Plan for Improving Community Emergency Resilience in Eilat, Israel

An Interactive Qualifying Project Report
submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
Degree of Bachelor of Science

By

Nicole Dombrowski
Joseph Durocher
Tyler Sanderville

Date: February 27, 2022

Report Submitted to:

Professor Isa Bar-On and Professor Seth Tuler
Worcester Polytechnic Institute

Elad Topel and Assaf Admon
Eilat Municipality Environmental Unit

Abstract

The City of Eilat, Israel is planning for city-wide emergencies, including heat waves, floods, and earthquakes. The goal of this project, sponsored by the Eilat Municipality Environmental Unit, was to assess opportunities for implementing community resiliency centers to mitigate the effects of natural disasters and severe weather. We conducted comparative analyses of emergency preparedness plans from 15 other cities and conducted interviews with key stakeholders in Eilat. We identified guidelines for center operation and recommended training curricula for volunteer-based community emergency response teams.

Acknowledgements

We would like to express our deepest gratitude to our project advisors, Isa Bar-On and Seth Tuler, along with our project sponsors, Elad Topel and Assaf Admon of the Eilat Municipality. We would also like to thank everyone who set time aside in their schedules to provide information to us that was essential to this project's recommendations. Finally, we would also like to thank Kibbutz Ketura for hosting us internationally and exposing us to a new environment. This project would not have been possible if not for everyone's contribution.

Authorship Table

Section	**Written by**	**Reviewed by**
Abstract	Nicole	Joe and Tyler
Chapter 1: Introduction	Joe	All
Chapter 2: Background	Nicole and Joe	All
2.1 Community Profile of Eilat	Nicole	All
2.2 Severe Weather and Climate Crisis in Eilat	Nicole and Joe	All
2.3 Mitigating Public Health Risk Using Resilience Centers	Joe	All
2.4 Volunteer Emergency Response through Resilience Centers	Nicole	All
Chapter 3: Methods	Joe and Nicole	All
3.1 Assess Existing Plans and Best Practices in other Communities	Joe	All
3.2 Understand the Specific Needs of Eilat's Community	Nicole & Tyler	All
3.3 Adapt Existing Expertise to Eilat's Specific Circumstances	Nicole & Tyler	All
Chapter 4: Findings and Analysis	Joe and Nicole	All
4.1 Risks to Eilat's Community	All	All
4.2 Existing Structures within Eilat	All	All
4.3 Emergency Resilience Centers	Joe and Nicole	All
4.3.1 Implementation of Emergency Centers	Nicole	All

4.3.2 Emergency Center Activation Plans	Joe	All
4.3.3 Allocating Community Members to Centers	Nicole	All
4.3.4 Management Structures	Joe	All
4.4 Volunteer Emergency Response Teams	Nicole	All
4.4.1 Youth Specific Volunteer Programs	Nicole	All
4.4.2 Different Communities Benefit from Different Volunteer Training	Nicole	All
Chapter 5: Conclusion and Recommendations	All	All

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

Climate change is radically shifting the weather of our planet. Like many other locations, Israel faces increased risk of severe weather and climate emergencies such as flooding, heat waves, droughts, and severe storms (Morel, B., & Linkov, I., 2006). With the average temperature across the Middle East increasing yearly, some experts predict Israel will be uninhabitable by the year 2050 (Price, 2020). In the city of Eilat, Israel, residents are put at higher risk of being exposed to these weather disasters. Earthquakes and power outages also affect the area as it lies along the edge of the Nubian tectonic plate, southern Israel is hundreds of years overdue for a massive earthquake (Pe'er, 2000). Although experts cannot predict the exact timing of a geologic event, it is predicted that the region is at risk for an earthquake of magnitude 7 or above on the Richter scale in the coming years (Schuster, 2019).

In Israel, climate change is increasing the intensity and frequency of heat waves, storms, and flash flooding. In the last decade, the number of days with average temperature above 30°C rose from 23 to 88 days per year in the City of Tel Aviv, Israel (Surkes, 2021). These intensified heat waves pose a threat to the residents of Israel, placing them at risk of deadly conditions like heatstroke and causing long-term health problems, especially in the elderly and young children (U.S. Department of Health and Human Services, 2017).

Flooding and storms have also become more severe in the winter. Throughout December and January, Israel can experience storms producing over 40mm of daily precipitation (Berman, 2022). These storms create flash floods due to the dry, nonabsorbent desert soil (Price, 2020). During these floods, people can become stranded in their homes, cars, or other buildings, and flooded roads can restrict access to food, medical care, and other necessities (Jha et al., 2012).

Relief centers are a useful resource to communities during city-wide disasters; these are public areas where community members can receive temporary emergency relief during and after a disaster (Larkin et al, 2015). Temporary emergency relief can consist of sheltering, medical attention, security, food and water, and other emergency services provided during and after a disaster (National Center for Disaster Preparedness, 2021). These centers can be large public buildings such as airports, schools, or other structures that are designed to hold a large number of people (Geelong, 2021). During disasters, these centers can be one of the few places for people affected to seek relief. In areas prone to flooding like Louisiana, United States, emergency relief centers have been vital to helping communities during and after natural disasters such as Hurricane Katrina and other events (Hossain, 2020).

The sponsors for this project are Assaf Admon, head of the Eilat Municipality Environmental Unit, and Elad Topel, a contractor with the unit. The Environmental Unit works to provide resources to help with environmental issues in the area (Anna Lindh Foundation, 2020). Our sponsors, in conjunction with other branches of Eilat's government, plan to create "resiliency centers" throughout the city that will provide public resources and community services during emergencies. The first center is currently in development, planned to be completed in 2022 (E. Topel, personal communication, January 20th, 2022). As Eilat's local

government expands its plans for disaster preparedness, this project will help the city learn the most effective ways to implement these centers, staff them, service the centers, and provide resources and relief to the community during and after a natural disaster.

The goal of this project is to identify best practices for implementing community resources for city-wide emergencies for the Eilat Municipality Environmental Unit. For this, we completed the following objectives: 1) assessed existing plans and best practices for community relief centers in other cities and created a comparative analysis of emergency plans; 2) developed an understanding the specific needs of Eilat's community through interviews with Eilat's community leaders; and 3) adapted other municipalities' best practices to Eilat's specific circumstances, creating a preliminary plan for disaster relief services, equipment, staffing, and recruiting / training for said staffing. We interviewed members of the community and reviewed literature on emergency resilience centers, community emergency teams, and disaster risk analysis. By completing these objectives, we hope to help the City of Eilat develop a useful plan for combatting future emergencies due to severe weather events.

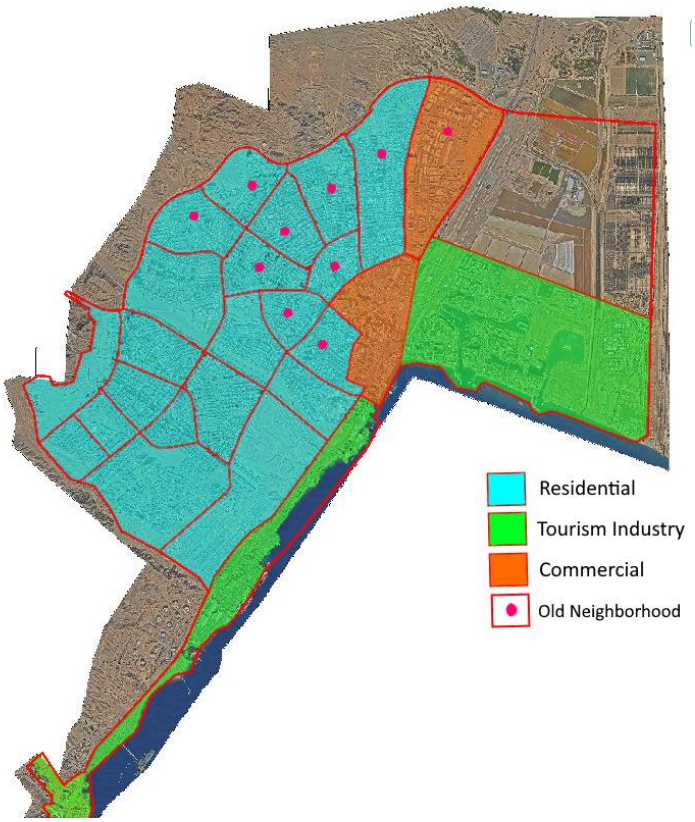
Chapter 2: Background

This chapter discusses existing literature relevant to our project. We discuss the City of Eilat, risk of severe weather and natural disasters in Eilat, describe the city's plan to develop community preparedness measures and resiliency centers, and examine relevant details to the development of emergency plans and disaster relief centers.

2.1 Community Profile of Eilat

Eilat is a city located at the southernmost point of Israel. The 52,000 residents live on 86.2 square kilometers of land. The city lies on the northern tip of the Red Sea, acting as a port city connecting Israel to Africa, India, and eastern Asia. It shares a border with the City of Aqaba, Jordan to the east, and Taba, Egypt to the south. However, Eilat is also very remote; there is only one major road leading into the city from the rest of the country. The nearest airport is located 19 kilometers from the city limits, a half hour's travel, this still creates isolation since the airport is no longer located within the city limits. Eilat is considered a travel destination within the Middle East. This is partly due to the city's close proximity to several remote and fragile ecosystems, from the wildlife in the Negev desert to the coral reefs in Eilat Bay. These ecosystems make the city a desirable travel destination to the 800,000 visitors per year (Strategy and Policy Administration, 2019). As seen in Figure 1, hotels are located along the coastline providing activities along the beaches while keeping the commercial zone in close proximity.

Figure 1: Map of Eilat



(Communication with Myri Lew, city planner, Feb 2022)

Eilat's economy is heavily dependent on tourism; up to 90% of the city's economy is dependent, either directly or indirectly, through international and domestic tourists (Municipality of Eilat, n.d.). This dependence on tourism means that Eilat's economy has suffered in recent years due to the COVID-19 pandemic. The virus has caused travel to decrease due to fear of infection, and unemployment in Eilat has soared to 45.6% since March 2020 (Municipality of Eilat, n.d.). Currently, over 21% of Eilat residents live below the poverty line (Gil-Ad, 2021).

Eilat has a large, diverse population of migrants; 14% of the city's population is Sudanese, and illegal immigrants from other African nations make up 10% of the city's foreign population (Gedalyahu, 2021). Eilat is 82% Jewish, while 4% of the city's residents are Arabs. Many of these groups are in direct conflict with one another; there can be religious tension between Jewish and Arab Israelis due to the Israel-Palestine conflict, and Eilat natives have been apprehensive of African migrants due to anti-immigrant sentiments (Hartman, 2011)(foreign population researcher, personal communication, February 17th, 2022). During a crisis, these tensions have the potential to erupt into conflict.

Additionally, language barriers between residents cause additional friction within Eilat's community. In particular, communicating in Arabic can cause problems because there are vastly different dialects of the language between regions (foreign population researcher, personal communication, Feb 17th, 2022). Sudanese migrants have a unique dialect that can be difficult to

understand for native Israelis, who usually speak the Palestinian or Israeli-Arab dialects. Language barriers also pose a problem with the prevalence of international tourists in the city. This problem is compounded in emergency scenarios; language barriers can hinder medical treatment and slow down emergency response during a crisis. (Becken, S., & Hughey, K. F. D., 2012).

2.2 Severe Weather and Climate Crises in Eilat

The climate of Eilat is hot and extremely arid. It experiences two distinct seasons–a cooler, rainy winter, and a dry, extremely hot summer. The winter is characterized by coastal storms and flash flooding, while the summer brings extreme heat and drought (Jewish Virtual Library, n.d.).

Although Eilat's annual average precipitation averages only 25mm, storms and flash flooding pose risks to the city (Municipality of Eilat, n.d.). A storm that struck the city in March of 2020 caused millions of shekels of damage to local infrastructure, especially buildings in the hotel area along the coast (Surkes, 2021). According to State Comptroller Matanyahu Englman, all of the city's infrastructure is at risk because it was not built to withstand large precipitation events (Bob, 2021). Hotels are at the highest risk of flooding because they lie in the drainage basin for several large streams, including the Arava, Tzin, Nekraot, Paran and Hayun; this poses a threat to Eilat's largely tourism-based economy (Municipality of Eilat, n.d.). Flash floods can also cause deaths by drowning, hypothermia, and collapsing structures; indirect health effects include animal bites, starvation, and diseases carried by contaminated water (Du, 2010). In the coming years, climate change will worsen the problem of flooding in the city by increasing the intensity and frequency (or size and duration) of the floods (Denchak, 2019).

In the dry season, heat waves pose the largest risk to the city; in August 2021, a week-long heat wave caused daily high temperatures of up to 45.5 ℃, and global warming is expected to increase their frequency and intensity in future years. As seen in Figure 2, 45.5 ℃ poses severe health threats. The Israel Meteorological Service predicts that by 2030, the city will see heat waves reach temperatures above 50 ℃ (Yaron, 2022). At these temperatures, heat-related illnesses like heatstroke, rhabdomyolysis, heat syncope and heat exhaustion can become a deadly threat to public health (National Institute for Occupational Safety and Health [NIOSH], 2020). Additionally, extreme heat can worsen pre-existing heart conditions, and heat waves have been linked to an increase in premature births and preeclampsia (World Health Organization [WHO], 2018). Heat-related illness poses the greatest risk to the elderly, young children, and people with disabilities or chronic illness (NIOSH, 2020).

Figure 2: Heat Index

HEAT INDEX °F (°C)

The heat index is an accurate measure of how hot it really feels when the affects of humidity are added to high temperature.

Temp.	RELATIVE HUMIDITY (%)												
	40	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
110	136												
(47)	(58)												
108	130	137											
(43)	(54)	(58)											
106	124	130	137							nbsp;			
(41)	(51)	(54)	(58)										
104	119	124	131	137									
(40)	(48)	(51)	(55)	(58)									
102	114	119	124	130	137								
(39)	(46)	(48)	(51)	(54)	(58)								
100	109	114	118	124	129	136							
(38)	(43)	(46)	(48)	(51)	(54)	(58)							
98	105	109	113	117	123	128	134						
(37)	(41)	(43)	(45)	(47)	(51)	(53)	(57)						
96	101	104	108	112	116	121	126	132					
(36)	(38)	(40)	(42)	(44)	(47)	(49)	(52)	(56)					
94	97	100	103	106	110	114	119	124	129	135			
(34)	(36)	(38)	(39)	(41)	(43)	(46)	(48)	(51)	(54)	(57)			
92	94	96	99	101	105	108	112	116	121	126	131		
(33)	(34)	(36)	(37)	(38)	(41)	(42)	(44)	(47)	(49)	(52)	(55)		
90	91	93	95	97	100	103	106	109	113	117	122	127	132
(32)	(33)	(34)	(35)	(36)	(38)	(39)	(41)	(43)	(45)	(47)	(50)	(53)	(56)
88	88	89	91	93	95	98	100	103	106	110	113	117	121
(31)	(31)	(32)	(33)	(34)	(35)	(37)	(38)	(39)	(41)	(43)	(45)	(47)	(49)
86	85	87	88	89	91	93	95	97	100	102	105	108	112
(30)	(29)	(31)	(31)	(32)	(33)	(34)	(35)	(36)	(38)	(39)	(41)	(42)	(44)
84	83	84	85	86	88	89	90	92	94	96	98	100	103
(29)	(28)	(29)	(29)	(30)	(31)	(32)	(32)	(33)	(34)	(36)	(37)	(38)	(39)
82	81	82	83	84	84	85	86	88	89	90	91	93	95
(28)	(27)	(28)	(28)	(29)	(29)	(29)	(30)	(31)	(32)	(32)	(33)	(34)	(35)
80	80	80	81	81	82	82	83	84	84	85	86	86	87
(27)	(27)	(27)	(27)	(27)	(28)	(28)	(28)	(29)	(29)	(29)	(30)	(30)	(31)

Category	Heat Index	Possible heat disorders for people in high risk groups
Extreme Danger	130°F or higher (54°C or higher)	Heat stroke or sunstroke likely.
Danger	105 - 129°F (41 - 54°C)	Sunstroke, muscle cramps, and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity.
Extreme Caution	90 - 105°F (32 - 41°C)	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Caution	80 - 90°F (27 - 32°C)	Fatigue possible with prolonged exposure and/or physical activity.

(US Department of Commerce N.O.A.A, 2015)

A common method of dealing with extreme heat waves is the use of air conditioning (AC), which is present in 80% of Israeli homes; however, this resource is not always an accessible option to community members (Döhler, 2020). Some households keep their air conditioners turned off due to the high cost of electricity; others have a broken AC that they cannot afford to repair (foreign population researcher, personal communication, February 17th, 2022). Latet, a nonprofit providing support to impoverished Israelis, reports that over 2,000 Israelis cannot afford reliable air conditioning (Alon, 2019). Additionally, severe weather or emergencies that damage Eilat's electrical infrastructure may prevent the use of air conditioning. In the case of a city-wide power outage or electrical grid failure, a heat wave can quickly go from a public health concern to a city-wide crisis (Vives, 2021) (I. Hadida, personal communication, February 23, 2022).

2.3 Mitigating Public Health Risk Using Resiliency Centers

The Eilat Municipality Environmental Unit is developing a climate change preparedness plan to guide the public through extreme weather events and natural disasters. This plan includes the implementation of community resiliency centers that will provide public resources in case of a city-wide emergency. The emergencies that they're preparing for include, but are not limited to, heat waves, flash floods, storms, power outage, and earthquakes.

Relief centers throughout the United States, Europe, and the Middle East have been established in buildings that serve other purposes. Some common examples include public buildings, senior and community centers, schools, and stadiums (Tso, 2021). These centers are designed to best fit communities and provide basic needs during a disaster including: a working electrical system, reliable water source, sanitary facilities, areas for food preparation, basic security, and waste disposal (Office of Foreign Disaster Assistance [OFDA], 2005). Common themes across centers include building location and design, amenities and services, safety and equipment.

The building location and design of relief centers are very similar across the globe. The location of an emergency centers is designed around mitigating risk and accessibility (OFDA, 2005). Commonly located at public buildings, these centers are easily accessible and provide adequate parking and areas for people to congregate. In 2021, the most common cooling centers in Los Angeles County were libraries and senior centers, followed by parks, and recreation centers (Workforce Development Aging & Community Service [WDACS], 2021). In addition to being accessible, these centers are required to adhere to a national building code ensuring strong external walls, window verification, and sturdy roofing among other requirements (The Building Codes Assistance Project, 2016)(International Building Code Council, 2019). These building codes ensure that these buildings can withstand, to an extent, strong winds and heavy rains experienced within a major storm (International Building Code Council, 2019). During Hurricane Katrina in 2005, the Mercedes Benz Superdome and the New Orleans Convention Center were turned into relief shelters. These two centers hosted thousands of people as the city flooded (Nigg et al., 2006).

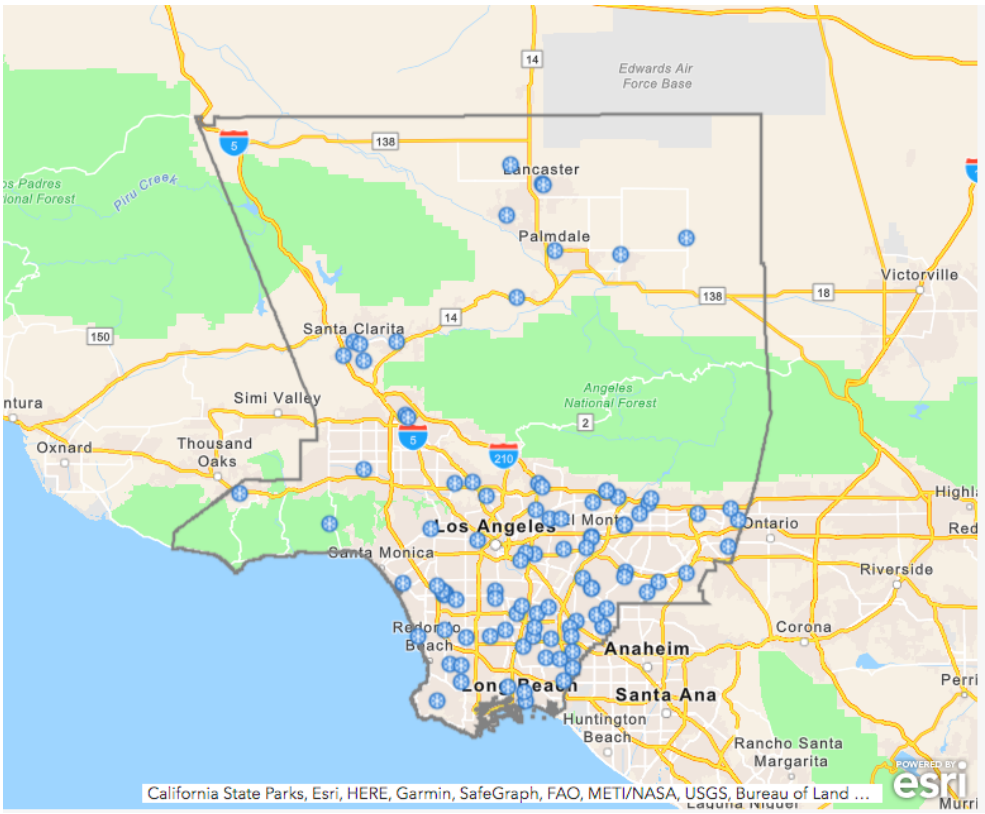
These centers provide services and amenities to help during emergencies. Adhering to national building codes, these facilities have the basic adequate amenities of an electrical system, water and plumbing, and waste/disposal areas (The Building Codes Assistance Project, 2016) (International Building Code Council, 2019). As emergency centers, they also include additional backup power, food preparation and storage, and sanitation practices (OFDA, 2005) (City of Los Angeles, 2018) (Bashawri, 2017). Emergency services are also provided through the centers. A coverage of services found throughout plans include emergency food and water, air conditioning, medical aid, temporary sheltering and security. In New Orleans, the last-minute shelters provided medical attention, food and water, security, and sheltering during the extreme hurricane and flooding (Nigg, Joanne & Barnshaw, John & Torres, Manuel, 2006). Security is provided through local law enforcement in these centers due to the hostile environment that can be created. New Orleans witnessed high amounts of crime attempts within the shelters during

hurricane Katrina and used their local law enforcement to mitigate it (Nigg, Joanne & Barnshaw, John & Torres, Manuel, 2006).

Los Angeles County, California provides relief from extreme heat through its network of over 100 cooling centers seen in Figure 3. Libraries are the most common area cooling centers in the area because the books serve as a distraction from the heat and the air conditioning provides relief from the heat (Los Angeles Emergency Management Department, 2021). Common approaches to improve preparedness for heat waves include advertising tips to beat the heat such as staying hydrated, limiting extreme outdoor activity, alerting the city of the week's weather forecast, and advertising the symptoms of heat related illnesses (Los Angeles Emergency Management Department, 2021)(Arizona Heat Safety Resource Guide, 2014).

Centers vary based on the contents of the facility.

Figure 3: Map of Cooling Centers throughout Los Angeles County



(Los Angeles Emergency Management Department, 2021).

The Young Men's Christian Association (YMCA) is another community center that is prominent in disaster relief across the United States and worldwide. With over 2700 facilities nationwide, they have provided relief for many types of disasters including earthquakes, fires, tornadoes and hurricanes. These centers are commonly used as recreation areas but are known disaster relief centers. These centers provide resources during and after disasters such as sheltering, food and water distribution, and childcare (YMCA, 2022). The YMCA's work with a network of other organizations to provide relief and resources to the community (K. Grosshorn,

personal communication, January 14, 2022). These centers are equipped with many of the supplies that emergency centers need such as cooking supplies, food banks, cleaning supplies, and miscellaneous supplies such as matches and rope (YMCA, 2022) (OFDA, 2005).

New York City, New York USA, like Eilat, also experiences extreme heat events throughout the summer months (May-August). The NYC Health Department adapted their heat emergency plan by lowering their threshold from 40.6℃ to 37.8℃ for declaring a heat emergency in hopes of reducing heat related illnesses (HRI) (Tarik Benmarhnia et al., 2019). Lowering this threshold activated their emergency plan for extreme heat sooner. The plan mainly included alerting the public, activating cooling centers, and providing medical relief services. Temperature was tested every 24 hours at the LaGuardia airport and results for heat related illnesses were provided from the city. The study found between 2006 and 2007 there was an average of 1.49 HRI per day versus 0.65 HRI per day between 2009-2010 after the threshold had been lowered (Tarik Benmarhnia et al., 2019). By setting the threshold lower to activate the plan sooner, the city experienced less illnesses mitigating public health risks and proving their plan effective.

2.4 Volunteer Emergency Response through Resiliency Centers

In addition to developing emergency resiliency centers, Eilat is considering a plan to train community members to support emergency responders in response to city-wide disasters. While emergency centers provide stationary resources and points of operation for a disaster response effort, volunteer emergency response teams can help on-scene during a disaster, assisting with search-and-rescue, and providing basic medical care. Many cities implement programs to train volunteers from the community to provide support and communal resources during a crisis; in the United States, the most common and highly-structured program involves the use of Community Emergency Response Teams (CERTs).

The CERT program is supported nationally by the United States Federal Emergency Management Agency (FEMA) and provides a standard curriculum to train volunteers in basic disaster response. To get official support and funding from FEMA, a program’s training must include units on disaster management, fire safety, disaster triage, medical triage, and terror response; many programs also discuss amateur radio use, good response, and the details of daily emergency center operations (Federal Emergency Management Agency, n.d.). As of 2021, there are 2,584 approved CERT programs in the United States (Federal Emergency Management Agency, 2021). On average, a CERT member receives 18 to 20 hours of training in total; however, this number varies between different CERTs (FEMA, n.d.). Sometimes CERT training is offered as a course in schools through programs like Teen CERT and Campus CERT; these programs often include additional training and average 25-30 hours in total (West Virginia University School of Medicine, 2017).

After receiving training in basic disaster response, CERT members act as a supplemental resource to support professional emergency responders during large-scale crises. With CERT

members handling high-volume, low-effort response efforts, highly-trained professional responders can focus on more technical tasks.

A typical CERT contains a minimum of 10 members distributed across six different roles: team leader, fire suppression team, search and rescue team, medical triage team, medical treatment team, and safety officer (FEMA, n.d.). These roles are highly versatile; because all members receive the same basic training, every volunteer is expected to fill any role within the team. This flexibility is useful during chaotic emergency situations, where not all CERT members may be able to respond, as members can switch between roles as needed in order to provide adequate emergency response (Hall, n.d.).

Some of these team members operate in the field where a disaster is taking place (e.g. fire suppression team and search and rescue team). Other volunteers work at a fixed base of operations, usually an activated emergency center; for instance, the medical treatment team is assigned a treatment area to work from, either a hospital or an activated emergency center, and work in coordination with emergency center staff (FEMA, n.d.).

Various studies have shown CERT programs to be an effective way of mitigating risk to a community during a large-scale crisis. This is especially true in rural areas, which tend to receive less media attention and end up on the periphery of large-scale disaster relief efforts (Brennan et al., 2013).

Chapter 3: Methods

The goal of this project is to identify, for the Eilat Municipality Environmental Unit, best practices for implementing community resources for city-wide emergencies. To this end, we completed three objectives:

1. Assessed existing plans and best practices for emergency preparedness in other, comparable cities.
2. Identified requirements that will affect the design of relief centers within Eilat's community.
3. Developed a plan adapting existing expertise in the field of emergency response to Eilat's circumstances.

In this chapter, we describe the methodology we used to gather and analyze information from various cities and stakeholders, and how the results of our analyses informed the final recommendations for the Eilat Municipality Environmental Unit.

3.1 Assess Existing Plans and Best Practices in Other Communities

Our project's first objective was to assess existing emergency preparedness plans in locations similar to Eilat. We searched for cities across the United States, Europe, and the Middle East for which information on emergency preparedness planning was available. We compiled this information and assessed common features among different emergency plans.

City Identification and Comparative Analysis

We developed a list of cities and areas where common emergencies and climate crises were similar to those of Eilat. The initial list of cities came from recommendations from the sponsor, advisors, and teammates' previous disaster relief experience. These cities were sorted into a city comparison matrix (see Appendix A) which contained information on their size, population, average temperature, climate, and features of city emergency preparedness plan. We collected plans for cities in the United States through their local Emergency Management Department website. Plans and information for emergency centers and volunteer-based disaster relief teams were found through search engines such as Google Scholar, JSTOR, and WPI database search. Team members individually searched for plans and uploaded them into a google drive folder for the rest of the group to access. Additionally, they added the city to the City Matrix along with the information that accompanied it. Our analysis was based on the following research questions to establish a baseline understanding of other cities' plans:

1. How were the emergency centers activated?
2. Who runs the emergency centers? What roles do they have?
3. How are the emergency centers organized? Who was responsible for this?
4. What emergency/hazard were the centers designed for?
5. What did the emergency plan cover in detail?

6. What role do volunteers have in the emergency centers?
7. What are key demographics to monitor when designing these centers?

We initially planned to create a list of specific, key aspects of different cities' emergency centers, from information on their daily operations to detailed aspects of their design. This proved difficult because of the decentralized, scattered nature of the information involved. Many cities had limited information available on their emergency plans, keeping their public information on a "need-to-know" basis; the only records available were public PSAs for their residents about preparing their home for emergencies. Other municipalities were more forthcoming, publishing details on the implementation, activation, and management of their emergency centers; we focused on these highly descriptive plans and looked for commonalities in how the centers operated. We tracked and compiled the information available to us in the city matrix.

3.2: Understand the Specific Needs of Eilat's Community

We focused on three main features of Eilat's community: existing emergency programs, vulnerable groups in the city, and potential resources for the new resiliency centers. Understanding these features helped us assess the state of Eilat's current emergency preparedness, identify areas that needed the most support from the centers, and determine potential resources to provide support. In addition to reviewing literature on the city's existing climate resiliency plan provided by our sponsors, we interviewed key stakeholders and community leaders within Eilat. A semi-structured interview was used due to limited prior information about interviewees. Interview questions were developed based on the following research questions:

1. What are the different communities in Eilat? What are their needs and conditions?
2. What is the current emergency plan within Eilat? Who is responsible for operating it?
3. Which are the emergencies the community is most concerned about?

We used these research questions to develop questions specific to each interviewee's position and responsibilities within Eilat's community. Interviewees included a project manager for the Environmental Unit, city planner, the head of education system, head safety officer, and a researcher with many years of experience of assessing Eilat's social climate; for more details and a full list of interviewees, see Table 1. We conducted interviews virtually using Zoom and recorded them with the interviewees' consent (seen in Appendix B); this allowed us to revisit the interviews throughout our project as we developed our recommendations. Recording these interviews also ensured that all group members were able to watch and review the conversations, as time zone differences prevented remote group members at their respective homes from attending interviews in real-time. The questions used in these interviews can be located in Appendix C.

Table 1: Eilat Interviewee Information

Interviewee Position	Interviewee Name	Interview Content
Environmental Unit Project Manager	Avi Naim	Emergency plans and RiskPACC
MDA National Director	Chaim Rafalowski	EMT service through MDA, volunteers
Foreign Population Researcher	Anonymous - Omitted name from study due to potential political impacts on reputation.	Vulnerable communities within Eilat, social tensions with immigrants
City Planner	Myril Lew	City Layout Neighborhood locations
Business Coordinator	Marlen Rosenfeld	Businesses within Eilat
City Safety Officer	Ilan Hadida	Existing emergency plans within Eilat
Education Head	Dr. Drori Ganiel	Youth Involvement Insights

By ensuring that both government officials and residents had their perspectives represented, we were able to build a more holistic understanding of Eilat and the relationships between different communities within the city.

We attempted to incorporate both a top-down and bottom-up approach into our interview process. Our top-down analysis focused on community leaders in the city, including Eilat's city planner, city safety officer, and education head. The bottom-up analysis focused on average or disadvantaged Eilat citizens, including an interview with a researcher of Eilat's foreign documented and undocumented communities

3.3: Adapt Existing Expertise to Eilat's Specific Circumstances

Our third objective in this project was to develop recommendations for the City of Eilat on the staffing, equipment, and logistics of emergency resiliency centers using information collected from objective one and two. We analyzed the benefits and disadvantages of implementing different emergency center activation methods and management structures, as well as different volunteer training methods in Eilat based on the city's current resources; we also determined which practices may be difficult to implement in Eilat due to scale, resources, or social factors. We aimed to answer the following questions while developing these recommendations:

1. Which disasters /emergencies should Eilat's centers prepare for?
2. How should Eilat's resiliency centers operate normally, and how should they activate into full emergency centers?
3. How should Eilat's centers be staffed?
4. What populations in Eilat will need the most support from the centers, and how should the centers provide that support?

Chapter 4: Findings and Analysis

Through an evaluation of our collected data, we made several discoveries about the state of Eilat's disaster preparedness and emergency resiliency. This chapter gives an overview of the current risks facing Eilat's community. We then assess Eilat's current programs for emergency preparation and response, using evidence from our interviews to identify successful and unsuccessful aspects of these programs. We investigate how other cities have implemented emergency centers and

4.1 Risks to Eilat's Community

While researching how other cities created plans to combat these disasters, a risk analysis matrix was created with each disaster and the services with the most impact to them as seen in Appendix A. This highlights the most prominent disasters and the services that best suit the disaster based on evidence from other cities' plans for that disaster. The most prominent disasters to Eilat are heat waves, earthquakes, floods, storms, power outages, and droughts; these pose a serious threat to the Eilat community. We spoke to Avi Naim, a member of the Environmental Unit who works on the RiskPACC project. The RISKPACC project covers disaster resiliency projects throughout the EU and Middle East. Countries in this project took responsibility for different disasters; Eilat being responsible for Earthquake preparedness (RiskPACC, 2022). The first objective was to interview the community on their perception of emergency preparedness. The results from this questionnaire can be seen in Appendix D. We found that citizens do not feel prepared for emergencies; there is a concern on preparation for an emergency and notification for when preparation is important. In a survey done, only 55% of the surveyed population felt that they are certain that they and their related family know how to handle emergency situations at home (RiskPACC, 2022).

Some demographics are considered in Eilat's disaster response plan while others will only be provided reactionary measures the same as other residents. The vulnerable populations within Eilat consist of the elderly population, mentally ill, children, tourists, and immigrants. (foreign population researcher, personal communication, February 17th, 2022) (Becken, S., & Hughey, K. F. D., 2012). These groups are of higher risk during emergencies due to additional services they require either medically or socially, lack of knowledge during emergencies, or lack of knowledge of the city (Centers for Disease Control and Prevention, 2015). The elderly population requires medical attention during emergencies since they have more chronic illnesses and limited mobility. Tourists are at increased risk during emergencies as well; they lack knowledge of the region and have cultural barriers between them and the residential population being at a higher risk during emergencies than the rest of the population (Becken, S., & Hughey, K. F. D., 2012). In an interview with a foreign population researcher, we found that working with foreign populations can be difficult throughout emergencies. Since not all the foreign workers are legal citizens, they fear government services since they are unsure how they will be treated.

Children in these communities will also often be left at home for extended periods of time while adults work long shifts in the tourism sector in Eilat. Remaining prejudice towards some of these communities may also cause challenges in assisting Eilat's population (foreign population researcher, personal communication, February 17th, 2022). The social landscape of Eilat is sensitive, complex, and unique, so there exists a struggle to have egalitarian preparation for all communities.

4.2 Existing structures within Eilat

Within Eilat, there are plans in place for some disasters. Although Eilat hasn't had an earthquake in over 25 years, the city is actively preparing (I. Hadida, personal communication, February 23, 2022). There is a plan in place led by the Safety Officer for Eilat for earthquakes, toxic spills, terror attacks, tropical storms, and floods. Although plans could not be fully disclosed, general insight on the plan was provided. There are areas that have been allocated within the city for community members to congregate to during earthquakes. These fields are in a central location and will provide medical services amongst other amenities. For flooding, it is planned that tourists go to the second floor of the hotels to avoid the rushing water. There are currently no plans for an extreme heat situation (I. Hadida, personal communication, February 23, 2022).

A strong volunteering presence exists in Eilat. A semi-structured interview with the Eilat head of education found that approximately 60% of Eilat's youth 10-18 is active in community service (D. Ganiel, personal communication, February 21, 2022). Many volunteer groups also exist for the explicit purpose of community relief to disasters, and many individuals also rise to the task in disaster situations. Though there is a problem with lack of centralized leadership / training for all these volunteering entities (I. Hadida, personal communication, February 22, 2022).

There is a strong community volunteering presence around Magen David Adom (MDA) which is the emergency prehospital medical care service in the community (Magen David Adom of Israel [MDA], 2022) (I. Hadida, personal communication, February 23, 2022). MDA provides treatment regardless of ethnicity, race, or political or religious affiliation within the country. Throughout Israel, there are over 26,000 participants, 14000 of them being between 15-18 years old and the other 12,000 adults within 18-75 years of age (MDA, 2022). They mainly recruit youth by word of mouth and the snowball effect of a person getting a friend involved and the repeated effect. This is perceived as a popular activity among Eilat's young adults and waitlists are common to join. (C. Rafalowski, personal communication, February 22, 2022) These individuals are useful for assembling volunteers for the emergency resiliency centers, as formally trained MDA volunteers will prove useful for providing medical triage.

4.3 Emergency Resiliency Centers

This section covers information found from the city comparison matrix. Here we cover information found on how centers are implemented, activated, and managed, including the benefits and disadvantages of applying these concepts to Eilat.

4.3.1 Implementation of Emergency Centers

Through our literature review and interviews with Eilat officials, we identified several key considerations for the implementation of emergency centers. One primary concern is location; the characteristics of the buildings housing a city's emergency centers can either assist or impede the delivery of emergency services to a community. According to the World Health Organization, if the building housing an emergency center is not designed to hold a large number of people, then it can quickly become overwhelmed and overcrowded during an emergency (2012). Meanwhile, large buildings like stadiums and convention centers can house thousands of residents if needed (Nigg et al., 2006). Buildings in isolated, safe locations, far from potential threats, are the safest places to be during an emergency. Buildings on unstable ground, in floodplains, surrounded by hazardous material, or in the path of flying debris are dangerous and less likely to be visited by residents (WHO, 2012).

Eilat currently plans to use an old airport near the tourism sector as a resiliency center. Like the stadiums, this building is designed to hold a large volume of people and is unlikely to be overcrowded during a crisis. Its location also has benefits: its proximity to the city's hotels will provide easy access to tourists, who might struggle with traveling long distances in a foreign city during a crisis. However, the airport also sits in the basin of the Nahal Yotom and several other streams, placing the building at risk of flooding (Municipality of Eilat, n.d.). This decreases the building's overall safety, making access during a flood difficult and increasing the risk of the center becoming the site of an emergency (WHO, 2012). We were unable to assess the other buildings currently being considered for center placement but are unaware of other planned center locations in flooding-intensive areas.

Another important consideration is what amenities and services should be provided. Typically, emergency centers keep a stock of food, water, and medical supplies in preparation for a disaster. Amenities like electricity, however, cannot be saved up to be used during an emergency; centers cannot have reliable access to electricity if they are designed without independent electrical infrastructure in mind. According to the Institute for National Security Studies, Israel's electrical grid is unprepared for a variety of emergencies; although the grid is somewhat resistant to earthquakes, events like heat waves or floods pose a massive threat to Israel's electrical infrastructure (Weinstock et al, 2017). The Eilat Municipal Environmental Unit plans to have the resiliency centers power themselves through renewable energy, which will

reduce the centers' dependence on the country's comparatively fragile electrical grid while reducing the city's carbon emissions (Municipality of Eilat, n.d.).

We found that the other services and amenities provided by emergency resiliency centers varied wildly between cities. They were also highly dependent on the type of building used as a center; these included churches, museums, rec centers, schools, and swimming pools (City of Charleston, 2021)(Miami-Dade County, 2017)(City of Chico, California, 2019). Outside of meeting the basic needs outlined in the Service Matrix in Appendix A, centers in other cities did not share any auxiliary services outside of an emergency.

4.3.2 Emergency Center Activation Plans

Many resilience centers operate based on if an emergency is underway or not, this is known as binary or two-phase activation. These centers have emergency plans set in place and activate them based on whether an emergency situation is present. Two phase activation is more popular with emergencies like heat waves where the plan consists of opening cooling centers and providing medical relief to community members (Arizona Heat Safety Resource Guide, 2014). Drawbacks to this type of planning are that shelters need to always be prepared and ready for activation. Ensuring a constant state of preparedness for activation is not always feasible or realistic.

A three-phase activation plan is a method of activating emergency centers through separate phases spread out over an interval of time. Using three different phases allows centers to open at a slower pace. Three phase activation plans vary in two different practices found: plans for long term and short term. A short term three phase activation can be seen in Los Angeles and Miami-Dade County Emergency preparedness plans seen in Appendix E (City of Los Angeles, Emergency Operations Plan, 2018)(Miami-Dade County, Florida Comprehensive Emergency Management Plan [CEMP], 2017). The short-term plans are phased by intensity of emergencies after activation. The three-phased short-term plan consists of: 1) minor localized incident, 2) moderate incident, 3) major city/regional incident. This activation plan is effective because not every department is activated until needed. Only activating once needed reduces wasted time and resources. This is common in larger cities with more immediate resources and centers.

A long term three phase plan is slowly developed over a longer period of preparation prior to activation. The phases of three phase activation includes 1) Seasonal monitoring for potential disasters, 2) Alert and preparation, 3) Full activation of the emergency center. Chico's three-phased plan benefits the city in that emergency staff begin preparation long before an extreme heat event is forecasted (City of Chico, 2019). Due to Eilat's periodic seasons of extreme heat waves followed by extreme flooding and precipitation, a long-term three phase activation could keep the centers prepared long before an emergency. A long-term plan also gives time to budget and slowly accumulate resources and staffing.

4.3.3 Allocating Community Members to Centers

Two models were found for allocating staffing and resources through a study for FEMA disaster recovery centers (DRCs). The Jurisdiction Model creates an estimation for the minimum visitor demand threshold for the county. The minimum threshold for opening a DRC, the staffing requirements per expected visitor, and the expected demand can be determined with this model. This in-depth breakdown for this model can be found in Appendix F. The Jurisdiction Model is based on county lines. The quantities needed are determined based on recent emergency shelter operations and policies. This model can be applied for adequately displacing neighborhoods to centers and the number of DRCs to open per disaster. The second model is a Time Travel Model. This model differs from the Jurisdiction Model because jurisdiction lines are ignored and there's no minimum threshold. This model determines the DRC locations based on the time it takes a visitor to get to the center. It is expected that the centers can serve every expected visitor. A deeper explanation of this model can be seen in Appendix F. This model is useful in times where emergencies happen rapidly such as an earthquake or flash flooding. In Chicago, an area prone to flooding, was able to calculate staffing and DRC needs based off of previous data and used it in future applications. These models could benefit Eilat in allocating the citizens. The negative side to these models is that they are inexact estimations that require significant data.

Another method to direct citizens is to design certain centers for specific populations. Washington, D.C. allocated specific centers for senior citizens without air conditioning due to their additional medical needs. Although they were welcome in other centers, senior citizens were encouraged to attend these centers so that their additional needs could be taken care of there (District of Columbia Heat Emergency Plan, 2021). In addition to the senior citizens, attention to the homeless population was included in their plan as well. Centers such as homeless shelters and other organizations were promoted to the homeless population. The incentive for the homeless to attend these centers included essential survival provisions for them including clothing, food, water, and access to air conditioning (District of Columbia Heat Emergency Plan, 2021). In a study evaluating the compliance of people during hurricanes in Mexico, people were given options for safety in which they could follow the evacuation plan or find relief in a shelter of their choice. When given a decision that fit them, participants were found to be more compliant during an emergency (Atalay, 2020). This distribution of different vulnerability groups can help centers operate smoother. During times of disasters, when tensions/anxiety is already high, allowing people to go to the center of their choosing may make people more willing to go to the centers. Reaching capacity could become a problem if there is no direction for which centers to attend.

4.3.4 Management Structures

We assessed different practices for organizing emergency centers and the leadership managing them, and identified two main forms of management: split model management and branch model management that can be seen in Appendix G. Within the split model, there exists

one main center manager with two assistant managers below. One assistant is responsible for the upfront, day to day facility operations once activated and the other is responsible for the long term, logistical needs prior to activation and operation of the facility (OFDA, 2005)(City of Los Angeles, 2018). Underneath each assistant is coordinators for various services the center provides including the registrar for patron intake, cooks, general storekeepers, secretaries for finance and planning, medical care, drivers, and sanitation services (OFDA, 2005)(City of Los Angeles, 2018). This model allows for more delegation and assistance. It disperses the responsibilities over a range of people but there is limited communication from the lower level coordinators to the main center manager due to the chain of operations.

The other model found was the branch model approach. Within this model, there is one main center manager with individual chair positions for departments within the centers such as finance, infrastructural and service affairs, coordination, medical services, food preparation, and others (Bashawri, 2017). This model has direct communication to the center manager but also places the majority of the responsibility to them. There is little communication between branches due to the single manager balancing operations. Organization and coordination between branches are extremely difficult to have within this model.

4.4 Volunteer Emergency Response Teams

Our review of various emergency plans revealed that volunteer disaster response teams provide an effective method of dealing with local emergencies; they also significantly ease the workload of first responders during a crisis. We found that the most prominent provider of information and training resources for volunteer responders was CERT training facilitated through FEMA in the United States (FEMA, n.d.). FEMA publishes a large volume of training material for its programs, and its curricula have proved effective in multiple countries; Canada, Brazil, New Zealand, Georgia, the Philippines, and the British Virgin Islands have all used FEMA's curricula in the development of their own CERT teams (Los Angeles City CERT, 2022). We also discovered that within Israel, the small "Bar-Sam" communal settlement introduced a CERT-based program between 2010 and 2013 where teen volunteers were trained using FEMA's protocols; however, we found no literature indicating that CERT programming has been used in larger Israeli cities like Eilat (Miriam & Friedman, 2017).

Through our interviews, we discovered that Eilat does have existing volunteer-based response programs, including fire rescue services and the MDA; however, these community organizations are highly decentralized and do not often communicate with one another (C. Rafalowski, personal communication, February 22, 2022)(I. Hadida, personal communication, 2022). In comparison, CERT training is more centralized, training its volunteers in fire safety, emergency medical services, search and rescue, and other forms of basic disaster response (FEMA, 2021).

4.4.1 Youth-Specific Volunteer Programs

We found that while communities with limited funding and resources had one general CERT program, cities with the resources to do so often offered specialized programs aimed at youth volunteers. Teen and Campus CERT programs were present in Miami, Houston, Phoenix, and Washington, D.C.; these programs tended to receive more positive press, and locals within the community were more likely to view them positively (Slutsky, 2015)(Teen SERT, 2004)(Hall, n.d.). Receiving disaster response training at a younger age benefits both the community and the trainee. Teens who received CERT training were more likely to report feeling connected to their community; these effects are especially beneficial in cities like Eilat, where the large transient population is less likely to feel like part of the city's community (Miriam & Friedman, 2017). Youth CERT volunteers report increased feelings of altruism and self-efficacy and are more likely to pursue careers in public service or emergency response (Miller et al., 2016).

Compared to existing youth volunteer services in Israel, Miriam & Friedman found that trainees in youth CERT programs are more adaptable and autonomous. Existing programs in Eilat like the MDA and fire rescue services have their youth volunteers fill predetermined roles and follow the orders of professional emergency responders. Meanwhile, although youths in Teen CERT programs still receive guidance from professional responders, trainees are also encouraged to fill a more active role in the disaster response process, taking part in general discussions and decision-making with professional emergency staff (Miriam & Friedman, 2017).

The main risk associated with implementing programs like Teen CERT is the possibility of endangering young volunteers. Emergency response workers operate in high-stake, extremely stressful situations, and young volunteers' lack of life experience can leave them unable to psychologically handle the job (Cull, 2019). To decrease the risk of psychological damage and ensure volunteers can operate calmly in a crisis, Teen CERT programs in Phoenix include periodic check-ins to ensure trainees are completely comfortable with the program before they are sent into the field or exposed to the psychologically damaging aspects of emergency response work (Slutsky, 2015). Additionally, trainees under the age of majority require parental consent in order to participate in CERT training. In the Bar-Sam communal settlement, teen CERT recruiters screened potential volunteers for mental and emotional maturity in order to mitigate the risk of causing psychological harm to minors during emergency response training (Miriam & Friedman, 2017).

Another challenge in implementing youth-based CERT programs is the attitude of professional emergency workers, who can respond negatively to the presence of teenage volunteers in their workplace. The Bar-Sam settlement initially reported pushback when it implemented its youth CERT program; adult emergency workers did not think the teens would be able to handle the pressure of disaster relief work, and reported not wanting the program to be geared towards adolescents. However, these feelings subsided after a few weeks as the professional responders acclimated to the presence of the new recruits. By the end of the study,

the professional responders were enthusiastic supporters of the program, reporting that the youth volunteers brought a fresh perspective and new ideas to the job (Miriam & Friedman, 2017).

4.4.2 Different Communities Benefit from Different Volunteer Training

Our interviews and research into CERT programs indicated that FEMA's provided CERT training covers many of the disasters for which Eilat is at risk. FEMA's documentation includes curricula for training instructors and volunteers for CERT, Teen CERT, and Campus CERT programs; the training is intended to remain uniform across different communities throughout the United States, with communities implementing additional modules on a local scale to tailor the program to their specific community needs (FEMA, 2021). The required units for CERT training are shown in Table 4.

Table 4: CERT Training Unit Descriptions (FEMA, 2021).

Unit #	Unit Title	Contents of Training
1	Disaster Preparedness	Roles and Responsibilities for Community Preparedness: How everyone in a community has a role in disaster preparedness. Role of CERTs: CERT organization, disaster and non-disaster roles, and laws that protect disaster workers from liability. Elements of Disasters and Their Impact on Infrastructure: The potential effects of extreme emergencies and disasters on electrical service; emergency services; telephone communication; transportation; and availability of food, water, shelter, and fuel. Personal and Organizational Preparedness; How volunteers can prepare in advance to improve the quality of their survival and to reduce the damage from hazards.
2	CERT Organization	CERT Organization: How to organize and deploy a CERT team, including organizational principles and proper use of CERT resources. CERT Size-up: How to conduct the continual data-gathering and evaluation process at the scene of a disaster or emergency.

		Rescuer Safety: How volunteers can protect their own safety (and their partner's safety) during search and rescue. Documentation: Strategies for documenting situation and resource status during emergency response.
3	Disaster Medical Operations - Part I	Functions of Disaster Medical Operations: AN assessment of disaster medical operations' major functions. Disaster Medical Treatment Areas: Types of medical treatment areas. Public Health Considerations: How to maintain hygiene and sanitation during emergency response.
4	Disaster Medical Operations - Part 2	Assisting Disaster Medical Operations: How to assist by controlling bleeding, and maintaining normal body temperature, among other basic medical procedures. Mass Casualty Incidents: How to assist first responders in responding to mass casualty incidents. Head-to-Toe Assessment: How to perform a head-to-toe assessment to identify and treat injuries.
5	Disaster Psychology	Disaster Psychology: The psychological impact a disaster has on rescuers and survivors, and lessons on providing components of "psychological first aid." Caring for Yourself and Survivors: Steps volunteers can take individually and as part of a CERT before, following, and after a disaster.
6	Fire Safety and Utility Controls	Fire Chemistry: How fire occurs, classes of fire, and choosing the correct means to extinguish each type of fire. Fire Size-up Considerations: How to evaluate fires, assess firefighting resources and determine a course of action. Portable Fire Extinguishers: How to identify types of portable fire extinguishers and how to operate them.

		Fire Suppression Safety: How to decide if you should attempt to extinguish a fire; how to approach and extinguish a fire safely. Fire and Utility Hazards: How to identify potential fire and utility hazards in the home and workplace; how to implement successful fire prevention strategies.
7	Light Search and Rescue Operations	Search and Rescue Size-up: How to size up the situation in which the search and rescue teams will operate. Conducting Interior and Exterior Search Operations: How to search systematically for disaster survivors. Conducting Rescue Operations: Safe techniques for lifting, leveraging, cribbing, and survivor removal.
8	Terrorism and CERT	Terrorism: Defining terrorism, including the goals and tactics of some terrorist groups, and detailing how to respond when an active shooter is in your vicinity. Eight Signs of Terrorism: The eight signs of terrorism and how to report suspicious activity. Preparing for Your Neighborhood: Steps to take to be prepared at home, work, and in your neighborhood. Hazardous Materials (HazMat) and Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE): Identifying some basic guidelines during a Hazmat or CBRNE event.
9	Course Review, Final Exam and Disaster Simulation	Review: Volunteers will review the key points from the course, complete a final exam, and complete a final exercise of a simulated disaster.

To adapt a CERT program to a specific community, FEMA recommends the implementation of other emergency response training, including optional modules in the following: advanced first-aid, community relations, animal issues in disasters, Automated External Defibrillator (AED) use, shelter management, special needs concerns, donations management, utilities control, debris removal and crowd control (FEMA, 2021). While the

additional medical training units could give volunteers a wider understanding of medical procedures, we found that many of these skills overlap with existing training given to volunteers with Eilat's emergency medical services through MDA (C. Rafalowski, personal communication, February 22, 2022). The unit in shelter management would give Eilat's community a better understanding of the emergency resiliency centers as they are implemented; volunteers who complete this training would become a viable pool of potential staff members for the resiliency centers.

Even with the option to include additional modules, a drawback to the standardized CERT Basic Training used in the U.S. lessens the adaptability of CERT teams to their particular community; some communities are forced to deliver redundant or unnecessary training because FEMA requires all 9 units to formally recognize a CERT team. Because our recommendations concern an international variation on the curriculum, Eilat can change or remove the basic units as needed, reframing the training in terms more relevant to Israeli communities; for instance, since the risk of fire in Eilat is extremely low compared to other locations, the municipality could change out Unit 6 for a mandatory unit on flash flooding (Municipality of Eilat, n.d.). Another drawback to using the CERT Basic Training curriculum is that because FEMA is a division of the U.S. Department of Homeland Security, the standard CERT curriculum might be unacceptable in communities that are not politically or ideologically aligned with the United States. Problems arose in our research when we started assessing Unit 8 of CERT training, which deals with the Department of Homeland Security's guidance in responding to acts of terrorism (FEMA, 2021). Our project group is aware that as Americans, we lack the cultural and political understanding to provide recommendations to Middle Eastern communities living under the chronic threat of terrorism; for this reason, we chose not to make recommendations on the inclusion, adaptation, or exclusion of this unit.

Chapter 5: Conclusions and Recommendations:

This chapter provides our recommendations for improving disaster preparedness in Eilat. Through our interviews in Eilat, we gained a deeper understanding of both the risks facing the city and vulnerabilities in the Eilat's existing disaster mitigation framework. We analyzed these weaknesses, along with solutions implemented in other municipalities, and provide recommendations for practical improvements in this chapter. We believe that our recommendations can increase Eilat's emergency preparedness and public awareness of disaster mitigation. This chapter also includes suggestions for future work as Eilat continues to improve its community resilience.

The Eilat Municipality Environmental Unit should implement a three-phase activation plan for its resiliency centers.

Three phase activation allows for more preparedness in emergency centers. Contrary to binary activation plans which are either operating or not, three phase activation creates levels of activation. We recommend a long term three phase activation plan due to Eilat's specific climate emergencies. Since heat waves are prominent throughout the long, warm summers in Eilat along with the wet winters consisting of storms and flash floods, keeping these centers ready for activation will keep the city ready at all times for a disaster. There are common services that both seasonal emergencies require so the centers can provide those year-round. These long-term activation plans allow allocation of resources and staffing over a long period of time versus trying to allocate them immediately before an emergency.

While short-term, three-phase activation protocols have the advantage of providing resources and services as needed during an emergency, they do not allow for the long-term preparation Eilat will need moving forward. Budgeting the city's resources over an extended period of time also allows for a more cost-effective method of emergency preparedness. Instead of spending the municipality's emergency budget in a short period of time to prepare for an emergency, the costs can be spread out over the lengthier activation phases. This plan also allows for alerts to be sent out more in advance of emergencies and can better prepare the citizens with risk reduction practices.

The city of Eilat should direct members of vulnerable populations to specially allocated and equipped resiliency centers for them.

Eilat contains a diverse population consisting of certain vulnerable communities. These communities pose adversities in operating and managing emergency centers. Some members of these communities have additional needs such as medical care, mobility, situational awareness, and social tensions. We recommend directing certain populations to designated centers. They

will not be limited to these designated centers but attending to them will be easier if their needs can be taken care of in an additional service at the center. Primarily, we suggest providing a designated center for elderly, foreign immigrants/refugees and tourists.

The city should adapt a split management model for emergency center operations and services.

Management hierarchies help centers disperse responsibilities over a group of people versus one person managing the entire center. We recommend that Eilat consider using a split management model for operation of the center. This includes one main center manager to oversee all operations with two assistant managers: one assistant manager to handle long term logistical needs prior to emergencies such as communication/alerts, maintenance of the facility, security, and early phase activation; and another assistant manager to handle the day to day operations such storekeeping, food services, social activities, and general operation. Administrative staff are also recommended for finance positions, secretaries, nurses, janitors/cleaning services, and drivers for disasters. This system, in partnership with other city departments such as emergency services and public information offices, will allow for a smooth transition into activating and operating the centers.

Eilat should implement a volunteer CERT program for its citizens, including a youth-specific program.

In addition to functional community resiliency centers, Eilat has a need for increased community awareness about disaster preparedness. We discovered that many Eilat citizens lack an understanding of what to do during an emergency situation, and the community feels unprepared for dealing with natural disasters. To address this problem, we recommend the implementation of community emergency response teams within the city, including a specialized program aimed at recruiting youth volunteers. CERT training increases community disaster preparedness and increases citizens' feelings of autonomy and preparedness in emergency situations. Eilat's highly-involved youth population is a valuable resource to increase community resilience and will have long-term benefits to both the city and trainees.

Eilat should adapt or use FEMA's CERT training curriculum for instructing community volunteers.

While Eilat has implemented community programs for earthquake preparedness, it requires additional programming to train volunteers in responding to other types of natural disasters. The interdepartmental training used by this CERT program will help to centralize the community's efforts to increase emergency resiliency. We found that the most detailed and

commonly-used emergency training curriculum was produced by FEMA as part of their CERT training program; we recommend that Eilat use some variation of the CERT Basic Training curriculum in order to build community disaster preparedness. The units covered in FEMA's basic training program are designed to provide a comprehensive, accessible introduction to basic disaster response, and the curriculum has been successfully adapted to thousands of communities within and without the United States. We also recommend the addition of shelter management training, which will help integrate Eilat's resiliency centers into the community and provide a pool of potential staff for the centers. Additional training could be introduced as trainee's needs are assessed, and their weaknesses identified, by Eilat's professional emergency responders.

Eilat should increase communication between its various emergency response departments.

Although Eilat has several effective emergency response departments, the city requires more effective communication between these departments. Facilitating better lines of communication between Eilat's MDA, fire rescue services, and other disaster response resources will increase the city's emergency resiliency while reducing redundancy in its operations. Because CERT programs require instructors from several departments to train volunteers, it is likely that implementing a CERT program will marginally increase interdepartmental communication; however, we recommend the city explore additional systems for improving these lines of communication. Future research could explore the efficacy of these programs, including their ease of implementation and potential to improve Eilat's interdepartmental collaboration.

Future Work

During our work in Eilat, we discovered challenges facing the municipality that were outside the scope or scale of this project. We were not able to fully address all aspects of Eilat's emergency preparedness infrastructure, nor did we have time to interview certain stakeholders who may have provided insight into our project. We believe these challenges could be addressed through future social science research.

The municipality could benefit from improving its interdepartmental communication practices to reduce redundancy in its emergency response infrastructure; Eilat's existing emergency response infrastructure is highly decentralized, split between many departments with little communication between them. We have found that implementing a CERT program may help develop lines of communication because of the interdepartmental training involved in the program; however, there is still much to learn about how Eilat can improve communication between different branches of its emergency infrastructure. Other work could explore how Eilat can improve its public communication of emergency practices to its residents.

Due to time constraints, we were unable to explore the role of Eilat's businesses in the city's disaster relief programming. As well as further information on volunteerism within Eilat through the head of volunteers and Jewish Community Center. Further work on the assessment of the immigrant and foreign population can be found through contact lists with Ilan.

Conclusion

The goal of this project was to identify best practices for implementing community resources for city-wide emergencies for the Eilat Municipality Environmental Unit. The effort to properly prepare for serving Eilat's community amidst worsening risks for disasters due to climate change is ongoing. Our main contribution to this effort was centralizing Eilat's robust volunteer force to mobilize community resiliency centers in response to disasters. These recommendations will reduce program redundancy and provide a clearer disaster response plan for citizens by word of mouth. This will be beneficial to Eilat's community who live within a diverse social and geographic environment that needs appropriate measures.

References

Alon, A. (2019, January 22). Unable to afford heating, Israel's elderly freeze in winter. Ynetnews. https://www.ynetnews.com/articles/0,7340,L-5450382,00.html

American Red Cross. (2022). *Disaster Action Team*. Red Cross. https://www.redcross.org/volunteer/disaster-action-team.html

Anna Lindh Foundation. (2020). *Eilat Municipality Environmental Unit*. Euromed. https://www.annalindhfoundation.org/members/eilat-eilot-environmental-unit

Atalay, A. S., & Meloy, M. G. (2020). Improving evacuation compliance through control: Implications for emergency management policy and disaster communications. *Journal of Nonprofit & Public Sector Marketing*, *32*(4), 364–378. https://doi.org/10.1080/10495142.2020.1798855

Bashawri , A. M. A. (2019, May). *An emergency relief shelter response ... - core.ac.uk*. AN EMERGENCY RELIEF SHELTER RESPONSE FRAMEWORK FOR FLASH FLOODS IN SAUDI ARABIA. Retrieved February 22, 2022, from https://core.ac.uk/display/200759271

Becken, S., & Hughey, K. F. D. (2012, December 25). *Linking tourism into emergency management structures to enhance disaster risk reduction*. Tourism Management. Retrieved February 23, 2022, from https://www.sciencedirect.com/science/article/pii/S0261517712002063

Berman, L., & STAFF, T. O. I. (2022, January 16). *Residents stranded as torrential rains flood roads, cut off neighborhoods*. The Times of Israel. Retrieved February 17, 2022, from https://www.timesofisrael.com/residents-stranded-as-torrential-rains-flood-roads-cut-off-

neighborhoods/

Bob, Y. (2021, June 30). Israel suffers from deficiencies in how it handles floods - Comptroller. The Jerusalem Post. https://www.jpost.com/israel-news/israel-suffers-from-deficiencies-in-how-it-handles-floods-comptroller-672459

Center for Disease Control and Prevention. (2015). *Planning for an Emergency: Strategies for Identifying and Engaging At-Risk Groups* . Planning for an Emergency: Strategies for Identifying and Engaging At-Risk Groups. Retrieved February 22, 2022, from https://cdn.ymaws.com/www.cste.org/resource/resmgr/DisasterEpi/Nicole_Nakata.pdf

City of Charleston. (2021, August 12). *City wide cooling centers now open through friday*. City of Charleston, West Virginia. https://www.charlestonwv.gov/news-items/thu-08122021-1426/cooling-centers-open

City of Chico, California . (2019). City of Chico Extreme Heat Event Preparedness Plan. Retrieved February 22, 2022, from https://www.nxterra.orfaleacenter.ucsb.edu/wp-content/uploads/2020/01/ASSIGNMENT-Cal-Adapt-in-the-Classroom-Extreme-Heat-Event-Preparedness-Plan-Stemen-2019.pdf

Denchak, M. (2019, April 10). *Flooding and climate change: Everything you need to know*. NRDC. https://www.nrdc.org/stories/flooding-and-climate-change-everything-you-need-know

Döhler , D. (2020, June 29). Could there be an Israel without air conditioning in the future? Zavit. https://www.zavit.org.il/intl/en/weather-climate/could-there-be-an-israel-without-air-conditioning-in-the-future/

Du, W., FitzGerald, G. J., Clark, M., & Hou, X. Y. (2010). Health impacts of floods. Prehospital and disaster medicine, 25(3), 265–272. https://doi.org/10.1017/s1049023x00008141

Federal Emergency Management Agency [FEMA]. (2021). *Community Emergency Response Team Dataset*. CERT Approved Programs.

FEMA. (2021). *CERT Basic Training Participant Manual*. US Department of Homeland Security. https://www.ready.gov/sites/default/files/2019.CERT_.Basic_.PM_FINAL_508c.pdf

FEMA. (n.d.). *Community Emergency Response Team*. Ready.Gov. Retrieved February 22, 2022, from https://www.ready.gov/cert

Gedalyahu, T. B. (2021, May 28). African immigrants 25 percent of S. Tel Aviv. Israel National News. https://www.israelnationalnews.com/news/156251

Geelong . (2021, December 31). *Emergency relief centres and recovery centres - city of ...* Emergency relief centres and Recovery centres. Retrieved February 17, 2022, from https://www.geelongaustralia.com.au/em/management/article/item/8cbe261e7d4b35b.aspx

Gil-Ad, H. (2021, December 29). 1 in 5 Israelis live in poverty due to lack of state assistance, report finds. Ynetnews. https://www.ynetnews.com/business/article/r1vt11ayiy

Government of the District of Columbia . (2021). 2021 District of Columbia Heat Emergency Plan. Retrieved February 22, 2022, from https://hsema.dc.gov/sites/default/files/dc/sites/hsema/page_content/District%20Heat%20Emergency%20Plan_Summer%202021.pdf

Hall, S. (n.d.). *Community Emergency Response Team policies and procedures*. Serve DC.

https://serve.dc.gov/sites/default/files/dc/sites/serve/publication/attachments/CERT_Program_Policies_Procedures.pdf

Hossain, B. (2020, November 25). *Role of organizations in preparedness and emergency response to flood disaster in Bangladesh*. SpringerOpen. Retrieved February 25, 2022, from https://geoenvironmental-disasters.springeropen.com/articles/10.1186/s40677-020-00167-7

International Building Code Council . (2019, February 19). *The International Building Code*. International Building Code. Retrieved February 26, 2022, from https://www.iccsafe.org/products-and-services/i-codes/2018-i-codes/ibc/

Jewish Virtual Library. (n.d.). *Eilat*. Jewish Virtual Library - a Project of AICE; The American-Israeli Cooperative Enterprise. Retrieved February 12, 2022, from https://www.jewishvirtuallibrary.org/eilat

Jha, A. K., Bloch, R., & Lamond, J. (2012). *Cities and flooding: A guide to integrated urban flood risk management for the 21st Century: A summary for policy makers*. World Bank.

Larkin, S., Fox-Lent, C., Eisenberg, D. A., Trump, B. D., Wallace, S., Chadderton, C., & Linkov, I. (2015, June 6). *Benchmarking agency and organizational practices in Resilience Decision Making - Environment Systems and decisions*. SpringerLink. Retrieved February 26, 2022, from https://link.springer.com/article/10.1007/s10669-015-9554-5

Los Angeles City CERT. (2022). *International CERT*. City of Los Angeles. https://www.cert-la.com/cert-programs-information/international-cert/

Los Angeles Emergency Management Department . (2021). *Beat the heat*. Beat the Heat | Emergency Management Department. Retrieved February 19, 2022, from https://emergency.lacity.org/la-responds/beat-heat

Magen David Adom of Israel (MDA) . (n.d.). *MDA Overseas Volunteers Program*. Mdais.org. Retrieved February 22, 2022, from https://www.mdais.org/en/volunteers

Meischke, H. W., Calhoun, R. E., Yip, M. P., Tu, S. P., & Painter, I. S. (2013). The effect of language barriers on dispatching EMS response. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors*, *17*(4), 475–480. https://doi.org/10.3109/10903127.2013.811565

Miami-Dade County. (2017, November). Miami-Dade County, Florida Comprehensive Emergency Management Plan (CEMP). Retrieved February 22, 2022, from https://www.miamidade.gov/fire/library/OEM/CEMP.pdf

Miller, A., Clery, S., Richardson, S., & Toffer, A. (2016, December). *Promising practices for increasing diversity among first responders*. U.S. Department of Labor. https://www.dol.gov/sites/dolgov/files/OASP/legacy/files/FirstResponders_Full_Report.pdf

Ministry of Environmental Protection. (2020, May 31). *Natl Monitoring Reveals Damage from Eilat Storm in March 2020: Percentage of Coral Living in Reef is Down Significantly; Algal Blooms May Delay Coral Rehabilitation* . Ministry of Environmental Protection. https://www.gov.il/en/departments/news/storm_in_eilat_032020_damaged_coral_reef_reserve

Ministry of Tourism . (2019, January). *Israel's Tourism Industry 2018 annual summary*. Israel's

Tourism Industry – 2018 Annual Summary. Retrieved February 25, 2022, from https://motwebmediastg01.blob.core.windows.net/nop-attachment/9153_2018%20Summary.pdf

Miriam, B., & Friedman, N. (2017). Integrating volunteering youth in a community emergency response team (CERT) as a driver of communal change and empowerment: A case study of the "Bar-Sam" communal settlement / שילוב בני נוער מתנדבים בצוות חירום יישובי (צח"י) כתהליך לשינוי והעצמה קהילתית - חקר מקרה ביישוב בר-שם. *Social Issues in Israel / סוגיות חברתיות בישראל*, *29*(23), 62–90. https://doi.org/10.2307/27058869

Morel, B., & Linkov, I. (2006). *Environmental security and environmental management the role of risk assessment*. Springer.

National Center for Disaster Preparedness. Earth Institute. Columbia University . (2021, August). *Best Practices Checklist for Emergency Shelters* . Best Practices for Emergency Shelters . Retrieved February 18, 2022, from https://rcrctoolbox.org/wp-content/uploads/2018/05/Best-Practices-Checklist-for-Emergency-Shelters.pdf

National Institute for Occupational Safety and Health. (2020, November 13). *Heat stress related illness*. Workplace Safety and Health Topics; National Institute for Occupational Safety and Health. https://www.cdc.gov/niosh/topics/heatstress/heatrelillness.html

Nigg, Joanne & Barnshaw, John & Torres, Manuel. (2006). Hurricane Katrina and the Flooding of New Orleans: Emergent Issues in Sheltering and Temporary Housing. Annals of The American Academy of Political and Social Science - ANN AMER ACAD POLIT SOC SCI. 604. 113-128. 10.1177/0002716205285889.

Office of Foreign Disaster Assistance [OFDA]. (2005). Shelters and Shelter Management

Reference Guide (Vol. 1.4), 2050.

Pe'er, G. (2000, October). *Climate Change Israel National Report under The United Nations Framework Convention on Climate Change. Impact, Vulnerability and Adaptation*. Effect of future climate change in Israel: Retrieved February 17, 2022, from https://www.bgu.ac.il/bidr/rio/Global91-editedfinal.html

Price, C. (2020, October 29). *Climate Change and Israels National Security* . The Institute for National Security Studies . Retrieved February 18, 2022, from https://www.inss.org.il/publication/climate-change-and-israel/

RiskPacc. (n.d.). About RiskPACC. Retrieved February 22, 2022, from https://www.riskpacc.eu/about-riskpacc/

Schuster, R. (2019). Israel Is Hundreds of Years Overdue for a Massive Earthquake . Haaretz. https://www.haaretz.com/israel-news/.premium.MAGAZINE-southern-israel-is-hundreds-of-years-overdue-for-an-earthquake-1.6933565

Slutsky, A. (2015, November 9). *Emergency Management shares similarities internationally*. Department of Emergency and Military Affairs. https://dema.az.gov/node/638

Surkes, S. (2020, May 31). *Extreme March storms wreaked vast damage on Eilat's coral reefs, study finds*. Times of Israel. https://www.timesofisrael.com/extreme-march-storms-wreaked-vast-damage-on-eilats-coral-reefs-study-finds/

Teen SERT. (2004). *About CERT and Teen CERT*. CERT LA. http://www.cert-la.com/downloads/links/TeenSERTbrochure.pdf

The Building Codes Assistance Project . (2016, October 27). *Israel: The Building Codes Assistance Project*. The Building Codes Assistance Project . Retrieved February 26, 2022, from http://bcapcodes.org/code-status/country/israel/

Tso, P. (2021, June 16). *Want to beat the heat? Visit one of LA's public libraries*. LAist. https://laist.com/news/climate-environment/one-way-to-beat-the-heat-visit-one-of-42-reopened-la-public-libraries\

US Department of Commerce, N. O. A. A. (2015, July 15). *Heat Index Chart*. National Weather Service. Retrieved February 26, 2022, from https://www.weather.gov/ffc/hichart

U.S. Department of Health and Human Services. (2017, July 20). *Effects of heat - climate and human health*. National Institute of Environmental Health Sciences. Retrieved February 17, 2022, from https://www.niehs.nih.gov/research/programs/climatechange/health_impacts/heat/index.cfm#:~:text=Prolonged%20exposure%20to%20extreme%20heat,%2C%20cerebral%2C%20and%20cardiovascular%20diseases.

Vives, R. (2021, October 7). As heat waves intensify, AC can mean life or death. *Los Angeles Times*. https://www.latimes.com/environment/story/2021-10-07/as-heat-waves-intensify-access-to-air-conditioning-can-mean-life-or-death

Weinstock, D., Elran, M., Altshuler, A., Ganani, E., Netanyahu, S., Parness, E., Steiner, A., & Toledano, S. (2017, June 1). *Jstor Home*. https://www.jstor.org/stable/resrep17016 Cite. Retrieved February 26, 2022, from https://www.jstor.org/?refreqid=pub-view%3A9d3b9cdb955d376ae7de4d8434ba426b

West Virginia University School of Medicine. (2017, June 22). *Community Emergency*

Response Team (CERT) Course to be offered in the fall. School of Medicine | West Virginia University. https://medicine.hsc.wvu.edu/News/Story?headline=community-emergency-response-team-cert-course-to-be-offered-infall

Workforce Development Aging and Community Service . (2021). *Los Angeles County Cooling Centers 2021*. Los Angeles County Cooling Centers 2021 - ready.lacounty.gov. Retrieved February 19, 2022, from https://ready.lacounty.gov/wp-content/uploads/2021/06/Cooling-Center-List-6-8-2021.pdf

World Health Organization [WHO]. (2012). *Emergency Risk Management for health: an overview*. The United Nations Office for Disaster Risk Reduction. https://www.who.int/hac/techguidance/preparedness/risk_management_overview_17may2013.pdf

World Health Organization. (2018, June 1). Heat and health. *World Health Organization: WHO*. https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health

Yaron, L. (2022, January 2). The climate crisis has not skipped Israel: 2021 fourth-hottest year on record. *Haaretz*. https://www.haaretz.com/israel-news/.premium-the-climate-crisis-has-not-skipped-israel-2021-fourth-hottest-year-on-record-1.10509605

YMCA of the US. (2022). *YMCA Disaster Response*. YMCA. Retrieved February 19, 2022, from https://www.ymca.org/what-we-do/social-responsibility/diverse-communities/disaster-response

Appendix A - Matrices

City	State	Country	Population	EPopDif	Size (sq km)	ESizeDif (sq km	Climate	Temp	Disasters Anticipated in Plan	Plan Found?	CERT Team?	Activation	Locations
Eilat	---	Israel	50724	---	84.80	---	Arid	Hot	Heat waves, flooding, earthquakes, severe storms	---	---	---	Schools, airport
Charleston	WV	USA	48006	-2,718	84.54	-0.26	Humid	Hot	Severe storms, flooding, landslides, mass chemical spills	Yes	Yes	2 phases	Community/rec centers
LA	CA	USA	3967000	3,916,276	1,302.76	1,217.97	Mediterranean (Humid	Hot	Heat waves, flooding, earthquakes, severe storms		Yes	3 Phase	
Houston	TX	USA	2310000	2,259,276	1,732.70	1,647.91	Humid	Hot	heat waves	Partial	Yes		
Phoenix	AZ	USA	1633000	1,582,276	1,339.02	1,254.23	Arid	Hot	heat waves	Partial	Yes	2 phase	
Washington, DC	**---**	**USA**	**692683**	**641,959**	**177.00**	**92.20**	**Semi-continental**	**Temperate?**		**Yes**		**2 phase**	**Community/rec centers, se**
Charleston	SC	USA	135217	84,493	405.59	320.80		Temperate		Yes	Yes		
Bay Area / Foster Cit	**CA**	**USA**	**33997**	**-16,727**	**51.36**	**-33.44**	**Mediterranean (Humi**	**Temperate**	**Flooding, earthquakes**	**Yes**	**Yes**	**permenent**	
Miami	FL	USA	454279	403,555	143.10	58.30	Humid	Hot	Flooding, hurricanes, severe storms, tornadoes, drought, n	Yes	Yes	3 phases of activatic	Churches, museums, commu
Chico	**CA**	**USA**	**94529**	**43,805**	**89.67**	**4.87**	**Mediterranean (Humi**	**Hot**	**heat waves**	**Yes**	**Yes**	3 phases	**Libraries, Community/rec c**
Neom	---	Saudi Arabia	---	---	5.18	-206.21	Arid	Hot		Yes. Saudi Arabia		2 phase	
Masdar	---	United Arab Emirates	---	---	5.18	-206.21	Arid	Hot					
Calgiari	---	Sardinia	154460	103736	85.44	1.68	-		Earthquakes, flooding, droughts				
Aqaba	**---**	**Jordan**					**Arid**	**Hot**		**Yes**			
Nicosia	---	Cyprus								Immigration plan.			

Figure 4: City Comparison Matrix. This is a comparison of the 15 cities to the city of Eilat.

Services Provided \ Disasters	Heat Wave	Earthquake	Flooding	Storm	Power Outage	Drought
Sheltering						
Cooling						
Medical Services						
Transportation						
Security						
Fire Prevention						
Search and Rescue						
Communication						
Food and Water						
Backup Power						
Hazardous Material Disposal						
Waste disposal						

Likelihood \ Impact	Very High	High	Medium	Low	Very Low
Risk Matrix					
Almost Certain					
Likely					
Possible					
Unlikely					
Unknown					

Figure 5: Disaster Scenario Matrix. This is a comparison of disasters and the services that are best accompanied by them.

Appendix B - Informed Consent Form

Informed Consent Agreement for Participation in Research Study

Investigators: Nicole Dombrowski, Joseph Durocher, Tyler Sanderville
Contact Information: gr-eilatproject1@wpi.edu
Title of Research Study: Climate and Emergency Adaptation Plans for the city of Eilat focusing on Emergency Energy Supply
Sponsor: Eilat Municipality Environmental Unit

Introduction
Before participating in this research study, you must be fully informed about the purpose of this project, as well as the procedures to be followed and any potential effects of your participation. This form presents information about our research so you can make a fully informed decision about your participation.

Purpose of the Study
The purpose of this study is to assess public knowledge and sentiments about Eilat's emergency preparedness and planning for the use of public community centers in the case of an emergency.

Procedures to be Followed
The procedures used in this project will be that of recorded interviews with questions pertaining to the project scope around the city of Eilat. The questions in these interviews will be available prior to the interview.

Risks and Benefits to Study Participants
The foreseeable risks to participants in this study are the risks associated with your information being used for this study and recommendation. In addition to that, the political and social tensions are high in the area. We understand that there may be political/social repercussions for being publicly associated as a source of data for this study.

Record-Keeping and Confidentiality
All information volunteered by participants during this study will be stored online in a secure database. Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor or it's designee and, under certain circumstances, the Worcester Polytechnic Institute Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you. If you would like to remain anonymous, please make it known prior to the interview.

Compensation or Treatment in the event of Injury
It is unlikely that you will be injured while conducting this study; however, in the event of participant injury, you do not give up any of your legal rights by signing this statement.

For more information about this research or the rights of research participants, or in case of research-related injury, contact the study investigators using the contact information listed above. In addition, you can contact IRB Manager Ruth McKeogh (phone 508 831-6699, email irb@wpi.edu) or our Human Protection Administrator Gabriel Johnson (phone 508 831-4989, email gjohnson@wpi.edu).

Your participation in this research is voluntary! Refusing to participate will not cause any penalty or loss of benefits to which you are entitled. You may withdraw from the study at any time, and the project investigators reserve the right to suspend or cancel the experimental process at any point they deem fit.

By signing below, you give informed consent to be a participant in the study described above. In acknowledging that you have been informed about the study, please make sure that your questions are answered to your satisfaction before signing. You retain the right to keep a copy of this consent agreement.

_____ Date: _____

Study Participant Signature

Appendix C - Interview Questions

1. **Ilan Hadida - City Safety Officer**
    a. Goal
    b. Assess Eilat's status on general disaster prep, learn status quo of Eilat's usual response to disasters
        i. Discover ways our programs can mesh with one another, reduce redundancy
    c. What parts of Eilat are at most risk during an earthquake / other emergency?
        i. Floods
        ii. Earthquakes
        iii. Heat Wave
        iv. Who lives in these areas / what industries are here?
    d. How is Eilat prepared for earthquakes and other emergencies?
        i. What needs to be done in an earthquake response? What is most important?
            1. How will it be done?
        ii. Is this plan based upon another plan? How was it created and designed?
        iii. Is there a long-term plan versus short term?
            1. What are the differences?
            2. Is shelter a part of the long-term plan?
                a. Where will the homeless be sheltered?
        iv. How do you plan to deal with earthquakes of differing magnitudes?
            1. Do you have different levels of response for differing scenarios?
                a. If so, what are they?
                b. How did you come up with this design?
        v. What services to the people does this response provide?
            1. Food / water?
            2. Shelter?
            3. Clothing?
            4. Medical aid?
            5. Etc.
        vi. Who is the staff of this plan?
            1. How are they trained?
            2. How are they recruited?
            3. Does this response make use of volunteers?
                a. If not, why? Has this been considered before?
                b. How are the volunteers trained and recruited?
                c. What do volunteers do?
                d. How are they communicated with?
                e. Are they given supplies to conduct aid?
                f. Is MDA a part of this response? To what extent and how numerous are the volunteers?
        vii. What is the leadership and communication structure for the disaster response?
            1. What are the most important roles? What do they do?
            2. What is the hierarchy?
                a. Who answers to who?
        viii. What are citizens supposed to do / what are citizens anticipated to do in an emergency earthquake situation?
            1. Are citizens given earthquake response information of any kind? IE, drills, pamphlets, etc.
        ix. Does this response make use of volunteers?

1. If not, why? Has this been considered before?
2. How are the volunteers trained and recruited?
3. What do volunteers do?
4. How are they communicated with?
5. Are they given supplies to conduct aid?

x. Does this plan have special considerations for populations in Eilat who are more vulnerable?
1. Tourists
2. Low income
3. Homeless
4. Disabled
5. Elderly
6. Children
7. Single mothers
8. Foreign workers
a. Differing communities?
b. Language barrier?

xi. Has this plan ever been used in Eilat before?
1. If not, has it been practiced in a drill before?
2. If so, what was effective?
3. What was less effective?

xii. Are aspects of this plan similar to other disaster responses in Eilat, if any?
1. Heat waves / Power Outages
2. Tropical storms
3. Flooding
4. Etc.

xiii. Talk about 2019 storm
1. I have heard that citizens went to aid the disaster themselves. Can you describe how this happened?
2. Was the influx of volunteers a good thing?
a. Was it negative in any way?
b. Was there any leadership structure?

e. Israel Community Response Team Equivalent?
i. How active is this program in Eilat?
1. Has it been tested before?

2. Chaim Rafalowksi - MDA Manager

a. Who are you and what do you do in MDA?
i. How long have you been a part of MDA?

b. How active is this program in Eilat?
i. How many members are approximately In Eilat?
1. How many youths vs. Adults in Eilat?

ii. Is there high demand to do work similar to MDA in Eilat?
1. Is it competitive to take part in MDA in Eilat?

iii. What is the training regimen?
1. Who does the training?
a. Instructors
i. What are their qualifications?
ii. How does one become a structure?
2. What is the curriculum like?
a. What skills are learned?
i. How are they taught?

ii. How are skills learned tested after training?
b. Where can this curriculum be found if possible?
3. How does the training regimen differ between adult and youth volunteers?
a. Do youth volunteers participate in decision making in the MDA, or is their role more to follow orders of adult volunteers/responders?

iv. What would you say are the biggest challenges/obstacles in the current MDA program?
v. Does MDA have a plan for disaster relief when infrastructure is put under great stress?
1. What is detailed in this plan if any?
a. How is it different from normal ambulance service?
b. If ambulance service is overwhelmed, could volunteers be called upon to triage an area?

vi. Recruiting
1. How do you reach out to potential volunteers?
2. What sort of dignification do volunteers receive?

vii. Discuss disaster relief ideas
1. Could MDA trainees expand to?
a. Community Emergency Response Team

3. Foreign Population Researcher

a. Goal
i. Assess social challenges to Sudanese Migrants in Eilat that may exacerbate in disaster situations
ii. Discover and Assess cultural biases that may create challenges for running resiliency centers.
b. What was your role within Eilat's school system?
i. Was this a specific program or were you a teacher at a public school?
c. How familiar are you with the culture / community / citizenry of Eilat?
i. How long have you lived close by?
ii. How often do you travel there?
iii. What do you go to Eilat for?
d. What do you think are the specific differences between the Sudanese migrants' culture and the culture within the citizens of Eilat?
e. Are there migrants still arriving in Eilat? (especially with recent civil war in Sudan)
f. What do you think the average citizen in Eilat's opinions on the migrants are?
i. Is this opinion split within Eilat?
ii. How have these opinions changed over time?
iii. What certain treatments or behaviors manifest from these sentiments?
g. What do the Sudanese think of Eilat and its citizens?
i. What certain treatments or behaviors manifest from these sentiments?

4. Avi Naim - RiskPacc Project Manager

a. Where does RiskPacc currently stand? (how far along is the progress?
i. In Eilat / Israel specifically?
ii. Is there a response plan developed specifically for Eilat?
1. If yes, then what is it?
a. Follow similar questions to Ilan Interview
2. If no, is one in progress, where is that currently?
3.

b. I read that there is a case study based in Eilat that studies Volunteer Preparedness, could you tell me more about this?
    i. What was the goal of the study?
    ii. How was the info collected?
    iii. Who was studied, and how many people?
    iv. What were the main findings?
c. I also saw a case study that is very similar to our project here in Eilat which is the Municipality of Madova, Italy
    i. How were the previous communication methods not working?
    ii. What new communications were devised?
    iii. What are the vulnerable populations (other than the elderly)?
        1. How were the mentioned vulnerable populations served better?
d. About
    i. Awareness of risks and levels of preparedness across Europe remain low with gaps between the risk perceptions and actions of citizens, and between the risk perceptions of citizens and Civil Protection Authorities (CPAs). The RiskPACC project seeks to further understand and close this Risk Perception Action Gap (RPAG). Through its dedicated co-creation approach, RiskPACC will facilitate interaction between citizens and CPAs to jointly identify their needs and develop potential procedural and technical solutions to build enhanced disaster resilience.
e. Objectives
    i. (relating to objective 1) What is the Sendai framework / EU commissions Sendai Action plan?
        1. Does it apply to Eilat? How?
    ii. Is the RPAG in Eilat especially significant or worrying?
    iii. (Objective 10) How does RiskPACC plan to reach and inform
        1. CPA's (civil protection agency)
        2. CSO's (civil society organization)
        3. General citizens of differing needs
            a. Ideal Alert system
            b. Training
        4. What's the best way to keep communication between all of these entities?
    iv. How do you plan to address the various socioeconomic needs of the population in Eilat?
        1. Foreign Workers
        2. Social Tensions
    v. How does RiskPACC plan to incorporate volunteers?
f. Does this RPAG exist within Eilat? To what extent?
g. What is Volunteer geographical Information?
    i. How does this metric apply to Eilat?
    ii. Are volunteers a good idea in Eilat?
h. RiskPacc aims to provide advisory in both bottom up and top down solutions
    i. What is RiskPACC's plan for Eilat's Bottom up?
    ii. What is Riskpacc's plan for Eilat's Top down?
i. What are some specific challenges that face RiskPacc when considering Eilat?
j. (Objective 9) What novel technologies has RiskPacc found to be helpful in disaster situations? Especially for alerts and training.

5. Myri Lew - City Manager/Engineer

a. Goal
    i. Familiarize with the layout of the city to assess the best locations for centers
    ii. Discover the 'way of the land,' who lives where? Where do people work? Why?

b. To clarify, what is your role in the Eilat's government?
c. What are you most knowledgeable about considering Eilat?
d. Where do people usually go in Eilat on a given day? Where do people commute to and from?
e. What are the primary districts in Eilat?
    i. IE, Residential neighborhoods
    ii. Business parks
    iii. Commercial areas
    iv. Tourism areas
    v. Socioeconomic status map
        1. Where does the working class preside?
        2. Are there buildings in places that are vulnerable to failing in extreme conditions?
    vi. Where are the densest population centers?
f. How do most people in Eilat get around? (transportation)
    i. Some of Eilat is on an incline, transportation will be required if elderly or disabled need access to distribution / shelter?
    ii. Walking?
    iii. Biking?
    iv. Car?
    v. How resilient and consistent is the bus service?
        1. Could it be adapted for an emergency plan?
g. What are weaknesses in Eilat's design / engineering of layout?
    i. Are there places that will likely take a lot of traffic in a disaster situation?

6. Anna Liaison - Head of Business and Innovation

a. Goal
    i. Discover ways businesses can help in disaster situations and how to incentivize them - what can they give back to the community? Tax exemptions?
    ii. Network to get into Eilat's tourism sector
    iii. How to serve businesses?
b. Seek connections to hotel business owners
c. What businesses are most at risk in Disaster situations?
d. Do you know if businesses have a plan for their employees / customers in city wide disaster situations?
    i. If so, then what is it?
        1. Have these plans ever been practiced before?
    ii. Is there a standard that all businesses must follow?
        1. If not, why? Should there be one?
e. What businesses have the most employees on site during working hours?
    i. Who works at these businesses?
f. What is important to a business during a disaster situation?
    i. What services do they need? Supplies?
g. How can we ensure that businesses keep their employees safe?
h. Do you know the number of foreign workers in Eilat?
    i. What industries do they usually serve?
i. Tourism
    i. Do businesses have emergency plans for customers or employees?
        1. Are these plans ever practiced? Are drills mandatory?
        2. Have these plans ever been tested in a real situation?
            a. How do you think it went?
                i. What was effective?

ii. What wasn't?
ii. What are the peak seasons for tourists in Eilat?
iii. Where do they stay? Where do they go?
iv. Where are the fullest hotels located? How far are they from the old airport?

j. Are there businesses that may be of assistance in disaster situations?
    i. Discuss Ideas
        1. How could businesses be incentivized to assist the city during emergencies?
    ii. Opportunities:
        1. Shelter / distribution center
            a. Long term shelter?
            b. Short term shelter
            c. Cooling center
            d. Are there any businesses who are likely to have the capability to operate off grid?
        2. Transportation
            a. Extra ambulance / patient transport in case of overload of normal services?5
        3. Supplies
            a. Food
            b. Water
            c. Medical supplies
            d. Social activities / ‘spirit’
        4. Services
            a. Plumbing
            b. Medical
            c. Security
            d. Carpentry

Appendix D - RiskPACC Questionnaire

RISKPACC WP1 and WP2

Questionnaire for CPAs and Citizen Groups

Case study country: Israel
Case study name: Eilat/MoE
Name of representing organization: Citizen
Administrative level[1]:
Current position:
Years in position:

PART 1: General questions

1. What kind of risks (natural or human-made) are you concerned about in the location (municipality/county/state/other) that you work in? Earthquakes and oil spills in the Eilat Gulf

   a. How do you personally understand risk in your location? Risk to my family or to the surrounding environment we live in.

   b. Do you believe that the perception of risk between CPAs and local citizens/citizen groups coincide? Please explain. Yes, only that the CPA role and perception is much bigger

c. What types of other stresses does your area/community/municipality (beyond the above-mentioned risks) concern you? Car accidents, Covid,

d. What kind of actions are you currently taking to address these hazards? Precaution on the streets and reducing physical interactions.

2. What are your current needs in terms of addressing the impacts of these risks?

a. Do you have enough resources available that you need? No, we lack explanation on the risks and how to act when they occur

b. What would you like to do differently? Have more information mainly and contact person

3. Is the word resilience relevant in your area of work? yes

a. If used, what does it mean for your area of work? Energy resilience is the ability to return to business as usual after an extreme effect that harms the energy market and distribution.

b. Are there any dedicated policies to increase disaster or community resilience? Please specify. Not that I know of

c. If resilience isn't a term commonly used in your area, what are the terms used to describe the process by which hazards are managed (this might for example be risk management, emergency management, etc.)

Part 3: Community group questions

1. How would you describe community action in your area with regard to the risks faced? Develop tools for communications before, during and after a disaster.

a. Are there recent hazard events that the community has responded to? COVID19

b. Are community members organized in groups/teams/organizations etc.? There are volunteers that worked together during the Covid pandemic quarantine to help people in need and elderly

c. Is there more than one community organization in your area working on issues of risk reduction? Yes, at least three – MDA, the community center and the city CPA

i. If yes, do they communicate with each other? They do at least the community center and the CPA

ii. Are there any specific policies from the municipality that encourage the formation of such groups, or is this the result of communities self-organizing not that I know of

d. In your opinion, is there a shared sense of community in your area or are there divisions? There is a sense of community in the neighborhood that I live in,

2. Is there any communication between local authorities and community groups/individuals in your area with regard to the risks faced? Not regularly

a. How is communication done? Through schools

b. Would you describe the communication as effective? no

c. How could communication be made better? Not sure

3. In your opinion, are existing approaches to risk management mechanisms adequate for confronting risk in your area? No so much

a. What are the strengths and weaknesses of existing risk management policies and mechanisms in place? It does not address the actions needed to prevent mass-destruction when earthquake will happen

b. As a community group, do you think that your views on risk are currently addressed by existing risk management approaches? no

c. What opportunities are there for citizens/community groups to influence policy and decision making in your area? meeting with the Mayor, and addressing the CPA

d. If not, what more would you like to see occurring?

4. Related to the risks you mentioned above, for which kind of events

a. Do you feel well prepared? Why?

b. Do you feel not well prepared? Why? Because there is lack in information

5. What kind of support would you expect from CPAs? More information on the action plans

6. Is citizens' perception of risk important for effective risk planning and response, in your opinion? Please elaborate. Citizens' perception of risk will affect the planning and response since it is what will make them act to prevent the risk or minimize it.

a. Is citizens' perception of risk incorporated in existing risk management plans and policies in your location? Don't know

b. What would you like to see changing in the existing context? Get more information so I can relate to the plans

c. Can you think of any possible ways that risk perception could be registered and incorporated in future risk management plans and policies? There should be more public hearings to sound the citizens' concerns and to give more information

Part 4: Summary

1. Has the COVID-19 global crisis changed the way you think about risks?
    a. If yes, how? It was a glimpse to what can really happen if a more deadly situation will arise – we are not ready.
2. Has the COVID-19 global crisis changed the way you plan for managing future risks
    a. If yes, how? The lesson was not learned.

---

[1] Administrative levels used are: National, state, region, municipality, community.

Appendix E - Activation and Management

Table 5: City of Chico Three Phase Approach to an Extreme Heat Event (City of Chico, 2019). This table describes an analysis of Chico, CA three phase activation plan for emergency center operation.

Phase 1 - Seasonal Readiness Months prior to the warm season. Extreme heat waves are not yet expected.	Actions Taken: ● Initial stakeholders are alerted ● Existing plans, procedures, and resources are evaluated. ● Verification of availability of key facilities to be used. ● Updating/Validating notification system. ● Initiate awareness campaigns to the community
Phase 2 - Heat Alert Heat Warning/Advisory is initiated if: ● Temperature reaches 37.8℃ for two consecutive days ● California Independent System Operator (CAISO) issues a Stage 3 Electrical Emergency or rotating outages during an Excessive Heat Event ● Increased reports of heat related illnesses, medical emergencies or mortality reported by local ● healthcare providers or other credible sources	Actions Taken: ● Activation of cooling center ● Continued monitoring of weather ● Issue press release(s) ● Provide information to public ● Consider activating call centers and/or public information lines through various county departments. If not activated, set up for rapid activation ● Increased monitoring of persons with disabilities and others with access and functional needs ● Increase surveillance of heat related illnesses/injuries ● Coordinate and pre-identify potential transportation issues ● Monitor electrical demands and any CAISO issues ● Look ahead to Phase Three activities
Phase 3 - Extreme Heat Event NWS issues an Excessive Heat Warning or Advisory indicating the	Actions Taken: ● Continue to monitor weather ● Issue press release(s)

following criteria: ● Heat index of over 110°F (air temperature & humidity combined) or high daytime air temperature greater than 115°F or nighttime temperatures of 80°F or more ● NWS Heat Warning/Advisory issued for more than three days ● CAISO issues a Stage 3 Electrical Emergency or rotating outages during an Excessive Heat Event ● Increased reports of heat related illnesses, medical emergencies or mortality reported by local healthcare providers or other credible sources	● Provide information to public ● Maintain and support the call center and/or public information hotlines ● Increased monitoring of persons with disabilities and others with access and functional needs ● City of Chico ● As necessary, activate cooling center(s) ● Coordinate any transportation requests to cooling centers ● Monitor electrical demands and any CAISO issues

Table 6: Activation plan for Los Angeles Emergency Centers (Los Angeles Emergency Management Department, 2021).

Event Examples and Characteristics	**Level**	**Response Actions**	**Additional Staffing Requirements**
● Severe Weather ● Minor Localized Incident Involving Two or More Departments ● Planned Events	Level 1	Activate EMD Duty Officer and Duty Team staff ● EMD communicates with departments via Teleconferences, WebEOC ● Technical specialists, agency reps may be requested to respond	Level I is the lowest level where all required positions are staffed by the Emergency Management Department (EMD)
● Moderate	Level 2	Activate Level II EOC staff to	Level II and III

Earthquake Affecting the City ● Major Fire, Wind, or Rainstorm Affecting the City ● Two or More Large Incidents Involving Two or More Departments ● Longer Term Incident – Two or More Shifts		include: ● Management Staff ● All Section Coordinators and Deputy Coordinators ● Branches and Units as appropriate to the situation ● Liaison representatives as appropriate ● Any staff specifically required by the requesting agency or EOC ● Director Recovery and Reconstruction Unit	activations require staff from other City and outside agencies to respond according to predetermined plans. Level II and III activations vary in terms of lead City agency: ● ALPHA: Fire/EMD Lead ● BRAVO: Law Enforcement Lead ● CHARLIE: Undetermined Lead
● Major City or Regional Emergency ● Three or More Departments with Heavy ● Resource Involvement ● Mutual Aid Resources May Not Be Available for Twenty-Four Hours or More ● Long Duration, Several Days to Weeks	Level 3	Activate Full EOC organization staff to include: ● Management Staff ● All Section Coordinators and Deputy Coordinators ● All Branches and Units Liaison representatives as appropriate ● Any staff specifically required by the requesting agency or EOC Director ● Recovery and Reconstruction Unit	

Table 7: Miami-Dade Activation Plan

Level	Personnel	EOC activation	Notifications	Sample Events
Level III: **Monitoring & assessment**	• OEM Duty Officer; • Director of Emergency Management; • OEM Division Director; • Appropriate coordinators.	Yes, but only for OEM staff. OEM functions at near normal operations; may hold periodic planning meetings.	• OEM Management Staff • State Warning Point • Key ESF agencies	• Limited hazardous materials event; • Multiple alarm fire; • "Unusual Event" at Turkey Point Nuclear Power Plant.
Level II: **Partial**	ICS Positions: • Incident Commander; • Operations Chief; • Logistics Chief; • Planning Chief; • Admin/Finance Chief; • Branch Directors • Key ESF agencies.	Yes – ICS • GIS; • Mission Tracking & Message Control Center; • The 311;* • PIO;* • Radio (RACES) communications;* • Media Center;* • EOC Security.*	• County Mayor; • Chief of Staff; • Municipal Branch Representative; • Miami-Dade departments; • State Warning Point; • Key agencies.	• Threatening tropical storm or hurricane; • Area flooding; • Major urban aviation incident; • Wildfires; • Minor disasters‡; • "Alert" or greater at Turkey Point Nuclear Power Plant.
Level I: **Full-scale**	• ICS Positions; • Municipal Branch Representatives; • ESF Reps.; • State Liaison; • Policy Group. • Federal Liaisons; • Military Support.	Yes - 24 Hours • GIS; • Mission Tracking & Message Control Center; • The 311; • PIO; • Radio (RACES) communications; • Media Center; • EOC Security.	• Adjacent county EOCs; • State EOC; • FEMA; • Other appropriate agencies.	• Hurricane;** • Major Turkey Point Nuclear Power Plant incident; • Major hazardous materials incident;** • Major disasters‡; • "Site Area Emergency" or "General Emergency" at Turkey Point Nuclear Power Plant; • Any event with a federal declaration of emergency or disaster; • Catastrophic disasters‡.

** These positions may be activated at Level 2 but are not mandatory at a Level 2.*

*** Generally any event which requires evacuation and sheltering of a **significant** portion of Miami-Dade County will require a Level 1 activation. Cold-weather sheltering or isolated area (high-rise fire) evacuation will **probably** not prompt a Level 1 activation.*

‡ Refer to "Classification of Events" in the Concept of Operations Section.

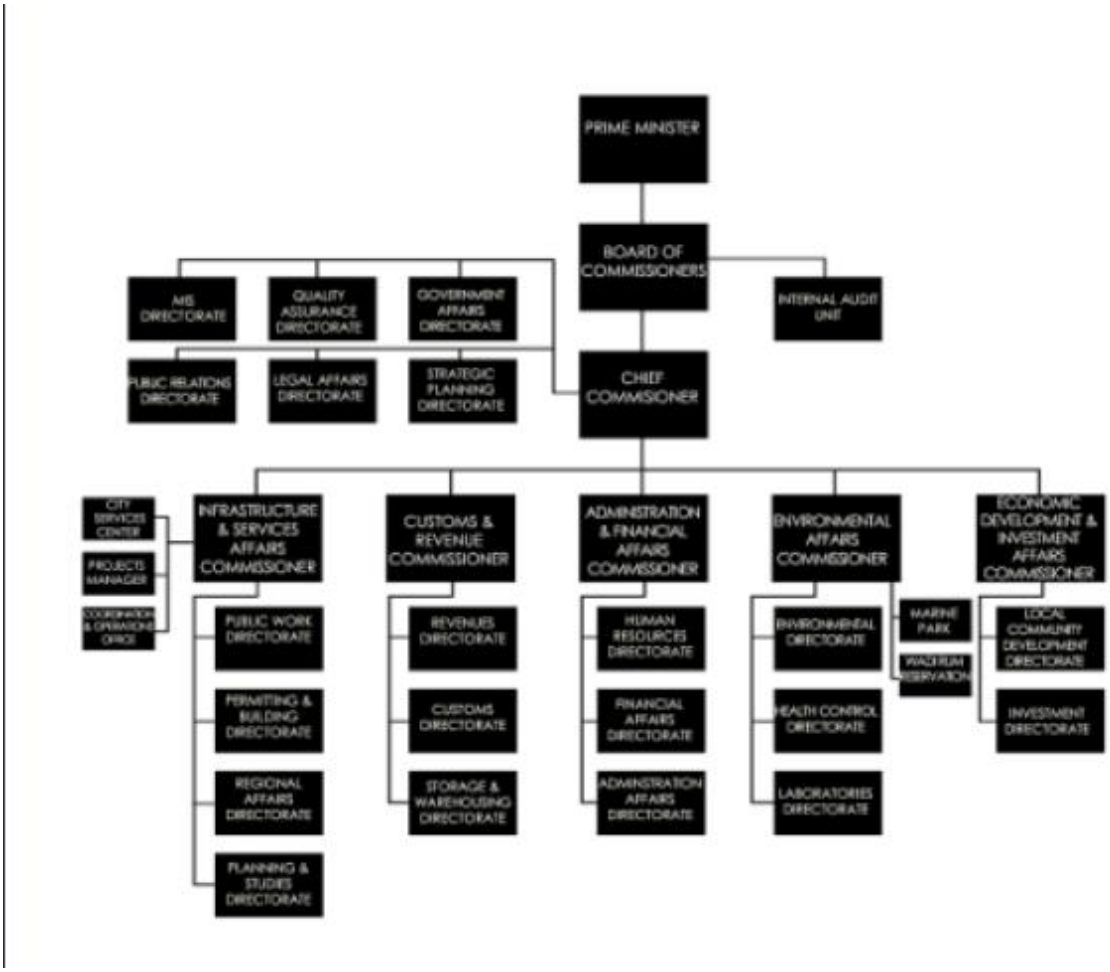


Figure 6: Kingdom of Saudi Arabia Organization Structure (Bashawri, 2017). This figure describes the administrative plan for the emergency disaster plan for Saudi Arabia.

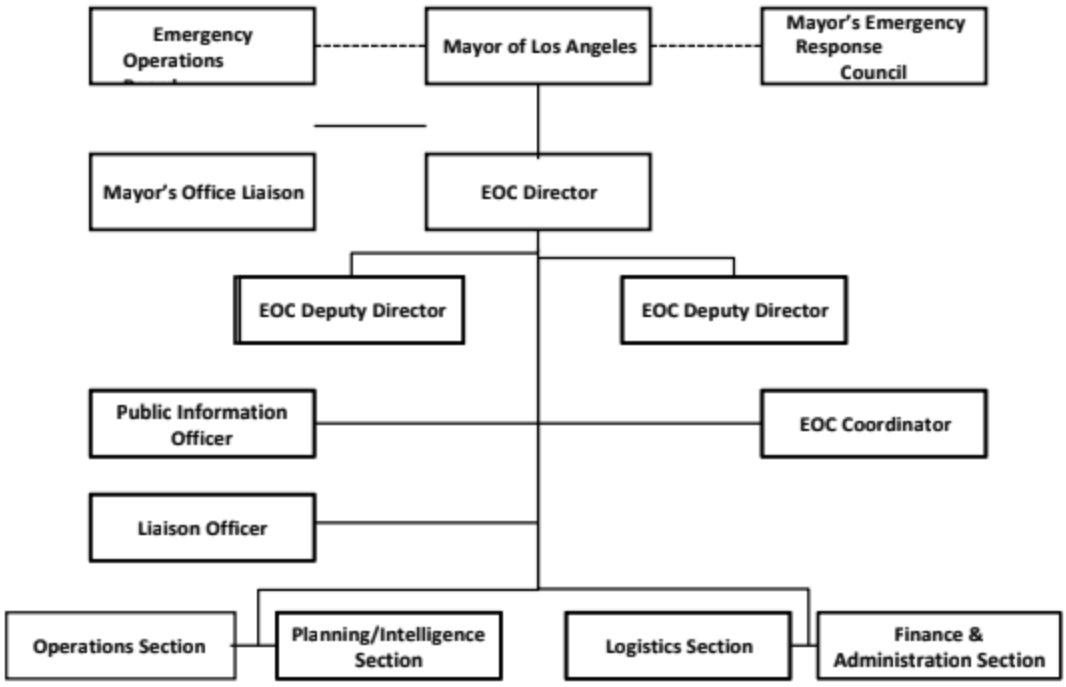


Figure 7: Los Angeles Organization Structure (City of Los Angeles, 2018). This is the management plan for Los Angeles County.

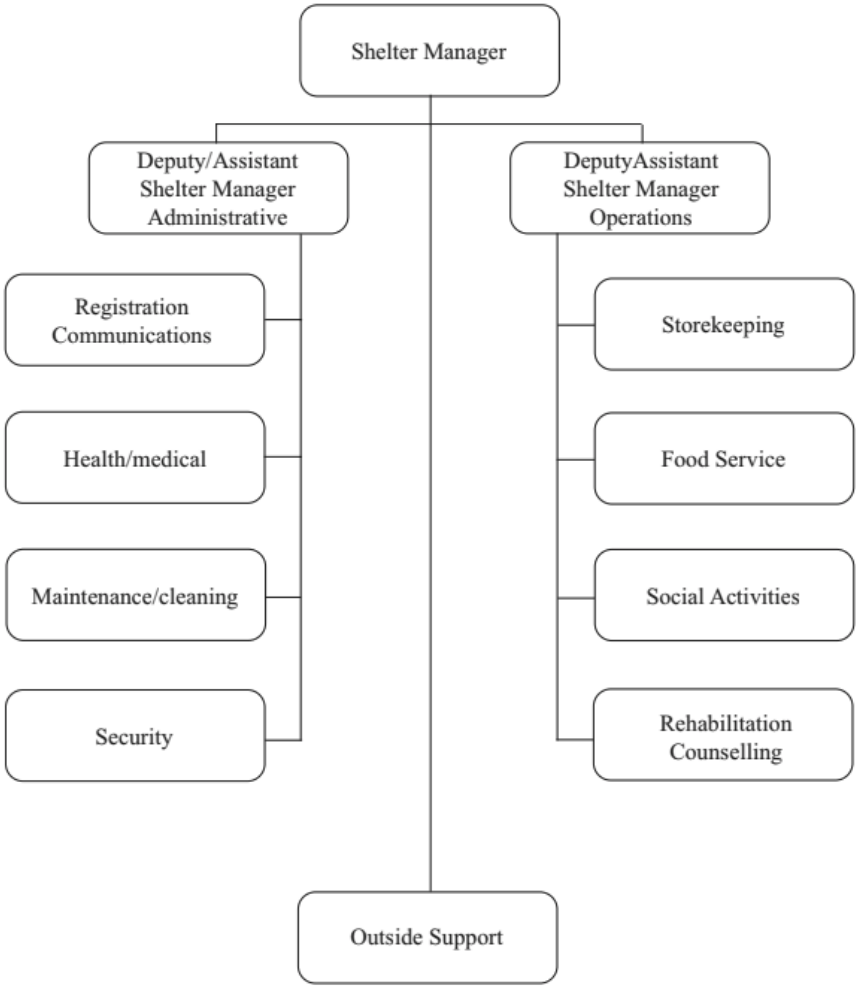


Figure 8: FEMA Emergency Shelter Management Guide. This figure describes the management plan for FEMA's Emergency Shelter Management Guide.

Appendix F. Staffing Model Analysis

Jurisdiction Model

Setting Minimum Threshold:

$$Vmin = Smin * Hmin * Qmin$$

Determining the Number of DRCs, Initial Staffing Levels, and Costs:

$$QtargetYk(Smin * Hmin + Xk) \geq Vpeak, k$$

Total Number of DRC to open

$$Yk = \{Vpeak/(kQtarget(SminHmin + xmax), Vpeak, k \geq Vmin$$

Cost Associated with Opening and operating the required number of DRCs

$$Ck = Yk\ (Cf + Cv\ (Xk + Smin * Hmin$$

Table 8: Parameters for model analysis. This table describes the parameters that were used in the Jurisdiction and Time Travel Model.

Notation	Description	Baseline
Parameters		
S_{min}	Minimum number of survivor-assistance staff working in a DRC	3 staff
S_{max}	Maximum allowable number of staff working in a DRC	23 staff
H_{min}	Minimum number of DRC operating hours per week	30 hours
H_{max}	Maximum allowable DRC operating hours per week	84 hours
x_{max}	Maximum allowable additional staff-hours (beyond the minimum) at each DRC	$S_{max}H_{max}$–$S_{min}H_{min}$
Q_{min}	Minimum acceptable hourly throughput (visitors per staff-hour)	1 visitor per hour
Q_{target}	Average number of visitors served per staff-hour	1.3 visitors per hour
Q_{max}	Maximum possible throughput capacity (visitors per staff-hour)	2.1 visitors per hour
V_{min}	Minimum number of visitors for opening a DRC	$S_{min}H_{min}Q_{min}$
$V_{peak,k}$	Expected peak weekly demand in county k (number of visitors)	Estimated based on empirical data
$V_{k,w}$	Expected weekly demand in county k in week w	Estimated based on empirical data
v_i	Expected peak visitors from town i	Computed from $V_{peak,k}$
C_F	Fixed cost of opening a DRC ($)	$28,091 plus min staff costs
C_V	Variable cost of each additional staff-hour worked at a DRC ($/hr)	$156
C_T	Hourly travel cost for survivors	FEMA standard value
μ	Maximum survivor travel time to reach a DRC	1 hour
t_{ij}	Travel time between towns i and j	See Appendix in the online supplement
p_{ij}	Indicates whether town i is within μ minutes of town j	Computed from travel time data
Decision Variables		
y_k	Number of DRCs to open in county k (jurisdiction model) or town k (travel time model)	(decision variable)
x_k	Additional staff-hours (beyond the minimum) required at each DRC in county k (jurisdiction model) or town k (travel time model)	(decision variable)
m_{ij}	Number of visitors from town i allocated to visit the DRC in town j	(decision variable)

L. Time Travel Model

Mixed Integer Programming Formulation

$$\min \sum_j C_F y_j + \sum_j C_V \left(x_j + S_{\min} H_{\min}\right) + \sum_{i,j} C_T m_{ij} t_{ij}$$

Subject to

$$y_j x_{\max} - x_j \geq 0 \; \forall j$$

$$\sum_j m_{ij} = v_i \quad \forall i$$

$$\sum_j p_{ij} Q_{\text{target}} \left(S_{\min} H_{\min} y_j + x_j\right) \geq v_i \; \forall i$$

$$Q_{\text{target}} \left(S_{\min} H_{\min} y_j + x_j\right) \geq \sum_i m_{ij} \; \forall j$$

$$p_{ij} M - m_{ij} \geq 0 \; \forall i, j$$

$$y_j, x_j, m_{ij} \geq 0$$

Total Number of Staffing Hours Calculations

$$z_n = \frac{V_{k,w}/N}{Q_{\text{target}}}$$

Total Number of Staff

$$s_n = \max\left(S_{\min}, \frac{z_n}{H_{\max}}\right),$$

Operational Hours

$$h_n = \max\left(H_{\min}, \frac{z_n}{s_n}\right)$$

Appendix G- Emergency Center Guideline

These guidelines serve as a recommendation for centers to use prior to activation. One reference is from the Office of US Foriegn Disaster Assistance and the other is from the National Center for Disaster Preparedness, Columbia University. Both have very similarities; the first is a larger overview of the facility while the second covers more family-based needs and assistive services. The first source was dominantly used in analysis for this project. The main components from the guideline are building location and structure, amenities and services in particular electrical, water, food preparation, security; Management structure, sanitation and hygiene and safety/security.

1. https://scms.usaid.gov/sites/default/files/documents/1866/SSM%20-%20RM.pdf
2. https://rcrctoolbox.org/wp-content/uploads/2018/05/Best-Practices-Checklist-for-Emergency-Shelters.pdf

Appendix H - CERT Training and Curriculum

These manuals provide curricula for FEMA's CERT training programs. One reference is the CERT Basic Training Instructor's Manual, and the other is CERT's Train the Trainer Instructor's manual. The former is a curriculum for instructing CERT team members, including CERT's nine required units along with instructor material. The latter provides resources for training instructors for CERT courses and discusses how to educate volunteers about basic disaster response.

1. https://www.ready.gov/sites/default/files/2019.CERT_.Basic_.PM_FINAL_508c.pdf
2. https://rcrctoolbox.org/wp-content/uploads/2018/05/Best-Practices-Checklist-for-Emergency-Shelters.pdf