Game of Extremes Adaptation Strategies and Estimated Costs

	Adaptation Strategy	Stressor(s) Addressed		Cost Estimate	Key Implementation Considerations *(aside from funding)*
	Physical Strategies				
PH1	**Build a living levee along a specific stretch of shoreline** *Living levees provide flood protection and habitat value. The slope of the waterside of the levee is more gradual than a traditional levee to allow for marsh vegetation and upland transition zones. The natural habitats can be designed to provide wave dissipation, resulting in a lower levee height. Living levees are more costly, can require substantial fill material, and can be challenging to permit.*		Flood	**$60 M** per 10,000 linear ft. ($$$)	• Environmental regulations and permitting • Cost for operation and maintenance (O&M), such as regular inspection and maintenance due to the constant natural forces the levee is subjected to and tending to vegetation and habitat on levee.
PH2	**Build a seawall along a specific stretch of shoreline** *Seawalls provide erosion protection from tides and waves by reflecting the energy back into the sea. These can reduce damage to properties and beaches, but also disrupt natural shoreline and sediment transport processes destroying some habitats. This is advised for major infrastructure and assets that cannot easily be relocated or raised.*		Flood	**$100 M** per 10,000 linear ft. ($$$)	• Cost for O&M, such as regular inspection and maintenance due to the constant natural forces the seawall is subjected to, vegetation removal, and any material repair or replacement needed • Environmental regulations and considerations (change of coastline habitat and erosion)
PH3	**Raise specific assets out of flood vulnerability zone** *Raising assets out of flood zones protects them from future damage and increased maintenance costs. These efforts may provide more temporary relief in comparison to relocation as water levels continue to rise. This is advised for homes.*		Flood	• Burns Estates: $130k/home • School: $1.5M • Riverwalk: $150k • Light Rail: $3M /10,000 linear ft. • Roadway: $2 M/ 10,000 linear feet ($$-$$$)	• Historical building regulations • Temporary vs. permanent relief

PH4	**Relocate specific assets out of flood vulnerability zone** *Relocating assets out of flood zones by physically moving the structure protects them from future damage and increased maintenance costs. There are few structures where relocating through moving is cost effective.*		Flood	• Burns Estates: $225k/home • Riverwalk: $50k • Light Rail: $800k/10,000 linear ft. • Roadway: $250k/ 10,000 linear feet ($$-$$$)	• Land acquisition • Land use codes for new location • Historical building regulations
PH5	**Build a solar or wind farm to increase the city's renewable portfolio**	Heat		**$500,000** per acre of solar **$3 million** per 2MW wind turbine ($$$)	• Land acquisition • Environmental regulations and permitting • Backup power storage • Renewable energy integration into the grid
PH6	**Build constructed wetlands** *Wetlands trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Vegetation slows the speed of flood waters and distributes them more slowly over the floodplain. Provides habitat.*		Flood	**$850,000 per acre** ($$$)	• Cost for O&M, such as repair of embankments, vegetation control, replacement of wetland plants, maintenance of water level and flow, monitoring of wetland performance, and mosquito control • Land acquisition • Environmental regulations and permitting
PH7	**Build stockpile of temporary flood protection measures (e.g., sandbags) ready for predicted floods**		Flood	**$700,000** Per linear ft., 3 ft. tall sandbag wall ($$$)	• Cost for O&M, such as inspecting after each rain and reshaping or replacing damaged materials.
PH8	**Restore natural habitats (e.g., mangroves, wetlands, marsh, floodplains)** *Restoring these habitats can provide an important buffer to communities along the water against extreme weather and soil erosion.*	Heat	Flood	**$100,000** per acre ($)	• Cost for O&M, such as periodic inspections, repair, replacement of water control structures and earthworks, regular monitoring of the new/restored habitat's performance criteria, and keeping ecosystem healthy by removing pests / diseased plants • Land acquisition • Environmental regulations and permitting

PH9	**Add solar PV and storage to an asset to reduce grid power reliance** Note: Cost is for a 5kW system and storage	Heat		**$36,000** ($)	• Backup power storage • Renewable energy integration into the grid
PH 10	**Install diesel generators in individual buildings for backup power** *Diesel generators can provide power for short amounts of time in the event of a power outage. This can be useful for buildings that require electricity for safety or health purposes. This would require the building owner have fuel on hand to run them. Generators require regular testing and the staff time to complete these tests and maintain records. This is a less than ideal situation for the local environment and health of the city residents. Diesel fuel is a dirty fuel, contributing to local air pollution and increasing health impacts on children, seniors, and people with respiratory illnesses.*	Heat	Flood	**$20,000** Per commercial generator ($)	• Cost for O&M, such as required regular testing and record keeping associated labor • Annual fuel supply • Increased greenhouse gas emissions, local air pollutants, and associated health impacts (i.e., exacerbated respiratory illnesses)
PH 11	**Elevate key components above flood zone** *Elevating key mechanical and electrical equipment, such as electrical boxes and generators, out of flood areas onto higher floors can reduce or remove the risk of flooding and subsequent damage.* Note: Cost is to raise three electrical panels.		Flood	**$5,100** ($)	• May require rewiring and change of ventilation, not included in estimate • Raising more complicated mechanical equipment may require much more effort and finances
PH12	**Add shading structures to popular city and tourist destinations** *City residents and tourists can be exposed to direct sun when visiting the city's popular destinations, which can exacerbate heat-related illnesses. By providing shading, individuals are more comfortable and less likely to fall ill.*	Heat		**$6,000** per shading structure ($)	• Cost of operations and maintenance (O&M), including regular cleaning and repair • Potential for vandalism due to public nature of structures

PH13	**Collect and preserve rainwater to feed back into the river during times of low flow** Heat can impact local water levels and quality due to increased evaporation of surface water bodies. Through rainwater harvesting, the city can reduce its reliance on the local river during times of low flow and can feed that water back into the river when needed.	Heat		**$15,000** for a 5,000 gallon cistern ($)	• Cost of operations and maintenance (O&M) of rainwater harvesting materials, including equipment cleaning, repair, and pump replacement • Lack of water quantity in times of drought
	Design Guidelines				
D1	**Create a resilient infrastructure design policy that requires ability to tolerate specific extreme heat and flood events** *Integrating resilience into infrastructure design can reduce damage, required maintenance, and potential injuries associated with failure. This will benefit the city's infrastructure and the populations that rely on them daily.* Note: Costs are to hire a consultant to develop design criteria.	Heat	Flood	**$150,000** ($$)	• Policy change • Developer buy in • City staff time to track and ensure policy is implemented correctly • Policy review and update at a regular interval (e.g., 5 years)
D2	**Establish resilience design criteria for transit and other transportation systems to withstand extreme heat (e.g., including AC in signal or communications boxes, painting rails white to reduce buckling) and flooding events (e.g., elevating signal and other electrical boxes)** *Integrating resilience into transit and transportation design can reduce damage to infrastructure, delay in travel times, and also potential injuries associated with transit failure. This will benefit the city's transit lines, roadways, and the populations that rely on them daily.* Note: Costs are to hire a consultant to develop design criteria.	Heat	Flood	**$150,000** ($$)	• City staff time to track and ensure policy is implemented correctly • Policy review and update at a regular interval (e.g., 5 years)

D3	**Create a city green design guidance document** *A city green design guidance document will show developers how to utilize green, energy-efficient, and healthy design components into their design build projects in the city. As development is projected to continue in the city, green design can lessen the impacts to the environment and the health of the city moving forward. Also, more energy efficient buildings in the city have the co-benefit of lowering peak energy demand potentially reducing likelihood of power outages.* Note: Costs are to hire a consultant to develop design criteria.	Heat	Flood	**$150,000** ($$)	• Policy change • Developer buy in • City staff time to track and ensure guidance is used correctly • Policy review and update at a regular interval (e.g., 5 years)
D4	**Establish requirement to use cool paving materials for sidewalks and parking lots (or other large expanses of hard surface) in heat islands** *Cool paving materials are designed to reflect more sunlight and absorb less heat, reducing local air temperatures. This will help reduce heat impacts to assets and populations located in urban heat islands. One trade-off is cool pavement materials can require more energy to manufacture than conventional pavement materials.*	Heat		**$15,000** ($)	• Policy change • Developer buy in • Increased energy for manufacturing • City staff time to track and ensure policy is implemented correctly • Policy review and update at a regular interval (e.g., 5 years) • Cost for O&M of cool pavements, such as regular cleaning to retain solar reflectance
D5	**Update building and zoning code to restrict development within the projected 24" water level rise inundation zone** *By restricting development in the water level rise inundation zone, the city will avoid unnecessary costs of repair needed as water level rise progresses. This will also help target less vulnerable areas of the city for new development.*		Flood	**$15,000** ($)	• Code change • Developer, elected officials, and community buy in • Reduced access to coastline and potential recreation, tourism impacts • City staff time to track and ensure policy is implemented correctly • Policy review and update at a regular interval (e.g., 5 years)

D6	**Require that new development manage on site the annual increase in runoff volume from the natural land cover condition to the post-developed condition using green infrastructure** *Green infrastructure reduces dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat. This can reduce urban heat islands, as well as better manage stormwater and reduce flooding in the city.*	Heat	Flood	**$15,000** ($)	• Policy change • Developer buy in • City staff time to track and ensure policy is implemented correctly • Policy review and update at a regular interval (e.g., 5 years)
	Budget Process				
B1	**Include extreme heat tolerance and water level rise vulnerability as evaluation criteria in the capital planning/budgeting allocation process** *Considering materials and construction measures that withstand extreme heat and/or water level rise with city capital planning or budget allocation will promote the longevity of those structures. They would also require less maintenance and associated labor.*	Heat	Flood	**$15,000** ($)	• Political will and process to update budget allocation process • Projection data availability and credibility • How to address already built structures' longevity
B2	**Develop a monitoring approach to track use of city funds for extreme heat and flood management purposes** *By tracking funding, the city can better identify efficiencies for the heat and flood management programs. This is also important when justifying heat and flood preparedness and management initiatives to better understand the cost-benefit analysis of being proactive about projected climate conditions.*	Heat	Flood	**$15,000** ($)	• Operational monitoring and costs City Budget Department's ability to manage program

B3	**Undertake a cost of inaction study to justify taking action on requiring flood mitigation measures in buildings sector** *Studies have found the costs of inaction are often 4 to 10 times greater than the cost of investing in hazard mitigation. Building a study based on local climate factors and assets would provide influential data.*		Flood	**$100,000** ($)	• Political will • Availability of cost data • Historical building regulations
	Programs				
PR1	**Expand existing tree planting program to increase tree canopy coverage (by 25% or 5,000 trees)** *Trees lower surface and air temperatures by providing shade and increased evapotranspiration. When planted in strategic locations (i.e. near impervious surfaces), trees can be an effective heat island mitigation strategy. Other co-benefits include the potential for reduced energy use if shading a building, improved air quality, enhanced stormwater management, reduced pavement maintenance, and an overall improved public realm and quality of life. Focus should be on drought- and saltwater tolerant species.* Note: Cost includes initial tree planting as well as ongoing maintenance and upkeep.	Heat	Flood	**$700,000** per 1,000 trees ($$$)	• Cost for O&M can be significant because of needs such as regular pruning and watering of trees, removal and replacement of dead trees, and pest control • Parks Department ability to manage program • Operational monitoring and costs

PR2	**Support and develop Community Resilience Hubs which support residents and coordinate resource distribution and services before, during or after a natural hazard event** *Resilience Hubs serve to reduce vulnerability and risk of the community, while also reducing greenhouse gas emissions and supporting social equity. Hubs can serve to meet community-specific needs and reduce strain on emergency shelters, by shifting responsibility from the local government onto community organizations and residents.* Note: Costs are to install solar and associated storage system, print post-disaster materials, stock emergency water and food supply, and install charging stations for cell phones and medical equipment in one Hub.	Heat	Flood	**$287,000** per site ($$)	• Community buy-in/ will • Upfront costs • Operational monitoring and costs
PR3	**Set up the already funded stormwater retention credit trading program** *City capital funds have already been set aside for a stormwater retention credit program. The program would promote projects that reduce harmful stormwater runoff by installing green infrastructure or by removing impervious surfaces. This allows developers to meet the city's stormwater retention requirements on their own sites or elect to purchase "credits" for stormwater retention from others who have voluntarily retrofitted their properties through a stormwater credit-trading program.* Note: Costs include setting up the program, associated labor, outreach, and legal fees.		Flood	**$250,000** ($$)	• Developer awareness and buy in • Operational monitoring and costs

PR4	**Undertake feasibility study for a microgrid to enable the city to maintain power during blackouts (and supply renewable energy during standard operation)** *A microgrid is a discrete energy system consisting of distributed energy sources and loads capable of operating in parallel or independently from the main power grid. This provides energy security for communities, government, and other entities that may require electricity when there are issues with the main grid. This would benefit locations, such as a hospital, where uninterrupted electricity is absolutely necessary to keep medical equipment energized.*	Heat		**$100,000** ($$)	• Energy utility buy-in and support
PR5	**Flush the Water Treatment Plant's distribution system following low pressure events** *Flushing the water distribution system and treatment plant is a safe way to remove contaminants following a low-pressure event that could result from a power outage or high demand. This helps protect the city population from potentially harmful contaminants that could lead to diarrheal illness.*	Heat		**$75,000** ($)	• Period of time without water access • Provision of clean (i.e., water bottles) to community during flushing • Dedicated staff during flush periods • Operational monitoring and costs
PR6	**Work with local utility to develop / increase take up of energy demand response programs** *Energy demand response programs help reduce or shift electricity usage during peak periods by providing users financial incentives to use less electricity at those times. This reduces stress on the grid and therefore the risk of a power outage. This also forces end-users to evaluate their energy usage and often reduce their overall consumption as associated greenhouse gas emissions. The city's role would be to help promote the program.*	Heat		**$40,000** ($)	• Community buy in/ awareness of program • Operational monitoring and costs

PR7	**Hold a small business resilience educational campaign and training** *Educate local business on resilience strategies to bolster them against the effects of climate change. Emphasis can be focused on practical actions they can take, such as elevating assets within their business if they are located in a flood or water level rise zone.*	Heat	Flood	**$30,000** ($)	• Local business interest • Language barriers • Operational monitoring and costs
PR8	**Begin a residential weatherization incentive program** *Weatherization improvements can significantly reduce energy consumption and optimize energy efficiency of residential buildings. This will reduce energy costs for residents and city greenhouse gas emissions.*	Heat	Flood	**$30,000** ($)	• Community buy in/awareness of program • Level of subsidies for target populations • Operational monitoring and costs
PR9	**Develop a heat wave and flooding response program, including establishing local threshold for alert, creating a hotline and alert system** *Alert systems can be activated in the event of a flood and at an established temperature threshold to notify residents when to reduce outdoor activity, take preventative measures, and/or seek shelter. This would reduce heat and flood exposure across the city, subsequently reducing illness and death. By reducing the incidence of these illnesses, it should also reduce the burden on the local healthcare system to care for these individuals. A potential barrier to these programs is that not all populations may have access if alerts are only in English or low-income if alerts only come through inaccessible technology (i.e. television, cell phone).*	Heat	Flood	**$10,000** to establish ($)	• Citizen access to communication devices (cell phones, internet) • Language barriers • Operational monitoring and costs

PR10	**Write a grant proposal that enables you to access additional funding for adaptation strategy implementation.** *Increase your city budget for adaptation strategies by applying to a state or federal resilience grant program and access an additional $250,000.*	Heat	Flood	**$10,000** ($)	• Upfront costs • Grant restrictions on how money can be spent
	Planning				
PL1	**Develop a Combined Climate Mitigation and Climate Resilience Plan with Equity at the core of the plan development** *A Climate Mitigation and Resilience Plan would provide a city with the roadmap and framework to prioritize and organize their actions to mitigate and adapt to climate change. It is important that the plan takes equity into account to be effective. These are often public facing documents with stakeholder involvement.* Note: Costs are to hire a consultant to develop plan.	Heat	Flood	**$200,000** ($$)	• Political will • Stakeholder involvement
PL2	**Establish a position in the city that is responsible for resilience**	Heat	Flood	**$100,000** ($$)	• Political will • Integration in city government operations
PL3	**Update policies in the city's comprehensive or general plan to respond to risks from heat and flood projections** *These long-range plans describe what a city wants to be like in the future and how it will achieve that vision. The city can establish goals for heat and flood preparedness in these plans, and define related policies and programs.*	Heat	Flood	**$40,000** ($)	• Political will • Projection data availability and credibility

PL4	**Update city zoning to proactively address to risks from heat and flood projections** *Zoning ordinance revisions may be necessary to implement revisions to the land use diagram and comprehensive/general plan. For example, a flood-risk overlay designation on the land use diagram may result in maximum building height increases in the zoning code to allow raised finished floor elevations that avoid risks.*	Heat	Flood	**$40,000** ($)	• Political will • Projection data availability and credibility
PL5	**Incorporate green streets requirements into city streetscape plans for new streets and street upgrades** *Green streets can incorporate a wide variety of design elements including street trees and permeable pavements. Coordinating green infrastructure installation with broader transportation improvements can significantly reduce the amount of heat-absorbing impervious surfaces in a city, as well as the cost of stormwater management.*	Heat	Flood	**$10,000** ($)	• Political will • City and developer knowledge of green street design and maintenance
PL6	**Revise health and safety plan requirements for extreme heat events for industries employing outdoor workers (construction, transit, agriculture etc.) to reduce exposure (i.e. modifying construction schedules to focus on night and early morning man hours)** *Simple changes to health and safety plans, such as shifting construction schedules to avoid the hottest parts of the day, mandatory water breaks, and temperature thresholds for outdoor labor, could greatly reduce the number of heat-related illness among this population. Reduces burdens on employers and local healthcare facilities.*	Heat		**$10,000** ($)	• Local industry buy in • Potentially slower construction times or agricultural output with reduced daytime work hours

PL7	**Develop a nutrient management plan to reduce agro-chemical runoff into the river.** *To avoid contamination of the river water upon which certain assets depend, especially in high-heat periods, the City can develop a nutrient management plan to combat agrochemical runoff into the river.*	Heat	Flood	**$10,000** ($)	• Local farmer buy-in • Change of suppliers and farming systems, may require additional equipment • Cost for O&M once the plan is implemented, such regular soil testing.

Note: All costs provided are estimates developed for the purpose of the game only. Where possible, they are derived from reports and case studies. They are illustrative only, and will vary greatly depending on location, exact design of strategy, permitting requirements, construction costs and vulnerability of the asset (among other variables).

Game of Extremes - Mapping of Adaptation Strategies to Assets

The following strategies apply to all assets (or most, as noted in parentheses):

Buildings/Built Environment

- PH5: Build a solar or wind farm to increase the city's renewable portfolio
- PH9: Add solar PV and storage to an asset to reduce grid power reliance (NB: this strategy doesn't apply to Wetlands and Park/Green Space/Trees assets)
- D1: Create a resilient infrastructure design policy that requires ability to tolerate specific extreme heat and flood events
- D3: Create a city green design guidance document
- D5: Update building and zoning code to restrict development within the projected 24" water level rise inundation zone
- D6: Require that new development manage on site the annual increase in runoff volume from the natural land cover condition to the post-developed condition using green infrastructure
- B1: Include extreme heat tolerance and water level rise vulnerability as evaluation criteria in the capital planning/budgeting allocation process
- PR3: Set up the already-funded stormwater retention credit trading program
- PR6: Work with local utility to develop / increase take up of energy demand response programs (NB: this strategy doesn't apply to Wetlands and Park/Green Space/Trees assets)
- PL4: Update city zoning to proactively address risks from heat and flood projections
- PL5: Incorporate green streets requirements into streetscape plans for new and upgraded streets

People Focused

- PR2: Support and develop Community Resilience Hubs which support residents and coordinate resource distribution and services before, during or after a natural hazard event (NB: this strategy doesn't apply to Wetlands and Park/Green Space/Trees assets)
- PR7: Hold a small business resilience educational campaign and training
- PR9: Develop a heat wave and flooding response program, including establishing local threshold for alert, creating a hotline and alert system
- PL6: Revise health and safety plan requirements for extreme heat events for industries employing outdoor workers (construction, transit, agriculture etc.) to reduce exposure (i.e. modifying construction schedules to focus on night and early morning man hours) (NB: this strategy doesn't apply to Wetlands and Park/Green Space/Trees assets)

Research/Information Studies

- B2: Develop a monitoring approach to track use of city funds for extreme heat and flood management purposes
- B3: Undertake a cost of inaction study to justify taking action on requiring flood mitigation measures in buildings sector

Local Government and Budget

- PR10: Write a grant proposal that enables you to access additional funding for adaptation strategy implementation
- PL1: Develop a Combined Climate Mitigation and Climate Resilience Plan with Equity at the core of the plan development

- PL2: Establish a position in the city that is responsible for resilience
  PL3: Update policies in the city's comprehensive or general plan to respond to risks from heat and flood projections

The following strategies apply to specific assets:

Asset	Specific Adaptation Strategies
Power Plant	• PH7: Build stockpile of temporary flood protection measures (e.g., sandbags) for predicted floods • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power • PH11: Elevate key components above flood zone • PR4: Undertake feasibility study for a microgrid to enable the city to maintain power during blackouts (and supply renewable energy during standard operation) • D4: Establish requirement to use cool paving materials for sidewalks and parking lots (or other large expanses of hard surface) in heat island afflicted areas
Water Treatment Plant	• PH1: Build a living levee along a specific stretch of shoreline • PH2: Build a seawall along a specific stretch of shoreline • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power • PH11: Elevate key components above flood zone • PR5: Flush the WTP's distribution system following low pressure events • D4: Establish requirement to use cool paving materials for sidewalks and parking lots (or other large expanses of hard surface) in heat island afflicted areas
Wastewater Treatment Plant	• PH1: Build a living levee along a specific stretch of shoreline • PH2: Build a seawall along a specific stretch of shoreline • PH11: Elevate key components above flood zone • D4: Establish requirement to use cool paving materials for sidewalks and parking lots (or other large expanses of hard surface) in heat island afflicted areas
Senior Center	• PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power • D4: Establish requirement to use cool paving materials for sidewalks and parking lots (or other large expanses of hard surface) in heat island afflicted areas
Hospital	• PH7: Build stockpile of temporary flood protection measures (e.g., sandbags) for predicted floods • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power PH11: Elevate key components above flood zone • PR4: Undertake feasibility study for a microgrid to enable the city to maintain power during blackouts (and supply renewable energy during standard operation)
Emergency Service (Police/Fire)	• PH1: Build a living levee along a specific stretch of shoreline • PH2: Build a seawall along a specific stretch of shoreline • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power • PH11: Elevate key components above flood zone • PR4: Undertake feasibility study for a microgrid to enable the city to maintain power during blackouts (and supply renewable energy during standard operation)

Daycare Center	• PH7: Build stockpile of temporary flood protection measures (e.g., sandbags) for predicted floods • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power PH11: Elevate key components above flood zone
Public Housing – The Townhomes	• PR8: Begin a residential weatherization incentive program • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power • D4: Establish requirement to use cool paving materials for sidewalks and parking lots (or other large expanses of hard surface) in heat island afflicted areas
High-income Housing – Burns Estates	• PR8: Begin a residential weatherization incentive program • PH1: Build a living levee along a specific stretch of shoreline • PH2: Build a seawall along a specific stretch of shoreline • PH3: Raise specific assets out of flood vulnerability zone • PH4: Relocate specific assets out of flood vulnerability zone • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power PH11: Elevate key components above flood zone
Transportation Hub	• PH7: Build stockpile of temporary flood protection measures (e.g., sandbags) for predicted floods • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power • PH11: Elevate key components above flood zone • D2: Establish resilience design criteria for transit and other transportation systems to withstand extreme heat (e.g., including AC in signal or communications boxes, painting rails white to reduce buckling) and flooding events (e.g., elevating signal and other electrical boxes).
Light Rail Transit Line	• PH3: Raise specific assets out of flood vulnerability zone • PH4: Relocate specific assets out of flood vulnerability zone • PH11: Elevate key components above flood zone • D2: Establish resilience design criteria for transit and other transportation systems to withstand extreme heat (e.g., including AC in signal or communications boxes, painting rails white to reduce buckling) and flooding events (e.g., elevating signal and other electrical boxes).
Roadways	• PH3: Raise specific assets out of flood vulnerability zone • PH4: Relocate specific assets out of flood vulnerability zone • D2: Establish resilience design criteria for transit and other transportation systems to withstand extreme heat (e.g., including AC in signal or communications boxes, painting rails white to reduce buckling) and flooding events (e.g., elevating signal and other electrical boxes).
Rural Area	• PR4: Undertake feasibility study for a microgrid to enable the city to maintain power during blackouts (and supply renewable energy during standard operation) • PH13: Collect and preserve rainwater to feed back into the river during times of low flow • PL7: Develop a nutrient management plan at the surrounding rural areas to reduce agricultural runoff into the surrounding waterways.
Park/Green Space/Trees	• PH1: Build a living levee along a specific stretch of shoreline • PH2: Build a seawall along a specific stretch of shoreline • PH8: Restore natural habitats (e.g., mangroves, wetlands, marsh) • PR1: Expand existing tree planting program to increase tree canopy coverage (by 25% or 5,000 trees)

Public School	• PH1: Build a living levee along a specific stretch of shoreline • PH2: Build a seawall along a specific stretch of shoreline • PH3: Raise specific assets out of flood vulnerability zone • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power • PH11: Elevate key components above flood zone (if flood vulnerable asset is chosen to be have internal components raised)
Riverwalk	• PH3: Raise specific assets out of flood vulnerability zone • PH4: Relocate specific assets out of flood vulnerability zone • PH7: Build stockpile of temporary flood protection measures (e.g., sandbags) for predicted floods • PH11: Elevate key components above flood zone • PH12: Add shading structures to popular city and tourist destinations
Stadium	• PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power • D4: Establish requirement to use cool paving materials for sidewalks and parking lots (or other large expanses of hard surface) in heat island afflicted areas
Wetlands	• PH6: Build constructed wetlands • PH8: Restore natural habitats (e.g., mangroves, wetlands, marsh) • PH13: Collect and preserve rainwater to feed back into the river during times of low flow • PL7: Develop a nutrient management plan at the surrounding rural areas to reduce agricultural runoff into the surrounding waterways.
Dam	• PH7: Build stockpile of temporary flood protection measures (e.g., sandbags) for predicted floods • PH9: Add solar PV and storage to an asset to reduce grid power reliance • PH10: Install diesel generators in individual buildings for backup power • PH11: Elevate key components above flood zone