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This work and its defense approved by:

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Abstract:
Due to their locations around the world, small islands are especially vulnerable to natural disasters. Most of the islands are in hurricane and cyclone paths, and many are of volcanic origin, thus increasing the threat of an earthquake. However, the natural beauty of these locals and the uniqueness of their geographical features often make these islands magnets for tourism. As a result, the limited area for development is often dense, located near the most aesthetically striking features which also are the most vulnerable locations.

The goal of the study was to prove that the present models for small island disaster planning are inadequate, and furthermore, a more complete model could be developed. By not just comparing the two models and case studies, but by understanding the methodologies of each, as well as citing additional cases, these goals were achieved.
Acknowledgements

Over the summer of 2005, I had the wonderful opportunity of spending three months in Santorini, Greece. Obviously, this thesis was born from that trip, so I’d like to thank Prof. Michael Romanos and Prof. Carla Chifos for accepting me into the program and being patient with me throughout the process. Speaking of patience, I’d like to thank my parents for allowing me the time to find my own path. Not only have they supported me during the time I have spent in graduate school, but my two dogs as well! I’d also like to thank the rest of my family for not pressing me too much, even though I know they all feel it’s about time for me to start my career.
List of Figures

Figure 3.1 County of Hawaii Disaster Response Organization........................................................7
Figure 5.1 View of Nea Kameni from the Caldera.........................................................................17
Figure 5.2 Athinios Port on Caldera................................................................................................20
Figure 5.3 Current Transportation Network....................................................................................21
Figure 5.4 Road Network Upgrades and Evacuation Routes...........................................................23
Figure 5.5 Medical Locations and Facilities....................................................................................25
Figure 5.6 Detail of Fira Medical......................................................................................................26
Figure 5.7 Site to House Temporary Shelters..................................................................................26
Figure 5.8 Detail of Ia Medical.........................................................................................................26
Figure 5.9 Temporary Shelters and Cave Locations.........................................................................27
Figure 5.10 Warning Siren Locations.............................................................................................29
List of Tables

Table 4.1 Variables and Sources.....................................................................................................14
Table 4.2 Composite Framework...................................................................................................15
Table 5.1: Hierarchical Organization.............................................................................................19
Chapter 1: Problems and Issues

Since the earthquake and tsunami that devastated Asia on December 26, 2004, the world has been inundated with reports of disasters throughout the world. From January to October 2005, an estimated 97,490 people were killed in disasters globally and 88,117 of them in natural disasters, according to the Center for Research on the Epidemiology of Disasters (CRED) (Braine, Pg. 4). However, many experts believe that the term “natural disaster” is a misnomer. In fact, “natural disasters would not have such a devastating effect on people’s lives if they were not exposed to such risks in the first place (Braine, Pg. 4).” This risk not only involves the places people choose to live, but also the risk associated with not being prepared.

The tsunami of 2004 exposed the risks associated with place and preparedness. The small islands located throughout the south Pacific and Indian Oceans were easy targets for this monster wave, but the death toll would have been far less if disaster plans had been in place. Not only were medical response teams unable to handle the thousands of injured, but tourists and children, alike were oblivious to the grave threats that are associated with the paradise islands. Hundreds of thousands of lives were needlessly lost in the tsunami and its aftermath. Many were tourists who came to enjoy the exotic beaches and blue waters. Many more were the children of the islanders who followed the receding waters out to pick up stranded fish just before the first waves hit. Because they were never taught the warning signs of a tsunami, they were destined to die.

As defined by the Small Island Developing States Network, SIDS are “small islands that share similar sustainable development challenges including small population, lack of resources, remoteness, susceptibility to natural disaster, and excessive dependence on international trade and vulnerability to global developments (SIDSnet).” They present a number of issues that need to be considered when preparing for a disaster.

Due to their locations around the world, small islands are especially vulnerable to natural disasters. Most of the islands are in hurricane and cyclone paths, and many are of volcanic origin, thus increasing the threat of an earthquake. However, the natural beauty of these locals and the uniqueness of their geographical features often make these islands magnets for tourism. As a result, the limited area for development is often dense, located near the most aesthetically striking features which also are the most vulnerable locations.

Their small size, as well as a narrow range of human and non-human resources and markets (Island Network on Natural Disaster Risk Management), make small island economies generally less-diversified in their production and export structures. Therefore, certain disasters can leave an island with no economic resources. For example, if a hurricane or typhoon destroys an entire season’s crop, the economy of an island will be crippled. Additionally, small island economies that are supported by tourism can be equally affected if a weather season is especially volatile or infrastructure is destroyed.

Finally, due to their small permanent population sizes and the remoteness of the islands themselves, as well as the less-diversified production and export structures previously mentioned, resources available on the island at any one time are often limited. Locals typically rely on agriculture for self sustainability, while tourists must rely on shipments from outside sources for their basic needs. If the flow or the production of goods is compromised by a disaster, an island can be crippled, with no means of further sustainability. In this situation, with the island isolated from the rest of the world, completely surrounded by water, the seas can be viewed as an insurmountable barrier.

Models for emergency preparedness in the event of a disaster are commonly divided into five main categories of post-disaster needs. These are direction and coordination, transportation, health and medical, warning systems and public information and training. However, small islands have special needs for disaster planning. The current models used for island disaster planning are too general and are unable to address the
emergencies needs unique to small islands. It is not the categories themselves that are erroneous, rather what is included in each. Therefore, an alternative model for small island disaster planning is needed.

**Direction and coordination**

Direction and coordination are extremely important in developing a plan. Should the command and control of the response start with the local municipalities or the national government, and who takes control if the designated coordinator is unable to perform the required duties? Is there a chain of command? It is essential to determine which agencies are involved and delineate their required duties. In the event of a disaster, it can be assumed the initial period after the event will be chaotic. In this scenario, who is in control of internal security, protection of property, looting and tourism facilities? Having clear direction from the onset of the disaster is critical in saving lives.

**Transportation**

Transportation is another integral part of the emergency plan. For islands, this can be especially difficult. Evacuating hundreds, or even thousands of people from an island would overwhelm the public transportation and road network. What determines best practices for evacuation, and how should islands prepare their infrastructure to accommodate these circumstances? What are the road network patterns, what is their capacity, and will they be sufficient to support evacuation practices? Where are the ports, airports, and is there easy access for use in the arrival of assistance vessels and the evacuation of residents? Additionally, it will also be useful to look at the region as a whole. Typically, islands exist in systems or archipelagos. Therefore, other considerations would be their access to other islands, the extent of their facilities, and the scope of their regional plan for emergencies.

**Health and Medical**

The third area to be considered is health and medical preparedness. Often, island hospitals are small and ill-equipped to handle serious emergencies or a large patient load. Any emergency plan needs to consider the location of existing hospitals, their capacity, their location and what, if any, medications should be stockpiled.

The general health and well-being of the population is also included in this section. Considered are questions of food, water, shelter, and sanitation. Life is fragile, and we have learned from recent events that if these simple necessities are not secure, lives will be lost. Therefore, careful thought must be used in answering the questions of where and how much water should be stored, what is the feasibility of stockpiling food rations until support groups arrive, how one deals with sanitation if systems are rendered inoperable, where the best areas for temporary shelter are, and what types of shelters should exist.

**Warning Systems and Public Information**

Additionally, warning systems and public information need to be addressed. To minimize chaos in the event of a disaster, residents and tourist alike, should have an idea of what actions are to be taken if such an event occurs. Are radio and television stations prepared to broadcast in the event of an emergency? Do hotels, restaurants and businesses have evacuation and emergency plans in place and are they visible? At the same time, are there existing open spaces for assembly, including schools, and educational facilities? In the likelihood that these facilities are used, how will schooling continue, and at what capacity?

**Education and Training**

Finally, it is necessary to determine the types of emergency preparedness training that exist. This includes not only training government and support institutions, but residents as well. Since there may be a period of time which the island needs to be self-sufficient, to what extent should the island be prepared to take care of itself? Should training to achieve that include young children as well as adults?

In light of these questions, this thesis has three principle objectives:
1) to assess the adequacy of the current models for disaster planning,
2) to present a more complete model for small island disaster planning and,
3) to apply the complete model to one small island, Santorini.

The first objective is to prove that the current models being used are inadequate. In order to do this, the author will review guidelines provided by both the Federal Emergency Management Agency (FEMA), and the United Nations (International Strategy for Disaster Reduction). From this review, the author will understand the basic logic, main goals, delegation of responsibilities, as well as the overall strategies of each model.

Additionally, the author will review two case studies, the disaster plan for the County of Hawaii and the disaster plan for the Kingdom of Tonga, to determine how well the models are being utilized. Once this is accomplished, examples from other islands will be included to highlight specific practices which are either superior practices, or an addition to, the models and case studies reviewed.

The second objective of this thesis is to present a more complete model for small island disaster planning. This will be achieved through selecting the best practices from the models and case studies being used, as well as adding elements from outside research.

The third and final objective of this thesis is to use the island of Santorini, Greece as a template for the application of the enhanced model. This will show how the model can be applied to a specific island to manage emergency situations.

The thesis will conclude with the assessment of the strength and weaknesses of the authors approach, as well as addressing the application of the composite model. Additionally, recommendations will be made by the author for areas of future work.
Chapter 2: The FEMA and UN Models

The guidelines of the FEMA and UN models will be evaluated in order to understand the basic logic, main goals, delegation of responsibilities, and the overall strategies of each model, the guidelines from each will be reviewed in this chapter. These two reports were selected because they represent the two most influential bodies in the world. It is the authors goal to determine the adequacy of these two models for small island disaster preparedness. This will be achieved by determining whether or not each model address the issues associated with direction and coordination, transportation, health and medical, warning systems and public information and education and training.

The FEMA Model

As an agency of the United States of America, FEMA prepared these guidelines to “describe who will do what, as well as when, with what resources, and by what authority-before, during, and immediately after an emergency (FEMA, Pg. i).” Additionally, the agency aims to clarify preparedness and response elements of planning. To be used as a “toolbox,” the guide is intended for each community’s emergency operations plan “to reflect what that community will do to protect itself from its hazards with the resources it has or can obtain (FEMA, Pg. iii).”

Direction and Coordination

To respond to an emergency situation in a specific location, FEMA has determined that an emergency organization should be created. The organization should compile a listing to include specific positions which clearly state the tasks to be performed. Also, this listing should establish a hierarchy in the event that two or more organizations perform the same kind of task. Furthermore, “for the sake of clarity, a matrix of organizations and areas of responsibility (including functions) should be included to show at a glance the primary and supporting roles. (FEMA, Pg. 43)” An example of the required agencies, and tasks that would likely be associated with each, is given by FEMA and is shown in Appendix 1.

Transportation

FEMA states that several factors must be considered when planning for evacuation. Among these, “are the characteristics of the hazard or threat itself…The magnitude, intensity, speed of onset, duration, and impact on the local community, are all significant elements to be considered (FEMA, Pg. 110).” By understanding these elements, one can determine the number of people to be evacuated, the time available in which to effect the evacuation, and the time and distance of travel necessary to insure safety. Next, one can identify areas of assembly and evacuation routes. Estimates for the traffic capacity of each designated evacuation route also should be addressed, and evacuation routes from risk area to designated mass care facilities should be noted. Additionally, evacuation routes from each part of the affected area should be mapped.

Health and Medical

According to the FEMA guidelines, “This section details the provisions for mobilizing and managing health and medical services. It addresses pre-disaster, disaster, and post-disaster considerations. It identifies who will be in charge of directing health and medical operations and provides a general overview of how health and medical activities will be accomplished (FEMA Pg. 132).” Specifically stated, the plan should address the following concerns:

- Establishment of medical command post at the disaster site(s).
- Coordinating health and medical response team efforts.
- Triage of the injured, if appropriate.
- Medical care and transport for the injured.
- Identification, transportation, and disposition of the deceased.
- Holding and treatment areas for the injured.
- Isolating, decontaminating, and treating victims of hazardous chemical or infectious diseases, as needed.
- Identifying hazardous chemicals or infectious diseases, controlling their spread, and reporting...
their presence to appropriate State and Federal health or environmental authorities.
• Issuing health and medical advisories to the public on such matters as emergency water supplies, waste disposal, mass feeding services, vectors, immunizations, disinfection, and others (FEMA, Pg. 133).

Warning Systems and Public Information

According to FEMA, there are several criteria necessary to create an effective warning system. To begin with, a system must be created to notify key government officials and emergency response organizations. Once a plan is in place for the notification of key officials, a method to warn and disseminate emergency alerts to the public can be created. To do this, officials must specify the types of warning devices that are necessary, as well as their specific locations, and the geographical areas of each device (these can include sirens, Emergency Alert System (EAS) broadcast stations, telephone, radio… etc.) (FEMA, Pg. 88). Additionally, procedures for warning special locations such as schools, hospitals, and institutions, as well as special considerations for groups such as the impaired and non-speakers of the local language need to be included. Finally, the meanings of all alerts and signs must be easily understood by all.

Education and Training

In guidelines provided by FEMA, there are no specific references to the education and training of residents. However, it is implied throughout.

The United Nations Model

This model provided by the United Nations seeks to mitigate the devastating impact of disasters throughout the world. It contains examples of actions by individuals, communities and governments, “not only to reduce the risk and impacts of natural and technological hazards, but also to avoid creating those risks in the first place (UN/ISDR, Pg. vii).” By reviewing disaster reduction initiatives throughout the world, it is the hope of the United Nations that, “it will contribute to a more informed decision-making, including improved planning, better regulatory mechanisms and, most of all, innovation in development and environmental protection activities (UN/ISDR, Pg. vii).” It seeks to provide guidance, policy orientation, and inspiration for disaster planning.

Direction and Coordination

In the guidelines set forth by the UN, it is their belief that, while response and coordination can benefit from a centralized command, there is a need to decentralize disaster risk reduction efforts. Therefore, “risk reduction at the local level needs to be encouraged and supported… requiring that a consensus be developed on the roles of government agencies, technical institutions, commercial interests, communities, and individuals themselves (UN/ISDR, Pg. 81).” The local authorities are uniquely knowledgeable about their local surroundings and are, therefore, well-placed to know the risks. Furthermore, they should be able to identify resources and opportunities available to manage the given risks.

Transportation

The guidelines provided by the UN do not stipulate what should be done in regards to the transportation systems.

Health and Medical

The UN feels that all nations should be particularly diligent in the identification and selection of their key infrastructure and service facilities. Because these facilities are vitally important, they should be built of the highest quality and be maintained to protect against hazardous impacts to ensure they remain operational.

It should be understood, also, that strengthening regional linkages improves overall disaster and risk management practices. For example, “the similarity of hazards that Pacific small island developing states (SIDS) face, the shared problems they experience, and generally common approach adopted in their institutional
arrangements have provided a fruitful basis for regional cooperation (UN/ISDR, Pg. 162).”

Additionally, the UN advises that health risks associated with the disruption of water distribution and sewage systems in the aftermath of disaster, “…contribute greatly to mortality rates (UN/ISDR, Pg. 338).” It is imperative to maintain and protect these facilities so that waste does not mix with water supplies.

**Warning Systems and Public Information**

According to the UN, the media is a greatly undervalued means of transmitting public awareness and providing information pertaining to threats. Media outlets should take the lead to “network within and between their respective organizations, working together on a basis of information sharing and dissemination of the information to the community (UN/ISDR, Pg. 288).”

In reference to warning systems, they should be considered a cornerstone of disaster reduction. One of the goals of the UN is that “all countries…have ready access to global, regional, national, and local warning systems and broad dissemination of warning (UN/ISDR, Pg. 358).” These warning systems must be comprehensive and accessible to all users. Furthermore, the warning systems “must reach, be understood, believed and personalized by the public at risk, in order to be acted upon so as to reduce immediate exposure to hazards (UN/ISDR, Pg. 363).” Community involvement is critical in the design and placement of these systems.

**Education and Training**

According to the UN, “disaster reduction is most effective at the community level where specific needs can be met…when used alone, government and institutional interventions often prove to be insufficient and are frequently seen to be sporadic in response to crisis (UN/ISDR, Pg. 177).” In order to be prepared, communities must be aware of the importance of disaster prevention. Skills need to be developed to aid in practices of survival, prevention, and sustainability. In the time of crisis, these essential skills mean the difference between life and death.

It should be noted that International Strategy for Disaster Reduction prepared by The United Nations uses specific case studies as examples to illustrate strategies for disaster planning. For example, after discussing the importance of disaster reduction at local levels, several case studies were used, including New Zealand, South Africa and Cologne, Germany, to cite specific examples of strategies in practice.

**Conclusion**

Both models selected for this thesis address several issues that threaten small islands. However, as stated by each, they are not intended to identify all specific issues that a location might face. Instead, they are to be used as tools to aid in the identification of the special issues they may face, as well as providing techniques for planning for those issues. Therefore, it is necessary to review specific plans from islands to determine if the special issues that threaten an island are indeed addressed. Specifically, the disaster plan for the County of Hawaii, as well as the plan for the Kingdom of Tonga will be used.
Chapter 3: Case Studies

To illustrate how the FEMA and UN models have been used to create a disaster plan for an island, the plans for the County of Hawaii and the Kingdom of Tonga will be reviewed in relation to the guidelines. The Hawaii County plan is representative of FEMA, while the Kingdom of Tonga represents the United Nations. After extensive research, these cases were selected because of the limited number of small island disaster plans available. Furthermore, where plans did exist, they were either incomplete or unobtainable.

As stated by both FEMA and the UN, individual states are to use the guidelines as tools in addressing their specific issues. By reviewing these two case studies, the author will determine if the models are adequate, as well as identify island specific issues.

Hawaii County Case Study

Since 1977, the Island and County of Hawaii has experienced 40 natural disasters. Due to its location, variety of topology, including active volcanoes, the island is susceptible to several types of major disasters. As stated in the report, “the purpose of this multi-hazard mitigation plan is to provide a strategy to reduce or eliminate loss of life or property caused by natural hazard events (County of Hawaii, Pg. vii).”

Direction and Coordination

It is clear that the disaster plan for the County of Hawaii specifically uses the FEMA guidelines to prepare its own direction and coordination. During an emergency, the Emergency Operations Center (EOC) is to take command. This is to ensure that each agency is operating effectively since, “numerous (other) agencies must carry out the many different functions needed in an emergency...one agency cannot do its job well without information from another agency. (County of Hawaii, Pg. 78)”

Hawaii’s EOC operates at different levels depending on the level of emergency. For severe or full disasters, it is necessary for the entire EOC (Figure 1) to be mobilized to “carry out and coordinate warning, evacuation, police,
fire, rescue and ambulance services, mass care, damage assessment, debris clearance, health, medical and sanitation services, public works, radiological protection and any other services required to protect public health and safety. (County of Hawaii, Pg. 79)” However, for minor emergencies, it is stated that the Civil Defense staff will assist only certain agencies until the situation becomes clearer. Appendix 2 shows in detail the agencies required by the Hawaiian plan, and their respective roles during an emergency.

Transportation

In the Hawaiian plan, the County Police, “…control all State highways and County roads, assisted by the department of Public Work’s pre-planned barricade system (County of Hawaii, Pg 94).” The county will determine alternate routes if a road or bridge is compromised in any way. Due to the high number of bridges on the island, and the consequent threat of lava flows, landslides, and tsunamis, it is deemed impossible to determine the exact routes until an initial assessment can be done.

To evacuate persons from the island, two deep-draft harbors with port facilities, as well as four public airports (two primary commercial airports with the ability to receive large cargo planes, and two smaller airports) will be used. The “resilience of the two port facilities is crucial for efficient post-disaster recovery since (it) is the entry point for bulk supplies and heavy equipment (County of Hawaii, Pg. 94).” It is also noted here that none of the airports are located in a tsunami evacuation zone, flood zone, or high hazard zone.

Additionally, it is stated that the capacity and functions related to air-travel are sufficient to remain operational for several days, and in an emergency, “…the basic control functions of the tower can be handled by portable radio equipment from any location in the airport (County of Hawaii, Pg. 94).” Furthermore, the four airports combined, have sufficient runway lengths to support all types of planes.

Health and Medical

As stated in the plan for Hawaii, the island has five hospitals with emergency and intensive care units. These five hospitals, which comprise the state hospital system, are also equipped to aid outlying rural districts. Additionally, “certain primary public facilities, consisting of schools, parks, community centers, and office buildings have the capacity to accommodate large numbers of people and are basically structurally sound to withstand (disasters) (County of Hawaii, Pg. 80).” Currently, the civil defense inventory includes 14 shelters and 51 centers island-wide (“center” refers to a shelter that is not hurricane resistant) (County of Hawaii, Pgs. 80-83).

A substantial section of the Hawaii plan is devoted to water supplies. Since the county water system serves a majority of the island’s population, and would be relied upon by non-county users in the event of an emergency, it is imperative that facilities and sources of water are maintained. It is believed that physical structures that house the water would be at minimum risk, other than leakage after an earthquake. However, since the majority of the water supply is pumped, and no pump stations are equipped with diesel back-ups, alternative sources of water must be designated. The plan stipulates that water will be trucked in from functioning systems that rely on gravity-fed systems (County of Hawaii, Pgs. 100-101).

Finally, the plan for Hawaii addresses sanitation concerns. Primarily, the county focuses on mitigation strategies to prevent leakage of sewage into the watershed. After a tsunami in 1946 caused sewage to fill Hilo Bay, the wastewater treatment facility was relocated out of the tsunami zone (County of Hawaii, Pg. 101). Although other treatment facilities are in hazard zones, all are built to withstand earthquakes. Moreover, “all treatment plants and pump stations have standby diesel or propane generators in case of power failure (County of Hawaii, Pg. 101).” During the recovery phase after an emergency, the county will rely on portable facilities and toilets with on site disposal available (County of Hawaii, Pg. 101).
Warning Systems and Public Information

With regards to Hawaii, the county relies on specific agencies to “watch” for impending emergencies and the county Civil Defense Agency to alert the public. The Civil Defense Agency does this through the use of sirens to alert residents to seek further information on the television or radio. Simultaneously, the Emergency Alert System broadcasts over all television and radio stations. According to the disaster plan, “the County currently has 68 sirens and 12 simulators in operation around the island. Simulators provide a signal to manned stations around the island where personnel disperse the warning. Sirens have an effective average range of one-half mile (County of Hawaii, Pg. 89).”

The county also relies on a basic communications system provided by Verizon. This consists of wire and standard and optical cable connections. Also, during an emergency, the county can rely on the private radio, microwave, and leased phone line system operated by Hawaiian Electric, and cable access provided by Time-Warner.

Of special concern are the hotels and resorts on the island. Since many are located in tsunami evacuation zones, and public shelters do not have the capacity to accommodate all visitors adequately, hotels and resorts are relied upon to act as their own shelters. The disaster plan calls for future planning to ensure that all hotels and resort have their own emergency plans approved by the Civil Defense Agency (County of Hawaii, Pg. 109).

Lastly, the plan points out that local traffic flow could be compromised if an emergency is declared during school hours. This would be due to the significant increased travel of parents to the schools to pick-up their children. However, no specific resolution is given to alleviate this problem, if it should occur.

Education and Training

While not specifically referenced, the emergency plan of the County of Hawaii has created a set of goals to achieve a greater public awareness. These are as follows:

- Develop a level of awareness among the general public and businesses, particularly the visitor industry, that results in calm and efficient evacuations, self-sufficient survival skills, and willingness to abide by preventive or property protection requirements.
- Develop a broad-based public information program that utilizes a diversity of communication media.
- Develop special public information programs targeted to vulnerable populations.
- Develop a community-based network that double-functions as the Community Emergency Response Team and provides input into mitigation planning (County of Hawaii, Pg. 122).

Similarly, goals have been set for training procedures and efficiency. These are as follows:

- Develop a training program of the highest standard to ensure that all involved personnel efficiently and effectively carry out their responsibilities as set forth in an updated emergency operations plan.
- Achieve a level of readiness among existing and new employees who understand their role in a coordinated system.
- Maintain an updated emergency operations plan to continually identify and add to contact list of resources that could provide assistance and improve procedures (County of Hawaii, Pg. 121).

Kingdom of Tonga Case Study

The Kingdom of Tonga is an archipelago in the South Pacific consisting of 169 islands, with almost two-thirds of the population living on its main island, Tongatapu. The present plan, produced through the National Disaster Management Office, updates the previous 1987 plan. Using lessons learned from Tropical Cyclone, Hina of 1997, the plan looks to
expand the disaster management emphasis from post impact relief to a more comprehensive approach.

**Direction and Coordination**

In Tonga, the Cabinet, chaired by the Prime Minister will form the National Disaster Council (NDC) with overall authority and responsibility for disaster management programs and activities, including response issues. Unless otherwise stipulated by the Chair of the NDC, the Commander of the Tongan Defense Services (TDS) is the disaster controller for all disaster and emergency situations. In the absence of the TDS Controller, the Police Commander will have authority.

The National Disaster Management Committee (NDMC) is responsible to the NDC for guiding and supporting the disaster management systems. Through regular meetings, the NDMC will ensure that their respective departments and organizations are committed to the implementation of the plan if necessary. The complete membership of the NDMC is located in Appendix 3.

**Transportation**

The emergency plan for Tonga does not include a transportation section.

**Health and Medical**

In the Tongan report, roles and responsibilities are delegated to the specific sectors related to the health and medical fields. Therefore, roles and responsibilities are not specifically addressed.

**Warning Systems and Public Information**

Tonga relies on a warning system that advises of a developing or impacted disaster from two main sources, official and unofficial. It is the responsibility of the NDMO to verify the accuracy of unofficial reports. The Tongan government also relies heavily on the national radio service to provide a link to the community at large, as well as the outlying islands.

**Education and Training**

In Tonga, programs are to be chaired by the Tonga president, who will be responsible for the design, development and implementation of education awareness programs in support of disaster management planning and disaster mitigation programs (Kingdom of Tonga, Pg. 17). There is no specific reference in the document as to what these programs are, how they are to be used, or by whom.

**Additional Cases**

After reviewing the specific cases of Hawaii and Tonga, it is necessary to cite additional examples. There are additional concerns that are unique to islands that either have not been adequately explored by the two models or were not mentioned by the two case studies. These are: an island’s carrying capacity, regional linkages/plans, on-site facilities for storage, infrastructure upgrades, school plans, hotel and travel agent requirements, and education in self-sufficiency.

**Issue 1: Limited access routes on and off the island can compromise evacuation procedures.**

**Example: Sanibel Island, Fl**

One way to address the evacuation procedures is to limit the number of people on the island at a given time. As an example of this, we can reference the plan for Sanibel Island. After the strengths and weaknesses were analyzed to determine the appropriate carrying capacity of the Island, a vision within the politically feasible boundaries was developed. In order to limit the capacity, it was therefore planned to allow only as much capacity as could be dealt with, based on the time it would take to evacuate the Island across the four-lane bridge to the mainland in anticipation of a major hurricane. Simply put, a vision was formulated based on analysis, and a specific strategy was produced to obtain the desired goal. In this case, the goal is to limit the number of people on the island, not to increase the carrying capacity of the road network.
Issue 2: Further developed islands in a system often are relied upon by other islands for support and supplies.

Example: The Bahamas
The Commonwealth of the Bahamas is comprised of almost 700 islands with nearly 95% of the population focused on only seven islands. Of these islands, the population is at its most dense in two cities, the capital of Nassau located on the island of New Providence, and Freeport on Grand Bahama.

To serve the public with medical needs, the Commonwealth relies on a combination of out-of-hospital ambulances and a privately owned air ambulance company that provides transportation of the seriously injured either to Nassau from outer islands or to Florida from Nassau. In the event of a large emergency, a division of the National Disaster Committee is deployed. This division is comprised of two units, the first being the response team sent to determine the severity of the disaster. The second team dispatched, if necessary, is an additional medical unit with physicians, nurses and volunteers.

Issue 3: Due to the remoteness of some islands, there can be a delay of critical resources delivered to the island.

Example: The Caribbean
One of the problems faced by Caribbean nations after disasters is that often stores and shops are destroyed or badly damaged. To further complicate the issue, the shops and stores are looted for food and basic items. In order to prevent critical supplies from being looted, and to dramatically shorten the time it takes to deliver aid to a disaster area, the United States has began to build warehouses. These warehouses, “would be stocked with everything from drainage pumps to water to ready-to-eat meals for distribution to the nearest affected island (New York Amsterdam News, Pg. 14).” Moreover, these warehouses can serve not only the island where they are located, but the surrounding islands as well.

Issue 4: Road networks may be insufficient or antiquated.

In the event of a disaster, the primary road networks are vitally important to an island. Not only will they be used for evacuation, but also by police and emergency vehicles, busses and cargo trucks. However, since infrastructure often predated before the tourism boom, roads are not equipped to handle large vehicles. Therefore, an assessment of these road networks must be completed to ensure an adequate system.

Issue 5: School children are vulnerable if a disaster occurs during school hours.

To ensure the safety of children in school, a contingency plan must be in place. This plan consists of five parts; cancellation of school prior to start, shelter-in-place, early dismissal, lockdown, and evacuation, and it is required that this plan be posted in each room and that drills and tests be performed once per month. The school Superintendent is in charge of the implementation of the plan. Each part of the plan is explained as follows.

School Cancellation Prior to Start
The school Superintendent will notify the local media that school has been cancelled or that times have been changed. All students, parents, faculty and staff should monitor local radio and television stations for announcements.

Shelter-in-Place
The Superintendent, upon being notified by the Communications Coordinator, will notify all school administrators to implement the shelter-in-place option. Administrators then will shelter students in pre-determined shelters within the school, and a 100% accounting of all students will be completed and verified. The Superintendent will notify administrators when it is safe to resume normal operations.

Early Dismissal
The Superintendent will notify all on-site administrators, as well as the local media of the time the early dismissal is to take place. On-site administrators will be responsible for notifying parents. A 100% accounting of all students will be completed and verified.

Lockdown
Superintendent, upon being notified by the Communications Coordinator, will notify on-site administrators, who will oversee the lockdown and notify the Superintendent upon completion of the procedure. All students and faculty should then move to isolated areas of the building to minimize risk, where a 100% accounting of all students will be completed and verified. The Superintendent will notify on-site administrators when it is safe to resume normal operations.

Evacuation
Superintendent, upon being notified by the Communications Coordinator, will notify on-site administrators to evacuate students to the primary safe area, unless directed to go to a secondary location or care center. All persons will evacuate the building by traveling along pre-assigned routes. Faculty is to ensure that all students remain calm. Additionally, a 100% accounting of all students will be completed and verified. All persons are to remain in a safe area until notified by an on-site administrator.

Issue 6: Tourists may not be familiar with the disaster risks associated with an island or the procedures and plans if one occurs while on the island.

To ensure the safety of all tourists, all hotel operators and owners of rental rooms/properties are to complete a seminar in disaster management and emergency preparedness. Under the authority of the Public Information Coordinator, this program is to ensure that all visitors are adequately served in time of need. Additionally, it is required that each room has an approved disaster plan map highlighting the key points of the warning system, the location of emergency health and medical facilities, and contact information for public information. Travel agencies also have the responsibility of notifying the tourists of procedures to follow in the event of an emergency. A brochure that includes emergency plans and meeting points is to be included with any travel documents issued by the agency.

Issue 7: Local residents may not be familiar with the disaster risks associated with an island or the procedures and plans if one occurs.

A vitally important aspect of disaster planning revolves around the education of the local residents to be personally prepared in the event of a disaster. Lives can be saved if residents are familiar with the risks that surround them and they have prepared their own plans and survival kits in the event that an emergency is declared.

Issue 8: Local children may not be familiar with the disaster risks associated with an island or the procedures and plans if one occurs.

Knowledge of the risks that surround the island, as well as the skills needed in the event of a disaster, should be taught through the school curriculum. Beginning with the child’s first year of school and ending with his/her primary school graduation, the student will study these principles through classroom education, field trips, and drills.

Conclusion
Using FEMA and the United Nations models as guidelines, Hawaii and Tonga prepared disaster plans tailored to their specific needs. However, these plans still did not reflect all of the issues associated with small island disaster planning. Therefore, it was necessary to review other sources of information, as well as include suggestions from the author. In combination with planning practices previously identified, this creates a more complete composite model for small island disasters.
Chapter 4: A Composite Model for Small Island Disasters

After reviewing the sources selected for this thesis, it has become clear that the guidelines set forth by both FEMA and the United Nations are just that, general guidelines. While they are helpful in creating a generic plan, they do not specifically address all of the needs and variables of small islands. The two island plans do take additional steps in tailoring their plans to their specific needs; unfortunately, these too fall short of addressing all of their requirements. However, after listing the variables planned for by each source, and combining these into a table, one can develop a superior framework for disaster planning. Even then, though, the framework is not complete. There are additional concerns that are not addressed by the sources. Specifically, three concerns that need to be addressed are the island’s carrying capacity, regional linkages among neighboring islands, and a warehouse to store supplies needed in the event of a disaster. Table 4.1 lists each source, with the variables planned for by each, while Table 4.2 combines the variables and sources, with additional suggestion from the author built into a new hybrid model for disaster planning.

Direction and Coordination

It is clear from all four sources that direction and coordination are vitally important. In fact, much of the FEMA document is devoted to delineating agencies and their responsibilities during a specific disaster. Without a clear plan of specific roles and responsibilities, confusion is likely, and lives often are lost. Therefore, this must be the cornerstone of any disaster plan. While not all disaster plans have to be as comprehensive as the FEMA guidelines would suggest, certain agencies must exist in order to ensure a smooth management process. These agencies are to include a CEO, Police Chief, Fire Chief, Emergency Manager, Public Works Officer, Public Information Officer, Health and Medical Coordinator, Communications Coordinator, and an Evacuation Coordinator. Depending on the island and its needs, additional agencies can be created to aid and assist the primary agencies. Appendix 1 details the roles and responsibilities of various agencies.

Transportation

While only mentioned by FEMA and Hawaii County, transportation networks need to be carefully evaluated and designed to be efficient in times of disaster. These are the island’s lifeline. Without adequate road networks, ports and airports, the island will not be able to receive and move supplies. By taking stock of these transportation networks, it becomes possible to identify any weaknesses in the system and provide upgrades if needed.

The Hawaii plan does an excellent job of identifying the ports, airports and road networks. Additionally, the plan accounts for the capacity of each, as well as its sufficiency for evacuation. However, the plan does not mention if the current system is currently the best system. Due to the high number of bridges on the island, it would be helpful to determine whether or not an alternate road network should be developed.

Health and Medical

FEMA has determined that there are several factors to take into consideration for managing the general health and medical issues of an affected area. These are to include taking stock of the number of hospitals and their capabilities, selecting sites for medical command posts and triage centers, morgues, and identifying decontamination areas. Additionally, water and sewage systems should be accounted for to ensure that water is available and sewage waste remains contained.

The plan for Hawaii does an adequate job in addressing these concerns and provides a sufficient example of addressing the guidelines provided by FEMA. However, in the plan for Tonga, these issues are left for the medical field to address. This is unacceptable. A disaster plan must provide a basis for future decision making by the medical staff, not simply leave it in the hands of the hospital staffs. This ensures coordinator between all departments, as well as ensuring all
### Table 4.1 Variables and Sources

<table>
<thead>
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<th>Variable</th>
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Source: Author
Table 4.2 Composite Framework

Source: Author
networks are coordinated for smooth operations. The United Nations briefly notes that regional linkages for small islands developing states (SIDS) are important, but only briefly touches on the subject. This led the author to search for other sources for examples.

**Warning Systems and Public Information**

FEMA, the United Nations, Hawaii and Tonga all have devoted substantial sections of their respective reports to warning systems and public information. Both FEMA and Hawaii suggest that an effective warning system should include sirens, Emergency Alert System (EAS) broadcast stations, telephone, and radio. The United Nations adds that the local media should be included in an effective warning system. Because the Kingdom of Tonga is comprised of several regional islands, they rely heavily on a radio system of alert.

With regards to public information, FEMA has provided a framework to address schools, the impaired and those with foreign language requirements. The author has provided additional action steps to be included when addressing schools. These are to include; school cancellation prior to the start, shelter-in-place, early dismissal, lockdown, and evacuation. To alert and provide adequate support for tourists, lessons provided by the Hawaii plan are included in the composite framework. The author has also included additional steps for addressing tourism.

**Education and Training**

The Hawaii plan does not specifically have procedures in place to address local survival skills, education in self-sufficiency, or school curriculum, but it does provide future goals. These goals, along with the United Nations suggestion that disaster reduction needs to begin with the communities, serve as the basis for additions by the author. These include public information campaigns, and a developed school curriculum.

**Conclusion:**

By identifying the best practices present in the FEMA and UN models and the Hawaii County and Tonga case studies as well, the inclusion of additional sources, including suggestions from the author, develops a more complete composite model for small island disaster planning. The composite model is superior in highlighting specific issues that are magnified by the uniqueness of small islands. To understand how this new composite model can be used to create an effective disaster plan, the Greek island of Santorini serves as a template.
Chapter 5: The Santorini Example

In order to demonstrate how the framework can be applied, the Greek island of Santorini will be used as a template to create a disaster plan. Located in the Aegean Sea, just north of Crete, the island of Santorini is one of the most remarkable places in the world. Since the middle 1970s when the government of Greece invested millions into the island (ironically after massive destruction caused the 1956 earthquake), Santorini has thrived as a tourist destination. Every year, thousands of visitors come here to revel in the magnificent volcanic landscapes.

A once diverse economy is presently supported almost exclusively by tourism, and in fact, the number one sector of employment on the island is tourism. All sectors of the economy rely on tourism to survive. This is true from the large industries that build hotels and tourist destination, to the farmers and fisherman who provide food and wine for the local restaurants for the tourist’s big night out. Today, it is not uncommon for a local resident to give up the traditional farming practices for a chance to build a rental room or hotel on his land.

Worst-Case Eruption

In the event of an eruption, it is likely that the following will occur:
• phreatic explosions zone—posing a relatively high localized hazard zone depending on where the eruption begins;
• ballistic ejecta zone—posing a relatively high localized hazard zone; historical data suggest trajectories for ballistics reach little more than 1 km from the vent (but may be up to 5 km; and may therefore pose a significant hazard within the intra-caldera area if the eruption were centred on the Kameni line.
• tsunami zone—may pose a relatively high localized hazard to parts of the eastern and southeastern coastline (e.g., Kamari and Perissa) to a distance of 200 m from the shoreline;
• toxic gas/ash fall zone—depending on wind speed and direction, may present a major hazard effecting all areas of the islands; and
• landslide zone—considered to be an especially high hazard in the intra-caldera area where slopes are extremely steep (Dominey-Howes, Pg. 291).

Direction and Coordination

In the event of an emergency situation caused by a disaster, the Disaster Emergency Manager (CEO) will be notified by either the Mayor of Thira, or the President of Ia. This post is to serve as the official coordinator of all disaster planning and management. The CEO is to take the lead because of the intricate knowledge
he/she will possess by virtue of serving as the full-time coordinator. It is assumed that in the time of disaster, this person will be in constant communication with the Mayor and President to ensure all tasks are being managed. The following section details the roles and responsibilities of the major parties listed on Table 5.1.

**Disaster Emergency Manager (CEO)**

Once notified by either the Mayor or the President, the CEO is to act as the official coordinator of disaster management. The first responsibility of the CEO is to contact the direct subordinate agencies to begin the response procedures. Additionally, this will ensure that the proper organizations are notified and that they begin to address their own responsibilities. If needed, the CEO will notify the Red Cross as well as the Greek Ministry of Defense and ask for assistance. The CEO also will provide overall direction and coordination until each subordinate group has established its own command and begun the coordination of their specific tasks.

It is vitally important that the CEO activates the warning system at the appropriate level. The CEO should be the only one authorized to activate the warning system to assure that warnings are official and accurate. Finally, when deemed appropriate, the CEO is responsible for the termination of response and release of personnel. This is to ensure that all jobs are completed and subordinate agencies have fulfilled their duties.

**Police Department**

When notified of an emergency situation, the Police Department will send personnel, equipment and vehicles to the emergency scene and emergency shelters (temporary and permanent). Personnel will report updated information to the chief who will, in turn, update the CEO. The Police Department will also continue their law enforcement responsibilities, which may include but are not limited to directing and controlling traffic, assisting in the evacuation, controlling access to risk areas, providing security, and assisting in search and rescue.

**Fire Department**

When notified of an emergency situation, the Fire Department will send personnel, equipment and vehicles to the emergency scene and emergency shelters (temporary and permanent). Personnel will continue to update the chief, who will in turn, update the CEO. The fire department also will continue to perform their normal duties of managing fire and rescue resources, directing fire operations, search and rescue, and evacuation of injured. Finally, the Fire Chief is to notify all other emergency response organizations of any hazards and dangers that may place lives in harm’s way.

**Public Works Department**

When notified of an emergency situation, the Public Works Department will send personnel, equipment and vehicles to the emergency scene and emergency shelters (temporary and permanent). Personnel will report updated information to the chief, who in turn will update the CEO. This department is also responsible for public works resources and directing public works operations. These duties are to include, but are not limited to removing debris, assisting in search and rescue operations, providing fuel, generators and lighting, assisting in evacuation around emergency sites, and coordinating with utility companies to ensure that power, water, and sewage system are operational, or back-up systems are in place. Additionally, this department will be in charge of assembling any temporary housing facilities that may be needed.

**Public Information**

This officer handles all public inquiries. He/She needs to be in constant contact with the CEO to disseminate current information. Furthermore, this officer is to be in contact with both the restaurant and hotel owners’ associations because these organizations are best positioned to serve as a first link of communication with tourists and travelers. Additionally, this officer is to take necessary steps to protect and care for companion animals, farm animals, wildlife, and labor animals.
**Health and Medical Coordinator**

The health and medical coordinator will be in charge of all health and medical treatment activities and response organizations involved in providing medical assistance to disaster victims. Additionally, this coordinator will be responsible for the coordination of activities of hospitals, triage centers, clinics, temporary medical facilities, morgues and temporary morgues, as well as the identification of the injured and deceased. The coordinator will also take the lead in preparing, managing, and assembling all temporary disaster work stations.

**Communications Coordinator**

The Communications coordinator will be responsible for all communications links, as well as all warning systems communications.

Therefore, the responsibilities are to include, but are not limited to, developing a phone list/tree of all local municipality mayors, volunteer groups, school personnel, and special-needs groups (nursing homes, institutions, places of public assembly, industrial sites, etc.), the management of all warning systems, and the responsibility of ensuring that vital communications systems are in working order.

**Evacuation Coordinator**

This coordinator will work closely with the Police, Fire, and Public Works departments to coordinate evacuation procedures. Additionally, the coordinator will be in contact with the Port Authority of Fira to determine the best locations for evacuation.

**Transportation Network**

Presently, Santorini has the infrastructure to support ground, air, and water modes of transportation. The island is blessed with a

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**Table 5.1: Hierarchical Organization**

Heirarchical Organization for Disaster Response  
Santorini, Greece

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Source: Author
former NATO airport that has a major regional runway large enough to support commercial airliners. This airport also serves a number of the regional islands. Water transportation is well-served as well. The current infrastructure is able to support ferry boats and cruise ships. However, the major port that accepts large ships (cruise ships are unloaded by tender boats, they do not dock) is located on the caldera side of the island. This makes it difficult an easy transition between water and ground transportation.

While adequate for the local population, ground transportation becomes overloaded during tourist season. There is an extreme demand on the road networks to accommodate the large busses that move tourists. Additionally, several roads are narrow, congested, and generally unsafe. Figure 5.3 shows the current transportation network including the airport, the two major ports and roadways.

**Ports**

Located on the caldera side of the islands, the port of Anthinios serves as Santorini’s principal port. It is equipped to receive passenger ferries, tenders from cruise ships, bulk cargo and fuel ships. The port, however, is located at the base of the caldera. Therefore, large busses must traverse the steep slopes of the caldera face to link with a primary road. In the event of a disaster, it is highly probable that this access road to the port will become impassable by vehicles. As a result, alternative ports must be used for evacuation. Located on the non-caldera side of the island, the ports of Vlichada, Monolithos, and Ammoudi would allow easier access to water transportation to aid in evacuation. Figure 5.4 shows the location of these ports and the areas they would serve.

**Port of Athinios**

As stated above, the port of Athinios is primary port for the island of Santorini, but due to its location, it is highly susceptible to damage in the event of a disaster. Located at the base of the caldera, the port is linked to the road network through a narrow, winding road cut into the face of the soft volcanic rock. This alone makes it probable that in the event of seismic activity (the main threat to Santorini), the road may slide, crack, or become littered with large rocks and boulders. This would make vehicle traffic impossible, but it still could be used for foot traffic. Therefore, while the port could not be used for supplying the island, it could be used as a point of evacuation. This port is already served by ferries with the capacity to hold hundreds of person and would be essential to lessen the burden of evacuation at other points on the island.

**Port of Fira**

While not as large as the port of Athinios, and not equipped to dock ferries, this port does accept tender boats shuttling approximately 80 persons. Like Athinios, the port of Fira also is located at the base of the caldera and is linked to the main town by trail which can be walked or traversed by donkey, as well as accessed by cable car. Therefore, this port also could be used to alleviate some of the stress of the evacuation process by persons walking or riding donkeys down to the port. It is assumed that in the event of a disaster, the cable car system would be inoperable.

**Port of Vlichada**

The present marina at Vlichada is a busy facility that supports fishing, recreation, and visiting yacht needs. Due to its unique coastal cliffs, major renovation to this marina would
Figure 5.3 Current Transportation Network

Source: 2005 UC Sustainable Development Team
cause catastrophic damage to its environment. However, there is adequate room to upgrade its structure to support evacuation needs in the event of a disaster. It also docks enough local boats to shuttle would-be evacuees to larger boats if necessary. Additionally, the marina is equipped with floating docks to extend its range.

**Port of Monolithos**

Because of its proximity to the airport, it is proposed that a deep water port be constructed at Monolithos to complement the port of Athinios. Not only would this port relieve some of the current stresses on Athinios, but in a time of disaster it would act as the focal point of disaster relief and evacuation. Large cargo ships would be able to dock and deliver supplies. Additionally, hydroplanes could be docked and ferries would be available for evacuation purposes. Furthermore, its location relative to primary road networks makes it ideal for access by vehicles, such as busses, large machinery, ambulances, and cargo trucks.

**Port of Ammoudi**

Located on the northern most side of the island, the port of Ammoudi will serve the needs of Ia. Although it is located at the edge of the caldera, if upgraded, the road network would be sufficient for access. Presently, the port supports small ferry boats, fishing, and small recreational boats.

**Airport**

The airport located on Santorini is the largest of the five in the Cyclades and the sixth largest in Greece (UC Sustainable Development Group 2005, Pg. 40). Presently it can handle passenger, commercial, and private planes. Located on the relatively flat area of Santorini, it is not susceptible to any major catastrophe, save the possible threat of tsunami. A new 120,000 square meter terminal has been planned, but finances have not materialized. The building of this terminal would further enhance the importance of the airport.

**Ground Transportation**

The ground transportation network is comprised of primary, secondary and tertiary roads. For the most part, the primary roads are the largest, but some are not wide enough to support two lanes with large vehicles. In the event of a disaster, it is imperative that these roads be wide enough to support easy travel and access to major settlements. Additionally, because some roads are located on cliffs or contain steep slopes, there is a high probability that some may become impassable. Consequently, some roads must be upgraded to allow for better connections between the settlements, airports, ports, shelters and medical facilities (temporary and permanent). Figure 5.4 illustrates the roads that need to be upgraded, as well as roads that may become impassable. Additionally, evacuation routes are charted.

**Regional Linkages**

Because the airport serves additional islands, the island of Santorini will be required to act as a hub for air evacuation. This makes the upgrade of the Monolithos port especially important. It is likely that this port will need to accommodate an increase of ferry traffic from the other islands, shuttling additional evacuees.

**Island Capacity**

While this study will not calculate the capacity for Santorini, it should be calculated when preparing a complete disaster plan for an island. To determine the capacity for evacuation purposes, one should determine the amount of time it would require to evacuate every person in a given time frame. Therefore, if a standard is set for evacuating all persons in a twelve-hour time frame, no more persons should be allowed on the island that can be evacuated in that time frame.

**Thirasia**

The small island of Thirasia has limited road networks, which should be sufficient to move persons to the port of Riva for evacuation off the island. There are daily ferries between Riva and Athinios.

Craig Yacks
Figure 5.4 Road Network Upgrades and Evacuation Routes
Health and Medical

The island of Santorini has minor medical clinics located in Fira and Akrotiri. Presently, these clinics are able to perform simple medical procedures, but in the event of a disaster, these facilities can be used to address more serious medical issues until the critically injured are evacuated off the island by helicopter.

Command Post/Airport Location

In the event of a disaster, the emergency command post is to be located at a site located on the grounds of the airport. This location was chosen because of several factors. First, the location is on relatively flat ground with ample open space, and can be secured easily. Second, the central location and current road network allows it to be accessed from anywhere on the island. Third, its proximity to the airport and Monolithos port makes it easy to transport the critically injured off the island. Finally, the location is outside the highest risk areas for devastation. There is a lower probability of infrastructure, road networks, and power sources being affected by any disaster. The airport location also will serve as a site for a triage station, a treatment station, the temporary morgue, and the medical warehouse.

Medical Warehouse

Under the authority of the CEO, with the close collaboration of the Health and Medical Coordinator and the Public Works Coordinator, a permanent medical warehouse is located on the airport grounds. Placed here for the same reasons as the command post, this warehouse is to hold the supplies needed for an emergency. This is to include, but is not limited to all, supplies and equipment for the triage and treatment stations, emergency vehicles, emergency equipment, back-up generators, food rations, temporary waste receptacles and additional water supplies.

Triage Stations

There is the capacity to construct four temporary triage stations on the island. To serve as temporary medical facilities, and to be under the authority of the Health and Medical Coordinator, these facilities are to have the capacity to treat moderate level, non-life threatening injuries, such as broken bones, lacerations, or minor surgeries. These facilities will alleviate some of the burden on the island’s one hospital, which will be reserved for major injuries. The exact medical supplies used in the triage stations will be determined by the Health and Medical Coordinator.

The triage stations will be strategically located on a primary road and are to be easily accessible from the highest risk locations. Figure 5.5 shows the general location of each station, while Figures 5.6 and 5.8 show the exact location of the Fira, and Ia triage centers, respectively.

Treatment Stations

Additionally, there is the capacity to construct 15 treatment stations. These are to be located in each major settlement, as well as in the three evacuation ports and the airport. These stations are to serve as minor injury care centers and will be stocked with minor survival supplies such as water, bandages, disinfectants, antibiotics, and minor medications. The exact supplies stored at the treatment stations are to be determined by the Health and Medical Coordinator. Figure 5.5 shows the general location of each treatment station.

Decontamination Center/Morgue

If needed, a temporary decontamination center can be constructed near the airport, but not on the airport site. This is to prevent contamination of the sterile medical facilities. For security reasons, the morgue will be located on the airport site. Figure 5.5 illustrates their locations.

Temporary Shelter Facilities

The Island of Santorini has an approximate population of 12,500. However, during the tourist season (April-October), the population increases dramatically. At its peak, the number of persons on the island can grow by nearly 50,000, with many of the travelers visiting the towns of Fira and Ia on day trips (cruise ship vacationers) or staying in their caldera viewing hotels. Therefore, it is vitally important that, in the case of an
Figure 5.5 Medical Locations and Facilities

Source: Author
emergency, temporary shelters be in place, and easily accessible. Figure 5.9 shows the location of these facilities.

Located throughout the island, there are nine areas to be designated “tent-cities.” Primarily, these areas are agricultural fields located on the main road network that can be cleared to hold up to 500 tents, with each tent providing shelter for four persons. However, some areas such as the soccer stadium in Kamari, are open public spaces. If each location held its maximum capacity, a total of 18,000 people could be sheltered.

Additionally, the areas of the island where caves are found are highlighted on Figure 5.9. Many of these caves either sit dormant, or are used as storage areas by the local residents. Under the supervision of the Public Works Officer, these sites will be assessed to determine if the caves are safe enough to be used as temporary shelters. It also should be determined if the water and sewage networks are available for linkage. If not, temporary water and waste systems could be included.

**Water Systems**

Presently, the water systems of Santorini are poor and inadequate. All current sources of water in the Municipality of Thira do not meet EU water quality standards. Sixty percent of the water demand of the municipality is covered by municipal wells with private water vendors covering the remaining 40%. Both sources of water do not meet quality standards set by both EU (#98-83-EK) and Greek (Y2-2600-2001) guidelines (UC Sustainable Development Group 2004, Pg.15). In the event of a disaster, the situation will become only worse. Therefore, the island has two reserves of water in case of an emergency.

First, stored in the medical warehouse, the island has a reserve supply of 5,000, 16 ounce bottles of water. Second, located near the warehouse, a large well and cistern system has
Figure 5.9 Temporary Shelters and Cave Locations

Source: Author
been built to collect and store rain water. The system is also equipped with a simple purifying and filtration system and both can run on local power or generator.

**Sewage Systems**

The existing sewerage network does not reach all settlements or the scattered developments. The quality of this network is also uneven, with non-standardized pipes and connections, making it difficult to plan for maintenance and repair. The main sewer network of the island is sound. However, not all communities are served by the network. Those communities that are connected to the main network lack a strategic plan to be internally connected. Approximately only 50% of the houses with municipal water have municipal sewage connections (UC Sustainable Development Group 2004, Pg. 6).

Like the water system, the sewage systems are likely to be breached in the event of a disaster. Since these systems are vital to the safety and wellness of the inhabitants, precautions need to be in place to ensure that contamination of the environment does not occur. In the event of a disaster, the Public Works Department is responsible for surveying the system and determining if any action needs to taken. Additionally, portable facilities will be available at all temporary shelters. Several of the temporary facilities are presently being stored in the warehouse for mobilization; however most will have to be transported in from other islands if extended use is necessary.

It is also important to note that additional studies are presently being conducted to develop new and better water and sewage systems for Santorini. It is the hope that these studies will produce a system that will be disaster resistant, and provide a reliable system for the entire island.

**Warning Systems and Public Information**

To warn the public and to disseminate information, Santorini relies on a combination of sirens, telephones, radio, television, EAS stations, and social capital. As stated previously, the CEO is in charge of activating the alert system, while the Communications Coordinator is responsible for all other facets of the communications system.

**Sirens/Television/Radio**

The primary method to warn residents of an emergency is through the use of sirens. This alerts the population to seek further information from television and radio. The system is comprised of 15 sirens which have a range of one-half mile in a given direction. Figure 5.10 shows the location of the sirens and their effective range. The communications coordinator is responsible for broadcasting and/or delivering the appropriate emergency message to the media.

**Emergency Alert System Stations**

In addition to the sirens, there are two emergency alert system (EAS) stations. These stations are required to monitor applicable resources for disaster information. Additionally, these stations are the communications link between the island and mainland Greece. Each is to serve as the backup to the other in case of complete failure. It is imperative that one remains operational to maintain constant communication capabilities. It is also necessary for the satellite services to be flexible. In the event of an earthquake, the receiver must be able to uplink with the satellite to ensure communication.

**Social Capital**

The island of Santorini is blessed with an extensive social capital network. In the event of an emergency situation, this network can be called upon to disseminate valuable information. Starting with the CEO, information can be spread down the chain of command to local municipal mayors, association heads, and social group leaders. Civic leaders then can serve as conduits to relay vital information to the publics they serve. Additionally, special needs individuals are to be warned in this fashion. Because of the close networking of the residents, the local leaders are to have lists of all special needs persons, with appropriate contact information.
Figure 5.10 Warning Siren Locations

Source: Author
School Contingency Plans

The school contingency plan consists of five parts: cancellation of school prior to start, shelter-in-place, early dismissal, lockdown, and evacuation, and it is required that this plan be posted in each room and that drills and tests be performed once per month. The school Superintendent is in charge of the implementation of the plan. Each part of the plan is explained as follows.

School Cancellation Prior to Start

The school Superintendent will notify the local media that school has been cancelled or that times have been changed. All students, parents, faculty and staff should monitor local radio and television stations for announcements.

Shelter-in-Place

The Superintendent, upon being notified by the Communications Coordinator, will notify all school administrators to implement the shelter-in-place option. Administrators then will shelter students in pre-determined shelters within the school, and a 100% accounting of all students will be completed and verified. The Superintendent will notify administrators when it is safe to resume normal operations.

Early Dismissal

The Superintendent will notify all on-site administrators, as well as the local media of the time the early dismissal is to take place. On-site administrators will be responsible for notifying parents. A 100% accounting of all students will be completed and verified.

Lockdown

Superintendent, upon being notified by the Communications Coordinator, will notify on-site administrators to evacuate students to the primary safe area, unless directed to go to a secondary location or care center. All persons will evacuate the building by traveling along pre-assigned routes. Faculty is to ensure that all students remain calm. Additionally, a 100% accounting of all students will be completed and verified. All persons are to remain in a safe area until notified by an on-site administrator.

Evacuation

Superintendent, upon being notified by the Communications Coordinator, will notify on-site administrators to evacuate students to the primary safe area, unless directed to go to a secondary location or care center. All persons will evacuate the building by traveling along pre-assigned routes. Faculty is to ensure that all students remain calm. Additionally, a 100% accounting of all students will be completed and verified. All persons are to remain in a safe area until notified by an on-site administrator.

Tourist Information

To ensure the safety of all tourists, all hotel operators and owners of rental rooms/properties are to complete a seminar in disaster management and emergency preparedness. Under the authority of the Public Information Coordinator, this program is to ensure that all visitors are adequately served in time of need. Additionally, it is required that each room has an approved disaster plan map highlighting the key points of the warning system, the location of emergency health and medical facilities, and contact information for public information. Travel agencies also have the responsibility of notifying the tourists of procedures to follow in the event of an emergency. A brochure that includes emergency plans and meeting points is to be included with any travel documents issued by the agency.

Foreign Language Requirements

All disaster materials available to the public are to be available in both Greek and English.

Education and Training

Local Survival Skills/Education in Self-Sufficiency

A very important aspect of disaster planning revolves around the education of the local residents to be personally prepared in the event of a disaster. Lives can be saved if residents
are familiar with the risks that surround them and they have prepared their own plans and survival kits in the event that an emergency is declared. Therefore, the island under the auspices of the Public Information Department, has developed a set of programs to educate the local populace in disaster planning. Coinciding with some of the local festivals that celebrate the history of the island, the staff has prepared sample survival kits, brochures, and games for kids, all with the goal of exposing the inhabitants to the risks that surround them. Additionally, the Public Information Department has met with local leaders to address this issue. It is the hope that through the social network that exists on the island, a grass roots campaign of education will aid in the dissemination of survival strategies.

**School Curriculum**

It is the belief of the local government that knowledge of the risks that surround the island, as well as the skills needed in the event of a disaster, be taught through curriculum developed by the Superintendent/School Board. Beginning with the child’s first year of school and ending with his/her primary school graduation, the student will study these principles through classroom education, field trips, and drills. This curriculum is to include, but not be limited to, the history of the island (past cataclysmic events and their effects), the science of volcanoes, earthquakes and tsunamis, as well as their effects on other islands, and health (the necessity of survival kits and how they save lives).
Chapter 6: Conclusion

In comparison to one another, the models for disaster planning published by FEMA and the United Nations are very different. Each provide an extensive framework for creating a disaster plan, however they differ in their approach. The FEMA model serves as a pragmatic model that relies heavily on the roles and responsibilities required from each government agencies. Appendix 1 illustrates the detail FEMA provides for such agencies.

The United Nations, on the other hand, does not stipulate specific guidelines to follow. Rather it gives general methods of planning responses, and supports these methods with specific case studies. While the examples are helpful, a true template for disaster planning does not exist.

By using actual guidelines provided by the United States and the United Nations, the argument presented provided in this thesis is strengthened. By critically reviewing these frameworks, it is the hope of the author that future guidelines will evolve and become even better tools for developing disaster plans.

The two case studies used in this thesis are true examples of the guidelines followed in each respective case. The County of Hawaii plan devotes a great deal of the report to command and control and the responsibilities associated with each group. Additionally, the plan addresses nearly every variable highlighted in the FEMA guidelines. This produces an adequate plan, but fails to address all the concerns associated with small islands.

In comparison, the disaster management plan for the Kingdom of Tonga is extremely vague. While the plan outlines a chain of command, and assigns responsibilities for various departments, the plan fails to adequately address the other categories of disaster planning.

The goal of this study was to prove that the present models for small island disaster planning are inadequate, and furthermore, a more complete model could be developed. By not just comparing the two models and case studies, but by understanding the methodologies of each, as well as citing additional cases, these goals were achieved.

However, the overall strength of this thesis could be greatly increased with additional case studies of small island disaster plans. Unfortunately, it has not been until recently that much attention has been brought to disasters, and therefore disaster planning for small islands. Even though a great deal of research was done by the author, it was extremely difficult to locate additional disaster plans. It is the author’s belief that by being limited to two case studies, several issues associated with small islands may have been overlooked.

The composite model provided in this study, along with the plan created using Santorini as a template, can serve as a better model for small island disaster planning. However, if this model, or any other model that exists is ignored, lives will be lost. No amount of spontaneous reaction can prevent the loss of life as well as a well-prepared disaster emergency plan. It is the author’s hope that by incorporating this model in their respective emergency plans, small islands will be better prepared in the event of a disaster.

As an increasing number of islands create disaster plans, a more complete idea of all the issues that small islands face will become clearer. As the technology becomes more efficient in predicting and understanding disasters, plans can be better developed to prepare for the inevitable crisis. The world is ever changing. However, as long as man is alive, the threat of catastrophe will exist. Therefore, future studies are vital to understanding the threats that surround us.

If we are to prevent loss of life we must be willing to analyze and critique the practices in place to enhance our methods and understanding. Mother Nature does not rest; instead she moves on, indifferent to man. To live within her indifference, man must be ever vigilant, always striving for greater knowledge.
Appendix 1: Required Agencies– FEMA

**Chief Executive Official (“CEO”)**

- Activates EOC (full or partial activation), when appropriate.
- Directs tasked organizations to ensure response personnel report to the
- Appropriate locations (EOC, emergency scene, work center, staging area, etc.) in accordance with the organization's SOP.
- When notified, reports to the EOC.
- If appropriate, identifies and establishes contact with IC(s) in the field.
- Provides overall direction of emergency response operations, until an emergency scene is established and an IC assumes this responsibility. (For emergency situations that occur with little or no warning, an IC may already have responded to the scene and taken charge before notification of the “CEO.”)
- As appropriate, designates an IC to direct tactical operations at each emergency scene.
- As appropriate, directs implementation of protective actions for public safety.
- If necessary, directs EOC staff to relocate to the alternate EOC to continue operations.
- When appropriate, terminates response operations and release personnel (Pg. 67).

**Fire Department**

- When notified of an emergency situation, sends response teams/personnel, equipment, and vehicles to the emergency site, staging areas, or other location, as appropriate.
- Identifies an IC and establishes an ICP, if appropriate; assigns appropriate personnel to IC staff.
- Performs IC duties at the emergency scene, if appropriate.
- Sends a senior representative to the EOC, when the EOC has been activated during an emergency.
- Notifies the EOC of the situation if the original notification did not come from the EOC.
- Sends a senior representative to the EOC, when the EOC has been activated during an emergency.
- Manages fire/rescue resources, directs fire operations, rescues injured people during emergency operations, and determines the need, as appropriate, for evacuation of the immediate area in and around the emergency scene.
- Assists as appropriate in the evacuation of people at risk in the immediate area in and around the emergency scene.
- Alerts all emergency response organizations of the dangers associated with technological hazards and fire during emergency operations (Pg. 68).

**Police Department**

- When notified of an emergency situation, sends response teams/personnel, equipment, and vehicles to the emergency scene or other location, as appropriate.
- Identifies an IC and establishes an ICP if appropriate; assigns appropriate personnel to IC staff.
- Performs IC duties at the emergency scene, if appropriate.
- Sends a senior representative to the EOC, when the EOC has been activated during an emergency.
- Sends a senior representative to the EOC, when the EOC has been activated during an emergency.
- Manages law enforcement resources and directs law enforcement operations. Duties may include:
  - Directing and controlling traffic during emergency operations.
  - Assisting in the evacuation of people at risk in and around the emergency scene.
  - Controlling access to the scene of the emergency or the area that has been evacuated.
  - Providing security in the area affected by the emergency to protect public and private property. Conducting damage assessment activity (through use of aircraft, helicopter, or other police vehicles as appropriate) (Pgs. 68-69).

**EOC Manager** (Normally, this job is performed by the jurisdiction’s Emergency Manager.)

- Immediately notifies the “CEO” of significant emergency situations that could affect the jurisdiction.
- When directed by the “CEO,” or when
circumstances dictate, notifies all tasked organizations, informs them of the situation, and directs them to take the action appropriate for the situation (report to EOC, scene of the emergency, stand by, etc.) in accordance with their organization's SOP.

• Activates EOC when directed to do so by the “CEO” or when the situation warrants such action.
• Manages EOC resources and directs EOC operations. Duties may include ensuring the following activities/actions are done:

   **Information processing.**
   This task involves the collection, evaluation, display, and dissemination of information about the emergency situation to help support the jurisdiction’s response operations.
   Information collection sources include, but are not limited to: emergency response organizations, media, neighboring jurisdictions, State and Federal governments, volunteer groups, private sector businesses, citizens, etc. Typical tasks associated with information processing may include:
   – Maintaining a significant events log.
   – Message handling.
   – Aggregating damage information from all available sources.
   – Identifying resource needs.
   – Preparing summaries on status of damage.
   – Preparing briefings for senior management officials.
   – Displaying appropriate information in the EOC.
   – Preparing and submitting necessary reports when required (re: situation, critical resource status, etc.), including situation reports to the State EOC, as appropriate.
   – Coordinating logistical support for response personnel and disaster victims.
   – When directed by the “CEO,” or when conditions warrant such action, relocating staff to the alternate EOC in order to continue response operations.
   – When directed by the “CEO,” terminating operations and closing the EOC (Pgs. 70-71).

**Public Works**
• When notified of an emergency situation, sends response teams/personnel, equipment, and vehicles to the emergency scene, staging area, or other location, as appropriate.
• Identifies IC and establishes ICP, if appropriate; assigns appropriate personnel to IC staff.
• Performs IC duties at the emergency scene, if appropriate.
• Notifies the EOC of the situation if the original notification did not come from the EOC.
• Sends a senior representative to the EOC, when the EOC has been activated during an emergency.
• Manages public works resources and directs public works operations.
Duties may include:
   - Performing debris removal operations.
   - Assisting in urban search and rescue (US&R) efforts.
   - Conducting damage assessment activities (through the use of vehicles, remote video equipment, etc., as appropriate).
   - Providing emergency generators, fuel, lighting, sanitation to support emergency responders at the emergency scene and at the EOC.
   - Assisting in the evacuation of people at risk in and around the emergency scene.
   - Coordinating with utility companies to restore power to disaster victims (Pgs. 72-73).

**Emergency Manager**
• Ensures appropriate staff members report to the EOC.
Duties may include:
   - Coordinating EOC operations.
   - Staffing the Information Processing Section.
   - Advising/briefing the “CEO” and other key members of the emergency response organization on the emergency situation.
   - Recommending to the “CEO” actions to protect the public from the life threatening consequences associated with the emergency situations (Pg. 73).

**Public Information Officer (PIO)**
• When notified, reports to EOC or incident scene as appropriate.
• Handles inquiries and informs the public about disaster damage, restricted areas, actions to protect and care for companion animals, farm animals, and wildlife, and available emergency assistance (Pg. 73).

Health and Medical Coordinator
• When notified of an emergency situation, sends a representative to the EOC, if appropriate.
• Coordinates the health and medical treatment activities of all response organizations involved in providing medical assistance to disaster victims.
• Coordinates necessary mortuary services, to include operations of temporary morgues, and identification of victims.
• Collects information and reports damage/status of health and medical facilities and equipment to the EOC (Pg. 74).

Communications Coordinator
• Serves as a member of the EOC team.
• Ensures the emergency communications section in the EOC is equipped with the appropriate communication gear (Pg. 74).

Warning Coordinator (When practical, this individual should be permanently assigned to the EOC).
• Develops and maintains a phone and/or radio frequency list for notifying emergency response personnel, neighboring jurisdictions, and the State EOC of an emergency situation.
• Develops and maintains a phone list or other means for warning special locations, such as schools, hospitals, nursing homes, major industrial sites, institutions, and places of public assembly.
• Identifies public and private service agencies, personnel, equipment, and facilities that could be called upon to augment the jurisdiction's warning capabilities (Pg. 74-75).

Evacuation Coordinator
• When notified of an emergency situation, reports to the EOC, if appropriate.
• Coordinates implementation of evacuation actions with the appropriate tasked organizations (Pg. 75).

Mass Care Coordinator
• When notified of an emergency situation, reports to the EOC, if appropriate.
• Coordinates implementation of mass care actions for the public with the appropriate tasked organizations (Pg. 75).

Resource Manager
• When notified of an emergency situation, reports to the EOC, if appropriate.
• Coordinates implementation of resource management activities with the appropriate tasked organizations (Pg. 75).

Legal Department
• When notified of an emergency situation, sends a representative to the EOC, if appropriate (Pg. 75).

Education Department (School Superintendent)
• When notified of an emergency situation, sends a representative to the EOC, if appropriate.
• Protects students in school when an emergency situation occurs.
• Evacuates students, if appropriate.
• When directed by appropriate authority, closes school facilities and releases students.
• When directed by appropriate authority, makes schools available for use as mass care facilities.
• Conducts damage assessment of school facilities (Pgs. 75-76).

Jurisdiction Comptroller/Clerk/Bookkeeper/Tax Assessor
• When notified of an emergency situation, reports to the EOC, if appropriate.
• Provides the Resource Manager and the "CEO" summary briefings on status of financial transactions.
• Maintains records of all financial transactions during response operations.
• Handles all procurement requests initiated by response organizations.
Establishes a procedure for the jurisdiction to accept "cash donations", where statute permits such action; however, jurisdictions may wish to avoid competing with non-profit organizations' efforts to fund their activities.

Upon termination of the response effort, prepares the appropriate reports that address costs incurred by the jurisdiction during the emergency situations (Pg. 76).

Military Department
- Provides personnel and equipment to support direction and control actions at the scene and/or the EOC (at the direction of the Governor) (Pg. 77).

Volunteer Organizations
- When notified of an emergency situation, send a representative to the EOC, if appropriate (Pg. 77).

Private Utility Companies
- When notified of an emergency situation, send a representative to the EOC, if appropriate (Pg. 77).

Animal Care and Control Agency
- When notified of an emergency situation, sends a representative to the EOC, if appropriate.
- Manages public and private sector efforts to meet the animal service needs that arise including:
  - Rescue and capture of animals that have escaped confinement and displaced wildlife.
  - Evacuation.
  - Sheltering.
  - Care of the injured, sick, and stray.
  - Disposal of dead animals.
- Activates emergency response teams (evacuation, shelter, medical treatment, search and rescue, etc.) as needed.
- Prepares a resource list that identifies the agencies/organizations that are responsible for providing the supplies (medical, food, and other necessary items) needed to treat and care for injured and sick animals during large-scale emergencies and disasters.
- Coordinates response activities with the appropriate representative in the EOC (EOC Manager, Evacuation Coordinator, Mass Care Coordinator, ARC, PIO, Health and Medical Coordinator, Resource Manager, etc.).
- Coordinates the rescue of injured or endangered animals with fish and game departments, wildlife organizations, county cooperative extension offices, veterinarians, etc (Pgs. 77-78).

Other Organizations
- The organization and assignment of responsibilities section should list any other agencies/departments that have not been included in one of the above categories and itemize the services they provide (e.g., coroner's office, airport authority, marine resources council, U.S. Department of Agriculture, emergency board, etc.) (Pg. 78).

All Tasked Organizations
- Activate a control center to support and facilitate the organization's response activities (dispatch and manage personnel and resources, maintain a significant events log, report information to the Information Processing Section at the EOC, coordinate with organizational personnel at the emergency scene or EOC, etc.).
- If appropriate, send a representative to the EOC.
- Establish a procedure to identify, and report to the Information Processing Section in the EOC, damage to organizational resources and facilities. Additional tasking may include responsibility for reporting damage to, or status of, critical facilities such as:
  - Emergency service facilities and equipment (fire stations; police stations; custodial facilities, such as jails and juvenile detention centers, hospitals, and other health care facilities; rescue squads; public works facilities, etc.).
  - Communications networks (telephones, emergency service radio systems, repeater sites and base stations, television and radio stations, etc.).
  - Water supply system/facilities, to include waste water treatment.
  - Utilities (power plants, substations, power lines,
etc.)
− Transportation networks (roads, bridges, airports, rail terminals, maritime ports).
− Homes, businesses, public facilities, etc.
• Where appropriate, ensure that organization staff member(s) tasked to work in the EOC during emergencies have authority to commit resources and set policies.
• Provide support to the IC, as required.
• If appropriate, establish a protocol for interfacing with State/Federal responders.
• Coordinate with the PIO and clear press releases with the “CEO” before releasing information to the media for public consumption (Pgs. 78-79).
Appendix 2: Hawaiian Agencies

Policing – Hawaii
The County Emergency Operations Plan describes the responsibilities of the Police Department during disaster response and recovery phases as follows:

Evacuation
• Direct and control traffic flow into and out of restricted disaster areas, and ensure open trafficways for all emergency and lifesaving services; protect life and property.
• Assist in disseminating warning information.
• Direct evacuation of the public from threatened areas.
• Provide for security of vacated homes and facilities.
• Establish and man roadblocks and barricades as required; deny entry into restricted areas.
• Monitor, communication, coordination.
• Provide the department’s operations control and emergency communications and activate emergency procedures.
• Transmit vital information and requests for assistance from field units to the Civil Defense EOC by timely spot and situation reports; keep field units informed.
• Maintain interagency communication, coordination and support to facilitate operations as established by CD procedures.
• Assist with conducting radiological monitoring and reporting as required.

Post-disaster
• Survey, assess and report estimated disaster-related damages, losses and relief needs to the Civil Defense EOC on a continuing basis, especially during the initial stages.
• Perform other tasks related to the situation as may be directed by appropriate authority.

At a hurricane or tsunami watch, all off-duty and volunteer officers report to their respective main station. There are eight main district police stations around the island along with four substations and ten mini police stations (see Figure 3-4). Central dispatch facilities are located in the Hilo station. There are approximately 350 officers assigned to the various stations with an island-wide average of approximately 2.5 officers per 1,000 residents. None of the main stations are located in the tsunami evacuation zone. Two of the substations are unavoidably located in the lava hazard zone 2 (Pahoa, Hawaiian Ocean View) (Pg. 84).

Fire and EMS- Hawaii
The County Emergency Operations Plan describes the responsibilities of the Fire Department during disaster response and recovery phases as follows:

Fire-fighting, rescue, emergency medical
• Direct and control fire hazard reduction, fire fighting, search and rescue operations to save life and property and to maintain or restore lifeline services and facilities.
• Operate the department’s Communication Control Center to facilitate the direction and control of all Fire-Rescue forces and operations “round the clock” shifts.
• Provide ambulance and emergency medical services.
• Assist in damage control.

Evacuation
• Assist in disseminating warning information and evacuating public.
• Coordinate use of vehicles from other agencies for ambulatory and evacuation needs.

Monitoring, communication, coordination
• Transmit vital information and requests to the Civil Defense EOC by timely spot and situation reports; keep field units informed.
• Assist in dispatching health and medical personnel to areas where their services are required.
• Request on-scene augmentation as soon as the need is anticipated.
• Initiate and maintain interagency communication, coordination and cooperation to facilitate operations.
• Conduct radiological monitoring and reporting as required.

Post-disaster

• Survey, assess and report to the Civil Defense EOC estimated disaster-related damage, losses and relief needs.

• Perform other tasks as may be required by the situation or directed by appropriate authority (Pgs. 84-86).

**Department of Public Works - Hawaii**

The County Department of Public Works carries out an important role during and after emergencies. The County Emergency Operations Plan describes the responsibilities of the Department of Public Works as follows:

• Lifeline infrastructure repair and debris clearance

• Direct and control overall public works and engineering operations to maximize the saving of life and property and maintenance or restoration of lifeline service. Direct and control emergency debris clearance, hazard removal and repair of vital facilities.

• Isolate damaged sewer mains, disinfect raw sewage spills, restore service on priority basis and decontaminate polluted areas in coordination with the District Health Office.

• Assist in providing emergency transportation, emergency power and illumination.

• Assist in search and rescue operations in conjunction with debris clearance and other public works functions.

• Construct emergency fallout shelters, or improve existing shelters, in accordance with plans for expedient public shelter construction during a period of national emergency.

Evacuation

• Provide assistance to the Police Department in establishing roadblocks or other traffic and crowd controls.

• Assist with warning and evacuation of department personnel and the public.

• Monitoring, communication, coordination

• Provide the required liaison in the Civil Defense EOC with appropriate “round-the-clock” shifts.

• Assist in damage control.

• Transmit vital information and requests to the Civil Defense EOC by timely spot and situation reports; keep field teams informed.

• Initiate and maintain interagency communication, coordination and cooperation with all Public Works engineering centers, baseyards and work teams to facilitate operations.

• Conduct radiological and other hazardous material monitoring and response as required to ensure the safety of the work crews.

Post-disaster

• Prepare mass burial sites in coordination with the District Health Officer.

• Assess disaster-related damage and operational requirements; report estimates to Hawaii Civil Defense EOC.

• Assume other responsibilities as may be required by the situation or directed by competent authority.

The Department of Public Works has eight baseyards which serve as their operational, storage and maintenance centers. These baseyards are situated in Kurtistown, Hilo, Honokaa, Waimea, Hawi, Honalo, Captain Cook and Waiohinu. None of these baseyards are situated in areas highly susceptible to natural hazards (Pgs. 87-88).
Appendix 3
The NDMC membership shall comprise the following:
• Hon Minister for Works and Disaster Relief Activities (Chairperson).
• Director of Works (Deputy Chairperson).
• Commander, Tonga Defense Services.
• Commander of Police.
• Director of Health.
• Director of Agriculture and Forestry.
• Director of Central Planning.
• Secretary of Civil Aviation.
• Secretary for Foreign Affairs.
• Director of Lands and Natural Resources.
• Secretary of Finance.
• Secretary of Marine, Harbor and Ports.
• Chairman, TANGO.
• Director General, Tonga Red Cross.
• Director of Education.
• General Manager of Tonga Telecommunication Commission.
• General Manager, Tonga Water Board.
• General Manager, Tonga Electric Power Board.
• General Manager, Tonga Broadcasting Commission.
• Deputy Director Works, OIC NDMO (Executive Officer).
The Chairperson may co-opt other members as required (Pgs. 9-10).


