Russian River County Sanitation District 2016 Local Hazard Mitigation Plan

June 2016

Public Review Draft

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LIST OF ABBREVIATIONS

ABS	Acrylonitrile Butadiene Styrene Pipe
AC, ACP	Asbestos Cement Pipe
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)
FEMA	Federal Emergency Management Agency
FHSZ	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
GIS	Geographic Information System
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
NEHRP	National Earthquake Hazards Reduction Program
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
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
RRCSD	Russian River County Sanitation District
SC	Steel Cased Pipe
SCWA	Sonoma County Water Agency
sec	seconds
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: RRCSD Collection System, Geology, Quaternary Deposits, Liquefaction, Flood Zone, Fire Hazard Zone, and Historic Wild Fires Figures

Appendix B: Proof of Public Outreach

Appendix C: Internal Meeting Agendas & Notes

Appendix D: Board Resolution Adopting the RRCSD Local Hazard Mitigation Plan

1. Introduction

1.1 Purpose of the Plan

Hazard mitigation, as defined by the Russian River County Sanitation District (RRCSD), 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.

RRCSD 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 RRCSD 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 RRCSD system. In direct response to this mitigation action, the RRCSD has prepared this Local Hazard Mitigation Plan and conducted a multi-hazard vulnerability assessment of the RRCSD sanitation facilities.

The RRCSD's wastewater collection, treatment, and disposal 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 RRCSD'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 RRCSD'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, RRCSD Profile** describes the RRCSD'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 RRCSD stakeholders, County officials and staff, and the public.
- **Chapter 4, Natural Hazard Reliability Assessment** identifies and prioritizes natural hazards affecting RRCSD, and assesses the RRCSD'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 RRCSD's plan to monitor, evaluate, update and maintain the LHMP.

2. RRCSD Profile

2.1 History

The Russian River County Sanitation District (RRCSD) began operations in 1983. During a 1995 restructuring of the county government, the Sonoma County Water Agency assumed responsibility for managing the county sanitation zones and districts. Each sanitation zone and district operates under a unique, individual permit from the California Regional Water Quality Control Board (San Francisco and North Coast regions) that sets the requirements for operation. The RRCSD operates under a permit from the North Coast Regional Water Quality Control Board.

The RRCSD now serves an area of about 2,700 acres. The sewer service area includes the unincorporated areas of Rio Nido, Guerneville, Guernewood Park, and Vacation Beach. The service area has been identified as a Disadvantaged Community with a median household income under 80% of the State's average.There are approximately 3,160 equivalent single family dwelling units in the RRCSD service area. Figure 1 shows an aerial view of the primary service area for the RRCSD and Figure 2 shows the topographical relief of the area served by the RRCSD. Figure RR-1 (Appendix A) contains an overall map with the District Boundaries.

The current design capacity of the RRCSD wastewater treatment plant (WWTP) is 0.71 million gallons per day (MGD) under average dry weather flow conditions. The WWTP includes primary, biological (secondary), and tertiary levels (filtration) of treatment, followed by UV disinfection.

Between October 1 and May 14, recycled water from the WWTP is discharged into the Russian River. Between May 15 and September 30, the recycled water is used for irrigation on forested land adjacent to the WWTP and on the Northwood Golf Course.

The following chapters provide more details on the RRCSD wastewater collection system and wastewater treatment facilities.

2.2 RRCSD's Existing Authorities, Policies, Programs and Resources

The RRCSD is a County Sanitation District. Its enabling legislation is Health & Safety Code Section 4700 *et seq.* The RRCSD has the authority to construct and operate works of improvement for sanitation related purposes; to execute related contracts, incur debt, and issue bonds for works of improvement; to fix rates, collect charges, and levy assessments for such purposes; and to acquire real property and related property rights such as easements and rights of way, including eminent domain authority if necessary. These core authorities provide the RRCSD a fundamental basis upon which to implement its hazard mitigation plan.

The RRCSD's policies are predominantly represented in its adopted Sanitation Codes and Standards. These codes and standards set forth uniform requirements for contributors to the wastewater collection and treatment systems of the District, and enable the District to comply with all applicable State and Federal laws including the Clean Water Act of 1977, as amended, and the General Pretreatment Regulations (40 CFR Part 403). More information regarding RRCSD's Sanitation Code Ordinance can be found at
http://www.scwa.ca.gov/files/docs/sanitation/codes/Russian_River_Cumulative_Sanitation_Code_rev_12-3-13_accessible.pdf

By ordinance, the RRCSD can establish regulations (codes) and standards and enforce compliance therewith for new improvements to be designed and constructed to withstand or be more resilient in responding to hazards.

The Water Agency has a Capital Projects Plan. This plan describes the infrastructure projects that are planned over the next five years to meet the needs of the water system, the wastewater districts, and flood management facilities that the Agency manages. These projects can take the form of pipelines, storage tanks, treatment facilities, and flood management projects. The projects are designed to meet regulatory requirements and to replace aging facilities. The Capital Projects Plan is modified each year to reflect changes in regulatory requirements and budget constraints. A diverse group of sections in the Water Agency supports Capital Projects and they including: Design Engineering, Construction Management, CAD/GIS, Land Surveying & Right-of-Way, Technical Writing, and Environmental Resources. Together, these sections ensure that infrastructure projects are implemented in compliance

with regulatory requirements and industry standards. More information on the Water Agency's Capital Projects Plan can be found at http://www.scwa.ca.gov/capital-projects/

In addition to the Capital Projects Plan, the Water Agency has a Strategic Plan approved by its Board of Directors listing strategic priorities and water policy statement. The strategic priorities identify key initiatives related to water supply, sustainability, sanitation, flood control and organizational effectiveness. These priorities were developed with the intent to remain unchanged for a five-year period. However, the actions identified to address these priorities are reviewed and updated annually. The 2013 Strategic Plan includes hazard mitigation strategies and objectives, such as:

1. Conduct hazard and emergency preparedness activities by evaluating infrastructure vulnerabilities and impacts to our customers, and continue implementation of Local Hazard Mitigation Plan and infrastructure improvement projects ;
2. Increase community outreach on Water Agency services and projects;
3. Provide flood protection service in a cost-effective manner
4. Increase awareness of flood control facilities and watershed protection;
5. Evaluate future flood protection needs by creating or updating hydrologic and hydraulic models; and
6. Develop emergency/disaster response plans for each sanitation system.

More information on the Water Agency's Strategic Plan can be found at http://www.scwa.ca.gov/strategicplan/

2.3 Geography, Topography, and Climate

2.3.1 Geography

The RRCSD treatment plant is located among the redwoods of the Russian River watershed in Guerneville, California.
Guerneville is located in western Sonoma County, along the Russian River on State Route 116, between Monte Rio to the west and Forestville to the east.

2.3.2 Topography

The topography of the area that RRCSD provides services to is characteristic of the north Coast Ranges with surface relief dominated by northwest-southwest trending ridges and valleys. The Coast Ranges are generally located to the west of the Russian River watershed with peak elevations between 1,000 and 3,500 feet and slopes often in excess of 30 percent. Valley elevations range from 100 to 400 feet. The project area is located within a portion of the Russian River watershed. The headwaters of the Russian River are located approximately 15 miles north of Ukiah in Mendocino County. The Russian River meanders west through the coastal mountain range, and the elevation of the river gradually declines until it reaches sea level at the river's mouth at Jenner.

2.3.3 Climate

Guerneville has cool, wet winters and warm, dry summers, a climate typical of northern coastal California. Although rainfall is rare during the summer months, fog often comes up the river from the

Pacific Ocean, producing enough condensation to create "fog drip," which sustains the numerous redwood trees, ferns, and other vegetation.

The National Weather Service reports that Guerneville has an average annual rainfall of 49.15 inches (1,248 mm). Measurable precipitation occurs on an average of 73 days each year.

Figure 1: RRCSD Service Area Aerial View

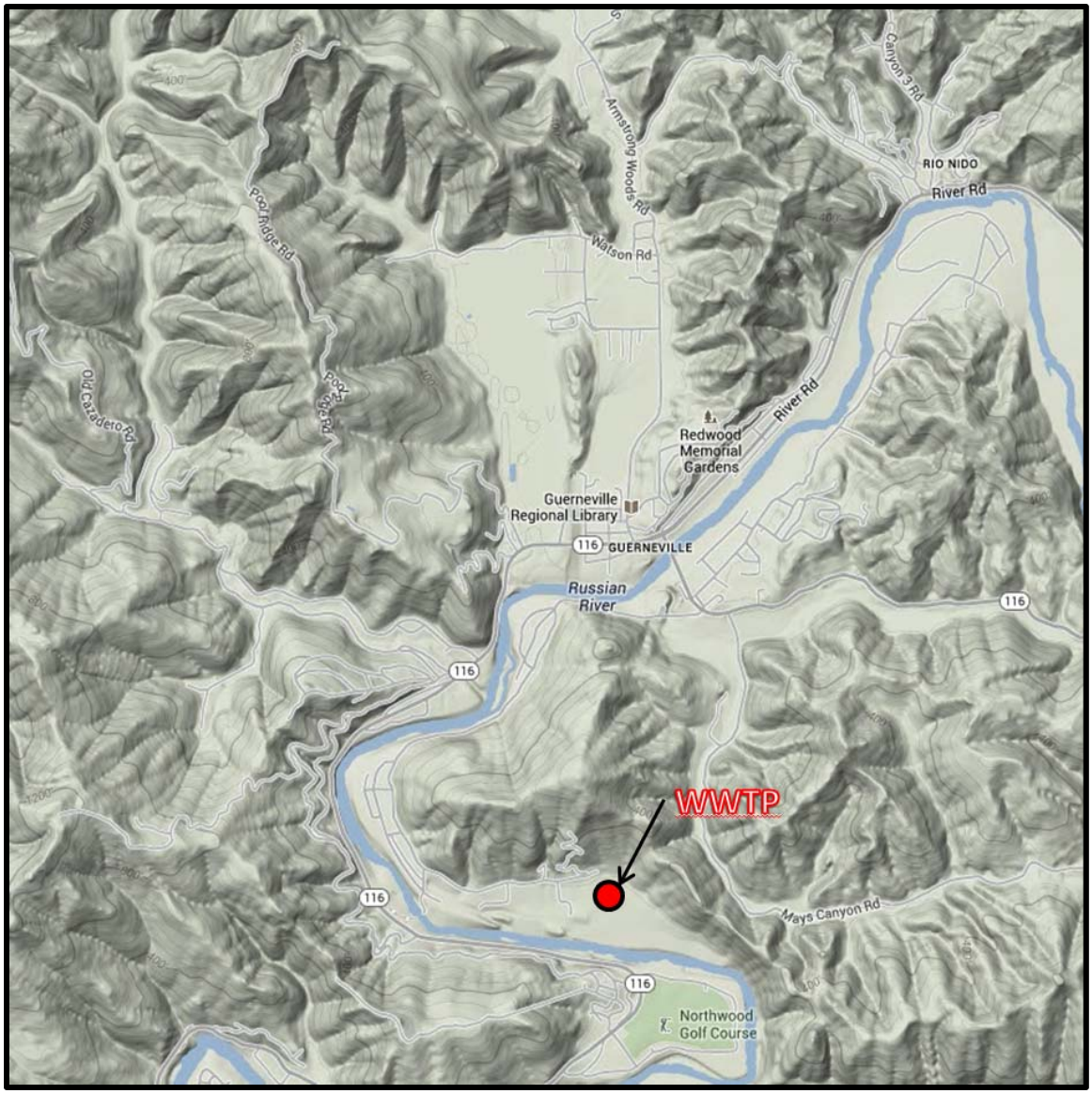

Figure 2: RRCSD Regional Area – Topographical Relief

2.4 RRCSD Collection System

Figure RR-1 highlights the main features of the collection system. Raw sewage is collected by a series of small diameter (typically 4" to 8" diameter) collection pipes. A single backbone sewer main (with 12", 15", 16", and 21" segments) transfers collected wastewater to the WWTP. The 16" pipeline is a force main that terminates at the Headworks Building at the WWTP. An 8" ductile iron pipeline takes effluent from the WWTP to a tank, and delivers the treated effluent to the Northwood Golf Course.

Treated (tertiary treatment) sewage leaves the WWTP via an outfall to enter the Russian River when discharge is allowed between October 1 and May 14.

There are a total of 39.06 miles of pipe in the collection system shown in Figure RR-1. Table 1 provides a breakdown of the pipe by diameter and material, and highlights that the most common pipe material is ABS (33.89 miles), representing nearly 87% of all pipes. There are small amounts of cast iron, ductile iron, PVC, and VCP.

The ABS pipe material was most likely chosen due to its light weight (ease of installation) and corrosion protection for raw sewage.

Table 1: Pipe Collection System RRCSD

Pipe Material*	Length (Miles)	Diameter (Inches)
ABS	33.89	4, 6, 8, 10, 12, 15, 21, 24, 27, 30
ACP	.05	6
CIP	0.03	4
CMLCS	1.98	8, 16
DIP	0.41	4, 6, 8
PVC	2.33	2, 4, 6, 8, 12
VCP	0.37	21, 24
Total	**39.06**	

* ABS: Acrylonitrile Butadiene Styrene
ACP Asbestos Cement Pipe
CIP: Cast Iron Pipe
CMLCS: Cement Mortar Lined and Coated Steel
DIP: Ductile Iron Pipe
PVC: Polyvinyl Chloride Pipe
VCP: Vitrified Clay Pipe

Figures RR-2 through RR-5 show the sewer collection system along with local creeks (blue lines). The soils at many creeks are Holocene age, and are prone to seismic-induced liquefaction, which is discussed further in Chapter 4.1. The potential for pipeline damage and the consequences of pipe failure are larger at creeks because pipe damage would entail release of raw sewage into the potentially sensitive creek environment.

Furthermore, there are 11 lift stations in the collection system:

- S57. Drake Estates (two pumps)
- S56. Rio Nido (three pumps)
- S58. Drake Road (two pumps)
- S54. Laughlin Road (two pumps)

- S55. Watson Road (two pumps)
- S53. Guerneville Lift (three pumps)
- S59. Beanwood (three pumps)
- S60. Center Way (two pumps)
- S52. Guernewood Park (two pumps)
- S51. Main (three pumps)
- S61. Vacation Beach (two pumps)

2.4.1 Wastewater Treatment Plant

The Russian River County Sanitation District WWTP is located on 18400 Neeley Road, Guerneville, CA and covers an area of approximately 12.5 acres. The wastewater treatment plant and facilities are shown in the aerial view of Figure 3. 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 enters at the Headworks through a 16" force main. At this point, large inorganic solids in the waste stream are removed.
- Secondary Treatment
  - Aeration basins. There are two rectangular reinforced concrete aeration basins, and one reinforced concrete equalization basin on the western side of the developed site. The wastewater undergoes biological treatment in the aeration basins. Air is injected into the wastewater to promote the growth of microorganisms that feed on organic materials in the sewage. The aeration basins are also configured to remove nutrients (nitrogen and phosphorus) from the waste stream.
  - Secondary clarifiers. There are three circular concrete tanks (two smaller and one larger) called the secondary clarifiers. The wastewater from the aeration basins is pumped into these clarifiers to separate the wastewater from the mixed liquor suspended solids. The suspended heavier materials settle to the bottom of the clarifiers as sludge, and the sludge is then returned to the aeration basins. The secondary-treated water flows over the weirs of the clarifiers and is then sent to the tertiary filters.
- Tertiary Treatment
  - Tertiary filters. The secondary-treated water from the clarifiers flows by gravity 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.
- Disinfection. The clear effluent from the tertiary filters is disinfected using ultraviolet light.

- Solids Handling. The excess sludge in the wastewater after secondary treatment is mixed with polymer and dewatered in a press for disposal to landfill.
- Storage reservoirs. Two reservoirs with a combined capacity of 4.5 million gallons are used to store recycled water. The recycled water is transported directly from the 3.5 million gallon holding pond to the seasonal discharge locations, including nearby forests and the Northwood Golf Course. Tertiary effluent that does not meet water quality standards is automatically diverted to a one million gallon emergency pond, where it is then pumped back to the headworks or to an aeration basin for retreatment.
- Control Buildings

The normally occupied buildings at the site include the operations building, generator building and maintenance building. There is a transformer pad to the north of the generator building.

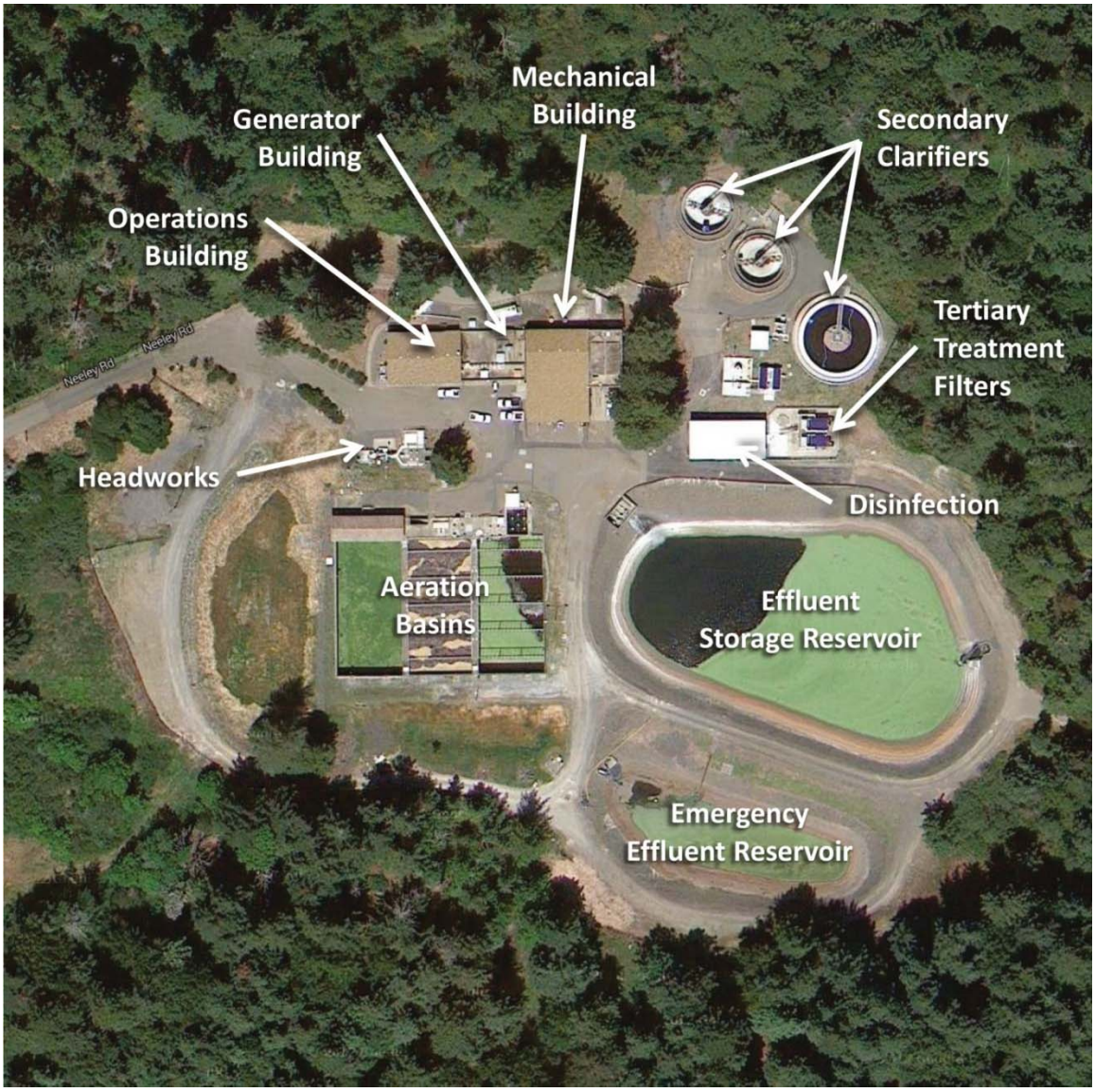

Figure 3: RRCSD Regional Area – Topographical Relief

3. Planning Process

3.1 Plan Development Process

Recognizing its obligation to provide reliable sanitation services to the Public, the RRCSD embarked on a Natural Hazard Reliability Assessment (NHRA) to better evaluate the RRCSD's vulnerabilities to natural hazards. This assessment was initiated by the Water Agency's Department of Engineering and Resource Planning in 2013, with the Water Agency Principal Engineer, Mr. Kent Gylfe, as the Project Manager. The RRCSD 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, participating in meetings and reviewing drafts of the plan. Key staff included, Assistant General Managers, Deputy Chief and Principal Engineers, Wastewater Operation and Maintenance Coordinators, Public Affairs staff, Emergency Response staff. In addition, a former RRCSD Board Member and former 5th District Supervisor attended a meeting, providing a vast amount of institutional and historical knowledge. Several meeting were held to gather those involved in crafting the plan, including the following meetings held at the held at the Sonoma County Water Agency:

Local Hazard Mitigation Plan - Project Kickoff Meeting 08-20-2013			
Name	**Agency**	**Department**	**Title**
Kent Gylfe	SCWA/RRCSD	Design Engineering	W.A. Principal Engineer
Curran Price	SCWA/RRCSD	Design Engineering	W.A. Engineer III
Pam Jeane	SCWA/RRCSD	Water/Wastewater Operations	Assistant General Manager
Cordel Stillman	SCWA/RRCSD	Engineering	W.A. Deputy Chief Engineer
Michael Bendik	SCWA/RRCSD	Risk Management, Safety and Ergonomics	Risk Management Analyst III
Courtney Ellerbusch	SCWA/RRCSD	Drafting/GIS	GIS/CAD Manager
Tim Gahagan	SCWA/RRCSD	Drafting/GIS	Department Information Systems Specialist II
Iver Skavdal	GHD		Operating Center Manager, USA West
Alex Culick	GHD		Regional Office Manager, Santa Rosa
Jeff Richmond	Kleinfelder		Project Engineering Geologist
Bill McCormick	Kleinfelder		Principal Engineering Geologist
John Eidinger	G&E Engineering Systems Inc.		President
Donald Duggan	G&E Engineering Systems Inc.		

Local Hazard Mitigation Plan - Public Outreach Meeting 10-08-2013			
Name	**Agency**	**Department**	**Title**
Kent Gylfe	SCWA/RRCSD	Design Engineering	W.A. Principal Engineer
Curran Price	SCWA/RRCSD	Design Engineering	W.A. Engineer III
Brad Sherwood	SCWA/RRCSD	Public Affairs	W.A. Principal Programs Specialist

Lynne Rosselli	SCWA/RRCSD	Budgets/Accounting/Long Range Financial Planning	Administrative Services Officer II
Joan Hultberg	SCWA/RRCSD	Grants and Funded Projects	Administrative Services Officer I
Jake Spaulding	SCWA/RRCSD	Grants and Funded Projects	Technical Writing Specialist
Carly Cabrera	SCWA/RRCSD	Public Affairs	W.A. Programs Specialist II
Pam Kuhn	SCWA/RRCSD	Public Affairs	W.A. Programs Specialist II

Local Hazard Mitigation Plan - Hazard Identification Meeting 03-04-2014			
Name	**Agency**	**Department**	**Title**
Kent Gylfe	SCWA/RRCSD	Design Engineering	W.A. Principal Engineer
Curran Price	SCWA/RRCSD	Design Engineering	W.A. Engineer III
Jay Jasperse	SCWA/RRCSD	Engineering and Resource Planning	W.A. Chief Engineer/Director of Groundwater Management
Pam Jeane	SCWA/RRCSD	Water/Wastewater Operations	Assistant General Manager
Michael Thompson	SCWA/RRCSD	Maintenance Worker Services	Assistant General Manager
Cordel Stillman	SCWA/RRCSD	Engineering	W.A. Deputy Chief Engineer
Michael Bendik	SCWA/RRCSD	Risk Management, Safety and Ergonomics	Risk Management Analyst III
Lori Armbrust	SCWA/RRCSD	ISO/Emergency Response	Department Analyst
Joan Hultberg	SCWA/RRCSD	Grants and Funded Projects	Administrative Services Officer I
Pam Kuhn	SCWA/RRCSD	Public Affairs	W.A. Programs Specialist II
Eric Keel	SCWA/RRCSD	Maintenance Mechanic Services	W.A. Coordinator
Erik Brown	SCWA/RRCSD	Environmental Services	W.A. Coordinator
Frank Mello	SCWA/RRCSD	Water/Wastewater Operations	W.A. Coordinator
Mitchell Southard	SCWA/RRCSD	Maintenance Mechanic Services	W.A. Coordinator
Alex Culick	GHD		Regional Office Manager, Santa Rosa
Laura Bryan	GHD		Project Administrator
Adam Fisher	GHD		Civil Engineer
Bill McCormick	Kleinfelder		Principal Engineering Geologist
John Eidinger	G&E Engineering Systems Inc.		President

Local Hazard Mitigation Plan - Public Outreach Meeting 04-01-2014			
Name	**Agency**	**Department**	**Title**
Kent Gylfe	SCWA/RRCSD	Design Engineering	W.A. Principal Engineer
Curran Price	SCWA/RRCSD	Design Engineering	W.A. Engineer III
Pam Jeane	SCWA/RRCSD	Water/Wastewater Operations	Assistant General Manager
Cordel Stillman	SCWA/RRCSD	Engineering	W.A. Deputy Chief Engineer
Michael Thompson	SCWA/RRCSD	Maintenance Worker Services	Assistant General Manager
Michael Bendik	SCWA/RRCSD	Risk Management, Safety and Ergonomics	Risk Management Analyst III

Brad Sherwood	SCWA/RRCSD	Public Affairs	W.A. Principal Programs Specialist
Joan Hultberg	SCWA/RRCSD	Grants and Funded Projects	Administrative Services Officer I
Jake Spaulding	SCWA/RRCSD	Grants and Funded Projects	Technical Writing Specialist
Pam Kuhn	SCWA/RRCSD	Public Affairs	W.A. Programs Specialist II

Local Hazard Mitigation Plan - Vulnerability Meeting 05-21-2014			
Name	**Agency**	**Department**	**Title**
Kent Gylfe	SCWA/RRCSD	Design Engineering	W.A. Principal Engineer
Curran Price	SCWA/RRCSD	Design Engineering	W.A. Engineer III
Jay Jasperse	SCWA/RRCSD	Engineering and Resource Planning	W.A. Chief Engineer/Director of Groundwater Management
Pam Jeane	SCWA/RRCSD	Water/Wastewater Operations	Assistant General Manager
Michael Thompson	SCWA/RRCSD	Maintenance Worker Services	Assistant General Manager
Cordel Stillman	SCWA/RRCSD	Engineering	W.A. Deputy Chief Engineer
Michael Bendik	SCWA/RRCSD	Risk Management, Safety and Ergonomics	Risk Management Analyst III
Lori Armbrust	SCWA/RRCSD	ISO/Emergency Response	Department Analyst
Eric Keel	SCWA/RRCSD	Maintenance Mechanic Services	W.A. Coordinator
Erik Brown	SCWA/RRCSD	Environmental Services	W.A. Coordinator
Brian Anderson	SCWA/RRCSD	Water/Wastewater Operations	W.A. Coordinator
Mitchell Southard	SCWA/RRCSD	Maintenance Mechanic Services	W.A. Coordinator
Courtney Ellerbusch	SCWA/RRCSD	Drafting/GIS	GIS/CAD Manager
Pam Kuhn	SCWA/RRCSD	Public Affairs	W.A. Programs Specialist II
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Local Hazard Mitigation Plan - Mitigation Review 05-10-2016			
Name	**Agency**	**Department**	**Title**
Jake Spaulding	SCWA/RRCSD	Grants and Funded Projects	Administrative Services Officer
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Kent Gylfe	SCWA/RRCSD	Design Engineering	W.A. Principal Engineer
Scott Carter	SCWA/RRCSD	Design Engineering	W.A. Engineer III
Eric Keel	SCWA/RRCSD	Maintenance Mechanic Services	W.A. Coordinator
George Lincoln	SCWA/RRCSD	Operations Engineering	W.A. Engineer IV

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 RRCSD's facilities, historic aerial photographs and available geotechnical and geologic data both from the RRCSD 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 RRCSD to obtain all relevant information necessary for identifying potential hazards, risks, and threats related to the RRCSD, 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 RRCSD has made an extensive effort to actively involve the Public and local Stakeholders in the planning and review of this Plan. Efforts included:

- June 4, 2013 Consultant Agreement went to the RRCSD Board of Directors with a description of the Plan
- June 9, 2014 Information about the Plan posted on the RRCSD's website
- Approximately 3,264 Sanitation newsletters were mailed to all RRCSD costumers in the Fall 2013, Spring 2014, Fall 2014, and Spring 2016 with information about the Plan
- June 2014 and July 2014 electronic newsletters emailed to approximately 530 subscribers with information about the Plan
- June 2014 Press Release about the Plan distributed to local news outlets posted on the RRCSD's website
- 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 2014 Paid advertisement in the Gazette newspaper announcing a Public meeting to go over initial findings for the Plan with approximately 34,000 copies distributed
- June 10, 2016 Press Release about the Plan and announcing public comment period distributed to local news outlets posted on the RRCSD's website
- June 15, 2016 Notices sent out to local stakeholders about the publication of the Plan
- June 22, 2016 Facebook and Twitter posts announcing plan availability and public comment period
- June 22, 2016 Draft Plan published on the RRCSD's website for review and comment
- September 13, 2016 RRCSD Sonoma County Board of Supervisors Meeting approving and adopting the RRCSD LHMP

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 RRCSD's Board of Directors on September 13, 2016. The formal resolution of adoption is included in Appendix D.

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 RRCSD 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 faults. The San Andreas Fault defines the westernmost boundary of the local bedrock and is located approximately 10 miles southwest of the RRCSD. 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 Blake, et al. (2002). These references generally agree that the majority of the site and vicinity is underlain by bedrock of the Jurassic-Cretaceous age Franciscan Complex. The northeastern portion and the southernmost end of the system are underlain by Franciscan Coastal Belt sandstone. The

southwestern part of the system is shown to be underlain by Franciscan Central Belt greywacke sandstone and mélange. Mélange typically consists of resistant blocks of variable lithology within a highly sheared argillite or shale matrix. The central, north-central, and location adjacent to the Russian River are underlain by Pleistocene and Holocene alluvium. That part of the Blake, et al. (2002) map that includes the site is presented in Figures RR-2 through RR-5. In addition, landslide deposits have been mapped on many of the slopes in the project vicinity. Most of the elevated portions of the system have been designated by Huffman and Armstrong (1980) as having a high susceptibility to landslides.

The alluvial deposits in the vicinity have been further separated into distinct Quaternary deposit designations by Knudson, et al. (2000). That portion of the Knudson, et al. (2000) map that includes the site is presented in Figures RR-6 through RR- 9.

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 RRCSD wastewater system is exposed to four of these five hazards: ground shaking, liquefaction, creek hazards, and landslides. For purposes of the current work, the approach to quantify these hazards was as follows:

- Ground shaking. Chapter 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. Chapter 4.1.2.3 describes how the strength and stiffness of soils are reduced by earthquake shaking, and how that affects the RRCSD 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. Chapter 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.
- Landslides. Chapter 4.1.2.5 describes the landslide hazard and quantifies how it is treated within context of this report.

- Surface faulting. Discussed in Chapter 4.1.2.6, the likelihood of surface rupture occurring within the RRCSD is very low. As of 2014, there are no known active faults that traverse the RRCSD.

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 RRCSD 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 (ref. Toppazada et al. 1979, Toppazada 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 RRCSD area are illustrated in Figure 4.

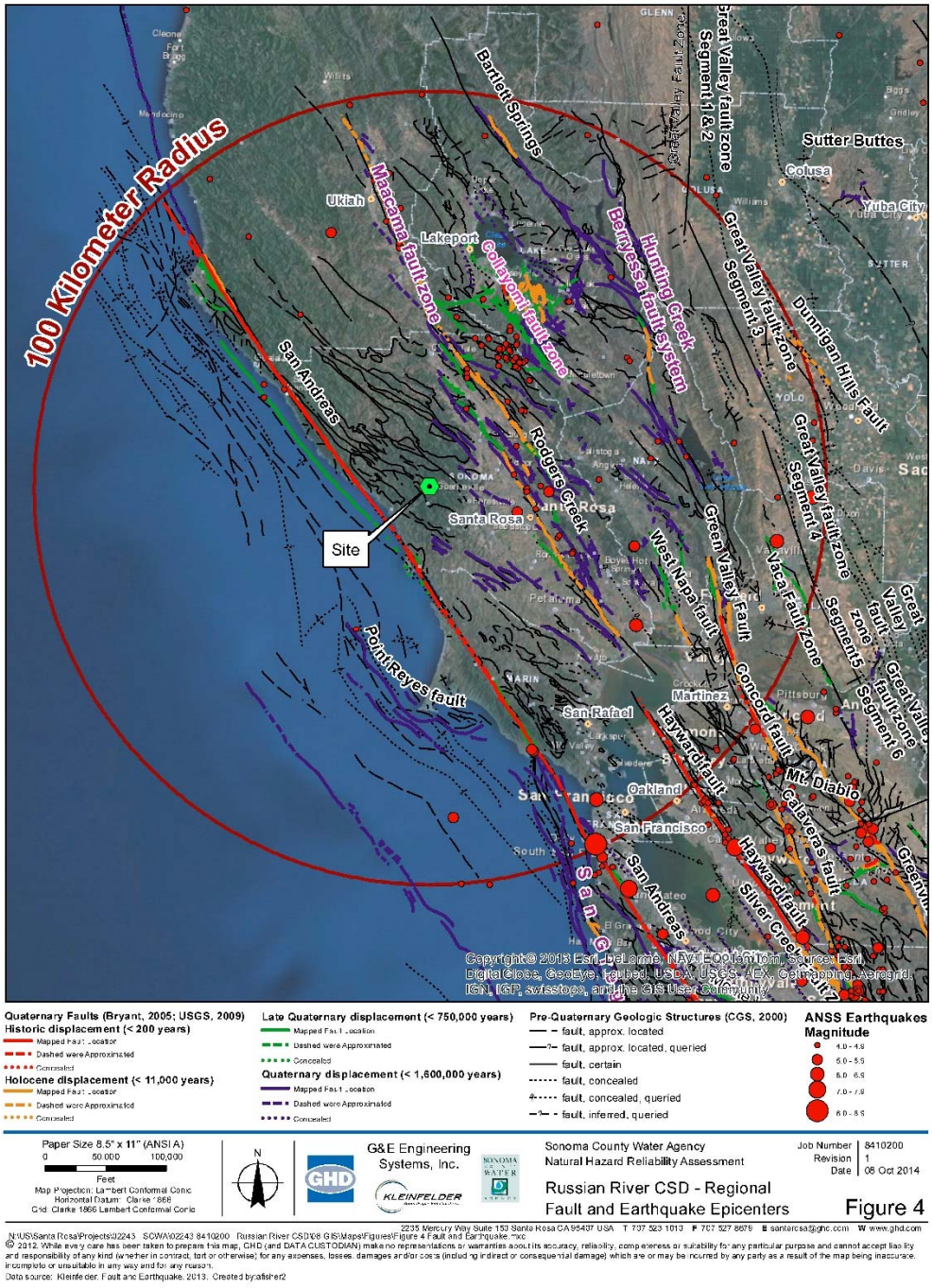


Figure 4: RRCSD Fault and Earthquake Epicenters

4.1.2.2 Ground Shaking Hazard

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

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

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, 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, a M 6.3 event in October 1965, the great M 8 earthquake in April 1906, 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 RRCSD. 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 a less than 5 percent probability of a M 8 earthquake along the north coast segments of the fault. More recent work (Working Group 2008) 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 RRCSD pipelines. The north coast segment of the San Andreas fault is located about 10 miles southwest of Guerneville.

This report assumes an M 8 event on the north coast segment of the San Andreas Fault is the controlling event for the purposes of planning.

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 M 7.2 to M 7.4 earthquake can occur.

There are no traces of the Rodgers Creek - Healdsburg fault that are known to traverse or bisect any of the RRCSD pipelines or the RRCSD WWTP. The fault is located east of the RRCSD, about

11 miles from the RRCSD WWTP. Any earthquake on the Rodgers Creek – Healdsburg Fault with M 6.25 or larger is likely to produce surface rupture in Sonoma County. While it would create surface rupture in Sonoma County it would not in the RRCSD. Overall, surface faulting hazard in the RRCSD system is not likely from any earthquake on the Rodgers Creek – Healdsburg Fault.

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 RRCSD, the Rodgers Creek – Healdsburg fault is not controlling; a larger magnitude event on the closer San Andreas Fault is likely the controlling event.

Maacama Fault. This fault extends from near Laytonville in Mendocino County to near Mark West Creek in Sonoma County. It has been interpreted as a right stepping extension of the Rodgers Creek - Healdsburg Fault. Fault creep has been measured near Ukiah and Willits at about 5.6 to 7.6 mm per year. The most recent event is prehistoric and occurred between 1520 AD and 1650 AD. Trenches suggest a long term slip rate of between 11 and 14 mm per year.

The southern section of the fault that is closest to the RRCSD, is about 33 miles long, and could produce M 7 earthquakes. If the Maacama Fault breaks along both its southern, central and northern segments, magnitude could be M 7.7.

There are no traces of the Maacama Creek Fault that are known to traverse or bisect any of the RRCSD pipelines. The fault is located east of the RRCSD, about 15 miles from the RRCSD WWTP.

For planning purposes for the RRCSD, an M 7.7 event on the Maacama fault would represent the maximum credible earthquake from that fault. No specific return period has been provided for earthquakes on the Maacama fault system. Earthquakes on the Maacama fault system will not be as severe for the RRCSD as compared to an M 8 or larger event on the San Andreas Fault. The seismic hazard in Table 2 includes contribution from the Maacama Fault.

Hayward Fault. The Hayward Fault is situated about 44 miles to the southeast of the RRCSD 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, 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

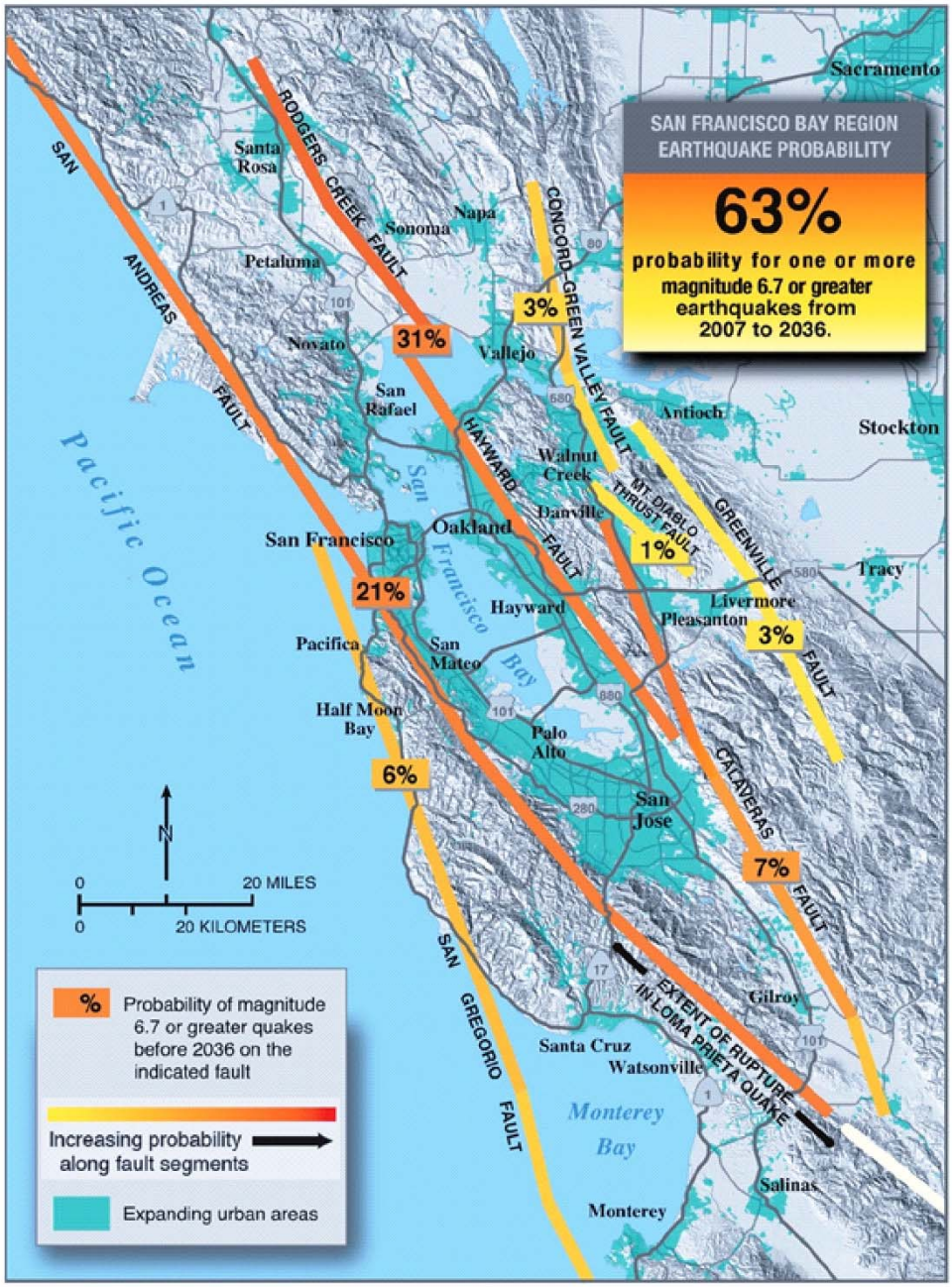
to M 7.25; the average recurrence of such events is estimated to be approximately 150 to 250 years.

Other Potentially Active Faults. There are a number of potentially active faults that are as close to Guerneville as the San Andreas, Rodgers Creek or Maacama faults. The activity rates for these faults are relatively low, with the last large rupture over M 5, thought to be between 11,000 and 1,600,000 years ago. Generally (except for the reclamation pond), there is no requirement to design any part of the RRCSD collection system, nor the WWTP, for such rare earthquake events. The reclamation pond is under the jurisdiction of the California Division of Safety of Dams (DSOD). DSOD makes periodic inspections and completed an inspection and report in 2013.

For completeness, some of the known mapped faults are listed below:

- Joy Woods. About 6 miles south of the WWTP. Could produce M 5 to M 6 events.
- Bloomfield. About 9 miles south - southeast of the WWTP. Could produce M 5 to M 6.5 events.
- Americano. About 16 miles south - southeast of the WWTP. Could produce M 5 to M 6.5 events.
- Tolay. About 19 miles southeast of the WWTP. Could produce M 5 to M 6.5 events.
- Point Reyes. Under the Pacific Ocean, about 19 miles southwest of the WWTP. Could produce M 5 to M 7.5 events.
- Alexander. About 15 miles northeast of the WWTP. Could produce M 5 to M 6.8 events.
- Unnamed. Several unnamed faults, about 5 to 7 miles northeast of the WWTP. Could produce M 5 to M 6.5 events.

Figure 5 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

Russian River CSD
Earthquake Probabilities

Job Number 8410200
Revision 0
Date 10 Feb 2014

Figure 5

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

N:\US\Santa Rosa\Projects\02243 - SCWA\02243-8410200 - Russian River CSD\08-GIS\Maps\Figures\Figure 5 Earthquake Probabilities.mxd

© 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 5: RRCSD Earthquake Probabilities

The common seismic design philosophy for earthquakes at the time when many of the RRCSD wastewater system facilities were built (mid-1980s) was to design for a base shear value (V) that is 18% of the effective seismic weight (W) (V = 0.18W), implying a design for reasonable structural performance for reasonably well detailed buildings for ground motions of about PGA = 0.30g. The average shear wave velocity (V or Vs) is reported in meters per second (m/sec) at the top 30 meters of soil at a specific site. Common design codes (such as the 1976 UBC code, which was the original design basis for the WWTP) 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.

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. Most RRCSD facilities are on soils, ranging from thin layers of firm soil to medium-deep layers of relatively softer soils.

Table 2 provides the PGA values for three return periods, following the USGS 2002 National seismic hazard model.

Table 2: Probabilistic Ground Motions (Horizontal PGA, NEHRP Class B, in g)

Facility Name	PGA 475 Years	PGA 975 Years	PGA 2475 Years
Russian River WWTP	0.42	0.53	0.67

The numeric values in Table 2 are based on pre-2000 ground motion prediction equations, and ignore the factors of soil, basin effects, and directivity. All these factors can be locally important at the WWTP, and elsewhere in the RRCSD service area.

Another approach to establish the ground motions is to presume occurrence of a specific earthquake, and then select a suitable non-exceedance level. For the RRCSD, the governing scenario earthquake is a magnitude M 8 event on the nearby San Andreas Fault, North Coast segment. The San Andreas Fault produces earthquakes that are strike slip, right lateral.

Most of the RRCSD sites can be characterized as having local soil conditions bounded as having Vs30 = 450 m/sec (stiffer soil sites) or 250 m/sec (softer soil sites). Tables 3 through 6 give the median expected horizontal ground motion (median of two horizontal directions). Considering the orientation and natural period of the RRCSD facility (buried pipe, buildings, tanks, water basins, etc.), the effectiveness of directivity should be considered.

In Tables 3 through 6, the PGA and PGV values are reported using five different ground motion models (ASK13, I13, CY13, CB13 and BSSA13). The I13 model is not suitable for softer soil sites and therefore not used in Tables 5 and 6.

For purposes of evaluating system-wide performance, the average of the relevant ground motion prediction models (right most columns) is used. As shown, the average PGA = 0.34g value for Vs30 = 450 m/sec is based on median motion for a M 8 event on the San Andreas Fault (Table 3). The PGA = 0.59g value is based on the 85th percentile motion for an M 8 event on the San Andreas Fault (Table 4). These PGA values were used for the vulnerability assessment for the RRCSD 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)	0.24	0.52	0.34	0.28	0.31	**0.34**
PGV (cm/sec)	37.76	53.39	57.25	45.85	42.80	**47.41**

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

Seismic Parameter	ASK13	I13	CY13	CB13	BSSA13	Average
PGA (g)	0.44	0.97	0.48	0.47	0.57	**0.59**
PGV (cm/sec)	71.33	110.80	94.90	81.59	82.10	**88.14**

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

Seismic Parameter	ASK13	CY13	CB13	BSSA13	Average
PGA (g)	0.25	0.36	0.26	0.31	**0.30**
PGV (cm/sec)	54.89	91.37	54.85	52.83	**63.48**

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

Seismic Parameter	ASK13	CY13	CB13	BSSA13	Average
PGA (g)	0.42	0.47	0.41	0.55	**0.46**
PGV (cm/sec)	102.92	69.51	93.84	97.75	**91.01**

To evaluate the existing system for emergency planning purposes, it is recommended to use the median values reported in Tables 3 and 5. Lacking site-specific conditions, it would be reasonable to assume Vs30 = 250 m/sec at locations where pipes are in alluvial materials near the Russian River, or cross creeks.

For design of non-redundant new pipes, it is recommended to use the 84th percentile motions as listed in Table 4 or Table 6.

For design of new buildings and pump stations that should remain functional after a large earthquake (once power is restored), it is recommended to use the 84th percentile motions, coupled with limiting "response modification coefficients" in common codes to no more than 3 for ductile structures; or 1 for brittle structures (unreinforced masonry, segmented precast vaults).

Lacking site-specific subsurface date, it is recommended to use 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.

For design of future new buried pipelines, in cases where there is no site-specific geotechnical / geologic investigations, and at locations where there is low to moderate liquefaction potential (see Chapter 4.1.2.3), it is recommended that the pipes 10" diameter and smaller be designed for PGV = 64 cm/sec for ground shaking; and pipes 12" diameter and larger be designed for PGV = 91 cm/sec. For sites with high to very high liquefaction potential, and at locations near open cuts / creeks, the pipes should be designed for the effects of liquefaction, including imposed permanent

ground displacements (PGDs). 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, which are discussed in the following sections of this chapter.

Considering that the RRCSD system is located more than 6 miles from active faults, 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. Alternatively, the vertical spectrum can be assumed to be 2/3 of the horizontal spectrum.

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.

Liquefaction Information from Previous Geotechnical Reports

The available geotechnical reports prepared for SCWA by others were reviewed and the following summarizes some of the pertinent information.

- Giblin Associates (1997a) prepared a geotechnical investigation as part of the waste disposal expansion project. The sites that were investigated are adjacent to the WWTP at 18400 Neeley Road, Guerneville. The sites are located at elevations of about 700 feet, or about 400 feet higher than the WWTP. Giblin noted that landsliding had been observed in a portion of the study area. Debris flow chutes were noted. The purpose of the study was to examine the hillside locations for possible treated wastewater disposal. No discussion is made of the geotechnical hazards and conditions within or immediately adjacent to the WWTP site.
- Giblin (1997b) examined the soils for a proposed equalization pond and aeration facility (31-acre-feet) at the WWTP, located immediately to the west of the existing WWTP

aeration basins (within the area mapped red (very high)) in Figure RR-11. The aeration facility was to include a one-story reinforced masonry block building with concrete slab-on-grade. The pond was to have embankment fills to about 20 feet high on the downhill side, with cuts on the uphill side. The pond was to be lined with concrete, gunite or similar hard-shell surfacing. Six borings were advanced. In the top 15 feet, one boring shows loose, wet sandy clayey gravel, with 6 blows per foot; another boring shows soft, wet brown sandy clay with abundant organics; one boring shows wet, medium dense sandy clayey gravel. Giblin noted that liquefaction could occur in this area.

- EBA (2002) advanced 10 borings at the WWTP to perform testing of the soils, looking for soil contaminants potentially associated with the originally-installed buried diesel fuel tank. EBA reports the site is underlain at depth by the Franciscan complex (confirmed by Giblin borings). EBA reports that there are gravelly silty sands to depths of 18 to 25 feet at the site, with clays beneath that; the soils are alluvial deposits; the lithology of the site includes several discontinuous layers (generally consistent with Giblin observations, although there may also be colluvial deposits).
- Giblin (2002) considered the earthquake hazards at the RRCSD WWTP as part of the Aeration Basin 3 and Clarifier 3 upgrade project (2002). Giblin noted the following:
  - Clarifier 1, 2 and part of 3 are located at the base of a hill, at the confluence of two south-flowing ravines. These ravines had previously produced debris flows affecting the clarifier and aeration basin areas.
  - Clarifier 3 area is underlain by sandy silts and clays and clayey sands with gravels, overlying highly weathered and sheared rocks of the Franciscan Complex. Soils show cobbles, indicating past debris flows.
  - Aeration Basin 3 area is underlain by sandy clays and gravels, clayey sands and gravels and sandy clays. Native soils below existing fills consist of medium dense clayey sands and soft to medium stiff sandy clays, with gravel, to depths of 18 to 29 feet. These are underlain by very stiff to hard sandy clay alluvial soils with high strength. Groundwater was observed at 13-14 feet below grade.

The above reports suggest that the WWTP site likely has a high ground water table (within about 10 feet of the surface, but can vary quite a bit seasonally), there may be old logging debris locally under undeveloped parts of the site (including roadways). A 2007 Supplemental Report, by Giblin (2007), and a 2011 Geologic Technical Memorandum, by Cotton, Shires & Associates (2011), have also been completed for a proposed equalization basin. These reports further discuss liquefaction, landslide, and debris flow potential at the WWTP.

Liquefaction Areas

The majority of the RRCSD system is located within young (Holocene) alluvial deposits that have been categorized as having a high liquefaction potential. A few localized segments within the collection system also cross into areas considered to have very high liquefaction susceptibility. It should also be noted that the majority of the WWTP is underlain by young alluvium that is considered to have 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 preliminary vulnerability assessment, it is our opinion that collection segments/improvements within 200 feet of creek banks with high or very high liquefaction susceptibility (and underlain by such deposits), 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 that 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/improvement damage or rupture.

Youd (1978) reports that there was liquefaction and lateral spread near Duncan's Mills in the 1906 San Andreas earthquake; extensive ground cracking and sand boils occurred 200 to 250 feet back from the river. This site is about 4 miles downstream of the Russian River from the WWTP. This brings into question whether the mapped liquefaction zones in the RRCSD are similarly prone to liquefaction and lateral spreads.

Knudson, et al. (2000) have produced liquefaction susceptibility maps that include the RRCSD system locations. The liquefaction susceptibility maps are presented in Figures RR-10 through RR-13 with an overlay of the RRCSD pipeline system. Areas in red have "Very High" liquefaction susceptibility; orange have "High"; yellow have "Moderate", and white have "Very low (none) – not mapped". The maps show that the "High" and "Very High" zones are concentrated next to active creeks, including the Russian River 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 spreads occur, will suffer great amounts of damage.
- Pipes in the white zones are generally not susceptible to liquefaction-caused damage.
- 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.
- Pipes in white areas might be susceptible to landslides

Based on the available information, it is estimated that possibly 10% to 20% of the overall WWTP site is liquefiable for PGA > 0.2g. The slope of the site would allow a lateral spread should liquefaction occur. The discontinuous nature of the soils suggests that lateral spreads that mobilize a large part of the site are unlikely. Debris flows from the hillside to the north are likely to occur in the future, posing a threat to people and to facilities; the debris flows can be triggered by intense ground shaking.

4.1.2.4 Creek Hazards

As previously described, the creeks pose hazards to the collection pipes, both because creeks have 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 RR-14 through RR-17 can be used to locate the areas where segments of the collection system cross a creek. As shown in the figures, there are numerous creek crossings within the RRCSD collection system that pose potential hazards.

Geologic reconnaissance along the RRCSD collection system has identified location-specific geologic hazards, other than more regional seismic-related liquefaction hazards. Such hazards include areas of static or seismically-induced landsliding (i.e. existing or imminent landslides), creek bank failures, slope creep hazards, and erosion or drainage flow debris impact hazards. Nine location-specific areas have been identified and are in Figures RR-2 through RR-5. 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 are constructed beneath drainage channels. The burial depth is assumed shallow, potentially exposing the pipeline to erosion or debris impact during periods of rapid stream flow.

(3) Sewer mains that extend through culverts, bridge abutments or are located near the thalweg of creeks have potential for debris build-up during high creek flows, and could result in damage to the main.

4.1.2.5 Landslide Hazards

The landscape in the RRCSD is characterized by steep ridges and canyons, as evidenced by the topography of the area shown in Figure 2. Local drainage is mostly into the Russian River. The service area receives much greater rainfall than eastern parts of Sonoma County.

Landslide movements in and near the hillside portions of the RRCSD wastewater system have been reported in the past and have been identified generally and as described above from the geologic reconnaissance of the system.

Active landsliding located along the north edge of the treatment plant has previously inundated a portion of the plant improvements. The remaining landslide mass is contained by concrete rails (k-rail) adjacent to the plant property line at the toe, but the feature extends upslope onto the private property north of the plant. Landslide potential is high on all slopes above the plant. Southward-facing slopes have static and seismic landslide potential with potential impact to the plant facilities.

Deep Seated Landslides

Landslides of most concern to the wastewater system are deep seated slides that cause rotation slumps of the top 5 to 30 feet of soils. These movements, also sometimes 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.

Debris Flows

Debris flows can also damage RRCSD facilities, primarily by inundation of materials (such as at the WWTP). Debris flows can also impact non-RRCSD structures and roads, hampering RRCSD's response to an emergency. Debris flows in stream channels can also impact overhead pipes, and also result in scour that could impact buried pipes.

Avalanche / Rockfall

Avalanche / rockfall-type landslides are not likely a hazard to the RRCSD.

Earthquake Landslide Characteristics

Earthquakes can trigger landslides. This reflects that the inertia shaking will create additional lateral and vertical forces on the terrain.

Ultimately, the parameters of a deep-seated landslide of concern to the wastewater system are the amount and spatial extent of soil movement that includes the pipe.

For deep seated landslides, the amount of movement is generally correlated to the level of shaking, as well as the duration of shaking. Terrains on a stable slope generally have a safety factor greater than 1; a slope with a static safety factor of 1.5 is sufficiently safe against landsliding. Terrains that have a factor of safety greater than 1 also have higher loads on them during the time of ground shaking. Whenever ground shaking forces increase, the driving force of the soil block downhill is greater than the resisting friction, such that the factor of safety against a landslide decreases below 1, causing the soil block to move downhill for the duration of ground shaking. In most cases, once the inertial motion reverses itself (often multiple times per second), the sliding stops; however, landslides can be re-triggered if there are subsequent high levels of shaking.

For debris slides, once the material/ soil block starts to move with sufficient velocity, the movement is self-propagating until the slope flattens out. Debris flows that impact wastewater treatment facilities can pile up debris; with sufficient debris and/ or with sufficient velocity, the debris can damage above-grade facilities.

For rock falls, once the materials start to move, the materials will continue moving until the slope flattens out.

The prevalence of earthquake-triggered landslides will be highest when the underlying hillside soils are saturated. In the RRCSD 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 so until April. For the current project, it was assumed that the scenario earthquake occurs when the soils are saturated, and hence there could be landslide movements.

Should landslide debris enter a creek (or the Russian River), the debris can form a dam, impounding water upstream. This impounded water can reach sufficient depths before breaking the dam, which causes a sudden release of water downstream. The sudden release of the water can be a life safety threat to all people caught in the release. Additionally, the release of water can destroy most above-grade wood structures and can cause rapid erosion that can undermine foundations and buried pipelines.

Regional scale landslide maps for Sonoma County include the map prepared by David Ramsey and Jonathan Godt (1999), which maps the landslides resulting from the 1997-1998 El Niño rainstorms. Rio Nido is located at the northern edge of the RRCSD service area. This community is in and along the margins of several steep canyons. In February 1999, a rotational and translational rock slump began to move high on a ridge above the town following heavy rains of early February. The frontal part of the slide slumped and liquefied, forming debris flows that crashed into homes along Upper Canyon Three Road. Three homes were destroyed and four more were severely damaged with damage to another 32 properties. The road and all underground and above-ground utilities were destroyed. The threat of further slippage of the main slide and resulting debris flow activity forced the evacuation of 140 homes downslope from the slide. The landslides in Sonoma County, from January – April 1999, caused about $21 million in losses in Sonoma County with most of this loss concentrated near Rio Nido Figure 6 shows the locations of mapped debris flows (red dots) from the winter of 1999 (Ramsey et al, 1999).

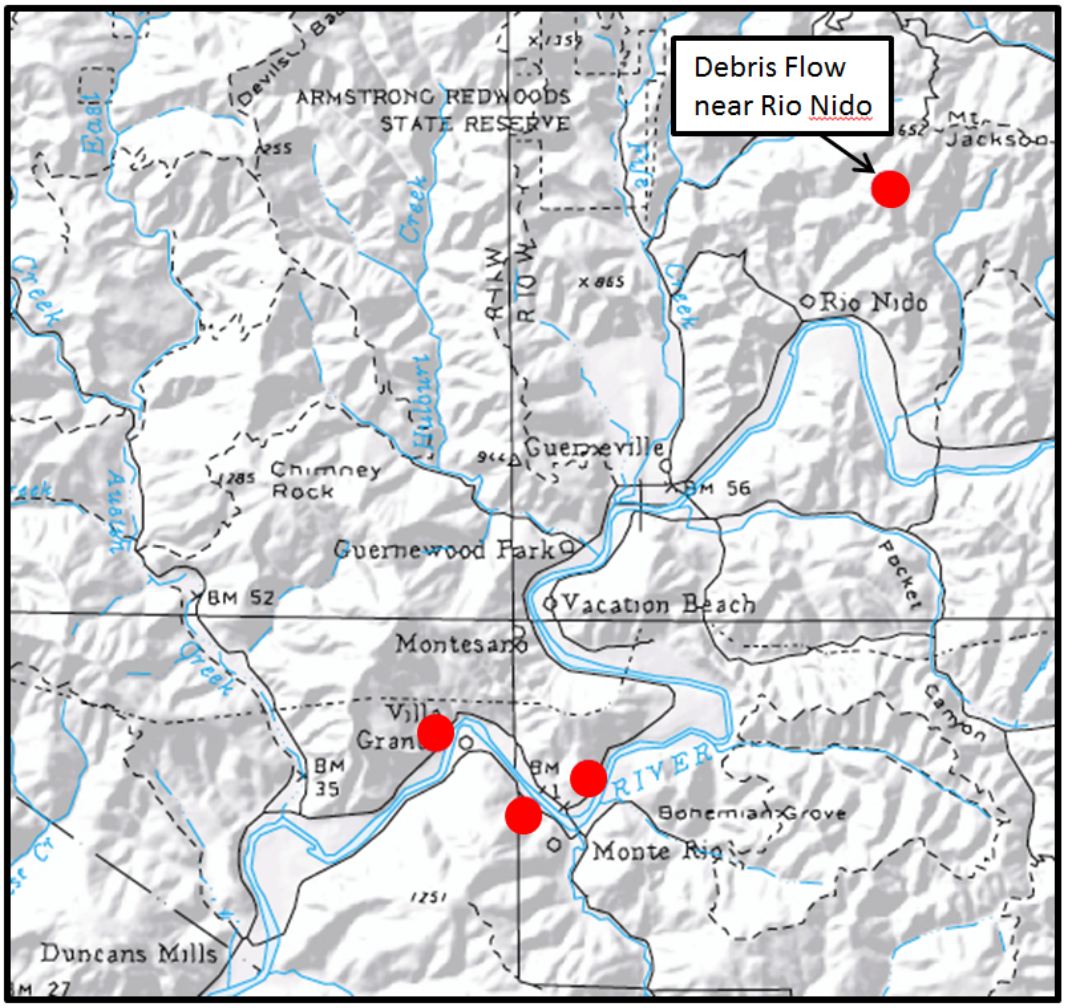


Figure 3: Mapped Debris Flows near RRCSD, adapted from winter (1999)

According to Giblin (2002), a debris flow occurred at the WWTP in 1992 during periods of heavy rainfall, with debris deposited between Clarifier 1 and the Mechanical Building, extending to the effluent storage reservoir. A San Andreas earthquake that occurs during the winter time, with PGA > 0.3g and ground-saturated conditions, could trigger multiple debris flows.

No site specific geotechnical investigations or landslide mapping have been performed as part of this effort; such investigations can provide improved estimates of landslide susceptibilities and probabilities based on future seismic events at different magnitudes. This report does not map the landslide risk, although this should be done to support any future pipeline design effort. Regional maps (including Wills et al, 2011) should not be used for evaluating the potential of landslides at any specific pipeline or facility location in the RRCSD service area.

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 known active faults that traverse the RRCSD service area, there is a minimal chance of fault offset thorough any RRCSD pipeline or facility.

4.1.3 Ground Motions in Sonoma County in Past Earthquakes

Sonoma County has undergone a number of earthquake events over 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 prior to 1960*. It should be recognized that the modern RRCSD was built after 1983.

- 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 70 km east of Guerneville. 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.

4.1.4 Seismic Performance Goals

One of the tasks of the seismic assessment of the RRCSD 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.

The RRCSD system will be assessed for a San Andreas M 8 earthquake as described in Chapter 4.1.2.2. Depending on the findings, the RRCSD system may be assessed for a more probable earthquake, which in the case of the performance goals, is defined as an earthquake that produces ground motions that are not expected to be exceeded more than once every 100 years. The potential level of ground shaking can be approximated by evaluating the system for 60% of the motions (and assuming eight to 10 seconds of strong ground motions) using the values presented in Tables 2 through 6.

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.

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 RRCSD 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 RRCSD, 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 RRCSD staff. Due to the type of facilities involved, in most cases, the concern for life safety is primarily related to RRCSD's own personnel and typically involves preventing the collapse of RRCSD'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 local streets.
   - Maintaining minimal disinfectionand 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 RRCSD System

Service Category	Probable Earthquakes	Maximum Earthquake San Andreas M 8.0
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. Provide secondary treatment within two weeks. Provide tertiary treatment within four weeks.	Provide primary treatment within two weeks. Provide secondary treatment within three months. Provide tertiary treatment within six months.

Protection of Receiving Waters (Wet Weather Conditions)	Provide primary treatment within two weeks.	Provide primary treatment within six months.

Based on observations to date, 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 highly vulnerable to liquefaction damage.

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 which are 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 need not be immediate (hours or days).

Table 8: Structural Performance Objectives

Facilities	Probable Earthquake (60% of motions in Table 2)	Maximum Earthquake (median motions in Tables 3 and 5)	Maximum Earthquake (84th percentile 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 filed reconnaissance the following geologic and seismic related issues relevant to the planning area should be considered:

1. The RRCSD wastewater system is exposed to four of the five identified geologic hazards (ground shaking, liquefaction, creek hazards and landslides) which present hazards that could result in damage to RRCSD facilities including the WWTP, collection system and pump stations with the potential of sewage spills and loss of use of the WWTP.
2. The RRCSD WWTP, which is located at the end of Neely Road at the south end of the system, has a series of geologic and seismic conditions that could adversely affect the improvements and operations of the plant, both in a static and seismic situation. The plant has already been adversely affected by a debris flow circa 1992 that originated off-site on the slopes and travelled between the clarifier area of the plant and the mechanical building, into the downslope effluent storage reservoir. All of the slopes bordering the northern boundary of the site should be considered to have a high potential for landsliding, both statically (due to seasonal heavy rains) and seismically (due to intense shaking). There is little to no protection from such slope movements to protect the facility at this site.
3. It should also be noted and emphasized that based on subsurface data from Giblin (1997a, 1997b) and from published geologic and seismic references, the southern half of the WWTP site is underlain by fill over young alluvium; which has a very high liquefaction potential and

at least a moderate lateral spread susceptibility. Groundwater has also been demonstrated to be shallow, varying from five to 15 feet below existing ground surface. If such phenomena were to occur, differential settlement and lateral movement would most likely disrupt pipelines and other infrastructure and may result in slope failure or rupture of reservoirs.

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

5. There are locations within the RRCSD 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 RRCSD is located within the Russian River watershed, where the Russian River meanders through the area served by the RRCSD. Here, floodwaters from the Russian River pose a potential hazard to the RRCSD facilities.

Flooding is the overflow of excess water from a river, stream, or 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 contains unconsolidated sediments that are accumulations of sand, gravel, loam, silt, and/or clay that extend below the stream bed. Because of the fertile soil, flat, reclaimed floodplains 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.

Sonoma County has had significant flooding in the past and is expected to have floods in the future. Table 11 shows the highest recorded stage of the Russian River at Guerneville between 1940 and 2006 [1, 2]. According to the National Weather Service (NWS) of National Oceanic and Atmospheric Administration (NOAA) various flood related stages at the Guerneville station are defined as, action stage at 29 feet, flood stage at 32 feet, moderate flood stage at 35 feet and major flood stage at 40 feet [1, 3]. Other sources [4] provide additional details such as various road intersections and landmarks flooded at different river stages. Water level in the Russian River as high as 17.5 feet above the flood stage (32 feet) has occurred in the past as shown in Table 11.

Table 11: Historic Floods in Sonoma County

No.	Date	Historical Crests for Russian River at Guerneville
1	February 18, 1986	49.50
2	January 10, 1995	48.00
3	December 23, 1955	47.62
4	December 23, 1964	47.35
5	February 28, 1940	46.87
6	January 1, 1997	44.99
7	January 2, 1997	44.25
8	January 5, 1966	42.50
9	January 1, 2006	41.81
10	March 10, 1995	41.45
11	January 24, 1970	41.30
12	February 1, 1963	41.10
13	January 17, 1974	40.70
14	January 27, 1983	40.40
15	February 25, 1958	40.20
16	January 17, 1978	39.50
17	January 14, 1969	39.50
18	January 22, 1943	39.50
19	January 21, 1967	39.30
20	December 20, 1981	39.00
21	February 6, 1942	39.00
22	January 17, 1954	38.35
23	January 8, 1960	38.10
24	January 12, 1973	37.90
25	February 4, 1998	36.60
26	February 13, 1975	36.60
27	December 4, 1970	36.50
28	January 21, 1993	36.30
29	February 7, 1998	36.04
30	January 14, 1980	36.00
31	February 13, 1962	35.80
32	December 28, 1945	35.22
33	December 4, 1950	34.70
34	December 25, 1983	34.20
35	January 10, 1953	34.15
36	February 20, 1998	33.06
37	February 16, 1959	32.50
38	April 5, 1941	31.80

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 one-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 one-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 equaled or exceeded in a given year. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a one-percent chance of being equaled 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 one-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 one-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 principal tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data sources 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 the Russian River and within the RRCSD boundaries generally result from intense rainfall that lasts for a short period, or, in longer storms, up to six hours. Figures RR-14 through RR-17 show the 100-year floodplain that lies within the RRCSD boundary. The floodplain is generally confined to the area nearby Russian River within the RRCSD boundary and expands up several of the low lying creeks that drain to the Russian River.

4.2.2 Hazard Profile

4.2.2.1 Principal Flooding Hazard

The principal source of flooding within the RRCSD is the Russian River. Figures RR-14 through RR-17 show areas where sections of the RRCSD collection system, lift stations, and force mains from pump stations intersect creeks.

Several pump stations are located along creek crossings and within the 100-year floodplain. These areas pose the highest risk of flood damage to the RRCSD facilities. Debris flowing within the Russian River and its tributaries where the pipelines cross presents a hazard to damaging the crossings. Potential for scour also presents a hazard. As discussed and listed as geologic hazards in Chapter 4.1, there are specific locations identified where damage to the system could occur.

Based on the FIRMs, the RRCSD WWTP is located outside of the 100-year floodplain, and outside the 500-year (0.2% annual chance) floodplain. However, pump stations and equipment, including pumps and controls, can potentially be damaged in the event of a flood. It is important to ensure that all electrical components are elevated above the 100-year flood elevation.

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 floodway 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, neighborhoods, rivers, and streams.

4.2.3 Potential Hazard Related Issues

The following flood-related issues relevant to the RRCSD 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, and the WWTP subject to floods. Coastal flood hazard ratings may also need to be reviewed in order for the RRCSD to adapt to climate change effects.

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 RRCSD 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 map for the RRCSD are shown in Figures RR-18 through RR-21. This map serve as the basis for the 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 RR-22 shows historical fires that have occurred near the RRCSD.

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 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 infrastructure. Most roads and railroads would be without damage except in the worst scenarios. 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. Wildfires typically do not have a major direct impact on bridges, but they can create conditions in which bridges are obstructed. Bridges in areas of high to moderate fire risk are important because bridges provide the only ingress and egress to large areas and, in some cases, to isolated neighborhoods.

Wildfires can also generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. One of these effects is flooding. Wildfires strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn 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, and, essentially bake soils (especially those high in clay content), thus decreasing the imperviousness of the ground. This increases runoff generated in storm events, which thereby increases the chance of flooding.

To further complicate the problem, heavy rains could follow, causing flooding and landslides and releasing sediment into rivers, permanently changing floodplains and damaging sensitive habitat and riparian areas. Such a fire followed by rain could release millions of cubic yards of sediment into streams for years, creating new floodplains and changing existing ones. 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 RRCSD 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 and pump stations. 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.

4.4 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 RRCSD. 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 so that, 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 RRCSD.

In the event of a hurricane or tropical storm, the RRCSD has the ability to continue the system operations using its SCADA system at two alternative locations: the Water Agency's Concourse Boulevard facility and at the Sonoma Valley CSD's WWTP. Radio communications between the three facilities is maintained at the Concourse Boulevard facility. Damage to the Concourse Boulevard facility would result in loss of the SCADA link between the operation centers.

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 RRCSD 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. As discussed in Chapter 4.2.2, flooding can change stream hydraulics and sediment carrying capacity of waterways, which may cause stream water backup flooding. Climate change also has potential to decrease precipitation in the Russian River watershed, which would increase fire hazards. While the effects of climate change remain uncertain, it is speculated that its effect on flooding and wildfire hazards could pose significantly increased risk to RRCSD infrastructure. Flood and wildfire hazards to RRCSD are discussed in Chapters 4.2.2 and 4.3.3, respectively.

4.5 Vulnerability Assessment

The purpose of completing the Vulnerability Analysis is to assess the extent to which the RRCSD facilities can withstand the applicable hazards discussed in Chapter 4.1 – 4.4. The facilities include gravity and pressure pipelines, lift stations, and the wastewater treatment plant (including treatment, storage, reclamation, irrigation and related facilities). Mitigations and future emergency operations plans will serve as a guide for planning and developing a response to natural hazards; effects of hazards on the RRCSD system will be based on the identified vulnerabilities of the system.

The vulnerability assessment included a review of data collected, as-built drawings of the system, and a field review of the system. Potholing as well as underground and in-pipe investigations were not included in the assessment. As additional data is developed and vulnerabilities of the RRCSD system are identified, the RRCSD 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 is meant to meet the following objectives:

1. Identify and quantify the hazards that may affect the RRCSD system;
2. Quantify the susceptibility of essential sewer service and treatment facilities to the effects of natural disasters;
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 of the RRCSD facilities and lift stations. 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 RRCSD facilities. Additionally, the vulnerabilities associated with the lower risk hazards would be similar to those identified and associated with earthquakes. Specific vulnerabilities to the collection system 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 RRCSD 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 RR-2 through RR-5.

Vulnerabilities

The site-specific vulnerable areas identified based on hazard reconnaissance points on Figures RR-2 through RR-5 are described below:

Point 1: The sewer main was constructed beneath the existing drainage channel in multiple locations; the burial depth below the channel thalweg is unknown and assumed shallow.

Hazard: There is a potential for exposure and damage of the pipeline due to erosion and debris impact during periods of rapid stream flow.

Point 2: The sewer main and manholes are located/founded within young alluvium (Holocene) and are locally proximal (less than 10') to the creek/drainage channel embankment. The embankments are generally steeper than 1H: 1V (Horizontal:Vertical) and the channels are up to 20 feet in depth below the roadway. Localized embankment undermining and failure were observed.

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

Point 3: The sewer main and manholes are constructed within generally contour-parallel roadways. The slopes above and below the roadways are generally steeper than 2H:1V (Horizontal:Vertical). Abundant edge parallel and arcuate (curved) cracking of the pavement (due to fill prism settlement and creep on ridge flanks) and through colluvial swales were observed. Overland sections of the sewer main and associated manholes are potentially found in creep or failure prone colluvial soil and weathered bedrock.

Hazard: There is static and seismic landslide potential with possible damage to main, manholes and laterals.

Point 4: The 16-inch force main between the Main Lift Station and Vacation Beach Lift Station is a concrete-encased, mortar-lined, rigid steel cylinder truss pipeline that has had a recent failure and is susceptible to failure during seismic events and landslides. In addition, it is advisable to upgrade and replace the force mains at the Beanwood Lift Station up to MH 37-17, Guernewood Lift Station up to MH 23-16 and the Rio Nido Lift Station up to MH 72-6 due to similar reasons.

Hazard: The potential exists for static and seismic failure potential of the force mains resulting in sewage spills.

Point 5: Active land sliding along the north edge of the treatment plant has previously inundated portions of the plant improvements and is discussed further in Chapters 4.1.2.5 and 4.1.2.5

Hazard: The southward-facing slopes have static and seismic landslide potential with potential impact to the plant facilities.

Point 6: The gravity line along the alignment between MH 31-3 and MH 31-4 is potentially shallow.

Hazard: The potential exists for undermining and exposure of the pipeline during high-flow events and during a flood.

Point 7: The sewer main was constructed beneath the existing drainage channel. The burial depth below the channel thalweg is unknown and is assumed to be shallow.

Hazard: There is potential exposure and damage of the pipeline due to erosion and debris impact during periods of rapid stream flow.

Point 8: The sewer main and manholes are constructed within generally contour-parallel roadways. The slopes above and below the roadways are generally steeper than 2H:1V (Horizontal:Vertical). Abundant edge parallel and arcuate cracking of pavement due to fill prism settlement and creep on ridge flanks and through colluvial swales was observed. Overland sections of the sewer main and associated manholes are potentially founded in creep/failure prone colluvial soil and weathered bedrock.

Hazard: There is static and seismic landslide potential with possible damage to the main, manholes and laterals.

Point 9: The sewer main and manholes are located/founded within young alluvium (Holocene) and are locally proximal (less than 10') to the creek/drainage channel embankment. The embankments are generally steeper than 1H:1V (Horizontal:Vertical) and the channels are up to 15 feet in depth below the roadway, locally. There is localized embankment undermining and failure observed.

Hazard: There is static and seismic embankment failure (landslide) potential with possible damage to main, manholes, and laterals.

The highest vulnerability to the collection system is due to the potential damage due to seismic events, which also translates to the highest potential cost to the RRCSD. 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 installed in an open-cut trench adjacent to a stream or river, where significant lateral spreads can occur. An occurrence of an M 8 event on the San Andreas Fault was assumed, which on average produces PGA = 0.34g at the ground surface near each pipe. For the pipeline inventory, the typical style of pipe installation uses cemented joints (ABS pipes) or non-seismic push-on joints (CIP, DIP, PVC, VCP pipes).

The number of pipe failures was then estimated, given the level of shaking (PGA = 0.34g), and the pipe fragility models of ALA (2001). Given these assumptions, approximately 42 pipe repairs will be required, of which about nearly all will occur in the areas mapped as having high to very high 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 RRCSD collection system, should a M 8.0 earthquake occur along the San Andreas Fault. Uncertainties in the ground motions and pipe performance suggest these median-based quantities may vary ±50%.

Table 9: Pipe Damage – San Andreas M 8.0 Earthquake

Liquefaction Zone	Total Pipe Length (miles)	Total Pipe Repairs	Pipe Breaks	Pipe Leaks
Very High	1.6	15	7	8
High	28.0	27	14	13
Moderate	1.9	< 1	<1	<1
Low, None	7.8	< 1	< 1	<1
Total	**39.3**	**42**	**21**	**21**

Equipment at the lift stations (pumps, motors, controls) are well anchored and therefore not subject to damage from seismic shaking. The lift stations themselves and the connected piping are, however, vulnerable to damage from liquefaction, typically due to flotation and/or rotation of the lift station.

Mitigations

The vulnerable areas of the collection system 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 RRCSD.
- 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 groundwater 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. 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, then 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 return to the leaking pipes to make permanent repairs.
- Jet-flush the repaired pipes to clean out accumulated silts, sands, and debris.

Pipe replacement might be the most effective solution in 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.
- 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 where:

- Manholes or lift stations have floated.
- Multiple breaks between manholes have occurred.
- Hydraulic / flow issues are known to exist.

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 be damaged 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 one percent soil strain. All overhead pipes that are self-supporting or on bridges over creeks should be replaced or upgraded to sewers that can sustain PGA = 0.59g. Pipe replacements can be installed piecemeal 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 and seismic hazards, and fire. Seismic hazards include ground shaking; water impulse and sloshing forces; differential ground displacements due to landslide or liquefaction; and debris flow.

Vulnerability to wildfire includes limited access to RRCSD facilities for maintenance and fire suppression. This is particularly true at the RRCSD WWTP site. Alternate access is desirable to allow easier access for emergency vehicles, but availability of right-of-way is limited. Wildfires could also cause secondary natural hazards like landslides. For this reason, the mitigations discussed for geologic and seismic-induced landslides are similar to those planned for wildfires.

A description of the flow process in the RRCSD WWTP was provided in Chapter 2.4. The following paragraphs discuss the WWTP structures and systems that are at risk primarily during earthquake hazards.

4.5.2.1 Aeration Basins

The aeration basins are part of a reinforced concrete rectangular structure with three basins.

The two eastern-most basins are used for aeration. The western-most basin was empty at the time of inspection and contained no equipment (no baffles, no aeration).

Vulnerabilities

If the aeration basins are full at the time of the earthquake, the water impulse and sloshing forces will load the downcomers. If the downcomers are deteriorated, they may break. The header air-pipe above the water level might be impacted by sloshing forces.

Mitigations

None recommended.

4.5.2.2 Clarifiers

There are three clarifiers in use at the treatment plant: two original (1980s) 40-foot diameter clarifiers, and a newer (2003) 60-foot diameter clarifier. These are circular reinforced concrete structures located in the northeast part of the site, along the bottom of the slope of the mountainous terrain to the north of the site.

Vulnerabilities

Circular clarifiers commonly experience significant damage during major earthquakes. During earthquakes, water sloshing in the clarifiers results in waves that over-top the clarifier and increase the forces applied to the central tower, baffles, and launders. Figure 7 shows the typical clarifier layout and Figure 8 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 0.34 g at the treatment plant will likely cause yielding of the clarifiers' rake arms lattice structure, the central tower, and the anchor bolts (the weakest component), and will thus render the clarifiers inoperable.

From an inertial point of view, all three tanks are considered adequate for PGA = 0.34g. The remaining weaknesses include:

- Damage of the rotating mechanisms within the clarifiers due to seismic inertial and wave loading;
- Damage to attached inlet-outlet pipes due to differential soil movements;
- Damage to attached ladders due to differential soil movements;
- Damage due to deep-seated landslide; and
- Damage due to debris flow.

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.

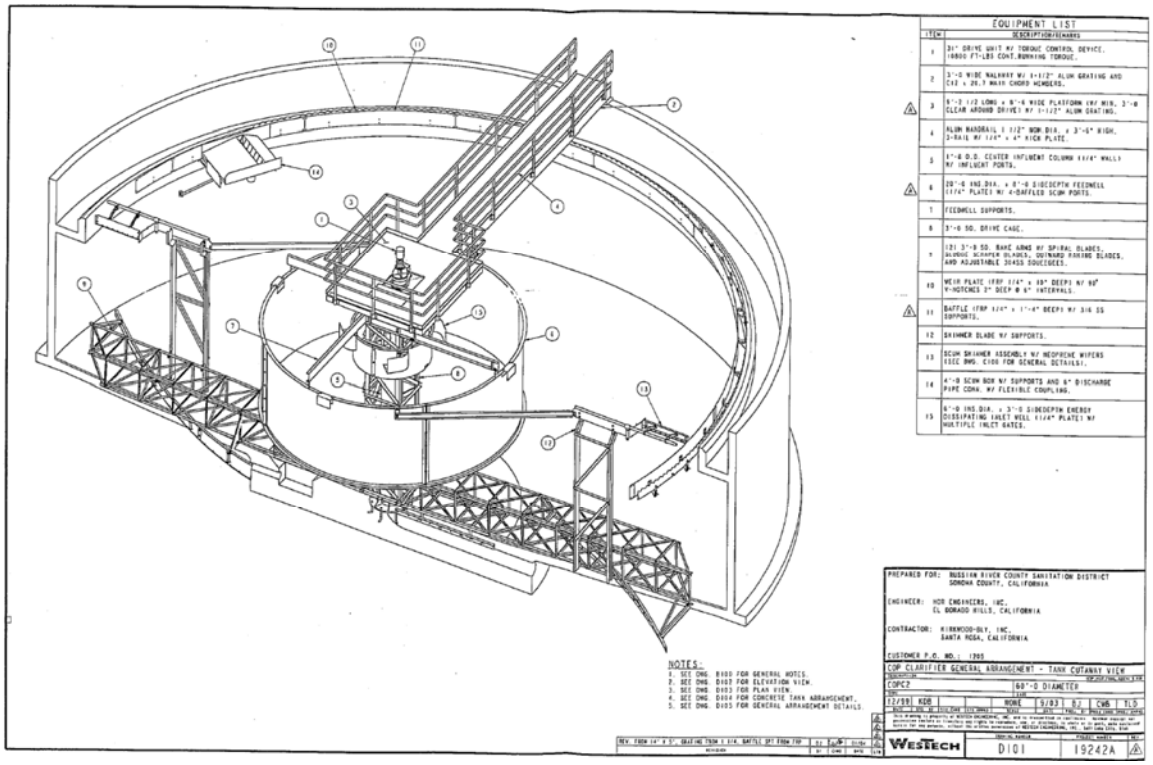


Figure 7: RRCSD WWTP 60 ft. Clarifier (2003) – General Layout

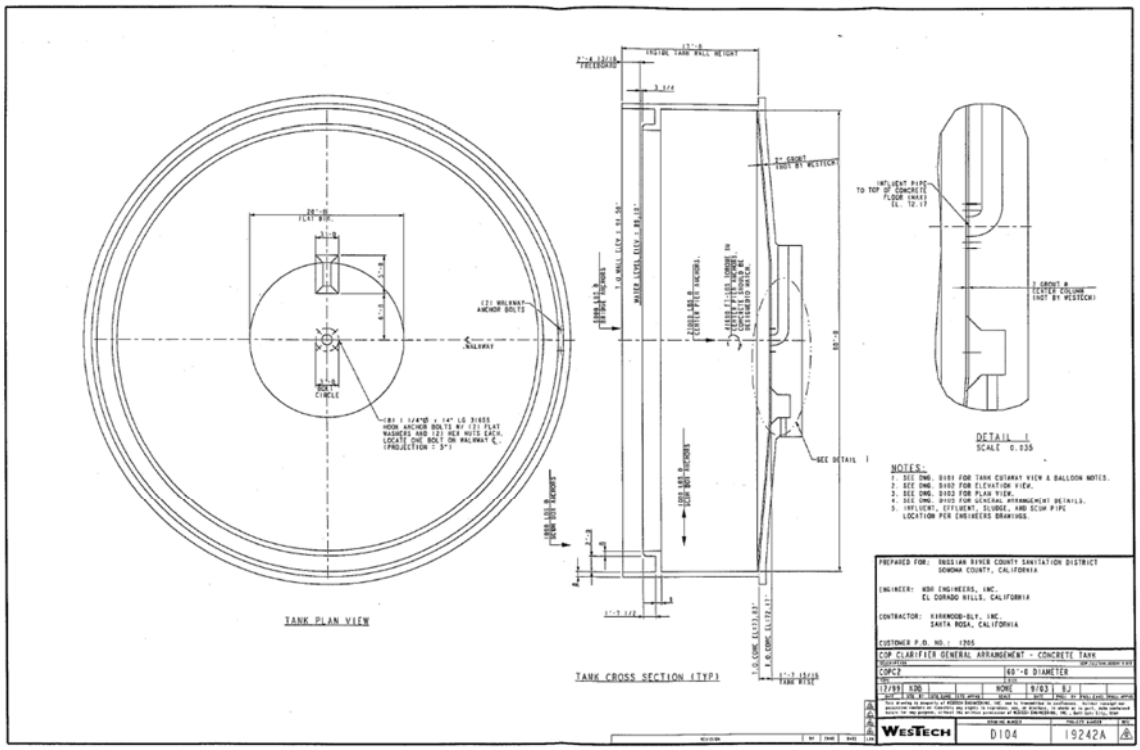


Figure 8: RRCSD WWTP 60-foot Clarifier – Key Dimensions

4.5.2.3 Buried Piping at the WWTP

The pipes installed at the WWTP are generally welded steel, with bolted connections for valves and dresser couplings used 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. Figure 9 shows a plan of the WWTP as of 2013.

Vulnerabilities

Assuming ground shaking at the site of PGA = 0.34g and firm soil conditions without liquefaction or landslide, buried pipe will survive the shaking, except where the pipe has become distressed due to corrosion (internal or external) or if it has construction defects (like improper welds).

This being said, the northern part of the site appears to be exposed to ongoing slope movements, and the site might also be exposed to liquefaction. The primary locations where pipes are likely to be damaged are: a) where pipes enter tanks / structures, and b) where tanks are founded on deep foundations but adjacent pipes buried just a few feet underground.

There is a strong possibility that given PGA = 0.34g, there will be differential displacements exceeding an inch between some of the concrete tanks / structures and the surrounding soil. Consequently, there might be multiple pipe failures at the WWTP site with PGA = 0.34g (San Andreas M 8), 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 such that the valve becomes inoperable.

Additionally, there are two geotechnical issues that can lead to differential soil movements at the site:

- In the northern part of the site, near the clarifiers, there are steep slopes. Long-term creep of the slopes can impose differential movements on the pipes, especially where the pipes connect to concrete structures (like the clarifiers) that are founded on deeper, more stable soils. Earthquake-triggered movements can be larger than the long-term soil movement. Figure 10 shows one such pipe connection where there is already evidence of differential movement—this pipe contains flexible connections already. Figure 11 shows another set of pipe connections where the differential movements would result in increasing stress in the pipe.
- In the central and southern parts of the site, where the ground surface is flatter, there is potential for liquefaction-induced settlements; the potential of a lateral spread towards the river exists, especially for the southern part of the site.

The specifications and designs for the existing buried piping for this site were unavailable for review, but the drawings and specifications for several recent upgrades, including the 2003 Third Unit Process Project, the 2011 Disinfection Upgrade, and the 2013 Biological Nutrient Removal Project were reviewed. It is clear that these projects implemented current code requirements for seismic shaking, but there is no evidence that the piping, buried or above ground, was designed for differential displacement. It appears that most pipe installations include Dresser (or similar) couplings, which are usually able to absorb about an inch of movement, but in strong shaking there can be much more than an inch of movement, and the existing pipes would be challenged.

A few locations in the northern part of the site (high slope area) have above-ground piping. These pipes were not traced back to drawings / pipe-specific calculations, but it seems likely that the above-ground configuration were used to address ongoing movement of the steeper slopes. As installed, these installations are adequate for inertial shaking, but are still subject to failure should there be imposed PGDs or a debris flow.

Given these observations, it is therefore anticipated that there will be damage to buried piping during an earthquake. The probability of pipe breaks at the RRCSD WWTP as a result of a San Andreas event is high. These pipe breaks can occur nearly anywhere in site, concentrated in areas where the pipes enter structures.

Mitigations

Given the significant chance of pipeline damage at the plant and current uncertainty in assessing which portions are the most vulnerable, pre-earthquake mitigation to the buried large bore conveyance pipes at the plant are not recommended at this time. Any such mitigation improvements would likely still remain vulnerable to damage following a significant San Andreas event, and thus not likely prove to be cost effective without a more detailed analysis of the piping systems. However, a prudent approach would 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 pipe repair(s) within 24 hours. Assuming the causative earthquake is a San Andreas M ~8 earthquake, there will be extensive pipe damage in Sonoma County (as well as other parts of the greater Bay Area), thus having a pre-set agreement to mobilize pipe repair crews will be useful. Receiving aid

from other lesser-impacted agencies in the Bay Area might also be another option. (In the Bay Area, only 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.) Although steel pipe will not likely need to be replaced, the ability to roll steel shapes will likely be needed for repairs. Larger pipe contractors might have this capability, but from a planning perspective, RRCSD should assume that there will be a larger demand for their services than usual.

Going forward, when RRCSD 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 three inches of knife-edge settlements when entering concrete vaults. This can usually be accommodated using a combination of bellows, ball-joints with slip joints, dresser-like couplings (at least two per pipe, generally restrained), expansion loops in vaults, etc.

In order to mitigate the geotechnical vulnerabilities, and until geotechnical investigations can be done, it is recommended that for future water (including wastewater / sludge) pipe installations:

- All pipe-structure connection points be designed to accommodate three inches of differential “knife-edge” type movements at soil-structure connection points (where ground slope is more than five degrees).
- All buried pipe throughout the plant be designed to handle liquefaction and slope movement (resulting in a one percent strain on the pipe). All buried chemical pipes should be similarly designed. Above-ground pipe installations can be used, but such pipe should be checked for inertial loads per ASME B31 provisions, assuming elastic limits (no pipe stress over yield) for PGA = 0.34g / firm soil spectra in each of the two horizontal directions, and a corresponding vertical spectra.

By following these recommendations, future pipe installations will be much more likely to withstand future earthquakes.

This still leaves open the question of how vulnerable the pipe network is at the existing WWTP, and what to do to lessen the impacts. The choices include:

- Do nothing.
- Improve emergency response capability, including the ability to quickly repair broken pipes, or to use above ground temporary hose to bypass damaged pipe.
- Do modest level of mitigation, where the costs are lowest and the existing vulnerability the highest.
  - First priority: From influent / grit chamber to aeration to discharge to the river. This reinforces the primary treatment process.
  - Second priority: From influent to secondary clarifier (at least clarifier 3, 60-foot) to disinfection to discharge to the river. This reinforces secondary treatment process. Included are the sludge pipes from the secondary clarifier.
  - Third priority: From secondary clarifiers to tertiary treatment to the disinfection of discharge to the river or to tertiary water users (golf course).

- Fourth priority: Pipeline from the WWTP to the tank serving the tertiary water user (golf course).
- Fifth priority: Ensure tank at Northwood Golf Course is seismically robust.

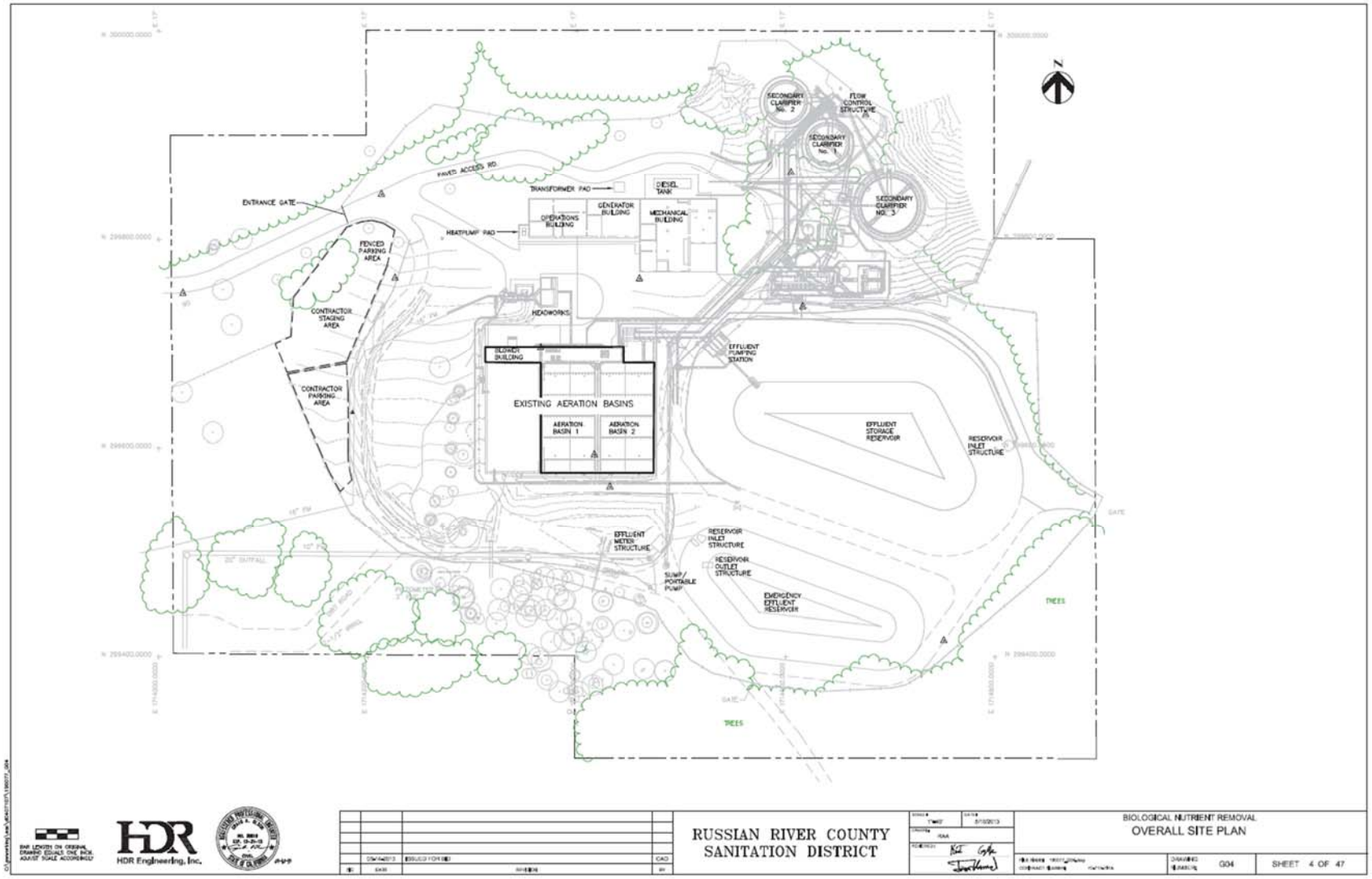


Figure 9: RRCSD WWTP Site Plan in 2013

Figure 10: Buried Piping for Clarifier (note the offset of top-most coupling)

Figure 4: Attached Piping for Filter Tanks (no flexible connections)

4.5.2.4 Structures at the WWTP

There are several buildings at the WWTP, and most date to the original plant construction. The style of construction is reinforced masonry.

There are three building structures on the north side of the plant as shown on Figure 3:

- The westernmost building includes control, administration, and water quality lab. This is a two-story building with a gable roof and is labeled the Operations Building.
- The central building contains the emergency generator and is labeled the Generator Building. It is a single story building with a flat roof. The fuel tank for the emergency generator is currently located uphill of the building, and is anchored. The fuel pipe from the fuel tank to the emergency generator building is supported by the fuel tank that sits on two small concrete blocks on fill.
- The easternmost building contains chemical-mixing equipment and is labeled the Mechanical Building. This is a tall single-story building with a gable roof.

To accommodate the slope of the site, each of these three buildings is partially buried on the north site. The solid waste handling building is a rectangular two-story building made of reinforced masonry. Pipes and conduits between the solid waste building and the adjacent control building should be able to sustain at least one inch of differential movement between the buildings.

The blower building is a single-story reinforced masonry structure.

Vulnerabilities

All of these buildings were apparently designed for seismic forces consistent with 1979 UBC, or about V = 0.18W. For inertial loading, this should be sufficient to provide reasonably good performance at PGA = 0.34g for long-duration shaking.

It is suspected that there is ongoing slope movement in this area of the site, and this has led to partial separation between the solid waste building and the adjacent control building (Figure 12).

Mitigations

Upgrading the fuel pipe that provides fuel from the fuel tank to the emergency generator to accommodate up to three inches of differential movement is recommended.

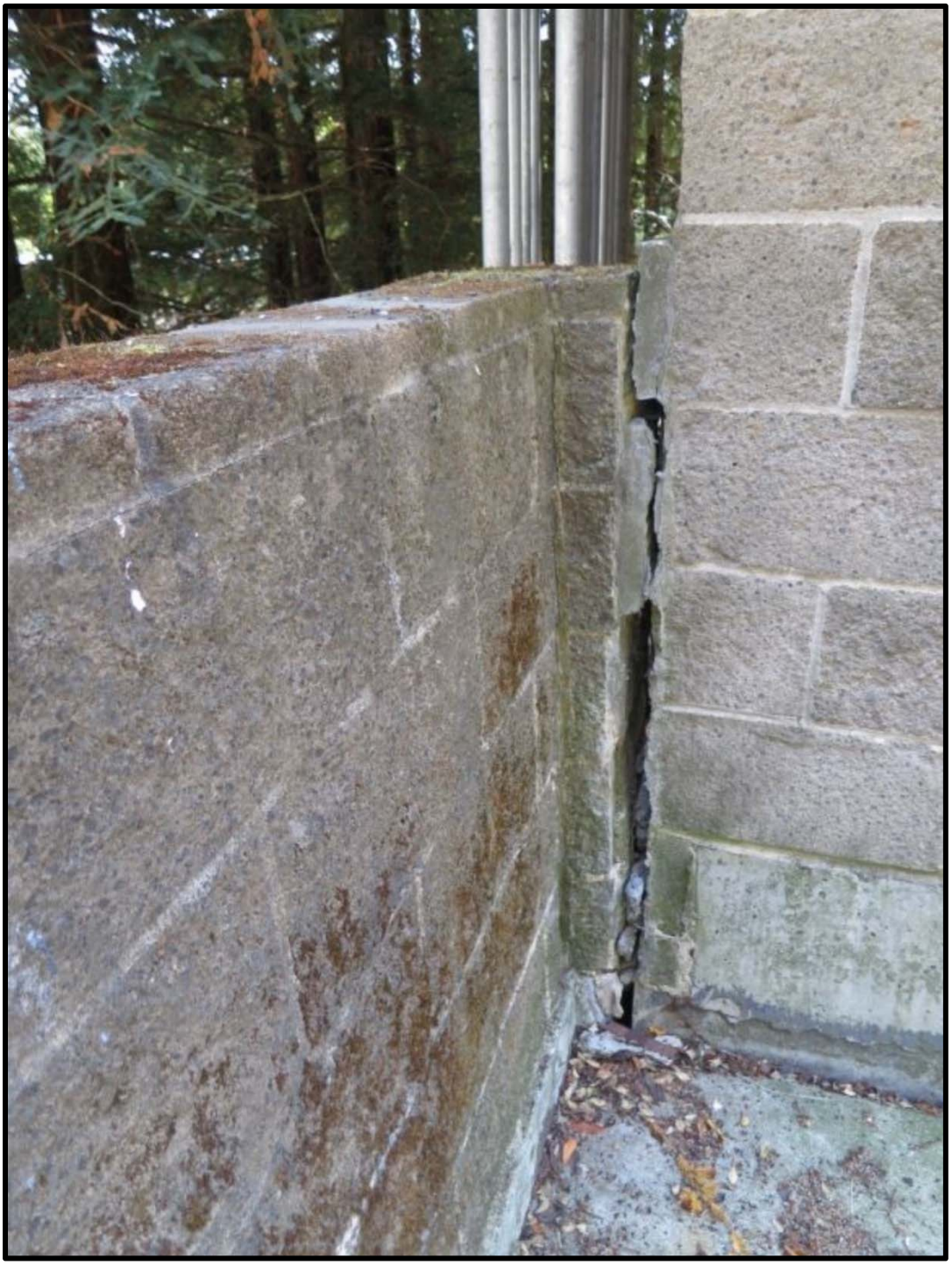


Figure 5: Separation of Parapet Wall (control building) from Solid Waste Building

4.5.2.6 Flocculation Tank

There is a flocculation tank in a rectangular concrete vault. From an inertial point of view, the concrete vault is adequate to handle ground-shaking hazards.

Vulnerabilities

Adjacent to the flocculation tank is a vertical chemical tank (plastic). The plastic tank is tied down with steel cables to prevent rocking (and sliding to a lesser extent) under seismic motions. Although the steel cables are adequate for inertial loads, the attached pipes may be damaged if there are PGDs.

Mitigations

None recommended

4.5.2.7 Ultraviolet Treatment and Filters

Vulnerabilities

The UV system is composed of several arrays of vertically-oriented glass tubes that are inserted into the water. It is unknown if such a system has undergone strong earthquake shaking in the past, and it is possible that rattling of the glass tubes within or above the water will result in occasional glass breakage.

The UV treatment system is located under a steel frame, which is adequate for inertial loading.

Adjacent to the UV system are two steel water-holding tanks for the tertiary filters resting on a concrete pad that do not appear to be anchored. Assuming the tanks are full of water during an earthquake, the tanks could slide sideways a few inches; this would lead to damage to several of the attached pipes.

Mitigations

For purposes of this report, it is suitable to allow for UV System damage under an earthquake and to have plans to make repairs within two weeks (for sporadic damage of tubes) or 12 weeks (for major damage).

It is recommended that the water-holding tanks be anchored and all attached pipes be upgraded to accommodate up to three inches of differential movement.

4.5.2.8 Ponds

Vulnerabilities

The ponds are cut into the site; possibly with fill at the southern embankments. The slopes are lined with asphalt-type material. Under strong shaking, sloshing of water out of the ponds (if full) will occur; this is considered acceptable.

Mitigations

None recommended.

4.5.2.9 Housekeeping

The term "housekeeping" refers to two types of seismic issues:

1. Equipment with inadequate anchorage / restraint and whose failure would impact plant operations. For example: switchgear.
2. Items with inadequate anchorage / restraint and whose failure might result in some losses, but are unlikely to impact plant operations. For example: storage cabinets and suspended ceilings over office areas.

Vulnerabilities

The following housekeeping items were assessed:

- The emergency generator uses manufacture-supplied isolation mounts. The start-up battery for the emergency generator is adequately installed.
- Air blowers and blowers were adequate.
- A chemical mixing tank is anchored.
- A water heater tank is not anchored.
- Electric switchgear cabinets in the control building (nine bays) and the blower building have unknown anchorage.
- Two vertical air tanks are unanchored.
- House transformers were anchored.
- The suspended ceiling over an office room (containing SCADA equipment) is likely non-seismic. There are no fire sprinkler heads through the tiles.
- A six-bay switchgear cabinet is located in the control building in the SCADA room; anchorage was not confirmed.
- A SCADA cabinet is marginally anchored.
- There is a loose computer in the SCADA room.
- There are several unanchored storage shelves in the water quality lab.
- There are counter-top ovens (and similar) devices in the water quality lab. These devices have small counter-top lips to prevent slippage to the floor below. There are several floor-mounted storage shelves and refrigerators that are unanchored / on wheels in the water quality lab.
- There is a counter-top oven / device in the water quality lab. This has no counter-top lip to prevent slippage to the floor below.
- The SCADA cabinets in the blower building are anchored.
- There is an unanchored cabinet in the blower building.

Mitigations

All cabinets that are unanchored/ marginally anchored should have anchors/ restraints based on PGA = 0.34g with Ip = 1.5, where anchor bolts have a factor of safety of at least two for these loads (R = 1). All shelves and racks are recommended to be anchored and the shelves should be

modified to have restraints to prevent items from sliding onto the floor. Adding low cost restraint devices to lab equipment would prevent the equipment from rocking during ground shaking.

For very strong shaking, it is recommended to install supplemental snubbers to the emergency generator.

A seismic-rated ceiling could be installed, but this is considered low priority because falling tiles can be readily addressed post-earthquake, and there is little life safety risk.

4.5.2.10 Landslides

There are series of geologic and seismic conditions that could adversely affect the improvements and operations of the plant, both in a static and seismic situation. The plant has already been adversely affected by a debris flow circa 1992 that originated off-site on the slopes and traveled between the clarifier area of the plant and the mechanical building, into the downslope effluent storage reservoir.

Vulnerabilities

There is little to no protection from slope movements to protect the facility at this site. The slopes immediately adjacent and upslope of the site are prone to landsliding, including relatively fast-moving and laterally extensive debris flows. Giblin Associates (2002) performed an evaluation of the site in preparation for the 2003 Third Unit Process Project and reported that debris from earlier flows were approximately six feet deep at the site of the 60-foot clarifier. Additionally, a large debris flow in 1992 was triggered by heavy rains when debris extended into the effluent reservoir. The paths of debris flows are shown on Figure 13.

Mitigations

All of the slopes bordering the northern boundary of the site are at high risk for landslides, both statically (due to seasonal heavy rains) and seismically (due to intense shaking). Giblin recommended improvement in upslope drainage to reduce the risk of future rain-initiated debris flows. Debris slides can be initiated by seismic shaking, and although improved drainage will reduce the risk, the risk remains substantial.

A comprehensive geologic and geotechnical assessment should be performed on these slopes (and offsite properties) to refine the areas of existing and potential landslides and develop impact mitigation alternatives in the case of a landslide. Design mitigation scheme could include construction of debris diversion / catchment walls or impact fences to protect the essential operations of the treatment plant. (See Figure 14.) These could be deep-founded structures (possibly soldier-pile walls) intended to deflect the debris away from the primary operational areas or catchment-type fences that prevent the debris from crossing the site or impacting improvements.

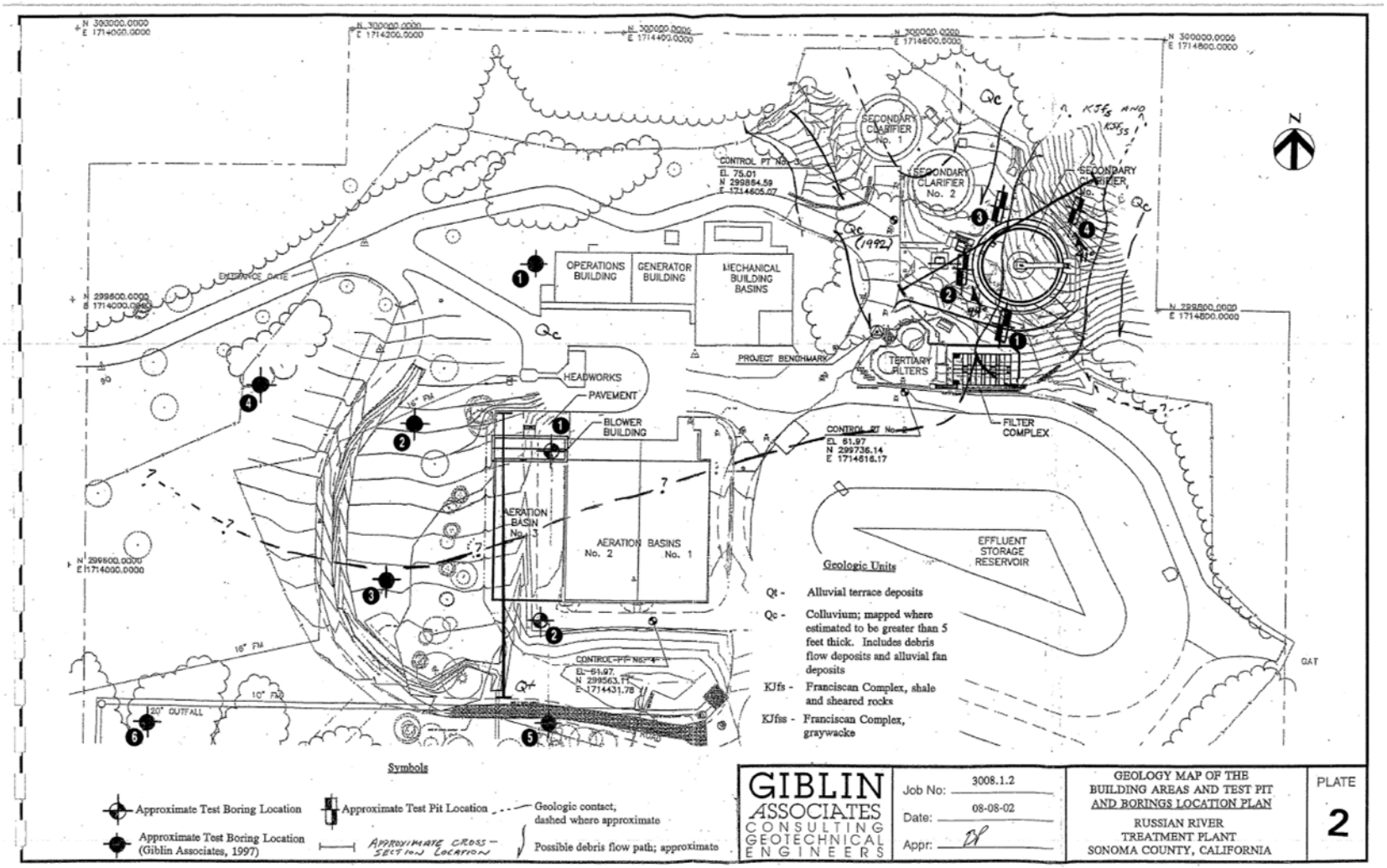


Figure 6: Debris Slides at Russian River WWTP

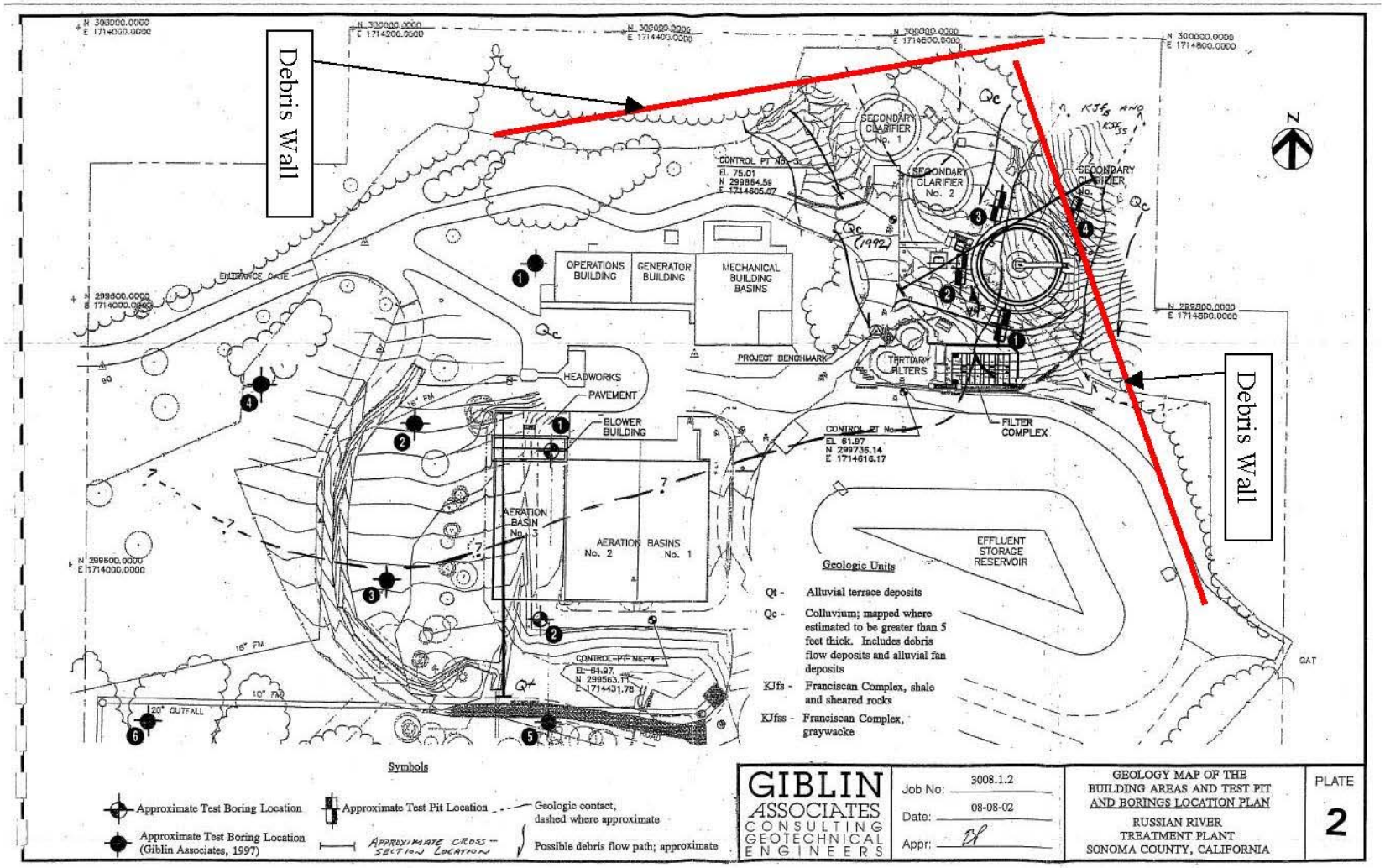


Figure 7: Recommended Debris Diversion Structures at RRCSD WWTP

4.5.3 Lift Stations

There are 11 lift stations in the RRCSD collection system. The lift stations are generally seismically rugged, being comprised of a wet well, pumps, motors, and switchgear. All lift stations have submersible pumps. The following is a listing of the lift stations:

1. S57. Drake Estates (2 pumps)
2. S56. Rio Nido (3 pumps)
3. S58. Drake Road (2 pumps)
4. S54. Laughlin Road (2 pumps)
5. S55. Watson Road (2 pumps)
6. S53. Guerneville Lift (3 pumps)
7. S59. Beanwood (3 pumps)
8. S60. Center Way (2 pumps)
9. S52. Guernewood Park (2 pumps)
10. S51. Main (3 pumps)
11. S61. Vacation Beach (2 pumps)

Vulnerabilities

As part of this project, several lift stations were visited, but in-depth inspections were not completed, nor were the design drawings for the lift stations reviewed. Based on these limited inspections, the following assumptions have been made:

- The lift stations are located in areas not prone to liquefaction or were designed to resist buoyancy should liquefaction occur.
- The lift stations are not prone to lateral spreads due to liquefaction.
- As part of implementation of a seismic improvement plan, these assumptions should be validated.

Mitigations

It is recommended that RRCSD make provisions to have on hand enough emergency generators to operate critical lift stations in the system for 48 hours following a San Andreas M 8 earthquake. Of particular concern is the Vacation Beach Lift Station, which is powered by the Russian River Treatment plant generator. Guernewood Park, Guerneville, and Beanwood Lift Stations are powered by the Main Lift Station, which contains an old generator. The generator at the Main Lift Station should be replaced, the system providing the distribution of power should be evaluated, and portable generators should be made available in accordance with the results of evaluation of the electrical distribution system. This presumes dry weather flows at the time of the earthquake. By "critical," it is meant that, under dry weather flows, a lift station is needed to operate within 48 hours of the earthquake, otherwise a sewage backup and spill will occur. This presumes there will generally be potable water flowing after the earthquake.

After 120 hours, it is reasonable to assume that PG&E power will be restored to the Main Lift station, but emergency generators may still be needed for a few of the lift stations. All lift stations should be outfitted with quick-connect couplings (sometimes called "pigtails") to allow rapid hook-up to an emergency generator (i.e. just plug in, use a manual transfer switch, and without need for an electrician to wire the emergency generator into the bus).

4.5.4 Emergency Response

This report addresses only the Russian River County Sanitation District. For emergency response planning, it would be prudent to collectively use the resources from all of the sanitation systems owned and/or operated by the Water Agency.

Vulnerabilities

A number of pipes in the RRCSD collection system may be damaged or broken due to liquefaction.

Mitigations

It is recommended that RRCSD 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 in the RRCSD can be made. Specifically, the following equipment is recommended:

- Two sets of pumps (with engine sets).
- 1,200 feet of 12-inch diameter hose. This should be enough hose to bypass two sets of manholes spaced about 500 feet apart. The hose should be in variable lengths to allow for different actual lengths that might be needed.
- Include in the emergency response plan the ability to obtain additional pumps and hose from other agencies, should the need arise.

Include one pump / engine set and half the hose as "high" priority; the second pump / engine set and the remaining hose should be considered "moderate" priority.

5. Mitigation Goals, Objectives, and Actions

RRCSD is directly responsible for providing wastewater sanitation services to over 3,161 single-family dwellings in the unincorporated areas of Rio Nido, Guerneville, Guernewood Park, and Vacation Beach. The RRCSD is the sole entity providing public wastewater collection, treatment, and disposal services for these areas. The public relies on the domestic and industrial sanitation services supplied by the RRCSD to be functional in both emergency and non-emergency circumstances.

The RRCSD'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 RRCSD'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 RRCSD takes this responsibility seriously and has developed this plan to systematically address the vulnerabilities of its sanitation system. In this capacity, the RRCSD'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 RRCSD 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 RRCSD'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 RRCSD'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 RRCSD-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 RRCSD'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 RRCSD'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 the steel tertiary filter tanks at the treatment plant.

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

2.1.3 Seismically retrofit piping at the treatment plant to allow for differential movement.

2.1.4 Develop and implement strategy to reinforce clarifier and/or modify operational procedures to mitigate seismic risk.

2.1.5 Seismically retrofit suspended ceiling over SCADA Control Room.

2.1.6 Install equipment to protect the emergency generator against voltage spikes.

Objective 2.2: Provide additional storage capacity to enhance operational ability to store wastewater during and after a natural disaster.

Mitigation Actions:

2.2.1 Develop and implement a design strategy to provide additional storage capacity at the treatment plant to enhance operational ability to store wastewater during and after a natural disaster while repairs are made to restore treatment capabilities.

Objective 2.3: Implement measures to reduce the potential damage from landslides and debris flows at the treatment plant.

Mitigation Actions:

2.3.1 Conduct geotechnical assessment of the slopes bordering the Northern boundary of the treatment plant.

2.3.2 Develop and implement a design strategy to mitigate the effects of landslides and debris flows at the WWTP.

Objective 2.4: Develop and implement a design strategy to mitigate the effects of earthquakes in areas of potential liquefaction or significant differential movement.

Mitigation Actions:

2.4.1 Conduct site specific geotechnical assessment of the portions of the WWTP that are within the very high or high liquefaction zone.

Objective 2.5: Develop and implement a design strategy to minimize the potential effects of wild-land fire.

Mitigation Actions:

2.5.1 Develop and implement a design strategy to upgrade the asphalt shingle/tar and gravel roofs at the treatment plant to mitigate the effects of wild-land fire.

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 Develop and implement a design strategy to mitigate the effects of liquefaction on the collection system (including lift stations and related force mains) in areas that have very high and high liquefaction potential.

3.1.2 Develop and implement a design strategy to mitigate the effects of liquefaction on the collection system (including lift stations and related force mains) in areas that have moderate liquefaction potential.

3.1.3 Develop and implement a design strategy to mitigate the effects of liquefaction on the tertiary recycled water system.

3.1.4 Conduct condition assessment of critical pipelines.

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

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 embankment failure/landslides on portions of the sewer collection system that are in close proximity to creeks, drainage channels or steep slopes.

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

Mitigation Actions:

3.3.1 Develop and implement a design strategy to mitigate the effects of high stream flows (e.g., erosion and debris flows) on portions of the sewer collection system at creek crossings where the burial depth is unknown and assumed shallow.

3.3.2 Develop and implement a design strategy to elevate and/or protect pump stations from flood related damage.

Objective 3.4: Enhance District's ability of supplying emergency power at the lift stations during power outages.

Mitigation Actions:

3.4.1 Install quick connects at lift stations to allow emergency generator to be operated if loss of power occurs.

3.4.2 Conduct assessment of power distribution system to lift stations.

3.4.3 Develop and implement a design strategy to replace the existing emergency backup power system at the Main Lift Station.

Objective 3.5: Develop and implement a design strategy to minimize the potential effects of wild-land fire.

Mitigation Actions:

3.5.1 Develop and Implement a design strategy to mitigate the effects of wild-land fire on critical facilities.

6. Plan Implementation

The RRCSD 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 RRCSD 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 RRCSD'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 16 inch force main which serves the whole RRCSD 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.** Mitigation 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 RRCSD 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	1.1.1	Develop RRCSD-specific measures to include in an integrated Sonoma County Water Agency emergency response and recovery plan for sanitation operations.	• Reduces service disruption • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness • Can be completed within existing authority	• Ongoing effort and costs to maintain plan and train staff on implementation
		1.2.1	Enhance the reliability of SCADA operations by upgrading network hardware, computer hardware, and radio hardware.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Reduces energy use • Can be completed within existing authority	• Ongoing effort and costs to maintain system and train staff on implementation
		1.3.1	Obtain flexible hoses, emergency pumps, generators, and related emergency response equipment to enhance the RRCSD's ability to restore service in the collection system after a natural disaster.	• Reduces service disruption • Reduces risk of releasing inadequately or untreated wastewater • Can be completed within existing authority	F
		2.1.6	Install equipment to protect the emergency generator against voltage spikes.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Can be completed within existing authority	
		2.1.1	Seismically restrain/anchor the steel tertiary filter tanks at the treatment plant.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Can be completed within existing authority	• Ongoing operational effort for some systems
		3.4.1	Install quick connects at lift stations to allow emergency generator to be operated if loss of power occurs.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Can be completed within existing authority	
		3.5.1	Develop and Implement a design strategy to mitigate the effects of wild-land fire on critical facilities.	• Reduces service disruption • Reduces asset damage • Improves risk awareness • Can be completed within existing authority	• Requires training to adapt to new standards
		2.1.2	Seismically restrain/anchor miscellaneous equipment at the treatment plant.	• Reduces service disruption • Reduces asset damage • Can be completed within existing authority	• Ongoing operational effort for some systems
		2.1.4	Develop and implement strategy to reinforce clarifier and/or modify operational procedures to mitigate seismic risk.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness • Can be completed within existing authority	• Capital cost
		3.1.5	Update construction standards to address liquefaction potential along the collection system.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Can be completed within existing authority	• Requires additional resources to implement public outreach and training to adapt to new standards • Increased cost to new development
	B1	2.1.3	Seismically retrofit piping at the treatment plant to allow for differential movement.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Can be completed within existing authority	• Capital cost
		3.4.2	Conduct assessment of power distribution system to lift stations.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Reduces energy use • Improves risk awareness • Can be completed within existing authority	• Facilitates potential future mitigation efforts, but does not in itself mitigate any hazard
		3.4.3	Develop and implement a design strategy to replace the existing emergency backup power system at the Main Lift Station.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Reduces energy use • Improves risk awareness • Can be completed within existing authority	• Capital cost

Tier	Priority	LHMP Action	Description	Benefits (Pros)	Costs (Cons)
Tier 1	B1	3.1.4	Conduct condition assessment of critical pipelines.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness • Can be completed within existing authority	• Facilitates potential future mitigation efforts, but does not in itself mitigate any hazard
		3.1.1	Develop and implement a design strategy to mitigate the effects of liquefaction on the collection system (including pump stations and related force mains) in areas that have very high and high liquefaction potential.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness • Can be completed within existing authority	• Capital cost • Community impacts • Construction complexities • Extended implementation timeline
		2.3.1	Conduct geotechnical assessment of the slopes bordering the Northern boundary of the treatment plant.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness • Can be completed within existing authority	• Facilitates potential future mitigation efforts, but does not in itself mitigate any hazard
		2.4.1	Conduct site specific geotechnical assessment of the portions of the WWTP that are within the very high or high liquefaction zone.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness • Can be completed within existing authority	• Facilitates potential future mitigation efforts, but does not in itself mitigate any hazard
		3.2.1	Develop and implement a design strategy to mitigate the effects of embankment failure/landslides on portions of the sewer collection system that are in close proximity to creeks, drainage channels or steep slopes.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness	• Capital cost • Environmental impacts • Community impacts • Permitting challenges • Construction complexities • Extended implementation timeline
		3.3.2	Develop and implement a design strategy to elevate and/or protect pump stations from flood related damage.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness • Can be completed within existing authority	• Capital cost
Tier 2	A2	2.1.5	Seismically retrofit suspended ceiling over SCADA Control Room.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Can be completed within existing authority	
	B2	3.1.3	Develop and implement a design strategy to mitigate the effects of liquefaction on the tertiary recycled water system.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Reduces water use • Improves risk awareness • Can be completed within existing authority	• Capital cost • Community impacts • Environmental impacts
		3.1.2	Develop and implement a design strategy to mitigate the effects of liquefaction on the collection system (including pump stations and related force mains) in areas that have moderate liquefaction potential.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness • Can be completed within existing authority	• Capital cost • Community impacts • Construction complexities • Extended implementation timeline
		3.3.1	Develop and implement a design strategy to mitigate the effects of high stream flows (e.g., erosion and debris flows) on portions of the sewer collection system at creek crossings where the burial depth is unknown and assumed shallow.	• Reduces service disruption • Reduces asset damage • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness	• Capital cost • Environmental impacts • Permitting challenges • Construction complexities • Extended implementation timeline
		2.2.1	Develop and implement a design strategy to provide additional storage capacity at the treatment plant to enhance operational ability for storage during and after a natural disaster while repairs are made to restore treatment capabilities.	• Reduces service disruption • Reduces risk of releasing inadequately or untreated wastewater • Improves risk awareness • Can be completed within existing authority	• Capital cost
		2.5.1	Develop and implement a design strategy to upgrade the asphalt shingle/tar and gravel roofs at the treatment plant to mitigate the effects of wild-land fire.	• Reduces service disruption • Reduces asset damage • Can be completed within existing authority	• Capital cost

The RRCSD'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 B1 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 RRCSD, as part of its maintenance program, has undertaken some of the objectives identified in Chapter 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 RRCSD. These actions include enhancing the Sonoma County Water Agency's Emergency Operations Center and ensuring emergency backup power is available for critical facilities (including RRCSD).

On behalf of the RRCSD, 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 RRCSD 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 RRCSD 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 RRCSD's commitment to reducing its hazard vulnerability and improving the reliability of its system is demonstrated by the fact that the RRCSD on its own initiative undertook a system-wide multi-hazard reliability assessment and improvement program. The RRCSD 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 RRCSD 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 RRCSD will keep the plan "alive" through continued monitoring of the plan goals and objectives. The high priority mitigation actions are being included in the RRCSD's Capital Improvement Plan (CIP). Because of the involvement of the RRCSD's department heads of Planning, Operations, Maintenance and Capital Improvements in the development of the plan, the entire executive management of the RRCSD is committed to implement the goals and objectives of the plan. The department heads will meet annually to review the current LHMP. This team will work together to identify areas, such as climate change research and mitigation where the plan can be updated or improved. New studies and other resources that can be used to assess risks and be integrated into the LHMP update process will be identified and implemented into the LHMP accordingly.

The RRCSD 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 RRCSD's Chief Engineer has been identified as the person responsible to ensure completion of an annual evaluation to monitor the implementation, update and assess the effectiveness in achieving the plan's stated goals and objectives. As required by DMA2000, this plan will be updated every five years. The RRCSD 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 RRCSD, 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. Our planning process will begin by developing an outreach plan to engage stakeholders and the public in the mitigation planning process. Stakeholders will include Sonoma County Office of Emergency Services, Sonoma County Department of Public Works, Sonoma County Regional Climate Protection Authority; cities/counties/local governments; state and federal agencies; Water

Agency water contractors; non-government organizations, service organizations, and the local business community; and the general public.

As part of the approval process the CIP is presented to the RRCSD's Board of Directors in an open public meeting and by virtue of this, progress towards achieving RRCSD's goals and objectives identified in the hazard mitigation plan will also be open for public review and comment. Outreach methods will include public meetings, printed materials, email and websites, surveys, social media, news media, presentations to governing bodies, community events, among other methods.

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Appendices

APPENDIX A – RRCSD FIGURES

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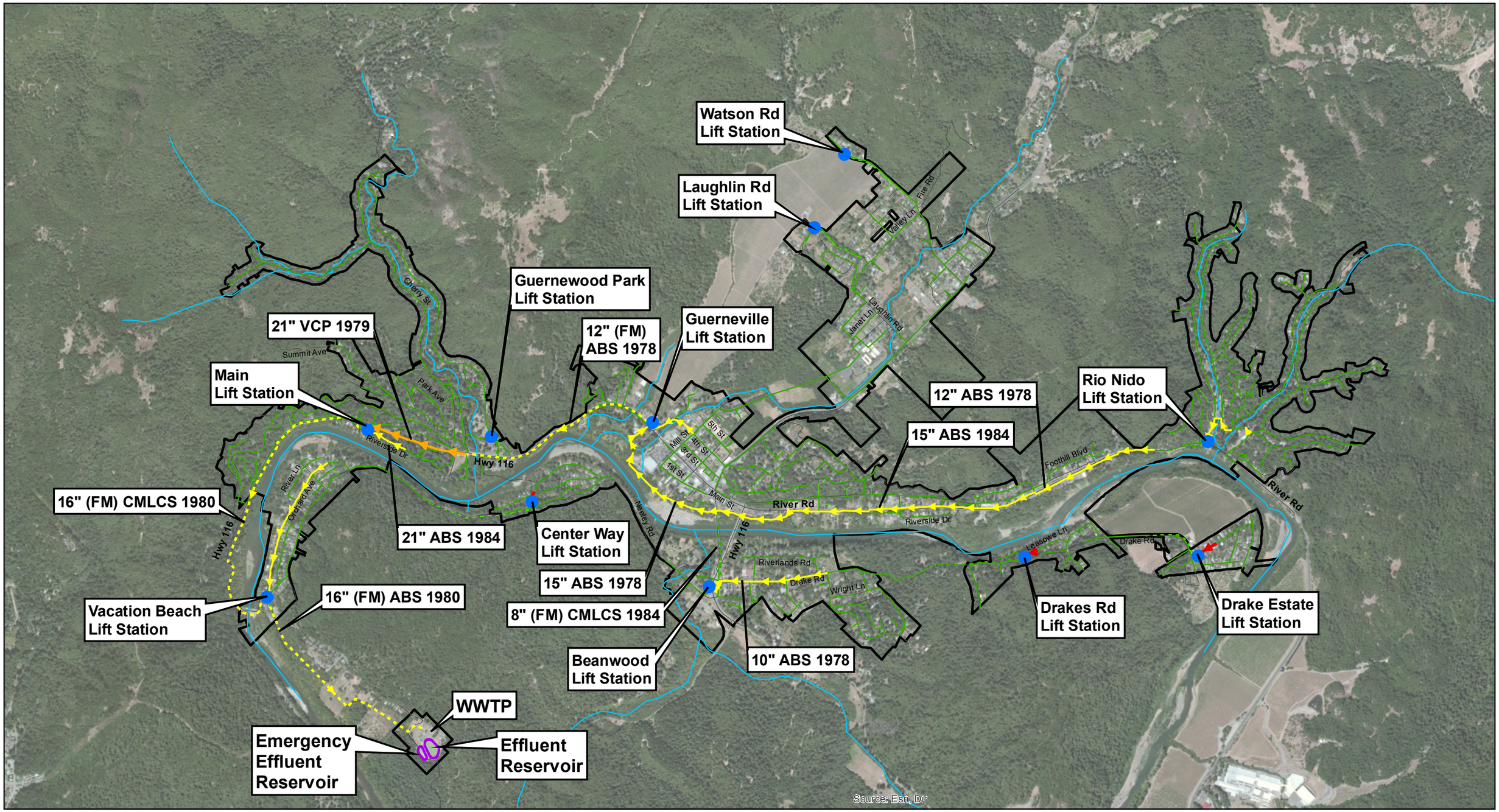

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Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

RRCSD Boundary
Street
Creek
Pump Station
<= 4" Force Main
<= 4" Sewer Main
6" - 8" Force Main
6" - 8" Sewer Main
10" - 16" Force Main
10" - 16" Sewer Main
18" - 21" Sewer Main
24" - 30" Sewer Main

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Revision	2
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Russian River CSD Collection System

Figure RR-1

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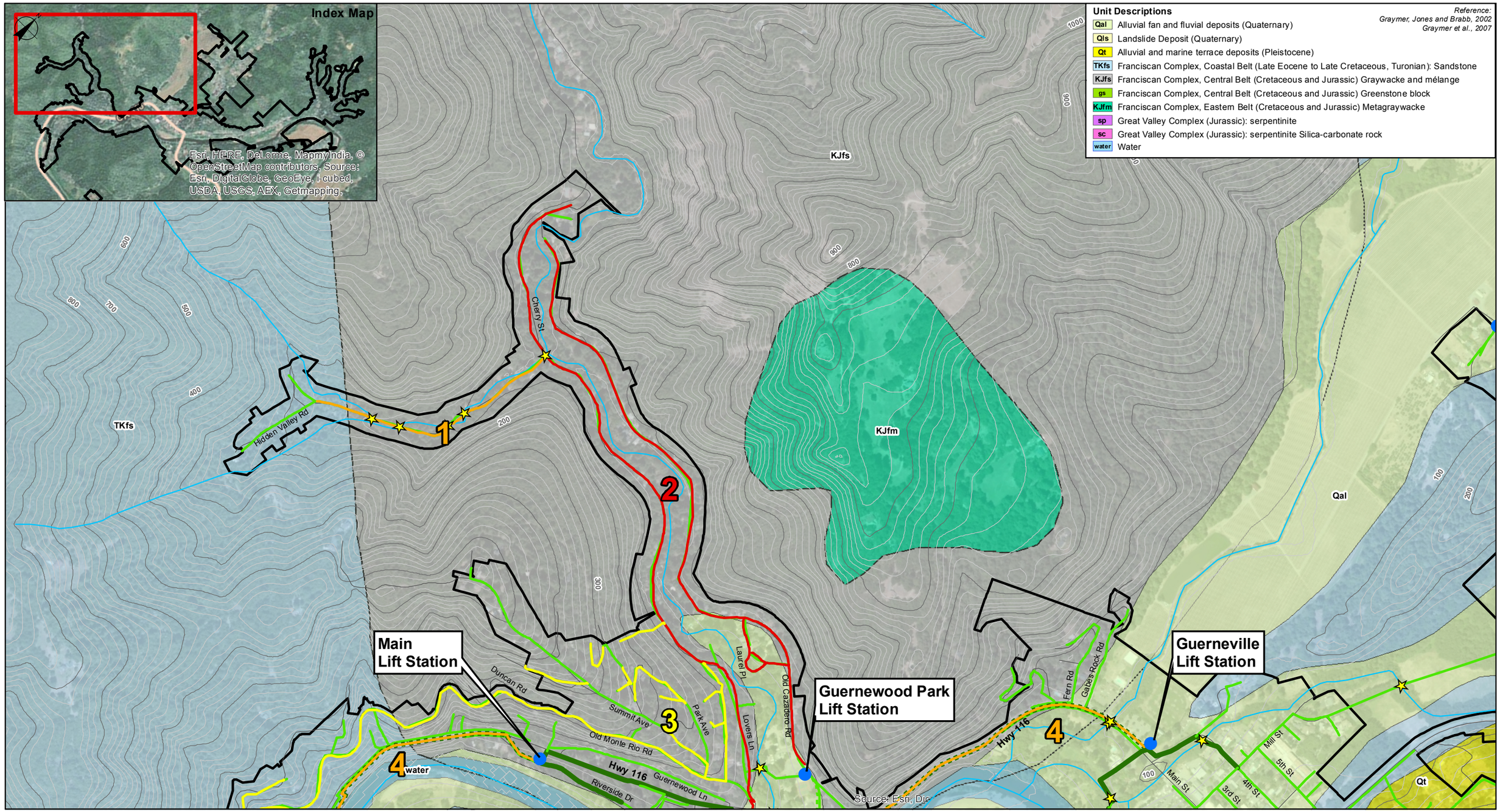

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RRCSD Boundary
Street
Creek
100' Contour
20' Contour
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")

Geologic Hazard Recon Lines & ID

1
2
3
4

Geologic Hazard Recon Point
Pump Station
Crossing Location

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Natural Hazard Reliability Assessment

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Russian River CSD
Geology (1 of 4)

Figure RR-2

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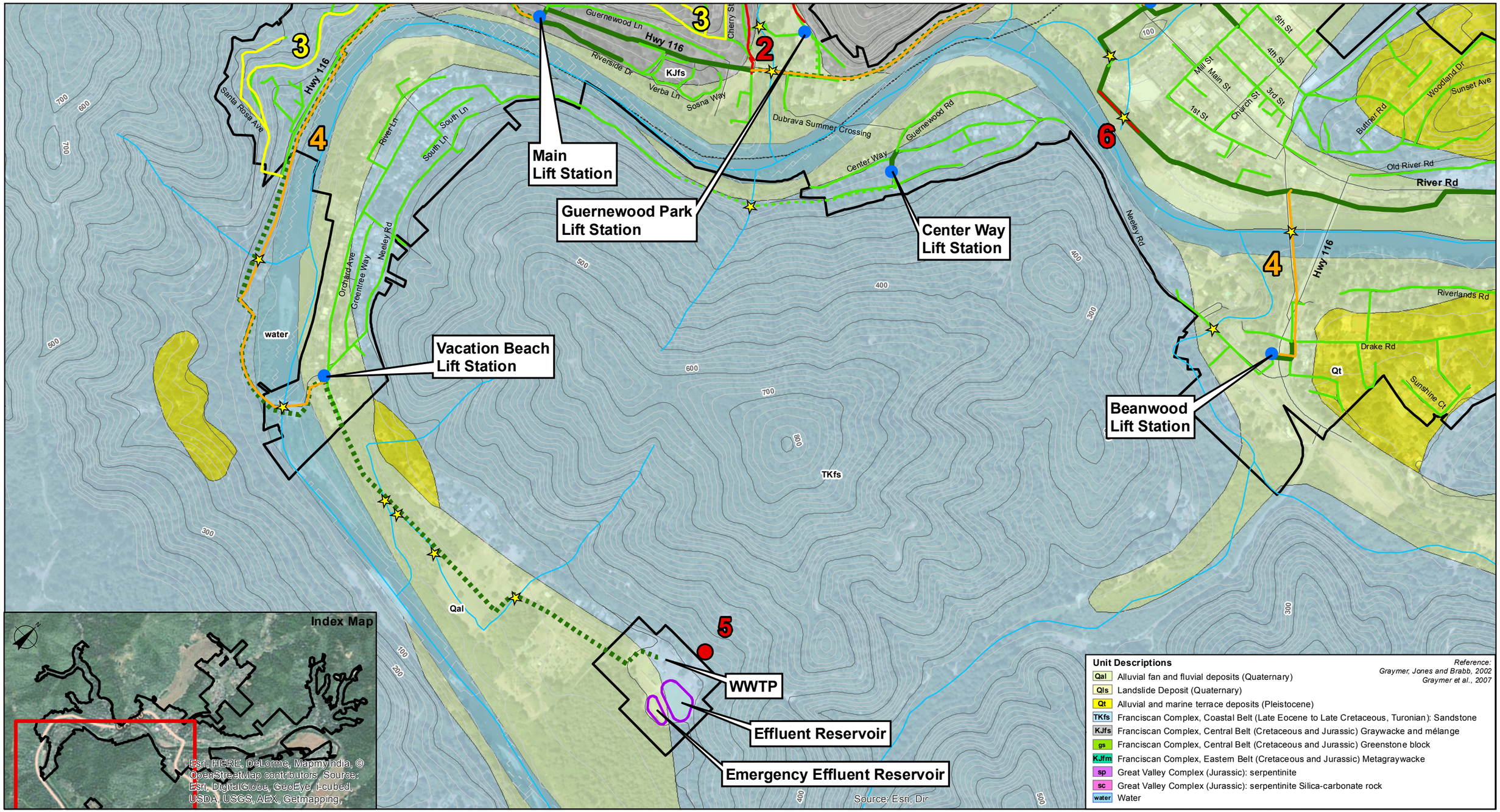

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RRCSD Boundary
Street
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100' Contour
20' Contour
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")

Geologic Hazard Recon Lines & ID

2
3
4
6

Geologic Hazard Reconnaissance Point
Pump Station
Crossing Location

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Russian River CSD
Geology (2 of 4)

Figure RR-3

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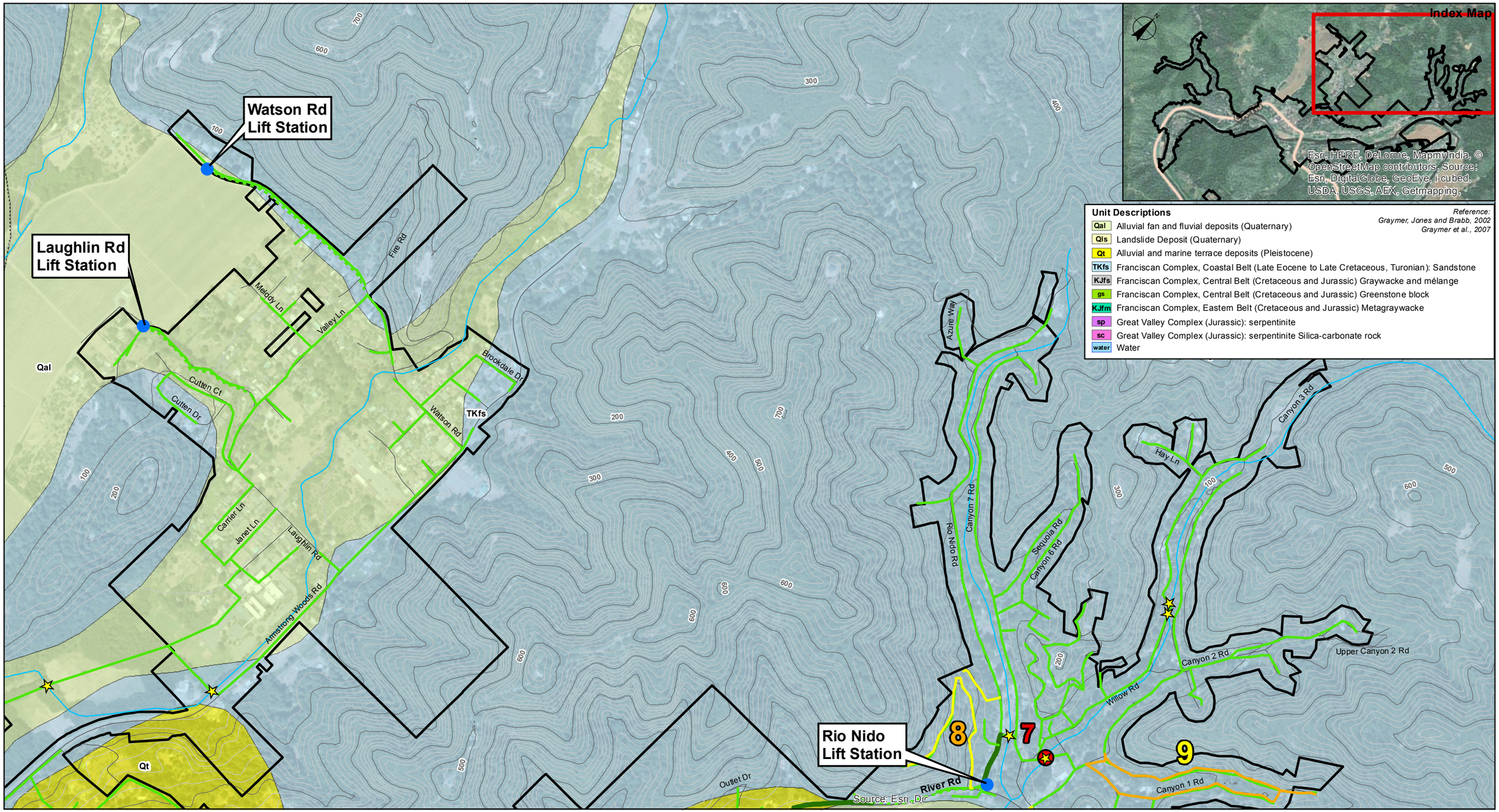

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RRCSD Boundary
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Creek
100' Contour
20' Contour
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
Crossing Location

Geologic Hazard Recon Lines & ID

8
9

Geologic Hazard Reconnaissance Point
Pump Station

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Russian River CSD Geology (3 of 4)

Figure RR-4

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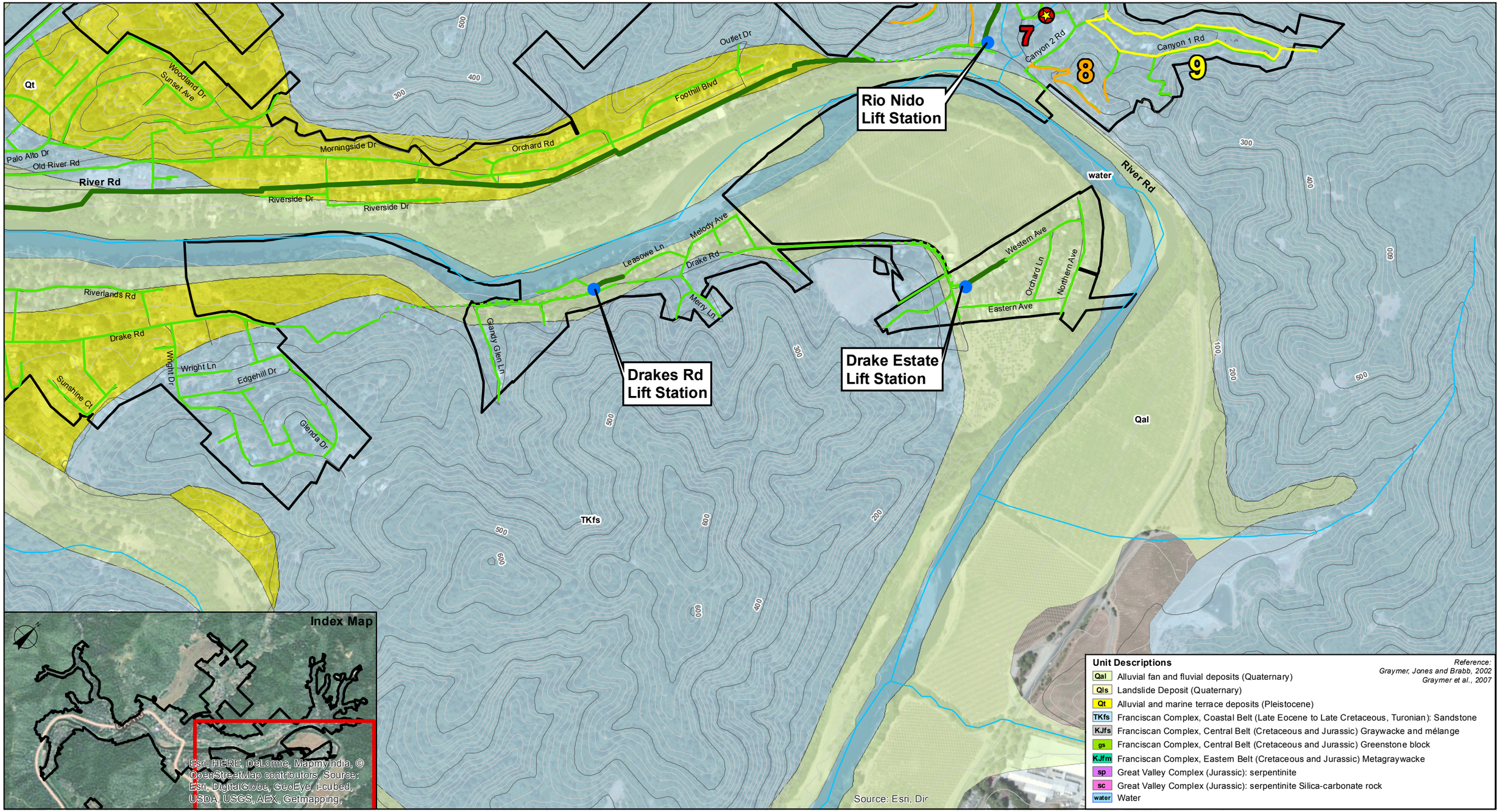

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Geologic Hazard Reconnaissance Point
Pump Station

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Natural Hazard Reliability Assessment

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Russian River CSD
Geology (4 of 4)

Figure RR-5

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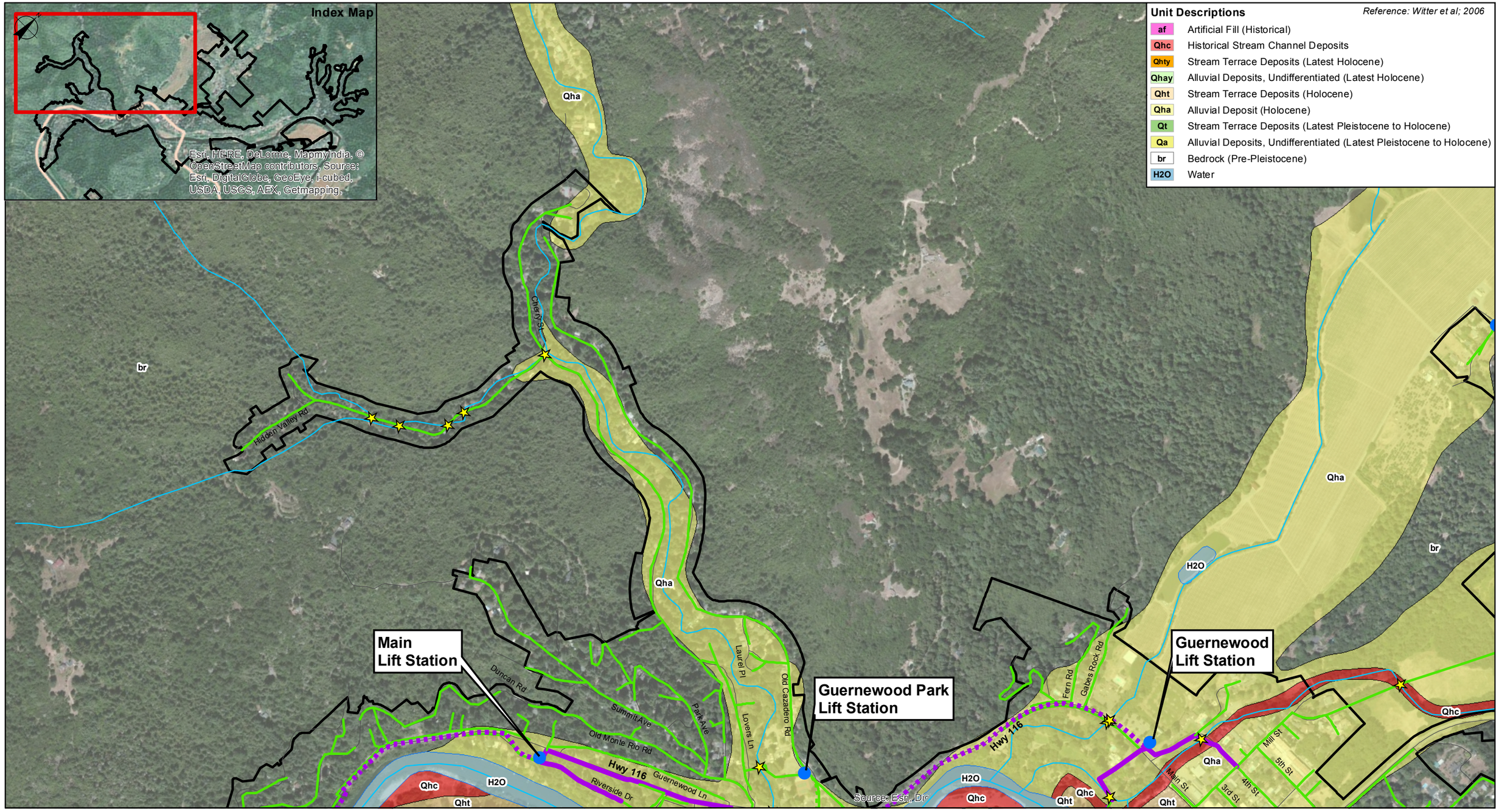

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Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

Job Number	8410200
Revision	2
Date	11 Jun 2015

Russian River CSD
Quaternary Deposits (1 of 4)

Figure RR-6

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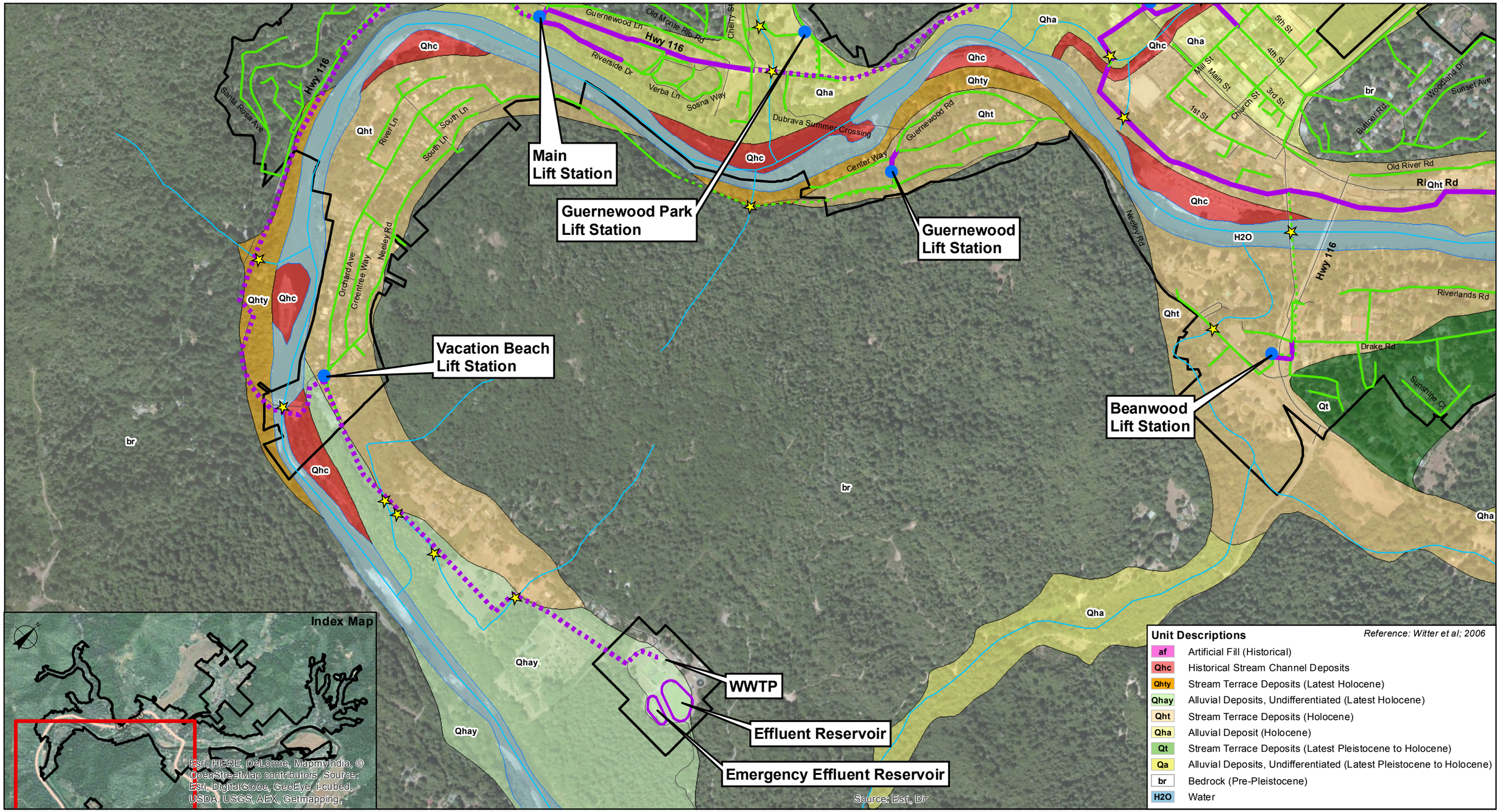

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Feet

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

RRCSD Boundary
Street
Creek
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
Crossing Location
Pump Station

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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Russian River CSD
Quaternary Deposits (2 of 4)

Figure RR-7

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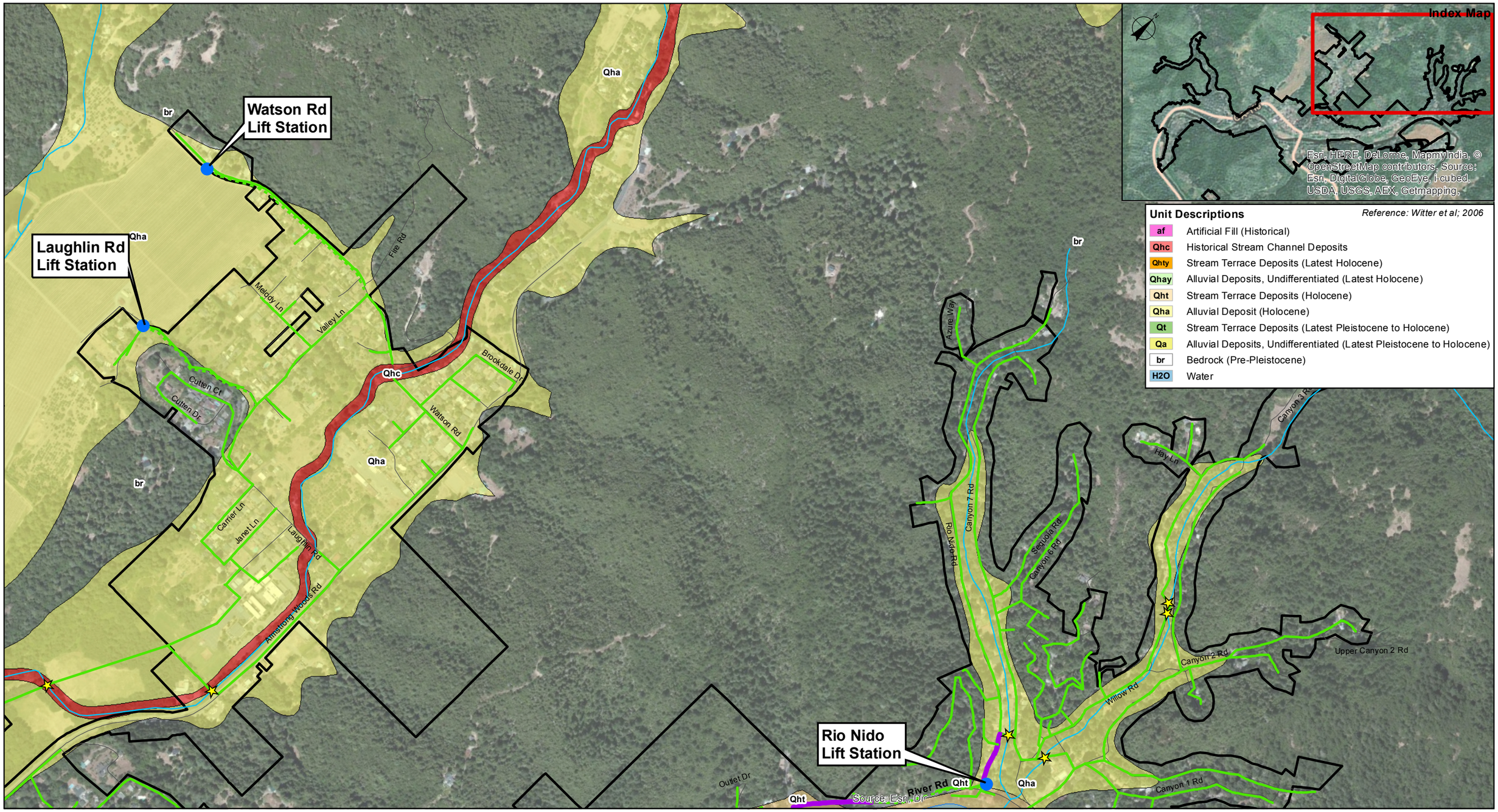

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Feet

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

RRCSD Boundary
Street
Creek
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
Crossing Location
Pump Station

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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Date	11 Jun 2015

Russian River CSD
Quaternary Deposits (3 of 4)

Figure RR-8

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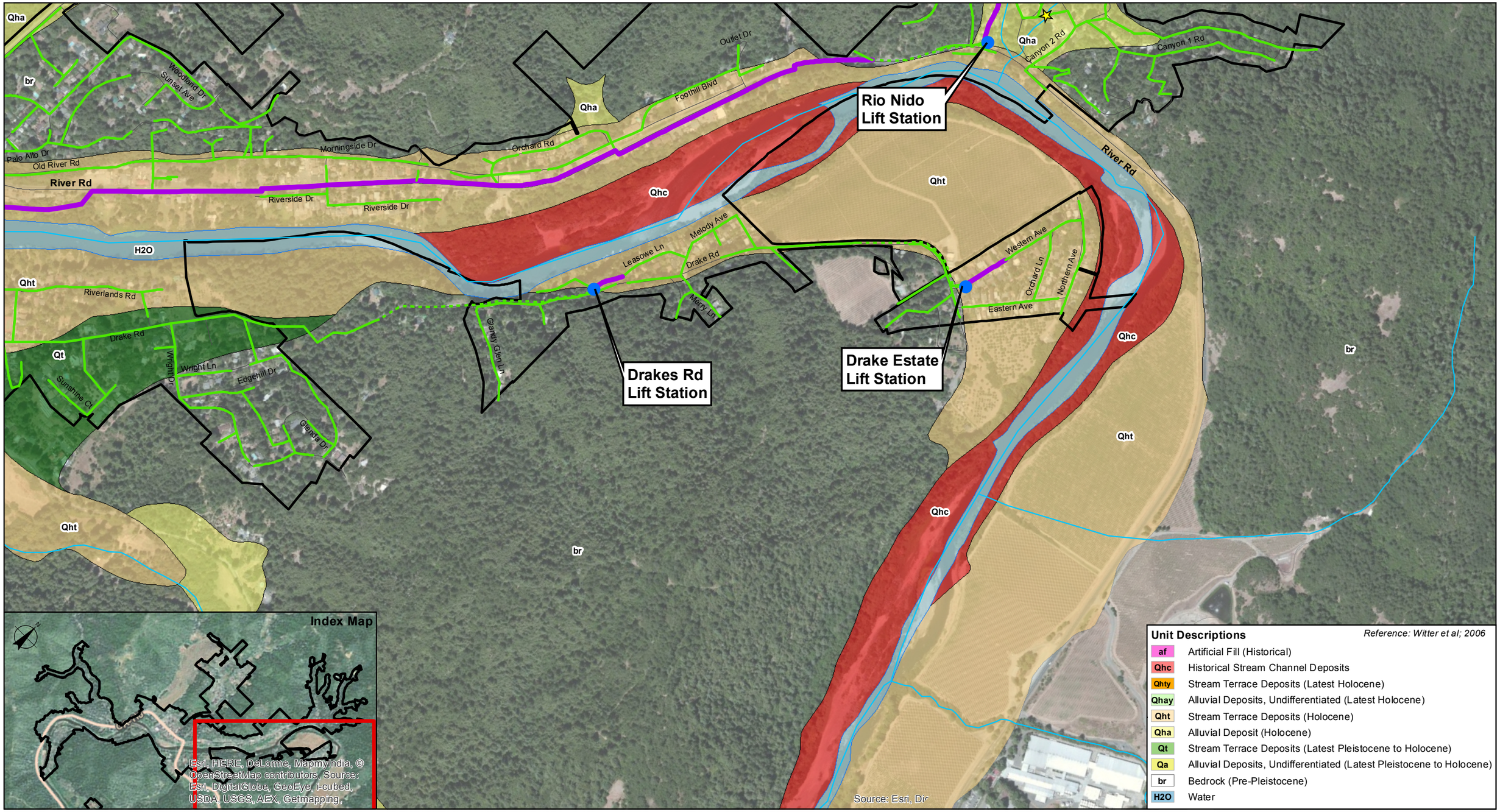

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Feet

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

RRCSD Boundary
Street
Creek
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
Crossing Location
Pump Station

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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Russian River CSD
Quaternary Deposits (4 of 4)

Figure RR-9

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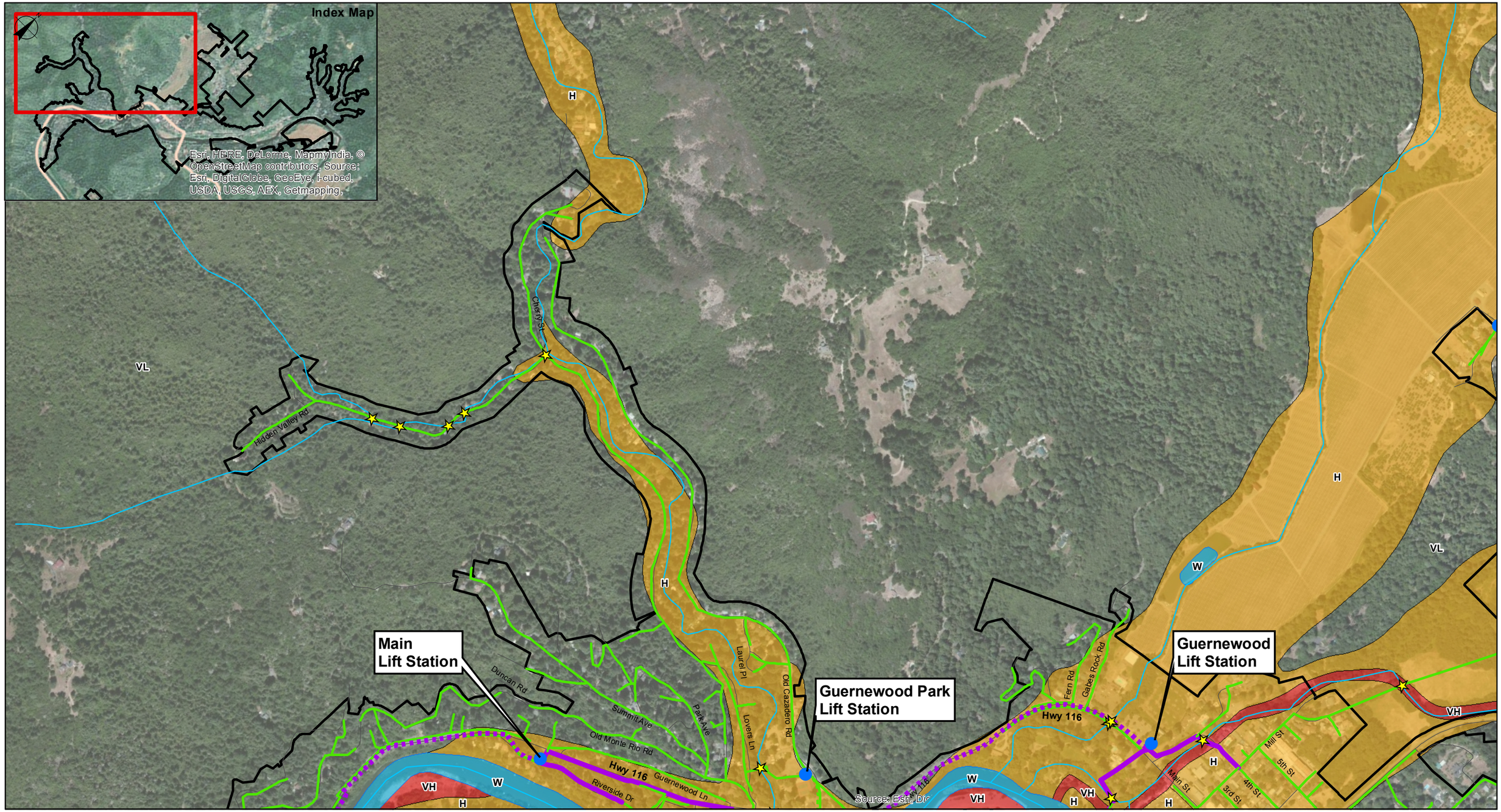

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
contact, well located
water boundary

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

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Revision	2
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Russian River CSD Liquefaction (1 of 4)

Figure RR-10

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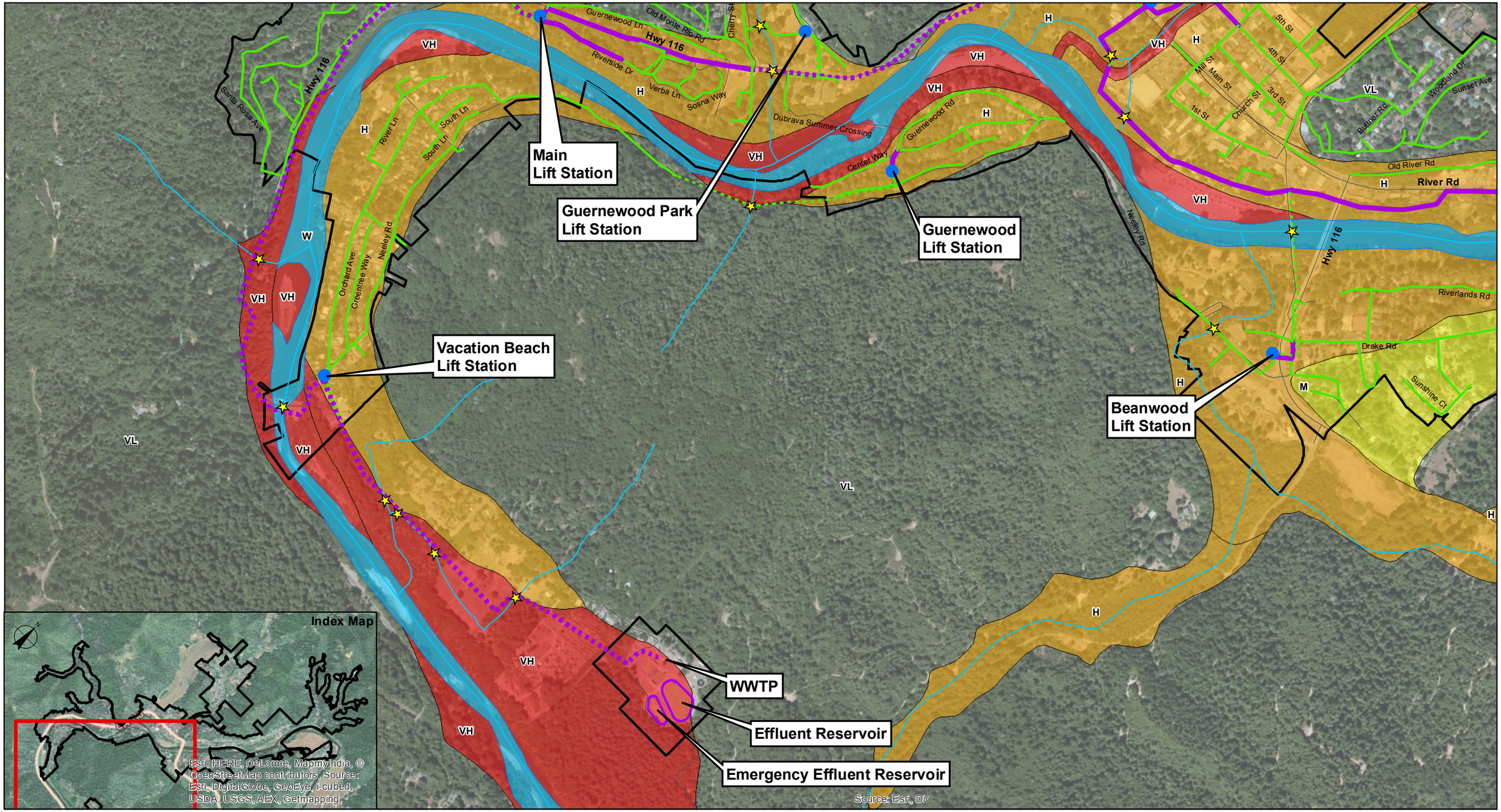

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
contact, well located
water boundary

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

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Russian River CSD Liquefaction (2 of 4)

Figure RR-11

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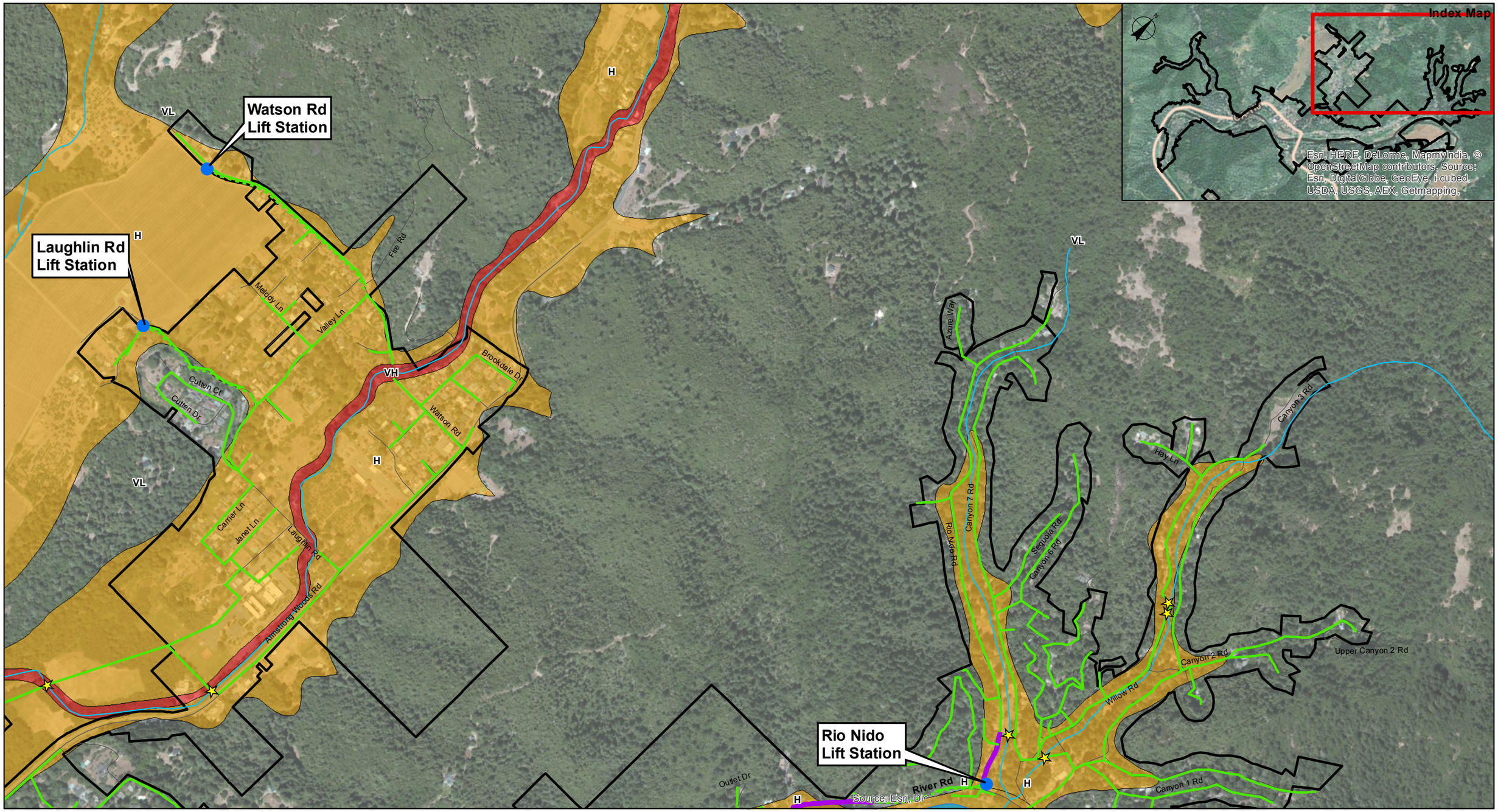

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
contact, well located
water boundary

Liquefaction Susceptibility

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

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Sonoma County Water Agency
Natural Hazard Reliability Assessment

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Russian River CSD
Liquefaction (3 of 4)

Figure RR-12

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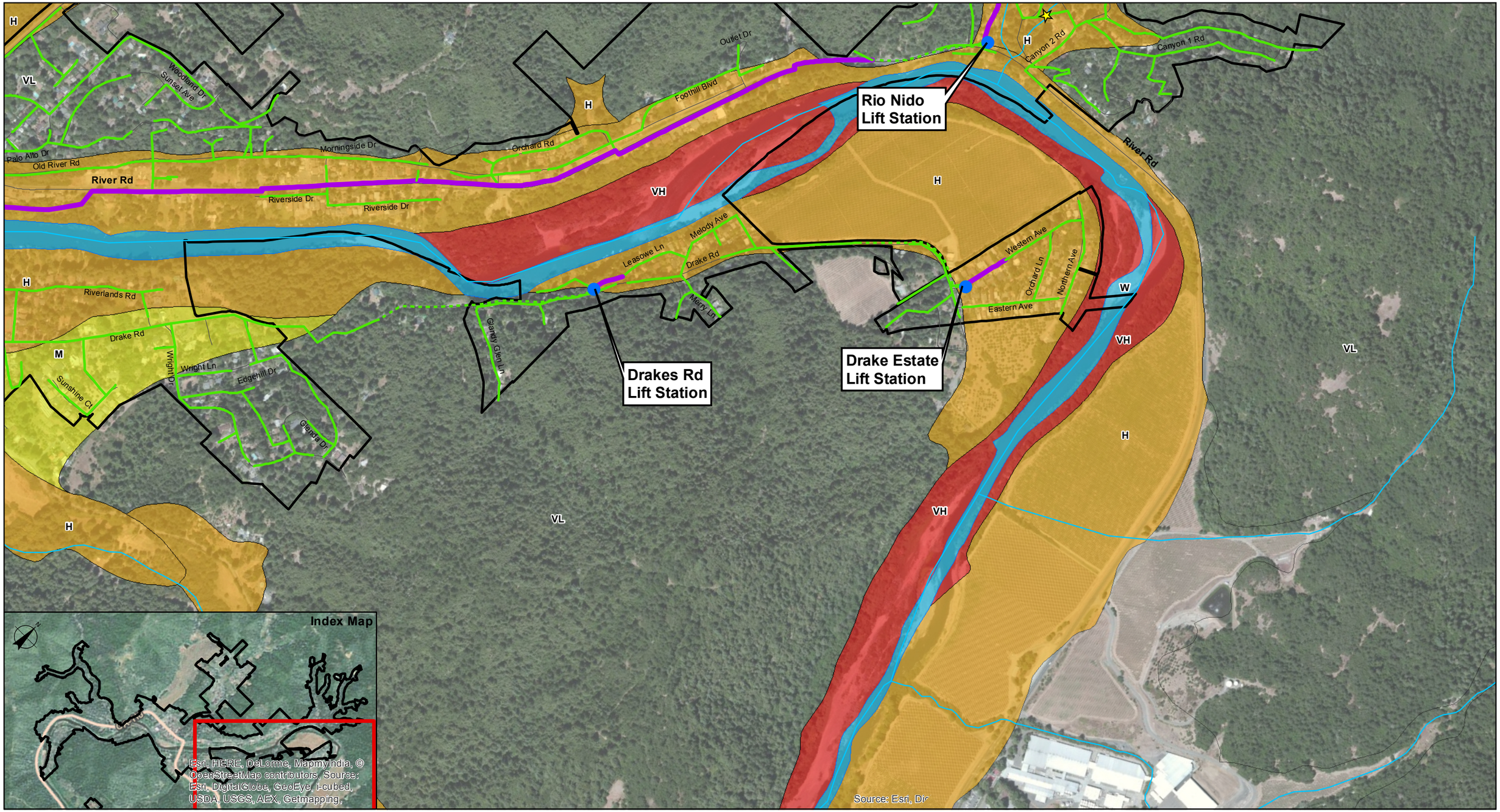

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
contact, well located
water boundary

Liquefaction Susceptibility

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

G&E Engineering Systems, Inc.

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Natural Hazard Reliability Assessment

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Russian River CSD
Liquefaction (4 of 4)

Figure RR-13

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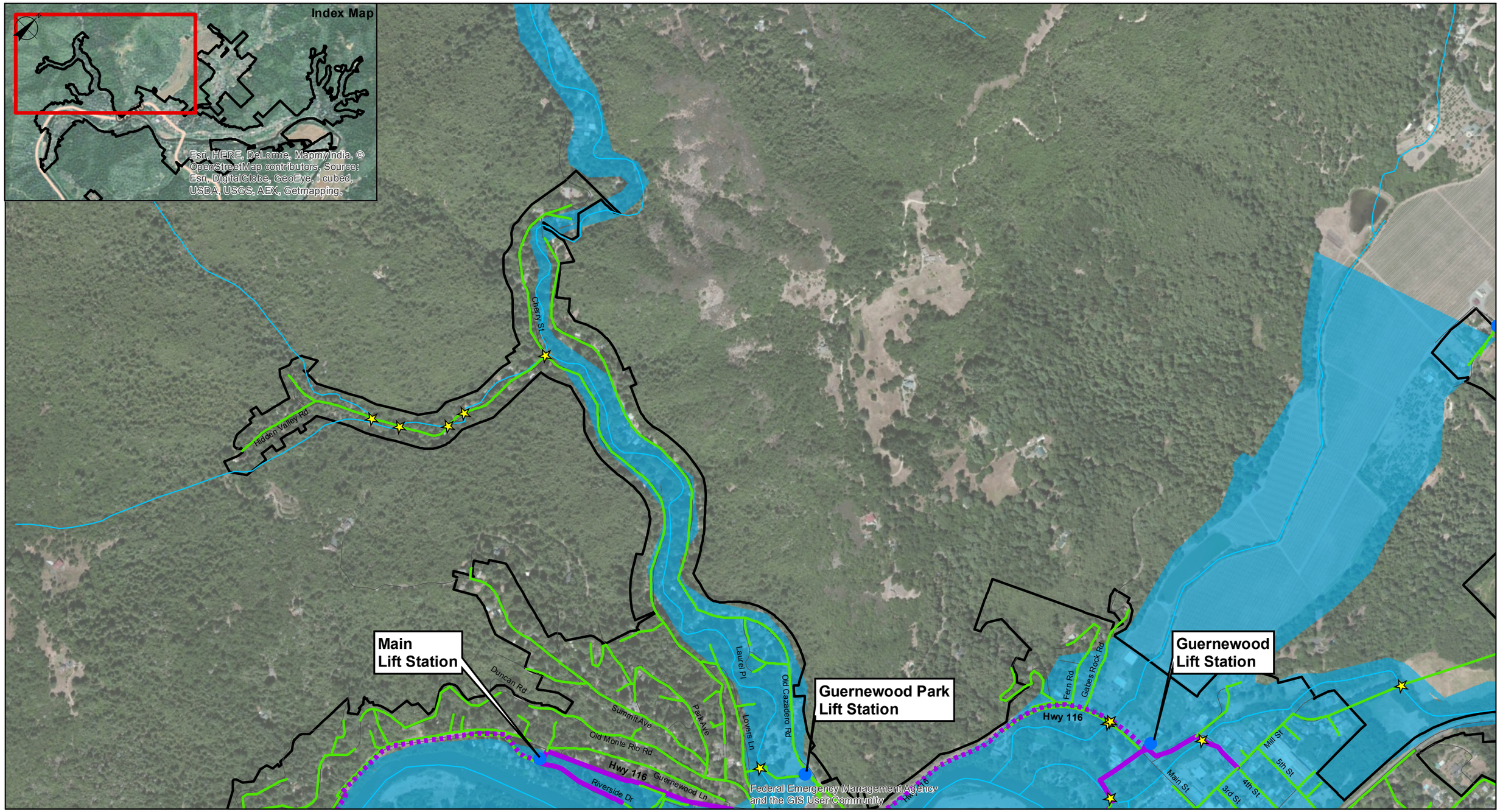

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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Russian River CSD
Flood Zone (1 of 4)

Figure RR-14

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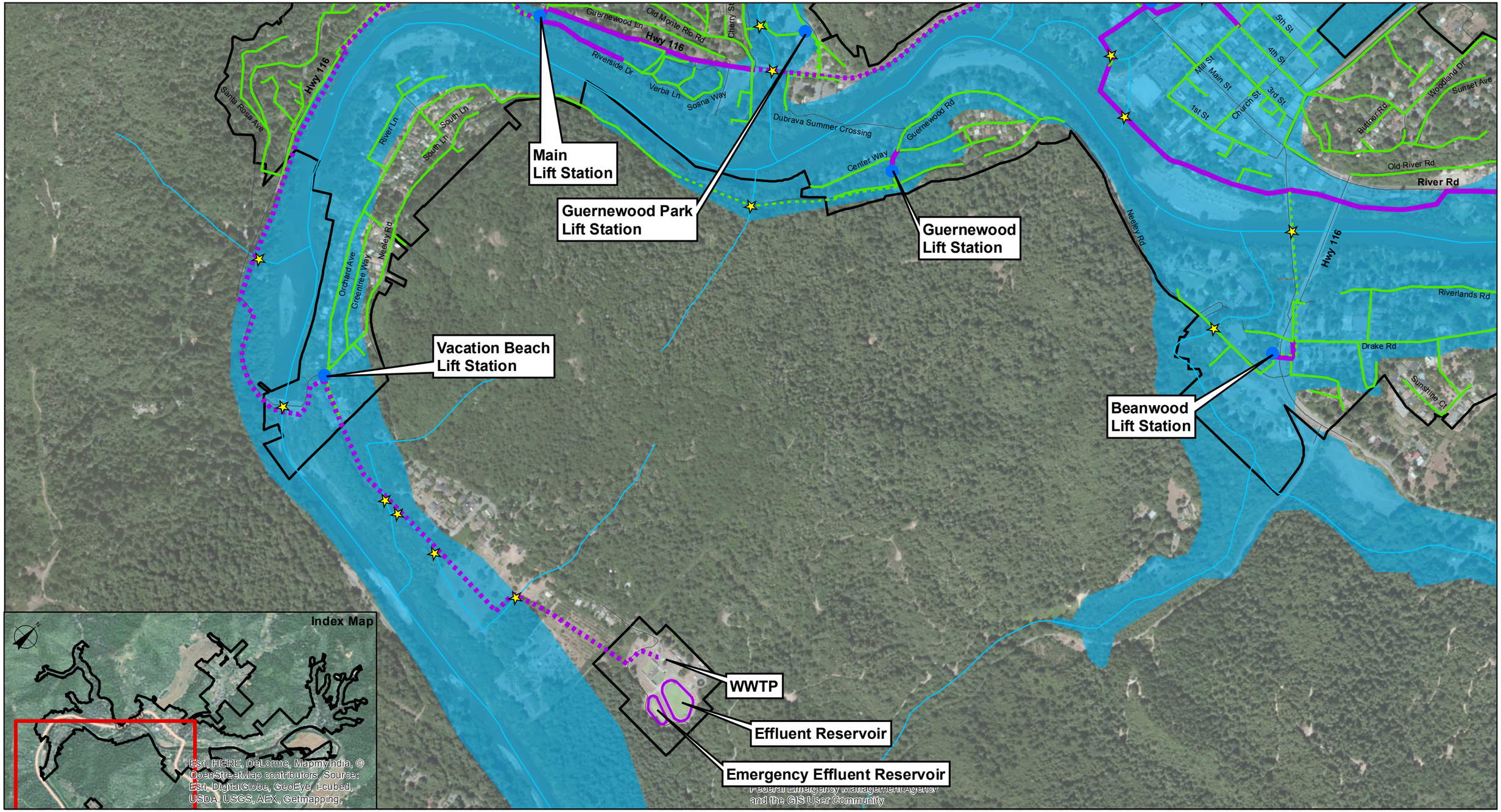

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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Russian River CSD
Flood Zone (2 of 4)

Figure RR-15

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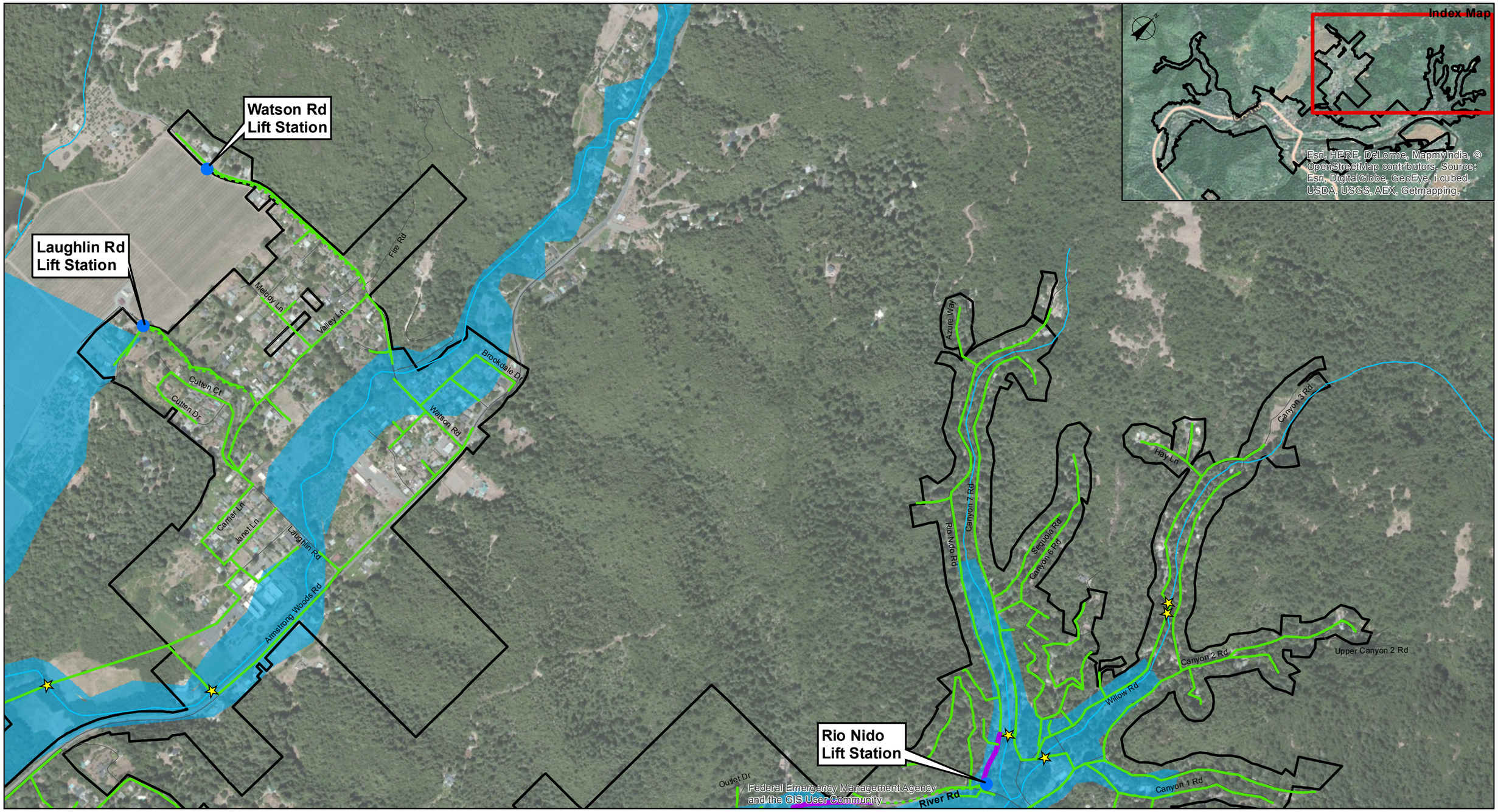

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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Russian River CSD
Flood Zone (3 of 4)

Figure RR-16

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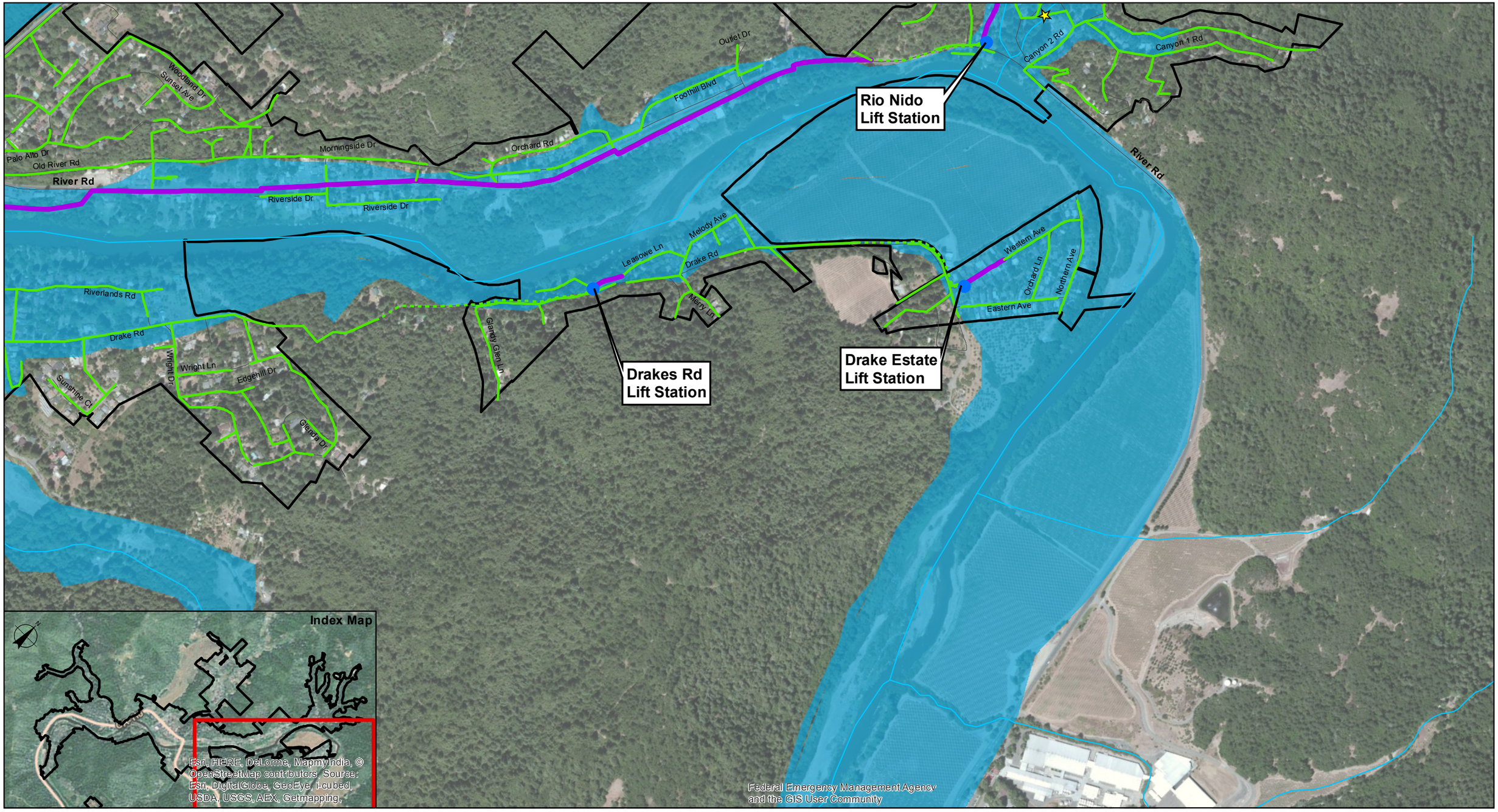

Paper Size 11" x 17" (ANSI B)

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")
100 Year Flood Zones

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

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Russian River CSD
Flood Zone (4 of 4)

Figure RR-17

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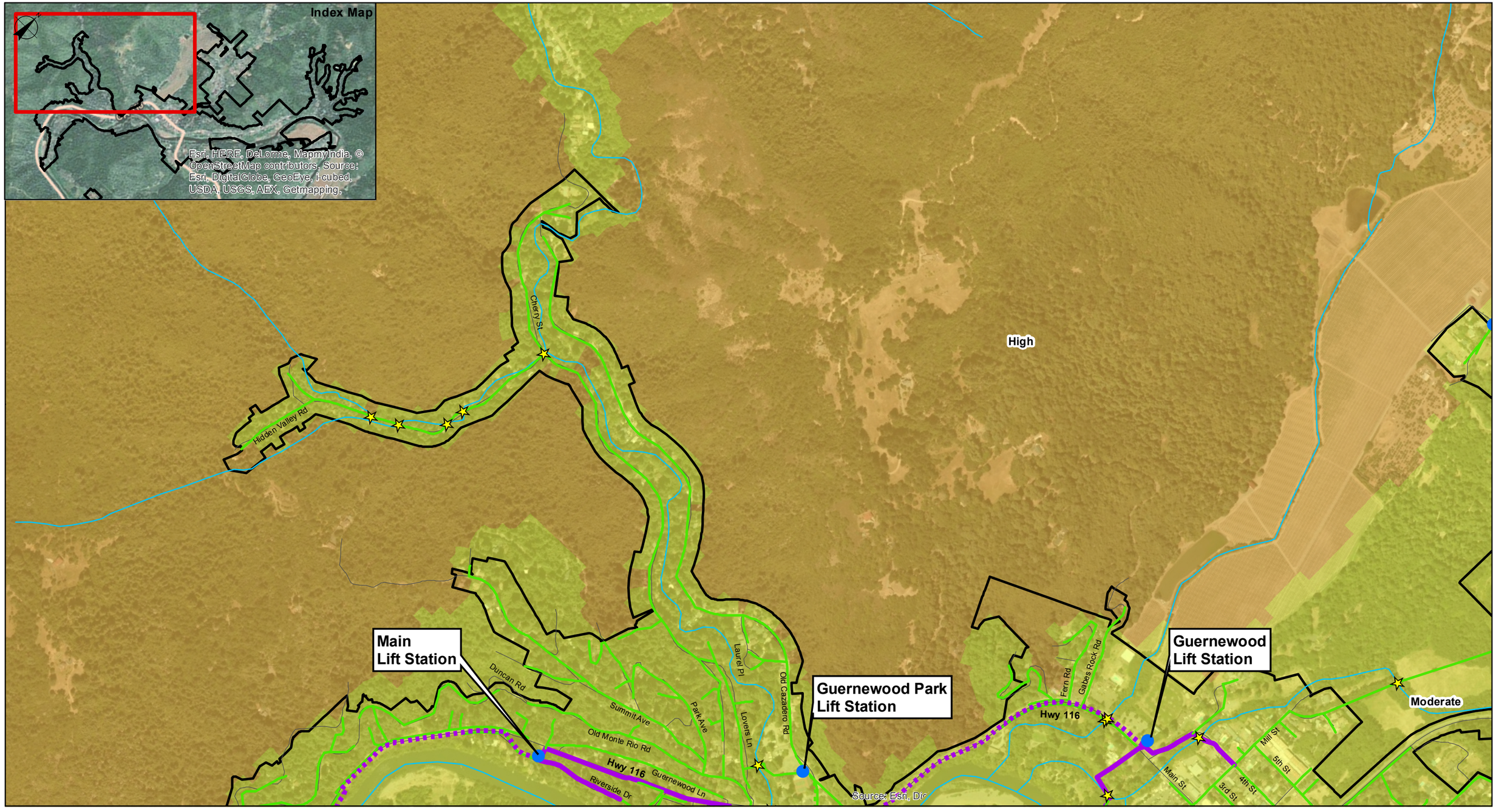

Paper Size 11" x 17" (ANSI B)

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")

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	8410200
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Russian River CSD
Fire Hazard Zone (1 of 4)

Figure RR-18

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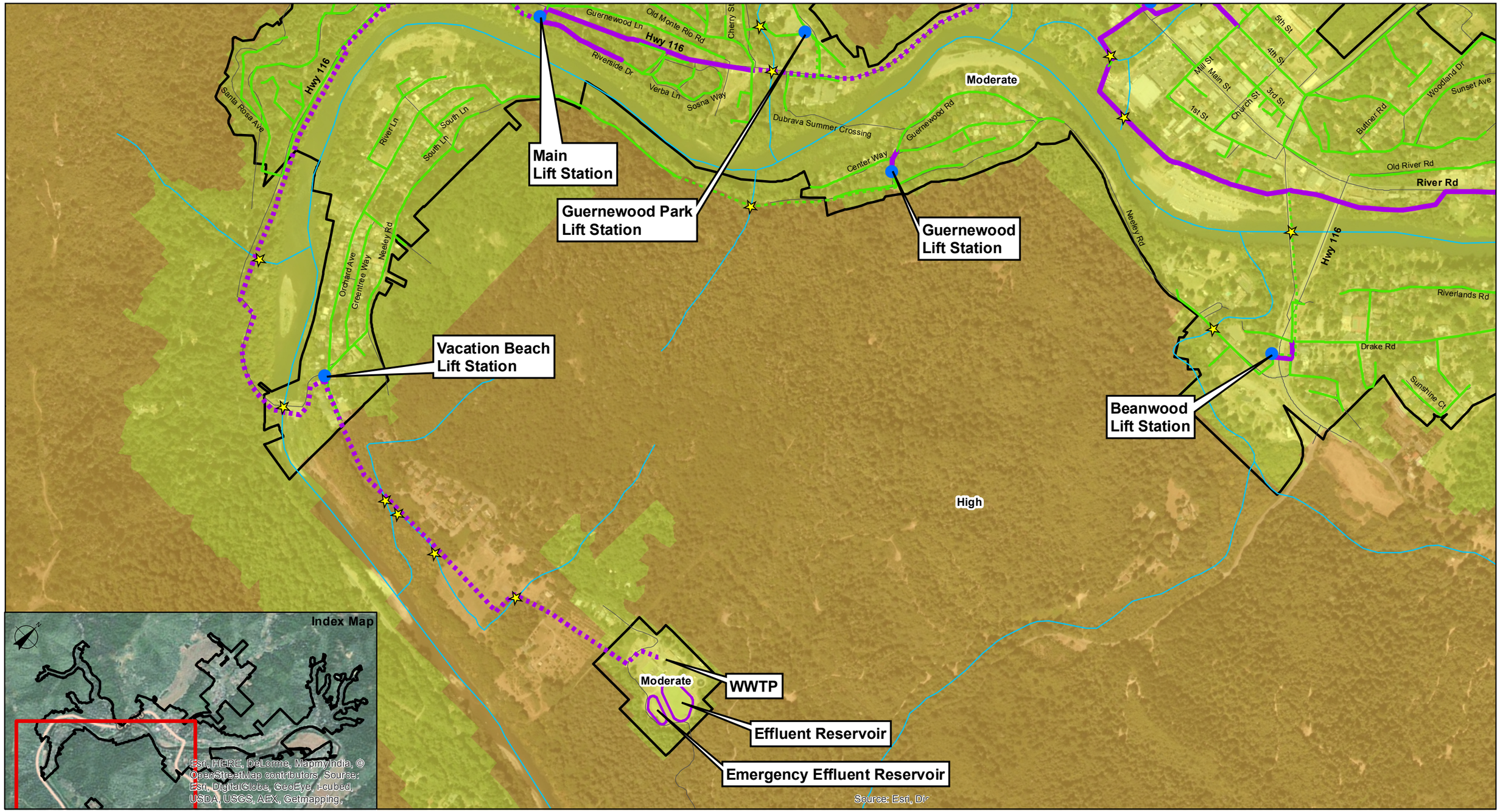

Paper Size 11" x 17" (ANSI B)

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")

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	8410200
Revision	2
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Russian River CSD
Fire Hazard Zone (2 of 4)

Figure RR-19

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

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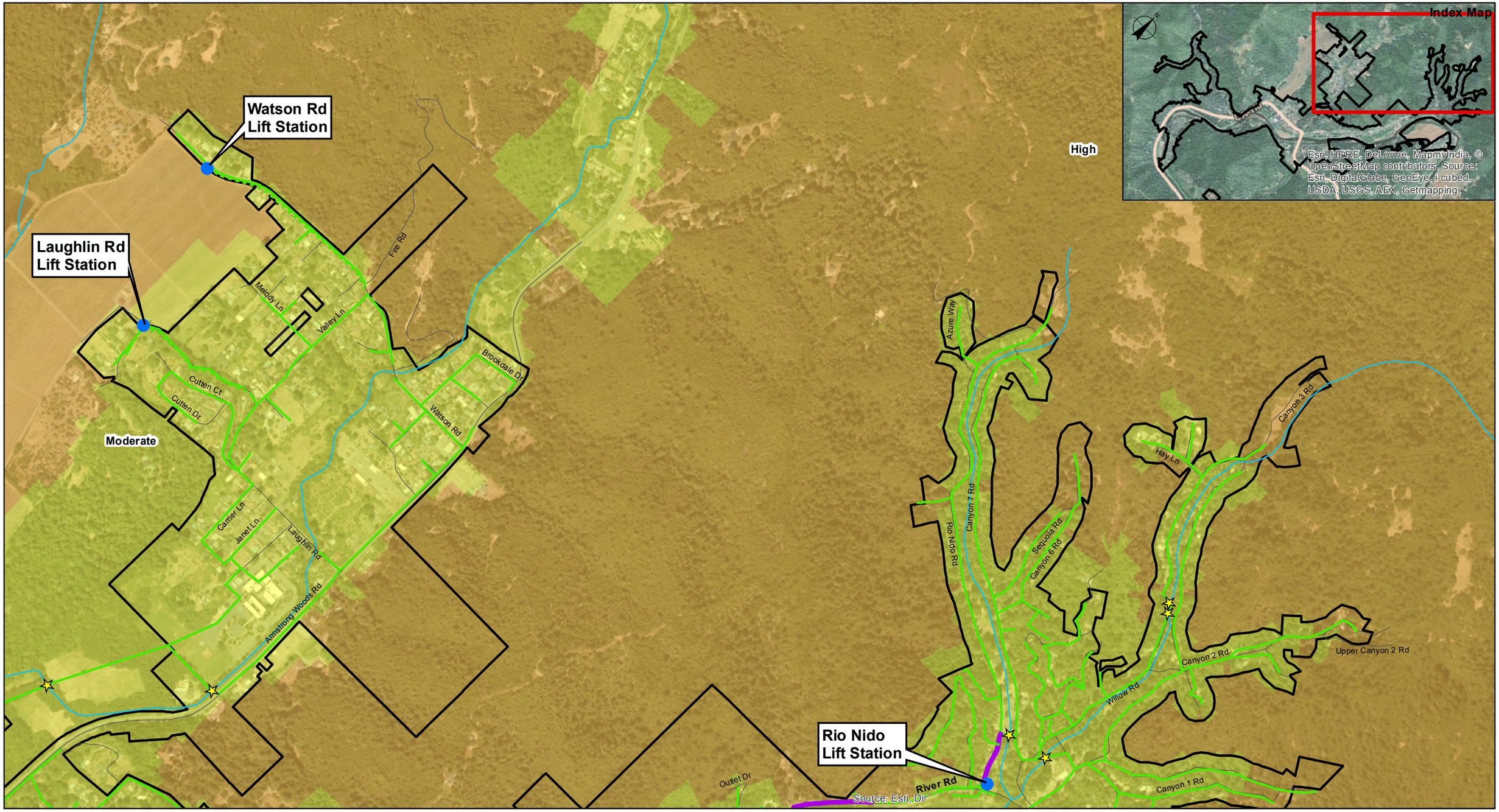

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")

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	8410200
Revision	2
Date	11 Jun 2015

Russian River CSD
Fire Hazard Zone (3 of 4)

Figure RR-20

N:\US\Santa Rosa\Projects\02243 - SCWA\02243-8410200 - Russian River CSD\08-GIS\Maps\Figures\Figure RR-20 Fire Hazard 3.mxd

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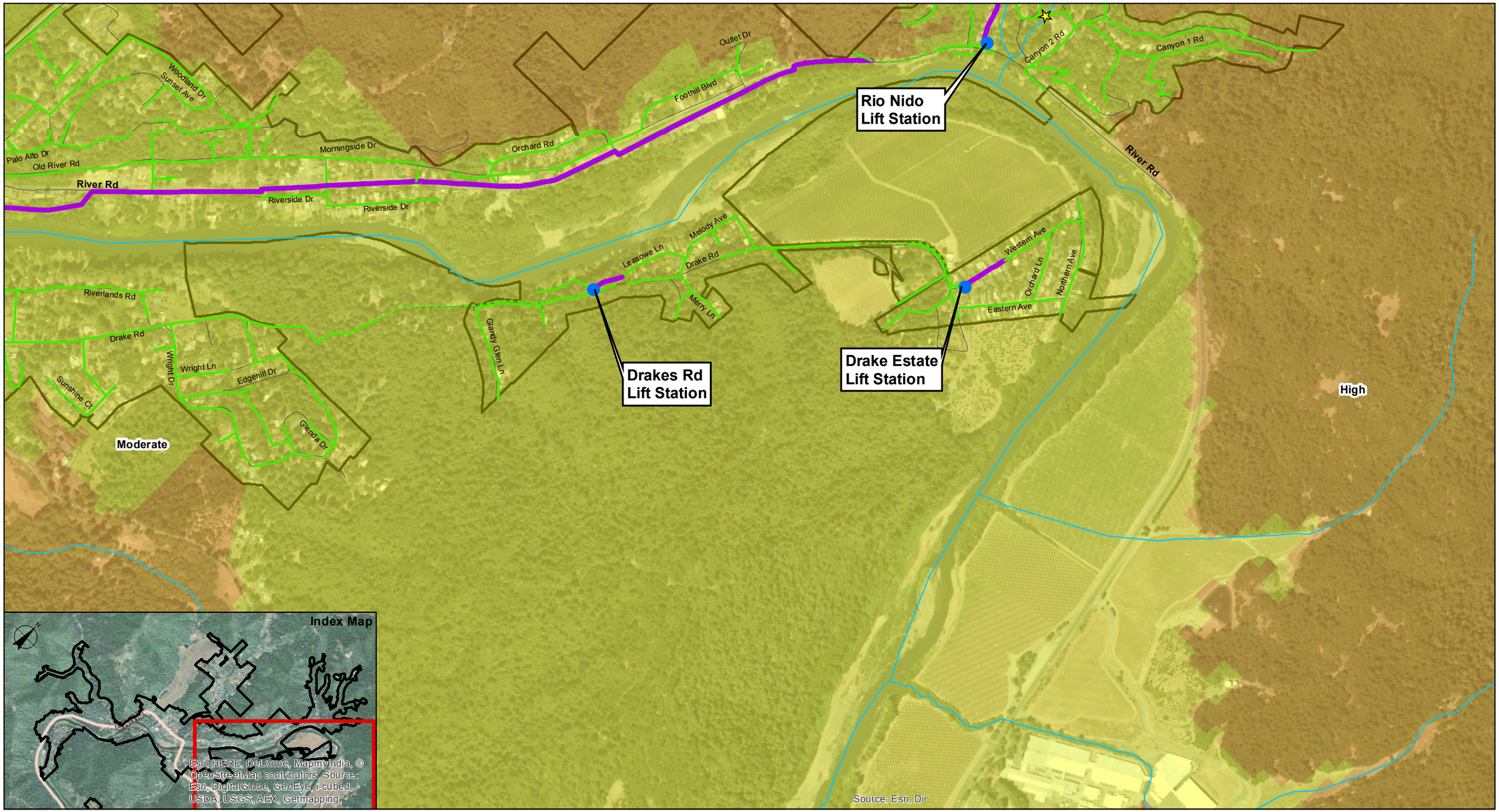

Paper Size 11" x 17" (ANSI B)

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Feet

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

RRCSD Boundary
Street
Creek
Crossing Location
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")

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	8410200
Revision	2
Date	11 Jun 2015

Russian River CSD
Fire Hazard Zone (4 of 4)

Figure RR-21

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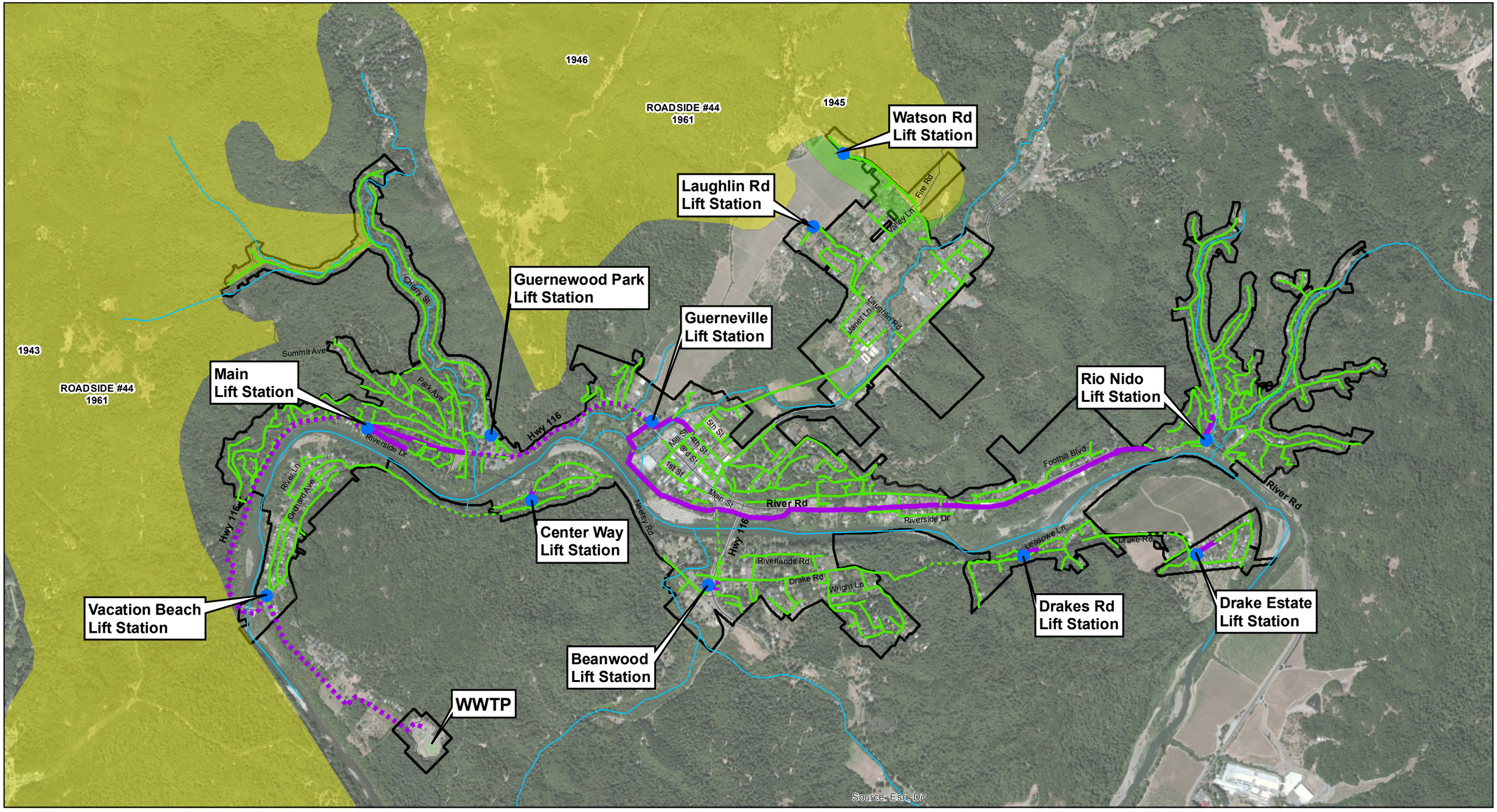

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Feet

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

RRCSD Boundary
Street
Creek
Pump Station
Force Main (2" - 10")
Sewer Main (2" - 10")
Force Main (12" - 30")
Sewer Main (12"- 30")

Historical Wild Fires

Oldest

Most Recent

G&E Engineering Systems, Inc.

Sonoma County Water Agency
Natural Hazard Reliability Assessment

Job Number	8410200
Revision	2
Date	11 Jun 2015

Russian River CSD
Historical Wild Fires

Figure RR-22

N:\US\Santa Rosa\Projects\02243 - SCWA\02243-8410200 - Russian River CSD\08-GIS\Maps\Figures\Figure RR-22 Historical Fires.mxd

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

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APPENDIX B – PROOF OF PUBLIC OUTREACH

NHRA Phase

Exhibit 1A:	RRCSD Newsletter, Fall, 2013 the District Newsletter, Volume 1, Issue # 2
Exhibit 1B:	RRCSD Local Hazard Mitigation Plan Webpage
Exhibit 1C:	RRCSD Treatment Plant Tour with NHRA & LHMP Overview
Exhibit 1D:	Public Notices Webpage
Exhibit 1E:	Event Calendar Webpage
Exhibit 1F:	ENews June 2014
Exhibit 1G:	Press Release
Exhibit 1H:	Stakeholder Letter
Exhibit 1I:	Stakeholder List
Exhibit 1J:	Sonoma County Gazette Advertisement
Exhibit 1K:	Social Media – Twitter
Exhibit 1L:	Social Media – Facebook

LHMP Phase

Exhibit 2A:	RRCSD Newsletter, Spring 2016 the District Newsletter
Exhibit 2B:	LHMP Stakeholder Postcard
Exhibit 2C:	Postcard Mailing List
Exhibit 2D:	Press Release
Exhibit 2E:	Sonoma County Gazette Newspaper Advertisement
Exhibit 2F:	RRCSD Local Hazard Mitigation Plan Webpage
Exhibit 2G:	Event Calendar Webpage
Exhibit 2H:	Social Media – Twitter
Exhibit 2I:	Social Media – Facebook
Exhibit 2J:	Sonoma West Newspaper Advertisement

Exhibit 1A

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

FALL 2013

Vol. 1, Issue #2

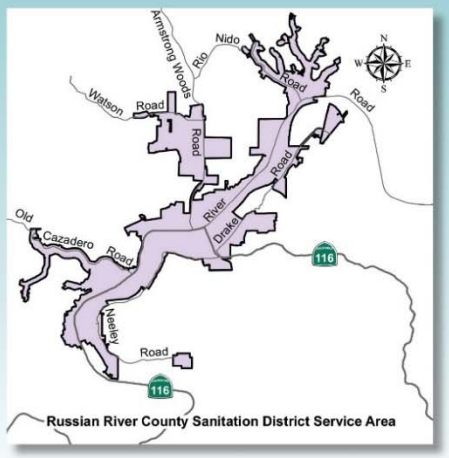
RUSSIAN RIVER COUNTY SANITATION DISTRICT NEWS

INSIDE FALL 2013

2 Budget Update
2 How to Contact Your Board
3 Employee Spotlight
3 Watch What You Flush
3 FOG
4 Efficiency Programs

The Russian River County Sanitation District ultraviolet disinfection system, above.

About Your Sanitation District



During a 1995 restructuring of the Sonoma County government, the Sonoma County Water Agency (Water Agency) assumed responsibility for managing and operating 11 different sanitation districts and zones. C
operates eight differ
Sonoma County, inclu
District (District).

The District, which b
Equivalent Single-Far
area.

The sanitation facilit
per day (average dail
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 October 1 and May 14, recycled water from the treatment plant is discharged into the Russian River. Between May 15 and September 30, recycled water is used to irrigate the Northwood Golf Course and forests adjacent to the plant.

Preparing for Natural Disasters

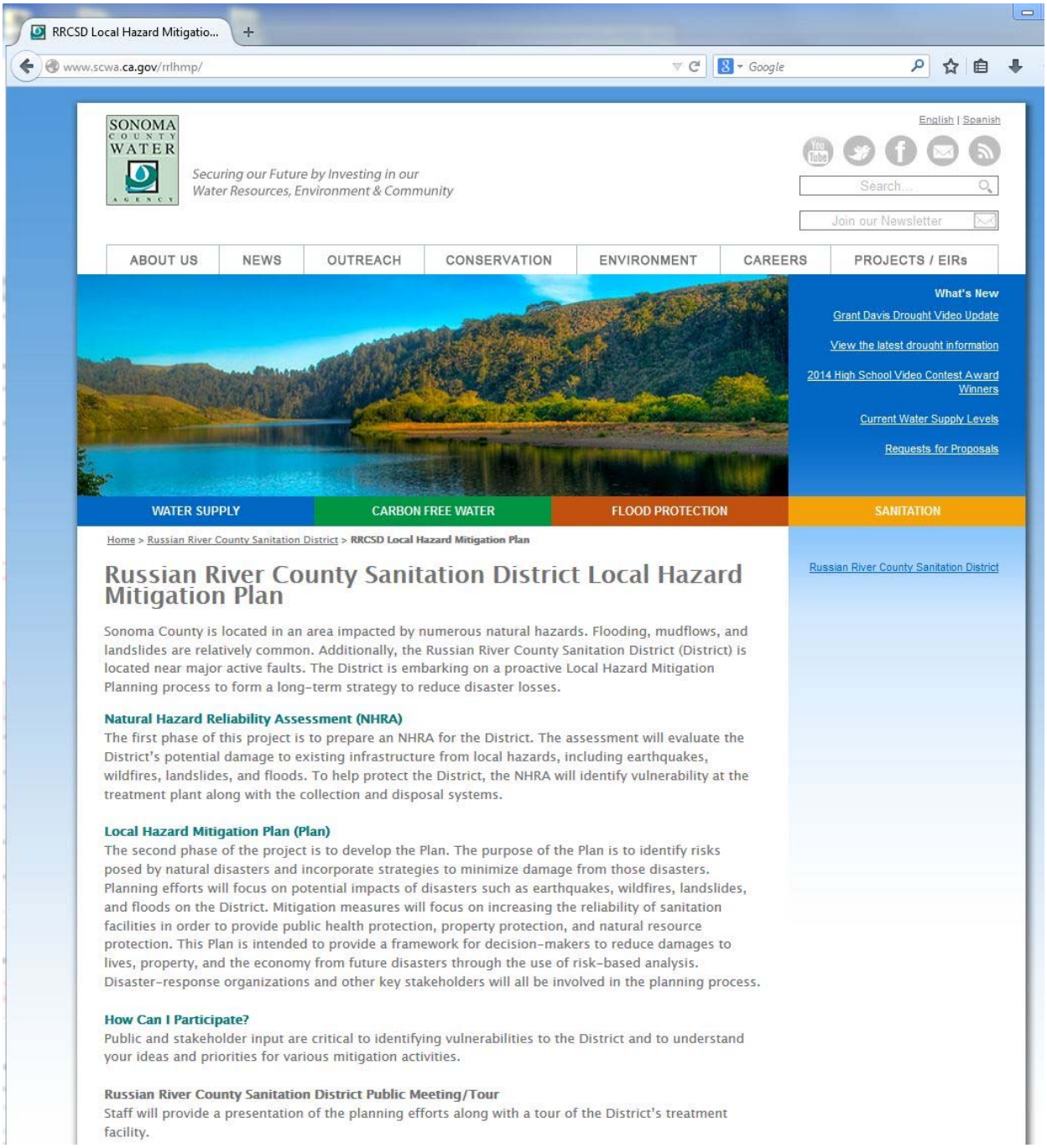
As Californians, we know that floods, fires and earthquakes are inevitable. The District wants to be sure that service will continue when the next natural disaster occurs. The District is currently assessing potential vulnerabilities that may cause disruption to service and invites the public to participate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

SONOMA COUNTY WATER AGENCY

www.sonomacountywater.org/RRCSD

Exhibit 1B

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



RRCSD Local Hazard Mitigatio...

www.scwa.ca.gov/rrlhmp/

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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 > Russian River County Sanitation District > RRCSD Local Hazard Mitigation Plan

Russian River County Sanitation District

Russian River 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 Russian River 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 plant 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 and other key stakeholders will all be involved in the planning process.

How Can I Participate?

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

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.

Tours

www.scwa.ca.gov/tours/

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 > Outreach > **Tours**

Tours

Upcoming public tours

The Sonoma County Water Agency is pleased to host public tours of the Russian River water supply system, sanitation districts, and energy projects. Please select the date of the tour you'd like to attend, and fill out the registration form. You will be notified with additional details and directions once you have registered.

Russian River Water Supply System Tour

The Sonoma County Water Agency invites the public to attend a free half day tour of the Russian River water supply system. Tour participants will visit facilities that divert, pump and treat the water delivered by the Water Agency to more than 600,000 residents in portions of Sonoma and Marin counties. These facilities will include the rubber dam, fish ladders, infiltration ponds and water collector 6 – one of the largest water collector of its type in the world.

- Saturday September 20th 2014 9:00 AM

Tour del Sistema de Suministro de Agua del río Russian River

La Agencia del Agua del Condado de Sonoma invita al público a asistir a un tour gratuito de medio día donde visitaremos el sistema del suministro de agua del río Russian River. Los participantes de este paseo visitarán las instalaciones que desvían, bombean y tratan el agua suministrada por la Agencia del Agua a más de 600,000 residentes en partes de los Condados de Sonoma y Marin. Estas instalaciones incluirán la represa de goma, las escalerillas para los peces, los estanques de infiltración y el recolector de agua 6 – el cual es uno de los más grandes recolectores de agua de su tipo en el mundo. Para registrarse en este tour, contacte a Hugo Mata al 877-689-7721 o hugo@c2alts.net.

Sanitation Treatment Plant Tour

Tour participants will get an in depth look at how their wastewater is cleaned and how this water is used once it is clean. Tours are one hour and thirty minutes in duration.

- Penngrove Sanitation Zone Tour at the Ellis Creek Water Recycling Facility in Petaluma: Wednesday September 17th 4:00 PM
- Russian River Treatment Plant Tour: In Guerneville on Tuesday July 8th 6:00 PM
- Sonoma Valley Treatment Plant Tour on Saturday October 18th at 11:00 AM

Outreach

Water Education Program

Public Notices

Calendar

Social Media - Youtube, Facebook, Twitter

Multicultural

Exhibit 1C

RRCSD Treatment Plant Public Tour & NHRA/LHMP Overview, 7/8/14

SONOMA COUNTY WATER AGENCY

Russian River County Sanitation District (District) Local Hazard Mitigation Plan (Plan)

Sonoma County 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 by attending a District Public Meeting & Tour! Staff will provide a presentation of the planning efforts along with a tour of the District's treatment facility.

Tuesday, July 8, 2014
6pm - 8pm
District treatment plant
18400 Neeley Road, Guerneville, CA 95446
RSVP: pamela.kuhn@scwa.ca.gov

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 www.sonomacountywater.org/rrlhmp.

Russian River County Sanitation District
Local Hazard Mitigation Plan

Presentation and Facility Tour
Tuesday, July 8, 2014
6:00pm – 8:00 pm
18400 Neeley Road
Guerneville, CA 95446

Meeting Objective: Inform and involve the public in the LHMP planning process, understand the public's ideas and priorities for various mitigation activities, and identify any previously unidentified vulnerabilities that should be captured in the plan.

- **Welcome and Introductions** Cordel Stillman
- **Natural Hazard Reliability Assessment** Cordel Stillman
- **Local Hazard Mitigation Plan** Curran Price
- **Q&A**
- **Facility Tour** Frank Mello

Russian River County Sanitation District Local Hazard Mitigation Plan Presentation & Facility Tour
Tuesday, July 8, 2014
6:00-8:00pm
18400 Neeley Road
Guerneville, CA 95446

	First Name	Last Name	Affiliation/Organization	SIGNATURE
1	Brenda	Adelman	Russian River Watershed Protection Committee	
2	Lynn	Berglund	Joseph Swan Vineyards	
3	Katie	Gerber		
4	Allison	Jenks		
5	Pam	Kuhn	Sonoma County Water Agency	
6	Steve	Mack	Sweetwater Springs Water District	
7	Frank	Mello	Sonoma County Water Agency	
8	Tom	O'Day		
9	Curran	Price	Sonoma County Water Agency	
10	Sukey	Robb-Wilder	Sweetwater Springs Water District	
11	Cordel	Stillman	Sonoma County Water Agency	
12	John	Uniack	FRIENDS OF RIO NIDO	
13	Vera	Zaro		
14	JEFF	BOHEIM	SCWA - COORDINATOR	
15				
16				
17				
18				
19				
20				

Russian River County Sanitation District
Local Hazard Mitigation Plan Presentation & Facility Tour

7-8-14

Attendees:

Steve Mack, Sweetwater Springs Water District
Tom O'Day, citizen
John Uniack, Friends of Rio Nido
Jeff Boehim, Water Agency Coordinator
Suey Robb-Wilder, Sweetwater Springs Water District Board Member

Staff:

Pam Kuhn, Water Agency
Cordel Stillman, Water Agency
Curran Price, Water Agency
Frank Mello, Water Agency

Agenda:

Cordel Stillman began informal presentation of NHRA and LHMP process using a handout to describe areas of focus. This was followed by a tour of the treatment plant given by Frank Mello.

Summary of Public Concerns and Comments during Presentation:

- **Concern Expressed:** Earthquakes seem to encompass much of potential mitigation efforts. Earthquakes are 100-year events while flooding is a 10- to 20-year event. **Response Given:** Water Agency is also looking at flooding. Much of the flood mitigation has already occurred (elevating lift stations above 100-year flood mark, securing manholes, working with the Regional Water Quality Control Board to meet treatment standards, and reduce Inflow and Infiltration down to the point where we can manage it). Earthquakes represent a very large threat when they do occur and shouldn't be minimized.
- **Concern Expressed:** Some pumps can't handle the volume of water during floods and might back up into houses flooding event. Especially in the Rio Nido area where all the houses flow down to one pump station. How do you keep the water out of Rio Nido? **Response Given:** The Water Agency will look into this issue.
- **Concern Expressed:** With the pipe break this year, wondering how/if the system is working and what is being done to prevent this from happening. **Response Given:** The Water Agency provided a detailed report to the Water Quality Control Board on this issue. This was an isolated issue on the collection system and we are doing what we can to prevent something like this from ever happening again.
- **Concern Expressed:** What is the cost to the 3000 ratepayers for mitigation? We're already maxed out. Every year there's some new $2 million project going in and it's not affordable to the

ratepayers. **Response Given:** The state often has regulations that we have to comply with and that ends up costing ratepayers to be in compliance. We want to keep costs as low to the ratepayers as possible and we're always looking for potential grant and funding opportunities. FEMA funding and grants would hopefully pay for a large majority of mitigation coming from this plan.

- **Question:** In earthquake history, can you point to what's the biggest to hit this local area and what kind of damage occurred? **Response Given:** The 1906 quake in San Francisco caused significant damage in Santa Rosa; despite the epicenter being along the San Andreas close to San Francisco, effects from a large earthquake from afar can greatly affect the area and has a lot to do with the local geology. This area is at high risk of liquefaction and is prone to significant damage during a seismic event. There has been recorded evidence of soil liquefaction along the River
- **Question:** You use Christchurch as an example in your handout. What are the similarities in the system to Christchurch? **Response Given:** They have a bigger system, but we possibly have higher liquefaction potential here since a significant portion of the collection system is along creeks and rivers that have had significant loose sand deposits over the years and higher groundwater table in close proximity to these areas.
- **Comment:** Sewer line break last year blew our park apart.
- **Question:** The collection system was put in place in late 70s and getting old. Is there anything that can help replace infrastructure? **Response Given:** We're hoping that we can kill two birds with one stone: receiving FEMA funding to mitigate for earthquakes will allow us to replace some of that infrastructure.
- **Comment:** The main pressure system is probably the part that's aging fastest. We encourage you to take a look at that.
- **Comment:** Part of your sewer systems are embedded in mercury rock that is toxic. It will be big costs to do any project where mercury rock occurs.
- **Comment:** I suggest that you have a bigger meeting of community members during the comment period. During floods and other disasters, there is no power, no water, and no food. Make sure the community has some understanding of that. They will be concerned with floods and costs.

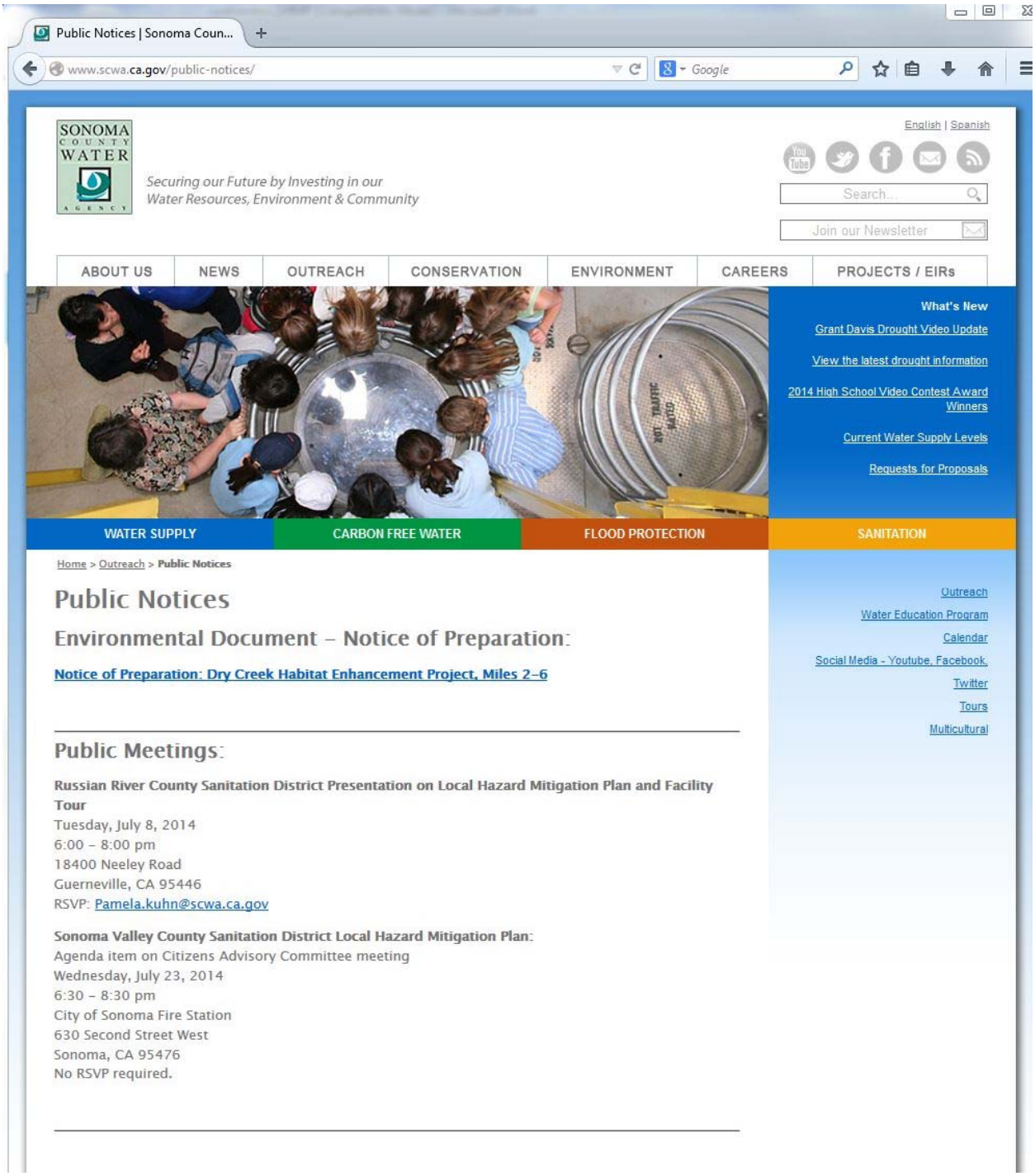
Summary of Tour Questions:

- What are the energy costs of the new system?
- What level are you treating water to?
- What's going to be in the third basin?
- Is there some sort of mitigation to dump your secondary if there's overflow?
- Do you prefer new UV system to old chlorine method?
- Is the UV and polymer a redundant system?
- Do you still have the ability to chlorinate?
- Do you have staff on hand that still know how to handle emergencies, diversions, electricians, chlorine, etc…?

- How much gets processed in a day – how much time elapses from sewage coming in to water going out?
- Is sludge considered a toxic?
- How many people work here every day?
- At one time, there was a plan to hook up to Monte Rio, Camp Meeker…could you still hook up to them?
- Do you have emergency power here?
- What do you do when the entrance road floods?
- Can you give a talk to the Friends of Rio Nido? (next one would be on a Saturday in late August probably)
- What are you doing to make sure another pipe burst like what happened in February doesn't happen again?
- Comment: See if you can locate Redwood Empire Section CWEA presentation entitled "Christchurch and Canterbury Earthquakes, could we be next?" given by Mary Anne Johnson. Very convincing imagery about scale of damage to expect in earthquake.
- Comment: See if you can locate something local as an example for earthquakes
- Comment: local public will be concerned with flooding and costs
- Is there FEMA money for flooding?
- Comment: Really would've been a problem if Sweetwater was pumping when the pipe break happened…we were lucky.
- Comment: Really more concerned about equipment failure and pipe/valve failure than an earthquake.
- Comment: $7-8 million of local money for earthquake upgrade will not fly. People will be yelling "Prop 218!"

Exhibit 1D

Public Notices Webpage, posted on 6/9/14



Public Notices | Sonoma Coun...

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

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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 1E

Event Calendar Webpage, posted on 6/9/14

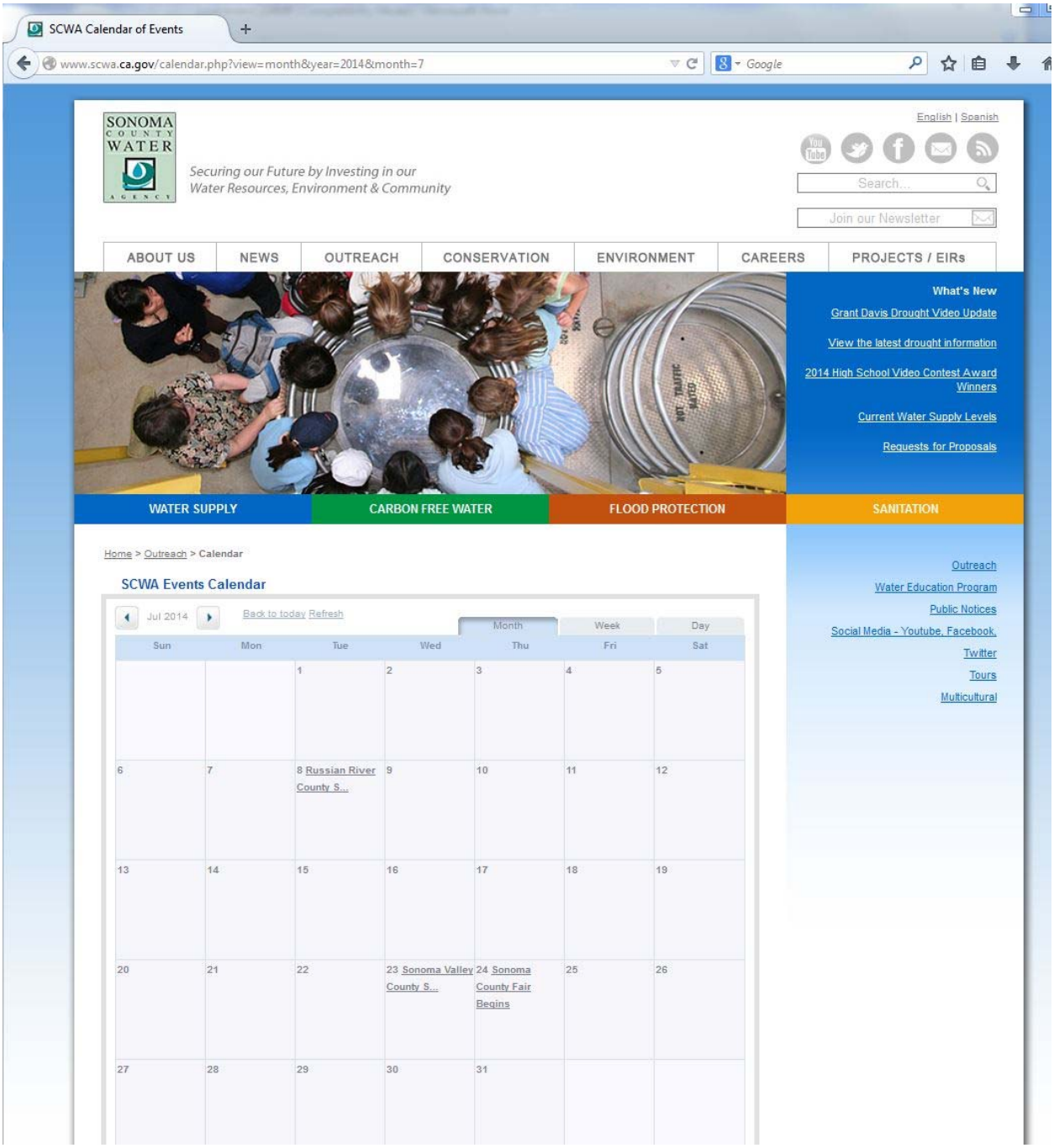


Exhibit 1F

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 1G

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 1H 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 1I

Stakeholder List

AGENCY CONTACT FIRST NAME	AGENCY CONTACT LAST NAME	ORGANIZATION	TITLE
		Cities/Counties/Local Govt	
Stephan	Betz	County of Sonoma Dept of Health Services	Director
Max	Ming	Forestville FPD	Chief
Steven	Bandettini	Forestville Water District	Chair, Board of Directors
Matthew	Froneberger	Forestville Water District	General Manager
Marshal	Turbeville	Geyserville Fire Protection District (FPD)	Chief
Brittany	Heck	Gold Ridge Resource Conservation District	Executive Director
Steve	Baxman	Monte Rio FPD	Chief
David	Schiltgen	Permit and Resource Management Department	Land Use Planner III
James	Dunton	Russian River Co Water District	President
Max	Ming	Russian River/Guerneville FPD	Chief
Hal	Wood	Russian River Utility	Consultant
Anthony	Gossner	Santa Rosa FPD	Chief
Bill	Keene	Sonoma County Agricultural Preservation and Open Space District	General Manager
Susan	Klassen	Sonoma County Department of Transportation & Public Works	Director
Christopher	Helgren	Sonoma County Emergency Services	Emergency Services Manager
Steven	Herrington	Sonoma County Office of Education	Assistant Superintendent Educational Services
Kara	Heckert	Sonoma Resource Conservation District	Executive Director
Steve	Mack	Sweetwater Springs Water District	General Manager
Sukey	Robb-Wilder	Sweetwater Springs Water District	Financial Coordinator
		State Agencies	
Mark	Cowin	California Department of Water Resources	Director

Scott	Wilson	California Dept of Fish & Wildlife	Regional Manager
Catrina	Christian	California Emergency Management Agency (CalEMA)	Emergency Services Coordinator
Sarah	Kline	Groundwater Resources Association of California	Administrative Director
Dave	Dearborn	California Highway Patrol (CHP)	Environmental Crimes Investigator Hazardous Materials Technician
Laurel	Marcus	California Land Stewardship Institute	Executive Director
Catherine	Colman	California Regional Water Quality Control Board	Executive Officer
Karla	Nemeth	California Resources Agency	Deputy Secretary for Water Policy
Zachary	Rounds	California State Dept of Health Services	Associate Sanitary Engineer
~~Jenny~~	~~Donovan~~	California State Parks Department, Bay Area District	~~Public Safety Superintendent Russian River District~~
Gary	Lippner	Department of Water Resources	Chief, Regional Planning and Coordination
		Federal Agencies	
~~Dick~~	~~Butler~~	NOAA Fisheries	Resources Manager
Patrick	Rutten	NOAA Restoration Center	Restoration Center Southwest Region Supervisor
Randy	DeCaminada	Pacific Gas & Electric Company	Executive Manager
John	Woodling	Regional Water Authority	Executive Director
~~Don~~	~~Silverek~~	Santa Rosa Junior College	Emergency Management Coordinator
Tony	Linegar	Sonoma County Fish & Wildlife Advertising Commission	Department Head
Claudia	Luke	Sonoma State University, School of Science and Technology	Professor
Eric	Sklar	California Fish & Game Commission	President
~~Eric~~	~~Oppenheimer~~	State Water Resources Control Board, North Coast Region	~~Chief - Russian River Watershed Unit~~

Stephanie	Larson	University of CA Cooperative Ext	County Director and Livestock Range Management Advisor
Mike	Dillabough	US Army Corps of Engineers	Chief
		US Fish & Wildlife Services	Assistant Regional Director: Fisheries and Water Resources
~~Michael~~	~~Webster~~	US Geological Survey	Ukiah Field Officer
		Elected Representatives	
Marc	Levine	California State Assembly	State Assembly Member
Jim	Wood	California State Assembly	State Assembly Member
Mike	McGuire	California State Senate	State Senator
Mike	Thompson	US House of Representatives	US Representative - California
Jared	Huffman	US House of Representatives	US Representative - California
		Non-governmental Organizations	
Eileen	Adams	American Red Cross	Chair, Community Volunteer
Kandis	Gilmore	Community Clean Water Institute	President
		Environmental Forum of Sonoma County	Coordinator
David	Keller	Friends of the Eel River	Bay Area Director
John	Uniack	Friends of Rio Nido	President
Brittany	Heck	Gold Ridge Resource Conservation District	Executive Director
Kevin	Munroe	Laguna de Santa Rosa Foundation	Executive Director
Craig	Anderson	LandPaths	Executive Director
Anthony	Chatwin, Ph.D.	National Fish and Wildlife Foundation	Executive Vice President, Science and Evaluation
~~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	President
Ellie	Cohen	Point Reyes Bird Obseravitory Conservation Science	Executive Director
		Rohnert Park and Cotati Creek Council	

		Russian River Historical Society	
Don	McEnhill	Russian River Keeper	Program Director
Brenda	Adelman	Russian River Watershed Protection Committee	Chair
Jane	Nielson	Sebastopol Water Information Group	President
Victoria	Brandon	Sierra Club: Redwood Chapter	Chair
Vesta	Copestakes	SoCo Gazette	
~~Dennis~~	~~Rosatti~~	Sonoma County Conservation Action	
Kim	Vail	Sonoma County Farm Bureau	Executive Director
Mike	Frey	Sonoma County Surfrider Foundation	Chapter Co-Chair
Stephen	Fuller-Rowell	Sonoma County Water Coalition	Co-founder
Karissa	Kruse	Sonoma County Winegrape Commission	President
Richard	Dale	Sonoma Ecology Center	Executive Director
Dave	Koehler	Sonoma Land Trust	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 Director/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	
Chris	Bingham	Alexander Valley Association	President
Roberta	Larson	California Association of Sanitation Agencies	Executive Director
Richard	Kagel	Dry Creek Valley Association	President
Tracy	Huotari	North Bay Association of Realtors	Chief Executive Officer
Judy	Kelly	North Bay Watershed Association	Executive Director
Max	Broome	Forestville Planning Association	Board Member

		Business/Chambers of Commerce	
Danielle	DiBari Alexander	Geyserville Chamber of Commerce	President, Board of Directors
Chuck	Ramsey	Monte Rio Chamber of Commerce	President
Debra	Johnson	Russian River Chamber of Commerce	President
Shannan	Wesley	Russian River Valley Winegrowers	Manager
Jonathan	Coe	Santa Rosa Chamber of Commerce	President/CEO
Brian	Ling	Sonoma County Alliance	Executive Director
		Service Organizations	
Jeff	Davis	Russian River Rotary	President

Exhibit 1J

Sonoma County Gazette Advertisement 7/15/2014 (reader circulation approx. 130,000)

FREE
Compliments of our Advertisers
Helen Putnam Regional Park in spring

JULY 2014

SONOMA COUNTY GAZETTE
WRITTEN BY READERS
CONNECTING SONOMA COUNTY COMMUNITIES

ACT NOW to Improve Broadband

By Carl Wahl
On May 15th the Federal Communications Commission (FCC) opened the door to public comment on how the government should treat the Internet and the telecom industry. The comment period closes on July 15th. It is imperative that all citizens weigh in on this very important issue. The FCC's broadband decisions will affect you for decades to come.

If you have been following my previous Gazette articles, you should be aware of our country's current Internet crisis. If you are new to these articles, please visit www.sonomacountygazette.com, type "Carl Wahl" in the Article Search box at the top of the home page, and read my past broadband articles. Learn why Internet speeds and reliability are so poor in the US and why you are paying so much more than people in other nations while simultaneously receiving inferior service.

Lack of industry regulation is the root of our Internet problems. Deregulation effectively took place in 2002 when the FCC, pressured by then chairman Michael Powell (a G.W. Bush appointee), voted to classify the Internet

INTERNET cont'd on page 16

EXPLORE
Readers FAVORITE Hikes & Bike Rides

Wal-Mart ...the Race to the Bottom

by Martin J Bennett
Wal-Mart has again submitted a proposal to expand its existing discount store in Rohnert Park into

Russian River County Sanitation District (District)
Local Hazard Mitigation Plan (Plan)

Sonoma County 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 hazard mitigation strategies to minimize damage to the District from natural disasters.

Participate in the planning process by attending a District Public Meeting & Event. Staff will provide a presentation of the planning efforts along with a tour of the District's treatment facility.
Tuesday, July 8, 2014
6pm - 8pm
District treatment plant
18400 Healdy Road, Guerneville, CA 95446
RSVP: pamela.kahn@sewa.ca.gov

We welcome your comments at any point in the planning process. Contact Project Manager Carmen Price at the Sonoma County Water Agency by emailing carmen.price@sewa.ca.gov or via: www.sonomacountywater.org/rrlmp.

MAP & GUIDE to Sonoma County Regional & State Parks ~ pgs 35-38

BIKE SHOPS pg 34

The Economic Policy Institute calls the 2000s a "lost decade" for low and middle-income working families.

WAL-MART cont'd on page 13

Homeless are US pg 8
Reasons to Convert your Lawn pg 22
Living Wage vs. Minimum Wage pg 15
A Humbling Experience pg 38
SONOMA COUNTY CALENDAR: pgs 58 ~ 71
www.SonomaCountyGazette.com

This QR CODE will take you to our web site. Use your Smart Phone with a QR CODE app such as RedLaser

Exhibit 1K

Social Media – Twitter Posted on 7/7/2014

Exhibit 1L

Social Media – Facebook Posted on 7/7/2014

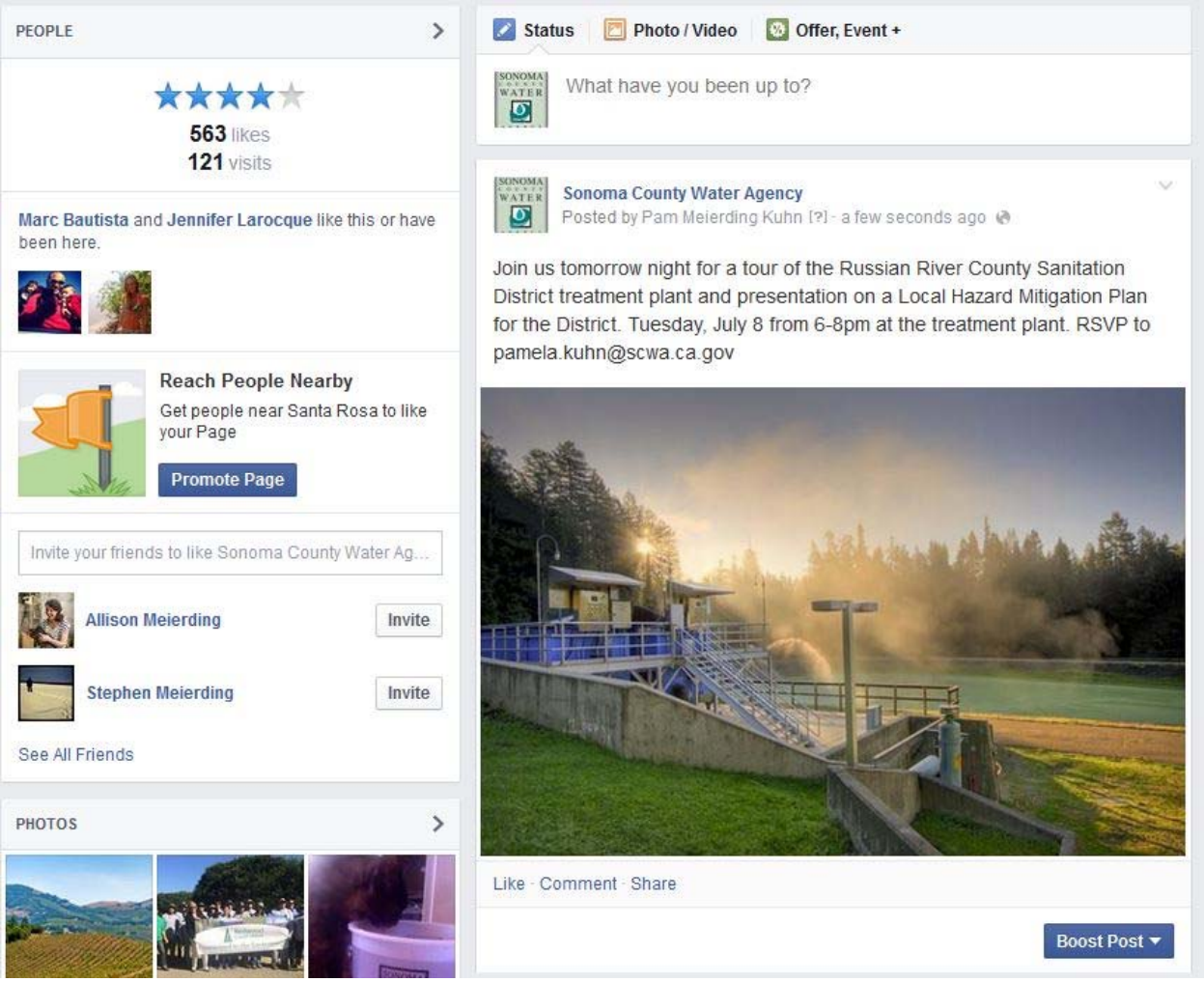


Exhibit 2A

RRCSD Newsletter, Spring 2016 the District Newsletter, Volume 4, Issue #1 mailed to all ratepayers on March 28, 2016

RUSSIAN RIVER COUNTY SANITATION DISTRICT NEWS

SPRING 2016
Vol. 4, Issue #1

Rates Go Directly to Operate and Maintain Community's Sanitation District Facilities

The Sonoma County Water Agency (Water Agency) operates eight sanitation systems in Sonoma County, including Russian River County Sanitation District. Fees from ratepayers are used to collect wastewater from homes and businesses, turn this wastewater into recycled water, and then release this water back into streams or provide it to farms, parks, schools, and others for outdoor irrigation and other beneficial uses. The recycled water produced by the various treatment plants in this process must meet numerous regulatory requirements aimed at protecting public health, water quality, and the environment.

Equipment and facilities used to treat wastewater must operate reliably under harsh conditions and need to be replaced or rebuilt on a regular basis. Fees collected from ratepayers pay for such replacements and rebuilds. Rate increases, low-interest loans, and grants are used to fund infrastructure replacements and upgrades.

INDEX

02 How Your Sanitation District Budget Works
03 Rebates
04 Project Update
05 All About Prop. 218
07 Rate Protest Form

For example, between 1995 and 2014 more than $140 million in capital expansion and replacement projects were funded among the eight systems.

Annual rate increases have averaged below 6% for the sanitation Districts and Zones operated by the Water Agency. By comparison, sewer rate increases for municipal wastewater systems in Sonoma County over the past 10 years averaged 8% per year. This has been accomplished while keeping up with operations and maintenance and investing in capital replacement funds, which are used to pay for the depreciation of equipment and facilities and protect the investment in these community assets.

The strategic goal in setting rates for the sanitation Zones and Districts is to operate, maintain and replace facilities and equipment in order to preserve the systems' assets and protect ratepayers' investments. Ratepayer funds and the wastewater collection and treatment facilities are community assets, and the Water Agency is committed to their long-term protection and safe operation.

www.sonomacountywater.org/RRCSD

SONOMA COUNTY WATER AGENCY

How Your Sanitation District Budget Works

The Water Agency strives to operate and maintain these sanitation facilities in an environmentally responsible and fiscally prudent manner. As part of its financial duties, the Water Agency each year publishes proposed changes to sewer service fees in accordance with Proposition 218.

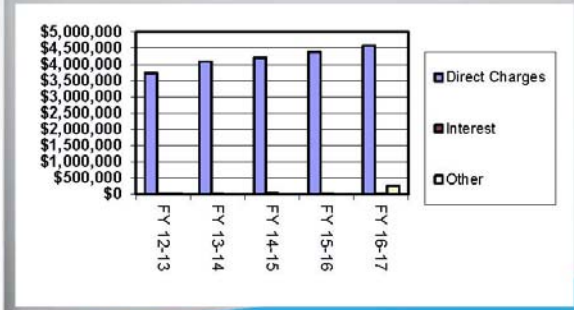
The fiscal year for the Districts and Zones, begins July 1 of each year and runs through June 30 of the following year, so the information in this notice is for the period from July 1, 2016 through June 30, 2017. A five-year capital plan is prepared for the Districts based on the need for replacement of aging collection systems and other assets necessary to process the wastewater according to regulatory requirements. Budgets take into account current maintenance and operations costs, any bond or loan repayments, and the necessity to maintain sufficient financial reserves to cover unexpected damage or system failures. Budgets are developed using estimates for these items and for revenues. For some systems, the revenues generated from user fees are not sufficient to keep pace with the rate in which equipment is wearing out. For such systems, fee increases are set incrementally above the rate of inflation to generate a reliable source of funding to replace worn out equipment before it fails.

Budget Approval

After the proposed budgets and rates are developed, the budgets are available for public review at libraries throughout the county and at the Water Agency office located at 404 Aviation Boulevard, Santa Rosa. Typically, this happens at the end of March. In addition, notices of the proposed rates are mailed to the owners of the properties in the Districts and Zones at that time. They are also available online. The public can protest rate increases up to the date of the rate hearings, which are typically held in mid-May at the Board of Supervisors chambers. (A protest form and rate hearing information is available on pg. 7 of this notice).

Budget Summary Revenue

The primary sources of revenues are the user fees charged to the District ratepayers and collected on property tax bills sent out by the Sonoma County Tax Collectors Office. Additional revenue sources include interest on fund balances and new connection fees. Proceeds from bonds and debt paid through property assessments may increase the funds available to spend on capital projects but are not counted as District revenue. Grants are also a revenue source. Below is a chart showing the District revenue for the last four years and the projected revenues for the next fiscal year:



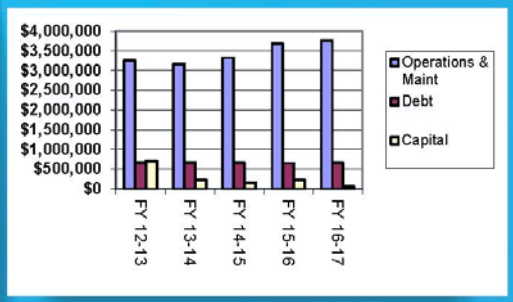
Expenditures

Your District spends money to:

- Operate the wastewater collection and treatment facilities;
- Maintain and repair District facilities;
- Repay bond, other debt and miscellaneous liabilities that may occur as a result of operation; and
- Replace aging infrastructure or make capital investments needed to comply with water quality standards.

Your District also spends money to accomplish the capital projects needed in the District.

The chart below shows expenses for the past four years and next year's budget:



Rebates

CLOTHES WASHER Receive up to $125 back on the purchase and installation of a new, qualifying high-efficiency clothes washer (HEW). Rebates are available for all Energy Star Most Efficient listed clothes washers except those containing silver ion technology. A $75 rebate may also be available from PG&E.

TOILET Get up to $150 back on the purchase and installation of each new, qualifying high-efficiency toilet (HET) from the List of Qualifying Models. Download rebate application forms and learn more at www.sonomacountywater.org/rebates or call (707) 547-1918.

HIGH-EFFICIENCY FIXTURE DIRECT INSTALL PROGRAM
A limited number of high-efficiency fixture retrofits, including toilet, urinal, faucet aerator and showerhead replacements, are offered at no cost to eligible properties. For more information and to register, go to: www.sonomacountywater.org/direct-install.

GRASS REMOVAL If you are a well user within the Russian River watershed, you may now be eligible to save money and conserve water by replacing the grass at your home. Through emergency drought relief funding, the Water Agency is offering homeowners $0.50 per square foot of grass removed and replaced with low water use plants, up to 500 sq. feet. To view a full list of the program guidelines and qualifications visit www.sonomacountywater.org/drought. Due to limited funds, this program will only be offered while funding is available.

Public Invited on Free Tours

The Water Agency is pleased to host public tours of the Russian River water supply system. To sign up for the tour described below, please fill out the online registration form at :

www.sonomacountywater.org/tours

Additional details will follow once your registration is received.

Russian River Water Supply System Tour
The Sonoma County Water Agency invites the public to attend a free half-day tour of the Russian River water supply system. Tour participants will visit facilities that divert, pump and treat the water delivered by the Water Agency to more than 600,000 residents in portions of Sonoma and Marin counties. These facilities will include the Westside Water Education Center, fish ladders, infiltration ponds and Water Collector 6 – one of the largest water collectors of its type in the world. This tour is offered in English and Spanish.

Sign up in English / Inscríbete en Español
Saturday, April 30th, 9 a.m. - Noon

Sign up in English/ Inscríbete en Español
Saturday, October 8th, 9 a.m. - Noon

For more information on the above tours, contact us on the Public Affairs hotline at 707.524.6430.

Sewer System Management Plan Updates

The Water Agency is in the process of updating the Sewer System Management Plans (SSMP), which are designed to ensure that sewer agencies review their maintenance and repair records in order to keep sanitary sewer overflows (SSO) to a minimum. The goal of the process is to determine the overall health of the system based on the number of SSOs that occur every year.
The five-year SSMP update is expected to be considered for approval by the Water Agency Board of Directors in the spring of 2016.
The SSMPs are available at our 404 Aviation Blvd. office in Santa Rosa and also at:
www.sonomacountywater.org/sewer-sytem-management-plans/

Public Input Sought on Hazard Mitigation Plan in Russian River County Sanitation District

Sonoma County is vulnerable to numerous natural hazards. Flooding, mudflows, and landslides are relatively common. Additionally, the Russian River County Sanitation District (RRCSD) is located near major active earthquake faults. The RRCSD has embarked on a proactive Local Hazard Mitigation Planning process to form a long-term strategy to reduce disaster losses.

The RRCSD initially conducted an assessment to identify potential damage to existing infrastructure from local hazards. The second phase of the project was to develop a Local Hazard Mitigation Plan (LHMP) that incorporates strategies to minimize damage to the sanitation system and increase its reliability during disasters.

The RRCSD is in the process of finalizing a draft LHMP. A copy of the LHMP will be available online later this spring at: www.sonomacountywater.org/rrlhmp/

Public comments will be accepted during a 30-day period when the report is released, and ratepayers and other people are encouraged to submit comments. The RRCSD Board of Directors will review comments at the conclusion of the 30-day period.

The LHMP 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.

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 Guerneville Regional Library, 14107 Armstrong Woods Rd, Guerneville, CA 95446. For questions about the LHMP, contact Jake Spaulding at 707-524-8373 or jake.spaulding@scwa.ca.gov

Russian River District's Complicated Collection System

The RRCSD is, by far, the most complicated collection system pipeline network in the County. It takes 11 separate pumping stations to get wastewater from users' homes and businesses to its treatment plant. These stations represent the harshest working conditions of for electrical and mechanical equipment. These stations require constant maintenance and frequent pump rebuilds, and periodically their high voltage electrical systems must be completely replaced. Over the next decade, the RRCSD will be attempting to rebuild one station a year.

Danger: Wet Paint!

Don't pour leftover paint, solvents or chemicals down the drain, into toilets, cleanouts or manholes. These products can end up in the RRCSD treatment plant. At worst, harsh contaminants can literally kill the bacteria that is used to treat wastewater. It can take days and thousands of dollars to restart a plant after the bacteria has died. At best, sanitation maintenance workers will discover the contaminant before it reaches the treatment plant. But even an early discovery results in costly isolation, removal, testing, and disposal. Go to http://www.recyclenow.org/toxics/house_tox_facility.asp to find out where you can safely drop off household hazardous waste.

PROPOSITION 218

Sonoma County Water Agency
Russian River County Sanitation District

NOTICE OF PUBLIC HEARING REGARDING PROPOSED SEWER SERVICE FEE INCREASE

Date, Time, and Place of Public Hearing

On May 17, 2016, at 2:10 p.m. or as soon thereafter as the matter may be heard, in the Board Meeting Room, 575 Administration Drive, Room 102A, Santa Rosa, California, the Board of Directors (Board) of the Russian River County Sanitation District (District) will conduct a public hearing to consider increasing the annual sewer service fee to be collected on account of sewage collection and treatment services provided by the sewer system of the District to property within the District.

Property Owner Obligation

The fee will be imposed on each parcel upon which is located one or more structures which are connected to the system and the fee will be collected on the general property tax bill administered by Sonoma County. Payment of the fee will be the responsibility of the owner of the parcel.

What the Fee is for and How the Funds Collected Will be Used

The fee is imposed for two purposes: (a) to finance the ongoing operation and maintenance costs of the system and, (b) to pay the capital replacement program costs of the system. The purpose of the capital replacement program is to provide for the long-term replacement of system facilities as they wear out.

Amount of Proposed Fee Increase and Method of Calculating the Increased Fee

Effective July 1, 2016, the District proposes to increase the fee to $1,416 per year per "equivalent single-family dwelling" (ESD), an increase of $61, or 4.5% versus current year. A standard single-family home constitutes one ESD. Parcels which have other uses (for example, apartments and commercial buildings) will be assigned a number of ESDs using standard equivalency factors which estimate the probable quantity and quality of sewage effluent normally generated by such uses in comparison to a single-family home.

The increased fee has been calculated by dividing the annual costs of providing wastewater treatment and collection service by the estimated number of ESDs to arrive at the fee per ESD of $1,416, and for parcels having more than one ESD assigned, the fee is calculated by multiplying the number of ESDs assigned to the parcel times $1,416. The draft proposed budget for fiscal year 2016-17 describes the total annual expenses in detail and is available for review at the Russian River County Sanitation District, c/o the Sonoma County Water Agency, 404 Aviation Boulevard, Santa Rosa, California 95403, and the Sonoma County Regional Libraries in Santa Rosa (Main & Northwest), Windsor, Healdsburg, Cloverdale, Guerneville, Sebastopol, Petaluma, Rohnert Park, Rincon Valley, Sonoma, and Forestville (El Molino High School).

PROPOSITION 218

Further Information Available Prior to the Hearing

At the hearing, the Board will consider adoption of an ordinance which will establish the increased fee. A copy of the ordinance is on file and available for review at the Sonoma County Water Agency, 404 Aviation Boulevard, Santa Rosa, CA 95403. In addition, the following persons may be contacted at the Agency at (707) 526-5370 for further information and/or obtaining copies of the draft proposed budget for fiscal year 2016-17:

Manuel Olvera, Engineering Technician III
Candi Bryon, Accountant III

Property Owner Protest Procedure

This notice has been mailed to you because records of the Sonoma County Assessor list you as an owner of one or more parcels within the District which will be subject to the fee while connected to the system. In the event you have sold property you may have owned within the District, please send this notice to the new owner.

Either prior to or at the public hearing, property owners may submit written protests respecting the fee. At the public hearing, the Board will consider all written protests which have been received by the prescribed deadline. In order to be considered, a written protest must be made on the attached form. Only one protest will be counted per parcel. Only protests signed by the current owner(s) will be allowed and must be received no later than the following deadlines:

- If submitted by mail, they must be received (NOT postmarked) no later than 5:00 p.m. on Monday, May 16, 2016, at the mailing address on the form.

- If hand delivered, they must be delivered no later than the close of the public hearing on May 17, 2016, to: Clerk of the Board
  Board Meeting Room, as set forth in the opening paragraph

Date of this Notice: March 28, 2016

RATE PROTEST FORM

NOTE: IN ORDER TO BE CONSIDERED, ANY PROTEST MUST BE ON THIS FORM

WRITTEN PROTEST

I am the parcel owner of the property located at the address on the back of this form. I am submitting this form to protest the proposed sewer rate increase.

Additional Comments: _____

_____

_____

_____

_____

Use opposite side or attach additional sheets if needed.

_____
Signature of Property Owner Required

_____
Print Name

Fold Here First

Place Postage Here

Russian River County Sanitation District
c/o Sonoma County Water Agency
404 Aviation Blvd.
Santa Rosa, CA 95403

Fold Here Second

7

Russian River County Sanitation District
c/o Sonoma County Water Agency
404 Aviation Blvd.
Santa Rosa, CA 95403

IMPORTANT
Sewer service fee
NOTICE (Prop 218)
Enclosed: Russian
River County
Sanitation District

HEARING DATE
May 17 2016, 2:10 p.m.

HEARING LOCATION
575 Administration Drive,
Room 102A, Santa Rosa, CA

Included in this issue is the Proposition 218 Notice proposed for Fiscal Year 2016-2017 sewer rates.
The Notice with information about the proposed rates is included on pages 5-6 of this newsletter. The return protest form is located on page 7.

Securing our Future by Investing in our Water Resources, Environment & Community
www.sonomacountywater.org/RRCSD

SONOMA COUNTY WATER AGENCY

Exhibit 2B

Stakeholder Postcard – Mailed 06/16/2016 to 70 individuals and organizations

NATURAL DISASTER PLANNING

Public Input Sought on Local Hazard Mitigation Plan for the Russian River County Sanitation District

The Russian River County Sanitation District (RRCSD) is preparing a Local Hazard Mitigation Plan (LHMP) to increase the reliability of its infrastructure during natural disasters. RRCSD has scheduled a 30-day public review period beginning June 22, 2016 to gather input on the draft plan and members of the public are encouraged to submit comments during this review period. Copies of the LHMP can be viewed online beginning June 22, 2016 at: *www.sonomacountywater.org/rrlhmp*.

A public meeting before the RRCSD Board of Directors is scheduled for September 13, 2016, in the Board of Supervisors Chambers, 575 Administration Drive, Room 102A, Santa Rosa, CA. For board agendas, visit: *www.sonomacounty.ca.gov/Board-of-Supervisors/Meeting-Agendas-Minutes-and-Videos/*

Comments on the LHMP should be submitted by email 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 Guerneville Regional Library, 14107 Armstrong Woods Rd. Guerneville, CA 95446

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

SONOMA COUNTY WATER AGENCY

Sonoma County Water Agency/
Russian River 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 Russian River County Sanitation District facilities for natural disasters, such as earthquakes, floods and fires. See the back of this postcard for more information.

Exhibit 2C

Stakeholder Postcard Mailing List–

AGENCY CONTACT FIRST NAME	AGENCY CONTACT LAST NAME	ORGANIZATION	TITLE
		Cities/Counties/Local Govt	
Stephan	Betz	County of Sonoma Dept of Health Services	Director
Max	Ming	Forestville FPD	Chief
Steven	Bandettini	Forestville Water District	Chair, Board of Directors
Matthew	Froneberger	Forestville Water District	General Manager
Marshal	Turbeville	Geyserville Fire Protection District (FPD)	Chief
Brittany	Heck	Gold Ridge Resource Conservation District	Executive Director
Steve	Baxman	Monte Rio FPD	Chief
David	Schiltgen	Permit and Resource Management Department	Land Use Planner III
James	Dunton	Russian River Co Water District	President
Max	Ming	Russian River/Guerneville FPD	Chief
Hal	Wood	Russian River Utility	Consultant
Anthony	Gossner	Santa Rosa FPD	Chief
Bill	Keene	Sonoma County Agricultural Preservation and Open Space District	General Manager
Susan	Klassen	Sonoma County Department of Transportation & Public Works	Director
Christopher	Helgren	Sonoma County Emergency Services	Emergency Services Manager
Steven	Herrington	Sonoma County Office of Education	Assistant Superintendent Educational Services
Kara	Heckert	Sonoma Resource Conservation District	Executive Director
Steve	Mack	Sweetwater Springs Water District	General Manager
Sukey	Robb-Wilder	Sweetwater Springs Water District	Financial Coordinator
		State Agencies	
Mark	Cowin	California Department of Water Resources	Director

Scott	Wilson	California Dept of Fish & Wildlife	Regional Manager
Catrina	Christian	California Emergency Management Agency (CalEMA)	Emergency Services Coordinator
Sarah	Kline	Groundwater Resources Association of California	Administrative Director
Dave	Dearborn	California Highway Patrol (CHP)	Environmental Crimes Investigator Hazardous Materials Technician
Laurel	Marcus	California Land Stewardship Institute	Executive Director
Catherine	Colman	California Regional Water Quality Control Board	Executive Officer
Karla	Nemeth	California Resources Agency	Deputy Secretary for Water Policy
Zachary	Rounds	California State Dept of Health Services	Associate Sanitary Engineer
~~Jenny~~	~~Donovan~~	California State Parks Department, Bay Area District	~~Public Safety Superintendent Russian River District~~
Gary	Lippner	Department of Water Resources	Chief, Regional Planning and Coordination
		Federal Agencies	
~~Dick~~	~~Butler~~	NOAA Fisheries	Resources Manager
Patrick	Rutten	NOAA Restoration Center	Restoration Center Southwest Region Supervisor
Randy	DeCaminada	Pacific Gas & Electric Company	Executive Manager
John	Woodling	Regional Water Authority	Executive Director
~~Don~~	~~Silverek~~	Santa Rosa Junior College	Emergency Management Coordinator
Tony	Linegar	Sonoma County Fish & Wildlife Advertising Commission	Department Head
Claudia	Luke	Sonoma State University, School of Science and Technology	Professor
Eric	Sklar	California Fish & Game Commission	President
~~Eric~~	~~Oppenheimer~~	State Water Resources Control Board, North Coast Region	~~Chief - Russian River Watershed Unit~~

Stephanie	Larson	University of CA Cooperative Ext	County Director and Livestock Range Management Advisor
Mike	Dillabough	US Army Corps of Engineers	Chief
		US Fish & Wildlife Services	Assistant Regional Director: Fisheries and Water Resources
~~Michael~~	~~Webster~~	US Geological Survey	Ukiah Field Officer
		Elected Representatives	
Marc	Levine	California State Assembly	State Assembly Member
Jim	Wood	California State Assembly	State Assembly Member
Mike	McGuire	California State Senate	State Senator
Mike	Thompson	US House of Representatives	US Representative - California
Jared	Huffman	US House of Representatives	US Representative - California
		Non-governmental Organizations	
Eileen	Adams	American Red Cross	Chair, Community Volunteer
Kandis	Gilmore	Community Clean Water Institute	President
		Environmental Forum of Sonoma County	Coordinator
David	Keller	Friends of the Eel River	Bay Area Director
John	Uniack	Friends of Rio Nido	President
Brittany	Heck	Gold Ridge Resource Conservation District	Executive Director
Kevin	Munroe	Laguna de Santa Rosa Foundation	Executive Director
Craig	Anderson	LandPaths	Executive Director
Anthony	Chatwin, Ph.D.	National Fish and Wildlife Foundation	Executive Vice President, Science and Evaluation
~~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	President
Ellie	Cohen	Point Reyes Bird Obseravitory Conservation Science	Executive Director
		Rohnert Park and Cotati Creek Council	

		Russian River Historical Society	
Don	McEnhill	Russian River Keeper	Program Director
Brenda	Adelman	Russian River Watershed Protection Committee	Chair
Jane	Nielson	Sebastopol Water Information Group	President
Victoria	Brandon	Sierra Club: Redwood Chapter	Chair
Vesta	Copestakes	SoCo Gazette	
~~Dennis~~	~~Rosatti~~	Sonoma County Conservation Action	
Kim	Vail	Sonoma County Farm Bureau	Executive Director
Mike	Frey	Sonoma County Surfrider Foundation	Chapter Co-Chair
Stephen	Fuller-Rowell	Sonoma County Water Coalition	Co-founder
Karissa	Kruse	Sonoma County Winegrape Commission	President
Richard	Dale	Sonoma Ecology Center	Executive Director
Dave	Koehler	Sonoma Land Trust	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 Director/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	
Chris	Bingham	Alexander Valley Association	President
Roberta	Larson	California Association of Sanitation Agencies	Executive Director
Richard	Kagel	Dry Creek Valley Association	President
Tracy	Huotari	North Bay Association of Realtors	Chief Executive Officer
Judy	Kelly	North Bay Watershed Association	Executive Director
Max	Broome	Forestville Planning Association	Board Member
		Business/Chambers of Commerce	

Danielle	DiBari Alexander	Geyserville Chamber of Commerce	President, Board of Directors
Chuck	Ramsey	Monte Rio Chamber of Commerce	President
Debra	Johnson	Russian River Chamber of Commerce	President
Shannan	Wesley	Russian River Valley Winegrowers	Manager
Jonathan	Coe	Santa Rosa Chamber of Commerce	President/CEO
Brian	Ling	Sonoma County Alliance	Executive Director
		Service Organizations	
Jeff	Davis	Russian River Rotary	President

Exhibit 2D

Press Release – emailed 06/13/2016 to local news outlets & posted to website

PRESS RELEASE

For Immediate Release
June 13, 2016

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 for Russian River County Sanitation District

GUERNEVILLE, CA — The Russian River County Sanitation District (RRCSD) is preparing a Local Hazard Mitigation Plan (LHMP) to increase the reliability of its infrastructure during natural disasters. RRCSD has scheduled a 30-day public review period beginning on June 22, 2016 to gather input on the draft plan and members of the public are encouraged to submit comments during this review period. Copies of the LHMP can be viewed online beginning June 22, 2016 at: *www.sonomacountywater.org/rrlhmp*.

A public meeting before the RRCSD Board of Directors is scheduled for September 13, 2016, in the Board of Supervisors Chambers, 575 Administration Drive, Room 102A, Santa Rosa, CA. The RRCSD 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 costs to communities. Protecting human and environmental health is our highest priority as we identify potential hazards in our wastewater collection and treatment infrastructure," said Water Agency and RRCSD Director Efren Carrillo. "The Local Hazard Mitigation Plan for the Russian River County Sanitation District will form the foundation for a long-term strategy to reduce disaster losses."

The RRCSD 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 LHMP focus on increasing the reliability of sanitation facilities in order to protect public health, property, and natural resources. The LHMP 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 RRCSD is also developing the LHMP in order to qualify for federal disaster grant assistance.

The Russian River County Sanitation District began operations in 1983 and serves 3,161 Equivalent Single-Family Dwellings within a 2,700-acre service area. The treatment plant has a design capacity of 710,000 gallons per day and treats wastewater to tertiary treatment levels and provides tertiary treated water for irrigation.

Comments on the LHMP should be submitted by email 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 Guerneville Regional Library, 14107 Armstrong Woods Rd. Guerneville, CA 95446

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

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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 County Gazette Advertisement 06/16/2016 (reader circulation approx130,000)

Bodega Bay Beat

By Joan Poulos
Joangp@comcast.net

The **Fish Fest** was successful as always, although the weather cut into the profit margin a little. The community reaps the benefit of the hard work all these citizens put in and the money they earn (and distribute to the community). The annual "success fest" is June 17 at the **Grange Hall** and a great "success"in and of itself. Don't forget the Firefighters' Pancake breakfast July 2 .It is always excellent (even if you don't elect to buy a glass of champagne).

Bodega Bay voters flocked to the very successful meeting **John Dolittle** put together to introduce all five candidates for the **Fifth Supervisorial District**. *The Press Democrat* estimated that two hundred attended, but for those of us who are more used to counting the house at the Grange, the estimate is a bit lower. Nevertheless, the house was full and the attendees were full of questions. **Noreen Evans** was late, but the others were all ready to go on time and the public was fully involved in both the questions and the answers. The public was polite, but some questions were not answered to the apparent satisfaction of the attendees. Two questions hung in the air, and were answered by all candidates to whom the questions were addressed. They were: 1: How long have you lived in this district? and 2: What is the source of funding for your campaign?

Three candidates had no problem answering the residency question. **Tom Lynch** said he had lived here many years (he has been on the planning commission eight years), and **Marion Chase** was born in west county. The teacher, **Tim Sergent** has lived here 36 years. The two that the *Press Democrat* calls the "front runners" **Noreen Evans** and **Lynda Hopkins** dodged the residency question. Clearly Evans had represented another district in the legislature, but she reiterated her commitment to the West county (until she was duly chastened for "re-trying" our **Supervisor Efren Carrillo**, who is a dedicated representative for the Fifth District as an issue in her campaign) and Lynda Hopkins struggled with the huge contributions she has received from out of district sources (mostly construction/realty folks.) Tom Lynch got the only spontaneous applause during the presentations when he suggested that each candidate conduct a campaign without innuendos or unpleasantness.

Other questions showed that the voters had been thinking about the campaign. They really wanted to know what the experience of each candidate was and what they would use for decision making. All the candidates struggled with the pension question, which Lynch was the first to raise. It is the elephant in the room and there are no easy answers. It was surprising that no candidate referred to the **Independent City Advisory Committee on Pension Matters**, even though it is a City committee. They are really working to come up with some ideas. It is a tough issue.

Evans, who has received the support of the unions, had the most trouble with this, in spite of her legislative experience, which should be useful. Lynch, who had broached the issue, had no strong recommendations but did reflect his knowledge of city policies (he has been on the planning commission eight years). Chase was a popular candidate, with her acknowledgment of a lack of knowledge of public policy procedures but a charming willingness to work hard and give each issue her best effort. Sergent gave reasoned, thoughtful answers but was a little outside his comfort zone. There was none of the hostility we see in the Presidential campaigning. Local elections can bring out citizenry at its best. We owe our thanks to each candidate willing to do all this work and show their commitment to making public policy as effective as possible. If only the Presidential debates were as civilized (or as informative.

Maybe all our filibustering paid off. The Board of Supervisors has agreed to dedicate a portion of the TOT (transit occupancy tax) to public services. Our Fire Chief Sean Grinnell was very active in this effort and our Supervisor Efren Carrillo worked hard on this. The fire fighters put on an intense effort for a just resolution. It is easier when you do the splendid job our firefighters do, and when you have the support of your grateful community.

One more way we can show our support for our local **Fire Protection District** is to approve the **Appropriations Limit Override (Measure A)** which is on the ballot June 7. Although we have previously voted (and approved) Measure E, now we have to re-vote to give our permission to use the money we gave the fire department the power to collect. We need to vote Yes on Measure A to assure that we continue to get the fire and emergency service levels we agreed that we needed. Thanks to **Sean Grinnell** for staying on top of this. Things like this make the nonsense some of the recent Presidential candidates have been spouting almost understandable. The good news: June 7 the Presidential primary will be over in California. Most of us who have mail-in votes got our ballots at the same time as we got official voter recommendations. The latter perplexes me. The Democrats leave out their most visible candidate Hillary Clinton (Bernie has never made up his mind about whether or not he is a Democrat) and name only Thompson and Huffman for Congress.

NATURAL DISASTER PLANNING

Public Input Sought on Hazard Mitigation Plan for Russian River County Sanitation District

The Russian River County Sanitation District (RRCSD) 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 beginning June 22, when members of the public are encouraged to submit comments during the public review period. Copies of the LHMP can be viewed on-line beginning June 22, 2016 at: *www.sonomacountywater.org/rrlhmp*. Public comments will be accepted until September 13, 2016.

A public hearing before the RRCSD Board of Directors is scheduled for September 13, 2016, in the Board of Supervisors Chambers, 575 Administration Drive, Room 102A, Santa Rosa, CA. For board agendas, 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 Guerneville Regional Library, 14107 Armstrong Woods Rd. Guerneville, CA 95446

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

SONOMA COUNTY WATER AGENCY

A tougher issue, for me, is AA, the San Francisco measure. I support the concept but don't believe the parcel tax is the way to go. The ocean belongs to all of us, not just to the oil industry; not to the shipping industry; not to the hoteliers. We are already financing the restoration of the wetlands along Highway 37, why is this one different? A general tax would be more fair and there would be wider dissemination of correct environmental data.

Regarding the ocean, both salmon and crab seasons are still on, as this is written. The price of crab is high, but the numbers aren't great. It has been a tough year to be in the fishery industry. We wish them the best. In the meantime, eat salmon (even at $20 a pound in the market). We pay more; but fishermen also get more.

One last issue, the **Mason's Marina** issue has been updated. The gasoline pumps are history (too expensive; too much possible contamination). The Regional Parks are continuing their still looking into the repairs for the docks and slips and they haven't foreclosed the idea of a mini-market. They were very active in trying to help out in the recent financial crisis the fishing industry underwent (especially deck hands). Berthing fees were waived for three months, gift cards were purchased by Regional Parks as well as by church members. Good job of pulling together, **Ms. Hart** and **Mr. Nantell**.

Spring has come. The local school is gathering books for its annual book sale in August; pitch in and help out. Books can be left at the school after June 14.

The whales are making their way north; the orange crabs haven't visited us, the token humpback has visited close by; the ocean is a never ending tale. We are lucky to be able to be so close. Make a pledge to take care of it.

Exhibit 2F

Public Notices Webpage, posted on 06/XX/16

PLACEHOLDER

Exhibit 2G

Event Calendar Webpage, posted on 06/XX/16

PLACEHOLDER

Exhibit 2H

Social Media – Twitter posted on 06/XX/16

PLACEHOLDER

Exhibit 2I

Social Media – Facebook, posted on 06/XX/16

PLACEHOLDER

Exhibit 2J

Sonoma West Newspaper Advertisement, published on 06/22/16

PLACEHOLDER

APPENDIX C – INTERNAL MEETINGS

Exhibit 1A:	Project Kickoff Meeting Agenda, 08/20/2013
Exhibit 1B:	Project Kickoff Meeting Sign-in Sheet, 08/20/2013
Exhibit 1C:	Project Kickoff Meeting Minutes, 08/20/2013
Exhibit 1D:	Public Outreach Meeting Agenda, 10/08/2013
Exhibit 1E:	Public Outreach Meeting Minutes, 10/08/2013
Exhibit 1F:	Hazard Identification Meeting Agenda, 03/04/2014
Exhibit 1G:	Hazard Identification Meeting Sign-in Sheet, 03/04/2014
Exhibit 1H:	Hazard Identification Meeting Minutes, 03/04/2014
Exhibit 1I:	Hazard Identification Meeting Presentation, 03/04/2014
Exhibit 1J:	Public Outreach Meeting Agenda, 04/01/2014
Exhibit 1K:	Vulnerability Meeting Agenda, 05/21/2014
Exhibit 1L:	Vulnerability Meeting Sign-in Sheet, 05/21/2014
Exhibit 1M:	Vulnerability Meeting Presentation, 05/21/2014
Exhibit 1N:	Mitigation Review Meeting Agenda, 05/10/2016
Exhibit 1O:	Mitigation Review Meeting Notes, 05/10/2016

Exhibit 1A

Project Kickoff Meeting Agenda, 08/20/2013

AGENDA – LHMA SANITARY FACILITIES – J/N 7612 (A1-SV & A2-RR)

DATE: **August 20, 2013**

ORGANIZER: **Curran Price**

SUBJECT: **Kickoff Meeting – LHMP Sonoma & Russian River Sanitation District**

1. Introduction
2. Hazards at SVCSD & RRCSD

Invited Attendees:

Curran Price	Project Manager	Brian Anderson	Operations Coordinator
Kent Gylfe	Engineering Management	Frank Mello	Operations Coordinator
Iver Skavdal	GHD Operating Manager	GHD and G&E Engineering Team Members	

Exhibit 1B

Project Kickoff Meeting Sign-in sheet, 08/20/2013

LHMA 8/20/13 — SIGN IN SHEET

CURRAN PRICE	
KENT GRACE	
Jeff Richmond	Kleinfelder
BILL MCCORMICK	KLEINFELDER
John Eldinger	GTE
DONALD DUGGAN	GTE
IVER SKAVDAL	GHD
ALEX CULICK	GHD
Cindel Gillman	SCWA
Courtney Ellerbusch	SCWA
Tim GAHAGAN	SCWA
Michael Bendik	SCWA
Pam Jeane	SCWA

Exhibit 1C

Project Kickoff Meeting Notes, 08/20/2013

SONOMA COUNTY WATER AGENCY

Meeting Minutes

7612 – Local Hazard Assessment SVCSD & RRCSD

DATE: 08/21/2013

RE: **LOCAL HAZARD ASSESSMENT SVCSD & RRCSD - KICKOFF**

1. Curran discussed that we had a site tour earlier in the day at SV Treatment Plant (TP) (led by Ryan Hall) and RR TP, to look at some of the vulnerabilities and see how the TP operated. Meeting is to discuss what we see as vulnerabilities and what we are going to be doing moving forward.
2. Iver discussed that this is a kickoff meeting to just lay down the basic framework of what we will be doing, which is an assessment of the infrastructure at the sanitation districts. The first phase will be data collection. GHD needs GIS information of the collection system, which will be overlaid with vulnerabilities. Then there will be an assessment of the vulnerabilities along the system. There will also need to be future meetings to discuss what is priority infrastructure and how we come up with an evaluation procedure to come up with a priority of vulnerabilities.
3. John talked about the visit at the treatment plants and experience with previous earthquakes and how it might relate to vulnerabilities along our system. John ideally wants drawings on the whole treatment system plant system with piping. At Sonoma treatment plant, he would like drawings of the headworks structure because of concerns it might float/have differential settlement during a large earthquake. At both SV and RR he would like drawings and ideally product information on the clarifiers because there have been instances of them jamming up after an earthquake. At RR TP there is the issue of the landslide and how we might be able to mitigate that involves a series of discussions. There is also a question of the collection system. At SVCSD we have deep sewer pipes and there might be the possibility of the sewers breaking and debris entering through these breaks creating huge material flows to our treatment that make it unmanageable for the TP. How we evaluate and prioritize this will be important. John also talked about FEMA funding. John discussed that there is the typical process of applying for a grant and being put in line for possible funding. John said that after a disaster hits your area and it is declared a national emergency, which would happen if there is a major earthquake, we would be able to repair the infrastructure with getting 90% of it funded as long as we have a natural hazard mitigation plan. Of the total amount we spend, 10% will remain for replacement of any vulnerabilities that we deem as still vulnerable at the 75/25. What will often happen is that a declaration of emergency is often elsewhere in the state, and that the local area doesn't have the desire to pursue all the funds, so these funds are then opened up to the rest of the state, and they will pick a project that has applied for funding. So even though the federal government may not have much funding for projects in a particular year, you still want to apply for funding

for your project because it could be funded due to a disaster in an area in another portion of the state being declared a national emergency. John said that there are going to be some projects that are just too expensive to try and fix at the 75/25 range and may not be critical to the function of the system. Others might need to be done because of the fines that might be imposed if a spill occurs. It will need to be the judgment of the agency to decide what priorities the agency has and how much of the infrastructure we want to mitigate. We could rehabilitate the whole collection system or just the main vulnerabilities, and this will be a question of the direction the agency wants to take.

4. The group discussed that we have GIS information on the collection system: size and type of pipe, in Sonoma the various creek crossings with vulnerability rating system.

Action Item:
SCWA to provide GHD with GIS information on the Collection system, as built drawings on the treatment plant, and geotechnical reports.

Attendees

Iver Skavdal (Engineer – GHD), Alex Culick (Project Manager – GHD), Donald Duggan (Structural Safety - G+E), John Eldinger (Structural/Earthquake Safety – G+E)Jeff Richmond (Soil Engineer – Kleinfelder), Bill McCormick (Soil Engineer – Kleinfelder), Michael Bendik (Risk and Safety - SCWA), Cordell Stillman (Engineering - SCWA), Pam Jeane (Operations Engineering - SCWA) Courtney Ellerbusch (GIS - SCWA), Tim Gahagan (GIS - SCWA), Kent Gylfe (Engineering - SCWA), & Curran Price (Project Manager - SCWA)

Exhibit 1D

Public Outreach Meeting Agenda, 10/08/2013

AGENDA – LHMP SANITARY FACILITIES – J/N 7612 (A1-SV & A2-RR)

DATE: **October 10, 2013**

ORGANIZER: **Pam Kuhn**

SUBJECT: **Public Outreach – LHMP Sonoma & Russian River Sanitation District**

1. LHMP Background/Outreach Requirements
2. Outreach Action Items
   a. Near term action items
   b. Future action items

Invited Attendees:

Curran Price	SCWA Project Manager	Jake Spaulding	Grants/Funding
Kent Gylfe	Engineering Design	Joan Hultberg	Grants/Funding
Brad Sherwood	Public Affairs	Pam Kuhn	Public Affairs
Carly Cabrera	Public Affairs	Lynne Rosselli	Budgets/Accounting

Exhibit 1E

Public Outreach Meeting Minutes, 10/08/2013

Local Hazard Mitigation Plans (LHMP) Outreach for Sonoma Valley and Russian River CSD's

Meeting Minutes 10-8-13

Attendees: Carly Cabrera, Brad Sherwood, Curran Price, Pam Kuhn, Kent Gylfe, Joan Hultberg, Jake Spaulding, Lynne Rosselli

Background

- SCWA is developing 2 LHMPs, 1 for SCVSD and 1 for RRCSD. Both will need outreach efforts.
- SCVSD is seeking $75K grant from FEMA and therefore needs to comply with various outreach efforts in order to qualify.
- Not yet seeking funding for RR, but will probably occur in future; outreach may not be quite as robust pending funding. Would like to involve stakeholders early, both because it may affect rates and because it will be necessary to secure future funding.
- Both LHMPs encompass 2 processes: facility vulnerability assessment (Natural Hazard Resource Assessment) and planning (with parallel outreach effort).
- Documentation of outreach efforts is critical and must be incorporated into plan appendix.
- Already made mention of efforts in recent sanitation newsletter.
- Press releases, public notices and e-newsletters can be used to meet many of the stakeholder requirements.
- After draft plan is released, there is a 4 week public involvement process that must include a public meeting and access to the draft plan.

Current Outreach Action Items (mostly pertaining specifically to SVCSD, but RR will likely parallel.)

- Jake to develop outreach project schedule chart; indicate at which point the 2 stakeholder groups need to be involved *(in next week or so)*.
- Curran and Jake to develop 2 stakeholders lists: 1 for general outreach and 1 for more sustained planning outreach *(in next week or so)*.
- Pam to develop outreach content with Curran.
- Carly to help with necessary graphic design.
- Involve Susan Gorin (SVCSD) and Efren Carrillo (RRCSD) after stakeholder list for each District is developed for buy-in.
- Curran to email stakeholders list to introduce the project and invite them to let him know if they'd like to be involved/informed of project.
- Pam to create e-newsletter for stakeholders - work with Michelsen to get this up on the website.

Future Outreach Action Items (mostly pertaining specifically to SVCSD, but RR will likely parallel.)

- Possible Intersections: Advertise for SVCSD tour and public meeting at same time to leverage marketing dollars.
- At some stage, involving Susan's water advisory panel and the local stakeholder Basin Advisory Panel is a good way to reach out.
- Provide for equal access to all individuals: copies of plan at SVCSD, Spanish language 1-sheet (Hugo Mata to help translate)
- Contact RR stakeholder list to create awareness of project

Brad will assist with setting up Board of Director meetings as needed, and work on earned media efforts, such as press release(s) as needed.

Exhibit 1F

Hazard Identification Meeting Agenda, 03/04/2014

AGENDA – LHMA SANITARY FACILITIES – J/N 7612 (A1-SV & A2-RR)

DATE: **March 4, 2014**

ORGANIZER: **Curran Price**

SUBJECT: **Hazards Meeting – LHMA Sonoma & Russian River Sanitation District**

1. Introductions
2. Background
   a. Water Transmission, Grants, etc.
   b. Kickoff Meeting, TP Visit, Information on our system
3. Hazard Mapping
   a. Draft chapters
   b. Areas of significant vulnerabilities
4. Vulnerability Assessment
   a. Areas of focus for Vulnerability Assessment
   b. Comments on suggested areas to look at during the vulnerability assessment

Invited Attendees:

Curran Price	SCWA Project Manager	Brian Anderson	Operations
Kent Gylfe	Engineering Design	Frank Mello	Operations
Jay Jasperse	Chief Engineer	Cordel Stillman	Deputy Chief Engineer
Pam Jeane	Operations Manager	Mike Thompson	Maintenance Manager
Erik Brown	Maintenance	Eric Keel	Maintenance
Mitch Southard	Maintenance	Don Seymour	Engineering Planning
Lori Armbrust	Emergency Response	Mike Bendik	Risk Management
Jake Spaulding	Grants/Funding	Joan Hultberg	Grants/Funding
Courtney Ellerbusch	Drafting/GIS	Pam Kuhn	Public Affairs
Alex Culick	GHD Project Manager	Bill McCormick	Kleinfelder
John Eidinger	G&E Engineering	Laura Bryan	GHD Project Assistant

Exhibit 1G

Hazard Identification Meeting Sign-in Sheet, 03/04/2014

SONOMA COUNTY WATER AGENCY

SIGN IN SHEET – LHMA SANITARY – J/N 7612 (A1-SV & A2-RR)

DATE: March 4, 2014

ORGANIZER: Curran Price

SUBJECT: Hazards Meeting – LHMA Sonoma & Russian River Sanitation District

NAME	FIRM/ORGANIZATION
Alex Culick	GHD
John Eidinger	G+E
Bill McCormick	Kleinfelder
Adam Fisher	GHD
Laura Bryce	GHD
Mike Thompson	SCWA
Eric Keel	SCWA
Lori Armbrust	SCWA
Pam Kuhn	SCWA
Curran Price	"
Kent Gylfe	"
Cordel Stillman	"
Erik Brown	"
Michael A. Beuchli	SCWA

Exhibit 1H

Hazard Identification Meeting Minutes, 03/04/2014

MEETING NOTES – LHMA SANITARY FACILITIES – J/N 7612 (A1-SV & A2-RR)

DATE: **March 4, 2014**

ORGANIZER: **Curran Price**

SUBJECT: **Hazards Meeting – LHMA Sonoma & Russian River Sanitation District**

1. **Background**
   a. Water Transmission, Grants, etc.

      Water Agency conducted a Local Hazard Mitigation Plan for the Water Transmission infrastructure. This was successful in identifying hazard for the water supply and providing a source of grant funding to mitigate these issues.

   b. Kickoff Meeting, WWTP Visit, Information on our system
      - GHD Team has visited both SVCSD and RRCSD WWTP's, collected data and information on the systems.

2. **Hazard Mapping**
   a. Draft chapters
      - Chapters completed to date including: Background & Introduction, Geologic, Seismic, Flood and Fire Hazards

      1. Geologic/Seismic Hazard and Mapping
         - Kleinfelder compiled the map data identifying critical pipe crossings, crossing features (abutments) high and low liquefaction zones, slope stability. Liquefaction based on material/soils types (bedrock = low, alluvial = high) and USGS Mapping, previous limited geotechnical info.
         - RRCSD WWTP: Critical – high liquefaction and landslide occurrences, steep slopes, reoccurring landslides – majority of piping in the high liquefaction zones (red/brown on maps). Treatment plant built on higher stable ground, debris flow into plant an issue.
         - SVCSD WWTP – Low impact at treatment plant, high impact on piping - does not meet liquefaction goals.
      2. SCWA to decide WWTP goals based on information developed. G&E completed Seismic hazard and mapping. John Eidinger spoke at length regarding potential damage and consequences due to seismic events.

      3. Flood Hazard and Mapping
         - SVCSD – creek crossings highest hazard due to flooding, bank stability, debris flow, and scour present.
         - RRCSD – Lift station failures due to flood and some hazards as identified in SVCSD.

      4. Fire Hazard and Mapping
         - SVCSD – Loss of power due to downed lines, debris in creek after rains in following seasons, lack of access, potential fire damage to wood structures.

- RRCSD – Loss of power due to downed lines, debris in creek flow

b. Areas of significant vulnerabilities
   - SVCSD treatment plant is in not in a liquefaction zone if mapping is correct. Issue is pipe type. Affected by the Rodgers Fault, shorter duration of shaking, liquefaction.
     - None of the pipes currently used in the SVCSD are seismic resistant. ACP most prevalent.
     - Recommended High Density Polyethylene piping for either replacement or new pipes.
       - Earthquakes in New Zealand, Chile and Japan had 0 failures with HD Polyethylene Piping
     - 20 miles of large diameter pipe.

   - RRCSD WWTP located in area of high liquefaction. Young sediments, plant located in a gravel bar. Affected by the San Andreas Fault, longer duration of shaking.
     - 85% of RRWWTP piping is in critical liquefaction, slide zones
     - Recommend diversion wall at plant to prevent slide impact
     - Locate the original Montgomery Geotech report or original borings for further study
       - Low probability Montgomery did ground improvements
     - Not all pipe materials accounted for on Pipe Attribute list. Mortar welded steel not on list. New updated GIS data showing additional pipe types

3. Vulnerability Assessment
   a. Areas of focus for Vulnerability Assessment
      - Creek Crossings, slope stability for all the Red & Brown zones
      - Piping Materials
      - ALA 2005 Liquefaction Recommendations
      - USGS mapping not reliable for RRWWTP, need original borings
      - Debris flow barrier at RRWWTP
      -Tertiary ponds at SVWWTP, not enough info will need DSOD Evaluations: if applicable, GIS Mapping
      -Emergency Response – check wastewater plan (porta potty's) how to dispose of wastewater
        Silt in pipes
        PG&E response time at RRWWTP will be slow.
        Porta Potty's likely required

   b. Comments on suggested areas to look at during the vulnerability assessment
      Closer look at vulnerability
      - Facilities – create mitigation goals
      - Tsunami is not a risk to embankments, potential for downstream flooding
      - Seismic waves from ponds are a risk
      - Address non-significant hazards for FEMA
      - Local Hazard Mitigation Plan - Add info from original report
      - Force Main Assessment RRWWTP – Priority due to recent spill

   c. Schedule
      1. Vulnerability Report – Completed in April
         - Public Meeting May 16th for SVCSD
      2. Mitigation Goals and Objectives - will be developed after the Vulnerability Assessment
      3. Hazard Assessment Final Report – Final end of August-early September
      4. SCWA to produce the Official Plan
      5. Public Outreach (today's meeting part of public outreach) has to be completed in an ongoing basis.

Action Items:
Curran Price to provide GHD with updated GIS and provide all comments to the draft report

Invited Attendees:

✓Curran Price	SCWA Project Manager
✓Kent Gylfe	Engineering Design
✓Jay Jasperse	Chief Engineer
✓Pam Jeane	Operations Manager
✓Erik Brown	Maintenance
✓Mitch Southard	Maintenance
✓Lori Armbrust	Emergency Response
Jake Spaulding	Grants/Funding
Courtney Ellerbusch	Drafting/GIS
✓Alex Culick	GHD Project Manager
✓John Eidenger	G&E Engineering
✓Laura Bryan	GHD Project Coordinator
Brian Anderson	Operations
✓Frank Mello	Operations
✓Cordel Stillman	Deputy Chief Engineer
✓Mike Thompson	Maintenance Manager
✓Eric Keel	Maintenance
Don Seymour	Engineering Planning
✓Mike Bendik	Risk Management
✓Joan Hultberg	Grants/Funding
✓Pam Kuhn	Public Affairs
✓Bill McCormick	Kleinfelder
✓Adam Fisher	GHD GIS

Exhibit 1I

Hazard Identification Meeting Presentation, 03/04/2014

Russian River CSD
Local Hazard Mitigation Plan

July 8, 2014

Cordel Stillman, P.E.
Deputy Chief Engineer

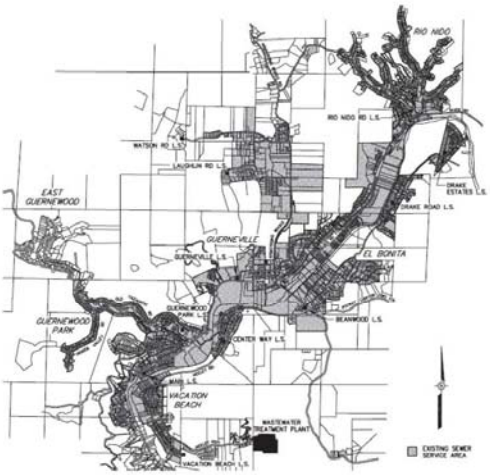
Curran Price, P.E
W.A. Engineer

SONOMA COUNTY WATER AGENCY

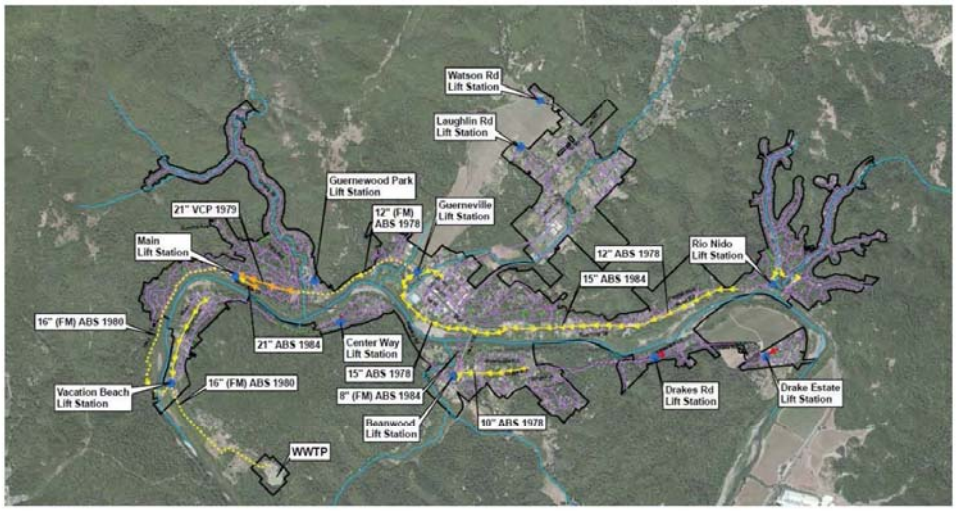
www.sonomacountywater.org

Sanitation District

- Serves approximately 3,300 parcels
- Treatment plant operational in 1983
- Treats an average dry weather flow of 0.3 MGD



Collection System



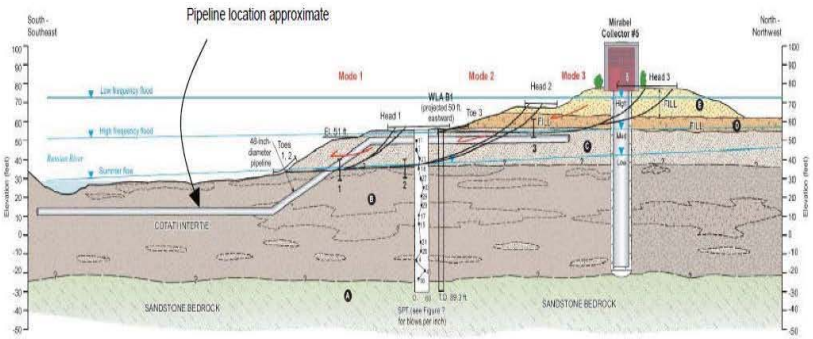
Treatment Plant

Local Hazard Mitigation Plan (LHMP)

- Identify local natural hazards
- Identify the District's vulnerabilities to natural hazards
- Identify mitigation goals, strategies, and actions to increase the sanitation systems resiliency to natural hazards
- Qualify for FEMA grant funding

FEMA Grant Funds

- Water Transmission-Awarded over $10 million in Project funding



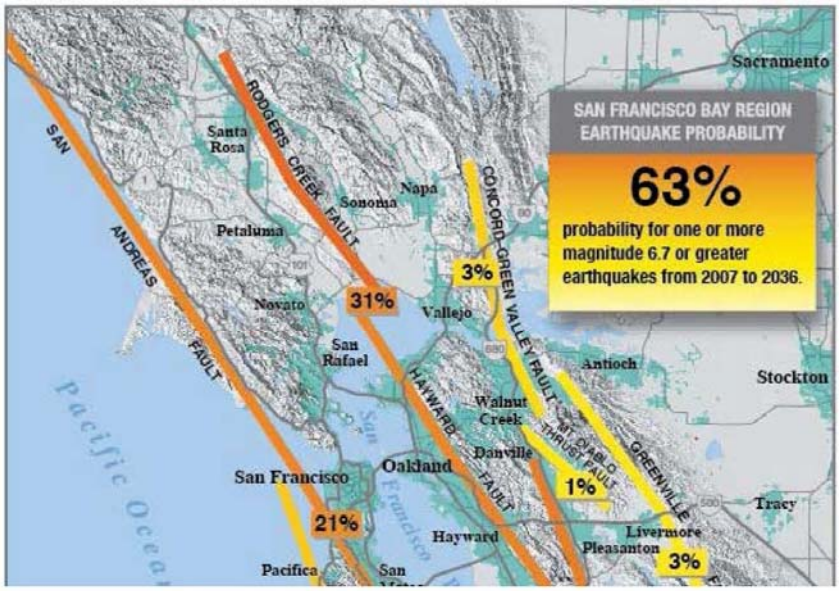
Natural Hazards

- Earthquake
- Flooding
- Landslides
- Fires

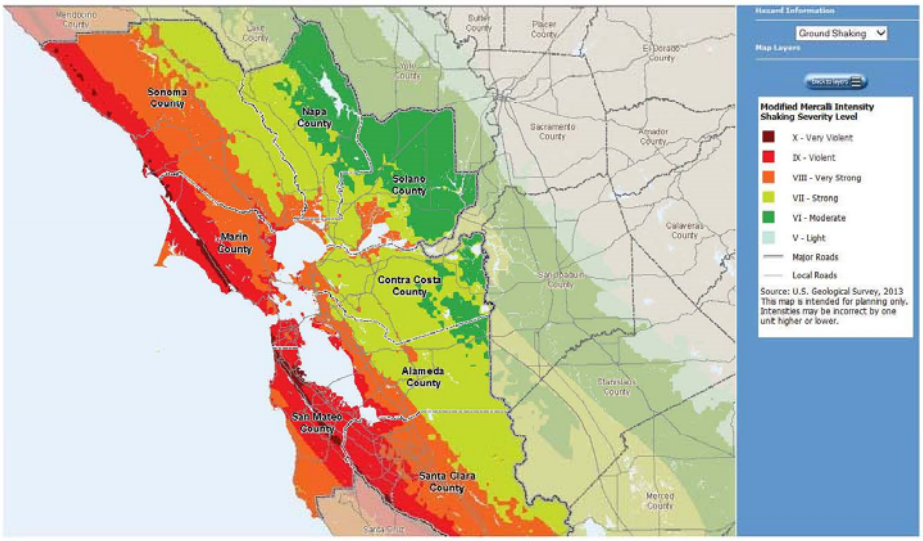
Flooding

Landslides

Earthquakes



Earthquakes

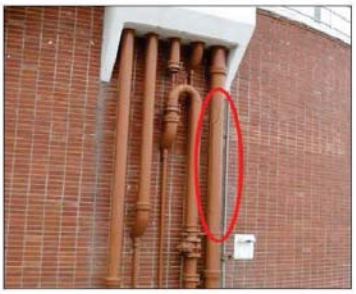


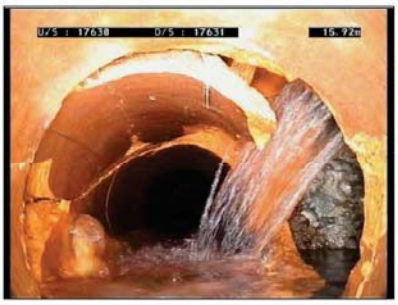
Christchurch Earthquake

Figure A-35. Flotation of Sewer Lift Station, April 2011

- 7.1 Sept 2010 and 6.3 Feb 2011
- Significant damage at the treatment plant
- 31% of Collection system damaged
- Over 400,000 tons of silt/sand removed at the treatment plant

Christchurch Earthquake

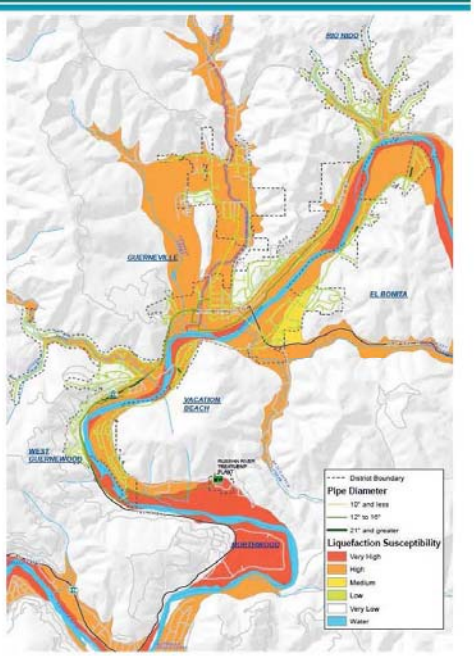




- 1.5 foot wide cracks and settlement shut down treatment plant ponds
- Flotation of manholes and lift station
- Pipe Breaks and Leaks
- Raw sewage dumped directly into rivers and streams
- Sewage Leaks estimated at 10 MGD of sewage 5 weeks after earthquake
- Portable toilets deployed throughout the city
- Repair of sewers took 3 to 10 times longer than water pipes

Liquefaction

- Saturated Soils
- High liquefaction near Creeks
- Differential Settlement
- Lateral Spread
- M8.0 - Estimated 42 breaks/leaks



Mitigation Actions

- Protect the treatment plant from debris flows
- Seismically anchor and retrofit equipment at the treatment plant
- Retrofit collection system in very high or high liquefaction zones
- Obtain emergency response equipment
- Increase storage capacity
- Stabilize creek banks or replace sewers near creek bank failures

A ruined residence, Santa Rosa, Cal., after the earthquake, April 18, 1906.

Contact Us

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Cordel.Stillman@scwa.ca.gov

Curran Price, P.E.
Curran.Price@scwa.ca.gov
(707)524-1179

SONOMA COUNTY WATER AGENCY

www.sonomacountywater.org

Exhibit 1J

Public Outreach Meeting Agenda, 04/01/2014

AGENDA – LHMP SANITARY FACILITIES – J/N 7612 (A1-SV & A2-RR)

DATE: **April 1, 2014**

ORGANIZER: **Curran Price**

SUBJECT: **Public Outreach – LHMP Sonoma & Russian River Sanitation District**

1. LHMP Outreach Requirements
    a. Planning Stage
    b. Final Draft Stage

2. Meetings
    a. Planning Meeting Options
        i. Combined Public/Stakeholders meeting with both Districts (1 meeting)
        ii. Public/Stakeholders meeting at each District (2 meetings total)
        iii. Separate Public & Stakeholders meeting at each District (4 meetings total)
    b. Draft Plan Stage:
        i. Post Draft of Plan to the Web for Comment
        ii. Present at Board Meeting
        iii. After review period, get approval by Board
    c. Content of Presentations
    d. Presenters

3. LHMP
    a. Content/Sensitive Information
    b. Areas of significant vulnerabilities

Invited Attendees:

Curran Price	SCWA Project Manager	Jake Spaulding	Grants/Funding
Kent Gylfe	Engineering Design	Joan Hultberg	Grants/Funding
Mike Bendik	Risk Management	Cordel Stillman	Deputy Chief Engineer
Pam Jeane	Operations Manager	Mike Thompson	Maintenance Manager
Brad Sherwood	Public Affairs	Pam Kuhn	Public Affairs

Exhibit 1K

Vulnerability Meeting Agenda, 05/21/2014

AGENDA – NHRA SANITARY FACILITIES – J/N 7612 (A1-SV & A2-RR)

DATE: **May 21, 2014**

ORGANIZER: **Curran Price**

SUBJECT: **Vulnerability Meeting – NHRA Sonoma & Russian River Sanitation District**

1. Introductions
2. Vulnerability Assessment including Mitigations/presentation of draft costs
   a. Sonoma Valley
   b. Russian River
3. Mitigation Goals, Objectives, and Actions

Invited Attendees:

Curran Price	SCWA Project Manager	Brian Anderson	Operations
Kent Gylfe	Engineering Design	Frank Mello	Operations
Jay Jasperse	Chief Engineer	Cordel Stillman	Deputy Chief Engineer
Pam Jeane	Operations Manager	Mike Thompson	Maintenance Manager
Erik Brown	Maintenance	Eric Keel	Maintenance
Mitch Southard	Maintenance	Don Seymour	Engineering Planning
Lori Armbrust	Emergency Response	Mike Bendik	Risk Management
Jake Spaulding	Grants/Funding	Joan Hultberg	Grants/Funding
Courtney Ellerbusch	Drafting/GIS	Pam Kuhn	Public Affairs
Alex Culick	GHD Project Manager	Bill McCormick	Kleinfelder
John Eidinger	G&E Engineering	Laura Bryan	GHD Project Assistant

Exhibit 1L

Vulnerability Meeting Sign-in Sheet, 05/21/2014

SONOMA COUNTY WATER AGENCY

SIGN IN SHEET – NHRA SANITARY – J/N 7612 (A1-SV & A2-RR)

DATE: May 21, 2014

ORGANIZER: Curran Price

SUBJECT: Vulnerability Meeting – NHRA Sonoma & Russian River Sanitation District

NAME	FIRM/ORGANIZATION
CURRAN PRICE	SCWA
Eric Keel	SCWA
ERIK BROWN	" "
Mitchell Southard	SCWA
Pam Kuhn	SCWA
KENT GYLFE	SCWA
Cordel Stillman	SCWA
Courtney Ellerbeck	SCWA
Lori Pimbrust	SCWA
Pam Jeane	SCWA
Michael Thompson	" "
Jay Jasperse	SCWA
ALEX CULICK	GHD
Laura Bryan	GHD
JOHN EIDENGER	G&E ENGINEERING
BRIAN ANDERSON	SCWA

Exhibit 1M

Vulnerability Meeting Presentation, 05/21/2014

Sonoma Valley and Russian River County Sanitation District's

Natural Hazard Reliability Assessment Vulnerability Assessment Meeting

May 21, 2014

GHD

G & E Engineering Systems, Inc.

KLEINFELDER

SONOMA COUNTY WATER AGENCY

Natural Hazard Reliability Assessment Draft Report – Vulnerability Assessment Chapter

1. Introduction
2. Review of Identified Vulnerabilities to the SVCSD System
3. Review of Identified Vulnerabilities to the RRCSD System
4. Discussion, Development of Mitigations, Goals and Actions

Draft Chapter 5 Vulnerability Assessment presents a summary of the identified vulnerabilities resulting from the Hazards previously discussed.

March 2014

Natural Hazard Reliability Assessment Draft Report – Vulnerability Assessment Chapter

Vulnerability Assessment includes:

1. Identification and quantification of the hazards that may affect the SVCSD and RRCSD system;
2. A quantification of the susceptibility to damage of essential facilities (conveyance and treatment) to providing sewer service and treatment in the event of a natural disaster;
3. Development of measures that will be included in a mitigation plan to provide a decrease in the vulnerability of the system.

March 2014

Natural Hazard Reliability Assessment Draft Report – Vulnerability Assessment Chapter

Vulnerabilities identified through review of record drawings, site visits and meetings with operations staff.

1. Specific areas and facilities at the WWTP's identified as vulnerable
2. Specific locations and also broad areas of the collection system identified as vulnerable

March 2014

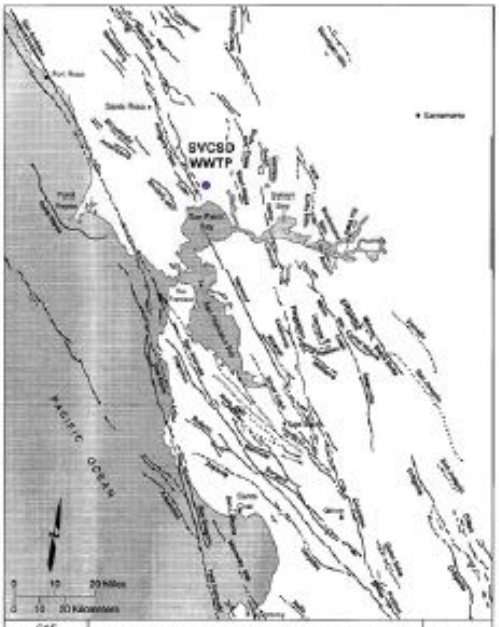


Figure 3-1. Map of Regional Earthquake Faults

R518.01.01
12/27/2013

March 2014

Sonoma Valley WWTP

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	[illegible]

Table 3-2. Deterministic Motions, Idealion, VS30 = 450 m/sec, Median

Evaluation

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	[illegible]

Table 3-3. Deterministic Motions, Median, VS30 = 450 m/sec, 84th

Design

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 3-4. Deterministic Motions, Idealion, VS30 = 250 m/sec, Median

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**

Table 3-5. Deterministic Motions, Median, VS30 = 250 m/sec, 84th

Horizontal PGA, PGV, Mean of 2 Directions, Vs30 = 450 m/sec or 250/sec
Assumes occurrence of nearby Rodgers Creek M 7 Earthquake

March 2014

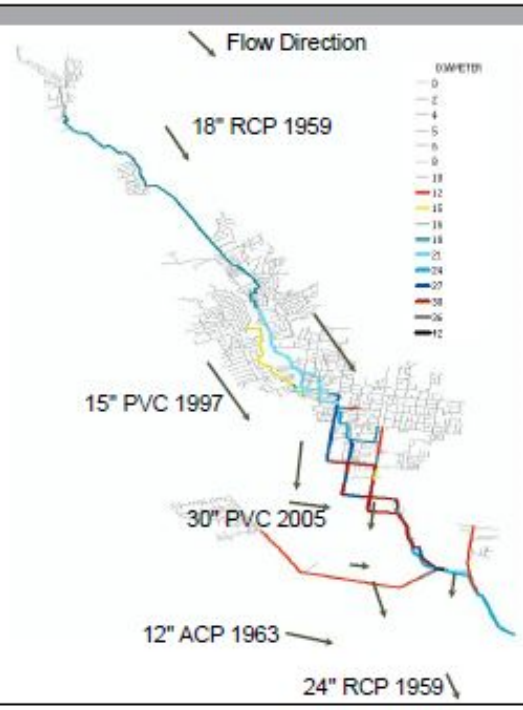
Sonoma Valley Performance Goals (Draft)

Service Category	Probable Earthquake	Maximum Earthquake Rodgers Creek M 7
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 Water (Dry Weather Conditions)	Provide primary treatment continually. Provide secondary treatment within 2 weeks. Provide tertiary treatment within 4 weeks.	Provide primary treatment within 2 weeks. Provide secondary treatment within 3 months. Provide tertiary treatment within 6 months.
Protection of Receiving Water (Wet Weather Conditions)	Provide primary treatment within 2 weeks.	Provide primary treatment within 6 months.

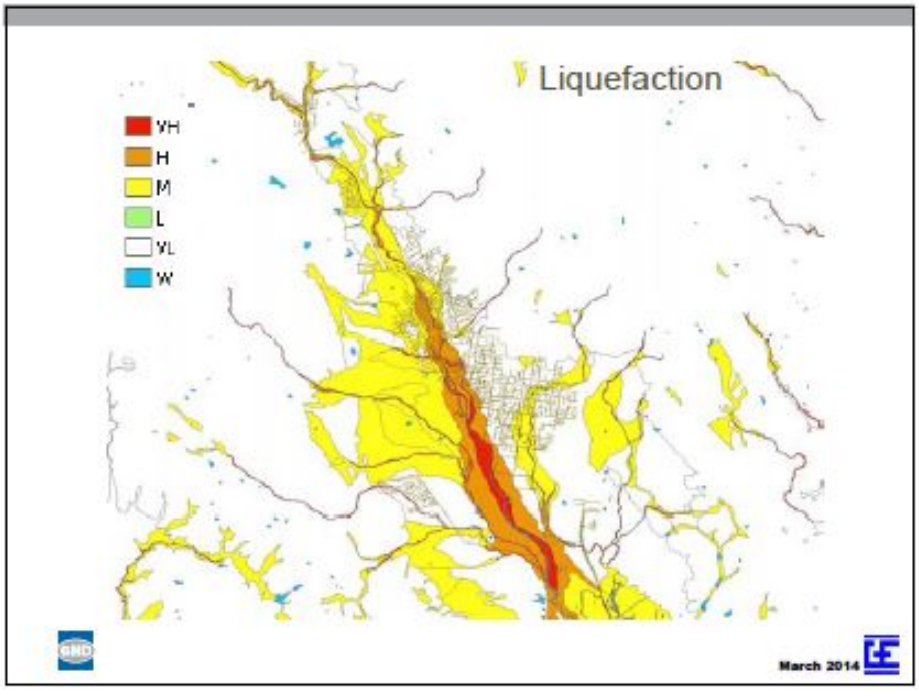
Probable earthquake, 100 year event, ~60% of RC M 7

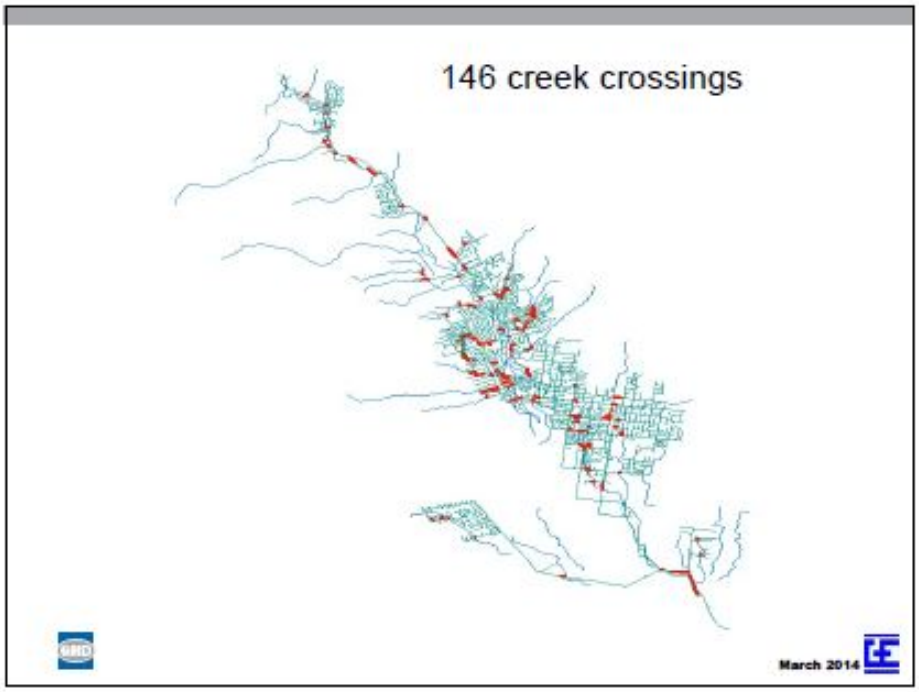
Rodgers Creek. ~16% chance in next 30 years. 3 Large events between 1000 AD and 1776 AD. Recurrence interval 230 years±. Last event most likely between 1715 and 1776 AD (238 years ago).

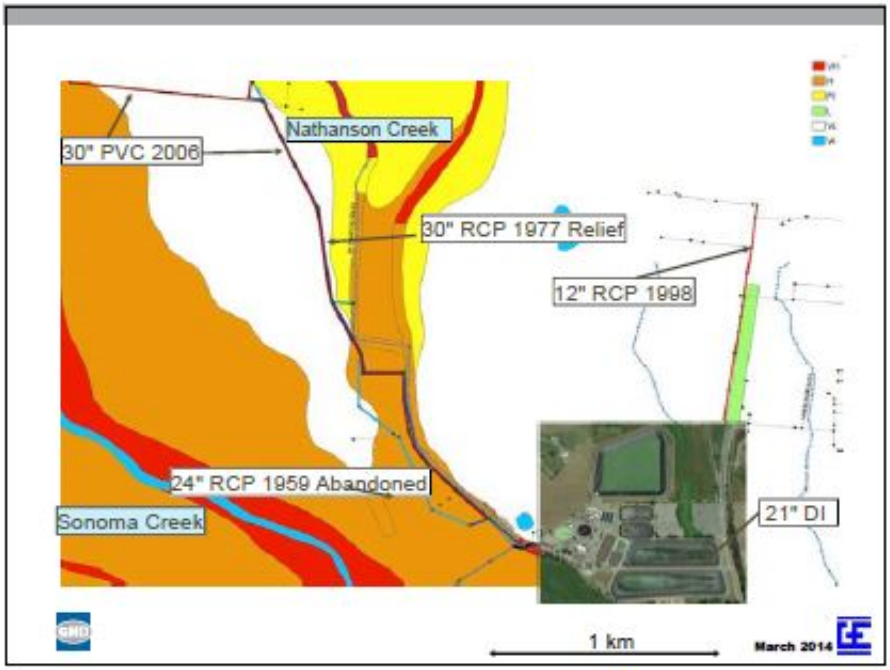
March 2014



March 2014


Liquefaction
VH
H
M
L
VL
W
March 2014


146 creek crossings
March 2014



Pipe Attributes, Sonoma Valley

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	0, 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	0, 6, 8, 10, 12, 15, 18, 21, 27

Total, 140.42 Miles

March 2014

Key Findings - SVCSD

Given Rodgers Creek M 7, about 26 failures in the pipe collection system. Most will be within 100 feet of a creek

WWTP: Buildings reasonably OK for PGA = 0.42g. Some equipment issues.

A Seismic Improvement Plan (SIP) is developed to address seismic issues

March 2014

SVCSD Pipeline Damage

Liquefaction Zone	Total Pipe Length (km)	Total Pipe Repairs	Pipe Breaks	Pipe Leaks
VH	2.5	12	6	6
H	32.9	10	5	5
M	89.6	4	2	2
Low, None	109	< 1	< 1	<1
Total	234	26+	13+	13+

Table 3-1. Pipe Damage – Rodgers Creek M 7.0 Earthquake

Notes

1. Breaks will require repair before the sewer can be re-used
2. Quantities reflect average motions and installations. Actual quantities can vary ±50% (plus/minus one standard deviation)

March 2014

Repair Strategy (Part 1)

Locate obvious damage at surface (sewage backup). Might be infrequent.

From WWTP, trace back to find locations with no flow. Visual inspect under manholes.

Map out damage, floated manholes. Between floated manholes, there will be a lot of pipe damage.

Use video cameras to do internal inspection

March 2014

Repair Strategy (Part 2)

Do 100% video survey for pipes in VH, H liquefaction zones. Depending on findings, extend to pipes in moderate zones, possibly all pipes.

At key locations, isolate manhole, use pumps and flex hose to move the sewage between usable manholes (ideal), or from manhole to local creek (if necessary).

Repair broken pipes, then leading pipes

March 2014

Repair Strategy (Part 3)

Flush the repaired pipes to clean out accumulated silts, sands, debris.

On average, assume 2 flushes per repaired pipe.

Working with other agencies, coordinate deployment of portable toilets

March 2014

Repair Strategy (Part 4)

Repair pipes as fast as possible. This means using clamps, replace short sections of pipe, etc.

The repaired pipe will break again in future earthquakes / aftershocks.

Selectively post-earthquake, replace broken pipes with seismic-resistant pipes

March 2014

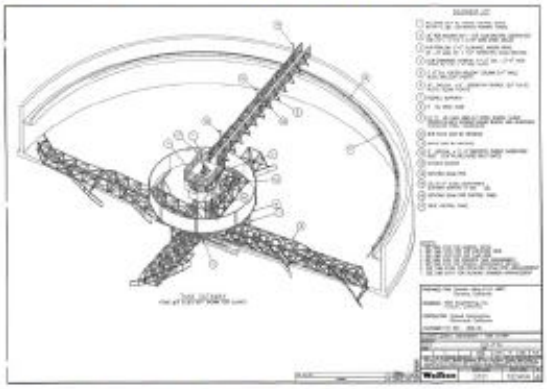
WWTP Issues

Chlorine: OK at PGA = 0.42; uncertain at PGA = 0.74g. Mixing equipment: do additional qualification at PGA = 0.74g. Possibly, add top level bracing to equipment. Accept small bow pipe damage.

Secondary clarifiers. Barring liquefaction, concrete tank OK, but operating mechanism will be damaged.

March 2014

SVCSD Secondary Clarifiers



Center column anchored with 12 1-inch bolts. If full, and steel baffles do not fail, the sloshing forces yield (break) the bolts. This tilts the central tower, damaging rake arms, etc.

Choice 1. Keep one clarifier empty.
Choice 2. Brace central tower

March 2014

Electric Power

Given Rodgers Creek M 7, assume PG&E power restored within 48 hours to most lift stations.

All lift stations should have quick connect couplings.

March 2014

Emergency Response

Have 2 sets of pumps with engine sets, and 1,200 feet of 12" diameter flex hose.

Mutual aid: plan on getting more pumps / hose via mutual aid.

Reclaimed water pipe. If it fails, discharge as needed into local receiving water; mitigation might be expensive.

March 2014

Seismic Improvement Plan SIP

	SIP-1	SIP-2	SIP-3	SIP-4
Cost	$2 million	$4.6 million	$12.2 million	$25.3 million

Costs are in $2014, exclude inflation
Costs are cumulative.
SIP-2 includes all of SIP-1; SIP-3 includes all of SIP-2; SIP-4 includes all of SIP-3

March 2014

	SIP-1	SIP-2	SIP-3	SIP-4
Item	Very High Priority	High Priority	Moderate Priority	Low Priority
Suspended ceiling over office area				$10,000
Restrain ladder in effluent pump station				$100
Restrain 2 shelves, upgrade anchorage if heavy items placed on racks				$500
Restrain spare pump motor			$1,000	
Anchor old GE switchgear				$1,000
Restrain 4 batteries	$2,000			
Snub emergency generator			$1,000	
Anchor electrical cabinets (5) if needed		$5,000		
Aeration pond pipes – re-support for 1" differential settlements and slosh loads			$5,000	
Bolt down 5 pump sets		$2,500		
Anchor / restrain 2 book cases / cabinets				$1,000
Restrain air compressor			$1,000	
Restrain rolling case, ladder				$500
Anchor tall cabinet			$500	
Upgrade suspended ceiling over water quality lab			$10,000	
Restrain equipment in water quality lab		$5,000		
Restrain communication rack in control area	$2,000			
Upgrade restraint for water heater tank			$500	
Restrain 7 gas bottles (top and lower levels)			$1,000	
Anchor and restrain parts storage bins			$2,000	
Restrain storage shelves			$1,000	
Upgrade chlorine building to remain functional at PGA = 0.74g			$40,000	
Brace Chlorinators			$25,000	
Install seismic-designed chlorine gas pipes				$100,000
Upgrade one-ton rail system for PGA = 0.74g				$25,000
Brace secondary clarifier		$125,000	$125,000	
Lift Stations – quick connects		$50,000		
Portable pumps and hose		$100,000	$100,000	
Emergency response plan to repair any underground pipe at the WWTP within 48 hours post Rodgers Creek M 7; Emergency Generators		$50,000		
Collection system pipe upgrades	$2,000,000	$2,000,000	$7,000,000	$12,000,000
Total	$2,004,000	$2,567,500	$7,596,000	$12,148,2 00
Total, Cumulative	$2,004,000	$4,571,500	$12,166,5 00	$25,402,7 00

March 2014

Pipe Replacement

Stage 1. Upgrade to PGA = 0.74g for overhead creek crossings. Replace ~1 mile of buried sewers within 100 feet of creeks, in VH or H zones.

Stage 2. Replace 1.5 miles of buried sewers within 200 feet of creeks in VH and H zones.

Stage 3. Replace 7 miles of buried sewers within 500 feet of creeks in VH and H zones.

Stage 4. Replace 13 miles of buried sewers more than 500 feet of creeks in VH and H zones.

March 2014

Pipe Replacement

For planning purposes, assume $1,000,000 per mile, installed. Actual costs will vary based on diameter, other utilities, etc.

Replacement pipe should be seismically designed, assuming soil strains of 1%.

- Fusion welded HDPE (all ø). Electric-coupling welded HDPE (up to 8" ø)
- Chained DI pipe with suitable corrosion protection
- Butt welded steel, D/t < 90, w/ corrosion protection

March 2014

Goals Met: Probable Earthquake

Goal	As Is	SIP-1	SIP-2	SIP-3	SIP-4
SIP Cost ($ million)	$0	$2.0	$4.6	$12.2	$25.3
Life Safety	Yes	Yes	Yes	Yes	Yes
Hydraulic flow < 24 hours	No	0.5	Yes	Yes	Yes
Primary treatment (dry weather) continuous	No	Yes	Yes	Yes	Yes
Secondary treatment (dry weather) 2 weeks	0.9	0.9	Yes	Yes	Yes
Tertiary treatment (dry weather) 4 weeks	0.9	0.9	Yes	Yes	Yes
Primary treatment (wet weather) 2 weeks	No	Yes	Yes	Yes	Yes
Goals Met (out of 6)	2.8	5.3	6	6	6

Table 1-1. SIP versus Performance Goals – Probable Earthquake

March 2014

Goals Met: Maximum Earthquake

Goal	As Is	SIP-1	SIP-2	SIP-3	SIP-4
SIP Cost ($ million)	$0	$2.0	$4.6	$12.2	$25.3
Life Safety	0.9+	0.9+	0.9+	Yes	Yes
Hydraulic flow < 72 hours	No	No	0.1	0.5	Yes
Primary treatment (dry weather) 2 weeks	No	Yes	Yes	Yes	Yes
Secondary treatment (dry weather) 3 months	0.3	0.3	0.8	Yes	Yes
Tertiary treatment (dry weather) 6 months	0.3	0.5	0.9	Yes	Yes
Primary treatment (wet weather) 6 months	Yes	Yes	Yes	Yes	Yes
Goals Met (out of 6)	2.5	3.7	4.7	5.5	6

Table 1-2. SIP versus Performance Goals – Maximum Earthquake

March 2014

SIP Key Points

SIP-1 includes the most vulnerable and most important items.

SIP-2, SIP-3, SIP-4 address successively less vulnerable or less important items.

The bulk of the costs (95% in SIP-4) are for pipeline improvements in the collection system.

Non-pipeline costs: ($1.3 million in SIP-4) address equipment issues at the WWTP. Implement these within 5 years.

March 2014

Pipeline Replacement

Choice 1: Pipeline improvements should be done within the next 10 years, in order to address the seismic weaknesses.

Choice 2: All pipeline replacements be done as part of long term pipeline replacement, within ext 50 years.

Choice 3: Do nothing. Potentially fail the Performance Goals given an earthquake, or Change the Performance Goals.

March 2014

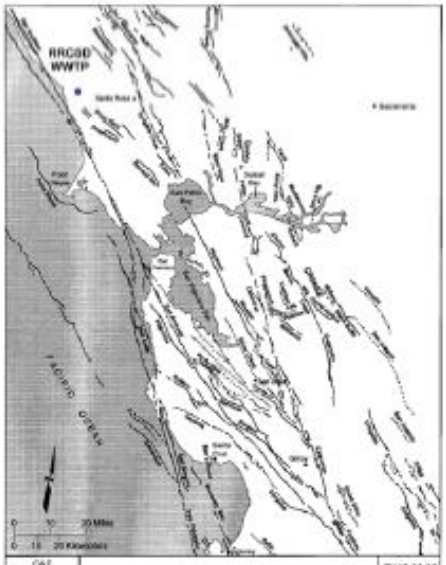


Figure 3-1. Map of Regional Earthquake Faults

March 2014

Russian River WWTP

Seismic Parameter	ASK13	I13	CY13	CB13	BSSA13	Average
PGA (g)	0.24	0.52	0.34	0.28	0.31	**0.34**
PGV (cm/sec)	37.76	53.39	57.25	45.85	42.80	[illegible]

Evaluation

Table 3-2. Deterministic Motions, Median, Vs30 = 450 m/sec, Median

Seismic Parameter	ASK13	I13	CY13	CB13	BSSA13	Average
PGA (g)	0.44	0.97	0.48	0.47	0.53	**0.59**
PGV (cm/sec)	71.33	110.80	94.90	81.59	82.39	[illegible]

Design (Minimum, for essential facilities)

Table 3-3. Deterministic Motions, Median, Vs30 = 450 m/sec, 84th

Seismic Parameter	ASK13	CY13	CB13	BSSA13	Average
PGA (g)	0.25	0.36	0.26	0.31	**0.30**
PGV (cm/sec)	54.89	91.37	54.85	52.83	**63.48**

Table 3-4. Deterministic Motions, Median, Vs30 = 250 m/sec, Median

Seismic Parameter	ASK13	CY13	CB13	BSSA13	Average
PGA (g)	0.42	0.47	0.41	0.55	**0.46**
PGV (cm/sec)	102.92	69.51	93.84	97.75	**91.01**

Table 3-5. Deterministic Motions, Median, Vs30 = 250 m/sec, 84th

Horizontal PGA, PGV, Mean of 2 Directions, Vs30 = 450 m/sec or 250/sec
Assumes occurrence of nearby San Andreas M 8 Earthquake

March 2014

Russian River Performance Goals (Draft)

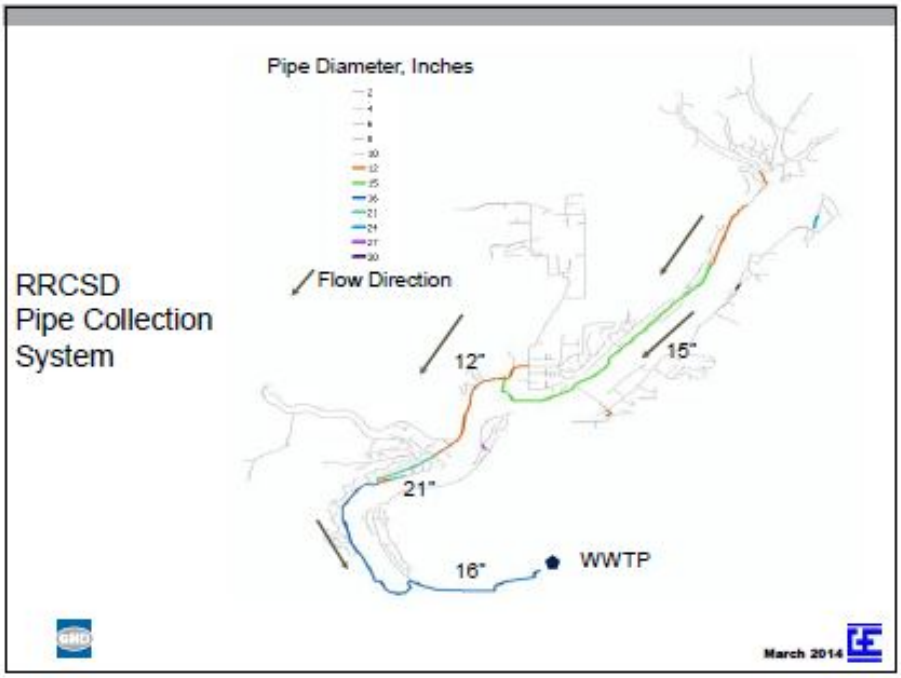
Service Category	Probable Earthquake	Maximum Earthquake San Andreas M 8
Life Safety	Minimal life-safety risk	Minimal life-safety risk
Public Health	Maintain hydraulic flow and disinfection within 24 hours.	Maintain hydraulic flow and disinfection within 72 hours.
Protection of Receiving Water (Dry Weather Conditions)	Provide primary treatment continually. Provide secondary treatment within 2 weeks. Provide tertiary treatment within 4 weeks.	Provide primary treatment within 2 weeks. Provide secondary treatment within 3 months. Provide tertiary treatment within 6 months.
Protection of Receiving Water (Wet Weather Conditions)	Provide primary treatment within 2 weeks.	Provide primary treatment within 6 months.

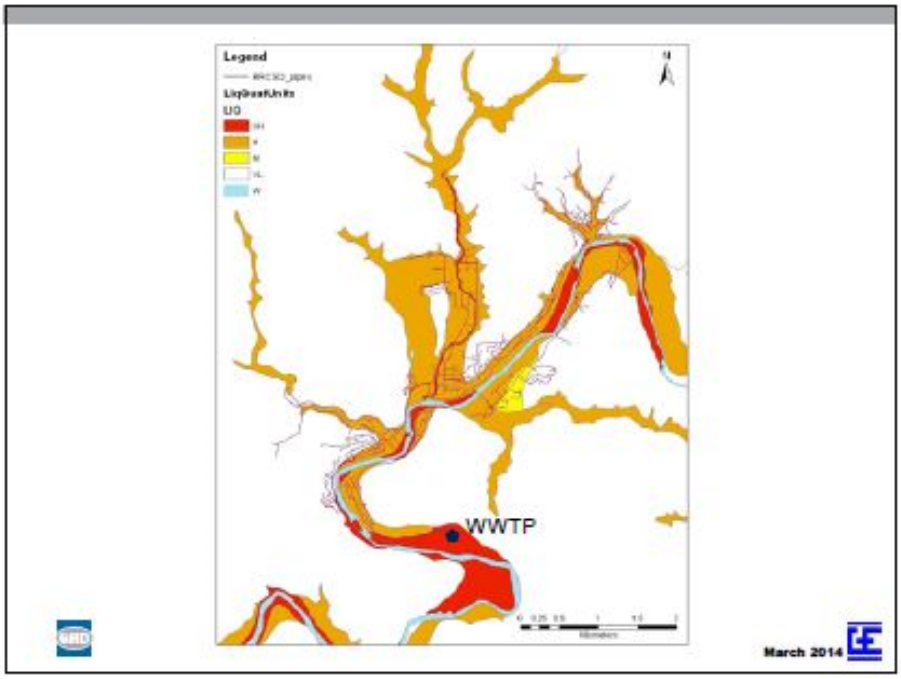
Probable earthquake, 100 year event, ~60% of SA M 8

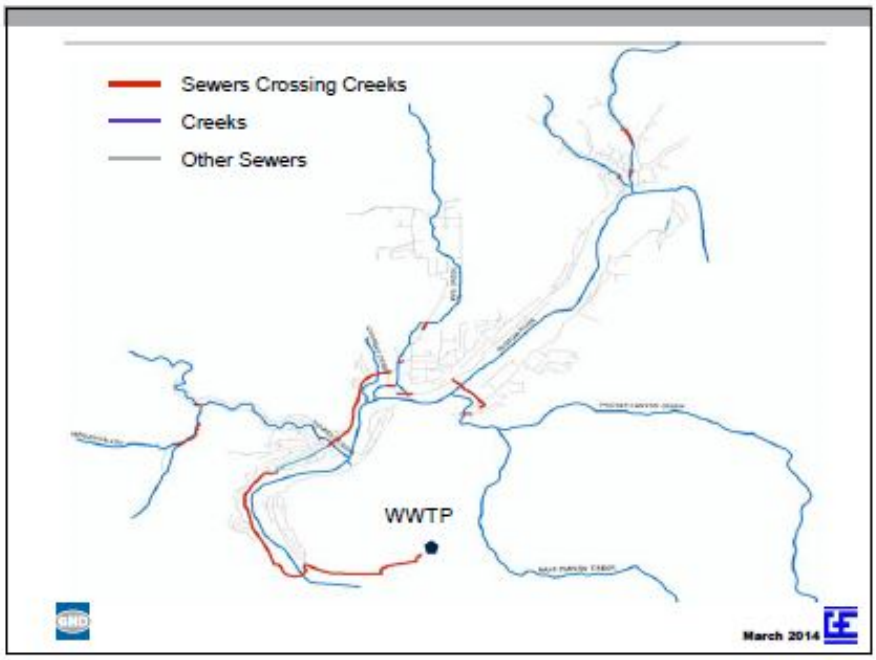
San Andreas M 8. ~3% chance in next 30 years. Last event 1906. M 7 more likely.

March 2014

March 2014


RRCSD
Pipe Collection
System
Pipe Diameter, Inches
Flow Direction
12"
15"
21"
16"
WWTP
March 2014


Legend
WWTP
March 2014



Pipe Attributes, Russian River

Material	Length (Miles)	Diameter (inches)
ABS	38.4	2, 4, 6, 8, 10, 12, 15, 16, 21, 24, 27, 30
CIP	0.02	4
DIP	0.22	4, 6
PVC	0.29	4, 6, 8
VCP	0.37	21, 24

March 2014

Russian River Other Hazards

Debris Flows at WWTP

Debris Flows elsewhere in system (hamper access by road)

19 creek crossings

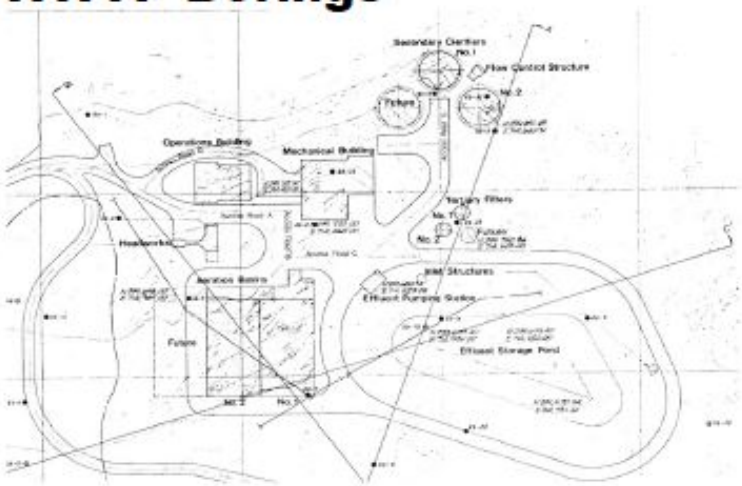
Some deep seated landslides

Slides can impound creeks

Some slides likely for PGA > 0.3g, during rainy season. Say 5% - 10% of slopes > 20° will have some type of slide, given PGA > 0.5g.

March 2014

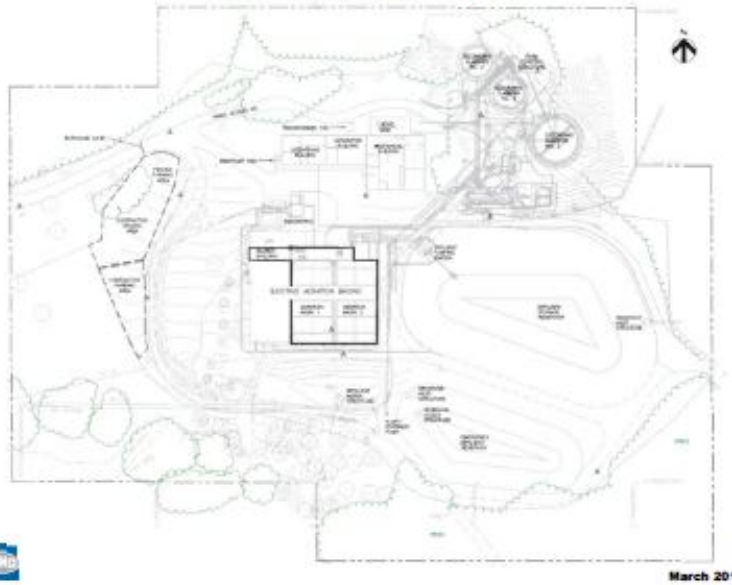
WWTP Borings



Note: logs for these borings (ESA 1978) are unavailable

March 2014

Modern Site Plan (2013)



March 2014

March 2014

Key Findings - RRCSD

Given San Andreas M 8, about 42 failures in the pipe collection system. Most will be within 500 to 1,000 feet of the Russian River / creeks

WWTP: Buildings reasonably OK for PGA = 0.42g. Some equipment issues.

A Seismic Improvement Plan (SIP) is developed to address seismic issues

March 2014

RRCSD Pipeline Damage

Liquefaction Zone	Total Pipe Length (km)	Total Pipe Repairs	Pipe Breaks	Pipe Leaks
VH	2.5	15	7	8
H	46.6	27	14	13
M	3.1	< 1	<1	<1
Low, None	15.8	< 1	< 1	<1
Total	63.3	42	21	21

Table 5-1. Pipe Damage – San Andreas M 8.0 Earthquake

Notes

1. Breaks will require repair before the sewer can be re-used
2. Quantities reflect average motions and installations. Actual quantities can vary ±50% (plus/minus one standard deviation)

March 2014

Repair Strategy (Part 1)

Locate obvious damage at surface (sewage backup). Might be infrequent.

From WWTP, trace back to find locations with no flow. Visual inspect under manholes.

Map out damage, floated manholes. Between floated manholes, there will be a lot of pipe damage.

Use video cameras to do internal inspection

March 2014

Repair Strategy (Part 2)

Do 100% video survey for pipes in VH, H liquefaction zones. Depending on findings, extend to pipes in moderate zones, possibly all pipes.

At key locations, isolate manhole, use pumps and flex hose to move the sewage between usable manholes (ideal), or from manhole to local creek (if necessary).

Repair broken pipes, then leading pipes

March 2014

Repair Strategy (Part 3)

Flush the repaired pipes to clean out accumulated silts, sands, debris.

On average, assume 2 flushes per repaired pipe.

Working with other agencies, coordinate deployment of portable toilets

March 2014

Repair Strategy (Part 4)

Repair pipes as fast as possible. This means using clamps, replace short sections of pipe, etc.

The repaired pipe will break again in future earthquakes / aftershocks.

Selectively post-earthquake, replace broken pipes with seismic-resistant pipes

March 2014

WWTP Issues

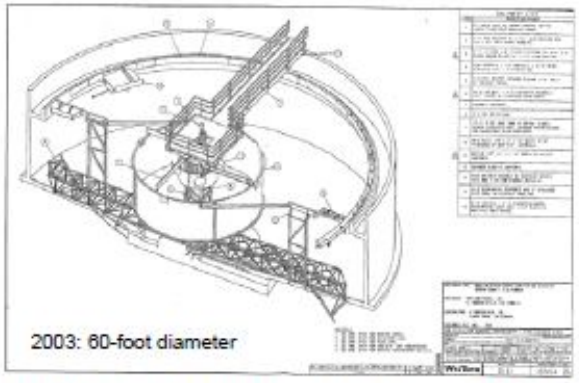
Secondary clarifiers (two original 40-foot diameter from early 1980s, and one newer 60-foot from 2003). Assuming full at the time of the earthquake: barring landslide, concrete tanks are OK, but weaknesses include:

Operating mechanisms will be damaged due to sloshing forces

Side entry pipes, ladders may break due to landslide. Debris flow may inundate.

March 2014

SVCSD Secondary Clarifiers



Center column anchored with 8 1.25-inch bolts. If full, and steel baffles do not fail, the sloshing forces yield (break) the bolts. This tilts the central tower, damaging rake arms, etc.

Choice 1. Keep at least one clarifier empty and serviceable.
Choice 2. Brace central tower

March 2014

WWTP Pipes

Based on available subsurface information, differential settlements > 1 inch might be expected for SA M 8. This will damage some multiple pipes. Damage will be concentrated at south side of site (liquefaction) or near secondary clarifiers (landslide), where the pipes enter concrete structures.

Be able to fix a steel pipe at WWTP in 24 hours (emergency response). Pre-purchase spare pipe segments, butt straps. Ensure a rapid mobilization procedure.

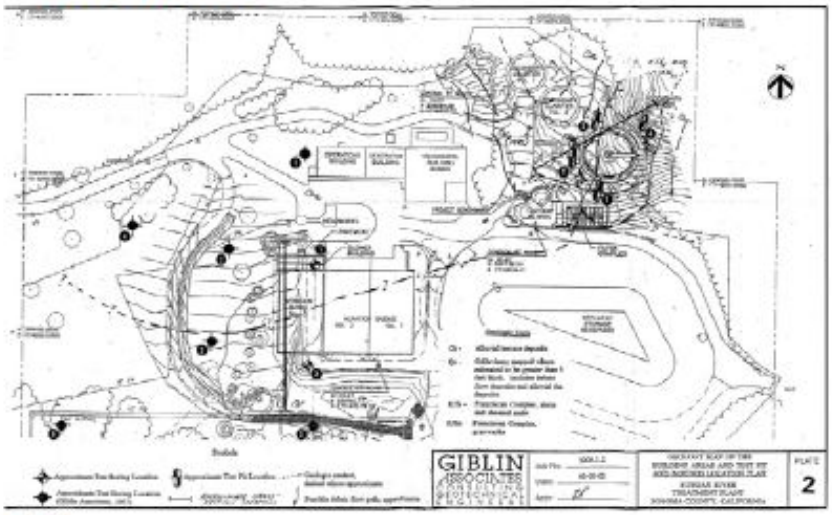
March 2014

WWTP Pipes (Part 2)

Future: al; pipes at site designed to take 3 inches of knife-edge movement where they enter concrete structures (or have geotech show smaller potential for movements)

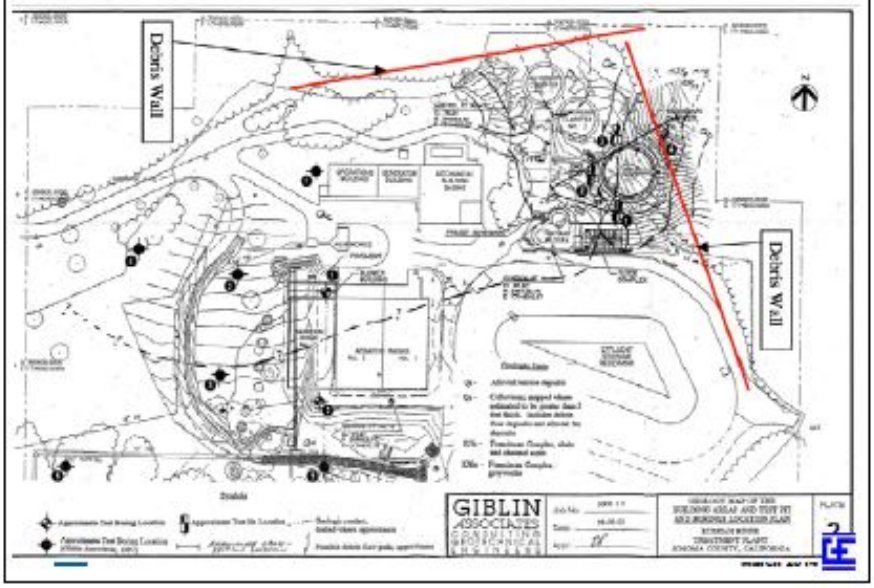
March 2014

Colluvium



March 2014

Debris Walls



Electric Power

Given San Andreas M 8, assume PG&E power restored within 120 hours to most lift stations.

All lift stations should have quick connect couplings.

March 2014

Emergency Response

Have 2 sets of pumps with engine sets, and 1,200 feet of 12" diameter flex hose. (4 system-wide, to address SA M 8 or RC M 7 events)

Mutual aid: plan on getting more pumps / hose via mutual aid.

Reclaimed water pipe. If it fails, discharge as needed into local receiving water; mitigation might be expensive.

March 2014

Seismic Improvement Plan SIP

	SIP-1	SIP-2	SIP-3	SIP-4
Cost	$3.1 million	$7.4 million	$16.1 million	$38.3 million

Costs are in $2014, exclude inflation
Costs are cumulative.
SIP-2 includes all of SIP-1; SIP-3 includes all of SIP-2; SIP-4 includes all of SIP-3

March 2014

Item	CompID or Section	SIP-1 Very High Priority	SIP-2 High Priority	SIP-3 Moderate Priority	SIP-4 Low Priority
Brace Clarifier 3 (60-foot)	5.2.1		$100,000		
Brace Clarifier 2 (40-foot)	5.2.1			$70,000	
Brace Clarifier 1 (40-foot)	5.2.1				$70,000
Pipeline primary	5.2.2	$100,000			
Pipeline secondary	5.2.2		$1,150,000		
Pipeline tertiary	5.2.2			$100,000	
Pipeline and tank (tertiary golf course)	5.2.2				$2,075,000
Fuel tank pipe	55		$2,000		
Filter tanks - anchor, add flex pipes	66			$15,000	
Restrain transformer	57				$1,000
Add snubbers to emergency generators	68			$1,000	
Restrain water tank	72			$1,000	
Inspect, anchor switchgear	74, 177		$5,000		
Anchor, restrain air tanks	77		$1,000		
Upgrade suspended ceiling over office area	78				$15,000
Inspect, anchor switchgear	79, 177		$3,000		
Upgrade anchors for SCADA cabinet	80			$500	
Restrain computer	81			$200	
Anchor, restrain shelves in Water Qual lab	82		$2,000		
Restrain counter top equipment	83			$500	
Restrain storage shelves	52			$1,000	
Anchor, restrain equipment in lab	84		$1,500		
Restrain equipment in water quality lab	85		$300		
Restrain, anchor cabinet	178				$200
Debris deflection walls	5.2.9		$150,000	$150,000	
Lift Stations - quick connects	5.3		$50,000		
Portable pumps and hose	5.4		$300,000	$300,000	
Emergency response plan to repair any underground pipe at the WWTP within 48 hours post San Andreas M 8	5.4		$50,000		
Collection system pipe upgrades	6.1	$3,000,000	$2,500,000	$8,000,000	$20,000,000
Total		$3,100,000	$4,344,800	$8,669,200	$22,161,200
Total, Cumulative		$3,100,000	$7,444,800	$16,114,000	$38,275,200

March 2014

Pipe Replacement

Stage 1. Upgrade to PGA = 0.59g for overhead creek crossings. Replace ~2.5 km of buried sewers within VH zones.

Stage 2. Replace 3 km of buried sewers within 200 feet of creeks in VH and H zones.

Stage 3. Replace 10 km of buried sewers within 500 feet of creeks in VH and H zones.

Stage 4. Replace 34 km of buried sewers more than 500 feet of creeks in H zones.

March 2014

Pipe Replacement

For planning purposes, assume $1,000,000 per mile, installed (6"-8"); $1,600,00 per mile (12" and larger). Actual costs will vary based on diameter, other utilities, etc.

Replacement pipe in VH, H zones should be seismically designed, assuming soil strains of 1%.

- Fusion welded HDPE (all ø). Electric-coupling welded HDPE (up to 8" ø)
- Chained DI pipe with suitable corrosion protection
- Butt welded steel, D/t < 90, w/ corrosion protection

March 2014

Goals Met: Probable Earthquake

Goal	As Is	SIP-1	SIP-2	SIP-3	SIP-4
SIP Cost ($ million)	$0	$3.1	$7.4	$16.1	$38.3
Life Safety	Yes	Yes	Yes	Yes	Yes
Hydraulic flow < 24 hours	No	0.5	0.8	Yes	Yes
Primary treatment (dry weather) continuous	0.5	0.9	Yes	Yes	Yes
Secondary treatment (dry weather) 2 weeks	0.4	0.5	0.9	0.9	Yes
Tertiary treatment (dry weather) 4 weeks	0.3	0.4	0.8	0.9	Yes
Primary treatment (wet weather) 2 weeks	0.5	0.7	0.8	0.9	Yes
Goals Met (out of 6)	2.7	4.0	5.3	5.7	6

SVCSD:	2.8	5.3	6	6	6

March 2014

Goals Met: Maximum Earthquake

Goal	As Is	SIP-1	SIP-2	SIP-3	SIP-4
SIP Cost ($ million)	$0	$3.1	$7.4	$16.1	$38.3
Life Safety	0.9+	Yes	Yes	Yes	Yes
Hydraulic flow < 72 hours	No	0.2	0.4	0.6	Yes
Primary treatment (dry weather) 2 weeks	0.3	0.7	0.8	0.9	Yes
Secondary treatment (dry weather) 3 months	0.2	0.3	0.9	0.9	Yes
Tertiary treatment (dry weather) 6 months	0.1	0.2	0.6	0.9	Yes
Primary treatment (wet weather) 6 months	0.3	0.8	0.9	0.9	Yes
Goals Met (out of 6)	1.8	3.2	4.6	5.2	6

SVCSD:	2.8	5.3	6	6	6

March 2014

SIP Key Points

SIP-1 includes the most vulnerable and most important items.

SIP-2, SIP-3, SIP-4 address successively less vulnerable or less important items.

The bulk of the costs (88% in SIP-4) are for pipeline improvements in the collection system.

Non-pipeline costs: ($4.8 million in SIP-4) address equipment and pipe issues at the WWTP. Implement these within 5 years.

March 2014

Pipeline Replacement

Choice 1: Pipeline improvements should be done within the next 10 years, in order to address the seismic weaknesses.

Choice 2: All pipeline replacements be done as part of long term pipeline replacement, within ext 50 years.

Choice 3: Do nothing. Potentially fail the Performance Goals given an earthquake, or Change the Performance Goals.

March 2014

Summary of Earthquake Hazards for the SVCSD and RRCSD

- Liquefaction/Creek Crossings and affects on WWTP and Pipelines
- Debris Flows at RRCSD WWTP
- Debris Flows elsewhere in system (hamper access by road)
- Some deep seated landslides
- Slides can impound creeks
- Some slides likely for PGA > 0.3g, during rainy season. Say 5% - 10% of slopes > 20° will have some type of slide, given PGA > 0.5g.

March 2014

Summary of Hazards for the SVCSD and RRCSD

- Mitigations due to flood hazards similar to seismic hazards
- Fire hazards are different and could mostly affect power supply and access to facilities
- Prioritization of hazard mitigation key to developing the overall mitigation plan for each District.

March 2014

Next Steps

Vulnerability Assessment

1. District's input on mitigations and priorities for addressing vulnerabilities:
   - Wastewater Treatment Plant
   - Conveyance systems – Pressure and gravity pipelines
   - Lift Stations

2. Develop Mitigation Goals

March 2014

Exhibit 1N

Mitigation Review Meeting Agenda, 05/10/2016

AGENDA
RRCSD LHMP

DATE: **May 10, 2016**

ORGANIZER: **Mollie Asay**

SUBJECT: **RRCSD LHMP – Draft Plan/Mitigation Review**

1. Draft RRCSD LHMP plan review
2. Mitigation table/action review

Invited Attendees:

Jake Spaulding	Project Manager	Kent Gylfe	Principal Engineer - Design
Mollie Asay	Grants/Funding	Scott Carter	Engineer III
Kevin Booker	Principal Engineer – Ops	Eric Keel	Coordinator – Maintenance
Garett Walker	Coordinator –Wastewater	George Lincoln	Engineer IV - Operations

Exhibit 1O

Mitigation Review Meeting Minutes, 05/10/2016

RRCSD LHMP

Minutes

DATE: **May 10, 2016**

ORGANIZER: **Mollie Asay**

SUBJECT: **RRCSD LHMP –Mitigation Review**

1. Mitigation table/action review

Scott Carter distributed copies of the draft mitigation action chart (also previously distributed via email with draft plan to all invitees) and led team though chart organization. Scott explained the difference between tiers 1/2 and subgroups A/B.

A discussion commenced about pros and cons of identified actions as well as omissions that should be addressed. Eric asked what type of projects could be funded through this process (he specifically asked about flexible hose). Kent explained that the funding tends to be designated for capital projects, but that flexible hose could be eligible (most likely as part of a larger project). Part and current FEMA funded projects were discussed as examples of fundable projects.

A short discussion on DAC status of the Russian River CSD commenced. RRCSD recently received a letter from SWRCB verifying it qualifies as a small community with financial hardship and is therefore eligible as a "compliance project". More research needs to be conducted to verify this letter will suffice for other funders. DWR's map of DACs in the North Coast region also indicated the area has DAC status.

Kevin Booker discussed an above ground fuel tank @ the main lift station. Regulatory requirements mandate its removal by 2025. A replacement project (incorporating improvements to address hazards) will be added to B2.

Several attendees with intimate knowledge of the WWTP indicated the NHRA underestimated fire risk to WWTP roofing system. NHRA indicated risk was not severe due to masonry building. However, roof is mostly composite shingle with small flat tar/gravel system. If an ember hits the roof, fire could burn down and leave only masonry walls. Several attendees used first hand visual experience from recent Valley Fire to substantiate their opinions. Move this to B2.

The living nature of the document was discussed and everyone was reminded to notify LHMP manager of all mitigations implemented in RRCSD, however small. The example of anchoring furniture to walls was provided.

Next, the group went through the chart one by one and discussed several actions:

Tier 1: (high Priority, <5 years)

- 3.1.5 – Garrett inquired whether this addressed current pipes or new construction only. Scott indicated that question would be answered in another action.

- 3.4.3 - covers fuel tank @ main lift station – this covers Kevin's comment from earlier.

- 3.1.4 - Raising priority on this action to A1 was discussed and ultimately consensus was to leave it in its current ranking of B1.

- 3.1.1 – Add pump stations and related force mains

- 2.3.1 – This action addresses slides. Participants discussed the most recent slide.

Tier 2: (lower priority, 5+ years)

- 3.3.2 – Garrett commented that we have already lifted many of the stations but there are still risks, especially with the electrical system. Water could enter exposed conduits/splice box. Replacing conduits will not be cheap but will need to be done eventually. No consensus on whether this is a >5 or <5 year project.
- George would like to see a condition assessment for all lift stations
- Competing priorities were discussed. Attendees discussed the general feelings held by workers in the field that costly repetitive repairs are sometimes implemented instead of a long term fix. Kent discussed the limited money for improvements in the district's budget. This discussion, resulted in an agreement that the pump stations are a higher priority than the WWTP roof.
- 3.1.3 – Can dump or replace pipe. We will not spend funds on RW to golf course.

Scott Carter recapped the proposed additions/modifications, and reordering of priorities.

Lastly, the electric configuration for the lift stations was discussed. Current system routes all electrical through main lift station. So all the other lifts are dependent on the main. Why this was done when plant was first developed is not known, but several participants wanted to explore making each lift stations independent.

Attendees:

Jake Spaulding	Project Manager	Kent Gylfe	Principal Engineer - Design
Mollie Asay	Grants/Funding	Scott Carter	Engineer III
Kevin Booker	Principal Engineer – Ops	Eric Keel	Coordinator – Maintenance
Garett Walker	Coordinator –Wastewater	George Lincoln	Engineer IV - Operations

APPENDIX D: BOARD MEETING AGENDA, MINUTES, AND RESOLUTION ADOPTING THE RRCSD LHMP

Exhibit 1A: Sonoma County Board of Supervisors Meeting Agenda

Exhibit 1B: Sonoma County Board of Supervisors Meeting Minutes

Exhibit 1C: Resolution of the Board of Directors Adopting the RRCSD LHMP

Exhibit 1A

Sonoma County Board of Supervisors– Agenda, posted on 09/XX/16

PLACEHOLDER

Exhibit 1B

Sonoma County Board of Supervisors– Meeting Minutes, posted on 09/XX/16

PLACEHOLDER

Exhibit 1C

RESOLUTION OF THE BOARD OF DIRECTORS FORMALLY ADOPTING THE RRCSD LHMP

PLACEHOLDER