2407 N. Roosevelt Blvd.
Hurricane Management Plan

Executive Summary

This plan demonstrates the capabilities of a well-planned marina to provide safe and secure dockage during a storm.

Marinas are concerned about both the vessels and their docks/infrastructure. The level of storm preparation falls primarily on the vessel owner. The level of experience and concern varies greatly. Preparation and execution determine which vessels experience minimum damage and which are severely damaged and/or cause damage to the marina facilities.

Both the vessel design (large, well placed cleats) and the marina design (strong oversized cleats and pilings exceeding storm surge wave height) will maximize the protection of the assets. Execution of a well-designed storm plan is in the marina's best interest as it protects assets, minimizes repair expenses and speeds the return of revenue producing residents.

According to leading research, the most damaging component of a hurricane, for marinas, is storm surge, not wind. Pilings need to exceed the storm surge wave height so vessels may rise with the surge but not overtop the pilings. This marina, at 2407 N. Roosevelt, is well placed on the Gulf/ Bay side, exposed to north west winds, which according to Jonathan Rizzo, at the National Weather Service[1], would require a hurricane to pass to the east (further up the Keys), which means the weakest side of the storm would impact this location.

Additionally, post-hurricane research has shown that vessels tied both individually and collectively prior to a hurricane reduces the risk of single-point failures. The similarity of vessels and proposed marina design will allow the vessels and marina infrastructure to be tied into large networks that utilizes all connections to protect against single point failures.

[1] Email from Johnathan Rizzo dated April 18, 2019 (Exhibit A)

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Section 1 - Goals, Objectives, Teams

Goals:

- Assure the safety of residents, marina staff, and neighbors in the event of a hurricane.
- Protect the vessels, marina facilities, and neighboring property.\
- Assure the safe and timely evacuation of residents and staff.
- Reopen as quickly as possible after a storm event following marina assessment, and any necessary repairs and inspections.

Objectives:

Provide clear and concise procedures for marina staff and vessel occupants to follow and to execute these plans in a safe and timely manner.

- Assure safety is the primary concern as each step of the plan is executed.
- Yearly Update, maintain and practice a workable and effective plan.
- Assure staff and residents are trained and understand their responsibilities.
- Maintain supplies and materials on hand in good working order.
- Practice the plan and execute an early execution.

Teams:

- Leadership Team - Dockmaster will be responsible for communication, coordination, and all decisions.
- Vessel Preparation Team - Dockmaster and dockhands will be responsible for vessel storm lines, utilities management, final vessel inspections.
- Marina Preparation Team - Dockmaster and dockhands will be responsible for securing the buildings, common areas, vehicles, and clearing of the docks.

Section 2 – Hurricane Plan Management

Responsibilities - Leadership Team

Decisions:

Marina ownership in consultation with the dockmaster will make the final decisions about when to execute all phases of this plan. The dockmaster will be responsible for the execution of the plan.

Facility Inspection:

Dockmaster shall conduct a complete facility inspection no less than weekly to ensure piers, docks and utilities are in good working order and are free from clutter.

Communication:

Dockmaster shall keep the resident contact list updated. Dockmaster shall ensure that all residents have copy of the plan and understand the procedures and their responsibilities in the event of a hurricane. The plan will be posted on the marina web site.

Coordination:

Dockmaster shall ensure staff is familiar with the plan, facility preparation and response procedures and the location of equipment and supplies. Specific hurricane preparation requirements shall be written down and posted on the marina's web site.

Maintain a list of alternate personnel and former employees who will assist the regular staff with preparation of the vessels and marina.

Maintain a list of local contractors who will support unanticipated preparation efforts and post storm restoration efforts.

Conduct resident workshops & training to assure understanding of what will be provided by the marina, what is required from each resident and what timeline will be used.

Timelines:

See appendix B

Section 3 – Vessel Preparation

Marina responsibilities:

- The marina will inspect (and if necessary, provide, install and adjust) all dock lines and chafing gear.
- The marina will disconnect electric, water, wastewater to every vessel in the event of a storm.

Residents responsibilities:

- Remove and stow below all accessories - shade canvas, flags and staff, coolers, deck furniture, cushions, life rings, BBQ grills, satellite dishes, fishing equipment, poles, scrub brushes, boat hooks, gaffs, etc.
- Remove all items from the dock and stow per the marina plan
- Position vessel fenders per the marina plan.
- Charge the Batteries,
- Clear the bilge and check the bilge pumps,
- Close all sea cocks except bilge discharge,
- Secure doors, windows, vents,
- Rig interior for heavy weather,
- Remove or secure all flammables – turn off propane.
- Assure all bicycles are stored properly per the marina plan.
- Remove dingeys, kayaks, etc. to the storage area and secure.
- Remove all vehicles before the 48-hour mark.

Residents will ensure emergency contact information is up to date with cell phone and e-mail if available.

Section 4 – Marina Preparation

The marina staff will spend the off season refurbishing and repairing the dock lines, storm lines cleats and marina infrastructure necessary to secure vessels in a storm.

Following the timelines in appendix B, office and dock staff will assuring obtain necessary supplies secure the marina buildings and storage areas.

- Buildings and contents - All records and computers will be unplugged, moved off the floor and covered to protect from possible water.

  Doors, windows and openings will be secured and covered per the marina plan.

- Docks and infrastructure - Inspect and repair on an ongoing basis to minimize any last-minute repairs in the face of a hurricane.

- Tools - Ensure adequate supplies of tools, equipment, etc. to deal with preparation and recovery are on-hand and located in the marina storage facility.

- Materials - Stock an adequate supply of dock lines, communication radios and batteries, gas/diesel fuel, rain gear, bottled water, food, flashlights, duct tape, pumps, etc., within the marina storage facility.

- Equipment –

  Generators **-** Check all generators for proper operation (change oil, test batteries, start & run, run under load, ensure plug-in receptacles in good working order.

  Work vessels should be kept in good working order with safety equipment on-board, batteries charged, fuel topped off, bilge pumps and generator operational.

  Vehicles will be kept in good working order with fuel topped off. Staff will relocate vehicles to safe area.

Section 5– Resident Evacuation

Consistent with KW Code Sec. 108-1154. Specific Standards and Requirement, dockmaster shall issue mandatory evacuation order contemporaneously with the City's order for transient evacuation.

Rental agreements shall contain a disclosure requiring tenants to acknowledge that failure to adhere to the evacuation requirement could result in severe penalties, including eviction.

Mandatory Evacuation Agreements will be required of all residents. That agreement shall include the following language:

> "Consistent with Tenant's Rental Agreement, Tenant hereby agrees to evacuate the marina immediately following a City of Key West-issued mandatory evacuation order for transient residents. Failure to evacuate may result in severe penalty, including eviction."

Residents will be kept informed of mainland shelters available to County residents.

Section 6– Restoration and Reopening

Damage Assessment will begin as soon as staff can reenter the marina. The marina will remain closed and residents will not be allowed back onto the vessels until vessel and marina infrastructure safety has been assured.

Residents will be notified of marina conditions via web site postings as soon as area communications systems are restored. The marina voice mail system will also be used to keep status on conditions and projected timetables.

Contractor coordination will begin as soon as the damage assessment and restoration plan has been approved. The Dockmaster will make every effort to coordinate contractor activities to expedite the return of residents.

Safety is always the first priority.

Appendix A – Storm lines

Pre-made storm lines will required for each vessel. Lines will consist of either ¾ inch laid (3 strand) or double braid line depending on the amount of stretch desired. Chafe gear will be installed at all contact points. Pre-spliced loops inside firehose or red heater hose will ease installation. Dock ends will have spliced thimbles with shackle and chain attachment to the walkway cleats. Storm lines will be removed as soon as practical and stored out of the sun. As lines age they will be replaced to assure strength and shock absorption.

Vessels will be equipped with oversized bow, stern and midship cleats that are through bolted to structural members using backing plates. Docks will be equipped with oversized cleats through bolted to backing plates. These cleats will be positioned to accommodate maximum surge. Poles will be equipped with vertical fendering material on each side and oversized line holders to keep bow lines from falling down or rising up.

For everyday use, each vessel will be tied with crossed bow and stern lines and fore and aft spring lines. A short breast line may be utilized for ease of boarding.

For hurricanes, each vessel will be moved forward into the fairway. They will be cross tied at 30-degree angles with two extended length bow lines to poles across the fairway, and two extended stern lines to cleats on the far side of the walkways. This extended length will accommodate higher storm surge. High and low level springs will be installed.

When the storm advisory is issued:

- Vessel will begin to be moved back from the walkway three feet and the everyday bow, stern and spring lines will be replaced or readjusted. Entry gangplanks will be readjusted.
- All vessels will be breast tied to one another. They will rise and fall together with the storm surge.
- Extended bow and stern lines will be connected to the vessel and set in a coil but not yet connected at the other end.
- When the storm watch is issued the supplementary bow lines will be placed cross fairway by the marina workboats.

- At 48 hours before tropical force wind landfall residents must leave and the marina will be closed.
- Marina staff will then connect the cross walkway stern lines.

At 24 hours before tropical force wind landfall staff will check the latest weather report for wind speed and direction and predicted storm surge and make final line adjustments as necessary.

Appendix B – Timeline & Checklists

Phase 1 – 96 Hours Before Arrival

Dockmaster

- Notify staff of work schedule.
- Schedule time for staff to prepare their homes.
- Contact and reserve needed contractors.

Office Staff

- Notify residents to prepare vessels per marina hurricane plan.
- Update web site and resident bulletin board.
- Have dumpsters & recycle containers emptied by the service company.

Dock Staff

- Inspect entire marina for potential problems & secure marina equipment.
- Inspect and secure all fuel and flammables.
- Collect storm lines, shackles, chafe gear, oil absorb, etc.
- Obtain last-minute supplies

Phase 2 – 72 Hours Before Arrival

Dockmaster

- Ensure residents are completing protective measures. Address deficiencies.
- Inform dock staff of vessels unable to complete preparations.

Office Staff

- Update web site and resident bulletin board.

Dock Staff

- Ready work boat(s), position storm lines, operate dewatering pump.
- Reposition vessels and connect breast lines.
- Move all hazardous materials to their safe location.
- Clear docks and common areas.
- Check flashlights, radios, power tools, etc.
- Hook up and re-test emergency generators.

Phase 3 – 48 Hours Before Arrival

Dockmaster

- Declare marina closed.
- Ensure all residents have evacuated and vessels are secure.
- Assure marina is secure.

Office Staff

- Last update to marina web site and resident bulletin board.
- Secure office equipment and evacuate.

Dock Staff

- Connect bow and stern storm lines to all vessels.
- Secure work boat(s).
- Remove and secure any remaining equipment.
- Recheck marina and vessels.
- Non-essential personnel evacuate.

Phase 4 – 24 Hours Before Arrival

Dockmaster

- Monitor dock staff - Assure marina is secure.
- Create a video record of marina preparations.
- Retreat to shelter.

Dock Staff

- Secure utilities – Turn off electric, water, wastewater.
- Secure trash dumpsters and recycling bins.
- Retreat to shelter.

Post Storm

Dockmaster & Dock Staff

- Assess damage and develop a restoration plan.
- Secure any damaged vessels – prevent further damage.
- Contact contractors and begin restoration.

Office Staff

- Update marina web site and begin notifying residents of marina status.

Owen Trepanier

From: Jonathan Rizzo - NOAA Federal <jonathan.rizzo@noaa.gov>
Sent: Thursday, April 18, 2019 1:08 PM
To: Owen Trepanier
Subject: Re: Storm Surge
Attachments: KW-MOM-Cat5-HighTide.tif; KW-MOM-Cat4-HighTide.tif; KW-MOM-Cat3-HighTide.tif

Owen,

I've attached 3 simple images of the SLOSH Maximum of Maximums (MOMs) for category 3, 4 and 5 hurricanes. Each image represents the *highest* predicted water mark of the SLOSH model for numerous (likely thousands of cases), regardless of size (extent of tropical storm and hurricane force winds), landfall location anywhere across the Keys and South Florida, angle of approach, forward speed of the hurricane, etc. So, while no *one* hurricane does this level of water everywhere across South Florida, it represents the reasonable "worst case" a Category 3, 4 or 5 could do. Also, the "high" in the image refers to the prediction at high tide. Here, we're talking about one foot, give or take, over mean sea level.

Each image is of Key West, and the value flags in each model grid box surrounding the location of the project to get a reasonable appraisal of potential storm surge).

SLOSH is now computing values in **NAVD-88**. The difference in the City of Key west from NGVD-29, which I believe is still used in flood certificates and the *current* FEMA flood code is, is that NAVD is +1.34 feet over NGVD-29 at the Tide Gauge located at the Truman Waterfront. Since we're talking fractions of an inch, lets' conservatively say that different is +1.4 feet. That is, what is *zero* feet on NAVD-88 is 1.4 feet *HIGHER* than NGVD-29. A value of **9.0 feet NGVD-29** would equate to about **7.6 feet NAVD-88.**

If we look at the attached file **KW-MOM-Cat5-HighTide.tif**, you notice the project location is very near the junction of 4 model grid boxes. One of the boxes is averaged over a pure water area north of Garrison Bight, so it's likely the least representative. I would put the most emphasis on the two boxes near the waterfront but mostly over land, reading 10.6 ft NAVD88 and 11.0 feet NAVD88 respectively. If we consider 11.0 feet NAVD-88 reasonable for the Cat5 hurricane MOM value, then that would equate to about 12.4 feet NGVD-29.

So, your original assessment is correct...the 9.0 foot NGVD-29 is significantly lower than what a category 5 could produce near that location.

Now, SLOSH unfortunately is a flat-water prediction, and does not include wave action. The average depth (outside of any boat channels) is a mere 2 feet or so according to NOAA charts, and sea level is roughly 1 foot (give or take an inch) below in height from NAVD-88. Thus, 11 feet NAVD-88 is about 12 feet above mean sea level. 12+2 = 14, and roughly 1 in every 1,000 waves (considered the "maximum" wave height) would be half that height in shallow water, **about 7 feet.**

Thus, the flat-water Category 5 *worst case* level, in my opinion, would be about **12 1/2 feet NGVD-29**, and to stay completely out of the waves, at **19.5 feet NGVD-29**. However, being on the Gulf /Bayside side, the hurricane that could produce a strong onshore wind there would require the hurricane to pass to the east (further up the Keys). This is normally the weaker side of the hurricane, making 19.5 feet a bit above and beyond possibility with sea level as it is in the year 2019. I don't know what that true limit is against wave action, but generally speaking, each foot rise in setting your critical base elevation for the project above the **12 1/2 foot NGVD-29** flat-water Category 5 surge value would significantly increase your mitigation against wave action in the most intense hurricanes.

I know I'm writing like a scientist, but a similar storm surge request was made for planning for the new Fishermans' Hospital in Marathon. There was a unique issue there, because there was an artificial grade on the parking lot there that showed up in the elevation data, which in turn tricks SLOSH into thinking the average elevation in that grid box is *higher* than the true ambient elevation of Vaca Key. In the project, they were planning on modifying that graded lot. Their chief engineer and architects understood they had to consider the water heights over flatter terrain nearby, other than betting the farm on the seemingly "lucky" grid box with a lower value, due to the graded parking lot and higher floor elevation of the old hospital.

Jon

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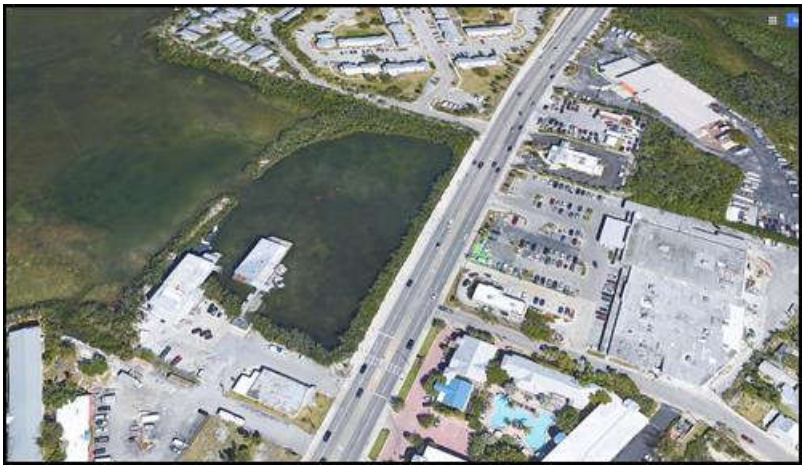
Help us build a Weather-Ready Nation; become a Weather-Ready Nation Ambassador today!

On Thu, Apr 18, 2019 at 12:11 PM Owen Trepanier <owen@owentrepanier.com> wrote:

> Hi Jon,
>
> Thank for your time. We are purchasing a permitted (but as yet unbuilt) marina at the old Flipper's Seaschool. When I reviewed the existing permit plans, the piling height (about 9ft above NVGD) appears inadequate to accommodate storm surge effectively (I understand Wilma was about 6.5ft in this area). I was wondering if you could educate me about what the surge height is estimated to be, in that area, with a Cat 5 storm. Our intent is to make this marina as storm-resilient as possible.
>
> Thanks a lot.



Owen Trepanier

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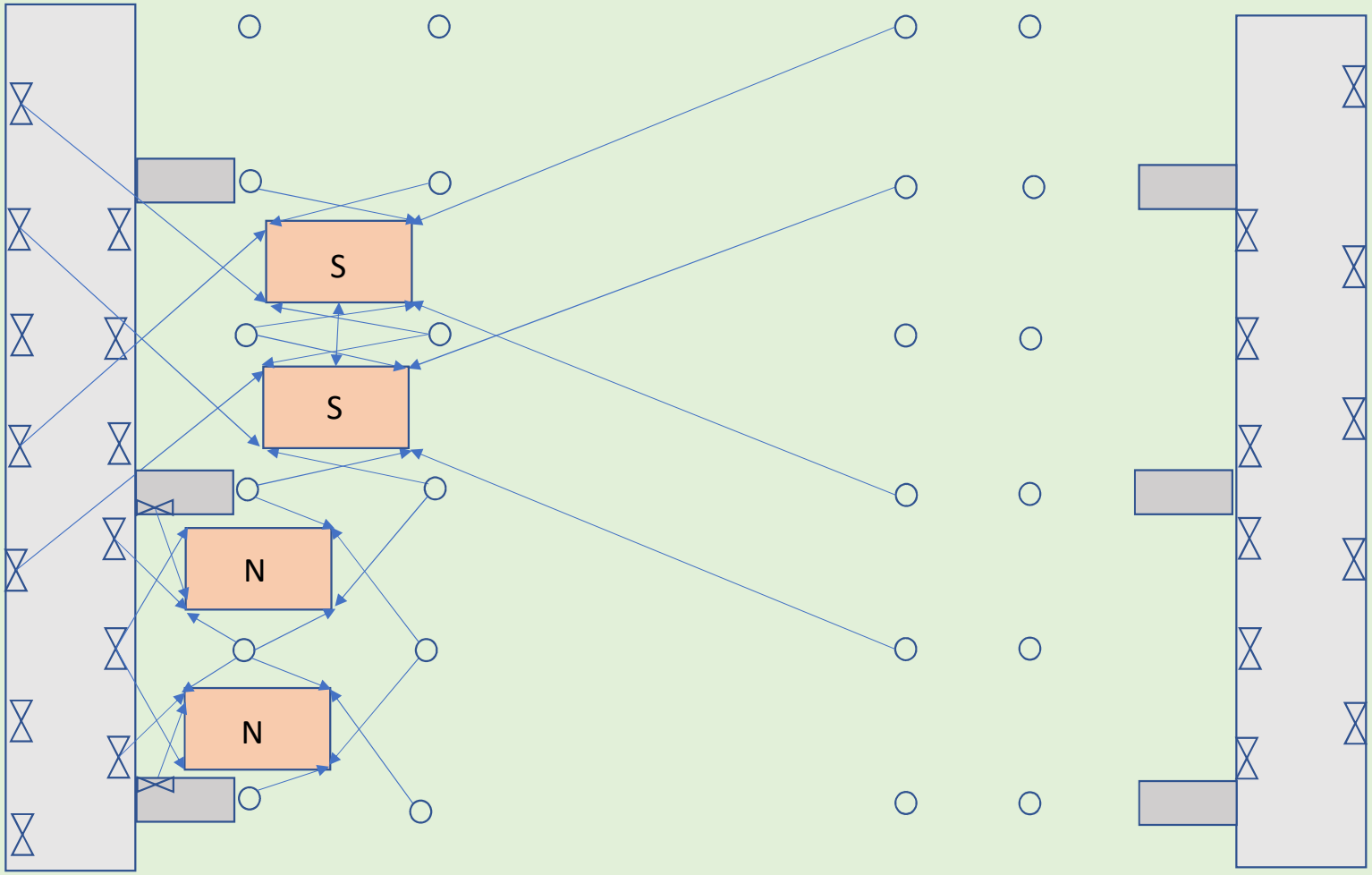
Trepanier & Associates, Inc.

Land Planners & Development Consultants

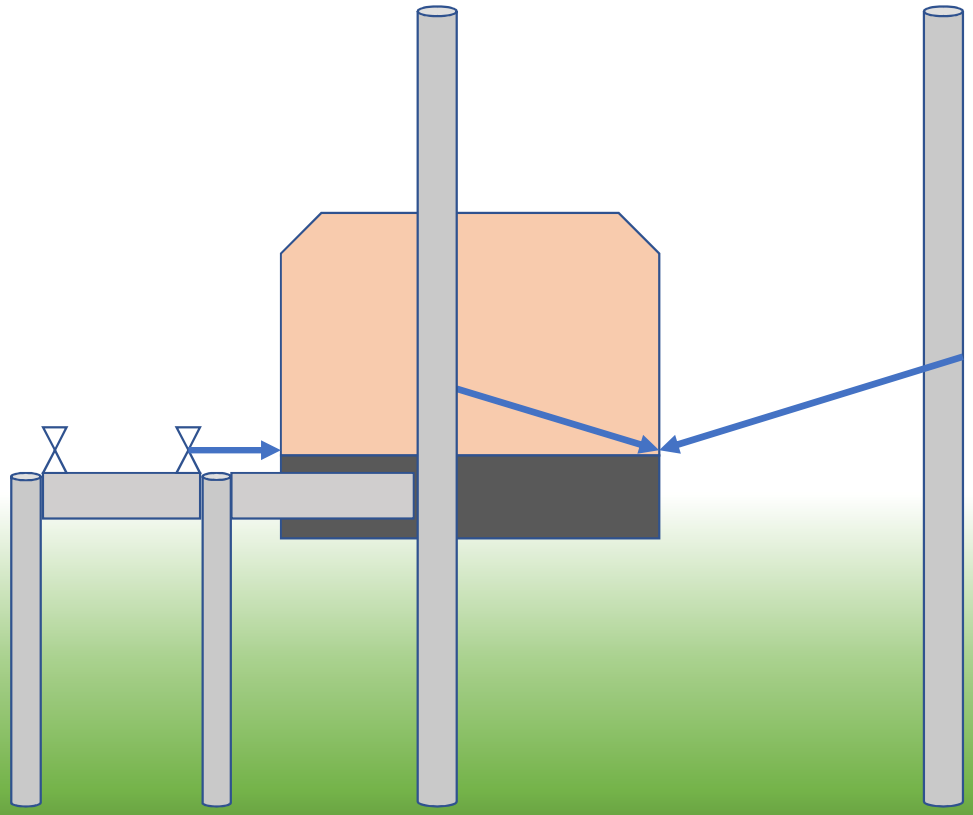
305-293-8983



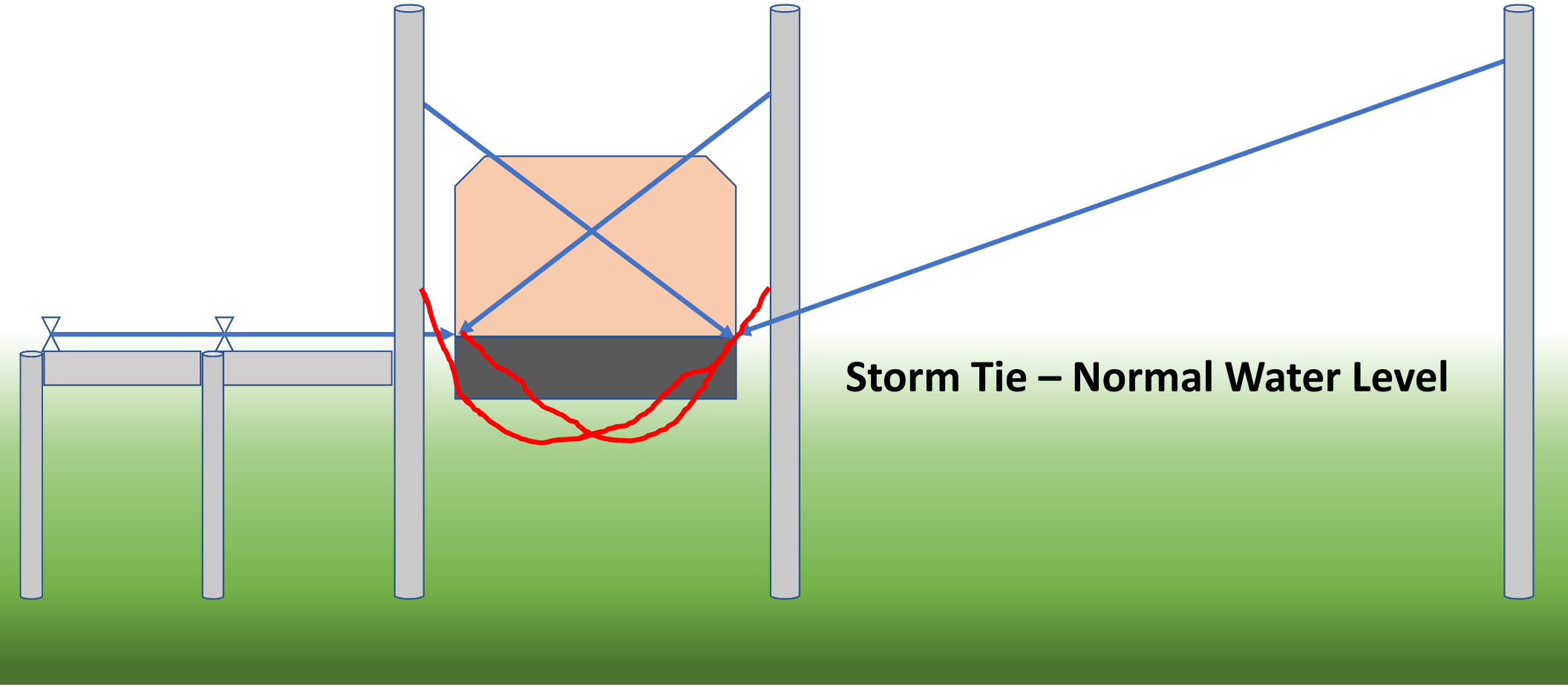
N - Normal Dock Lines
S - Storm Lines

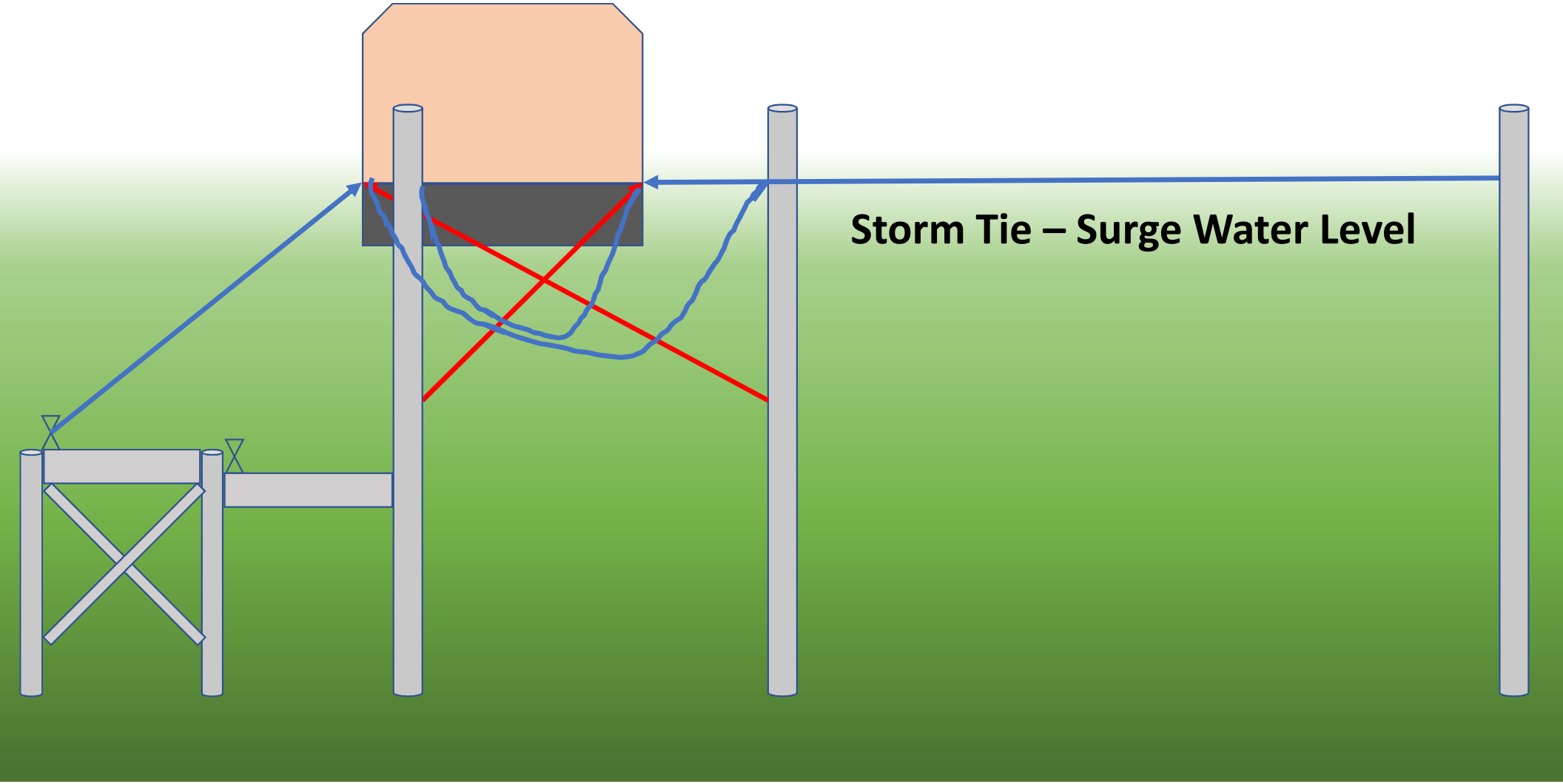
Key West Workforce Marina

Diagram 1



Normal Tie – Normal Water Level


Storm Tie – Normal Water Level


Storm Tie – Surge Water Level