Appendix A:
Summary Discussion Groups

Gray, Maine

ERG met with five groups in Portsmouth, New Hampshire; Camp Ellis/Saco, Maine, and Gray, Maine, on March 6-7, 2013. The groups were made up of a mix of people, including EMs, state and regional planners, coastal and ocean-observing researchers and modelers, broadcast meteorologists, advocacy groups, and members of a coastal adaptation workgroup. A meteorologist from the Taunton, Massachusetts, WFO participated in one group and provided insights into that state's coastal communities. ERG also met with members of the public who were part of a shoreline commission.

Top 10 "Take-Aways" from the Northeast Discussion Groups

1. People rarely evacuate for flooding or storms, and there is a general sense of complacency and a lack of preparedness for a major large event.
2. "Storm surge" is not a familiar term to many people. People are attuned to tides and are used to hearing "coastal flooding" terminology. Storm surge is generally viewed as anything above high tide.
3. Risk communication in the Northeast happens on a personal and localized level.
4. The storm surge warning must convey that conditions are life threatening.
5. The maps need to account for waves.
6. The maps need an accompanying textual statement (one for the public and one for high-end users) that includes information on timing, duration, and probability.
7. The maps need to be interactive.
8. People will need to be educated about the maps and what they mean, and messaging should be tied to specific actions.
9. There is a need for flexibility at the WFO level in issuing and interpreting the maps for their area.
10. The maps should be used year round for more than tropical systems.

Community Vulnerability

The New Hampshire and Maine coastal communities have not recently experienced damages from a hurricane, but they routinely experience Nor'easters, particularly in the winter. Tides are dominant in this region, and most people define storm surge as anything above the expected high tide. Communities are most concerned about **high tides and wave action**. People rarely evacuate for coastal flooding, and there is a general lack of preparedness for a major storm. This complacency was of concern to forecasters attending the discussion groups, who noted that it is simply a matter of time before their communities experience a major event. They stated that "even though people think they have seen the worst, they have not." Compounding the situation is that a number of vulnerable populations exist in these areas, including seasonal residents without experience or institutional memory of large storms and flooding.

Storm Surge Understanding and Communication

A central challenge in communicating around storm surge in the Northeast is that "storm surge" is **not a familiar term to many people.** People are used to hearing "coastal flooding" terminology. Discussion group participants stated: "Most people have no clue about storm surge. People use the term coastal flooding rather than storm surge." The timing of high tides (especially astronomical high tides) is the most dominant factor affecting flooding, inundation, and preparation for storm events. There was not a common definition for, nor a common understanding of, storm surge. The most succinct definition was "anything that's above high tide."

These coastal areas routinely experience **high tides of 10 to 13 feet or more, as well as the battering effect of waves.** The issue of waves came up many times during the discussion groups, with participants noting the importance of accounting for waves in the NWS storm surge warning and inundation

maps. Thus, storm surge is just one element, and not a particularly central one, that is perceived to affect the severity of storms in the area.
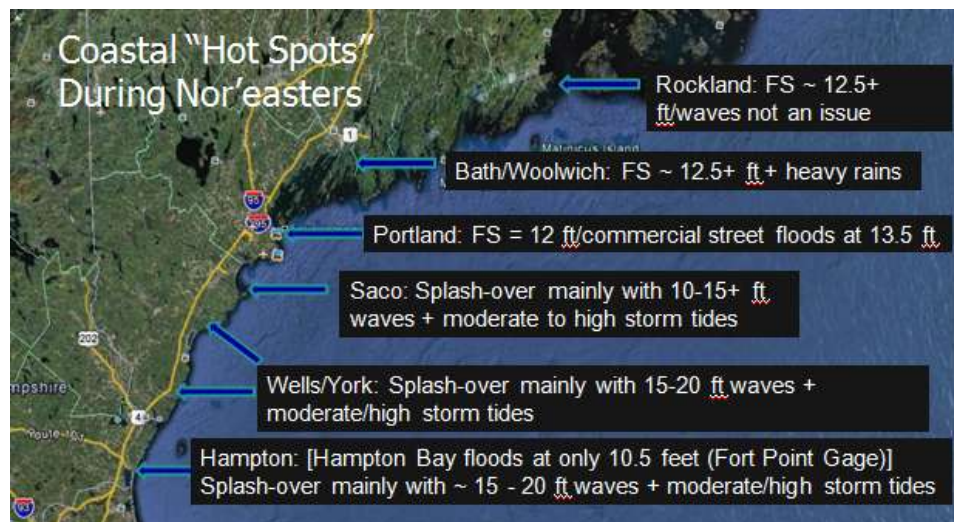
Risk communication in these northeast locations tends to happen on a **personal and localized level.** The EM, fire chief, and police are all key messengers. People remember large storms by name and can understand potential storm risks by referencing or comparing an impending event to these **past storms**. **Visual markers** (e.g., photos in restaurants, lines marked on the sides of buildings or along roadsides) were noted as important means for messaging to the public to keep past memory alive.

During storms, residents get their information primarily from **television,** but more and more people also use their **computers and cell phones** to get information. In some large storms, a "reverse 911" system has been used very effectively, whereby local first responders go door to door to warn residents of the impending storm. Power outages are common during storms, and although evacuations are rare, when they do occur, they are most often related to power outages and the lack of heat and electricity during cold weather. Most people choose to go to families' or friends' homes with power rather than shelters, however.

Many people are particularly attuned to the shoreline in these coastal communities, and many marine interests are represented. Some lay residents, such as the local fishermen, are savvy enough to tune in to the NOAA, NWS, and the Northeast Regional Association of Coastal and Ocean Observing Systems (NERACOOS) websites for technical information during a storm, and they understand enough about tides, wind speed, and storm surge to understand their risks. However, this level of knowledge does not extend to all members of the general population. **Seasonal residents and transient populations** are especially perceived to be ill-prepared for a major storm. Some communities, such as York, Maine, have implemented educational initiatives focused on storm preparedness and evacuation procedures to target these groups. In New Hampshire, a Coastal Adaptation Workgroup is sponsoring workshops to raise citizens' awareness and preparedness for extreme weather and storms.

Storm Surge Warning and Inundation Products

In general, the discussion groups were enthusiastic about the storm surge warning and the two new NWS maps. Some participants thought the maps were useful for EMs and planners but didn't feel they were user-friendly enough for the public. Others disagreed and stated that the maps are similar to other tools currently used.

Storm Surge Warning

Many participants liked the idea of a separate storm surge warning. EMs indicated that the warning and map would assist them in their work by giving them information they do not currently have, helping them convey severity, and making them more credible to local officials and the public. Some individuals wondered how a storm surge warning would be different from the coastal flooding warning that they currently have. They cautioned that the warning will need to be marketed correctly to **differentiate between storm surge and coastal flooding,** as the two terms can be used interchangeably. Participants noted the significance of the term "life threatening" in the definition of the storm surge warning and felt that NWS should ensure that **"life threatening"** is conveyed. They stated that "this language gets the point across" and would encourage people to take the warning seriously.

Storm Surge Inundation Map

Discussion group participants responded favorably to the storm surge inundation map. Many commended the categories and choice of colors, **though some took issue with the "low"** category (pointing out that 3 feet of water is not considered low in their community) and felt that the map only needed numbers. Others supported the idea of turning the categories into **zones** (e.g., red zone; blue

zone; A, B, C zones). Many people indicated that they **would like to have this map year round** and not just for tropical systems. Other key comments and suggestions regarding the map included:

- Develop an accompanying text or narrative product to provide more detail and explanation.

- Include probability, timing, and duration components on the map or text product.

- Include more landmarks and critical infrastructure.

- Make the maps come alive by displaying them in interactive platforms.
    - Show what the different flooding levels would look like in a photograph or diagram.
    - Provide overlapping tools with different resolutions.
    - Layer the information on GIS to allow someone to zoom in.

- Provide public education about what the different risk categories mean.

- Tie the different categories to action messages (e.g., here is what you should be doing if you are in the red zone).

While some of the more technical participants and planners felt that it is important for people to understand how all the forces (i.e., waves, tides, and storm surges) work together (e.g., some suggested developing a **threat index** that takes everything into account or showing the different components on a map), others disagreed and said that people don't care where the water is coming from, and that water is water.

While cell phones are being used extensively, one participant noted that cell phones get overloaded during a storm. They also stop working and can't be recharged when the power goes out. Several participants referenced **text messaging** and the **self-registration venues** now open to some communities, where individuals can sign up for "code red" messages. Another noted that it is important to have multiple communication channels. "We need it all," he stated.

NERACOOS is another regional resource. During a storm, NERACOOS sets up conference calls with NWS. It also posts information on its website for public audiences, and the organization notes that website traffic increases substantially during a storm. NERACOOS also is trying to broaden its reach through various means, including linking to other websites, optimizing searches, and using social media.

Marketing, Training, and Coordination

When asked how communication occurs during an event, the following information was shared:

- EMs are key messengers.

- EMs focus on conveying information to local officials and first responders; they try to reach the public, but their focus is on first responders.

- The chain of information is generally from NWS to state to county to local officials.

The WFO in Gray conducts regular conference calls and support briefings for emergency managers prior to high-impact events to answer questions ahead of time. Different trigger points are used to initiate these notifications, including surge and astronomical high tides. The briefings are considered very successful. The WFO in Taunton produces a three- or four-slide PowerPoint, which is generally provided at the state level. The state then disseminates it to emergency managers at the local level. Emergency managers stated that they need impact timing on an hour-by-hour basis for decision-making.

The local WFO expressed the need for **flexibility** in deciding how and when to push out the maps and in interpreting them for its area. The WFO also wondered whether to use the storm surge warning or wind warning during a tropical event that has both wind and surge. Finally, it pointed to the need for a **smooth transition between tropical and sub- or post-tropical conditions.** It would like to see the NHC produce inundation maps for **Nor'easters and storms that transition out of a tropical status.** The WFO stated that "the maps should be produced regardless of what category storm created it or how the storm is classified."

Tampa Bay, Florida

On April 1-2, 2013, ERG conducted a series of meetings at the Tampa Bay Regional Planning Council in Pinellas Park, Florida. Discussion groups were held with EMs, the media, decision-makers, and community groups. The EM group included emergency management personnel from Tampa and several nearby counties, including Pinellas, Pasco, Manatee, and Hillsborough. The media group included broadcast meteorologists from television stations and an editor from the Tampa Bay Times. Decision-makers included directors of emergency operations from several counties, as well as planners and a representative from the Florida Governor's Hurricane Conference.
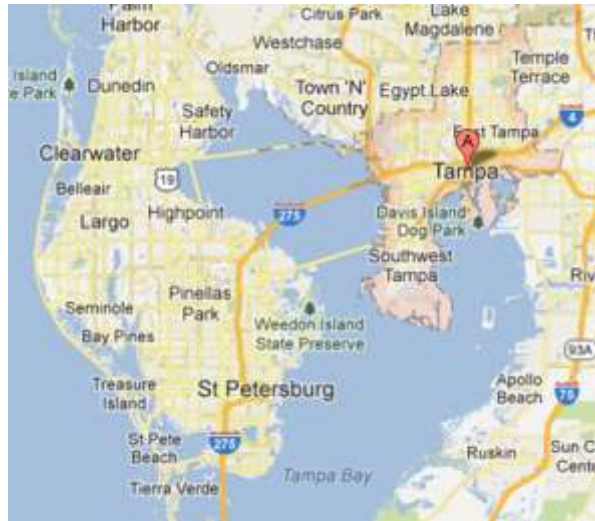
Top 10 "Take-Aways" from the Tampa Bay Discussion Groups

1. There is a broad sense of complacency regarding collective perceptions of storm surge vulnerability.
2. Effective communications about storm surge hazards will require more personalized messages.
3. To further address complacency, language used in storm surge warning and related messaging should be very direct and stern.
4. There is broad and very strong interest in having inundation maps available in shapefile format (compatible with GIS software) as opposed to a static image.
5. Tampa Bay comprises a variety of vulnerable population groups that receive their information about hurricanes from numerous sources; developing messaging for each of these population groups will be very important.
6. To avoid potential confusion, it will be very important for NHC, NWS, news outlets, and EM officials to communicate consistent messages.
7. Given the unique geography of the Tampa Bay region, EM officials need to understand potential storm surge threats in advance of the 48-hour lead time associated with the planned storm surge watch.
8. There will need to be extensive education across numerous stakeholder groups associated with the release of the storm watch/warning and two maps.
9. The use of the term "low" to describe the potential storm surge hazard in the inundation map is misleading.
10. The use of numerous datum to reference storm surge depth is confusing, and a high priority should be placed on establishing a single, consistent reference standard for describing surge depth.

Community Vulnerability

Clearwater, FL: Then and Now

As a result of its geography, rapid coastal development, and population growth, Tampa Bay is among the **most vulnerable U.S. regions regarding storm surge**. While the Tampa Bay region is regularly impacted by tropical storms, it has been more than 90 years since the region was in the direct path of a major hurricane. Additionally, Tampa Bay has experienced an influx of newly transplanted residents. Many of the focus group participants expressed concern that these factors have contributed to a **widespread sense of complacency** with respect to perceptions of risk associated with a major land-falling hurricane and storm surge.

Throughout the various meetings, participants mentioned the following specific segments of the population in the Tampa Bay region as being particularly vulnerable:

- Medically at-risk and elderly populations.

- Disabled and deaf and blind populations.

- Economically vulnerable (those that don't have the means to prepare or respond adequately) populations.

- Uninformed individuals.

- Undocumented and foreign language speakers.

- Barrier island residents.

- Long-time waterfront residents (those that believe they have already lived through the worst and can withstand any future storms that come their way).

Storm Surge Understanding and Communication

A consistent theme that came out of the meetings is a broad sense of complacency that exists among Tampa Bay residents regarding their vulnerability to storm surge. Many participants explained how this **entrenched complacency** makes it extremely difficult to effectively communicate the potential risks associated with storm surge and to successfully convince these individuals to evacuate when necessary. Many participants provided insights and opinions regarding the dynamics that play into this challenge. One participant noted that "If people live through a hurricane event, their experiences stick with them

and drive their decision-making for subsequent storm events." For select, risk-averse individuals, these memories may prompt their desire to evacuate. In other cases, however, **memories of past storms can be very problematic**, especially when individuals incorrectly associate a previous glancing blow with a memory of what they believe to be a more significant event. Another participant added that "People can't conceive what they haven't experienced. They can't wrap their mind around what 10 feet of water looks like. In recognizing these challenges, participants provided numerous suggestions for improving communication regarding storm surge, including:

- **Personalizing the hazard communication,** including using visuals and hyperlocal landmarks that provide a more personal context (e.g., "This is what 4 feet of water looks like on your street.").

- **Disseminating "after" photos** to reinforce the potentially devastating impacts from storm surge.

- **Sharing testimonials** from individuals who have survived storm surge events.

- **Emphasizing the risks of not evacuating,** including using actual recordings of 9-1-1 dispatchers informing individuals that emergency officials are unable to come rescue them.

- **Using more direct and stern language** (e.g., "There is the potential for death associated with the forecasted storm surge.").

The broadcast meteorologist group provided numerous additional insights regarding the challenges of communicating about storm surge via television. These challenges include the following:

- A large segment of the viewing audience doesn't understand the difference between storm surge and flooding rains.

- It is difficult to find a balance between **providing forecasts as early as possible** and communicating the **potential for forecasts to change considerably** as new data become available.

- Most people don't understand the **uncertainty** involved with tropical storms.

- There is often **pressure by senior news directors to go on air with graphics** in a snap decision without all of the information necessary to confidently explain the key messages to the audience.

- Some of the images provided by commercial weather vendors are **not in a format that can easily be displayed on air.**

Regarding communication channels, the especially vulnerable population segments in the Tampa Bay region receive hurricane information from **numerous sources**, including the Weather Channel and local television news outlets, information pamphlets distributed at grocery stores, hurricane expos and festivals at local malls, senior centers, and neighborhood associations. Residents who are either undocumented or do not speak English as their first language often do not trust government officials for

information. The Red Cross in the Tampa Bay region has identified that the most effective way to reach this segment of the community is often via **faith-based organizations and community groups.**

Storm Surge Warning and Inundation Products

While the various groups generally agreed on the positive intent of the storm surge warning and the two new NWS maps, there was a broad spectrum of opinion regarding a number of nuances and the degree to which they should be used.

Storm Surge Warning

Some participants within the broadcast meteorologist group expressed concern that NWS already has **too many different watches/warnings** and suggested that it may be confusing and redundant to have both a coastal flood warning and a storm surge warning. Participants felt that if NWS chooses to use both, there will need to be accompanying education and clear communication explaining the differences between the two.

Another concern expressed during the meeting with EM officials was the potential for confusion resulting from **inconsistent messages** from different sources. One example noted was the release of the surge warning map by the NWS, but EMs in regions under the surge warning that have not yet ordered evacuations ("The map indicates there will likely be life-threatening flooding; why isn't the county doing anything yet?"). Conversely, there is potential for similar confusion if EM officials are ordering evacuations but NWS has not yet issued a storm surge warning. Participants across all four meetings agreed on the importance of developing a **single, official voice** to avoid confusion and reinforce the intended message.

Regarding the **lead time** for the storm surge watch/warning, some participants expressed concern that 48 hours is not sufficient lead time for evacuations; in many communities, 60 hours of lead time is required for an effective mass evacuation. Conversely, one participant in the broadcast meteorologist group suggested that any more lead time might confuse people.

With respect to the language used for the surge warning, there was overwhelming feedback in the EM group that the language needs to more explicitly communicate the threat of storm surge (e.g., using terms such as **"imminent" or "dire"**). The EM group also discussed the idea of varying the language between the watch and warning, whereby the watch might include language similar to "conditions are favorable for…" and the warning would incorporate more **stern** language, such as "there exists an immediate threat of …"

Storm Surge Inundation Map

Responses to the storm surge inundation map were quite varied. One participant commented that the visual will be very helpful in communicating the dynamics of storms with respect to both the timing and location of anticipated storm surge relative to forecasted landfall arrival time and location. Numerous participants in the EM group expressed concerns about providing the general public with too much information, and in a format that suggests that **the precision of the forecast is greater than it truly is**.

Others in the EM group, however, made several counter arguments. One EM official noted the value in better understanding the locations forecasted to experience greater storm surge so that the county can make more informed decisions about where to **deploy limited emergency response resources**. Another participant mentioned that this graphic will likely remove some of the randomness from the group of individuals that choose to evacuate and help **increase the rate of evacuation** among the more vulnerable populations.

Numerous participants **took issue with the term "low"** to describe the range of surge depth of 3 feet or less above ground level. As an example, someone mentioned that three feet of water can cover electrical outlets and present a major risk for electrocution.

Another topic that surfaced across the numerous meetings is the significant confusion surrounding the use of **different datum to describe storm surge depth.** One participant noted that the various products generated and disseminated for Hurricane Sandy used at least three different datum references for surge depth. The group provided consistent feedback regarding the need to move to a **single reference standard** for communicating storm surge depth to avoid confusion across all relevant stakeholder groups, especially the general public.

Marketing, Training, and Coordination

Throughout the various meetings, participants provided an array of suggestions for improving future coordination between the NWS and the various stakeholder groups and marketing the availability of the new storm surge products. Across all meetings, participants conveyed the overwhelming need for a single, consistent message. The broadcast meteorologist group commented that some of the images that commercial weather vendors provide to the broadcast meteorology community as part of paid subscriptions are not in a format that can easily be used on air. This group voiced a strong desire for NOAA/NWS to engage with the commercial weather vendor community to enable **NHC graphical products to be interchangeable with commercial vendors' products**.

Participants suggested that the NWS involve commercial weather vendors in the process now to ensure that vendors are able to quickly incorporate the new products into their services. This same group also unanimously expressed their appreciation for the NWS chat rooms, particularly because they help the broadcast meteorologists feel more comfortable about speaking openly about their opinions regarding the forecast. The group expressed a need, however, to have more geographic-specific, access-controlled chat rooms.

The community group meeting discussed the potential value of Tampa Bay Cares (accessed by dialing 2-1-1 by phone), which maintains communications with an extensive network of organizations and could potentially be used as a critical hub for hurricane information dissemination. During the meeting with EMs, one participant suggested the revival of the Storm Stories series on the Weather Channel and noted that this could be a great way to roll out new storm surge products nationally. Another participant suggested advertising the new storm surge products on the jumbo-tron at Tropicana Field as part of a more broad **marketing campaign.**

During the decision-makers group, one participant provided a notably poignant comment regarding the importance of education and communication. To effectively market NHC's new storm surge products, this individual suggested that NOAA craft its messaging in a manner that ensures the audience **"receives, remembers, and reacts."**

Slidell/New Orleans, Louisiana

ERG met with five groups in New Orleans and Slidell, Louisiana, on April 6–7, 2013. One group consisted primarily of EMs from New Orleans parishes, levee districts, and the Army Corps of Engineers. Another group consisted of EMs from parishes north and west of Lake Pontchartrain, as well as from several counties in Mississippi. ERG met with a group of broadcast meteorologists from New Orleans and Mississippi and a reporter from the New Orleans Times-Picayune. A community group included representatives from a citizen emergency response team, disaster relief organizations, hospital and nursing associations, and an association for the elderly. ERG also met with a group of NWS/WFO staff in Slidell and conducted a webinar with a small group of EMs who could not attend the in-person meetings.

Top 10 "Take-Aways" from the Discussion Groups

1. While the level of awareness of "storm surge" is generally high in this region, people still correlated storm surge with Saffir-Simpson hurricane categories.
2. Every storm surge is different; areas can be vulnerable even if they have not flooded in the past.
3. There needs to be consistent and unified messaging among all groups during a hurricane. This is particularly important because people "shop for the forecast they want to hear among multiple sources of information," making messaging even more challenging.
4. There needs to be greater coordination among EMs, public officials, media, and NWS during a hurricane in the Gulf State region.
5. The maps need an accompanying textual statement for the public that explains what the maps mean, as well as a full technical description for EMs, planners, and others.
6. The levee inundation map needs a disclaimer stating that people are always at risk in a levee-protected area; people are overconfident in the rebuilt levee system.
7. There needs to be more clarity on how the storm surge warning and inundation map will correspond to evacuation zones.
8. People need to know that even if they are in a FEMA non-flood zone, they could be in a storm surge zone.
9. It would be useful to have the storm surge watch/warning continue past the diminishing tropical event to account for ongoing flooding from rivers and rainfall.
10. EMs need the watch/warning earlier—at least 50 to 62 hours in advance.

Community Vulnerability

The New Orleans area has been ravaged repeatedly by hurricanes during its history. The Mississippi coastline is also very vulnerable. Two of the highest storm surges ever recorded in the United States (e.g., > 20 feet) occurred along the Mississippi Coast with Camille (1969) and Katrina (2005).

Since Hurricane Katrina, the Army Corps of Engineers has rebuilt portions of the levee system in New Orleans. The levee system, called the Risk Reduction System, is now stronger and higher and has greater resiliency. However, modeling still indicates that the levee system can be **overtopped in major hurricanes**. Overtopping would likely result in significant and deep flooding within the system, especially if accompanied by any breaches. A large portion of the metropolitan New Orleans area (with land elevation near sea level) is in this protected area.

A significant portion of the population also lives in **low-elevation areas** (<10 feet in elevation) **unprotected by levees,** including areas north and west of Lake Pontchartrain and Lake Maurepas, and in the coastal areas southwest of New Orleans. Bays and rivers provide additional avenues for **surge to spread inland.**

Many participants noted that **every storm is different,** and that it can be difficult to predict which areas will or will not flood in a storm. One EM with 10 years of experience noted that he has not "gotten the storm surge in the same place ever." One EM commented that "It's a mystery where the vulnerabilities are." Another said that it is not uncommon to be surprised by weak storms.

In total, approximately 2 million people live in the surge threat area in the region. A number of **vulnerable groups** live in the area, including low-income populations; a growing Hispanic population that may present language barriers; and a large population of seniors (age 65 or older), which currently makes up about 12 percent of the total population or about 277,000 people. The **senior population** was particularly hard hit by Katrina. Tourists are another vulnerable population, as they tend to be unaware of the storm surge risk.

Storm Surge Understanding and Communication

For people who have experienced storm surge, the **awareness of the threat is high.** Those who have not experienced storm surge are often under the mistaken impression that "it can't happen here because it's never happened here," or "I am behind the levee system so I am safe." EMs pointed out, however, that the **level of awareness tends to drop every year the region doesn't experience a catastrophic event.** One person noted: "We saw the gap between Isaac and Katrina. When Gustav came soon after Katrina, people left. Ivan in '04 and Gustav in '08 were our best storms because they were close to major storms, and everyone left."

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Some EMs stated that Hurricane Isaac was a "huge wakeup call." One person noted that St. John's Parish never flooded before, and suddenly it had 4 feet of water. Another stated: "We have a new awareness of storm surge. No one thought Isaac would be a big deal, but in lots of ways, it was worse than flooding that's happened before."

EMs noted that storm surge has a lot of **"uniqueness."** It is a challenge to show the public and the public officials what the experience will be like for them. One EM said, "We want to provide the worst case scenario. It is better for people to leave on a dry street and return on a dry street. We've had that experience, and people were upset for about 10 days. Conversely, we're getting sued for not warning people to leave during Isaac."

EMs also noted that a lot of people have experience with storm surge in New Orleans and know how to react, but that they can get **fixated on the storm category** and not look at storm surge. The problem of disentangling storm surge from Saffir-Simpson categories is a challenge, and they noted that "everybody is still entrenched in storm category. It's in the culture. People don't know the category is separated from surge." This can become a major issue when the area experiences a strong storm surge but not a high category storm.

Discussion groups also noted that people get storm surge mixed up with **FEMA flood maps.** One EM noted: "The surge zone and flood zone are very different things. You can be in a non-flood zone, but you can still be vulnerable to surge." He noted that the FEMA maps are based on rain, not storm surge. One person noted that "We had areas in Isaac that flooded, which had not flooded in 20 years. Yet, these people are told by FEMA they are not in flood zones and don't have flood insurance. We need to take away the 100- and 500-year marks."

Storm Surge Warning and Inundation Products

The various groups were generally enthusiastic about the storm surge warning and the two new maps. They were very interested in the preliminary New Orleans inundation map prototype, although they had many comments about how overtopping should be depicted and how risk should be communicated.

Storm Surge Warning

The groups had many comments on the storm surge watch/warning definition. They generally agreed that the definition was **too long and wordy.** They also wanted to see a stronger word than "significant," such as "serious" or "severe." They also noted that people think storm surge is like a tsunami and that "it's coming all at once." It is important for the definition to clarify that storm surge is not a tidal wave. Several participants also wanted to take out the reference to "flooding," because the public would be confused if they didn't live in a flood zone. Others in the group agreed and edited that wording to read "A significant risk of life-threatening rising water." Still others thought that NHC should use the word "storm surge" in the definition instead of flooding.

Like other regions, EMs and relief organizations wanted the watch/warning **at least 50 hours in advance.** Many people stated they would prefer to have it **62 hours in advance.** By the time a watch is issued, EMs have already made their evacuation plans. Some individuals also worried that if the public

knows that this watch/warning is coming, they will wait for it to be issued before they evacuate. By then, it may be too late to leave.

Reactions to the storm surge warning map were **mixed**. Some individuals thought that the map showed such a large area that it wasn't very useful. Others disagreed and felt that the map gave a good graphic depiction of the big picture. An Army Corps of Engineers representative stated that the map was useful and "makes you think." He added that the map is saying: "Someone is telling me that I will be in trouble, that I should be worried about water. That's valuable."

As with discussion groups in other regions, people wondered how the storm surge warning will fit in with **current hurricane watches/warnings and with coastal flooding warnings**. They asked if there could be communities that are under a hurricane warning but not a storm surge warning and vice versa? Some individuals also wondered if the storm surge watch/warning could be **continued past the diminishing tropical event.** They noted that flooding after a storm can be a three-day event. They wondered if some information could be added to the map along the lines of: "Pay attention to coastal flooding and local flooding. Just because the storm surge is over, your flooding may not be over."

Storm Surge Inundation Map

Participants in the New Orleans groups viewed the Florida inundation map and a New Orleans inundation prototype map showing levees and overtopping. Appendices B and C include field notes that capture all the comments raised by the groups represented on these maps.

Generally, many participants reacted enthusiastically to these maps, although a few individuals thought they were better as a planning tool for EMs and planners than for the general public. As with other regions, numerous participants in each group **took issue with the term "low"** to describe the range of surge depth of 3 feet or less above ground at that location. There was also consensus that the **highest category should not have an upper bound.**

EMs expressed concern with how the storm surge inundation map and warning map would **line up with their evacuation zones.** They commented that evacuation plans may need to be updated to reflect the possibility of an area not being under a hurricane warning but still being under a storm surge warning. They worried that the maps could make an EM's job more difficult if the inundation or warning map showed an area under evacuation as dry or in the "low" category. The map could make the public second-guess an evacuation order. They also worried that if the map shows dry spots, people will evacuate to those areas. To address this concern, people suggested that the maps **caveat that people should follow the directions of local officials.**

While many people wanted to zoom in on the map (as did participants in discussion groups in all the other regions), others felt that more level of detail would "tie you up in litigation." EMs said they would not use the map to evacuate one street and not another. They would use caution and evacuate an area greater than what the map shows.

Many people wanted the map to include a **disclaimer conveying a level of uncertainty**. They pointed out that if the map is wrong nine times of out 10, it will lose its effectiveness. The disclaimer should convey that the map is telling people what they need to prepare for, but that it won't necessarily happen. The disclaimer should caveat that **the map is subject to change**. They also noted that it will be

important to have a timestamp on the map. For the map showing the levees and overtopping possibilities, participants wanted an additional disclaimer along the lines of **"there is always a risk in a levee-protected area."** In some discussion groups, a number of EMs and forecasters said that they were interested in seeing **range of confidence maps.** One individual said, "Let us chose which certainty to pick."

Marketing, Training, and Coordination

As in other pilot regions, the discussion groups urged NHC to develop a **textual message** for the inundation map. One individual noted that "you need a person to say what's going to happen, to explain the map." Other people indicated that another important part of messaging is to communicate that **storm surge can occur early and late,** and that people in some regions can experience flooding days after a storm makes landfall due to rainfall and water backing up in rivers and tributaries.

Many discussion group participants stated that messaging needs to use **strong and forceful language.** Several EMs suggested that messaging convey that "we can't come and get you if you decide to stay." One EM commented on his experience during Katrina: "At one point, we told people if they didn't get out, they would die, and they still didn't leave." Because of this complacency, many people thought it was important to message the **aftermath** of a storm. One individual said, "Even if people are not really in danger of imminent flooding, they can lose their power—and their power could be out for a week."

Some pointed to the use of a **catchy slogan** to get people's attention. Several EMs said they use "Run from water, hide from wind." They noted that more people die because they don't pay attention to water.

Broadcast meteorologists expressed an interest in both **shorter and longer messages** to use on the air and on their websites and social media platforms. They commented that they could "spend hours going over every detail with who will/will not flood," but that their on-air time is limited. They can, however, go into more detail on their websites. Typically, they need a script for a 30-second spot to communicate the essence of what's happening during a storm and what people should do. They also can use messaging for a three- to four-minute slot of continuing coverage. These longer spots provide an opportunity to educate people more generally about storm surge as well.

Broadcasters commented that **teaching moments** after an event don't happen often. One broadcaster commented: "We do post-hurricane stories, but people don't tune in because they are still cleaning up. Then when they do tune in, it's too late because it's old news." Newspaper reporters commented that they have more flexibility to do post-hurricane stories, longer stories, and series.

Many community groups and relief organizations are actively distributing **preparedness information** in New Orleans **before, during, and after a storm**. They are working with big retail chains and grocery stores and have a large distribution. These groups are also actively reaching out to vulnerable populations and have found that a useful way of doing this is through church leaders and faith-based organizations.

Numerous participants expressed the need for **coordination among all the different entities interacting with the public** and the importance of a **single, consistent message.** One person noted: "A unified

message is important. All the weather people need to be on board. But they all say different things." The importance of media being on the same page as NWS was particularly important, participants stated, because the television broadcasters are on the front lines. Participants noted there is a tendency for people to "listen to the TV guy, not the official from parish." Compounding this problem is turnover in EMs. The public is "more familiar with the TV guy because they see him every day."

In one discussion group, EMs expressed that, while local meteorologists are "in theory with us," their ratings are also important and they must stay competitive. A broadcaster in the media session echoed this sentiment and stated: "At the behest of people that want to have high ratings, we are made to do stuff that we aren't necessarily comfortable with. We should get out of the business and let NWS do it." Broadcasters also noted that management can be more concerned with what a graphic looks like rather than if it is accurate.

Participants in the discussion groups also noted that **"people shop around and listen to the forecast they want to hear."** Several pointed to academic groups that are doing their own models, and this can also present a problem if the forecasts don't mesh.

As in other pilot regions, the broadcast meteorologists who attended the media session in New Orleans noted that they will always make their own graphics and urged **NHC to coordinate with vendors.** They also noted that there can be a lag of up to a day before a vendor can use and ingest data from NHC.

EMs in one group also talked about the importance of coordination among the **different Gulf States** (Mississippi, Louisiana, and Alabama) and the **WFOs** that serve these states. The flow of evacuation in one state impacts all the others, and traffic can back up as a result of the actions of one state. Different state agencies can be listening to different weather forecasts, and some of these agencies can be disconnected from the coast. One EM stated: "We get accurate information from NHC and from the Mobile and Slidell WFOs, but others have to deal with the Jackson WFO, which is getting information from different sources and not meshing with coastal concerns."

The issue of coordination between NHC and local WFOs also was discussed. Participants wondered who would **issue the storm surge warning**. One possibility would be to follow the Storm Prediction Center model for tornado watches/warnings. In this scenario, NHC would put out the overall watch, and the local WFO would issue the warning. Several participants noted, however, that people pay attention when NHC says something, and for this reason, it might make most sense for NHC to issue the warning. Participants agreed that **flexibility and collaboration** would be important in ensuring a smooth operation.

To this end, everyone agreed on the need for **training.** One person suggested that a training module be developed for the graphics that could be viewed on a computer. Others wanted to see training exercises in which people had to deal with different threat scenarios using the storm surge warning and the maps. Training is needed at least **six months in advance** of the rollout of the products.

Newport/Morehead City, North Carolina

ERG facilitated five discussion groups in Newport, Beaufort, Washington and Manteo, North Carolina. The groups consisted primarily of EMs, town and county managers, planners, police and fire chiefs, broadcast meteorologists, reporters, coastal management GIS analysts, National Park Service officials, and school officials.

**Top 10 "Take-Aways" from the Discussion Groups**

1. For the most part, storm surge is not on people's radar. "Coastal flooding" and "high water" are more commonly used terms.
2. People are skeptical about storm surge because past predictions of surge have not come true.
3. Communication is needed for two unique groups: 1) those who refuse to leave when they can and 2) those who want to leave but can't or have nowhere to go.
4. Storm surge must be communicated in a simple, personal, and humanistic way without jargon.
5. People need to understand that storm surge impacts can occur before or after a storm.
6. The storm surge definition should make clear that the storm surge is a coastal threat and that it involves "rapidly rising" water.
7. The maps should include terminology based on confidence: "this could happen" or this is "likely to happen."
8. Outreach needs to be graphical (e.g., using local markers, diagrams, videos, and visualization tools).
9. A key challenge is that people are very familiar with the Saffir-Simspon hurricane categories and associate storm category with water level.
10. Messages should be tailored to different age groups (e.g., television and radio for older people; social media for young people) and different income levels.

Community Vulnerability

High-risk storm areas for North Carolina include a broad expanse of the coast and inlying areas. Vulnerable counties are located along the Albemarle and Pamlico Sounds, including lower reaches of the Neuse and Pamlico Rivers and coastal areas from North Topsail Beach to Duck. The Outer Banks cover a huge area (both north to south and ocean-facing to inner sound) and can get a number of different impacts in a given storm.

Populations of concern include:

- **Low-income populations** in rural Pamlico County along the water in coves. These populations don't have the resources to leave, and they have nowhere to go.

- **New residents and transient populations** (e.g., college students, personnel at major military bases, tourists). While the **Camp LeJeune Marine Base** is very vulnerable, the military has established evacuation procedures and the base has its own emergency center and shelters. If a bridge closure is announced ahead of time, tourists will generally leave; it's the permanent residents who are more reluctant to leave. Sometimes tourists take everything before they leave and create shortages (e.g., gas, food for those who stay behind.

- A large **immigrant community** in Morehead City, which presents a language barrier and requires specialized outreach.

- **Nursing homes and homes** along the Neuse River inlet.

- **Outer Banks' communities,** which are extremely vulnerable to both ocean and sound-side flooding. Some towns on the Outer Banks can be cut off from the mainland by breaches along the highway that occur during storms.
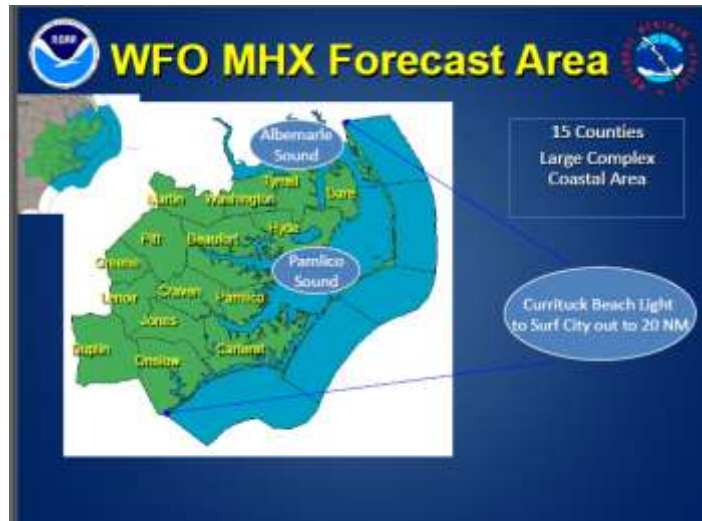
Participants suggested that there was a need to communicate to two unique groups: 1) those who refuse to leave when they can and 2) those who want to leave but can't or have nowhere to go. In flood-prone areas, people can be **very stubborn and resistant to evacuation.** Many aging and long-time local residents have a mindset of "it never happened here." In fact, it can be a badge of courage for "salty dogs" to wait out the storm in place.

Many people are also accustomed to 2 or 3 of feet of water on the roads and school buses taking children home with that level of flooding, but not taking action to close schools or evacuate. Compounding the situation is that people have had **negative evacuation experiences**, such as with

Hurricane Floyd. Participants mentioned that many people who evacuated early couldn't get home for up to two weeks. People also don't want to leave their "stuff."

Storm Surge Understanding and Communication

For the most part, storm surge is **not on people's radar.** One participant estimated that only 15 to 20 percent of the population understands the term. The public doesn't understand what storm surge will look like or what it will do. People think it's a beachfront problem, **not an inland or sheltered shoreline** problem. Most people think it's just the storm coming up the coastline. It is viewed as storm track or a big wall of water, like a tsunami.

Most recently, local TV forecasters have talked about **"rising water"** and did not refer to storm surge by name so that people would understand what it meant. Participants noted that it is really hard to explain storm surge when there are not recent events within living memory. "Coastal flooding" is the term most commonly used. "High water" is also terminology that people understand. Most people only want to know how much wind and how much rain a storm will bring.

Participants also mentioned that since Hurricane Floyd, there have been surge predictions that have not come to pass, and so people **discount storm surge.** Participants indicated that there are opportunities to educate people when they come in for a building permit and that there are discounts on flood insurance if people build above freeboard.*

Several discussion group participants stated that "most people don't care what you call it and **don't care nor understand the difference between precipitation, flooding, and storm surge**. Water is water." Participants also conveyed that there is a need to communicate storm surge in a **humanistic way.** They stated that people just want to know: "Is there going to be water or not? They don't care where the water comes from." We need to humanize announcements and take out **the technical jargon** and explain impact in a **personal way.**

Most people base understanding **on past experience and recent storm events.** People don't realize that Category 1 hurricanes can result in extreme storm surge. A key challenge is **disentangling storm surge from the Saffir-Simpson categories.** Some participants noted that with recent events, people are starting to understand that category levels are not necessarily an indication of water level.

Another challenge is conveying that **storm surge can occur along mouths of rivers.** Riverine flooding can occur during flood peak at the end of the storm and can combine with storm surge or happen after storm surge when people think the threat is over. Participants stated that **timing is one element of confusion,** and people don't expect impacts before or after a storm.

Storm Surge Warning and Inundation Products

Storm Surge Warning

Participants thought the warning would be useful, but that **continual education is needed** to convey the difference between a watch and warning. A key way to reach people is to educate **children who can bring messages back to parents**.

They also wondered if a storm surge warning would be confusing if it was just **"one more layer"** and "one more warning" among other issued warnings. It would be important to emphasize when storm surge, rather than hurricane category, was the greatest threat. They noted that there could be differences along the coast, and that people will be confused if there is a patchwork of warnings and advisories in effect. They noted that this already happens now to some extent.

Discussion groups also asked how the storm surge warning **tied into the coastal flooding terminology** already being used and if there could be areas under a hurricane warning but not a storm surge warning, and vice versa. Some people noted that it would be helpful to develop a whole new system for rating storms to take all components into account. They envisioned a **consolidated ranking,** with different categories of threats for each component: wind, tides, waves, surge, and precipitation. Participants commented favorably on a popular color-coded graphic that NWS used for Sandy that showed consolidated threats by county based on the combination of wind, surge, and rain. Although it didn't necessarily deal with uncertainty, it conveyed **total impact.** A potential problem with a consolidated threat is that risks can be very different for wind, waves, and surge**.**

Discussion groups had many suggestions for revising the working definition of the storm surge warning. They wanted to ensure the definition clarified that the storm surge was a **coastal threat** and that people understood the concept of **"rapidly rising"** water. They had issues with the words "significant" and "shoreline," noting that the terms were too vague for the complex shoreline in North Carolina. One discussion group edited the definition to read: "Extreme and immediate danger of life-threatening flooding resulting from rapidly rising ocean water."

Inundation Map

The discussion groups appreciated the level of detail depicted in the inundation maps. There was, however, a difference of opinion among groups concerning the **risk level categories** in the legend. Some liked the categories; others thought only foot ranges should be used. Among all the groups, there was a desire to add **landmarks and local shelters,** as well as to be able to zoom into the map to be able to see land parcels and inundated roads. They would like to add a GIS layer to the map.

Many groups commented on the terminology of **"above ground level (AGL)."** Participants said that in the past, coastal flooding was talked about in terms of above "normal" or above "mean sea level" versus AGL. The switch from mean sea level to AGL caused a lot of confusion. Participants stated that most people with flood insurance have a reference to mean sea level from the state's maps. Others presented a counter argument and suggested that most people really don't know their elevation, and they simply

put insurance papers in their file cabinet and forget about them. Some participants wondered if both terms could be used; others thought that would cause confusion. A number of people stated that the new terminology "above ground" has been very useful in helping people understand their vulnerability.

In terms of timing, EMs would like the map **72 hours to 48 hours** in advance. The groups understood the reluctance of getting the maps earlier, given the uncertainty of predicting the storm intensity too far in advance. They also expressed a desire to see **wave action** in addition to surge. Many participants wanted to see terminology on the map based on confidence: "this could happen" or this is "likely to happen." Others noted that it might be important to state that the map is showing the worst case, but noted the 6-hour run will change probability." EMs also stated that they wanted to see both the **peak and onset** of storm surge.

Marketing, Training, and Coordination

The discussion groups suggested that it will be important to rely on all media outlets (e.g., newspapers, radio, television, social media) to reach as many people as possible. Messages should be **tailored to different age groups** (for example, television and radio for older people; social media for young people) and **different income levels.** They also noted the importance of television, stating that 80 percent of the public comes back to television for verification (to see it, hear it). People suggested using **cell phone alerts** to let users know there is a warning out and to work with municipal and county officials (such as social services, schools, and health departments).

They also suggested using a **rapid notification system** (schools do this now and can reach five phones per parent) and a **database of phone numbers** (land lines, emails, and cell phones) to send out the storm surge warning using "code red" or a similar means of dissemination. People also suggested using Twitter because it is only text and doesn't take as much battery power as the images that go out via other media.

Participants noted that outreach needs to be graphical and cited the importance of **visual markers,** such as videos showing rapidly rising levels, rather than a wall of water. Local markers and diagrams would also be useful. Both the public and local officials need to be educated. One participant noted that the best way to convey information is graphically, saying "People don't get numbers, they get pictures." Participants also mentioned **visualization tools** to show progression of storm surge during an event in terms of timing and inundation.

They also considered **videos** to be better tools than static images to show the threat and impacts of storm surge. People who directly experience storm surge tend to understand the danger, as opposed to those who have not had direct experience. That's why video and town halls are so important; those who haven't experienced it need to see how much damage can occur in their own neighborhoods.
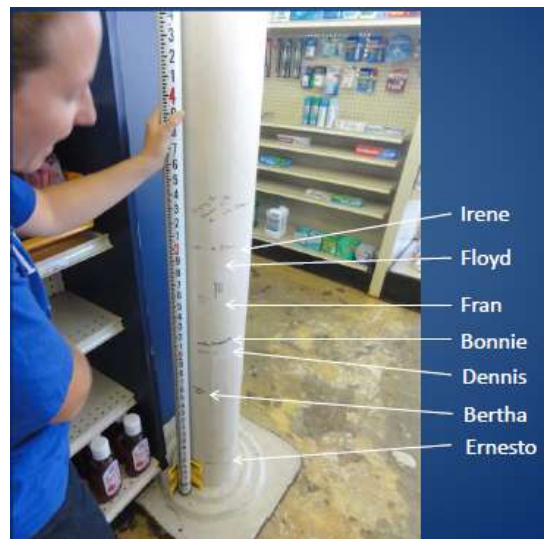
The discussion groups commented that "We need to do better job educating people to show them what we mean by storm surge." There was a difference of opinion on whether it is useful to compare a storm to a **past event.** Some thought that such a comparison can make a storm relevant to personal experience. Others noted problems referring to past events, saying "it can make people who weren't hit think they are okay with this new storm when they may not be okay." Others suggested that "most people do have fascination with weather, so we need to cultivate that."

The groups cited the need for training for EMs and media. They liked the idea of **town halls** and said this approach had been a useful educational tool for Irene. They noted that the WFO website was not used much except for "power users" who want to dig into the details. Most people want the information to be conveyed simply, like on Facebook or in a Powerpoint presentation.

The discussion groups felt that coordination was generally good during a storm. Most media are very responsible and follow the NWS forecast. One problem is that some broadcasters still talk about category-level storms to communicate storm surge hazards. This can lead to public confusion. In fact, the public was very surprised that Irene (Category 1) caused such high surge. Participants mentioned that the NWS gets a lot of feedback from media through NWS chat but not as much from EMs. They stated that EMs have their own Web emergency operations center (EOC), which NWS can also access.

Appendix B
Storm Surge Inundation Map Field Notes

The following comments were culled from the site visits in all four regions. These are comments focused on the storm surge inundation map and may be useful in making final revisions to the map and in preparing for rollout. In general, the reaction to this map was very positive and enthusiastic among all the different stakeholders: broadcast meteorologists, emergency managers, planners, decision-makers, and community groups. We heard:

- Broadcast meteorologists would definitely put this on the air.
- This tool would be great for local evacuation officials. It would give them better information on where to go and what needs to be done with respect to traffic controls and other preparedness efforts.

Color choices

Many commended the choice of colors:

- You know just looking at the map that red is bad. You can look at this without even looking at legend and know that red is bad.
- Color scheme makes sense.
- Good colors.

Applicability to Public

In all regions, there was some concern about whether the map was suitable for the general public. This concern was greatest in Tampa, where numerous participants in the EM group expressed concerns about providing the general public with too much information and in a format that suggests the precision of the forecast is greater than it truly is. In Portland, many wondered if the map was user-friendly enough for the public. However, other individuals in these groups, in all locations, offered counterarguments, including:

- This map is similar to other products already being disseminated.
- There is value in better understanding the locations forecasted to experience greater storm surge so the county can make more informed decisions about where to deploy limited emergency response resources.
- The graphic will likely remove some of the randomness from the group of individuals that choose to evacuate and help increase the rate of evacuation among the more vulnerable populations.

In every region, several people suggested developing **two maps: one for the public and one for more sophisticated users.**

Descriptive Categories

There was a difference of opinion about whether to include descriptive categories (low, moderate, high, and extreme) with the expected water levels. Most wanted just numbers. Some wanted categories because people "get" categories. Some supported the idea of turning the categories into

zones (e.g., red zone, blue zone, or A, B, C zones) to communicate risk and what actions should be taken. Many people wanted to see actions tied to the categories. **Universally, in every region, people cite a problem with the "low" category.**

Anchors and Landmarks

Many individuals called for the addition of more landmarks, though some participants thought roads were enough. Comments included:

- Need picture of landmarks, roads.
- Need layer of critical infrastructure.
- Develop an accompanying text or narrative product to provide more detail and explanation.
- Include more anchors, landmarks, and layers of critical infrastructure.
- People cannot read and understand their maps. People do not understand their own community. Need to add schools, community centers.
- Need anchor points, popup pictures with town hall in red.
- Are other visual anchors needed besides roads? Roads should be enough.

Every region wanted to see which roads would be under water:

- The road network is misleading because it looks like the roads are dry – might want to show what roads are potentially impassable (make them transparent).
- Need to see which roads are under water.

Legend Title and Above Ground Level

- Label the legend **"Potential Storm Surge."** "Hazard" is redundant.
- There was also a suggestion to label the legend **"Storm Surge Risks and Impacts."**
- There was a difference of opinion about "above ground"; some people continue to be confused by AGL concept, but most think the AGL concept is good for the public.
- One comment was to **remove "above ground,"** so the legend would say, for example, "**3 feet of water or less at that location."**
- Another commenter suggested **removing "at that location," too**, so the legend would just say "3 feet of water or less."
- Some people felt that the feet ranges should not be standard, **but tailored to ranges that are typical with regional geographies**. Others disagreed and stated that if you are going to use a map over time, you want a consistent range, so that, for example, orange is always 9-10 feet. Feet ranges shouldn't be specific to a storm. Use the range with a color that will always be standard.

Different Probability Scenarios

The question of probability came up: "Is this most likely scenario or worst-case scenario?"
In Portland, one individual thought that emergency managers and the public need the most likely scenario and visually what is a worst case scenario. He suggested producing **two maps: 1) plausible/what we think will happen, and 2) worst case scenario.** Others in the group disagreed and though two scenarios would be too confusing and the public wouldn't know what to do.

Some EMs and the Army Corps of Engineers in New Orleans also supported the idea of having different maps showing different ranges of probability for the EMs and experienced users:

- Give us this is what you think is going to happen and give us "this is the worst case."
- Tweak map. Keep on training the local official; those are the people need to understand the variability.
- CORPS: Show a **variety of confidence maps** to EMs and let them chose which certainty to pick. If we see 10 and 90 percent are the same, good idea that it will be what it is. Don't assume just the 10 percent map is the best, 20 percent is one in 5 – would think we need this.

Waves/Tides
All regions mentioned the issue of factoring in **waves and tides**. Comments were:
- Say additional damage from waves is possible.
- Add time stamp for tides, indicating highest water level at specific times.
- Show the base of what is normal – what the tides are already doing. Click on storm surge on top.

Additional Information to Put on the Map/Text Product
All regions thought some descriptive narrative would be necessary, either on the map or in a mouseover. They also had suggestions for additional text, timestamps, and disclaimers.
- Put where to go for more information on the map.
- Put follow the advice of your EM. Don't use this to make evacuation decision.
- Add "for planning purposes only."
- Add a disclaimer about what this map assumes and does not assume.
- Include probability, timing, and duration components on the map or text product.
- Add timestamp.
- Add a disclaimer about uncertainty.
- Hurricane x, be sure to put Public Advisory X.
- Need temporal 6-hour timesteps, is it going to be evening, add what time map was issued and when the peak is going to hit.
- Need a verbal product or text.
- Need narrative from WFO that translates the gravity of map.
- Need text to convey the uncertainty component and what is timing on maximum water elevation and for how long (duration).
- Need to tie actions to messages (e.g., this is what you should be doing if you are in the red zone).

Impact Visuals/Additional Information
In all regions, people suggested developing accompanying visuals to help illustrate what is meant by different levels of water.
- Use of visual, recognizable landmarks would be helpful; not just visual, but also specific examples; here's what six inches of water will look like in your neighborhood.
- Would be helpful to have more "impacts" pictures to accompany the map.
- Videos would be better than static images to show impacts.
- Visualization tools to show progression of storm surge and how it progresses during an event in terms of timing and inundation.
- Have mouseovers on map to give more information: xx will happen here.
- Suggest mouseovers to get more information like: You are in X Parish. The impact is X.

- Show the surge warning and then immediately show the impacts of surge – there is a warning… and this is what the impact could look like. This is linking the warning AND the potential results of the threat associated with the warning.
- Likes ideas of taking photos of landmarks – here is what 6 feet of water looks like at this landmark.
- Need to have a graphical image of the "after" – this is what happens
- Visual messages are critical – stop sign markers; signs – this is what 5 feet of water looks like.
- Need to attach landmarks with picture of how much water they can expect to see.
- Make the maps come alive by displaying them in interactive platforms.
    - Show what the different flooding levels would look like in a photograph or diagram.
    - Provide overlapping tools with different resolutions.
    - Layer the information on GIS to allow someone to zoom in.

Interactivity
Many people also discussed the need to have the map interactive:
- Make the map come alive. What is going to happen because of the levels depicted?
- Provide street view – Google maps. Show what flooding would look like. Include a photograph of what 3 feet of water looks like.
- Improvement would be to take legend box and put high up top and incorporate pictogram-showing nature of impact (water up to house windows, wave with car submerged etc.) to eliminate language barrier and graphically depict inundation depths.
- Will there be zoom-in capability? If this information is overlaid on GIS, you would be able to zoom in.
- Would want multiple software formats
    - For example, need to be able to pull layer into their GIS to show this relative to other data layers for example, where shelters are located
    - Is there a standard for NWS software? Conversion beginning to enable GIS
    - Would like cell phone/smart phone compatibility. Attach to text message.

Other Questions/Issues
Everyone wants a full technical description of how the inundation map is developed, its resolution, and scale.
- Does the map include waves?
- Does it include rainfall?
- Does it factor in all sources of water, including river flooding?
- What is the resolution level of the map? Intriguing. Wants to know scale and models that would be used to generate.
- What is the grid cell resolution of this map?

In every region, the relationship between the storm surge warning and inundation map came up:
- What's the connection between the purple map and the color-coded map?
- Do the two maps match up or not? How do they relate?

In every region the linkage to coastal warning came up: do we do coastal flooding and storm surge at the same time?

Training

All regions want training before the product is rolled out. WFOs want to know more specifically what their role will be.

- 6 months in advance of map roll out needed to educate
- June 2014 would be best time to roll out.
- Would be good to know now when these will be rolled out – at least 6 months ahead of time to prepare.

Appendix C
New Orleans Inundation Map Field Notes

Crosshatching

Across the groups, there was a general agreement that the red crosshatching diagonal black lines did not work and that the visual design was not adequately conveying the risk.

- Crosshatching looks like a lower threat than the solid red.
- The map is very busy.
- The worst thing that you see visually has to be the overtopping.
- Have a problem with the black lines. It conveys certainty.
- Get rid of crosshatching; should be consistent, just a plain color.

Suggestions for revising were to bring over the solid color (red), or use another color like purple, green (people took issue with green because of color blindness issues), or even black. People seemed to like the purple color best.

For the area where "overtopping not expected," several people suggested just making this area a white (or grey) block; make it look the same as other areas on map that won't get inundation. Don't need the black lines.

Highlight Levee Area

There was consensus among groups that the map should highlight the levee-protected area.

- Show that someone is behind a levee. Need to show some kind of demarcation. Very important for people to know if they are in levee protected area. Maybe keep the demarcation of levee structure with bold black lines. Risk mapping is needed; they are still at risk.
- Highlight levee area somehow.
- Show levee protection but no hash marks. Just show it white. Put a caveat that inside the black line (or whatever that shows the levee system), there is always a risk. Whether it's dry or no, you are at some risk.
- Box in levee system to show drama.

Timestamp/Disclaimer

People remarked that the map "is of this moment" and that things can change. They definitely want to see a timestamp and a disclaimer about uncertainty. The disclaimer should also reflect that there is always risk inside a levee system. In addition to the disclaimer, they want to see metadata/a technical description of what the map assumes/does not assume.

- Problem is this map "is of this moment." Things can change.
- Add a timestamp.
- Have a disclaimer that we don't know levels of water in levee, that the numbers are suspect.
- Say that this information is coming from a model. Should convey this is a prediction, we don't know.
- Add words stating there is always a risk in a hurricane situation behind a levee system.
- You just killed 200,000 people. Dry to extreme event just takes one breach. Need to convey that.

Timestamp/Disclaimer (continued)

- Saying overtopping is not expected is downplaying the risk. Need to say something like "this map does not account for a breach happening."
- Breach or rainfall in this graphic is not being accounted for. Must say what this map is and what it is not.
- Need a technical description for the levee map for what it is and is not assuming.
- Put in metadata: Assumes all gates are closed.

Disagreement on Whether People Understand Overtopping

There was disagreement on whether or not the public understood "overtopping." But there was a general consensus to remove the words "Overtopping NOT expected."

- Useless to tell you overtopping or not. We need to know the level of the water.
- Lose the "overtopping Not expected."
- Overtopping not expected"? Would not even have it in there. It will cause a problem, litigation, if there is a breach.
- Would not say "NOT" expected. Will screw up evacuation. People are looking for a reason not to evacuate and then will go right to that "NOT" expected and come back with a lawyer.
- In a bad storm, anything could happen. If overtopping is expected *anywhere* in a levee system, the whole system should be lit up.
- Hard to explain if you have some of the levee showing overtopping and some not. Maybe add these words: "Levee Protected Area, Overtopping Possible."
- Think people understand overtopping. Have to make sure it's reported properly. Will get calls about breach, when it is overtopping.
- Tell people what the consequence of what overtopping is.
- Need to communicate to public what overtopping is. Also, there is a difference between overtopping and breach.
- This map is telling me that where there is possible overtopping, I am in trouble!
- Overtopping possible but flood depth unpredictable. Just because we are saying overtopping possible, disagree that there needs to be education on it. If you are saying overtopping is possible, then I get that.

Other Comments

- Add parish boundaries.
- Add words stating these are federal levees – add to legend.
- Show two separate graphics: threat or no threat.
- Good to mouse over, and get more information like "You are in X Parish. The impact is X." Tourists don't know what parish they are in.

Appendix D
Storm Surge Marketing
Discussion Group Script

WFO provide quick welcome and thank you to participants for coming to today's session, acknowledge participants' efforts today will be invaluable in helping NWS improve its communication around hurricane forecasting.

INTRODUCTIONS

ERG Facilitators:
- **We'll be asking you some questions related to storm surge**
- **We'll be showing you some new NWS forecast tools related to storm surge**
- **Today's session is about "you"**
- **We are eager to hear your insights and observations**

QUESTION 1: (10 minutes)
Let's begin by talking a little bit about your community and storm surge. We want to better understand your community's storm surge vulnerability and past experience with hurricanes.

1. What is your community's recent experience, level of awareness, and understanding of storm surge? Do you have evacuation zones based on surge risk? How has your community responded to recent events?

QUESTION 2: (10 minutes)

Let's talk about how you currently communicate about storm surge.

1. What language do you currently use to communicate what storm surge is and the threats a storm surge can pose?

2. What graphical products do you use?

3. Have there been any special community initiatives to educate the public about storm surge (such as markers and other visuals, workshops, etc.)? If so, how would you rate their success?

4. What barriers do you face in communicating about storm surge?

SHOW DEFINITION
QUESTION 3: (10 minutes)
The National Weather Service is considering having its National Hurricane Center issue a separate storm surge warning/watch for tropical cyclones. This will be in addition to the hurricane warning/watches the National Hurricane Center already issues. The earliest the National Weather Service would implement this warning is 2015.

A working definition for this warning is: **"A significant risk of life-threatening flooding from rising water moving inland from the shoreline."** The watch would be generally issued within 48 hours of the arrival of tropical cyclone conditions that would hinder evacuation or other preparedness actions and the warning within 36 hours.

QUESTION 3 CONTINUED: (10 minutes)

- Do you think a separate storm surge watch/warning will be useful to you? How far in advance do you need it? How will you use it? Probe for how the warning will complement/complicate what they already do. Probe for differences in how they might use it for decision-makers/public.

- Do you think people will need to be educated about it? If so, do you have any ideas about how this can best be done? What would help get the message across?

SHOW WARNING MAP
When the National Hurricane Center issues a storm surge watch/warning, it will issue maps showing the entire area under the storm surge watch/warning. More detailed maps will be provided for localities.

- Do you think this map will be effective in showing a specific area under a watch/warning from a specific storm?

- What barriers do you foresee in using this map?

SHOW STORM SURGE INUNDATION MAP
QUESTION 4: (10 minutes)
In addition to the storm surge warning map we just looked at, the National Hurricane Center has created a new storm surge inundation map that it is planning on releasing in 2013 or 2014. During a hurricane, the Hurricane Center would issue this map, along with its public advisories (every 6 hours) for affected areas.

- How would you use this map in your community? How far in advance do you need it? Probe for how this map will complement/complicate what they already have.

- Do you think people will understand this map? What do you need to help people understand this map? Probe for how participants think the uncertainty and probability associated with the map should be expressed.

- What barriers do you foresee in using this map?

SHOW LEVEE MAP – NEW ORLEANS ONLY
QUESTION 5: (10 minutes)
The National Hurricane Center has created a very preliminary prototype storm surge inundation map for New Orleans. This is a variation of the map we just looked at, specific to New Orleans.

- Do you think people will understand this map?
    - Probe for if participants/the public will understand the term "overtopping."
    - Probe for if participants like the crosshatching.
    - Probe for if a map like this would affect evacuation decisions.
- What barriers do you foresee in using this map?

QUESTION 6: (5 minutes)
What other storm surge needs do you have?

- What else could the National Weather Service do to assist you in both outreach and actual storm surge event response?

CONCLUSION:
Thank people for coming and for providing their input. Let them know their feedback will be conveyed to the National Weather Service and that their comments will be taken into consideration as these products are finalized and rolled out.