

Storm Surge Management

Group 3

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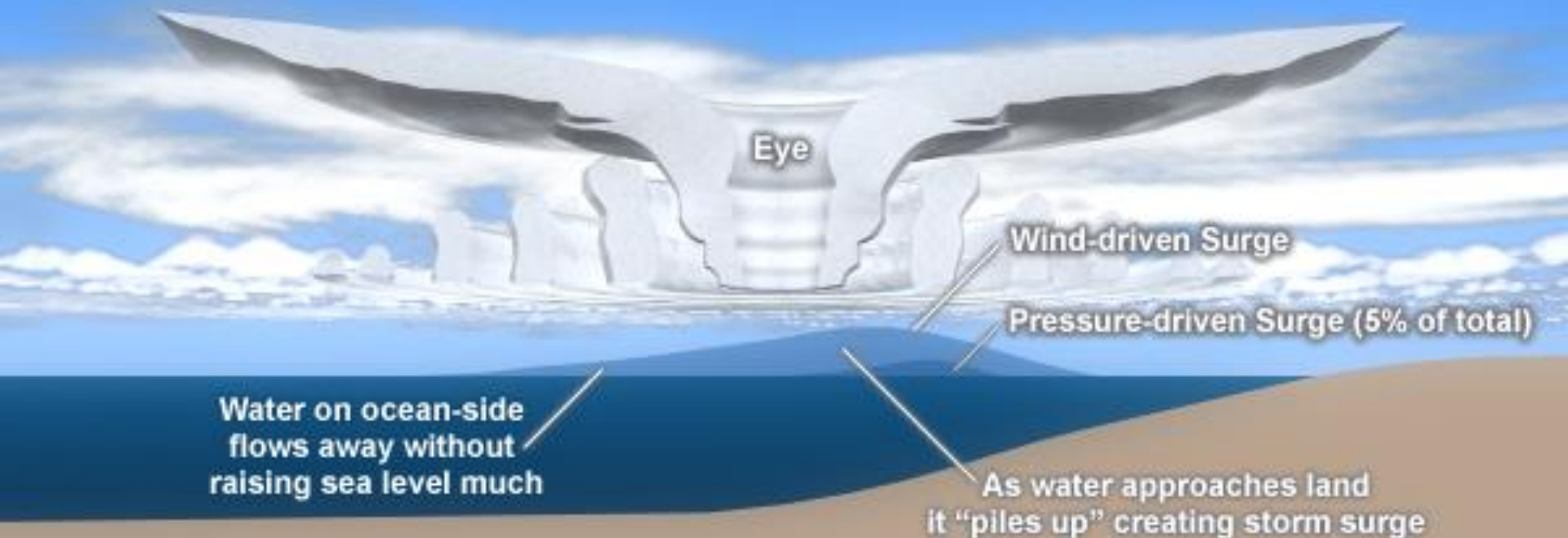
Jiahao Dong

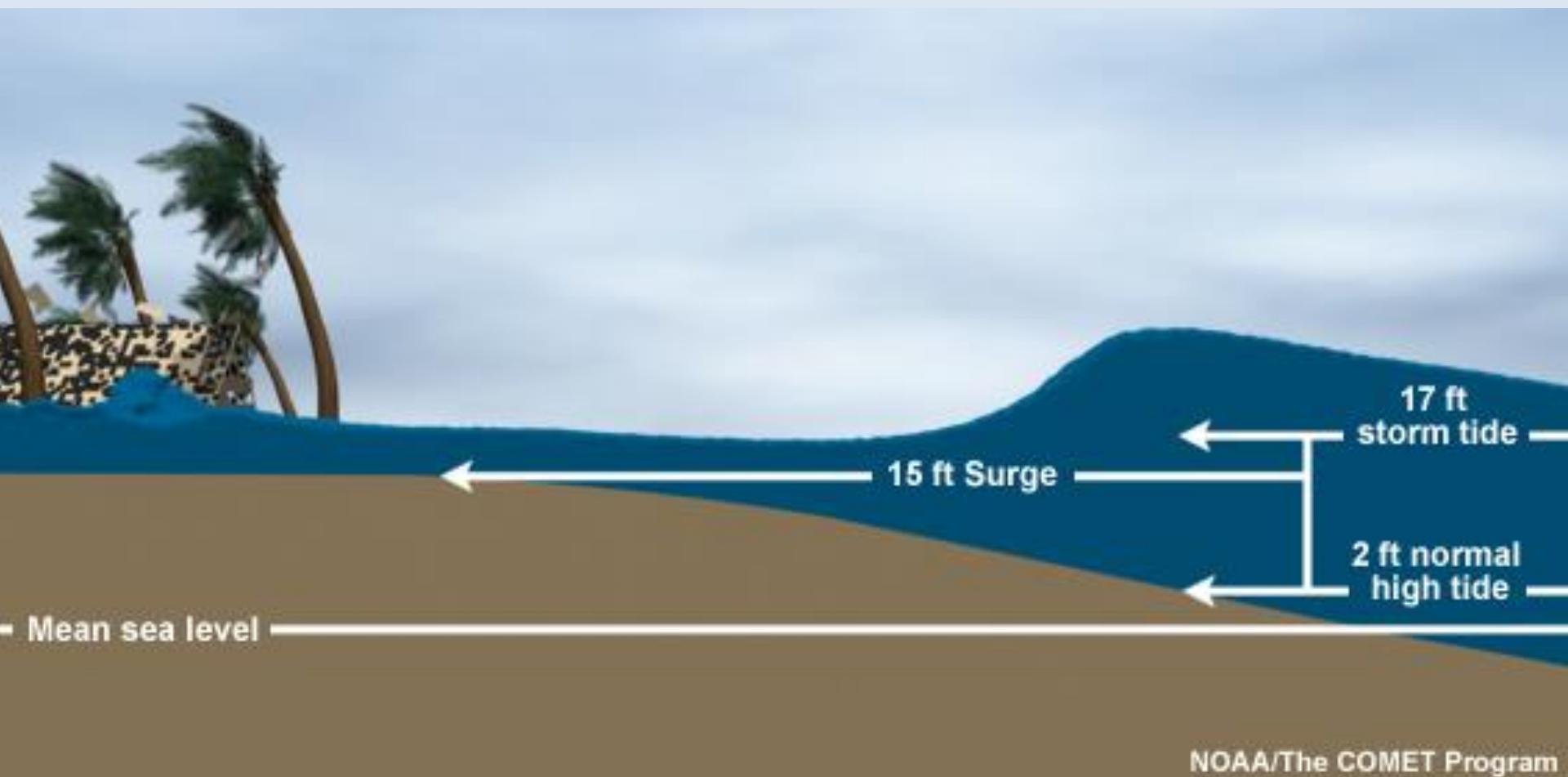
Neil Kohan

Assumptions

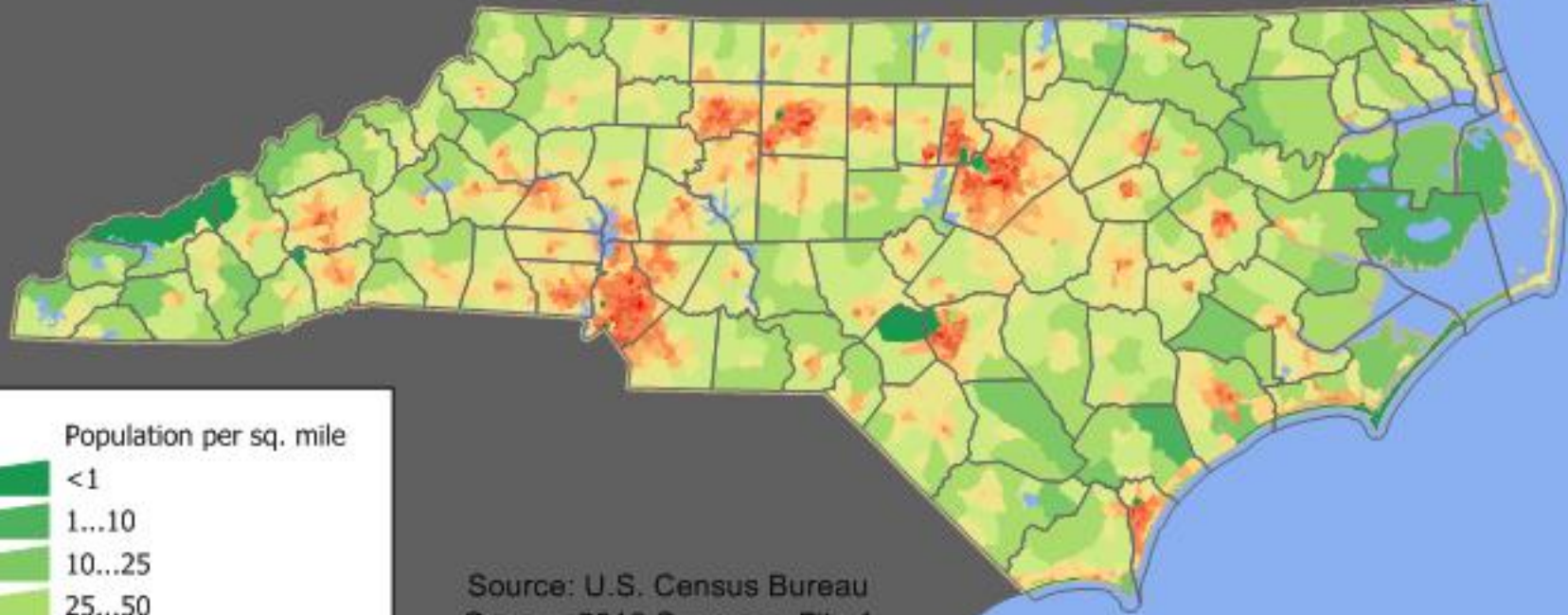
- Accurate storm monitoring will be supplied to the Weather Disaster Management Division
- Estimates for persons displaced, persons injured, persons rescued, property damage, response times will be estimated from previous storm surge disaster (Katrina 2005, Sandy 2012, Florence 2018)

Wind and Pressure Components of Hurricane Storm Surge

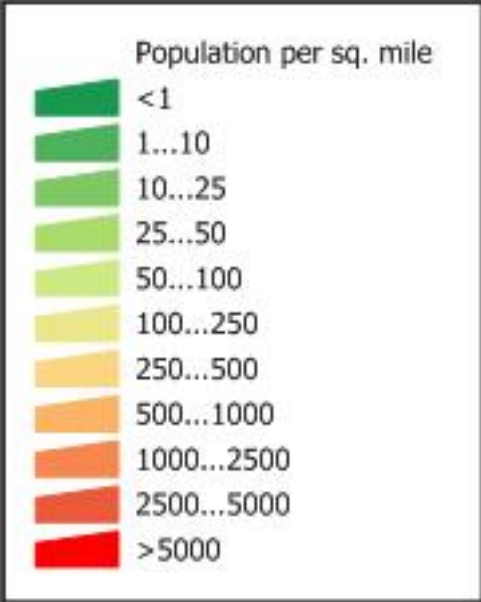




North Carolina: Flood Risk & Population Density

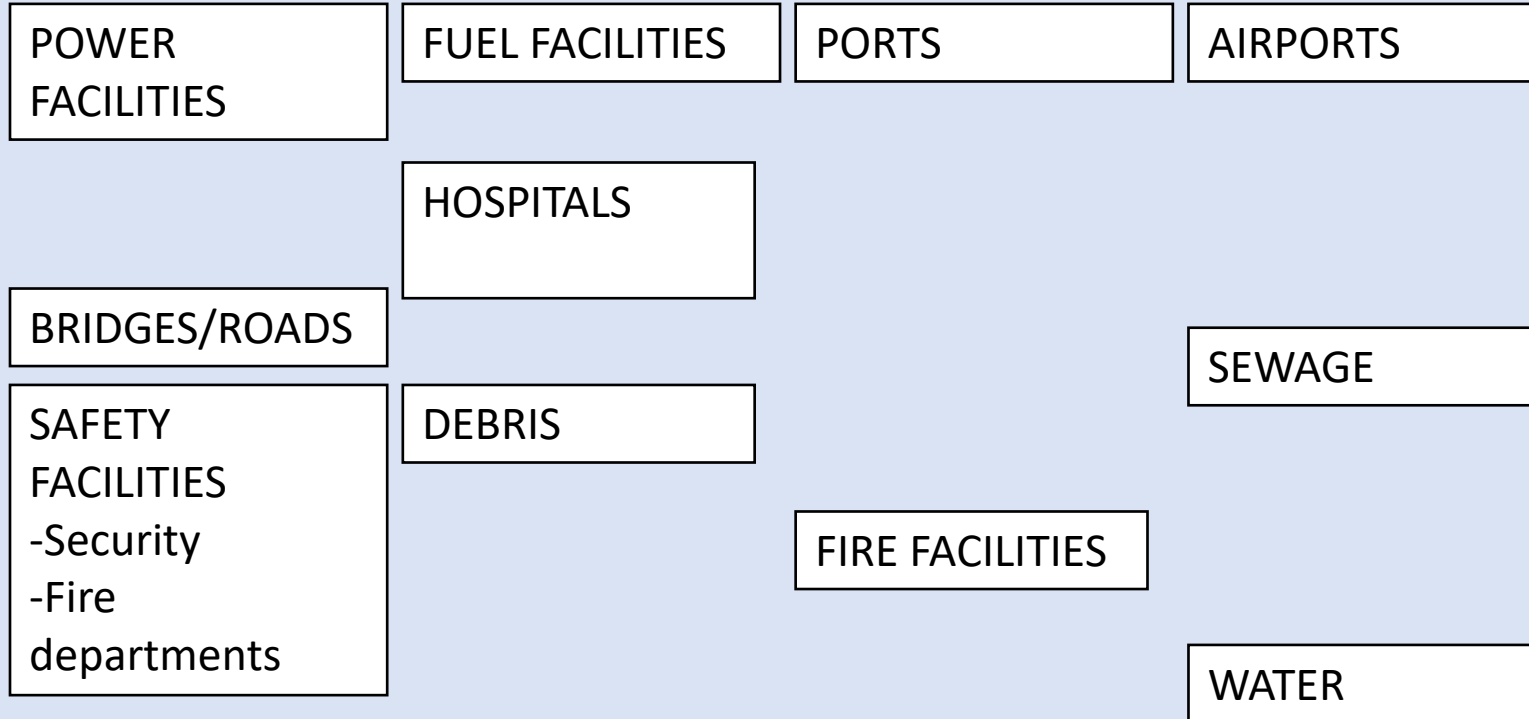


Source: U.S. Census Bureau
Census 2010 Summary File 1
population by census tract



Brainstorming

Infrastructure



Brainstorming

Population

SHELTERS

DISPLACED
PERSONS

SPECIAL
CONSIDERATIONS

- Elderly
- Disabled
- Young
- Missing

EVACUATION

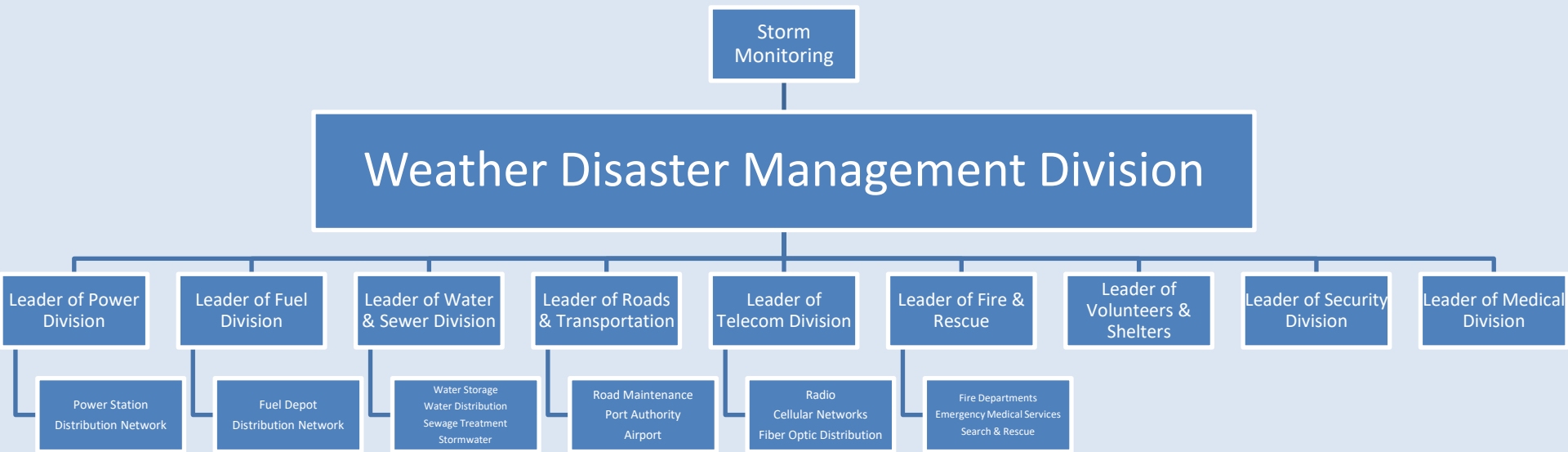
INFORMATION

COPQ	Internal	External	Appraisal	Prevention
Power	-Loss power station -Transmission & distribution infrastructure down	-No power for rescue efforts -Loss of telecom -Threat to life, property	-Check integrity of transmission & distribution network infrastructure	-Design for storm resilience (structural design)
Fuel	-Inadequate fuel -Rupture of storage tanks -Contamination of fuel	-No fuel for rescue -Damage from fuel leak -Hinder evacuation -Threat to life, property	-Check structure integrity -Ensure there is enough storage	-Design for storm resilience (excess capacity, structural design)
Water & Sewer	-Unable to treat waste water -Damage to water storage & transmission network	-No potable water -No sewer -Additional flooding -Threat to life, property	-Check structure integrity -Maintenance -Ensure there is enough storage	-Design for storm resilience (pressure relief, excess capacity)
Roads	-Roads impassable (flooding, debris) -Traffic jam	-Hinder recue efforts by ground transportation -Hinder evacuation	-Ensure roadways have adequate drainage -Methods to keep roads clear of debris	-Design for storm resilience (in cooperation with Water & Sewer)
Telecom	-Networks down	-Hinder rescue efforts	-Maintenance	-Design for storm resilience (in cooperation with Power)
Medical	-Facilities unsafe -Inadequate supplies -Inadequate personnel	-Threat to life	-Ensure adequately staffed and supplied	-Design for storm resiliency -Stock for disaster -Staff for disaster
Fire & Rescue	-Inadequate training, staffing, equipment	-Fire -Hindered rescue effort -Threat to life, property	-Training, drills -Equipment maintenance	-Hire qualified persons -Appropriate equipment -Training program
Volunteers & Shelters	-Lack of volunteers -Inadequate training -Inadequate shelters	-Hindered rescue effort	-Training, drills	-Training program -Designation or construction of shelters
Security	-Inadequate training, staffing, equipment	-Looting -Threat to life, property	-Training, drills	-Hire qualified persons

Quality Audit

- Organizational chart
- Items of Concern
- Quality Assessment
- Root Cause Analysis

Organizational Flowchart



Items of Concern

- Inadequate power for rescue effort as result of damage to power generation or distribution
- Inadequate fuel for rescue effort as result of damage to fuel storage or distribution
- Lack of potable water as result of damage or overload of water treatment or distribution system
- Ground transportation limited as result of impassable roadways
- Rescue efforts hindered by lack of communication resulting from damage to telecom networks
- Medical system overload or damage hinders rescue effort leading to loss of life
- Deficiencies in fire & rescue staffing, training, or equipment leads to hindered rescue efforts
- Overload or damage to shelters leads to hindered rescue efforts and loss of life
- Poor training, staff, or equipment in security result in unrest

Quality Assessment:

List of Individuals to interview

- Leader of Power division
- Leader of Medical division
- Leader of Fire & Rescue department
- Leader of Water & Sewer department
- Leader of Roads & Transportation department
- Leader for Volunteers & Shelters
- Leader of Security division
- Leader of Telecom division

Quality Assessment: Questions for Individuals

- Leader of Medical division
 - Are there enough doctors, nurses for the expected situation?
 - Are the medical facilities adequate for the emergency situation?
- Leader of Fire & Rescue department
 - Are the number of employee adequate for the expected situation?
 - Are the rescue apparatus & equipment sufficient for the expected situation?
- Leader of Roads & Transportation department
 - If there are any emergency preparedness to keep the transportation for the main road?

Quality Assessment: Questions for Individuals

- Leader of Security division
 - Were there enough police to keep the order?
 - What actions you take to keep the messages conveyed to the citizens timely?
- Leader for Volunteers & Shelters
 - Were volunteers enough?
 - How many victims?

Quality Assessment: Responses from Individuals

- Leader of Medical division
 - We really need more professional doctors during the hard time.
 - We need more medical facilities to help doctors to improve their efficiency.
 - Thousands of people
- Leader of Fire & Rescue department
 - We need more small boats to rescue people.
- Leader of Power division
 - We built the power station following the building code, we need to develop the higher quality of the power station.

Quality Assessment: Responses from Individuals

- Leader of Water & Sewer department
 - Yes, we have. But the sewer in our city cannot support such water discharge.
- Leader of Security division
 - No, absolutely we need more police to keep the order..
- Leader for Volunteers & Shelters
 - We use the radio broadcast, television, internet to inform the citizen about the news.
 - Yes, we do have enough volunteers, but we need to train them better.
 - Thousands of people's life and property had been influenced.

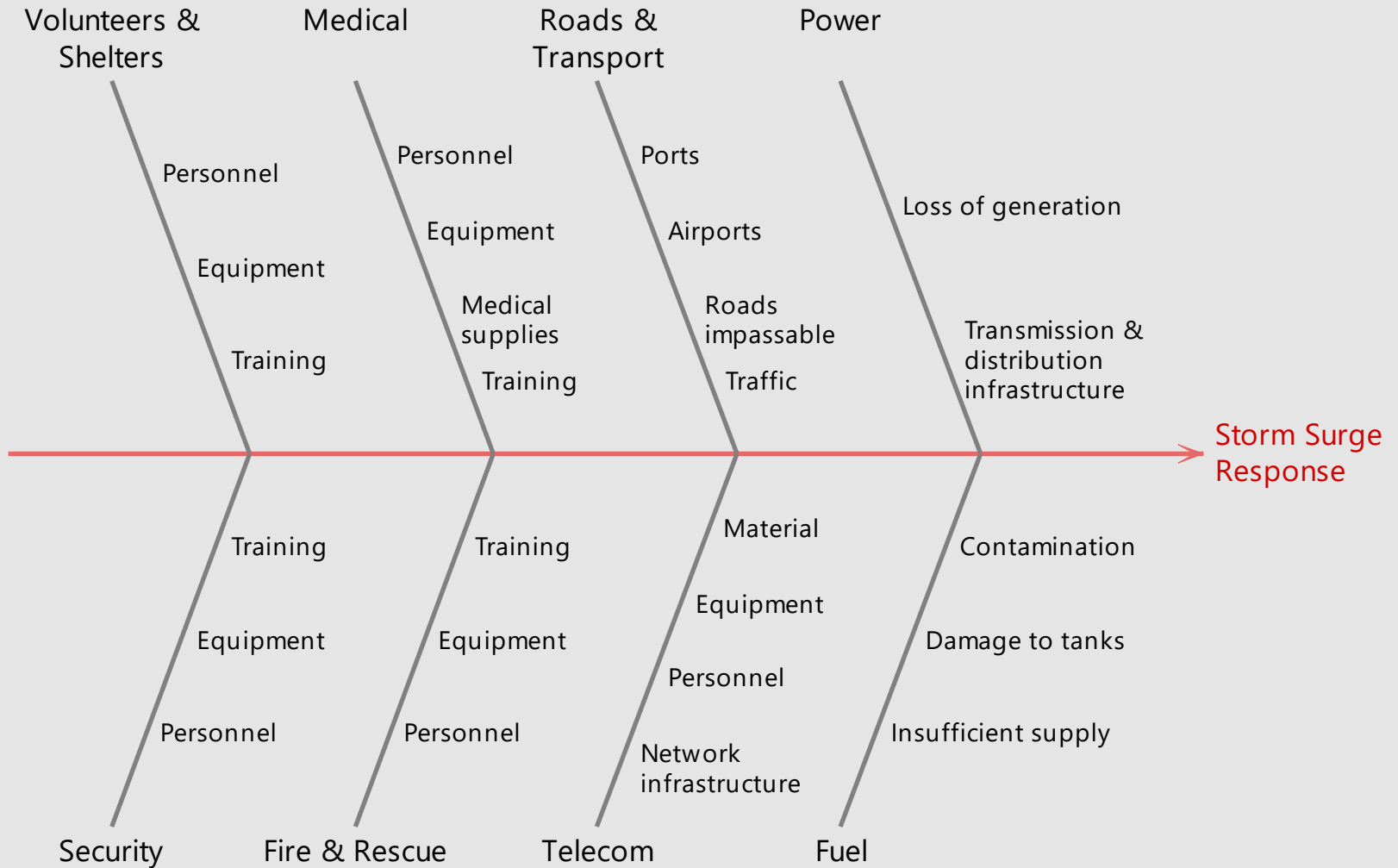
Quality Assessment: Diagnostic of issues uncovered

- Volunteers were not trained enough.
- Poor quality of the power station.
- Medical facilities were insufficient.
- The citizen cannot get the latest news.
- More police needed during the hard times
- Low forecast efficiency and accuracy.
- Insufficient rescue staff and equipment

Quality Assessment: The Results

- The residents cannot get the information in time.
- The rescue teams cannot communicate with each other timely.
- Some victims cannot get the treatment timely.
- The environment could be worse.
- Rescue activities will meet some problems.
(transportation, equipment, fund)

Cause-and-Effect Diagram



Quality Issues

The Solutions

- Train the rescue worker and medical staff to improve their ability.
- Simplify the procedure of news report and stuff distribution.
- Improve the transportation efficiency through using air craft.
- Enlarge the team of trained rescue worker and medical staff.
- Improve the monitor accuracy.
- Set higher standards for emergency stuff.
- Store more food and medicine and check the quality of these things at a regular interval

Improvement Assessment

- Training the rescue worker and medical staff based on corresponding standards.
- Verify the new monitor system.
- Verify the delivery time and quantity through using new transportation methods.
- Simulate the disaster to verify the number of rescue worker and medical staff.
- Check the quality and quantity of emergency stuff based on corresponding standards.

Measures To Make Improvements Sustainable

- Check the quality of emergency staff at a regular interval.
- Educate the residents at a regular interval.
- Training the rescue worker and medical staff based on corresponding standards at a regular interval.
- Verify the new monitor system at a regular interval.
- Verify the delivery time and quantity through using new transportation methods at a regular interval.
- Simulate the disaster at a regular interval.
- Emergency Drills needs to be organized more often.