Flood Resilience Policy Framework

Draft for Public Review

April 22, 2024

CITY OF PETALUMA
GENERAL PLAN UPDATE

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Overview

This Public Draft Policy Framework was prepared for review by the Petaluma community. The first two sections provide important context and are identical in each of the draft policy frameworks. The "Introduction" section briefly explains general plans, Petaluma's General Plan Update project, policy frameworks, project next steps, and key terminology. The "Policy Framework Foundations" section summarizes the analysis and community input that informed this policy framework.

The remaining sections are the core of this document that the City would like the community to review. The first of these sections, "Summary of Framework Approach," summarizes the overall approach to the topic addressed by this framework. Next is the main body of the framework, the "Goals, Policies, and Actions" section, which is organized into several goals. Each goal, in turn, has several related policies. And many policies have actions that implement those policies.

Introduction

General Plans

State law requires that each city "adopt a comprehensive, long-term general plan for the physical development of the county or city." This general plan must contain an "integrated, internally consistent and compatible statement of policies" that appropriately responds to local conditions and circumstances. General plans are organized into different "elements," or chapters, like conservation, housing, and land use. There is no required time interval at which jurisdictions must update their general plans, though Housing Elements must be updated every eight years.

State law stipulates that capital improvements and certain other planning policies, such as specific plans, zoning actions, development agreements, and subdivisions, must be consistent with the general plan. The general plan also includes policies that relate to a wide variety of matters under local jurisdiction, which can guide future decision-making.

Petaluma's General Plan Update

The current Petaluma General Plan was adopted in 2008 and last updated in 2012, and it accounts for a planning period through 2025. Petaluma has experienced a great deal of change since then, so the City initiated an update to the General Plan in 2020, and brought a consultant team on to assist with the project in 2021.

Petaluma's updated General Plan will address many topics, including: natural environment, hazard mitigation, historic preservation, land use, urban design, housing, mobility, parks, facilities, the arts, economic development, and environmental justice. To meet State deadlines, the Housing Element was completed, adopted, and certified by the State in early 2023. Concurrently with the General Plan Update, the City is also developing a Climate Action Plan, the "Blueprint for Carbon Neutrality" (Blueprint); the team has worked to align the two concurrent efforts and will continue to align greenhouse gas reduction strategies with the General Plan elements as the Blueprint moves through the adoption process.

For more information about General Plans and Petaluma's General Plan Update process, go to https://www.planpetaluma.org/.

Policy Frameworks

Purpose and Structure

Policy frameworks such as this one outline the proposed General Plan goals, policies, and implementation actions for each topic addressed by the General Plan. They were developed based on:

- The existing General Plan (https://cityofpetaluma.org/general-plan/)
- Key findings from the Existing Conditions Reports (see the "Policy Framework Foundations" section below)
- State requirements and guidance
- Related technical, policy, and programmatic resources
- Extensive community input (https://www.planpetaluma.org/getinvolved)
- The Vision, Pillars, and Guiding Principles developed based on community input (see the "Policy Framework Foundations" section below)
- Input from the General Plan Advisory Committee (GPAC) (https://www.planpetaluma.org/gpac-page)
- Input from City committees, boards, and commissions, and
- Guidance from City staff and consultants.

Topics Covered

There is a draft Policy Framework for each of the following topics[1]:

- Natural Environment
- Safety
- Flood Resilience
- Land Use & Community Character
- Transportation
- Infrastructure & Utilities
- Public Facilities
- Parks & Recreation
- Historic Resources
- Arts, Culture, and Creativity
- Economic Development
- Noise
- Health Equity and Environmental Justice
- Implementation & Governance.

There are many connections among the topics covered in different frameworks. Generally, the following topics are addressed as follows. This list includes overarching topics and subtopics, and then lists the frameworks that address this topic in brackets. This is not a comprehensive list of topics covered or of intersections among frameworks:

Climate Change

- Greenhouse gas reduction (Blueprint for Carbon Neutrality, Parks & Recreation, Transportation, Infrastructure & Utilities)
- Mode shift, active transportation, EV charging, vehicle miles traveled (VMT) (Transportation)
- Green building[2] (Land Use & Community Character, Public Facilities, Infrastructure & Utilities)
- Low impact development[3] (Natural Environment, Infrastructure & Utilities)
- Climate adaptation (Safety, Flood Resilience, Land Use & Community Character, Health Equity & Environmental Justice)
- Just transition[4] (Economic Development)

Ecosystems

- Habitats, wildlife corridors, & open space (Natural Environment, Parks & Recreation, Transportation)
- Urban forestry[5] (Parks & Recreation, Health Equity and Environmental Justice)

Petaluma River and Tributaries

- Ecology, habitats, & wildlife corridors (Natural Environment)
- Flooding (Safety, Flood Resilience)
- Adjacent land uses (Land Use & Community Character, Parks & Recreation, Historic Resources)
- Trails and transportation (Transportation)
- River Access and Enhancement Plan (Parks & Recreation, Flood Resilience)

Stormwater, Water Supply, and Wastewater

- Watershed and river protection (Natural Environment)
- Flood control (Flood Resilience, Parks & Recreation, Safety)
- Public water, water conservation, drought, & wastewater systems (Infrastructure & Utilities, Safety)

Transportation

- Mobility network[6], accessibility[7], safety, and VMT (Transportation, Parks & Recreation, Economic Development, Safety)
- Public realm[8] (Land Use & Community Character, Noise)

15-Minute Neighborhoods

- Types, locations, and characteristics (Land Use & Community Character)
- Mobility networks, design, and safety (Transportation)

Equity (in addition to the Health Equity and Environmental Justice Framework)

- Tribal collaboration[9] (Natural Environment, Historic Resources)
- Equitable transportation (Transportation)
- Park and public facilities access (Parks & Recreation, Public Facilities)
- Recreation program access (Parks & Recreation)
- Cultural equity (Arts, Culture, & Creativity)
- Economic justice[10] (Economic Development)
- Community engagement (Parks & Recreation, Implementation & Governance).

Next Steps

The Public Draft Policy Frameworks will be reviewed by the public, Petaluma committees and commissions, the GPAC, and the City Council. Community input and related direction from the City will inform the Draft General Plan, which will also be reviewed by the community before it is presented to the City Council for adoption. A Program Environmental Impact Report (EIR) will be prepared and approved along with the updated General Plan. For the most up-to-date project information and schedule, go to https://www.planpetaluma.org/.

Key Definitions

When reviewing the Policy Frameworks, keep in mind these definitions:

- **Goal**: a general statement that expresses the outcomes towards which planning efforts are directed; often a topic-specific component of the Vision
- **Policy**: a statement of intent or direction that contributes toward achieving a goal and that guides decision-making
- **Action**: a specific activity, procedure, program, or project aimed at implementing a policy.

Flood Resilience Background and Context

Key Terms Used in the Framework

Stakeholder and Reference Agencies

ART: Adapting to Rising Tides, a program of BCDC.

ASCE: American Society of Civil Engineers.

BCDC: San Francisco Bay Conservation and Development Commission.

CDF&W: California Dept of Fish and Wildlife

City: City of Petaluma.

FEMA: Federal Emergency Management Agency.

NOAA: National Ocean and Atmospheric Administration.

OPC: California Ocean Protection Council. OPC 2018 in this document refers to their publication "State of California Sea-Level Rise Guidance, 2018 Update".

Petaluma Valley GSA: Petaluma Valley's Groundwater Sustainability Agency.

Sonoma Water: Formerly Sonoma County Water Agency.

USACE: United States Army Corps of Engineers.

WEDG: Waterfront Edge Design Guidelines, as developed by the Waterfront Alliance, a private policy advocacy non-profit.

Hydrology and Meteorology Terms

100-Year Event: An event that has a 1% chance of occurring or being exceeded in any given year. Applies to rainfall and storm surge. Also referred to as the 1% exceedance event or the base flood.

500-Year Event: An event that has a 0.2% chance of occurring or being exceeded in any given year. Applies to rainfall and storm surge. Also referred to as the 0.2% exceedance event.

Floodplain: Any land area susceptible to being inundated by water from any source. Defined by the City and currently identical to the FEMA-defined floodplain. Shown on FIRMs.

Floodway: The channel of a waterway and adjacent land areas that must be reserved to discharge the base flood. Defined by FEMA. Shown on FIRMs.

King Tide: A high tide that meets or exceeds 1.26 feet above the Mean Higher High Water level. Occurs two to three times a year. Identified by the City based on data from NOAA and USACE.

Mean Higher High Water (MHHW): Every 24-hour day typically has two high tides. This is the annual average water height of the higher of those two high tides. Defined by NOAA. For Petaluma, currently measured at the NOAA Tide Gauge #9415584.

Sea Level Rise (SLR): The increase in global ocean water elevation due to human activity. Projections used in this framework are from "Rising Seas in California: An Update on Sea-Level Rise Science," published by OPC in 2018. The draft 2024 OPC Sea Level Rise Guidance was reviewed, but not able to be incorporated due to not being fully published at the time of drafting this framework.

Special Flood Hazard Area: An area that will be inundated by the flood event having a 1-percent change of being equaled or exceeded in any given year, as depicted on the FEMA FIRM.

Storm Surge: an increase in water elevation due to atmospheric pressure changes and other impacts of a storm. A storm in the Pacific or San Francisco Bay may cause storm surge (higher Petaluma River Water Elevation), independent of rainfall in Petaluma itself. Current conditions defined by USACE; future conditions considering SLR modeled by the City.

Flood Regulation Terms

100 Year Design Flood Elevation (100DFE): The elevation of surface water shown on the map depicting the flooded areas in the Current 100-year Flood Hazard. Defined by the City.

500 Year Design Flood Elevation (500DFE): The elevation of surface water shown on the map depicting the flooded areas in the Current 500-year Flood Hazard. Defined by the City.

Base Flood Elevation (BFE): The elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that elevation in any given year, without taking into account sea level rise or changing climatic conditions. Defined by FEMA and shown on Flood Insurance Rate Maps (FIRM).

Finished Floor Elevation (FFE): The elevation of the lowest finished enclosed area, including a basement and accessory machinery, equipment, whether enclosed or not. Defined by the City.

Flood Insurance Rate Map (FIRM): Official community maps displaying special flood hazard areas. Published by FEMA.

Future Water Surface Elevation (FWSE): The elevation of surface water shown on the map depicting the flooded areas in the appropriate Future Flood Hazard Map (Mid-Century Very Low Probability Flood Hazard Map, End-of-Century Low Probability Flood Hazard Map, or End-of-Century Very Low Probability Flood Hazard Map). Based on the Project Lifespan and Risk Tolerance of each project, only one FWSE will apply. Defined by the City.

Habitable Space: An enclosed area having more than 20 linear feet of finished interior walls (paneling, etc.) or used for any purpose other than solely for parking of vehicles, building access or storage. Defined by FEMA.

King Tide Water Surface Elevation (KWSE): The elevation of surface water shown on the map depicting the King Tide flooded areas in the appropriate Future Flood Hazard Map (Mid-Century Very Low Probability Flood Hazard Map, End-of-Century Low Probability Flood Hazard Map, or End-of-Century Very Low Probability Flood Hazard Map). Based on the Project Lifespan and Risk Tolerance of each project, only one KWSE will apply. Defined by the City.

Net-Zero Fill: A balance of earthwork (including both material removal and addition) that results in no additional material added both below and above the relevant flood elevation. This is vital to maintaining existing floodplain storage capacity. Defined by the City.

Adaptation Terms

Accommodation: An adaptation strategy that does not change a project's location, but may modify the structure to allow repeated flooding. Examples include floodable ground floors or raising the habitable area and accessory mechanical equipment to provide required freeboard above the BFE.

Adaptation: As paraphrased from ART, actions that reduce the vulnerability of human and natural systems to, in this case, rising floods. Four adaptation strategies are proposed here: protection, accommodation, avoidance, and land use realignment.

Adaptation Pathway: A methodology to phase in adaptation based on external factors. As used in this document, an Adaptation Pathway has three basic components: a current requirement, a trigger condition, and a future, heightened requirement.

Avoidance: An adaptation strategy that does not change a project's structure, but changes the location to reduce the possibility of flooding. Examples include shifting the use to a portion of the property with less flood risk.

Land Use Realignment: A suite of policy strategies to remove the use from an area at risk of flooding. Includes strategies like transfer of development rights, down- or up-zoning, and eminent domain.

Protection: An adaptation strategy that does not change a project's location or structure, but rather adds infrastructure to defend the project from flooding. Examples include flood control barriers or levees.

Project and Land Use Terms

Project Lifespan: The time in which the project serves its purpose with no expected changes to the structure or its use. Defined by the City, based on the project use and permit application.

Risk Tolerance: The "level of comfort associated with the consequences of sea-level rise and associated hazards" (OPC 2018). Categories of tolerance are defined in this Framework based on guidance from the OPC and ASCE.

Risk-Aversion: The desire or importance to avoid risks associated with flooding. A project with a low risk aversion has a high tolerance to risk. A land use might have high risk aversion if it serves a purpose in an emergency, like a hospital or a community center.

Short-Lived Use: A land use with a lifespan ending before 2050. It is assumed most projects which will be developed during the life of the General Plan have a longer project lifespan than 2050.

Risk-Tolerant Use: A land use that is not vital to the City's ability to recover from a disaster or poses a moderate danger to the general public if flooded or otherwise damaged. Examples include retail,

residential, and non-hazardous industrial. Defined by the City based on ASCE Document 24-14 Classes 1 and 2. See Table 3.

Risk-Intolerant Use: A land use that poses a significant danger to the general public if flooded or otherwise damaged or is vital to post-disaster recovery. Examples include electrical substations, hospitals, and high capacity gathering places like auditoriums. Defined by the City based on American Society of Civil Engineers (ASCE) Document 24-14 Classes 3 and 4.

Current City Flood Resilience Strategies

Current City General Plan, zoning, and building requirements/restrictions pertaining to new and substantially improved development are applicable in three main areas:

1. The Floodway as defined by FEMA and shown on FIRMs and the current General Plan land use map;
2. The 100-year floodplain as defined by FEMA and shown on FIRMs and the current General Plan and Zoning Land Use Map; and
3. "Zero-net fill - the area along the Petaluma River west of the freeway, upstream of the Payran Street Bridge and including the area along Willowbrook Creek east of the freeway downstream of Old Redwood Highway" [Petaluma IZO 6.070-F], an area also referred to as the Petaluma River Corridor (PRC) in Policy 8-P-28 of the current General Plan.

When a property falls into one or more of these areas, it is subject to heighted regulations to minimize flood risk. For example, a residential property in the floodplain must be built with a Finished Floor Elevation (FFE) of at least 1 foot above the FEMA Base Flood Elevation (BFE), while an identical property within the Petaluma River Corridor must have an FFE of at least 2 foot above the FEMA BFE. To create a more resilient City and prepare for worsening flooding due to climate impacts, this Framework proposes similar maps based on updated modeling that considers future flood conditions and incorporating higher building standards.

Complementary Land Use Policies

Land use policy can play a significant role in flood resilience. Therefore, this Flood Resilience Policy Framework was developed in coordination with the Land Use Policy Framework and Land Use Alternatives. Specifically, preliminary Flood Resilience Land Use Concepts have been developed that propose a combination of avoidance, protection, accommodation; and land use realignment strategies based on the same modeling and mapping used to develop the maps proposed in this Framework. Those Flood Resilience Land Use Concepts are not included in this Framework but should be considered along with the goals and policies below to understand the full complement of flood resilience strategies being considered.

Policy Framework Foundations

Existing Conditions Key Findings

The Existing Conditions Reports for Petaluma's General Plan Update serve as the technical analysis of diverse dimensions of the city's status as evaluated in 2021. They provide a detailed analysis of current conditions and provide a data-based foundation for policymaking. The nineteen Existing Conditions Reports as well as a summary presentation can be downloaded from the "Plan Documents" section of the project website: https://www.planpetaluma.org/documents#ecr-final.

In addition to the current City flood resilience strategies summarized above, the following key findings from Existing Conditions Reports informed the preparation of this policy framework:

- Historical hydrological function of the Petaluma River watershed has been degraded with channelization, reducing meanders, urban growth, and extensive losses of wetland and floodplain connectivity in the watershed.
- The City currently has many residential, commercial, and industrial lands at risk from flooding, per the 2020 Local Hazard Mitigation Plan (LHMP).
- The LHMP indicates that 5 critical utility facilities (2 electrical substations, 3 water facilities) are at risk of flooding.
- The City has updated its flood modelling to take into account SLR and other climactic changes.

Related Vision, Pillars, and Guiding Principles

The Vision Statement, Pillars, Guiding Principles, and Supporting Concepts reflect community engagement input that occurred during the Visioning Phase of the General Plan Update in 2021. On February 17, 2022, the GPAC voted unanimously to recommend that the City Council accept these Vision materials as the guidance for the ongoing General Plan Update planning process, and the City Council accepted them on March 21, 2022.

- The Vision Statement describes the desired future conditions and characteristics of the city.
- The Pillars are the core community values.
- The Guiding Principles and Supporting Concepts provide the broad direction and pathways to achieve the vision and honor community values, with a focus on the community's specific challenges and opportunities.

The Vision Statement, Pillars, and Guiding Principles and Supporting Concepts can be downloaded from the "Plan Documents" section of the project website: https://www.planpetaluma.org/documents#gpuvision. Together, the Vision Statement, Pillars, and Guiding Principles and Supporting Concepts provide the basis for the goals, policies, and programs included in General Plan elements.

The following verbatim excerpts from the Vision Statement, Pillars, and Guiding Principles informed the preparation of this policy framework:

Vision

We are prosperous. We support our local businesses that provide jobs for our own residents and services to our City and region. Our economy is localized and self-reliant and builds wealth for residents of all socioeconomic backgrounds. We invite new businesses and development to join in our vision. Our City infrastructure and facilities are sustainably financed, resilient, and well-maintained.

We are forward-thinking leaders. By achieving carbon neutrality in 2030, we demonstrate that equitable, carbon-neutral, regenerative communities and economies are possible through action and collaboration with other cities, communities, and our region. We have adapted to climate change with a community-driven, whole systems, and nature-based approach to development.

Pillars

Climate Action, Resilience, and Sustainability. Petaluma is committed to bold action to achieve carbon neutrality by 2030 and to building resilience to climate change impacts, including sea level rise, increasing temperatures, drought, and wildfire intensity. The General Plan must build climate-ready communities using science, technology, and bold ways of thinking to advance change in our relationship with the natural environment and to plan for current and future impacts.

Guiding Principles

There are a total of sixteen Guiding Principles, each with multiple, lettered Supporting Concepts. The following Guiding Principles and Supporting Concepts informed this policy framework:

1. Achieve carbon neutrality by 2030 and equitably foster a **sustainable and resilient community** in which today's needs do not compromise the ability of the community to meet its future needs.

    c. Recognize that urban development and nature must coexist and mutually support each other.

    d. Capitalize on Petaluma's natural assets (river, streams, marshes, trees, plains, etc.) to address climate change and sea level rise.

    e. Develop strategies to elevate the ecological and environmental benefits of existing parks and open spaces.

    h. Take bold measures to address watershed management, water use and expected long-term drought conditions.

    j. Make the city more resilient to natural and man-made disasters including sea level rise, fires, earthquakes, and flooding.

3. **Protect and restore the natural function of the Petaluma River** and its tributaries while expanding complementary recreational, entertainment, and civic opportunities**.**

    a. Restore the beauty and natural function of the Petaluma River.

    f. Maintain and expand setbacks from the river to enhance its natural function and provide wildlife corridors.

    j. Update and then implement the Petaluma River Access and Enhancement Plan.

13. **Ensure infrastructure supports infill development and addresses the impacts of climate change**.

    a. Maintain and continually improve the City's infrastructure to support the evolution of the City and ensure a high quality of life in Petaluma.

b. Co-plan infrastructure improvements with urban development patterns and the preservation and enhancement of the natural environment.

c. Incorporate new (and potential) climate impacts and hazards into the design of infrastructure systems so that infrastructure is resilient and “climate-ready.”

16. **Be a leader** in advancing these guiding principles within the region and beyond.

d. Encourage the exploration of “experimental” policies, ordinances, and infrastructure.

Summary of Framework Approach

This framework synthesizes the existing General Plan, other existing documents like the Petaluma River Access and Enhancement Plan, state and regional sea level rise (SLR) guidance, and more recent documents including the Petaluma Climate Action Framework into a set of goals, policies, and actions that can be modified and added to as climate conditions and the built environment change.

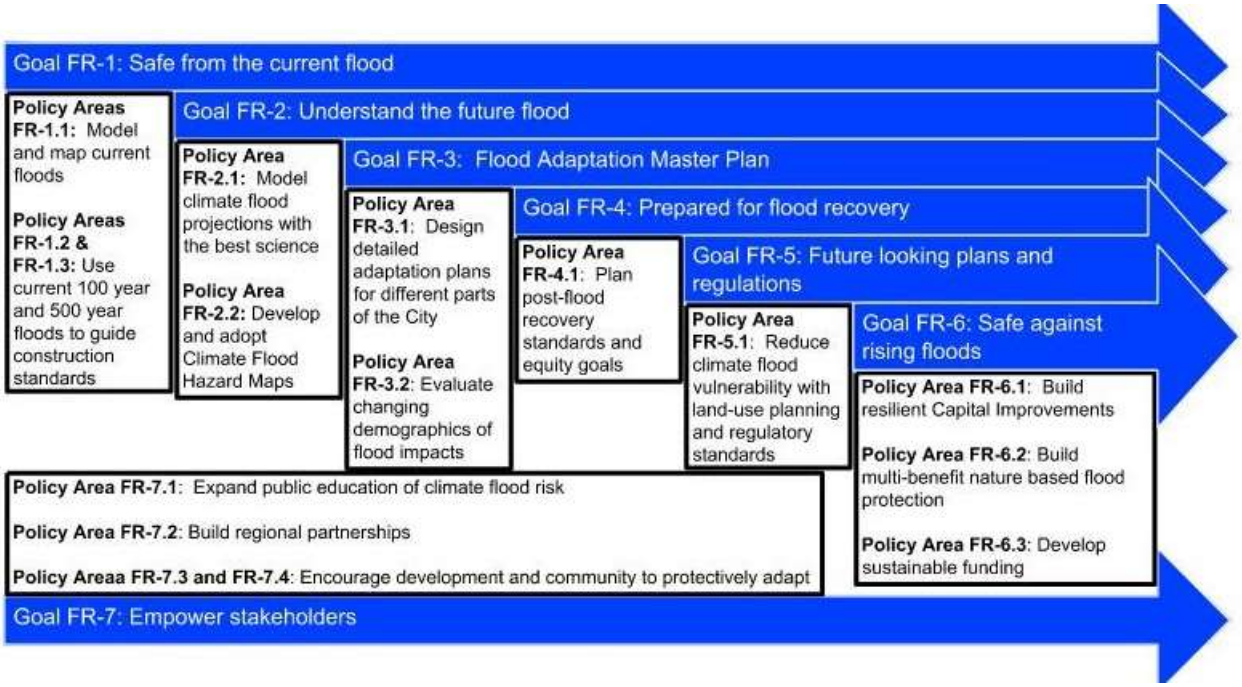
The current Petaluma General Plan flood-related policies and actions are based on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM). While FIRMs are the federal baseline for assessing the current risks from flooding, sea level rise (SLR) or other impacts of the climate crisis such as increased storm intensity or frequency were not available at time of Plan adoption in 2008, so no analysis was undertaken. The General Plan Update will guide the City of Petaluma (City) and its occupants through the middle of the century. Given the longevity of the built environment, this means that decisions made under this updated General Plan will have century-long ramifications to both the existing and future built environment. The City can proactively prepare for future flood conditions by using a policy framework that requires planning and construction projects to meet current flood threats while also preparing for future flood risks. The Policy Framework strikes a balance between allowing the City to evolve and grow while providing for the future needs of the City by reducing impacts from flood risk.

This Administrative Draft Policy Framework is organized into seven Goal Areas:

- Goal FR-1: Safe from the Current Flood
- Goal FR-2: Understand the Future Flood
- Goal FR-3: Flood Adaptation Master Plan
- Goal FR-4: Prepared for Flood Recovery
- Goal FR-5: Future Looking Plans and Regulations
- Goal FR-6: Safe Against Rising Floods
- Goal FR-7: Empowered Stakeholders

The flow between policy areas under Goal Areas 1 through 7 is shown in Figure 1 below.

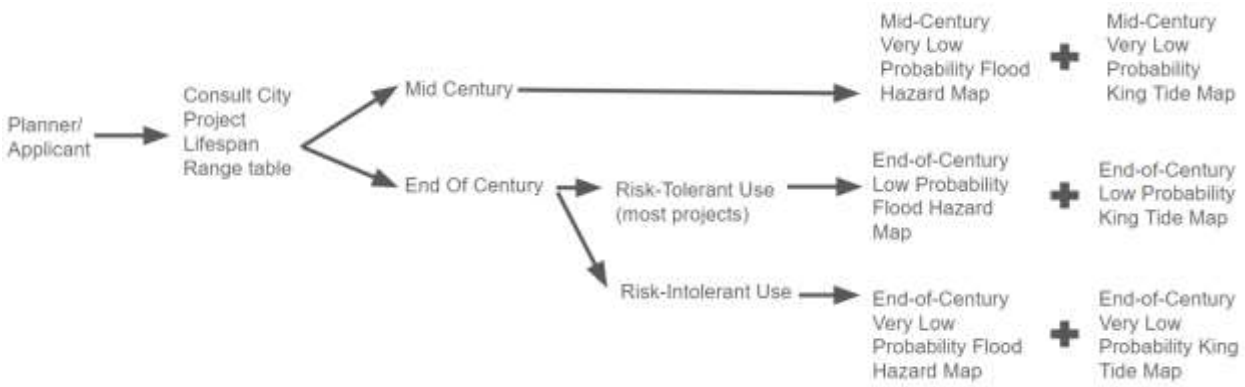
Figure 1: Policy Flow Diagram



Goal Area FR-1 develops and implements updated **Current Flood Hazard Maps,** which describe the current understanding of hazards from the 100-year and 500-year floods. These will implement building standards intended to be more protective than required by FEMA.

Future Flood Hazard Maps are established in Goal Area FR-2 and implemented in Goal Areas 3,4, and 5. Maps are established for **three scenarios: Mid-Century Very Low Probability Flood Hazard, End-of-Century Low Probability Flood Hazard, and End-of-Century Very Low Probability Flood Hazard.** These will inform what future flood hazards a project will have to be adaptable to, in addition to the current construction standards described in Goal Area FR-1. In accordance with State guidance provided by the California Ocean Protection Council in its 2018 Report (OPC2018), the use of different sea level rise (SLR) projections for each map tailors flood adaptation strategies to projects' risk tolerance. Only one Map will be applicable to a project, based on the type of use and the expected Project Lifespan. The proposed maps are shown in Figures 5, 6, and 7. An accompanying map also describes the areas subject to additional standards based on the vulnerability to future King Tide inundation, shown in Figures 8, 9, and 10. The selection process is described in Figure 2 below.

Figure 2: Selection Process of Appropriate Future Flood Hazard Maps



Importantly, these Future Flood Hazard Maps mimic how current FEMA regulations and City building regulations are used. The Flood Hazard Maps identify what areas will need to be resilient to future flood conditions. The policies in Goal Area FR-5 then identify which of the maps is appropriate for different types of projects and project lifespans. The policies in FR-5 also specify the flood resilience standards required to meet these future floods. These policies will promote the project being able to adapt as flood hazards rise. Table 1 summarizes the requirements proposed in Goal Area FR-5 for different scenarios.

Because providing complete resilience against future flood conditions may be costly or impractical during initial construction, the framework allows, via **Adaptation Pathways**, for additional flood resilience to be phased in as flood risk increases due to sea level rise and other climate change impacts. An Adaptation Pathway has three basic components: a current requirement, a trigger condition, and a heightened future requirement. The flood resilience standards are intended to ensure projects are built ready for near-term flood hazards, with the opportunity for later adaptation as climate science, building technology, and applicable regulations and funding evolve over the coming decades.

Goals, Policies, and Actions

Goal FR-1: Safe from the Current Flood

The City uses the most up-to-date understanding of flood hazards to protect life and property based on the updated rainfall, king tide, and storm surge data, thereby exceeding regulatory standards as appropriate.

Policy FR-1.1: Understand the current flood conditions

Continue to proactively model local current flood conditions.

Action FR-1.1.1: Maintain, as appropriate based on updating City and weather conditions, the Current 100-Year Flood Hazard Map (See Figure 3), which is the combined maximum area of flooding in the following:

- The output of a flood model of the current 1% exceedance rainfall event (100-year rain).
- Areas with an elevation lower than the River or creek water surface elevation during the current 1% exceedance storm surge (100-year storm surge) event, per USACE.

Action FR-1.1.2: Maintain, as appropriate based on updating City and weather conditions, the Current 500-Year Flood Hazard Map (See Figure 4), which is the maximum area of flooding in the following:

- The output of a flood model of the current 0.2% exceedance rainfall event (500-year rain).
- Areas with an elevation lower than the River or creek water surface elevation during the current 0.2% exceedance storm surge (500-year storm surge) event, per USACE.

Policy FR-1.2: Exceed FEMA standards

Require uses within the Current 100-Year or Current 500-Year Flood Hazard Maps to adhere to regulatory standards higher than required by FEMA.

Action FR-1.2.1: Require new development within the Special Hazard Flood Area to provide a Finished Floor Elevation (FFE) of at least 2 feet above the Base Flood Elevation (BFE) indicated on the 100-year Flood Insurance Rate Map (FIRM).

Action FR-1.2.2: Require new development within the Current 100-Year Flood Hazard Map to provide a FFE of at least 2 feet above the Design Flood Elevation (100DFE) indicated on the Current 100-Year Flood Hazard Map.

Action FR-1.2.3: Require new development within the Current 500-Year Flood Hazard Map to provide a FFE of at least 1 foot above the Design Flood Elevation (500DFE) indicated on the Current 500-Year Flood Hazard Map.

Action FR-1.2.4: Where multiple FFE requirements exist, the highest will be applied.

Action FR-1.2.5: Prohibit new buildings within the Special Hazard Flood Area or the Current 100-Year Flood Hazard Map where the BFE or 100DFE is greater than 2’ above the existing grade.

Policy FR-1.3: Reduce current risk

Reduce the risk posed by current flood conditions to existing structures.

Action FR-1.3.1: Where additional habitable space is to be added to an existing structure within the 100-year Flood Insurance Rate Map (FIRM, Current 100-Year or 500-Year Flood Hazard Map), the FFE of the additional habitable space must meet the standards of FR-1.2.

Action FR-1.3.2: When an existing structure within the Current 100-Year or 500-Year Flood Hazard Maps sustains more than 50% flood damage and the BFE or 100DFE is greater than 2 feet above existing grade at the building footprint, prohibit reconstruction and replacement and require the removal of damaged portions of the structure.

Action FR-1.3.3: Develop a funded relocation/purchase program to assist property owners with a current structure in an area expecting greater than 2 ft of flooding as shown on the Current 100-year or Flood Insurance Rate Map.

Action FR-1.3.4: Coordinate with the County to promote compatible freeboard regulations in flood-prone areas in County lands that may be annexed into the City in the future.

Figure 3: A map showing the extent and depths of the Current 100-Year Flood Hazard Map

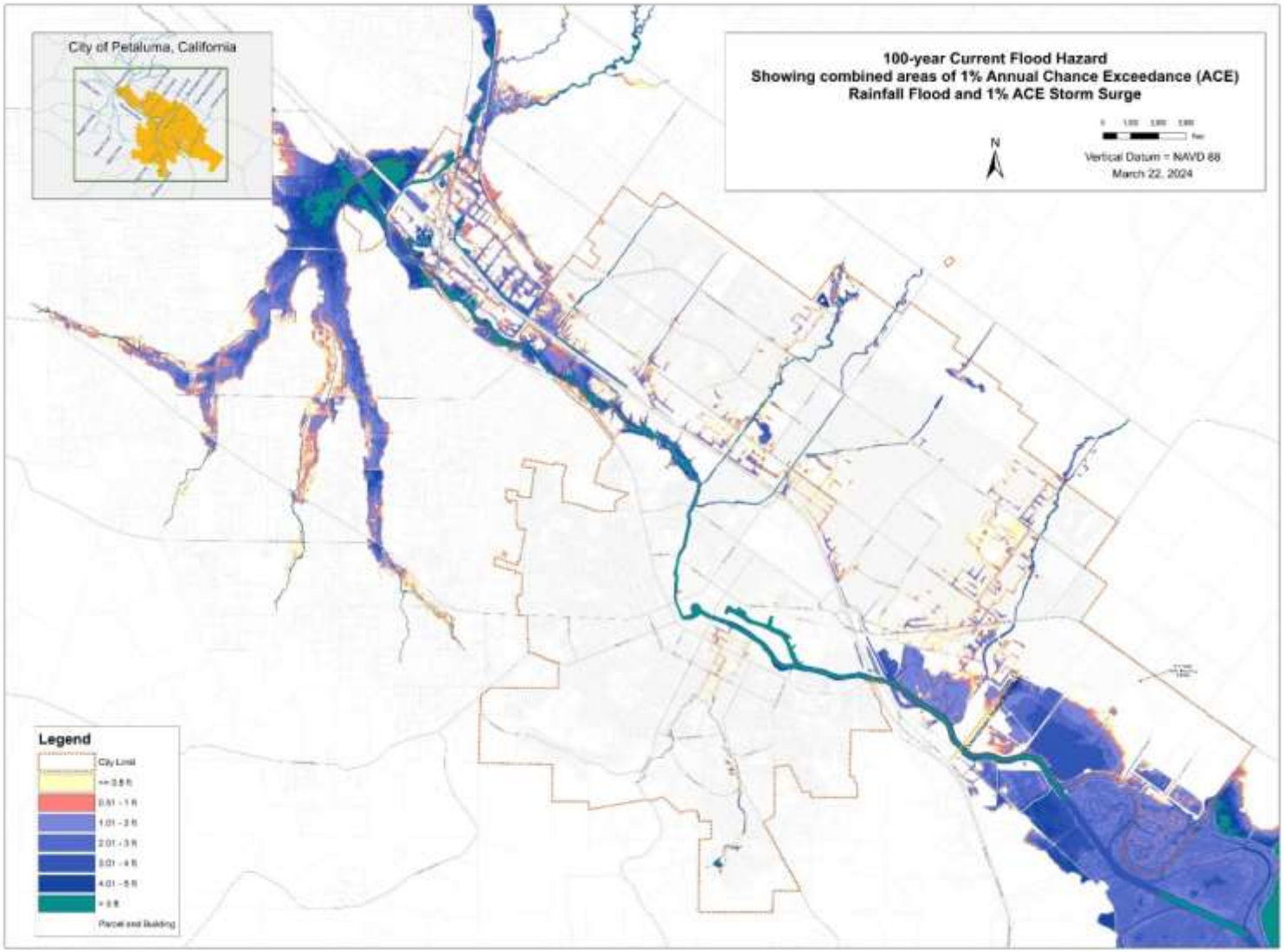
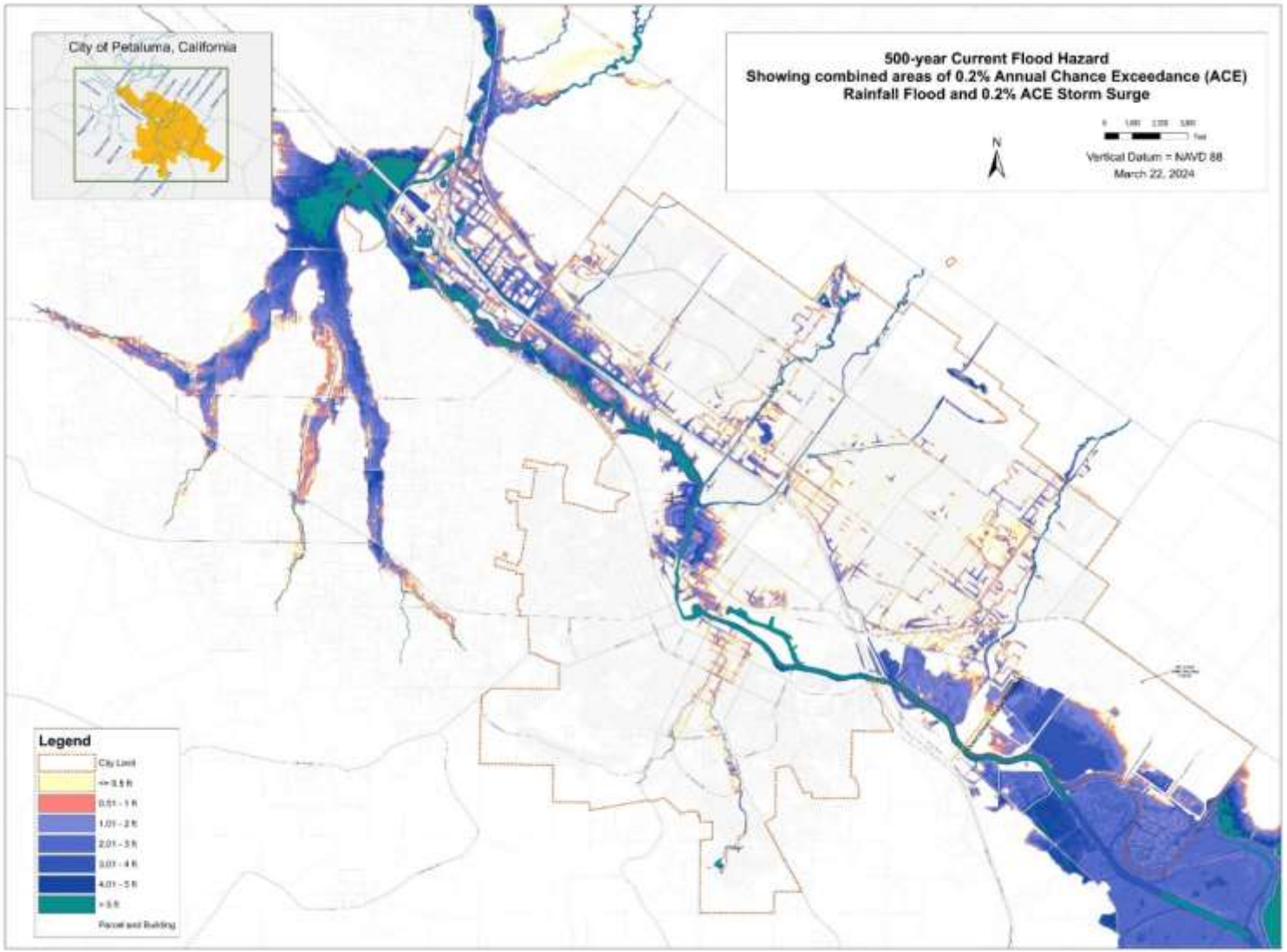


Figure 4: A map showing the extent and depths of the Current 500-Year Flood Hazard Map



Goal FR-2: Understand the Future Flood

The City uses the best available science and data to understand the potential impacts of the climate crisis on flooding.

Policy FR-2.1: Track climate change impacts

Use the best available sea level rise projections, precipitation models, and policy guidance to predict future flood conditions.

Action FR-2.1.1: Define the King Tide elevation as 1.26 feet above the Mean Higher High Water (MHHW), or as amended by scientific study or policy guidance.

Action FR-2.1.2: Create a simple public data and policy memorandum, listing the sources of current sea level rise projections, precipitation, and other flood model inputs. Expand the stream gauge network to comprehensively monitor changes in tide elevations and related effects on Petaluma River tidal levels.

Action FR-2.1.3: Monitor and update precipitation data based on a changing climate; develop End-Of-Century precipitation models through coordination with Sonoma Water.

Action FR-2.1.4: Maintain the integration of the City's flood model methodology and data with Sonoma Water.

Action FR-2.1.5: When new or updated SLR guidance is released that does not simply replace previous guidance, engage technical and community advisors as well as regional organizations to interpret and incorporate.

Policy FR-2.2: Model future floods

Continuously improve the City's understanding of watershed-flood dynamics, including flood protection capacity, as necessitated by changes to policy, climate conditions, and planning needs.

Action FR-2.2.1: Maintain a watershed-wide hydrologic flood model that can consider sea level rise (SLR) and other climate projections.

Action FR-2.2.2: Through the Army Corps of Engineers (USACE), remap the regulatory Floodway and Floodplain to consider changes in hydrology and hydraulics.

Action FR-2.2.3: Develop Future Hazard Flood maps that describe the potential flood hazards in the future, informed by projections of future conditions.

Future Flood Hazard Maps

- The **Mid-Century Very Low Probability Flood Hazard Map** is the combined maximum area of flooding (regardless of depth) shown in the following map (see Figure 5):
    - The output of a flood model of the 1% exceedance rainfall event (100-year rain) that factors in the "2050 Medium-High Risk Aversion" projection for sea level rise (per California Ocean Protection Council (OPC) 2018, or as amended), which assumes 1.9 feet of sea level rise at the time this framework was drafted. The City has defined this as having a "0.5% chance by mid-century: the maximum elevation of OPC's projected SLR

range." This was intended to address the threats from the highest SLR scenario that is plausible.
    - Areas with an elevation lower than the river water surface elevation during a 1% exceedance storm surge (100-year storm surge) event (per USACE) under a sea level rise scenario matching that described above.
    - In addition, The King Tide area of the Mid-Century Very Low Probability Flood Hazard Map is the extent of areas lower than the River or creek elevation during a King Tide, which factors in the "2050 Medium-High Risk Aversion" projection for sea level rise (per OPC 2018, or as amended) (see Figure 8).
- The **End-of-Century Low Probability Flood Hazard Map** is the combined maximum area of flooding (regardless of depth) shown in the following map (see Figure 6):
    - The output of a flood model of the 1% exceedance rainfall event (100-year rain) that factors in the "2100 Likely" projection for sea level rise (per OPC 2018, or as amended, which assumes 3.4 feet of sea level rise at the time this framework was drafted. The City has defined this as having a "17% chance by end-of-century: the maximum elevation of OPC's projected likely SLR range." This was intended to provide a low-risk aversion scenario.
    - Areas with an elevation lower than the River or creek water surface elevation during a 1% exceedance storm surge event (100-year storm surge, per USACE) under a sea level rise scenario matching that described above.
    - The King Tide area of the End-of-Century Low Probability Flood Hazard Map is the extent of areas lower than the River or creek elevation during a King Tide, which factors in the "2100 Likely" projection for sea level rise (per OPC 2018, or as amended) (see Figure 9).
- The **End-of-Century Very Low Probability Flood Hazard Map** is the combined maximum area of flooding (regardless of depth) shown in the following map (see Figure 7):
    - The output of a flood model of the 1% exceedance rainfall event that factors in the "2100 Medium-High Risk Aversion" projection for sea level rise (per OPC 2018, or as amended), which assumes 6.9 feet of sea level rise at the time this framework was drafted. The City has defined this as having a "0.5% chance by end-of-century: the maximum elevation of OPC's projected SLR range." This was intended to address the threats from the highest SLR scenario that is plausible.
    - Areas with an elevation lower than the River or creek elevation during a 1% exceedance storm surge event (per USACE) under a sea level rise scenario matching that described above.
    - The King Tide area of the End-of-Century Very Low Probability Flood Hazard Map is the extent of areas lower than the River or creek elevation during a King Tide that factors in the "2100 Medium-High Risk Aversion" projection for sea level rise (per OPC 2018, or as amended) (see Figure 10).

Map Updates

- Review and update Flood Hazard Maps to reflect changes in the watershed hydrologic flood model, either when a major flood control project is completed, when new guidance on SLR or rainfall intensity is published and found relevant to the Petaluma River, or at minimum, on a 5-year cycle[11].
    - Updates to hydrologic flood modeling which consider climate change from sea level rise will also incorporate climate change impacts from increased rainfall intensity. This will be

in lieu of continued use of the current 1% exceedance rainfall or storm surge events, to fully consider the conditions expected to be experienced in the future. Use regulatory guidance and climate scenarios appropriate to the time frame and risk-aversion of the modeling effort.

Update the Petaluma River Access and Enhancement Plan to plan for future floods

- Inform the update of the Petaluma River Corridor (PRC) set aside for the design and construction of flood protection systems to allow the River or tributary creeks, as applicable, to accommodate a 100-year storm event in the year 2100 (as opposed to current flood conditions), to the extent feasible given existing physical and natural constraints.

Note: The maps below show Flood Depth and the maximum extent of flooding. The intent is for Flood Hazard Maps to be viewable on the City's GIS portal by planners/community in a method similar to FEMA FIRMs. Given that an applicant will need to determine the water surface elevation of not only the floods shown here, but also the Current 100 and 500-year floods in FR-1, this is best accomplished using the City GIS portal where a specific building site can be selected, and all the relevant flood elevations will be provided automatically.

Figure 5: A map showing extents and depth of the Mid-Century Very Low Probability Flood Hazard Map

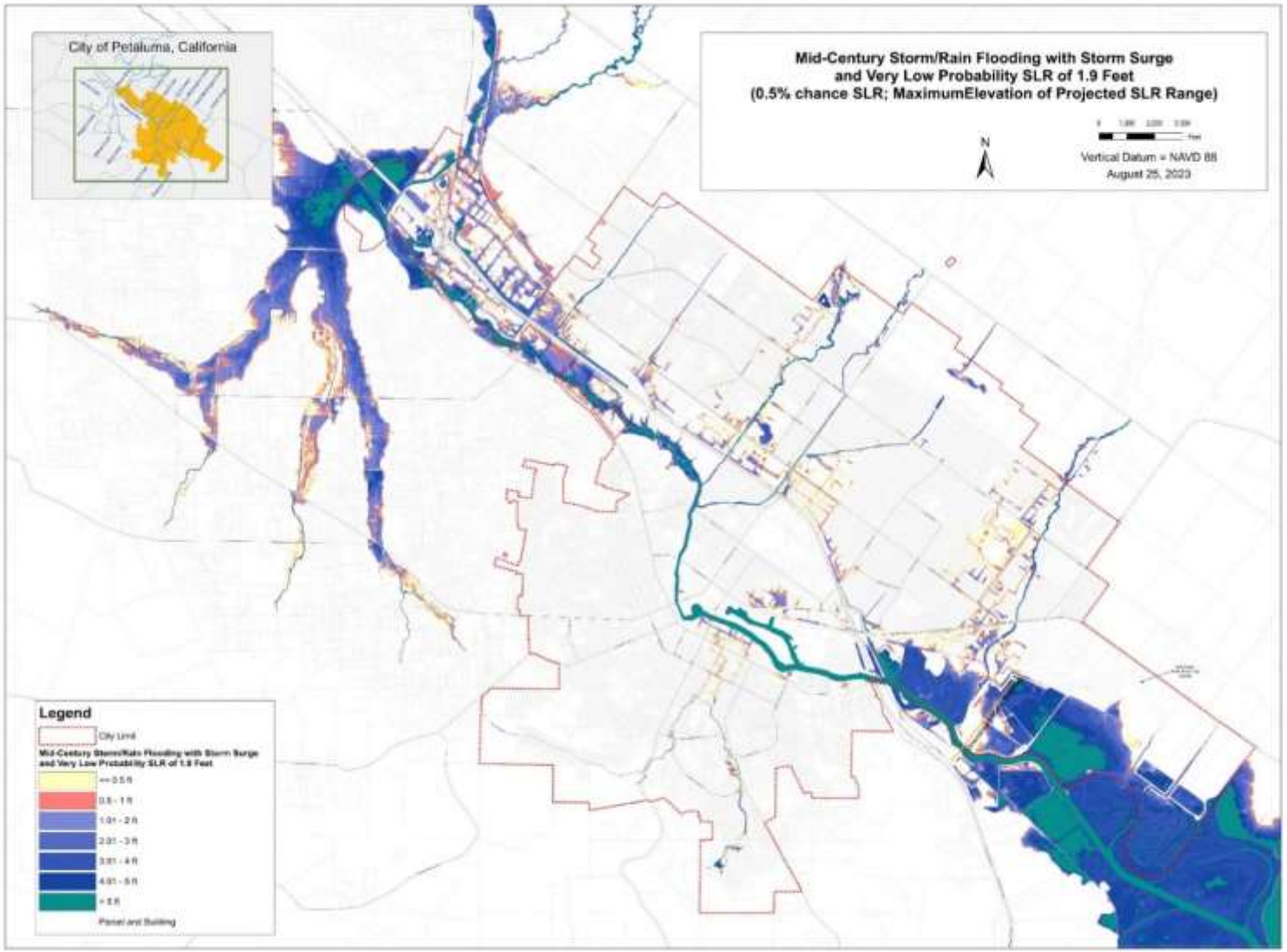


Figure 6: A map showing extents and depth of the End-of-Century Low Probability Flood Hazard Map

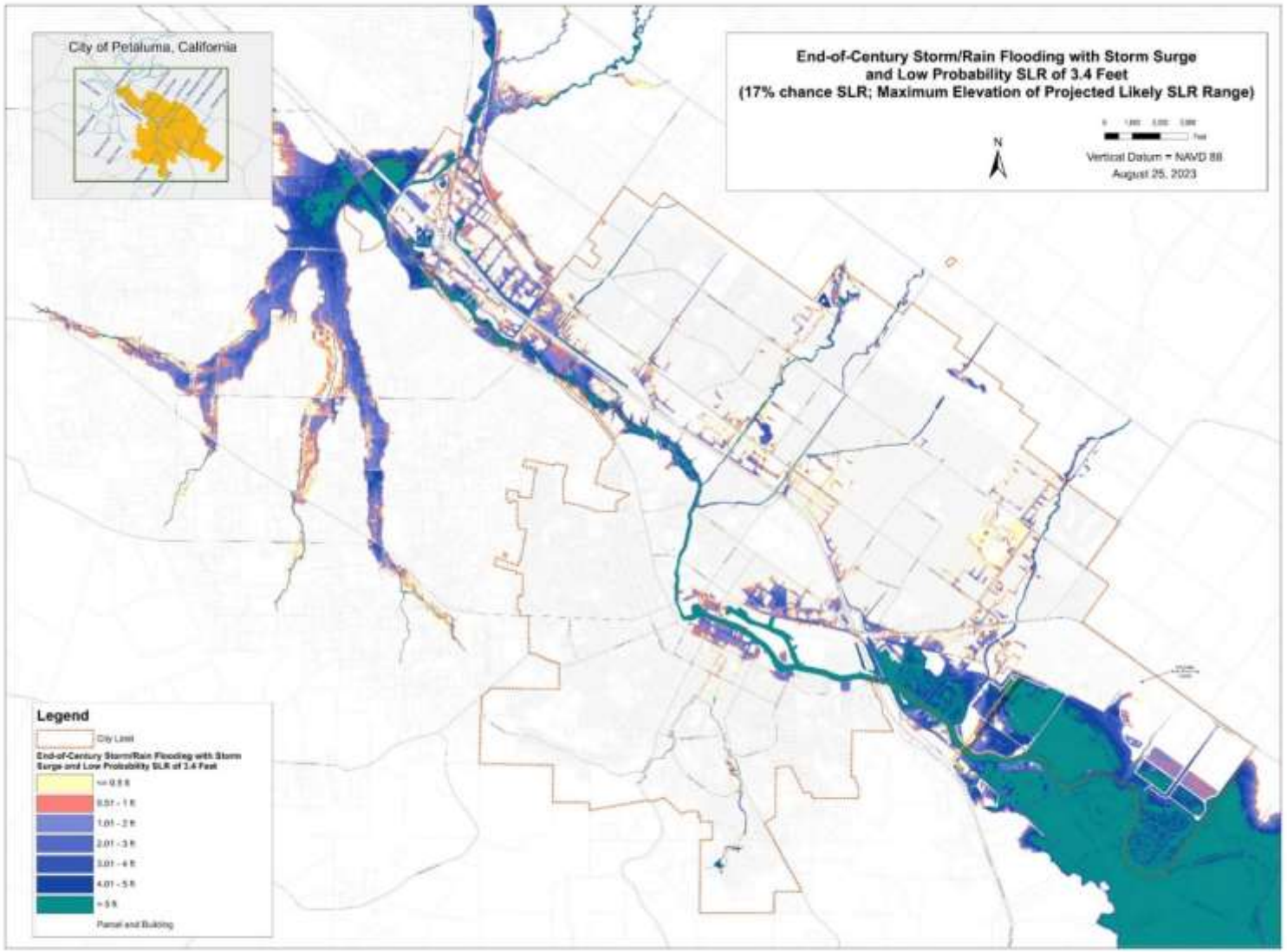


Figure 7: A map showing extents and depth of the End-of-Century Very Low Probability Flood Hazard Map

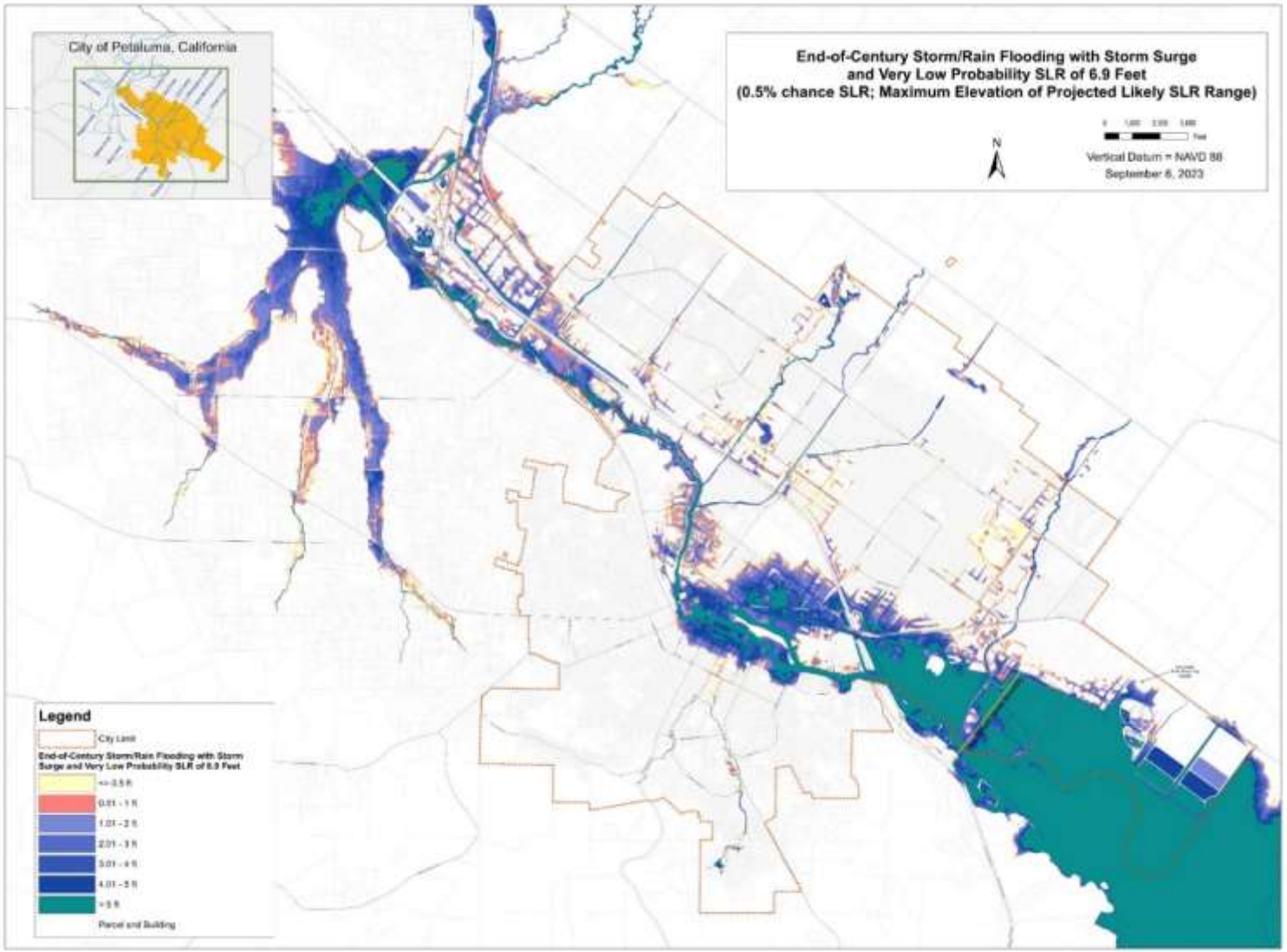


Figure 8: A map showing King Tide areas and depths of the Mid-Century Very Low Probability Flood Hazard Map

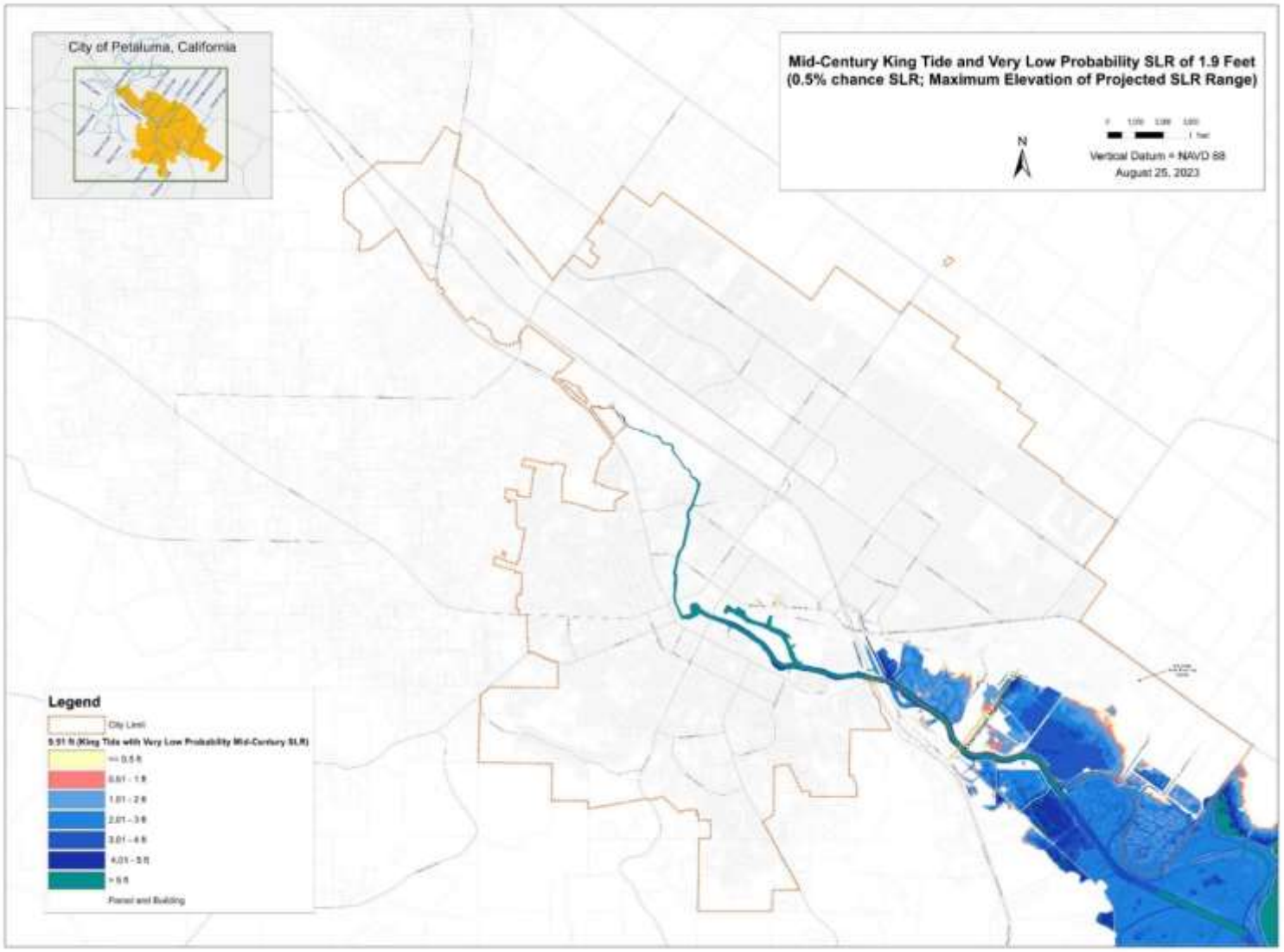


Figure 9: A map showing King Tide areas and depths of the End-of-Century Low Probability Flood Hazard Map

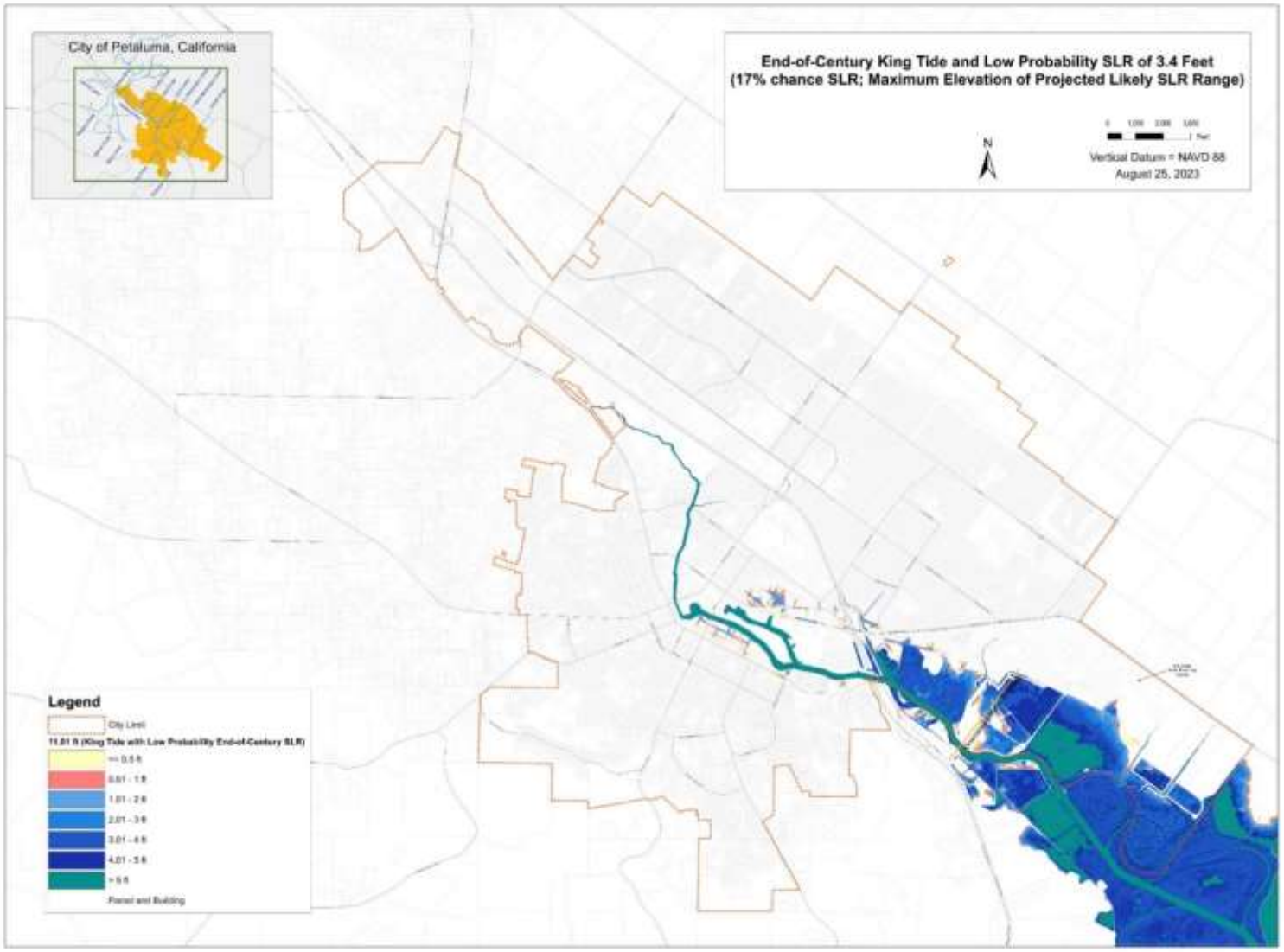
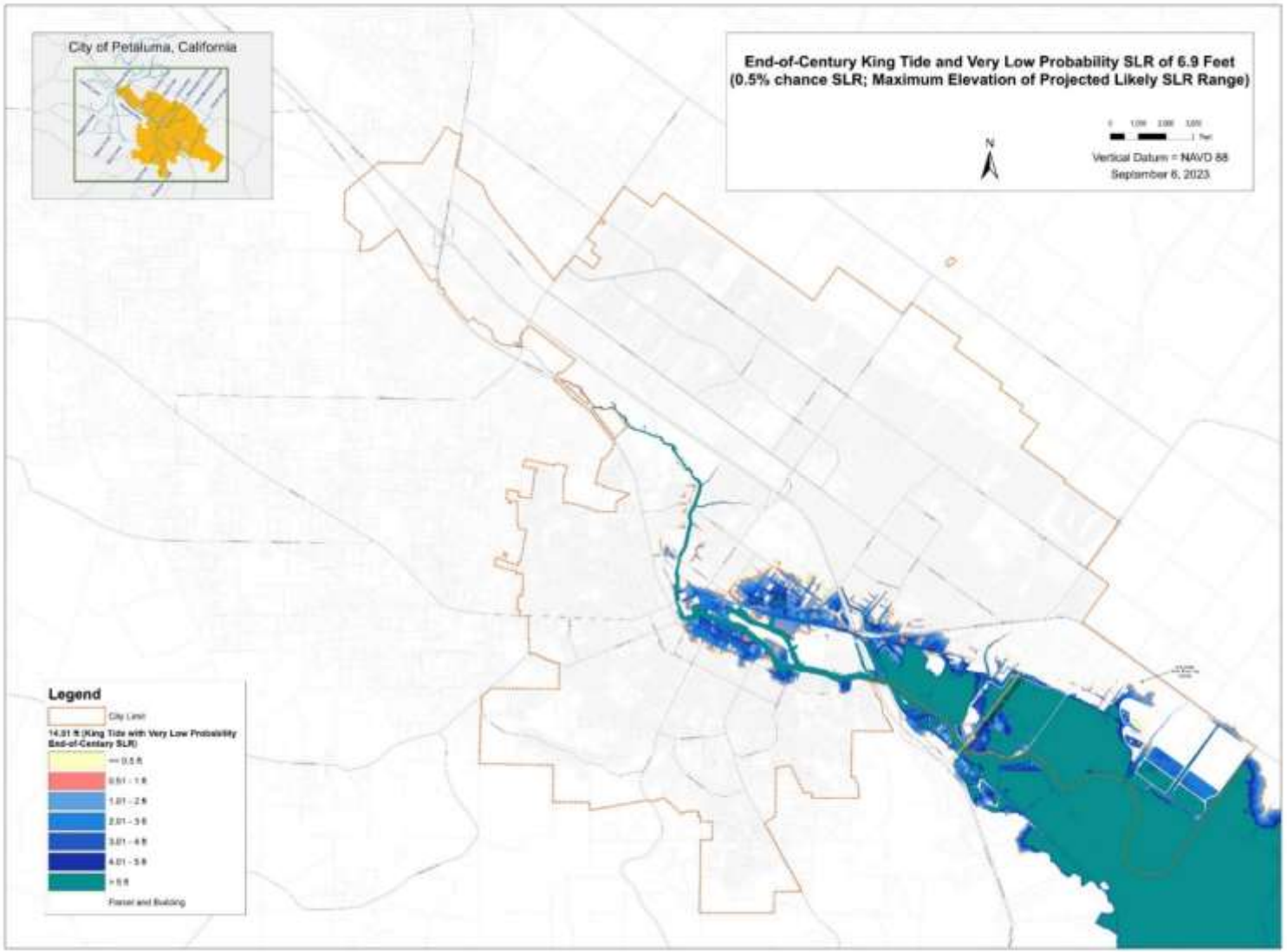


Figure 10: A map showing King Tide areas and depths of the End-of-Century Very Low Probability Flood Hazard Map



Goal FR-3: Flood Adaptation Master Plan

The City plans for the future using a Flood Adaptation Master Plan that refines regional and city-wide guidance for individual areas of the city.

Policy FR-3.1: Develop a Flood Adaptation Master Plan

Develop and maintain a Flood Adaptation Master Plan (FAMP) which prioritizes and plans the appropriate flood adaptation strategies (avoid, protect, accommodate, realign land use) for different areas of the City.

Action FR-3.1.1: Develop a new Stormwater Master Plan as a component of the Integrated Water Master Plan to inform policy for surface water supply, flood protection, and watershed restoration.

Action FR-3.1.2: Develop appropriate adaptation pathways that lay out the steps that parcels, districts, and the City will take as flood conditions change through the remainder of the century.

Action FR-3.1.3: Update district-specific building and zoning standards, select the appropriate adaptation strategy for different portions of the city, prioritize flood protection projects, refine guidance on preferred adaptation efforts, etc.

Action FR-3.1.4: Determine which parcels within the End-of-Century Very Low Probability Flood Hazard Map will achieve resilience to future flood scenarios by parcel/project-specific measures, and those which will be protected by district or regional projects.

Action FR-3.1.5: Develop a policy for relaxing flood resilience standards for an area where risk is reduced by flood protection infrastructure. The policy will determine the minimum completion level required of that flood protection infrastructure that warrants reductions in flood resilience standards (e.g., does the flood control system need to be designed, funded, permitted, constructed, etc.)

Action FR-3.1.6: Assess the possible increase in sewer inflow and infiltration due to changing precipitation patterns, increased pluvial flooding, and rising SLR/Groundwater levels.

Policy FR-3.2: Study the impacts of future floods

As part of the FAMP, evaluate the demographics and severity of short- and long-term impacts from changing flood conditions.

Action FR-3.2.1: Utilize the Local Hazard Mitigation Plan (LHMP) update process to evaluate the potential impacts within the Flood Hazard Map Areas. Include detailed assessments of the demographic distribution of flood impacts. During this process, analyze the comparative impacts of different future flood scenarios to map which areas of the City are vulnerable to different types of flooding: rainfall versus storm surge versus king tide. This will inform what areas are more suitable to the strategies of avoidance, protection, accommodation, or land use realignment (see Goal FR-5).

Goal FR-4: Prepared for Flood Recovery

The City, communities, and individual stakeholders understand the measures the City will take when properties are impacted by floods.

Policy FR-4.1: Prepare post-disaster plans

By or before 2030, prepare regulatory standards and post-disaster recovery overlays for flood-affected properties which are in alignment with long term planning documents, adaptation standards, and equity goals.

Action FR-4.1.1: Develop rebuilding standards for specific areas of the City that come into effect once a building has been inundated by flooding. Depending on the land use and local flood conditions, an adaptation pathway will preemptively inform the occupants what adaptation measures will be triggered by specific flood risk or impact conditions.

Action FR-4.1.2: For parcels where retreat is the preferred adaptation strategy, identify measures to remediate the site.

Action FR-4.1.3: Analyze the impact of post-disaster strategies on renters and other stakeholders in addition to the affected property owner.

Action FR-4.1.4: Encourage property owners to proactively retreat from high-risk areas via a Transfer of Development Rights (TDR) program.

Goal FR-5: Future Looking Plans and Regulations

The City implements land use planning and regulatory standards to reduce vulnerability from climate-induced flooding, particularly for disadvantaged communities.

Policy FR-5.1: Update building codes to provide future flood resilience

Develop planning and building code standards that lay out adaptation pathways that require development and significant remodels to reduce individual and collective risk from flooding while still providing for a vibrant City. Include regulatory standards that will prevent increased risk from flood unless those areas are otherwise protected by completed and maintained flood protection systems.

Codify Standards

Action FR-5.1.1: For common uses the City will determine a “Project Lifespan Range” defining the expected minimum and maximum lifespan a given use is assumed to have. The City assumes that developments will have a project lifespan longer than 2050; exceptions may be granted by the City after review.

Action FR-5.1.2: Identify the position or department responsible for reviewing development proposals for flooding resilience.

Action FR-5.1.3: Undergo a public process to update the Zoning Ordinance and Building Code to lay out adaptation pathways for occupants to improve their flood resilience as flood risk increases, including lifespan ranges for various land uses.

Action FR-5.1.4: Develop low-impact development (LID) standards and guidance, in accordance with a new Stormwater Master Plan, to include more permeable surfacing and green space, and that ensures that development on sites greater than 1/4 acre does not increase peak stormwater runoff volume or flow, or else provide for offsite mitigation.

Action FR-5.1.5: To protect existing flood water storage, implement a Net-Zero Fill policy for all uses within the extent of the 500-Year Current Flood Hazard Map.

Action FR-5.1.6: As currently described in the Petaluma Implementing Zoning Ordinance, prohibit any development within the regulatory floodway which removes vegetation, restricts, or reduces the carrying capacity of the floodway, or adds impervious area.

Action FR-5.1.7: Require submission of an elevation "Construction Certificate", on a FEMA approved form, prior to the completion of a final building inspection and issuance of a Certificate of Occupancy for any structure required to have a specified FFE.

General Plan Standards

See Figure 11 and Table 1, which summarize the standards detailed below.

Action FR-5.1.8: When City flood resilience standards differ from FIRM or other regulatory standards, the higher standards will apply.

Action FR-5.1.9: Within the Mid-Century Very Low Probability Flood Hazard Map (see Policy FR-2.2), for all uses with a lifespan shorter than 2050 as decided by the City, require:

- An FFE 2 feet above the nearest adopted Flood Insurance Rate Map (FIRM) Base Flood Elevation (BFE) or the nearest Current 100-Year Flood Hazard Map Design Flood Elevation (100DFE), or 1 foot above the nearest Current 500-Year Flood Hazard Map (500DFE), whichever is higher;
- For new or remodeled uses, show the design is adaptable to the mapped Future Water Surface Elevation (FWSE), either by raising the FFE to 2 feet above the FWSE, or by other means deemed appropriate by the City; and
- A decommissioning or adaptive reuse plan is to be funded and implemented by 2050 or the end of the project lifespan, whichever is first.

Action FR-5.1.10: Within the End-of-Century Low Probability Flood Hazard Map (see Policy FR-2.2), for projects with a Risk-Tolerant use (as defined by ASCE 24-14 Flood Design Class 1 and 2, or as informed by regional guidance, shown in Table 3), with a lifespan longer than 2050 as decided by the City, require:

- An FFE 2 feet above the nearest adopted Flood Insurance Rate Map (FIRM) Base Flood Elevation (BFE) or the nearest Current 100-Year Flood Hazard Map Design Flood Elevation (100DFE), or 1 foot above the nearest Current 500-Year Flood Hazard Map (500DFE), whichever is higher; and
- Design adaptable to the mapped Future Water Surface Elevation (FWSE), either by raising the FFE to 2 feet above the FWSE, or by other means determined to be appropriate by the City.

Action FR-5.1.11: Within the End-of-Century Very Low Probability Flood Hazard Map see Policy FR-2.2), for projects with a Risk-Intolerant use (as defined by ASCE 24-14 Flood Design Class 3 and 4, or as

informed by regional guidance, shown in Table 3), with a lifespan longer than 2050 as decided by the City, require:

- An FFE 2 feet above the nearest adopted Flood Insurance Rate Map (FIRM) Base Flood Elevation (BFE) or the nearest Current 100-Year Flood Hazard Map Design Flood Elevation (100DFE), or 1 foot above the nearest Current 500-Year Flood Hazard Map (500DFE), whichever is higher; and
- Design adaptable by being able to raise the FFE to 2 feet above the mapped Future Water Surface Elevation (FWSE) or by other means determined to be appropriate by the City.

Action FR-5.1.12: Within the King Tide area of the End-of-Century Low and Very Low Probability Flood Hazard Maps, in addition to other flood resilience standards described in FR-5, require new or remodeled development of any use to:

- Have a FFE 1 foot above the nearest mapped King Tide Water Surface Elevation (KWSE) on the appropriate Hazard Map; and
- Projects in King Tide areas will have four requirements for the currently built FFE (BFE, 100DFE, 500DFE, KWSE). The highest standard shall be applied.

Action FR-5.1.13: When a parcel located in any Future Flood Hazard Map is not also located in the current FIRM floodplain or the 100- or 500-year Current Flood Hazard Areas and therefore does not have an associated BFE or DFE, the BFE or DFE nearest to the project will be used. See Figure 12 below.

Action FR-5.1.14: Require development projects that, due to physical or technical limitations, cannot provide onsite protection from or adaptation to those flood elevations required by code to otherwise mitigate flood risk. This may include constructing and operating a planned floodplain improvement, detention/retention facilities, or other measures as approved by the City Floodplain Administrator and through the discretional approval process. The mitigation must result in an improvement to the pre-project conditions by way of a net reduction in flood elevations, improved downstream flows, and water quality.

Action FR-5.1.15: Require development of all uses within the City to identify the disposal site for any excavated or hauled soil and verify that no disposal takes place within the End-of-Century Very Low Probability Flood Hazard Map.

Figure 11: A summary of the steps a project applicant or planner would use to determine the flood resilience building standards applicable to their project

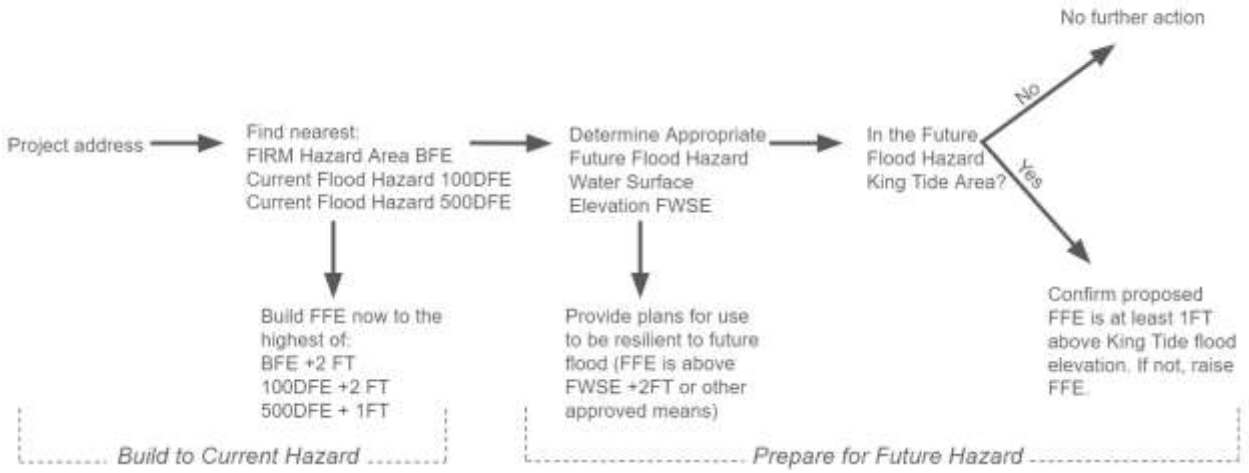


Table 1: Proposed Flood Resilience Standards Summary

Proposed Flood Resilience Standards Summary			
Map	**Requirement**	**Impacted by King Tides**	**Not Impacted by King Tides**
Mid-Century Very Low Probability Flood Hazard Map (Applicable to any short-lived uses)	**Required Finished Floor Elevation**	2' above FIRM BFE and 100DFE, and 1' above 500DFE	
	Adaptability Standard	FFE 2' above Hazard Map FWSE, or other means	
End-of-Century Low Probability Flood Hazard Map Applicable to any Risk-Tolerant uses (retail, residential, etc.)	**Required Finished Floor Elevation**	2' above FIRM BFE and 100DFE, and 1' above 500DFE and King Tide KWSE	2' above FIRM BFE and 100DFE, and 1' above 500DFE
	Adaptability Standard	FFE 2' above Hazard Map FWSE, or other means	
End-of-Century Very Low Probability Flood Hazard Map Applicable to any Risk-Intolerant uses (hospital, emergency shelter, etc.)	**Required Finished Floor Elevation**	2' above FIRM BFE and 100DFE, and 1' above 500DFE and King Tide KWSE	2' above FIRM BFE and 100DFE, and 1' above 500DFE
	Adaptability Standard	FFE 2' above Hazard Map FWSE, or other means	

To represent the differences between the current and proposed requirements, an example of a project's general journey through permitting under both scenarios is shown below. Wherever possible, the process should mimic how current FEMA regulations and City building regulations are communicated. A GIS portal which provides the relevant water surface elevations for the 100DFE, 500DFE, all three FWSE, all three KWSE and the flood depths of each will expedite the process and allow preapplication understandings of flood resilience requirements without a detailed site survey or engineer involvement.

Table 2: Comparison of Current and Proposed FFE Regulations

Comparison of Current and Proposed FFE Regulations	
Current Regulations	**Proposed Regulations**
1. A applicant decides to build a mid-scale residential building downtown.	1. A applicant decides to build a residential building downtown.
2. The applicant consults the relevant FIRM and notes that the parcel is within the Flood hazard Zone AE and has a Base Flood Elevation of "X" feet.	2a. The applicant consults the relevant FIRM and notes that the parcel is within the Flood hazard Zone AE, and documents the Base Flood Elevation (BFE)
	2b. The applicant references the City's "Project Lifespan Range" table (see Policy FR-5A), which indicates a residential building is a Risk-Tolerant use expected to last between 50-80 years.
	2c. The applicant, based on the Risk-Tolerant classification and projected lifespan of the proposed use, references the End-of-Century Low Probability Flood Hazard Map. The building in question is located within the Future Flood Hazard Map area, but not within the King Tides area.
	2d. Based on the same map, the applicant notes the Future Flood Hazard Water Surface Elevation (FWSE) (which is higher than the FIRM Base Flood Elevation).
	2e. The applicant references the City's Current 100-Year Flood Hazard Map and notes the building areas 100-Year Design Flood Elevation (100DFE) and confirms the flood depth is less than 2 feet.
	2f. The applicant references the City's Current 500-Year Flood Hazard Map and notes the building area 500-Year Design Flood Elevation (500DFE).

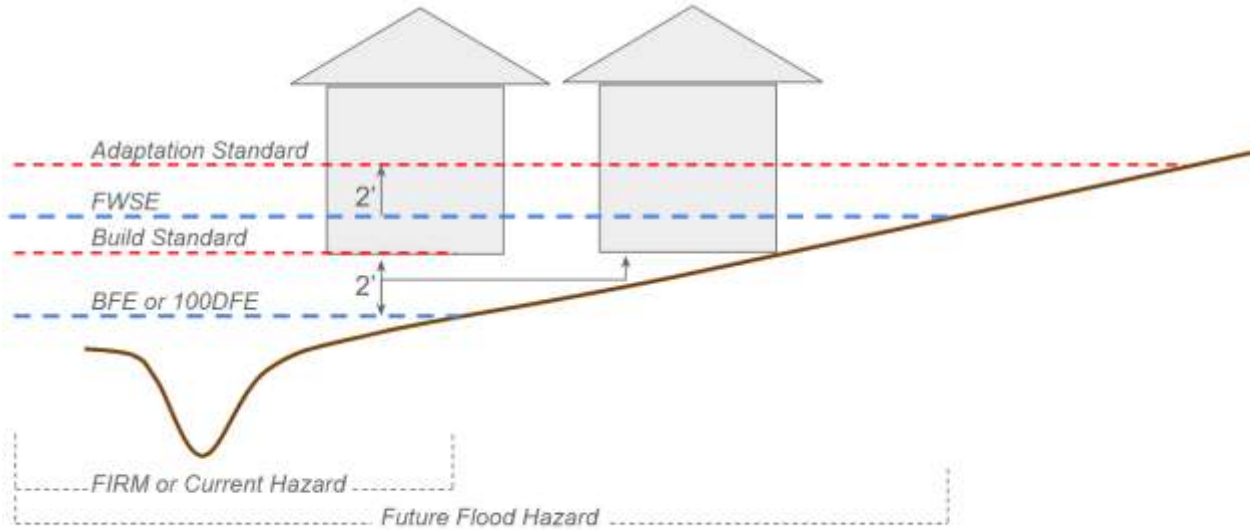
Comparison of Current and Proposed FFE Regulations	
Current Regulations	**Proposed Regulations**
3. The applicant designs the building with a Finished Floor Elevation of BFE**+1** feet in accordance with the regulations.	3. The applicant designs the building with a Finished Floor Elevation of at least: BFE and 100DFE**+2** and 500DFE **+1**. An elevation "Construction Certificate," on the appropriate FEMA form, is submitted to the City prior to a request for final inspection.
	3b. To prepare for the future adaptation requirement of raising the FFE to FWSE+2 or otherwise being resilient to the future flood, the applicant includes structural design and ADA details and an extra-high first floor "floor to ceiling" to allow the FFE to be easily raised in the future.
4. The applicant submits the permit application. There are no existing requirements to prepare additional future flood resilience.	4. As part of the permit application, the applicant submits documentation of the future adaptation methods.

Table 3: Flood Design Class of Buildings and Structures

Excerpted from ASCE 24-14

ASCE 24-14 Table 1-1 Flood Design Class of Buildings and Structures	
Use or Occupancy of Buildings and Structures	**Flood Design Class**
Buildings and structures that normally are unoccupied and pose minimal risk to the public or minimal disruption to the community should they be damaged or fail due to flooding. Flood Design Class 1 includes (1) temporary structures that are in place for less than 180 days, (2) accessory storage buildings and minor storage facilities (does not include commercial storage facilities), (3) small structures used for parking of vehicles, and (4) certain agricultural structures. [Note (a)]	1
Buildings and structures that pose a moderate risk to the public or moderate disruption to the community should they be damaged or fail due to flooding, except those listed as Flood Design Classes 1, 3, and 4. Flood Design Class 2 includes the vast majority of buildings and structures that are not specifically assigned another Flood Design Class, including most residential, commercial, and industrial buildings.	2
Buildings and structures that pose a high risk to the public or significant disruption to the community should they be damaged, be unable to perform their intended functions after flooding, or fail due to flooding. Flood Design Class 3 includes (1) buildings and structures in which a large number of persons may assemble in one place, such as theaters, lecture halls, concert halls, and religious institutions with large areas used for worship; (2) museums; (3) community centers and other recreational facilities; (4) athletic facilities with seating for spectators; (5) elementary schools, secondary schools, and buildings with college or adult education classrooms; (6) jails, correctional facilities, and detention facilities; (7) healthcare facilities not having surgery or emergency treatment capabilities; (8) care facilities where residents have limited mobility or ability, including nursing homes but not including care facilities for five or fewer persons; (9) preschool and child care facilities not located in one- and two-family dwellings; (10) buildings and structures associated with power generating stations, water and sewage treatment plants, telecommunication facilities, and other utilities which, if their operations were interrupted by a flood, would cause significant disruption in day-to-day life or significant economic losses in a community; and (11) buildings and other structures not included in Flood Design Class 4 (including but not limited to facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing toxic or explosive substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released. [Note (b)]	3
Buildings and structures that contain essential facilities and services necessary for emergency response and recovery, or that pose a substantial risk to the community at large in the event of failure, disruption of function, or damage by flooding. Flood Design Class 4 includes (1) hospitals and health care facilities having surgery or emergency treatment facilities; (2) fire, rescue, ambulance, and police stations and emergency vehicle garages; (3) designated emergency shelters; (4) designated emergency preparedness, communication, and operation centers and other facilities required for emergency response; (5) power generating stations and other public utility facilities required in emergencies; (6) critical aviation facilities such as control towers, air traffic control centers, and hangars for aircraft used in emergency response; (7) ancillary structures such as communication towers, electrical substations, fuel or water storage tanks, or other structures necessary to allow continued functioning of a Flood Design Class 4 facility during and after an emergency; and (8) buildings and other structures (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, or hazardous waste) containing sufficient quantities of highly toxic substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released. [Note (b)]	4
[Note (a)] Certain agricultural structures may be exempt from some of the provisions of this standard; see ASCE 24-14 Section C1.4.3. [Note (b)] Buildings and other structures containing toxic, highly toxic, or explosive substances shall be eligible for assignment to a lower Flood Design Class if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in ASCE 7-10 Section 1.5.3 of *Minimum Design Loads for Buildings and Other Structures* that a release of the substances is commensurate with the risk associated with that Flood Design Class.	

Figure 12: Demonstrating how projects that are within a future flood hazard map but are outside the FIRM or Current 100-Year Flood Hazard Map will reference the nearest BFE or 100DFE to set their FFE standard, see FR-5, General Plan Standards



Goal FR-6: Safe Against Rising Floods

The City implements avoidance, protection, accommodation, and land use realignment projects that reduce the risk from future flood scenarios, emphasizing nature-based solutions and a watershed restoration strategy.

Policy FR-6.1: Build for long-term flood resilience

Design all City capital improvements (buildings, infrastructure, roads, parks, etc.) for resilience against the flood scenario appropriate to its risk tolerance and project lifespan.

Action FR-6.1.1: Design new City capital improvement projects to be protected from, be able to accommodate, or otherwise not be vulnerable to the flood impacts relevant to the project's lifespan and risk avoidance using the Future Flood Hazard Maps.

Action FR-6.1.2: Require certain new critical City Infrastructure to be resilient to the flood elevations expected in the “worst case” Extreme SLR Scenario, as described by OPC 2018 (or as amended). The infrastructure required to be resilient includes those defined as Flood Design Class 4 by ASCE 24-14, or other uses meeting all of the following criteria per OPC 2018:

- Considerable public health, public safety, or environmental impacts;
- Design life beyond 2050;
- Little to no adaptive capacity; and
- Deemed excessive in cost or difficulty to relocate or quickly repair.

Action FR-6.1.3: When planning capital improvements within the Petaluma River Corridor, identify procedures for reuse or removal at end-of-life.

Action FR-6.1.4: For each City-owned facility identified in the LHMP as at risk from flooding within its projected lifespan, determine an Adaptation Pathway to protect, accommodate, or retreat the facility. In the case of retreat, the adaptation pathway must include steps to remediate the original site.

Policy FR-6.2: Develop flood control efforts

Develop flood protection strategies and projects that prioritize multi-benefit nature-based solutions and prevent a disproportionate impact on disadvantaged communities.

Action FR-6.2.1: Inspect and maintain the conveyance capacity of open channels and the piped system within the City's authority.

Action FR-6.2.2: Identify and seek opportunities to preserve vacant parcels adjacent to creeks and the Petaluma River, within and without the City, and preserve them for flood protection and floodplain management. Evaluate their flood control opportunities based on future flood conditions.

Action FR-6.2.3: Continue to monitor and maintain the adequacy, safety, and strength of existing berms and levees and other flood protection/reduction facilities, improving as needed with nature-based solutions, with emphasis on improving public access and wetland and habitat systems.

Action FR-6.2.4: Evaluate the feasibility of small-scale stormwater management solutions integrated into neighborhoods as an alternative to centralized flood protection projects.

Action FR-6.2.5: Use updated models and Climate Change projections to inform the river dredging methodologies that are used for maintaining the federal channel navigation clearances, in consideration of environmental damages and flood protection.

Action FR-6.2.6: Promote dual-use of areas including ball fields, parks, and open space as flood storage and attenuation, with consideration for water quality impacts.

Action FR-6.2.7: On properties acquired by the City within or adjacent to the FIRM floodway, plan and seek funding for surface water improvements and riparian habitat enhancements.

Action FR-6.2.8: Design the future Stormwater Pumping Station infrastructure as required by the Flood Adaptation Master Plan (including developing a funding mechanism) to manage projected increases in flooding due to changes in precipitation intensity & distribution, SLR, and urban development.

Action FR-6.2.9: Build flood protection systems to allow the Petaluma River and its tributaries to accommodate future flood scenarios to the extent possible given existing natural and physical constraints, with an emphasis on projects that benefit wildlife habitat and the climate. The design flood should be the 1% storm event predicted for the year 2100 considering predicted changes in climate and watershed conditions, or a higher severity as determined by the City Floodplain Administrator.

Action FR-6.2.10: Develop conceptual plans for the suite of flood protection projects that may be required to accommodate the design storm event in the year 2100 during a Medium-High Risk Aversion SLR Scenario (currently 6.9 feet per OPC 2018, or as amended) with no increase in flood risk to the City and its occupants.

Action FR-6.2.11: Prioritize the implementation of projects identified in the Flood Adaptation Master Plan that also further the goals of the River Access and Enhancement Plan, with emphasis on protection, public access, and restoration.

Action FR-6.2.12: Acquire properties identified as necessary for land-use realignment, flood defense, and flood protection infrastructure in the Flood Adaptation Master Plan, prioritizing properties with existing development facing inundation.

Action FR-6.2.13: Ensure that flood protection efforts do not disproportionately displace disadvantaged communities. Measure flood risk by the number of people affected rather than the economic value of infrastructure or property protected.

Action FR-6.2.14: Coordinate with Sonoma Water and other agencies to improve the early warning for extreme rain and storm surge events. Expand the City's flood alert system as opportunities and funding become available.

Policy FR-6.3: Identify funding sources

Identify sustainable funding streams to facilitate both public and private flood protection strategies and stormwater network maintenance from parcel to regional scales.

Action FR-6.3.1: Charge proposed development applications a model update fee to cover costs associated with the evaluation of the projects and their impacts on the regional storm drainage system.

Action FR-6.3.2: Implement a stormwater utility fee to ensure a dedicated source of funds is available for all surface water drainage system maintenance and improvement needed within the City.

Action FR-6.3.3: Develop a funding mechanism to maintain in perpetuity and improve the PRC, associated nature-based flood protection, stormwater flow capacity, environmental habitat, and public access.

Action FR-6.3.4: Support continuation of Zone 2A parcel tax for funding regional surface water improvements.

Action FR-6.3.5: Create Climate Resiliency District(s) as authorized by the State to fund neighborhood-scale adaptation projects.

Action FR-6.3.6: Work with Sonoma County to fund and plan the acquisition and relocation or demolition of structures remaining within the FIRM Floodway, or a future floodway as mapped by the City.

Goal FR-7: Empowered Stakeholders

The City empowers stakeholders to collaborate on solutions to climate-induced flooding, which in turn creates a more resilient City.

Policy FR-7.1: Expand public education

Expand public education on the growing risks from climate-induced flooding and support access to adaptation guidance.

Action FR-7.1.1: Continue and expand the City's FEMA NFIP participation to educate the public on the City's process for developing flood models and Flood Hazard Maps that consider Climate Change.

Action FR-7.1.2: Include plain language (both English and Spanish) sections in the Flood Adaptation Master Plan that explain its findings and implications for a variety of demographics: by standard categories like race, income, age, Tribal affiliation, etc., as well as typical cross-sections such as families renting homes in the current floodplain or commercial property owners.

Action FR-7.1.3: Encourage all real estate transactions to include all three Flood Hazard Maps with the property's location marked, or other acknowledgment of the property's future flood hazard status, in addition to any federally- or state-mandated flood risk disclosures.

Action FR-7.1.4: Develop a Petaluma-focused Climate Flooding Adaptation Guide and toolkit for how the City, developers, and residents can prepare for climate-induced flooding, referencing local guidance documents such as Adapting to Rising Tides (ART) and industry guidance such as Waterfront Edge Design Guidelines (WEDG).

Action FR-7.1.5: Continue to create educational programming at existing and future river and creek access sites centered on stewardship, restoration of waterways, and the importance of watershed function for natural habitat and flood protection.

Action FR-7.1.6: Collaborate with school districts and private educational institutions to incorporate localized watershed education into curriculums.

Action FR-7.1.7: Collaborate with schools and community organizations to collect frequent qualitative flood data and monitoring photos. Save data in a centralized, publicly available database.

Action FR-7.1.8: Update the Petaluma River Access and Enhancement Plan and incorporate adaptation pathways to preserve public access in future conditions.

Action FR-7.1.9: In addition to information about disaster preparedness, distribute information regarding post-disaster recovery expectations and policies.

Policy FR-7.2: Partner with regional stakeholders

Partner with public and quasi-public agencies in the region to collaboratively pursue larger-scale adaptation measures.

Action FR-7.2.1: Coordinate with County agencies to ensure that net zero fill policies outside the City match those within the City.

Action FR-7.2.2: Collaborate with the County to implement regional components of plans such as:

- Petaluma River Watershed Master Drainage Plan,
- Petaluma River Floodplain Management Plan,
- Petaluma River Access and Enhancement Plan, and
- Any other relevant plans that may be developed.

Action FR-7.2.3: Continue to collaborate with Sonoma Water and USACE to ensure the protection afforded by the USCOE Petaluma River Flood Protection Project is not compromised by the proposed development.

Action FR-7.2.4: Continue the ongoing efforts with Sonoma Water to maintain or improve historic channel capacity and provide enhanced floodplain connectivity using carbon-neutral methods.

Action FR-7.2.5: Work with Sonoma County, Sonoma Water, and other responsible agencies to preserve and expand nature-based flood mitigation lands within the Petaluma River watershed, and maintain or reduce peak discharge volumes from contributing tributaries.

Action FR-7.2.6: Work with Sonoma Water to identify, design, fund, and construct regional solutions to minimize the flooding impacts associated with future rainfall conditions that occur from increasing storm flow and velocity from out-of-City areas into the City.

Action FR-7.2.7: Work with regulatory and advisory agencies to facilitate the preservation and environmental enhancement of the natural corridor for species of importance and native to the area.

Action FR-7.2.8: Work with Sonoma Water, regulatory agencies, and/or property owners, as appropriate given maintenance authority, to ensure maintenance of the engineered channels, natural creeks, and enclosed surface water system.

Action FR-7.2.9: Participate in the Petaluma Valley Groundwater Sustainability Agency (Petaluma Valley GSA) to maximize the groundwater benefits from City flood management strategies and assess the possible impacts on infrastructure and land uses in the City from changing groundwater tables.

Action FR-7.2.10: Continue to participate in and collaborate with nearby municipalities and the County to maximize the benefits of the National Flood Insurance Program's Community Rating System.

Action FR-7.2.11: Coordinate with regional partners to respond to the risks of future sea level rise.

Policy FR-7.3: Promote proactive adaptation

Encourage new and existing development to proactively adopt adaptation measures.

Action FR-7.3.1: Collaborate with agencies and organizations such as those listed below to provide funding, guidance, and streamlined permitting for maintenance and restoration of floodplains and natural channels in and outside of the City.

- USACE
- Natural Resource Conservation Service (NRCS)
- California Department of Fish and Wildlife (CDFW)
- Regional Water Quality Control Boards (RWQCB)
- Sonoma Resource Conservation District (Sonoma RCD)

Action FR-7.3.2: Support community members and organizations in undertaking maintenance and restoration efforts in the watershed.

Action FR-7.3.3: Provide design and regulatory guidance to private waterway owners to promote voluntary restoration and flood protection activities.

Action FR-7.3.4: Require development to ensure the maintenance and continued health of restored floodplains and natural channels, in perpetuity, as a condition of development entitlement.

Action FR-7.3.5: Provide incentives such as expedited permit reviews, design/permitting assistance, or fee reductions to projects that exceed the current standards of flood protection.

Policy FR-7.4: Support community efforts

Support neighborhood-scale adaptation plans and projects.

Action FR-7.4.1: Where the Flood Adaptation Master Plan determines areas that will adapt with parcel-specific plans, and develop neighborhood-scale adaptation and emergency response plans to reduce their flood risk.

Notes

[1] The Flood Resilience and Land Use policy frameworks will be released after the other frameworks. These Frameworks relied on the development of a comprehensive update to the City's floodplain model, which was completed in late 2023.
[2] Environmentally responsible and resource-efficient planning, design, construction, operation, maintenance, renovation, and demolition of buildings
[3] Techniques to increase water infiltration, reduce runoff, and improve water quality
[4] The protection of workers' rights and livelihoods while economies are shifting to sustainable production, combating climate change, and protecting biodiversity
[5] The management of trees in urban settings
[6] The system of streets, walkways, trails, and railroads used to move goods and people
[7] The ease of reaching destinations by people of all abilities
[8] Public space that is open and accessible to the general public, including roads, trails, public squares, and parks
[9] Communication and coordination among local government and Native American Tribes
[10] Creating opportunities for every person to have a dignified, productive, and creative life
[11] Note: The City has reviewed the California SLR2024 draft guidance, which is intended to replace OPC2018. Its predictions of SLR values are slightly lower than those described and mapped in this document. There is not at present sufficient clarity in the draft document about the probability and appropriateness of its 5 SLR scenarios, and how that should guide planning in the City.