Results from a VCAPS Planning Workshop for Extreme Weather in Orange Beach, Alabama: Final Report

Social and Environmental Research Institute

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Introduction

Like most coastal cities, Orange Beach, Alabama and its neighboring communities have experienced extreme weather events, including hurricanes. Expectations are that there will face increased exposure to extreme weather in years to come. Situated on the Gulf of Mexico and bordered on the north by the Intercoastal Waterway, the City sits at low elevations and faces many impacts from storms. Flooding is already a major problem and it is likely to get worse. The City faces challenges in preparing for hurricanes and in mitigating the impacts of storms. In addition, extreme heat events are projected to become more frequent.

To better understand and mitigate the impacts of extreme weather events and especially flooding from severe rainfall and coastal storms, city officials in Orange Beach organized a workshop on June 14, 2012. With funding from Mississippi and Alabama Sea Grant and with the cooperation of the City government, the Social and Environmental Research Institute (SERI) led a workshop that used a mediated modeling process called Vulnerability and Consequences Adaptation Planning Scenarios (VCAPS). SERI developed VCAPS with funding from the National Oceanic and Atmospheric Administration (NOAA). The purpose of the workshop was to document the vulnerability of Orange Beach and neighboring communities to extreme weather events and to identify actions that the communities could undertake to increase their resilience.

Multiple stakeholders, including city officials, officials from neighboring municipalities, local residents and business people participated in the workshop. The workshop began with a presentation on the floodplain and watershed management issues and proceeded to a discussion about impacts of precipitation and storms on infrastructure, commerce, public safely, and ways of life. SERI diagrammed the participants' understandings of how these weather-related hazards created damaging consequences. The results of the workshop are presented here in both diagram and narrative-formats.

Flooding Risks in Orange Beach and surrounding communities

The workshop began with Landon Smith, the Floodplain Administrator and the Emergency Management Director for Orange Beach, presenting data and general information on flooding risks.

He noted that the flooding risks that homeowners and residents face are increasing in coastal Alabama and Florida. The base flood elevation is rising, as storms are increasingly more severe and relative sea levels rising. Smith presented this statistic: the chances are one in three that a resident's home will be flooded during the life of their mortgage, if they live in a flood zone.

In addition, it was noted that hurricane and tropical storms are expected to increase in severity and frequency in the near and long terms. Gulf Coast cities and states are taking actions now to prevent or reduce future damages and to protect human lives. There are many kinds of "mitigative actions" that are being taken now or that could be taken in the future.

Managing Flooding Risks in Orange Beach

The entire community of Orange Beach and substantial parts of neighboring communities are susceptible to flooding. Orange Beach has a Floodplain Management Committee, in which City

officials work with local residents and state officials to prepare for and mitigate flooding losses. The City has an emergency response system and integrated flood management system in place. Despite these efforts, areas of concern persist and gaps in preparedness and opportunities to mitigate impacts can be further explored, as they were in the VCAPS workshop.

The VCAPS Process

The VCAPS (Vulnerability and Consequences Adaptation Planning Scenarios) process combines structured discussion with interactive concept mapping to create visual summaries of local knowledge about vulnerability and resilience. It helps government staff and stakeholders depict how a community is impacted by weather related hazards and the actions that could help reduce those impacts.

A VCAPS process begins by identifying a small set of concerns or hazards that the community would like to explore. This focuses and defines the boundaries of the discussion, ensuring that the exercise is relevant to decisions. The discussion centers on one concern at a time. During the discussion, a VCAPS diagram is constructed by the research team while listening to the facilitated dialogue in the room.

The participants at the meeting choose which hazards to focus upon. Groups sometime define the hazards quite broadly (e.g. super storms) or quite narrowly (e.g. coastal erosion).

After selecting the hazard VCAPS diagramming progresses to trace pathways that describe how that hazard affects the community and its environment. A pathway model is made that documents the sequence of steps that lead to harmful

consequences. For example, precipitation causes run-off, which leads to storm sewer overflows, which leads to flooding of underground transformers, which leads to electrocution. Each box in this diagram is called an "intermediary outcome." There are normally many intermediary outcomes in a pathway.

At some point, the pathway of outcomes ends in a consequence. A consequence is an outcome for which it is not necessary to ask the question, "Why do we care if this happens?" To take the example above about runoff, it is not obvious why we should care about run-off, the mobilization of debris, the clogging of a sewer drain, or flooding of basements. But if flooding leads to electrocution, then electrocution is a consequence, because it is obvious that we all care about loss of life.

Management actions are also identified in the diagram. These are actions that can be taken to change the way the stressor affects the community. VCAPS differentiates between actions taken by private individuals and groups and actions taken by public organizations or government. The diagrams can include actions that are already in place or those that are proposed by the participants.

Contextual factors are the final component in the VCAPS diagram. These are specific qualities associated with an intermediary outcome or consequences that amplify the effect of the hazard. For instance, the mobilization of debris by run-off is made worse when there is more debris on the streets, therefore an amplifying contextual factor might be: "time since last street sweeping." (For more details see Appendix A: How to Read a VCAPS Diagram.)

VCAPS in Orange Beach

At the start of the meeting on June 14, 2012, Seth Tuler from SERI led a discussion about which weather related hazards the workshop would like to focus upon. The group decided to discuss heavy rainfall and severe coastal storms. Separate VCAPS diagrams were made for each of these hazards, starting with heavy rainfall.

During the discussions, SERI diagrammed the causal pathways and added contextual factors and management actions to the diagrams as participants mentioned them. These diagrams were projected onto a wall in front of the participants. The remainder of this report will be a summary of those results. VCAPS diagrams that relate to these abbreviated narratives are attached to this report as Appendices.

Hazard: Heavy Rainfall

Heavy precipitation events, such as what occurred in early June 2012, can have serious impacts on Orange Beach and neighboring communities. Participants in the VCAPS workshop identified the following immediate outcomes from heavy rainfall:

1. The transport of nutrients, sediments, sand, pollutants, and debris. These materials are carried into marine waters where they can contaminate oyster beds, harm seagrasses that are nursery grounds for fish, and promote unwanted algae growth. There are consequences for oystermen, recreational tourism, and recreational fishing. Healthy water was identified as a key to a healthy tourism sector.
2. Erosion of roadbeds and bridge foundations. This compromises structural integrity and can lead to loss of public property or the disruption of transportation. Some repairs can take months, requiring inconvenient detours.
3. Movement of sand onto roadways. This blocks traffic, which can compromise the delivery of emergency services and delay the restoration of normal life.
4. Drainage ditches that are designed to channel floodwaters away can become eroded or blocked, compromising the effectiveness of this water management system. The result can be increased local flooding.
5. Localized flooding in people's yards can compromise their septic leaching fields and their homes. Water can flow backwards through the septic lines into people's homes, or flood directly into their homes with unsanitary water. This leads to property damage (furniture, belongings) and can lead to the growth of mold, which is a health danger.

Standing water produces a number of problems that need to be addressed:

a. It can block roadways, interrupting normal flows of traffic.

b. It can become temporary habitat for unwanted pests such as mosquitos and snakes.

c. It can short circuit electrical pumps installed to move wastewater, thereby compromising the public wastewater treatment system.

d. It can short circuit electrical transformers and create power outages.

Water damage to property can lead to a number of issues associated with insurance, repair, and compensation. Consequences include inconvenience to homeowners who must get compensation from insurance companies to possible loss of property (and it's accompanying tax revenues) if the structure must be abandoned.

The final VCAPS diagram for intense precipitation documents other implications as well. It also identifies specific qualities or conditions that can aggravate the damages.

While building the VCAPS diagram, the group also identified some management actions that could be taken by private homeowners, businesses, or government to reduce harm and speed compensation and recovery. However, due to a lack of time, this list was quite abbreviated. With more time, this list could be more fully developed.

Management action items identified during this short meeting were:

- Keep drainage ditches clean and in good repair
- Renourish beaches
- Condemn easements
- Remove sand from roadways
- Make a stronger building code
- Have city buy out vulnerable buildings
- Elevate structures
- Floodproof structures
- Strengthen roofs
- Have insurance companies agree on a single adjuster
- Pass the transparency bill for insurance companies
- Have an open market for re insurance industry
- Other reforms of insurance industry
- Expand the scope of FEMA

Hazard: Severe Coastal Storms

After completing the VCAPS diagram on heavy rainfall and taking a break for lunch, the group moved on to discuss severe coastal storms. The discussion began with the impacts that result from the forecast of a storm, which includes the cancellation of reservations, traffic jams, congestion at gas stations and hardware stores.

The three main weather related stressors associated with coastal storms are storm surges, heavy precipitation, and wind.

Storm surges can lead to five different outcomes:

1. Contamination of shorelines and structures can occur when debris, oil contaminated sediments, and sand are brought onshore. Contaminated sediments are a result of the Deepwater Horizon disaster.

1. Sand and other debris is washed ashore where it blocks roads, damages property, and contaminates sensitive ecosystems. Cleaning up debris is costly and time consuming.

2. Saltwater can be pushed inland, causing numerous ecological and economic impacts. The wastewater

treatment facility may be damaged from saltwater entering the sanitary sewer system and salt can damage powerlines, leading to power outages.

3. Wave action from storm surges damages beaches, can damage roads seawalls, and coastal infrastructure.

4. Finally, outfall pipes may become inlets, along with creeks and streams, serving as conduits to push stormwater further inland. This leads to numerous problems, several of which were identified in the discussion about flooding from heavy precipitation.

The outcomes and consequences of heavy precipitation were discussed in the morning. Those were replicated in this diagram for severe storms.

Wind was only briefly discussed. The group talked about damage to trees and the consequences of electricity disruption. The impacts from power outages were also briefly discussed. The group identified inoperable ATM machines and inoperable credit/debit payment systems, which put demands on the cash economy. Loss of a/c in homes is a problem, which leads to other consequences when people seek comfort in their cars and drive around, endangering themselves, others, and interfering in cleanup and response activities. Finally, loss of power means a loss of supply for drinking water and inoperable wastewater collection and treatment systems.

A significant number of management actions were identified by the group. These are listed in a table in Appendix A of this report.

Discussion of Management Actions

After completing the severe storm diagram, SERI encouraged the group to discuss management actions that could be promoted now and that would increase resilience to storms events.

While time was very limited, a few interesting discussions did take place.

First, the group discussed what prevented adequate maintenance of drainage ditches. People recognized this as the State's responsibility and argued that public demand would help promote State action. A regional stormwater management plan would also help promote action, but such a plan faces obstacles, namely a lack of consensual vision at the county level.

Mention was also made of a growth management plan, which, if in place, could show where new infrastructure should be

located to minimize its vulnerability to flooding. Mapping of local problem areas was identified as an action that would help to mitigate future losses.

Similarly, some people pointed out that a watershed management plan would help to identify management resources that should be adapted and preserved to help mitigate floodwaters.

The group discussed the management and care for pets during storm events. Instituting a system where lost and found pets could be repatriated with owners was noted as a possible future action. Such a system could be based on the model that Tuscaloosa developed for after tornados.

Finally, the group had a lengthy discussion about how people could receive information about the condition of their property immediately after the storm and when an evacuation order is still being enforced. The lack of information was identified as the major cause of people attempting to re-enter damaged neighborhoods. The group discussed several ideas including a block captain system, where one individual collects and shares information about a specific neighborhood.

The workshop ended with a speedy discussion to gauge interest in establishing a Citizens Advisory Committee or another *ad hoc* body to follow through with the work of the day.

Participant Feedback

Several weeks after the workshop, SERI conducted telephone interviews with six participants. We asked about thoughts and opinions on the VCAPS process. All six participants found the process to be beneficial and all agreed that they gained perspectives from the diverse viewpoints and from neighboring officials. Some of the public officials said they came to better understand the concerns of local citizens. One said the discussion helped him understand the reason behind some of the regulations in place and also how some regulations may need to be tweaked to better address the underlying issues. Another participant noted that she learned about the connections between climate change and flooding and intense storms.

All of the interviewees agreed that the facilitation was excellent. They found that the facilitators did not dictate the topics, but helped to elicit local knowledge and diverse perspectives. Participants said that everyone seemed to feel included and that every perspective was heard.

There was agreement among all six individuals that the diagramming during the meeting helped to keep people on task. One person noted that this can be difficult, particularly in discussions among people with diverse experience and expertise. One person said the visual aspect "equalized" everybody and drew attention away from personalities and towards the issues. The diagramming process led the discussion through many causal pathways that were new to some. Following the logical framework of one outcome to another was widely seen as helpful.

People identified one of the positive products of the workshop as the discussion about how to gather and distribute information about homes and businesses to people who have evacuated. All interviewees considered such a project to be critically important, yet something that officials had not considered prior to the VCAPS workshop. The workshop also helped voice the value of planning activities, which may help the planning win support from the public and the City Council.

> *The diagramming helped the audience take a subject matter and look at what else is affected by that subject, branching off into conversations about cause and effect for some of the issues we were talking about. Without that diagramming process, I don't know if the discussion would have gone that way.*
>
> City official, Orange Beach
> August 2012

When asked about how to improve the VCAPS process, several interviewees said the diagrams were difficult to read and understand when they received them after the workshop, although they felt the diagrams were extremely helpful during the workshop. Some recommended presenting the information in a different format, with outcomes lined up into tables. One said that receiving information on the VCAPS process before the workshop would be helpful to be better prepared.

> *One thing that was brought up in the discussion that I haven't been involved in as much was habitat issues for our coastal wetlands. We had a lot of discussion and questions about natural habitat issues that I hadn't put a lot of thought into.*
>
> City official, Orange Beach
> August 2012

Conclusion

Examination of local hazards with city and state officials, interested citizens and members of the private sector can illuminate vulnerabilities and highlight potential mitigation projects for municipalities to adopt.

VCAPS is one approach to help elicit and organize this knowledge in a format that can empower local action. This workshop drew upon local experience to document vulnerabilities and mitigation actions.

Like other municipalities across the country, Orange Beach and its neighboring communities will continue to experience increased exposure to extreme weather. The state, county, and city systems that are in place to manage, cope, and adapt to this weather can be improved upon and will need to innovate more efficient and effective systems to prepare for storms and to restore services. Such systems ought to be informed with the knowledge and experience of city employees and local stakeholders. VCAPS is one tool to bring this is to fruition.

Appendix A

Management Actions for Extreme Coastal Storms in Orange Beach, Alabama Results from Meeting on June 14, 2012				
Actions	**Dep. of Public Works**	**Dep. of Emerg Mgt**	**Dep. of Building and Planning**	**Individual and Private Sector Actions**
Pre-Storm Actions				
Prepare earlier	X	X		
Shift traffic lanes	X	X		
Stage evacuation lanes	X	X		
Reach out to vulnerable populations		X		
Regional coordination		X	X	
Storm warnings issued		X		
Manage the media		X		
Present info to the public		X		
Plan for speedy recovery of services	X	X	X	X
Encourage businesses to make storm plan		X	X	X
Designate safe harbor areas		X	X	
Private business storm plan				X
Build new roads	X	X	X	
Voluntary evacuation				X
Boats move safe harbor				X
Anchor boats before storm				X
Code enforcement on structures			X	
Remove piers that could be projectile	X			X
Take up boards on piers or release nails to release pressure	X			X
BP: Clean up tar mats				X
Get appropriate training for BP oil removal	X		X	X
HAZMAT training	X		X	X
Have contract with cleanup company			X	X
Designate areas for safe storage and disposal	X		X	
Have contracts and plans ready			X	X
Educate people on how to build piers that don't fail		X	X	
Beach nourishment	X		X	
Condemn easements			X	
Get funding for infrastructure improvements			X	
Dredge some areas	X		X	
Install sand fencing	X	X		
Partnership with USFW, TNC, Island Perdido Foundation			X	
Clean ditches	X	X		

	Dep. of Public Works	Dep. of Emerg Mgt	Dep. of Building and Planning	Individual and Private Sector Actions
Close streets to non-residents		X		
Retrofit construction			X	X
Floodproof	X	X	X	X
Roof strengthening	X		X	X
Insurance programs			X	X
Build fortress homes				X
Outreach to condo and homeowner associations to proactively develop plans		X		
Inter-agency cooperation and communication to deal at regional level	X	X	X	
Install silt fencing, plant on their own	X			X
Refurbish their sea walls				X
Recovery after storm				
Remove large debris with heavy equipment	X	X		
Remove debris (open roads, public property)	X	X		
FEMA picks up debris after roads cleared				
Organizations help people (eg. churches)		X		X
Wash power lines	X			
Replace, repair roads	X	X		
Rebuild sea walls	X			
Replace, repair infrastructure	X		X	X
Shut down pumps for sanitary sewer	X			
Pump out salt water from private septic systems				X
Repair and rebuild public infrastructure when wet and damaged	X		X	
Remove sand from roads	X			
Oyster bed restoration	X		X	
Repair ditches	X			
City buys out property			X	
Get people more timely info about homes/property		X		
Allow people back in to see homes		X		
Buy outs			X	
Redesign of system				
Create living shorelines	X		X	
Water tight manhole covers	X			
Build and regenerate dunes- Classes for grasses	X		X	
Get rid of armored shorelines	X		X	
Stronger building code			X	
Increase building elevation			X	
Put everything under FEMA			X	

	Dep. of Public Works	Dep. of Emerg Mgt	Dep. of Building and Planning	Individual and Private Sector Actions
Insurance companies agree on single adjuster				X
Density zoning			X	
Establish zones where fed relief is not available			X	
Require concrete pilings to disincentivize small buildings			X	
Develop growth management and watershed/land use plan considering vulnerability to storms			X	
Restrict building			X	

Appendix B

Types of mitigative actions identified in VCAPS workshop, Orange Beach AL June 2012 *(Private actions in italics)*		
Pre-storm	**Post-storm**	**Redesign of system**
Reach out to vulnerable populations	Remove large debris with heavy equipment	Create living shorelines
Prepare earlier	Remove debris (open roads, public property)	Water tight manhole covers
Shift traffic lanes	FEMA picks up debris after roads cleared	Build and regenerate dunes- Classes for grasses
Stage evacuation times	Organizations help people (e.g. churches)	Get rid of armored shorelines
Build new roads	Wash power lines	Stronger building code
Regional coordination	Replace, repair roads	Increase building elevation
Storm warnings issued	Rebuild sea walls	Put everything under FEMA
Manage the media	Replace, repair infrastructure	Open market for re-insurance
Present information to public	Shut down pumps for sanitary sewer	Insurance companies agree on single adjuster
Plan for speedy recovery of services	*Pump out salt water from private septic systems*	Density zoning
Encourage businesses to make a storm plan	Repair and rebuild public infrastructure when wet and damaged	Establish zones where fed relief is not available
Designate safe harbor areas	Remove sand from roads	Require concrete pilings to dis-incentivize small buildings
Private business storm plan	Oyster bed restoration	Develop growth management and watershed/land use plan, consider vulnerability to storms
Voluntary evacuation	Repair ditches	Restrict building
Move boats to safe harbor	City buys out property	*Flood proof buildings and homes*
Anchor boats before storm	Get people more timely info about homes/property	*Roof strengthening*
Code enforcement on structures	Allow people back in to see homes	*Insurance programs*
Get rid of old piers that could become projectiles	Buy outs	*Build fortress homes*
Take up boards on the pier or release nails to release pressure on the boards		*Roof strengthening*
BP: Clean up tar mats		
Get appropriate training for BP oil removal		

Pre-storm	Post-storm	Redesign of system
HAZMAT training		
Have contract with clean-up company		
Designate areas for safe storage and disposal		
Have contracts and plans ready		
Educate people on how to build piers that don't fail		
Beach nourishment		
Condemn easements		
Get funding for infrastructure improvements		
Dredge some areas		
Install sand fencing		
Partnership with USFW, TNC, Island Perdido Foundation		
Clean ditches		
Close streets to non-residents		
Retrofit construction		
Outreach to condo and homeowner associations to proactively develop plans		
Inter-agency cooperation and communication to deal at regional level		
Install silt fencing, plant on their own		
Refurbish their sea walls		


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