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## 7.0 FLOODING AND FLOODPLAIN MANAGEMENT

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# 7.0 FLOOD AND FLOOD PLAIN MANAGEMENT

## 7.1 INTRODUCTION

Flooding is the most predictable and potentially most damaging hazard affecting Corte Madera residents, property owners and businesses. Measured in terms of capital investments and management effort, flood control is the Town's highest safety priority. Accordingly, flooding is addressed as a separate element of the General Plan, distinct from other safety issues. The Flooding and Flood Plain Management Chapter is designed to reduce hazards by continuing and reinforcing the Town's existing flood control programs and by providing a policy basis for exploring new, long-range approaches to further reducing the risk.



Increased impermeable surfaces, alterations of natural drainage patterns, and climate change have increased the frequency and severity of flooding events. With increases in sea level due to climate change, flooding is predicted to increase in the future, especially when high tides and more severe storms happen simultaneously. Impacts to hydrological conditions in the Town can be mitigated with careful consideration in the planning, siting and construction of proposed developments.

## 7.2 REGULATORY FRAMEWORK

### CALIFORNIA GOVERNMENT CODE

This chapter has been prepared to fulfill a portion of the California Government Code requirement for a Safety Element in the General Plan that addresses a variety of hazards, including flooding. California Government Code §65302g states that the purpose of the Safety Element is to provide information:

“for the protection of the community from unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, and dam failure; slope instability leading to landslides, subsidence and other geological hazards; flooding; hazardous material accidents; and wildland and urban fire” (emphasis added).

Chapter 8 of the General Plan also addresses the Safety Element requirements.

### NATIONAL FLOOD INSURANCE PROGRAM

The National Flood Insurance Act, adopted by the U.S. Congress in 1968, made federally subsidized flood insurance available to property owners if their communities participate in the National Flood Insurance Program (NFIP). A community establishes its eligibility to participate in the NFIP in two ways:

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- ◆ By adopting and enforcing floodplain management measures to regulate new construction, and
- ◆ By ensuring that substantial improvements within Special Flood Hazard Areas (SFHA's) are designed to eliminate or minimize future flood damage.

An SFHA is an area within a floodplain having a 1 percent or greater chance of flood occurrence within any given year. SFHAs are delineated on flood hazard boundary maps issued by the Federal Emergency Management Agency (FEMA) for individual communities. The Flood Disaster Protection Act of 1973 and the National Flood Insurance Reform Act of 1994 make flood insurance mandatory for most properties in SFHAs.

In 1977 FEMA completed a Flood Insurance Study for Corte Madera that delineates a SFHA covering substantial areas of the community.

### CHAPTER 16, MUNICIPAL CODE

Corte Madera adopted Ordinances 751, 845, and 889 (the latter in 2005), addressing flooding damage prevention in the Town. These provisions are contained in Chapter 16 of the Municipal Code, which establishes the Town's eligibility to participate in the National Flood Insurance Program. The Town requires all new buildings in Special Flood Hazard Areas to be built with finished floors at least one foot above base flood elevations established by FEMA. The Ordinance requires individual development projects to complete a detailed hydrologic study prior to Town issuance of development permits. These studies are aimed at identifying downstream areas that experience localized flooding, detailing potential impacts that proposed projects could create on these areas, and identifying both on- and off-site mitigation measures that would be required to prevent these impacts.

## 7.3 FLOODING AND FLOODPLAIN MANAGEMENT OVERVIEW

Flooding in Corte Madera generally results from a combination of high tides and storm runoff in low-lying areas. The extent of flooding is not life threatening, typically impacting culverts, channels and other drainage facilities. The Town continues to respond to flooding issues through a wide range of facility improvements and by addressing potential storm drainage impacts from new development. In many respects, differential settlement of streets, curbs, gutters and sidewalks, and not the drainage system per se, result in some of Corte Madera's most pressing flooding problems. Since long-term corrective actions for differential settlement are either infeasible or unavailable, the flooding problems associated with Town development in areas underlain by Bay Mud is expected to get worse. Policy approaches in response to differential settlement, therefore, tend to focus upon short-term solutions, such as continued repairs to existing improvements.

### FLOODING CONDITIONS

Flooding in Corte Madera is generally the result of extreme high tides due to low pressure storm cells, storm water runoff, and inadequate drainage channels and systems in certain

locations, and inadequate levees. When tides are high, storm water cannot drain into San Francisco Bay. Steep hills south and west of Corte Madera also contribute to the flooding problem whenever there is severe rain due to inadequate drainage facilities.

Significant waterways that contribute to flooding within the Town include Corte Madera Creek (draining the Ross Valley watershed), San Clemente Creek (a tidal slough winding between subdivisions and open space draining runoff into the San Francisco Bay), High Canal and associated channels, lagoons, and the Shorebird Marsh ponding area. Siltation within San Clemente Creek has significantly reduced its capacity to carry floodwaters from Town. Areas of potential flooding are shown on **Figure 7.1**.

The Federal Emergency Management Agency (FEMA) Flood Insurance Study for Corte Madera (1977) determined that all floods of any consequence in Corte Madera have occurred in the low areas that have been “reclaimed” from the San Francisco Bay’s marsh and tidal lands. Generally speaking, these reclaimed areas encompass everything in and east of Madera Gardens and the lands north of Paradise Drive, and as such constitute a significant portion of the incorporated Town area.

Factors that affect flooding in the bayside area of Corte Madera are precipitation, tides, sea level rise, sedimentation, land subsidence and substandard drainage design. Bayside streets flood at certain places during extremely high tides, including those created by a “storm surge,” or when high tides combine with storm driven waves, rainwater runoff, or both. Tidal influences are exacerbated during the winter when prolonged high winds and low barometric pressure raise the water level along the Pacific Coast, and affect areas north of Paradise Drive, including the Marina Village and Mariner Cove subdivisions, Marin Estates, the Paradise Shopping Center, and Madera Gardens.

The bayside developments of Mariner Cove and Marina Village are experiencing subsidence from being built on five to ten feet of fill placed over San Francisco Bay Mud. The land is sinking faster than predicted when the developments were built 40 to 50 years ago. As a result, some areas have subsided to elevations that are expected to flood during a 100-year storm event. Further, storm runoff that naturally would have drained to these areas must now be conveyed to lagoons and channels and pumped to the San Francisco Bay.

### **HISTORICAL CONDITIONS**

In the early years of the post World War II housing boom, developers built a system of lagoons and drainage canals to prevent flooding in the lowland areas of the Town. Foreseeing the need for additional drainage works to facilitate new development, the Town adopted a comprehensive drainage plan in 1956. The plan designated certain areas for a “high level” fill method and other areas for a “low level” fill method. The high level method involved filling low areas so that they would drain properly during the highest probable tides. The low level method involved protecting the areas to be developed with levees, allowing the fills to be placed at lower elevations than with the high level method. The low level method also called for holding ponds to contain runoff during high tides until the water could be discharged into the Bay with pumps or through culverts with tide gates.

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In succeeding years drainage problems became more severe due to settlement, poor design, and poor construction as areas built in conformance with the drainage plan recommendations experienced flood damage. In 1970 the Town Council commissioned an updated Master Storm Drainage Plan which was prepared by Yoder - Trotter - Orlob and Associates. The 1970 Master Plan (often referred to as the YTO report) divided the planning area into ten separate watersheds, analyzed the existing facilities, and made recommendations for upgrades to the storm drainage system for each watershed. A number of important drainage improvements were built under the 1970 Master Plan including numerous channel and culvert improvements, the Shorebird Pump Station, the Marina Village Pump Station, the Lagoon 1 Pump Station, the Marquart Lagoon Pump Station, the Black Kettle Pump Station, the High Canal Pump Station and the San Clemente Creek Pump Station. The 1970 Master Plan set the foundation of the drainage system that protects Corte Madera today.

Several drainage studies and reports have been prepared for specific areas of the Town subsequent to the YTO report. These include (but are not limited to) the Evaluation of Stormwater Drainage Problems in Watershed 6 by Yarnell and Associates (1979), the Madera Gardens Flood Control Study by Kennedy/Jenks (1983), the Paradise / San Clemente Area Drainage Study by Bissell and Karn (1986), the Mariner Cove Flood and Drainage Study by Winzler and Kelly (1986), a variety of studies prepared for the San Clemente Creek area in the 1980's, and numerous studies prepared for the Mariner Cove Subdivision under the Tidal Protection Project in the 1990's.

A progress report on the implementation of the recommendations outlined in the 1970 Master Plan was prepared in 1988 by the Town Engineer. The progress report also identified improvements that deviated from the recommendations in the Master Plan and the rationale behind those deviations.

The worst flooding in the Town occurred in 1982, when San Clemente Drive was closed as floodwaters covered the roadway. In response, the Town has overseen the installation of approximately \$30 million of improvements, including eight pump stations. In the mid-1980s, Corte Madera partnered with the U.S. Army Corps of Engineers (Corps of Engineers) to study the possibility of a "permanent" solution to certain types of flooding in the area. The project identified to resolve the flooding problem is now known as the Tidal Protection Project. This project, selected from various alternative solutions, consists of an offshore tidal barrier with a lock, pumps, and tidal exchange gate. The Tidal Barrier Project is still in the study phase and has not progressed for several years, due to opposition from local environmental groups, concern from homeowners, lack of funding, and difficulty in attaining land suitable to mitigate the loss of the required 18 acres of wetland habitat for environmental mitigation. The Town does not expect the Corps of Engineers to resume work on the Tidal Barrier Project study.

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### EXISTING IMPROVEMENTS

The Town is continually working on ways to identify options to address the tidal flooding problems along San Clemente Creek. Proposed mitigation measures include constructing levees or other on-shore floodwalls or barriers, raising houses immediately adjacent to San Clemente Creek, and improving the drainage infrastructure.

In response to flooding conditions, many residents in the San Clemente Creek area have raised and reinforced the foundations when remodeling their homes. The Town is addressing flooding conditions through a voter-approved Storm Drainage Tax levied on parcels to fund maintenance projects for the Town's existing flood control system, to raise money for storm drainage/flood control improvements and to pay remaining debts.



Future improvements will focus on protection from tidal flooding, especially in the Lucky Drive area and the Mariner Cove subdivision. Other improvements will include CMP (corrugated metal pipe) replacement, pump station upgrades, and 100-year protection for the FEMA designated floodplain.

### PROGRAMS

The Corte Madera Fire Department is responsible for monitoring and responding to imminent/actual flooding. The Director of Emergency Services organizes the Emergency Operating Center (EOC) staff and emergency procedures, search and rescue teams, and provides emergency instructions through local radio stations, such as the Corte Madera Emergency Broadcast (1330 AM). The Department of Public Works is in charge of initiating sandbagging, levee reinforcement, utility shutoff, and flood fighting activities. Emergency response is also coordinated with the Office of Emergency Services (OES) Mutual Aid Regional Office. When necessary, evacuation is ordered by the Twin Cities Police Department (e.g., dispatching volunteer Community Emergency Response Teams [CERT] to inform residents of flood danger and evacuation methods).

In 1986, the Corte Madera Town Council established the Flood Control Board, as the successor to the Flood Control Committee. The purpose of the Flood Control Board is to advise the Town Council on all matters affecting flooding in Corte Madera and to recommend ways to provide flood protection for the Town.

The Disaster Mitigation Act of 2000 (DMA) requires local governments to develop and submit mitigation plans by November 1, 2004 as a condition of receiving Hazard Mitigation Grant Program and other related funds. FEMA will continue to make funds available for hazard mitigation planning. Also, FEMA distributes monies for Flood Mitigation Assistance to States that, in turn, provide funds to communities. The emphasis for allocating these funds is on repetitive loss properties.

7.4 GOALS, POLICIES, AND IMPLEMENTATION PROGRAMS FOR FLOODING AND FLOODPLAIN MANAGEMENT

GOAL F – 1

Flood control planning and implementation as high priority

POLICY F – 1.1

Develop and maintain an ongoing planning process that shall be the basis for flood control projects and managing development in flood prone areas of the community.

*Implementation Program F - 1.1.a: Master Plan*

Continue to administer the Storm Drainage Master Plan. The Master Plan identifies preferred options and long-range solutions for reducing flood hazards. The Master Plan recommends policies for areas that are subject to flooding, but are not within the FEMA 100-year flood zone, and also recommends projects that will provide “100 year” protection for areas within the FEMA flood zone. The Master Plan also evaluates the existing informal drainage system to assess areas that are deficient in providing flood and drainage control. Continue to use the Master Plan as guidance for maintaining and improving the storm drain system.

Responsibility: Public Works Department  
Timeframe: On-going  
Resource: Storm Drainage Tax

*Implementation Program F - 1.1.b: Master Plan updates*

Periodically update the Storm Drainage Master Plan.

Responsibility: Public Works Department  
Timeframe: On going  
Resource: Storm Drainage Tax

*Implementation Program F - 1.1.c: Flood Control Ordinance*

Update Chapter 16 of the Municipal Code, “Protection of Flood Hazard Areas” as recommended FEMA revisions become available.

Responsibility: Public Works Department  
Timeframe: On-going  
Resource: Storm Drainage Tax

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### *Implementation Program F - 1.1.d: BCDC Shoreline Studies*

Consider working with BCDC to implement strategies for adapting to Bay-related impacts of climate change. Strategies may include shoreline vulnerability analyses and shoreline management issues that cross jurisdictional boundaries.

Responsibility: Public Works Department  
Timeframe: On-going  
Resource: Storm Drainage Tax

### *Implementation Program F - 1.1.e: FEMA Coordination*

Continue to coordinate with FEMA and other agencies in the evaluation and mitigation of future flooding hazards that may occur as a result of sea level rise.

Responsibility: Public Works Department  
Timeframe: On-going  
Resource: Storm Drainage Tax

## **POLICY F - 1.2**

Continue to budget Capital Improvement Funds for flood control improvements as one of the Town's highest priorities after the protection of life.

### *Implementation Program F - 1.2.a: Capital Improvement Budget*

Prepare annual budget requests to implement priorities and projects identified in the Storm Drainage Master Plan

Responsibility: Public Works Department  
Timeframe: On-going  
Resource: Storm Drainage Tax

## **POLICY F - 1.3**

Work with FEMA to periodically update the Town's FEMA flood maps.

### *Implementation Program F - 1.3.a: FEMA Maps*

Utilize FEMA's Cooperating Technical Partners Program to update the Town's Flood Insurance Rate Maps.

Responsibility: Public Works Department  
Timeframe: On-going  
Resource: Storm Drainage Tax

## **POLICY F - 1.4**

Use local plans and groups to help identify flooding hazards and mitigation options.

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### *Implementation Program F - 1.4.a: Flood Control Board*

Continue to utilize the services of the Town's Flood Control Board to advise the Town Council on the provision of flood control protection and storm water management for Corte Madera. The Town's Flood Control Board shall incorporate the latest climate change science in order to advise the Town Council, including research from the California Environmental Protection Agency and California Energy Commission.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	General Fund

### *Implementation Measure F - 1.4.b: Implementation of Hazard Plan*

Complete and implement provisions of a Local Hazard Mitigation Plan, consistent with the requirements of FEMA.

Responsibility:	Public Works Department
Timeframe:	Three years
Resource:	General Fund

## **GOAL F - 2**

**Reduced flood-related hazards to life and property.**

### **POLICY F - 2.1**

Require new development and redevelopment in areas subject to flooding to minimize or eliminate flooding hazards.

### *Implementation Program F - 2.1.a: 100-Year Flood Protection*

Continue to review new development and remodeling proposals in areas subject to flooding for compliance with Chapter 16, Flood Damage Prevention, of the Municipal Code. Require improvements that provide a minimum flood protection level equal to a 100-year storm event.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	Application Fees

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### *Implementation Program F - 2.1.b: Reduce Flood Hazards*

Require individual development projects located in areas subject to flooding to reduce or alleviate flood hazard conditions through preparation of hydrological studies and incorporation of mitigation measures. Individual development project mitigation shall demonstrate, through qualified engineering analyses, that no adverse flooding impacts are created by development on upstream and downstream properties in the project vicinity. Compliance requirements shall be consistent with those prescribed in Chapter 16 (Flood Damage Prevention) of the Municipal Code.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	Application Fees

### **POLICY F - 2.2**

Require construction of storm drainage facilities and Low Impact Development (LID) techniques for new development.

### *Implementation Program F - 2.2.a: Drainage Improvements*

As a condition of approval for new development and redevelopment of existing sites, require storm water detention or retention facilities (on- or off-site), if necessary, to prevent flooding due to run-off or where existing storm drainage facilities are unable to accommodate increased storm water drainage.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	Application Fees

### *Implementation Program F - 2.2.b: Landscaping Design Requirements*

Require the use of native or compatible nonnative plant species indigenous to the site vicinity as part of the discretionary review of proposed developments and encourage the use of LID strategies as part of the landscaping requirements.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	Application Fees

### *Implementation Program F - 2.2.c: Water*

Require the use of innovative storm drainage facilities such as bioretention, rain gardens, and pervious pavement.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	Application Fees

### POLICY F – 2.3

Continue to implement flood hazard mitigation measures for San Clemente Creek and other areas subject to flooding.

*Implementation Program F – 2.3.a: Infrastructure Improvements*

Employ dredging, construct upgrades to drainage infrastructure and continue maintenance activities as a collective program solution to flooding problems in the San Clemente Creek area and other areas subject to flooding.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	CIP Budget

### POLICY F – 2.4

Allow the use of flood control and prevention measures for individual development applications where determined to be feasible and supported by qualified engineering documentation.

*Implementation Program F- 2.4.a: Flood Control Alternatives*

Review development applications for appropriate engineering measures to mitigate flood hazards.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	Application Fees

### POLICY F – 2.5

Utilize Best Management Practices (BMPs) to prevent storm water pollution from construction-related actions.

*Implementation Program F – 2.5.a: Storm Water BMPs*

Adopt a set of BMPs, consistent with storm water recommendations from the State Water Resources Control Board, for use in regulating construction and grading activities. Coordinate with Marin County National Pollutant Discharge Elimination System (NPDES) planning efforts.

Responsibility:	Public Works Department
Timeframe:	Three years
Resource:	CIP Budget

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### GOAL F – 3

**Increased community awareness of flooding hazards.**

#### POLICY F – 3.1

Implement a public outreach program to increase public awareness of storm water management issues and techniques for residents to mitigate storm water issues on their property.

*Implementation Program F – 3.1.a: Website Information*

Using the Town’s website and newsletter, inform the public of areas subject to flooding, steps they can take to reduce potential property damage, and evacuation procedures to be followed in the event of a flooding emergency. The presence of Bay Mud and its resultant differential settling and flooding impacts shall also be stressed.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	General Fund

*Implementation Program F – 3.1.b: Education and Outreach*

Promote LID and other storm water management design techniques through public education and outreach. Provide information and tools for residents to implement these design techniques on their property.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	General Fund

#### POLICY F – 3.2

Work closely with Marin County to ensure implementation of all applicable National Pollutant Discharge Elimination System requirements relative to storm drainage and storm water run-off.

*Implementation Program F – 3.2.a: Guidance Manual*

Develop a Guidance Manual for the Town for application with new development or redevelopment. This may incorporate Best Management Practices.

Responsibility:	Public Works Department
Timeframe:	Three years
Resource:	CIP Budget

### GOAL F – 4

**Acquisition of funds for construction of flood control measures.**

### POLICY F – 4.1

Aggressively pursue sources of State and Federal funding.

***Implementation Program F - 4.1.a: Flood Control Funding***

Town staff, working with Marin County, will regularly pursue funding for flood control and storm drainage improvement and maintenance activities, such as upgrades or repairs to pump stations.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	CIP Budget

***Implementation Measure F - 4.1.b: Disaster Management Act***

Coordinate flood hazard mitigation efforts with Marin County to seek compliance with the Disaster Management Act 2000 to ensure eligibility for funding through FEMA grant programs.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	CIP Budget

***Implementation Measure F - 4.1.c: Sea Level Rise Funding***

Pursue funding for adequate protection from sea level rise and continued subsidence and construction in areas threatened by sea level rise and/or settlement.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	CIP Budget

### POLICY F – 4.2

Utilize Storm Drainage Tax funds for programmed improvements.

***Implementation Program F - 4.2.a: CIP Prioritization***

Prioritize use of storm drainage construction funds through the Town's Capital Improvement Program.

Responsibility:	Public Works Department
Timeframe:	On-going
Resource:	CIP Budget

### POLICY F– 4.3:

Ensure adequate provision of storm drainage facilities within the Town.

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### *Implementation Program F-4.3.a: Storm Drainage Upgrades*

Review plans for new development or redevelopment of existing sites to ensure necessary upgrades are provided to the Town's storm drainage system.

Responsibility: Public Works Department  
Timeframe: On-going  
Resources: Application Fees

### *Implementation Program F-4.3.b: Maintain Drainage*

Maintain the integrity and viability of drainage courses for their intended purpose.

Responsibility: Public Works Department  
Timeframe: On-going  
Resources: CIP Budget

### *Implementation Program F-4.3.c: Permeable Paving*

When feasible, promote the use of permeable paving or similar improvements in constructing patios, walkways, paths, driveways, and parking areas as a means of increasing natural percolation while reducing impacts to the Town's storm drainage system.

Responsibility: Public Works Department  
Timeframe: On-going  
Resources: Application Fees

### **POLICY F-4.4:**

All development shall be required to construct and dedicate to the Town necessary infrastructure improvements to support proposed projects.

### *Implementation Program F-4.4.a: Improvement Dedications*

Require offers of dedication for public storm drainage improvements when built by private developers.

Responsibility: Public Works Department  
Timeframe: On-going  
Resources: Application Fees