# Sonoma Valley County Sanitation District 2015 Local Hazard Mitigation Plan

November 2015

Public Review Draft

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| ABS | Acrylonitrile Butadiene Styrene Pipe |
| AC, ACP | Asbestos Cement Pipe |
| ADWF | Average Dry Weather Flow |
| ALA | American Lifelines Alliance |
| ASK | Abrahamson-Silva-Kamai Model for ground motion |
| BSSA | Boore-Stewart-Seyhan-Atkinson Model for ground motion |
| CB | Campbell-Bozorgnia Model for ground motion |
| CI, CIP | Cast Iron Pipe |
| cm | centimeters |
| CY | Chiou-Youngs Model for ground motion |
| DI, DIP | Ductile Iron Pipe |
| DSOD | Division of Safety of Dams |
| g | acceleration of gravity (= 32.2 feet per second squared) |
| gpm | Gallons per Minute |
| FEMA | Federal Emergency Management Agency |
| FHSZ | Fire Hazard Severity Zones |
| FIRM | Flood Insurance Rate Maps |
| GIS | Geographic Information System |
| HDPE | High Density Polyethylene Pipe |
| I | Idriss Model for ground motion |
| IBC | International Building Code |
| m | meters |
| mm | millimeters |
| m/ sec | meters per second |
| M | Magnitude (moment magnitude) |
| MG | Million Gallons |

| | |
|---|---|
| MGD | Million Gallons per Day |
| MH | Manhole |
| N.A. | Unknown Pipe Material |
| NEHRP | National Earthquake Hazards Reduction Program |
| NFIP | National Flood Insurance Program |
| NOAA | National Oceanic and Atmospheric Administration |
| PEP | Polyethylene Pipe |
| PGA | Peak Ground Acceleration (measured in g) |
| PGD | Permanent Ground Deformation (measured in cm) |
| PGV | Peak Ground Velocity (measured in cm/second) |
| PG&E | Pacific Gas and Electric |
| PVC | Polyvinyl Chloride Pipe |
| RAS | Return Activated Sludge |
| RC | Rogers Creek Fault |
| RCP | Reinforced Concrete Pipe |
| SC | Steel Cased Pipe |
| SCWA | Sonoma County Water Agency |
| sec | seconds |
| SVCSD | Sonoma Valley County Sanitation District |
| UBC | Uniform Building Code |
| VCP | Vitrified Clay Pipe |
| V, Vs | Seismic Base Shear Force |
| W | Weight |
| WAS | Waste Activated Sludge |
| WWTP | Wastewater Treatment Plant |

# APPENDICES

Appendix A: SVCSD Collection and Recycled Water System, Geology, Quaternary Deposits, Liquefaction, Flood Zone, Fire Hazard Zone, and Historic Wild Fires Figures

Appendix B: Proof of Public Outreach

Appendix C: Board Resolution Adopting the SVCSD Local Hazard Mitigation Plan

# 1. Introduction

## 1.1 Purpose of the Plan

Hazard mitigation, as defined by the Sonoma Valley County Sanitation District (SVCSD), is a way to limit or eliminate damage to infrastructure and facilities that occur as a result of natural disasters. Hazard mitigation plans are often executed through developing short-term and long-term strategies, establishing a program to address potential hazards, and commencing a program or projects to mitigate the potential impacts of specific and identified hazards to infrastructure and facilities.

SVCSD is located in an area impacted by multiple natural hazards. Historically it has been subjected to floods, wildfires, landslides and mudflows. Due to its proximity to the San Andreas Fault system, one of the major active fault systems in the world, Sonoma County also has a very high earthquake hazard.

Natural disasters can result in enormous cost to the public through loss of life, human suffering, property damage and economic loss. Lack of preparedness can make recovery a very long and arduous process, which can last for many months or years and can depress a region for a time long after the physical signs of the disaster have disappeared. Recognizing this, the Federal Government passed the Disaster Mitigation Act of 2000 (DMA 2000), which encourages and rewards pre-disaster planning at all levels of local, tribal and state government. DMA 2000 was signed into law (Public Law 106-390) by the President on October 10, 2000.

The Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390) requires state and local governments to develop hazard mitigation plans as a preliminary measure in order to receive federal disaster grant assistance. Prior to 2000, federal disaster funding was primarily appropriated towards disaster relief and recovery programs after an incident. Through the establishment of the DMA, there is now an increased emphasis on proactive planning for disasters before they occur; municipalities are encouraged to put mitigations in place in order to reduce damages due to hazards identified in a Natural Hazard Reliability Assessment and a Hazard Mitigation Plan.

As an incentive for pre-disaster mitigation planning, the DMA 2000 has established a pre-disaster mitigation (PDM) program, administered through the Federal Emergency Management Agency (FEMA), and incorporated new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). Through the PDM program, a larger amount of funds are available for communities that have developed a comprehensive mitigation plan prior to a disaster. States, territories, tribes, universities, and communities must have an approved mitigation plan in place before receiving PDM funds. Funding for the implementation of these plans reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds. An approved Local Hazard Mitigation Plan (LHMP) is a pre-requisite for applying for a PDM grant.

The DMA encourages state and local authorities to work together on pre-disaster planning by identifying and developing mitigation actions to minimize damage from hazards. Mitigation actions are based on short-term and long-term activities and goals, which include reducing the cause or occurrence of hazards, reducing exposure to hazards, reducing the effects of hazards through preparedness, and reinforcing response and recovery activities. Through thoughtful planning and implementation of an effective plan, mitigation actions will effectively reduce the adverse impacts to infrastructure and facilities, which will therefore minimize the costs of rebuilding damaged structures should a disaster occur.

In January 2008, the Board of Directors of the Sonoma County Water Agency (Water Agency), which manages the SVCSD operations, adopted a Local Hazard Mitigation Plan (LHMP) in accordance with the DMA, and in 2012, the Water Agency's LHMP was updated. The LHMP assesses the natural hazards that are most likely to impact facilities operated by the Water Agency and includes a vulnerability assessment

of the infrastructure. The updated LHMP documents the progress towards the mitigation of hazards identified, and provides a vision for the next five years to further reduce the exposure to the identified hazards. The 2012 update provides an overview of hazards that relate to the Water Agency facilities, including the water supply system, sanitation system, flood control, emergency power and administrative infrastructure.

One of the hazard mitigation actions identified in Water Agency's 2012 LHMP includes development of a multi-hazard vulnerability assessment of the sanitation systems managed and operated by the Water Agency, such as the SVCSD system. In direct response to this mitigation action, the SVCSD has prepared this Local Hazard Mitigation Plan and conducted a multi-hazard vulnerability assessment of the SVCSD sanitation facilities.

The SVCSD's wastewater collection, treatment, and disposal facilities, which also include recycled water storage and distribution facilities are distributed over a large geographical area and traverse zones of varying geology and potential hazards. A comprehensive LHMP is prepared in recognition of the SVCSD's responsibility to the community and its role in preserving the economic vitality of the region. The public places trust in the operators of wastewater systems to safely manage their operations in a manner that protects the health and safety of the public and the environment, even after a disaster. Uninterrupted collection and treatment of wastewater is essential for the health and safety of the community and to minimize the potential for loss of life and property damage following a major natural disaster. The SVCSD's LHMP will be managed in the same manner as the Water Agency's LHMP.

## 1.2 Plan Organization

After the Introduction, the LHMP is organized into six chapters and includes all relevant documentation required to meet the necessary criteria for FEMA approval. Each chapter is briefly described below.

- **Chapter 2, SVCSD Profile** describes the SVCSD's history, geography, topography.
- **Chapter 3, Planning Process** describes the LHMP Planning Process, and includes a list of meetings and public outreach activities that occurred to engage SVCSD stakeholders, County officials and staff, and the public.
- **Chapter 4, Natural Hazard Reliability Assessment** identifies and prioritizes natural hazards affecting SVCSD, and assesses the SVCSD's vulnerability to these hazards.
- **Chapter 5, Mitigation Goals, Objectives, and Actions** identifies mitigation goals, objectives and actions and prioritizes the actions.
- **Chapter 6, Plan Implementation** discusses the LHMP's adoption and implementation
- **Chapter 7, Plan Maintenance** discusses the SVCSD's plan to monitor, evaluate, update and maintain the LHMP.

# 2. SVCSD Profile

## 2.1 History

SVCSD began its operation in 1954. During a 1995 restructuring of the county government, the Sonoma County Water Agency assumed responsibility for managing the county sanitation zones and districts, which provide wastewater treatment, reclamation, and disposal for residences and businesses. SVCSD operates under a permit from the California Regional Water Quality Control Board (San Francisco Bay region) that sets the requirements for operation. The SVCSD Board of Directors is composed of the three

people who hold these elected positions: Mayor, City of Sonoma; First District Supervisor, Sonoma County; Chair of Sonoma County Board of Supervisors.

SVCSD now serves an area of about 4,500 acres. The service area extends from Glen Ellen in the north to Schellville in the south, and includes the City of Sonoma, and the nearby communities of Agua Caliente, Boyes Hot Springs, Eldridge, El Verano, Fetter Hot Springs, Vineburg, and Temelec. There are approximately 17,030 equivalent single family dwelling units in the sewer service area. Figure 1 shows an aerial view of the primary service area for the SVCSD. Figure SV-1 (Appendix A) contains an overall map with the SVCSD Boundaries.

The SVCSD provides wastewater collection and treatment, and recycled water distribution and disposal services to a population of approximately 42,000 and maintains more than 100 miles of sewer and recycled water pipeline (Figure SV-1). After treatment, tertiary recycled water is used for irrigation and environmental restoration purposes or discharged through Shell Slough which ultimately flows into the San Pablo Bay.

The average dry weather design flow and permitted capacity of the SVCSD wastewater treatment plant (WWTP) is 3.0 million gallons per day (MGD). Current average dry-weather flow (ADWF) is 2.7 MGD with a peak wet weather capacity of 16 MGD. The WWTP is the largest wastewater plant in the Sonoma County Water Agency's jurisdiction and includes primary, biological (secondary), and tertiary levels (filtration) of treatment, followed by chlorine disinfection.

The solids handling system includes a gravity thickener to process primary and waste activated sludge, and a screw press to dewater the solids before being transferred to a landfill.

The following sections provide more details on the SVCSD wastewater collection system and wastewater treatment facilities.

## 2.2 Geography, Topography, and Climate

### 2.2.1 Geography

Sonoma Valley is located in southeastern Sonoma County, California, and is located 46 miles northeast of San Francisco and approximately 30 miles southeast of Santa Rosa, along Highway 12.

### 2.2.2 Topography

The topography of the SVCSD is varied and includes mountainous areas, rolling hills, broad flat river valleys, and bay flats. The valleys and foothills are predominantly devoted to agriculture but also contain most of the urbanized areas and population. The economic base of the unincorporated County is largely tourism and agriculture.

### 2.2.3 Climate

The Sonoma Valley has a "Mediterranean" climate. Temperatures in the Valley rarely drop below freezing during the rainy winter months; in the summertime, coastal fog and breezes bring cool evenings even after very warm days.

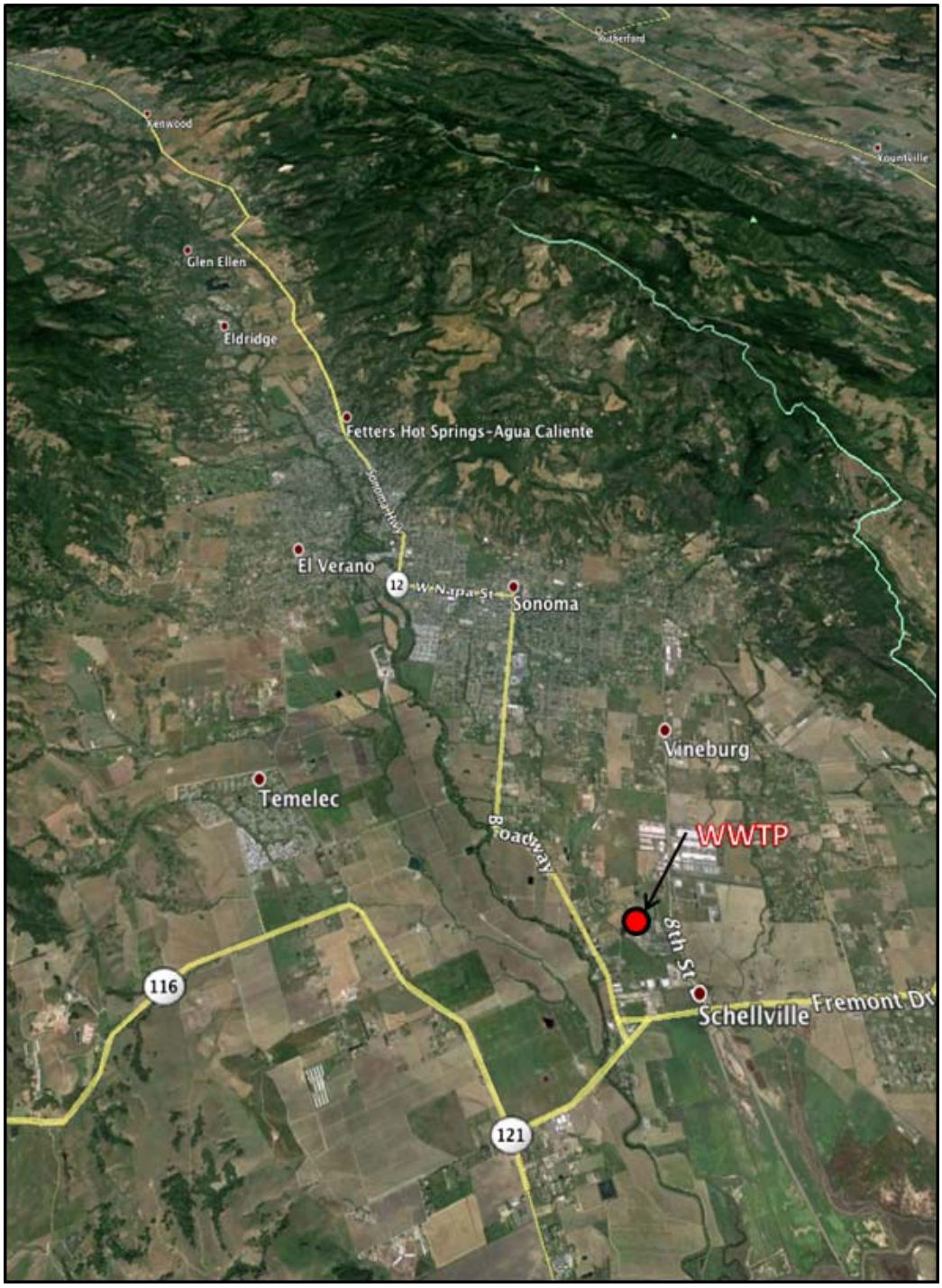



**Figure 1: SVCSD Service Area Aerial View**

## 2.3 SVCSD Collection System

Figure SV-1 (Appendix A) shows the SVCSD boundaries and highlights the main features of the collection system. Raw sewage is collected by a series of small diameter collection pipes (typically 4" to 8" diameter) up to 18" reinforced concrete pipe (RCP) and 42" PVC mains. Sewage then proceeds downslope and to the south, eventually reaching the wastewater treatment plant as shown in Figure SV-1.

There is a total of approximately 140 miles of pipe in the collection system. Table 1 provides a breakdown of the pipe by diameter and material and highlights that the most common pipe materials are ACP (58 miles), VCP (38 miles), and PVC (23 miles). These pipe materials were likely chosen due to their corrosion resistance to sewage.

Table 1: Pipe Collection System

| Pipe Material* | Length (Miles) | Diameter (Inches) |
|---|---|---|
| ABS | 0.33 | 6 |
| ACP | 57.58 | 4, 6, 8, 10, 12, 16, 18, 36 |
| CIP | 0.37 | 4, 6, 8, 18 |
| CP | 0.57 | 6, 8 |
| DIP | 3.01 | 4, 6, 8, 10, 12, 16, 18, 21, 42 |
| N.A. | 3.22 | 4, 6, 8 |
| PEP | 2.75 | 6, 8, 10 |
| PVC | 22.67 | 2, 4, 5, 6, 8, 10, 12, 15, 18, 21, 27, 30, 36, 42 |
| RCP | 12.23 | 6, 8, 12, 18, 21, 24, 27, 30 |
| SC | 0.03 | 30 |
| VCP | 37.66 | 6, 8, 10, 12, 15, 18, 21, 27 |
| **Total** | **140.42** | |

* ABS: **Acrylonitrile Butadiene Styrene**
ACP: Asbestos Cement Pipe
CIP: Cast Iron Pipe
CP: Concrete Pipe
DIP: Ductile Iron Pipe
N.A.: Unknown Pipe Material
PEP: Polyethylene Pipe
PVC: Polyvinyl Chloride Pipe
RCP: Reinforced Concrete Pipe
SC: Steel Cased Pipe
VCP: Vitrified Clay Pipe

### 2.3.1 Wastewater Treatment Plant

The SVCSD WWTP is located immediately north of Schell Creek on 22675 8th Street East in Sonoma, and is currently rated to treat an average dry-weather daily design flow of 3.0 MGD. Construction of the WWTP began during the 1950's, and various modifications have been made to the buildings, tanks and pipelines at the site over the past 50+ years. The WWTP and facilities are shown in the aerial view of Figure 2. The wastewater treatment process and the major facilities are described below:

- Preliminary Treatment
  - Preliminary treatment includes screening, grit removal and flow measurement.

- Headworks: Raw sewage from domestic and commercial sources, including wastewater from the septic waste holding tank and the scum tank, enters the WWTP at the Headworks Building. Wastewater from the aerated equalization basin also enters the Headworks Building, and flows are monitored with an equalization flow meter. At this point, large inorganic solids in the waste stream are removed via mechanical bar screens. During emergency conditions, such as may occur during periods of exceptionally high flows or mechanical failure of the screens, the influent wastewater can be directed through a bypass channel that is equipped with a bar screen. The wastewater is then pumped through another flow meter and into a vortex grit tank, where smaller solids, or grit, are removed from the wastewater. The grit passes through a grit pump, separator and washer before it is removed for disposal in a landfill; the wastewater from the headworks and grit tank then flows through a control structure into the aeration basins. The flow control structure can divert wastewater to the aeration basins, or to the aerated equalization basin, depending on flow conditions.

- Secondary Treatment
  - Aeration basins. Four rectangular aeration basins provide biological treatment to reduce the quantity of organic material and nutrients contained in the wastewater. Air is injected into the wastewater to promote the growth of microorganisms that feed on organic materials in the sewage.
  - Secondary clarifiers. The wastewater from the aeration basins is pumped through a flow-split structure and into the secondary clarifiers, where the wastewater is separated from the mixed liquor suspended solids. The two (2) secondary clarifiers, constructed as circular concrete tanks, allow the suspended heavier materials to settle to the bottom of the clarifiers as sludge. A portion of the settled solids is pumped to the Gravity Thickener as waste activated sludge (WAS), while the remaining portion is pumped back to the aeration tanks as return activated sludge (RAS). The secondary-treated water flows over the weirs of the clarifier and is then sent to the tertiary filters.
- Tertiary Treatment
  - Tertiary filter. The secondary-treated water from the clarifiers is pumped into the tertiary filter complex to produce the effluent (tertiary-treated water, also called recycled water). This filtering process removes the remaining suspended solids in the effluent. To prevent clogging, the solids that accumulate in the filters are occasionally flushed out during a backwash cycle and returned to the aeration basins. Several bypass channels exist in order to maintain plant operations during maintenance of the tertiary filter complex.
- Disinfection
  - Chlorine Contact Basin. The clear effluent from the tertiary filters enters one of two twin reinforced concrete basins, called the chlorine contact basin. The flow path through the basin provides a long enough contact time for the chlorine to destroy pathogenic organisms. After disinfection, the remaining chlorine is neutralized with sulfur dioxide. The effluent then flows into the effluent wet well, where it is pumped to the reclamation system or discharged to the San Pablo Bay through the Schell Slough.
- Solids Handling

- The excess sludge in the wastewater is pumped to a screw press where it is dewatered for disposal in a landfill. Filtrate water from the screw press is then sent back to the headworks for treatment.

- Storage Reservoirs
  - There are four off-site storage reservoirs. Three of the reservoirs are in use with a combined capacity of over 200 million gallons that are used to store the recycled water. There is a fifth storage reservoir, R5, which is located at the WWTP and has a storage capacity of 35 million gallons. The recycled water is used in the summer months for irrigation of local crops. Tertiary water that does not meet water-quality standards is diverted to equalization basins that can store up to 33 million gallons, where it is then pumped back to the headworks or to an aeration basin for subsequent treatment.
- Control Buildings
  - The WWTP Facility includes many buildings and structures including an administration building, a maintenance building, the Influent Pump Station, the RAS/WAS Pump Station, the Filter Control Building, the Blower Building, the Screw Press & Loadout Building, and a building that contains the chlorination facilities.

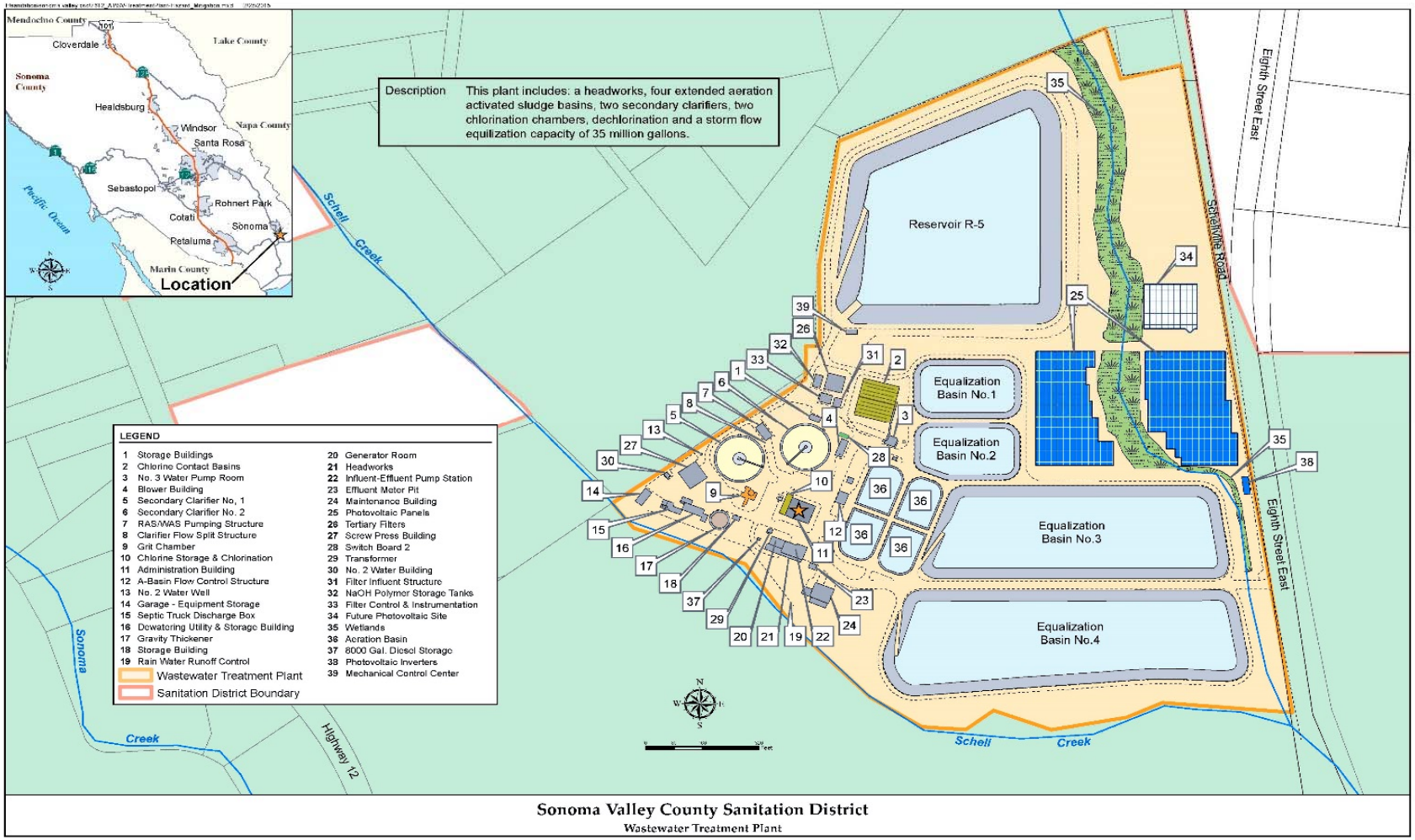



Figure 2: SVCSD WWTP

# 3. Planning Process

## 3.1 Plan Development Process

Recognizing its obligation to provide reliable sanitation services to the Public, the SVCSD embarked on a Natural Hazard Reliability Assessment (NHRA) to better evaluate the SVCSD's vulnerabilities to natural hazards. This assessment was initiated by the Water Agency's Department of Engineering and Resource Planning in 2013. The SVCSD contracted the services of GHD, Inc., a specialty engineering firm with expertise in the assessment of natural and man-made hazards and their impact on Sanitation facilities. The GHD team included G&E Engineering (specialists in structural/earthquake engineering), Kleinfelder Inc. (specialists in geotechnical engineering), and GHD wrote the NHRA (see Chapter 4). Throughout the course of the project key staff was involved in setting the course of the project, participated in meetings and reviewed drafts of the plan. Key staff included, Assistant General Managers, Deputy Chief and Principal Engineers, Wastewater Operation and Maintenance Coordinators, and Emergency Response staff.

### 3.1.1 Document Review

This plan has been developed through an extensive review of available information on hazards, Graphical Information Systems (GIS) databases, engineering drawings, reports for District's facilities, historic aerial photographs and available geotechnical and geologic data both from the District and outside sources, Sonoma County Water Agency Local Hazard Mitigation Plan, Sonoma County Hazard Mitigation Plan, Association of Bay Area Governments Multi-Jurisdictional Local Hazard Mitigation Plan for the San Francisco Bay Area, and FEMA 386 series of documents (See Chapter 8, References).

### 3.1.2 Public and Local Stakeholder Involvement

Public and local Stakeholder participation allow the SVCSD to obtain all relevant information necessary for identifying potential hazards, risks, and threats related to the SVCSD, prepare decision-makers and the community for potential future disasters, and provide critical input on what the communities priorities are during a natural disaster. The SVCSD has made an extensive effort to actively involve the Public and local Stakeholder in the planning and review of this Plan. Efforts included:

- June 4, 2013 Consultant Agreement went to the SVCSD Board of Directors with a description of the Plan
- June 9, 2014 Information about the Plan posted on the SVCSD's website
- Approximately 10,400 Sanitation newsletters were mailed to all SVCSD costumers in the Fall 2013,Spring 2014 and Fall 2014 with information about the Plan
- June 2014 and July 2014 electronic newsletters emailed to approximately 530 subscribers with information about the Plan
- June 20, 2014 Notices sent to 127 local Stakeholders announcing a meeting to go over initial findings for the Plan
- July 2014 Facebook post about the Plan posted on SCWA's website with approximately 560 friends
- July 2014 Twitter post about the Plan posted on SCWA's twitter account with approximately 2,800 subscribers

- July 15, 2014 Paid advertisement in the Sonoma Index Tribune newspaper announcing a Public meeting to go over initial findings for the Plan with approximately 5,100 copies distributed
- July 23, 2014 Presented information on the initial finding from the Natural Hazard Reliability Assessment at the Sonoma Valley Citizens Advisory Committee.
- November 2, 2015 Draft Plan published on the SVCSD's website for review and comment
- November 2, 2015 Notices sent out to local stakeholders about the publication of the Draft Plan

Documents related to Public and local Stakeholder involvement are included in Appendix B

### 3.1.3 Plan Adoption

This plan was formally adopted by the SVCSD's Board of Directors on December 15, 2015. The formal resolution of adoption is included in Appendix C.

# 4. Natural Hazard Reliability Assessment

## 4.1 Geologic and Seismic Hazard

### 4.1.1 General Background

In order to provide an assessment of the geologic and seismic hazards for the SVCSD for system-wide vulnerability identification, several resources were utilized. The scope included review of available published geologic and seismic literature and maps, review of selected unpublished consultant reports, review of aerial photographs (particularly Google Earth images) and a geologic reconnaissance along the entire system. The literature review provided the basis for a region-wide, broad-scale assessment of potential geologic and seismic hazards, and the geologic reconnaissance provided location-specific identification of existing and/or potential geologic hazards along the collection pipeline system and the Wastewater Treatment Plant (WWTP). This study did not include any subsurface exploration, sampling, laboratory testing or quantitative analysis of hazards.

#### 4.1.1.1 Regional Geology

The site is located within the Coast Range Geomorphic Province of Northern California. This province is generally characterized by northwest-trending mountain ranges and intervening valleys, which are a reflection of the dominant northwest structural trend of the bedrock in the region. The basement rock in the northern portion of this province consists of the Great Valley Sequence, a Jurassic (200 to 145 million years old) volcanic ophiolite sequence with associated Jurassic to Cretaceous (200 to 65 million years old) sedimentary rocks and the Franciscan Complex, a subduction complex of diverse groups of igneous, sedimentary and metamorphic rocks of late Jurassic to early Tertiary age (161 to 34 million years old). The Great Valley Sequence was tectonically juxtaposed with the Franciscan Complex most likely during subduction accretion of the Franciscan, and these ancient fault boundaries are truncated by a modern right-lateral fault system that includes the San Andreas, Hayward-Rodgers Creek and Maacama and West Napa faults. The San Andreas Fault defines the westernmost boundary of the local bedrock

and is located approximately 22 miles southwest of the SVCSD. In the site vicinity, the Franciscan Complex is overlain by Tertiary age continental and marine sedimentary and volcanic rocks. These Tertiary age rocks are locally overlain by younger Quaternary alluvial, colluvial and landslide deposits.

#### 4.1.1.2 Local Geology

The local geology has been mapped by Huffman and Armstrong (1980) and Graymer, et al. (2002, 2007). These references generally agree that the majority of the site and vicinity is underlain by Pleistocene and Holocene alluvium. In the northern and northeastern portion of the collection system, localized areas are underlain by either early Pliocene to late Miocene Sonoma Volcanics (andesite, basalt, rhyolite flows and tuff) or early Pleistocene to Pliocene Glen Ellen or Huichica Formation bedrock (claystone, sandstone siltstone and gravel). That part of the Graymer, et al. (2002, 2007) maps that includes the site is presented as Figures SV-2 through SV-11. In addition, landslide deposits have been mapped locally on slopes adjacent to the northern portion of the system. Most of the elevated portions of the system have been designated by Huffman and Armstrong (1980) as having a high susceptibility to landsliding; however, the overwhelming majority of the system is shown to have a low susceptibility to landsliding due to its location within the flatter valley floor.

The alluvial deposits in the vicinity have been further separated into distinct Quaternary deposit designations by Witter, et al. (2006). That portion of the Witter, et al. (2006) map that includes the site is presented as Figures SV-12 through SV-21.

### 4.1.2 Earthquake Hazard

There are five primary hazards induced by earthquakes:

- Ground Shaking
- Liquefaction
- Creek Hazards
- Landslide
- Surface Faulting

To varying extents, the SVCSD wastewater system is exposed to three of these five hazards (ground shaking, liquefaction, and creek hazards). For purposes of the Hazard Assessment, the quantification of these hazards is described as follows:

- Ground shaking. Section 4.1.2.2 describes how ground motion shaking will affect the wastewater treatment plant, pump stations and collection pipelines. For WWTP facilities and buildings, the ground shaking hazards are best quantified in terms of Peak Ground Acceleration (PGA) with accompanying response spectral shape. PGA is reported as a percentage, or decimal, of gravity (g). For the buried pipe network, the ground shaking hazard is best quantified in terms of Peak Ground Velocity (PGV).
- Liquefaction. Section 4.1.2.3 describes how the strength and stiffness of soils are reduced by earthquake shaking, and how that affects the SVCSD collection system and WWTP facilities, in terms of liquefaction and lateral spreading. Areas at risk of liquefaction were determined from liquefaction susceptibility maps.

- Creek Hazards. Section 4.1.2.4 describes how sewer mains and service laterals at creek crossings can be damaged during earthquakes. Locations of main creek crossings were provided for analysis.
- Landslide. Section 4.1.2.5 describes the landslide hazard and quantifies how it is treated within context of this report.

  Surface Faulting. Discussed in Section 4.1.2.6, the likelihood of surface rupture occurring within the SVCSD is very low. As of 2014, there are no known active faults that transverse the SVCSD.

#### 4.1.2.1 Seismology

Based on its record of historic earthquakes and its position astride the North American - Pacific plate boundary, the San Francisco Bay region, within which the SVCSD is located, is considered to be one of the more seismically active regions of the world. During the historical period (approximately 170 years), faults within the region have produced 14 moderate to large magnitude (M > 6) earthquakes affecting the Bay Area, as well as many significant smaller magnitude (5 < M < 6) earthquakes (Toppozada et al., 1979; Toppozada et al., 1981; and Real et al., 1978). Faults within the 100 km (62-mile) wide North American - Pacific plate boundary zone that may influence potential earthquake ground shaking and other earthquake-related hazards within the SVCSD area are illustrated in Figure 3.

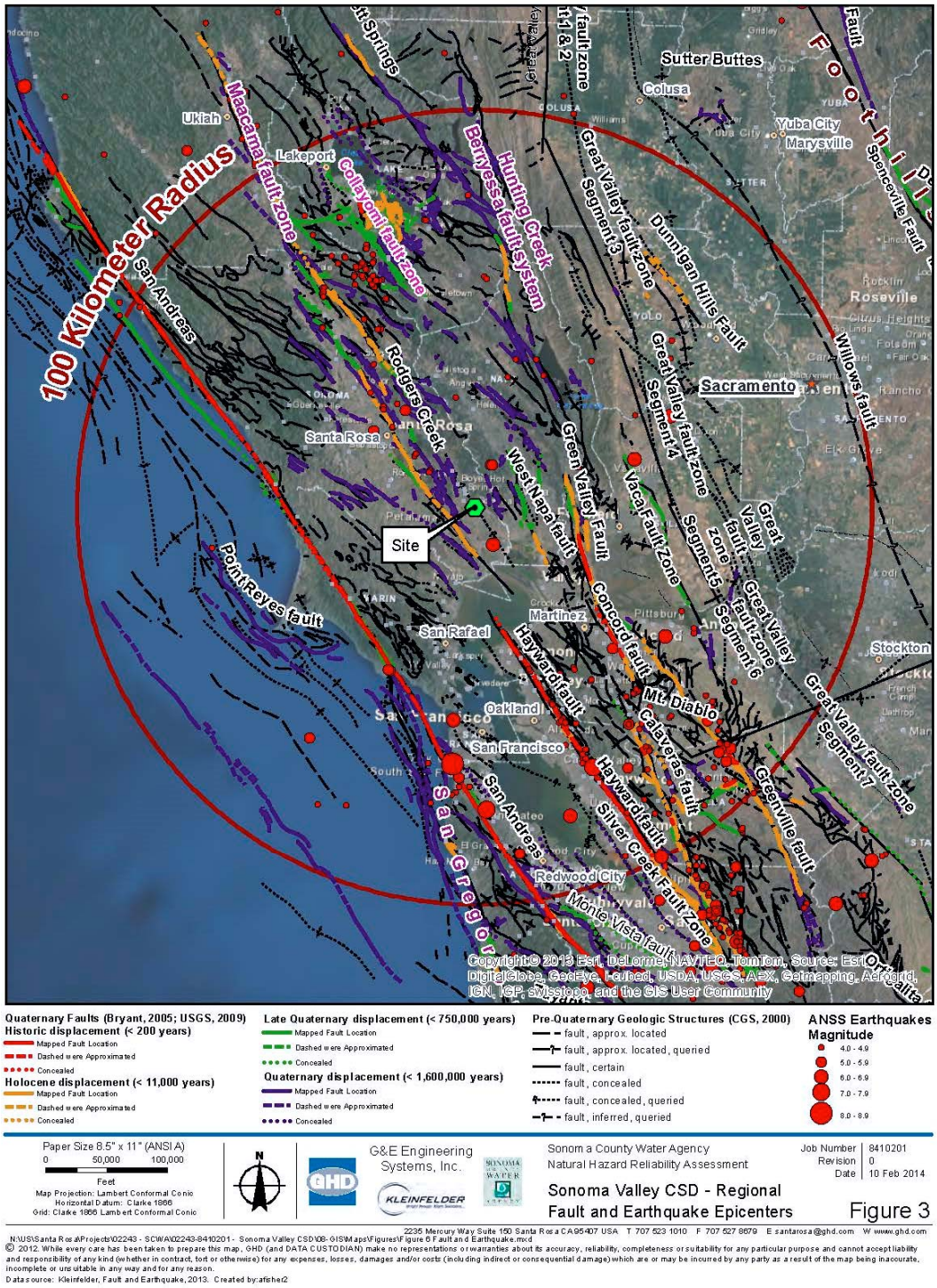



Figure 3: SVCSD Fault and Earthquake Epicenters

#### 4.1.2.2 Ground Shaking Hazard

Among the historically active regional faults, those anticipated to have potential significance to the performance of the SVCSD wastewater facilities include the following:

- San Andreas
- Rodgers Creek - Healdsburg Fault
- Hayward Fault
- Calaveras Fault

Detailed characterizations of these sources have been conducted during seismic evaluations of Caltrans bridges in the San Francisco Bay Area (ref. Geomatrix, 1993). Brief discussions of each of these sources are presented in the following paragraphs. Unless otherwise noted, magnitude (M) refers to moment magnitude.

**San Andreas Fault**. The San Andreas Fault is situated about 24 miles to the southwest of the SVCSD WWTP. The San Andreas Fault, which extends over 750 miles from the Gulf of California to Cape Mendocino, is the major fault within the region and has generated four moderate to large earthquakes during the historical period (approximately 170 years): a M 7 event in June 1838, the great M 8 earthquake in April 1906, a M 6.3 event in October 1965, and the recent M 6.9 Loma Prieta earthquake on October 17, 1989. The Southern Santa Cruz Mountains segment of the San Andreas Fault, on which the Loma Prieta earthquake is thought to have occurred, is situated about 62 miles south of the SVCSD. The Working Group on California Earthquake Probabilities (Working Group 2003) has estimated that during the 30 year time period between 1990 and 2020, there is a 23 percent probability of a M 7 or larger earthquake occurring on the San Francisco Peninsula segment of the San Andreas Fault (which extends northward from the Loma Prieta rupture segment), and less than 5 percent probability of a M 8 earthquake along the north coast segments of the fault. More recent work (Working Group 2003) by the U.S. Geological Survey (USGS) has confirmed that these probabilities are still considered suitable. The maximum earthquake for the San Andreas Fault is judged to be in the range of M 7.75 to M 8 (moment magnitude); recent work (Niemi and Hall, 1992) indicates that on the average, an event of such magnitude can be expected to occur approximately every 200 to 300 years.

There are no traces of the San Andreas Fault that traverse or bisect any of the SVCSD pipelines. The San Andreas Fault more or less parallels the northwest trend of the SVCSD collection system, typically located about 22 miles southwest of the westerly side of the system, 24 miles to the WWTP, or about 26 miles southwest of the easterly side of the system.

**Rodgers Creek - Healdsburg Fault**. The Rodgers Creek - Healdsburg fault is a major component of the San Andreas Fault system in the Bay Area and extends from San Pablo Bay in the south to about Santa Rosa in the north. The fault extends to the Healdsburg Fault in the north. It is well-defined locally by numerous sag ponds and linear trends in the topography. The Rodgers Creek - Healdsburg fault is interrupted in places by landslide topography and may consist of a zone of en echelon faults. The fault runs through the hills immediately west of the City of Sonoma. The fault is considered capable of M 7 events, and if the fault breaks at the same time as the Hayward Fault to the south (considered less likely), as high as a M 7.2 to M 7.4 earthquake can occur.

There are no traces of the Rodgers Creek Fault that are known to traverse or bisect any of the SVCSD pipelines. However, the fault more or less parallels the northwest trend of the SVCSD collection system, which is typically located about 2.5 miles to the west of the westerly side of the system (about 4 miles to the WWTP, or about 5 miles west of the easterly side of the system). Any earthquake on the Rodgers Creek Fault with M 6.25 or larger is likely to produce surface rupture in Sonoma County; although a surface rupture can occur in Sonoma County, surface rupture would not occur within the SVCSD.

The Working Group on California Earthquake Probabilities (Working Group 2014) has estimated that during a 30 year time period following 2014, there is a 32 percent probability of a M 6.7 or larger earthquake occurring along the Rodgers Creek Healdsburg Fault. For preliminary planning purposes, a Rodgers Creek M 7 might be assumed to occur within the next 100 to 300 years. Even higher magnitude events are considered possible, especially if the Rodgers Creek - Healdsburg and Hayward faults break in the same event, although the return period for such events is likely in excess of 1,000 years. For the SVCSD system, the Rodgers Creek event is considered controlling. A larger magnitude event on the more distant San Andreas Fault or an earthquake on the relatively nearby West Napa Fault are not likely the controlling events, for the SVCSD.

**Hayward Fault**. The Hayward Fault is situated about 15 miles to the south of the SVCSD WWTP. The Hayward Fault is a major component of the San Andreas Fault system in the Bay Area and extends approximately 71 miles from its intersection with the Calaveras Fault southeast of San Jose and northward through and along the East Bay hills to San Pablo Bay. It has been suggested on the basis of micro-seismicity data that the Hayward Fault may connect with the Rodgers Creek-Healdsburg Fault beneath San Pablo Bay (Ellsworth et al, 1982), although such a connection requires an en echelon jump between the faults. It is commonly postulated that there are two potential rupture segments for the Hayward Fault: a southern segment extending from Warm Springs (Fremont) to the San Leandro-Mills College area (or perhaps as far north as northern Oakland), and a northern segment extending from the this transition point to San Pablo Bay. The southern segment has been the source of a large (M 6.8) earthquake during the historical period (October 1868). The Working Group (2008) has estimated that during the 30 year time period from 2006 to 2036, there is a 31 percent probability of a M 6.7 (or larger) earthquake occurring on the Hayward Fault. The maximum earthquake for the Hayward Fault is judged to be in the range of M 7 to M 7.25; the average recurrence of such events is estimated to be approximately 150 to 250 years.

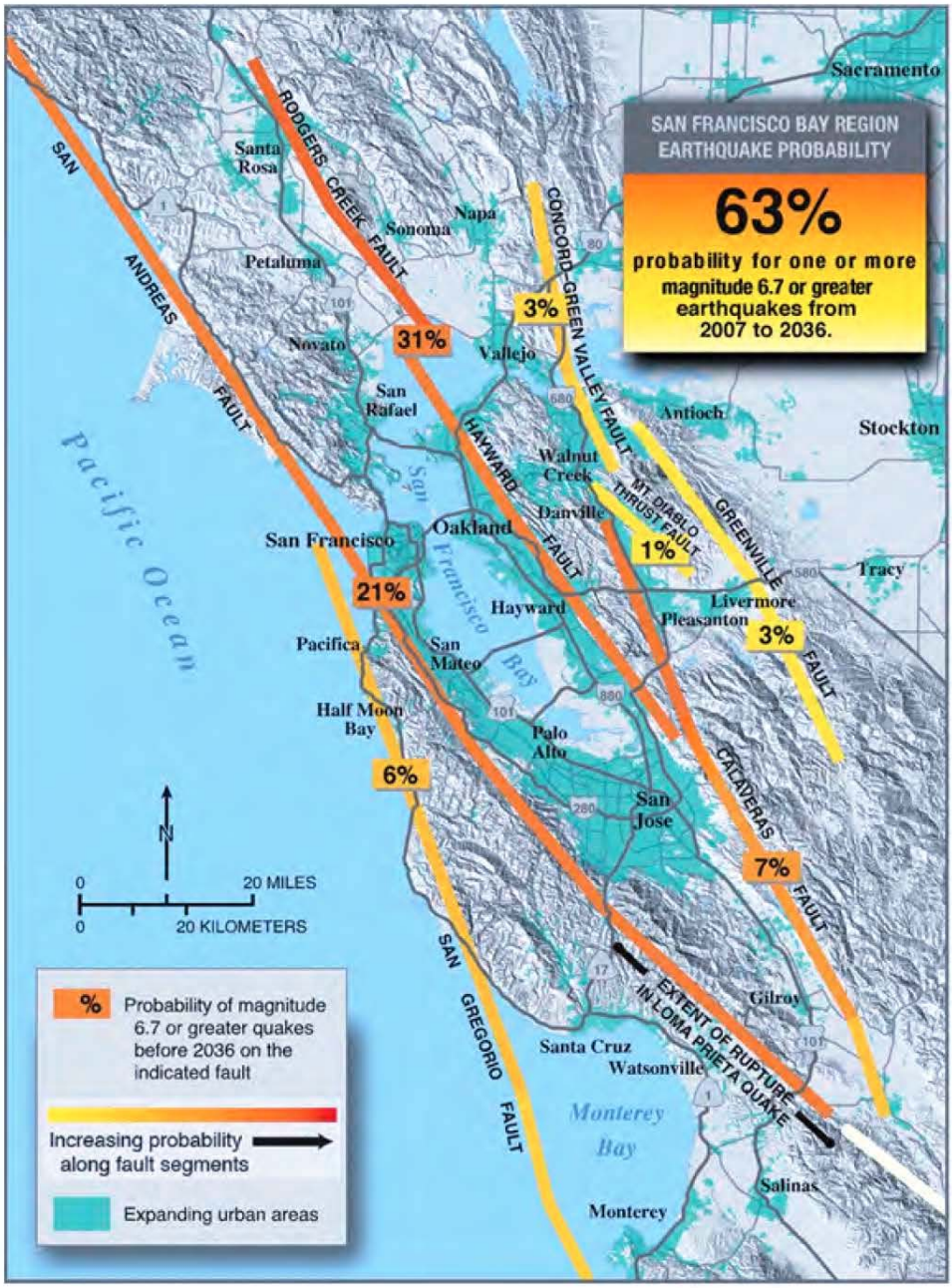
**Calaveras Fault**. The Calaveras Fault is situated about 37 miles to the southeast of the SVCSD WWTP. The approximately 75 miles long Calaveras Fault extends from south of Hollister to near Danville in Contra Costa County. The fault has been associated with the historical earthquakes of M 5.6 (July 1861), M 5.6 (March 1866), M 6.2 (June 1897), M 5.8 (July 1899), M 6.6 (July 1911), M 5.8 (August 1979), M 6.2 (April 1984) and M 5.1 (February 1988). The maximum earthquake for the Calaveras Fault is judged to be in the range of M 6.75 to 7; the average recurrence of such events is estimated to be approximately 150 to 300 years.

**Other Faults**: As shown in Figure 3, there are a number of other faults in the San Francisco Bay Area that could potentially impact the SVCSD. Of those not already mentioned above, the Green Valley, Concord, Napa, and Healdsburg Faults are a few of the more active and capable of large magnitude earthquakes. The Green Valley Fault is located about 12 miles to the east. The West

Napa Fault is located about 6 miles to the east, and is thought to be source for the 2000 Napa earthquake that produced PGA of about 0.2g in the City of Napa, damaged chimneys in Napa, and damaged more than 20 buried water pipes in Napa (Eidinger, 2000). The recent 2014 M 6.0 earthquake occurred on the West Napa Fault and resulted in extensive surface rupture and building and infrastructure damage in the Napa area, but relatively minor damage in the Sonoma Valley. Additionally, the Healdsburg Fault is nearby, active, and has contributed to several moderate sized earthquakes in Sonoma County over the past century.

**Controlling Event**: Given the location and potential magnitudes possible from these faults, it is apparent that an M 7 event on the nearby Rodgers Creek Fault will produce the highest levels of ground shaking in the SVCSD. An M 8 event on the more distant San Andreas Fault will produce lower levels of shaking in the SVCSD, but the duration will last longer than from a Rodgers Creek M 7 event. Although the duration of an event may be important for liquefaction, the close proximity of the Rodgers Creek Fault will still result in more liquefaction in SVCSD than an M 8 event on the more distant San Andreas Fault.

Figure 4 shows a map of the major faults in the San Francisco Bay area with associated probabilities of occurrence by the year 2036 (Working Group, 2008).




Paper Size 8.5" x 11" (ANSI A)

Map Projection: Lambert Conformal Conic
Horizontal Datum: Clarke 1866
Grid: Clarke 1866 Lambert Conformal Conic

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

Sonoma Valley CSD
Earthquake Probabilities

Job Number 8410201
Revision 0
Date 10 Feb 2014

Figure 4

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© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Kleinfelder, Fault and Earthquake, 2013. Created by: afisher2

Figure 4: SVCSD Earthquake Probabilities

The common seismic design philosophy for earthquakes at the time when many of the SVCSD wastewater system facilities were built (pre-1970) was to design for a Uniform Building Code base shear value (V) that is 14% of the effective seismic weight (W) (V = 0.14W), implying a design for reasonable structural performance of reasonably well-detailed buildings for ground motions of approximately PGA = 0.25g. Common design codes (such as the 1997 IBC code) require design of new buildings to the 475-year motions. The most recent code for buildings, the IBC 2012, specifies that new buildings should be designed for 2/3 of the 2,475 year motion, or about 0.5g to 0.8g within the SVCSD service area.

The potential level of ground shaking is evaluated in several ways. First, a probabilistic design motion is assumed, using common code-type assumptions, with return periods of 475, 975 or 2,475 years. Nearly all SVCSD facilities are on soils, ranging from thin layers of firm soil to deep layers of relatively softer soils. Following the USGS 2002 National Seismic Hazard Model, Table 2 lists the motions at locations best characterized as rock (with time-averaged shear-wave velocity in the top 30m of Vs30 = 760 m/sec), and is suitable for portions of the collection system that traverse volcanic rock.

### Table 2: Probabilistic Ground Motions (Horizontal PGA for NEHRP Class B)

| Facility Name | PGA 475 Years | PGA 975 Years | PGA 2475 Years |
|---|---|---|---|
| Sonoma Valley WWTP | 0.45 | 0.57 | 0.72 |

Another approach to establish the ground motions is to presume occurrence of a specific earthquake, and then select a suitable non-exceedance level. For SVCSD, the governing earthquake is a magnitude 7 event on the nearby Rodgers Creek Fault (RC M 7). A magnitude 7 earthquake is expected to be the near maximum possible earthquake on the Rogers Creek Fault, over the next thousand to two thousand years. A Vs30 of 450 m/sec (stiffer soil site) or 250 m/sec (softer soil site), strike-slip fault was assumed for the SVCSD.

Tables 3 through 6 provide the expected horizontal ground motion at the surface using Vs30=450 m/sec. As shown, the average PGA = 0.42g value is based on median motion for a RC M 7 event (Table 3). The 0.74g value is based on 84th percentile motion for a RC M 7 event (Table 4). A PGA of 0.4g is a historical value that is commonly used for structures built under older seismic codes; the WWTP facilities in SVCSD is assumed to be designed using PGA=0.4g. These PGA values were used for the vulnerability assessment for the SVCSD infrastructure in Chapter 4.5.

### Table 3: Deterministic Motions, Median, Vs30 = 450 m/sec, Median

| Seismic Parameter | ASK13 | I13 | CY13 | CB13 | BSSA13 | Average |
|---|---|---|---|---|---|---|
| PGA (g) | 0.31 | 0.60 | 0.42 | 0.41 | 0.38 | **0.42** |
| PGV (cm/sec) | 48.78 | 52.34 | 67.71 | 51.52 | 43.92 | **52.85** |

### Table 4: Deterministic Motions, Median, Vs30 = 450 m/sec, 84th

| Seismic Parameter | ASK13 | I13 | CY13 | CB13 | BSSA13 | Average |
|---|---|---|---|---|---|---|
| PGA (g) | 0.56 | 1.16 | 0.61 | 0.68 | 0.71 | **0.74** |
| PGV (cm/sec) | 92.13 | 111.91 | 79.03 | 91.69 | 84.25 | **91.80** |

Table 5: Deterministic Motions, Median, Vs30 = 250 m/sec, Median

| Seismic Parameter | ASK13 | I13 | CY13 | CB13 | BSSA13 | Average |
|---|---|---|---|---|---|---|
| PGA (g) | 0.29 | N.A. | 0.42 | 0.35 | 0.37 | **0.36** |
| PGV (cm/sec) | 70.51 | N.A. | 106.15 | 57.29 | 52.40 | **71.59** |

Table 6: Deterministic Motions, Median, Vs30 = 250 m/sec, 84th

| Seismic Parameter | ASK13 | I13 | CY13 | CB13 | BSSA13 | Average |
|---|---|---|---|---|---|---|
| PGA (g) | 0.49 | N.A. | 0.57 | 0.54 | 0.65 | **0.56** |
| PGV (cm/sec) | 131.94 | N.A. | 165.18 | 96.97 | 96.95 | **122.76** |

For purposes of evaluating system performance, it is recommended to use the average values (right most columns of Tables 3 through 6). Responses should be determined for both median and 84th percentile levels, in order to get the best estimate for emergency planning purposes.

Lacking site-specific subsurface data, it is recommended to use the Vs30 = 250 m/sec values for pipes at creek crossings and suspected deeper soil sites, and the Vs30 = 450 m/sec values at all other sites.

In a few locations along the boundaries of Sonoma Valley, the local soils near the surface are best characterized as volcanic. For these locations, the ground motions in Table 2 are applicable.

For design of future SVCSD facilities (including buildings, vaults, pump stations, tanks and small (under 5 MG) reservoirs), it is recommended that the seismic motions be based on the rightmost column of either Table 5 (firm soil sites) or Table 6 (deeper soft soil site). For sites underlain by rock (Vs30 of 760 m/sec or higher), the PGA values will be higher and the PGV values will be smaller than those in Table 5.

For design of future new buried pipelines, it is recommended that the 475-year (all pipe 12" and smaller) or 975-year motions (all pipe 15" or larger) be used, coupled with the provisions of ALA (2005).

Considering that most of the SVCSD system is located within approximately 5 miles of the active Rodgers Creek fault, the following approximation is used for consideration of vertical ground motions. The vertical response spectrum may be taken as equal to the horizontal spectrum for periods less than 1 second, or ½ the horizontal spectrum for periods greater than 2 seconds, and linearly interpolated for intermediate periods. Alternately, the vertical spectrum can be calculated using suitable vertical attenuation models. Simplifying assumptions such as the vertical spectrum = 2/3 the horizontal spectrum shall not be used for any facility in the SVCSD wastewater system.

#### 4.1.2.3 Liquefaction Hazards

Liquefaction describes a condition in which saturated soil loses shear strength and deforms as a result of increased pore water pressure induced by strong ground shaking during an earthquake. Dissipation of the excess pore water pressures will produce volume changes within the liquefied soil layer, which causes settlement. Factors known to influence liquefaction include soil type, structure, grain size, relative density, confining pressure, depth to groundwater and the intensity and duration of ground shaking. Soils most susceptible to liquefaction are saturated, loose sandy soils, and low plasticity clays and silts. If liquefaction occurs, pipelines above the liquefiable layers may undergo settlement. Within liquefiable soils, a pipeline can become buoyant or lose support

and settle if it is not buoyant. The degree of buoyancy or settlement will be affected by the fines content of the soil. More fines generally result in less susceptibility to buoyancy and settlement due to the residual soil strength that may be present.

Lateral spreading is a term describing the permanent deformation of sloping ground that occurs during earthquake shaking as a result of soil liquefaction. Depending on depth to liquefiable layers and slope geometry (free-face gradient and height), deformations can range from millimeters to several meters, with the greatest displacements usually occurring near free-faces, such as creek banks. Therefore, structures and pipelines adjacent to bodies of water are usually at the greatest risk of experiencing damage due to lateral spreading.

Sonoma Valley is a northwesterly trending syncline bounded on the northeast by the Mayacamas Mountains and on the southwest by the Sonoma Mountains. The valley is underlain by unconsolidated alluvial deposits of gravel and clay mantled by soil cover. The alluvial deposits are underlain by claystones and siltstones. The majority of the SVCSD system is located within older alluvial deposits or bedrock that has been categorized as having a very low liquefaction potential. The central portion of the collection system, from Glen Ellen to Sonoma, has been categorized as having a moderate to high liquefaction susceptibility. Several line segments cross through relatively narrow zones along Sonoma Creek, which has very high liquefaction susceptibility.

Areas that are categorized as having high or very high liquefaction susceptibility and that are located adjacent to creek banks should also be considered to have a high susceptibility for lateral spreading. Because lateral spreading is dependent on the liquefaction susceptibility as well as the distance from, and the height of a particular creek bank, it is not possible to determine how far away from the creek banks the effects of lateral spreading may occur. For the purpose of the preliminary vulnerability assessment, collection segments/improvements within 200 feet of creek banks with high or very high liquefaction susceptibility (and underlain by such deposits as shown on the liquefaction mapping in Appendix A), should be considered to have a high lateral spread susceptibility as well.

There is also an increased vulnerability for pipeline segments that cross boundaries of geologic deposits/materials to have drastically different liquefaction susceptibilities. This is mainly due to the differential movements that would occur in each of these deposits relative to the other deposits. As such, segments that cross from very low susceptibility zones into very high susceptibility zones would have the greatest risk for differential settlement due to liquefaction, and hence potential for pipeline damage or rupture.

Witter, et al. (2006) have produced a liquefaction susceptibility map that includes the SVCSD system locations; the information from the Witter (2006) map was extracted and presented as Figures SV-22 through SV-31, with SVCSD facilities shown as a separate layer. Areas in red have "Very High" liquefaction susceptibility; orange areas have "High" liquefaction susceptibility; yellow areas have "Moderate" liquefaction susceptibility; green areas have "Low" liquefaction susceptibility; and transparent areas have "Very low (none) – not mapped" liquefaction susceptibility. The map shows that the "High" and "Very High" zones are concentrated next to active creeks, including the main Sonoma Creek and its tributaries. From a pipeline point of view, the main issues will be:

- Pipes in the red (Very High) and orange (High) zones. These zones can liquefy locally when PGA > 0.15g, or liquefy over major areas when PGA > 0.5g.

- Non-seismically-designed pipes in the liquefied zones that are located within 200 feet of an open cut/slope, where lateral spread is possible, will suffer great amounts of damage.
- Pipes outside of the shaded zones (transparent) and marked VL are generally not susceptible to liquefaction.
- Pipes in the yellow zones might be locally susceptible to ground settlements under very strong ground shaking (PGA > 0.3g), but damage will be sporadic.

For purposes of evaluating the seismic performance of the system, it is recommended to use the local soil characterizations first, and then the regional liquefaction maps.

As shown in the Figures SV-22 through SV-31 it can generally be seen that:

(1) Most pipes within the vicinity of the creeks are in zones with moderate liquefaction susceptibility with some pipes in areas of high susceptibility.

(2) Pipes crossing and running parallel to Sonoma Creek are in zones of moderate and high liquefaction susceptibility.

(3) Most collection pipes west of Sonoma Creek are in zones with moderate liquefaction susceptibility.

As part of the vulnerability analysis, a listing and identification of pipelines generally larger than 12 inches was completed to specifically identify those pipes that are located in moderate to very high liquefaction susceptibility areas as seen in Figures SV-22 through SV-31. These pipes were evaluated to determine the extent of the vulnerabilities to the collection system in specific areas and to prioritize areas for mitigation.

The SVCSD WWTP, which is located on 8th Street East at the south end of the system, has been mapped as being underlain by late and early Pleistocene age, older alluvium with a very low liquefaction susceptibility. Several consultant investigations have been conducted at the WWTP through the last several decades. These studies generally agree with a designation of low liquefaction potential; however, thin isolated lenses of potential liquefiable sand deposits have been identified locally at the WWTP. The general consensus is that there could be isolated cases of liquefaction, generally resulting in settlements of less than ½ inch. A zone of high liquefaction susceptibility has been mapped immediately adjacent to the southwest boundary of the site along the creek. Liquefaction and/or lateral spreading in this area could adversely affect improvements in this corner of the WWTP. Some of the previous consultant studies have identified a boundary between more and less compressible subsurface geologic deposits within the southwestern portion of the site as well. Most investigations at this site have demonstrated a relatively high (seasonal) groundwater table, varying between 1.5 to 15 feet below existing ground surface.

#### 4.1.2.4 Creek Hazards

As previously described, the creeks pose hazards to the collection pipes, both because of their propensity to have softer soils and soils prone to liquefaction, as well as the consequences should the pipe fail (i.e. release of raw sewage into a sensitive environment). Figures SV-2 through SV-11 show the locations of the main creek crossings. In these figures, the heavy blue lines are the mapped locations of the creek centerlines, the thin green lines are the SVCSD sewers, and the stars indicate areas where segments of the sewers cross a creek. It can be seen

in the figures that there are numerous creek crossings within the SVCSD collection system that pose potential hazards.

Geologic reconnaissance was completed along the SVCSD collection system in order to identify location-specific geologic hazards in addition to regional seismic-related liquefaction hazards. Location-specific hazards include areas of static or seismically-induced landsliding/creek bank failures, erosion or drainage flow debris impact hazards and differing structural connection and support issues at creek crossings. Eleven location-specific areas have been identified and are shown on Figures SV-2 through SV-11. Generally, the geologic hazards identified include areas where:

(1) Creek bank failures were observed where static and embankment failure (landslide) potential exists with possible damage to mains, manholes and laterals.

(2) Sewer mains suspended from bridges have potential damage during a seismic event due to shaking and/or differential settlement of the structure.

(3) Sewer mains extended through culverts, bridge abutments or located near thalweg of creeks where the potential for debris build up during high creek flows and damage to the main.

#### 4.1.2.5 Landslide Hazards

Earthquakes can trigger landslides. Landslides of most concern to the wastewater system are deep-seated slides that cause rotation slumps to the top 5 to 30 feet of soils. These movements, also called lateral spreads, can result in inches to several feet of downslope movements of streets. Pipes in these streets will be highly stressed. Unless specifically designed for large lateral movements, most pipelines will break under lateral movements of more than a few inches.

Existing records do not indicate landslide movements in and near the hillside portions of the SVCSD wastewater system. During a site visit to the WWTP in August 2013, the SVCSD staff reported that they do not know of any pipelines affected by landslides, however, damages to pipelines due to landslides may have gone unnoticed.

The prevalence of earthquake-triggered landslides will be highest when the underlying hillside soils are saturated. While earthquakes are not dependent on seasons, the amount of ground failures, given an earthquake, will often be dependent on season. In particular, if the earthquake occurs when the ground is saturated/high ground water table (winter season), then there will be more triggered landslides and liquefaction. In the SVCSD service area, soils become saturated on an annual basis, once there has been sufficient winter rains. In a typical winter season, soils become saturated near the end of December, and remain saturated until April. Regional-scale landslide maps, including Wills et al 2011, prepared using slope and regional geologic parameters, are not considered sufficiently accurate or otherwise adequate to establish landslides at any specific SVCSD pipeline location. In addition, no site specific geologic or geotechnical investigations have been performed as part of this effort; however, such investigations can be implemented in the future in order to provide improved estimates of landslide susceptibilities and probabilities.

#### 4.1.2.6 Surface Faulting

Surface faulting, also known as surface rupture, occurs if movement of an earthquake causes a crack to form from the fault line to the ground surface. Not all faults intersect Earth's surface, and most earthquakes do not cause a rupture to the surface. When a fault does intersect the surface, objects may be offset or the ground may become cracked, or raised, or lowered. Because there are no active faults that traverse the SVCSD, surface faulting is not evaluated in the vulnerability assessment.

### 4.1.3 Ground Motions in Sonoma County During Past Earthquakes

Sonoma County has undergone a number of earthquake events over the recorded history of the past 170 years. A summary of the issues experienced in Sonoma County from these earthquakes are highlighted below (note that both the terms “intensity” and “magnitude M” were used to describe ground motions*). It should be recognized that the modern Sonoma Valley wastewater system was only put in place after 1957.

- 1865 March 8, 6:00 a.m. Intensity VIII at Santa Rosa and upper Bennett Valley. Plaster cracked, clocks stopped, and chimneys fell.
- 1868 October 21, 7:53 a.m. The Hayward Earthquake. Maximum intensity X at Hayward. Surface breakage was observed on the Hayward fault from Warm Springs to San Leandro. The shock was perceptible over an area of roughly 100,000 square miles. At Santa Rosa, the earthquake was reported as the "severest shock yet felt." Nearly all brick buildings in town were damaged and many chimneys demolished.
- 1888 February 29, 2:50 p.m. Intensity VII at Petaluma, where walls cracked; VI at Santa Rosa, where the shock was violent and people reportedly ran out of houses.
- 1891 October 11, 10:28 p.m. Maximum intensity VIII to IX at Napa and at Sonoma, where people were shaken out of their beds, chimneys demolished, windows broken, and considerable damage to plaster occurred. At Santa Rosa, one observer reported the shock as the "severest in four years" (presumably a recollection of February 29, 1888); the oscillations lasted 45 seconds; slight trembling perceptible for 3 or 4 minutes.
- 1892 April 19, 2:50 a.m. Intensity IX to X at Vacaville, Dixon, and Winters. The Holden catalogue (1898) estimated the intensity was VII at Santa Rosa, where many windows were broken, some plaster was damaged, and "panic prevailed at hotels."
- 1892 April 21, 9:43 a.m. Large aftershock of the foregoing earthquake on April 19, 1892. Maximum intensity IX at Winters. At Santa Rosa (VII) many brick buildings were cracked,

* In reviewing the historical record of ground motions, the terms Intensity (MMI scale), Magnitude (Moment magnitude unless otherwise noted) and PGA (Peak Ground Acceleration) are used. Instrumentation to measure PGA was generally non-existent prior to about 1940. Intensity scales were commonly used for earthquakes pre-1960. Intensity is a measure of observed damage; PGA is a measured value of ground motion. It is not straightforward to assign PGA values to older earthquakes, as there is no precise conversion from PGA to MMI.

more plaster damage occurred, two brick walls slightly bulged out, iron columns shifted, and in some parts of town, chimneys were wrecked.

- 1893 August 9, 1:15 a.m. Sonoma County, VII to VIII at Santa Rosa, where this was said to have been the most severe shock since 1868. Chimneys fell and windows were broken. The plaster in the courthouse was extensively damaged.
- 1898 March 30, 11:43 p.m. The Mare Island Earthquake (intensity VIII). At Santa Rosa, the vibrations lasted fully one and three-quarters minutes. Heavy plate glass windows in many business houses were broken; throughout the city, plaster was shaken from walls and ceilings.
- 1899 October 12, 9:00 p.m. Maximum intensity VII to VIII at Santa Rosa, where plaster was knocked from walls and some chimneys fell.
- 1906 April 18, 5:12 a.m. Moment Magnitude 7.8. One of the greatest shocks on record in California; caused by movement of the San Andreas Fault from San Benito County to Humboldt County. Maximum fault offset was a 21-foot horizontal shift near the head of Tamales Bay. Extensive damage at San Francisco, Santa Rosa, San Jose, Sebastopol, and many other places. In the opinion of Townley and Allen, Santa Rosa, 20 miles from the San Andreas Fault, sustained more damage, in proportion to its size, than any other city in the state. The duration of strong ground shaking was about 45 to 60 seconds. This earthquake exposed the then small city of Santa Rosa water system to strong ground shaking. There was one fire ignition reported in Santa Rosa.

Mercalli Intensity X (intense ground shaking with some ground failure) was noted in Santa Rosa. Simulation models by the USGS for a repeat of the 1906 event show additional intensity in Santa Rosa than would otherwise be predicted using common attenuation models, owing to the basin and other effects.

- 1906 to 1968. Many smaller earthquakes felt in Santa Rosa, the strongest being in 1919, 1929, and 1956. With the possible exception of the earthquake at 2:39 p.m. on February 25, 1919 (intensity VI), none was as severe as the earlier shocks in this tabulation. Seismic activity of interest to the residents of Santa Rosa was clearly at a much lower level throughout the 62 years following the major shock of April 18, 1906, than it had been in the 41 years preceding that event.
- 1968 April 25, 11:49 a.m. Epicenter 36° 28'N, 122° 40'W. Magnitude 4.6. This earthquake, with the epicenter just north or northwest of Santa Rosa, damaged some chimneys, broke windows, and rotated or overturned a number of tombstones. Maximum intensity VIII, at Santa Rosa.
- 1969 October 1, 9:56 p.m. and 11:20 p.m. Two earthquakes, magnitudes 5.6 and 5.7, respectively. Epicenters 38° 28'N, 122° 41.5'W, and 38° 27.3'N, 122° 41.5'W, respectively. Extensive light damage in the Santa Rosa area, where some chimneys fell, many windows broken, and a half-dozen frame houses with shifted or overturned foundations. Partial collapse of several brick building walls occurred, and minor structural damage was noted in one reinforced concrete building. There was damage to the Santa Rosa water system, and cracks in the Lake Raphine Dam. Some minor ground cracking occurred on the northeast

edge of Santa Rosa. One fire ignition occurred in Santa Rosa. The fault is thought to have occurred in a step-over between the Rodgers Creek and Healdsburg Faults.

Between 1969 and 2013, ground shaking in Sonoma County was relatively quiescent, with light levels of shaking in the 1989 Loma Prieta M 6.9 earthquake, and the 2000 Napa M 5.2 earthquake. In Napa, the 2000 earthquake damaged more than 20 buried water pipes, and knocked down many chimneys (see Eidinger, 2001, for a complete report on the Napa 2000 earthquake).

On August 24 2014, a M 6.0 earthquake occurred on the West Napa fault. This earthquake was located about 20 km east of Sonoma Valley. Ground motions in most of Napa exceeded PGA > 0.2g (places directly over the fault as high as PGA 0.6g). Preliminary review shows that there were more than 110 water pipe failures, or a failure of about 0.5 repairs per km of water pipe for the City of Napa; damage data for the sewer system is still being collected. There was no known damage in Sonoma Valley WWTP, where ground motions are estimated to be PGA < 0.10g. On firm soils (without liquefaction) in eastern Sonoma Valley, PGA values were about 0.15g, generally not damaging to buried pipe.

### 4.1.4 Seismic Performance Goals

One of the tasks of the seismic assessment of the SVCSD wastewater system is to develop a suitable set of earthquake performance goals. A performance goal reflects the desire to provide some level of adequate service following an earthquake, which reflects upon the balance of needs to provide service at a reasonable level of cost.

The "balance" between service and cost will vary on a case-by-case basis. For example, if the only function of a pipeline is to move storm water between two locations, an earthquake-induced temporary closure of that pipeline may be completely adequate, because temporary disruption of storm water transport may be acceptable once every 475 years. On the other hand, if damage to this same pipeline causes large sewage spills in populated areas that would inflict a significant life-safety impact (including disease) to people located near the leak, or serious release of raw sewage to the environment, damage may not be tolerable.

Another example for achieving a balance between service and cost for wastewater facilities would be the case where the performance goal is to provide hydraulic flow through a wastewater treatment plant. In this case, significant damage to non-redundant pipes necessary for primary treatment and disinfection would not be tolerable, whereas damage to pipes that are part of secondary (or tertiary) treatment might be tolerable.

The SVCSD system was assessed for a Rodgers Creek M 7 earthquake as described in this chapter and is described for the various structures in Chapter 4.5 While useful for establishing selected design parameters, no explicit performance goals are suggested for earthquakes that produce ground motions that are not expected to be exceeded more than once every 2,475 years, as experience has shown that mitigation for a 2,475 year event is generally not a cost effective allocation of scarce capital resources.

Table 7 provides suggested performance goals for the Probable and Maximum Earthquakes for the SVCSD wastewater system, which includes three main service categories: (1) life safety, (2) public health, and (3) protection of receiving waters under dry- and wet-weather conditions. These goals

should be adjusted to meet the particular needs of SVCSD, once an understanding of the capital cost to achieve these goals is established.

(1) Life safety is defined as no loss of life or serious injury to the public or to SVCSD staff. Due to the type of facilities involved, in most cases, the concern for life safety is primarily related to SVCSD's own personnel and typically involves preventing the collapse of SVCSD's structures. In addition, the release of hazardous chemicals (e.g., chlorine) into the atmosphere must be avoided.

(2) Most collection systems are primarily linear systems for which failure at key locations results in overflows. The concern for public health can be addressed by:

- Maintaining hydraulic flow at the treatment plants and in the major collection sewers, and thus preventing sewage from backing up into the streets.
- Maintaining chlorination and thus preventing bacterial contamination of the receiving water.

This goal can be achieved by maintaining the major collection sewers and pump stations, permitting treated discharge at the wastewater treatment plants (and possibly other temporary locations), and maintaining flow and disinfection through the wastewater treatment plants.

(3) The protection of receiving waters, under both dry- and wet-weather conditions, requires either maintaining primary or secondary treatment processes to prevent bacterial contamination of the receiving water.

### Table 7: Post Earthquake System Performance Goals for the SVCSD System

| Service Category | Probable Earthquakes | Maximum Earthquake Rodgers Creek M7 |
|---|---|---|
| Life Safety | Minimal life-safety risk | Minimal life-safety risk |
| Public Health | Maintain hydraulic flow and disinfection within 24 hours. | Maintain hydraulic flow and disinfection within 72 hours. |
| Protection of Receiving Waters (Dry Weather Conditions) | Provide primary treatment continually.<br>Provide secondary treatment within 2 weeks.<br>Provide tertiary treatment within 4 weeks. | Provide primary treatment within 2 weeks.<br>Provide secondary treatment within 3 months.<br>Provide tertiary treatment within 6 months. |
| Protection of Receiving Waters (Wet Weather Conditions) | Provide primary treatment within 2 weeks. | Provide primary treatment within 6 months. |

Based on observations to date within the SVCSD system, it is apparent that meeting the Public Health goal with no releases will require lift stations to be operable within the time noted in Table 7

and that buried pipe cannot break near creeks. Based on the initial assessments, the existing pipeline network may be vulnerable to liquefaction damage in a few locations.

It is often useful to provide a matrix that corresponds to specific structural performance for different types of structures, as indicated in Table 8, where:

- Class I structures are structures essential to the maintenance of wastewater flow. Loss of use of Class I structures would cause a major impact to the operation. Significant damage could result in sewage backup and environmental and public hazards.
- Class II structures are structures which are not directly necessary to preserve wastewater flow through the system. Loss of use of Class II structures would not result in immediate wastewater backup. Repairs or replacement would be required, but would not be needed immediately (hours or days).

Table 8: Structural Performance Objectives

| Facilities | Probable Earthquake (60% of motions in Tables 3 to 5) | Maximum Earthquake (median motions in Tables 3 and 5) | Maximum Earthquake (84th motions in Tables 4 and 6) |
|---|---|---|---|
| Class I | No structural damage; superficial non-structural damage only. No environmental damage. No loss of facility use. | Minor structural damage; minor to moderate non-structural damage only. Minimum partial temporary shutdowns possible, but not probable. | Minor to some moderate damage locally. No major structural damage, partial collapse or threatening conditions. Moderate non-structural damage possible. Limited partial shutdowns possible. Structural and non-structural damage repairable within days. |
| Class II | Minimal structural damage. Minor non-structural damage. Minimal partial temporary shutdowns possible, but not probable. | Minor-moderate structural damage. Moderate non-structural damage only. Limited partial shutdowns possible. Repairable within days to weeks. | Moderate structural damage. Moderate-major non-structural damage. No partial collapse or life threatening conditions. Structural and non-structural damage repairable within weeks to months. |

### 4.1.5 Potential Hazard Related Issues

Based on the data review and field reconnaissance, the following geologic and seismic related issues relevant to the planning area should be considered:

1) The SVCSD wastewater system is exposed to three of the five identified geologic hazards (ground shaking, liquefaction and creek hazards), which present risks that could result in damage to SVCSD facilities including the WWTP, collection system and pump stations, with the potential of sewage spills and loss of use of the WWTP.

2) Many pipes within the SVCSD collection system are located in areas of moderate to high liquefaction areas, which poses the potential for loss of use of a portion of the collection system or the potential for sewage spills.

3) There are locations within the SVCSD system with specifically identified areas with geologic hazards, including potential for damage from landslides, flooding, or creek related hazards.

## 4.2 Flood Hazard

### 4.2.1 General Background

The Sonoma Creek watershed consists of 170 square miles, which drains into the San Pablo Bay. The SVCSD is located within the Sonoma Creek watershed, where Sonoma Creek meanders through the area served by the SVCSD; floodwaters from Sonoma Creek poses a potential hazard to the SVCSD facilities.

Flooding is the overflow of excess water from a river, stream or adjacent body of water onto an adjacent floodplain. When floodwaters recede after a flood event, layers of rock and mud are left behind. The rock and mud gradually build up to create a new floor of the floodplain, which generally contain unconsolidated sediments that are accumulations of sand, gravel, loam, silt, and/or clay that often extend below the streambed. Because of the fertile soil, flat reclaimed floodplain lands are commonly used for agriculture. Floodplains have also been developed over time for commerce and residential development, which puts these areas and the infrastructure that supports them at risk for flood damage. Depending on the severity of a flood, impacts to development and infrastructure contained within a floodplain can be significant.

Connections between a river and the adjacent floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources, but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced which can increase the potential for flood damage to facilities.

#### 4.2.1.1 Definitions

**Flood** — The inundation of normally dry land resulting from the rising and overflowing of a body of water.

**Floodplain** — The land area along the sides of a river that becomes inundated with water during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

**100-Year Floodplain** — The area flooded by a flood that has a 1-percent chance of being equalled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a short period of time. The 1-percent annual chance flood is the standard used by most federal and state agencies.

**Return Period** — The average number of years between occurrences of a hazard (equal to the inverse of the annual likelihood of occurrence).

**Riparian Zone** — The area along the banks of a natural watercourse.

#### 4.2.1.2 Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equalled or exceeded in a given year. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1-percent chance of being equalled or exceeded in any given year. The "annual flood" is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area, this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

#### 4.2.1.3 Flood Mapping

The National Flood Insurance Program (NFIP) makes federally funded flood insurance available to homeowners, renters, and business owners in participating communities. For most participating communities, the Federal Emergency Management Agency (FEMA) has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood and the 0.2-percent annual chance flood (the 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities, FIRMs represent the minimum area of oversight under their floodplain management program. Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-year flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

Sonoma County entered the NFIP in January, 1982. The ordinance provisions, definitions, and requirements were modeled after language recommended by the NFIP and were reviewed and found fully compliant by the NFIP. The County's flood zones and mapping in the General Plan

Safety Element and other documents are based on the 100-year flood zones and floodways shown in the FIRMs. The Water Agency participates in the NFIP under the umbrella of Sonoma County.

Floods along Sonoma Creek and within the SVCSD boundaries generally result from intense rainfalls that last for a short period, or typically up to 6 hours for a longer duration storm. Figures SV-32 through SV-41 show the 100-year floodplain within the SVCSD boundary. The floodplain is generally confined to the area nearby Sonoma Creek within the SVCSD boundary and expands to a wider area to the south near San Pablo Bay.

## 4.2.2 Hazard Profile

### 4.2.2.1 Principal Flooding Hazard

The principal source of flooding within the SVCSD is Sonoma Creek. Although the SVCSD Wastewater Treatment Plant is located outside of the 100 year floodplain and would not experience a flooding hazard, the SVCSD collection system is susceptible to a flooding hazard.

Figures SV-32 through SV-41 show areas where sections of the SVCSD collection system and force mains from pumps stations intersect creeks. These areas, along with areas that experience high flows due to flooding, are at the highest risk of damage to the SVCSD facilities. Debris flowing within Sonoma Creek and its tributaries where the pipelines cross present a hazard to damaging the crossings as discussed in Section 4.1.2.4. Potential for scour and liquefaction at creek crossings also present a hazard. As discussed and listed as geologic hazards in Section 4.1.2.4, there are specific locations identified where damage to the system could occur.

### 4.2.2.2 Secondary Hazards

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than the actual flooding. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but the banks can be left scoured, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards, such as landslides, when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers or storm sewers. Additionally, sewer systems can be backed up, causing wastewater to spill into homes, neighbourhoods, rivers, and streams.

## 4.2.3 Potential Hazard Related Issues

The following flood-related issues relevant to the SVCSD should be considered:

1. The risk associated with the flood hazard overlaps the risk associated with other hazards such as earthquake, landslide, and wildfire losses. This potentially provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce risk for multiple hazards.
2. Climate change may cause more extensive flood problems due to possible sea level rise and more severe weather patterns. Consequently, the 500-year floodplain inundation area may become a higher probability risk. Coastal flood hazard ratings may also need to be reviewed.
3. More information is needed on flood risk to support the concept of risk-based analysis of capital projects.

4. Ongoing flood hazard mitigation will require funding from multiple sources.

## 4.3 Fire Hazard

### 4.3.1 General Background

Wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression and is a relevant hazard to the SVCSD facilities. Wildfires can be ignited by lightning, faulty or damaged electrical facilities, or by human activity such as smoking, campfires, equipment use, and arson. Fire hazards present a considerable risk to vegetation, wildlife habitats, private and public facilities, and public infrastructure. Short-term loss and long term effects caused by a wildfire can include the damage to and destruction of community infrastructure. In addition, wildfire can cause increased vulnerability to flooding due to the destruction of watersheds. The potential for significant damage to life and property exists in areas designated as “wildland urban interface areas,” where development is adjacent to densely vegetated areas.

#### 4.3.1.1 Definitions

**Conflagration** — A fire that grows beyond its original source area to engulf adjoining regions. Wind, extremely dry or hazardous weather conditions, excessive fuel build-up and explosions are usually the elements behind a wildfire conflagration.

**Fires Hazard** —The potential for fire in a given area, based on the fuels available to burn and how intense the fire would burn. It can be influenced by past disturbances or management activities that alter the hazard, for better or worse, by changing the overall site moisture. It is also affected by the volume and spatial arrangement of fuels. Fire hazard is distinguished from fire risk; fire risk incorporates the probability of wildfire occurrence—or ignitions—with fire hazard.

**Interface Area** — An area susceptible to wildfires and where wildland vegetation and urban or suburban development occur together. An example would be smaller urban areas and dispersed rural housing in forested areas.

**Wildfire** — Fires that result in uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas. Because wildfires can occur at a distance from firefighting resources, wildfires can be difficult to contain and can cause a great deal of destruction.

#### 4.3.1.2 Fire Hazard Mapping

Areas of significant fire hazards are mapped based on factors such as the following:

- **Fuel** —- Fuel may include living and dead vegetation on the ground, along the surface as brush and small trees, and above the ground in tree canopies. Lighter fuels such as grasses, leaves, and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs, and trunks take longer to warm and ignite. Trees killed or defoliated by forest insects and diseases are more susceptible to wildfire.
- **Weather** — Relevant weather conditions include temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere. Of particular importance for wildfire activities are wind and thunderstorms:

- Strong, dry winds produce extreme fire conditions. Such winds generally reach peak velocities during the night and early morning hours.
- The thunderstorm season typically begins in June with wet storms, and turns dry with little or no precipitation reaching the ground as the season progresses into July and August.

- **Terrain** — Topography includes slope and elevation. The topography of a region influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind; potential barriers to fire spread, such as highways and lakes; and elevation and slope of land forms (fire spreads more easily uphill than downhill).

Taking these factors into consideration, a fire hazard severity scale has been devised to characterize zones by the number of days of moderate, high and extreme fire hazard. These zones, referred to as Fire Hazard Severity Zones (FHSZ), define the application of various mitigation strategies to reduce risk associated with wildfires. The FHSZ maps for the SVCSD are shown in Figures SV-42 through SV-51; these maps serve as the basis for the fire/wildfire risk assessment.

The FHSZ model is built from existing data and hazard constructs developed by CAL FIRE's Fire and Resource Assessment Program. The model refines the zones to characterize fire exposure mechanisms that cause ignitions to structures. The model characterizes potential fire behavior for vegetation fuels, which are by nature dynamic. Since model results are used to identify permanent engineering mitigations for structures, it is desirable that the model reflect changes in fire behavior over the length of time a structure is likely to be in place. Significant land-use changes need to be accounted for through periodic updates to the model.

The model output of fire probability also is based on frequency of fire weather, ignition patterns, expected rate-of spread, and past fire history. It also accounts for flying ember production, and hazards based on the area of influence where embers are likely to land and cause ignitions. This is the principal driver of hazard in densely developed areas. A related concern in built-out areas is the relative density of vegetative fuels that can serve as sites for new spot fires within the urban core and spread to adjacent structures.

## 4.3.2 Hazard Profile

### 4.3.2.1 Past Events

Fire has been a hazard factor in Sonoma County's history due to the local climate and geography. Figure SV-52 shows historical fires that have occurred near the SVCSD.

### 4.3.2.2 Frequency

The wildfire season in Sonoma County generally begins in June and ends in mid-October; however, wildfires have occurred in every month of the year. Drought, light snow pack, and local weather conditions can expand or shorten the length of the fire season. The early and late shoulders of the fire season are usually associated with human-caused fires. The peak months of July, August, and September are usually related to thunderstorms and lightning strikes.

### 4.3.2.3 Critical Facilities and Infrastructure

Structures, above-ground infrastructure, critical facilities, and natural environments are all vulnerable to the wildfire hazard.

Critical facilities of wood frame construction are especially vulnerable during wildfire events. In the event of wildfire, there would likely be little damage to most of the SVCSD's infrastructure. Power lines are the most at risk from wildfire because most poles are made of wood and susceptible to burning.

Fires can create conditions that block or prevent access and can isolate residents and emergency service providers, which have the potential to affect SVCSD personnel and facilities due to the potential for limited access. Wildfires typically do not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed, which could also reduce the ability of access of SVCSD facilities.

Wildfires can also generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Secondary effects of concern to the SVCSD include flooding. Wildfires strip slopes of vegetation, exposing them to greater amounts of runoff. This can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, thus increasing the imperviousness of the ground. This increases the runoff generated by storm events, which thereby increases the chance of flooding

To further complicate the problem, heavy rains could follow, causing flooding and landslides and releasing tons of sediment into rivers, permanently changing floodplains and damaging sensitive habitat and riparian areas. With the forests removed from the watershed, stream flows could easily double. Floods that could be expected every 50 years may occur more frequently. With the streambeds unable to carry the increased discharge because of increased sediment, the floodplains and floodplain elevations would increase.

### 4.3.3 Potential Hazard Related Issues

The major issues for wildfire are the following:

1. Access to SVCSD Facilities may become difficult for maintenance and fire suppression.
2. Wildfires could cause landslides as a secondary natural hazard, which can induce additional sediment loading with potential risk to facilities.
3. Critical facilities in the planning area are at risk and have the potential of functional downtime post-event such as loss of power at the treatment plant. This creates not only a need for mitigation, but also a need for continuity of operations planning to develop procedures for providing services without access to essential facilities.
4. Fire department water supply may be at risk in wildfire hazard areas.

## 4.4 Low Risk and Other Hazards

### 4.4.1 Tornadoes

Tornado intensities are rated on a Fujita Scale that goes from 0-5. A Fujita Scale F0 tornado is defined by a wind speed range from 40-72 mph and is classified by light damage, broken tree

branches, and shallow rooted trees being pushed over. A Fujita Scale F1 is defined by wind a speed range from 73-112 mph and is classified by moderate damage; roof panels start to tear from houses, mobile homes are pushed off their foundations, or moving vehicles pushed off the road. A Fujita Scale F2 is defined by wind a speed range from 113-157 mph and is classified by considerable damage; roof tear from houses, mobile homes demolished, large tree snaps, or light-object missiles generated.

Tornadoes do not regularly occur in California. Tornadoes pose minimal risk to the SVCSD. In the last 60 years, there have been 292 tornadoes in 42 counties of California, but no deaths have occurred from the incidents. Over half of the tornadoes in California have been rated F0 on the Fujita Scale, about 40% have reached F1, and less than 10% were rated F2 or above. Based on historical tornado data files from the Storm Prediction Center (operating under the National Oceanic and Atmospheric Administration – NOAA), thirteen tornadoes occurred between 1958 and 2011 in Sonoma County, with the highest intensity of F2 from the June 1, 1958 tornado, which resulted in 1 injury.

### 4.4.2 Hurricanes

California is at low risk for hurricanes, primarily because the sea surface temperatures of waters off of California are cold even during the summer months. Hurricane, or tropical cyclone, formation requires very warm waters that extend to a depth of 160-feet. Additionally, the general path of hurricanes in the eastern Pacific tends to move north-westward or westward due to steering by the prevailing upper level winds; therefore, even if a hurricane does form near the coast of California, the wind would steer the hurricane out to sea and away from land. While no hurricanes have been found in NOAA's recorded history, tropical storms do result from low pressure waves generated from the Gulf of Mexico. The tropical storms that occur are typically a result of subsided hurricanes, but would still cause heavy rainfalls that may lead to flooding. Unlike floods or earthquakes, hurricanes primarily cause localized damage that also makes them a low hazard risk for the SVCSD. In the event of a hurricane or tropical storm, the SVCSD has the ability to continue the system operations using its SCADA system at two alternative locations.

### 4.4.3 Tsunamis

Water displacement that occurs from earthquakes can cause a series of rapid, hazardous waves called tsunamis. As indicated on USGS Tsunami Inundation Maps, areas of tsunami danger in Sonoma County are limited to those with coastal exposure, namely in Archer Rock, Duncans Mills, Bodega Head, Valley Ford, Petaluma River, Sears Point, Cuttings Wharf, Petaluma Point, Mare Island, and Novato. The SVCSD and the WWTP do not have coastal exposure and therefore are not anticipated to be affected by tsunamis.

### 4.4.4 Climate Change

Climate change over the next century may have a significant impact to both the natural and built environments in Sonoma County. Although Sonoma County has developed the Community Climate Action Plan and Climate Action 2020 to mitigate greenhouse gas emissions that cause climate change, the effects of climate change, such as rising sea levels and intensified storms, are imminent. Due to sea level rise, flooding in the Sonoma Creek watershed is likely to increase. As discussed in Chapter 4.2, flooding can change stream hydraulics and sediment carrying capacity of

waterways, which may cause streamwater backup flooding. Climate change also has potential to decrease precipitation in the Sonoma Creek watershed, which would increase fire hazards. While the effects of climate change remain uncertain, it is speculated that flooding and wildfire hazards would pose the most significant threat to SVCSD infrastructure. Flood and wildfire hazards to SVCSD are discussed in Chapters 4.2 and 4.3, respectively.

## 4.5 Vulnerability Assessment

The purpose of completing the Vulnerability Analysis is to assess the extent to which the SVCSD conveyance system can withstand the applicable hazards discussed in Chapters 2 through 4. The SVCSD system includes gravity and pressure pipelines, lift stations and the wastewater treatment plant (including facilities for treatment, storage, reclamation, irrigation and related facilities). Mitigation plans and future emergency operations plans will serve as a guide for developing a response to natural hazards; effects of hazards on the SVCSD system will be based on the identified vulnerabilities of the system.

The vulnerability assessment included a review of the data collected, as-built drawings of the system, and a field review of the system. Potholing and underground/in-pipe investigations were not included in the assessment. As additional data is developed and vulnerabilities of the SVCSD system are identified, the SVCSD will prioritize the vulnerable components of the system with the most relevant hazards; additional investigations will be completed as necessary in order to refine the assessment and develop a plan to mitigate the potential damages from the relevant hazards. The vulnerability analysis presented in this report is intended to meet the following objectives:

1. Identify and quantify hazards that may affect the SVCSD system;
2. Quantify the susceptibility to damage of essential facilities (conveyance and treatment) to providing sewer service and treatment in the event of a natural disaster;
3. Develop measures that will be included in a mitigation plan to decrease the vulnerability of the system.

The following sections describe the significant vulnerabilities to the SVCSD as identified in previous chapters. This vulnerability assessment emphasizes the geologic and seismic hazards (including earthquake and creek hazards) discussed in Chapter 4.1 because earthquakes pose the highest risk to SVCSD facilities. In addition, the vulnerabilities associated with the lower risk hazards would be similar to those identified and associated with earthquakes. Specific vulnerabilities to the collection system which are related to flooding, high creek flow, and seismic related events are also identified. Low risk hazards are not discussed in the vulnerability assessment because efforts to protect the SVCSD facilities against low hazards would not justify the costs.

### 4.5.1 Collection System

Hazards to the collection system and lift stations are generally directly related to the after-effects of seismic events, floods and fires. Specifically, landslides can occur due to geologic and seismic events, inundation due to flooding, and/or erosion from exposure of hillsides after fires. The existing collection system was reviewed via mapping and field reconnaissance. Field visits of areas with potential for landslides, creek crossings, and other potentially vulnerable areas were completed. Hazards were identified and then discussed with the field operations staff. Areas of potential

vulnerabilities were noted and mapped. The identified locations are presented in Figures SV-2 through SV-5.

**Vulnerabilities**

The site-specific vulnerable areas identified based on field reconnaissance and discussions with staff are described below:

Point 1: Creek bank failure was observed adjacent to the roadway. There is no sewer main within the roadway upslope of the failure. However, lateral/upslope migration of the failure could potentially impact manholes to the northeast and south.

*Hazard:* Static and seismic embankment failure (landslide) potential with possible damage to main, manholes and laterals.

Point 2: The existing manhole's proximity to an active creek can result in embankment failure. The sewer main was constructed beneath the existing channel; burial depth below channel thalweg is unknown and assumed shallow.

*Hazard:* Static and seismic embankment failure (landslide) potential with possible damage to sewer main and manholes. Potential exposure and damage of pipeline due to erosion and debris impact during periods of rapid creek flow.

Point 3: The sewer main and manholes are located at the top of the creek bank. Localized shallow failure and erosion of the bank during periods of peak flow have exposed the manhole at depth. Rock slope protection has been placed on the bank in an attempt to protect the manhole.

*Hazard:* Static and seismic embankment failure (landslide) potential with possible damage to main and manholes.

Point 4: The sewer main is suspended from the bridge with non-rigid anchors. The main appears to be fixed and extend through the abutment foundations at both the east and west ends of the bridge. Erosion of the slope below the abutments and within the channel has locally undermined the abutment and bridge bent foundations.

*Hazard:* Potential damage to main during a seismic event due to shaking, differential settlement of structure.

Point 5: The sewer main and manholes are constructed within a contour-parallel roadway. Slopes above and below the roadways are generally steeper than 2H:1V (Horizontal:Vertical). Edge parallel cracking of pavement due to fill prism settlement and creep on ridge flank observed.

*Hazard:* Static and seismic landslide potential with possible damage to main, manholes and laterals.

Point 6: The sewer main is suspended from the bridge with non-rigid anchors and apparently fixed at abutments.

*Hazard*: Potential damage to main during a seismic event due to shaking, differential settlement of structure.

Point 7: The sewer main extends through the walls of the arch culvert at the crossing location. The main is unsupported throughout the span, and is suspended approximately 1.5 feet above the creek thalweg.

*Hazard:* There is the potential for damage to the main from debris impact during high, and/or rapid creek flow.

Point 8: The sewer main is exposed above the creek from MH103-16 to MH103-17.

*Hazard:* Potential for damage to main from debris impact during high, and/or rapid creek flow.

Point 9: Sewer main and manholes are located/found within young alluvium (Holocene) at the creek crossing. Embankments are generally steeper than 2H:1V (Horizontal:Vertical) and the creek channel is 20 to 30 feet in depth below the top of the creek bank. Localized embankment undermining and failure observed.

*Hazard:* Static and seismic embankment failure (landslide) potential with possible damage to main and manholes.

Point 10: The sewer main extends under the east and west bridge abutments. The top of the pipe is roughly at thalweg elevation, and has been armored with concrete which has locally been undermined by stream flow.

*Hazard:* There is the potential for damage to main from debris impact during high and/or rapid creek flow and from future erosion.

Point 11: The sewer main extends under the east and west bridge abutments. The top of the pipe is roughly at thalweg elevation and has been armored with concrete.

*Hazard*: There is the potential for damage to the main from debris impact during high and/or rapid creek flow and from future erosion.

Point 12: The sewer main extends through the walls of the arch culvert at the crossing location. The main is unsupported throughout the span, is suspended approximately 2 feet above the creek thalweg, and is potentially exposed to debris impact during high creek flow.

*Hazard:* There is the potential for damage to the main from debris impact during high, and/or rapid creek flow.

The highest vulnerability to the collection system is due to seismic events, which also translates to the highest potential cost to the SVCSD. In order to quantify the potential for the seismic hazard, the length of pipelines in the Very High, High, and Moderate liquefaction zones were estimated using the maps referenced in Chapter 4.1 of this report. Within each of the zones, the pipelines were assumed to be in an open cut stream/river, where significant lateral spreads can occur. An occurrence of a M 7 event on the nearby Rodgers Creek Fault was assumed, which produces PGA = 0.42g at the ground surface near each pipe. For the pipeline inventory, the typical style of pipe installation uses non-seismic push-on joints (AC, PVC, RCP or VCP pipes).

The number of pipe failures was then estimated, given the level of shaking (PGA = 0.42g) and the pipe fragility models of ALA (2001). Given these assumptions, approximately 26 pipe repairs will be required, of which about 85% will occur in the areas mapped as having high to very liquefaction susceptibility. Of these repairs, approximately half can be assumed to be full breaks, and half will

be leaking joints (ALA, 2001). These repairs exclude damages to customer's service laterals. Table 9 quantifies the extent of pipe damages to the SVCSD collection system, should a M 7.0 earthquake occur along the Rodgers Creek Fault. Uncertainties in the ground motions and pipe performance suggest these median-based quantities may vary ±50%.

Table9: Pipe Damage – Rodgers Creek M 7.0 Earthquake

| Liquefaction Zone | Total Pipe Length (miles) | Total Pipe Repairs | Pipe Breaks | Pipe Leaks |
|---|---|---|---|---|
| Very High | 1.6 | 12 | 6 | 6 |
| High | 20.4 | 10 | 5 | 5 |
| Moderate | 52.7 | 4 | 2 | 2 |
| Low, None | 65.7 | < 1 | < 1 | <1 |
| **Total** | **145.4** | **26+** | **13+** | **13+** |

**Mitigations**

The vulnerable areas of the collection system and potential failures due to the hazards have the potential for a significant number of failures. If pipe breaks are identified after an earthquake, flooding, or due to high stream flow, full repair is required before the sewer can be re-used. In contrast, pipes with leaks can be kept in service while repairs are made. The general approach to pipe repair will be as follows:

- Identify obvious damage at the surface (i.e. sewage backups, readily seen at the surface). Damage at the surface may happen infrequently, but it is important to conduct an investigation, and/or notify property owners to report sewage backups to the SVCSD.
- From the WWTP, trace back to find locations where there is no flow. Visual inspection under manholes can often identify no flow conditions.
- Map out locations where manholes have floated. Manholes will float (rise up) when the pore pressure exceeds the weight of the manhole for a period of time. This will typically only occur at locations with Very High (or High) liquefaction susceptibility and a high ground water table. At these locations, there will almost certainly be broken pipes attached to the manhole at depth. For a gravity flow system, floated manholes will need to be replaced. For purposes of this report, assume 2 or 3 such manholes will float for each earthquake event (Previous earthquakes in Japan and the 2011 Christchurch earthquake caused a number of manholes to float. Given the available liquefaction maps, and assuming a high magnitude earthquake during ground saturated/high water table conditions, it would be prudent to plan for flotation of manholes. In order to provide a more precise/quantified value of floated manholes, additional assessments will need to be performed using precise manhole weights and geometries and local soil borings).
- Use video cameras to perform a visual inspection of all pipes suspected to be damaged. Start video inspection on all pipes within the mapped High and Very High zones, then proceed to the moderate and low liquefaction zones, respectively.
- At key locations where there is a sewage blockage or broken pipe, isolate the manhole and use pumps and flexible hose to move the sewage between usable manholes.

- Working radially from the WWTP, repair broken pipes and, where initially convenient, repair leaking pipes. Depending on site-specific conditions, leaking pipes might be left in service. Repair crews can be used to expeditiously repair broken pipes first (while leaving the street open), and then ultimately returning to the leaking pipes to make permanent repairs.
- Jet-flush the repaired pipes to clean out accumulated silts and sands and debris. On average, assume 2 flushes per repaired pipe.

Pipe replacement might be the most effective solution if there are a few highly damaged locations. Where repairs are made, some common approaches are:

- Install a pipe repair clamp for a small leak or break;
- Replace a short section of damaged pipe (a few feet to one segment) and insert a new length of pipe with collars at each end to make leak-tight joints; or
- Replace an entire length of sewer line if there are multiple damage points between two manholes.

Post-earthquake replacement of entire lengths of pipe between manholes can be the most cost effective strategy if:

- Manholes have floated;
- There are multiple breaks between manholes;
- There are known hydraulic/flow issues in this location, so replacement with a new pipe is already known to be warranted.

While pipe repairs will be satisfactory to return the pipe to service, it will not prevent further damage due to future earthquakes (or large aftershocks). Unless the replacement pipe is seismically designed, the replacement pipe will remain vulnerable to damage in aftershocks or future earthquakes. It is recommended that seismic resistant pipes be installed in the Very High and High liquefaction zones, in areas closest to creek crossings, or where the pipe runs parallel to creeks such that the pipe will not leak or break under a 1% soil strain. Pipe replacements can be installed piece-meal post-earthquake, or done prior to future earthquakes as part of a planned pipe replacement program.

### 4.5.2 Wastewater Treatment Plant

The wastewater treatment plant is vulnerable to several hazards including geologic, seismic and fire. Seismic hazards include ground shaking, water impulsive and sloshing forces; differential ground displacements due to seismic, lateral spread or liquefaction hazards.

A description of the flow process in the SVCSD wastewater treatment plant was provided in Chapter 2. The following paragraphs discuss the WWTP structures and systems that are at risk primarily during earthquake hazards.

#### 4.5.2.1 Chlorination System

One of the most hazardous materials in the sewage system is chlorine. Chlorine is used for disinfection, and sulfur dioxide is used to neutralize the chlorine before the treated water is discharged into the waterways. Seismic assessment of the chlorination facilities were based on the findings by Myers (1999), supplemented by observations presented in Kleinfelder, 2013.

**Vulnerabilities**

The disinfection system at the Sonoma Valley WWTP includes piping, contact tanks, vessels, equipment, and support structures. The chlorine is stored in "one-ton" containers. One of the key concerns for storing chlorine is the potential of the storage containers (vessels) to dislodge or move during earthquake motions, resulting in failure of the valve(s) on the containers, and thereby discharging an unrestricted amount of chlorine into the atmosphere. Two failure mechanisms of concern are:

- Rolling of the horizontal one-ton containers in a manner that could damage the outlet nozzle/valve (or secondarily, the hoses attached to the outlet nozzle); and

Based on accounts from a number of water and wastewater treatment plants after earthquakes, the following observations were made with regards to preventing failure mechanisms of the chlorine containers:

- Where one-ton containers are used, most (but not all) containers are strapped down to prevent slippage under earthquake motions. In Concepcion, Chile, the chlorine containers were not tied down, and thus moved sideways during sufficiently strong ground shaking. The water treatment plant was exposed to strong shaking from a nearby M 8.8 subduction zone earthquake in February, 2010 (PGA at the WWTP was about 0.3g, with over 60 seconds of string shaking). Even so, there was no damage to coiled pigtail attached pipes, and the plant manager reported that no chlorine was released.

There are other ways for the chlorine system to fail, notably between the pigtail hoses (from the containers) into the chlorinators/mixing systems, as well as in the various small diameter pipes that connect to various chemical injection points throughout the WWTP. On May 21, 2014, Mr. Brian Anderson of the SVCSD reported that the chlorine lines at the WWTP shut off immediately when vacuum pressure is not maintained. Furthermore, if there are leaks/damage to the equipment or pipes, the chlorine is by that time in a liquid state and diluted. Once a liquid and diluted, the chlorine does not have the immediate life safety consequences as if the chlorine gas is released directly from the containers.

Other potential failure modes would be the collapse (or severe distortion) of the buildings that house the chlorine containers/equipment; or the failure of the equipment/process when the chlorine containers were being handled by lifting devices (overhead cranes, etc.).

At the Sonoma Valley WWTP, the following were observed:

- The chlorine containers and mixing equipment are located in the chlorine building. This building is a single-story, reinforced masonry structure. No material weaknesses were observed in this structure, and the structure is assessed to survive (without collapse or severe distortion) following a Rodgers Creek M 7 earthquake.
- The overhead crane appears able to resist PGA = 0.42g (median level motion given Rodgers Creek M 7) without collapse. At PGA = 0.74g (84th percentile motion, Table 4), the building will be significantly overloaded beyond its original design basis, but it should remain standing, albeit with cracks and some distortions.
- The one-ton containers are strapped down.

- No 150-pound vertical chlorine cylinders were observed (other 150-pound cylinders were observed with less toxic gasses, and it is recommended that double restraints be installed for these).
- Mixing equipment was anchored. While the anchorage system appears sound for PGA = 0.42g, the overall equipment appeared flexible, and the equipment's performance at PGA = 0.74g cannot be reliably assessed based on visual observation alone. No shake table program is known that has been done to qualify the equipment for very high levels of shaking.
- Pipe were not inspected (typically small bore, 2-inch nominal diameter or smaller) from the chlorine building into the plant. Because drawings showing how these pipes were installed were not available, it is suspected the pipes are the commonly chemically-bonded PVC pipe that generally lacks ability to absorb differential movement without cracks. The WWTP is subject to minor differential settlements due to liquefaction. It is possible that there could be some pipe damage, particularly where the pipes enter structures. There is insufficient flexibility in the pipe to accommodate differential movements, and therefore pipe breaks at the structures would cause the chemical system to be hazardous.
- Myers (1999) checked that the typical off-loading steel frame for the one-ton containers has a margin of safety of about 1.1, given PGA = 0.4g (see Chapter 4.1), and that the earthquake occurs when a 4,000 pound tank is being supported by the frame. Assuming the frame is loaded about 7 hours per month (7 hours per 700 hours), and if it is assumed that PGA = 0.4g has a return period of about 1 in 475 years, the chance that such an event occurs is 1 in 47,500 years. There remains a chance that the site will experience about PGA = 0.74g (or higher), while the tank is being loaded, perhaps at a probability of once in 250,000 years.
- There are no suspended chemical containing equipment or piping in the chlorine room. PVC-type pipes are generally well supported on the walls. Lacking severe distortions of the building or crane (unlikely at PGA ~ 0.42g, might be an issue at PGA ~ 0.74g), there are no obvious material weaknesses.

**Mitigations**

A possible improvement would be to upgrade the building for PGA = 0.74g, keeping ductility demand less than 3; if the building cannot be upgraded, it is important to ensure the cranes lifting the chlorine containers do not derail and collapse during an earthquake, with the building envelope remaining accessible post-earthquake (at most, yellow tagged). Distortions in the building should be kept small enough to avoid any damage to one-ton containers pigtails/attached pipes between the containers and the chlorine mixing equipment, as well as, the connection to the scrubber system and duct work. Once the chlorine is mixed, the hazard level is substantially reduced.

In-use containers should be double chained/strapped (at lower and upper levels) to a structure capable of resisting at least V = 0.6W, elastically. It would be prudent for SVCSD to ensure that not-in-use chlorine containers are also similarly double chained, and a safety cap is kept around the nozzle with pressure devices atop the tank.

Additional measures can be taken to ensure minimal effects to the chlorination system during earthquakes. The SVCSD could seismically qualify the mixing equipment (and attached pipes) for PGA = 0.74g. To prevent cracks from pipe, especially at locations where pipes enter structures, the SVCSD may want to seismically upgrade all the pipes from the chlorine building into the plant. Additionally, the SVCSD can upgrade the off-loading steel frame for the chlorine containers to handle PGA= 0.74g.

#### 4.5.2.2 Clarifiers

The two (2) secondary clarifiers, constructed as circular concrete tanks, allow the suspended heavier materials to settle to the bottom of the clarifiers as sludge. A portion of the settled solids is pumped to the Gravity Thickener as waste activated sludge (WAS), while the remaining portion is pumped back to the aeration tanks as return activated sludge (RAS). The secondary-treated water flows over the weirs of the clarifier and is then sent to the tertiary filters.

**Vulnerabilities**

Circular clarifiers commonly experience significant damage during major earthquakes. During earthquakes, water sloshing in the clarifiers result in waves that over-top the clarifier and increases the forces applied to the central tower, baffles, and launders. Figure 5 shows the typical clarifier layout and Figure 6 shows the key dimensions. Barring liquefaction under the concrete tanks, the concrete tanks can sustain inertial loads without damage. With sufficient lateral forces due to sloshing, there will be overturning moments applied to the central tower; if the tower cannot sustain these forces, it will be damaged, rendering the clarifier inoperable until repairs are made.

An earthquake with a PGA of 0.42 g at the treatment plant will likely cause yielding of the clarifiers' rake arms lattice structure, the central tower, and the anchor bolts (weakest component), resulting in the clarifier's being inoperable.

**Mitigations**

Ways to mitigate this issue include:

- Keep one clarifier empty in order to eliminate the sloshing effect.
- Reinforce the central tower by bracing the top of the tower to the outer concrete tank walls. Additional bracing of the baffles may also be required.

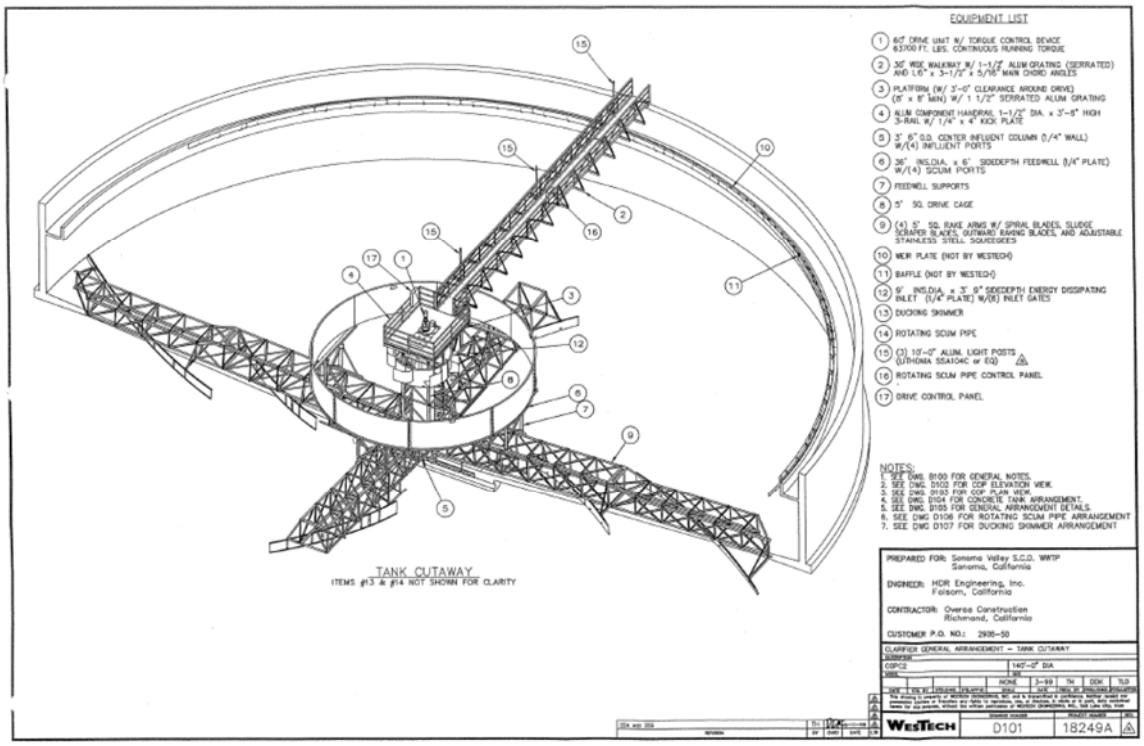


Figure 5: Sonoma Valley WWTP Clarifiers – General Layout

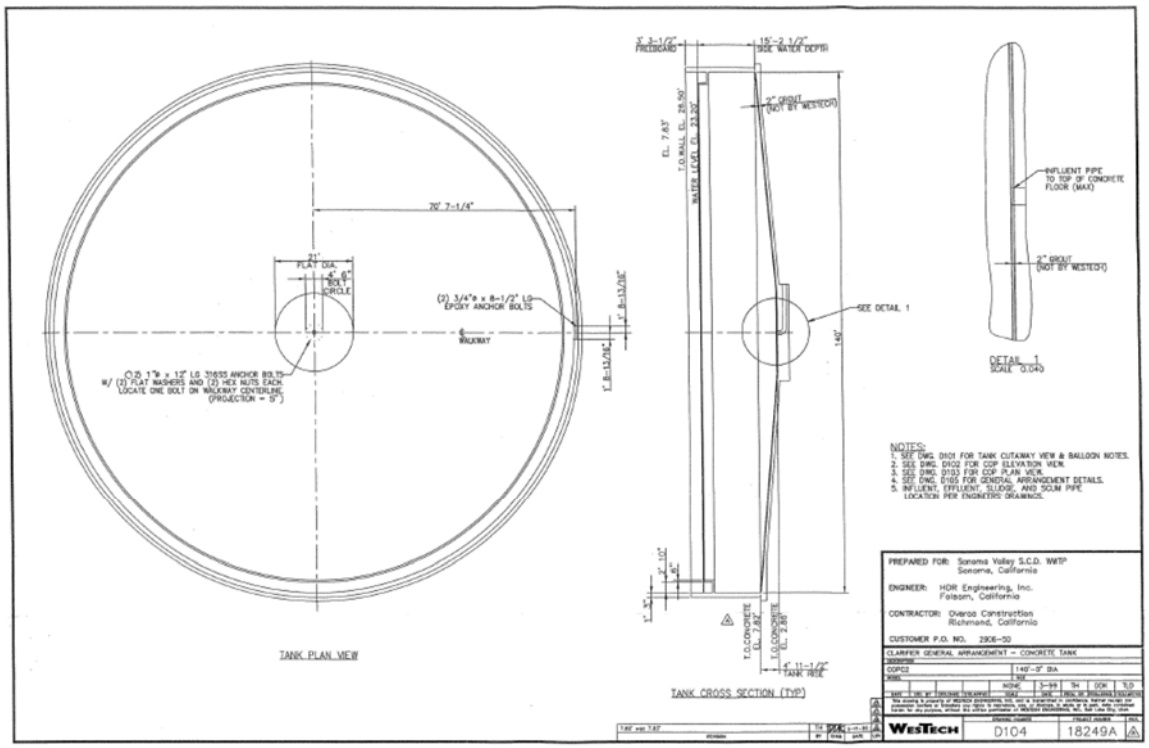


Figure 6: Sonoma Valley WWTP Clarifiers – Key Dimensions

#### 4.5.2.3 Buried Piping at the WWTP

Figure 7 shows a detail of the western portion of the plant and some of the buried piping. Figure 8 shows pipe in a concrete vault. Figures 9 and 10 highlight some pipes at the WWTP with flexible connections just outside concrete tanks.

It appears that the general style of pipes used at the WWTP are welded steel (possibly cement-lined), using bolted connections for valves, and with dresser couplings used occasionally where pipes enter/exit concrete tanks. Due to a lack of available records and calculations for the original WWTP design, it cannot be ascertained that any of the buried piping was specifically designed to handle earthquake loads.

**Vulnerabilities**

Assuming ground shaking at the site of PGA = 0.42g and firm soil conditions, buried pipe will survive the shaking, except where the pipe has become distressed due to corrosion (internal or external), has construction defects (like improper welds), or is exposed to much more than about an inch of sharp-edged differential settlements (where pipes enter concrete tanks).

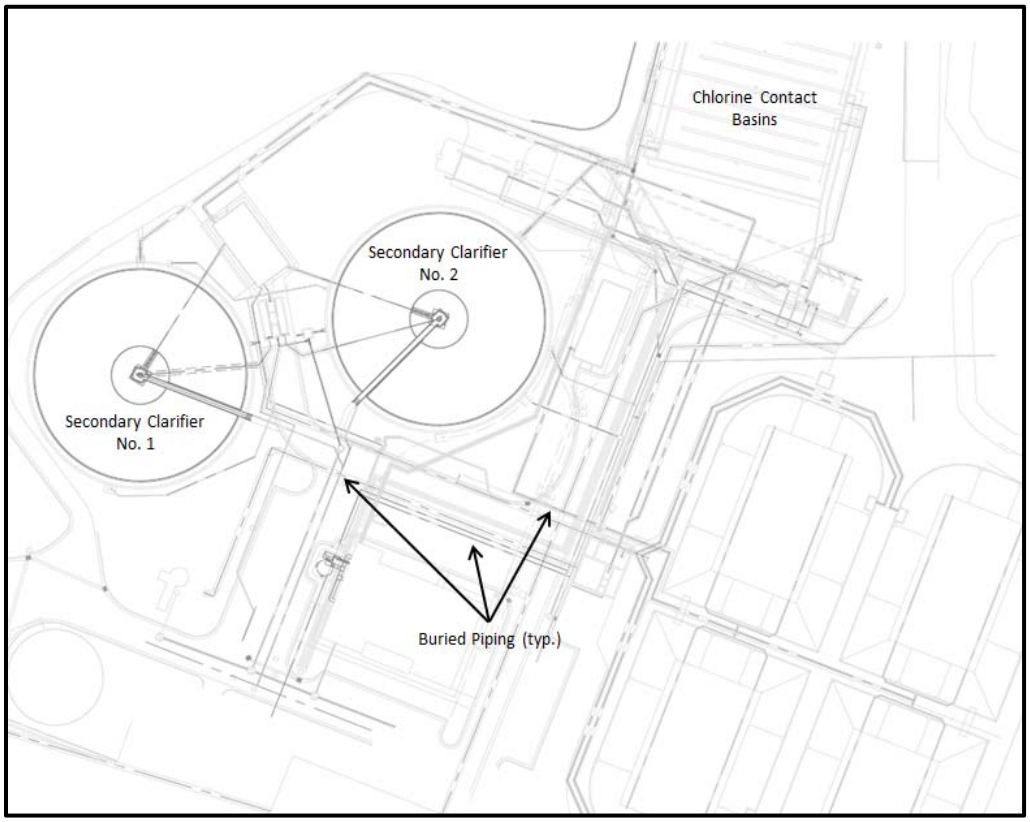


Figure 7: Partial Site Plan showing Buried Piping

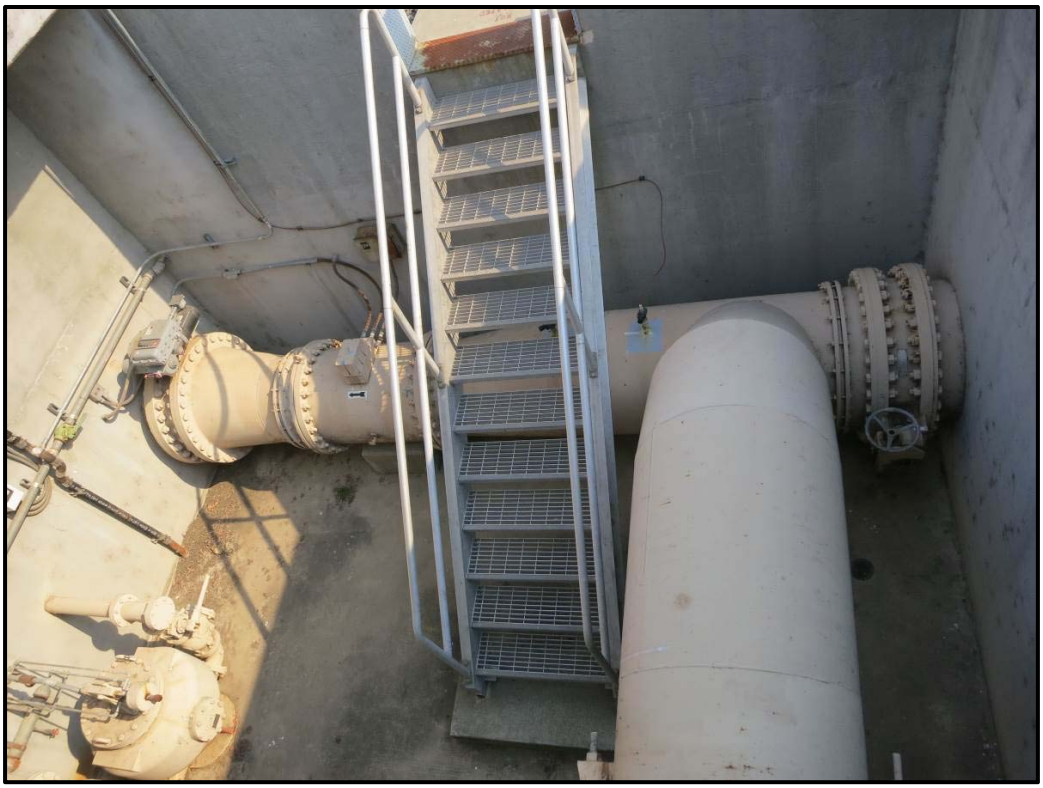

Figure 8: Buried Piping for Aeration Basins

There remains a relatively modest possibility that given PGA = 0.42g, there will be differential displacements exceeding an inch between some of the concrete tanks/structures and the surrounding soil. Various geotechnical studies for the site have indicated that the site will not experience liquefaction-related lateral spreading, but might experience differential displacement on the order of one inch.

Given these issues, there might be a pipe failure at the WWTP site with PGA = 0.42g (Rodgers Creek M 7), but there is insufficient information to highlight the specific location where this might occur. The pipe failure could manifest itself in imposed distortions on a valve (like on the right side of Figure 8), such that the valve becomes inoperable.

**Mitigations**

Given the relatively modest chance of pipeline damage at the plant and the uncertainty of specific locations, pre-earthquake mitigations to the buried large bore conveyance pipes at the plant are not recommended. Rather, a more prudent approach may be to have an emergency response plan that factors in that there might be the need to mobilize a pipe repair crew that could make a repair within 24 hours. Assuming the causative earthquake is a Rodgers Creek M ~7 earthquake, there will be lots of other pipe damage in Sonoma County (as well as other parts of the greater Bay Area), so having a pre-set agreement to mobilize pipe repair crews will be useful; or getting crews via mutual aid from other lesser-impacted agencies in the Bay Area (in the Bay Area, only the East Bay Municipal Utility District (EBMUD) has a large in-house crew capable of repairing 24" to 48" steel pipe; in Southern California, the Metropolitan Water District of Southern California has the ability to roll spare pipe to any size diameter). It is unlikely there will be a need to replace any steel pipe, but in making repairs, having the ability to roll steel shapes will likely be needed.

Larger pipe contractors might have this capability, but from a planning perspective, SVCSD should assume that there will be much more demand for their services than normal. To mitigate potential need for fabrication, it is recommended that the SVCSD pre-purchase of a few spare pipe segments and butt straps, and establish a procedure for rapid mobilization for repair crews.

Going forward, when SVCSD makes modifications at the WWTP, unless otherwise recommended by site-specific geotechnical assessment, it is recommended that all pipes (including chemical pipes and water conveyance pipes) be designed to accommodate 3 inches of knife-edge settlements at the entrance to concrete vaults. This can usually be accommodated using a combination of bellows, ball-joints with slip joints (such as Flex-tends by EBAA Iron, Inc., or equal); Dresser-like couplings (at least two per pipe, generally restrained); expansion loops in vaults, etc.

Figure 9: Attached Piping for Chlorine Contact Tank

Figure 10: Flexible Connections.

The concurrent purpose is to limit damage from vibrations or equipment replacement.

#### 4.5.2.4 Structures at the WWTP

There are reinforced concrete and masonry structures at the WWTP. Some of the main reinforced concrete structures at the WWTP include:

- The inlet structure (below grade reinforced concrete box-type). Combines 8th Street Feeder and Main Sewer.
- Headworks (below grade reinforced concrete box-type).
- Grit Chamber.
- A-Basin Flow Control Structure.
- Clarifiers and Clarifier Flow Split Structures.
- No.3 Water Pump Room.
- The Tertiary Filters.
- The chlorine contact tanks. There are two basins. It is assumed that there is sufficient steel in the reinforced concrete/masonry baffle walls to resist imposed water loads. Any possible damage to wood slide gate baffles/weirs is assume to be addressed by emergency response.
- The chlorine injection pit.
- Effluent Pump Station Wet Well. This is a reinforced concrete box-type structure that takes treated tertiary water and pumps it into the reclaimed water pipe system. Because permanent

ground displacements (PGDs) above an inch are not anticipated to occur at the site of the WWTP, this structure, the pumps and pipes would remain intact during an earthquake. (PGDs are a substantial source of damage to wastewater facilities, and types of PGDs include fault rupture, settlement, and liquefaction-induced lateral spreading or landslide deformations).

Masonry buildings with steel deck-type roofs include the following:

- Administration building. Reinforced masonry single story. Generally contains typical office cabinets, desks and laboratory equipment. It appears that most shelving and cabinets are marginally anchored.
- Headworks, Inlet and Effluent Pump Station Building. Reinforced masonry at grade, over a reinforced concrete vault/wet well. The inlet and effluent pump station is located below grade within the reinforced concrete portion of this structure. Vertical turbine pumps are anchored and likely have short shafts (under 20 feet), which are adequate. Pipes are adequately supported. Overhead crane should be adequate. Lacking PGDs or equipment requiring maintenance, this should perform well. House transformers located at grade above the effluent pump station are anchored (should be adequate). Storage racks (2) are marginally anchored; items in shelves can slide off shelves. A ladder can topple onto the pumps. The emergency generator has unrestrained batteries and "seismic" isolators that might be marginal at very strong shaking levels.
- Blower building, with 5 horizontal motors and blowers (all 5 motor sets not securely anchored).
- RAS/WAS. Reinforced masonry building atop reinforced concrete buried vault. Crane and overhead lights should be adequate. Pumps (6 horizontal) and pipe work in below grade reinforced concrete vault should be adequate. Electrical cabinets at grade level are anchored and should be adequate. There is an air compressor tank (vertical orientation) that is marginally anchored and unanchored cabinet and storage shelves in the basement level.
- Storage Building. This is a small rectangular building. The interior of the structure was not inspected.
- Filter Control Building. Water pipes within should be adequate. Rolling storage shelves and ladders should be restrained.
- Maintenance Shop. Single story. Several roll-up garage doors. Should be functional at PGA = 0.42g. At PGA = 0.74g, general yielding could distort the building and hamper the roll up doors. Considered acceptable for life safety purposes.

**Vulnerabilities**

Due to ground shaking effects, both the above and below ground structures are expected to perform well during an earthquake and to be operable after the earthquake. If there is minor differential settlements, the structures will remain intact, but attached pipes might be damaged (as discussed in Section 4.5.2.3). It is doubtful there would be loss of bearing capacity in the case of minor liquefaction. The inlet structure and channel are close to the creek, but available subsurface data suggest lateral spreads are not likely

**Mitigations**

The buildings are presumed to have been originally designed in accordance with life safety building codes (no collapse), and were designed with the seismic provisions in the code or record at the time. Any post-earthquake damage will be consistent with code based assumptions (original design calculations were not made available for review). Practically, these buildings should remain functional at PGA = 0.42g. Should upper-level shaking occur (say PGA = 0.74g), some buildings will have material yielding, although the life safety risk is thought to be small. Mitigations can include anchorage of cabinets, batteries, shelving and ladders that have been observed to not be anchored.

#### 4.5.2.5 Equalization Basins

There are two (2) 3 million gallon and two (2) 17 million storage basins that are used for equalization of influent. Two of the basins have membrane liners and two basins have asphaltic liners. The basins are connected so that as flows increase above the hydraulic capacity of the WWTP the flow is diverted to each basin in series through overflows. When visited, the basins were empty. The basins should be adequate, even if full, given earthquake induced ground movement as discussed under the vulnerabilities. Note: If full, water will slosh out of the basins. At PGA = 0.42g, some sloshing and spillage of water is likely, and this is thought to be acceptable but may result in untreated spill.

**Vulnerabilities**

Concrete spillways/overflows to/from the basins might be distorted if the soils slump. No geotechnical investigations were performed, so it was assumed that at PGA = 0.42g, there will be up to 1 inch of slope movements; at PGA = 0.74g, perhaps 3 to 6 inches if the basins are empty at the time of the earthquake, less if there is water in the basin at the time of the earthquake. This type of damage should be repairable, and any movements do not pose threat of a rapid release of water.

**Mitigations**

None recommended.

#### 4.5.2.6 Housekeeping

Under the term "housekeeping," two types of seismic issues are addressed:

- Equipment with inadequate anchorage/restraint, and whose failure would impact plant operations (i.e. switchgear).
- Items with inadequate anchorage/restraint, and whose failure might result in some losses, but unlikely to impact plant operations (i.e. storage cabinets, suspended ceilings over office areas).

Housekeeping items not essential to immediate hazards (i.e. ladders, storage cabinets) are rated for Class II structural performance (see Table 8), and it is recommended to restrain housekeeping items.

#### 4.5.2.7 Lift Stations

**Vulnerabilities**

There are two lift stations at the northern end of the collection system, serving a total of less than 20 properties, that could be impacted by a significant seismic event.

**Mitigations**

It is recommended to have on hand emergency generators to operate critical lift stations following a Rodgers Creek M 7 earthquake. After 48 hours, it is reasonable to assume that PG&E power will be restored to the majority of the lift stations; however, having emergency generators may still be needed.

### 4.5.3 Reclamation Reservoirs

The SVCSD reclamation system includes five storage reservoirs, including two reservoirs (R-1 & R-2) that are under the jurisdiction of the California Division of Safety of Dams (DSOD). DSOD makes periodic inspections and completed an inspection and report in 2013 of R-1 and R-2. The following are DSOD and current observations:

- Reservoir R-1 (West). Based on the DSOD (2013) report the dam and appurtenances are very well maintained by the SCWA, and no work other than regularly scheduled maintenance is required at this time. From the known information and visual inspection, the dam, reservoir and the appurtenances are judged safe for continued use.
- Reservoir R-2 (East). Based on the DSOD (2013) report the dam and appurtenances are very well maintained by the SCWA, and no work other than regularly scheduled maintenance is required at this time. From the known information and visual inspection, the dam, reservoir and the appurtenances are judged safe for continued use.
- Reservoir R-3. Reservoir R-3 is currently not being used. If it is returned to service it should be assessed prior to being put into service.
- Reservoir R-4. The dam and appurtenances are very well maintained by the SCWA, and no work other than regularly scheduled maintenance is required at this time. From the known information and visual inspection, the dam, reservoir, and the appurtenances are judged safe for continued use.
- Reservoir R-5 (at WWTP). The dam and appurtenances are very well maintained by the SCWA, and no work other than regularly scheduled maintenance is required at this time. From the known information and visual inspection, the dam, reservoir and the appurtenances are judged safe for continued use. At PGA = 0.42g, some sloshing and spillage of water is likely, and this is thought to be acceptable.

**Vulnerabilities**

An evaluation of the slopes for settlement under strong shaking, and an assessment of the pipelines, could be done as part of a further detailed investigation. If one presumes that DSOD's investigations in 2013 are valid, then the largest potential risk is failure of the pipelines to/from the reservoirs. As these pipelines deliver only tertiary treated water, their failure would normally not impose any public health (sewage) issues, but release of high volume water could still create inundation and erosion risks. From a seismic planning point of view, in case of damage to these pipes, it might be possible that SVCSD could likely safely discharge tertiary-treated water into receiving waters, and then make repairs.

**Mitigations**

None recommended.

### 4.5.4 Emergency Response

A number of pipes may be damaged in the collection system due to liquefaction. It is recommended that the SVCSD have on hand at least two sets of portable pumps and suitable lengths of large diameter hose (typically 12-inch diameter) so that emergency bypass around broken pipes can be made.

# 5. Mitigation Goals, Objectives, and Actions

SVCSD is directly responsible for providing wastewater sanitation services to over 42,000 people in the Sonoma Valley portion of the North Bay Area. The SVCSD is the sole entity providing public wastewater collection, treatment, and disposal services for the City of Sonoma and numerous unincorporated communities within Sonoma Valley. The public relies on the domestic and industrial sanitation services supplied by the SVCSD to be functional in both emergency and non-emergency circumstances.

The SVCSD's facilities stretch over an area of multiple natural hazards, and the system has a range of vulnerabilities to these hazards. Damage to one or more critical elements of the facilities can significantly jeopardize the SVCSD's ability to provide continuous sanitation services during and following a natural disaster, thus compromising public health and safety, as well as posing significant risk to the environment.

The SVCSD takes this responsibility seriously and has developed this plan to systematically address the vulnerabilities of its sanitation system. In this capacity, the SVCSD's goals are in line with the goals of the community as addressed in the Sonoma County (County) hazard mitigation plan. The County's main goals are to reduce the vulnerability of people and property exposed to earthquake, landslide, flood, and wild-land fire hazards. One of the approaches identified by the County for meeting these goals is to promote the implementation of disaster mitigation projects and to increase disaster resistance and reliability. Keeping in view the desires of the community, as expressed in the County's plan and the understanding of the system vulnerabilities, the SVCSD has formulated the following three main goals:

**Goal 1: Increase organizational efficiencies and effectiveness when responding to natural disasters**

**Goal 2: Increase reliability of the treatment system capabilities during and after natural disasters**

**Goal 3: Increase reliability of the wastewater collection system and disposal facilities to maintain conveyance capabilities during and after natural disasters**

Based on the insights obtained from a system-wide natural hazard reliability assessment of the SVCSD's wastewater facilities, a series of goals, objectives, and mitigation actions are included in this plan to form the basis of a hazard mitigation strategy. The identified goals and objectives are intended to enhance system reliability, emergency response, and overall operational resilience in the face of potential risks to public health and safety and the environment from specific hazards and system vulnerabilities associated with the SVCSD's wastewater facilities For each goal, objectives

that more specifically address particular areas of mitigation opportunity have been developed along with related mitigation actions that support implementation of those objectives.

**Goal 1: Increase organizational efficiencies and effectiveness when responding to natural disasters**

**Objective 1.1:** Develop an emergency response and recovery plan that addresses widespread damage and limited sanitation functions including a damage assessment process and restoration of collection and treatment capabilities.

**Mitigation Actions:**

1.1.1 Develop SVCSD-specific measures to include in an integrated Sonoma County Water Agency emergency response and recovery plan for sanitation operations.

**Objective 1.2:** Invest in Supervisory Control and Data Acquisition (SCADA) infrastructure upgrades which will allow operators to quickly identify and respond to issues during and after natural disasters.

**Mitigation Actions:**

1.2.1 Enhance the reliability of SCADA operations by upgrading network hardware, computer hardware, and radio hardware.

**Objective 1.3:** Obtain emergency response equipment to enhance the SVCSD's ability to restore service after a natural disaster.

**Mitigation Actions:**

1.3.1 Obtain flexible hoses, emergency pumps, generators, and related emergency response equipment to enhance the SVCSD's ability to restore service in the collection system after a natural disaster.

**Goal 2: Increase reliability of the treatment system capabilities during and after natural disasters**

**Objective 2.1:** Seismically retrofit vulnerable equipment, structures, treatment elements, and piping at the treatment plant.

**Mitigation Actions:**

2.1.1 Seismically restrain/anchor miscellaneous equipment at the treatment plant.

2.1.2 Seismically retrofit clarifiers.

**Goal 3: Increase reliability of the wastewater collection system and disposal facilities to maintain conveyance capabilities during and after natural disasters**

**Objective 3.1:** Develop and implement a design strategy to mitigate the effects of earthquakes in areas of potential liquefaction or significant differential movement.

**Mitigation Actions:**

3.1.1 Replace trunk main in the Maxwell Park vicinity to mitigate the effects of liquefaction.

3.1.2 Develop and implement a design strategy to mitigate the effects of liquefaction on the trunk main in areas that have very high to high liquefaction potential.

3.1.3 Develop and implement a design strategy to mitigate the effects of liquefaction on the collection system (non-trunk) in areas that have very high to high liquefaction potential.

3.1.4 Develop and implement a design strategy to mitigate the effects of liquefaction on the trunk main in areas that have moderate liquefaction potential.

3.1.5 Develop and implement a design strategy to mitigate the effects of liquefaction on the collection system (non-trunk) in areas that have moderate liquefaction potential.

3.1.6 Update construction standards to address liquefaction potential along the collection system.

3.1.7 Conduct site-specific studies to better evaluate seismic related vulnerabilities and further define the scope of capital project mitigation actions.

3.1.8 Develop and implement a design strategy for the Sonoma Creek crossing at Madrone Road to protect the trunk main from significant damage during a seismic event.

3.1.9 Develop and implement a design strategy for Sonoma Creek crossing at Agua Caliente Road to protect the collection system from significant damage during a seismic event.

3.1.10 Develop and implement a design strategy for Sonoma Creek crossing near Riverside Road/W. Napa Street to protect the trunk main from significant damage during a seismic event.

3.1.11 Seismically retrofit chlorine building including chlorinators, piping, and rail system.

3.1.12 Seismically retrofit suspended ceiling over office area and water quality lab.

**Objective 3.2:** Develop and implement a strategy to mitigate the potential effects of landslides.

**Mitigation Actions:**

3.2.1 Develop and implement a design strategy to mitigate the effects of landslides, high stream flows, and liquefaction on portions of the collection system along Sonoma Creek in the vicinity of Arnold Drive in Glen Ellen.

3.2.2 Develop and implement a design strategy to mitigate the effects of a landslide along Buena Vista Avenue.

3.2.3 Develop and implement a design strategy to mitigate the effects of a landslide on the trunk main at the Sonoma Creek crossing near Riverside Road/W. Napa Street.

**Objective 3.3:** Develop and implement a design strategy to minimize the potential effects of storms and flooding.

**Mitigation Actions:**

3.3.1 Replace the Trunk Main at the Agua Caliente Creek crossing to mitigate the effects of high stream flows and liquefaction.

3.3.2 Develop and implement a design strategy to mitigate the effects of high stream flows on the collection system for the Lilley Creek crossing at West Thompson Avenue.

3.3.3 Develop and implement a design strategy to mitigate the effects of high stream flows on the collection system for the Nathanson Creek crossings at France Street, Chase Street, and MacArthur Street.

# 6. Plan Implementation

The SVCSD believes that the hazard mitigation upgrades and safe operations of its systems will be accomplished most effectively with an implementation strategy consisting of an ongoing program in which the most significant vulnerabilities and those with the highest probability of occurrence are mitigated first, followed systematically by vulnerabilities of less significance and/or lower probability. Adding to that principle however, the SVCSD also believes that opportunities to address vulnerabilities that can be mitigated efficiently in conjunction with other necessary upgrades, planned maintenance work, or current pursuits should be included among first-tier mitigation priorities. Mitigation of newly identified vulnerabilities—based on new or refined information—should be prioritized similarly and addressed as resources are available. Continued improvement in the reliability of the system and responsiveness to natural disasters is expected to be a key outcome of this approach.

Prioritization of actions that support the SVCSD's mitigation goals and objectives is based upon qualitative categorization of planning level benefit/cost (pro/con) assessments of the individual mitigation actions identified in Chapter 5. Key factors that were considered in the development of the benefit/cost assessment included:

- **Significance of impact**. For example, a potential break along the trunk main which serves the whole SVCSD would have a more significant impact (number of people affected and risk to public health and safety) than a smaller diameter collection pipe serving a limited area.
- **Likelihood of failure**. For example, more damage is likely to occur in areas of very high liquefaction potential near waterways than areas with moderate liquefaction potential far from waterways.

- **Cost to implement**. Mitigations actions that are relatively low cost to implement will increase the overall benefit/cost assessment. For example, anchorage of critical equipment is considered a high priority because of the relatively low cost of installing anchors compared to the overall benefits.

Mitigation actions that address hazards having high significance of impact or high likelihood of failure will increase its overall benefit/cost assessment. However, additional considerations that may also influence the benefit/cost assessment of individual mitigation actions could include factors such as:

- Opportunities to implement certain actions as part of other SVCSD efforts or programmed work.
- Reliance on additional information (to better define the scope, benefit, or schedule of particular mitigation actions, especially larger, long-term programmatic actions).
- The complexity or challenges to implementation.

The prioritized mitigation actions are presented in Table 10. As presented, the mitigation actions determined to have higher benefit/cost assessments are prioritized ahead those having lower benefit/cost assessments.

Table 10: Summary Benefit-Cost Review of Mitigation Actions

| Tier | Priority | LHMP Action | Description | Benefits (Pros) | Costs (Cons) |
|---|---|---|---|---|---|
| Tier 1 | A1 | 2.1.1 | Seismically restrain/anchor miscellaneous equipment at the treatment plant | • Prevents failure of a variety of critical and non-critical equipment at treatment plant<br>• Low cost high return measure<br>• Expedites system recovery efforts<br>• Prevents damage to equipment needed in recovery | • Ongoing operational effort for some systems |
| | | 3.1.7 | Conduct site-specific studies to better evaluate seismic related vulnerabilities and further define the scope of capital project mitigation actions. | • Better informs an understanding of specific vulnerabilities and provides additional information to further refine mitigation approach<br>• Facilitates and streamlines mitigation design efforts | • Facilitates mitigation efforts, but does not in itself mitigate any hazard |
| | | 1.1.1 | Develop District-specific emergency response measures to include in an integrated Sonoma County Water Agency emergency response and recovery plan for sanitation operations. | • Critical emergency response<br>• Critical for reducing post-event restoration time<br>• Minimizes significant loss of services<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Ongoing effort and costs to maintain plan and train staff on implementation |
| | | 3.1.6 | Update construction standards to address liquefaction potential along the collection system | • Improves risk awareness to public and design/construction community<br>• Facilitates consistent system-wide application of reliability improvements<br>• Reduces the risk of collection system failure<br>• Minimizes significant loss of services<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Requires public outreach and training to adapt to new standards<br>• Increased cost to new development |
| | | 1.3.1 | Obtain flexible hoses, emergency pumps, generators, and related emergency response equipment to enhance the District's ability to restore service in the collection system after a natural disaster. | • Allows for rapid and effective first response<br>• Critical for reducing post-event restoration time<br>•Minimizes significant loss of services<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Storage and accessibility required<br>• Uncertainty in needed quantity |
| | | 1.2.1 | Enhance the reliability of SCADA operations by upgrading network hardware, computer hardware, and radio hardware. | • Critical emergency response<br>• Critical for reducing post-event restoration time<br>• Minimizes significant loss of services<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Ongoing effort to monitor, maintain, and upgrade system |
| | | 3.1.1 | Replace trunk main in the Maxwell Park vicinity to mitigate the effects of liquefaction. | • Reduces the risk of trunk main failure<br>• Avoids significant loss of services<br>• Benefits extensive service area<br>• Addresses additional system and regulatory needs<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital cost<br>• Deep installation<br>• Construction in riparian habitat<br>• Park use impacts during construction |
| | | 2.1.2 | Seismically retrofit clarifiers | • Prevents failure of a critical component needed for secondary treatment<br>• Avoids prolonged system recovery efforts<br>• Reduces public health and safety risk and environmental damage from release of inadequately treated wastewater | • Capital cost |
| | | 3.2.1 | Develop and implement a design strategy to mitigate the effects of landslides, high stream flows, and liquefaction on portions of the collection system along Sonoma Creek in the vicinity of Arnold Drive in Glen Ellen.* | • Reduces the risk of collection system failure<br>• Avoids significant loss of services<br>• Benefits significant service area<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital Cost<br>• Construction in riparian habitat<br>• Construction complexities<br>• Permitting challenges |
| | | 3.3.1 | Replace the Trunk Main at the Agua Caliente Creek crossing to mitigate the effects of high stream flows and liquefaction.* | • Reduces the risk of trunk main failure<br>• Avoids significant loss of services<br>• Benefits significant service area<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital costs<br>• Construction complexities<br>• Construction in riparian habitat<br>• Permitting challenges<br>• Increased maintenance |
| | | 3.3.3 | Develop and implement a design strategy to mitigate the effects of high stream flows on the collection system for the Nathanson Creek crossings at France Street, Chase Street, and MacArthur Street* | • Reduces risk of collection system failure<br>• Avoids loss of services<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital costs<br>• Possible riparian impacts, permitting challenges, and/or increased long-term maintenance depending on mitigation approach. |

| Tier | Priority | LHMP Action | Description | Benefits (Pros) | Costs (Cons) |
|---|---|---|---|---|---|
| Tier 1 | B1 | 3.1.3 | Develop and implement a design strategy to mitigate the effects of liquefaction on the collection system (non-trunk) in areas that have very high to high liquefaction potential | • Reduces the risk of collection system failure<br>• Avoids significant loss of services<br>• Benefits significant service area<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital costs<br>• Long-term goal |
| | | 3.2.3 | Develop and implement a design strategy to mitigate the effects of a landslide on the trunk main at the Sonoma Creek crossing near Riverside Road/ W. Napa Street | • Reduces the risk of trunk main failure<br>• Avoids significant loss of services<br>• Benefits significant service area<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital Cost<br>• Construction in riparian habitat<br>• Permitting Challenges |
| | | 3.1.8 | Develop and implement a design strategy for the Sonoma Creek crossing at Madrone Road to protect the trunk main from significant damage during a seismic event | • Reduces the risk of trunk main failure<br>• Avoids significant loss of services<br>• Benefits significant service area<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital costs<br>• Construction in riparian habitat<br>• Permitting challenges |
| | | 3.1.9 | Develop and implement a design strategy for Sonoma Creek crossing at Agua Caliente Road to protect the collection system from significant damage during a seismic event | • Reduces the risk of collection system failure<br>• Avoids loss of services<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital costs<br>• Construction in riparian habitat<br>• Permitting challenges |
| | | 3.1.2 | Develop and implement a design strategy to mitigate the effects of liquefaction on the trunk main in areas that have very high to high liquefaction potential | • Reduces the risk of trunk main failure<br>• Avoids significant loss of services<br>• Benefits significant service area<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital costs<br>• Construction complexities<br>• Long-term goal |
| | | 3.3.2 | Develop and implement a design strategy to mitigate the effects of high stream flows on the collection system for the Lilley Creek crossing at West Thompson Avenue | • Reduces risk of collection system failure<br>• Avoids loss of services<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital costs<br>• Possible riparian impacts, permitting challenges, and/or increased long-term maintenance depending on mitigation approach. |
| | | 3.2.2 | Develop and implement a design strategy to mitigate the effects of a landslide along Buena Vista Avenue | • Reduces the risk of collection system failure<br>• Avoids loss of services<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital cost<br>• Limited service area affected<br>• Road encroached by homes results in poor accessibility |
| Tier 2 | A2 | 3.1.11 | Seismically retrofit suspended ceiling over office area and water quality lab. | • Reduces risk of disrupted treatment operations<br>• Low cost | |
| | | 3.1.4 | Develop and implement a design strategy to mitigate the effects of liquefaction on the trunk main in areas that have moderate liquefaction potential | • Reduces the risk of trunk main failure<br>• Avoids significant loss of services<br>• Benefits significant service area<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital costs<br>• Construction complexities<br>• Long-term goal |
| | B2 | 3.1.10 | Seismically retrofit chlorine building including chlorinators, piping, and rail system. | • Reduces risk of disinfection system failure during most extreme seismic events<br>• Avoids significant loss of services<br>• Benefits significant service area<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of airborne toxin | • Capital costs<br>• Targets only the most extreme seismic events |
| | | 3.1.5 | Develop and implement a design strategy to mitigate the effects of liquefaction on the collection system (non-trunk) in areas that have moderate liquefaction potential | • Reduces the risk of collection system failure<br>• Avoids significant loss of services<br>• Benefits significant service area<br>• Reduces public health and safety risk and environmental damage from uncontrolled release of wastewater | • Capital costs<br>• Long-term goal |

The SVCSD's implementation strategy is based on a two tier system consisting of four priority categories as represented in Table 10 and described here:

- The first tier actions (Tier 1) are those that provide the highest cost benefit, and once implemented, will result in substantial improvement in the overall reliability of the system. Tier 1 actions include all actions assessed to have both high significance of impact and high likelihood of failure (principal actions). Tier 1 also includes any and all other mitigation actions with a benefit/cost assessment approximately equal to or greater than the lowest principal action. Within Tier 1, there are two priority categories: A1 and B1. Priority A1 actions include those actions that are estimated to have potential or likelihood to be completed or initiated within the 5-year life of this plan based on current projections of available resources and/or opportunities. Priority A2 consists of those actions for which the availability of dedicated resources or opportunity are not likely with the 5-year plan life.
- The second tier actions (Tier 2) are considered desirable and will further enhance the system reliability once the first tier objectives are achieved. Tier 2 actions include all remaining mitigation actions with benefit/cost assessments below the Tier 1 threshold. Within Tier 2, there are two priority categories, A2 and B2. Priority A2 actions include those actions that are estimated to have some potential to be completed or initiated within the 5-year life of this plan depending on the availability of resources and/or opportunity. Priority B2 consists of those actions for which the availability of resources or opportunity is not likely within the 5-year plan life.

With this approach, Tier 1 actions will generally be implemented with greater priority. However, some Tier 2 actions may be implemented ahead of more critical Tier 1 actions due to such factors as the availability of different resources or opportunities.

In addition, the SVCSD, as part of its maintenance program, has undertaken some of the objectives identified in Section 5. The most noteworthy being the stockpiling of standby materials and equipment. Likewise, the Sonoma County Water Agency has updated portions of its emergency response plan to include actions related to SVCSD. These actions include enhancing the Sonoma County Water Agency's Emergency Operations Center and ensuring emergency backup power is available for critical facilities (including SVCSD).

On behalf of the SVCSD, mitigation actions involving capital projects will be incorporated into the Sonoma County Water Agency's annual Capital Improvement Plan as funding is scheduled to occur. The SVCSD will actively work towards identifying outside funding sources for these projects such as FEMA's pre-disaster mitigation program and hazard mitigation grants program. Depending on the level of funding, it is anticipated that the SVCSD will initiate or complete implementation of the Priority A1 mitigation actions within 5 years following the adoption of the plan.

# 7. Plan Maintenance

In order to ensure the effectiveness of the goals and objectives, this plan relies on an ongoing program of assessing updated conditions to verify appropriate mitigation focus and priority based on current information. This process will be managed with continued monitoring and maintenance of this hazard mitigation plan through a five year update cycle.

The SVCSD's commitment to reducing its hazard vulnerability and improving the reliability of its system is demonstrated by the fact that the SVCSD on its own initiative undertook a system-wide multi-hazard reliability assessment and improvement program. The SVCSD recognizes that this commitment can only be met through a dedicated effort. Development of the Local Hazard Mitigation Plan is part of this effort. In meeting the requirements of the DMA2000, the SVCSD plans to update the Hazard Mitigation Plan every five years or if new information becomes available, priorities for implementation change or an actual hazard event occurs that may prompt an update to the plan sooner than five years.

## 7.1 Monitoring, Evaluating, and Updating the Plan

The SVCSD will keep the plan "alive" through continued monitoring of the plan goals and objectives. The high priority mitigation actions are being included in the SVCSD's Capital Improvement Plan (CIP). Because of the involvement of the SVCSD's department heads of Planning, Operations, Maintenance and Capital Improvements in the development of the plan, the entire executive management of the SVCSD is committed to implement the goals and objectives of the plan.

The SVCSD will incorporate the hazard mitigation plan in its yearly CIP planning process to monitor progress towards the goals of the hazard mitigation plan. To further facilitate this process, the SVCSD's Chief Engineer has been identified as the person responsible for monitoring and updating the hazard mitigation plan. As required by DMA2000, this plan will be updated every five years. The SVCSD will also update the plan if there is a significant change in the basic assumptions, for example a major hazard event that highlights vulnerabilities in the system not anticipated at the present time.

## 7.2 Continued Public Involvement

The SVCSD, with its decision to incorporate the hazard mitigation plan in its yearly CIP planning process, has ensured continued public involvement in this plan. The CIP approval is an open public process. As part of the approval process the CIP is presented to the SVCSD's Board of Directors in an open public meeting and by virtue of this, progress towards achieving SVCSD's goals and objectives identified in the hazard mitigation plan will also be open for public review and comment. Solicitation will occur in a newsletter, and if natural disasters occur, the SVCSD will reach out to the stakeholders to discuss.

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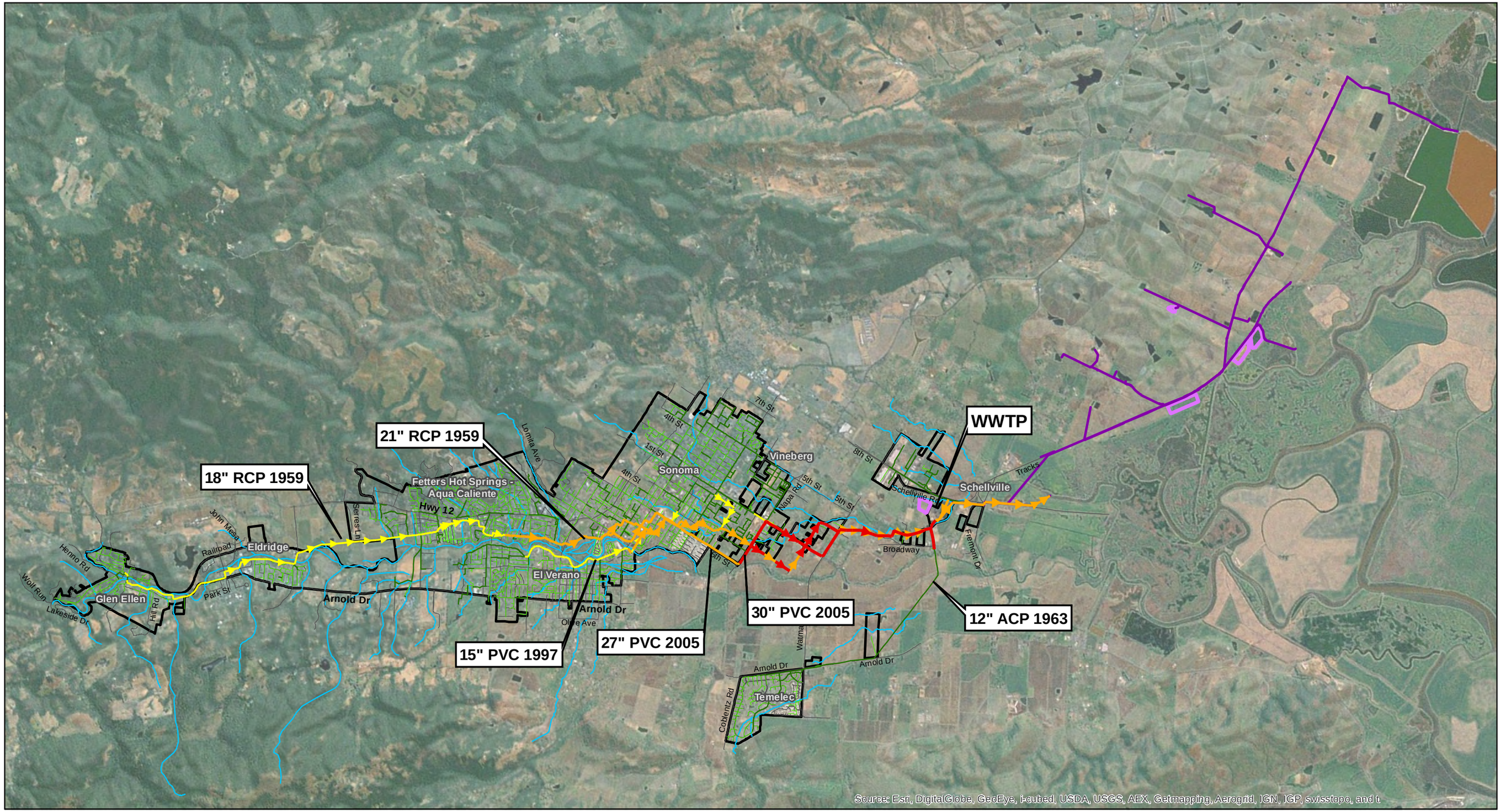
# Appendices

# APPENDIX A – SVCSD FIGURES

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

SVCSD Boundary
Street
Creek
Recycled Water Pipe
Recycled Water Reservoir

**Sanitary Sewer Pipe Diameter (inches)**

<= 6
8 - 12
15 - 18
21 - 27
30 - 42

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 12 Feb 2015 |

Sonoma Valley CSD
Collection and Recycled Water System

Figure SV-1

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Data source: SCWA, Sanitary Sewer, Street, Creek, Boundary, 2013. Created by:afisher2

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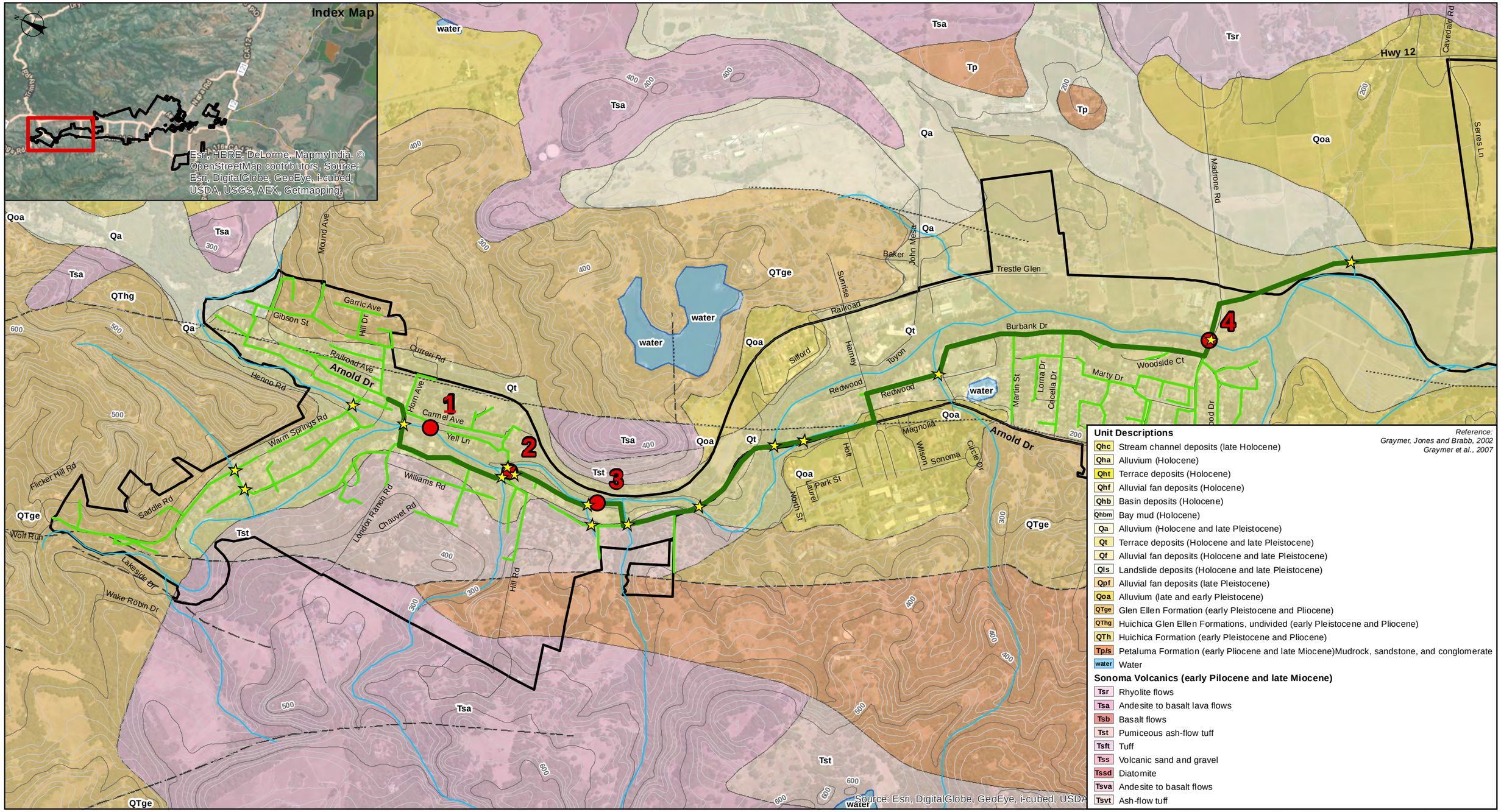


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Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
100' Contour
20' Contour
contact, approx. located
contact, certain
contact, concealed
fault, approx. located
fault, certain
fault, concealed
fault, inferred
water boundary
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
Geologic Hazard Reconnaissance Point

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| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

# Sonoma Valley CSD Geology (1 of 10)

# Figure SV-2

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Data source: SCWA, Sanitary Sewer, Street, Creek, Boundary, 2013; Kleinfelder, Geology, 2014. Created by:afisher2

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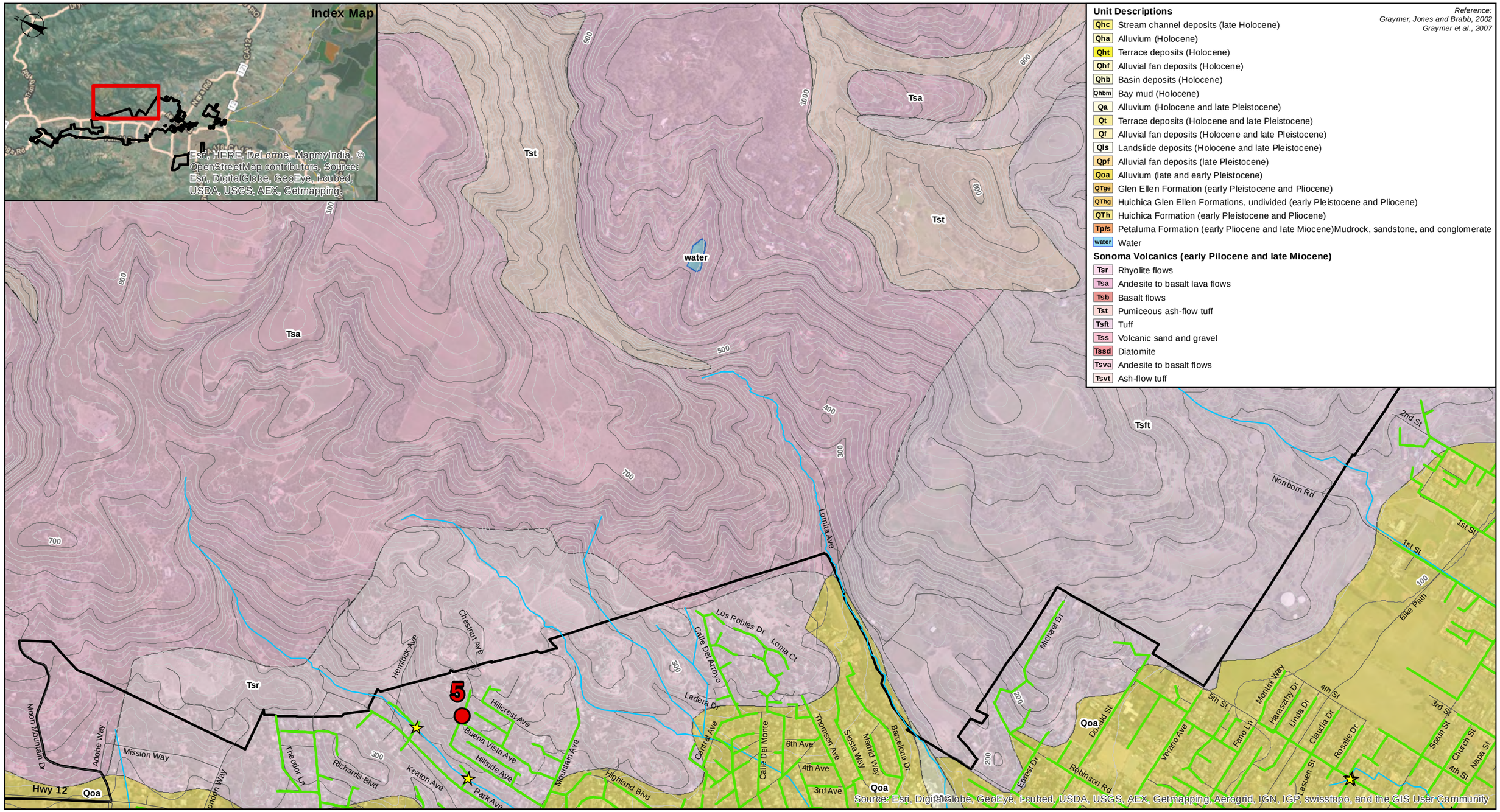


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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
100' Contour
20' Contour
contact, approx. located
contact, certain
contact, concealed
fault, approx. located
fault, certain
fault, concealed
fault, inferred
water boundary
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
Geologic Hazard Reconnaissance Point

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Geology (2 of 10)

Figure SV-3

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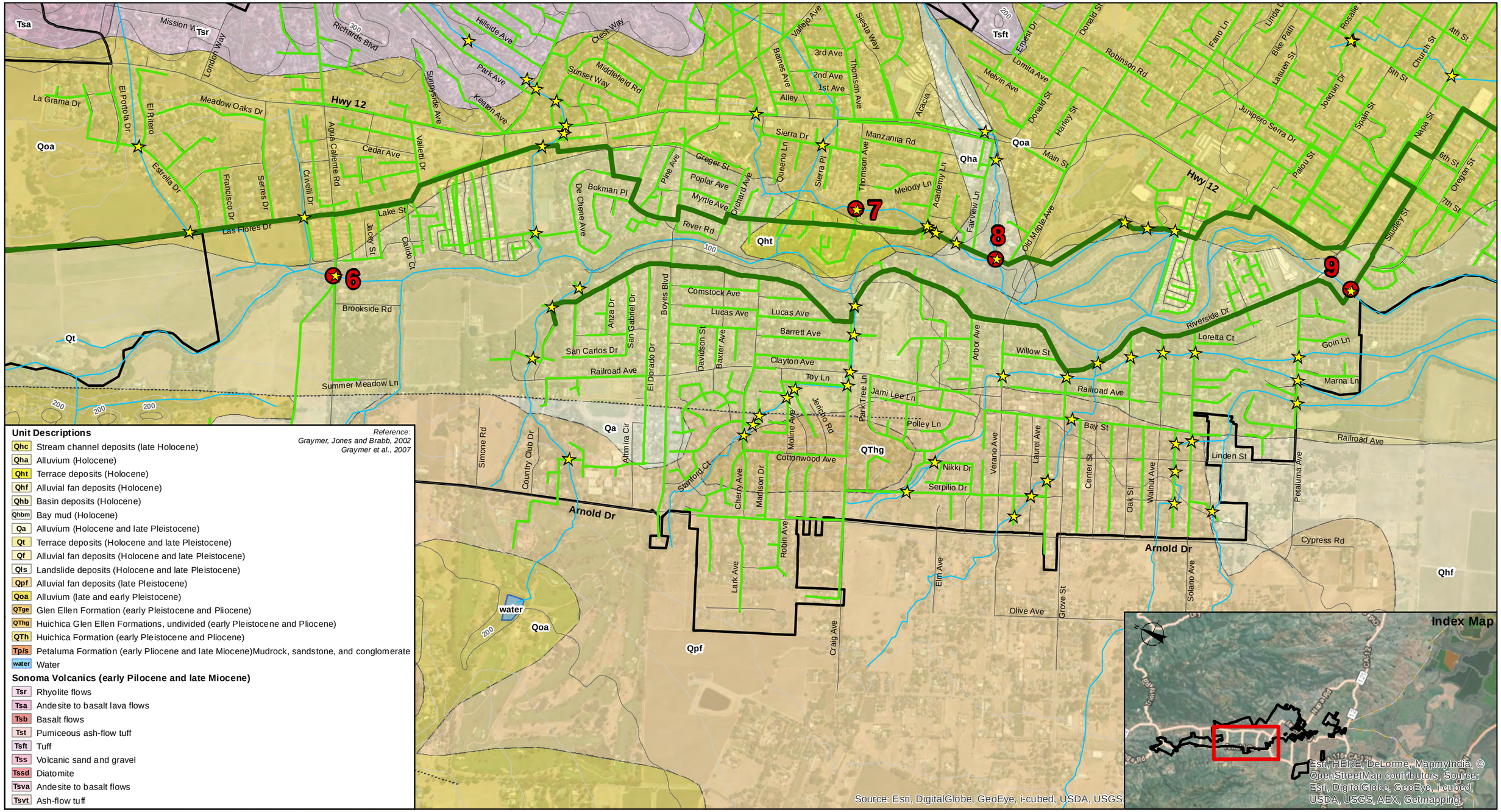


**Unit Descriptions**

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- Tsva — Andesite to basalt flows
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Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100
Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

- SVCSD Boundary
- Street
- Creek
- 100' Contour
- 20' Contour
- contact, approx. located
- contact, certain
- contact, concealed
- fault, approx. located
- fault, certain
- fault, concealed
- fault, inferred
- water boundary
- Sanitary Sewer Main
- Sanitary Sewer Trunk Main
- Crossing Location
- Geologic Hazard Reconnaissance Point

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Geology (3 of 10)

Figure SV-4

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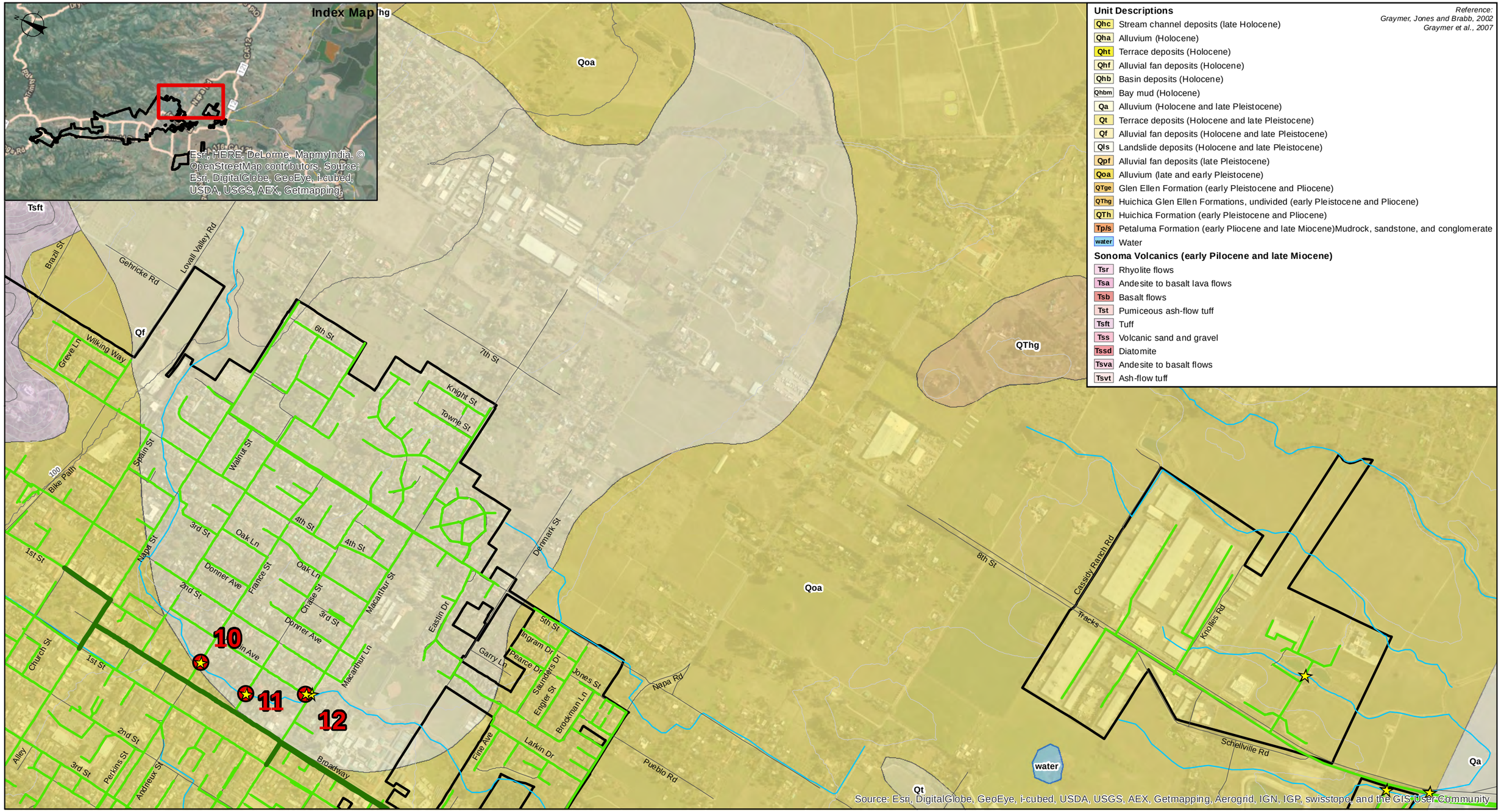


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
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SVCSD Boundary
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G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Geology (4 of 10)

Figure SV-5

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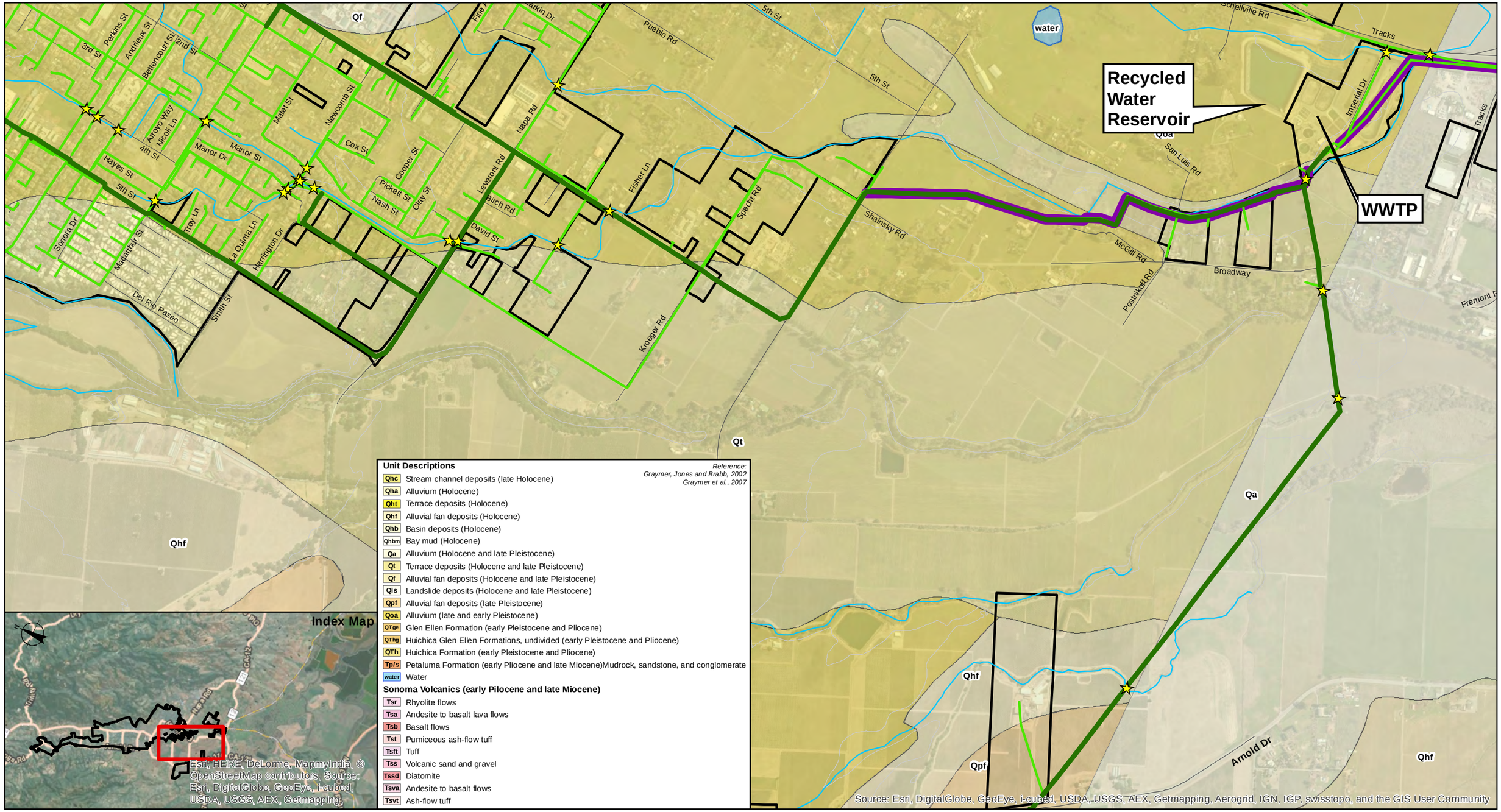


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0 300 600 900 1,200
Feet

Map Projection: Lambert Conformal Conic
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Crossing Location
Geologic Hazard Recon Point

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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| Job Number | 8410201 |
| Revision | 2 |
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Sonoma Valley CSD
Geology (5 of 10)

Figure SV-6

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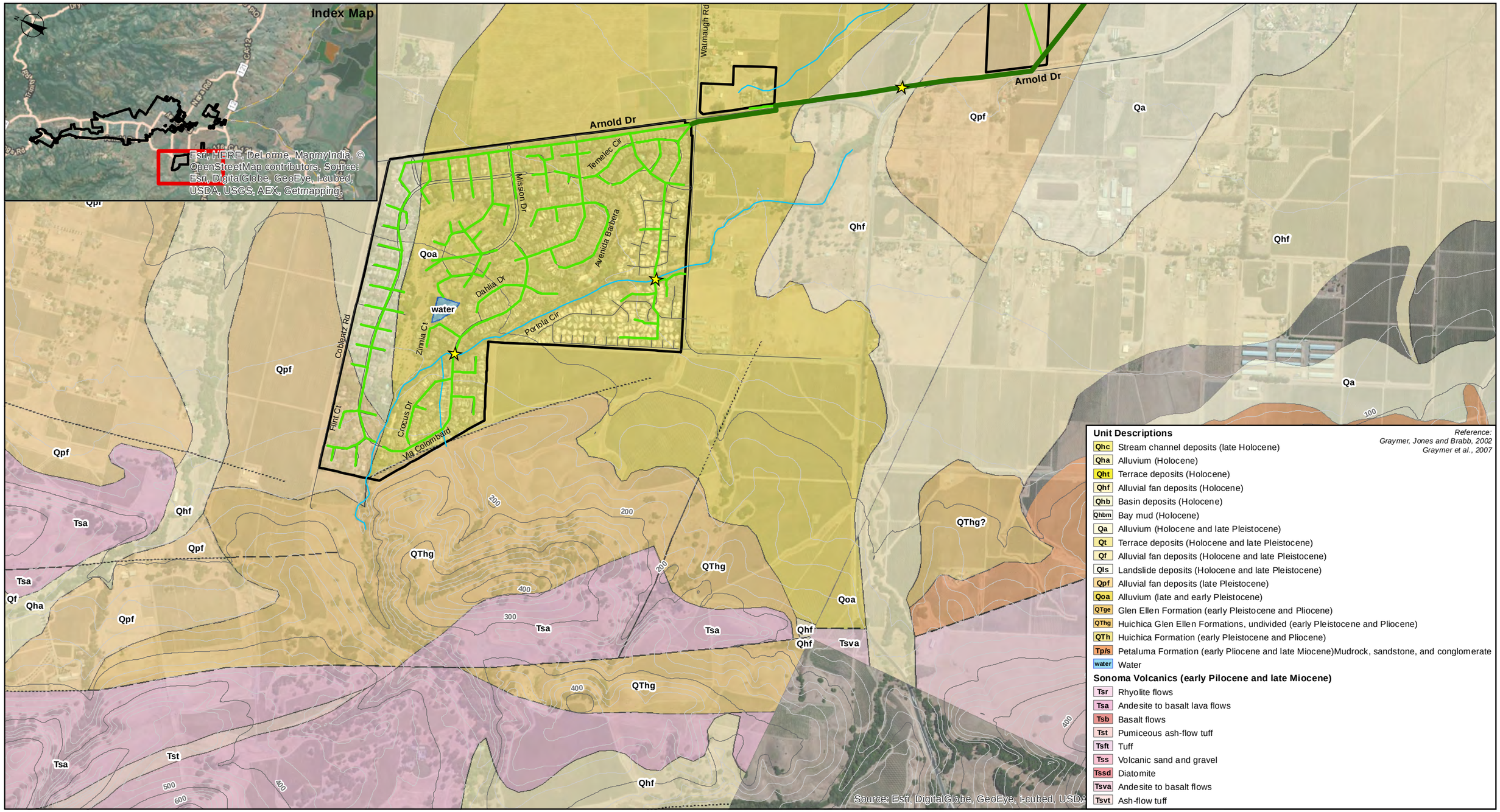


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Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100
Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
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Sonoma County Water Agency
Natural Hazard Reliability Assessment

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| Revision | 2 |
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Sonoma Valley CSD
Geology (6 of 10)

Figure SV-7

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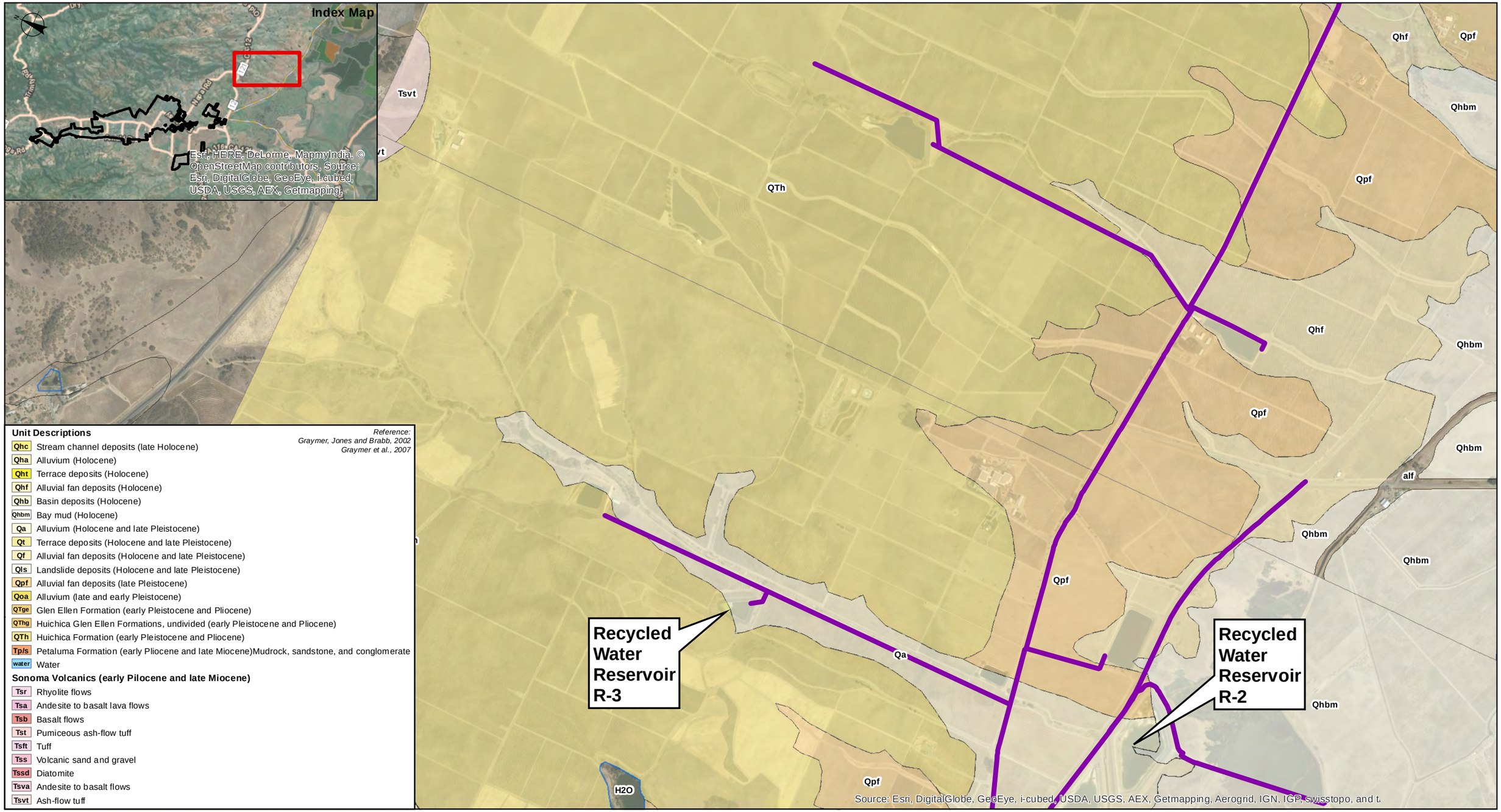


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0 275 550 825 1,100
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G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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| Job Number | 8410201 |
| Revision | 2 |
| Date | 12 Feb 2015 |

Sonoma Valley CSD
Geology (7 of 10)

Figure SV-8

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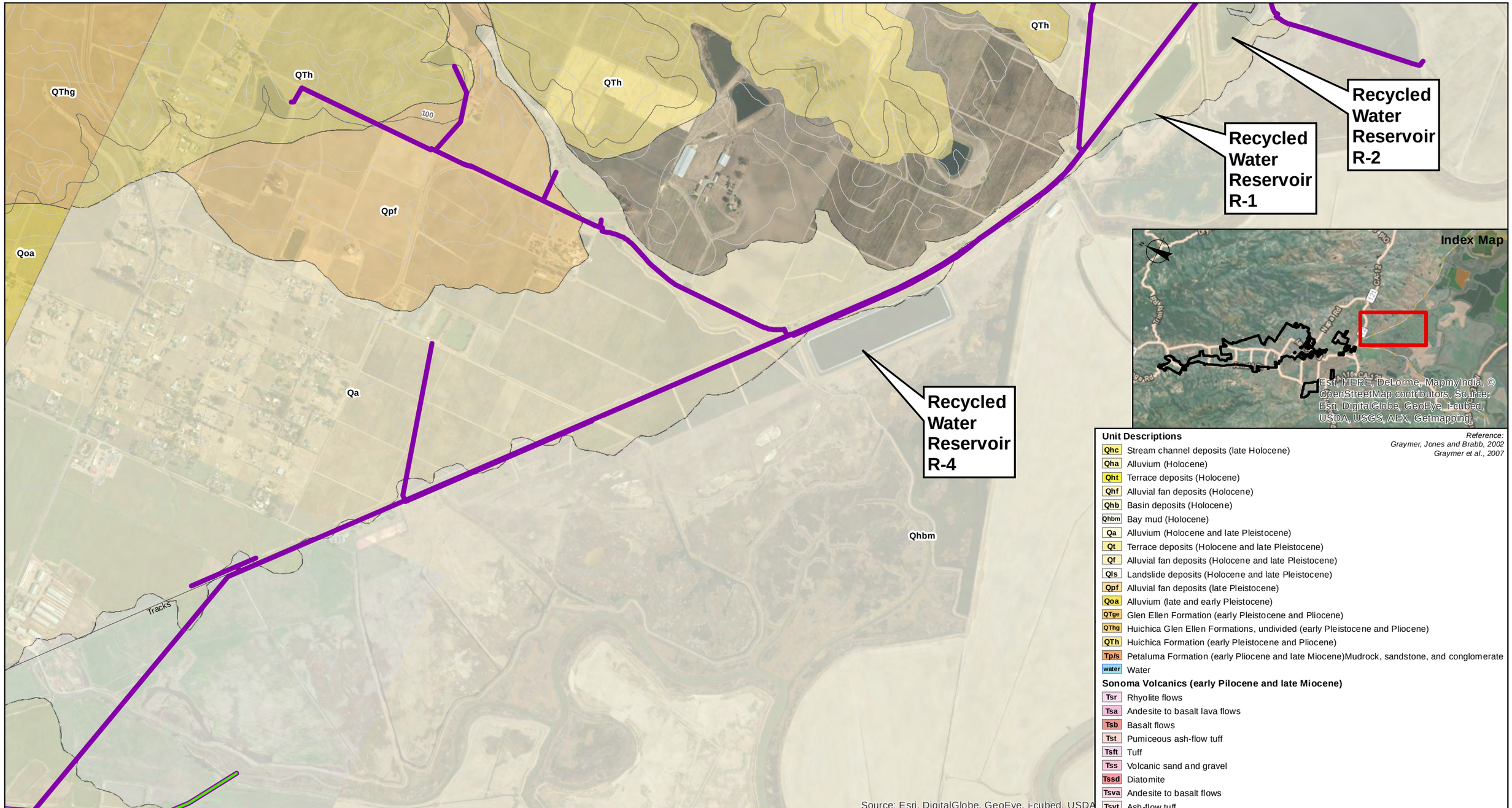


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Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100
Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

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G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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| Job Number | 8410201 |
| Revision | 2 |
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# Sonoma Valley CSD Geology (8 of 10)

# Figure SV-9

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0 275 550 825 1,100
Feet

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Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
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# Sonoma Valley CSD Geology (9 of 10)

# Figure SV-10

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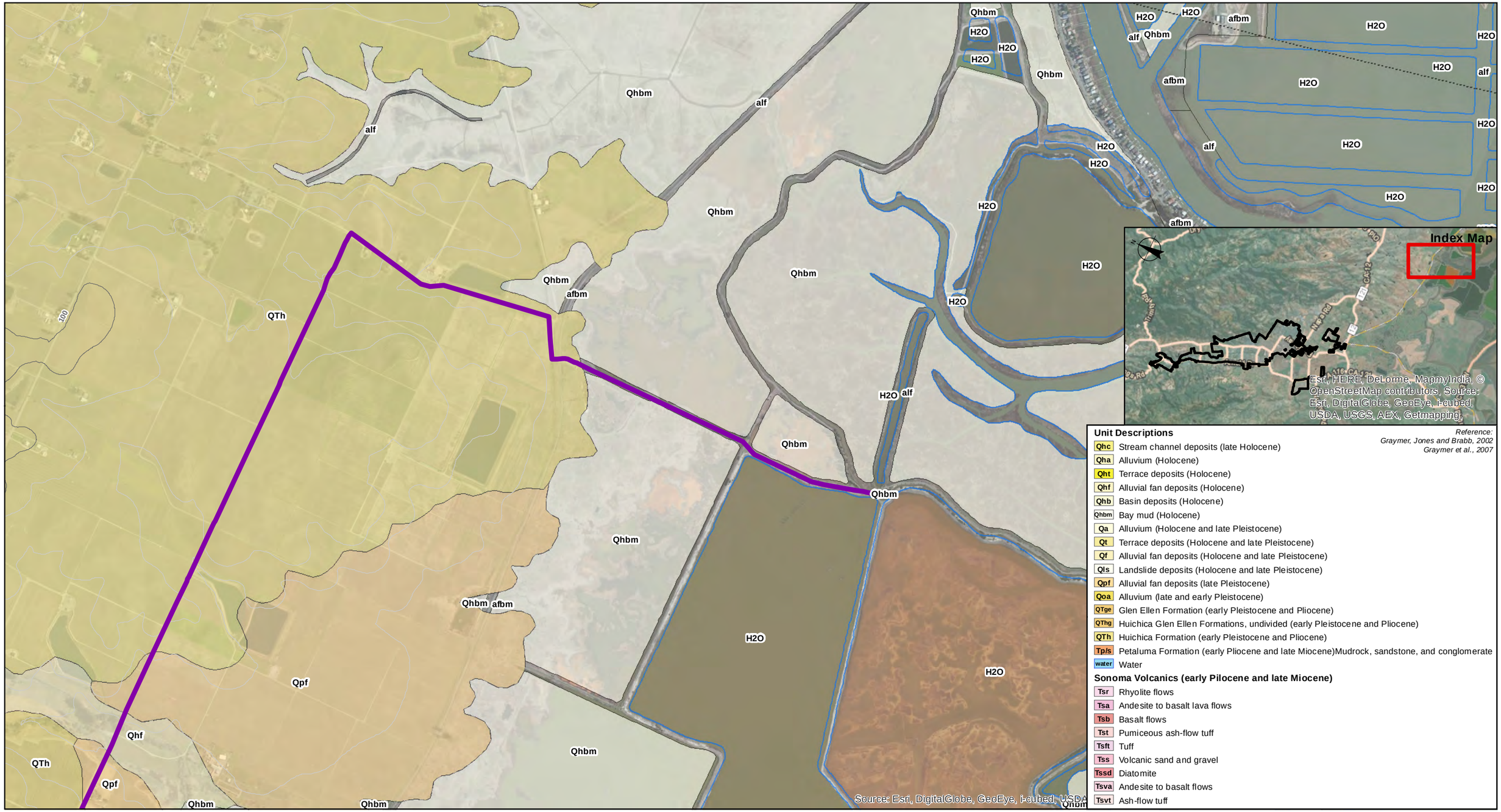


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Sonoma Valley CSD
Geology (10 of 10)

Figure SV-11

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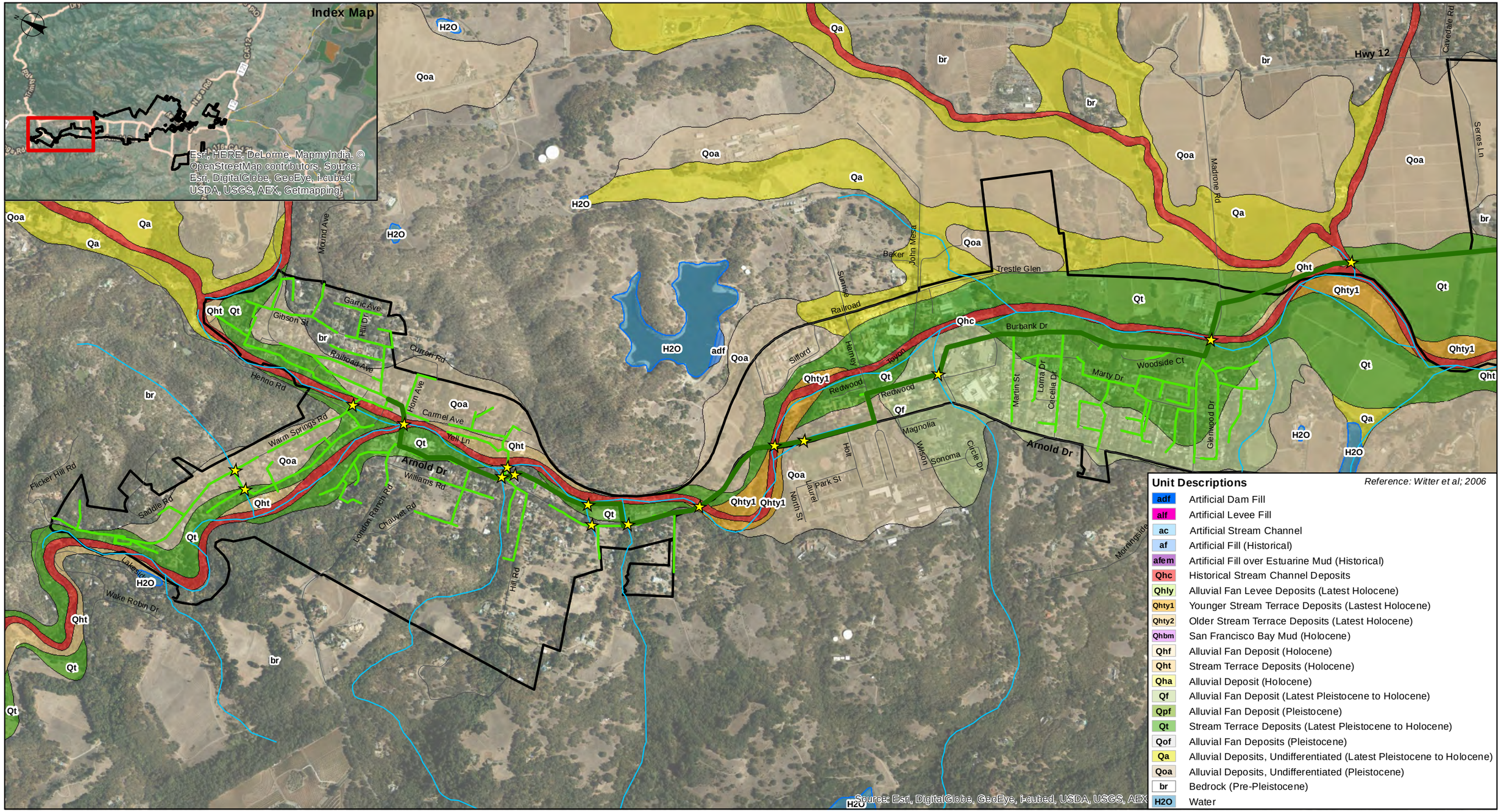


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 11 Feb 2015 |

Sonoma Valley CSD
Quaternary Deposits (1 of 10) Figure SV-12

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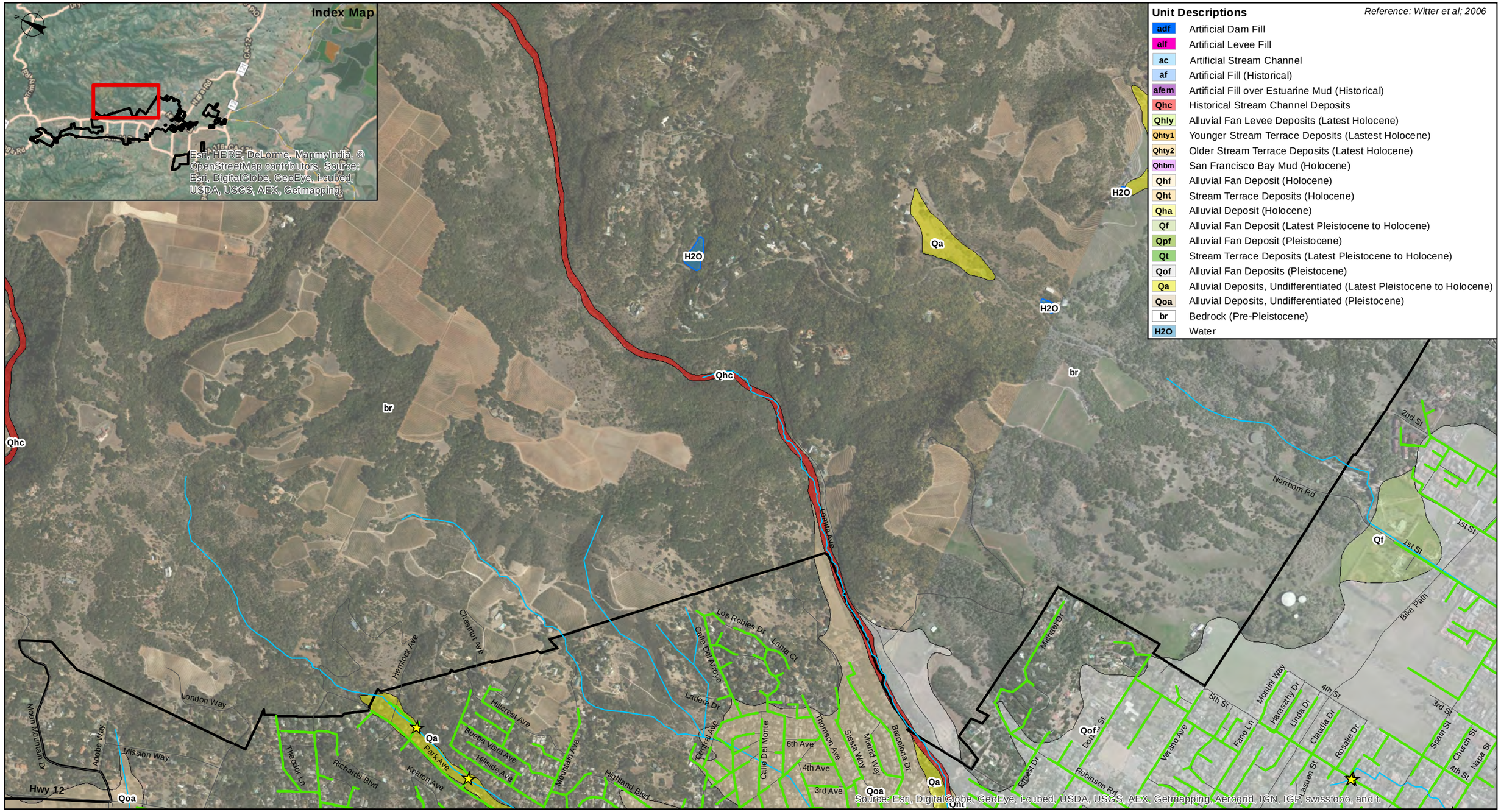


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 11 Feb 2015 |

Sonoma Valley CSD
Quaternary Deposits (2 of 10) Figure SV-13

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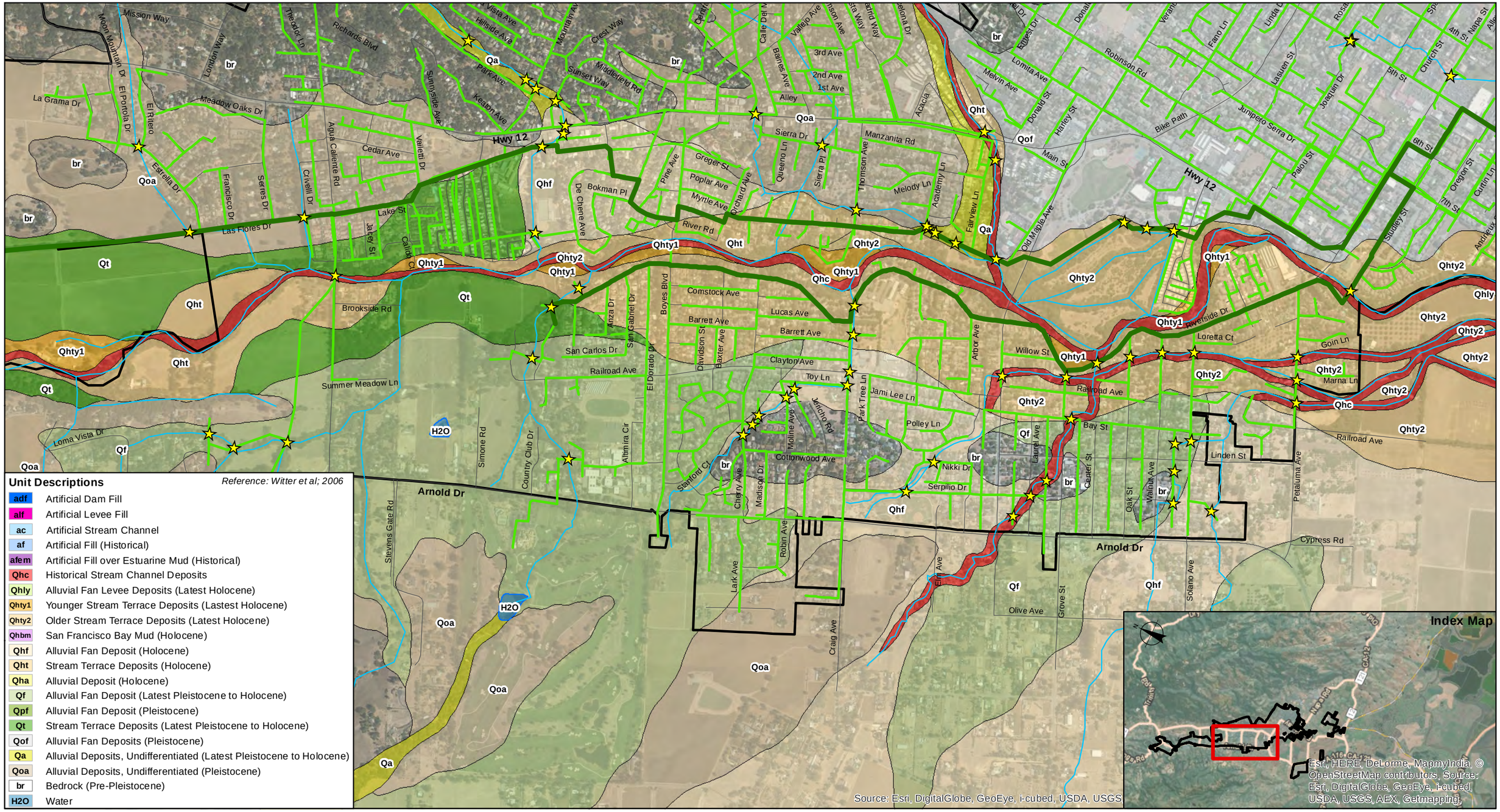


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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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Sonoma Valley CSD
Quaternary Deposits (3 of 10) Figure SV-14

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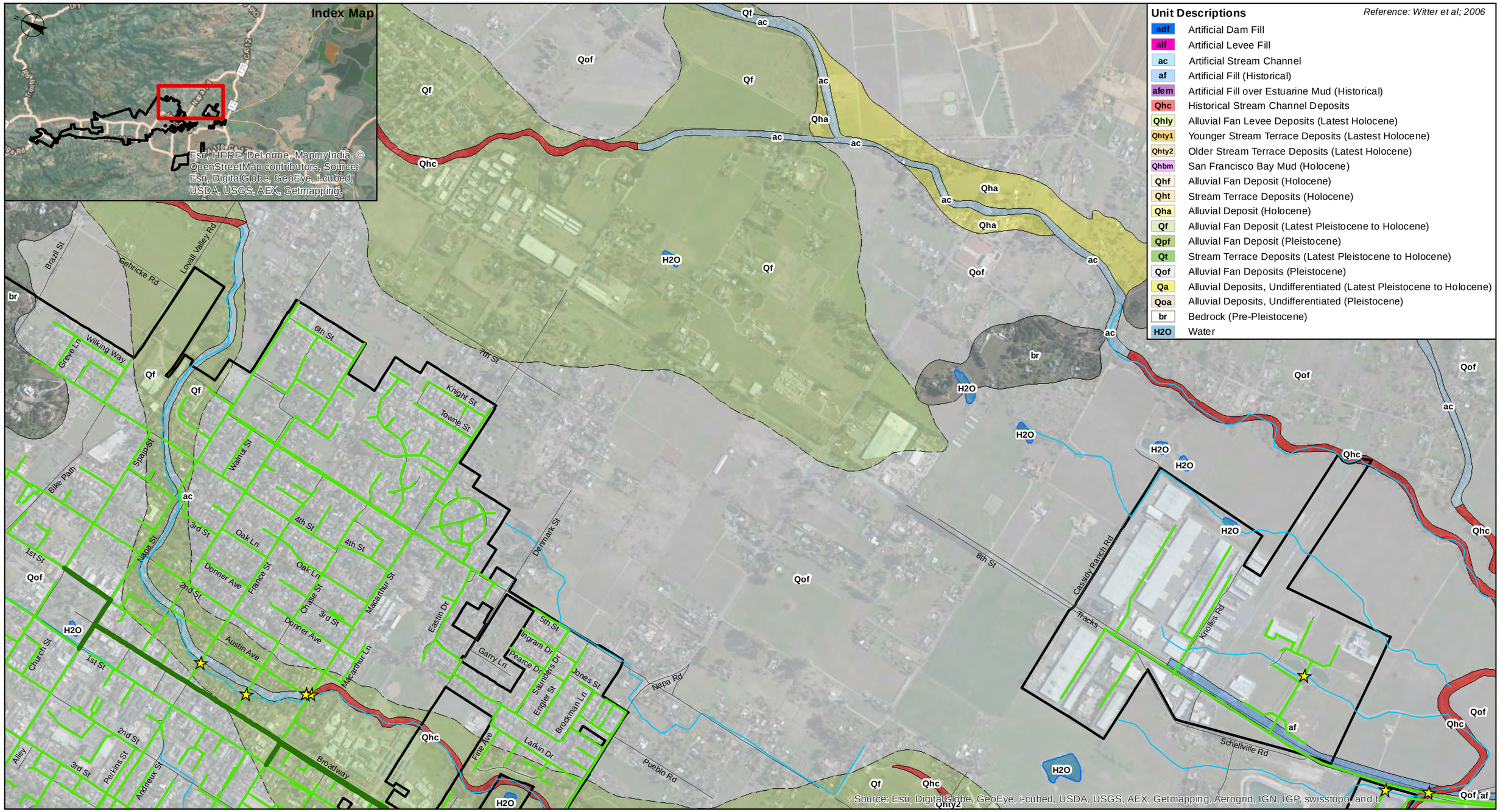


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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
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Sonoma Valley CSD
Quaternary Deposits (4 of 10) Figure SV-15

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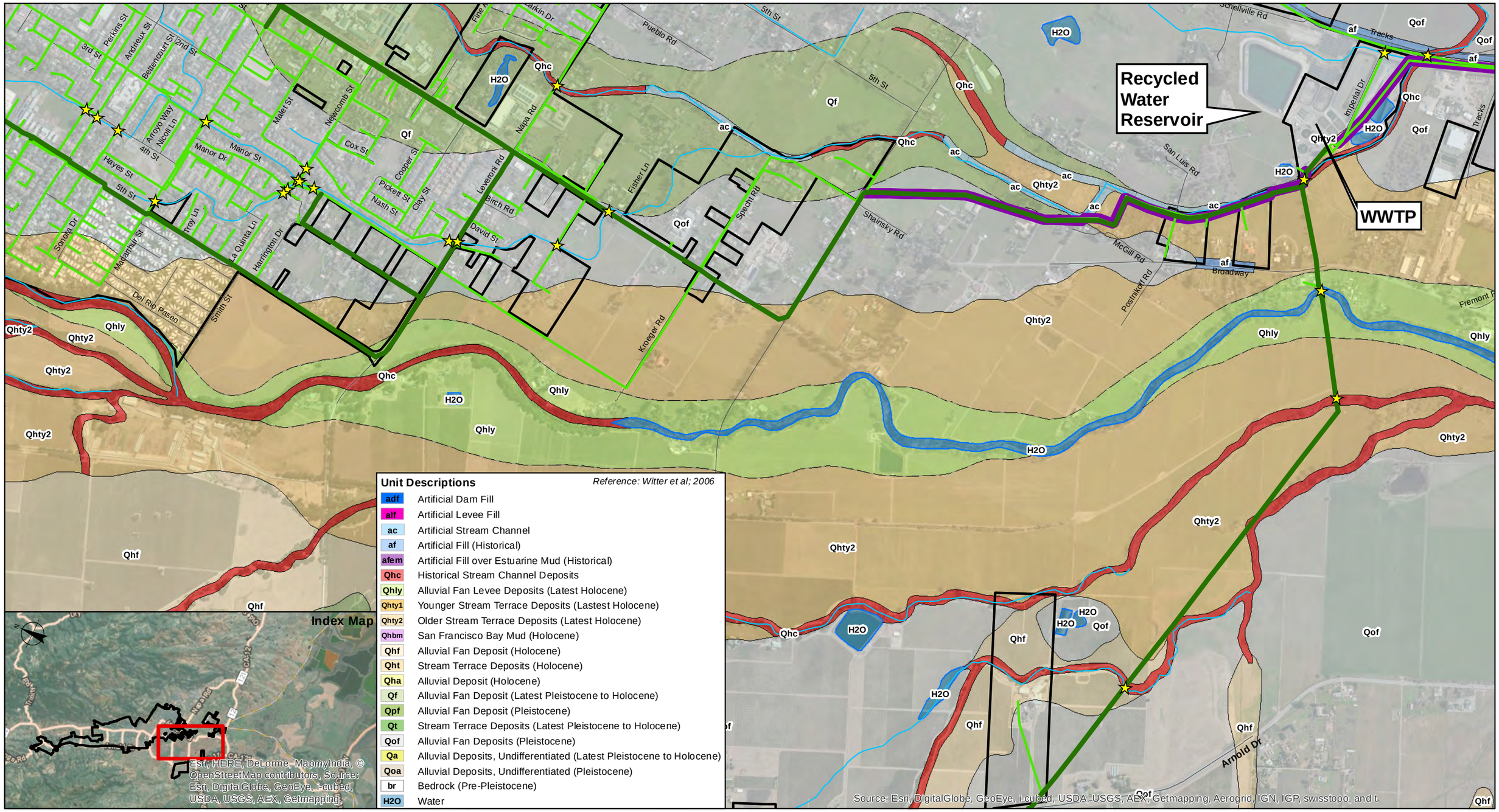


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
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| Revision | 2 |
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Sonoma Valley CSD
Quaternary Deposits (5 of 10) Figure SV-16

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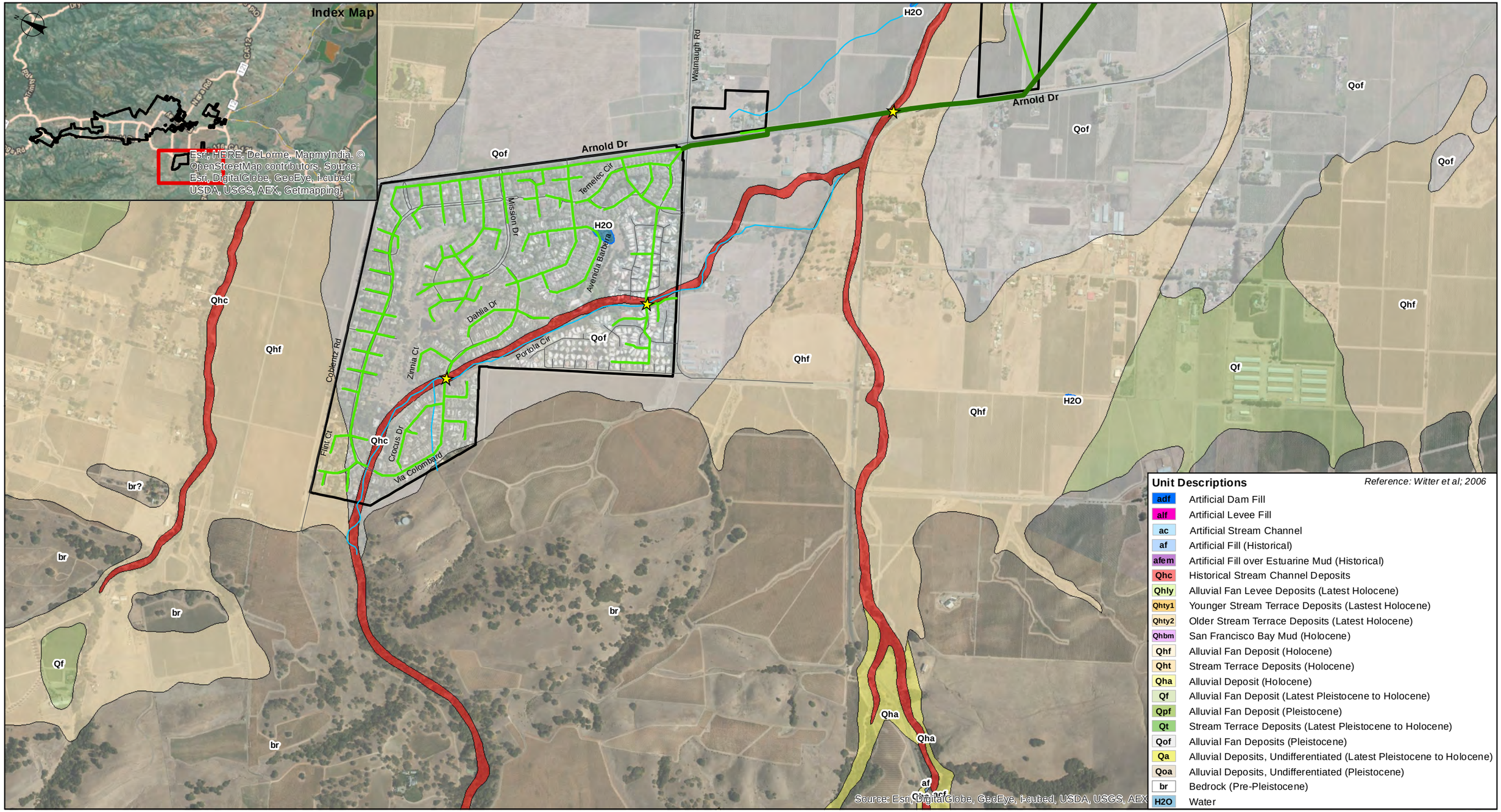


**Unit Descriptions** *Reference: Witter et al; 2006*

| | |
|---|---|
| adf | Artificial Dam Fill |
| alf | Artificial Levee Fill |
| ac | Artificial Stream Channel |
| af | Artificial Fill (Historical) |
| afem | Artificial Fill over Estuarine Mud (Historical) |
| Qhc | Historical Stream Channel Deposits |
| Qhly | Alluvial Fan Levee Deposits (Latest Holocene) |
| Qhty1 | Younger Stream Terrace Deposits (Lastest Holocene) |
| Qhty2 | Older Stream Terrace Deposits (Latest Holocene) |
| Qhbm | San Francisco Bay Mud (Holocene) |
| Qhf | Alluvial Fan Deposit (Holocene) |
| Qht | Stream Terrace Deposits (Holocene) |
| Qha | Alluvial Deposit (Holocene) |
| Qf | Alluvial Fan Deposit (Latest Pleistocene to Holocene) |
| Qpf | Alluvial Fan Deposit (Pleistocene) |
| Qt | Stream Terrace Deposits (Latest Pleistocene to Holocene) |
| Qof | Alluvial Fan Deposits (Pleistocene) |
| Qa | Alluvial Deposits, Undifferentiated (Latest Pleistocene to Holocene) |
| Qoa | Alluvial Deposits, Undifferentiated (Pleistocene) |
| br | Bedrock (Pre-Pleistocene) |
| H2O | Water |

Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 11 Feb 2015 |

Sonoma Valley CSD
Quaternary Deposits (6 of 10) Figure SV-17

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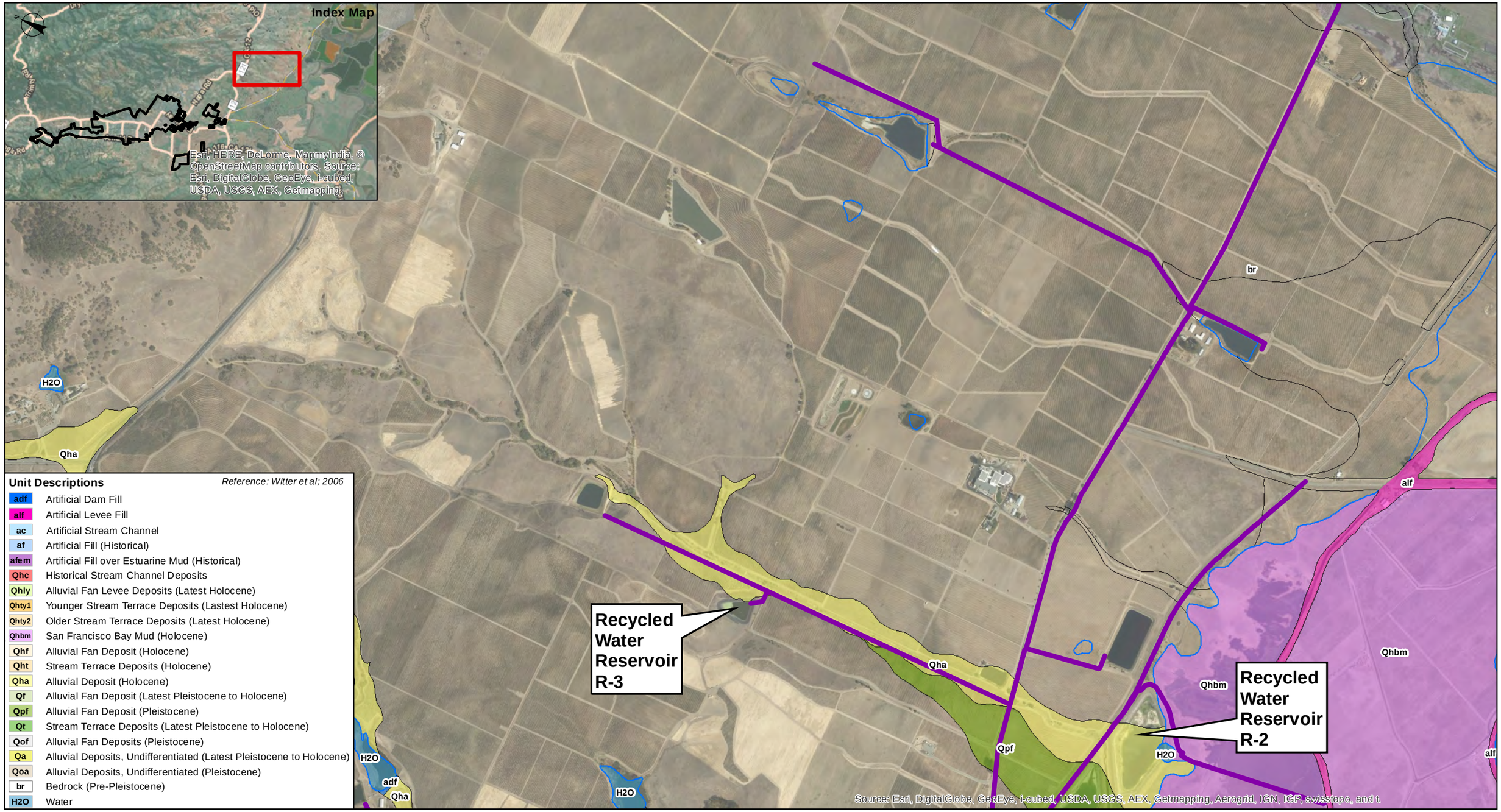


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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| Date | 12 Feb 2015 |

Sonoma Valley CSD
Quaternary Deposits (7 of 10) Figure SV-18

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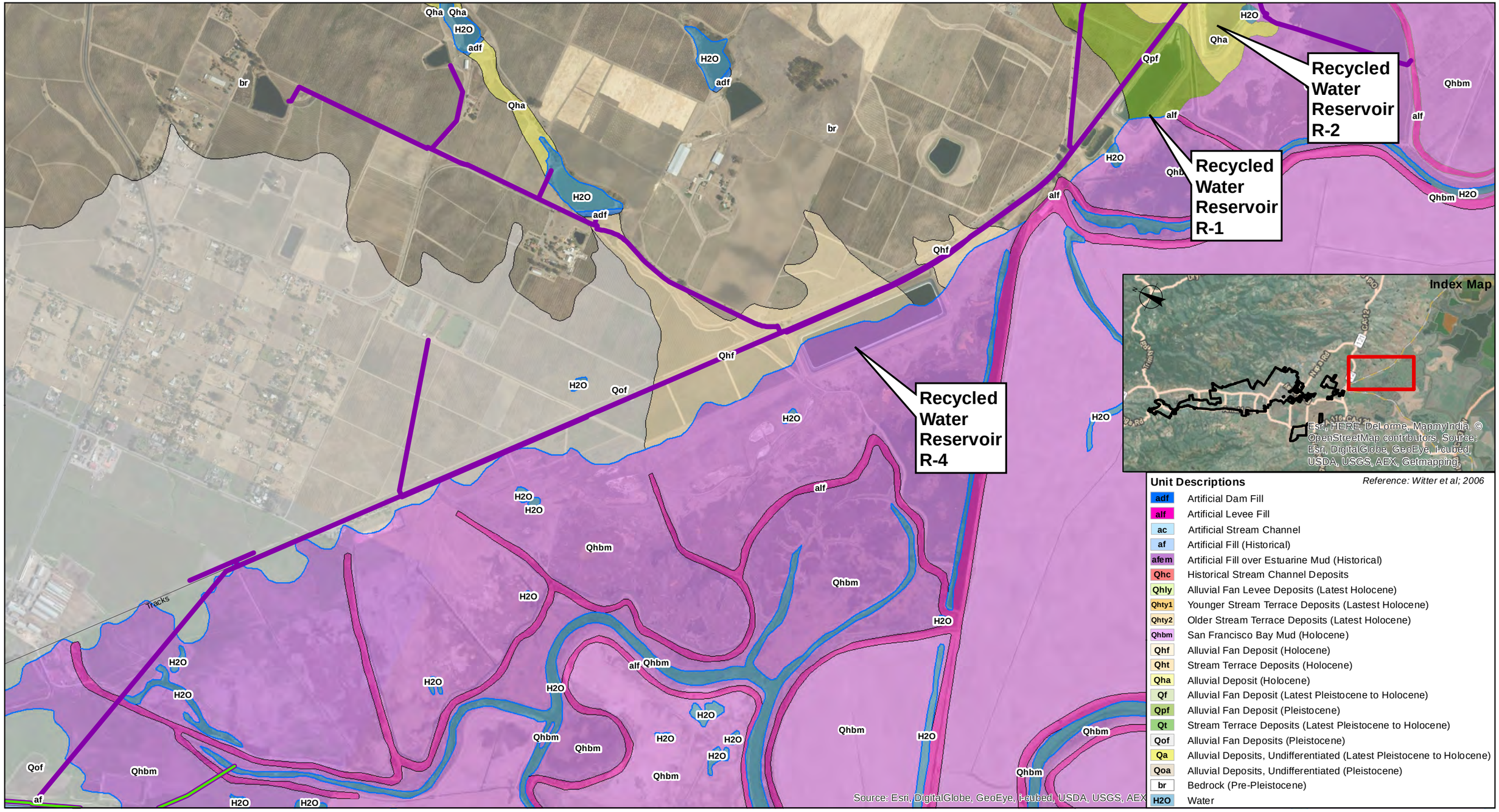


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 12 Feb 2015 |

Sonoma Valley CSD
Quaternary Deposits (8 of 10) Figure SV-19

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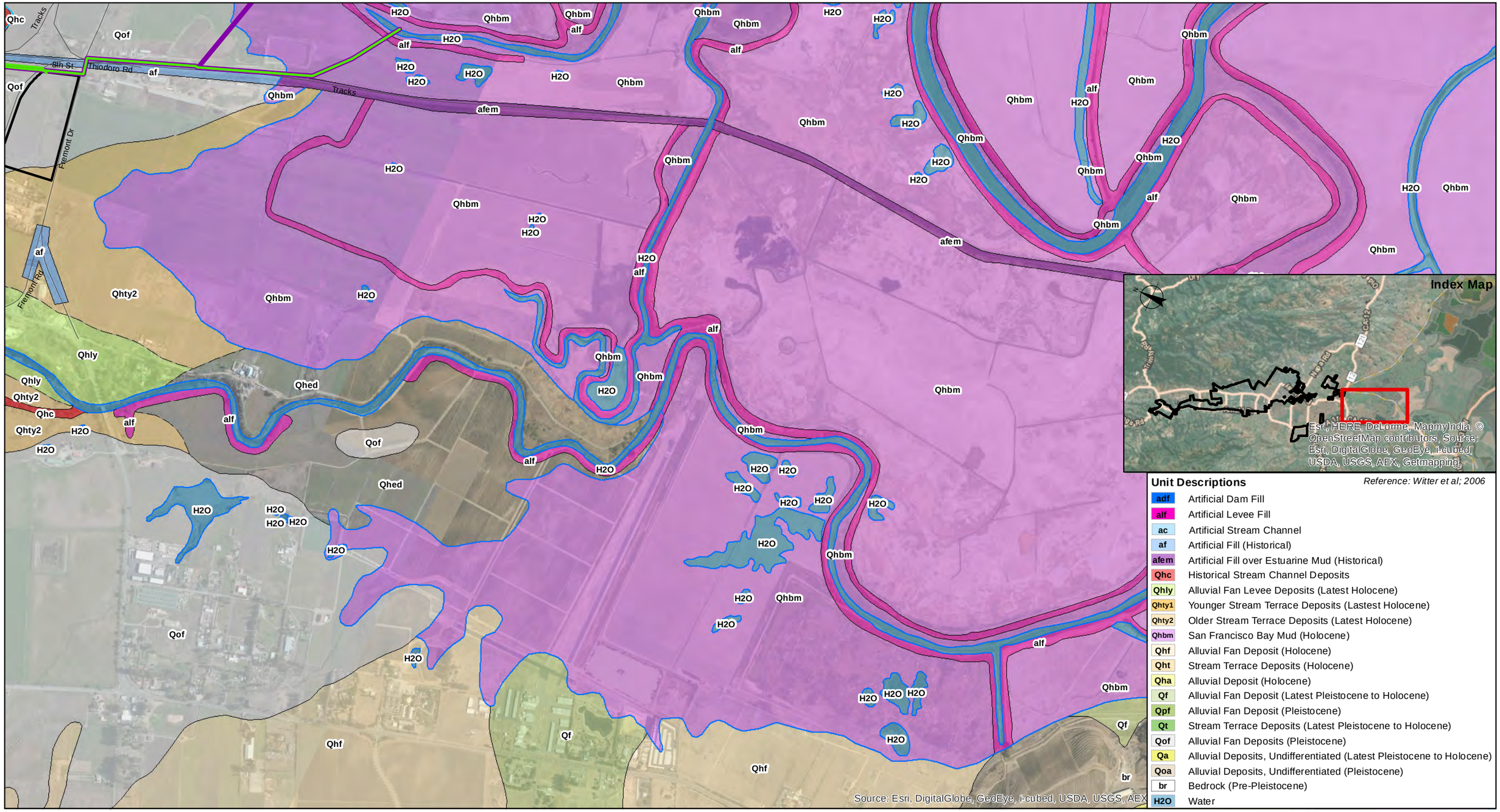


**Unit Descriptions** *Reference: Witter et al; 2006*

| | |
|---|---|
| adf | Artificial Dam Fill |
| alf | Artificial Levee Fill |
| ac | Artificial Stream Channel |
| af | Artificial Fill (Historical) |
| afem | Artificial Fill over Estuarine Mud (Historical) |
| Qhc | Historical Stream Channel Deposits |
| Qhly | Alluvial Fan Levee Deposits (Latest Holocene) |
| Qhty1 | Younger Stream Terrace Deposits (Lastest Holocene) |
| Qhty2 | Older Stream Terrace Deposits (Latest Holocene) |
| Qhbm | San Francisco Bay Mud (Holocene) |
| Qhf | Alluvial Fan Deposit (Holocene) |
| Qht | Stream Terrace Deposits (Holocene) |
| Qha | Alluvial Deposit (Holocene) |
| Qf | Alluvial Fan Deposit (Latest Pleistocene to Holocene) |
| Qpf | Alluvial Fan Deposit (Pleistocene) |
| Qt | Stream Terrace Deposits (Latest Pleistocene to Holocene) |
| Qof | Alluvial Fan Deposits (Pleistocene) |
| Qa | Alluvial Deposits, Undifferentiated (Latest Pleistocene to Holocene) |
| Qoa | Alluvial Deposits, Undifferentiated (Pleistocene) |
| br | Bedrock (Pre-Pleistocene) |
| H2O | Water |

Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 11 Feb 2015 |

Sonoma Valley CSD
Quaternary Deposits (9 of 10) Figure SV-20

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**Unit Descriptions** *Reference: Witter et al; 2006*

| | |
|---|---|
| adf | Artificial Dam Fill |
| alf | Artificial Levee Fill |
| ac | Artificial Stream Channel |
| af | Artificial Fill (Historical) |
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| Qhly | Alluvial Fan Levee Deposits (Latest Holocene) |
| Qhty1 | Younger Stream Terrace Deposits (Lastest Holocene) |
| Qhty2 | Older Stream Terrace Deposits (Latest Holocene) |
| Qhbm | San Francisco Bay Mud (Holocene) |
| Qhf | Alluvial Fan Deposit (Holocene) |
| Qht | Stream Terrace Deposits (Holocene) |
| Qha | Alluvial Deposit (Holocene) |
| Qf | Alluvial Fan Deposit (Latest Pleistocene to Holocene) |
| Qpf | Alluvial Fan Deposit (Pleistocene) |
| Qt | Stream Terrace Deposits (Latest Pleistocene to Holocene) |
| Qof | Alluvial Fan Deposits (Pleistocene) |
| Qa | Alluvial Deposits, Undifferentiated (Latest Pleistocene to Holocene) |
| Qoa | Alluvial Deposits, Undifferentiated (Pleistocene) |
| br | Bedrock (Pre-Pleistocene) |
| H2O | Water |

Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Crossing Location

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
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Sonoma Valley CSD
Quaternary Deposits (10 of 10) Figure SV-21

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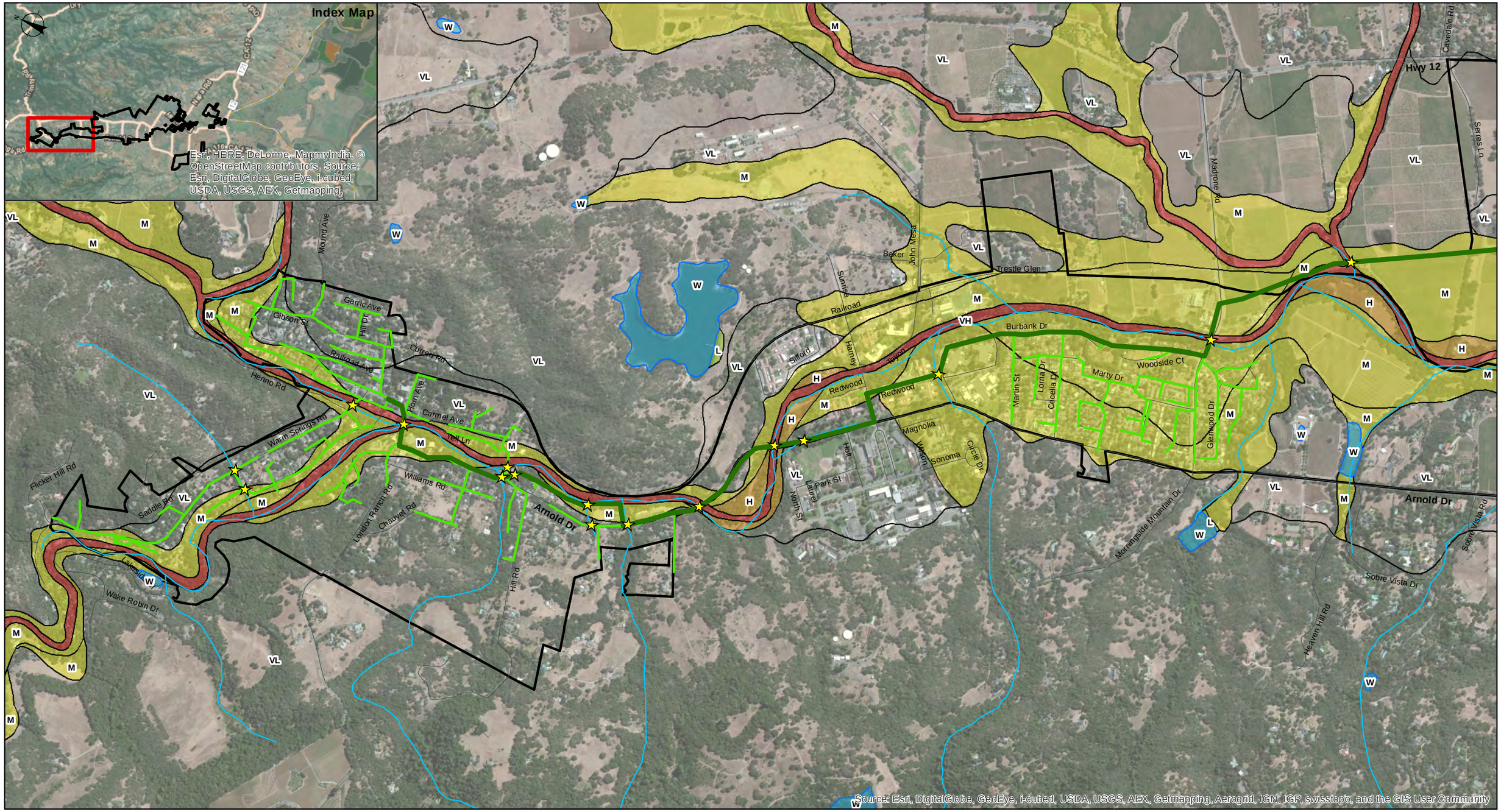


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main

Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s

**Liquefaction Susceptibility**

| | |
|---|---|
| VH | Very High |
| H | High |
| M | Moderate |
| L | Low |
| VL | Very Low |
| W | Water |

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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| Date | 09 Oct 2014 |

# Sonoma Valley CSD Liquefaction (1 of 10)

# Figure SV-22

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Data source: SCWA, Sanitary Sewer, Street, Creek, Boundary, 2013; Kleinfelder, Liquefaction, 2014. Created by:afisher2

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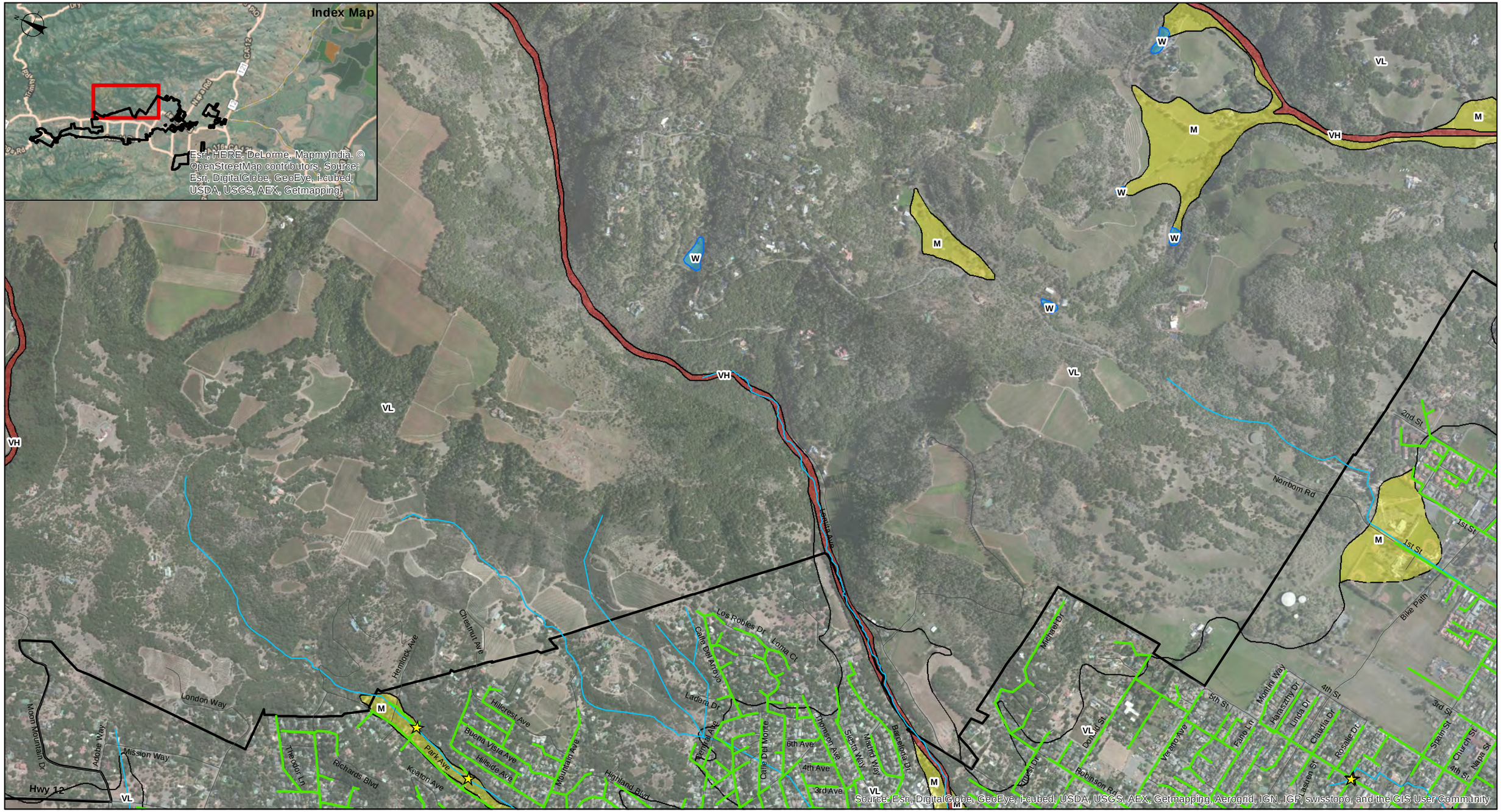


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main

Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s

**Liquefaction Susceptibility**

| | |
|---|---|
| VH | Very High |
| H | High |
| M | Moderate |
| L | Low |
| VL | Very Low |
| W | Water |

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

# Sonoma Valley CSD Liquefaction (2 of 10)

# Figure SV-23

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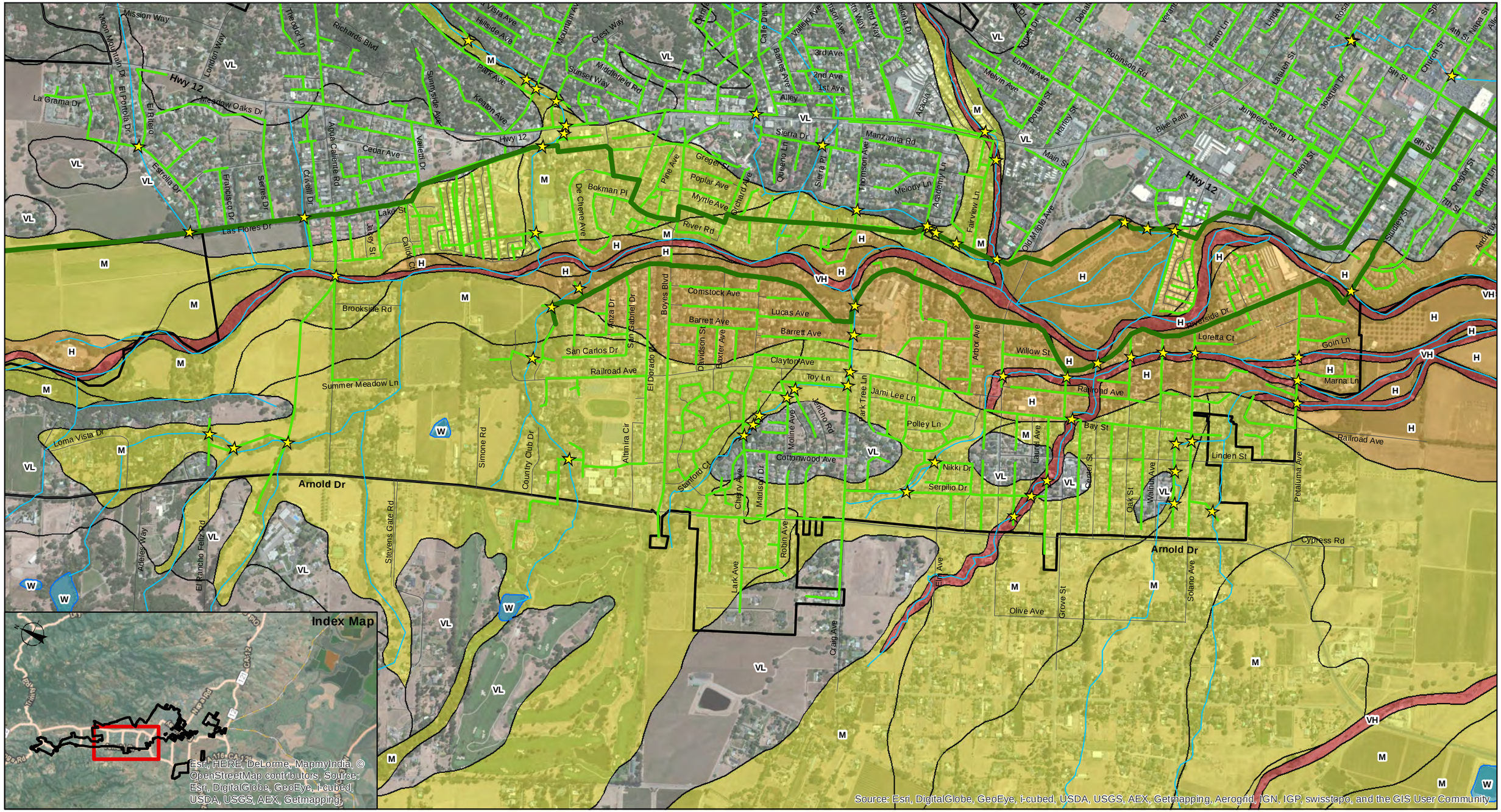


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0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main

Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s

**Liquefaction Susceptibility**

| | |
|---|---|
| VH | Very High |
| H | High |
| M | Moderate |
| L | Low |
| VL | Very Low |
| W | Water |

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Liquefaction (3 of 10)

Figure SV-24

N:\US\Santa Rosa\Projects\02243 - SCWA\02243-8410201 - Sonoma Valley CSD\08-GIS\Maps\Figures\Figure SV-24 Liquefaction 3.mxd

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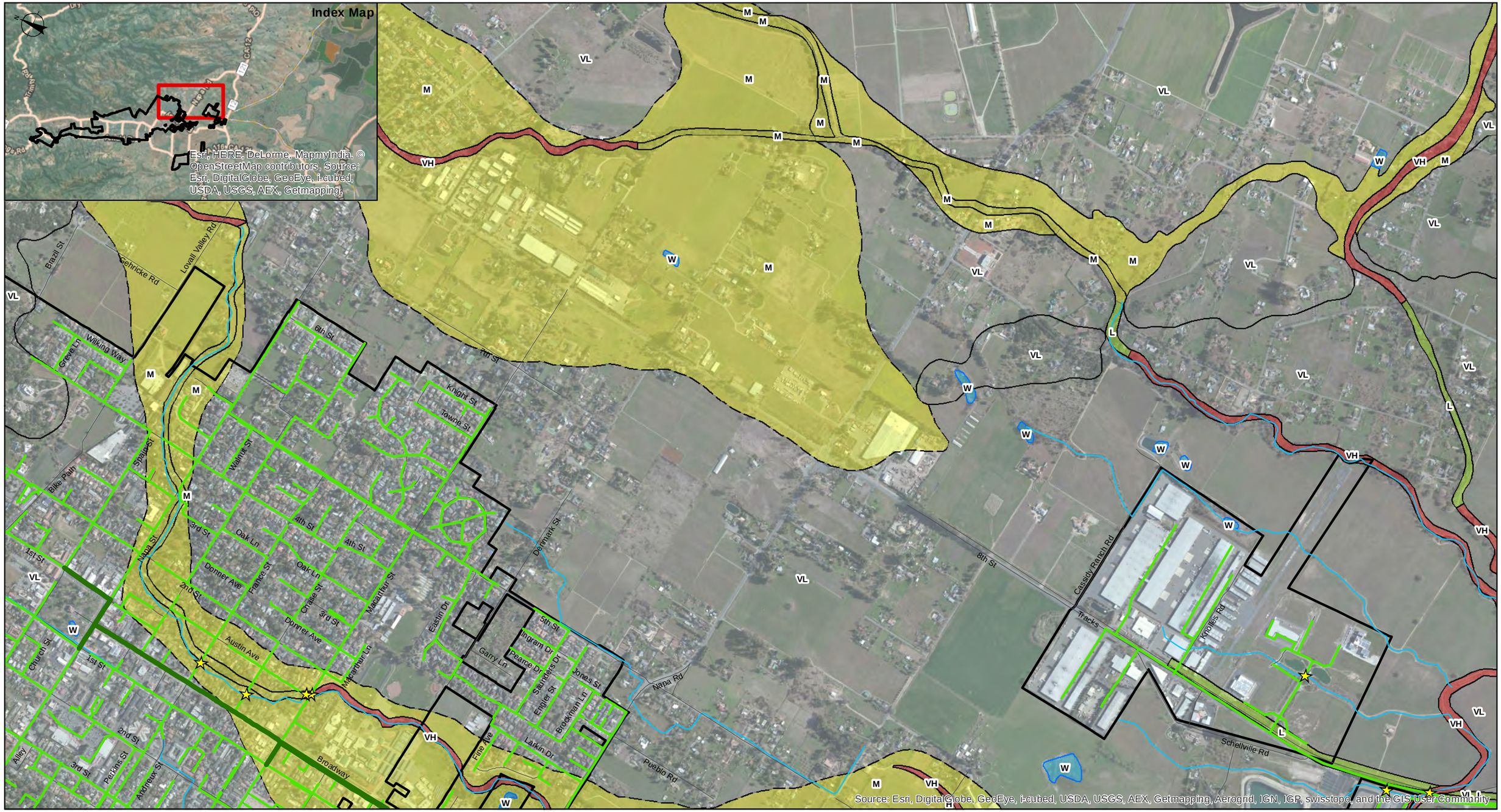


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0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main

Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s

**Liquefaction Susceptibility**

| | |
|---|---|
| VH | Very High |
| H | High |
| M | Moderate |
| L | Low |
| VL | Very Low |
| W | Water |

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Liquefaction (4 of 10)

Figure SV-25

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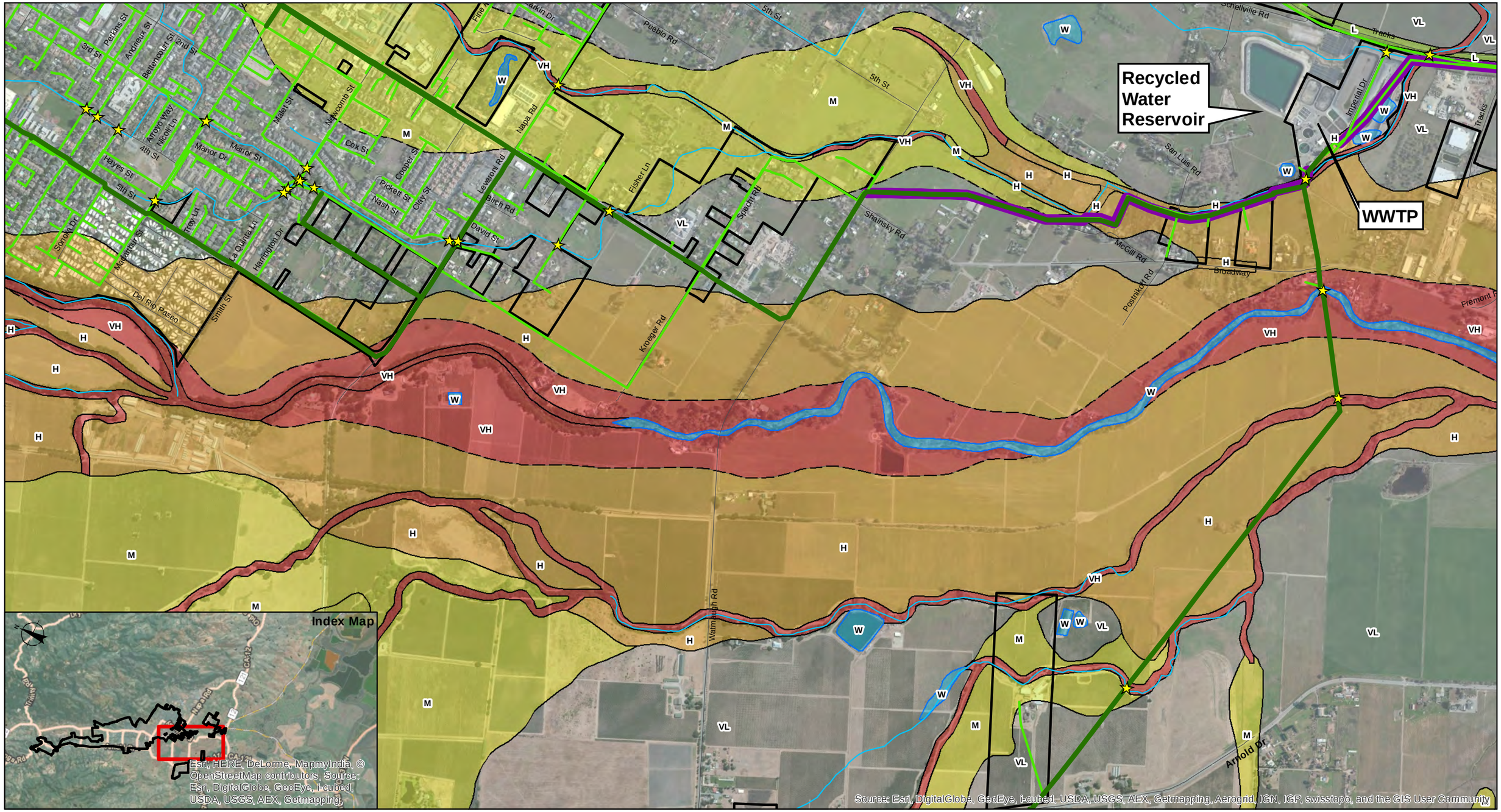


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Recycled Water Pipe

**Liquefaction Susceptibility**

VH Very High
H High
M Moderate
L Low
VL Very Low
W Water

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

## Sonoma Valley CSD Liquefaction (5 of 10)

## Figure SV-26

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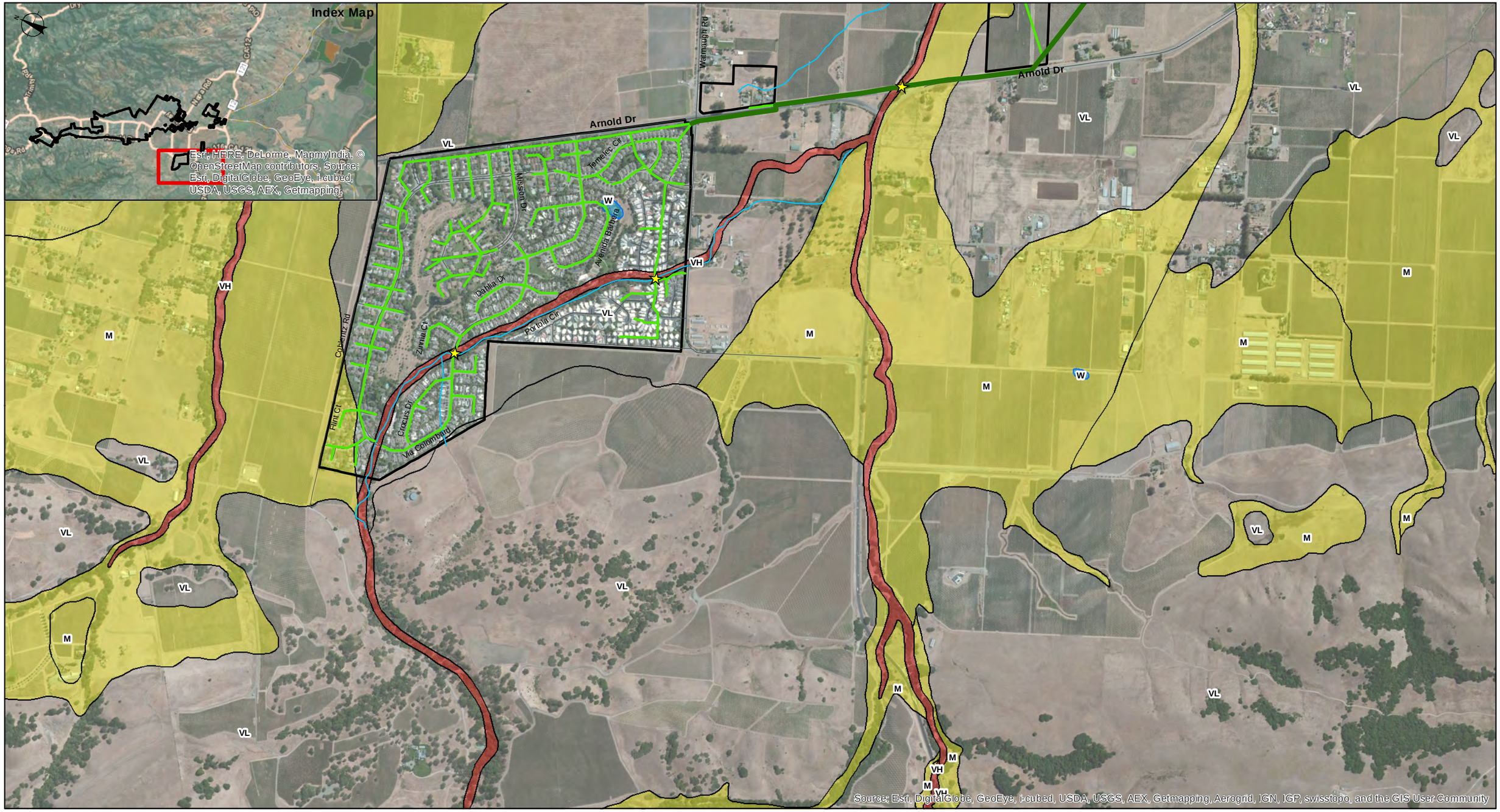


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0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main

Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s

**Liquefaction Susceptibility**

| | |
|---|---|
| VH | Very High |
| H | High |
| M | Moderate |
| L | Low |
| VL | Very Low |
| W | Water |

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Liquefaction (6 of 10)

Figure SV-27

N:\US\Santa Rosa\Projects\02243 - SCWA\02243-8410201 - Sonoma Valley CSD\08-GIS\Maps\Figures\Figure SV-27 Liquefaction 6.mxd

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Data source: SCWA, Sanitary Sewer, Street, Creek, Boundary, 2013; Kleinfelder, Liquefaction, 2014. Created by:afisher2

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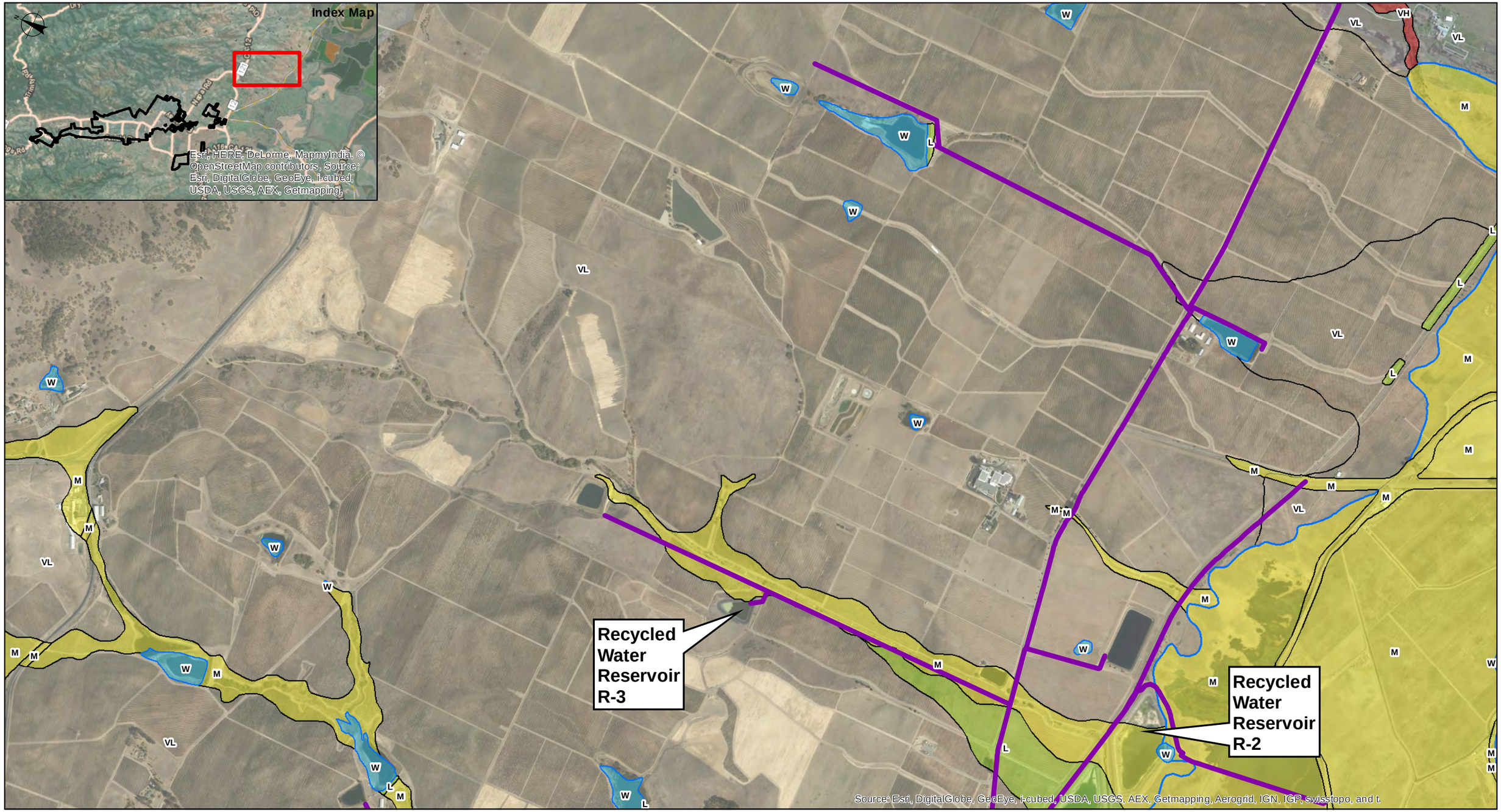


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Recycled Water Pipe

**Liquefaction Susceptibility**

VH Very High
H High
M Moderate
L Low
VL Very Low
W Water

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

Job Number 8410201
Revision 2
Date 12 Feb 2015

Sonoma Valley CSD
Liquefaction (7 of 10)

Figure SV-28

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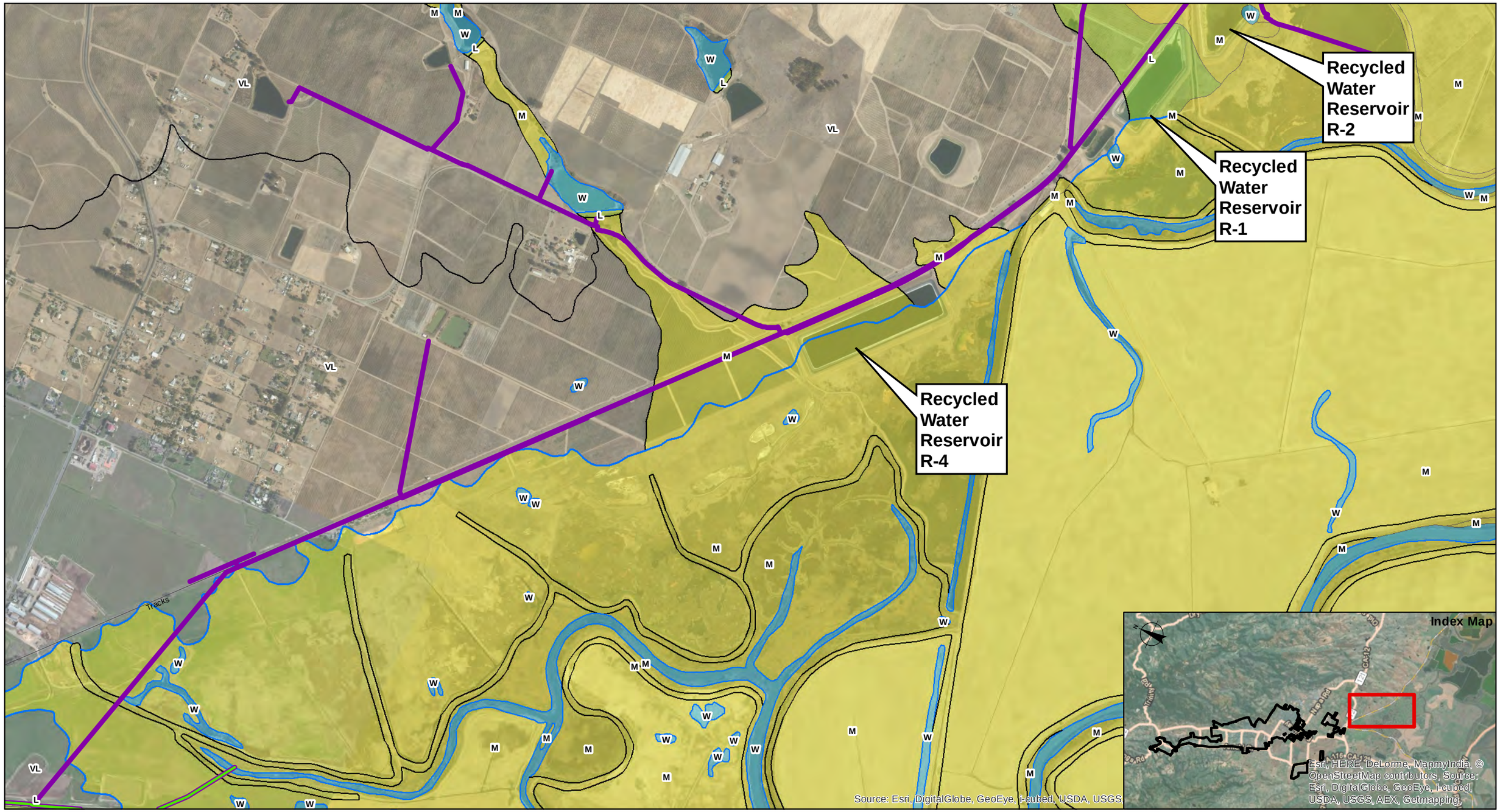


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Recycled Water Pipe

**Liquefaction Susceptibility**

VH Very High
H High
M Moderate
L Low
VL Very Low
W Water

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 12 Feb 2015 |

Sonoma Valley CSD
Liquefaction (8 of 10)

Figure SV-29

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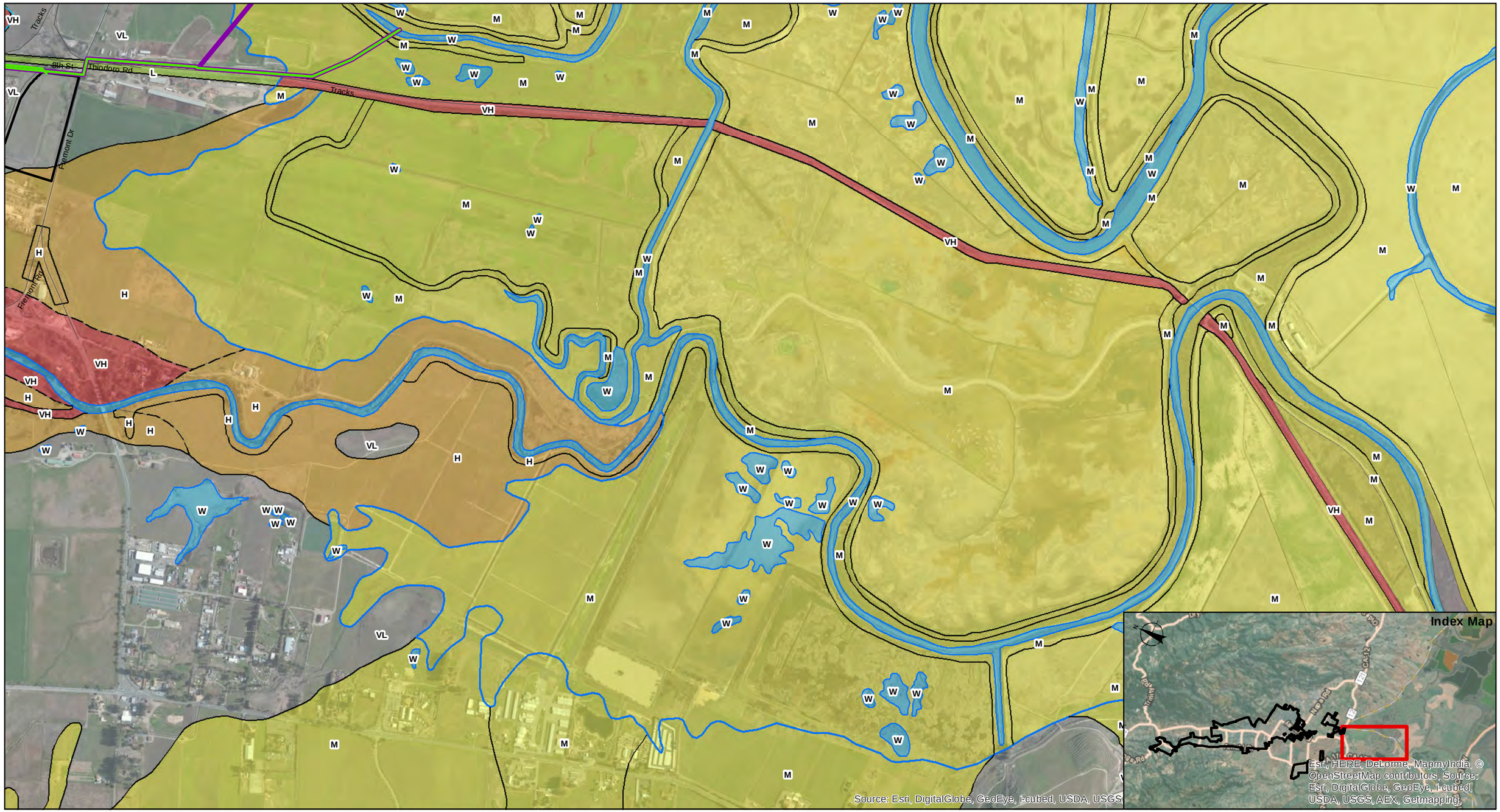


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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main

Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s

Recycled Water Pipe

**Liquefaction Susceptibility**

VH Very High
H High
M Moderate
L Low
VL Very Low
W Water

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Liquefaction (9 of 10)

Figure SV-30

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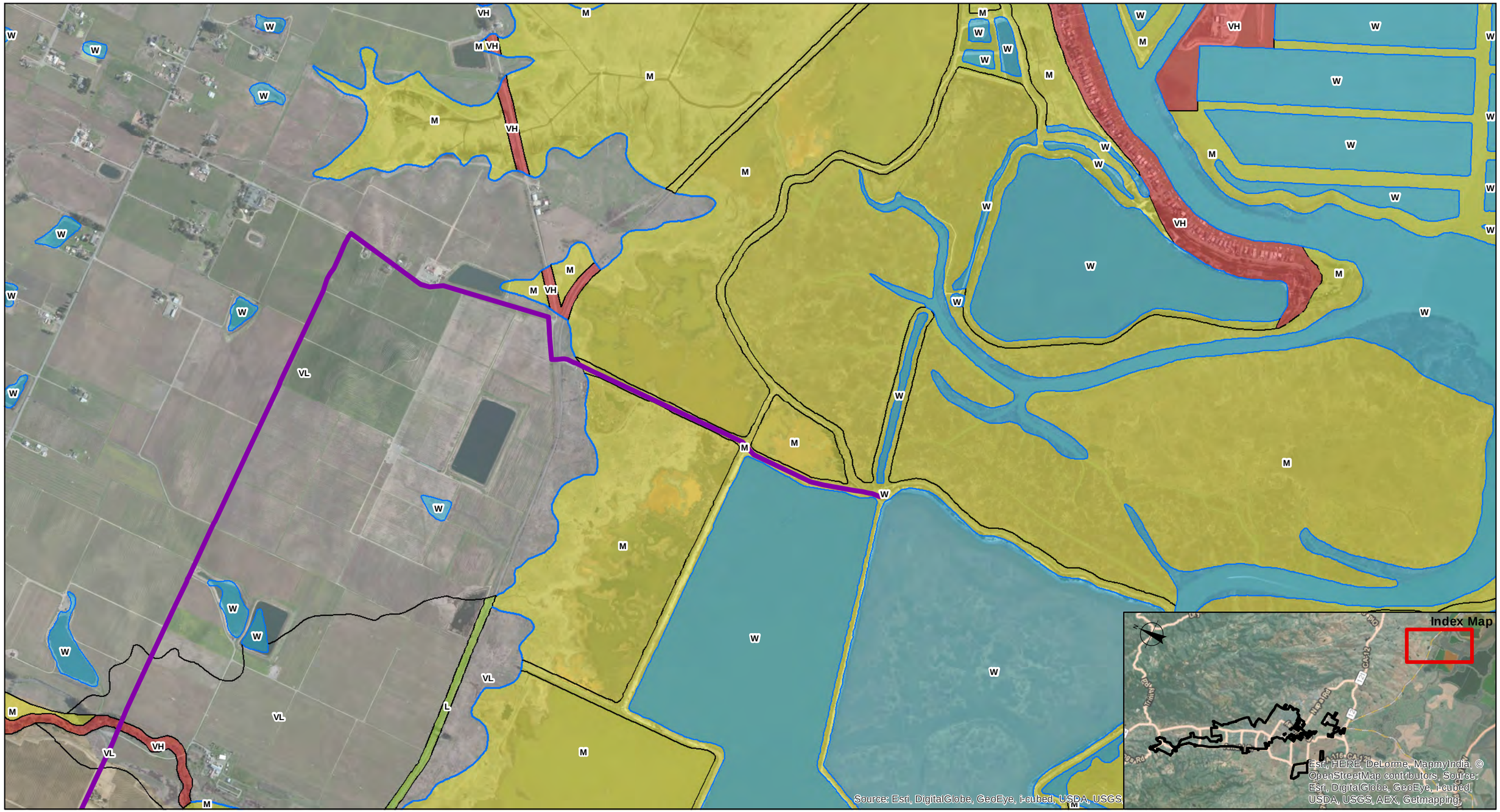


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0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
contact, approx. located
contact, well located
water boundary
water boundary, 1800s
Recycled Water Pipe

**Liquefaction Susceptibility**

VH Very High
H High
M Moderate
L Low
VL Very Low
W Water

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 23 Jan 2015 |

Sonoma Valley CSD
Liquefaction (10 of 10)

Figure SV-31

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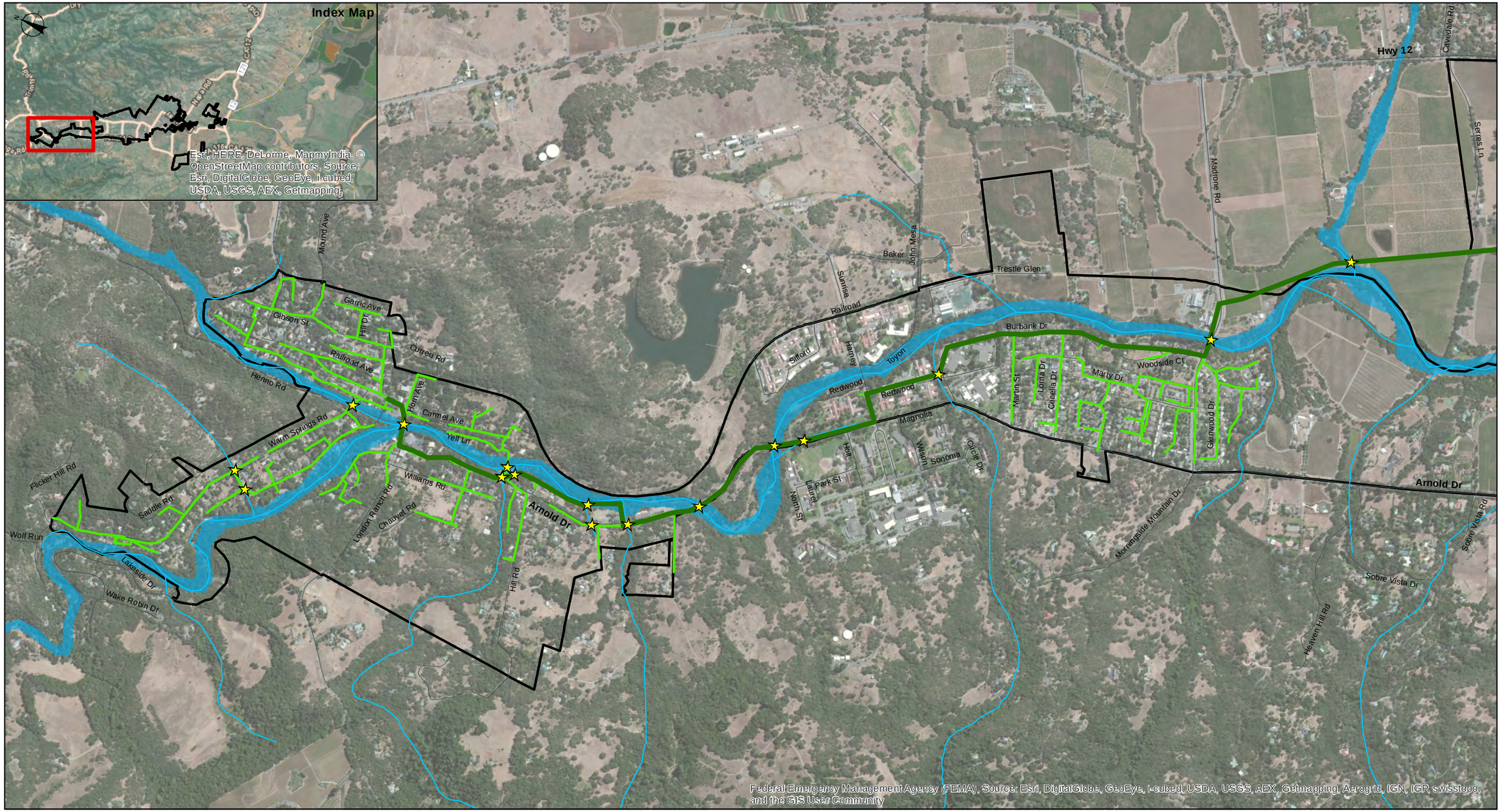


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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Flood Zone (1 of 10)

Figure SV-32

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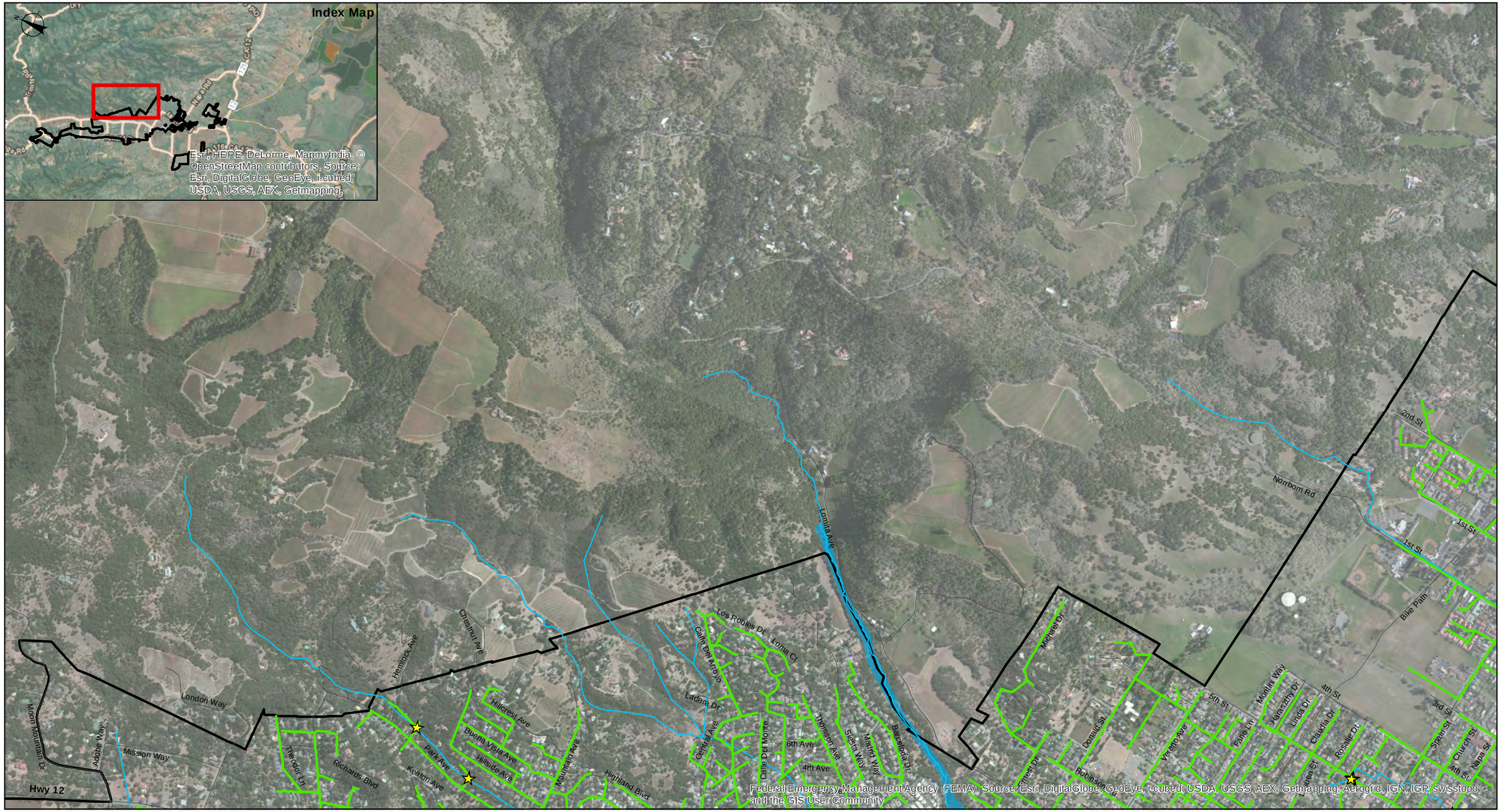


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Flood Zone (2 of 10)

Figure SV-33

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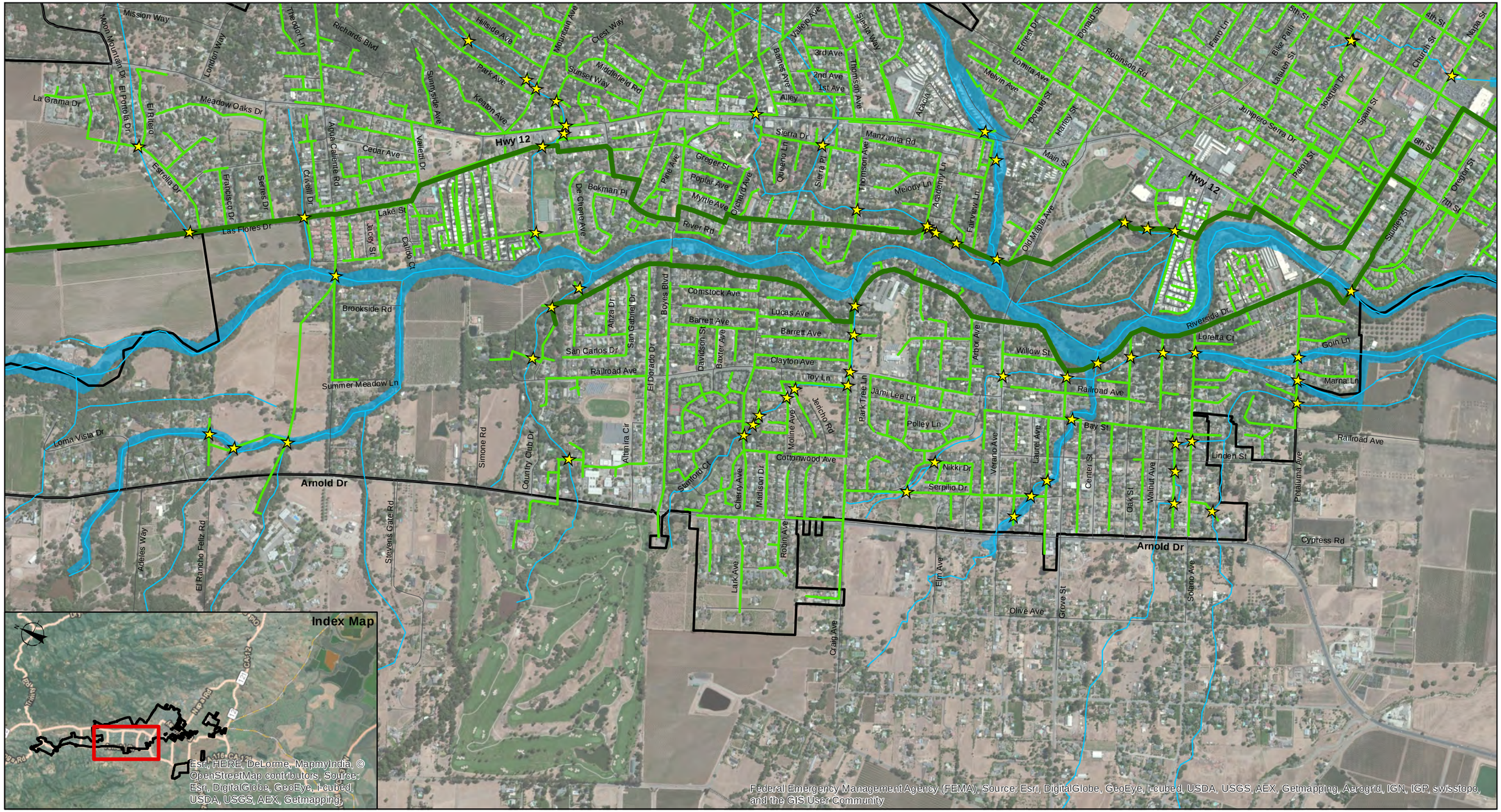


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Flood Zone (3 of 10)

Figure SV-34

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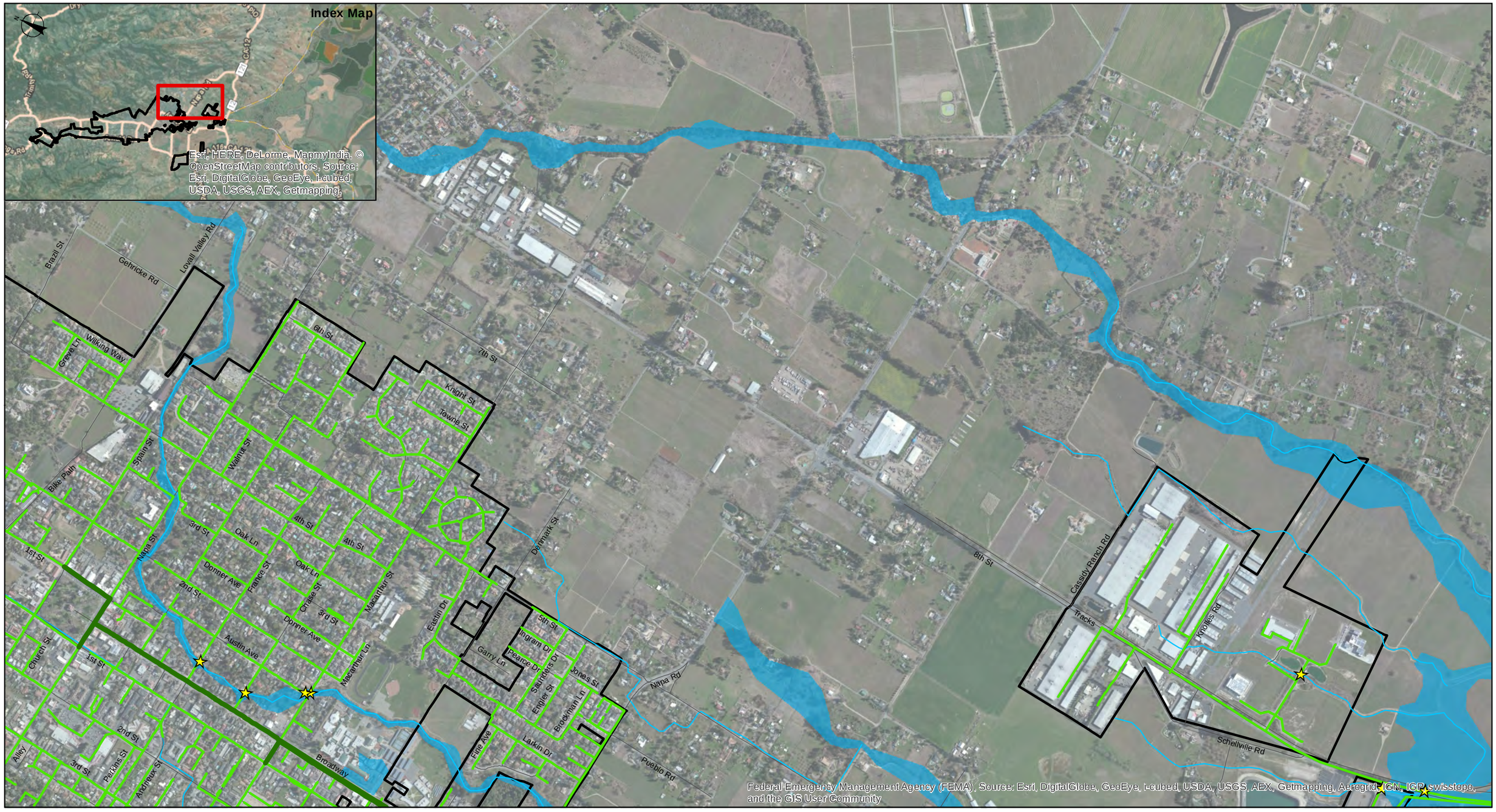


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

# Sonoma Valley CSD Flood Zone (4 of 10)

# Figure SV-35

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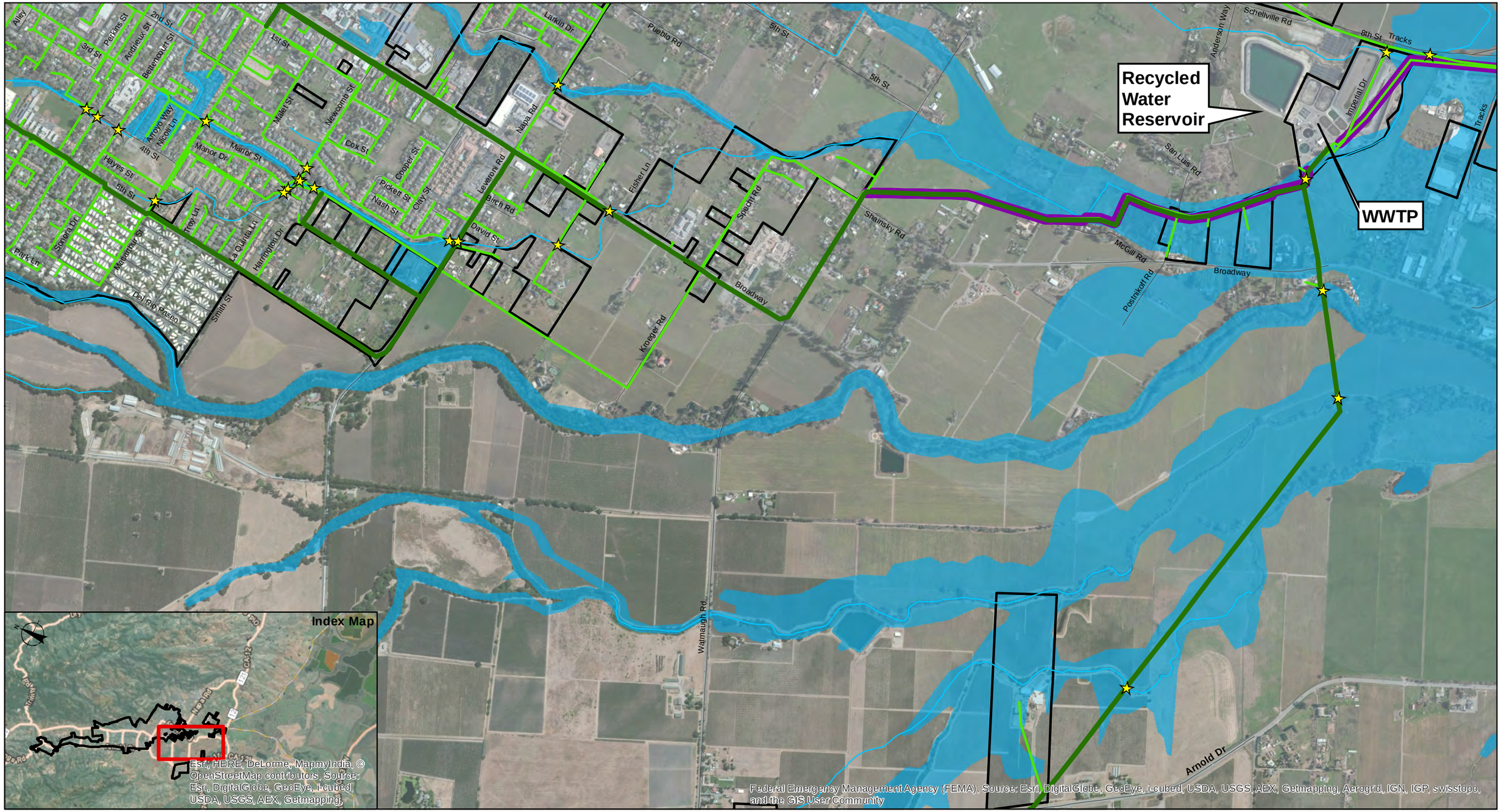


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Flood Zone (5 of 10)

Figure SV-36

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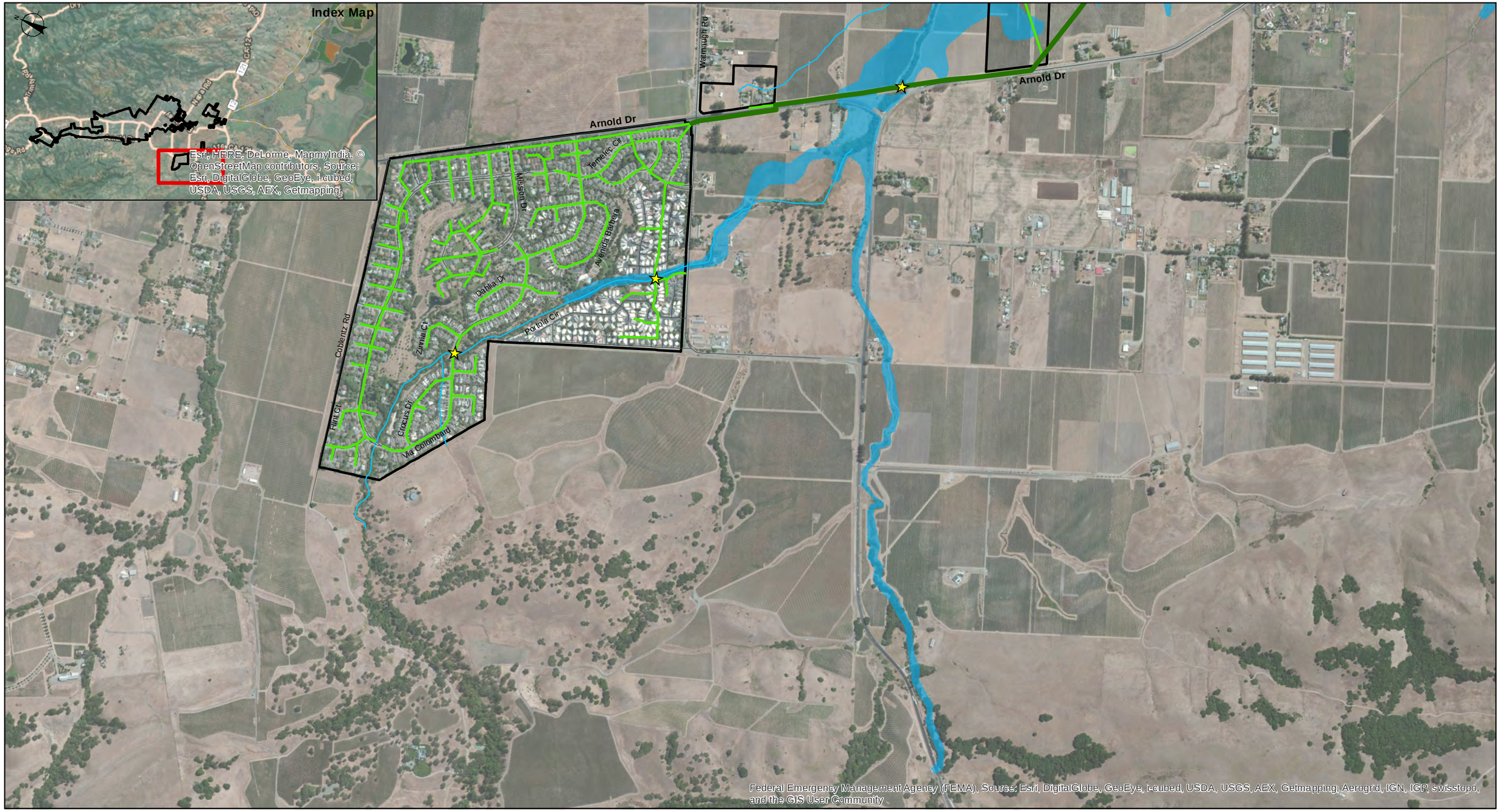


Paper Size 11" x 17" (ANSI B)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Flood Zone (6 of 10)

Figure SV-37

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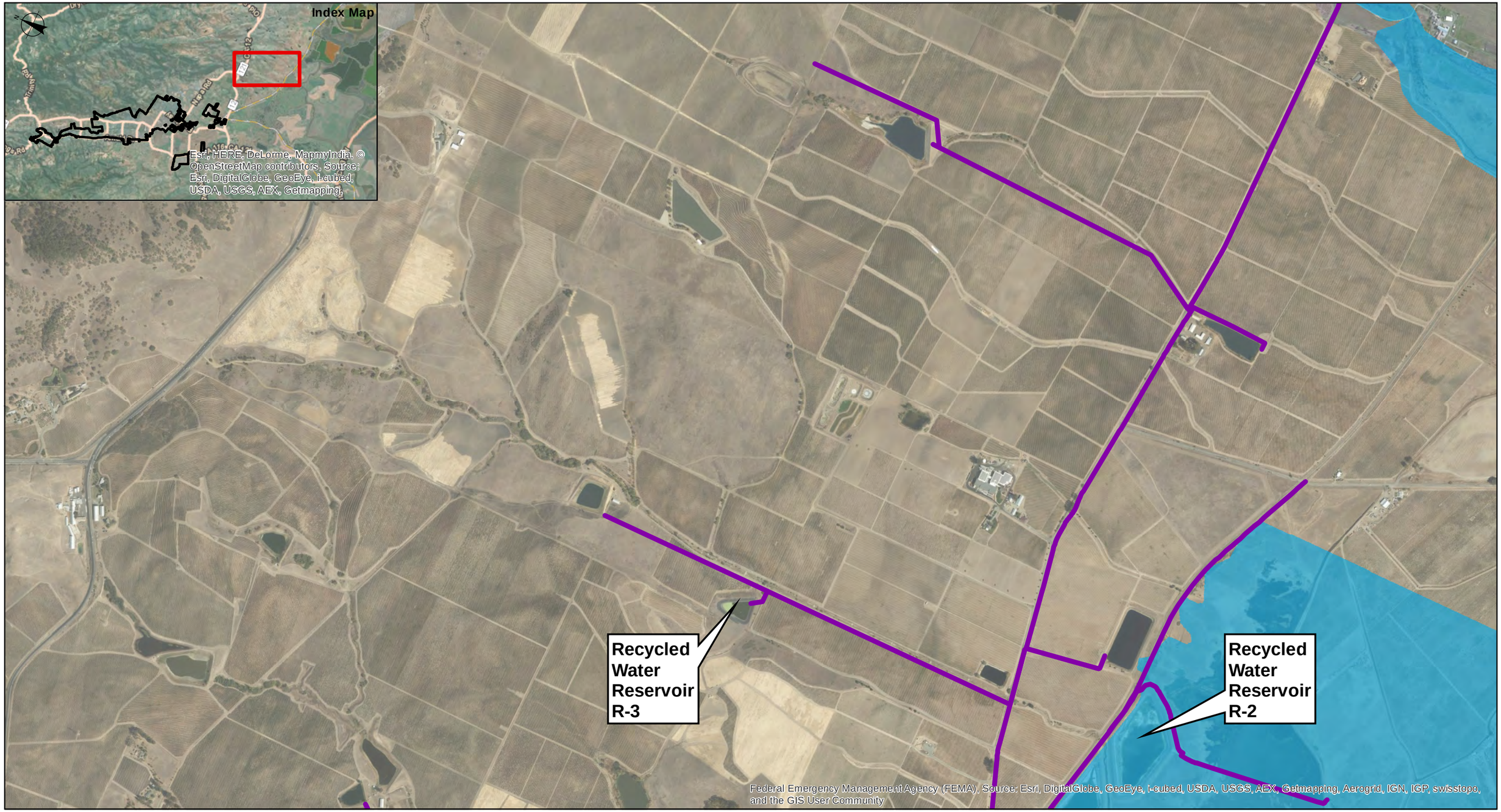


Paper Size 11" x 17" (ANSI B)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 12 Feb 2015 |

Sonoma Valley CSD
Flood Zone (7 of 10)

Figure SV-38

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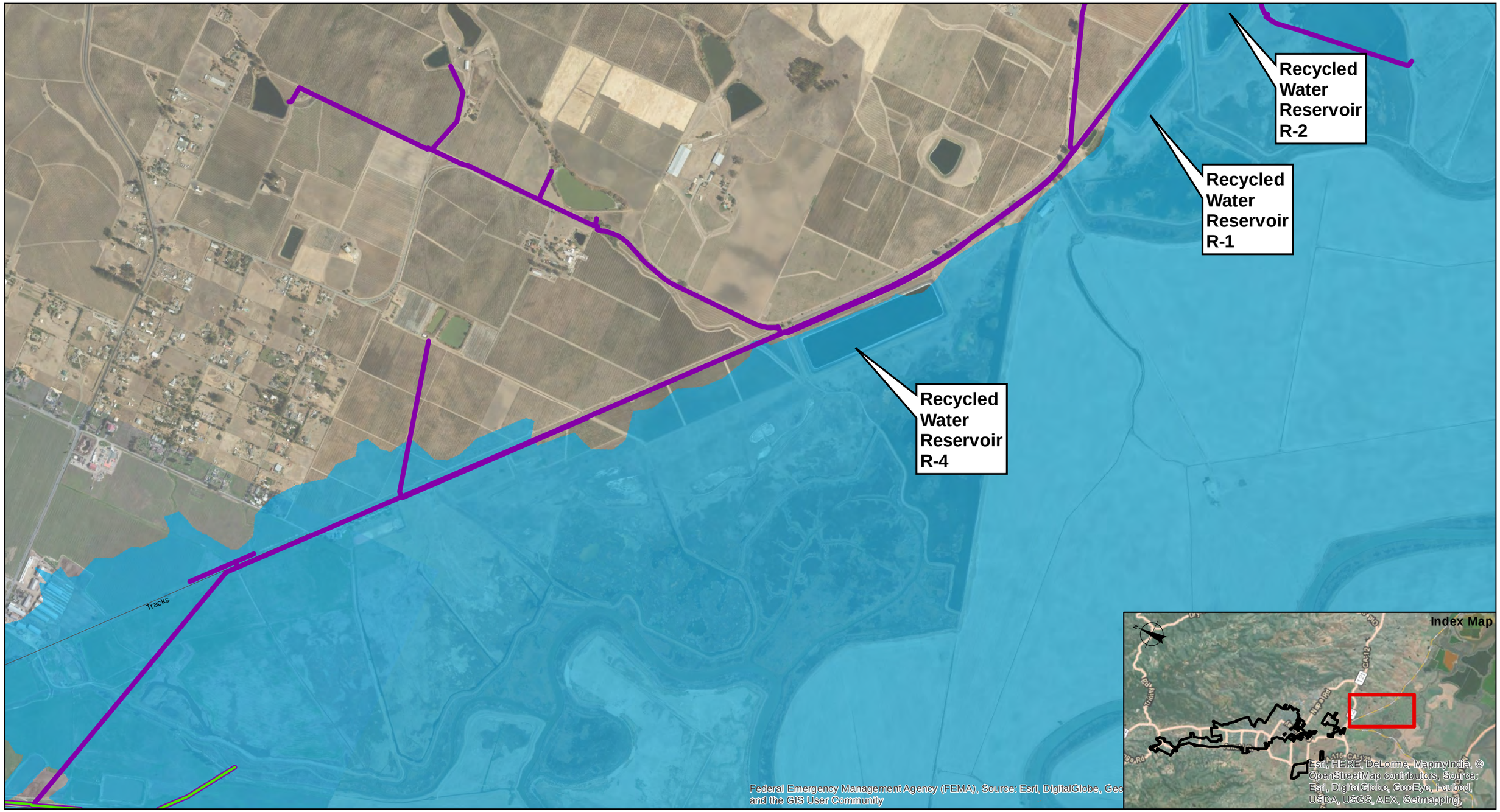


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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 12 Feb 2015 |

Sonoma Valley CSD
Flood Zone (8 of 10)

Figure SV-39

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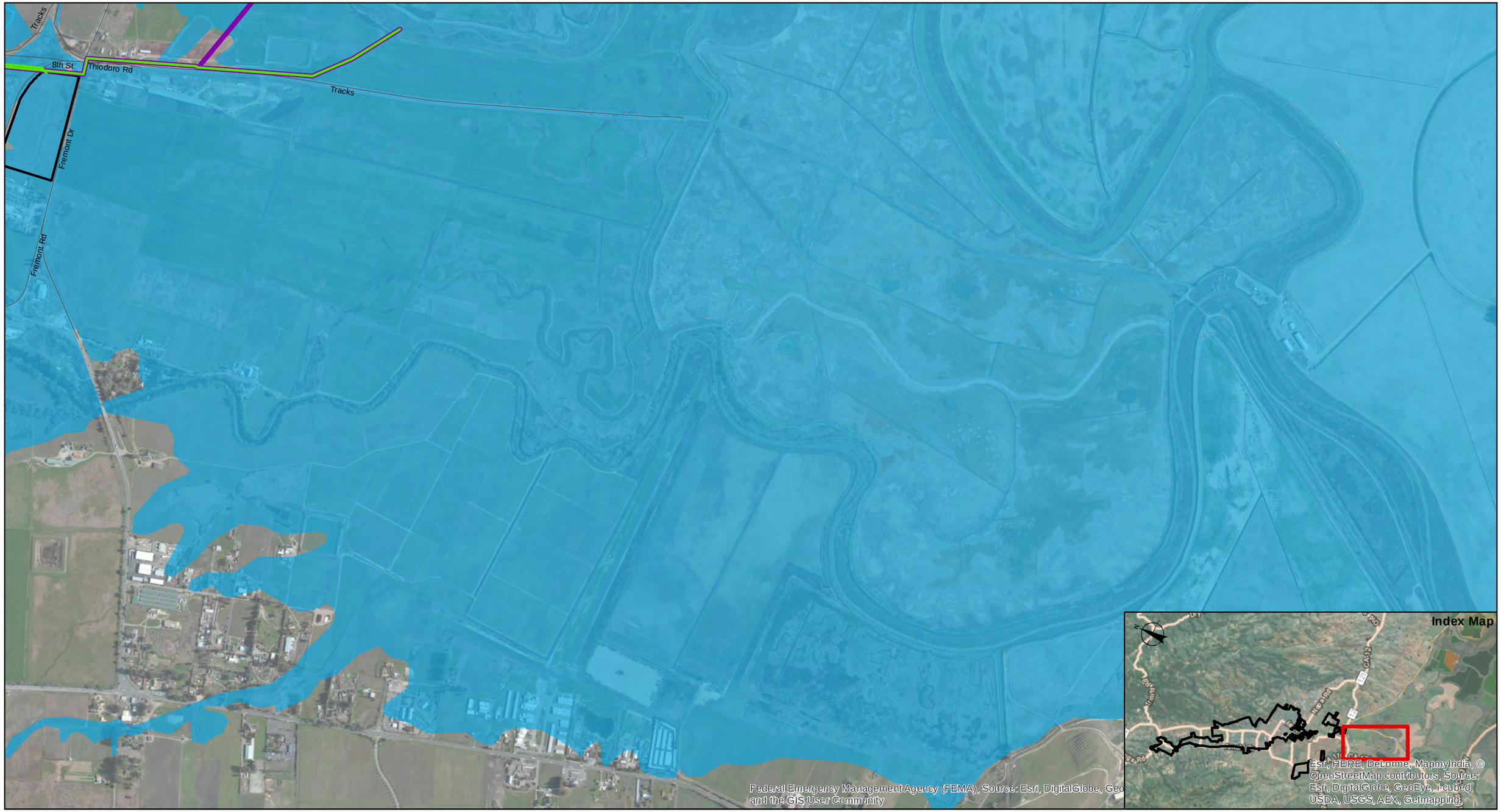


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Flood Zone (9 of 10)

Figure SV-40

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Flood Zone (10 of 10)

Figure SV-41

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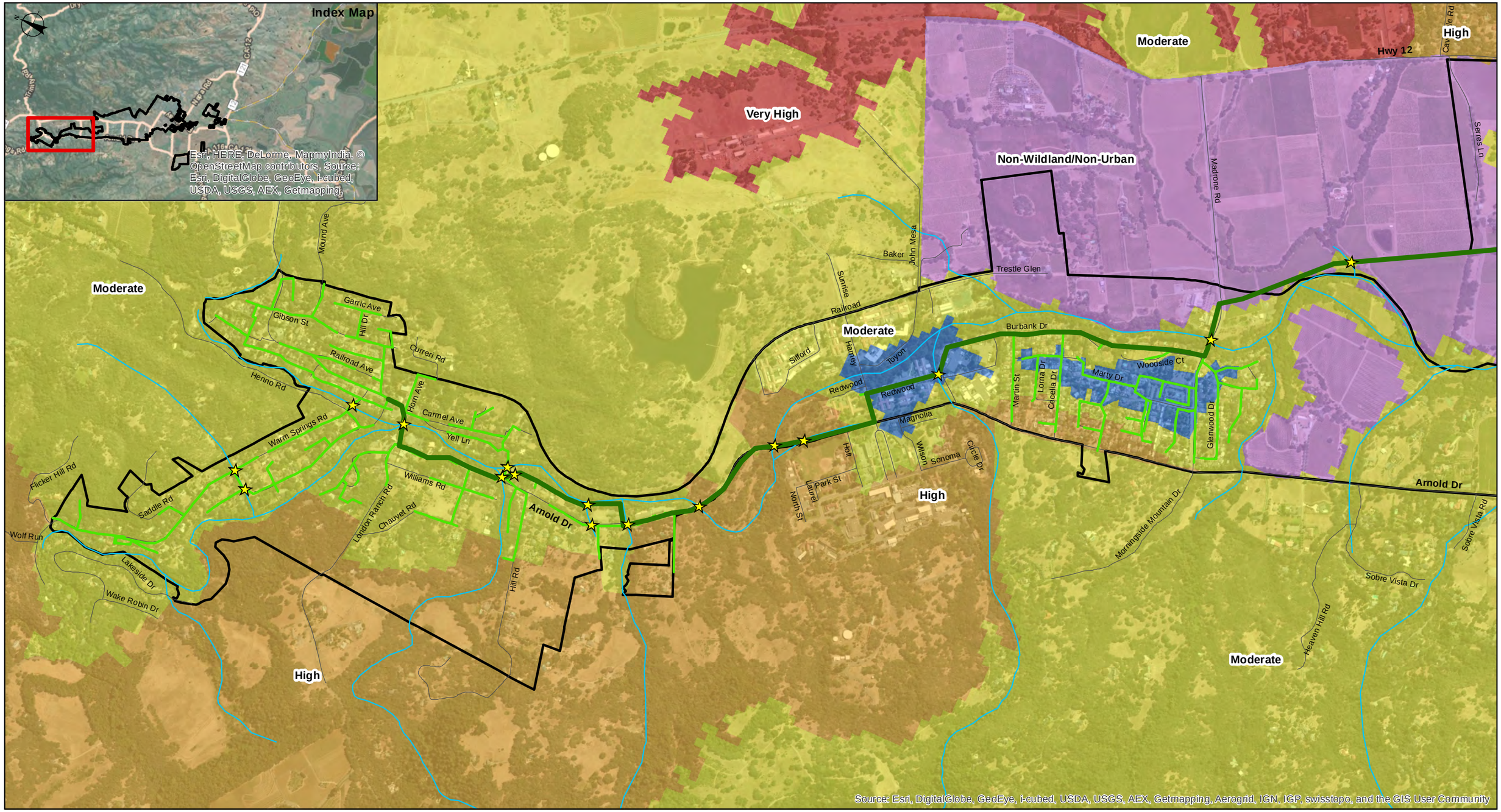


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location

**Fire Hazard Class**

Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 09 Oct 2014 |

Sonoma Valley CSD
Fire Hazard Zone (1 of 10)

Figure SV-42

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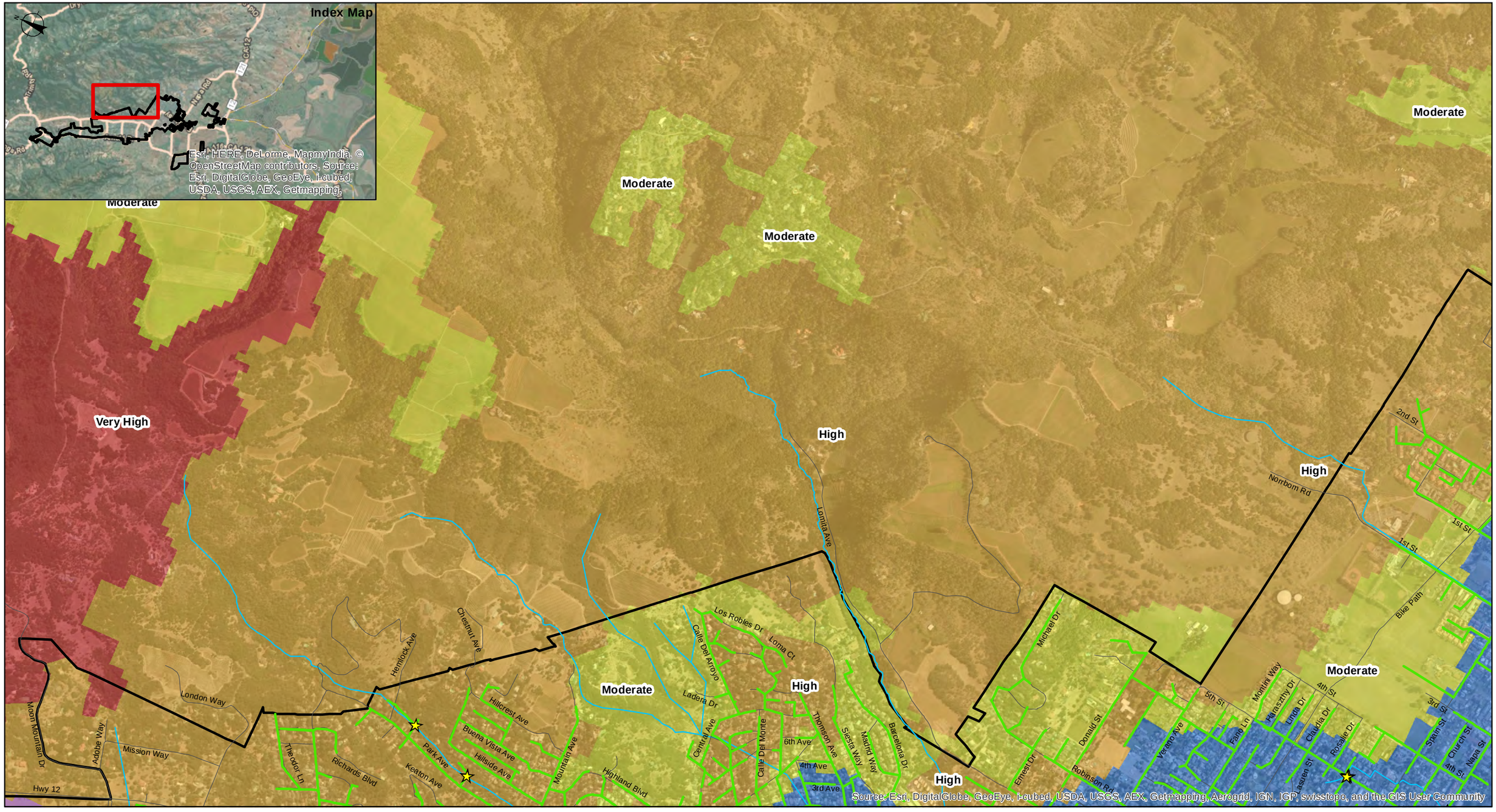


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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location

**Fire Hazard Class**

Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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| Date | 09 Oct 2014 |

Sonoma Valley CSD
Fire Hazard Zone (2 of 10)

Figure SV-43

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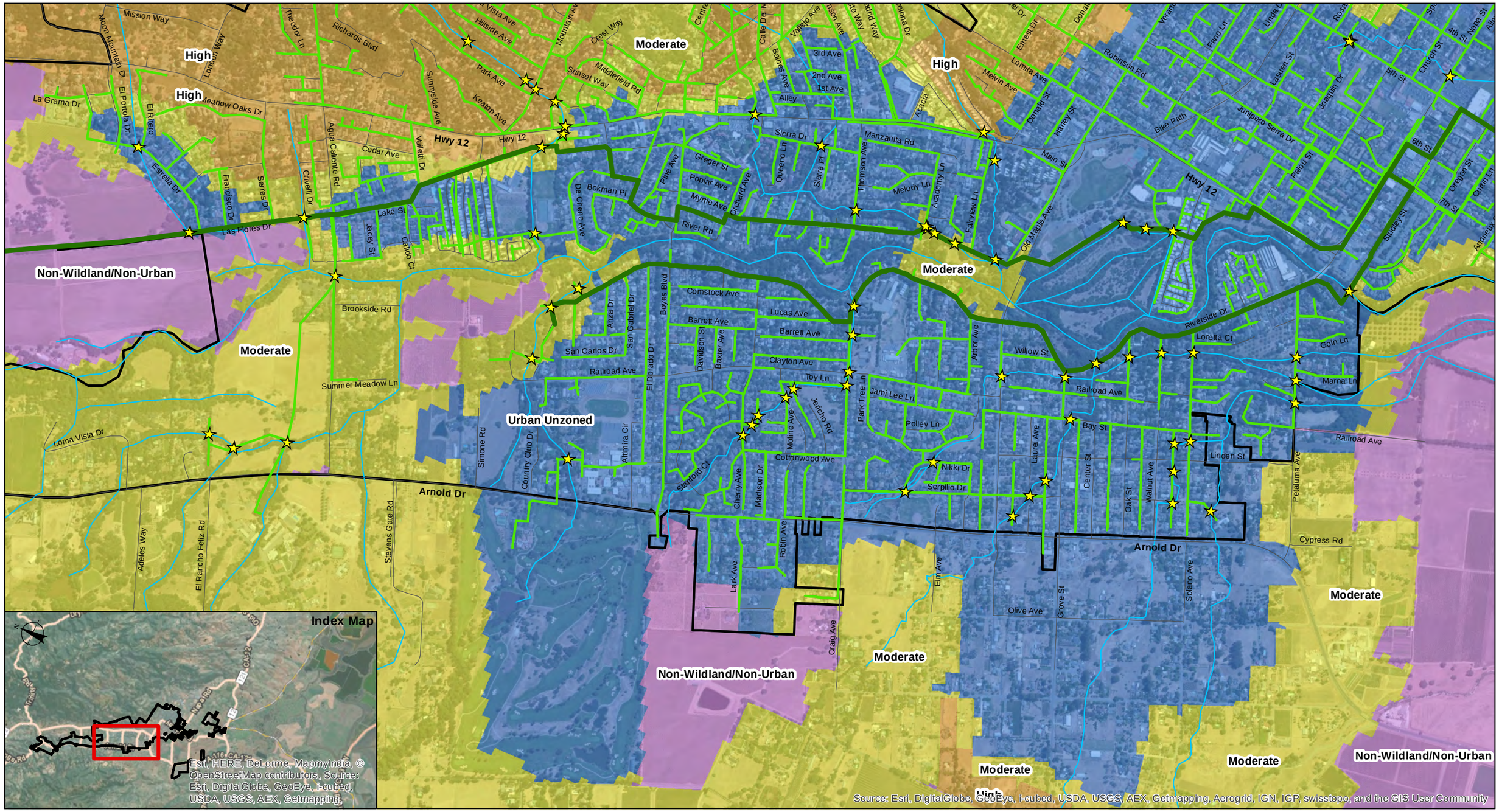


Paper Size 11" x 17" (ANSI B)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location

**Fire Hazard Class**

Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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Sonoma Valley CSD
Fire Hazard Zone (3 of 10)

Figure SV-44

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Data source: SCWA, Sanitary Sewer, Street, Creek, Boundary, 2013; Kleinfelder, Quaternary Deposits, 2014. Created by:afisher2

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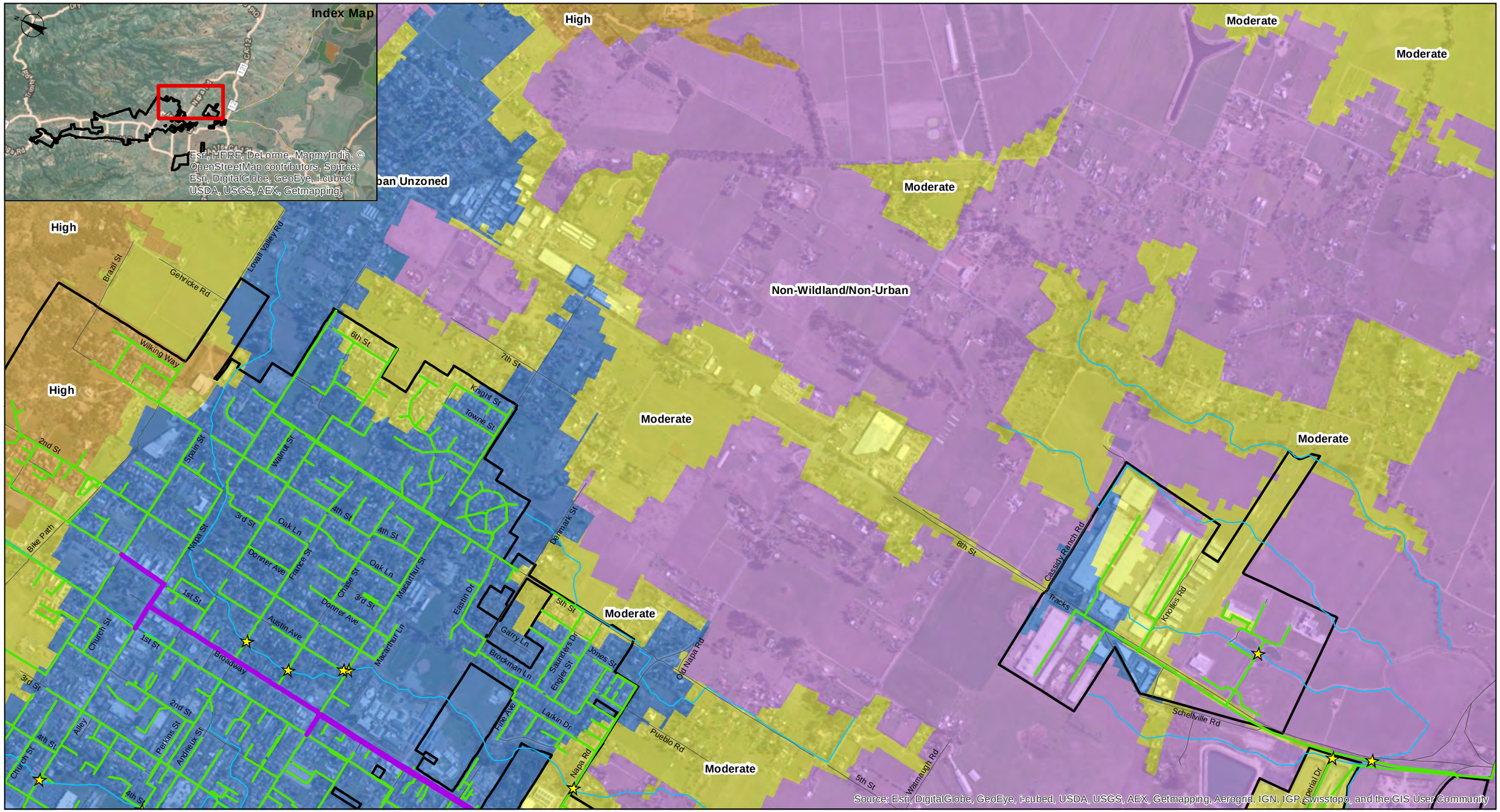


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location

**Fire Hazard Class**

Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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Sonoma Valley CSD
Fire Hazard Zone (4 of 10)

Figure SV-45

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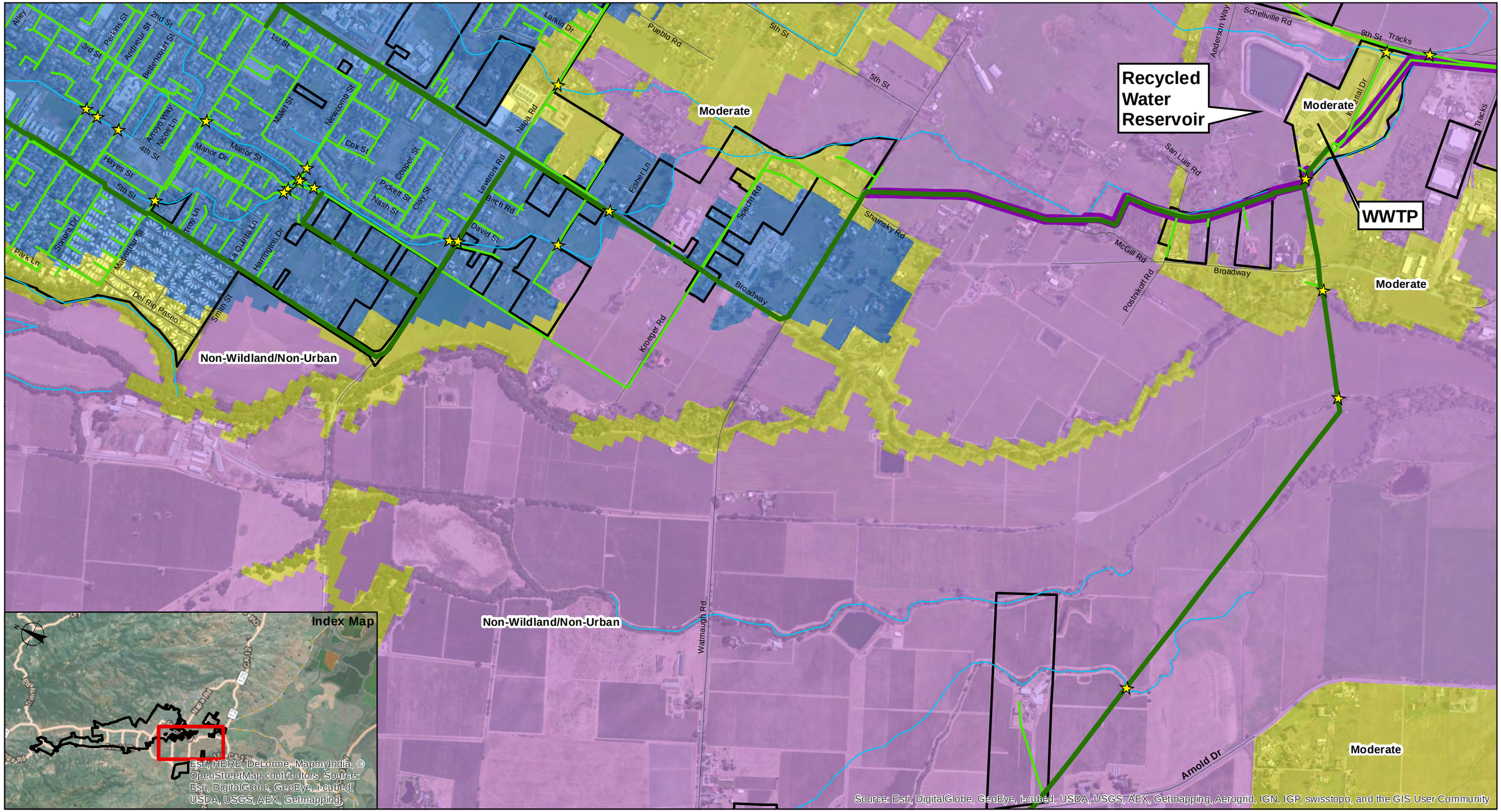


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location

**Fire Hazard Class**
Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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| Date | 09 Oct 2014 |

Sonoma Valley CSD
Fire Hazard Zone (5 of 10)

Figure SV-46

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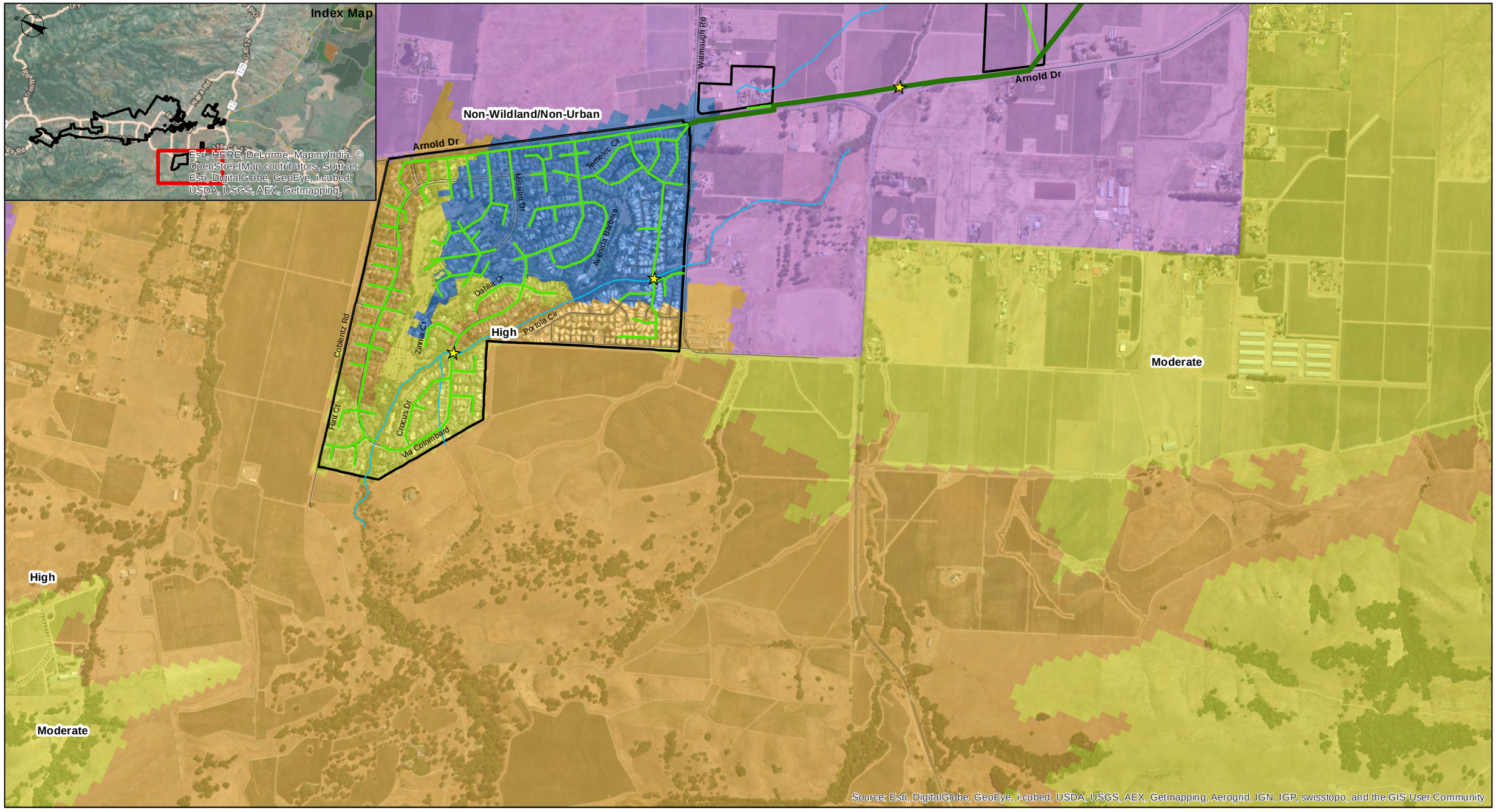


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Crossing Location

**Fire Hazard Class**

Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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| Date | 10 Oct 2014 |

Sonoma Valley CSD
Fire Hazard Zone (6 of 10)

Figure SV-47

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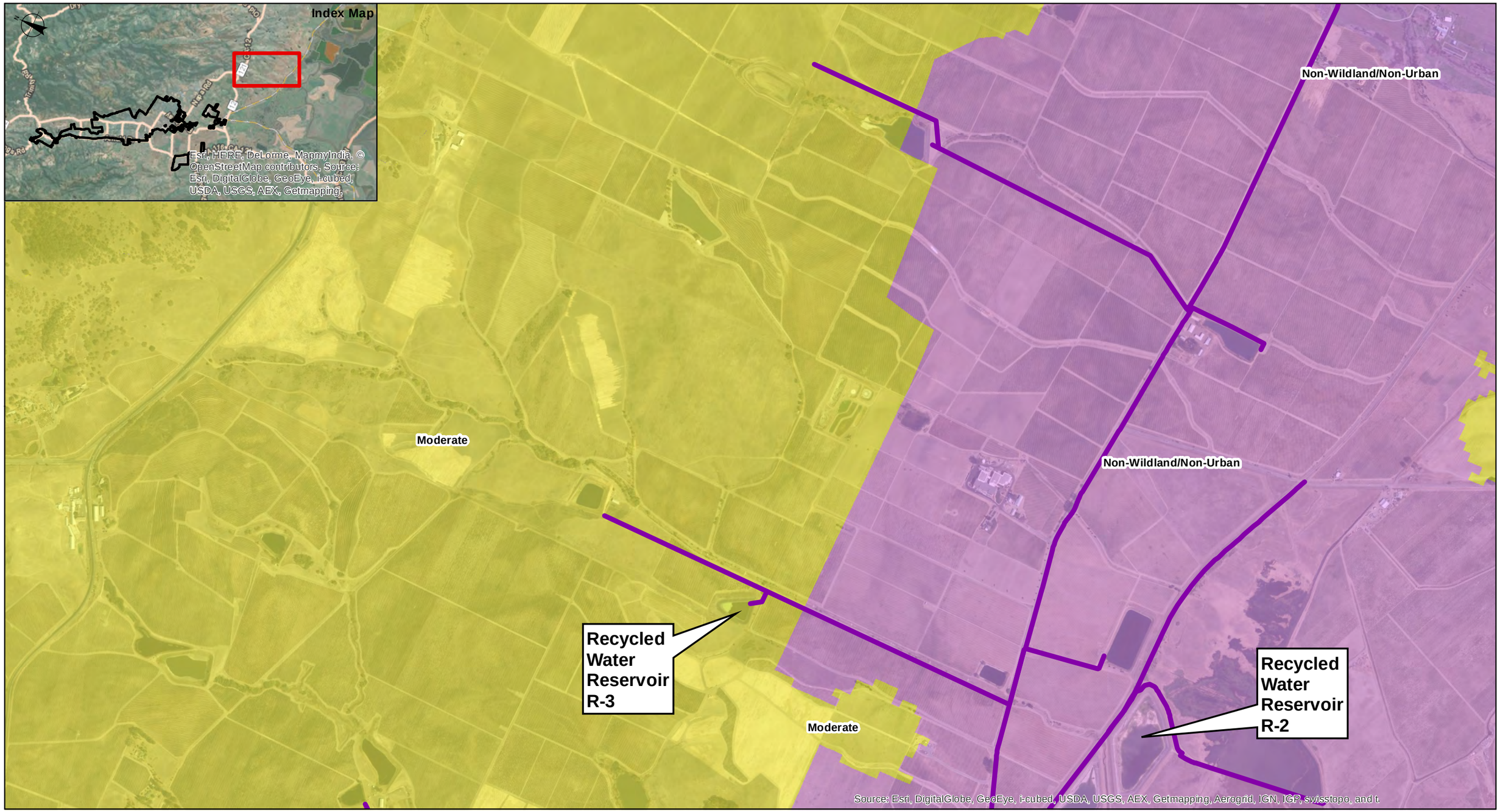


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location

**Fire Hazard Class**

Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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Sonoma Valley CSD
Fire Hazard Zone (7 of 10)

Figure SV-48

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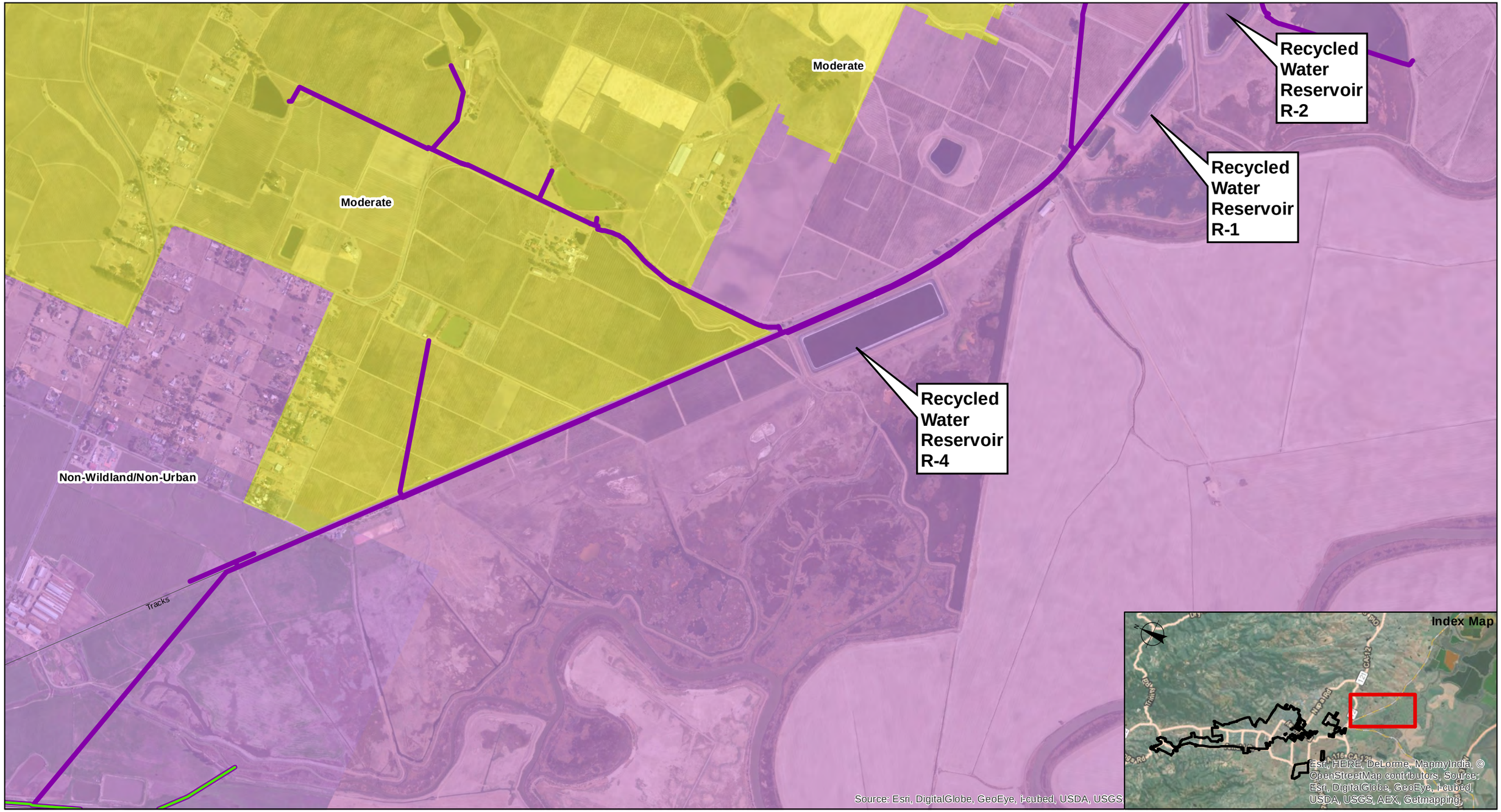


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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location

**Fire Hazard Class**

Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
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Sonoma Valley CSD
Fire Hazard Zone (8 of 10)

Figure SV-49

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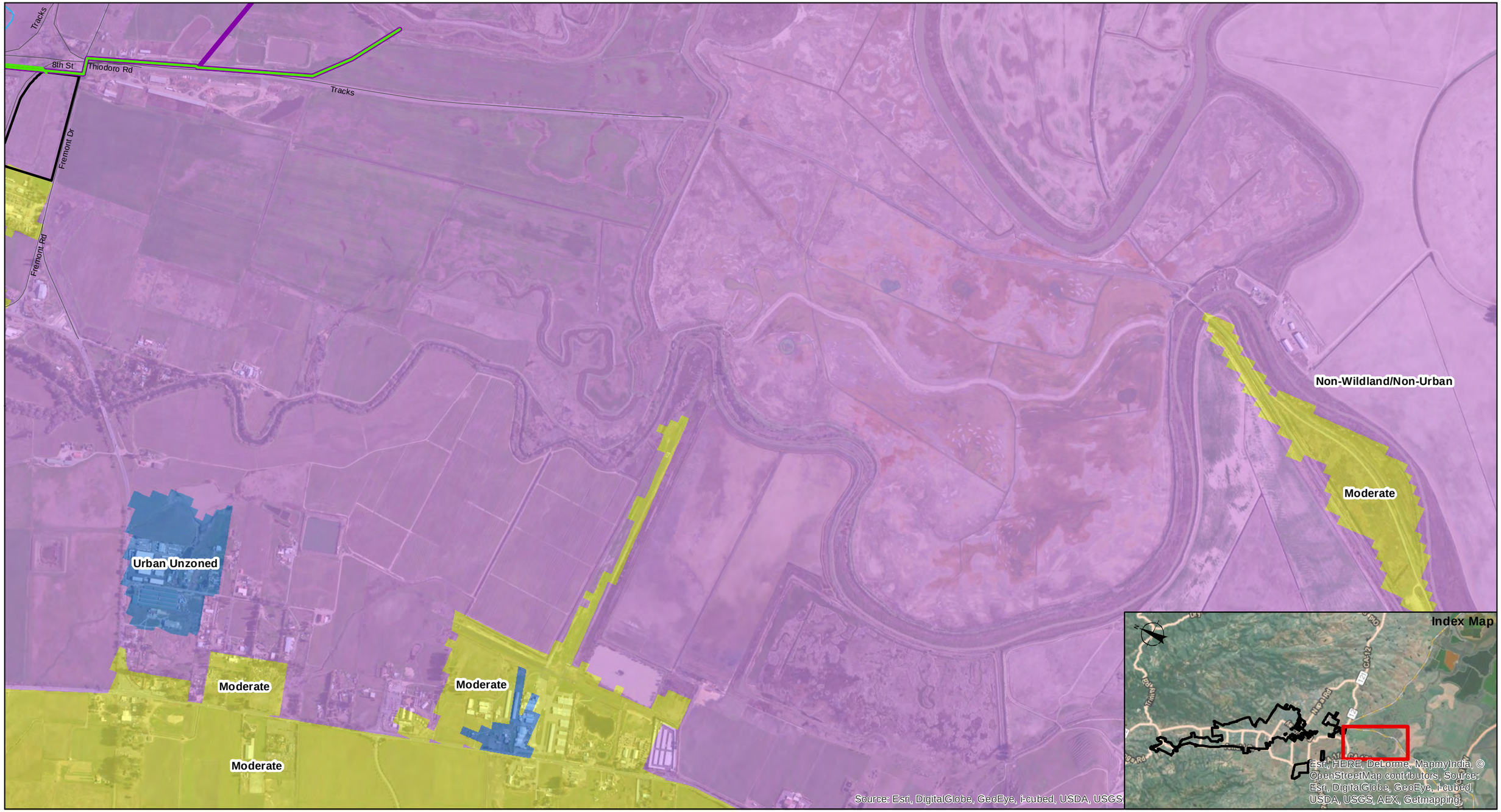


Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location

**Fire Hazard Class**

Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
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Sonoma Valley CSD
Fire Hazard Zone (9 of 10)

Figure SV-50

N:\US\Santa Rosa\Projects\02243 - SCWA\02243-8410201 - Sonoma Valley CSD\08-GIS\Maps\Figures\Figure SV-50 Fire Hazard 9.mxd

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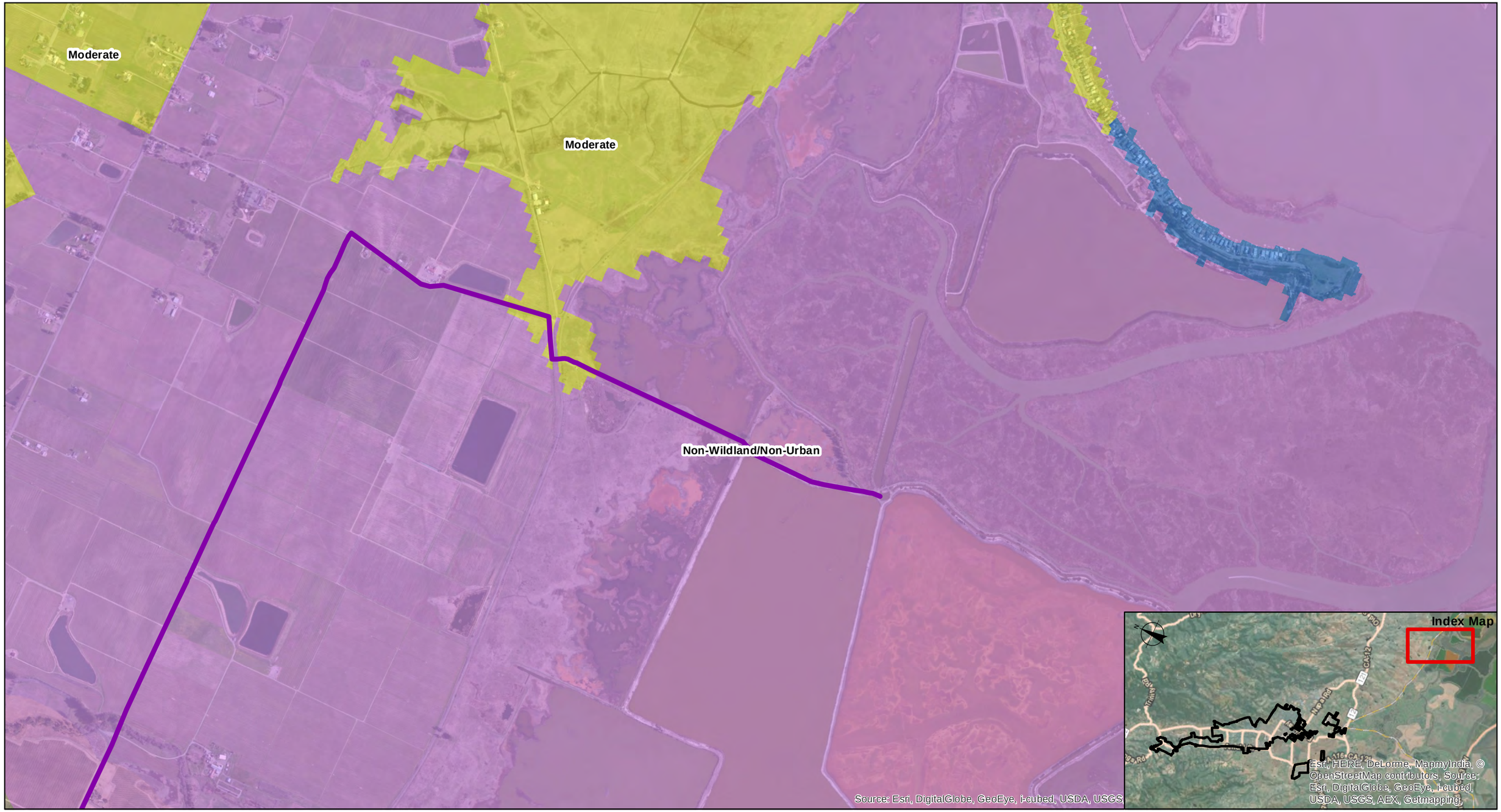
Data source: SCWA, Sanitary Sewer, Street, Creek, Boundary, 2013; Kleinfelder, Quaternary Deposits, 2014. Created by:afisher2

2235 Mercury Way Suite 150 Santa Rosa CA 95407 USA T 707 523 1010 F 707 527 8679 E santarosa@ghd.com W www.ghd.com




Paper Size 11" x 17" (ANSI B)

0 275 550 825 1,100

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe
Crossing Location

**Fire Hazard Class**

Very High
High
Moderate
Non-Wildland/Non-Urban
Urban Unzoned

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 23 Jan 2015 |

Sonoma Valley CSD
Fire Hazard Zone (10 of 10) Figure SV-51

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Data source: SCWA, Sanitary Sewer, Street, Creek, Boundary, 2013; Kleinfelder, Quaternary Deposits, 2014. Created by:afisher2

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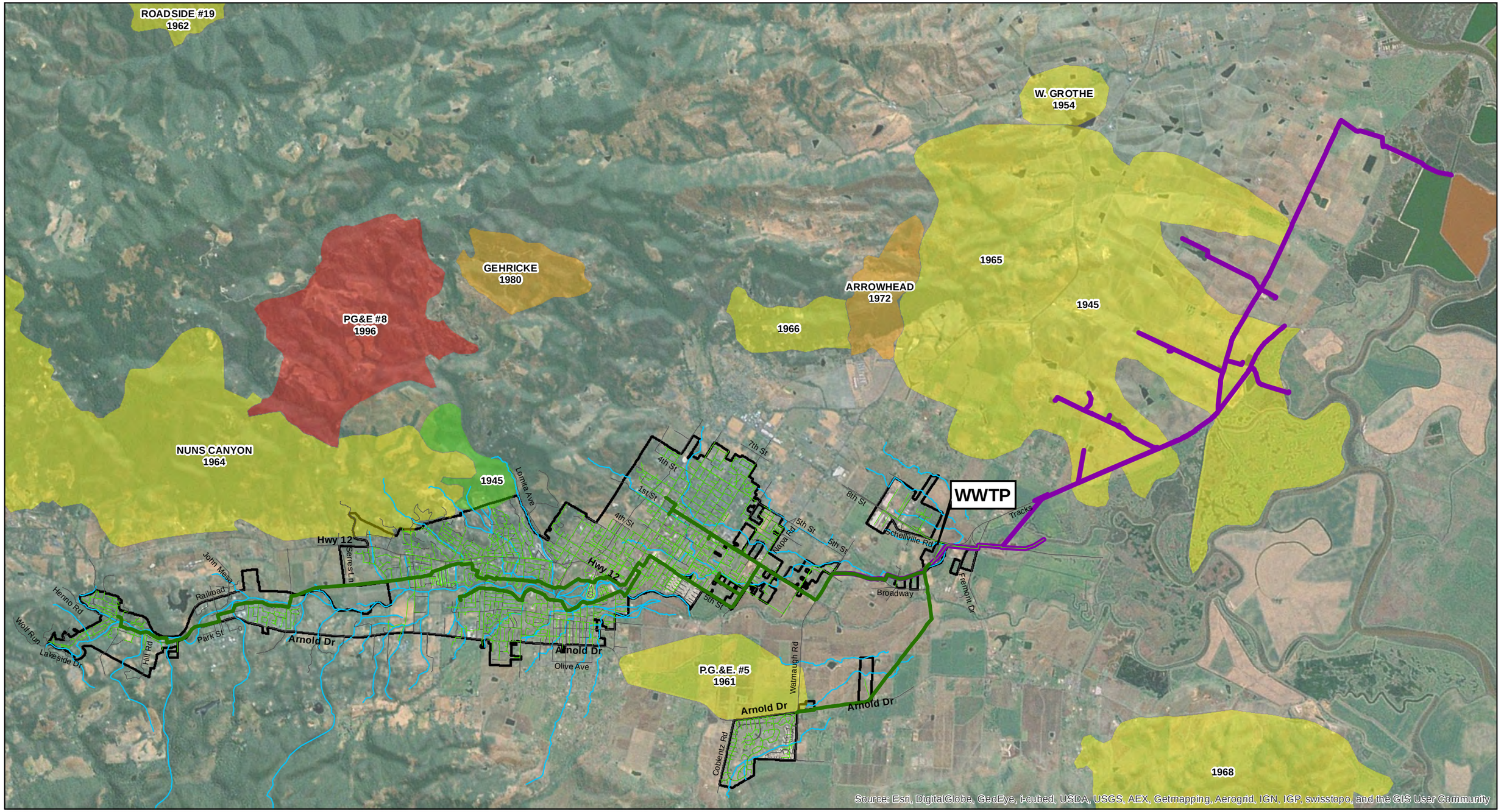


Paper Size 11" x 17" (ANSI B)

0 0.25 0.5 0.75 1
Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet 2011

N

SVCSD Boundary
Street
Creek
Sanitary Sewer Main
Sanitary Sewer Trunk Main
Recycled Water Pipe

**Historical Wild Fires**

Oldest
Most Recent

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

| | |
|---|---|
| Job Number | 8410201 |
| Revision | 2 |
| Date | 10 Oct 2014 |

Sonoma Valley CSD
Historic Wild Fires

Figure SV-52

N:\US\Santa Rosa\Projects\02243 - SCWA\02243-8410201 - Sonoma Valley CSD\08-GIS\Maps\Figures\Figure SV-52 Historical Fires.mxd

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Data source: SCWA, Sanitary Sewer, Street, Creek, Boundary, 2013. Created by:afisher2

2235 Mercury Way Suite 150 Santa Rosa CA 95407 USA T 707 523 1010 F 707 527 8679 E santarosa@ghd.com W www.ghd.com

# APPENDIX B – PROOF OF PUBLIC OUTREACH

*NHRA Phase*

| | |
|---|---|
| Exhibit 1A: | SVCSD Newsletter, Fall 2013 the District Newsletter, Volume 1, Issue #2 |
| Exhibit 1B: | SVCSD Local Hazard Mitigation Plan Webpage |
| Exhibit 1C: | Public Notices Webpage |
| Exhibit 1D: | Event Calendar Webpage |
| Exhibit 1E: | ENews June 2014 |
| Exhibit 1F: | Press Release |
| Exhibit 1G: | Stakeholder Letter |
| Exhibit 1H: | Stakeholder List |
| Exhibit 1I: | Sonoma Index-Tribune Advertisement |
| Exhibit 1J: | ENews July 2014 |
| Exhibit 1K: | Sonoma Index-Tribune News Article |
| Exhibit 1L: | Social Media – Twitter |
| Exhibit 1M: | Social Media – Facebook |
| Exhibit 1N: | Sonoma Valley Citizens Advisory Commission - Agenda |
| Exhibit 1O: | Sonoma Valley Citizens Advisory Commission – Meeting Minutes |

*LHMP Phase*

| | |
|---|---|
| Exhibit 2A: | SVCSD Newsletter, Winter 2015 the District Newsletter, DRAFT |
| Exhibit 2B: | LHMP Stakeholder Postcard |
| Exhibit 2C: | Postcard Mailing List |
| Exhibit 2D: | Press Release |
| Exhibit 2E: | Sonoma Index-Tribune Newspaper Advertisement |
| Exhibit 2F: | SUN Advertisement |
| Exhibit 2G: | SVCSD Local Hazard Mitigation Plan Webpage |
| Exhibit 2H: | Event Calendar Webpage |
| Exhibit 2I: | Social Media – Twitter |
| Exhibit 2J: | Social Media – Facebook |
| Exhibit 2K: | Sonoma County Board of Supervisors– Agenda |
| Exhibit 2L: | Sonoma County Board of Supervisors– Meeting Minutes |
| Exhibit 2M: | Brown and Caldwell's BC Water News |

**Exhibit 1A**

SVCSD Newsletter, Fall 2013 the District Newsletter, Volume 1, Issue #2 mailed to all ratepayers on October 14, 2013

FALL 2013

Vol. 1, Issue #2

SONOMA VALLEY COUNTY SANITATION DISTRICT NEWS

INSIDE FALL 2013


2 How to Contact Your Board
3 Employee Spotlight
4 Volume-Based Rate Structure
5 High-Efficiency Program
6 Watch What You Flush
6 FOG


*The Sonoma Valley County Sanitation District concluded*
*Restoration Pipeline Project. For more information, see*

For more information or to register, go online to www.sonomacountywater.org/direct-install to sign up on the waiting list or call the Water Efficiency Program at 707.547.1918.

## About Your Sanitation District

Sonoma Valley County Sanitation District Service Area

During a 1995 re
government, the
Agency) assumed
11 different sani
Water Agency ma
districts and zon
Sonoma Valley C
s per

The District bega
recipients number 17,027 Equivalent Single-Family Dwellings within a 4,500-acre service area. The treatment plant has a design capacity of 3 million gallons per day (average daily dry weather flow) and treats wastewater to tertiary treatment levels (also referred to as advanced water treatment). High-quality tertiary treated recycled water is an important source of water and its use offsets potable water demands.

Between May 1 and October 31, the recycled water is used for irrigation. Between November 1 and April 30, recycled water is discharged into Schell Slough or Hudeman Slough.

### Preparing for Natural Disasters

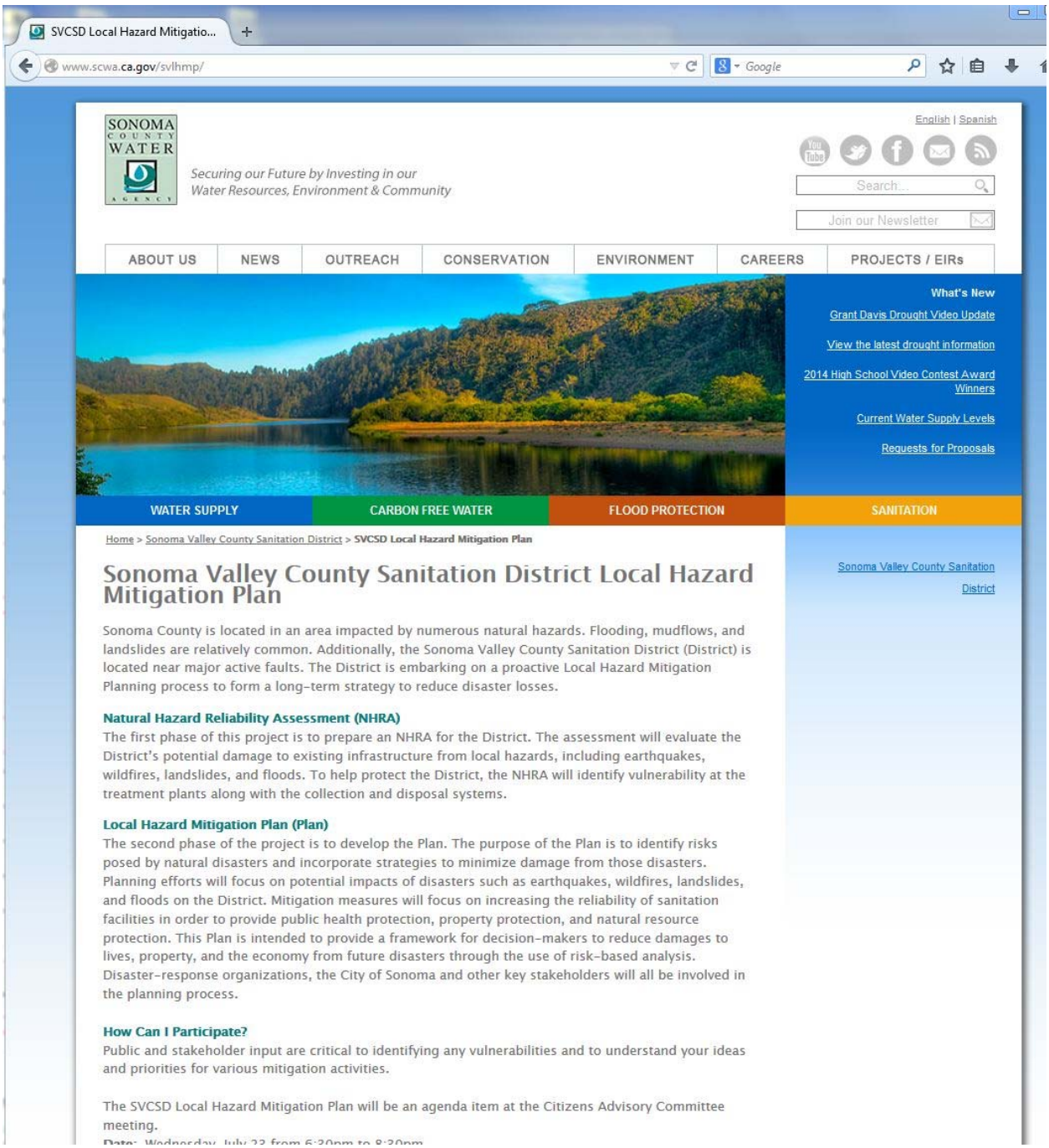
As Californians, we know that floods, fires and earthquakes are inevitable. The District wants to be sure that service will continue when the next natural disaster occurs. The District is currently assessing potential vulnerabilities that may cause disruption to service and invites the public to participate in this process. For more information, please contact Curran Price at curran.price@scwa.ca.gov or 707.524.1179.

www.sonomacountywater.org/SVCSD

SONOMA COUNTY WATER AGENCY

**Exhibit 1B**

SVCSD Local Hazard Mitigation Plan Webpage, posted on 6/9/14



SVCSD Local Hazard Mitigatio...

www.scwa.ca.gov/svlhmp/

SONOMA COUNTY WATER AGENCY

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What's New

Grant Davis Drought Video Update

View the latest drought information

2014 High School Video Contest Award Winners

Current Water Supply Levels

Requests for Proposals

WATER SUPPLY | CARBON FREE WATER | FLOOD PROTECTION | SANITATION

Home > Sonoma Valley County Sanitation District > **SVCSD Local Hazard Mitigation Plan**

Sonoma Valley County Sanitation District

## Sonoma Valley County Sanitation District Local Hazard Mitigation Plan

Sonoma County is located in an area impacted by numerous natural hazards. Flooding, mudflows, and landslides are relatively common. Additionally, the Sonoma Valley County Sanitation District (District) is located near major active faults. The District is embarking on a proactive Local Hazard Mitigation Planning process to form a long-term strategy to reduce disaster losses.

**Natural Hazard Reliability Assessment (NHRA)**

The first phase of this project is to prepare an NHRA for the District. The assessment will evaluate the District's potential damage to existing infrastructure from local hazards, including earthquakes, wildfires, landslides, and floods. To help protect the District, the NHRA will identify vulnerability at the treatment plants along with the collection and disposal systems.

**Local Hazard Mitigation Plan (Plan)**

The second phase of the project is to develop the Plan. The purpose of the Plan is to identify risks posed by natural disasters and incorporate strategies to minimize damage from those disasters. Planning efforts will focus on potential impacts of disasters such as earthquakes, wildfires, landslides, and floods on the District. Mitigation measures will focus on increasing the reliability of sanitation facilities in order to provide public health protection, property protection, and natural resource protection. This Plan is intended to provide a framework for decision-makers to reduce damages to lives, property, and the economy from future disasters through the use of risk-based analysis. Disaster-response organizations, the City of Sonoma and other key stakeholders will all be involved in the planning process.

**How Can I Participate?**

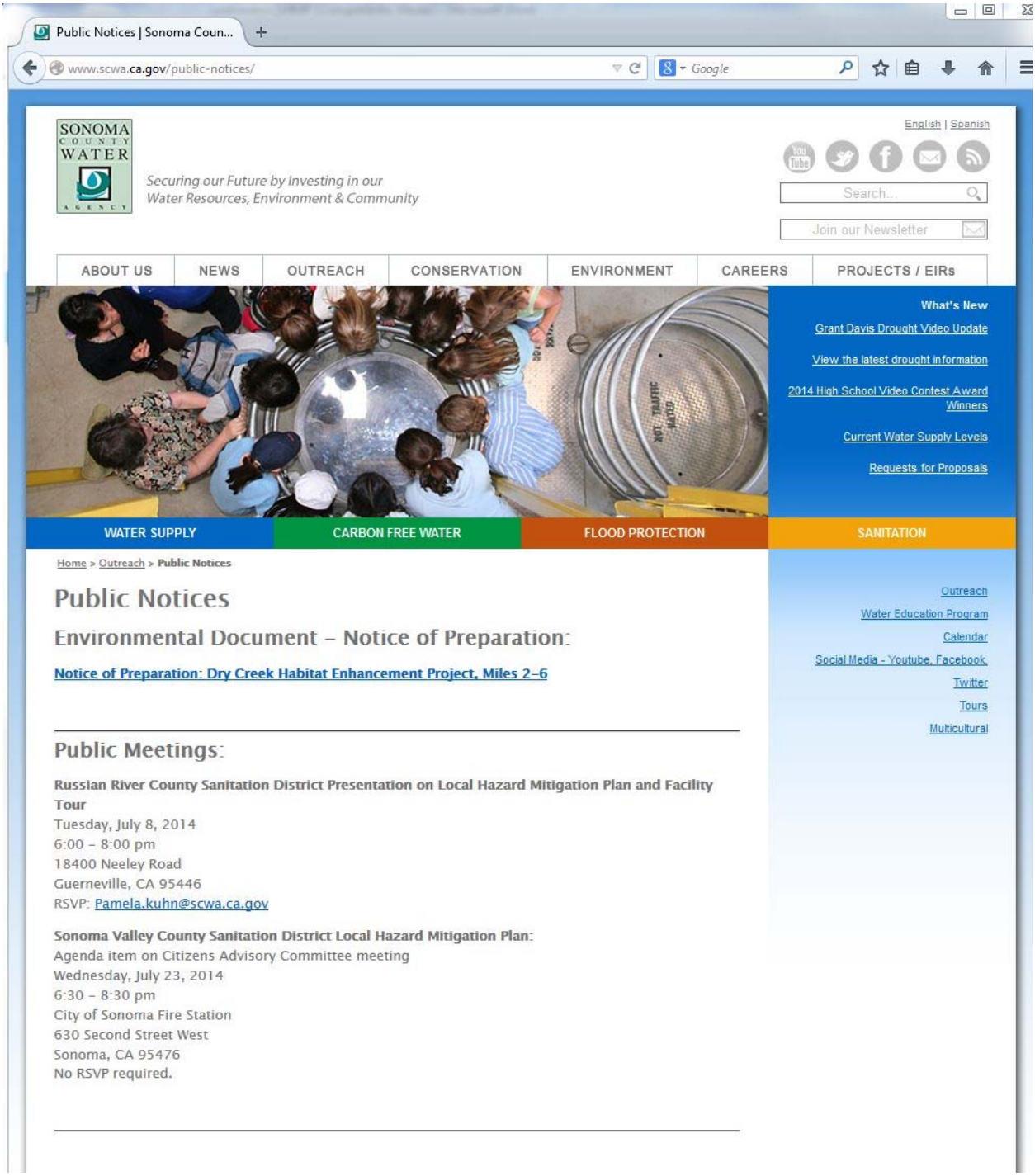
Public and stakeholder input are critical to identifying any vulnerabilities and to understand your ideas and priorities for various mitigation activities.

The SVCSD Local Hazard Mitigation Plan will be an agenda item at the Citizens Advisory Committee meeting.

**Date:** Wednesday, July 23, from 6:30pm to 8:30pm

**Exhibit 1C**

Public Notices Webpage, posted on 6/9/14



Public Notices | Sonoma Coun...

www.scwa.ca.gov/public-notices/

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English | Spanish

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View the latest drought information

2014 High School Video Contest Award Winners

Current Water Supply Levels

Requests for Proposals

WATER SUPPLY | CARBON FREE WATER | FLOOD PROTECTION | SANITATION

Home > Outreach > Public Notices

## Public Notices

### Environmental Document – Notice of Preparation:

Notice of Preparation: Dry Creek Habitat Enhancement Project, Miles 2–6

### Public Meetings:

**Russian River County Sanitation District Presentation on Local Hazard Mitigation Plan and Facility Tour**
Tuesday, July 8, 2014
6:00 – 8:00 pm
18400 Neeley Road
Guerneville, CA 95446
RSVP: Pamela.kuhn@scwa.ca.gov

**Sonoma Valley County Sanitation District Local Hazard Mitigation Plan:**
Agenda item on Citizens Advisory Committee meeting
Wednesday, July 23, 2014
6:30 – 8:30 pm
City of Sonoma Fire Station
630 Second Street West
Sonoma, CA 95476
No RSVP required.

Outreach
Water Education Program
Calendar
Social Media - Youtube, Facebook, Twitter
Tours
Multicultural

**Exhibit 1D**

Event Calendar Webpage, posted on 6/9/14

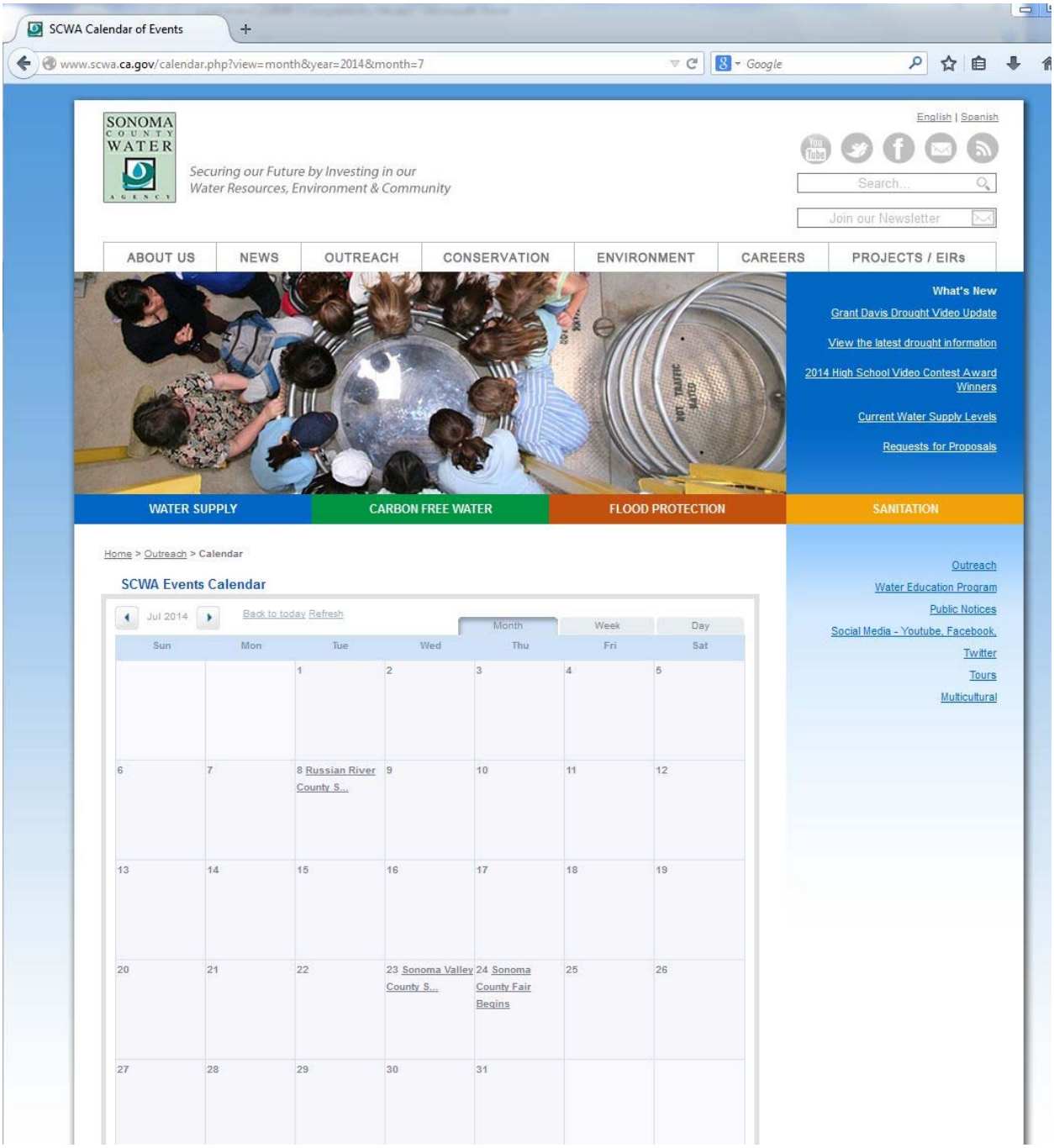


**Exhibit 1E**

ENews June 2014 – Sent 6/12/2014 to 528 subscribers

Web Version | Update preferences | Unsubscribe | Subscribe

SONOMA COUNTY WATER AGENCY

# ENews

A periodic electronic newsletter

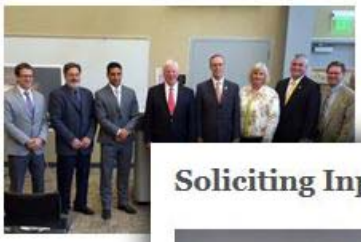
*Securing our Future by Investing in our Water Resources, Environment & Community*

June 2014

TABLE OF CONTENTS


- Water Resources Reform Development and Reform Act
- Beware Invasive Mussels: Popeye returns to Lakes Sonoma, Mendocino
- Below Average Water Supply Calls for Continued Conservation
- Lots Happening in Dry Creek and Russian River valley
- Soliciting Input for Hazard Mitigation Plans
- Groundwater in the Santa Rosa Plain
- Free Gardening Advice
- Local Youth Create Award-Winning Drought Videos
- A Growing Endeavor: Eco-Friendly Garden Tour
- Napa-Sonoma Marsh Project and Sonoma Valley CSD Receive Recognition


## Water Resources Reform Development and Reform Act



The recently approved Water Resources Reform and Development Act (WRRDA) is a water infrastructure bill that makes critical investments on

help complete e
assist with local
infesting local w
projects for ever
Corps. WRRDA
information on
and regional wa

## Beware In
## Lakes Son

Beginning on M
weekend, Popey
sniffing dog retu
Sonoma and La
to inspect water
invasive quagga
mussels. Boaters at both
reservoirs will be asked to
voluntarily allow Popeye to
inspect their watercraft for the thumb-sized mussels that have infested

## Soliciting Input for Hazard Mitigation Plans

Public input is being solicited in Local Hazard Mitigation planning efforts for both the Sonoma County Valley Sanitation District and the Russian River County Sanitation District. Both Districts are operated by the Sonoma County Water Agency. The first phase of the Local Hazard Mitigation project for the Districts was a natural hazard reliability assessment to identify potential damage to existing infrastructure from local hazards including earthquakes, wildfires, landslides and floods. The second phase of the project is to develop a Local Hazard Mitigation Plan that incorporates strategies to minimize damage from those disasters. See event sidebar for information on July presentations. For more information visit **www.sonomacountywater.org/sanitation** or email Project Manager **curran.price@scwa.ca.gov**.

**Exhibit 1F**

Press Release – emailed 6/18/14 to local news outlets & posted to website

# Sonoma County Water Agency
# Press Release

**For Immediate Release**
June 18, 2014

**CONTACT:**
Brad Sherwood
Community & Governmental Affairs Manager
707.547.1927 (Office)
707.322.8192 (Cell)
sherwood@scwa.ca.gov

## Public Input Solicited for Hazard Mitigation Plans in Sonoma Valley, Russian River County Sanitation Districts

**Santa Rosa, CA** – The Russian River County Sanitation District (RRCSD) and Sonoma Valley County Sanitation District (SVCSD) this July will seek public comment on hazard mitigation planning efforts to increase the reliability of sanitation facilities during natural disasters, such as an earthquake. Public comment on these planning efforts is encouraged at two upcoming meetings. Both Districts are operated by the Sonoma County Water Agency (Water Agency).

"The occurrence of natural disasters such as flooding, landslides, fires, and earthquakes—all relatively common in Sonoma County—can result in enormous cost to communities. The Local Hazard Mitigation Plans for these districts will form the foundation for a long-term strategy to reduce disaster losses," said Water Agency Director Susan Gorin.

Water Agency Director Efren Carrillo added, "I encourage our community to participate in these upcoming meetings. Protecting human and environmental health is our highest priority as we identify potential hazards in our wastewater collection and treatment infrastructure."

Both Districts have already undergone a Natural Hazard Reliability Assessment (NHRA) to identify potential damage to existing infrastructure from local hazards including earthquakes, wildfires, landslides and floods. The second phase of the project is to develop a Local Hazard Mitigation Plan (Plan) that incorporates strategies to minimize damage from those disasters. Public and stakeholder input are critical to identifying vulnerabilities to the Districts and to understand public ideas and priorities for various mitigation activities.

Mitigation measures in the Plan will focus on increasing the reliability of sanitation facilities in order to provide public health protection, property protection, and natural resource protection.

This Plan is intended to provide a framework for decision-makers to reduce damages to lives, property, and the economy from future disasters through the use of risk-based analysis.

**Russian River County Sanitation District Public Meeting/Tour**

Staff will provide a presentation of the planning efforts along with a tour of the District's treatment facility.

Date: Tuesday, July 8 at 6pm to 8pm
Location: RRCSD treatment plant, 18400 Neeley Road, Guerneville
RSVP: Please respond to pamela.kuhn@scwa.ca.gov

The Russian River County Sanitation District began operating in 1983 and serves 3,161 Equivalent Single-Family Dwellings within a 2,700-acre service area. The sanitation facility has a design capacity of 710,000 gallons per day and treats wastewater to tertiary treatment levels (also referred to as advanced water treatment).

**Sonoma Valley County Sanitation District**

The SVCSD Local Hazard Mitigation Plan will be an agenda item at the Citizens Advisory Committee meeting.

Date: Wednesday, July 23 at 6:30pm to 8:30pm
Location: Sonoma Police Department Community Room, 177 First Street West, Sonoma, CA
RSVP: No RSVP is required

The Sonoma County Valley Sanitation District began operations in 1953 and serves 17,027 Equivalent Single-Family Dwellings within a 4,500-acre service area. The treatment plant has a design capacity of 3 million gallons per day and treats wastewater to tertiary treatment levels.

In 1995 the Water Agency assumed responsibility from the County of Sonoma for managing the county sanitation zones and districts, which provide wastewater collection and treatment, and recycled water distribution and disposal services. Currently, the Water Agency manages and operates eight different sanitation districts and zones.

Please visit www.sonomacountywater.org/sanitation for more information.

###

*The Sonoma County Water Agency is working to secure our future by investing in our water resources, community and environment. The Water Agency provides water supply, flood protection and sanitation services for portions of Sonoma and Marin counties. Visit us on the Web at www.sonomacountywater.org*

**Exhibit 1G**Stakeholder Letter – Mailed 6/20/2014 to 127 individuals and organizations

Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95409

[Insert Name]
[Insert Address]
[Insert City, State, Zip]

June 20, 2014

Dear [insert name]:

The Sonoma County Water Agency (Water Agency) operates the Russian River County Sanitation District (RRCSD) and the Sonoma Valley County Sanitation District (SVCSD). The Water Agency is currently developing a Natural Hazard Reliability Assessment (NHRA) and a Local Hazard Mitigation Plan (Plan) for each District. These documents will be used to prepare a long-term strategy to reduce losses due to natural disasters. **We are reaching out to you directly today because we have identified your organization as one that would have valuable input into one or both of the planning processes.** More detailed information is provided below.

**Natural Hazard Reliability Assessment (NHRA):** The first phase of the projects was to prepare an NHRA for each District. The assessment evaluates the potential damage to each District's infrastructure from hazards, including earthquakes, wildfires, landslides, and floods. The NHRA identifies vulnerability at the treatment plants along with the collection and disposal systems.

**Local Hazard Mitigation Plan (Plan):** The second phase of the project will develop a Plan for each District. The purpose of the Plan is to identify risks posed to District facilities by natural disasters and develop strategies to minimize damage from those disasters. Planning efforts will focus on potential impacts of disasters such as earthquakes, wildfires, landslides, and floods. Mitigation measures will be identified and prioritized based on the results of the NHRAs.

**PARTICIPATION**

Public and stakeholder input are needed to identify vulnerabilities to each District and to understand your ideas and priorities for various mitigation activities. We welcome your comments at any point in the planning process.

We will be holding a public opportunity for input in each respective District (listed below). Additionally, you will be able to review the Draft Plan online (anticipated in Fall 2014) for the Russian River County Sanitation District at www.sonomacountywater.org/rrlhmp and Sonoma Valley County Sanitation District at www.sonomacountywater.org/svlhmp.
For additional information about the Plans, contact Project Manager Curran Price by calling (707) 524-1179 or emailing curran.price@scwa.ca.gov.

**Russian River County Sanitation District Public Meeting/Tour**
Staff will provide a presentation of the RRCSD planning efforts along with a tour of the District's treatment facility.

treatment facility.
**Date:** Tuesday, July 8 from 6pm to 8pm
**Location:** RRCSD treatment plant, 18400 Neeley Road, Guerneville, CA 95446
**RSVP:** Please respond to pamela.kuhn@scwa.ca.gov

**Sonoma Valley County Sanitation District**
The SVCSD Local Hazard Mitigation Plan will be an agenda item at the Sonoma Valley Citizens Advisory Committee meeting.
**Date:** Wednesday, July 23 from 6:30pm to 8:30pm
**Location:** City of Sonoma Fire Station, 630 Second Street West, Sonoma, CA 95476
**RSVP:** No RSVP is required

**TIMELINE**
**Fall 2013 – Summer 2014:** Conduct District NHRAs
**Summer 2014:** Solicit Public Input
**Fall 2014 – Winter 2014/15:** Public Scoping Period for Draft Plans
**Spring 2015:** Plans complete

**BACKGROUND**
The Russian River County Sanitation District began operating in 1983 and serves 3,161 Equivalent Single-Family Dwellings within a 2,700-acre service area. The sanitation facility has a design capacity of 710,000 gallons per day and treats wastewater to tertiary treatment levels (also referred to as advanced water treatment). Additionally, the District provides high-quality tertiary treated water for local agricultural uses.

The Sonoma Valley County Sanitation District began operations in 1953 and serves 17,027 Equivalent Single-Family Swellings within a 4,500-acre service area. The treatment plant has a design capacity of 3 million gallons per day and treats wastewater to tertiary treatment levels. Additionally, the District provides high-quality tertiary treated water for local agricultural uses.

Thank you very much. We look forward to your participation in this important planning effort.

**Best Regards,**

Grant Davis
Sonoma County Water Agency General Manager

## Exhibit 1H

Stakeholder List

| AGENCY CONTACT FIRST NAME | AGENCY CONTACT LAST NAME | ORGANIZATION | TITLE |
|---|---|---|---|
| | | **Water contractors** | |
| Dan | Takasugi | City of Sonoma - Public Works | Public Works Director/City Engineer |
| Daniel | Muelrath | Valley of the Moon Water District | General Manager |
| | | **Cities/Counties/Local Govt** | |
| Ezra | Rapport | Association of Bay Area Governments | Executive Director |
| Jack | LaRochelle | City of Napa | Public Works Director |
| Carol | Giovanatto | City of Sonoma | City Manager |
| David | Cook | City of Sonoma | Mayor |
| Bill | Willers | City of Sonoma<br>Planning Commission | Chair |
| Chris | Pegg | City of Sonoma<br>Public Works Department | Stormwater Compliance Specialist |
| | | City of Sonoma<br>Sonoma Disaster Council | |
| William | Keene | County of Sonoma<br>Agricultural Preservation and Open Space District | Assistant General Manager |
| Walter L. | Kruse | County of Sonoma<br>Department of Health Services | Director |
| Susan | Klassen | County of Sonoma<br>Department of Transportation & Public Works | Director |
| Christopher | Helgren | County of Sonoma<br>Fire and Emergency Services Department | Emergency Services Manager |
| Tony | Linegar | County of Sonoma<br>Fish & Wildlife Advertising Commission | Department Head |
| Tennis | Wick | County of Sonoma<br>Permit and Resource Management Department | Director |
| Dave | Schiltgen | County of Sonoma<br>Permit and Resource Management Department | Planner III |
| Peter | Van Fleet | Glen Ellen Fire Protection District | Chief |
| Bill | Shubin | Kenwood Fire Protection District | Chief |
| Will | Horne | Mayacamas Volunteer Fire Department | Chief |
| Kevin | Twohey | Napa County Office of Emergency Services | OES Coordinator |
| James | Keller | Napa Sanitation District | Plant Manager |
| Keith | Sorsdal | Napa Sanitation District | Collection system Manager |
| John | Woodling | Regional Water Authority | Executive Director |
| Ray | Mulas | Shell-Vista Fire Protection District | Chief |

| | | | |
|---|---|---|---|
| Steven | Herrington | Sonoma County Office of Education | Superintendent of Schools |
| | | Sonoma Developmental Center/Eldridge FD | |
| Kara | Heckert | Sonoma Resource Conservation District | Executive Director |
| Pat | Gilardi | Sonoma Valley Citizens Advisory Commission | |
| Mark | Freeman | Sonoma Valley Fire & Rescue Authority | Chief |
| | | **State Agencies** | |
| Scott | Wilson | California Department of Fish & Wildlife | Regional Manager |
| | | California Department of Public Health | |
| Sonke | Mastrup | California Fish and Game Commission | Executive Director |
| Andrew | Rush | California Governor's Office of Emergency Services | Senior Emergency Services Coordinator |
| Phyllis | Banks | California Governor's Office of Emergency Services | Emergency Services Coordinator |
| Dave | Dearborn | California Highway Patrol | Local Emergency Planning Committee Chair |
| John | Laird | California Natural Resources Agency | Secretary |
| | | California State Parks, Bay Area District | |
| | | California State Parks, Sonoma-Mendocino Coast District | |
| Mark | Cowen | Department of Water Resources | Director |
| Gary | Lippner | Department of Water Resources | Chief, Water Supply Evaluations Section |
| Matt | St. John | North Coast Regional Water Quality Control Board | Executive Officer |
| Bruce | Wolfe | San Francisco Bay Regional Water Quality Control Board | Executive Officer |
| Karen | Faria | Sonoma Developmental Center | |
| Eric | Oppenheimer | State Water Resources Control Board | Office of Research, Planning and Performance |
| | | **Federal Agencies** | |
| Lisa | Van Atta | NOAA Fisheries | Assistant Regional Administrator |
| Gary | Stern | NOAA Fisheries - North-Central Coast Office | Branch Chief |
| Patrick | Rutten | NOAA Restoration Center | SW Regional Supervisor |
| Mike | Dillabough | US Army Corps of Engineers | Chief, Operations and Readiness |
| | | US Fish & Wildlife Services | |
| | | US Fish & Wildlife Services - Bay Delta | |
| Michael | Webster | USGS Ukiah Field Office | Field Office Chief |
| | | **Elected Representatives** | |
| Marc | Levine | California State Assembly | State Assembly Member |
| Bill | Dodd | California State Assembly | State Assembly Member |
| Jim | Wood | California State Assembly | State Assembly Member |
| Mike | McGuire | California State Senate | State Senator |
| Lois | Wolk | California State Senate | State Senator |
| Jared | Huffman | US House of Representatives | US Representative - California |
| Mike | Thompson | US House of Representatives | US Representative - California |
| | | **Non-governmental Organizations** | |
| Crystal | Silva | American Red Cross of the California Northwest | Disaster Program Manager |

| | | | |
|---|---|---|---|
| Andy | Gunther | Bay Area Ecosystems Climate Change Consortium | Executive Coordinator |
| Laurel | Marcus | California Land Stewardship Institute | Executive Director |
| Kandis | Gilmore | Community Clean Water Institution | President |
| | | Environmental Center of Sonoma County | |
| Vicki | Rupp | Environmental Forum of Marin | President |
| David | Keller | Friends of the Eel River | Bay Area Director |
| Brittany | Heck | Gold Ridge Resource Conservation District | Executive Director |
| Tim | Parker | Groundwater Resources Association of California | Director |
| Kevin | Munroe | Laguna de Santa Rosa Foundation | Executive Director |
| Craig | Anderson | LandPaths | Executive Director |
| Jeff | Trandahl | National Fish and Wildlife Foundation | Executive Director and Chief Executive Officer |
| H. R. | Downs | O.W.L. Foundation | President |
| Brock | Dolman | Occidental Arts and Ecology Center - Water Institute | Program Director |
| Lisa | Micheli | Pepperwood Foundation, Dwight Center for Conservation Science | Executive Director |
| Ellie | Cohen | Point Reyes Bird Observatory Conservation Science | President and CEO |
| | | Rohnert Park and Cotati Creek Council | |
| Don | McEnhill | Russian River Keeper | Program Director |
| Brenda | Adelman | Russian River Watershed Protection Committee | Chair |
| Jane | Nielson | Sebastopol Water Information Group | President |
| Tom | Devlin | Sierra Club: Redwood Chapter | |
| Dennis | Rosatti | Sonoma County Conservation Action | |
| Kim | Vail | Sonoma County Farm Bureau | Executive Director |
| Vesta | Copestakes | Sonoma County Gazette | |
| Spencer | Nilson | Sonoma County Surfrider Foundation | Chair |
| | | Sonoma County Water Coalition | |
| Karissa | Kruse | Sonoma County Winegrape Commission | President |
| Richard | Dale | Sonoma Ecology Center | Executive Director |
| Dave | Koehler | Sonoma Land Trust | Executive Director |
| Maureen | Cottingham | Sonoma Valley Vintners & Growers Alliance | Executive Director |
| Michele | Luna | Stewards of the Coast & Redwoods | Executive Director |
| Marc | Holmes | The Bay Institute of San Francisco | Director |
| Brian | Johnson | Trout Unlimited | California State Director and Senior Attorney |
| Dan | Hubacker | United Anglers | Director/Teacher |
| Bob | Anderson | United Winegrowers for Sonoma County | Executive Director |
| Ann | Petersen | Wine Growers of Dry Creek Valley Alliance | Executive Director |
| | | **Associations/Groups** | |
| Nancy | Ousterhout | Alexander Valley Association | President |
| Kevin | Hardy | California Association of Sanitation Agencies | President |

| | | | |
|---|---|---|---|
| Roberta | Larson | California Association of Sanitation Agencies | Executive Director |
| Richard | Kagel | Dry Creek Valley Association | President |
| Jeff | Lokey | North Bay Association of Realtors | Sonoma Valley Chapter President |
| Daniel | Sanchez | North Bay Association of Realtors | Government Affairs Director |
| Harry | Seraydarian | North Bay Watershed Association | Executive Director |
| Thomas P | Conlon | Transition Sonoma Valley | Volunteer/Steering Committee |
| | | **Business/Chambers of Commerce** | |
| Brian | Ling | Sonoma County Alliance | Executive Director |
| Patricia | Shults | Sonoma Valley Chamber of Commerce | Executive Director |
| | | **Service Organizations** | |
| Brenda | Perry | Napa Rotary | Club Secretary |
| Gail | Cardaropoli | Petaluma Rotary | Club Secretary |
| Morill | Dunn | Sonoma Valley Rotary | Club Secretary |
| Valerie | Hulsey | The Rotary Club of the Valley Of The Moon | Club Secretary |
| | | **Academia** | |
| Don | Silverek | Santa Rosa Junior College | Emergency Management Coordinator |
| Missy | Brunetta | Sonoma State University | Interim Director, Emergency Management & Continuity Planning |
| Louann | Carlomagno | Sonoma Valley Unified School District | Superintendent |
| Stephanie | Larson | University of CA Cooperative Extension - Sonoma County | County Director |
| | | **Business** | |
| | | Fairmont Sonoma Mission Inn | |
| | | Glen Ellen Village Market | |
| | | MacArthur Place Hotel | |
| Randy | DeCaminada | Pacific Gas & Electric Company | Executive Manager |
| | | Sebastiani Winery | |
| | | Sonoma Market | |
| | | Sonoma Raceway | |
| Kelly | Mather | Sonoma Valley Hospital | CEO |
| | | St. Francis Winery | |
| | | The Lodge at Sonoma | |

**Exhibit 1I**

Sonoma Index-Tribune Advertisement 7/15/2014 (reader circulation approx. 5,100)

The Sonoma Index-Tribune

OUR 135TH YEAR SERVING SONOMA VALLEY

An edition of The Press Democrat

Tuesday, July 15, 2014 | Sonoma Valley, California | sonomanews.com | Vol. 135, No. 34 50¢

All eyes on c

Group works to heal community in wake of Andy Lopez tragedy

By Don Frances
Index-Tribune News Editor

Anger continues over the shooting death of 13-year-old Andy Lopez, with demonstrators staging a protest in Santa Rosa over the weekend that became tense after several people marched Highway 101 to block free fic.

That latest incident – n out from the Oct. 22 sho Lopez, gunned down by a deputy who mistook his for an AK-47 – ended pe But the raw emotions prompting a small group ty residents to work to the matter and, they hope trust between peace offic

Brown first to pull council papers

Four-term incumbent was at City Hall at 8 a.m.

A2

Impact100 names new board members

Board adds Hoffman, Kweller, Nisson, Sasson

A3

SONOMA VALLEY WASTEWATER TREATMENT PLANT

Sonoma Valley County Sanitation District (District)
Local Hazard Mitigation Plan (Plan)

Sonoma Valley is located in an area impacted by numerous natural hazards including flooding, wildfires, and earthquakes. The District, operated by the Sonoma County Water Agency, is embarking on a planning process to form long-term strategies to minimize damage to the District from natural disasters.

Participate in the planning process!

The District's Local Hazard Mitigation Plan will be an agenda item at the Sonoma Valley Citizens Advisory Committee (CAC) meeting:

Wednesday, July 23, 2014
6:30pm - 8:30pm
City of Sonoma Police Department Community Room
177 First Street West
Sonoma, CA 95476

We welcome your comments at any point in the planning process. Contact Project Manager Curran Price at the Sonoma County Water Agency by emailing curran.price@scwa.ca.gov or visit online at www.sonomacountywater.org/svlhmp.

SONOMA COUNTY WATER AGENCY

**Exhibit 1J**

ENews July 2014- Sent 7/19/2014 to 532 subscribers

Web Version | Update preferences | Unsubscribe | Subscribe

SONOMA COUNTY WATER AGENCY

# ENews

A periodic electronic newsletter

*Securing our Future by Investing in our Water Resources, Environment & Community*

July 2014

TABLE OF CONTENTS


- DROUGHT EDITION: Emergency Drought Regulations to Take Effect
- Water Conservation in the Sonoma-Marin Region
- Preserving Water in Lake Mendocino
- Conservation Tip: The Grass isn't Greener in Sonoma County


## DROUGHT EDITION: Emergency Drought Regulations to Take Effect

Marcus. "And, more important, we have no idea when it will end." The regulation will likely go into effect on August 1 and will remain in effect for 270 days, unless extended by the State Water Board due to ongoing drought conditions.

While the Sonoma County Water Agency is not immediately affected by this new regulation since it does not sell water directly to the end user, cities and water districts that purchase water from the Water Agency are working to understand how this new regulation will be implemented in their respective area. **Read more here.**

## Water Conservation in the Sonoma-Marin Region

How has our region fared

**Sonoma Valley County Sanitation District Local Hazard Mitigation Plan**

**July 23, 2014**
**6:30 - 8:30 pm**
Agenda item on Citizens Advisory Committee meeting agenda
City of Sonoma Police Department Community Room
175 1st St W
Sonoma, CA 95476

**Exhibit 1K**

Sonoma Index-Tribune News Article – 7/22/2014



Sonoma Index-Tribune

# Sonoma County Water Agency seeks input on 'hazard' mitigation

Tuesday, July 22, 2014 10:22 AM

By Don Frances

Like 0 Tweet 0 g+1 0

Two sanitation districts operated by the Sonoma County Water Agency are asking for the public's input on plans to make the region more robust in case of natural disasters – and Sonoma's turn comes this Wednesday evening.

It matters, officials say, because "hazard mitigation" depends in part on improving the reliability of sanitation facilities during events such as an earthquake.

County supervisor and water agency director Susan Gorin, who represents Sonoma Valley, explained in a statement that, "The occurrence of natural disasters such as flooding, landslides, fires and earthquakes – all relatively common in Sonoma County – can result in enormous cost to communities."

That's why the sanitation districts are putting together so-called Local Hazard Mitigation Plans, which "will form the foundation for a long-term strategy to reduce disaster losses," Gorin said.

The two districts – the Sonoma Valley County Sanitation District and Russian River County Sanitation District – already have undergone an assessment for "natural hazard reliability," officials said. The next step is to develop plans in response to those assessments – and public input is considered a crucial part of making that happen.

The Sonoma Valley County Sanitation District will make its Local Hazard Mitigation Plan an agenda item during the Wednesday, July 23, Sonoma Valley Citizens Advisory Commission meeting in the Sonoma Community Room, 177 First St. W. The meeting starts at 6:30 p.m. and is expected to last two hours.

Founded in 1953, the Sonoma County Valley Sanitation District serves more than 17,000 households in a 4,500-acre service area. Water officials say its treatment plant has a capacity of 3 million gallons per day and treats wastewater to "tertiary treatment levels."

By contrast, the Russian River County Sanitation District serves about 3,100 households in a 2,700-acre service area, with a capacity of 710,000 gallons per day. Altogether, the Water Agency manages and operates eight sanitation districts and zones.

For more information go to sonomacountywater.org/sanitation.

**Exhibit 1L**

Social Media – Twitter Posted on 7/23/2014

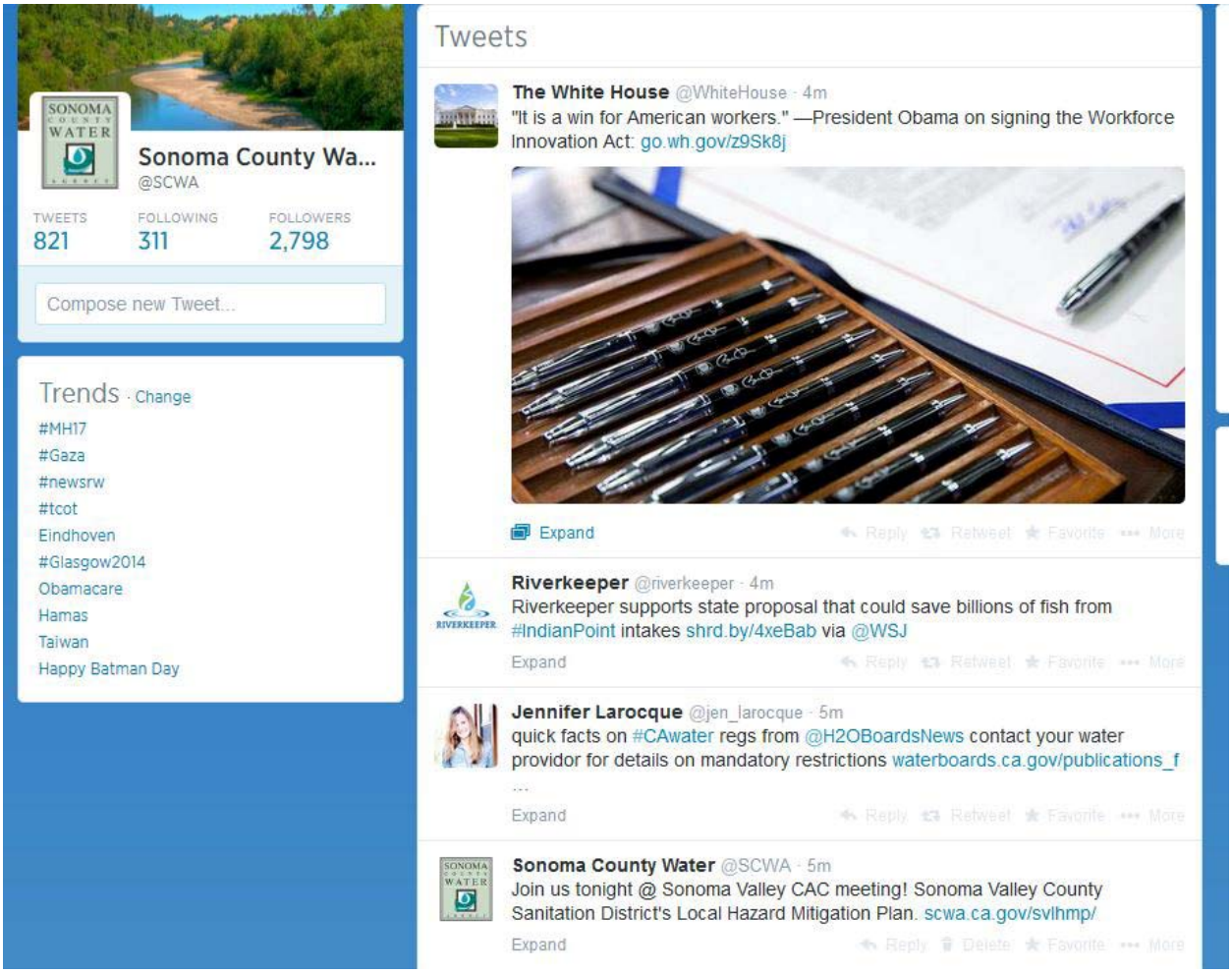


**Exhibit 1M**

Social Media – Facebook Posted on 7/23/2014

**Exhibit 1N**

Sonoma Valley Citizens Advisory Commission – Agenda 7/23/2014

SONOMA VALLEY CITIZENS ADVISORY COMMISSION
Notice of Meeting and Agenda
July 23, 2014
Sonoma Police Department, Community Room
177 First Street West, Sonoma
6:30 p.m.

Contact: Pat Gilardi, District Director to Supervisor Gorin at pat.gilardi@sonoma-county.org

1. Call to Order, Roll Call

2. Approval of Minutes of the meeting of June 25, 2014 — Resolution

3. Public Comment — Receive
   (Limited to items not appearing on the agenda)

4. Presentation: Local Hazard Mitigation Plan — Receive
   Presenter: Sonoma County Water Agency

5. Applicant Name: Dino Bonos Land Planning, Attn Dino Bonos — Resolution
   Owner Name: Elisabeth Coleman
   Site Address: 23450 Arnold Drive, Sonoma
   APN: 128-461-072
   Request for a Use Permit for a five room bed and breakfast inn and up to six weddings/parties per year on a 4.42 acre parcel

6. Report on Site Visit to 150 Adobe Way, Sonoma — Receive

7. Consideration of items for Future Agenda — Receive

8. Adjourn — Resolution

Materials related to an item on this Agenda submitted to the Sonoma Valley Citizens Advisory Commission after distribution of the agenda packet are available for public inspection in the Board of Supervisors' Office located at 575 Administration Drive, Room 100-Al, Santa Rosa, CA, during normal business hours.

Note: Consideration of proposed development projects will proceed as follows:
1. Presentation by project applicant
2. Questions by Commissioners
3. Questions and comments from the public
4. Response by applicant, if required
5. Comments by Commissioners

**Exhibit 1O**

Sonoma Valley Citizens Advisory Commission – Meeting Minutes 7/23/2014

**SONOMA VALLEY CITIZENS ADVISORY COMMISSION**
**MINUTES OF MEETING JULY 23, 2014**
**SONOMA POLICE DEPARTMENT, COMMUNITY ROOM**
**175 FIRST STREEET WEST, SONOMA**
**6:30 p.m.**

**COMMISSIONERS PRESENT**: Cynthia Wood, Pat Pulvirenti, Jack Ding, Greg Carr, Ken Brown, Bruce Green, Tom Martin, Dick Fogg, Ditty Vella, Angela White

**EXCUSED**: Sean Bellach, Kirsten Lindquist, Rochelle Campana

**1. Call To Order: 6:30 p.m.**

**2. Minutes Approved of June 25, 2014 Meeting**

**3. Public Comment: None**

Mr. Green apologized for the way he treated the representative of AT&T at the last meeting – it was all personal and he should have been more objective. Chair Ding said that he had expressed his personal opinion as well.

**4. Presentation: Local Hazard Mitigation Plan**
**Presenter: Sonoma County Water Agency**

**Presentation:**
Kent Gylfe, Principal Engineer of the Water Agency, accompanied by Curran Price, Engineer II, and Brad Sherwood, Program Specialist, said that they were presenting on behalf of Sonoma Valley Sanitation District to discuss what the district is doing to assess risks associated with the Valley's sewer system and risks associated with natural hazards. In order to minimize the adverse effects, the district has initiated a natural hazard reliability assessment to evaluate effects on district infrastructure and its operations.

Mr. Gylfe mentioned recent world events - disasters in Japan and New Zealand, and what the devastating effects can have on communities and utilities serving communities. He explained what the infrastructure and operations are and what the planning effort is, and said Curran Price will explain work that has been completed and preliminary findings. He showed a slide of the Santa Rosa courthouse that sustained severe damage during the 1906 earthquake and although the epicenter was in San Francisco, the effects reached Sonoma County.

The Sanitation District serves 11,400 parcels from Glen Ellen in the north to the treatment plant in Schellville to the south. The plant is on 8th St. East and serves the City and other incorporated areas: El Verano, BHS, Fetters, Agua Caliente, Eldridge, Glen Ellen, plus Temelec and Vineburg, and a few parcels in Schellville. The original treatment plant began operations in 1954. There are three primary elements to the infrastructure of the district:

1. Sewer collection system: gravity-fed network of pipelines following terrain of the ground, sewer trunk line follows along Sonoma Creek; in Glen Ellen, a couple of zones are served by local sub-stations pumped into the system.
2. Treatment plant and facilities: activated sludge plant, remove trash and debris from wastewater, grit removal, aeration basins where biological treatment occurs, clarifiers where settling occurs, filtration element where disinfection occurs, equalization basins for temporary storage of raw sewage, numerous pumping facilities at the site, sludge handling.
3. Reclamation system and discharge end: five storage reservoirs, also provide recycled water for Napa Salt Marsh for environmental restoration purposes.

The Local Hazard Mitigation Plan:

1. Identify natural hazards of concern for the area

2. Identify district's vulnerabilities to hazards
3. Appropriate mitigation actions, strategies, goals to increase sanitation system resiliency to natural hazards.

The LHMP is used as a planning document but is also required to seek funding through FEMA and administered through California Office of Emergency Services (OES). The Water Agency has been successful in securing 10 million dollars in FEMA grant funding. SVCSD has been awarded 75 thousand to develop LHMP.

Curran Price continued with the presentation and identified natural hazards to this area: earthquakes, flooding fire, and landslides. Tornadoes and hurricanes are low risk vs. earthquakes and flooding.
Flooding: several risks to district – heavy storms mean more water in collection system at treatment plant. Wet weather vs dry weather: heavy rains mean more water flows, streams and riverbanks erode, debris collects and sewers get exposed and can break if hit by floating log. There are 60 stream crossings in the Valley.
Earthquakes: 2008 forecast of 31% likelihood of 6.7 magnitude earthquake in 30 years along Rogers Creek, part of the Hayward Fault line. This is close to Sonoma Valley and goes up to Santa Rosa. If 7.1 magnitude occurred along Rogers Creek, Sonoma Valley would suffer substantial damage. The 1906 earthquake leveled many buildings in downtown Santa Rosa.

How would an earthquake affect the Sanitation district? Christchurch, New Zealand experienced two earthquakes: 7.1 in 2010 and 6.3 in 2011. They had significant damage at the treatment plant - sewers and lift stations had flotation from liquefaction. 31% of collection system had to be repaired or replaced and because of breaks and leaks, silt and sand entered and washed down to the treatment plant. 400,000 tons of silt and sand had to be removed and there were 1 ½ ft. wide cracks at some storage reservoirs that had to be shut down. Raw sewage was dumped into streams and rivers and five weeks after the earthquake, 10 million gallons of raw sewage leaked from the collection system per day. Portable toilets had to be deployed throughout the city for sanitation purposes. Collection system repairs took 3-10x longer than water pipes. Usually water pipes are 3-4 ft deep but in Sonoma Valley, they are 35 ft deep so would take extra time to dig down and make repairs.

The New Zealand and Japan earthquakes presented liquefaction issues. High liquefaction areas are near creeks and rivers where there is saturated soil, sand, gravel and clay. Sonoma Creek is a high liquefaction area. During an earthquake, there is differential settlement, lateral spread or slipping. If there is a 7.0 along Rogers Creek, there would likely be 26 breaks or leaks along the collection system.

Mitigation actions to protect the collection system from local hazard vulnerabilities: anchor/retrofit equipment, replace the collection system, emergency response equipment, replace creek crossings, and stabilize creek banks.

Schedule:
Summer 2014 – identify vulnerabilities and mitigation actions
Fall 2014 – publish draft LHMP
Winter 2014 – incorporate elements into LHMP, seek SVCSD board approval of plan, and submit to Cal OES for approval

**Commissioner questions:**
Mr. Green: What percentage of properties have their own septic system?

Kent Gylfe: We cover urbanized areas in the Valley other than Kenwood – don't have that number.

Mr. Green: If there is no natural disaster and septic systems fail, can they connect to the sanitation district?
Kent Gylfe: There are conditions for annexations or outside service areas.

Mr. Green: In an emergency, a large percentage of septic systems can fail, Do you have the capacity to take on properties?

Kent Gylfe: For properties adjacent to district facilities, for remote locations, easier to do on-site fixes.

Mr. Green: If someone's septic system fails in a natural disaster, can they stay on the property or must they vacate?

Mr. Carr: That's a public health issue. There's a time frame for the district to go and check. Some places will be closed down, some operational on temporary basis. You did not cover flooding, is that not a priority for the district?

Curran Price: We touched on the subject – higher flows at the treatment plant, possible erosion, logs coming downstream.

Mr. Carr: Has the treatment plant flooded out?

Kent Gylfe: No. In the '05/'06 flood, it did not flood.

Curran Price: The equalization ponds will temporarily store water.

Ms. Vella: Why the uptick in flow when it rains? Doesn't it go to the treatment plant?

Kent Gylfe: During storms, we get an increase in INI – inflow and infiltration into the system. It's a 50 year old system with deficiencies, cracks and leaks. When groundwater comes up, water seeps into the system. Some properties are incorrectly connected to the system so we'll get roof runoff. INI has gone down to 20, though.

Mr. Fogg: Do you use flexible pipes?

Curran Price: Yes. In Japan, they use earthquake resistant pipes. HDPE are also very resilient to earthquakes but very expensive.

Mr. Fogg: Are either in use in Sonoma Valley?

Curran Price: Used to some extent in Valley, but it's not more expensive than PVC.

Kent Gylfe: One of the actions proposed is to utilize HDPE. It's a bit more expensive but a viable alternative.

Chair Ding: Is there a link or webpage?

Curran Price: We will be publishing LHMP in the fall. We have a blurb on our webpage but no document yet.

Brad Sherwood: Sonomacountywater.org. Your district has a webpage with links on various projects and tour dates. One is planned this fall so you should take a tour.

**Public questions and comments:**
None

**5. Report on Site Visit to 150 Adobe Way, Sonoma**
Report as written by attendees and distributed to Commission members follows:

June 20, 2014 Site Visit 150 Adobe Way

Attended by:
SVCAC Commissioners Lindquist, Ding, Brown and Campana
Grygoriy Ladigin from Mork Ulnes Architects
Owner/Applicant
PRMD Planner, KarinTheriaut,

Purpose of Visit: Administrative Design Review - property is located within a Scenic Landscape unit. As it is in the foothills off of Hwy12, it is very likely partially or totally visible within the Valley.

Project Design is Modern, with green technologies - passive solar and heating. Finishes are rusted metal and concrete designed to blend into existing countryside. approximate living space of 2,000 sq. ft.

a new well and septic system will be installed, as well as a driveway conforming to current fire standards and a few retaining walls.

In general, with project was met favorably by the Commissioners, with the following caveats.

1) some confusion regarding whether or not structure conforms to height restrictions: building is taller, but sunk below grade. PRMD will clarify.

2) site map shows 2 building envelopes, and a second house plus a granny unit could ultimately by built on the site. further development on the site in the future remains a possibility, but as it has already been subdivided, it is beyond our scope.

3) there was also discussion of the 2 partially completed houses on the corner of Hwy 12 and Moon Mountain.

The Commissioners and applicant, both felt the presence of this abandoned construction site undermined our current and future influence on design reviews. We felt a little stupid reviewing this architecturally intelligent project for any possible impact on the view shed, while blue tarps flapped in the wind, and barbed wire fencing created a clearly visual blight just off of Scenic Highway 12.

**6. Consideration of Items for Future Agenda:**
Ms. Pulvirenti: Did the Moon Mountain project ever come before the Commission?

Pat Gilardi: That project was two homes; it was approved with no design review and met all of County's policies. It's being torn down because the original construction firm did not do a good job. It will go through design review this time and the County will resolve this issue.

Mr. Brown: A group at the Farmer's Market last night talked about the issue.

Mr. Green: Why was the other presentation removed from the agenda?

Pat Gilardi: The traffic report was not ready. They will continue at a later date.

**7. Meeting Adjourned: 7:20 p.m.**

**Exhibit 2A**

SVCSD Newsletter, Winter 2015 the District Newsletter, Volume X, Issue #X mailed to all ratepayers on November 4, 2015

# DRAFT
# Public Input Sought on Hazard Mitigation Plan in Sonoma Valley County Sanitation District

The Sonoma Valley County Sanitation District (SVCSD) is seeking public comment on a draft Local Hazard Mitigation Plan (LHMP) to increase the reliability of sanitation facilities during natural disasters. Public input on the plan is being accepted during the month of November, when members of the public are encouraged to submit comments. Copies of the LHMP can be viewed online beginning Nov. 2, 2015 at: www.sonomacountywater.org/scvsd-lhmp. Public comments will be accepted until Nov. 30, 2015. A public hearing before the SCVSD Board of Directors is scheduled for December 15, 2015. The SVCSD is operated by the Sonoma County Water Agency (Water Agency).

"The occurrence of natural disasters such as flooding, landslides, fires, and earthquakes—all relatively common in Sonoma County—can result in enormous cost to communities. The Local Hazard Mitigation Plan will form the foundation for a long-term strategy to reduce disaster losses," said Water Agency and SVCSD Director Susan Gorin.

The SVCSD initially conducted a Natural Hazard Reliability Assessment (NHRA) to identify potential damage to existing infrastructure from local hazards including earthquakes, wildfires, landslides and floods. The second phase of the project was to develop a LHMP that incorporates strategies to minimize damage from those disasters.

Mitigation measures in the Plan focus on increasing the reliability of sanitation facilities in order to protect public health, property, and natural resources. This Plan is intended to provide a framework for decision-makers to reduce damages to lives, property, and the economy from future disasters through the use of risk-based analysis.

The Sonoma Valley County Sanitation District began operations in 1953 and serves 17,027 Equivalent Single-Family Dwellings within a 4,500-acre service area. The treatment plant has a design capacity of 3 million gallons per day and treats wastewater to tertiary treatment levels.

Comments on the LHMP should be submitted by e-mail to jake.spaulding@scwa.ca.gov or mailed to Jake Spaulding, c/o Sonoma County Water Agency, 404 Aviation Blvd., Santa Rosa, CA 95403. Copies of the LHMP will be available for viewing at the Sonoma County Water Agency offices and at the Sonoma branch of the Sonoma Valley Regional Library, 755 West Napa Street, Sonoma, CA 95476.

For questions about the LHMP, contact Jake Spaulding at 707-524-8373 or jake.spaulding@scwa.ca.gov

**Exhibit 2B**

Stakeholder Postcard – Mailed 10/26/2015 to 123 individuals and organizations

## NATURAL DISASTER PLANNING

# Public Input Sought on Local Hazard Mitigation Plan for Sonoma Valley County Sanitation District

The Sonoma Valley County Sanitation District (SVCSD) is seeking public comment on a draft Local Hazard Mitigation Plan (LHMP) to increase the reliability of sanitation facilities during natural disasters. Public input on the plan is being accepted during the month of November, when members of the public are encouraged to submit comments. Copies of the LHMP can be viewed online beginning November 2, 2015 at: **www.sonomacountywater.org/scvsd-lhmp**. Public comments will be accepted until December 2, 2015.

A public hearing before the SVCSD Board of Directors is scheduled for December 15, 2015, in the Board of Supervisors Chambers, 575 Administration Drive, Room 102A, Santa Rosa, CA.

Comments on the LHMP should be submitted by e-mail to jake.spaulding@scwa.ca.gov or mailed to Jake Spaulding, c/o Sonoma County Water Agency, 404 Aviation Blvd., Santa Rosa, CA 95403. Copies of the LHMP will be available for viewing at the Sonoma County Water Agency offices and at the Sonoma branch of the Sonoma Valley Regional Library, 755 West Napa Street, Sonoma, CA 95476.

**FOR MORE INFORMATION: Jake Spaulding, 707.524.8373, jake.spaulding@scwa.ca.gov**

SONOMA COUNTY WATER AGENCY
Sonoma Valley County Sanitation District

Sonoma County Water Agency/
Sonoma Valley County Sanitation District
404 Aviation Boulevard
Santa Rosa, CA 95403

**RETURN SERVICE REQUESTED**

## YOUR INPUT IS NEEDED

## NATURAL DISASTER PLANNING

A plan has been developed to prepare the Sonoma Valley County Sanitation District facilities for natural disasters, such as fires, floods and earthquakes. See the back of this postcard for more information.

**Exhibit 2C**

Stakeholder Postcard Mailing List– 10/26/2015

| AGENCY CONTACT FIRST NAME | AGENCY CONTACT LAST NAME | ORGANIZATION | TITLE |
|---|---|---|---|
| | | **Water contractors** | |
| Dan | Takasugi | City of Sonoma - Public Works | Public Works Director/City Engineer |
| Daniel | Muelrath | Valley of the Moon Water District | General Manager |
| | | **Cities/Counties/Local Govt** | |
| Ezra | Rapport | Association of Bay Area Governments | Executive Director |
| Jack | LaRochelle | City of Napa | Public Works Director |
| Carol | Giovanatto | City of Sonoma | City Manager |
| David | Cook | City of Sonoma | Mayor |
| Bill | Willers | City of Sonoma<br>Planning Commission | Chair |
| Chris | Pegg | City of Sonoma<br>Public Works Department | Stormwater Compliance Specialist |
| | | City of Sonoma<br>Sonoma Disaster Council | |
| William | Keene | County of Sonoma<br>Agricultural Preservation and Open Space District | Assistant General Manager |
| Walter L. | Kruse | County of Sonoma<br>Department of Health Services | Director |
| Susan | Klassen | County of Sonoma<br>Department of Transportation & Public Works | Director |
| Christopher | Helgren | County of Sonoma<br>Fire and Emergency Services Department | Emergency Services Manager |
| Tony | Linegar | County of Sonoma<br>Fish & Wildlife Advertising Commission | Department Head |
| Tennis | Wick | County of Sonoma<br>Permit and Resource Management Department | Director |
| Dave | Schiltgen | County of Sonoma<br>Permit and Resource Management Department | Planner III |
| Peter | Van Fleet | Glen Ellen Fire Protection District | Chief |
| Bill | Shubin | Kenwood Fire Protection District | Chief |
| Will | Horne | Mayacamas Volunteer Fire Department | Chief |
| Kevin | Twohey | Napa County Office of Emergency Services | OES Coordinator |
| James | Keller | Napa Sanitation District | Plant Manager |
| Keith | Sorsdal | Napa Sanitation District | Collection system Manager |
| John | Woodling | Regional Water Authority | Executive Director |
| Ray | Mulas | Shell-Vista Fire Protection District | Chief |

| | | | |
|---|---|---|---|
| Steven | Herrington | Sonoma County Office of Education | Superintendent of Schools |
| | | Sonoma Developmental Center/Eldridge FD | |
| Kara | Heckert | Sonoma Resource Conservation District | Executive Director |
| Pat | Gilardi | Sonoma Valley Citizens Advisory Commission | |
| Mark | Freeman | Sonoma Valley Fire & Rescue Authority | Chief |
| | | **State Agencies** | |
| Scott | Wilson | California Department of Fish & Wildlife | Regional Manager |
| | | California Department of Public Health | |
| Sonke | Mastrup | California Fish and Game Commission | Executive Director |
| Andrew | Rush | California Governor's Office of Emergency Services | Senior Emergency Services Coordinator |
| Phyllis | Banks | California Governor's Office of Emergency Services | Emergency Services Coordinator |
| Dave | Dearborn | California Highway Patrol | Local Emergency Planning Committee Chair |
| John | Laird | California Natural Resources Agency | Secretary |
| | | California State Parks, Bay Area District | |
| | | California State Parks, Sonoma-Mendocino Coast District | |
| Mark | Cowen | Department of Water Resources | Director |
| Gary | Lippner | Department of Water Resources | Chief, Water Supply Evaluations Section |
| Matt | St. John | North Coast Regional Water Quality Control Board | Executive Officer |
| Bruce | Wolfe | San Francisco Bay Regional Water Quality Control Board | Executive Officer |
| Karen | Faria | Sonoma Developmental Center | |
| Eric | Oppenheimer | State Water Resources Control Board | Office of Research, Planning and Performance |
| | | **Federal Agencies** | |
| Lisa | Van Atta | NOAA Fisheries | Assistant Regional Administrator |
| Gary | Stern | NOAA Fisheries - North-Central Coast Office | Branch Chief |
| Patrick | Rutten | NOAA Restoration Center | SW Regional Supervisor |
| Mike | Dillabough | US Army Corps of Engineers | Chief, Operations and Readiness |
| | | US Fish & Wildlife Services | |
| | | US Fish & Wildlife Services - Bay Delta | |
| Michael | Webster | USGS Ukiah Field Office | Field Office Chief |
| | | **Elected Representatives** | |
| Marc | Levine | California State Assembly | State Assembly Member |
| Bill | Dodd | California State Assembly | State Assembly Member |
| Jim | Wood | California State Assembly | State Assembly Member |
| Mike | McGuire | California State Senate | State Senator |
| Lois | Wolk | California State Senate | State Senator |
| Jared | Huffman | US House of Representatives | US Representative - California |
| Mike | Thompson | US House of Representatives | US Representative - California |
| | | **Non-governmental Organizations** | |
| Crystal | Silva | American Red Cross of the California Northwest | Disaster Program Manager |
| Andy | Gunther | Bay Area Ecosystems Climate Change Consortium | Executive Coordinator |

| | | | |
|---|---|---|---|
| Laurel | Marcus | California Land Stewardship Institute | Executive Director |
| Kandis | Gilmore | Community Clean Water Institution | President |
| | | Environmental Center of Sonoma County | |
| Vicki | Rupp | Environmental Forum of Marin | President |
| David | Keller | Friends of the Eel River | Bay Area Director |
| Brittany | Heck | Gold Ridge Resource Conservation District | Executive Director |
| Tim | Parker | Groundwater Resources Association of California | Director |
| Kevin | Munroe | Laguna de Santa Rosa Foundation | Executive Director |
| Craig | Anderson | LandPaths | Executive Director |
| Jeff | Trandahl | National Fish and Wildlife Foundation | Executive Director and Chief Executive Officer |
| H. R. | Downs | O.W.L. Foundation | President |
| Brock | Dolman | Occidental Arts and Ecology Center - Water Institute | Program Director |
| Lisa | Micheli | Pepperwood Foundation, Dwight Center for Conservation Science | Executive Director |
| Ellie | Cohen | Point Reyes Bird Observatory Conservation Science | President and CEO |
| | | Rohnert Park and Cotati Creek Council | |
| Don | McEnhill | Russian River Keeper | Program Director |
| Brenda | Adelman | Russian River Watershed Protection Committee | Chair |
| Jane | Nielson | Sebastopol Water Information Group | President |
| Tom | Devlin | Sierra Club: Redwood Chapter | |
| Dennis | Rosatti | Sonoma County Conservation Action | |
| Kim | Vail | Sonoma County Farm Bureau | Executive Director |
| Vesta | Copestakes | Sonoma County Gazette | |
| Spencer | Nilson | Sonoma County Surfrider Foundation | Chair |
| | | Sonoma County Water Coalition | |
| Karissa | Kruse | Sonoma County Winegrape Commission | President |
| Richard | Dale | Sonoma Ecology Center | Executive Director |
| Dave | Koehler | Sonoma Land Trust | Executive Director |
| Maureen | Cottingham | Sonoma Valley Vintners & Growers Alliance | Executive Director |
| Michele | Luna | Stewards of the Coast & Redwoods | Executive Director |
| Marc | Holmes | The Bay Institute of San Francisco | Director |
| Brian | Johnson | Trout Unlimited | California State Director and Senior Attorney |
| Dan | Hubacker | United Anglers | Director/Teacher |
| Bob | Anderson | United Winegrowers for Sonoma County | Executive Director |
| Ann | Petersen | Wine Growers of Dry Creek Valley Alliance | Executive Director |
| | | **Associations/Groups** | |
| Nancy | Ousterhout | Alexander Valley Association | President |
| Kevin | Hardy | California Association of Sanitation Agencies | President |
| Roberta | Larson | California Association of Sanitation Agencies | Executive Director |
| Richard | Kagel | Dry Creek Valley Association | President |

| | | | |
|---|---|---|---|
| Jeff | Lokey | North Bay Association of Realtors | Sonoma Valley Chapter President |
| Daniel | Sanchez | North Bay Association of Realtors | Government Affairs Director |
| Harry | Seraydarian | North Bay Watershed Association | Executive Director |
| Thomas P | Conlon | Transition Sonoma Valley | Volunteer/Steering Committee |
| | | **Business/Chambers of Commerce** | |
| Brian | Ling | Sonoma County Alliance | Executive Director |
| Patricia | Shults | Sonoma Valley Chamber of Commerce | Executive Director |
| | | **Service Organizations** | |
| Brenda | Perry | Napa Rotary | Club Secretary |
| Gail | Cardaropoli | Petaluma Rotary | Club Secretary |
| Morill | Dunn | Sonoma Valley Rotary | Club Secretary |
| Valerie | Hulsey | The Rotary Club of the Valley Of The Moon | Club Secretary |
| | | **Academia** | |
| Don | Silverek | Santa Rosa Junior College | Emergency Management Coordinator |
| Missy | Brunetta | Sonoma State University | Interim Director, Emergency Management & Continuity Planning |
| Louann | Carlomagno | Sonoma Valley Unified School District | Superintendent |
| Stephanie | Larson | University of CA Cooperative Extension - Sonoma County | County Director |
| | | **Business** | |
| | | Fairmont Sonoma Mission Inn | |
| | | Glen Ellen Village Market | |
| | | MacArthur Place Hotel | |
| Randy | DeCaminada | Pacific Gas & Electric Company | Executive Manager |
| | | Sebastiani Winery | |
| | | Sonoma Market | |
| | | Sonoma Raceway | |
| Kelly | Mather | Sonoma Valley Hospital | CEO |
| | | St. Francis Winery | |
| | | The Lodge at Sonoma | |

**Exhibit 2D**

Press Release – Released 10/26/15 to local news outlets & posted to website

# PRESS RELEASE

**For Immediate Release**
**October 26, 2015**

**CONTACT:**
Ann DuBay
707.524.8378 (office)
707.322.8185 (cell)
Ann.DuBay@scwa.ca.gov

Brad Sherwood
707.547.1927 (office)
707.322.8192 (cell)
sherwood@scwa.ca.gov

## Public Input Sought on Hazard Mitigation Plan in Sonoma Valley County Sanitation District

SONOMA, CA — The Sonoma Valley County Sanitation District (SVCSD) is seeking public comment on a draft Local Hazard Mitigation Plan (LHMP) to increase the reliability of sanitation facilities during natural disasters. Public input on the plan is being accepted during the month of November, when members of the public are encouraged to submit comments. Copies of the LHMP can be viewed online beginning Nov. 2, 2015 at: www.sonomacountywater.org/scvsd-lhmp. Public comments will be accepted until Dec. 2, 2015. A public hearing before the SVCSD Board of Directors is scheduled for December 15, 2015. The SVCSD is operated by the Sonoma County Water Agency (Water Agency).

"The occurrence of natural disasters such as flooding, landslides, fires, and earthquakes—all relatively common in Sonoma County—can result in enormous cost to communities. The Local Hazard Mitigation Plan will form the foundation for a long-term strategy to reduce disaster losses," said Water Agency and SVCSD Director Susan Gorin.

The SVCSD initially conducted a Natural Hazard Reliability Assessment (NHRA) to identify potential damage to existing infrastructure from local hazards including earthquakes, wildfires, landslides and floods. The second phase of the project was to develop a LHMP that incorporates strategies to minimize damage from those disasters.

Mitigation measures in the Plan focus on increasing the reliability of sanitation facilities in order to protect public health, property, and natural resources. This Plan is intended to provide a framework for

decision-makers to reduce damages to lives, property, and the economy from future disasters through the use of risk-based analysis.

The Sonoma Valley County Sanitation District began operations in 1953 and serves 17,027 Equivalent Single-Family Dwellings within a 4,500-acre service area. The treatment plant has a design capacity of 3 million gallons per day and treats wastewater to tertiary treatment levels.

Comments on the LHMP should be submitted by e-mail to jake.spaulding@scwa.ca.gov or mailed to Jake Spaulding, c/o Sonoma County Water Agency, 404 Aviation Blvd., Santa Rosa, CA 95403. Copies of the LHMP will be available for viewing at the Sonoma County Water Agency offices and at the Sonoma branch of the Sonoma Valley Regional Library, 755 West Napa Street, Sonoma, CA 95476.

For questions about the LHMP, contact Jake Spaulding at 707-524-8373 or jake.spaulding@scwa.ca.gov

###

*The Sonoma County Water Agency is working to secure our future by investing in our water resources, community and environment. The Water Agency provides water supply, flood protection and sanitation services for portions of Sonoma and Marin counties. Visit us on the Web at www.sonomacountywater.org*

**Exhibit 2E**

Sonoma Index-Tribune Advertisement 10/30/2015 & 11/6/2015

## NATURAL DISASTER PLANNING

### Input Needed on Hazard Mitigation Plan for Valley Sanitation District

The Sonoma Valley County Sanitation District (SVCSD) is seeking public comment on a draft Local Hazard Mitigation Plan (LHMP) to increase the reliability of sanitation facilities during natural disasters. Public input on the plan is being accepted during the month of November, when members of the public are encouraged to submit comments. Copies of the LHMP can be viewed online beginning November 2, 2015 at: *www.sonomacountywater.org/scvsd-lhmp*. Public comments will be accepted until December 2, 2015.

A public hearing before the SVCSD Board of Directors is scheduled for December 15, 2015, at 10 a.m., in the Board of Supervisors Chambers, 575 Administration Drive, Room 102A, Santa Rosa, CA.

Comments on the LHMP should be submitted by e-mail to jake.spaulding@scwa.ca.gov or mailed to Jake Spaulding, c/o Sonoma County Water Agency, 404 Aviation Blvd., Santa Rosa, CA 95403. Copies of the LHMP will be available for viewing at the Sonoma County Water Agency offices and at the Sonoma branch of the Sonoma Valley Regional Library, 755 West Napa Street, Sonoma, CA 95476.

**FOR MORE INFORMATION:** **Jake Spaulding, 707.524.8373, jake.spaulding@scwa.ca.gov**

SONOMA COUNTY WATER AGENCY
Sonoma Valley County Sanitation District

**Exhibit 2F**

SUN Advertisement 10/30/2015 & 11/6/2015

## NATURAL DISASTER PLANNING

# Public Input Sought on Hazard Mitigation Plan for Sonoma Valley Sanitation District

The Sonoma Valley County Sanitation District (SVCSD) is seeking public comment on a draft Local Hazard Mitigation Plan (LHMP) to increase the reliability of sanitation facilities during natural disasters. Public input on the plan is being accepted during the month of November, when members of the public are encouraged to submit comments.

Copies of the LHMP can be viewed online beginning November 2, 2015 at: ***www.sonomacountywater.org/scvsd-lhmp***. Public comments will be accepted until December 2, 2015.

A public hearing before the SVCSD Board of Directors is scheduled for December 15, 2015, in the Board of Supervisors Chambers, 575 Administration Drive, Room 102A, Santa Rosa, CA.

Comments on the LHMP should be submitted by e-mail to jake.spaulding@scwa.ca.gov or mailed to Jake Spaulding, c/o Sonoma County Water Agency, 404 Aviation Blvd., Santa Rosa, CA 95403. Copies of the LHMP will be available for viewing at the Sonoma County Water Agency offices and at the Sonoma branch of the Sonoma Valley Regional Library, 755 West Napa Street, Sonoma, CA 95476.

**FOR MORE INFORMATION:**
**Jake Spaulding, 707.524.8373 or jake.spaulding@scwa.ca.gov**

SONOMA COUNTY WATER AGENCY
Sonoma Valley County Sanitation District

**Exhibit 1G**

Public Notices Webpage, posted on 11/02/15

***PLACEHOLDER TEXT***

# Sonoma Valley County Sanitation District Local Hazard Mitigation Plan

The Sonoma Valley County Sanitation District (SVCSD) is seeking public comment on a draft Local Hazard Mitigation Plan (LHMP) to increase the reliability of sanitation facilities during natural disasters. Public input on the plan is being accepted during the month of November, when members of the public are encouraged to submit comments. The LHMP can be viewed here:

**Sonoma Valley County Sanitation District Draft LHMP**

Public comments will be accepted until Dec. 2, 2015. A public hearing before the SVCSD Board of Directors is scheduled for December 15, 2015. For board agendas and the time of the hearing, visit: www.sonomacounty.ca.gov/Board-of-Supervisors/Meeting-Agendas-Minutes-and-Videos/

Comments on the LHMP should be submitted by e-mail to jake.spaulding@scwa.ca.gov or mailed to Jake Spaulding, c/o Sonoma County Water Agency, 404 Aviation Blvd., Santa Rosa, CA 95403. Copies of the LHMP will be available for viewing at the Sonoma County Water Agency office at 404 Aviation Blvd. and at the Sonoma branch of the Sonoma Valley Regional Library, 755 West Napa Street, Sonoma, CA 95476.

For questions about the LHMP, contact Jake Spaulding at 707-524-8373 or jake.spaulding@scwa.ca.gov

### How the LHMP was Developed

The SVCSD initially conducted a Natural Hazard Reliability Assessment (NHRA) to identify potential damage to existing infrastructure from local hazards including earthquakes, wildfires, landslides and floods. The second phase of the project was to develop a LHMP that incorporates strategies to minimize damage from those disasters.

### LHMP Provides Framework to Reduce Damages from Disasters

Mitigation measures in the LHMP focus on increasing the reliability of sanitation facilities in order to protect public health, property, and natural resources. This Plan is intended to provide a framework for decision-makers to reduce damages to lives, property, and the economy from future disasters through the use of risk-based analysis.

### Timeline

**Fall 2013 – Spring 2014:** Conduct District NHRA

**Summer 2014:** Solicit Public Input

**Fall 2014 – Winter 2014/15:** Public Scoping Period for Draft Plan

**Winter 2015/16:** Draft Plan complete

### About the District

The Sonoma Valley County Sanitation District began operations in 1953 and serves 17,027 Equivalent Single-Family Dwellings within a 4,500-acre service area. The treatment plant has a design capacity of 3 million gallons per day and the District provides high-quality tertiary treated water for local agricultural uses.

**Exhibit 1H**

Event Calendar Webpage, posted on 11/02/15

***PLACEHOLDER***

**Exhibit 1I**

Social Media – Twitter posted on 10/27/15

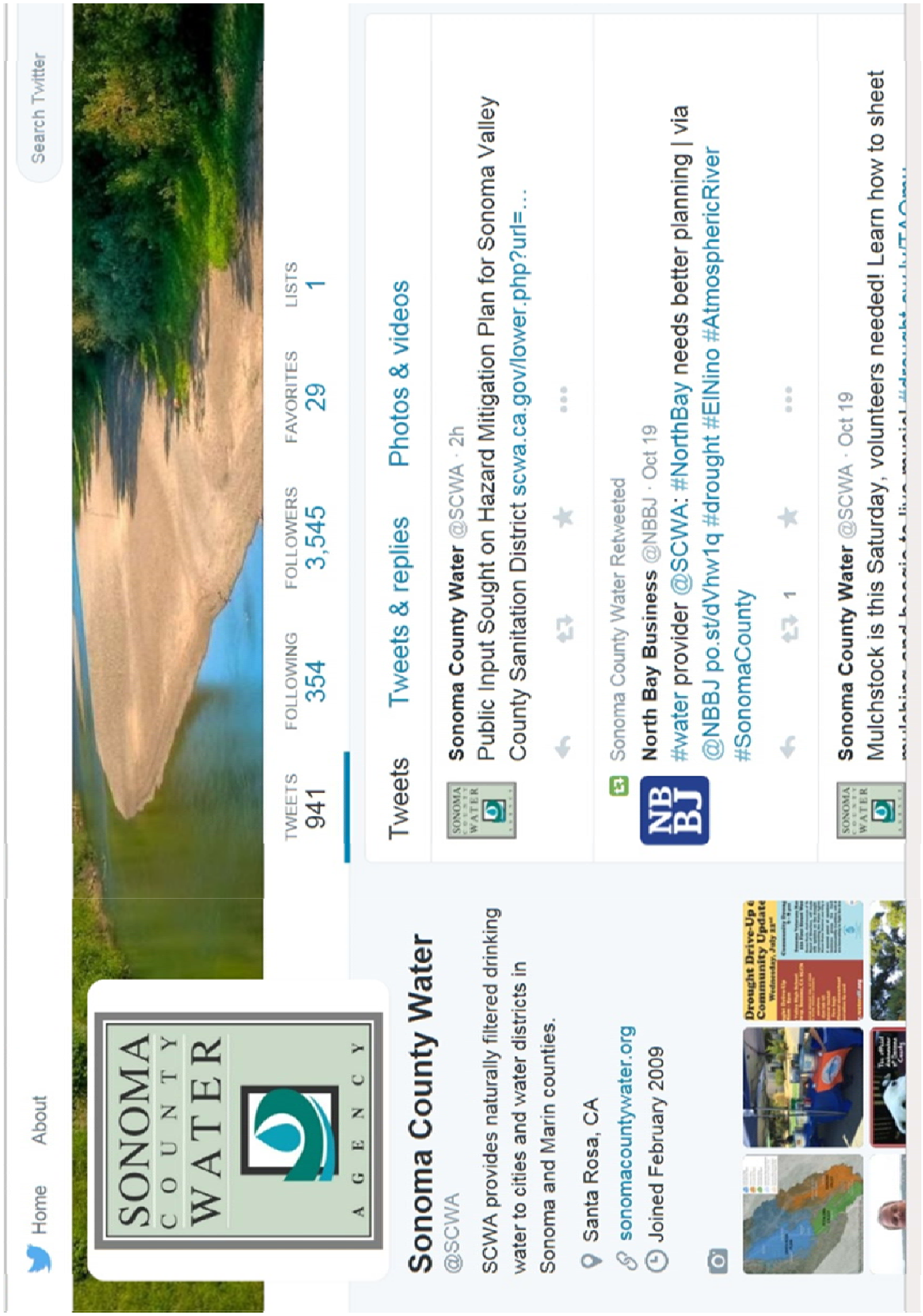


**Exhibit 1J**

Social Media – Facebook, posted on 10/27/15

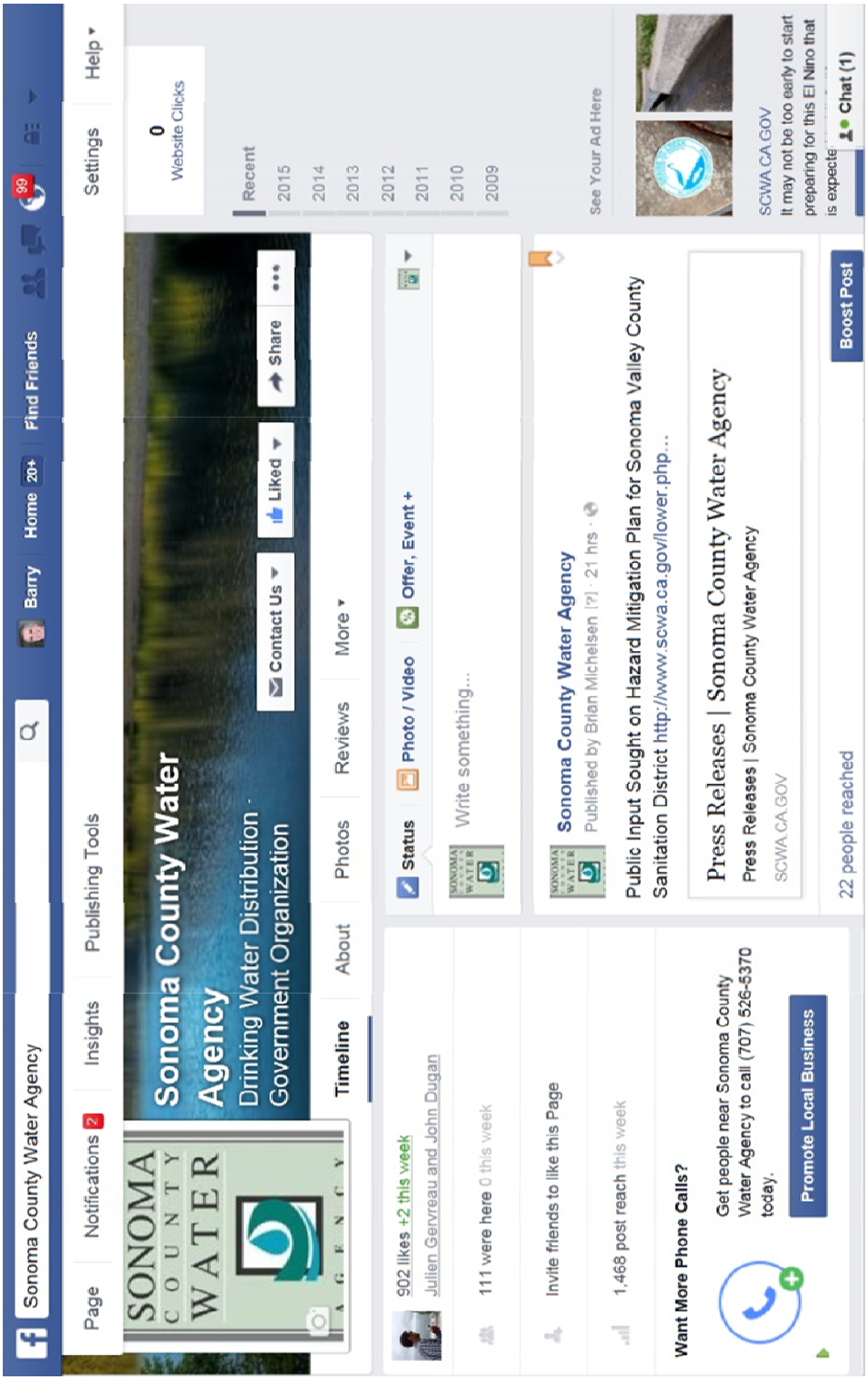


**Exhibit 1K**

Sonoma County Board of Supervisors– Agenda, posted on 12/XX/15

***PLACEHOLDER***

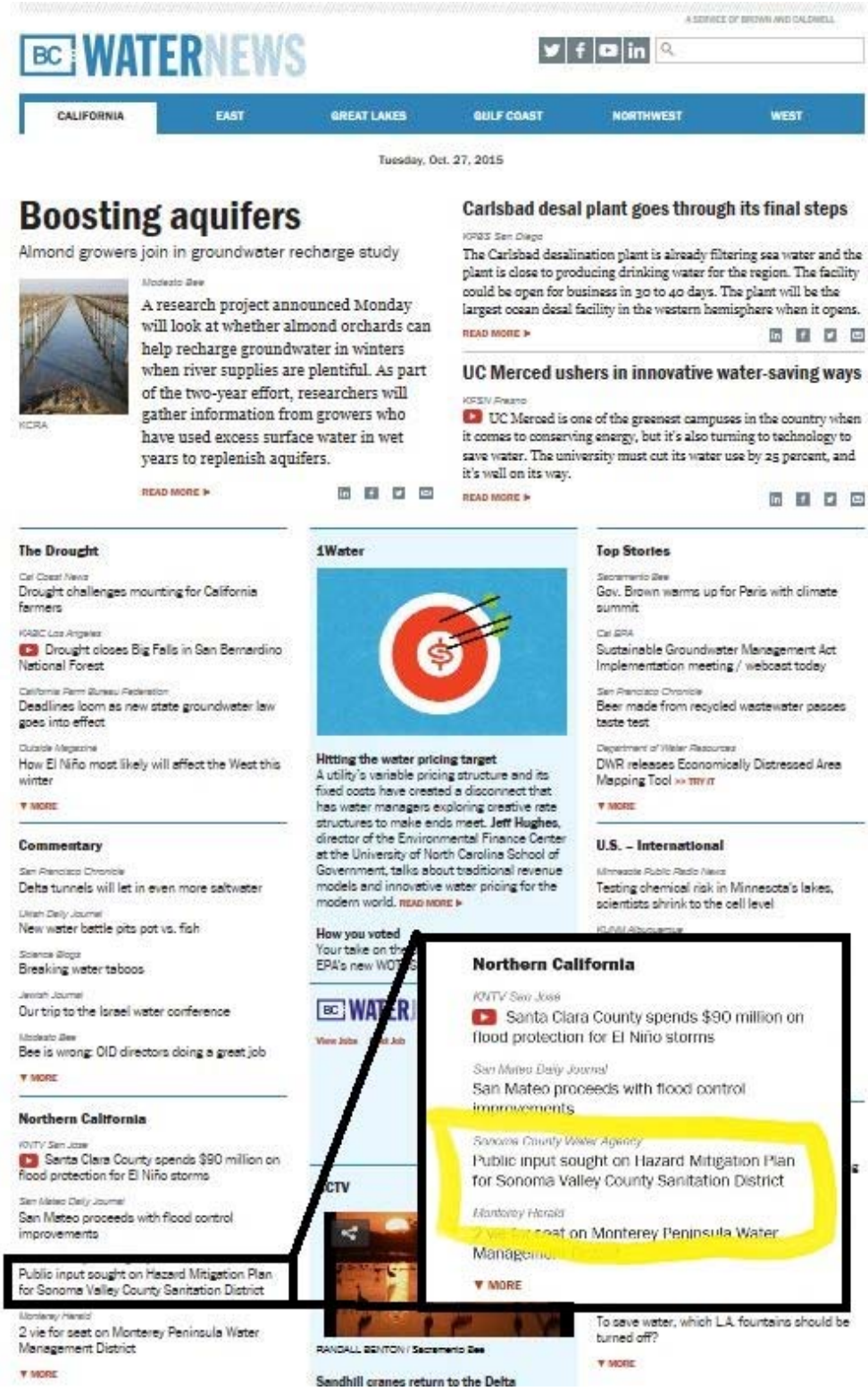
**Exhibit 1L**

Sonoma County Board of Supervisors– Meeting Minutes, posted on 12/XX/15

***PLACEHOLDER***

**Exhibit 1M**

Brown and Caldwell's BC Water News – Posted on 10/27/15



A SERVICE OF BROWN AND CALDWELL

BC WATERNEWS

CALIFORNIA | EAST | GREAT LAKES | GULF COAST | NORTHWEST | WEST

Tuesday, Oct. 27, 2015

## Boosting aquifers

Almond growers join in groundwater recharge study

Modesto Bee

A research project announced Monday will look at whether almond orchards can help recharge groundwater in winters when river supplies are plentiful. As part of the two-year effort, researchers will gather information from growers who have used excess surface water in wet years to replenish aquifers.

KCRA

READ MORE ▸

### Carlsbad desal plant goes through its final steps

KPBS San Diego

The Carlsbad desalination plant is already filtering sea water and the plant is close to producing drinking water for the region. The facility could be open for business in 30 to 40 days. The plant will be the largest ocean desal facility in the western hemisphere when it opens.

READ MORE ▸

### UC Merced ushers in innovative water-saving ways

KFSN Fresno

UC Merced is one of the greenest campuses in the country when it comes to conserving energy, but it's also turning to technology to save water. The university must cut its water use by 25 percent, and it's well on its way.

READ MORE ▸

**The Drought**

Cal Coast News
Drought challenges mounting for California farmers

KABC Los Angeles
Drought closes Big Falls in San Bernardino National Forest

California Farm Bureau Federation
Deadlines loom as new state groundwater law goes into effect

Outside Magazine
How El Niño most likely will affect the West this winter

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**Commentary**

San Francisco Chronicle
Delta tunnels will let in even more saltwater

Utah Daily Journal
New water battle pits pot vs. fish

Science Blogs
Breaking water taboos

Jewish Journal
Our trip to the Israel water conference

Modesto Bee
Bee is wrong: OID directors doing a great job

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**Northern California**

KNTV San Jose
Santa Clara County spends $90 million on flood protection for El Niño storms

San Mateo Daily Journal
San Mateo proceeds with flood control improvements

Public input sought on Hazard Mitigation Plan for Sonoma Valley County Sanitation District

Monterey Herald
2 vie for seat on Monterey Peninsula Water Management District

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**1Water**

**Hitting the water pricing target**
A utility's variable pricing structure and its fixed costs have created a disconnect that has water managers exploring creative rate structures to make ends meet. **Jeff Hughes**, director of the Environmental Finance Center at the University of North Carolina School of Government, talks about traditional revenue models and innovative water pricing for the modern world. READ MORE ▸

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Your take on the EPA's new WOTUS

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RANDALL BENTON / Sacramento Bee

**Sandhill cranes return to the Delta**

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To save water, which LA fountains should be turned off?

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**Northern California**

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Santa Clara County spends $90 million on flood protection for El Niño storms

San Mateo Daily Journal
San Mateo proceeds with flood control improvements

Sonoma County Water Agency
Public input sought on Hazard Mitigation Plan for Sonoma Valley County Sanitation District

Monterey Herald
2 vie for seat on Monterey Peninsula Water Management

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# APPENDIX C: BOARD RESOLUTION ADOPTING THE SVCSD LHMP

***RESOLUTION PLACEHOLDER***