a number of threats created by natural disasters affecting how resilient a marina will be to a major storm.

- Storm surge raises the water level far above normal high tide, cutting off roads, forcing evacuations, and lifting boats above their docks and pilings. Storm surge may submerge docks, causing boats to float above their moorings and potentially break free. Surge is responsible for extensive flooding and much of the loss of life that accompanies a hurricane.
- Tropical systems bring with them potential for extreme wind conditions. As wind speed doubles, wind pressure quadruples which greatly increases the chance for major damage. Reducing a boat's windage as much as possible will help reduce this risk.
- Wave heights are elevated during a tropical systems due to wind and storm surge. Because the surge submerges natural and manmade protective barriers, this has the effect of extending the distance over which wind can generate waves. The force of these waves breaking repeatedly against a marina can cause significant damage.
- Substantial rainfall can overwhelm the ability of deck drains and bilge pumps to evacuate water, causing boats to sink.
- Tornadoes can be spawned by tropical systems. There is little to be done to protect a boat from a tornado which further reinforces the need to get yourself and your boat as far from the coast as possible.

## **4.2 CHALLENGES TO ADDRESS**

With respect to developing procedures designed to aid in evacuating marinas, there are several challenges that should be addressed which include:

1. Having a workable hurricane plan,
2. Knowing what to do before the storm arrives,
3. Logistics of mobilizing large amounts of boats in a short time span,
4. Customers becoming familiar with the marina specific policies and procedures,
5. Tying boats down or moving to a safe, inland harbor,
6. Formation of a Hurricane Response Team (HRT) which is made up of marina employees, boat owners, and other volunteers,
7. Boat insurance,
8. Wet slip evacuation procedures,
9. Dry dock evacuation procedures,
10. Boat preparedness steps,
11. Clearly identified hurricane evacuation routes, and
12. Locate and map nearby shelters.

## **4.3 BEST MANAGEMENT PRACTICES**

Ideally, boats will be evacuated from the marina prior to a major storm. Marina operators, employees and boat owners need to be familiar with the marina's evacuation policies and be prepared to implement them.

Having a Disaster Preparedness Plan in place and the ability to implement the plan in a timely and effective manner are essential to successfully evacuating a marina and minimizing loss of life and property. Even marinas utilizing the most current construction technologies are not the optimal sanctuary for boats during a direct hurricane hit. It is encouraged that all boats in wet slips and dry storage be moved to safe havens at the time outlined in the marina specific hurricane plan.

Timetables for implementing different aspects of the plan will depend on a number of factors including the storm's forward speed/direction, probability of a storm hit, and the expected intensity of the storm. It should also be understood that different category storms can have drastically different impacts on the amount of damage caused.

### **4.3.1 SAFE HARBORS**

Safe Harbors are water-bound boat storage areas which are generally considered safest from damage by natural disasters due to their location in protected waterways. These safe harbors can include rivers, canals, bayous, estuaries, or small bays but generally are areas providing a level of protection from wind and storm surges associated with tropical storms and hurricanes. Also known as "Hurricane Holes," safe harbors have been used by boaters to successfully weather severe storms. This type of preparedness measure provides an alternative to dry docking or storage at a crowded marina.

Safe Harbors should be identified prior to hurricane season. Some items to look for in a safe harbor are deep water, suitable substrate (for anchorage), close proximity to the place the boat is normally harbored, no overhead structures (such as railroad or highway bridges), and an area with strong vegetation (large trees) along the shorelines.<sup>(26)</sup> Safe Harbors are commonly found in tidally influenced estuaries and therefore are susceptible to changes in water elevation.

When utilizing a safe harbor some considerations include:<sup>(27)</sup>

- Maintain a navigable waterway.
- If in a canal, or similar “dead-end” waterway, the boat should be facing the entrance.
- In large waterways, boats should be secured with lines tied to trees and additional anchors.
- The boat should be tied to nearby trees in at least two spots, being sure to keep enough slack to account for the predicted storm surge in the area.
- Small residential canals may allow for tie-downs on both sides of the boat. Ensure arrangements are made with nearby landowners.
- If located at a dock, position the boat farther from the dock, with additional lines offshore to prevent the boat from being pushed onto the dock.

Working with other boaters can provide benefits including assistance in tying the boat off to land, assistance in retrieving the boat after the storm, and ensuring a safe distance between boats at the safe harbor. Some marinas have developed Hurricane Response Teams or volunteer groups that will assist in hurricane preparedness by moving boats to safe harbors and assisting with boat-preparations for those boats remaining at the marina.<sup>(28)</sup> These groups can be especially helpful for marinas with out-of-town or out-of-state boat owners. Disaster preparation assistance (through a team or volunteers) can be included in contracts with or without additional fees. Some other points to consider:

- How many team members will you need and what should the make up of the team be?
- How many boats can be reasonably moved? How many will the safe harbor hold?
- When should you begin moving boats? You'll need someone to ferry people back to the marina after parking in the safe harbor.
- What will be the terms and/or fees for boaters enrolling in the program?

## 4.3.2 MARINA & BOAT OWNER RESPONSIBILITIES – PRE-HURRICANE SEASON

### Dry Storage Boat Owners

- Attend hurricane preparedness clinics held by the marina Hurricane Response Team.
- Prepare your boat evacuation plan and file it with the marina as required.
- Make your boat and trailer evacuation ready.
- If you have no trailer, keep your boat ready for storms by keeping the bilge plug pulled and canvas down.
- Review your boat insurance policy with your agent keeping marina contract requirements in mind.

### Wet Slip Boat Owner

- Attend hurricane preparedness clinics held by the marina Hurricane Response Team.
- Prepare your boat evacuation plan and file it with the marina as required.
- Make your boat evacuation ready.

26. Amaral, Mark. *Hurricane Plan for Boaters*. Rhode Island Sea Grant Fact Sheet. <http://seagrant.gso.uri.edu/factsheets/hurricane.html>

27. *The Boater's Guide to Preparing Boats & Marinas for Hurricanes*. Boat US Marina Insurance.

28. *What Works: A Guide to Preparing Marinas, Yacht Clubs and Boats for Hurricanes*. BoatUS Marine Insurance Publication.

## Dry Storage Safe Area Hurricane Hole Characteristics

Consider the nature of the severe weather approaching, the nature of the boat you are protecting and your position in relation to the on-coming system. Select an area that:

- Affords natural protection from storm surge,
- Provides adequate depth to moor your boat,
- Is not likely to experience an undue amount of floating debris,
- Is not likely to be subject to severe tidal surge or rising tides,
- Is reasonably accessible from your permanent storage area,
- Is not subject to excessive competition for mooring,
- Is not located in a navigable waterway,
- Has bottom characteristics that facilitate proper anchoring techniques and/or moorings?

*Source: BoatU.S. Marine Insurance Damage Avoidance Program. The Boater's Guide to Preparing Boats & Marinas for Hurricanes. <http://www.boatus.com/hurricanes/assets/pdf/p2>*

- Practice your evacuation and storm preparation plan.
- Review your boat insurance policy with your agent keeping marina contract requirements in mind.

### 4.3.3 RESPONSIBILITIES WHEN A STORM IS IN THE VICINITY

Marina Hurricane Response Teams may provide boat owners with additional assistance regarding tie-downs, evacuation timing, and by organizing evacuation crews for absentee boat owners if desired. This investment made at the front-end can minimize down time and financial losses to the marina operator. Boat owners need to take on responsibility of the safety of their own craft as described below.

#### Dry Storage Boat Owners

- Ensure your "Boat Owner's Hurricane Readiness Questionnaire" is current and complete and on file at the Marina Operations.
- Make final readiness checks on your boat trailer and on your towing vehicle.
- Advise the marina of your intent and schedule for evacuating your boat by trailer.
- Be aware that trailer loading will terminate when wind speed reaches 25 knots or at a specified time to allow completion of marina storm preparations, so plan to move early.
- If your boat will remain in place, secure your boat according to your plan.
- Be aware that costs associated with securing a boat at the marina will be charged to the boat owner.

#### Wet Slip Boat Owner

- Ensure your "Boat Owner's Hurricane Readiness Questionnaire" is current and complete and on file at the Marina Operations.
- Keep an adequate inventory of storm gear aboard and maintain dock and anchor lines of proper size and condition.
- Check your primary and alternate evacuation anchorages and review your evacuation plans.
- Adhere to the marina dockage contract provision that all boats must be able to get underway under its own power.
- Evacuation of your boat to safe anchorage or to haul out is strongly advised.
- Advise the marina of your intention and schedule for evacuating your boat by water or to take to a yard for haulout.
- If the boat will remain in place, secure it according to a pre-arranged plan.

#### **4.3.4 RESPONSIBILITIES WHEN A STORM IS WITHIN 48-72 HOURS OF LANDFALL**

##### **Wet Slip Boat Owner**

- Boats left docked at the marina should have extra lines, fending and chafing gear.
- Secure the boat according to the diagram posted at the marina.
- Anticipate that the floating docks may float off of the piling.
- Be aware that any costs associated with securing a boat at the marina will be charged to the boat owner.
- Once your boat is secured, leave it and do not return until it is deemed safe.

#### **4.3.5 RESPONSIBILITIES WHEN A STORM IS WITHIN 24 HOURS OF LANDFALL**

##### **Dry Storage Boat Owners**

- Complete all storm preparation efforts for your boat. Complete securing home and evacuating family as instructed by the County Emergency Management Agency.
- Stay clear of the marina unless you are a member of the Hurricane Response Team.

##### **Wet Slip Boat Owner**

- Complete all storm preparation efforts for your boat. Complete securing home and evacuating family as instructed by the County Emergency Management Agency.
- Stay clear of the marina, unless you are a member of the Hurricane Response Team.

#### **4.3.6 RESPONSIBILITIES WHEN UNDER HURRICANE INFLUENCES**

One of the most dangerous mistakes a skipper can make is to stay aboard during a hurricane. There is little, if anything, a skipper can do to save a boat when winds are blowing 100 mph, tides are surging, and visibility is only a few feet.

Note: In general, any expense incurred by damage/injury to the docks, property or personnel of the marina by a vessel will be the responsibility of the vessel's owner. Marinas will not be liable for hurricane related damage or damage resulting from implementation of a Boater's Hurricane Plan.

# STORMWATER MANAGEMENT & EROSION CONTROLS



# 5.0 STORMWATER MANAGEMENT AND EROSION CONTROL

When rain water is not absorbed by the ground, it moves across surfaces, carrying pollutants into storm sewer systems or nearest drainage way. Water in the storm sewer system is typically not pre-treated and this water travels directly into nearby natural waterbodies. Some of the pollutants which can be carried by stormwater include: hydrocarbons (from automotive fluids), soil and sediment, nutrients (from fertilizers), and biological pathogens (from fecal matter). Impervious surfaces such as asphalt, do not allow stormwater to infiltrate the ground at all, thus further contributing to increased runoff velocity. Cumulatively, these stormwater impacts may cause adverse impacts in nearby streams, rivers, lakes, and estuaries impacting fish and wildlife as well as recreation activities. In the 1987 Amendments to the Clean Water Act (CWA), EPA established Phase I of the National Pollutant Discharge Elimination System (NPDES) Stormwater Program to address these water quality concerns. Phase II of the NPDES program was established in 1999<sup>(29)</sup> and designated entities had to comply with the new regulations by March 2003.

Coastal areas face additional clean water requirements. In 1990 the United States Congress passed the Coastal Zone Act Reauthorization Amendments (CZARA, Section 6217) which entrusted the States with the task of developing and implementing State Coastal Non-Point Source Pollution Control Plans (CNPCPs). States with federally approved coastal zone management programs must also work with NOAA and EPA to develop and implement CNPCPs and put management measures into place to control or prevent pollution from five sources: agriculture, forestry, hydromodification, marinas and recreational boating, urban runoff (TSS) and wetlands, riparian areas, and vegetated treatment systems.

The integration of stormwater management and erosion control practices assist marina owners in promoting water quality. Protection of water quality improves a marina's resiliency by focusing attention on three areas:

1. Pollution Prevention and Stormwater Volume Control,
2. Erosion and Sediment Control, and
3. Flood Protection.

Many options for stormwater management found in the existing Gulf States Clean Marina Programs are beneficial in improving resiliency. Currently the Clean Marina Programs address pollution prevention by encouraging low impact development, cultivation of vegetative areas, minimizing the amount of impervious area, using structural controls (stormwater ponds, pocket wetlands, infiltration systems, and filter systems including oil grit separators), construction site erosion and sediment control, and education strategies such as storm drain identification.

## 5.1 RISKS TO RESILIENCE

### 5.1.1 POLLUTED WATER

Marinas are especially susceptible to stormwater pollution due to the following general characteristics: flat property at low elevations, diffuse drainage, diverse activities onsite and

29. Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s), EPA, <http://cfpub.epa.gov/npdes/stormwater/munic.cfm>. Accessed on 05/10/2012

in the water, and proximity to surface waters. Water pollution affects the boating industry negatively by reducing the number and types of people utilizing marina facilities. The 2010 Deepwater Horizon Oil Spill is one recent reminder of the loss of revenue which can accompany actual or perceived water pollution problems. While the Deepwater Horizon oil spill was an isolated, point-source pollution incident, the cumulative effects of water pollution have the long-term potential to be detrimental to marina businesses because of damages to facilities and negative impressions about water quality. A good Stormwater Pollution Prevention Plan (SWPPP) can minimize water pollution in the event of a natural or man-made disaster.

### **5.1.2 EROSION OF SHORELINES AND SEDIMENT ACCUMULATION**

Erosion along coastlines occurs on both exposed and sheltered shorelines and is often the result of current and wave action. In developed areas, this wave action can be amplified by boat wakes or excessively hardened shorelines (such as in channelized bayous or streams). Hardened structures such as bulkheads reflect the energy from waves back into the water.<sup>(30)</sup> Vegetated shorelines can accommodate and absorb natural wave action. When natural systems are impacted by increased wave action (due to storms, boat-wake, or upstream shoreline hardening), the soil is pulled away from shore by retreating waves or longshore currents, and the shoreline starts to erode.

Sediment transport is a natural process within the cycle of erosion and sedimentation along shorelines. However, it is also a byproduct of sediment transfer from areas of erosion. The process of shoreline erosion is potentially increased by uncontrolled stormwater runoff. By the very nature of stormwater runoff, some amount of sediments will end up within nearby waterways. When a marina is situated so that this sediment will readily precipitate out of the water column, sediment accumulation occurs. Sediment accumulation within navigable waters eventually becomes a safety concern for boaters but also can promote tidal flooding and increase the level of storm surge during tropical storms and can add to a facilities economic burden through an increased need for regular dredging.

### **5.1.3 FLOODING**

Flood control was the initial purpose of stormwater sewer systems. These underground sewers were built to quickly and efficiently move rainwater from streets, parking lots, and other impervious surfaces to prevent flooding. Intentionally, these sewer systems were designed to move water quickly without any natural filtration and treatment for potential pollutants. This design element is the primary reason stormwater runoff has become the primary source of water quality concerns in the United States. In shoreline environments, where topographic relief is low or non-existent, stormwater volume control and flooding are major concerns for property owners.

## **CHALLENGES TO ADDRESS**

The challenges for marinas attempting to improve their resiliency through better stormwater management practices include limitations in stormwater retention options due to space or existing infrastructure, unfamiliarity with stormwater pollution reduction practices, and erosion of shoreline due to natural and boat-made wave action.

The following items will be helpful in evaluating a marina's stormwater pollution and erosion

30. Hyndman, Donald and Hyndman, David. Waves Beaches and Coastal Erosion: Rivers of Sand. <http://scidiv.bellevuecollege.edu/gj/WavesCoastsChapter.pdf>. Accessed on 5/10/2012.

control measures:

- Evaluate the current stormwater conveyance system on site:
  - Through separate storm sewer drainage system,
  - As sheet flow into nearby waterway, or
  - Through concentrated flow through grassy swales or other low-impact stormwater conveyance system?
- Evaluate alternative stormwater storage, treatment, and conveyance best management practice options.
- Evaluate potential pollution sources.
- Evaluate employee and customer education programs.
- Conduct a full facility housekeeping inspection.
- Evaluate erosion of natural shoreline and catalysts.

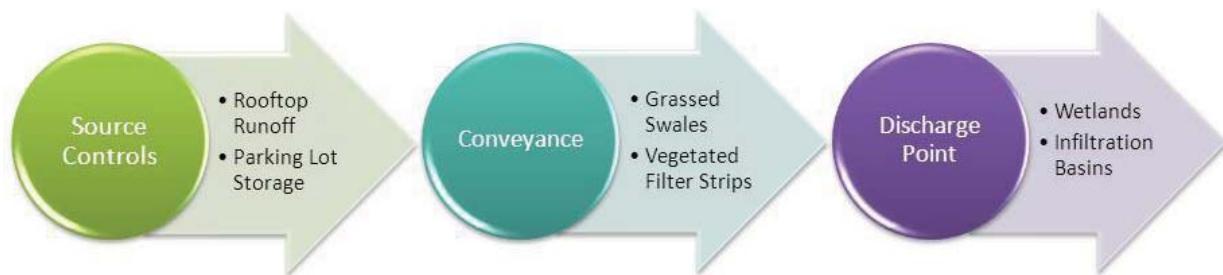
## 5.2 BEST MANAGEMENT PRACTICES

The best management practices associated with stormwater pollution and erosion and sediment control focus on the following areas:

- Preventing pollution through Stormwater Pollution Prevention Plans (SWPPP's),
- Reducing the amount of stormwater runoff by increasing infiltration onsite,
- Treating stormwater runoff onsite to remove or reduce pollution, and
- Preventing erosion of shorelines.

Stormwater pollution prevention plans are promoted in the Clean Marina Program. For more information on SWPPP's, please review your state specific Clean Marina Program guidelines or visit your state's environmental regulatory agency website.

For stormwater pollution control and prevention, a treatment train approach is suggested. This approach, which incorporates several treatment Best Management Practices (BMPs) and can lead to greater pollutant removal and decreased stormwater flow velocities (generally reducing erosion potential).



### 5.2.1 Reduction of Impervious Surfaces

1. Low Impact Development (LID) is an “innovative stormwater management approach with a basic principle modeled after nature: manage rainfall at the source using uniformly distributed decentralized micro-scale controls” (LID, 2007). LID promotes development of facilities so as to retain the natural hydrology of the area to the greatest extent possible. Principles of LID include:

- A series of stormwater management measures designed at a local scale to minimize impact of development on the local watershed.
- Ecosystem-based approach is utilized promoting developments designed as a functional part of the ecosystem, not apart from it.
- Stormwater management is addressed through small, cost-effective landscape features and integrated management practices.

2. Preservation of vegetation including native trees, understory vegetation and natural processes is a key practice in low-impact development. Preserving vegetation improves a site's resiliency during construction activities by decreasing erosion potential. After construction, preserved vegetation helps to reestablish areas by providing a seed source and helps to stabilize slopes. However, LID can also be incorporated into existing development through the integration of small-scale controls. Some common LID design components include:

- Bioretention/Rain Gardens,
- Rain Barrels/Cisterns,
- Filter Strips, Vegetated Swales, and Constructed Stormwater Wetlands, and
- Pervious Paving.

## 5.2.2 Pollutant Removal

1. **Assessment and Monitoring.** Water Quality assessments should be completed prior to site development to ensure ideal marina placement. Water quality assessments are completed regularly by state environmental agencies. More information on state-specific water quality is available in *Volume II Appendices*.

Monitoring water quality near stormwater outfalls onsite will provide information on the variety of pollutants leaving the marina. This information is helpful in designing stormwater management controls. For example, if excess nutrients are identified, stormwater treatment strategies focused on nutrient removal can be implemented. Continued monitoring will also help gauge the effectiveness of installed BMPs and the SWPPP.

2. **Bioretention areas**, also known as rain gardens are an aesthetically pleasing option for on-site stormwater collection and treatment. Pollutants and sediment will be absorbed into the soil and/or taken up by plants within the retention area. These retention areas are designed to drain within 24 to 48 hours, eliminating potential mosquito habitat. The treatment area should be planted with native vegetation capable of withstanding inundation. When functioning properly, bioretention areas add to site resiliency by promoting native plant growth and providing stormwater storage areas. Retrofitting existing marinas can be accomplished by incorporating bioretention into parking and storage areas and treating stormwater runoff from roofs.

3. Planting **vegetation/buffer areas** between developed areas and the water's edge not only provides stormwater treatment but also adds to the stability of the shoreline and prevents erosion. Choosing native plants is important for effective establishment of the vegetation, and adaptability of the vegetation. Native vegetation will better withstand variations in local environmental conditions.

## SHORELINE STABILIZATION IN LOUISIANA

Louisiana's marinas use a variety of techniques to protect and stabilize their shorelines. Because of tidal wave action, many of the marinas surrounding Lake Pontchartrain, like Mariners Village and South Shore Harbor, use structural stabilization. Mariners Village uses interlocking concrete blocks on a slope to absorb energy from wave action, protecting the shoreline from waves up to four feet high. Oak Harbor and Mariner's Village use steel encasing riprap in a perpendicular bulkhead. The bulkhead at Bowtie Marina is a 3/8-inch steel plate supporting a wood platform surface.

At Coco Marina, a wooden bulkhead encases gravel to preserve the shoreline. Lake End Marina protects some of its shoreline with a beach and other portions with stone riprap and a jetty. Buras Boat Harbor stabilizes a steep slope behind an extra-tall bulkhead. The top of it extends about six inches above the shore's surface to redirect runoff away from the marina basin.

*Source: Good Environmental Management Practices in Louisiana's Marinas. Sea Grant Louisiana: Marilyn Barrett-O'Leary, Michael Liffmann, Brian LeBlanc*

4. On-site **grassed swales** for stormwater control is an LID practice and can be used to transport stormwater around the site or to temporarily store stormwater runoff in heavy rain events. Grassed swales are similar to bioretention in that they are concave structures and allow for some infiltration but are also designed to transport water to another location and provide filtration similar to vegetative buffers.
5. **Infiltration trenches** are rock-filled and have no outlet. These trenches are often used as part of a treatment-train approach and receive stormwater from some pre-treatment BMP such as a grassed swale. Infiltration trenches remove pollutants by allowing stormwater to slowly infiltrate through the soil.

### 5.2.3 Erosion Control

Marina development and construction activities that disturb soil have the potential to cause erosion problems. Exposed soils are susceptible to erosion leading to sediment-tainted runoff. This type of runoff has the short-term effect of increasing water turbidity and the long term effect of sediment accumulation. Erosion prevention and control can be accomplished through the treatment train approach previously discussed. During construction activities, the treatment-train may include source controls such as erosion prevention through phased development/construction sequencing, preservation of vegetation, temporary seeding, etc. The next part of the approach includes runoff conveyance BMPs such as check dams, grassed or lined swales, and diversions. The next step would include sedimentation prevention through sediment basins, silt fencing, and vegetated buffers, etc. The final part of the treatment train would be to employ discharge point protection measures, such as silt fencing and vegetated buffers, to retain sediment onsite as well as to employ inlet protection measures, such as floating turbidity curtains for concentrated flows. References for these and other types of construction-related stormwater BMPs can be found in *Volume II Appendices*.

Beyond construction activities, erosion control and prevention is crucial along shorelines surrounding water dependent developments. Because of the erosive effect of wave action on shorelines, a No-Wake Zone is important in areas with heavy boat traffic. Enforcement is key to the success of a No-Wake Zone. Areas with increased wave action due to boat traffic may require additional shoreline stabilization. Several methods of shoreline stabilization are outlined below, and they can be combined to increase effectiveness. Always contact local and state regulatory agencies when performing land disturbance or construction activities in and around waterways to insure compliance with any applicable stormwater management, water quality protection, and wetland permitting laws and regulations. Some shoreline stabilization practices may require professional design by a State-licensed engineer or architect.

## LIVING SHORELINES

### Site Assessment

- Rate of Erosion
- Type of Shoreline
- Erosional Force
- Water Depth
- Substrate
- Salinity

### Project Design

- Combination of Strategies Based on Site Conditions.

### Planting

- Plant Selection
- Plant Spacing
- Timing of Planting (Feb-May)

### Permitting

- Check with State and Federal Agencies

### Materials

- Oyster shell
- Concrete bags
- Limestone rock
- Reef domes
- Erosion control fence
- Coir Logs
- Plants

### Marina Systems

- Fueling
- Sanitary Systems
- Electric and Communications
  - Hazardous Waste
  - Other Systems

\* See Appendix for more information on Living Shorelines

Source: Galveston Bay Foundation. (N.d.) "Living Shorelines: A Natural Approach to Erosion Control." From [http://galvbay.org/docs/LS\\_alternative.pdf](http://galvbay.org/docs/LS_alternative.pdf)

1. Structural controls have traditionally been used to prevent soil loss in areas of high wave/wind erosion along shorelines. Revetment/rip-rap, seawall protection and bulkheads are structures built into the water using either concrete or wood materials to create rigid walls of protection against the erosive power of waves along shorelines.
  - a. **Seawall protection** - Seawalls are often constructed of concrete to protect upland areas from heavy wave action.
  - b. **Revetment/rip-rap** - Large rocks or sections of concrete are used to stabilize shorelines. These materials will absorb some of the energy associated with breaking waves and also provide some habitat for wildlife.
  - c. **Bulkheads** - Commonly constructed of wood, bulkheads are vertical retaining walls to prevent soil from eroding into waterways.
  - d. **Dikes and levees** – Earthen structures built to protect low-lying areas from flooding. Not commonly used for erosion control, but can be beneficial in erosion prevention of low-lying, routinely flooded areas.
  - e. **Breakwaters** – Off-shore structures built parallel to the shoreline to reduce the amount of wave energy reaching the shoreline.
  - f. **Groins** – A form of shore-connected stabilization often found in beach areas that use structures which extend perpendicular from the shoreline. Groins are utilized to help trap and retain sand in order to renourish the beach.
  - g. **Jetties** – Jetties are stone structures built for controlling the navigation depth of channels by preventing intrusion of sediment. Jetties also affect channel depth by altering the flow velocity.



Example of Seawall Protection

2. Soil Bioengineering is a stabilization technique that utilizes stems or branches of living plants to reinforce and stabilize material. In some cases, this practice uses only vegetative materials and in other cases, a combination of structural and vegetative materials is required.
  - a. **Live Staking** – planting live, rootable plant cuttings so that these live stakes will take root and grow into individual plants. Willow species are commonly utilized in this practice. These live stakes can also be used to peg down erosion-control blankets.<sup>(31)</sup>

31. Mississippi Department of Environmental Quality. *Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas* 38

- b. **Live Facines** - bundles of branch cuttings bound together into sausage-like structures. These can be placed in shallow contour trenches and at angles to reduce erosion on steep, rocky slopes.
- c. **Brushlayering** - Brushlayering also involves placing live branch cuttings on slopes. In this case, the cuttings are oriented at angles to the slope contour. Brushlayering is done with loose, not bound cuttings and can be effective on slopes up to 2:1 (horizontal: vertical) in steepness.
- d. **Brush Mattressing** – Is a combination technique that involves digging a small trench on the bank and creating a mattress of wire and live, freshly cut branches.<sup>(32)</sup>
- e. **Branchpacking** – a technique used to repair small localized slumps and holes in slopes (usually no greater than 4 feet deep or 5 feet wide) which consist of alternating layers of live branch cuttings and compacted backfill.
- f. **Live Cribwalls** – A cribwell is a hollow, box-like interlocking arrangement of untreated logs or timber. These are often used at the base of a slope where a low wall maybe required to stabilize the toe of the slope.
- g. **Joint Planting** – A combined structural and vegetative practice that involved tamping live cuttings into soil between open spaces of rocks. This practice is also known as Vegetated Riprap.
- h. **Vegetative Rock Gabions** – These structures combine layers of live branches and gabions (rectangular baskets filled with rock). These are effective at the base of a slope where a low wall is required to aid in stabilizing the toe of the slope. These are not designed to resist large, lateral earth stresses.

3. Establishment of Living Shorelines is a method of shoreline stabilization that promotes marsh creation or protection. This strategy reduces erosion potential by improving vegetation both on the shoreline and within the shallow water near shore. Traditional structural controls such as revetment/rip-rap, seawall protection and bulkheads are not considered adaptable for future sea level rise. These types of protections also reduce habitat for aquatic and terrestrial organisms, reduce the amount of land-to-water interface, increase nutrient loading from stormwater runoff contributing to water quality degradation, and often cause erosion problems on adjacent properties. Living shorelines use natural vegetation alone or in conjunction with a reef system to create a more natural approach to shoreline stabilization. The overall goal of a living shoreline is to create a stabilization approach that will grow and change with changing water levels.

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32. U.S. Environmental Protection Agency. Streambank and Shoreline Erosion Management Measure. <http://www.epa.gov/owow/NPS/MMGI/Chapter6/ch6-4.html>. Accessed on 05/02/2012.

# CLIMATE ADAPTATION & SEA LEVEL RISE



# 6.0 CLIMATE ADAPTATION & SEA LEVEL RISE

Marinas occupy the first point of impact for extreme weather and volatile seas. While certain elements of a marina's business can be located on higher ground, many storage, supply and servicing activities must be anchored in the water or at the shoreline. Marinas have many tools at their disposal to help plan for risks. There are also programs in place at the Federal and state levels to assist in predicting any changes in climate and the resulting changes in shorelines, sea levels and tidal surges associated with tropical weather. Agencies such as National Oceanic and Atmospheric Administration (NOAA), Federal Emergency Management Agency (FEMA), United States Geologic Survey (USGS) and the United States Navy offer strategies to reduce potential climate change impacts on marinas.

The potential impacts of climate change and sea level variability will differ from one end of the Gulf Coast to the other due to variations in coastal slope, geomorphology, erosion and/or accretion rates, and mean tide ranges. However, appropriate planning can address these vulnerabilities by building upon existing tools and methods and appropriately applying them to development and expansion of marina operations. In addition to the state and Federal programs referenced above, the sections of this guidebook dealing with emergency preparedness and siting and design provide guidance on resiliency relative to sea level variability and changing shorelines. On the Gulf Coast, Clean Marina Program participants address shoreline changes by limiting erosion of their banks and minimizing damage to marshes and wetlands surrounding their facilities. Preserving natural estuaries also absorbs the shock of tidal waters and can even blunt the force of hurricane-related storm surge. These natural areas both improve the attractiveness of marinas and serve to protect manmade development along the Coast.<sup>(33)</sup>

This section outlines available data on climate and environmental trends, as well as strategies designed to minimize the potential impacts associated with sea level variability. The best management practices included are designed to make participating marinas more resistant to the effects of both volatile weather high winds and potentially rising waters.

## 6.1 CHALLENGES TO ADDRESS

Marinas should employ the following broad goals and strategies as part of an overall resiliency strategy to address the potential impacts of sea level change:

1. Monitoring the Long-Term Effects of Changing Gulf Waters,
2. Reducing the Exposure of Property to Damage,
3. Minimizing Damage to Property that cannot be Relocated, and
4. Adaptability to Changes in the Coastal Environment.

Multiple events that pose a risk to marinas are associated with extreme variations in climate. They include increased flooding caused by extreme rain events; an increase in the frequency and severity of natural disasters; and increased wave impacts because of development in areas prone to flooding. On the landward side, sea levels may change due to land subsidence and/or accretion and loss of marshes, estuarine areas and other important natural areas due to

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33. Assessment of Sea Level Rise in Coastal Mississippi. Mississippi Department of Resources Office of Coastal Management and Planning, as prepared by Eco-Systems, Inc.. July, 2011

greater salinity<sup>(34)</sup>. The impact of these events on the shoreline differs from location to location. Land subsidence is a serious issue in Louisiana and parts of Texas, the accretion of sediment and/or migrating marsh are the predominant phenomena in other locations. Increased salinity and saltwater intrusion into marshes and estuaries can lead to erosion of the natural coastline by negatively impacting both marine and vegetative species adapted to fresh and brackish habitats.

While extensive historical sea level trend data is available in some locations along the Gulf Coast, limited data availability to track sea level trends in other areas makes planning for sea level variability difficult. Particular vulnerabilities to changing sea levels will be discussed below, along with best management practices for assessment, planning and protection.

## 6.2 RISKS TO RESILIENCE

The specific effects of more frequent natural disasters and potential changes in sea level include:

- Increased wave height, frequency and related damage to marine structures,
- Damage to infrastructure such as roads, water, waste water and electricity,
- Receding shoreline caused by erosion or rising seas,
- Potential impacts related to the natural systems such as estuaries, marshes, wetlands, and other coastal ecosystems that protect manmade development along the coast.

NOAA's Digital Coast Program identifies a number of ways marinas can learn about and anticipate the effect of rising sea levels on their location. Resources available through the NOAA Digital Coast program may be accessed via the following web address: [www.csc.noaa.gov/digitalcoast](http://www.csc.noaa.gov/digitalcoast).

## 6.3 BEST MANAGEMENT PRACTICES

### Identify Trends through Data Analysis

The first step in preparing a marina for long-term changes in sea level is to determine the resources available for an accurate assessment of the historic trends in sea level rise in the marina's vicinity. Data such as continuous water level trends, wave height and frequency, flood risk, severe weather patterns, and historic storm surge levels all provide insight into what best management practices should be selected for a particular location.

#### 6.3.1 VISUALIZE SEA LEVEL RISE

- o ***Sea Level Rise and Coastal Flooding Impacts Mapping Tool:*** NOAA developed this tool to help users visualize the geographic extent of frequent floods and potential sea level rise. A special feature includes photographs of significant coast landmarks with a simulation of rising sea levels from one to six feet.<sup>(35)</sup>
- o ***Sea-Level Rise Visualization for Alabama, Mississippi, and Florida:*** The NOAA Coastal Services Center collaborated with the Mississippi-Alabama Sea Grant Consortium and U.S. Geological Survey (USGS) to produce a tool for sea-level rise visualization that provides a higher level of

34. J.T. Lockman, "Coastal Hazard Resiliency Tools Project: Background on Possible Policy & Regulatory Responses to Sea-Level Rise". Southern Maine Regional Planning Commission

35. National Oceanic and Atmospheric Administration: Sea Level Rise Viewer <http://www.csc.noaa.gov/slr/viewer/#>

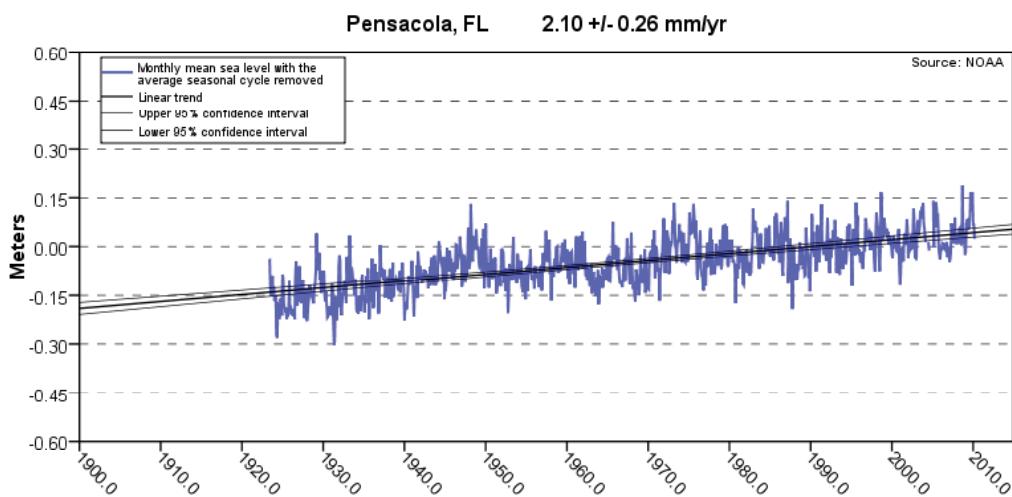
detail and accuracy for this geographic area. Sea-Level Rise Visualization for Louisiana will be available in the near future.

- o **Sea Level Data:** The NOAA Center for Operational Oceanographic Products and Services has maintained sea level data for approximately 150 years through measurements from 128 long-term water level stations on all U.S. coasts. Through the National Water Level Observation Network, NOAA has tracked changes in mean sea level (MSL) using a minimum span of 30 years of observations at each station. Data collected at these stations is averaged to remove the effect of high frequency phenomena such as tropical storms and hurricanes. The Mississippi Department of Marine Resources consulted this data for its Mississippi Sea Level Rise Action Plan, as presented in charts such as the example below from Pensacola, Florida.<sup>(36)(37)</sup>
- o **FEMA Risk Map Data:** FEMA is developing a Flood Hazard Data to address current gaps in information to improve accuracy of risk assessment, floodplain management, and soundness of the National Flood Insurance Program (NFIP). The Risk Map program is also meant to give communities the tools to conduct risk-based Hazard Mitigation Planning.
- o **Local Community Sea Level Rise Map:** Many cities offer local sea level rise data.

### 6.3.2 IDENTIFY HISTORIC TRENDS AT MARINA LOCATION:

#### Pensacola, Florida Sea Level Trend

The chart below presents sea level trends in Pensacola, Florida and demonstrates a mean rise in sea level of approximately .08 year inches per year based on sea level data from 1923 to 2006. This would be equivalent to a change of .69 feet (8.28 inches) in 100 years.



**Wave Height & Length:** NOAA's National Data Buoy Center uses two measures to describe ocean waves: height and length. Marina personnel can access this data by identifying the station closest to their location in the Gulf of Mexico East or West quadrants of the map and can determine current weather as well as the historical conditions occurring at that site. NOAA defines wave height as the height of the wave from the wave top, or crest, to the bottom of the wave or trough. The wave length is defined as the horizontal distance between two successive crests or troughs. During storms, the wave heights increase while the wave lengths decrease. The buoys provide the important measure of Significant Wave Height (SWH) or the average of the highest one-third of the waves over the course of an hour, which can be used to track the extreme range of wave heights in major storms.<sup>(38)</sup>

36. NOAA Tides and Currents, <http://tidesandcurrents.noaa.gov/slrtrends/index.shtml>

37. Mississippi Department of Marine Resources. Sea Level Rise Plan for Coastal Mississippi, 2011.

38. NOAA. National Data Buoy Center. <http://www.ndbc.noaa.gov/>. Accessed 7/6/1012.

### Track the Frequency & Severity of Natural Hazards

- o NOAA's National Climatic Data Center (NCDC) offers a Storm Events Database with extensive information from the National Weather Service on natural hazard events occurring by state and county. Some of the most relevant events to marina operation include tropical storms, tornados, hurricane, coastal flooding, high winds and storm surge. The database currently contains data from October 2006 to Present, as entered by NOAA's National Weather Service (NWS).<sup>(39)</sup>

### Identify the Federally Designated Flood Plain

- o FEMA's National Flood Insurance Program (NFIP) produces Flood Maps, on which FEMA delineates both the special flood hazard areas and the risk premium zones applicable to the community. Although marinas are water dependent and will most likely be located in designated flood zones, the higher impact Velocity, or V, zones are more susceptible to future damage and should be avoided where possible. For permanent structures insured under the NFIP, FEMA designates Base Flood Elevations (BFEs) to indicate the height above sea level necessary for safety from future flooding and storm surge.
- o Historical Storm Surge Activity from LSU SURGEDAT model. <http://surge.srcc.lsu.edu/>

### Protect Surrounding Marshlands

In many Gulf Coast areas, the Gulf of Mexico Alliance has teamed with the Nature Conservancy to conduct Sea Level Rise Affecting Marshes Models (SLAMM) for six coastal National Wildlife Refuges. As tidal marsh is lost to sea level rise, it is submerged and salt marsh moves landward to replace tidal freshwater and irregularly flooded marsh, which changes plant habitat, potentially resulting in the loss of high and dry ground. The SLAMM model simulates the processes involved in wetland conversion and shoreline modification during long-term sea level rise. Although marinas are generally not located in these study areas, the models provide useful guideposts to the processes occurring in coastal areas.<sup>(40)</sup>

### 6.3.3 ASSESS MARINA VULNERABILITY

Factors such as land form, coastal slope and shoreline erosion serve to predict the likelihood that a marina will be susceptible to sea level rise. The USGS Coastal Vulnerability Index has provided a means to quantify this vulnerability and thereby gain information useful for planning considerations and coastal management.

The Coastal Vulnerability Index uses data on the six physical variables as indicated in the table below. Each element is then applied to the formula as follows:  $CVI=V ((a*b*c*d*e*f)/6)$ , where:

- a = geomorphology,
- b = coastal slope,
- c = relative sea-level rise rate,
- d = shoreline erosion/accretion rate,
- e = mean tide range, and
- f = mean wave height.<sup>(41)</sup>

39. NOAA. National Climatic Data Center (NCDC) website. <http://www.ncdc.noaa.gov/stormevents/>. Accessed 7/6/1012.

40. Warren Pinnacle Consulting, Inc. Prepared for Gulf of Mexico Alliance Habitat Conservation and Restoration Priority Issue Team.

Application of the Sea-Level Affecting Marshes Model (SLAMM 6) to MS Sandhill Crane NWR. August 31, 2011.

41. USGS National Assessment of Coastal Vulnerability to Sea Level Rise.

## Ranking of Coastal Vulnerability Index<sup>(42)</sup>

Ranking of Coastal Vulnerability Index					
Variable	Very Low 1	Low 2	Moderate 3	High 4	Very High 5
Geomorphology	Rocky, cliffed coasts, fiords.	Medium cliffs indented coasts	Low cliffs, Glacial drift Alluvial Plains	Cobble beaches Estuary, Lagoon	Barrier beaches, Sand beaches Salt marshes, Mud flats, Deltas, Mangrove, Coral reefs
Coastal Slope (%)	> 11.5	11.5 to 5.5	5.5 to 3.5	3.5 to 2.2	< 2.2
Sea Level Rise (ini/yr)	< .07	.07 to 0.098	.098 to 0.12	.12 to 0.134	> .134
Shoreline Erosion/Accretion (ft/yr)	> 6.56	3.28 to 6.56	-3.28 to +3.28	-3.61 to 6.56	> 6.56
Mean Tide Range (ft)	19.69	13.45 to 19.69	6.56 to 13.12	3.28 to 6.23	< 3.28
Mean Wave Height (ft)	1.81	1.81 to 2.79	2.79 to 3.44	3.44 to 4.1	> 4.10

Each category in the table above results in scores associated from “Very Low” to “Very High”. In calculating the CVI, certain variables add more weight to the index than others. In other words, certain variables may have a higher impact on an area’s vulnerability than others. CVI values below 8.7 are considered low risk for sea level rise vulnerability. Values from 8.7 to 15.6 are considered moderate risk. Values from 15.6 to 20.0 are considered high risk, and values greater than 20.0 are considered very high risk.<sup>(43)</sup>

### 6.3.4 MAKE A PLAN FOR MULTIPLE HAZARDS

FEMA’s planning method for State and local governments takes into account the impact of multiple hazards on marinas, such as hurricanes, tropical storms and tornados as well as storm surge and flooding. Individual marinas can reach out to their cities or counties to be included in their hazard mitigation plans. Marinas may also use the data listed above in FEMA’s standardized planning method for States and local governments in their facility’s emergency planning for a variety of natural hazards.<sup>(44)</sup> Of course, being financially prepared with adequate insurance and cash reserves is crucial to resuming operations quickly. A multi-hazard mitigation planning process includes four steps: 1) Organization of resources, 2) Assessment of risks, 3) Development of mitigation strategies, and 4) Implementation and monitoring progress. FEMA illustrates the planning process as cyclical with frequent reviews and updates to integrate resiliency into daily marina planning.<sup>(45)</sup>



42. USGS National Assessment of Coastal Vulnerability to Sea Level Rise.

43. USGS National Assessment of Coastal Vulnerability to Sea Level Rise.

44. Assessment of Sea Level Rise in Coastal Mississippi. Mississippi Department of Resources Office of Coastal Management and Planning, as prepared by Eco-Systems, Inc.. July, 2011

45. FEMA. Local Multi-hazard Mitigation Planning Guidance. July 2008.

### 6.3.5 IMPLEMENT ADAPTIVE PRACTICES

Common marina development strategies like armoring the coastline and adapting to changes in the shoreline due to erosion and other factors can be used to increase a marina's future resiliency. Retreating from the water by including dry storage and moving non-water dependent operations away from shore is another option to increase resiliency.<sup>(46)</sup>

BEST MANAGEMENT PRACTICE	BENEFITTING SYSTEM	SECONDARY MANAGEMENT GOAL	BENEFITS	CONSTRAINTS
Minimize hard shoreline protection	Maintain sediment transport to promote accretion and prevent erosion	Maintain and restore protective wetlands	Preserves habitat for vulnerable species; minimizes erosion on surrounding property	Bulkhead alternatives may be more expensive and difficult to obtain permits for
Incorporate wetland protection into site and infrastructure planning	Transportation Infrastructure, sewer, utilities	Maintain and restore protective wetlands	Protects valuable marina and marina serving infrastructure	
Composite systems – Incorporation of elements of two or more methods (e.g. breakwater, sand fill, and planting vegetation.)	Shoreline maintenance ("soft" measures")	Preserve coastal land / development	Incorporates benefits of multiple systems; can address long stretches of coastline	"Softer" approach requires more maintenance over time and can become costly
Trap or add sand through beach renourishment	Coastal shoreline	Maintain sediment transport	Creates protective beach for upland protection of marina, potentially creates new access and recreation areas	Periodic maintenance cycle required with potentially high costs to import materials
Replace shoreline armoring with "Living Shorelines"	Preserves coastal land by using soft measures to protect the shoreline	Wetland restoration & habitat preservation	Reduces the down drift erosion associated with armoring	Requires more planning and maintenance than armoring
Preserve the biodiversity of waterfront vegetation	Shoreline protection, Wetlands, Tidal marshes, Sea grass meadows	Invasive species management, better water quality	Vegetation protects mainland shorelines against erosion caused by tidal energy, storm surge and wave force,	Regular maintenance required; Dynamic natural system
Install rock sills and other artificial breakwaters in front of tidal marshes along energetic estuarine shores.	Shoreline maintenance ("soft" measures")	Preserve coastal land / development; maintain water quality.	Naturally protect shorelines and marshes and inhibit erosion inshore of the reef; will induce sediment deposition.	May not be sustainable in the long-term because breakwaters are not likely to provide reliable protection against erosion in major storms.
Integrate marina planning into state coastal management plan & Local Hazard Mitigation Plans	Protection and preservation of coastal land for development	Maintains and restores wetlands while preserving valuable habitat	More state agency oversight; allows private conservation and management goals to be incorporated locally	Getting state & local agencies plus private marinas to agree on plan elements may be challenging

46. Mississippi Department of Marine Resources. Action Plan for Sea Level Rise for the Mississippi Gulf Coast. 2010.

BEST MANAGEMENT PRACTICE	BENEFITTING SYSTEM	SECONDARY MANAGEMENT GOAL	BENEFITS	CONSTRAINTS
Build permanent structures with additional “freeboard” height above the NFIP Base Flood Elevation	Protects structures from higher than anticipated flood level and storm surge		Minimize damage to surrounding areas from floating debris	Additional expense associated with higher elevations
Design and implement new coastal drainage systems.	Maintain water quality		Many systems may need to be restructured anyway	Planning, engineering, and construction can be very costly and time consuming

Sources: *Mississippi Department of Marine Resources. Action Plan for Sea Level Rise for the Mississippi Gulf Coast. 2010; Application of the Sea-Level Affecting Marshes Model (SLAMM 6) to MS Sandhill Crane NWR. August 31, 2011.*

Owners and operators should examine the region’s history and clearly identify the potential risks prior to selecting best management practices. Each of the included strategies offers an individualized approach to preventing erosion and the loss of critical habitat that lead to changes in the established shoreline. A well-considered combination of these strategies will promote greater resiliency to the impacts of natural disasters, as well as the slow and steady impacts of localized sea level variability and climate change.

# OUTREACH AND EDUCATION FOR MARINA OPERATORS & BOATERS



# 7.0 OUTREACH AND EDUCATION

A good outreach and education program is one of the first steps to promoting the use of new management practices and technologies. For marinas, there are two target audiences:

1. Marina operators and employees and,
2. Boaters and customers of the marina.

State Coastal Management and Planning (CMP) Agency officials are in charge of marina permitting and Clean Marina certification. This puts them at the forefront of this educational process. As the first point of contact for new marina operators, they are well-placed to share knowledge and best practices on resiliency with those relatively new to the business. Owners of existing businesses who wish to upgrade their operation can look to these entities for help as well. Boaters active in the States' waters frequently contact their CMP agencies for information about emergency preparedness and the safest places to harbor their vessels in a storm.

There are many options for education and outreach to both marinas and boaters. They are discussed in greater detail below, along with topics for education to promote greater resiliency. Many marinas already hold employee and staff education as well as outreach programs on safety. These outreach and education programs occur on an annual basis or more frequently depending on the size and function of the marina. Training new employees in practices promoting clean and resilient operations will improve the effectiveness of a regular training program. As Resilient Marina Programs grow, participants will develop a greater understanding of strategies that work, leading to new opportunities for partnerships between State agencies and the marinas putting these policies into practice.

## 7.1 RISKS TO RESILIENCE

Education and outreach will help alleviate risks associated with emergency preparedness, stormwater management and erosion controls, evacuation procedures, and climate adaptation through a better understanding of policies, procedures, and regulations by both staff and customers.

## 7.2 CHALLENGES TO ADDRESS

Take time to review education and outreach programs currently in place. Things to consider during this process include:

- What methods of boater and employee education are currently being used?,
- Have these strategies been effective?,
- Are boaters picking up educational brochures, stopping to read posters, etc.?,
- Is the education and outreach program reaching the target audiences?,
- Is employee training mandatory?,
- Is the staff providing information to customers verbally as well as with the use of handouts, posters, etc.?,
- Does the staff understand spill prevention strategies?,

- Does staff feel comfortable with evacuation and emergency preparedness plans?,
- What additional strategies could be incorporated?,
- Are there new funding sources for education and outreach programs available, i.e. grants, sponsored events, etc.?, and
- Is the information provided in multiple languages consistent with the cultural diversity of the region?

## 7.3 BEST MANAGEMENT PRACTICES

### 7.3.1 Marina Operators and Staff

Having a well-trained staff is essential to success for any business venture. Marina employees are generally expected to be knowledgeable about services and products supplied and to provide excellent customer service. Marina operators who choose to share knowledge about resilient practices with both their employees and their tenants can substantially increase the adoption of their recommendations. In addition to traditional presentations, some of the other education strategies successfully employed by marinas may include:

- Factsheets and brochures,
- Educational materials provided on CD,
- Bulletin board postings,
- Social Media,
- Video Clips,
- Employee recognition events, and
- Signage.<sup>(47)</sup>

Employing environmentally-knowledgeable staff is in itself a resiliency tool. Staff that can quickly and efficiently respond to minor disturbances and major disasters is an invaluable asset for any business. When discussing possible threats to the marina, it will be helpful to reference other areas of this guidebook as well as the information provided in your State's Clean Marina Guidebook. Clean Marina Programs already require training on an annual or bi-annual basis. Suggested topics for employee training on Resiliency include:

#### EMERGENCY PREPAREDNESS & RESPONSE

- o Carrying out an Emergency Preparedness Plan,
- o Boater evacuation prior to natural disasters,
- o Communication strategies with tenants prior to a natural disaster,
- o Safe boat storage for tropical storm events (safe harbors, tie-down procedures, etc), and
- o Routine drills for fires, natural disasters, medical emergencies and people falling overboard.

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47. California Clean Marina Toolkit, "Educating Boaters at your Marina." <http://www.coastal.ca.gov/ccbn/toolkit/marina-toolkit.pdf>. Accessed on 05/02/2012.

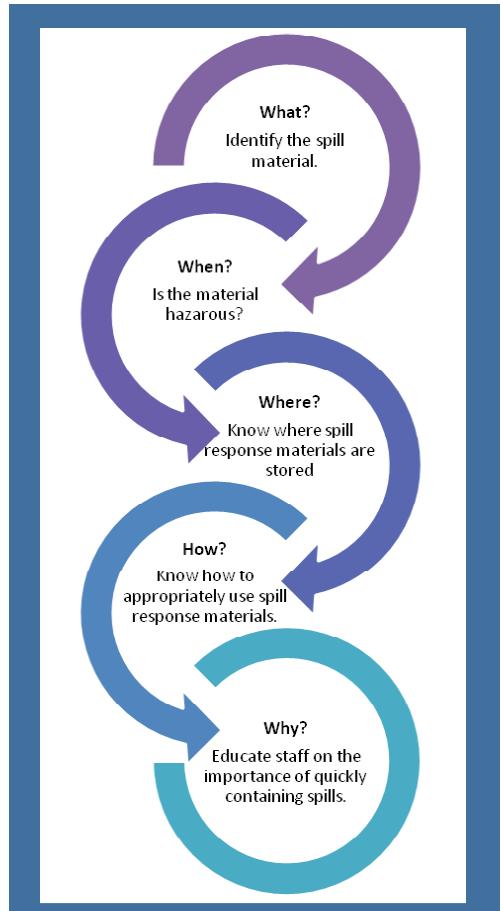
## FIRE & SAFETY MANAGEMENT

- o Train employees on how to use all fire safety systems, and
- o Develop communication strategies that encourage customers to employ safer boating practices.

## PETROLEUM SPILL RESPONSE

- o Identify the material spilled,
- o Determine when professionals should be contacted.
- o Is the material hazardous, check MSDS for more information?,
- o Where are spill response materials stored?,
- o How are spill response materials used and soiled materials disposed of?, and
- o Why is it important to quickly address spills?

The next section focuses on boater and customer education. Some strategies suggested can be used for both employee and customer education.



### 7.3.2 Customers and Boaters

Providing boaters and customers with educational materials on resilient and environmentally-sound boating practices increases awareness of environmental issues and promotes safe boating habits. The strategies below have proven useful for educating boaters at many marinas:

- Boater education displays,
- “Welcome” packets for new tenants,
- Lease agreement language regarding accepted marina practices,
- Dockwalker programs (staff provides information to boaters at the boat slip),
- Factsheets with monthly billing statement,
- Newsletters, and
- Clean and/or resilient marina features on marina maps.

No single strategy will reach every boater, so it is suggested that marinas employ a combination of the strategies mentioned above to improve awareness and education. Potential topics for boater education are outlined below.

### 7.3.3 Education Topics

#### EVACUATION AND EMERGENCY PREPAREDNESS

- o Provide clearly defined evacuation procedures in lease and other rental agreements (or welcome packet),
- o Provide clearly labeled facility maps with evacuation routes and shelter areas marked,

- o Educate boat owners about safe boat storage for tropical storm events (safe harbors, tie-down procedures, etc), and
- o Provide handouts for customers on all emergency preparedness and evacuation policies and procedures.

## SHORELINE EROSION

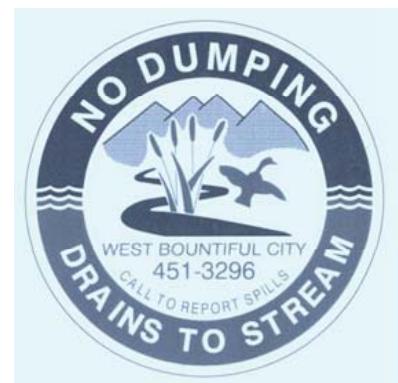
- o Inform boaters of damages caused by excessive wake,
- o Post signage for no-wake zones,
- o Use contracts and rental agreements to outline policies on no-wake zones, and
- o Discuss shoreline protection projects, such as living shorelines, with customers to educate on the benefits of natural shoreline systems.

## GAS/OIL & HAZARDOUS MATERIALS

- o Provide handouts on fuel spills, do not allow topping-off, encourage the use of oil-absorbing materials and filters in bilges,
- o Use signage around fuel pumps to educate boaters about safe fueling practices, and
- o Educate boaters about recycling for used oil, antifreeze, batteries, and lamps.

## STORMWATER

- o Inform customer & increase public awareness of storm drains emptying into surface waters by marking storm drains, and
- o Provide signage explaining stormwater pollution prevention items on-site such as rain gardens, rain barrels, impervious pavement, and other Best Management Practices.



## SEWAGE

- o Use signage stating no discharge of sewage and/or wastewater is allowed and provide directions on how to use the pump-out equipment, and
- o Provide directions on how to use pump-out equipment and state why it is important.

## FIRE & SAFETY MANAGEMENT

- o Provide handbook for possible emergency situations,
- o Provide Post emergency numbers, and
- o Have Material Safety Data Sheets (MSDS) available.

# **EXAMPLE 2012 HURRICANE PREPAREDNESS GUIDELINES FOR BLUEPOINTS MARINA**

GUIDELINES for BLUEPOINTS MARINA to create their own Hurricane Preparedness Plan. The document is also a model agreement demonstrating that the boater is aware of and agrees to the marina's policies. This Hurricane Preparedness and Response Plan for Bluepoints Marina in Cape Canaveral, Florida describes potential effects of a hurricane and includes a timeline for carrying out the plan, contacts for the hurricane response team, employee and boater responsibilities, basic safety procedures, recommended insurance coverage and procedures for return and recovery. Gulf Coast Marinas are encouraged to review this plan to see if it can advance their path to resilience and if so, to adapt it to meet their own requirements. Special thank you to Bluepoints Marina for allowing us to incorporate their plan in this document.

# 2012 HURRICANE PREPAREDNESS GUIDELINES FOR BLUEPOINTS MARINA

## A. Introductory Comments

The order of priority when preparing Bluepoints Marina for a hurricane is (1) Protect human life, (2) Seek to prevent or minimize personal injury, (3) Reduce the exposure of property to damage, (4) Minimize damage to property that cannot be relocated and (5) Seek to restore normal operations as quickly as possible.

The most dangerous and most critical tasks are, removing floating docks, associated gangways and securing boats. Experience has proven that marina docks and boats are most likely to survive a hurricane if all removed from the water and properly stored. Bluepoints Marinas wet slips being each equipped with a boat lift are not designed to accommodate boats during hurricanes and/or associated storm surge. These elements tend to push and pound boats against pilings, docks, and other vessels. Bluepoints Marina as a condition of use absolutely requires each wet slip user to evacuate their slip in the event of a Named Storm Condition. The floating docks may rise over the tops of piling and become adrift and as a precautionary measure Bluepoints Marina at its sole desecration will remove its floating docks in preparation of Named Storm Conditions. The management of Bluepoints Marina strongly encourages early evacuation of all boats in wet slips. Each wet slip user at Bluepoints Marina will be provided the option to store their boat (provided Bluepoints Marinas lift truck has the capacity to lift the boat and the boat will clear the overhead door height) to store their boat within Bluepoints Fully Enclosed Dry Storage Building for the duration of the Named Storm Conditions.

Preparing for a hurricane successfully depends on how early and how orderly we all act -although chances may be great that the storm will not hit us. Remember -wet slips must be evacuated and floating docks removed from the water well in advance of any projected landfall. We must be well into preparation procedures during the U.S. Weather Service Hurricane WATCH Phase. All boats must be secured and floating docks removed from the water by the time a hurricane WARNING is issued or sooner as directed by marina management, our actions must occur as much as 36 to 48 hours prior to an Emergency Management Agency call to evacuate the area and at least 24 hours prior to storm landfall.

Previous storms have taught us that, trailering or moving boats for the purpose of securing contents must be terminated early in the "watch" phase to allow marina personnel adequate time to secure the facility and evacuate the area.

Early action depends, of course, on early storm threat notice. Marina personnel and boat owners are encouraged to be aware of tropical weather conditions and to immediately report any storm news to the marina management.

This Hurricane Preparedness Plan outlines the procedures Bluepoints Marina will follow throughout hurricane season during hurricane watches, warnings, as well as during and after a hurricane. Marina customers are contractually required to be familiar with this plan (as well as the marina License Agreement and Marina Rules & Regulations).

Timetables for implementing the various stages of the plan will depend on the storm's forward speed/direction, probability of a storm hit, and the expected intensity of the storm. We will, of course, coordinate our timetables with those of the Canaveral Port Authority, United States Coast Guard and the local Emergency Management Agency.

Be aware that this Hurricane Preparedness Plan may work only for lower category hurricanes. Certainly, the impact from any hurricane could potentially result in major damage to the boats and marina facilities. We prepare in order to limit the damage or in hopes of a "near miss." For a major storm our efforts may or may not be adequate -but the job must be done quickly in order for all personnel to evacuate to safety. Remember -to attempt to secure boats while under storm influences are at the risk of the lives of marina personnel and boat owners. An approaching hurricane is a

potential killer -the inconveniences of early action are a small price to pay for safety.

## **B. Hurricane Information**

Marina employees and boat owners should take the time to learn about hurricanes. Storm formation, the history of hurricanes...hurricane preparation is a fascinating subject. An in depth understanding will not only make you more valuable to the marina and boat preparation efforts -but may save the lives of you and your family.

## **C. Summary of Bluepoints Marina Hurricane Preparedness Plan**

[Note: numbering of conditions may be found to be unfeasible because of the necessity for marinas to act on an earlier timetable to complete preparations prior to weather deterioration, bridge closings and non-business related evacuation requirements. Remember that these time frames are based on landfall of the hurricane EYE. Storm conditions will affect your preparation well in advance of eye landfall.]

<b>Condition</b>	<b>Activities</b>
<u>Preseason</u>	Review and revise plans, lists, and inventories. Generate customer awareness and conduct employee training.
<u>Condition 5</u> Season Starts (June 1)	Normal operation. Monitor weather and continue hurricane awareness – ensure all parties have updated plans.
<u>Condition 4</u> Storm in Vicinity	A storm has developed and could pose a threat to the coast. Assemble Leaders of the Hurricane Response Team to evaluate threat and review Hurricane Plan.
<u>Condition 3</u> 72 – 48 Hours to Landfall by the Hurricane Eye	A storm is threatening. Activate the full Hurricane Response Team. Begin implementation of Hurricane Preparedness Plan.
<u>Condition 2</u> 48-36 Hours to Landfall by the Hurricane Eye	A hurricane may strike within 36-48 hours. Complete securing of marina and boats. Hurricane WATCH has been issued by the National Hurricane Center and the County Emergency Management Agency probably recommends voluntary evacuation of islands and other low-lying areas. Determine marina closing and employee evacuation schedule. Establish limited entry.
<u>Condition 1</u> 24 Hours to Landfall by the Hurricane Eye	High probability of strike. Hurricane WARNING has been issued by the National Hurricane Center. Evacuation should be completed.
<u>Condition 0</u> Hurricane Conditions	Winds and flooding could stop further evacuation efforts. Hurricane Response Team maintains communication if possible.
<u>After the Storm</u>	Reestablish communications. Conduct search, rescue, damage
<u>Return and Recovery</u>	Assessment, salvage, and cleanup.

## **D. The Hurricane Response Team**

Marina management recruits the Hurricane Response Team (HRT). This team is involved in all phases of hurricane preparation at the marina and is recruited by Marina management. The purpose of the team is to help develop and implement the marina Hurricane Preparedness Plan, thereby maximizing human safety, while minimizing damage to the marina and boats. HRT members are marina employees and may include others as designated by marina management. HRT members, representing both marina and boat interests are in the best position to help educate other employees and boat owners – resulting in maximum acceptance and compliance with the plan. The Hurricane Preparedness Plan is premised on full cooperation of all employees and marina customers to act according to the plan.

**Hurricane Response Team Leadership:**

1. Marina Manager: Keith Smith
2. Office Manager-Communications Coordinator: Brenda Nugen
3. Lift Truck Operators: Tim Burgey, Ashton Davidson
4. Retail & Guest Relations: John Galioto, David Berry
5. Marine One Services, Inc. Kris McDonald

**E. Bluepoints Marina Management Policy Regarding Hurricane Preparation**

**Marina Employees**

Hurricane Response Team membership includes all marina employees. Unless instructed otherwise, marina employees will answer to the appropriate supervisor listed above during hurricane response.

There will be no excused absences once the marina is in Hurricane Condition III (a storm is in the vicinity). It is uncertain how long crewmembers will be required to be on duty during storm preparation. Therefore, at first notice of a storm there will be staggered relief shifts to allow each person time to go home to prepare their homes and families. This will be done well in advance of anticipated storm effects (as much as 2-3 days in advance).

Each employee must have a plan prepared for his/her personal preparation and evacuation in order to effectively reduce his/her required leave time, so other crewmembers can have adequate leave time. The marina manager will schedule leave time, with team leaders going first, in order to return to preparations as soon as possible. Each employee is required to attend Hurricane Preparedness Clinics given by the marina manager or his/her designee.

**Marina Responsibility**

The marina is not responsible for damage to any boat from storms or any other act of God. In the event that a boat is likely to cause bodily harm, loss of life, or damage to property; for example, on fire or sinking, the marina reserves the right to take any prudent action necessary to ensure the safety of its customers, employees or property. Any costs incurred in doing so will be charged to the boat owner.

**Hold Harmless Agreement**

The boat owner holds the marina harmless for accidental damage caused when the marina takes prudent emergency action before or during a storm and for salvage work done by the marina or salvage contractors. Emergency storm preparations and salvage operations include any activity which marina management deems necessary to protect persons from injury or property from damage, other than intentional acts that clearly increase the potential for damage to the renter's boat.

**Boat Insurance**

BOAT OWNER covenants and agrees that it has in full force and effect a marine hull insurance policy for "Named perils" or "all risks" for the value of the boat and a third party liability policy, also known as a P&I policy, in a minimum amount of \$500,000.00 naming Bluepoints Marina, Bluepoints International Fisheries, Inc., The First Republic Corporation of America and International Marine Group, LP, as additional Insured. BOAT OWNER shall provide evidence of such insurance to MARINA upon execution of this Agreement. Such Insurance policies shall provide that the insurer shall give MARINA (30) days written notice in advance of any cancellation or termination of any such policies. BOAT OWNER'S insurance policies shall include a contractual liability endorsement regarding BOAT OWNER'S indemnity of MARINA under this license. The insurer of such policies shall be an insurance company approved by MARINA and licensed in the

State of Florida. Failure to comply with any of the terms of this section shall, at the option of the MARINA, be cause for IMMEDIATE TERMINATION of the License Agreement by MARINA.

This will allow timely salvage operations and will cover damage to the boat or to damages caused by one boat to another. The License Agreement specifies that a boat owner is responsible for the damages his boat inflicts on another boat or to marina property – if he fails to take prudent efforts to properly secure the boat for the storm.

#### **Wet Slip/Boat lift Evacuation is Required as “condition of use.”**

Bluepoints Marina being located within Port Canaveral must comply with evacuation orders as set-forth by the Canaveral Port Authority. Both boats and the marina will suffer less damage if boats are not left on the boat lifts during a hurricane. The marina wishes to make it clear to boat owners that their boats will have a better chance at survival if evacuated. Remember that it is in everyone’s best interest to avoid damage to the marina -damage to the marina could affect the availability of a place to dock and the future cost of slip rentals.

Notice to evacuate wet slip boats will be the decision of the Hurricane Response Team according to guidelines in this Hurricane Preparedness Plan. The marina manager will issue the call to evacuate. The marina will not evacuate boats unless that becomes the prudent and necessary safety action. As a “condition of use of wet slips/boatlifts” all wet slips/boatlifts must be evacuated upon marinas order. Evacuation once ordered will be mandatory. Evacuation must be done early enough to allow marina staff ample time to prepare the marina for such conditions as well as their homes.

#### **Dry Stack**

The marina assumes no obligations in tying or otherwise securing dry rack boats. Boat owners must be aware that, there will be an announced cut off time after which loading on trailers will cease in order to complete the securing of marina property.

#### **Boat Handling Ceases When Winds Reach Sustained Speed of 10 Knots**

Launching, recovering, or otherwise handling a boat is unsafe when wind speed reaches 10 knots. Forklift, elevator and crane operations will cease at that time.

#### **Command and Notification System**

Marina management will assemble a Hurricane Response Team as an advisory panel to assist in improving the hurricane plans. The group will assist in implementing the plan during a storm threat. The marina manager makes the final decision on all policy and procedure recommended by the HRT. Notification of policy is in three forms: (1) the annual License Agreement, (2) posted Marina Regulations, and (3) this Hurricane Preparedness plan. Notification of changes will occur by mail or via E-mail 5 days prior to implementing change.

#### **Safety Consideration**

The overriding consideration in hurricane preparation and decision making in the marina Hurricane Preparedness Plan is the safety of employees and boat owners. Preventing damage to property is secondary to human safety.

#### **F. Bluepoints Hurricane Plan – Preseason**

During “Preseason,” prior to June 1, when hurricane season begins each year, there is no hurricane threat. This is the time to review the marina Hurricane Preparedness Plan and update or revise it as necessary. The marina crew will receive hurricane training. The marina will be inspected and housekeeping and maintenance will be done with storm readiness in mind.

**Responsibilities in Preseason are:**

**Marina Manager**

Reassess marina emergency procedures policy.

Review the marina License Agreement to ensure clarity of licensee liability for property damage and personal injury. Specify that vessel owners will be billed for services and materials necessary for preparation, response, and recovery.

Contact marinas' Marina Management Company and review the hurricane plan each spring

Emergency assistance communications

Wet slips evacuation concerns, considering such factors as severe weather, drawbridge policy, boat evacuation routes, safe harbors, etc.

Regional map of the marina's location with respect to storm surge, flood plain, wind damage potential, evacuation routes, and bridge locations

Review and update the detailed map of the marina showing locations of utility equipment and power shutoff points, sources of auxiliary power, potential hazard areas such as from fallen objects, trees, poles, etc.; emergency equipment and supplies, communication equipment, first aid stations and escape routes.

Identify items for evacuation in each department of the marina (Department managers to develop check lists).

Review and revise Hurricane Preparedness Plan as necessary.

Remind boat owners of responsibilities during hurricane season. Hold Hurricane Preparedness Plan training to include personal and family safety for marina personnel .

Emphasize cross training. Each person will have tasks as assigned in their own work area, but must be prepared to assist elsewhere when necessary.

Supervise /inspect all areas of the marina for pre-hurricane season safety, housekeeping, repair and maintenance. Correct problems immediately!

Verify with insurance agent that marina is adequately insured, particularly for wind and water damage. Keep current photographs of marina facilities on file and ensure that any applicable specifications required by the insurance policy (the fine print) have been met. Have this confirmed in writing.

Review listings for repair and salvage companies. Pre-qualify companies with references, proof of insurance, performance bonds and releases.

**Hurricane Response Team**

Review Hurricane Preparedness Plan (as revised for current year).

Assist Marina Manager with marina housekeeping, repair, and maintenance inspection program.

Update hurricane contact lists and distribute among HRT:

Agency and storm forecast emergency numbers

Marina Employees, wet slip and dry rack customers (See Communications Coordinator)

Materials and service vendors and contractors

**Communications Coordinator – \_\_\_\_\_**

Organize and train a communications team. Include the Store Manager on this team. Be aware that communications is the key element in successfully carrying out the Hurricane Preparedness Plan. The communications team has the responsibility to make equipment available and to make certain that communication takes place between marina management, the HRT, the various marina departments and boat owners.

Plan a communication system with boat owners, including name, address, E-mail address and telephone number of designated caretaker in the event they are out of town during hurricane season. Update employee emergency contact list.

Post and maintain a phone number list to include: Emergency Management Agency, insurance agent, pre-qualified repair and salvage companies, utility companies, fire department, police and Marine Patrol, rescue service, hospital, and employees Inventory marina handheld radios and weather alert radios.

**Dry Storage Boat Owners**

Review your boat liability insurance policy. The boat owner can be liable for damages caused by his boat.

**Wet Slip Boat Owners**

Review your boat liability insurance policy. The boat owner can be liable for damages caused by his boat.

**Marina Operations – Office**

Conduct pre-hurricane season housekeeping.

**Marina Operations – Dockmaster w/Lifttruck operators**

Conduct pre-hurricane season housekeeping, repair and maintenance of dry storage facility. Inspect and service rack system, doors and building. Inspect and service outside/wash racks. Inspect and service hauling equipment. Inspect and clear storm drains.

**Marina Operations – Dockmaster W/all outside employees**

Conduct pre-hurricane season housekeeping, repair and maintenance of wet slip facilities and equipment.

**Marina Operations – Dockmaster w/Retail Sales Team**

Conduct pre-hurricane season housekeeping, repair and maintenance of store and related retail areas.

Participate in planning and training sessions with Communications Coordinator. Inventory hurricane response kit(s) -replenish as necessary.

**Marina Operations – Repair Service Manager - \_\_\_\_\_**

Conduct pre-hurricane season housekeeping, repair and maintenance of repair facility and equipment.

Perform repair and maintenance to all emergency equipment. Perform repair and maintenance to all marina vehicles and boats.

Continually monitor weather forecasts.

Assist marina manager in a full facility hurricane readiness inspection.

Work with marina management to prepare and conduct hurricane preparation drills to instill a high degree of hurricane awareness and readiness among boat owners.

**Communications Coordinator - \_\_\_\_\_**

Develop assignment sheet for marina handheld radios to issue to employees.

Assemble/train team of 3 (with backups) for the emergency call network.

**Dry Storage Boat Owners**

If owner plans to evacuate marinas dry storage building, prepare your boat evacuation plan – file it with the marina as required.

Make your boat and trailer evacuation ready.

Review your boat insurance policy with your agent keeping marina contract requirements in mind.

**Wet Slip Boat Owners**

Prepare your boat evacuation plan – file it with the marina as required.

Make your boat evacuation ready.

Practice your evacuation and storm preparation plan.

Review your boat insurance policy with your agent keeping marina contract requirements in mind.

**Marina Operations – Office - \_\_\_\_\_**

Update the office equipment and records evacuation plan. Mark items for quick identification at evacuation.

Records to remove:

1. Call List

2. Cash register receipts, records, and cash

3. Petty cash box
4. Computer, software and backed up files

Meet with managers of each department to determine materials and equipment to be evacuated and determine transportation requirements

**Marina Operations – Dockmaster**

Inspect marina inside and out.

**Marina Operations – Dockmaster/Retail Sales Team**

Double check Hurricane Kit inventory.

Update plan (checklist) for evacuating and securing store stock.

Update “last minute order checklist.”

Prepare and sell “Hurricane Preparedness Kits” for boat owners.

**Marina Operations – Repair Service Manager -** \_\_\_\_\_

Update the plan (checklist) for evacuation tools, parts, and service records.

**H. Bluepoints Marina Hurricane Plan – Condition 4, Storm in the Vicinity**

In Condition 4 there is a tropical depression, tropical storm, or hurricane within a 1,200-mile radius of the marina. This is the time to assemble the Hurricane Response team to evaluate the threat to the area and to develop a preliminary action timetable for this particular storm.

All marina employees are to make contact with their supervisor. Plan to be called to duty at or before Condition 4.

Be aware that progression from Condition 4 to Condition 0 – hurricane in progress, can happen swiftly!

**Responsibilities in Condition 4 are:**

**Marina Manager**

Schedule and conduct meetings with HRT to determine threat potential and action time tables.

Meet with Communications Coordinator and volunteer team to review Communications strategy and requirements. Meet with each marina department head to review Communications strategy and requirements.

Establish communications with marina Management Company. Review list of preselected equipment and records to be evacuated in each department. Confirm with marina office readiness to secure rental trucks for evacuation (if needed).

Determine the number of absentee boat owners expected.

Schedule marina staff for storm duties. Include "shore leave" for crew to prepare homes and families. Coordinate securing marina facilities, equipment and boats.

Assign HRT member for follow-up on each.

#### **Hurricane Response Team**

Evaluate the storm threat potential by plotting the advance and assessing weather reports. Determine a timetable for action for this particular storm.

Initiate notification of wet slip boat owners. (Marina Manager)

When the storm is perceived as a threat, the HRT activates Communications.

Provide uniform written statements to the Communications Coordinator on storm position and any activation timetables.

#### **Communications Coordinator**

Assemble members of the communication team for briefing on the storm as advised by the HRT.

Disseminate only information from the HRT, as approved by marina manager, regarding the storm to maintain standard information and to minimize confusion.

Keep a list of persons not reached on the first call and or e-mail and continue to repeat this call list. Log each call made notifying boat owners (record message, time of call, recipient of notice or no answer).

Distribute handheld radios as advised by marina manager.

Perform initial communications regarding the storm and status of preparedness plan implementation to marina employees and boat owners as directed by the marina manager.

Begin maintaining "storm notice posting" at the marina office. Post storm information on bulletin board outside of store (to reduce the traffic of curious on-lookers in the store).

#### **Wet Slip Boat Owners**

Adhere to the marina dockage contract provision that all boats must evacuate the wet slip.

#### **Marina Operations – Office**

Meet with department managers to assist with preparing items for evacuation.

Marina Operations – Dry Storage-Marina Manager & Dockmaster

Perform storm readiness inspections on area and equipment.

Begin moving boats that will be evacuating.

#### **Marina Operations – Wet Storage Marina Manager & Dockmaster**

Perform storm readiness inspections on area and equipment.

### **Marina Operations – Dockmaster/Retail Sales Team**

Perform storm readiness inspections on area and equipment.

Distribute Hurricane Kit Supplies as directed by marina manager.

Mark supplies in store stock for marina use to avoid depletion of stock by customer demands.

Review the checklist for merchandise, store records, and cash that are to be evacuated.

### **Marina Operations – Repair Service Manager -** \_\_\_\_\_

Perform storm readiness inspections on area and equipment (refer to checklist). Review the checklist for tools, parts, and service records that are to be evacuated.

## **I. Bluepoints Marina Hurricane Plan – Condition 3: 72-48 Hours to Landfall**

In Condition 3, we are under a storm threat. This is the time to activate the full hurricane response team and to be well into implementation of the Hurricane Preparedness Plan. Everyone should frequently monitor radio, TV, internet or NOAA Weather Radio for official bulletins of the storm's progress. Also, everyone should review needs and working condition of emergency equipment, such as first aid kit, flashlights, and battery-powered radios.

All marina employee leave is canceled – everyone is to report to their supervisor.

**Responsibilities in Condition 3 are:**

### **Marina Manager**

Visit with each employee to increase his or her personal level of preparedness and to encourage prompt return to work after the threat passes.

Continually visit each marina area to inspect work progress.

Prepare to issue a notice that evacuation of wet slips is required.

### **Hurricane Response Team**

Evaluate the storm threat potential by plotting the advance and assessing weather reports. Advise manager on timing of issuing a notice that evacuation of wet slips is recommended. Do this very early in the U. S. Weather Service Hurricane WATCH stage in order that boats may be clear of the slips by the U. S. Weather Service Hurricane WARNING stage.

Issue a notice that preparation of the dry rack storage facility is underway early in the WATCH stage. The notice will include the deadline for access to boats in the racks. After this deadline boats in dry storage will not be loaded for trailering or moved for securing of contents. This is an effort to eliminate prolonging preparation efforts and marina personnel hazard exposure.

Activate the wet slip evacuation.

Be prepared to step up preparation timetables if forward speed and intensity increase.

As time allows, work with marina crew in assigned areas with boat evacuation and general facility preparations.

Marina Manager will initiate the wet slip evacuation and removal of floating docks.

#### **Communications Coordinator**

Maintain constant radio contact with marina manager and HRT. Continue efforts to contact boat owners to relay HRT messages. Maintain storm information on bulletin board outside of store.

Receive and log boat evacuation or preparation information. Designate a courier to convey information to Marina Manager and HRT.

Notify suppliers to hold shipments until further notice.

#### **Dry Storage Boat Owners**

Be aware that any costs associated with securing a boat at the marina will be charged to the boat owner.

Advise the marina of your intention and schedule for evacuating your boat by trailer.

Be aware that trailer loading will terminate when wind speed reaches 10 knots – or at a specified time to allow completion of marina storm preparations, so plan to move early. The marina will assist only with launch and recovery as weather conditions permit.

#### **Wet Slip Boat Owners**

Evacuation of your boat lift is required as a conditional use.

Provided marinas lift truck has the capacity to lift your boat and your boat height will clear the dry storage buildings doors you have the option to locate your boat inside the dry storage building stored in an aisle way or remove your boat from the marina.

Act soon ...Bridges will be locked down. Once wind speeds reach 10 knots sustained, marina will cease lifting boats from the water.

Advise the marina of your intention and schedule for evacuating your boat by water or to take to a yard for haul out or stored in the marinas dry storage building.

#### **Marina Operations – Office**

Secure and prepare for evacuation of preselected office equipment and records. Coordinate materials and equipment evacuation needs for each department.

#### **Marina Operations – Marina Manager & Dockmaster**

Load trailer boats for evacuation on first come, first serve basis. Launch boats only for evacuation by water.

Periodically check progress of all crews. Once notice is given to secure all boats:

Move all upper rack boats possible to lower racks.

Put all boats in dry racks if possible. Secure outside racks.

Ensure crew is working with extreme caution, wearing non-skid shoes, hard hats, and life safety vests where appropriate.

#### **Marina Operations – Dockmaster**

Assist evacuating boats.

Continue fuel dock operations.

Determine best locations for boats likely to be left in the marina.

#### **Marina Operations – Dockmaster/Retail Sales Team**

According to the checklist, prepare merchandise, store records, and cash that are to be evacuated.

As confusion in the stores mounts, close for retail business in order to assist with communications and to begin securing the store and contents for storm. (Remain open for ice and hurricane supply items until the situation is prohibitive).

#### **Marina Operations – Repair Service Manager**

According to the checklist, prepare tools, parts, service records and cash that are to be evacuated.

### **J. Bluepoints Marina Hurricane Plan – Condition 2: 48-36 Hours to Landfall**

In Condition 2, a hurricane may strike within 48-36 hours – a hurricane WATCH has been issued. This is the time to complete securing of marina and boats. The Emergency Management Agency probably has recommended voluntary evacuation of islands and other low-lying areas by this time. Marina management, in consultation with the HRT will determine marina closing and employee evacuation schedule. Entry to the marina is limited at this time to employees, members of the HRT and boat owners in the process of evacuation.

#### **Responsibilities in Condition 2 are:**

##### **Marina Manager**

Make continual checks of storm readiness preparations in all departments.

Determine security requirements as confusion mounts. Reducing unnecessary traffic at the marina may require a Security Guard.

##### **Hurricane Response Team**

Evaluate the storm threat potential by plotting the advance and assessing weather reports. Be prepared to step up preparation timetables if forward speed and intensity increase. Assist marina manager in checks of storm readiness preparations in all departments.

## **Communications Coordinator**

Prepare communications equipment and contact lists for evacuation. Put pre-qualified repair and salvage companies on stand-by.

## **Dry Storage Boat Owners and Wet Slip Boat Owners**

Be securing your boat according to your plan as filed with the marina.

## **Marina Operations – Office**

Back up computer files.

Process and mail all outgoing mail.

According to the checklist, load office equipment and files for evacuation.

## **Marina Operations – Dockmaster**

Facilitate boat evacuation by trailer until announced deadline.

Secure area flags, trashcans, carts, furniture, fire extinguishers, and other loose items that can be affected by wind.

## **Marina Operations – Lift Truck Operators**

Secure area flags, trashcans, carts, furniture, and other loose items that can be affected by wind.

Assist evacuating wet slip boats and wet slip boat owners asking to haul out. According to the checklist, load wet slip customer and operations files for evacuation.

## **Marina Operations – Retail Sales Team**

According to the checklist, load merchandise, store records, and cash for evacuation. Coordinate transportation with Marina Office.

Consolidate frozen items into 1 freezer, if possible.

Set up 12v batteries to power VHF during electrical outages.

Carefully monitor sales of ice, batteries, flashlights, rope and other storm supplies. Retain an adequate stock for marina's use.

Relocate merchandise that cannot be evacuated, but could be damaged by flooding. Ensure that storage room doors and vents are tightly secured with plywood and plastic. Assist Communications Coordinator as required.

## **Marina Operations – Repair Service Manager**

According to the checklist, load tools, parts, service records, and cash for evacuation. Coordinate transportation with Marina Office.

Coordinate boarding up of all windows at store, office and service shop.

Secure area flags, trashcans, carts, furniture, fire extinguishers, and other loose items that can be affected by wind.

Secure containers for used oil, antifreeze and other environmental hazards.

#### **K. Bluepoints Marina Hurricane Plan – Condition 1: 24 Hours to Landfall**

In Condition 1, there is high probability the hurricane will strike – a hurricane WARNING has been issued. This is the time to have completed evacuation efforts. Marina management will announce marina closing and employee evacuation schedule. Everyone will stand by to evacuate. Entry to the marina is limited at this time to employees, members of the HRT.

Everyone should continue to closely monitor radio, TV, internet, NOAA Weather Radio, or hurricane Hotline telephone numbers for official bulletins. Follow instructions issued by local officials. LEAVE IMMEDIATELY IF ORDERED TO DO SO. Under any circumstances -leave areas that might be affected by storm tide.

*Anyone working on the docks or near the water is required to wear life jackets.*

##### **Responsibilities in Condition 1 are:**

###### **Marina Manager**

Prepare to evacuate.

Account for all personnel and clientele. Arrange for transportation.

Make final checks of storm readiness of all departments. Prevent unnecessary traffic at the marina.

Base a decision to evacuate on recommendations from local authorities, marina management company and the condition of evacuation routes.

Evacuate customers, essential files, records, equipment and personnel when premises are secured or immediately on order from the Emergency Management Agency.

Ensure electrical power breakers to fuel system are in the “off” position.

###### **Hurricane Response Team**

Evaluate the storm threat potential by plotting the advance, assessing weather reports and listening to County Emergency Management Agency instructions.

Be prepared to step up preparation timetables if forward speed and intensity increase. Advise marina manager on final evacuation timing.

Assist marina manager in final storm readiness checks.

Organize post-storm rendezvous.

###### **Communications Coordinator**

Communicate evacuation order as directed.

Communicate post-storm rendezvous.

Maintain telephone and radio operations as long as possible.

#### **Dry Storage Boat Owners**

Stay clear of the marina. Boat Owner must have completed all storm preparation efforts for your boat. Complete securing home and evacuating family as instructed by the County Emergency Management Agency.

#### **Wet Slip Boat Owners**

Stay clear of the marina. Boat Owner must have completed all storm preparation efforts for your boat. Complete securing home and evacuating family as instructed by the County Emergency Management Agency.

#### **Marina Operations – Office**

Evacuate office equipment and files.

#### **Marina Operations – Lift Truck Operators**

Use forklift to assist with removal of heavy items from docks.

Fuel and then park forklifts at highest ground point. Park forklifts with forks in down position.

Marina boats: fuel and equip for trailering and evacuate when appropriate with designated vehicle.

#### **Marina Operations – Dockmaster**

Secure any boats not evacuated.

Lash dock boxes to cleats and wire/lock tops closed.

Secure all dock carts ashore.

Wire shut all power centers covers. Use 3" strips of wire.

Decommission and secure fuel docks, including pumpout station (remove all oils and other inventory).

Remove hose reels and other removable items.

Lash dispenser covers to the frames.

Seal fuel storage tanks.

Close all valves.

At last call for evacuation remove life rings.

#### **Marina Operations – Retail Sales Team**

Collect and consolidate Hurricane Kit materials and equipment not in use. Complete final boarding of building.

## **Marina Operations – Repair Service Manager**

Evacuation of service center complete.

### **L. Bluepoints Marina Hurricane Plan – Condition 0: Hurricane**

In Condition 0, we will be under hurricane influence. No boat or marina preparation will occur. Concern is for personal and family safety only.

**Responsibilities in Condition 0 are:**

Marina Manager, Hurricane Response Team, Communications Coordinator, area managers and employees remain in safe shelter.

#### **Dry Storage Boat Owners and Wet Slip Boat Owners**

*Remain in safe shelter; do not be aboard in a Hurricane!*

One of the most dangerous mistakes a skipper can make is to stay aboard during a hurricane. There is little, if anything, a skipper can do to save a boat when winds are blowing 100 mph, tides are surging, and visibility is only a few feet.

### **M. Bluepoints Marina Hurricane Plan – Return and Recovery**

After the hurricane has passed, everyone is advised to remain in a protected area until announcements are made on radio or TV that dangerous winds and flooding have passed. Telephone communications may not be possible. Listen to public radio broadcasts for this information. Marina personnel are expected to return to the marina as soon as possible to begin the cleanup process and to return the marina to operating conditions.

Controlling damage after the hurricane is important. This can save time and money for the marina and boat owners. Someone with authority must be available to work with salvors, owners, and insurance representatives and provide security to limit access to the property. We will admit only boat owners, authorities, insurance personnel, and only those contractors and surveyors on assignment. Salvage operations will be discussed with owners and their insurance companies before moving damaged boats. Calling insurers with a description of conditions at your marina will help expedite removal of boats as well as the payment of salvage bills and claims.

If there have been high waters, be careful of snakes or other animals that may have gotten into buildings or other high points.

**Responsibilities in Return and Recovery are:**

#### **Marina Manager**

Communicate with HRT and assemble at a designated time and place. Reenter marina when cleared by local emergency management. Prepare to assist in search and rescue activities.

Conduct a safety inspection and document damages photographically before permitting customers on the property. If necessary, request assistance from the Emergency Management Agency, fire department, utility companies, or police.

Clearly mark and blockade hazard areas; be particularly careful of fallen electrical lines and leaking fuel.

Deploy containment equipment for liquid spills.

Marina manager shall serve as spokesperson for media, insurance, and customers.

Evaluate boat condition reports. Prepare reports for customer notification by Communications Coordinator.

Contact local or state agencies regarding necessary permit requirements for rebuilding. Begin clean up and repair procedures only after insurance company has been contacted and legal documentation of damage has been accomplished.

Determine the priorities for getting the marina back in business – make assignments to HRT accordingly.

#### **Hurricane Response Team**

Assist marina manager with damage assessments and planning a repair schedule.

Make recommendations for improving the marina “Hurricane Preparedness Plan” (in writing within two weeks of Hurricane).

#### **Communications Coordinator**

Set up and supervise operations center, log in all arrivals and departures.

Contact employees not returned.

Contact repair and salvage companies as directed.

Contact customers to report boat condition and when marina is estimated to be open to inspect

#### **Dry Storage Boat Owners and Wet Slip Boat Owners**

Remain clear of the marina until notified.

Review insurance policy and prepare to evaluate and report damages to insurance agency.

#### **Marina Operations – Office**

Assist Communications Coordinator.

Restore offices to operation as soon as possible.

#### **Marina Operations – Dockmaster**

As approved by manager:

Evaluate boats in dry storage and submit a report to manager.

Put forklift and other lifts in service.

**Marina Operations – Dockmaster**

As approved by manager:

Prepare Marina boat for launch.

**Marina Operations – Retail Sales Team**

Obtain and account for emergency equipment issued.

Assist Communications Coordinator.

**Marina Operations – Repair Service Manager**

Assemble recovery equipment inventory – lifts and cranes, tractor, winches, blocks and tackle, lift slings, etc.

Work with qualified electrician to check out all circuits and electrical equipment. Assist manager.

**“Lets be prepared and Lets be Safe “We’re all in this together” Bluepoints Marina at Port Canaveral**

I have read, understand, and agree to Bluepoints Marina at Port Canaveral “Hurricane Preparedness Plan”.

Print name: \_\_\_\_\_, Employee \_\_\_\_\_, Boat Owner: \_\_\_\_\_

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

# Selected Definitions

**Anchorages:** Areas in which vessels are held by means of anchors or similar devices which are removed from the bottom and carried aboard the vessels once they are underway.

**Best Management Practices:** Methods, measures, or practices designed to meet certain pollution control needs. Best management practices include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. Best management practices can be applied before, during, or after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters.

**Boat Ramps:** Facilities which provide access to the water primarily for vessels that are carried on, launched from and returned to trailers.

**Breakwater:** A structure, parallel to the shore, which protects a shore area, harbor, anchorage, or basin from waves.

**Bulkhead:** A vertical walled structure or partition intended to retain or prevent sliding of the land, or to provide an interface between land activities and those which occur in the water, or intended to protect the upland against damage from wave action.

**Commercial Marinas:** Marinas which are operated primarily for profit.

**Critical Habitat:** Areas that serve an essential role in the maintenance of sensitive species. Critical habitat areas may include unique aquatic or terrestrial ecosystems that support rare, endangered, or threatened plants and animals. Rare, endangered, or threatened species are defined by both state and/or federal listings.

**Dedicated Pumpout Facility:** A semi-permanent connection made between a vessel and the shore for the purpose of removing vessel sewage from the vessel holding tank or head on a continuous or automatic intermittent basis to an approved sewage disposal facility.

**Discharge:** Any release, however caused, from a vessel, pier, or other marina facility. This includes any escape, disposal, spillage, leaking, pumping, emitting, pouring, dumping, or emptying.

**Dock:** A fixed or floating decked structure where a vessel or vessels may be secured either temporarily or indefinitely.

**Dry Slip:** A slip or berth in which the vessel rests in a rack or trailer located on land adjoining the water, rather than in or over the water.

**Dry Stack Marina:** A boating facility which stores vessels on dry land, including but not limited to, dry storage facilities, boatels, valet storage, pigeon hole storage, and stackominiums.

**Dump Station:** See **Pumpout Facility**.

**Exfiltration Area:** An underground stormwater retention area consisting of perforated pipes placed within an underground bed of crushed rock or other pervious granular material.

**Finger Pier:** A comparatively smaller dock structure attached (usually perpendicular) to a primary pier or bulkhead, usually provided to facilitate access to berthed vessels.

**Fishing Facilities:** Facilities which provide slips, anchorages, or mooring fields for charter fishing boats and other fishing operations.

**Gray water:** The liquid and water-borne waste derived from vessel galleys, showers, bathroom sinks and tubs, but not including sewage.

**Intertidal Flat:** That shallow water habitat situated between the extreme high and extreme low tidal limits.

**Live-aboard vessel:**

- A vessel used principally as a residence.
- A vessel used as a place of business, professional or other commercial enterprise and, if used as a means of transportation, said transportation use is secondary or subsidiary use.
- Any other floating structure used for purposes stated above under the above two parts.
- Charter and other similar fishing boats shall not be considered to be live-aboard vessels unless they are residences as described in the first part.

**Maintenance Dredging:** Dredging of previously dredged channels, ditches, dockages, lagoons and other waterways to maintain or restore the approach depth and width.

**Maintenance Wastes:** Materials collected while maintaining or operating vessels, including, but not limited to, soot, machinery deposits, solvents, hydrocarbons, scraped paint, deck sweepings, wiping wastes, and rags.

**Minimum Navigable Depth:** The minimum depth, at mean low tide, that is required for safe navigation by vessels.

**Mooring Fields:** An area in which vessels are held by means of mooring buoys or similar devices which are fastened to stationary underwater devices which are not carried aboard the vessels as regular equipment. Mooring fields have no direct access from land and the moored vessels can only be reached through the use of small dinghies or other vessels.

**Oil:** Oil of any kind and in any form including, but not limited to, petroleum products, tank bottoms, oil refuse, oil mixed with other wastes, and all other liquid hydrocarbons regardless of specific gravity.

**Pier:** A structure in, on or over subaqueous lands which is used by the public primarily for fishing, crabbing, swimming, or viewing. A pier shall not include vessel berthing use unless specifically designated as such.

**Private Slips or Ramps:** Facilities that are not part of a residential or planned community marina, serve a single residence, and are constructed exclusively for the personal use of the occupants of that residence.

**Public Marinas:** Marinas owned by governmental agencies and operated with their own

personnel or through a concession or other agreement with a private entity.

**Pumpout Facility:** A mechanical device which is temporarily connected to a vessel for the purpose of removing vessel sewage from its holding tank or head to an approved sewage disposal facility.

A **Dump Station** is a type of pumpout facility which receives vessel sewage from portable marine sanitation devices and from which sewage is delivered or transferred to an approved sewage disposal facility. See also **Dedicated Pumpout Facility**.

**Recreational Marinas:** Recreational marinas include residential or planned community marinas, water sports club marinas, and all other marinas which are not commercial marinas or public marinas.

**Retention:** Prevention of the discharge of a given volume of stormwater runoff into surface waters accomplished through on-site storage of a specified quantity of rainfall and/or runoff, with provision for controlled release of water in excess of the stored volume.

**Revetment:** A sloping structure made of stone, concrete, or other material, and built to protect a shoreline, scarp, embankment, or structure against erosion by wave action or currents.

**Riprap:** A layer, facing, protective mound of stones, or other durable material placed to prevent erosion, scour, or sloughing of a structure or embankment. Also, the stone or other material so used.

**Sewage:** Human body wastes and wastes from toilets and other receptacles intended to receive or retain human body wastes.

**Shellfish:** Any edible molluska or crustacea including oysters, clams, lobsters, mussels, whelks, crabs, and shrimp.

**Slip:** A place where a vessel may be secured to a fixed or floating structure, including, but not limited to, a dock, finger pier, or mooring. Anchorages may also be included if they provide non-transient berthing for vessels. Slips may be wet (in the water) or dry (in a rack or other device on land).

**Solid Waste:** Any garbage, refuse, sludge, or other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from commercial operations or from community activities. Solid waste does not include solid or dissolved material in domestic sewage or discharges which are point sources that are subject to permits.

**Structure:** Any man-made object including, but not limited to: piers, slips, docks, breakwaters, revetments, or bulkheads.

**Submerged Aquatic Vegetation:** Vascular plants rooted in the sediment and permanently growing on or below the surface of the water. Submerged aquatic vegetation does not include emergent wetland species.

**Subtidal Flat:** A shallow water habitat situated below the extreme low tidal limit.

**Support Facilities:** Installations or services that support the functions of a marina, such as utility services, fueling stations, repair and launching facilities, the marina headquarters, parking, retail facilities catering to the boating and aquatic recreational needs of marina users, and restrooms, showers, and laundries.

**Tidal Flushing:** The exchange of waters within a confined area, such as a marina basin, with water from a larger adjoining water body; such exchange being due to the rise and fall of the tide, and/or wind circulation with accompanying mixing of the water.

**Transient Mooring:** Anchorage or mooring periods less than forty-eight hours.

**Uplands:** Lands of elevations above the current mean or ordinary high water mark and which are not classified as wetlands.

**Vessel:** Every type of watercraft, boat, houseboat, or other form of man-made contrivance used, or capable of being used, whether or not capable of self-propulsion, for navigation on the waters of the state.

**Vessel Repair/Maintenance Yards:** Any facility which provides for the new construction, repair or maintenance of vessels.

**Wastewater:** The liquid and water-borne human and/or household waste derived from residential, industrial, institutional, or commercial sources, including vessels.

**Water Pollution:** The man-made or man-induced alteration of the natural chemical, physical, biological, and/or radiological integrity of water.

**Wetlands:** Land areas that are saturated by surface or groundwater at a frequency and duration sufficient to support hydric vegetation.

**Wet Slip:** A berth or slip space in the water.

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