Annex F Reclamation District 784

F.1 Introduction

This Annex details the hazard mitigation planning elements specific to Reclamation District 784 (RD 784 or District), a new participating jurisdiction to the 2021 Yuba County Local Hazard Mitigation Plan (LHMP) Update. ***Note***: RD 784 participated in the original 2007 Yuba County LHMP. Staff turnover in the past 14 years has reduced institutional memory of that 2007 Plan. Actions from the 2007 Plan

- Flood Control – Levee seepage testing.
  - ✓ Relief Well Inspection Program – In 2013, Reclamation District 784 began their relief well pump testing program which occurs approximately every 5 years. There are a total of 82 wells located along the land side toe of the Bear River setback levee and along the land side toe of the Feather River setback levee. The function of relief well systems is to reduce seepage uplift forces and thus reduce the potential for piping or internal erosion of the foundation. Proper relief well function is critical when the levee is subjected to high river levels. Proper inspection, maintenance, and evaluation of the relief wells on a routine basis are essential to the continuing safe operation of the levee system. The February 2017 highwater event also served as a test of all structural levee features.
- Flood Control – Stabilize Levee.
  - ✓ During the 2017 highwater event, all RD784 stabilized levee areas functioned as designed
- Flood Control – Increase drainage capacity by changing culvert to a bridge.
  - ✓ No update on this project.
- Operating Procedures – Flood Guide.
  - ✓ No update on this project.
- Flood Control Increase Depth of the Toe Drain.
  - ✓ No update on this project.
- Flood Control – Reduce levee seepage.
  - ✓ No update on this project.
- Flood control – Mitigate seepage along Bear River with a fill blanket.
  - ✓ No update on this project.
- Flood control – Mitigate seepage by full levee reconstruction.
  - ✓ Since 2004, TRLIA has improved levees along the Yuba, Feather, Bear River, and WPIC. TRLIA also constructed the Goldfields 100 yr. embankment and subsequently the 200 yr. project in 2020-2021
- Flood Control – Seepage mitigation.
  - ✓ Same response provided for previous item (Mitigate seepage by full levee reconstruction)
- Flood Control – Erosion mitigation.
  - ✓ RD784 applies erosion vegetation seed mix to newly repaired erosion sites to reduce the chances of erosion, levee grade soil and rock rip rap stockpiles are also in place if ever needed
- Flood Control – Increase capacity at detention pond and Culverts under SR70.
  - ✓ No update on this project.
- Flood Mitigation – Bingham Interceptor.
  - ✓ No update on this project.

- Elevate pump motors above flood level.
  - ✓ RD784 Pump Stations 2, 3, and 6 have been completed. Pump Station 10 is partially completed.
- Purchase and secure generators.
  - ✓ Completed. RD784 purchased a portable backup diesel generator that is set up to backup the District office, shop, and nearby Linda Fire Station #2. Electrical transfer switches set up to connect to portable rental generators in the event of a power outage have also been installed at Pump Stations 5, 7, and 9
- Enhance operations and maintenance Capabilities
  - ✓ RD784 utilizes a two-week scheduling spreadsheet to plan and organize weekly maintenance tasks as well as several "Check off" lists that have been added to enhance maintenance protocols for Storm Maintenance, Pump Station Maintenance, Relief Well monitoring activity, and Levee Patrol Logs
- Public Education and Awareness
  - ✓ As the Regional Flood Fight Coalition Lead Agency, RD784 Hosts annual DWR Flood Fight Training Classes which are open to the public.
- Increased protection of command and control facilities
  - ✓ A backup diesel generator and a security system has been installed at the RD784 Office and Shop facilities. A private security firm also regularly patrols much of the urban levee system.

It can be assumed that the 2007 Plan was not incorporated into any RD 784 planning mechanisms. Development in the District since 2007 was described by RD 784 as minimal. As such, it can be assumed that the vulnerability has not changed.

This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the District. This Annex provides additional information specific to RD 784, with a focus on providing additional details on the risk assessment and mitigation strategy for this District.

F.2 Planning Process

As described above, the District followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Yuba County Hazard Mitigation Planning Committee (HMPC), the District formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table F-1. Additional details on plan participation and District representatives are included in Appendix A.

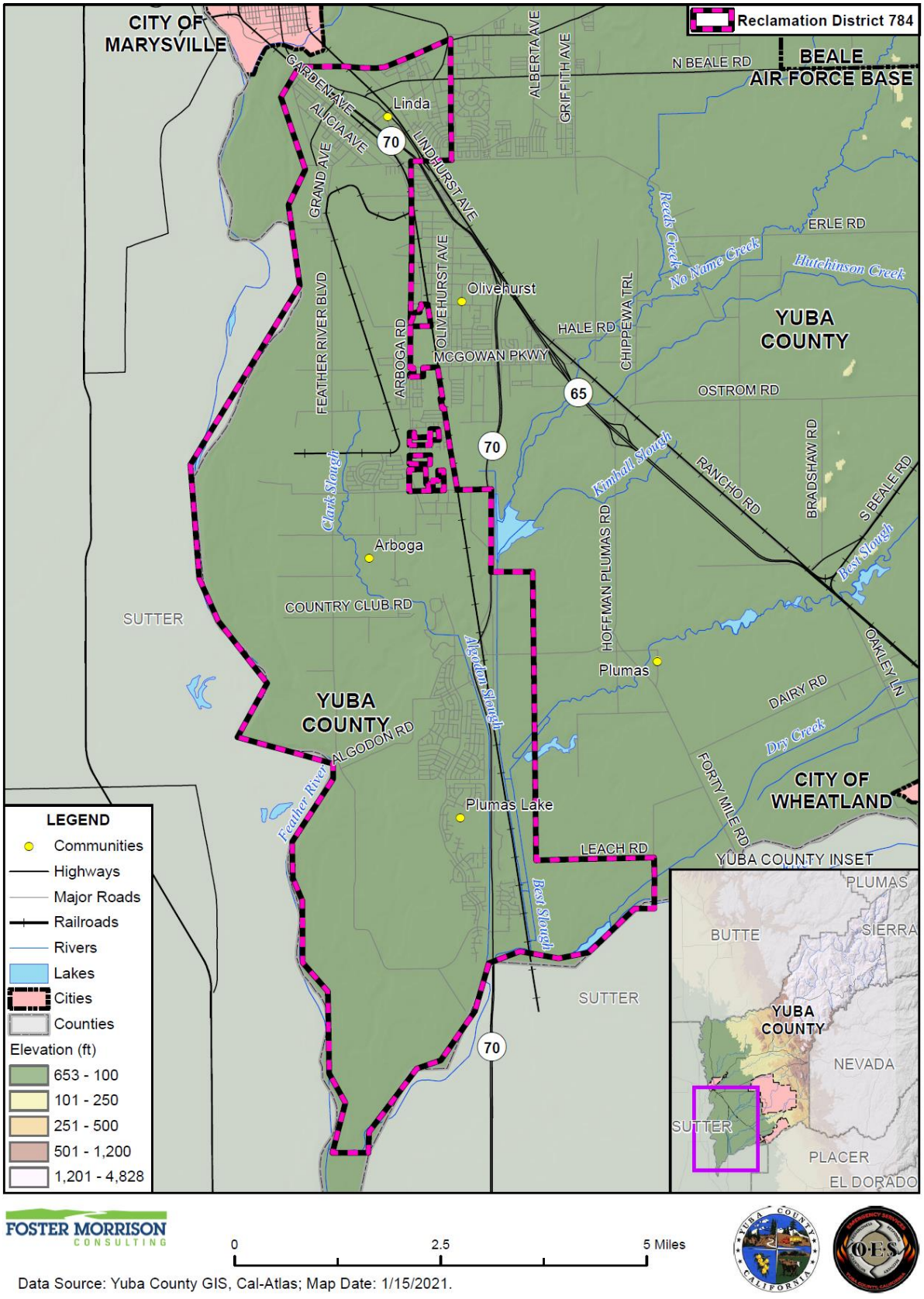
Table F-1 RD 784 – Planning Team

Name	Position/Title	How Participated
Patrick Meagher	General Manager	Researched and provided information. Attended planning meetings.
Sean Minard	District Engineer MHM Engineering	Reviewed draft updated plan

F.3 District Profile

The District profile for the RD 784 is detailed in the following sections. Figure F-1 displays a map and the location of the District within Yuba County.

Figure F-1 RD 784



F.3.1. Overview and Background

Reclamation District 784 (RD 784 or the District) is a special district originally formed in 1908 and is responsible for providing levee and internal drainage services to an area in South Yuba County generally located east of the Feather River between the Yuba and Bear Rivers. RD 784 is located on the valley floor, in the southern most portion of Yuba County. RD 784 operates and maintains over 33 miles of levees along the Bear, Feather, and Yuba Rivers, as well as the Western Pacific Interceptor Canal (WPIC). The District is also responsible for operating and maintaining the internal drainage system which includes approximately 60 miles of canals and drainage ditches, 10 pump stations, and more than 55 acres of detention basins that collects and remove rain and storm waters. RD 784 currently generates revenue to maintain the levee system and drainage facilities through an existing operations & maintenance (O&M) assessment.

The District encompasses approximately 2,000 commercial buildings and more than 12,500 residences. This includes the communities of Linda, Olivehurst, Plumas Lake, and Arboga. The District contains critical infrastructure including State Highways 65 and 70, that serve as material transport and/or evacuation routes. A board of trustees made up of 5 local landowners is the local governing body and they are elected to serve 4 year terms.

The District's first priority is to protect human life, property and the environment, within the land-side boundaries of Reclamation District 784. Except for the waterside slopes of the levees, the river bottoms are outside the jurisdiction of RD 784 and are governed by state and federal government organizations. Maintenance of project levees is accomplished in accordance with Federal and State regulations. During periods of high water the levees are patrolled to safeguard against possible leaks or undetected erosion.

F.4 Hazard Identification

RD 784 identified the hazards that affect the District and summarized their location, extent, frequency of occurrence, potential magnitude, and significance specific to District (see Table F-2).

Table F-2 RD 784—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Climate Change	Extensive	Occasional	Negligible	Low	-
Dam Failure	Extensive	Unlikely	Catastrophic	High	Medium
Drought & Water Shortage	Significant	Occasional	Negligible	Medium	High
Earthquake	Significant	Occasional	Critical	Medium	Low
Floods: 1%/0.5%/0.2% annual chance	Extensive	Unlikely	Critical	High	Medium
Floods: Localized Stormwater	Limited	Occasional	Negligible	Medium	Medium
Levee Failure	Extensive	Unlikely	Catastrophic	High	Medium
Pandemic	Extensive	Likely	Critical	High	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Negligible	Low	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Negligible	Low	High
Severe Weather: Heavy Rains and Storms	Extensive	Likely	Limited	Medium	Medium
Severe Weather: High Winds and Tornadoes	Extensive	Occasional	Negligible	Medium	Low
Wildfire	Limited	Occasional	Negligible	Low	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

F.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile the District's hazards and assess the District's vulnerability separate from that of the Yuba County Planning Area as a whole, which has already been assessed in Section 4.3 Hazard Profiles and Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Yuba County Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the District is included in this Annex. This vulnerability assessment analyzes the property and other assets at risk to hazards ranked of medium or high significance specific to the District. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

F.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section F.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard (as shown in Table F-2) affects the District and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Yuba County Planning Area.

F.5.2. Vulnerability Assessment and Assets at Risk

This section identifies the District's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the District. This data is not hazard specific, but is representative of total assets at risk within the District.

Assets at Risk and Critical Facilities

This section considers the RD 784's assets at risk, with a focus on key District assets such as critical facilities, infrastructure, and other District assets and their values. With respect to District assets, the majority of these assets are considered critical facilities as defined for this Plan. Critical facilities are defined for this Plan as:

> ***Critical Infrastructure describes the physical and cyber systems and assets that are so vital to the County of Yuba that their incapacity or destruction would have a debilitating impact on our physical or economic security or public health or safety. Critical infrastructure includes any location, facility, or infrastructure that are necessary to maintain normalcy in daily life, and that are essential for the delivery of vital services and for the protection of the community. Critical Facilities are further broken out into three Categories: 1) Essential Services Facilities, 2) Large Group and Vulnerable Populations Facilities, and 3) Infrastructure Facilities.***

Table F-3 lists critical facilities and other District assets identified by the District Planning Team as important to protect in the event of a disaster. RD 784's physical assets, valued at over $32 million, consist of the buildings and infrastructure to support the District's operations.

Table F-3 RD 784 Critical Facilities, Infrastructure, and Other District Assets

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
Broadway Shop and Office	District Headquarters	$600,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 1	Stormwater Pump Station	$1,500,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 2	Stormwater Pump Station	$5,000,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 3	Stormwater Pump Station	$6,000,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 4	Stormwater Pump Station	$1,500,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 5	Stormwater Pump Station	$1,500,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 6	Stormwater Pump Station	$6,000,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 7	Stormwater Pump Station	$1,500,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 8	Stormwater Pump Station	$700,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 9	Stormwater Pump Station	$1,500,000	Flooding/Earthquake/Fire/Vandalism
Pump Station 10	Stormwater Pump Station	$5,000,000	Flooding/Earthquake/Fire/Vandalism
5 Pickups	Stormwater Pump Station	$200,000	Flooding/Earthquake/Fire/Vandalism
2 Dump Trailers	Material Hauler	$14,000	Flooding/Earthquake/Fire/Vandalism
Water Tender	Water Truck	$95,000	Flooding/Earthquake/Fire/Vandalism
2 Backhoes	Earth moving equipment	$300,000	Flooding/Earthquake/Fire/Vandalism
2 Mower Tractors	Vegetation control equipment	$300,000	Flooding/Earthquake/Fire/Vandalism
2 Spray Rigs	Vegetation control equipment	$10,000	Flooding/Earthquake/Fire/Vandalism
Flood Fight Materials and Equipment	Steel Storage Containers with sandbags, shovels, plastic, etc. and patrol gear.	$300,000	Flooding/Earthquake/Fire/Vandalism
Total		**$32,019,000**	

Source: RD 784

Natural Resources

RD 784 has a variety of natural resources of value to the District. These natural resources parallels that of Yuba County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Historic and Cultural Resources

RD 784 has a variety of historic and cultural resources of value to the District. These historic and cultural resources parallels that of Yuba County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Populations Served

Also potentially at risk should the District be affected by natural hazard events are the populations served by the District. The District encompasses approximately 2,000 commercial buildings and more than 12,500 residences. This includes the communities of Linda, Olivehurst, Plumas Lake, and Arboga. The District contains critical infrastructure including State Highways 65 and 70, that serve as material transport and/or evacuation routes.

Growth and Development Trends

General growth in the District parallels that of the Yuba County Planning Area as a whole. Information can be found in Section 4.3.1 of the Base Plan. 2.5 miles of 200 yr. levee at the Goldfields near Hammonton Smartville Rd. will be completed in 2021.

Future Development

For RD784, discharge pipes down Murphy Rd. to complete the next 2 phases of Pump Station 10 may be completed, depending on if funding becomes available. Instrumentation improvements at Pump Stations 5, 7, and 9 are planned after a grant agreement is executed. I defer to TRLIA to provide any info on upcoming levee improvements.

The District has no control over future development in areas the District services. Future development in these areas parallels that of the Yuba County Planning Area. More general information on growth and development in Yuba County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Yuba County Vulnerability and Assets at Risk of the Base Plan.

F.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table F-2 as high or medium significance hazards. Impacts of past events and vulnerability of the District to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the Base Plan for more detailed information about these hazards and their impacts on the Yuba County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the District to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, critical facilities and infrastructure, populations at risk, and future development.

Power Outage/Power Failure

An impact of almost all hazards below relates to power outage and/or power failures. The US power grid crisscrosses the country, bringing electricity to homes, offices, factories, warehouses, farms, traffic lights and even campgrounds. According to statistics gathered by the Department of Energy, major blackouts are on the upswing. Incredibly, over the past two decades, blackouts impacting at least 50,000 customers have increased 124 percent. The electric power industry does not have a universal agreement for classifying disruptions. Nevertheless, it is important to recognize that different types of outages are possible so that plans may be made to handle them effectively. In addition to blackouts, brownouts can occur. A brownout is an intentional or unintentional drop in voltage in an electrical power supply system. Intentional brownouts are used for load reduction in an emergency. Electric power disruptions can be generally grouped into two categories: intentional and unintentional. More information on types of power disruptions can be found in Section 4.3.3 of the Base Plan.

The District is affected by both intentional and unintentional utility power failures. Backup diesel generators at the larger pump stations will automatically turn on when commercial power is lost. Other smaller pump stations in the District are equipped with manual transfer switches which are tied to the pump station's electrical system and are designed to accept connections to portable backup diesel generators. RD784 keeps an active contract with generator rental companies to ensure rapid delivery and connections when needed. There is also a portable diesel generator located at the RD784 headquarters that provides backup power to the District office, shop, and also the Linda Fire Station #2.

Public Safety Power Shutoff (PSPS)

A new intentional disruption type of power outage/failure event has recently occurred in California. In recent years, several wildfires have started as a result of downed power lines or electrical equipment. This was the case for the Camp Fire in 2018. As a result, California's three largest energy companies (including PG&E), at the direction of the California Public Utilities Commission (CPUC), are coordinating to prepare all Californians for the threat of wildfires and power outages during times of extreme weather. To help protect customers and communities during extreme weather events, electric power may be shut off for public safety in an effort to prevent a wildfire. This is called a PSPS. More information on PSPS criteria can be found in Section 4.3.3 of the Base Plan. So far, no RD784 has not been affected by PSPS's. The electrical grid that is shut off so far has never reached any facilities within our District.

Dam Failure

Likelihood of Future Occurrence–Unlikely
Vulnerability–Extremely High

Hazard Profile and Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, Cal DWR Division of Safety of Dams (DOSD) assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.3.7 of the Base Plan.

While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The District would be affected for as long as the flood waters from the dam failure took to drain downstream.

Extremely High Hazard Dams inside the County that can affect the District can be seen on Figure F-2. High Hazard Dams inside the County that can affect the District can be seen on Figure F-3. Extremely High

Hazard Dams outside the County that can affect the District can be seen on Figure F-4. High Hazard Dams outside the County that can affect the District can be seen on Figure F-5.

Figure F-2 RD 784 – Dam Inundation Areas from Extremely High Hazard Dams Inside the County

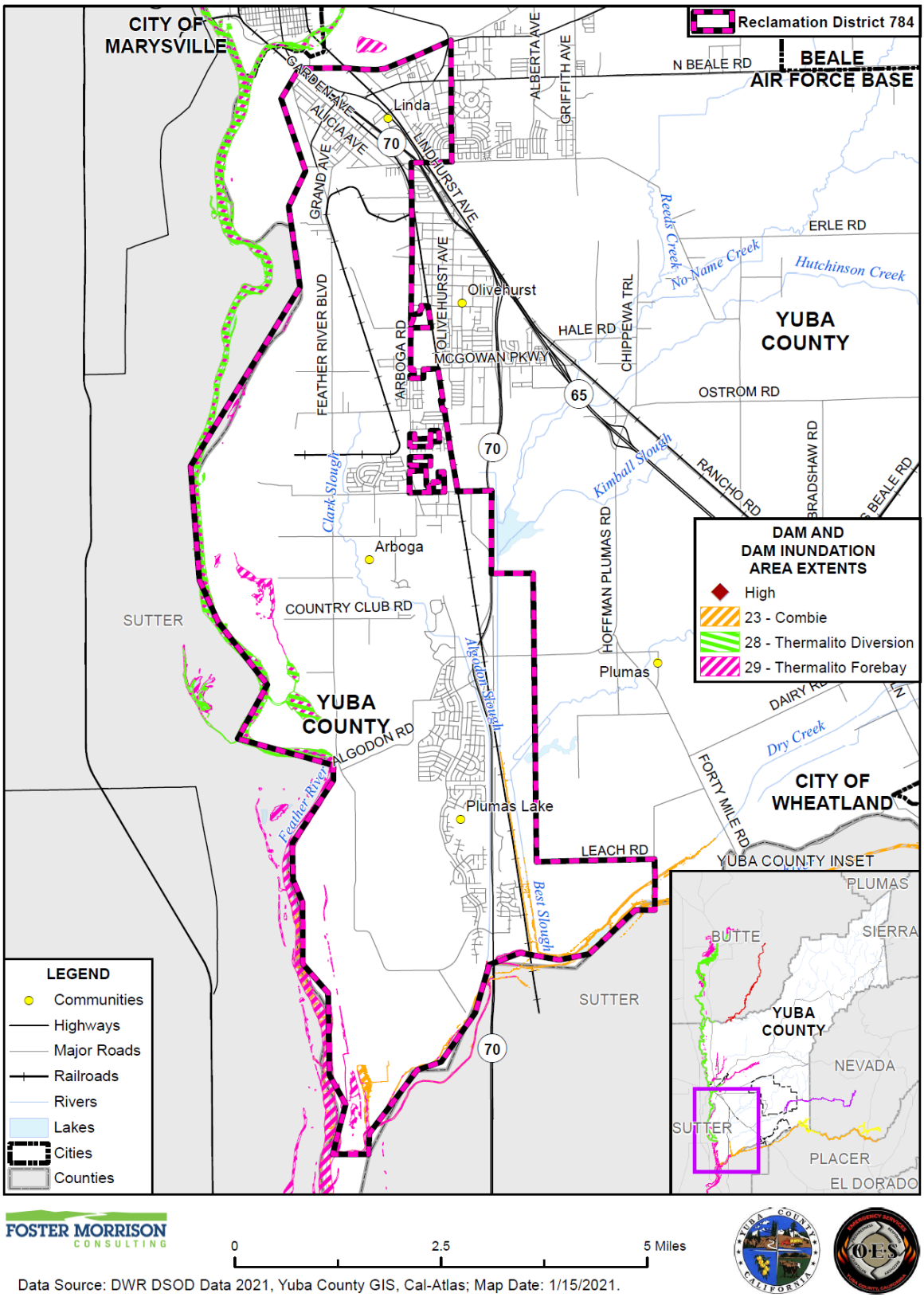


Figure F-3 RD 784 – Dam Inundation Areas from High Hazard Dams Inside the County

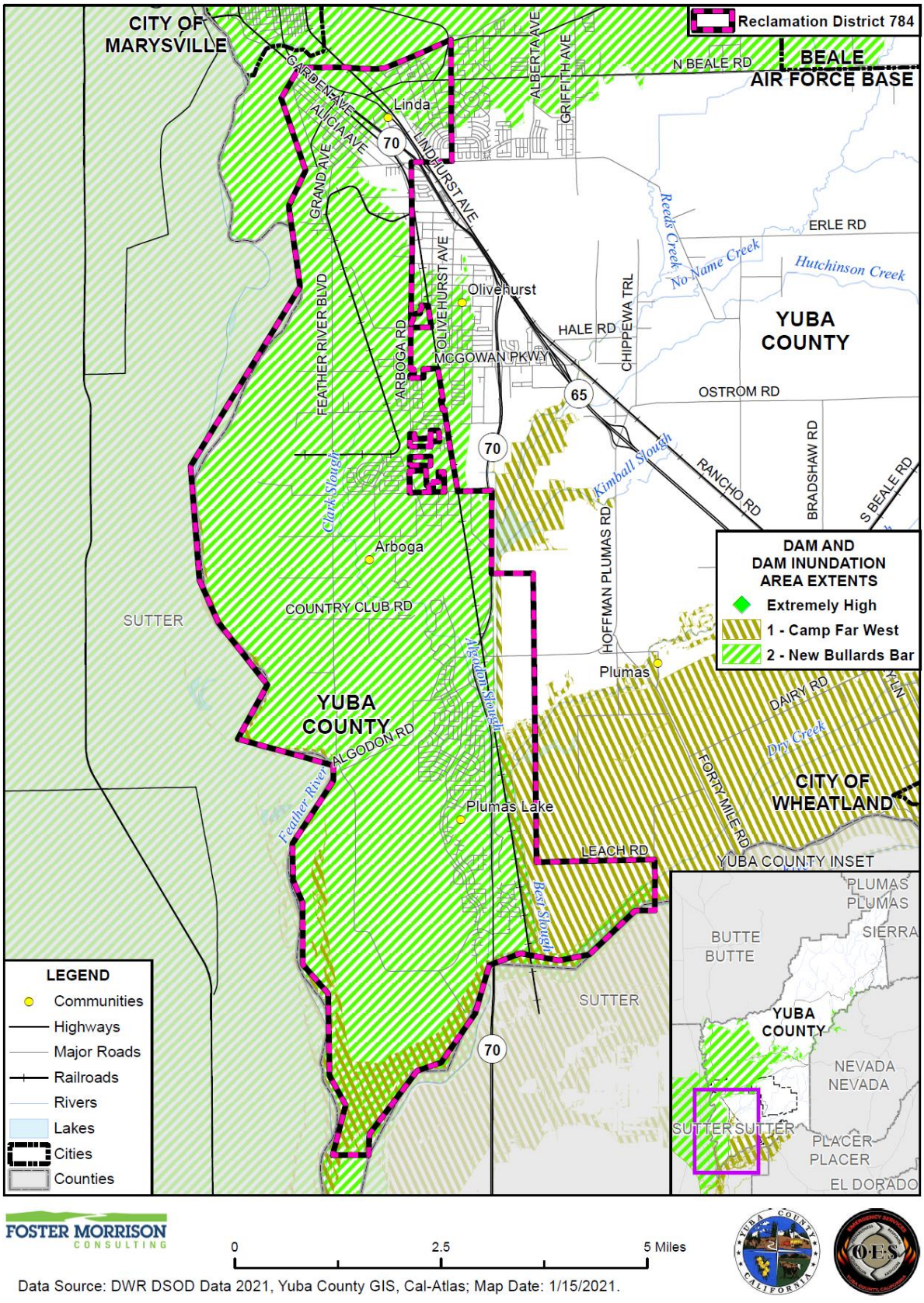


Figure F-4 RD 784 – Dam Inundation Areas from Extremely High Hazard Dams Outside the County

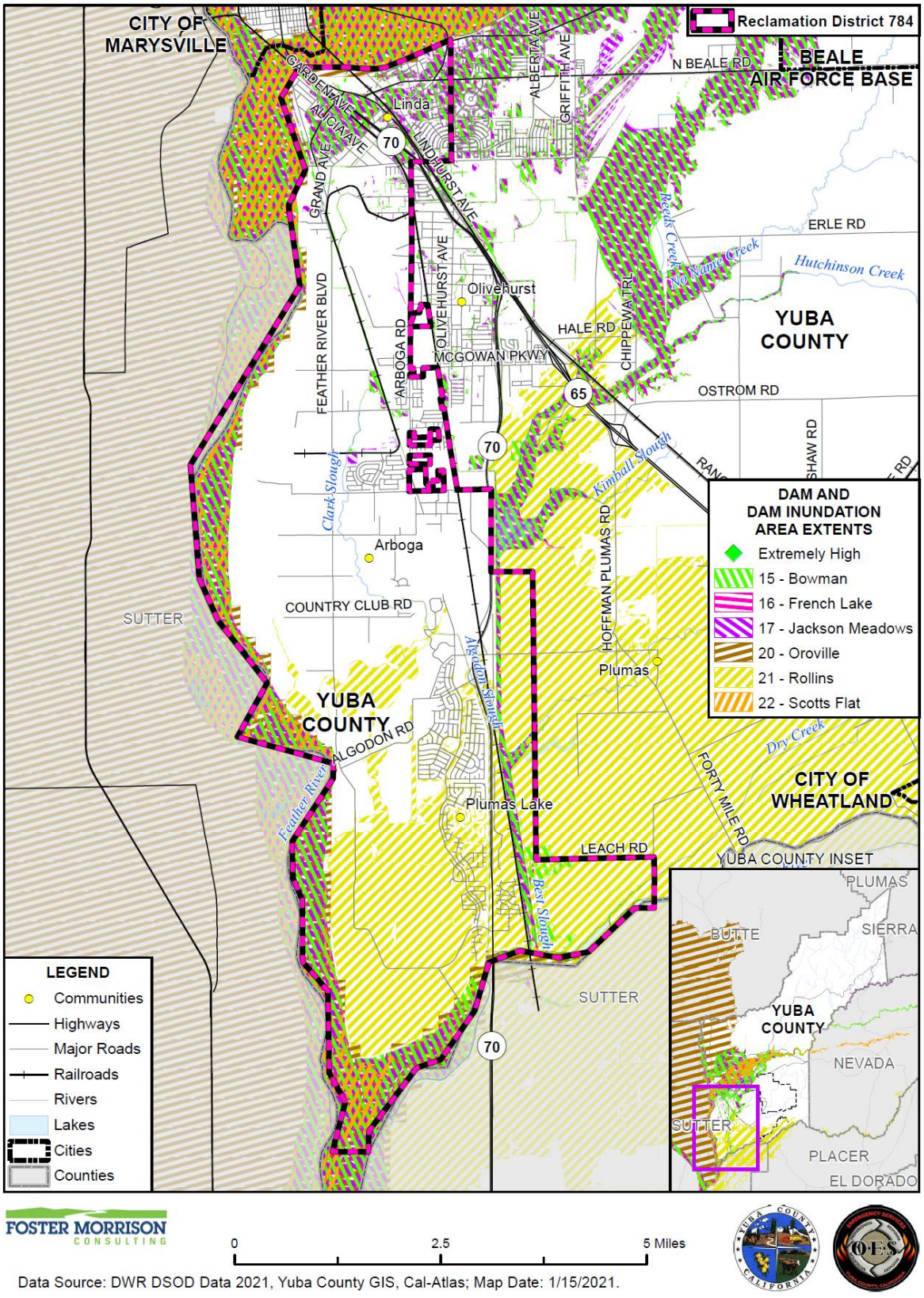
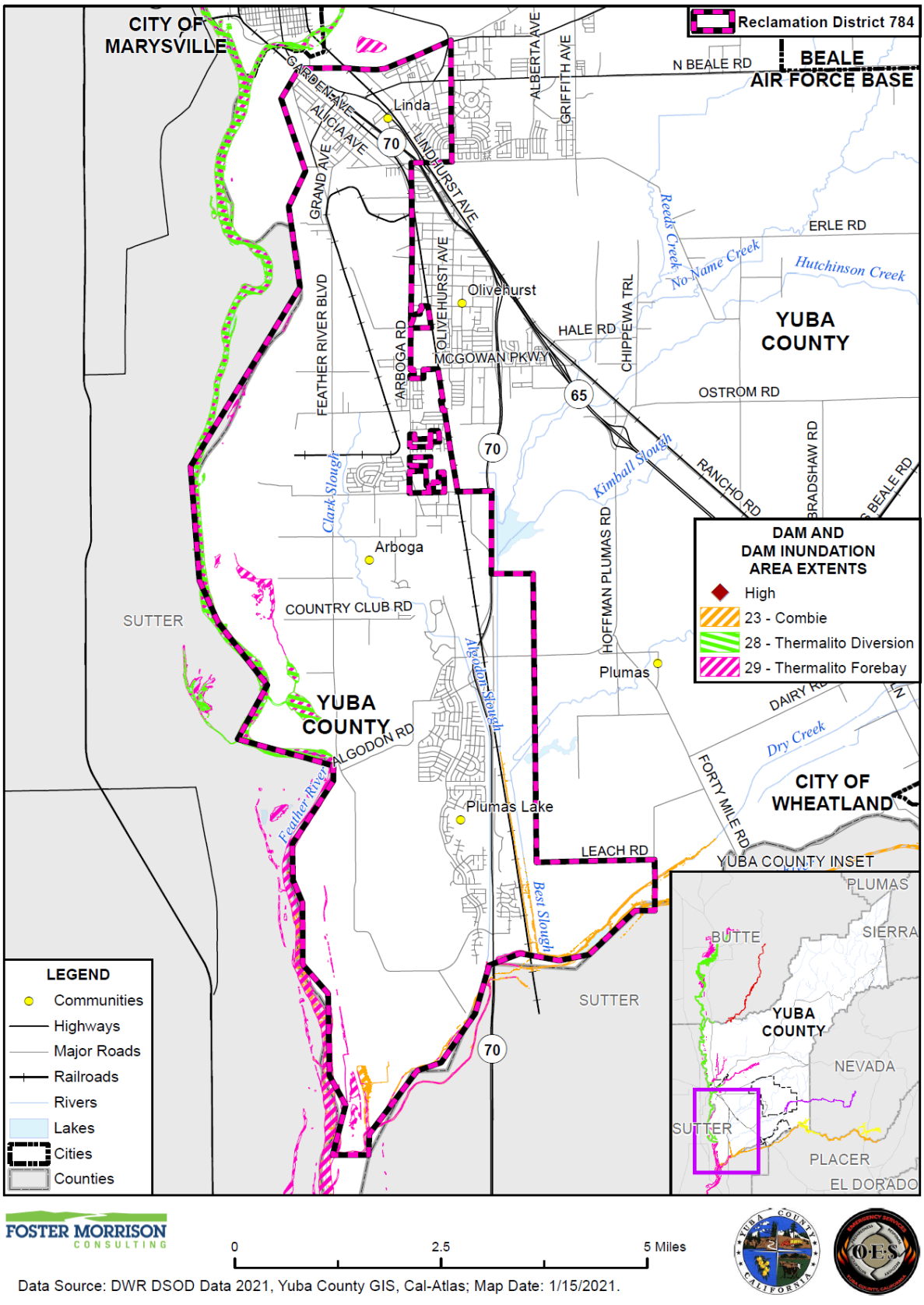


Figure F-5 RD 784 – Dam Inundation Areas from High Hazard Dams Outside the County



FOSTER MORRISON CONSULTING

Data Source: DWR DSOD Data 2021, Yuba County GIS, Cal-Atlas; Map Date: 1/15/2021.

Past Occurrences

There has been on federal or state disaster declarations for dam failure in the County, as shown on Table F-4. This was associated with the Oroville spillway incidence in Butte County. While the dam did not fail, mass evacuations were ordered resulting in significant economic and other impacts to Butte and neighboring counties.

Table F-4 Yuba County – State and Federal Disaster Declarations from Dam Failure 1950-2021

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

The Oroville Dam spillway incident impacted RD784 by triggering round the clock levee patrols for several weeks, cleanup afterwards along the levees, and high electrical power bills due to constant pump station operation (because of highwater keeping flap gates closed on the waterside of the levee when much of the area storm water would normally gravity drain through box culverts). Some of the extra costs associated with the high utility power bills and cleanup efforts were reimbursed through FEMA, however, many extra staff hours were necessary to make the claims.

Vulnerability to and Impacts from Dam Failure

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Impacts to the District from a dam failure flood could include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant. The 3 major Dams including Oroville, New Bullard's Bar, and Englebright Dam. If anyone of these dams were to fail, water in the floodways would likely overtop levees.

Assets at Risk

All District assets from Table F-3) are at risk from this hazard.

Drought & Water Shortage

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

Drought is a complex issue involving many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects. Drought is different than many of the other natural hazards in that it is not

a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue and is critical for agriculture, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

Location and Extent

Drought and water shortage are regional phenomenon. The whole of the County, as well as the whole of the District, is at risk. The US Drought Monitor categorizes drought conditions with the following scale:

- None
- D0 – Abnormally dry
- D1 – Moderate Drought
- D2 – Severe Drought
- D3 – Extreme drought
- D4 – Exceptional drought

Drought has a slow speed of onset and a variable duration. Drought can last for a short period of time, which does not usually affect water shortages and for longer periods. Should a drought last for a long period of time, water shortage becomes a larger issue. Current drought conditions in the District and the County are shown in Section 4.3.8 of the Base Plan.

Past Occurrences

There has been one state and one federal disaster declaration due to drought since 1950. This can be seen in Table F-5.

Table F-5 Yuba County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Drought	1	2014	1	1977

Source: Cal OES, FEMA

Since drought is a regional phenomenon, past occurrences of drought for the District are the same as those for the County and includes 5 multi-year droughts over an 85-year period. Details on past drought occurrences can be found in Section 4.3.8 of the Base Plan.

Vulnerability to and Impacts from Drought and Water Shortage

Based on historical information, the occurrence of drought in California, including the District, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts can be extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. Drought impacts are wide-reaching and may be economic, environmental, and/or societal. Tracking drought impacts can be difficult.

The most significant qualitative impacts associated with drought in the Planning Area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Mandatory conservation measures are typically implemented during extended droughts. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding. With a reduction in water, water supply issues based on water rights becomes more evident. Climate change may create additional impacts to drought and water shortage in the County and the District.

During periods of drought, vegetation can dry out which increases fire risk. Drought that occurs during periods of extreme heat and high winds can cause PSPS events to occur in the County. The District is affected by drought by the early arrival of fire season, thus requiring earlier vegetation abatement efforts along RD784 land areas adjacent to homes and other structures.

Assets at Risk

No District assets from Table F-3 are at direct risk from this hazard.

Earthquake

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design, type, and quality of building construction.

Location and Extent

The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Yuba County is located within an area of relatively low seismic activity and is not located within a highly active fault zone. No Alquist-Priolo Earthquake Fault Zones are located in the County. Faults include primarily inactive faults of the Foothills Fault System, running south-southeastward near Loma Rica, Browns Valley, and Smartville. Faults include the Prairie Creek Fault Zone, the Spenceville Fault, and the Swain Ravine Fault. More information on earthquake extent can be found in Section 4.3.9 of the Base Plan.

Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. The District is located in an area where few earthquakes of significant magnitude occur, so both magnitude and intensity of earthquakes are expected to remain low. Seismic shaking maps for the area show Yuba County and the District fall within a low to moderate shake risk.

Past Occurrences

There have been no past federal or state disaster declarations from this hazard. The District noted no past occurrences of earthquakes or that affected the District in any meaningful way.

Vulnerability to and Impacts from Earthquake

Earthquake vulnerability is primarily based on population and the built environment. Urban areas in high seismic hazard zones are the most vulnerable, while uninhabited areas are less vulnerable. The primary impacts of concern are life safety and property damage. Although several faults are within and near the County, seismic hazard mapping indicates that the County has low seismic hazard potential. Additionally, the County is not located within a delineated Alquist-Priolo Earthquake Fault Zone. The risks associated with earthquakes, such as surface fault rupture, within the County are considered low.

Fault ruptures itself contributes very little to damage unless the structure or system element crosses the active fault; however, liquefaction can occur further from the source of the earthquake. In general, newer construction is more earthquake resistant than older construction due to enforcement of improved building codes. Manufactured buildings can be very susceptible to damage because their foundation systems are rarely braced for earthquake motions. Locally generated earthquake motions and associated liquefaction, even from very moderate events, tend to be more damaging to smaller buildings, especially those constructed of unreinforced masonry (URM) and soft story buildings. There are none of these buildings in the District.

The Uniform Building Code (UBC) identifies four seismic zones in the United States. The zones are numbered one through four, with Zone 4 representing the highest level of seismic hazard. The UBC establishes more stringent construction standards for areas within Zones 3 and 4. All of California lies within either Zone 3 or Zone 4. The RD 784 is within the less hazardous Zone 3.

Impacts from earthquake in the District will vary depending on the fault that the earthquake occurs on, the depth of the earthquake strike, and the intensity of shaking. Large events could cause damages to infrastructure, critical facilities, residential and commercial properties, and possible injuries or loss of life. Unknown if any seismic studies have been conducted. The District would engage the District engineer to conduct an immediate inspection of the RD784 levee system if a significant earthquake were to occur.

It is unknown if any seismic studies have been conducted. The District would engage the District engineer to conduct an immediate inspection of the RD784 levee system if a significant earthquake were to occur.

Assets at Risk

All District assets from Table F-3 are at some risk to this hazard.

Flood: 1%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

This hazard analyzes the FEMA DFIRM 1% and 0.2% annual chance floods. These tend to be the larger floods that can occur in the County or in the District, and have caused damages in the past. Flooding is a significant problem in Yuba County and the District. Historically, the District has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. As previously described in Section 4.3.10 of the Base Plan, the Yuba County Planning Area and the RD 784 have been subject to historical flooding.

Location and Extent

RD 784 has areas located in the 1% and 0.2% annual chance floodplain. This is seen in Figure F-6.

Figure F-6 RD 784 – FEMA DFIRM Flood Zones

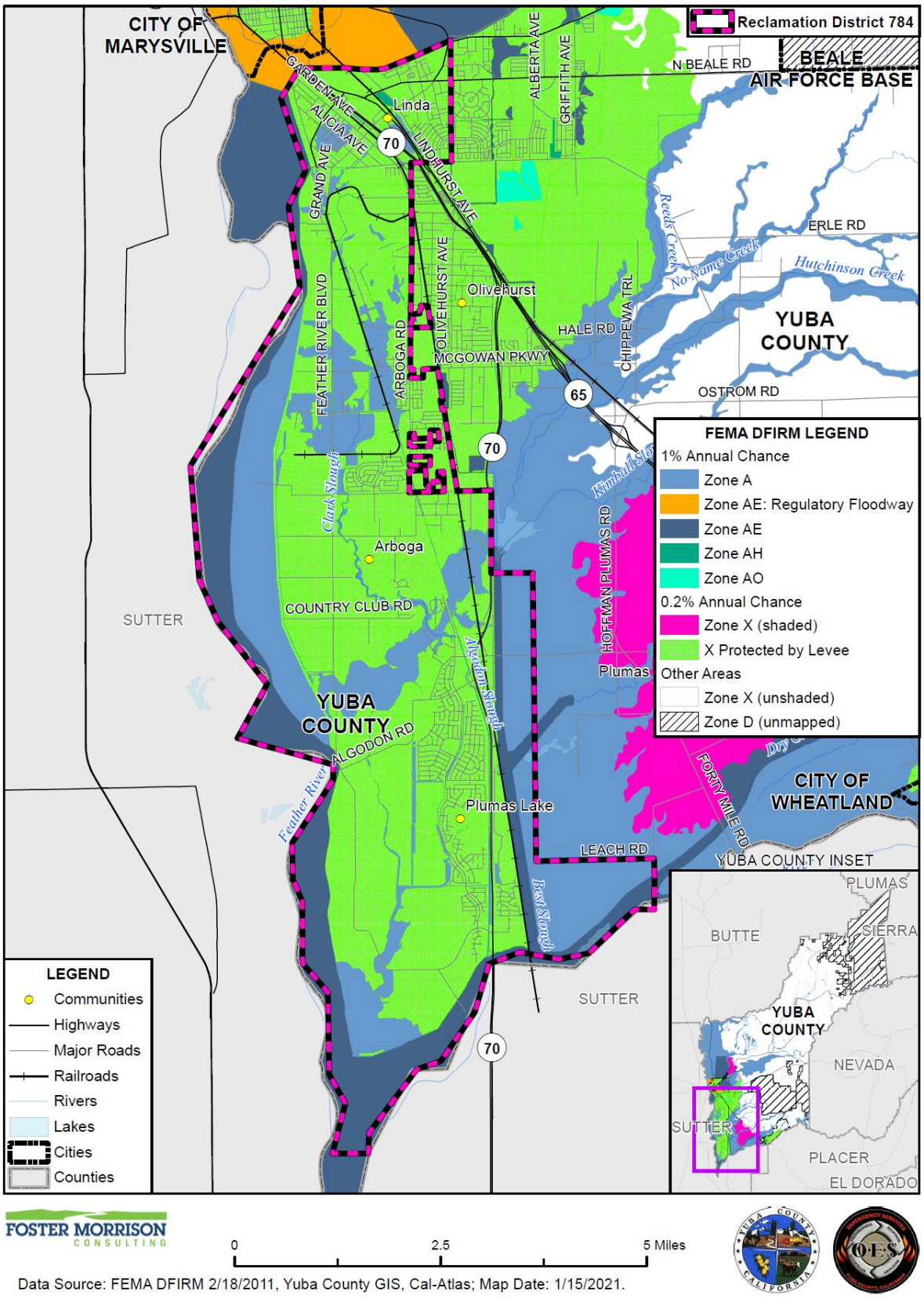


Table F-6 details the DFIRM mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the District.

Table F-6 RD 784– DFIRM Flood Hazard Zones

Flood Zone	Description	Flood Zone Present in the District
A	1% annual chance flooding: No base flood elevations provided	X
AE	1% annual chance flooding: Base flood elevations provided	X
AE Floodway	1% annual chance flood: Regulatory floodway; Base flood elevations provided	
AH	1% annual chance flood areas of shallow flooding between one to three feet deep. Regulatory floodway; Base flood elevations provided	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	0.2% annual chance flooding: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	X
X (unshaded)	No flood hazard	

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the District vary, depending on the nature and extent of a flood event; specific depths are unknown. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the District tends to have a shorter speed of onset, due to the amount of water that flows through the District.

Past Occurrences

A list of state and federal disaster declarations for Yuba County from flooding is shown on Table F-7. These events also likely affected the District to some degree

Table F-7 Yuba County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	16	1950, 1955, 1958, 1962, 1963 (twice), 1969, 1973, 1982, 1983, 1986, 1995 (twice), 1997, 2008, 2017	15	1955, 1962, 1963, 1964, 1969, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2006, 2017 (twice)

Source: Cal OES, FEMA

There have been past occurrences of flooding, associated with levee failure or overtopping events, in the District, which are discussed in more detail in the Past Occurrences of the Levee Failure section below.

Vulnerability to and Impacts from Flood

Floods have been a part of the District's historical past and will continue to be so in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths.

Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. Floods can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. Floods can be extremely dangerous, and even six inches of moving water can knock over a person given a strong current. During a flood, people can also suffer heart attacks or electrocution due to electrical equipment short outs. Floodwaters can transport large objects downstream which can damage or remove stationary structures. Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed through sediment deposition. Floodwaters can also break utility lines and interrupt services. Standing water can cause damage to crops, roads, foundations, and electrical circuits. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, loss of environmental resources, and economic impacts.

The District office and shop is within the floodplain. When highwater is forecasted, key District equipment is relocated to higher ground at Pump Station 3. If utility power is lost, backup diesel generator power will last several days, however, if roads are impassable, or if local refueling businesses are evacuated, temporary power keeping pumps going will eventually run out unless commercial power is restored. If highwater persists, the levees will become more saturated and more susceptible to erosion or other damages. Ensuring District Personnel safety is always a concern and also a priority.

Assets at Risk

All District assets from Table F-3 are at some risk to this hazard.

Flood: Localized Stormwater Flooding

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

Flooding occurs in areas other than the FEMA mapped 1% and 0.2% annual chance floodplains. Flooding may be from drainages not studied by FEMA, lack of or inadequate drainage infrastructure, or inadequate maintenance. Localized, stormwater flooding occurs throughout the County during the rainy season from

November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration.

Location and Extent

The RD 784 is subject to localized flooding throughout the District. Flood extents are usually measured in areas affected, velocity of flooding, and depths of flooding. Expected flood depths in the District vary by location. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Localized flooding in the District tends to have a shorter speed of onset, especially when antecedent rainfall has soaked the ground and reduced its capacity to absorb additional moisture.

RD 784 encompasses a drainage area of approximately 17,000 acres within the County of Yuba and is roughly bound by the Yuba River to the north, the Bear River to the south, the Feather River to the west, and the Western Pacific Interceptor Canal to the east. Within its watershed, RD 784 operates a system of drainage laterals that convey storm runoff to a number of pumping plants that discharge the runoff outside of the District boundaries.

RD 784 is divided into three major drainage basins based on historical drainage patterns in the area. Drainage Basin A encompasses about 4,900 acres in the southern portion of RD 784. Runoff from Drainage Basin A is conveyed within Lateral 5, Lateral 16, Linear Pond 16, and the lower Clark Slough; to Pump Station No. 2, where it is pumped into the Feather River. Drainage Basin B encompasses approximately 6,900 acres in the north-central portion of RD 784. The Major conveyance facilities within the basin are Lateral 13, Lateral 14, and the Plumas Lake Canal. The canals deliver water to Pump Station No. 3, where it is pumped into the Feather River. Drainage Basin C encompasses approximately 5,200 acres in the northeast portion and along the entire eastern portion of RD 784. The basin extends from the Yuba River to the Bear River, and consists of all lands east of the Lateral 15/Alogdon Canal. The major conveyance facilities in this basin are Lateral 15, Bingham Canal, and Algodon Canal. This is basically one canal which changes names at Island Road and at Algodon Road. A small portion of the water is pumped into the Feather River at Pump Station No. 9 (also called Island Road Pump Station); but the remaining runoff continues south to Pump Station No. 6, which pumps into the Bear River.

The District is responsible for operating and maintaining the internal drainage system which includes approximately 60 miles of canals and drainage ditches, 10 pump stations, and more than 55 acres of detention basins that collects and remove rain and storm waters. There are 3 more sub-drainage basins (Acreages unknown):

- Basin A-1 encompasses the southern portion of RD784 south of Basin A. Runoff from Drainage Basin A-1 is conveyed within Linear Pond 16, and the lower Clark Slough; to Pump Station No. 2, where it is pumped into the Feather River.
- Basin C-1 encompasses the southwest portion of RD784 east of the Lateral 15/Algodon Canal to the landside of the Western Pacific Interceptor Canal. The major conveyance facilities in this basin are the River Oaks Detention Basin (NOT YET ACCEPTED BY RD784 FROM THE DEVELOPER), and the Lateral 15 (South)/Algodon Canal; to Pump Station No. 6 where it is pumped into the Bear River.
- Basin C-2 encompasses the East Linda portion of RD784 northeast of the UP Railroad going toward Hammonton Smartville Rd. The major conveyance facilities in this basin are Lateral 15 (N) Bingham

Canal, Island Rd. Detention Basin; to Pump Station 9, and if necessary, to Lateral 15 (N) south of Island Rd. Detention Basin, Lateral 15 (S); to Pump Station 6.

RD784 drainage facilities are designed to convey storm water. No known localized flooding areas.

Past Occurrences

There have been no federal or state disaster declarations in the County due to localized flooding. The District noted no past occurrences of localized flooding that caused damages.

Vulnerability to and Impacts from Localized Flooding

Historically, much of the growth in the District and County has occurred adjacent to streams, resulting in significant damages to property, and losses from disruption of community activities when the streams overflow. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff.

Primary concerns associated with stormwater flooding include impacts to infrastructure that provides a means of ingress and egress throughout the community. Ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Objects can also be buried or destroyed through sediment deposition. Floodwaters can break utility lines and interrupt services. Standing water can cause damage to crops, roads, and foundations. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Erosion may occur along drainage lateral embankments when stormwater remains high for multiple days. Saturated embankments as a result of heavy precipitation will create access issues when attempting to extract obstructions such as fallen trees, etc. The RD784 internal drainage system currently functions as designed.

Assets at Risk

Pickup trucks, dump trailers, and backhoes (because they may become stuck) are at risk from this hazard.

Levee Failure

Likelihood of Future Occurrence–Unlikely
Vulnerability–Extremely High

Hazard Profile and Problem Description

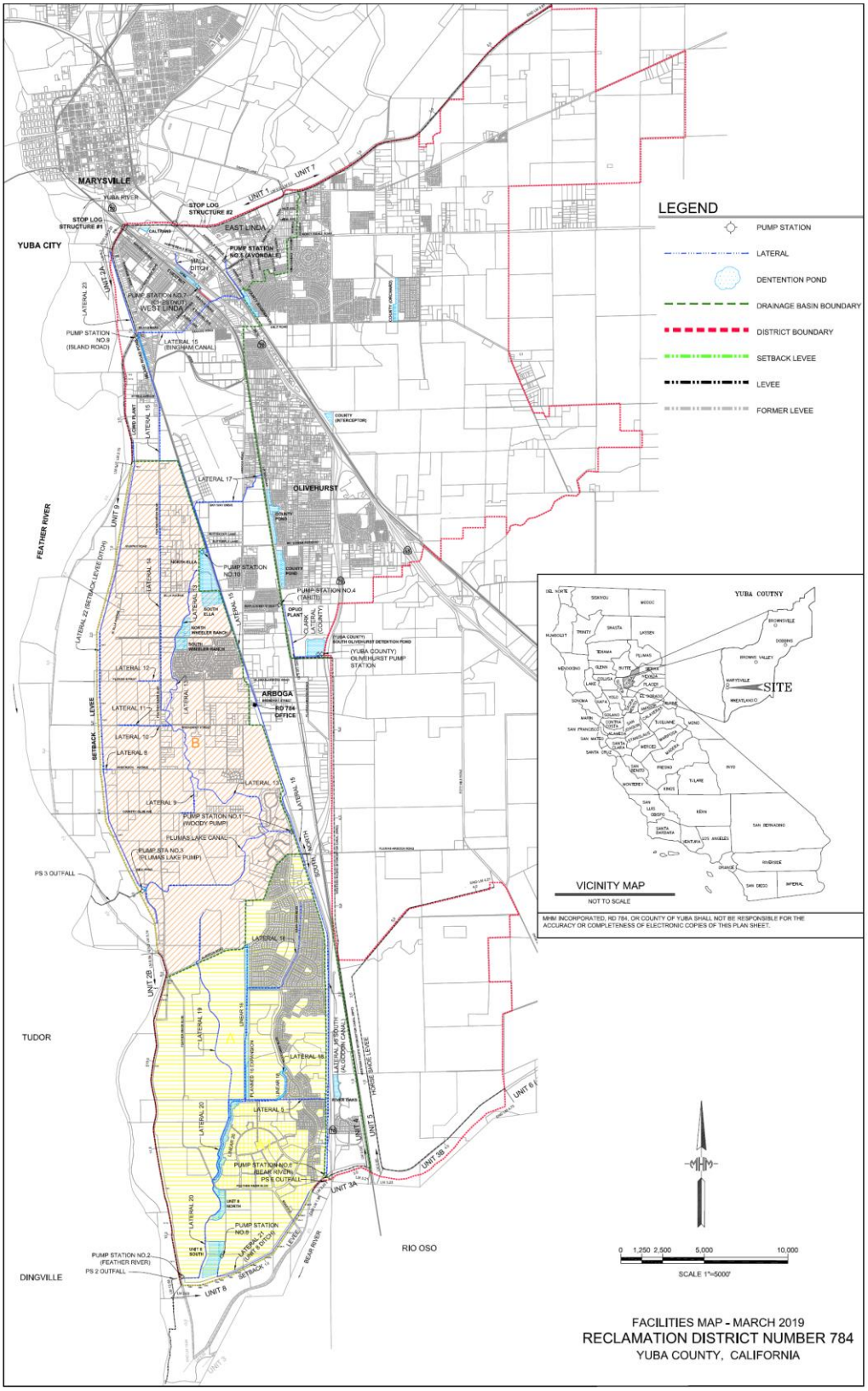
A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% annual chance flood. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Location and Extent

There is not a scientific scale or measurement system in place for levee failure. Expected flood depths from a levee failure in the District vary by event and location. The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. When northern California dams and reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees. RD 784 operates and maintains over 33 miles of levees along the Bear, Feather, and Yuba Rivers, as well as the Western Pacific Interceptor Canal (WPIC). Levees in the District are shown on Figure F-7.

Figure F-7 RD 784 – Levees and Internal Drainage



Source: RD 784

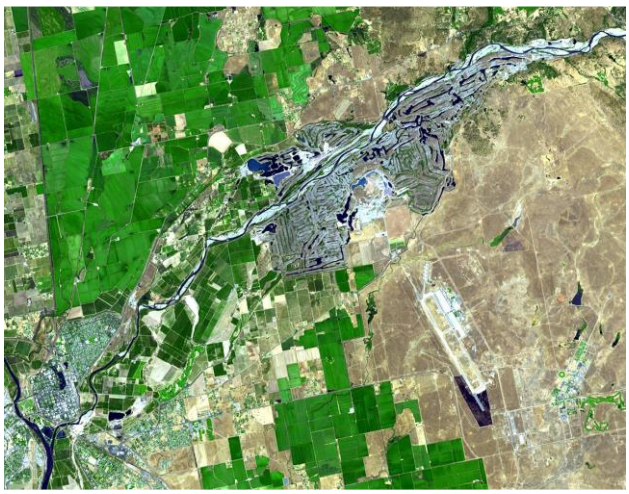
In addition, the District noted the following:

- 100-year Certification to FEMA – TRLIA has certified the RD 784 Urban levee system for 100yr LOP in 2019. It has not yet been accredited by FEMA.
- 200-year State ULDC Certification - 200 yr. certification for the RD 784 levee system is anticipated in 2022 following completion of the documentation and certification efforts.
- Levee Improvements - Since 2004, TRLIA has improved levees along the Yuba, Feather, Bear River, and WPIC. TRLIA constructed the Goldfields 100 yr. embankment and subsequently the 200 yr. project in 2020-2021 will provide 200 yr. level of protection for RD 784.

Past Occurrences

Several of the federal and state disaster declarations for flooding in Yuba County were associated with levee failure events. Historically, prolonged heavy rains and area flooding overwhelmed the levee systems, in some instances, causing them to fail. In addition, there have been many more past events of heavy rains and storms, and flood events, that have and continue to threaten the levees in the District. Events of levee failure and related events include:

1950 Yuba River Break in the Goldfields – Heavy rains in November 1950 caused extensive flooding in the Sacramento Basin. During the late afternoon of November 20, 1950; on rising stages of the second and largest peak of the Yuba River; flood flows broke through the dredger tailings of the Yuba Goldfields in the vicinity of Hammonton, upstream of the SRFCP levees, and flooded large areas adequately protected from flood flows in the downstream project reaches. The communities of Hammonton, Linda, Olivehurst, and Arboga, and over 40,000 acres of agricultural land, including Reclamation District No. 784; were inundated by the overflow. The peak flow in the Yuba River was approximately 107,000 cubic feet per second (cfs), approximately 40,000 cfs of which escaped through the Goldfields breach. Damages occurred to residential property, commercial and industrial property, public utilities, and agricultural properties. No lives were lost, but about 8,000 people were evacuated from the area.



1986 Yuba Levee Break – The 1986 flood was the largest flood since the construction of Oroville and New Bullards Bar Dams. During this event, many seepage areas and boils developed along the Feather and Yuba River levees. As flood flows began to recede, the stress on the levee system resulted in a breach of the south levee of the Yuba River just upstream of Highway 70, near the confluence of the Feather and Yuba Rivers. The northern portions of RD 784 flooded, including the communities of Linda and Olivehurst. However, only portions of southern RD 784 flooded, due to internal drainage cross levees near Plumas Arboga Road and a relatively low volume of water flowing through the levee breach, because failure occurred after the peak of the flood event.

Approximately 24,000 people were forced out of their homes in the Linda-Olivehurst area; 200 who did not leave in time waited on roofs for rescue by boats and helicopters. About 7,000 acres of land were inundated because of the levee failure and over 4,000 homes and businesses were either damaged or destroyed. Extensive evaluations of the 1986 Yuba River failure occurred due to the litigation.

Immediately after the flood, the plaintiffs hired a group to investigate the mechanism of the levee failure. The opinion of this group was captured in a letter written by consultants Leps, Sherard and Swiger, and was included in a report entitled "The Linda Flood of February 1986", written by the von Geldern Engineering Company in July 1986. This letter contains the following opinion of its authors on the Linda levee break in February 1986:

> ***"The levee failure most probably was caused by seepage through erodible foundation alluvial soils under the levee. Piping action created an open conduit in fine sand, followed by collapse of the levees into the 'pipe' or conduit thus formed. This action proceeded to failure because the levee was subjected to unusually extended flood level loading and the 1940 levee design did not incorporate provisions to control the exit of either underseepage or through seepage."***

The authors state that it is their opinion that "the failure most probably occurred by piping in the foundation (of the levee)." During the legal proceedings for the Paterno case, Richard Meehan, the plaintiffs' expert witness on the issue of levee failure mechanism claimed that the Linda levee failed because flood water had saturated a subsurface layer of gravel, then flowed underground far to the landward side of the levee and erupted, geyser-like, undermining the structures and causing their collapse. If piping had been the cause of failure, then flood forces should have noticed the boil at the exit of the "pipe" and steps could have been taken to prevent the erosion of material from the foundation. An eyewitness account of the boil and the very rapid embankment failure (20 minutes) did not support the normal concept of a piping failure.

Defense experts gave the opinion that the failure of the Linda levee was due to hydro fracture, not piping, as claimed by the plaintiffs. Hydro fracture in this case means that the "surface does have a clay layer on top it, which doesn't allow water to get to the surface, so pressure in the water builds up until it can cause a fracture through this layer of soil above the sand. And then, once it starts going, it can remove the material very fast" (Paterno, 1999). A hydro fracture failure would not have allowed time for flood fighting to combat the mechanism of failure.

While the jury found for the defense in this case, the Judge ruled that, even though the State was not liable for the break, there had been an inverse condemnation due to the lack of maintenance at this site and the State had to pay for the property damaged as a result of the break. This judgment was appealed and retried

and appealed again before the California Supreme Court found that the finding of inverse condemnation was correct. The State paid $450 million in damages as a result of the case.

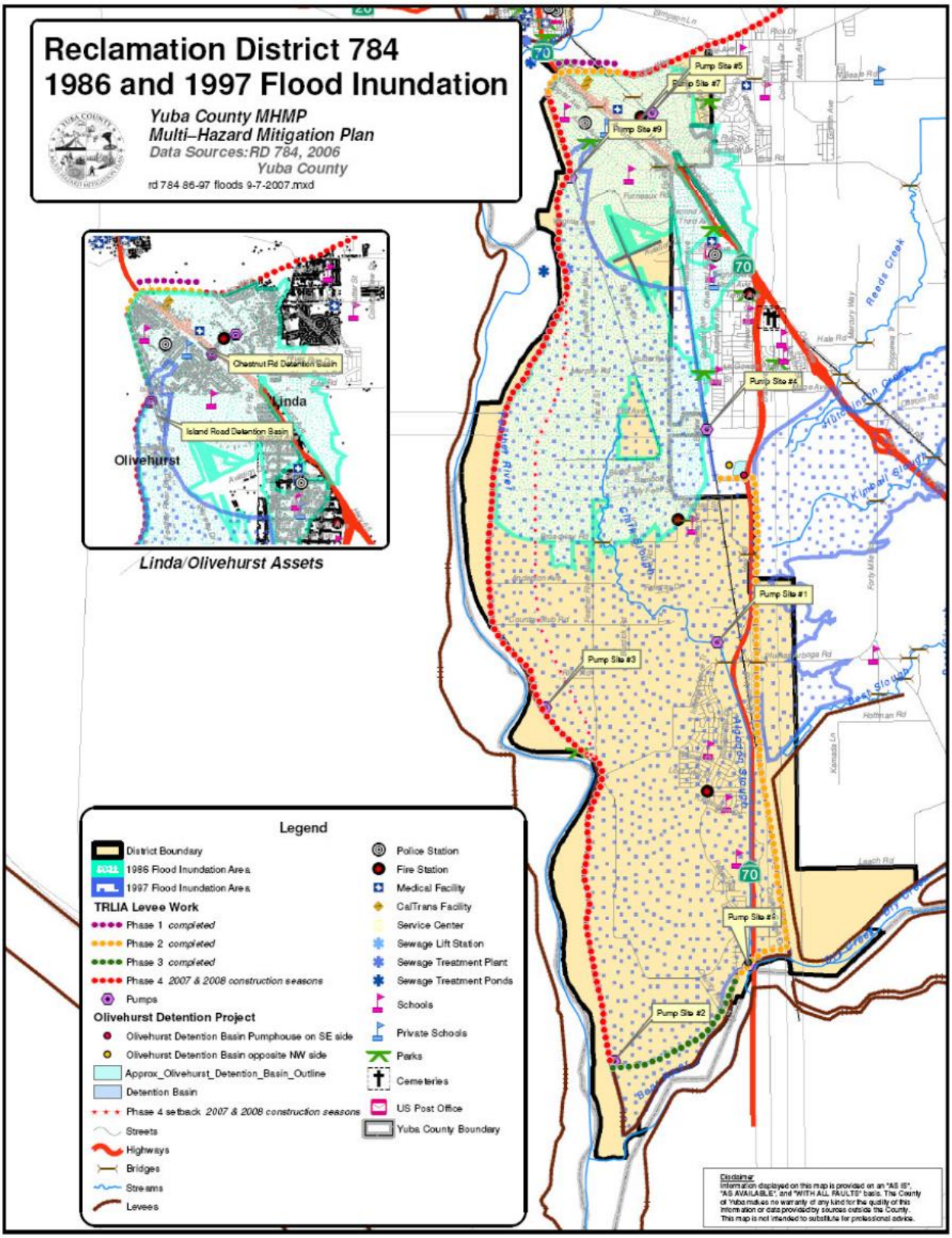
1997 Feather Levee Break – An even larger flood event occurred in 1997, with the Feather River east levee failing near the town of Arboga, California, which again flooded RD 784. The flood waters filled RD 784 until eventually the flooding reached a height that overtopped the north levee of the Bear River at the southern end of RD 784. High winds during this flood event resulted in significant wave damage to the Feather, Western Pacific Interceptor Canal, and Bear River levees. The Feather River levee break occurred at a location scheduled for repair in 1996 as part of the Systems Evaluation Project. Delays caused this work to be rescheduled for 1997. High floods in January 1997 caused the levee breach before the work was done.

With the 1997 levee break on the Feather River, both the opinions of the plaintiffs and defendant on failure mechanism were the same as those used in the Paterno case for the 1986 Linda levee break on the Yuba River. The plaintiffs maintained that the levee breach was caused by levee under-seepage through a layer of gravel and subsequent eruption of water on the landside of the levee. Again, the defense used the theory of hydro fracture, a rapid break of a clay layer via the upward penetration of water, to explain the rapid levee failure. This case was settled out of court for $50 million and there was no verdict on the failure mechanism in this case (Dean Marachi, State legal geotechnical expert witness for 1986 and 1997 flood cases, Personal Communication, August 2006). In the case of the 1997 levee failure, there were numerous personnel that observed the failure. Once again, the failure was very rapid (15 to 20 minutes) and catastrophic. The site of the 1997 failure was also the site of major boils in 1986.

It should be noted that the water levels in 1955 were much higher than either the 1986 or the 1997 floods, and the Yuba County levees held. There is a theory of progressive internal erosion that could explain that situation. The theory is that progressive wetting and drying of the sand lenses over many years has led to shrinkage and open passageways. Therefore, during the next flood event, the water moves rapidly horizontally to the landside with minimal hydraulic losses, which leads to higher pressures on the landside of the levee with each flood event. This idea is a companion to the "Hydraulic Fracture" theory.

A map of RD 784 flood inundations for the 1986 and 1997 flood inundations can be seen on Figure F-8.

Figure F-8 RD 784 – 1986 and 1997 Flood Inundations



Source: 2007 Yuba County Mitigation Plan, Annex I RD 784

January 2017 – High River Elevations along levees for multiple weeks. The magnitude of the event was critical. Along the Yuba River, Feather River, Bear River, Best Slough, and Dry Creek. No RD784 staff injuries or staff deaths occurred. Damages were limited, some fences were damaged. Gravel Patrol Road Rutting, etc. from frequent levee patrols occurred. There were no RD784 insured losses. The District received approximately $20,000.00 in reimbursements from FEMA for 2017 post highwater.

February 2017 to April 2017 – Heavy rains brought a high volume of stormwater to District drainage laterals. The magnitude of the event was critical along RD784's 60 miles of interior drainage laterals. No RD784 staff injuries or staff deaths occurred. Medium – Some drainage lateral erosion occurred in some areas. There were no RD784 insured losses. The District received approximately $50,000.00 in reimbursements from FEMA for 2017 post storm debris cleanup efforts, vehicle and fuel usage, and for excessive pump station electrical costs.

Post debris cleanup was performed by the District. Some of these areas can be seen on Figure F-9, Figure F-10, and Figure F-11.

Figure F-9 2017 Storm Damage and Debris Clean Up

Source: RD 784

Figure F-10 2017 Storm Damage and Debris Clean Up

Source: RD 784

Figure F-11 2017 Storm Damage and Debris Clean Up

Source: RD 784

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. The primary danger associated with levee failure is the high velocity flooding of those properties outside and downstream of the breach.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and life safety issues. Business and economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

In addition, RD 784's levee structures are being weakened by muskrats, beavers, rodents, soil erosion, storms, and high water events. The levees are also being further eroded and undermined by trees, brush, debris, refuse piled on or near the levees, and illegal driving on the levees.

A 2019 RD 784 Levee and Internal Drainage Operations and Maintenance Assessment Final Engineer's Report discussed some additional vulnerabilities. As described below, the two assessments currently supporting the services provided by RD 784 present funding restrictions that may hinder the providence of

the necessary levee and internal drainage O&M services that ensure the safety and usefulness of lands within the district.

The current RD 784 assessment was first levied in 1998 under the Reclamation Act (CA Water Code §51200 – 51894). The Reclamation Act permitted the RD 784 Board to raise funds in any given year based on a fixed rate per assessed value (CA Water Code §51335). Prior to the passage of Proposition 218 in 1996, an annual adjustment to the assessment roll required only Board action and could be levied without property owner approval. However, after its passage, RD 784 has been unable to increase the fixed rate under this section of the Water Code, as an increase would violate the requirements of Proposition 218 (specifically Articles XIIIC and XIIID of the State Constitution and Government Code §53750 et. seq.). As a result, the current RD 784 assessment is not keeping pace with the rising cost of providing levee and internal drainage O&M services.

In 2009, TRLIA formed a benefit assessment district for the purpose of raising funds to provide maintenance and repair to levees, maintained by RD 784, that had been enhanced through a comprehensive levee improvement program. The funds generated by the TRLIA assessment were intended to cover the incremental O&M costs associated with TRLIA levee improvements above the then existing services provided by RD 784. The funds provide by TRLIA supplement the current RD 784 assessment revenue. The supplemental funding provided to RD 784 is based upon annual approval of the RD 784 levee maintenance budget by TRLIA. The current TRLIA assessment may be increased according to the change in the Consumer Price Index (CPI), however, can only be used to support levee O&M of TRLIA improved levees and cannot be used for O&M of drainage facilities or levees outside of the improvement program.

In addition to the funding restrictions presented by both the current RD 784 and TRLIA assessments, in May of 2018, the Yuba County Local Agency Formation Commission (LAFCO) issued a Certification of Completion which approved changes to the previous RD 784 district boundaries. These include the annexation of parcels served by the future Goldfields Levee, the de-annexation of parcels no longer served due to the Feather River and Bear River setback levees, and the annexation of parcels which were islands within the previous boundary but not included within the District. While the annexed parcels receive services provided by RD 784, they cannot be assessed under the current assessment. Additionally, the de-annexed parcels are no longer within the RD 784 boundaries and, therefore, are no longer assessed.

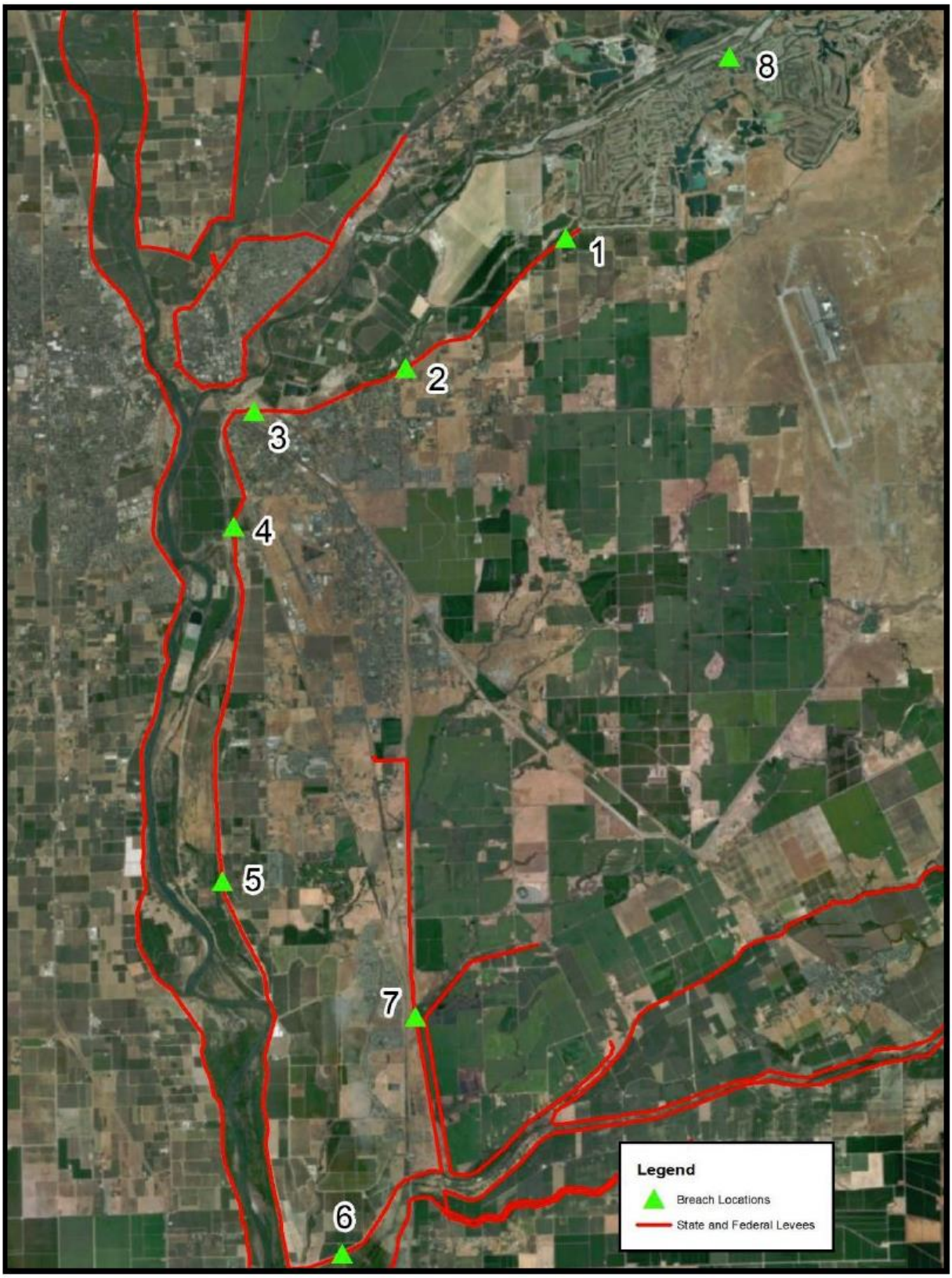
Due to these factors, RD 784 is proposing to levy a new assessment under the Benefit Assessment Act of 1982 for levee and internal drainage to adequately fund the required operation and maintenance activities. The new proposed Levee and Internal Drainage O&M Assessment (Proposed Assessment), if approved by landowners, would replace both the current RD 784 and TRLIA assessments beginning in Fiscal Year 2019/20.

Levee Breach Analysis

The 2019 Final Engineer's report included a breach analysis. The urban area benefiting from the Levee O&M Services provided by RD 784 is divided into four benefit zones based on maximum flood depths identified from the levee breach analysis presented in MBK Engineers' Technical Memorandum: Reclamation District 784 Assessment District Update, dated June 19, 2018 (MBK Tech Memo). MBK's

analysis consisted of eight (8) levee breaks at locations that are representative of a break anywhere along the levee system. Figure F-12 provides a map of the levee break locations used in the analysis.

Figure F-12 RD 784 – Hypothetical Levee Breach Locations



Source: 2019 RD 784 Levee and Internal Drainage Operations and Maintenance Assessment Final Engineer's Report

Although the benefit zones were derived from the maximum flood depth from all eight levee breaks, the special benefit received by each property is in proportion to the risk of flooding from a levee break anywhere along the levee system. The flood risk for a particular property is dependent on where the property is located. For example, a property in the East Zone is not at risk of flooding by a levee break in the southern end of the District, while a property in the South Zone is at risk of flooding by a break anywhere in the system.

As discussed, in order to prorate the risk of levee failure for each Benefit Zone, MBK analyzed each levee break separately to determine the average flood depth within each Benefit Zone and the length of levee wherein a break would produce similar results. The total sum of the product of average flood depth and associated length of levee for each break was divided by the total length of urban levees maintained by the District to determine the Average Weighted Flood Depth for each Benefit Zone. The calculations for determining the Average Weighted Flood Depth for each Benefit Zone are provided in Figure F-13.

Figure F-13 RD 784 Levee Breach Average Weighted Flood Depths

Levee Breach	Associated Length of Levee	South Zone		West Zone		Central Zone		East Zone	
		Avg. Depth	Depth x Length	Avg. Depth	Depth x Length	Avg. Depth	Depth x Length	Avg. Depth	Depth x Length
	A	B	C = (B) x (A)	D	E = (D) x (A)	F	G = (F) x (A)	H	I = (H) x (A)
Location 1	16,703	0.60	10,022	1.30	21,714	0.82	13,696	1.18	19,710
Location 2	11,136	3.81	42,428	3.89	43,319	2.36	26,281	2.19	24,388
Location 3	3,145	16.90	53,151	7.19	22,613	3.11	9,781	1.33	4,183
Location 4	23,200	16.96	393,472	5.12	118,784	2.88	66,816	0.00	0
Location 5	31,380	15.79	495,490	2.92	91,630	2.62	82,216	0.00	0
Location 6	27,692	11.41	315,966	0.00	0	0.17	4,708	0.00	0
Location 7	33,264	8.64	287,401	0.00	0	0.00	0	0.00	0
Location 8	14,045	2.55	35,815	2.29	32,163	1.46	20,506	1.50	21,068
Totals	*160,565*		*1,633,744*		*330,222*		*224,003*		*69,348*
Average Weighted Flood Depth [1]		=sum(C)/sum(A) **10.18**		=sum(E)/sum(A) **2.06**		=sum(G)/sum(A) **1.40**		=sum(I)/sum(A) **0.43**	

Source: Technical Memorandum: Reclamation District 784 Assessment District Update produced by MBK Engineers, dated June 19, 2018
[1] Rounded to two significant digits.

Source: 2019 RD 784 Levee and Internal Drainage Operations and Maintenance Assessment Final Engineer's Report

As detailed above, should RD 784 levees breach, flooding may be extensive, with flood depths and impacts varying depending on the breach location. All community assets protected by these levees are potentially at risk of flooding and damage. Life safety is also a concern; evacuations of affected areas will be important to protect lives, especially in the South Zone where flood depths and extents are greatest.

Assets at Risk

All District assets from Table F-3 are at risk from this hazard.

Pandemic

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a new virus appears against which the human population has no immunity. A pandemic occurs when a new virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the WHO to strengthen systems to detect outbreaks of that might cause a pandemic and to assist with pandemic planning and preparation. An especially severe pandemic could lead to high levels of illness, death, social disruption, and economic loss.

Location and Extent

During a pandemic, the whole of the District, County, and surrounding region is at risk, as pandemic is a regional, national, and international event. The speed of onset of pandemic is usually short, while the duration is variable, but can last for more than a year as shown in the 1918/1919 Spanish Flu. There is no scientific scale to measure the magnitude of pandemic. Pandemics are usually measured in numbers affected by the pandemic, and by number who die from complications from the pandemic.

Past Occurrences

There has been one state and federal disaster declaration due to pandemic, as shown in Table F-8.

Table F-8 Yuba County – State and Federal Pandemic Disaster Declarations 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Pandemic	1	2020	1	2020

Source: Cal OES, FEMA

The 20th century saw three outbreaks of pandemic.

- The 1918-1919 Influenza Pandemic (H1N1)
- The February 1957-1958 Influenza Pandemic (H2N2)
- The 1968 Influenza Pandemic (H3N2)

To date, the 21st century has seen two acknowledged pandemics.

- 2009 Swine Flu (H1N1)
- 2019/2020 COVID 19

Vulnerability to and Impacts from Pandemic

Pandemics have and will continue to have impacts on human health in the region. A pandemic occurs when a new virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. There are several strategies that public health officials can use to combat a pandemic. Constant surveillance regarding the current pandemic, use of infection control techniques, and administration of vaccines once they become available. Citizens can help prevent the spread of a pandemic by staying home, or "self-quarantining," if they suspect they are infected. Pandemic does not affect the buildings, critical facilities, and infrastructure in the District. Pandemic can have varying levels of impact to the citizens of the District and greater County, depending on the nature of the pandemic.

Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines. Hospitalizations and deaths can occur, especially to the elderly or those with pre-existing underlying conditions. As seen with Covid-19, multiple businesses were forced to close temporarily (some permanently), and unemployment rose significantly. Supply chains for food and essentials can be interrupted. Prisons may need to release prisoners to comply with social distance standards.

Primarily impacts to the District include temporary loss of staff, especially during flood season. Under normal circumstances, levee patrol protocols call for two people per patrol vehicle. During a pandemic, the risk of transmission of illness to one another is very high if there is more than one person to a vehicle, even if face coverings are worn. If there is an outbreak of illness, there is an even greater risk in losing the entire staff. Other concerns include a reduction in pump station monitoring time during storm events if there is little or no staff available due to the pandemic.

Assets at Risk

Pandemics do not affect District facilities, but can affect District personnel who operate District facilities.

Severe Weather: Heavy Rains and Storms

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Storms in the District occur annually and are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the District falls mainly in the fall, winter, and spring months.

Location and Extent

Heavy rain events occur on a regional basis. Rains and storms can occur in any location of the District. All portions of the District are at risk to heavy rains. Most of the severe rains occur during the fall, winter, and spring months. There is no scale by which heavy rains and severe storms are measured. Magnitude of storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of severe storms in California, Yuba County, and the District can range from minutes to hours to days. Information on precipitation extremes can be found in Section 4.3.4 of the Base Plan.

Past Occurrences

There have been past disaster declarations from heavy rains and storms, which were discussed in Past Occurrences of the Levee Failure section above. According to historical hazard data, severe weather, including heavy rains and storms, is an annual occurrence in the District. This is the cause of many of the federal disaster declarations related to flooding.

Vulnerability to and Impacts from Heavy Rain and Storms

Heavy rain and severe storms are the most frequent type of severe weather occurrences in the District. These events can cause localized flooding. Elongated events, or events that occur during times where the ground is already saturated can cause 1% and 0.2% annual chance flooding. Wind often accompanies these storms and has caused damage in the past. Hail and lightning are rare in the District.

Actual damage associated with the effects of severe weather include impacts to property, critical facilities (such as utilities), and life safety. Heavy rains and storms often result in localized flooding creating significant issues. Roads can become impassable and ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Floodwaters and downed trees can break utilities and interrupt services. During periods of heavy rains and storms, power outages can occur. These power outages can affect pumping stations and lift stations that help alleviate flooding.

Heavy rains and storms cause increased runoff, impacting internal and external drainage facilities. An increase in water volume puts an additional strain on both sides of the levees, causing further damage through erosion, scouring, sink holes, standing water, saturation and seepage. In a severe storm event the amount of rainfall and the short period of time it could fall, could cause a greater impact on the existing facilities to be able to handle increased flows.

Assets at Risk

Pump Stations 1, 2, 3, 4, 5, 6, 7, 8, 9, & 10 due to possible power outages are at risk from this hazard

Severe Weather: High Winds and Tornadoes

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

High winds, as defined by the NWS glossary, are sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration. High winds can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. High winds can also cause PSPS events.

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes form when cool, dry air sits on top of warm, moist air. Tornadoes are the most powerful storms that exist. Tornadoes, though rare, are another severe weather hazard that can affect areas of the Yuba County Planning Area, primarily during the rainy season in the late fall, winter, and early spring.

Location and Extent

The entire District is subject to significant, non-tornadic (straight-line), winds. Each area of the County is at risk to high winds. Magnitude of winds is measured often in speed and damages. These events are often part of a heavy rain and storm event, but can occur outside of storms. The speed of onset of winds can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of winds in California is often short, ranging from minutes to hours. The Beaufort scale is an empirical 12 category scale that relates wind speed to observed conditions at sea or on land. Its full name is the Beaufort Wind Force Scale. The Beaufort Scale was shown in Section 4.3.5 of the Base Plan.

Tornadoes, while rare, can occur at any location in the County and District. Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale (EF) provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis and better correlation between damage and wind speed. It is also more precise because it considers the materials affected and the construction of structures damaged by a tornado. The F Scale and EF Scale are shown in Section 4.3.5 of the Base Plan.

Past Occurrences

There has been no federal and one state disaster declarations in the County for winds and tornadoes. This can be seen on Table F-9. The District noted that since high winds is a regional phenomenon, events that affected the lower elevations of the County also affected the District. Those past occurrences were shown in the Base Plan in Section 4.3.5.

Table F-9 Yuba County – State and Federal Disaster Declarations from High Winds 1950-2021

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
High Winds	1	1983	0	–

Source: Cal OES, FEMA

The District noted that no specific events that caused damage in the District could be recalled. Each year, the District encounters periodic wind damages in general including down tree branches on the levees or in drainage laterals.

Vulnerability to and Impacts from Severe Weather: Wind and Tornado

High winds are common occurrences in the District throughout the entire year. Straight line winds are primarily a public safety and economic concern. Windstorm can cause damage to structures and power lines which in turn can create hazardous conditions for people. Debris flying from high wind events can shatter windows in structures and vehicles and can harm people that are not adequately sheltered. High winds can impact critical facilities and infrastructure and can lead to power outages. Wind can also drive wildfire flames, spreading wildfires quickly During periods of high winds and dry vegetation, wildfire risk increases. High winds that occur during periods of extreme heat can cause PSPS events to be declared in the County.

Impacts from high winds in the District will vary. Future losses from straight line winds include:

- Downed trees
- Power line impacts and economic losses from power outages
- Increased PSPS events
- Occasional building damage
- Wave actions on the levees contributes to erosion

Assets at Risk

Generally no District assets are at risk, but a tornado may cause any RD784 pump station to be at potential risk as well as the RD784 office and shop facilities.

F.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation education, outreach, and partnerships, and other mitigation efforts.

F.6.1. Regulatory Mitigation Capabilities

Table F-10 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the RD 784.

Table F-10 RD 784 Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan	Y	DWR Superintendent's Guide To Operation & Maintenance Of California's Flood Control Projects 09.2002 RD784 Master Drainage Plan 09.30.2008 RD784 Master Drainage Plan (Basin A) 12.06.2007 RD784 Master Drainage Plan (Basin B) 04.03.2007 RD784 Master Drainage Plan (Basin C) 07.07.2009 RD784 Master Drainage Plan (Basin C) All master drainage plans summarize the features of all drainage basins, improvements, O & M maintenance assumptions, storm frequency and degree of protection
Capital Improvements Plan	N	
Economic Development Plan	N	
Local Emergency Operations Plan	Y 2017	RD784 Emergency Operations Basic Plan It addresses hazards by providing District staff and trustees direction during a natural disaster or emergency event.
Continuity of Operations Plan	N	
Transportation Plan	N	
Stormwater Management Plan/Program	Y	RD784 utilizes storm maintenance check-off lists to ensure all drainage infrastructure has been inspected with any issues addressed before, during, and after storm events.
Engineering Studies for Streams	N	
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y	Drainage Master Plans Injury Illness Prevention Plan, Heat Illness Prevention Plan, COVID-19 Prevention Plan, Hazard Communication Plan, Emergency Action Plan, Hazardous Materials Business Plan, Storm Maintenance Check Off List Program, and Code of Safe Practices. USACE O&M Manuals for East Levee of Feather River, South Levee of Yuba River, Both Levees of Western Pacific Intercepting Channel, West Levee of South Dry Creek, and North Levee of Bear River
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	N/A	Version/Year:
Building Code Effectiveness Grading Schedule (BCEGS) Score	N/A	Score:
Fire department ISO rating:	N/A	Rating:

Site plan review requirements	N/A	
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	N/A	
Subdivision ordinance	N/A	
Floodplain ordinance	N/A	
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	N/A	
Flood insurance rate maps	N/A	
Elevation Certificates	N/A	
Acquisition of land for open space and public recreation uses	N/A	
Erosion or sediment control program	N/A	
Other	Y	Injury Illness Prevention Plan, Heat Illness Prevention Plan, COVID-19 Prevention Plan, Hazard Communication Plan, Emergency Action Plan, Hazardous Materials Business Plan, Storm Maintenance Check Off List Program, and Code of Safe Practices.
How can these capabilities be expanded and improved to reduce risk?		
The District noted the following ways to expand capabilities. 1) Employees are given annual reviews of the various plans and manuals to ensure all information is understood. This will continue and be expanded to reduce risk. 2) As things change in the District over time such as when the levee system is expanded or other improvements are completed, capabilities can be improved by updating or modifying plans or manuals as necessary. This will continue and be expanded to reduce risk. 3) District employees are regularly encouraged to share new ideas on how to reduce risk in all categories. This will continue and be expanded to reduce risk.		

Source: RD 784

RD 784 Emergency Operations Plan (2017)

This RD784, as an independent jurisdiction, has responsibility for the maintenance of the levee and drainage systems within its jurisdictional boundaries, except for "the Horseshoe" area (6.6 miles of levee upstream of the Western Pacific Interceptor Canal) where it only has levee responsibilities. While the District will work with, and assist if possible, the local jurisdiction(s) responsible for other public safety functions within the District, this District Emergency Operations Plan (EOP)only contains detailed procedures for meeting District emergency responsibilities. The manner of interacting with other jurisdictions is described, but the operational plans of other jurisdictions with public safety responsibilities within the area protected by District levees are only referenced in this document. This plan will cover in detail the following:

- District Flood Preparedness Procedures
- District Levee Patrol Procedures
- District Flood Fight Procedures
- District Flood Water Removal Procedures
- District Recovery and After-Action Follow up Procedures

Drainage Master Plan (2002)

A Drainage Master Plan for RD 784 was prepared in September 2002. The purpose of the Master Plan was to develop a comprehensive plan to cover all of RD 784. The North Arboga Study Area and the Plumas Lake Specific Plan Area were approved; and one of the conditions of this approval was the development of a comprehensive Master Plan to ensure the proper implementation of drainage facilities. Another goal was to protect existing and future property owners from unnecessary property damage resulting from new development.

In addition to the 2002 plan there is now a Drainage Basin C Drainage Master Plan Dated July 7, 2009. The 2009 report was prepared to summarize the features and projections of the new drainage models developed in 2008 and early 2009 for Basin C of Reclamation District 784 within the Plumas Lake Specific Plan Area of Yuba County. It is also intended to define additional storm runoff improvement facilities to be constructed and the design criteria to be used in preparing plans, specifications, and construction cost estimates for those improvements. New facilities covered by this report include various pond additions, pond expansions, culvert improvements, new pump stations and upgrades to existing pump stations.

F.6.2. Administrative/Technical Mitigation Capabilities

Table F-11 identifies the District department(s) responsible for activities related to mitigation and loss prevention in RD 784.

Table F-11 RD 784's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	N/A	
Mitigation Planning Committee	N/A	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	RD784 references to the 2019 USACE Operation and Maintenance Manual, DWR Superintendents Guide to Operations and Maintenance in addition to the District's own maintenance check off lists which comprise of Levee Patrol Logs, Storm Maintenance Check Off Lists, Pump Station Maintenance Check off Lists, and Equipment Check off Lists.
Mutual aid agreements	Y	The RD784 Urban Levee System is Active in PL (Public Law) 84-99 which gives the USACE the legal authority to conduct emergency preparation, response, and recovery activities and to supplement local efforts in the repair of flood damage reduction projects that are damaged by floods.
Other	Y	Yuba Sutter Regional Flood Fight Coalition (7 Member agencies and 6 supporting/partner agencies) - Established in 2013. RD784 is the Lead Agency.
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	N/A	
Floodplain Administrator	N/A	

Emergency Manager	Y	Patrick Meagher, General Manager serves as the Incident Commander or RD784 during an emergency and is trained on hazards and mitigation including DWR Flood Fighting and SEMS, NIMS, and ICS training.
Community Planner	N/A	
Civil Engineer	Y	Sean Minard of MHM Engineering serves as the official District Civil Engineer and is trained on hazards and mitigation including DWR Flood Fighting and SEMS, NIMS, and ICS training.
GIS Coordinator	N/A	
Other	Y	RD784 General Manager: Patrick Meagher RD784 District Engineer: Sean Minard (MHM Engineering Inc.) Field Superintendent: Jess McLaughlin is RD784's Field Superintendent and is trained on hazards and mitigation including DWR Flood Fighting and SEMS, NIMS, and ICS training. The Field superintendent will also serve as the alternate Incident Commander during emergencies if the General Manager is absent. Field Workers: RD784 currently employs 5 Field Workers who perform all field O&M activities, levee patrol, and storm maintenance activities. With the exception of new hires, most field workers are trained on hazards and mitigation, DWR Flood Fighting, and SEMS, NIMS, and ICS. Cal-Fire: RD784 has an active agreement with Cal-Fire who will deploy inmates to RD784 for O&M activities or for emergency flood fight assistance if needed. California Conservation Corps: RD784 has an active agreement with the CCC who will deploy work crews for O&M activities or for emergency flood fight assistance if needed.
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)	N/A	Supervisory Control and Data Acquisition system (SCADA) RD784 utilizes a SCADA system which will warn staff via telephone or computer message if pump station water basin levels reach high levels or if there is a power or pump malfunction RD784 relies on the Count of Yuba for any implementation of an additional warning systems or services to the general public including any reverse 911 or outdoor warning systems. RD784 monitors stream gauge data available on the DWR CDEC website. https://cdec.water.ca.gov/ DWR staff will also typically notify the RD784 General Manager or Field Superintendent via telephone or email if nearby rivers reach monitor stage.
Hazard data and information	Y	RD784 Hazard Communication Program. Staffing has been trained and is adequate to enforce regulations.
Grant writing	Y	Grant writing is completed by staff, District Engineer, and outside consultants, when necessary, through collaborative efforts.
Hazus analysis	N	
Other	N	
How can these capabilities be expanded and improved to reduce risk?		
The District noted that without additional funding, additional administrative and technical capabilities cannot be expanded. Additional funding is needed. If funding is received, RD784 would likely use the funding to hire a consultant to create an up to date Comprehensive/General/Master Plan and/or evaluate all existing plans/programs and update as necessary.		

Source: RD 784

F.6.3. Fiscal Mitigation Capabilities

Table F-12 identifies financial tools or resources that the District could potentially use to help fund mitigation activities.

Table F-12 RD 784's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Yes	Has not been used in the past. These funds cannot be used to fund future mitigation actions.
Authority to levy taxes for specific purposes	Yes	RD784 charges property assessments and issues delinquent penalty notices if fees are not paid on time. Cannot be used to fund future mitigation actions.
Fees for water, sewer, gas, or electric services	No	
Impact fees for new development	Y	Impact fees cannot be used for mitigation actions.
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	No	
Incur debt through private activities	No	
Community Development Block Grant	No	
Other federal funding programs	Yes	FEMA (After Disasters) Last used in 2017 for post highwater cleanup efforts and some gravel road rehabilitation.
State funding programs	Yes	DWR Flood Maintenance Assistance Program, Deferred Maintenance Program. These grants have been in use annually since 2018 to the present time. Funds used in the past for general levee maintenance and improvements.
Other	Yes	Occasional grants through Yuba Water Agency. Last used for a pipe replacement project in the rural section of the District
How can these capabilities be expanded and improved to reduce risk?		
Improvement for these types of capabilities may come as funding opportunities become available. When funds are received, projects such as levee patrol road repairs, pipe repairs and debris cleanup my commence without depleting the District's reserve funds.		

Source: RD 784

F.6.4. Mitigation Education, Outreach, and Partnerships

Table F-13 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information.

Table F-13 RD 784's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	2017 RD784 Emergency Operations Plan created with funds awarded to Yuba County under the DWR Flood Emergency Response Program
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	RD784 Hosts the DWR annual regional Flood Fight Training Education Day. Class time takes place in the morning followed by field instruction in the afternoon. The annual class is usually held in December at an available local establishment. Neighboring government agencies and the general public are encouraged to attend.
Natural disaster or safety related school programs	No	
StormReady certification	No	
Firewise Communities certification	No	
Public-private partnership initiatives addressing disaster-related issues	Yes	Yuba-Sutter Regional Flood Fight Coalition The Yuba-Sutter Regional Flood Fight Coalition was formed in 2010 as a way to encourage better planning, training, communication and response between Reclamation Districts, Levee Districts, and Public Agencies providing flood protection to Yuba and Sutter counties. Members include RD784, RD817, RD1001, RD2103, LD1, and Marysville Levee District. Partnering agencies include Yuba Community College, County of Yuba, Linda Fire Protection District, Sutter Butte Flood Control Agency, and Three Rivers Levee Improvement Authority.
Other	Y	SEMS/NIMS & ICS Training Provided
How can these capabilities be expanded and improved to reduce risk?		
It is possible the Yuba-Sutter Regional Flood Fight Coalition could be expanded if a new Levee or Reclamation District is ever formed in the Yuba-Sutter area. This program could be improved by providing a designated outside consultant to coordinate annual flood fight supplies inspections, information on material or equipment resources and any other updates that may be helpful to neighboring agencies. Although RD784 is the lead agency, it's primary purpose was to ensure emergency flood patrol supplies were purchased and distributed to member of the coalition. Continued efforts to communicate with all members year-round could reduce overall risk if the region is prepared as a whole		

Source: RD 784

The District EOP noted that the District is a member of the California Master Mutual Aid Agreement by virtue of being located within Yuba County who is a signatory to that agreement and will follow the processes outlined in those documents for requesting and providing mutual aid through standard and established protocols. Additional requests for support outside of the established Mutual Aid systems such

as requests for technical assistance and services, flood fight crews, supplies and materials, and other resources will be made through the Yuba Operational Area EOC as appropriate.

F.6.5. Other Mitigation Efforts

The District has many other completed or ongoing mitigation efforts that include the following:

Gauges

Gauges in the vicinity of RD784(Yuba River at Marysville and Feather River at Yuba City) have DWR assigned monitor, flood, and danger stages that do not reflect the new channel and levee-to-levee cross-section and conditions. Monitor, flood, and danger stages are assigned based on channel geometry, which is no longer relevant. Therefore, the District uses the gauges to monitor for swells (peaks) in the hydrograph, but have not yet established specific stages that prompt actions. The District diligently monitors stages and levee conditions to develop appropriate trigger conditions.

Past Grants

The District has also applied for and received multiple grants related to hazard mitigation. This includes:

- 2019/20 DWR Flood Maintenance Assistance Program (FMAP) grant funding
- YUBA IRWM Project Short form which was required to include with a YWA grant application to replace a storm drainpipe through a levee
- Yuba Sutter Regional Flood Fight Coalition Flood Safe Grant Application from 2013

Levee Maintenance

Routine levee maintenance functions center on vegetation control, erosion control, slope maintenance, patrol road maintenance, and rodent control. Vegetation control requires the removal of excess vegetation by either burning or mowing, and also ensuring that adequate vegetation cover exists for erosion control. As areas change from agriculture to urban development, vegetation control by burning is less acceptable and mowing the levees becomes the preferred practice. This requires additional and specialized equipment and more personnel, which increases maintenance costs. Slope maintenance involves checking for slumps and in keeping the slopes flat and even, which makes them more stable and easier to mow. Tracking and dragging levee slopes are methods to accomplish this. Tracking involves using a dozer blade to smooth small bumps and running the dozer up and down the slopes to even out others. Dragging involves a tractor or dozer dragging a large metal beam along the slope to even out bumps. Patrol roads must be kept in good shape with biannual grading and compaction. Patrol roads are important to ensure wet weather passage on top of the levee for levee patrol and flood fighting during flood events. Aggregate base material will have to be added from time to time. Ground burrowing rodents can do significant damage to a levee if not controlled. Their burrows can serve as paths for levee seepage which can ultimately result in failure. Rodent infestations can only be controlled; they cannot be wiped completely out. For means of control for beavers, the District utilizes the County trapper and authorized volunteer hunters For squirrel burrows, smoke cartridges are activated, bait stations are set up, or if a large cluster of burrows are present, grout is injected in each hole until the voids are filled. Gopher bait is also applied where necessary. Levees must be inspected

and surveyed for any settling, slope slumping, or erosion problems. Any identified levee section problems will have to be corrected. (RD784's rodent control program is satisfactory with DWR and the USACE).

F.7 Mitigation Strategy

F.7.1. Mitigation Goals and Objectives

The RD 784 adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

F.7.2. Mitigation Actions

The planning team for the RD 784 identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Dam Failure
- Drought & Water Shortage
- Earthquake
- Floods: 1%/0.2% annual chance
- Floods: Localized Stormwater
- Levee Failure
- Pandemic
- Severe Weather: Heavy Rains and Storms
- Severe Weather: Wind and Tornado

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement.

Multi-Hazard Actions

Action 1. Dam Failure Mitigation

Hazards Addressed: Dam Failure, Earthquake, Flood: 1% and 0.2% Annual Chance, Localized Flood, Levee Failure, Severe Weather: Heavy Rains and Storms.

Goals Addressed: 1, 2, 3, 4, 5, 6

Issue/Background: Several Levee and Reclamation Districts downstream of Lake Oroville were affected by the 2017 spillway incident. This brought to light the reality that a potential dam or levee failure is a very real and possible hazard that could occur at any time. All RD784 employees were called into work after regular work hours and began to prepare for possible levee overtopping. The dam is at risk from heavy rains and storms, upstream flooding, as well as earthquakes.

Project Description:

- Project A: Develop 500-Year Flood Protection for RD784.
- Project B: Hire an outside consultant to create a Dam/Levee Failure Emergency Action Plan that specifically focuses on the potential impacts of dam failures or levee breaches. The plan would include procedures such as relocating critical equipment to higher ground, procedures for dealing with possible flood inundation, overtopping levees, and keeping employees safe during the emergency.

Other Alternatives: Amend existing Emergency Action Plan, Hazard Communication Plan, and Emergency Operations Plan.

Existing Planning Mechanism(s) through which Action Will Be Implemented: RD784 Emergency Action Plan, Hazard Communication Plan, and Emergency Operations Plan

Responsible Office/Partners: Reclamation District 784

Cost Estimate:

- Project A – Construct 500-Year Flood Protection for RD784: $30 Million - $80 Million
- Project B: - Develop a Dam/Levee Failure Emergency Action Plan: $20,000

Benefits (Losses Avoided): This project will minimize the vulnerability of RD784 personnel in the event of a catastrophic situation such as a dam failure.

Potential Funding: FEMA Grant, DWR Grant, or other grant from local sources.

Timeline: Within 2 – 5 Yrs.

Project Priority (H, M, L): Low

Action 2. Drought & Water Shortage Mitigation

Hazards Addressed: Drought and Water Shortage, Wildfire, Climate Change, Severe Weather: High Winds and Tornadoes

Goals Addressed: 1, 2, 3, 4, 5, 6

Issue/Background: RD784's primary function is to maintain levees and ensuring storm water is conveyed back into the rivers through pump stations. During a drought/water shortage year, fire season arrives early. RD784 is responsible for maintaining several miles of territory that cover an expansive area of vegetation

which must be abated to reduce the fire hazard. Some sections of levee are burned annually during the summer months. 1) Levee Maintenance: During a drought year, it is not uncommon for burn requests through the local Air Quality District to be denied due to poor air quality, thus creating a hardship to complete regular burning maintenance. 2) Drainage Lateral Maintenance: Several RD784 drainage laterals and service roads are located adjacent to residential and/or commercial properties and require vegetation abatement at the beginning of fire season which typically begins around June during a normal water year. However, when an early fire season arrives, it becomes difficult to address all fire hazard areas at once while still completing other regular maintenance responsibilities.

Project Description:

- Purchase a slope mower and transport equipment to enable the District to mow levees when burning is not allowed.
- Hire a vegetation abatement contractor to handle extra maintenance along drainage laterals during a drought year.

Other Alternatives: Address the hazards with in-house funding and staff. However, early season vegetation abatement activities will inhibit work crews from completing other important tasks.

Existing Planning Mechanism(s) through which Action Will Be Implemented: RD784 in-house work crews.

Responsible Office/Partners: Reclamation District 784

Cost Estimate: $400,000 ($275,000 for slope mower and transport equipment and $125,000 for vegetation abatement contractor).

Benefits (Losses Avoided): This project will minimize the vulnerability of fire danger.

Potential Funding: FEMA Grant, DWR Grant, or other grant from local sources.

Timeline: Within 1 – 5 Yrs.

Project Priority (H, M, L): Medium

Action 3. Earthquake Mitigation

Hazards Addressed: Earthquake

Goals Addressed: 1, 2, 3, 4, 5, 6

Issue/Background: Most local earthquakes are minor. However, Northern California has a history of earthquakes that last much longer and have caused significant damage. A significant earthquake could cause damages to Levee and Pump Station infrastructure

Project Description: Hire an outside consultant to create an Earthquake Emergency Action and Recovery Plan. In the event of a major earthquake, The District would need to immediately assess the damages along

levees, drainage laterals, pump stations, and the office/shop. The District's Engineer or staff are capable of assessing all areas for damages after a major earthquake, however, a detailed inspection and recovery plan would be more beneficial.

Conduct seismic evaluation of all critical RD784 infrastructure including pump stations.

Other Alternatives: RD784 has an Emergency Action Plan that has a small section on Earthquake Emergency Procedures that only focuses on the immediate safety of personnel and not specifically how and where to inspect District Infrastructure after a major earthquake.

Existing Planning Mechanism(s) through which Action Will Be Implemented: RD784 Emergency Action Plan.

Responsible Office/Partners: Reclamation District 784

Cost Estimate: $40,000

Benefits (Losses Avoided): This project will better prepare staff and Engineers before and after a major earthquake.

Potential Funding: FEMA Grant, DWR Grant, or other grant from local sources.

Timeline: Within 2 – 5 Yrs.

Project Priority (H, M, L): Medium

Action 4. Floods: Localized Stormwater Mitigation and Drainage

Hazards Addressed: Floods: Localized Stormwater

Goals Addressed: 1, 2, 3, 4, 5, 6

Issue/Background: Heavy rains bring a high volume of stormwater to District drainage laterals. A good example would be the during the winter and spring months of February - April of 2017 when multiple storms resulted in mass amounts of storm water in drainage laterals and detention basins that needed to be evacuated as soon as practically possible in order to avoid localized flooding on lands beyond the drainage system.

Project Description: Design and construct improved culvert and/or box culverts and piping systems in key areas where high volumes of water are known to back up. Key areas where improvements are needed are as follows:

- Replace the existing concrete lined drainage lateral behind the old Peach Tree Mall with an enclosed storm drain piping system in order to eliminate tree branches and brush from falling into the lateral during a storm which end up plugging up the trash rack.
- Replace the existing 60" culvert at Linear Pond 16 with larger box or round style culverts with center access for removing obstructions caused by beaver activity.

- Replace the existing box culvert / flap gate system at the south end of Linear Pond 20 with a larger more serviceable culvert conveyance system to mitigate the problem of obstructions cause by beaver activity.
- Upgrade culverts along Lateral 14 at 3663, 3757, & 3804 Feather River Blvd., and culvert crossings at Ella Avenue and Murphy Rd.

Other Alternatives: Continue to maintain these areas the best the District can.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Work crews regularly check the critical sites where storm water backups are likely to occur using hook rakes and other equipment to keep laterals and trash racks clear of debris and obstructions. Storm maintenance check off lists are also completed during storms to ensure all critical areas of the District are checked.

Responsible Office/Partners: Reclamation District 784

Cost Estimate:

- Lateral 14 culvert upgrade at Murphy Rd. Crossing $275,000
- Lateral 14 culvert upgrade at 3663 F.R. Blvd. (P.S.I.) $200,000
- Lateral 14 culvert upgrade at 3757 F.R. Blvd. (Y.R.M) $200,000
- Lateral 14 culvert upgrade at 3804 F.R. Blvd (PMI): $200,000
- Lateral 14 culvert upgrade at Ella Ave: $400,000
- Replace open concrete ditch with pipe: $1,500,000
- Replace 60" culvert at Linear Pond 16: $500,000
- Replace existing box culvert/flap gate at the south end of Linear Pond 20: $500,000
- Total: 3,775,000

Benefits (Losses Avoided): These projects will reduce the need for such frequent storm maintenance actions which are necessary no matter what time of day/night it may be.

Potential Funding: FEMA Grant, DWR Grant, or other grant from local sources.

Timeline: Within 5+ Yrs.

Project Priority (H, M, L): High

Action 5. Flood Mitigation

Hazards Addressed: Floods: 1%/0.2% annual chance

Goals Addressed: 1, 2, 3, 4, 5, 6

Issue/Background: Reclamation District 784 was greatly affected by catastrophic flooding in 1986 and 1997 due to levee breaches resulting from highwater events which caused significant damages to many homes and businesses. Although significant levee improvements have been made since the 1997 event, there are always additional improvements that would benefit the system.

Project Description: Purchase Heavy Equipment such as a Loader and Excavator for purposes of moving and/or placing emergency materials where needed during a flood fight. The District owns emergency material stockpiles including sand, aggregate base, and rock rip rap.

Other Alternatives: Outsource equipment supply and operation to a local contractor and rental companies (if available)

Existing Planning Mechanism(s) through which Action Will Be Implemented: RD784 owns 2 backhoes and one small tractor loader that can be used to move or place material, however, larger equipment such as medium or large size Loaders and Excavators are more efficient during emergencies.

Responsible Office/Partners: Reclamation District 784

Cost Estimate: $600,000

Benefits (Losses Avoided): This project will reduce response time to address heavy seepage or boil issues in the event emergency repairs or construction of any type is needed.

Potential Funding: FEMA Grant, DWR Grant, or other grant from local sources.

Timeline: Within 2 – 5 Yrs.

Project Priority (H, M, L): Medium

Action 6. Pandemic Mitigation

Hazards Addressed: Pandemic, safety of employees and the general public

Goals Addressed: 1, 2, 3, 4, 5, 6

Issue/Background: In March 2020, the Yuba-Sutter region became affected by the COVID-19 pandemic. The pandemic triggered several new compliance rules and regulations which had to be immediately learned by management and administered to RD784 staff. The pandemic also unleashed a lot of unknowns when it came to knowing who and when an employee may become infected with COVID-19 and if so, how would the District continue to function in the event of an outbreak?

Project Description:

- Purchase PPE, supplies, and materials geared specifically toward safe social distancing practices.
- Hire a consultant to keep the RD784 COVID-19 prevention plan updated regularly.
- Purchase another pickup truck (To ensure no one has to share a vehicle)
- Purchase masks, sneeze guard barriers, hand sanitizers, gloves, and face shields.
- Hire a consultant to keep up with and administer updates to RD784 staff.

Other Alternatives: Amend existing Emergency Action Plan, Hazard Communication Plan, and Emergency Operations Plan.

Existing Planning Mechanism(s) through which Action Will Be Implemented: RD784 COVID-19 Prevention Plan

Responsible Office/Partners: Reclamation District 784

Cost Estimate: $50,000

Benefits (Losses Avoided): This project will reduce the chances of employees contracting COVID-19 which in turn, will allow RD784 to continue to operate to protect the general public from flooding.

Potential Funding: FEMA Grant, DWR Grant, or other grant from local sources.

Timeline: Within 2 – 5 Yrs.

Project Priority (H, M, L): Low

Action 7. Severe Weather Mitigation

Hazards Addressed: Heavy Rains and Storms, Wind, and Tornados

Goals Addressed: 1, 2, 3, 4, 5, 6

Issue/Background: District operations can be greatly impacted by severe weather. Several issues can arise including loss of power at stormwater pump stations which will result in lack of power and lighting at some sites.

Project Description: Install permanent emergency backup generators at Pump Stations 5, 7, 9, and 10. Backup diesel generators will enable critical stormwater pumping to continue during storms. Purchase (4) portable fuel powered light towers. These would enable crews to make critical repairs during nighttime hours when necessary.

Other Alternatives: Rent portable backup generators and lighting towers (if available)

Existing Planning Mechanism(s) through which Action Will Be Implemented: Continue to connect manual transfer switches at Pump Stations 5, 7, and 9 to rental backup generators when needed. Rent lighting towers from local equipment rental yard.

Responsible Office/Partners: Reclamation District 784

Cost Estimate: Permanent backup diesel generators at PS 5, 7, 9, and 10: $2,500,000. (4) portable fuel powered light towers: $55,000

Benefits (Losses Avoided): This project will minimize the vulnerability of RD784 personnel in the event of a catastrophic situation such as a dam failure.

Potential Funding: FEMA Grant, DWR Grant, or other grant from local sources.

Timeline: Within 2 – 5 Yrs.

Project Priority (H, M, L): Medium