

# East Lowland Climate Vulnerability Assessment and Climate Adaptation and Resilience Plan

The recent change in administration has resulted in a renewed focus on addressing climate change issues. The new administration would like to demonstrate the impacts of climate change on coastal municipalities throughout the country and has selected East Lowland for this analysis. Your consulting firm, *Fill in the name of your company*, has been asked by Climate Czar, John Kerry, and the EPA to prepare a Climate Vulnerability Assessment (CVA) for the Town of East Lowland. EPA is also looking for a Climate Adaptation and Resilience Plan (CARP) to address impacts on residences, businesses, critical facilities and other uses that will be affected by sea level rise/storm surge, increased rainfall, heat stress and vector borne diseases.

The scope of work calls for the CVA to **qualitatively** look at vulnerability up to the year 2050. While it is unknown exactly how much sea level will rise over that period, EPA has said that you should combine sea level rise and storm surge in your VA and CARP.

For the CARP, EPA wants to see suggestions for how to address the vulnerabilities identified in the CVA through a range of adaptation solutions. These include infrastructure improvements and retreat/relocation. There will be secondary impacts from the implementation of adaptive solutions. EPA has asked for an analysis of these secondary impacts. They have asked you to allocate \$ 1 Billion (\$1,000,000,000) in a way that provides the most benefit to the Citizens of East Lowland, the environment and the economy. Sources of funds include, municipal bonding (possible), user fees and state and federal grants. There will not be enough money to address all the identified vulnerable assets, the Scope of Work calls for you to analyze what will happen to those assets if no action is taken.

EPA has also asked you to look at social impacts of the solutions you recommend. They want you to predict how people will react to your recommendations and develop a plan that will address any negative impacts. There is a requirement that you must spend at least 5% (\$50,000,000) of the available funding to address identified social impacts of your recommendations.

Since CARP recommendations are often met with skepticism and concern over how the plan will affect people's lives, you need to develop a plan for how you are going to sell the CARP to city officials and the public.

More detail is provided on all of these tasks in the Scope of Work.

EPA is worried that the cost to protect and/or relocate citizens, businesses and critical infrastructure in large coastal cities, like Miami and New York, will be overwhelming and could cause a major recession if nothing is done to plan for it. EPA is interested in understanding the complex logistics that will be involved in protecting and/or relocating entire sections of a community. They have decided to use East Lowland for the purpose of this analysis because it is already experiencing the effects of climate change.

## East Lowland Community Profile

Like many established urban communities, East Lowland is comprised of a downtown/commercial center, surrounded by diverse neighborhoods. Industry accounted for 35% of the jobs in East Lowland until the 1950s when it began to decline. Today most of the industrial buildings are vacant,

contaminated and in various states of decay. To support the working waterfront of 100 years ago, working class neighborhoods developed on the coast. Realtors and others started to realize the value of waterfront property in the 1960s, resulting in decades of gentrification. The waterfront now has working class neighborhoods, middle income neighborhoods and affluent neighborhoods. The city had a 2020 population of 186,412 according to the US Census. The distribution of land uses is shown on the attached map. The demographics of the areas impacted by combined sea level rise and storm surge are shown in the Community Demographics attachment **NOTE:** This information has been simplified for the purpose of this exercise.

Being a southern city, East Lowland experiences hot summer months and significant amounts of precipitation. Both the summertime temperatures and amount of precipitation have increased over the years and that trend is continuing. Except for parks, most parts of East Lowland consist of impervious surfaces. There is an abundance of street trees in Neighborhoods 1 and 2 but less so in Neighborhood 3.

The sanitary and stormwater sewer systems were originally built as a combined system. They have been mostly separated but some portions have not yet been separated. In a portion of the less affluent neighborhood, the storm drainage system consists of open ditches which also act as a breeding ground for mosquitos. When the systems were separated in the 1960s, they were built to TP-40 standards and many portions of the system are inadequate to handle the increase in precipitation that East Lowland is experiencing. During heavy downpours, street flooding is common. In some cases, this has resulted to significant damage to homes, businesses, roads and drainage systems.

East Lowland has a strong mayor form of government with a seven-member city council. The current Mayor defeated a long-term conservative Mayor who was a climate change denier. The new mayor believes that climate change is happening but is aware it is a hot button issue. EPA has informed her of their study which she has reluctantly agreed to. She is concerned about the impact on her reelection chances if the study is not received well by the voters. She understands that communication is key and will coordinate public hearings throughout the process. She knows there are both strong advocates of aggressively addressing climate change with drastic action and those who claim it is a hoax created by a foreign power to destroy the country. She wants to see the results of the VA and CARP before she commits to supporting it. If she likes the analysis and recommendations, she will make it part of her reelection campaign. She is also aware that some of the recommendations may require the use of eminent domain, another controversial issue. The reality is that East Lowland is very vulnerable to climate change and experiences sunny day flooding frequently, has recently experienced a heat dome resulting in deaths and had increased cases of EEE (Eastern equine encephalitis) and other vector borne diseases. This flooding is happening more frequently every year. Some progressives in the state legislature are considering establishing and funding buyout programs for communities like East Lowland. A vote on this proposal will be taken but probably not before the VA and CARP are done.

EPA feels that highlighting the costs and impacts resulting from climate change is the only way to convince climate change deniers in Congress that action must be taken. **You are all powerful, within certain limits**, when deciding what to recommend, but you must **justify your decisions**. This part is important-you need to explain, in detail, what factors you considered when making decisions. You should consider how you plan to address climate impacts using infrastructure improvements, relocate some of the residential, commercial, industrial and critical facilities to a new location, or simply buy them out. A buyout program would involve using government funds to compensate residents and/or

businesses that may be impractical to relocate or just may not fit into the new community you are creating.

**LINK TO MAPS:**

<https://arcg.is/OTLKua>

## Scope of Work

### Summary

**Prepare a Climate Vulnerability Assessment and, based on the CVA decide what climate adaptations actions you would institute based on available funding. Describe and justify why you recommended those particular actions and how they will help protect East Lowland. Also describe, in detail, why you did not choose all or parts of other vulnerable assets and the consequences of not addressing these vulnerabilities as described in your CVA.**

### **Task 1 Interview East Lowland Department Heads (completed for you)**

The Mayor has instructed the municipal staff to provide your company with information on infrastructure, demographics, and other information related to climate change impacts. Your Company staff has already interviewed East Low Land Department Heads. Their findings can be found in the attached report.

### **Task 2 East Lowland Climate Vulnerability Assessment (minimum of 4 pages double spaced)**

Prepare a **qualitative** CVA for each of the four vulnerabilities that EPA wants you to address—sea level rise/storm surge, increased precipitation, heat stress and vector borne diseases for the year 2050.

- A. Describe these four climate vulnerabilities as they relate to East Lowland.
- B. Include a discussion of what is vulnerable and why. Use the information provided by the Department Heads, maps and the community profile in the preparation of your assessment.
- C. There are numerous models/examples of CVAs online. You can use one of these or use those from the 9/23/21 lecture.

### **Task 3 East Lowland Climate Adaptation and Resilience Plan (minimum of 8 pages double spaced)**

- A. Develop a strategy for addressing the vulnerabilities identified in the CVA that will result in the best possible outcome for the City of East Lowland. Determine what physical improvements you will make to address the identified vulnerabilities and why you elected to address the vulnerability in this way for 2050. You should explain in detail what you considered when deciding your recommendations for the CARP. Consider how you might phase the improvements leading up to the year 2050 to maximize the results. Also consider what improvements might address multiple climate vulnerabilities.
- B. Since you cannot address all of the vulnerable community assets in the VA, EPA has asked you to describe in detail why you did not choose the remaining vulnerable assets and prepare an analysis of the outcome from taking no action. What do you expect will occur in the future as a result of anticipated climate change to the vulnerable areas identified in the VA that you could

not address in the CARP? Be specific and provide details on the primary and secondary impacts. EPA wants to use this as a basis for showing the true extent of climate change impacts on a coastal community.

- C. EPA also wants you to provide an analysis of **secondary** impacts (the ripple effect) associated with climate impacts and to give a **non-quantified** narrative description of the resulting impacts. There are no right or wrong answers but make sure you justify what you think. You can make any assumptions based on what you think will happen, but you must explain why. You can assume that climate impacts will happen over time and actions may be taken over time to lessen the impacts. If you do, explain your assumptions. Also, there may be some positive developments that offset the losses. What are they?

Secondary impacts to East Lowland to consider:

- Will there be on-going flooding issues with the area upland from the new waterfront with sea level rise? How will access to the waterfront be affected?
- How will the physical improvements and relocations affect the town of East Lowland in the future?
- Financial issues within East Lowland: For example, how might banks and other financial institutions be impacted by loss of mortgages and business loans as well as fewer people doing business with them?
- Will there be any general economic impacts to what is left of East Lowland? (loss of jobs/unemployment costs, etc)
- Insurance costs including costs of flood insurance
- What future issues might East Lowland have as it continues to function as a municipality?
- Are there positive impacts for East Lowland?

#### **Task 4: Relocated Community Plan (minimum 3 pages double spaced)**

- A. Develop a plan for the new community that will result from your relocation of those residences, commercial uses, industrial uses and critical facilities that are vulnerable to climate related impacts that you decide should be moved. You have been asked to decide what type of replacement housing should be built—single family, multifamily—and which non-residential uses such as retail, industry and recreational uses can be moved to the new site. You do not have to pick a specific site for your new community. A general location is enough but explain why this area was chosen. For example, you could say we are building our new community in Magnolia County, Alabama or to an area 50 miles north of Greentree, Ohio. Your goal is to create a livable place that will experience limited impacts from climate change and be sustainable. Include a description of the climate challenges your new community may face. Be sure to include what decisions you made and what factors you considered when making them. This will be in the form of a narrative.
- B. Secondary impacts to your new community to consider:
- Did you consider the politics of the area where you are relocating? Why or why not?
  - Will there be loss of careers/new employment opportunities in the new community?

- What consideration did you give to the different economic circumstances of the people in the neighborhoods where physical improvements are made or people are relocated?

**Task 5: Prepare a Social Impacts Analysis (minimum of 1 page double spaced)**

- A. Describe the expected social, physical health and psychological health impacts on the population of East Lowland resulting from the recommendations in your CARP. What mental health, financial, legal, dealing with bureaucracy, etc., assistance might some people need? Who is impacted the most and why?
- B. Describe the expected social, physical health and psychological health impacts on the population of East Lowland resulting from not addressing the climate vulnerabilities identified in the VA for which there is no available funding. What mental health, financial, legal, dealing with bureaucracy, etc., assistance might some people need? Who is impacted the most and why?
- C. What social services programs would be needed to address the social impacts. Give a general description of programs that would assist those who are in most need of help.

**Possible adaptation actions EPA wants you to consider in the CARP**

If you have other ideas than those listed below, please contact Mayor Barrett or her assistant, Bruce Hyde, to discuss what you are proposing and the associated costs. You are encouraged to be creative and come up with an adaptation response not listed below.

**Infrastructure Improvements**

- 1) Replace open storm drains with pipe 500 per linear ft. (l.f.)
- 2) Acquire land and build a park \$40,000,000
- 3) Construct a seawall \$2000/ l.f.
- 4) New sewage treatment plant \$350 million including relocation of collection system and pump stations
- 5) Raising houses above predicted 2050 sea level rise and storm surge \$100,000/house

**Green Infrastructure Improvements**

- 1) Tree planting \$500/ tree or \$1000 with tree box filters
- 2) Rain gardens \$12,000/rain garden
- 3) Install a living shoreline \$150/l.f.
- 4) Beach nourishment and dune construction \$5/cubic yard

**Relocation/Buyout**

- 1) Relocation of residents \$400,000/ single family residence, \$200,000/ multi family unit (For example, a building with 6 apartments is equal to 6 units and would cost \$1,200,000)
- 2) Relocation of commercial/Office property \$1,000,000/ commercial/office property
- 3) Hospital construction \$300 million
- 4) Construction of a new school \$40,000,000, School expansion \$20,000,000
- 5) Nursing home \$10,000,000

- 6) Fire station/Emergency operations center \$15,000,000
- 7) College campus \$450,000,000
- 8) Industrial uses--\$300,000/fishing boat, \$18,250,000/ drydock

For simplicity, places of worship have not been included but might be something you want to consider.

Through a combination of Federal and state funds, there is \$1 billion available to implement your recommendations. EPA wants to understand the impacts of each of the possible adaptation actions and has said that you must spend at least 20% of the funds on relocation, 20% on infrastructure improvements and 10% on green infrastructure. But no more than 3% of the funds on buyouts. The federal government requires a set-aside of 5% of the funds be spent on social services. The remainder of available funds can be spent in any way you think will best achieve the goals in the CARP, just be sure to justify your choices.

**Budget**

Infrastructure	\$200,000,000
Green infrastructure	100,000,000
Social services set-aside	50,000,000
Relocation/Buyout	200,000,000 (Buyout max. \$30,000,000)
Administrative costs	48,000,000
Unrestricted funds	<u>402,000,000</u>
	\$1,000,000,000

**IMPORTANT:** Remember, you can do anything you want, but you must explain your decisions. If you have any questions or just want to talk something out, please **do not** hesitate to contact Bruce or Juliana. See important points below.

## VA and CARP Important Points

1. The most important part of this assignment is for your team to think about what climate change will impact in the future, some of which are likely to occur in your lifetime, and decide what your team would do to address the issue, if you were all powerful (within limits). You must justify your analysis, decisions and recommendations in the East Lowland Climate Vulnerability Assessment (CVA) and Climate Adaptation and Resilience Plan (CARP) that will count as your final exam. What we are most interested in is your ideas about climate adaptation decisions. What did you prioritize and why.
2. This will be done as a team of 4 that will be randomly selected. Everyone on the team is expected to participate in the discussions and contribute to the final product. You should schedule team meetings and report on progress.
3. You need to come up with a name for your consultant team.
4. Your team will prepare a qualitative CVA based on the information you are given for this assignment. It may be necessary to describe some of the vulnerabilities in more general terms. For example, you may not have information identifying the exact location of all undersized storm drains. In this case you can give a generic description of what the vulnerability is. In areas where storm drains are not adequate to handle more intense precipitation events, you could say---Street flooding can be expected in areas that have undersized storm sewers to handle increases in precipitation events. Street flooding can cause....*put in here what you think the secondary effects will be.*
5. Your team will prepare a CARP. You will have \$1 Billion in available funding to address the issues raised in the CVA. You will not have enough money to address all items in the CVA. You need to develop a strategic plan for how to spend the available money to benefit the citizens of East Lowland, the environment and the economy in the most effective way. Again, you are all powerful, within limits, and you can do anything you want but you must explain your decisions and recommendations. Some recommendations in the CARP can be non-specific. If you decide to plant 1400 trees, you do not have to locate where each tree is going to be planted. Explain why you planted them in a certain area and what the impact will be.
6. You can make assumptions but must explain the rationale behind them. If you decide to create a dune and beach, you can assume that the volume of sand you need will be based on an elevation starting at 0.
7. There are no right or wrong answers. Be creative and think about each decision in terms of how it affects or interacts with other parts of the plan. If you go down a few rabbit holes, that's not a bad thing. It will help you to figure out where you want to go. Have some fun with this. When we say explain, justify, detail, etc., a statement like, "We thought it was a good idea." doesn't cut it.
8. You can come up with your own ideas for adaptation. Check with us first.
9. Map with layers providing the information you need can be found at <https://arcg.is/OTLKua> The map will provide you with a lot of information and can be useful in measuring distance and area.
10. Do not wait until the last minute to start working on this. This project will take some time to work through.
11. If you have any questions, want to talk about an idea your team has, need some support you are moving in the right direction, etc. call or email us.