4.9 HYDROLOGY AND WATER QUALITY

This chapter discusses hydrology and water quality in Vacaville and evaluates the potential impacts resulting from the spatial location of development that would be allowed by the proposed General Plan and Energy and Conservation Action Strategy (ECAS). The following evaluation assesses water quality, groundwater, drainage, stormwater, and flood hazards; while water-related seismic hazards are discussed in Chapter 4.6, Geology, Soils, and Mineral Resources; and utilities provision relating to water supply, wastewater, and stormwater is discussed in Chapter 4.15, Utilities and Service Systems. As noted in Chapter 3, Project Description, impacts are determined by comparing the proposed General Plan and ECAS to existing conditions, rather than to the existing General Plan. The following evaluation is based on a spatial analysis and examines effects on existing water quality, runoff, and stormwater drainage, conflicts with water and stormwater quality standards, regulations, or plans, and the location of housing and people in relation to flooding and other water safety hazards (e.g. seiche, tsunami, etc.).

A. Regulatory Framework

This section summarizes existing federal, State, and local laws, policies, and regulations that apply to hydrology and water quality in and around Vacaville.

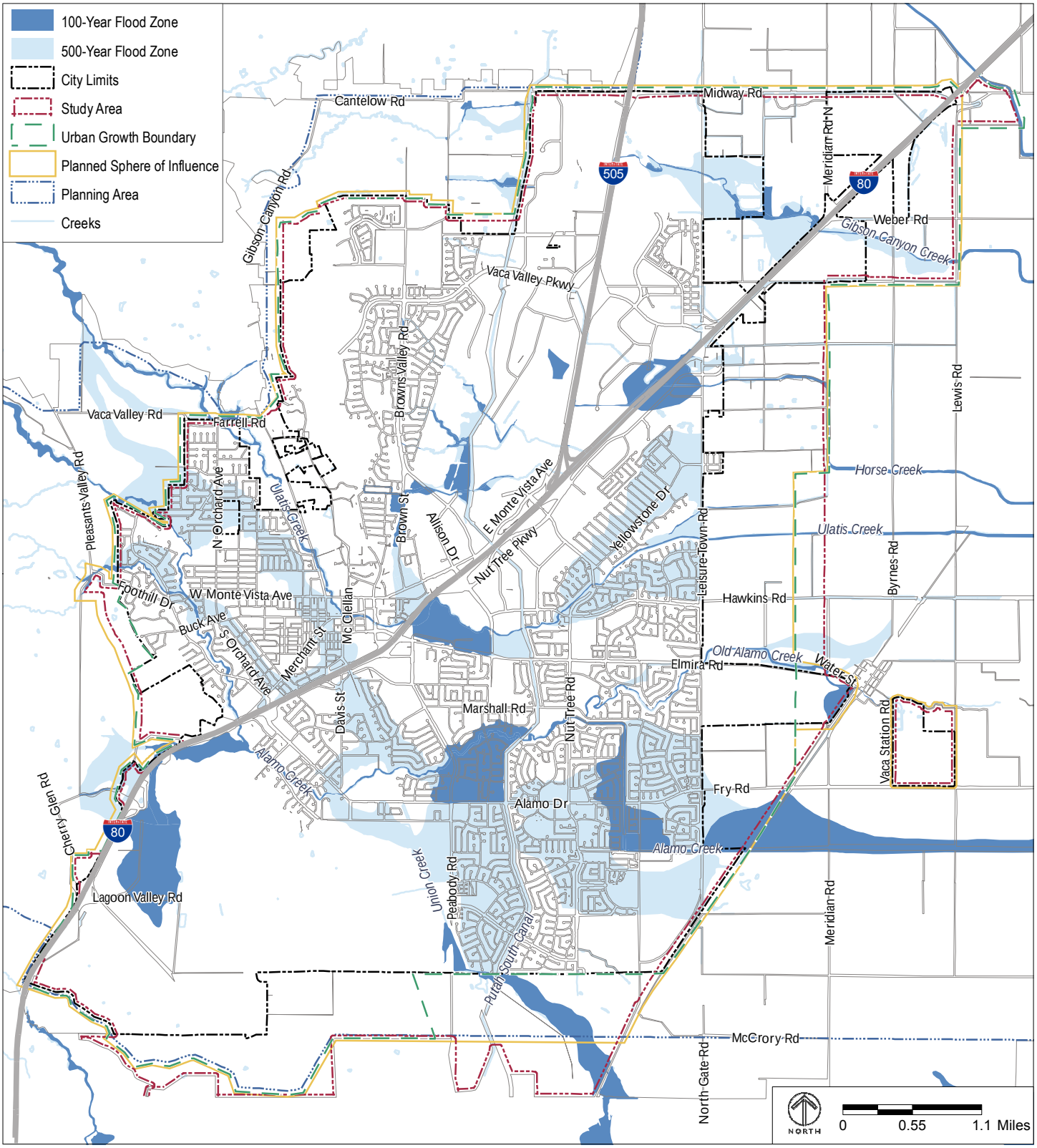
1. Federal Regulations and Programs

This section summarizes federal regulations and programs that apply to hydrology and water quality in Vacaville.

a. Floodplain Regulations

The Federal Emergency Management Agency (FEMA) is the federal agency responsible for disaster mitigation, preparedness, response, and recovery.[1] FEMA issues Flood Insurance Rate Maps (FIRMs) that identify which land areas are subject to flooding. These maps provide flood information and identify flood hazard zones in the community. The design standard for flood protection is established by FEMA. FEMA's minimum level of flood protection for new development is the 100-year flood event, which is described as a flood that has a 1-in-100 chance of occurring in any given year. As shown in Figure 4.9-1, FEMA Flood Insurance Studies have identified several areas of potential flooding within the city that could occur during an estimated 100-year storm event.

[1] FEMA, http://www.fema.gov/about-fema, accessed on August 31, 2012.



Source: FEMA, 2009.

FIGURE 4.9-1
FEMA FLOOD ZONES

b. Clean Water Act

The US Environmental Protection Agency (EPA) is the lead federal agency responsible for water quality management. The Clean Water Act (CWA) of 1972 is the primary federal law that governs and authorizes water quality control activities by the EPA as well as the states. Various elements of the CWA address water quality; they are discussed below.

Under federal law, the EPA has published water quality regulations under Volume 40 of the Code of Federal Regulations (40 CFR). Section 303 of the CWA requires states to adopt water quality standards for all surface waters of the United States. As defined by the CWA, water quality standards consist of two elements: (1) designated beneficial uses of the water body in question and (2) criteria that protect the designated uses. Section 304(a) requires the EPA to publish advisory water quality criteria that accurately reflect the latest scientific knowledge on the kind and extent of all effects on health and welfare that may be expected from the presence of pollutants in water. Where multiple uses exist, water quality standards must protect the most sensitive use. In California, the EPA has designated the State Water Resources Control Board (SWRCB) and its Regional Water Quality Control Boards (RWQCBs) with authority to identify beneficial uses and adopt applicable water quality objectives.

Section 303(d) of the CWA requires states to develop a list of water bodies that do not meet water quality standards, to establish priority rankings for waters on the list, and to develop action plans, called Total Maximum Daily Loads (TMDL), to improve water quality. The list of impaired water bodies is typically revised every two years.

c. National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) permit program was established by the CWA to regulate municipal and industrial discharges to surface waters of the United States from their storm sewer systems. NPDES permit regulations have been established for broad categories of discharges, including point-source municipal waste discharges and nonpoint-source stormwater runoff. The SWRCB is responsible for issuing NPDES permits to cities and counties through the RWQCB. Large communities, which have the potential to cause large impacts to receiving waters, are issued a permit with requirements specific to the community. For smaller communities, the California SWRCB elected to adopt a statewide general permit (Water Quality Order No. 2003-0005-DWQ) for Small Municipal Separate Storm Sewer System (MS4) operators to efficiently regulate stormwater discharges from small MS4s under a single permit. Permittees must develop and implement a Stormwater Management Plan (SWMP) with the goal of reducing the discharge of pollutants to the maximum extent practicable. The City of Vacaville is considered a permittee under the statewide general permit.

2. State Regulations and Agencies

This section summarizes State regulations and agencies that apply to hydrology and water quality in Vacaville.

a. Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) of 1969 is California's statutory authority for the protection of water quality. Under the Act, the State must adopt water quality policies, plans, and objectives that protect the State's waters for the use and enjoyment of the people. The Act sets forth the obligations of the SWRCB and RWQCBs to adopt and periodically update water quality control plans (Basin Plans). Basin Plans are the regional water quality control plans required by both the CWA and Porter-Cologne Act in which beneficial uses, water quality objectives, and implementation programs are established for each of the nine regions in California. The Act also requires waste dischargers to notify the RWQCBs of their activities through the filing of Reports of Waste Discharge (RWD) and authorizes the SWRCB and RWQCBs to issue and enforce waste discharge requirements (WDRs), NPDES permits, Section 401 water quality certifications, or other approvals.

b. State Regulatory Agencies

In California, the SWRCB has broad authority over water quality control issues for the State. The SWRCB is responsible for developing statewide water quality policy and exercises the powers delegated to the State by the federal government under the CWA. Other State agencies with jurisdiction over water quality regulation in California include the California Department of Health Services (DHS) for drinking water regulations, the California Department of Pesticide Regulation, the California Department of Fish and Game (CDFG), and the Office of Environmental Health and Hazard Assessment.

Regional authority for planning, permitting, and enforcement is delegated to the nine RWQCBs. The regional boards are required to formulate and adopt water quality control plans for all areas in the region and establish water quality objectives in the plans. Vacaville is in the jurisdiction of the Central Valley RWQCB.

The Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins is the Central Valley RWQCB's master water quality control planning document. It designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater. It also includes programs of implementation to achieve water quality objectives. The Basin Plan establishes water quality objectives for total dissolved solids (TDS), mineral constituents, and turbidity on a watershed-by-watershed basis within the region, while objectives for total and fecal coliform bacteria, nutrients (total nitrogen and total phosphorus), pH, dissolved oxygen, and un-ionized ammonia are set on a region-wide basis.

Additionally, water quality objectives for toxic organic and toxic inorganic constituents are established by the corresponding State and federal drinking water standards for waters designated as municipal supply. The RWQCB also implements the federal California Toxics Rule Water Quality Standards for Toxic Pollutants (CTR) established by the US EPA in Title 40, Section 141.38 of the Code of Federal Regulations. The California Toxics Rule establishes numeric criteria for cyanide, metals, and toxic organic constituents.

c. Regional Water Quality Control Board (Central Valley Region)

i. NPDES Construction General Permit

Construction activities that disturb 1 acre or more of land, and construction on smaller sites that are part of a larger project, must comply with a Construction General Permit[2] that regulates stormwater leaving construction sites. Site owners must notify the State, prepare and implement a Stormwater Pollution Prevention Plan (SWPPP), and monitor the effectiveness of the plan. The plan does not have to be submitted to the RWQCB, but must be on-site and available to inspectors.[3] A SWPPP must include "Best Management Practices" (BMPs) designed to reduce potential impacts to surface water quality through the construction and life of the project.

On September 2, 2009, the SWRCB adopted a new NPDES general permit pertaining to construction (Order No. 2009-0009 DWQ).[4] The General Construction Permit for Discharges of Stormwater Associated with Construction and Land Disturbance Activities expands the regulatory requirements pertaining to the treatment and control of stormwater effluent resulting from demolition, construction, and development activities.

ii. NPDES Post-Construction Stormwater Quality

Discharges of urban runoff in the City of Vacaville are regulated under the NPDES Phase II General Permit (Water Quality Order No. 2003-0005-DWQ). This permit requires that permittees implement BMPs that reduce pollutants in stormwater runoff to the maximum extent practicable to protect water quality. See additional information about stormwater runoff requirements in Section A.3.c, Vacaville Stormwater Management Plan. At the time of publication of this document, the permit had expired and a new permit is tentatively scheduled for approval.

d. California Fish and Game Code

The CDFG protects streams, water bodies, and riparian corridors through the streambed alteration agreement process under Section 1601 to 1606 of the California Fish and Game Code. The Fish and Game Code stipulates that it is "unlawful to substantially divert or obstruct the natural

[2] See: http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

[3] There are also post-construction requirements of the Construction General Permit that apply only to projects located in communities that are not covered under an NPDES MS4 permit. As Vacaville has an MS4 permit, these do not apply.

[4] This order was amended by 2010-0014-DWQ.

flow or substantially change the bed, channel or bank of any river, stream or lake" without notifying the Department, incorporating necessary mitigation and obtaining a streambed alteration agreement. CDFG's jurisdiction extends to the top of banks and often includes the outer edge of riparian vegetation canopy cover.

e. Assembly Bill 162 (Wolk)

Assembly Bill (AB) 162 was approved by the Governor in 2007, and amended Sections 65302, 65303.4, 65352, 65584.04, and 65584.06, and added Sections 65300.2 and 65302.7, to the Government Code. The new and amended sections require cities and counties to address flood management in the Land Use, Conservation, Safety, and Housing Elements of their General Plans. This ensures that flood management is addressed in General Plans in the following ways:

- Requires that areas subject to flooding, as identified by federal and State maps of floodplains, are identified in the Land Use Element for annual review.
- Requires that rivers, creeks, streams, flood corridors, riparian habitat, and land that may accommodate floodwater for specified purposes are identified in the Conservation Element, upon the next Housing Element review on or after January 1, 2009.
- Requires that flood hazard zones are identified and policies to avoid or minimize the unreasonable risks of flooding are established in the Safety Element, by the next Housing Element review on or after January 1, 2009.
- Permits areas where the flood management infrastructure is inadequate and housing development is impractical to be excluded from the determination of land suitable for urban development in the Housing Element analysis.

f. Senate Bill 5 (Machado)

The Central Valley Protection Act of 2008 was enacted by Senate Bill (SB) 5.[5] The requirements of SB 5 are as follows:

- By July 1, 2008, the State must develop preliminary 100-year and 200-year flood maps for areas in the Central Valley that are protected by project levees. The State completed this mapping effort in 2008, and it does not affect the EIR Study Area because it is not protected by project levees.[6]

[5] California Department of Water Resources, (undated), *2007 Flood Legislation Summary*, page 3.

[6] Best Available Maps that display floodplain information for the Sacramento-San Joaquin watershed are provided by the California Department of Water Resources on the following website: http://gis.bam.water.ca.gov/bam/. Maps showing Levee Flood Protection Zones within the Sacramento-San Joaquin watershed are provided by the California Department of Water Resources on the following website: http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/levee_protection_zones/LFPZ_maps.cfm.

- The Central Valley Flood Protection Board (CVFPB) (formerly the Reclamation Board) adopted the Central Valley Flood Protection Plan (CVFPP) in June 2012. The CVFPP establishes a system-wide approach to improving flood management, including recommendations for structural and non-structural means for improving performance and eliminating the deficiencies of flood management facilities.
- Within two years after the adoption of the CVFPP,[7] communities within the Sacramento-San Joaquin Valley, including Vacaville, must amend their General Plans to include data and analysis, goals, and policies for the protection of lives and property from flooding, and related feasible implementation measures that are consistent with the CVFPP. Within one year of General Plan adoption, zoning ordinance amendments must be enacted to maintain consistency with the General Plan.
- Counties must collaborate with cities within their jurisdiction to develop flood emergency plans.

Note that the implications for the City of Vacaville from the two SB 5 requirements listed below are currently uncertain. The State has not clarified whether these requirements apply to communities like Vacaville that are not protected by the State Project Levees and are not within the Sacramento-San Joaquin Watershed.

- Cities and counties must revise the Safety Element of their General Plan in order to show 200-year flood maps and maps of levee protection zones.
- By 2015, for areas with a population of 10,000 people or greater, local governments cannot approve new developments unless the land under review has 200-year flood protection, the city has conditioned the project to provide an adequate level of protection, or efforts are in place to provide that level of protection.[8]

g. Senate Bill 1278 (Wolk)

SB 1278, approved in 2012, amends State flood protection laws, including the Central Valley Protection Act of 2008. Specifically:

- Communities within the Sacramento-San Joaquin Valley must amend their General Plans to be consistent with the CVFPP within two years of July 2, 2013, rather than within two years of adoption of the CVFPP as had been previously required.
- Communities within the Sacramento-San Joaquin Valley can make a finding that, based on substantial evidence in the record, a property in an undetermined risk area (i.e. an area with a population of 10,000 people or greater within a moderate flood hazard zone that does not

[7] As indicated below, SB 1278 amended this timeline to instead be within two years of July 2, 2013.

[8] As indicated below, SB 1278 amended this requirement to allow an additional finding.

have an urban level of protection) has met the urban level of flood protection (i.e. 200-year flood protection for leveed systems) in order to approve development.

- By July 2, 2013, the State must release floodplain maps and data pertaining to facilities of the State Plan of Flood Control and the water surface elevation of flooding in urban areas in the event of their failure during a 200-year flooding event.

h. Senate Bill 17 (Florez)

Senate Bill (SB) 17, approved in 2007, makes a number of changes to the Reclamation Board. These changes include:

- Renaming it the Central Valley Flood Protection Board;
- Increasing the number of Board members;
- Changing Board-appointment authority from solely at the discretion of the Governor to sharing appointment authority between the Governor and the Legislature;
- Requiring adoption of a strategic flood protection plan by 2010;
- Requiring establishment and regular update of levee construction, operation, and maintenance standards;
- Requiring review of local and regional land use plans to ensure compliance with flood protection and public safety standards;
- Prohibiting allocation of funds to a local public agency for a flood control project unless a determination is made that the project ensures adequate flood protection consistent with the law; and
- Establishing procedures for the decertification of locally maintained flood control facilities as part of the State Plan of Flood Control.[9]

i. Assembly Bill 70 (Jones)

Assembly Bill (AB) 70 was approved by the Governor in 2007 and added Section 8307 to the Water Code. The section was developed to distribute responsibility for flood control damage among State and local entities and it requires local governments to contribute their fair share to a flood's cost when they make unreasonable development decisions.

[9] State of California Legislative Counsel, Senate Bill No. 17, http://www.leginfo.ca.gov/pub/07-08/bill/sen/sb_0001-0050/sb_17_bill_20071010_chaptered.pdf, accessed on August 31, 2012.

3. Local Regulations and Plans

This section summarizes local regulations and plans that apply to hydrology and water quality in Vacaville.

a. Floodplain Management Ordinance

The City has adopted a Floodplain Management Ordinance (Section 14.18 of the Land Use and Development Code) that describes methods for reducing flood losses. The Floodplain Management Ordinance contains a number of provisions for flood hazard reduction, including:

- Residential construction, either new or a substantial improvement, must have the lowest floor, including the basement, elevated to, or above, the base flood elevation, the computed elevation to which floodwater is anticipated to rise during a 100-year storm event. A 100–year storm is defined as storm that has a 1 percent chance of occurring in any given year. Upon the completion of the structure, the elevation of the lowest floor must be certified by a registered professional engineer or surveyor, and verified by the community building inspector to be properly elevated.
- Nonresidential construction, either new or a substantial improvement, must either be elevated to conform to the requirements described above for residential construction, or be flood-proofed below the base flood elevation. If the structure is flood-proofed, it must be watertight with the wall substantially impermeable to the passage of water, have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy, and be certified by a registered engineer or architect.
- All preliminary subdivision proposals must identify the special flood hazard area and the elevation of the base flood.
- All subdivision plans must provide the elevation of the proposed structure(s) and pad(s). If the site is filled above the base flood elevation, the lowest floor and pad elevations must be certified by a registered professional engineer or surveyor.
- All subdivision proposals must be consistent with the need to minimize flood damage.
- All subdivision proposals must have public utilities and facilities located and constructed to minimize flood damage.
- All subdivisions must provide adequate drainage to reduce exposure to flood hazards.
- Encroachments within designated floodways are prohibited, including fill, new construction, substantial improvement, and other new development, unless certification by a registered professional engineer is provided demonstrating that encroachments do not result in any increase in the base flood elevation during the occurrence of the base flood discharge.

b. Storm Drainage Master Plan

The City completed a Draft Storm Drainage Master Plan (SDMP) in 1996, and updated it in 2001. The SDMP evaluates the existing storm drain systems to identify existing deficiencies and required improvements. The focus of the SDMP is to identify improvements necessary to provide 100-year level flood protection to areas in Vacaville proposed for new development while maintaining, as a minimum, the existing level of protection in developed areas within the city that periodically flood. To this end, the SDMP outlined a staged capital improvements program to resolve existing storm drain deficiencies, and developed appropriate development impact fees for storm drainage facilities to ensure future development does not impact storm drainage for existing development within the city. The SDMP also provided a detailed inventory of existing storm drainage facilities.

c. Vacaville Stormwater Management Plan

The City has developed a Stormwater Management Plan that describes activities being performed and activities to be performed by the City to meet the requirements of the NPDES permit. Also, Section DS 4-13 of the City's Storm Drain Design Standards provides requirements for water quality control. This section requires that storm drain system improvements be designed to prevent any net detrimental change in runoff quality resulting from new development and requires that BMPs be implemented with development projects.

d. Vacaville Standard Specifications and Standard Drawings

City of Vacaville *Standard Specifications and Standard Drawings* require that detention basins be designed to the following criteria:[10]

- New development shall mitigate the increase of the 10- and 100-year peak runoff from a project site over the predevelopment conditions (due to higher peak flows from the site, filling or building in overflow area, or altered flow paths).
- In the Alamo Creek Watershed upstream of Peabody Road, which includes Alamo Creek, Encinosa Creek, and Laguna Creek, the 10- and 100-year post-development peak flows shall be reduced to 90 percent of pre-development levels. Additionally, the five-year storm shall be evaluated in the Alamo Creek Watershed upstream of Peabody Road to ensure that drainage facilities do not increase the peak 5-year flows downstream in the open channels or to receiving waters.
- Detention facilities must be designed for the 100-year, 24-hour storm event.

[10] City of Vacaville, 2006, *City of Vacaville Standard Specifications and Standard Drawings.*

e. Vacaville Municipal Code

The Vacaville Municipal Code has several sections relating to hydrology and water quality, including Sections 13.12 (Water), 13.14 (Control of Backflow and Cross-Connections), 13.20 (Water Conservation), and 14.26 (Urban Stormwater Quality Management and Discharge Control). These regulations provide guidelines for water service provision, describe standards for connection sizes, protect and maintain the potable water system, conserve water use, reduce water consumption, and protect water quality. Chapter 14.19 of the Land Use and Development Code is the Vacaville Grading Ordinance, which regulates grading and earth moving in the city.

B. Existing Conditions

This section describes the existing physical environment, creek systems, flooding, flood prevention and storm drainage infrastructure, and water quality in Vacaville.

1. Physical Environment

This section describes the physical environment that affects drainage systems in Vacaville, including the topography, soils, and climate conditions.

a. Topography

Vacaville is located within four watersheds (Gibson Canyon Creek, Horse Creek, Ulatis Creek, and Alamo Creek), all of which are part of the larger, 150-square mile Ulatis Creek watershed. The topography across most of the city is relatively flat. The western portion of the city is in the rugged, steep Vaca Mountain Range, which defines the western boundary of the Ulatis Creek watershed. The mountain range is dominated by Mount Vaca, with a peak elevation of 2,819 feet. Alamo, Ulatis, Encinosa, and Laguna Creeks, which are discussed further in Section B.2, Creek Systems, all have their headwaters in the Vaca Mountains.

The northwestern portion of the city includes a series of foothills commonly referred to as the English Hills. Horse Creek and Gibson Canyon Creek have their headwaters in the English Hills. The eastern and southeastern portions of the city consist of the flat to very flat slopes of the Sacramento Valley. The natural land slope is generally downward to the east-southeast, descending at a rate of 5 to 10 feet per mile.

b. Soils

The Natural Resources Conservation Service (NRCS), a US Department of Agriculture agency, is responsible for a variety of conservation to help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods

and other natural disasters.[11] Soil types and characteristics have been evaluated and mapped by NRCS and documented in the Soil Survey for Solano County.[12] Soils in and around the city range from shallow loams (i.e. soil that has relatively equal proportions of sand, silt, and clay) overlaying sandstone bedrock in the mountainous areas, to moderately-deep layers of sands, silts, and clays in the valley floor, as shown in Chapter 4.6, Geology and Soils, Figure 4.6-3. The majority of soils in the Vaca Mountains and English Hills consist of Maymen-Los Gatos loam, Millsholm loam, and Dibble-Los Osos loam. These soils range in permeability from moderate to high, with very high erosion potential. Permeability of the soils influences the rate at which rainfall seeps into the ground. When soil permeability is high, rainwater will seep into the ground more easily. When the permeability is low, rain will tend to accumulate on the ground surface or flow across the ground surface.

Soils in the Vaca Valley floor and into the Sacramento Valley consist of Brentwood clay loam, Altamont clay, Capay clay and silty clay loams, Corning gravely loam, San Ysidro sandy clay loam, and Yolo silt and silty clay loams, which have permeabilities in the moderate to low range.

c. Climate Conditions and Precipitation

Vacaville's climatic conditions are consistent with the temperate conditions that dominate the Sacramento Valley. The summers are hot and dry, and the winters cool and moist. Average monthly temperatures range from lows in the 40s and highs in the 50s during the winter months, to lows in the 60s and highs in the 100s during the summer months.

The predominant rainfall season is from November through April, with the heaviest storms occurring from December through February. Spatial rainfall distribution over the Vacaville area consists of higher intensities and volumes in the upper elevations of the western portion of the Ulatis Creek watershed and lower intensities and volumes to the east. Mean annual precipitation varies from 45 inches at the ridgeline of the Vaca Mountains to 22 inches in the flat southeastern portion of the watershed near Elmira.[13]

2. Creek Systems

Vacaville's major creeks are shown in Figure 4.9-2. In general, the creeks flow in an east-southeasterly direction and ultimately drain into the Sacramento River via Cache Slough. The southern portion of Vacaville drains either to the Noonan Drain, which discharges ultimately to Barker Slough, or to Union Creek, which discharges to Suisun Bay.

[11] United States Department of Agriculture NRCS Programs & Services, http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs, accessed on August 31, 2012.

[12] United States Department of Agriculture, 1977, *Soil Survey of Solano County, California.*

[13] West Yost Associates, 1999, *Hydrology Manual*, prepared for the Solano County Water Agency.

Existing Detention Basins

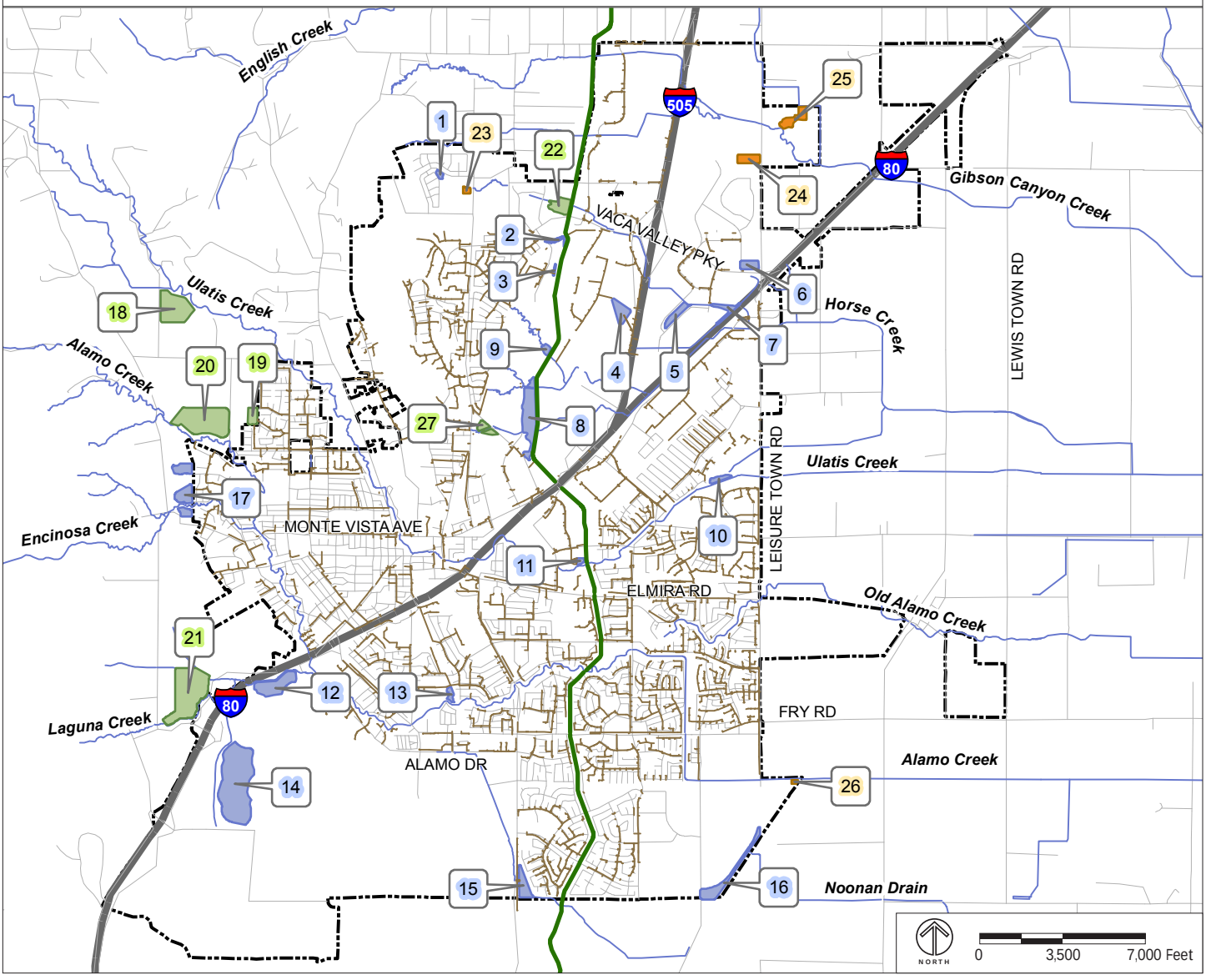
1. Temporary Cheyenne Basin
2. North Horse Basin #1
3. Middle Horse Basin #1
4. Middle Horse Basin #2
5. Vaca Valley Basin
6. North Village Basin #1
7. I-80 Basin
8. South Horse Basin #1
9. South Horse Basin #2
10. Stonegate Basin
11. Ulatis Basin #2
12. Lagunitas Basin
13. Alamo Basin #2
14. Lagoon Lake
15. Union Basin
16. Southtown Basin
17. Pleasants Valley Detention Basin

Proposed Detention Basins City Projects

18. Ulatis Basin
19. Ulatis/Florence Basin
20. Alamo Basin
21. Laguna Basin
22. North Horse Basin #2
27. Pine Tree Basin #1

Proposed Detention Basins Development Projects

23. Rancho Rogelio Project
24. North Village Basin #2
25. North Village Basin #3 (Gibson Canyon Creek Basin)
26. Alamo Basin #3



- Storm Drains
- Creeks
- Putah South Canal
- Existing Detention Storage
- Proposed City Detention Storage
- Proposed Development Detention Storage
- City Limits

Source: West Yost Associates, 2012.

FIGURE 4.9-2

EXISTING DRAINAGE FACILITIES

The major stream courses within the city include:

- ♦ Alamo Creek, including its tributaries Laguna Creek and Encinosa Creek
- ♦ Ulatis Creek
- ♦ Horse Creek, including its tributary Pine Tree Creek
- ♦ Gibson Canyon Creek

The major stream courses that flow through Vacaville are largely in their natural state and alignment, except at the eastern edge of the city where flood control channels have been constructed. The natural, unaltered portions of the creeks generally do not have adequate flow capacity to convey a 100-year storm event, which is a storm that has a 1 percent chance of occurring in any given year. Maintenance for the majority of the natural streams in the city is the responsibility of adjacent property owners.

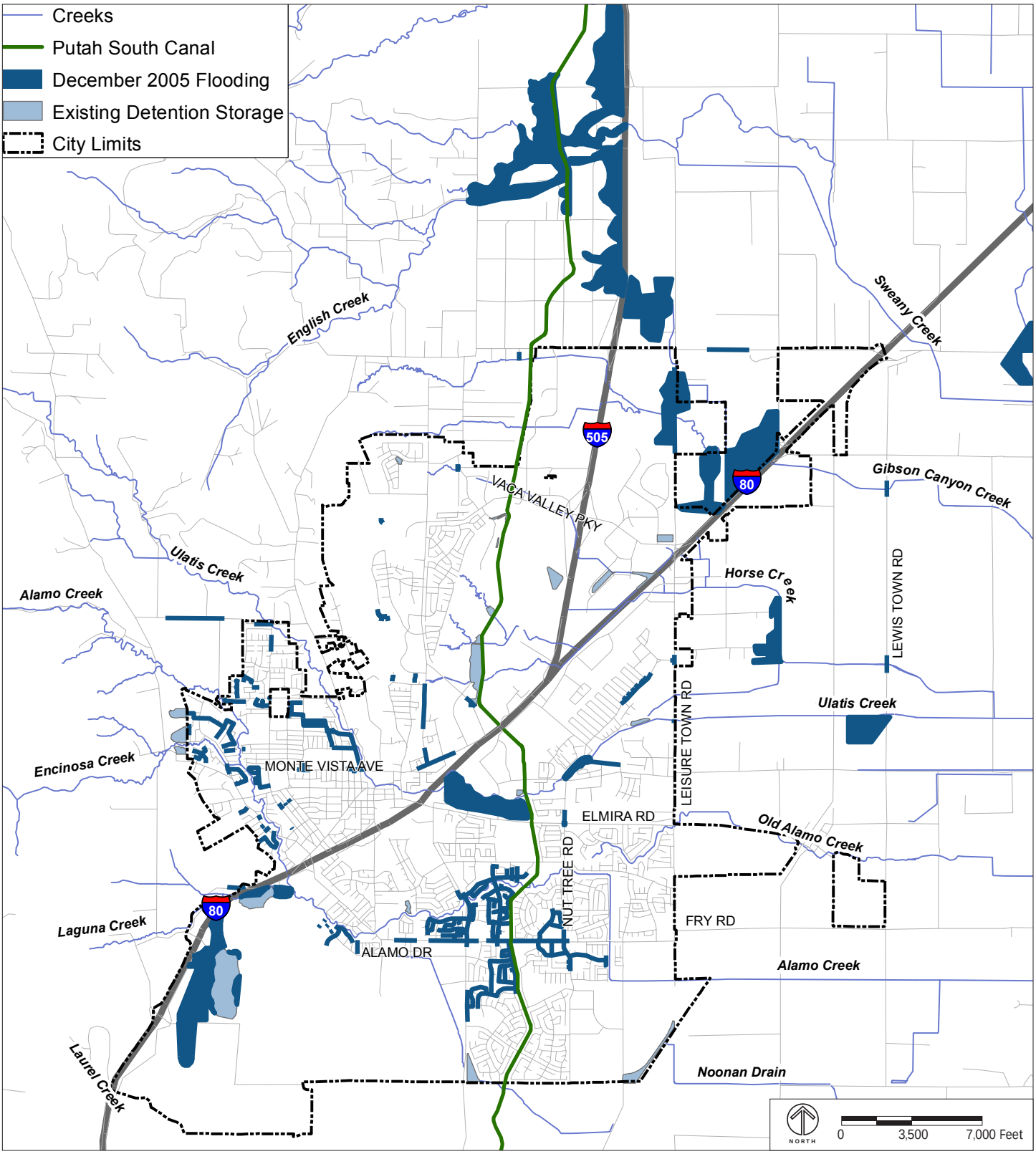
3. Flooding

Under existing conditions, considerable overbank flow has occurred during major storms (i.e. a 10-year event, which is a storm that has a 10 percent chance of occurring in any given year, or greater) in areas where channel and/or bridge capacities are exceeded. Overbank flow occurs when the creek water surface elevation exceeds the bank elevations, resulting in flow spilling out of the creek. Occasionally, the overbank flows have resulted in flooding residential properties, blocking roads, and disrupting traffic. Figure 4.9-3 shows areas that experienced flooding during a storm in December 2005 that caused significant property damage throughout the city.

4. Constructed Channels

In the 1960s, US Natural Resources Conservation Service (NRCS) modified natural channels in the Vacaville area to provide a 10-year level of protection and maintain a minimum freeboard[14] of 1.5 to 3.5 feet, except for a few reaches along Horse Creek and Ulatis Creek that were designed by NRCS for a 50-year level of protection. The channel modifications by NRCS consisted of realigning and widening Ulatis, Alamo, Horse, Gibson Canyon, Sweeney, and McCune Creeks. The channel modifications generally extended from the eastern city limits to Cache Slough. The Alamo Creek channel modification begins just downstream of Nut Tree Road. The Ulatis Creek channel modification begins just downstream of Ulatis Drive. The Horse Creek and Gibson Canyon Creek modifications begin at Interstate 80. Horse Creek was also modified and realigned between Interstate 505 and Interstate 80 through the development of the Vaca Valley Business Park. Other improvements constructed by NRCS include stabilization structures along Ulatis, Alamo, and Horse Creeks and levees along the lower reaches of Ulatis Creek and Alamo Creek. In addition, a new diversion channel was constructed on Alamo Creek downstream of Nut Tree Road.

[14] Freeboard is the vertical distance between the design peak water surface elevation and the top of creek bank.



Source: West Yost Associates, 2012.

FIGURE 4.9-3

FLOOD AREAS DURING DECEMBER 2005 STORM

5. Detention Basins

Vacaville has experienced significant flooding resulting in part from the large amount of flow coming from the Vaca Mountains. Therefore, the City built several regional detention basins that reduce the flow in the creeks before reaching the city in order to reduce flooding within the city. Detention storage basins are shown in Figure 4.9-2. There are two types of basins within the city: natural and constructed. Natural detention basins occur in natural depressions along the creeks where obstructions within the creek, such as culverts or roads, impede the flow. Constructed detention basins reduce the downstream flow within the creeks during major storm events. Many of the constructed detention basins were built as part of development projects. Development often changes the land use from open space, which has pervious surfaces, to urban uses, which have impervious surfaces, resulting in increased runoff. The purpose of these detention basins is to store the increased runoff resulting from developing the land so that the amount of runoff is less than or equal to the amount that occurred prior to development. Thus, the development does not adversely impact downstream neighborhoods.

6. Storm Drain Systems

The City maintains a network of storm drains within the city, some of which are modified creeks. The City maintains most of the channel reaches of the storm drains, keeping the channel flowlines free from debris and vegetation. The Solano County Water Agency (SCWA) maintains Ulatis Creek, west of Nut Tree Road to the city limit line, and Alamo Creek from Nut Tree Road to the city limit.[15] SCWA is also responsible for maintenance of the modified creeks downstream of the city.

The storm drain system is made up of a series of pipes under City streets that convey stormwater runoff to the various creeks. The storm drain pipes range in diameter from 12 to 96 inches. The capacities of these pipelines were designed for a storm event with a 10-year return frequency, which is a standard design practice. Stormwater in excess of a 10-year event would pond in the streets or be conveyed through the streets until it reaches a channel or creek. The City's existing drainage facilities are shown in Figure 4.9-2.

7. Surface Drainage and Overland Release

Storm drains within the city are required to convey the 10-year design flows; therefore, storm events that result in design flows greater than the 10-year storm flow over the surface. This surface drainage typically flows along streets and/or overland release paths designed into a project.

[15] The modified channels (creeks) are part of the Ulatis Flood Control Project planned and constructed by the NRCS. Upon the project completion the modified channels were turned over to the Solano County Water Agency for operation and maintenance. The channels are all constructed on private land with easements, and NRCS conducts annual inspections and reviews plans for major modifications or improvements to the project. SCWA is responsible for all maintenance and capital improvements.

In order to accommodate surface drainage, the City of Vacaville requires that streets and other public rights-of-way be designed to provide overland release of runoff for the 100-year storm. Overland release paths must be designed to the following criteria:

- Path designs shall assume that the underground storm drain system is plugged, all upstream areas are fully developed, and the rainfall has saturated the watershed.
- The 100-year storm flows shall be safely routed through and/or around a proposed development project to an acceptable downstream drainage facility. The overland flows shall maintain 1 foot of vertical clearance to building pads and shall not be higher than 0.5 feet above the roadway centerline elevation.

8. Existing Surface Water Quality

Water quality refers to the chemical, biological, and physical characteristics of water. The water quality within a watershed is influenced by surrounding land uses. Constituents found in urban runoff vary as a result of differences in rainfall intensity, geographic features, and the land use of the area, as well as vehicle traffic and the percentage of impervious surface.

Runoff from the Vaca Mountains and English Hills, which are the sources for the creeks draining through Vacaville, is laden with sediment due to the naturally erosive soils within the overall Ulatis Creek Watershed.

As described in Section B.1.c, Climate Conditions and Precipitation, the natural weather pattern in the Vacaville area consists of a long dry period from May to October, and a wet season from November to April. During the seasonal dry period, pollutants contributed by vehicle exhaust, vehicle tire and brake wear, oil and gasoline spills, and atmospheric fallout accumulate within the watershed. Household herbicides, pesticides, fertilizers, and other chemicals also accumulate within the watershed. Precipitation during the early portion of the wet season displaces these pollutants into the stormwater runoff, which can result in elevated pollutant concentrations in the initial wet weather runoff.

Concentrations of heavy metals present in dry weather runoff are typically higher than concentrations measured in wet weather runoff because of the lower volume of water and infrequence of rain events. Sources of dry weather runoff constituent pollutants include commercial and domestic irrigation, general wash-off, groundwater infiltration, and other illicit discharges.

The City has instituted a program to survey storm drain outfalls and sample water in order to identify possible illicit discharges and determine water quality during the dry season.

9. Seiches, Dam Inundation, and Tsunamis

A seiche is a violent oscillation of the surface of a landlocked body of water, such as a lake or reservoir. Usually induced by seismic events, seiches can vary in duration from a few minutes to several hours. Vacaville is not at risk from seiches because there are no major landlocked bodies of water within or nearby the EIR Study Area.

Any dam poses a potential risk of failure, which would most likely be caused from seismically-induced ground shaking or other seismic events, and which threatens the area below the dam with inundation. Since 1972, the State has required inundation maps for most dams, showing those areas within the potential dam failure inundation zone. As illustrated in Figure 4.9-4, the northeastern portion of Vacaville is subject to potential dam inundation by the Monticello Dam. Constructed between 1953 and 1957 in Napa County, the Monticello Dam forms Lake Berryessa, which stores over 1.6 million acre-feet of water when full.

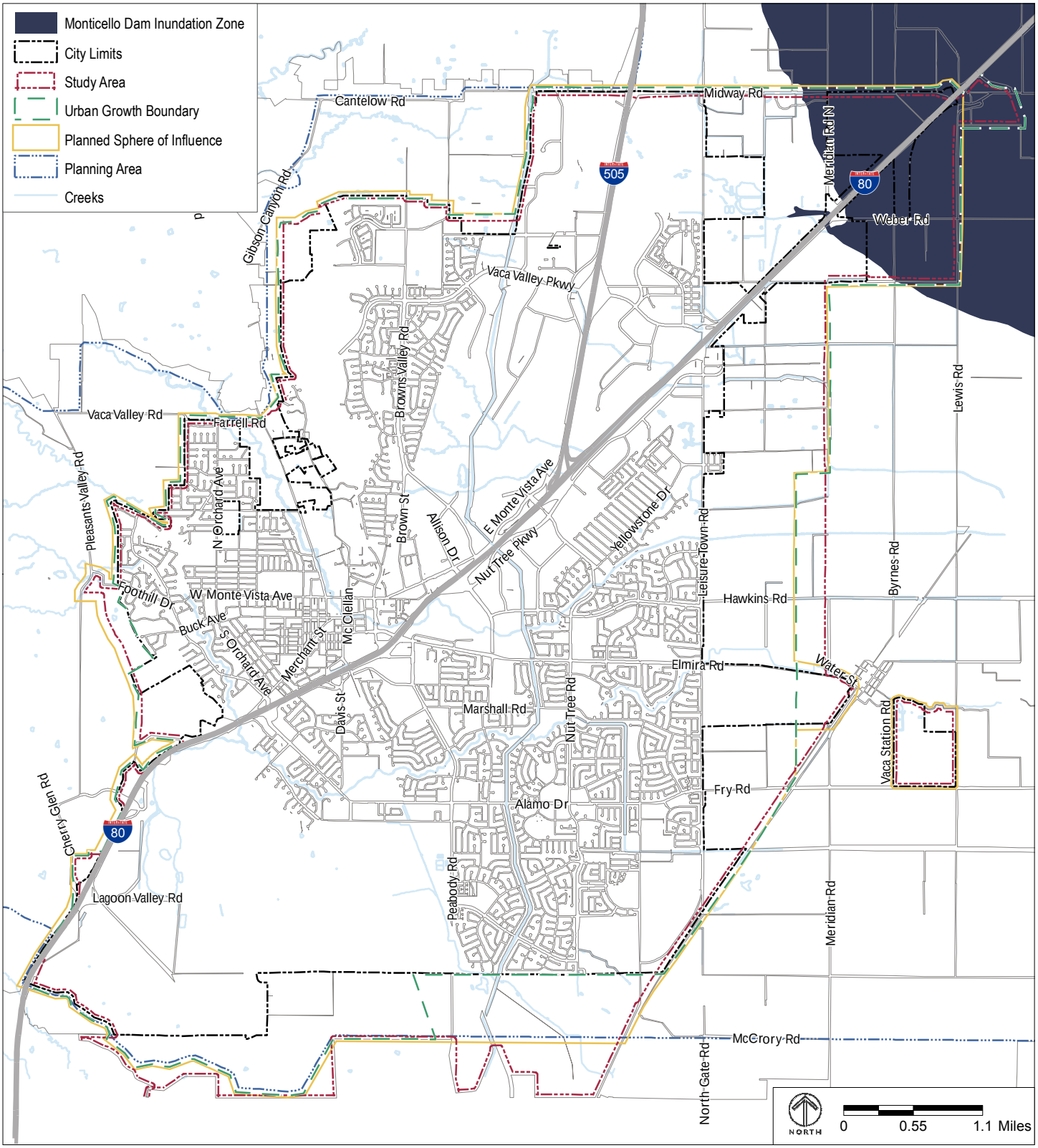
Vacaville is located more than 10 miles inland from Suisun Bay, the nearest large water body, and is therefore not at risk of tsunamis.

10. Groundwater Supply

The City owns and currently operates eleven municipal groundwater wells with very high quality groundwater. Eleven of the wells withdraw water from the deep aquifer in the basal zone of the Tehama Formation. Most City wells are located in the Elmira well field. However, new wells are being sited further north, near Interstate 80. Over the past fifty years, annual groundwater pumping has varied substantially from a low of 2,862 acre-feet per year (AFY) in 1968 to a high of 8,024 AFY in 1983. In 2010, approximately 5,100 AFY were supplied to the City.[16] Vacaville continues to explore well field expansion as a means of maintaining adequate water supply. A regional program is being implemented to monitor groundwater data as a means of ensuring against overdraft and/or contamination.

Generally, areas outside the city limits are agricultural land use and/or rural residential land use with private groundwater wells and/or potable water service from the Solano Irrigation District (SID).

[16] NV5, 2012, *SB 610 Water Supply Assessment Report for Brighton Landing*, page 9.



Source: State of California, Governor's Office of Emergency Services, 2000.

FIGURE 4.9-4
DAM INUNDATION AREAS

C. Standards of Significance

Implementation of the proposed General Plan and ECAS would have a significant impact with regard to hydrology and water quality if they would:

- Violate any water quality standards or waste discharge requirements.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g. the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Otherwise substantially degrade water quality.
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows.
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.
- Inundation by seiche, tsunami, or mudflow.

D. Impact Discussion

This section discusses potential impacts of the proposed General Plan on hydrology and water quality. Implementation of the proposed ECAS has minimal hydrology and water quality impacts and is discussed, where relevant, in the sections below.

1. Project Impacts

The discussion of potential project impacts is organized by and responds to each of the potential impacts identified in the Standards of Significance.

a. Violate any water quality standards or waste discharge requirements.

Construction of development projects allowed under the proposed General Plan would result in earth-disturbing activities such as site clearing and grading for construction of roads, parking areas, building pads, and park areas. Disturbed areas exposed to rainfall could lead to an increase in erosion and the discharge of sediment to receiving waters, resulting in a degradation of water quality. Additional pollutants can be introduced during construction from vehicular use, construction materials, and construction waste products. These activities can introduce pollutants such as nutrients, metals, pesticides, oils and grease, and trash.

In addition, development allowed by the proposed General Plan would convert some existing agricultural lands to urban uses. Urban development creates new sources of water pollution, including higher levels of vehicle emissions, vehicle maintenance wastes, pesticides, fertilizers, household hazardous wastes, and pet wastes. As a result, the runoff from an urban area may have a higher concentration of pollutants than the pre-development runoff from the same area.

As described in Section A.2.c, RWQCB (Central Valley Region), new development projects constructed under the proposed General Plan that disturb 1 acre or more of land, and construction on smaller sites that are part of a larger project, would be required to comply with the National Pollution Discharge Elimination System (NPDES) General Permit for Discharges of Stormwater Associated with Construction Activities issued by the SWRCB. The Construction General Permit requires the development and implementation of a SWPPP. The SWPPP must contain a site map(s) which shows the construction site perimeter; existing and proposed buildings; lots; roadways; stormwater collection and discharge points; general topography, both before and after construction; and drainage patterns across the project area. The SWPPP must list BMPs that the discharger will use to protect stormwater runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants, to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

BMPs to prevent or reduce potential erosion control could include mulch covering, temporary seeding, soil stabilizers, binders, fiber rolls, temporary vegetation, and permanent seeding. BMPs to control sediment that may be introduced into runoff could include silt fences, straw wattles, and sediment basins. BMPs for controlling run-on and runoff include control berms and swales that direct runoff away from sensitive areas. Source control BMPs that prevent pollutants from

entering runoff could include establishment of vehicle fueling and maintenance areas and material storage areas that are either covered or are designed to control runoff.

In addition, the proposed General Plan includes Goal COS-14 and its associated policies and actions, protect water quality in Vacaville by minimizing point and non-point source pollutants, integrating City planning and programs with other watershed planning efforts, minimizing pesticide use, and requiring BMPs to protect water quality from both construction and new impervious surfaces.

Because the NPDES Construction General Permit process requires appropriate BMPs to prevent erosion, control sediment, control runoff, and prevent pollutants from entering runoff, and because the proposed General Plan includes additional goals, policies, and actions that protect water quality, the impact would be *less than significant.*

b. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g. the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).

Total water demand in 2035 was projected based on the anticipated development in 2035 under the proposed General Plan. The projected 2035 average day water demand would be approximately 26.2 million gallons per day (MGD). The maximum day demand in 2035 would be approximately 52.4 MGD. As described in Section A of Chapter 4.15, Utilities and Service Systems, to provide a minimum production of the maximum day demand (52.4 MGD), additional production facilities would be required, including expansion of the existing North Bay Regional Water Treatment Plant (NBR Plant), revised operations of the Diatomaceous Earth Water Treatment Plant (DE Plant) to increase the hours of production, and/or the development of new groundwater wells. More information on these improvements and facilities is provided in Chapter 4.15, Utilities and Service Systems.

Three new groundwater wells (shown as Well 17, Well 19, and Well 24 in Figure 4.15-2 in Chapter 4.15, Utilities and Service Systems) would need to be added to meet 2035 production capacity demands. The exact location of these new groundwater wells is not yet finalized, but it is assumed they would be sited in the northeast sector of the city (north of Interstate 80). In addition to the new groundwater wells, the City anticipates replacing five existing wells.

Groundwater in Vacaville is extracted from the Solano Subbasin of the Sacramento Valley groundwater basin. The City is the primary user of groundwater in the Vacaville area. The Solano Subbasin is not considered to be in a state of "critical condition of overdraft," and if cur-

rent water management conditions continue, the Solano subbasin is not expected to become overdrawn.[17] With three new groundwater wells and replacement of other wells to meet 2035 production capacity demands, the water supply available would be 8,100 acre-feet per year (AFY),[18] which is consistent with the water supply planned for in the 2010 UWMP and which would enable the City to meet the average day demand of 26.2 MGD.[19]

The proposed General Plan also includes policies and actions under Goal COS-13, and the proposed ECAS includes a range of measures in the water and wastewater sector, to promote water conservation, which will reduce demands on water supply, including groundwater resources. In addition, the proposed ECAS includes measures to encourage the use of non-potable water, which would also reduce the demand on groundwater resources.

In addition, the proposed General Plan includes policies and actions that would protect groundwater recharge. Specifically, Policy COS-P14.6 directs the City to protect existing open spaces, natural habitat, floodplains, and wetland areas that serve as groundwater recharge areas; Policy COS-P14.7 directs the City to protect groundwater recharge and groundwater quality when considering new development projects; and Action COS-A14.1 directs the City to work with SID, nearby cities, and/or Solano County to develop a recharge area map to guide future development, and to require that developments proposed in areas identified as "valuable" to the recharge area mitigate adverse impacts to the greatest extent possible.

Because the projected groundwater demand could be met with the water supply planned for under existing water management conditions, and because the proposed General Plan and ECAS include policies, actions, and measures to protect groundwater recharge areas and promote water conservation, the impact would be *less than significant*.

c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.

Development allowed under the proposed General Plan would convert existing agricultural and vacant lands to residential, commercial, industrial, public, and park land uses. This land use conversion would increase the impervious surfaces and would alter the existing drainage pattern, which could cause an increase in the peak flows and volumes discharged from the developed land during storm events. Increased flows could result in substantial erosion or siltation downstream if they discharged directly to downstream receiving waters.

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[17] City of Vacaville, 2011, *Draft 2010 Urban Water Management Plan Update*, page 3-5.

[18] Alaniz, Victor M., Associate/Manager, Nolte Vertical 5. Personal communication with Tanya Sundberg, The Planning Center | DC&E, June 18, 2012.

[19] City of Vacaville, 2011, *Draft 2010 Urban Water Management Plan Update*, page 6-2.

However, the proposed General Plan includes policies and actions to prevent alterations to the drainage patterns, erosion, and siltation. Specifically:

- Policy COS-P14.5 requires the implementation of BMPs to minimize erosion, sedimentation, and water quality degradation resulting from construction or from new impervious surfaces.
- Policy SAF-P3.1 requires that the storm drainage needs for each project be evaluated, accounting for projected runoff volumes and flow rates once the drainage area is fully developed. In the Alamo Creek watershed upstream of Peabody Road, post-development 10-year and 100-year peak flows are required to be reduced to 90 percent of predevelopment levels. In the remainder of Vacaville, for development involving new connections to creeks, peak flows may not exceed predevelopment levels for 10- and 100-year storm events.
- Policy SAF-P3.3 requires a Storm Drainage Master Plan for new development. A Storm Drainage Master Plan would ensure that new development adequately provides for on-site drainage facilities to protect the new development from potential flood hazards and ensure that potential off-site impacts are fully mitigated.
- Action SAF-A3.1 directs the City to update and maintain the City's Storm Drainage Master Plan, which ensures that new development adequately provides for on-site and downstream off-site mitigation of potential flood hazards and drainage problems.
- Action SAF-A3.2 directs the City to revise the Land Use and Development Code to limit the amount of impervious surfaces in non-residential parking lots.

Furthermore, as described in Section D.1.a, Project Impacts, new development projects constructed under the proposed General Plan that disturb 1 acre or more of land, and construction on smaller sites that are part of a larger project, would be required to comply with the NPDES General Permit for Discharges of Stormwater Associated with Construction Activities, which requires the development and implementation of a SWPPP. The SWPPP must address drainage patterns across the project area, list BMPs that the discharger will use to protect stormwater runoff, and contain a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

In addition, the Vacaville Grading Ordinance (Chapter 14.19.242 of the Land Use and Development Code) regulates grading and earth moving in the city. A grading permit is not issued for construction activities subject to the NPDES permitting requirements described above unless an Erosion and Sediment Control Plan is submitted. The Erosion and Sediment Control Plan must show that proposed erosion and sediment control measures are capable of controlling surface runoff and erosion, retaining sediment on the project site, and preventing runoff pollution in compliance with the Clean Water Act.

Therefore, the proposed General Plan policies and actions, in combination with the NPDES and local grading permit requirements, would reduce drainage pattern impacts to a *less-than-significant* level.

d. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.

Development allowed under the proposed General Plan, particularly construction activities through which soil is disturbed during grading and site preparation, could alter the existing drainage pattern of the site and increase flooding. Land development could also significantly increase the stormwater runoff rates in a watershed without mitigation.

However, the proposed General Plan and ECAS include policies, actions, and measures to prevent alterations to the drainage patterns and flooding. As discussed in Section D.1.c, Project Impacts, Policy SAF-P3.1 requires that post-development 10-year and 100-year peak flows be reduced to 90 percent of predevelopment levels in the Alamo Creek watershed upstream of Peabody Road, and that peak flows do not exceed predevelopment levels for 10- and 100-year storm events in other areas of Vacaville where development discharges to creeks. This would generally be accomplished through either construction of stormwater detention basins, or payment of drainage impact fees which are then used by the City to construction regional detention basins. Policy SAF-P3.3 requires a Storm Drainage Master Plan, which ensures adequate on-site drainage facilities to protect the new development from potential flood hazards and ensure that potential off-site impacts are fully mitigated. Action SAF-A3.1 directs the City to update and maintain the City's Storm Drainage Master Plan, which ensures that new development adequately provides for on-site and downstream off-site mitigation of potential flood hazards. In addition, Policy SAF-P4.4 requires that new development mitigate its additional runoff and mitigate removal of any floodplain areas. Finally, the proposed ECAS includes measures to promote the use of pervious paving materials and reduce watering of non-vegetated surfaces, which would reduce runoff.

Furthermore, as described in Section D.1.c, Project Impacts, the Vacaville Grading Ordinance requires an Erosion and Sediment Control Plan for construction activities subject to the NPDES permitting requirements. This Plan requires that the proposed erosion and sediment control measures are capable of controlling surface runoff and erosion.

With implementation of proposed General Plan and ECAS policies and measures and existing development requirements, the impact of flooding resulting from alteration of drainage patterns would be *less than significant*.

e. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

Development allowed by the proposed General Plan would convert existing agricultural and vacant lands to residential, commercial, industrial, public, and park land uses. This land use conversion would cause a substantial increase in runoff rates compared to existing rates. However, several proposed General Plan policies and actions ensure that the stormwater sewer system is adequately maintained and expanded on a site-specific basis when necessary. Proposed General Plan Policy SAF-P2.1 directs the City to continue to develop a comprehensive system of storm drainage improvements to minimize flooding and maintain stormwater infrastructure in good condition. Under Policy SAF-P2.2 and Action SAF-A2.8, the City would plan for infrastructure improvements, as needed, to serve existing developed areas, developing areas, and new development in undeveloped areas. Under Policies SAF-P3.1 and SAF-P3.2, the City would evaluate storm drainage needs for each development project and continue to require development impact fees for storm drainage improvements. Lastly, Policy SAF-P3.3 requires a Storm Drainage Master Plan for new development, and Policy SAF-P4.4 requires that new development mitigate its runoff.

With implementation of the proposed General Plan policies and actions, future development under the proposed General Plan would not create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems, and therefore would have a *less-than-significant* impact.

f. Otherwise substantially degrade water quality.

As discussed in Section D.1.a, Project Impacts, development and land uses allowed by the proposed General Plan could degrade water quality in Vacaville. However, as described above, construction activities that disturb 1 acre or more of land, and construction on smaller sites that are part of a larger project, would be required to comply with the Construction General Permit, which requires the development and implementation of a SWPPP containing BMPs to protect stormwater runoff and the placement of those BMPs. In addition, the proposed General Plan includes Goal COS-14 and its associated policies and actions that would protect water quality in Vacaville. Therefore, water quality impacts would be *less than significant*.

g. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

The majority of the urbanized area of Vacaville is outside of the 100-year floodplain and thus would not be at risk to flooding hazards. Figure 4.9-1 shows the areas within the EIR Study Area that are designated as areas subject to a flood on average once in 100 years (100-year flood zone) or once in 500 years (500-year flood zone). As shown in Figure 4.9-1, scattered parts of the EIR Study Area are within the 100-year flood zone. The proposed General Plan designates

these areas for both residential and non-residential land uses. The development of new housing under the General Plan within the 100-year flood zone could result in a significant impact.

To minimize the risk of exposing people or property to flood hazards, the proposed General Plan includes policies and actions to minimize risks to development related to flooding. Specifically:

- Policy SAF-P2.1 directs the City to continue to develop a comprehensive system of drainage improvements to minimize flood hazards and maintain storm drainage infrastructure in good condition.
- Policy SAF-P4.1 prohibits development within mapped flood-prone areas unless mitigation of flood risk is assured.

In addition, several actions would put procedures in place to ensure that the City's policy and regulatory documents reflect up-to-date flood hazard information:

- Action SAF-A4.3 directs the City to review and revise the Safety Element concurrently with the adoption of each Housing Element to identify any new housing areas prone to flood hazards.
- Action SAF-A4.4 directs the City to annually review the Land Use Element to account for new flood information made available during the previous year.
- Action SAF-A4.5 directs the City to update the Land Use and Development Code to appropriately reflect the Central Valley Flood Protection Plan and to identify current flood hazards and information.

Implementation of the proposed General Plan policies and actions would reduce the potential impact associated with placing housing within a 100-year flood hazard area to a *less-than-significant* level.

h. Place within a 100-year flood hazard area structures which would impede or redirect flood flows.

As described in Section D.1.g, Project Impacts, and shown in Figure 4.9-1, the majority of the urbanized area of Vacaville is outside of the 100-year floodplain and thus would not place structures in the flood zone that would impede or redirect flows. However, portions of the EIR Study Area are within the 100-year flood zone and the proposed General Plan designates these areas for both residential and non-residential land uses. Therefore, under the proposed General Plan, new structures could be placed within the 100-year flood zone, which could create a significant impact by impeding or redirecting flood flows.

However, the proposed General Plan includes policies and actions that would prevent structures from impeding or redirecting flows. Specifically:

- Policy SAF-P2.5 directs the City to maintain open areas needed to retain stormwater and prevent flooding of urban or agricultural land.
- Policy SAF-P2.6 requires new development adjacent to creeks to dedicate the area within 40 feet of the stable top of bank to the City and be designed to allow access to, and visibility of, creek areas for maintenance and public safety purposes.
- Policy SAF-P3.3 requires that Storm Drainage Master Plan be prepared for new development projects to ensure new development adequately provides for on-site drainage facilities necessary to ensure that potential off-site impacts are fully mitigated.
- Action SAF-A3.1 directs the City to update and maintain the Storm Drainage Master Plan, which ensures that new development adequately provides for downstream off-site mitigation of potential flood hazards and drainage problems.
- Policy SAF-P4.4 requires that new development mitigate its additional runoff and mitigate removal of any floodplain areas.

With the implementation of the proposed General Plan policies and actions, the impact would be reduced to a *less-than-significant* level.

i. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

Risks from flooding are discussed in Section D.1.g, Project Impacts, above. In addition to flood zones, the northeastern portion of Vacaville is subject to potential dam inundation by the Monticello Dam, as illustrated in Figure 4.9-4. The proposed General Plan designates this dam inundation area for residential, commercial, and industrial uses, which could expose people and structures to flooding risk. In addition, development allowed by the proposed General Plan could expose new development to flooding risk as a result of a levee failure.

The proposed General Plan includes Policy SAF-P4.3, which directs the City to consider risks from potential dam failure when reviewing proposals for new development in dam inundation areas, and Action SAF-A4.6, which directs the City to support the efforts of levee owners and regional, State, or federal agencies to design and reconstruct levees that do not meet flood protection standards to bring them into compliance with adopted State and/or federal standards. In addition, the proposed General Plan includes Goal SAF-7 and its associated policies and actions that reduce risks associated with emergencies and natural and manmade disasters, such as dam or levee failure. In particular, Policy SAF-P7.3 directs the City to maintain an adequate level of disaster response preparedness through careful review of proposed developments and through

staff training in and exercise of the local hazard mitigation plan; Policies SAF-P7.1 and SAF-P7.2 promote awareness and education about disaster preparedness; and Action SAF-P7.2 directs the City to identify and regularly update emergency access routes.

However, the policies and actions described above do not eliminate the risks to people and property from flooding. The Monticello Dam is owned and operated by the US Bureau of Reclamation. Similarly, levees are owned and operated by other agencies. It is therefore not feasible for the City's General Plan to completely address maintenance or improvements to this dam or levees to the extent necessary to eliminate risks from dam or levee failure. The impact is therefore considered *significant and unavoidable*.

Impact HYDRO-1: Although the proposed General Plan's policies and actions reduce risks associated with dam or levee failure, they do not eliminate risks to people and property.

As discussed above, it is not within Vacaville's power to require or complete maintenance and improvements to dams or levees around Vacaville that are owned and maintained by other agencies. Therefore, this impact is considered *significant and unavoidable*.

j. Inundation by seiche, tsunami, or mudflow.

Vacaville is located approximately 10 miles from Lake Berryessa, formed by the Monticello Dam. While seiche waves could occur in Lake Berryessa, they would not reach the EIR Study Area. In addition, Vacaville is located more than 10 miles inland from Suisun Bay and is therefore not at risk of tsunamis.

While most of Vacaville is relatively flat, the western portion of the EIR Study Area contains some areas of steep slopes, and could be subject to mudflows during periods of heavy precipitation. However, the proposed General Plan includes policies that reduce impacts of mudflows. Specifically:

- Policy SAF-P1.1 directs the City to consider geologic conditions when designating land use and designing development, and where potential geologic or seismic risks are high and unmitigable, retain low-occupancy or open space forms of use.
- Policy SAF-P1.2 prohibits development on ridges and slopes at or exceeding 25 percent.
- Policy SAF-P1.3 directs the City to evaluate and consider the geologic and soil hazards for any proposed extension of urban or suburban land uses into areas that are characterized by slopes from 15 to 25 percent.
- Policy SAF-P1.5 requires geotechnical studies prior to approving rezoning requests, specific plans, or subdivision maps in areas that have experienced landslides in the past.

- Policy SAF-P1.10 limits cut slopes to 2:1 (50 percent slope) except where an engineering geologist can establish that a steeper slope would perform satisfactorily over the long term, and where practicable, requires more gentle slopes than the 2:1 standard.

Furthermore, new construction is subject to the California Building Code, which contains building criteria and standards that are designed to reduce landslide risks to acceptable levels.

Therefore, the proposed General Plan policies, in combination with the California Building Code and other State and local requirements, would ensure that mudflow impacts would be *less than significant*.

2. Cumulative Impacts

Although the proposed General Plan would mainly have less-than-significant impacts on water quality, stormwater, and flooding, as future development proceeds in the watersheds that include the Vacaville area, impervious surfaces will increase, thereby potentially increasing stormwater drainage rates.

Development projects within the City of Vacaville and throughout Solano County would be required to comply with the NPDES General Permit for Discharges of Stormwater Associated with Construction Activities issued by the SWRCB. This permit requires development projects to implement measures to prevent impacts, individual and cumulative, to water quality during construction. In addition, projects would also be required to comply with the City's NPDES stormwater permit from the Central Valley RWQCB and their Stormwater Management Plan, which prevent impacts to water quality after construction of a project. Therefore, the potential for cumulative impacts to water quality is less than significant.

Development projects with Solano County that could contribute to cumulative impacts would also be subject to local, State, and federal regulations designed to minimize individual and cumulative impacts related to stormwater runoff rates and flooding. The implementation of mitigation measures and anticipated mitigation measures for other projects that will be required to maintain compliance with these regulations will reduce the potential cumulative impacts resulting from increased runoff and flood hazard risks to a less-than-significant level.

However, the proposed General Plan would contribute to development in levee and dam inundation areas, resulting in a *significant and unavoidable* cumulative impact.

Impact HYDRO-2: The proposed General Plan would contribute to development in dam and levee inundation areas, resulting in a significant cumulative impact.

It is not within Vacaville's power to require or complete maintenance and improvements to dams or levees around the city owned and maintained by other agencies. Therefore, the impact is considered *significant and unavoidable.*

E. Full Buildout

The full buildout anticipated under the proposed General Plan would include significantly more development than the 2035 horizon-year development projection analyzed in Section D, Project Impacts, in terms of both the amount and the extent of development. Therefore, the potential for impacts to hydrology and water quality would increase. However, as discussed in Chapter 3, Project Description, it is extremely unlikely that full buildout would ever occur under the proposed General Plan. Therefore, an analysis of full buildout is not required by CEQA.

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