Draft

Woodacre Wastewater Feasibility Study

Prepared for:

Marin County Community Development Agency
Environmental Health Services Division
3501 Civic Center Drive, Room 236
San Rafael, California 94903

By:

Questa Engineering Corporation
1220 Brickyard Cove Road, Suite 206
Point Richmond, California 94801

August 2024

Draft

Woodacre Wastewater Feasibility Study Marin County, California

---

Prepared for:

Marin County Community Development Agency
Environmental Health Services Division
3501 Civic Center Drive, Room 236
San Rafael, California 94903

Prepared by:

Questa Engineering Corporation
1220 Brickyard Cove Road, Suite 206
Point Richmond, California 94801
Tel: 510.236.6114
Fax: 510.236.2423
www.questaec.com

Questa Project no. 2200054

August 2024

Norman N. Hantzsche P.E.

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

AMSL	above mean sea level
ABS	acrylonitrile butadiene
ave	Average
BOD	biochemical oxygen demand
CCF	one hundred cubic feet
CSA	County Service Area
CSD	Community Services District
CWA	Federal Clean Water Act
CWD	County Water District
cy	cubic yard
DDW	Division of Drinking Water
ea	Each

EHS	Environmental Health Services
EIR	Environmental Impact Report
EPA	U. S. Environmental Protection Agency
EQ	Equalization
ESD	Equivalent Single-Family Dwelling
fm	force main
ft	Feet
gal	Gallon
gpd	gallons per day
gpm	gallons per minute
GHG	Greenhouse Gas
GW	Groundwater
HDD	horizontal directional drilling
HDPE	high density polyethylene
hr	Hour
I/I	infiltration and inflow
kW	Kilowatt
kWhr	kilowatt-hour
LAFCO	Local Agency Formation Commission
lf	lineal feet
ls	Lump sum
l	Liter
MCEHS	Marin County Environmental Health Services
MMWD	Marin Municipal Water District
MBR	Membrane Bioreactor
MBAS	Methylene Blue Active Substances
mg	Milligram
ml	Milliliter
MPI	minutes per inch
MRP	Monitoring and Reporting Program
MPN	most probable number
NCSS	National Cooperative Soil Survey
NTU	Nephalometric Turbidity Units
OWTS	Onsite Wastewater Treatment System
O&M	Operation and Maintenance
PD	pressure distribution
PLC	Programmable Logic Controller
PUD	Public Utility District
PVC	polyvinyl chloride
qty	Quantity
RVSD	Ross Valley Sanitary District (RVSD)
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
sf	square-foot
STEG	Septic Tank Effluent Gravity

SRT	solids residence time
STEP	Septic Tank Effluent Pump
SSMP	Sewer System Management Plan
SWRCB	State Water Resources Control Board
TBWC	Tomales Bay Watershed Council
TDS	total dissolved solids
TKN	total kjeldahl nitrogen
TMDL	total maximum daily load
TSS	total suspended solids
typ	Typical
UV	ultra-violet
WDR	Waste Discharge Requirements
ww	Wastewater

EXECUTIVE SUMMARY

BACKGROUND AND INTRODUCTION

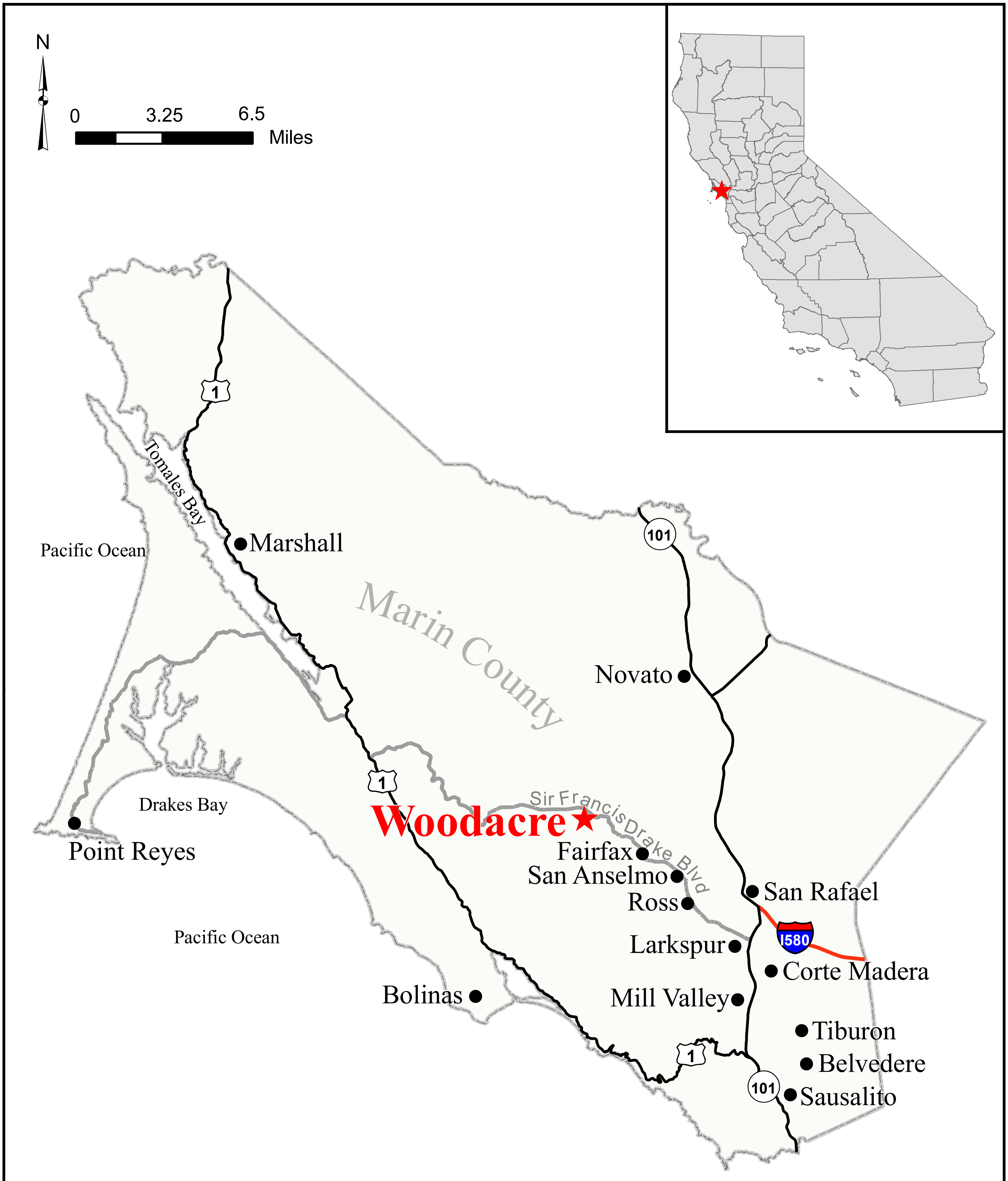
This report presents the results of a feasibility study regarding wastewater management solutions for the unincorporated community of Woodacre, located at the eastern end of the San Geronimo Valley, Marin County. The study focused specifically on the low-lying portions of Woodacre, encompassing approximately 250 developed properties in the area commonly referred to as the "Woodacre Flats" and adjacent areas (**Figure ES-1**). All properties in Woodacre rely on the use of individual septic systems for sewage disposal.

Woodacre lies within the watershed of Woodacre Creek, a year-round stream which drains into San Geronimo Creek, then Lagunitas Creek, and eventually into Tomales Bay. Lagunitas Creek and Tomales Bay are federally listed as impaired for pathogens. The Tomales Bay Pathogen TMDL of 2005 identifies lower San Geronimo Creek as the second greatest source of fecal coliforms entering Tomales Bay, after Walker Creek, and requires the County of Marin to take action to address failing septic systems.

Inspections of existing septic systems in the winters of 2004-05 and 2007-08 in Woodacre found a high percentage (77%) of homes had marginal or failing systems. Water quality monitoring in Woodacre Creek by the Tomales Bay Watershed Council (TBWC) during the same timeframe found generally high levels of total and fecal coliform, nitrates and ammonia, as well as methylene blue active substances (MBAS), a component of detergents. This led to their identification of Woodacre as a high priority for correction of failing septic systems, the formation of a local homeowner steering group (Woodacre Flats Wastewater Group), and eventually the initiation of a wastewater feasibility study for the "Woodacre Flats" area in 2010, sponsored by the County of Marin with funding from the local community, the County, the U.S. EPA.

Questa Engineering was hired by Marin County to conduct the initial Woodacre Flats Wastewater Feasibility Study, which was completed in 2011. The study identified and evaluated various wastewater improvement alternatives for approximately 150 parcels in the most problematic areas of the community affected by high groundwater, poor drainage, clayey soils, small parcel size and age of systems. The study identified two promising options: (1) a local community leachfield option with limited capacity for properties in Woodacre; and (2) a wastewater recycling alternative centered around the San Geronimo Golf Course that could potentially support a larger number of homes, including and extending beyond Woodacre. The water recycling alternative was favorably received by the community and prompted an additional follow-on study of a project that could potentially serve homes in both the Woodacre and San Geronimo communities. With grant funding from the State Water Resources Control Board, a water recycling study was initially completed in 2017, modified in 2019, but eventually dropped from further consideration following the sale of the golf course property and conversion of the land for other open space and conservation uses.

The current wastewater feasibility study was initiated in fall of 2022 for the purpose of returning to the local community leachfield option identified in the 2011 Questa study, and determining in greater depth the engineering feasibility, capacity, costs, and current viability of this approach in comparison to the alternative of continued use and management of individual septic systems.



QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Woodacre Wastewater Feasibility Study
Woodacre, Ca

Figure ES-1
Location Map

EXISTING WASTEWATER DISPOSAL PRACTICES

There are no public sewers serving the Woodacre study area or other parts of the San Geronimo Valley. All properties in the study area rely on individual onsite septic systems for sanitary waste treatment and disposal (also termed "OWTS", short for onsite wastewater treatment system). This typically includes a septic tank for collection and settling of solids, with some type of leaching system for disposal (percolation) of the liquid into the soil. Most of the properties in the area were developed prior to the adoption of current County Codes. Gravity systems are most common, although more recent development has included the use of alternative systems, such as mounded and pressure distribution dispersal fields and advanced treatment units.

There are many existing septic systems in Woodacre with unknown construction features, indicating the likelihood of an antiquated or questionable design that differs significantly from modern codes and practices. County records show more than half of the developed properties have no septic system permit information on file with Marin County EHS. In 2004-2005 voluntary (confidential) septic system inspections conducted as part of a County-wide outreach effort ("Septic Matters Program") found roughly two-thirds of the systems inspected in Woodacre to have marginal to unacceptable operating conditions due to many of the following conditions and factors:

- System age, pre-dating modern standards and codes
- Small systems, undersized for current uses
- Additional living units, placing increased demand on sewage disposal systems
- Small parcel size, high intensity of development and limited area for sewage disposal
- Restricted access to yard areas for system maintenance and repair
- Unpermitted repairs and greywater systems
- Shallow depth to groundwater, including seasonal saturation at or near ground surface
- Shallow soils and marginal soil permeability
- Close proximity to streams and local drainages

File and field reviews conducted as part of the 2011 study of Woodacre Flats and updated as part of the current feasibility study revealed information consistent with the above findings. The most recent review of County files shows the following status of septic systems according to EHS classification:

- Class 1 – 1984 Code: 5%
- Class 2 – Post-1984 Repair: 23%
- Class 3 – Pre-1984 Permit: 15%
- Class 4 – No Documentation: 57%

SERVICE AREA

Wastewater improvement projects are planned and developed around a given geographical area termed the "service area". The service area provides the basis for estimating wastewater facility requirements, project alternatives and costs. Delineating the service area is often an iterative process, whereby initial boundaries are assumed for feasibility analysis, and subsequently adjusted in response to findings, recommendations, and other factors, which is the case for this project.

The 2011 Wastewater Feasibility Study for Woodacre Flats addressed a service area encompassing approximately 150 predominantly residential parcels in the low-lying portions of Woodacre. The tentative service area extended from San Geronimo Valley Dr south along Railroad Ave, Central Ave, Taylor Ave, and Redwood Dr to about Castle Rock Ave. At the time, 150 parcels was judged to be the upper limit of the community leachfield site being studied.

In response to interest from residents beyond Castle Rock Ave and with additional topographic data and other information now indicating greater potential leachfield capacity, the service area considered in the current study was expanded to include up to approximately 250 parcels, extending south past the Fire Station to include parcels on Castle Rock, Crescent, Elm and Oak Grove Ave (**Figure ES-2**). This would be the maximum extent of wastewater service; the actual adopted boundaries could end up being a smaller area.

The approach to this project does not anticipate a condition or requirement for mandatory connection to community wastewater facilities for all properties in the service area or for any specific properties. It does, however, include the understanding that the facilities would be planned and implemented to serve existing developed properties within the designated service area, with possible allowance for a modest amount of expansion for low-incoming housing, child day care facilities or similar community needs.

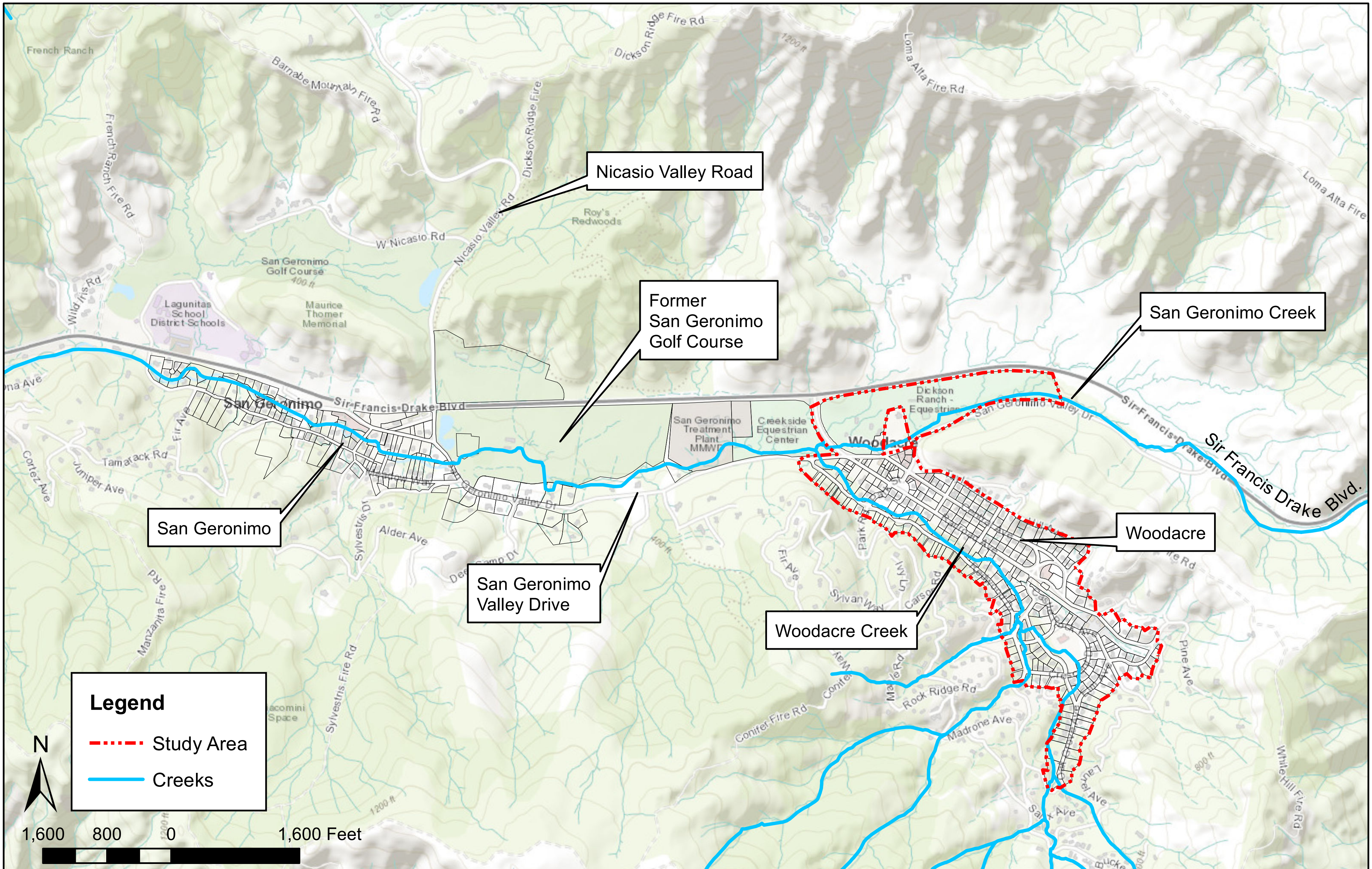
There is varied property owner interest in connection to community wastewater facilities, as well as differing wastewater improvement needs from property to property. The type of wastewater collection system favored for the project (on-lot septic tanks with effluent only collection piping) lends itself to providing service to a mix of “connected” and “non-connected” properties along the sewer route. Recognizing this, cost estimates were developed for different numbers of connections within the overall maximum service area.

ESTIMATED WASTEWATER FLOWS

Information regarding wastewater flows is important for assessing the required capacity of collection, treatment, and disposal facilities for community wastewater alternatives. Estimated wastewater flows for this study were developed based on the assumed number of parcels to be served, the type of development on those parcels, and review of typical reference data and monitoring information from other small community wastewater facilities.

The Woodacre service areas consist almost entirely of single-family residential parcels, with a few commercial uses. The commercial uses are mainly the types that generate wastewater volumes similar to or less than single family residences (e.g., deli, offices, shops, Post Office, small apartments). Wastewater flows for this feasibility study were estimated by applying a typical unit wastewater flow for residential use uniformly to all parcels in the service area.

Unit wastewater flows in gallons per day (gpd) per single family residence (or equivalent) were developed from review of actual daily and monthly flow data for three small community wastewater systems that have been in operation for the past 15 to 25 years: (1) French Ranch development, (2) Marshall Community Wastewater Facility, and (3) Lake Canyon Community Services District near Los Gatos in Santa Clara County. Monitoring data from these facilities indicates wastewater flows averaging less than 100 gpd up to 150 gpd per residence. Additionally, 5 years of winter water use data for the Woodacre area were obtained from Marin Water District to provide an additional local point of reference. Winter water use is a reasonable



DATE:	08/14/2024
PROJECT:	WOODACRE WW
PROJECT NO.:	2200054
DRAWN:	DD
APPROVED:	NH

QUESTA ENGINEERING CORP

STUDY AREA

FIGURE ES-2

indicator of sewage flow since irrigation and other outdoor seasonal uses are typically minimal in the winter. Information on winter water use was also solicited in a questionnaire survey of residents and property owners in Woodacre. These data showed winter water use in Woodacre averaging less than 120 gpd per residence.

Based on the various sources of information, an average wastewater flow of 135 gpd per parcel was assumed for purposes of estimating wastewater treatment and disposal system requirements. This is equivalent to an average flow of 55 gpd per person and occupancy of 2.45 persons per household. Using this unit flow, the resulting wastewater system flows for different levels of wastewater service connections are:

- 100 connections: 13,500 gpd
- 150 connections: 20,250 gpd
- 200 connections: 27,000 gpd
- 250 connections: 33,750 gpd

QUESTIONNAIRE SURVEY

Midway through the study a Wastewater Survey Questionnaire was developed and mailed by Questa to owners of the approximately 250 developed properties in Woodacre Flats and adjoining areas being studied for community wastewater improvements. The purpose of the survey was to obtain input directly from property owners about their experiences, knowledge, concerns, and views on existing septic systems and potential long-term wastewater management options for the community. The survey was voluntary, anonymous, and did not require identification of property owner name or address. A total of 80 completed questionnaires were returned, a 32% response rate.

The following table presents summarizes survey responses regarding current concerns about septic system (OWTS).

Table ES-1. Questionnaire Survey Results

Issue	Level of Concern (%)	
	Low	Medium to High
OWTS Functioning Problems		
Normal year winter operation	59	41
High rainfall winter operation	46	54
Summer operation	80	20
OWTS Code Compliance/Functioning Concerns		
For possible selling/refinancing	51	48
For house/property improvements	48	52
OWTS Interference with Property Uses		
For current uses	67	33
For planned house/property improvements	48	52
Public Health/Water Quality Impacts		
Contamination in yards and drainages	42	58
Contamination in Woodacre/San Geronimo Creeks	36	64
Odors and other Nuisances	50	50

In response to questions about long-term wastewater alternatives for Woodacre, about 70 percent of the respondents indicated preference for some type of community wastewater facility. Alternatives providing a higher level of treatment and opportunities for recycling were favored over basic primary (septic tank) treatment with a community leachfield.

PROJECT ALTERNATIVES

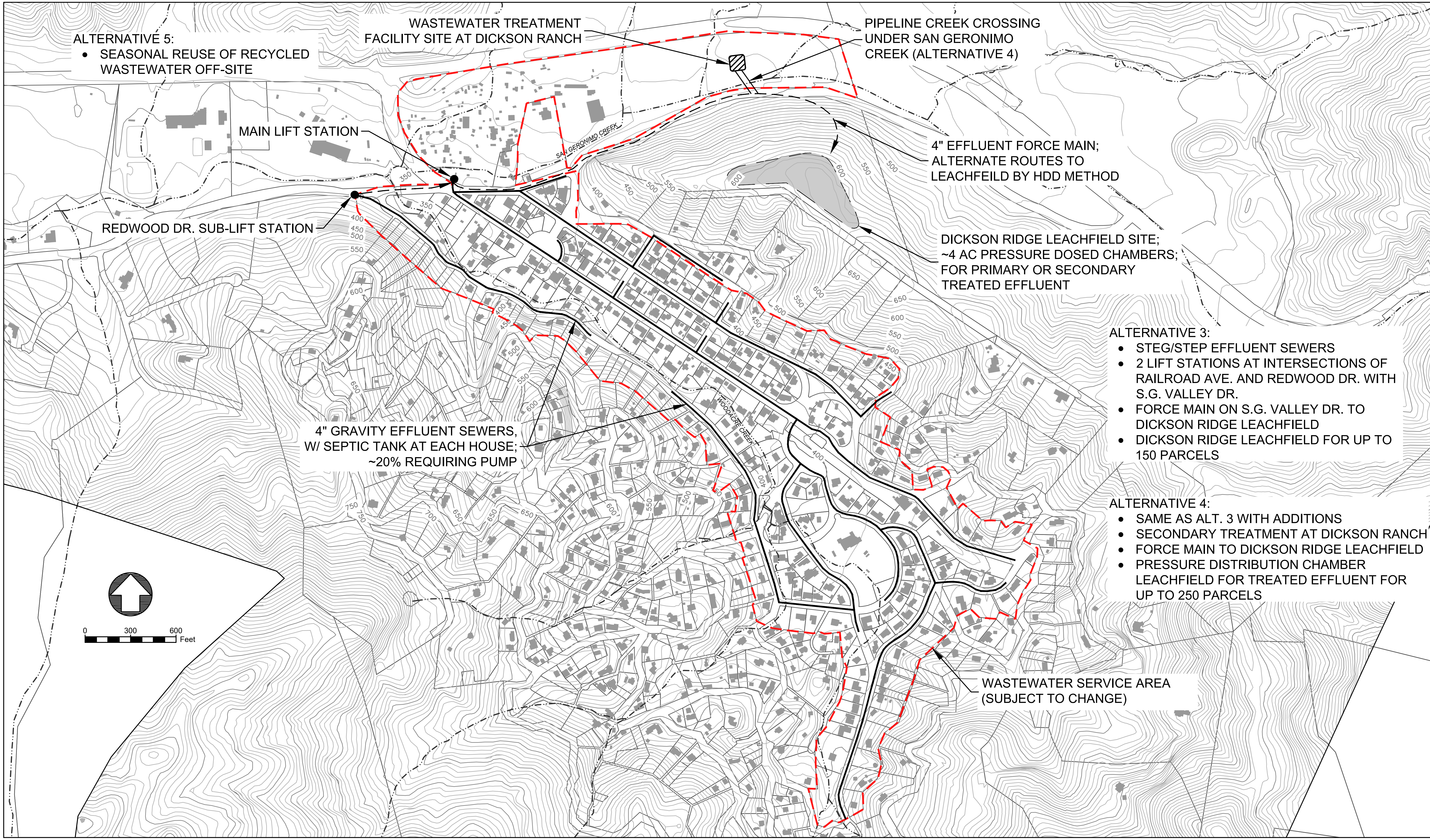
Project alternatives were formulated in consultation with Marin County and Regional Water Board staff utilizing the results of the prior 2011 Woodacre Flats study, new information from soils testing and field surveys, input from members of the community, and multiple meetings with representatives of the Dickson Ranch, where wastewater treatment and disposal facilities would be located. Project alternatives evaluated in the study are described below, with **Figure ES-3** provided for illustration and orientation.

- **Alternative 1 - No Project**. This would involve maintaining the status quo, where individual property owners would be responsible for maintaining and upgrading their own onsite systems and for abatement of septic system failures as directed by Marin County EHS and/or the San Francisco Bay Regional Water Board.

- **Alternative 2 - Onsite Wastewater Management Program**. This alternative considers the upgrade of onsite systems in conjunction with the formation of a local septic system maintenance and inspection program. The program would be operated under the authority of a Wastewater Maintenance District, County Service Area or similar public entity with existing or newly established authority encompassing the boundaries of the selected service area. Financing of individual septic system improvements could potentially be accomplished with grant and/or loan assistance to bring all currently developed properties into conformance with minimum acceptable “repair” standards adopted for the service area.

- **Alternative 3 – Primary Treatment (Septic Tanks) with Community Leachfield.** This alternative would provide for the construction of a central wastewater collection system for properties in Woodacre, leading to a community a leachfield system located on the wooded hillside of the nearby Dickson Ranch. The recommended collection system is a gravity effluent sewer, with individual septic tanks on each property draining to a network of small, 4” diameter collection lines terminating at a main lift station near the intersection of Railroad and San Geronimo Valley Dr. From the lift station, effluent would be pumped in a 4” diameter force main to the community leachfield site. The identified area for a community leachfield is a wooded knoll on the north facing slope along the Fire Road ridgeline northeast of Woodacre. The site has been explored and tested for soil suitability, groundwater, and percolation. It has also been surveyed to locate and map protected trees, slopes, drainages, and other potential constraints. The site is estimated to have sufficient capacity for approximately 8,800 to 9,000 lineal feet of leaching trench, with the preferred design being shallow (30” deep) pressure-distribution trenches using infiltrator chambers in place of drain rock. Facilities and associated cost estimates were developed for two service levels under this alternative: 100 and 150 connections.

- **Alternative 4 – Secondary Treatment with Community Leachfield.** This alternative would provide the same wastewater collection and disposal facilities as Alternative 3 but



PLOT STYLE: ----
LAST SAVED: 8/12/2024 PLOT DATE: 8/12/2024

WOODACRE WASTEWATER FEASIBILITY STUDY

WOODACRE, CA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht:	Rev:	Date:	By:	Description:	App'd:

Design: NH
Drawn: ER
Checked: NH
Appr'd: NH

PROJECT ALTERNATIVES OVERVIEW

WOODACRE, CA

FIGURE
ES-3

IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE – ADJUST ACCORDINGLY would add a secondary wastewater treatment system ahead of the leachfield. The purpose of the secondary treatment system would be two-fold: (1) to decrease the amount of trench length required for disposal; and (2) to improve the quality of wastewater discharged, in particular to minimize nitrate loading to the leachfield and watershed area. The secondary treatment system would be located on the Dickson Ranch property, east of the main equestrian activities. Effluent would be pumped to the treatment plant directly from the main lift station at Railroad and San Geronimo Valley Dr. This would entail pipeline crossing under San Geronimo Creek installed with by trenchless horizontal directional drilling (HDD). The treated effluent would then be to the hillside leachfield site via a second pipeline crossing under the creek, also installed by HDD methods. The recommended treatment system is the AdvanTex recirculating textile treatment system. The system utilizes a relatively passive biofiltration process, is designed to accept and treat septic tank effluent, and poses minimal visual, noise and odor impacts. Facilities and associated cost estimates were developed for three service area levels under this alternative: 150, 200 and 250 connections.

- **Alternative 5 – Secondary Treatment with Community Leachfield and Seasonal Water Recycling.** This alternative considers the possibility of recycling some of the treated wastewater for irrigation or other approved uses. Several possible options and locations for water recycling were investigated as part of this study, but none were of a suitable size or location to be practical. As a result water recycling was not fully developed as a project alternative at this time. The possibility remains that water recycling could occur as a future addition or modification to the wastewater facilities and operations under **Alternative 4.**

ESTIMATED PROJECT COSTS

Table 2 presents a summary of estimated capital costs and annual operation and maintenance (O&M) costs for various project alternatives and service area sizes, along with the estimated cost per residential connection (parcel) served by the system.

Capital Costs

The estimated capital costs include facilities construction as wells as the necessary engineering and environmental studies, project administration, district formation and financing costs. A 20% contingency allowance is also included. Preliminary allowances for land/easement costs for the treatment plant and leachfield on the Dickson Ranch properties are included; however, based on preliminary discussions with the property owners, long-term lease agreements may be preferred and financial agreement would be subject to negotiations.

Annual Operation and Maintenance Costs

The estimated annual O&M costs include costs for administration, labor, equipment, materials, and other expenses required to perform the necessary inspections, treatment plant operation (as applicable), water quality sampling, data analysis, report preparation, pump-outs, and routine maintenance for wastewater facilities. The level and nature of required O&M activities vary according to the wastewater facilities and operating requirements under each alternative. An additional annual cost not yet determined are lease payments for the use of portions of the Dickson Ranch property identified for the community leachfield and wastewater treatment plant, should that the agreed-upon arrangement with the property owners.

Table ES-2: Summary of Estimated Costs

Alternative		No. of Parcels	Capital Costs ($)		Annual O&M Costs ($)	
			Total	Ave Per Parcel	Total	Per Parcel
1	No Project	-	-	0 to 90,000+	-	200 to 2,000+
2	Onsite Upgrades & Management Program	250	17,453,280	69,800	302,500	1,210
3	Primary Treatment (STEP) Community Leachfield	100	6,015,500	60,155	143,000	1,430
		150	7,625,700	50,838	195,800	1,305
4	Secondary Treatment at Dickson Ranch Community Leachfield	150	8,969,700	59,798	235,400	1,569
		200	11,534,700	57,674	269.500	1,348
		250	13,343,700	53,375	303,600	1,214
5	Secondary Treatment at Dickson Ranch Seasonal Irrigation Community Leachfield	250	N/A	N/A	N/A	N/A

COMPARATIVE REVIEW AND RECOMMENDED PROJECT

A comparative review was made of the advantages and disadvantages of the various project alternatives with respect to regulatory compliance, environmental impacts, reliability, energy use, water conservation/water recycling, land use, and costs. The comparative analysis shows **Alternatives 4** and **5** to have the highest ranking among the alternatives evaluated and are identified as the “apparent best” alternatives for the Woodacre study area. Since **Alternative 5** has not been fully developed through this study, **Alternative 4** would be identified as the preferred alternative at this time. **Alternative 4** can be viewed and pursued as either a standalone project or as an initial step toward the development of **Alternative 5** should sufficient water recycling opportunities become viable in the future.

SECTION 1: INTRODUCTION AND BACKGROUND

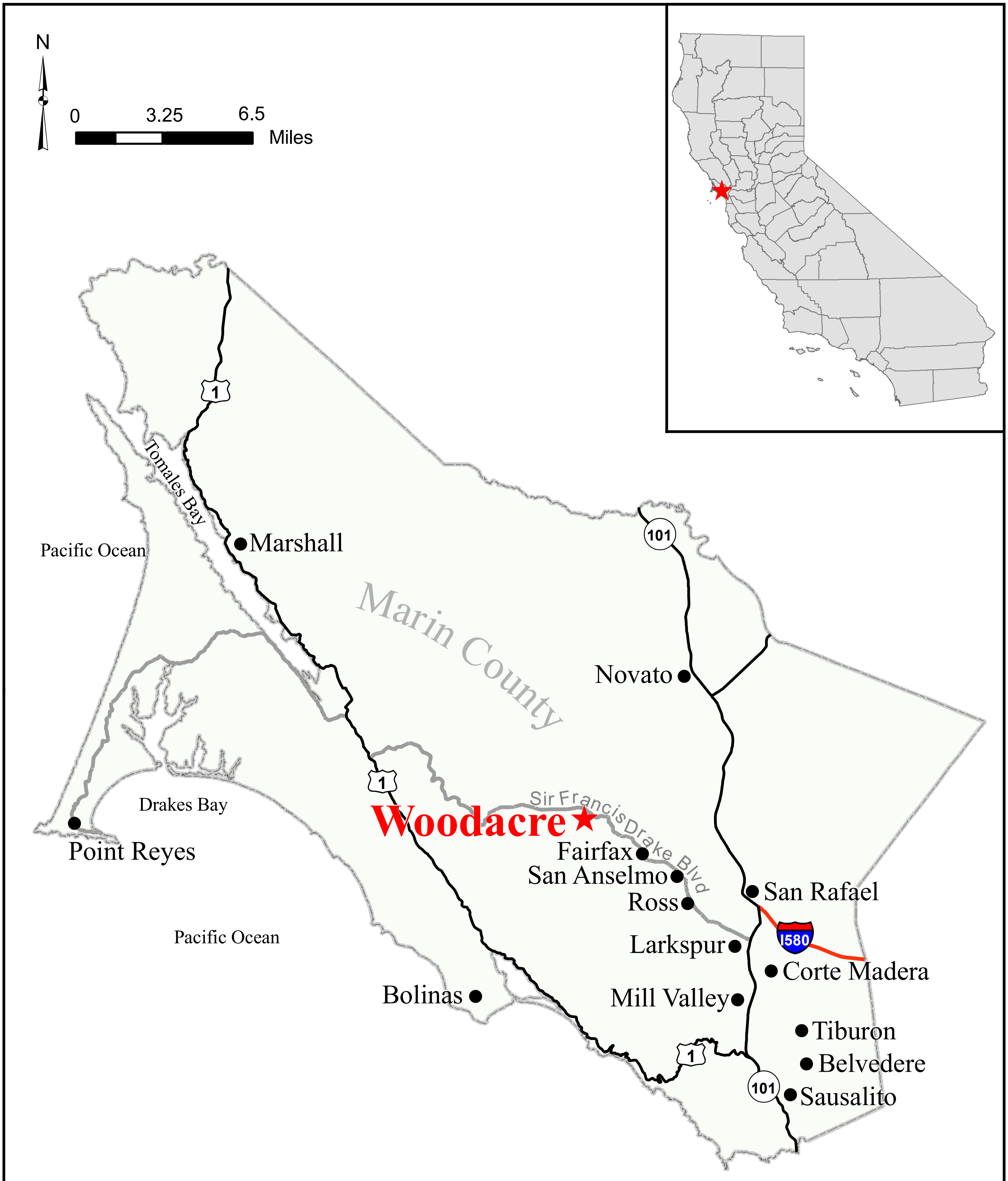
This report presents the results of a feasibility study regarding wastewater management solutions for the unincorporated community of Woodacre, located at the eastern end of the San Geronimo Valley, Marin County. The study focused specifically on the low-lying portions of Woodacre, encompassing approximately 250 developed properties in the area commonly referred to as the "Woodacre Flats" and adjacent areas (**Figure 1-1**). All properties in Woodacre rely on the use of individual septic systems for sewage disposal.

Woodacre lies within the watershed of Woodacre Creek, a year-round stream which drains into San Geronimo Creek, then Lagunitas Creek, and eventually into Tomales Bay. Lagunitas Creek and Tomales Bay are federally listed as impaired for pathogens. The Tomales Bay Pathogen TMDL of 2005 identifies lower San Geronimo Creek as the second greatest source of fecal coliforms entering Tomales Bay, after Walker Creek, and requires the County of Marin to take action to address failing septic systems.

Inspections of existing septic systems in the winters of 2004-05 and 2007-08 in Woodacre found a high percentage (77%) of homes had marginal or failing systems. Water quality monitoring in Woodacre Creek by the Tomales Bay Watershed Council (TBWC) during the same timeframe found generally high levels of total and fecal coliform, nitrates and ammonia, as well as methylene blue active substances (MBAS), a component of detergents. This led to their identification of Woodacre as a high priority for correction of failing septic systems, the formation of a local homeowner steering group (Woodacre Flats Wastewater Group), and eventually the initiation of a wastewater feasibility study for the "Woodacre Flats" area in 2010, sponsored by the County of Marin with funding from the local community, the County, the U.S. EPA.

Questa Engineering was hired by Marin County to conduct the initial Woodacre Flats Wastewater Feasibility Study, which was completed in 2011. The study identified and evaluated various wastewater improvement alternatives for approximately 150 parcels in the most problematic areas of the community affected by high groundwater, poor drainage, clayey soils, small parcel size and age of systems. The study identified two promising options: (1) a local community leachfield option with limited capacity for properties in Woodacre; and (2) a wastewater recycling alternative centered around the San Geronimo Golf Course that could potentially support a larger number of homes, including and extending beyond Woodacre. The water recycling alternative was favorably received by the community and prompted an additional follow-on study of a project that could potentially serve homes in both the Woodacre and San Geronimo communities. With grant funding from the State Water Resources Control Board, a water recycling study was initially completed in 2017, modified in 2019, but eventually dropped from further consideration following the sale of the golf course property and conversion of the land for other open space and conservation uses.

The current wastewater feasibility study was initiated in fall of 2022 for the purpose of revisiting the local community leachfield option identified in the 2011 Questa study, and determining in greater depth the engineering feasibility, capacity, costs, and current viability of this approach in comparison to the alternative of continued use and management of individual septic systems.



QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Woodacre Wastewater Feasibility Study
Woodacre, Ca

Figure 1-1
Location Map

SECTION 2: STUDY AREA CONDITIONS

GEOGRAPHICAL SETTING

The Study Area comprises a portion of the unincorporated community of Woodacre, located in the eastern end of the San Geronimo Valley in western Marin County (**Figure 2-1**). The portion of Woodacre addressed in this study is roughly defined as the area bordered by and adjacent to San Geronimo Valley Drive on the north, Taylor and Central Avenues on the northeast, Redwood Drive on the southwest, and Oak Grove and Elm Avenues on the southeast. This study area includes approximately 250 developed parcels, primarily the low-lying and most densely developed portions of Woodacre. The developed properties are almost entirely single family residences, with a small number of commercial occupancies. There are also a small number of undeveloped (vacant) parcels within the boundaries of the Study Area.

Based on 2020 Census data, the average household size in Woodacre is 2.28 persons/residence, giving a total Study Area population estimate of about 570 people. In the prior 2010 census the occupancy was reported as 2.27 persons/household. Due to the essentially fully developed conditions of the Study Area, projected population growth is assumed to be negligible.

HYDROLOGY

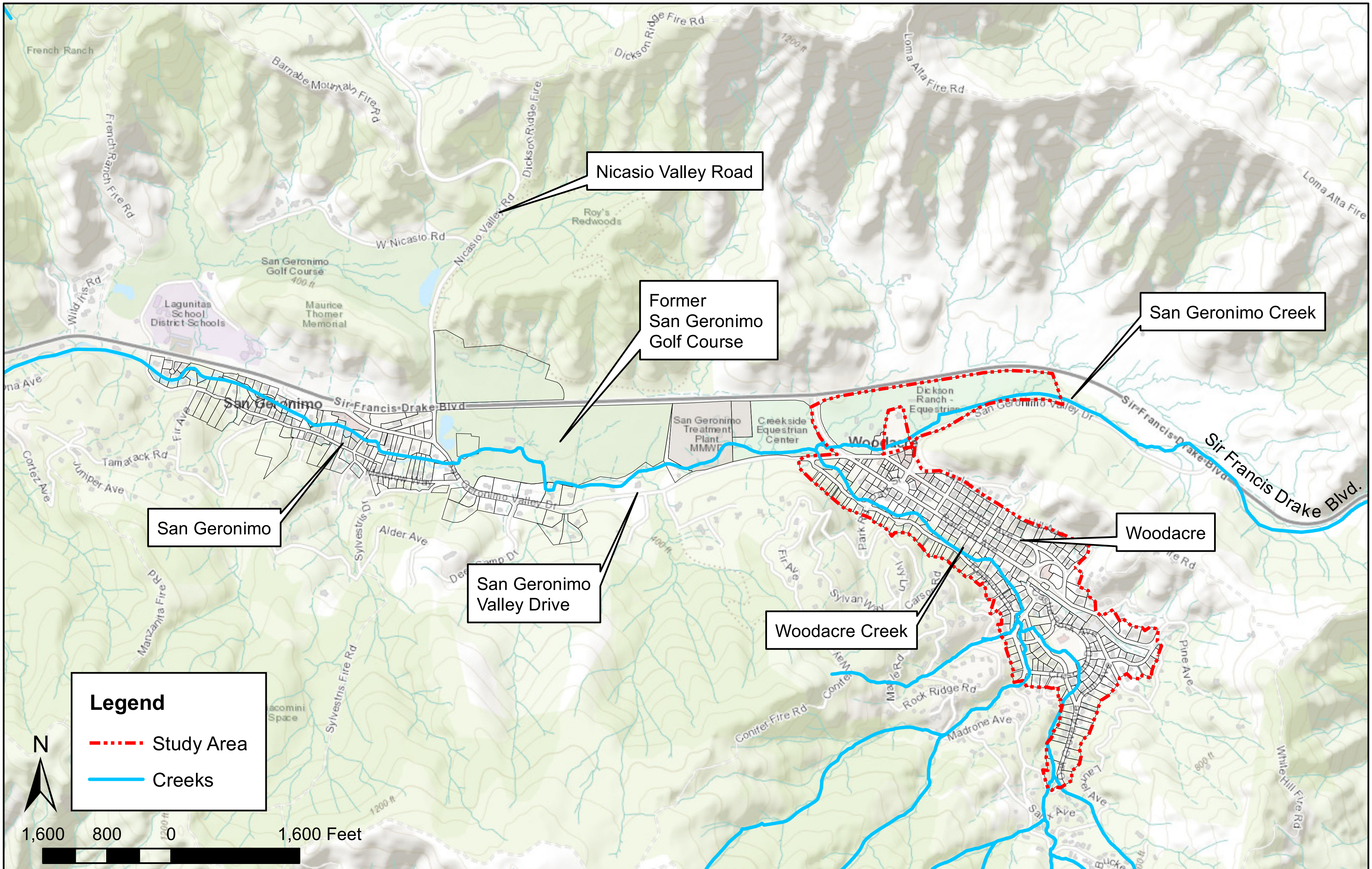
Woodacre lies within the watershed of San Geronimo Creek, a year-round stream tributary to Lagunitas Creek and eventually into Tomales Bay (**Figure 2-2**). Woodacre Creek flows through the study area parallel to Redwood Drive, in a southeast-to-northwest direction. Woodacre Creek receives surface runoff and drainage from several small tributary branches and a network of storm drainage channels in the community.

The ground elevations in the study area range from about 370 to 400 feet above mean sea level (AMSL) in the Woodacre area. The surrounding upland portions of Woodacre occupy steeper terrain, with elevations up to about 700 feet AMSL.

In Woodacre, the local hydrology is strongly influenced by the relatively flat gradients (2 to 3 percent in the Flats), concentrated runoff and drainage from the surrounding steep hills, and alteration of local drainage patterns by roads, the former railroad grade, and development of individual lots. Localized soil saturation and ponding of surface waters is common during the wet season. This has prompted many property owners to install various drainage mitigation measures in yards and around buildings, including curtain drains, sumps, and drainage ditches.

There is no recognized groundwater basin in the Study Area and vicinity. The area is dominated by rock formations of the Franciscan Complex, with spotty groundwater occurrence and generally low yields. There are no municipal or domestic supply wells in the Study Area, but there are believed to be some private agricultural wells in surrounding areas.

Like most of the California coastal areas, the climate is Mediterranean, with wet winters and dry summers. The annual average rainfall for the area is approximately 42 inches, with 85 percent of the annual total typically occurring during the months of November through April. **Table 2-1** presents average monthly rainfall amounts for the Woodacre area based on rainfall measurements at the Woodacre Fire Station, located within the study area. The table also

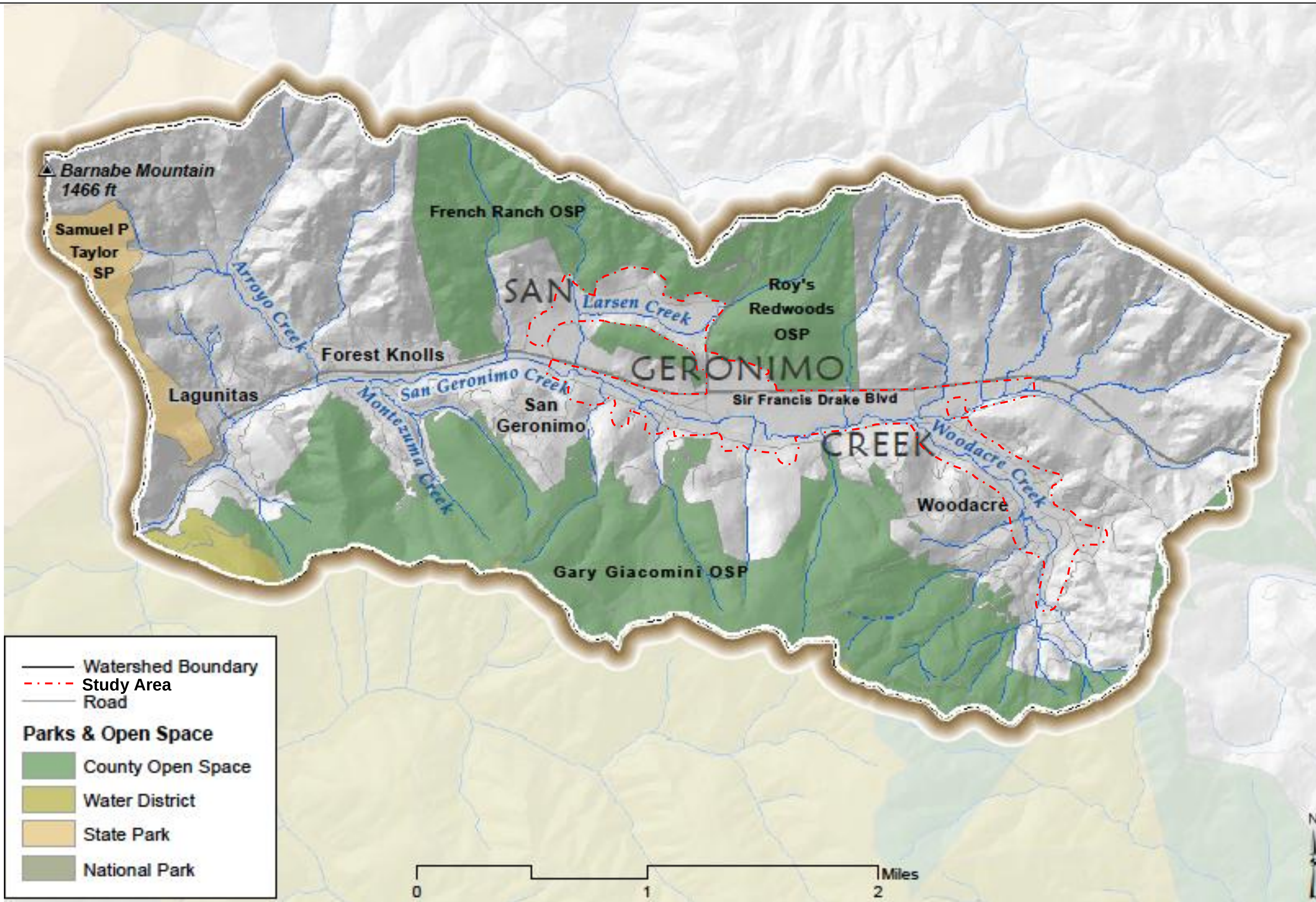


DATE:	08/14/2024
PROJECT:	WOODACRE WW
PROJECT NO.:	2200054
DRAWN:	DD
APPROVED:	NH

QUESTA ENGINEERING CORP.

STUDY AREA

FIGURE 2-1



DATE:	8/12/2024
PROJECT:	WOODACRE WW
PROJECT NO.:	2200054
DRAWN:	N/A
APPROVED:	NH
SOURCE:	MARIN COUNTY DPW

QUESTA ENGINEERING CORP.

SAN GERONIMO CREEK WATERSHED

FIGURE 2-2

shows monthly rainfall estimates for 10-year and 100-year frequencies as determined statistically from long-term rainfall records at San Rafael and Kentfield.[1]

Table 2-1. Monthly Rainfall for Woodacre, California (inches)

Month	Average Year	10-Year	100-Year
January	5.13	7.56	9.28
February	8.01	11.81	14.49
March	9.39	13.84	16.99
April	7.53	11.10	13.62
May	5.29	7.79	9.57
June	2.40	3.54	4.34
July	1.03	1.51	1.86
August	0.28	0.41	0.51
September	0.05	0.07	0.08
October	0.09	0.13	0.15
November	0.39	0.58	0.71
December	2.05	3.02	3.70
Total	**41.6**	**61.3**	**75.3**

GEOLOGY AND SOILS

Geology

The regional geology consists of the folded, faulted, and sheared bedrock of the Franciscan Complex, which is an accretionary mélange comprised of greywacke, chert, serpentine, schist, greenstone, and other rock types. The Franciscan Complex was formed 65 to 190 million years ago by the subduction of the Farallon Tectonic Plate and the northwest movement of the Pacific Plate to the North American Plate. Subsequent compression, uplift and faulting occurred during the Miocene and Pliocene epochs of the Tertiary Period (between 5 and 15 million years ago). The current tectonic setting is related to the movement along the northwest-southeast trending faults such as the San Andreas and Hayward Faults.

Locally, the Woodacre area consists of a valley with ridges rising up on both the northeast and southwest sides, and at the southeasterly end. Along the western side, the ridge is formed mainly of sandstone. In contrast, the eastern ridge (Fire Road area) and the uplands in the southern end of the valley consist of Franciscan Melange, including a mixed composition of serpentine, greenstone, chert, shale and sandstone blocks in a clayey/shale matrix. A sizeable sandstone block has been identified along the northern end of the eastern ridge, which is the area studied for a community leachfield system, referred to in this study as Dickson Ridge.

Soils

Soils in Woodacre are derived from the accumulation of materials that have washed into the valley from the surrounding upland slopes and ridges. The soils are deep in some areas, but are generally somewhat poorly to very poorly drained, with seasonal groundwater levels less than 3 feet from ground surface, and within a foot or two during high rainfall years. Deeper, sandy alluvial soils occur along the drainageways.

[1] Questa Engineering, 2019.

According to the Soil Survey of Marin County, soils in the Woodacre area are primarily Blucher-Cole Complex, 2 to 5 percent slope, which occur in basins and alluvial fans. The distribution of soils in this complex is roughly as follows:

- **40% Blucher Silt Loams**. Blucher soils occur near drainageways and are deep and somewhat poorly drained, with seasonal high water table normally between 3.5 to 5 feet below ground surface. Permeability is typically moderate in near surface soils (to about 2-feet deep), and slow at deeper depths.

- **30% Cole Clay Loam** – Cole soils occur on basin rims and depression areas; they are very deep and somewhat poorly drained, with seasonal high water table normally between 1.5 to 3 feet below ground surface. Permeability is typically slow in Cole soils.

- **30% Clear Lake Soils** – Clear Lake soils occur in depressions and slopes less than 2%; they are similar to Cole soils, but more clayey and with slow permeability.

- **Cortina Soils** - Cortina soils are deep, gravelly sandy loams that have developed from alluvial deposits along streams.

Soils in the adjacent hills and uplands along the edges of the Study Area, e.g., along Redwood Drive, are mapped as Dipsea-Barnabe gravelly loams and clay loams. These soils are derived from weathering of sandstone and shale, well drained, varying from shallow to moderately deep over bedrock, on moderately to very steep slopes.

WATER SUPPLY

Water Supply Facilities. The San Geronimo Valley receives water service from the Marin Municipal Water District (MMWD). The District provides drinking water to nearly 200,000 customers in Central and Southern Marin County, as well as raw water for irrigation uses. The District also operates the Las Gallinas Valley Water Recycling Facility which serves up to 2 million gallons of recycled water per day to 350 customers in northern San Rafael, which is about 15 miles from the San Geronimo Valley.

Water Quality. Treated water supplied by MMWD meets or surpasses all drinking water requirements set by the State Water Board and the EPA.

Groundwater. There are no known domestic water supply wells in Woodacre. A review of well completion reports on file with California Department of Water Resources shows a 35-ft deep irrigation well was installed in 1999 in the vicinity of Garden Way and Oak Grove Ave, near the southern extent of the Study Area.

WATER QUALITY

Monitoring and protection of water quality in Tomales Bay and tributary watersheds, including Lagunitas Creek and its tributary streams, falls under the authority of the San Francisco Bay Regional Water Quality Control Board (Regional Water Board.) The Regional Water Board is charged with the responsibility of ensuring maintenance of water quality conditions at levels that are protective of the beneficial uses in the Bay and tributary streams, which include shellfish harvesting, water contact recreation, and noncontact water recreation, as well as aquatic habitat uses. The Water Quality Control Plan for the San Francisco Bay Region identifies the following beneficial uses of Lagunitas Creek, San Geronimo Creek and Woodacre Creek:

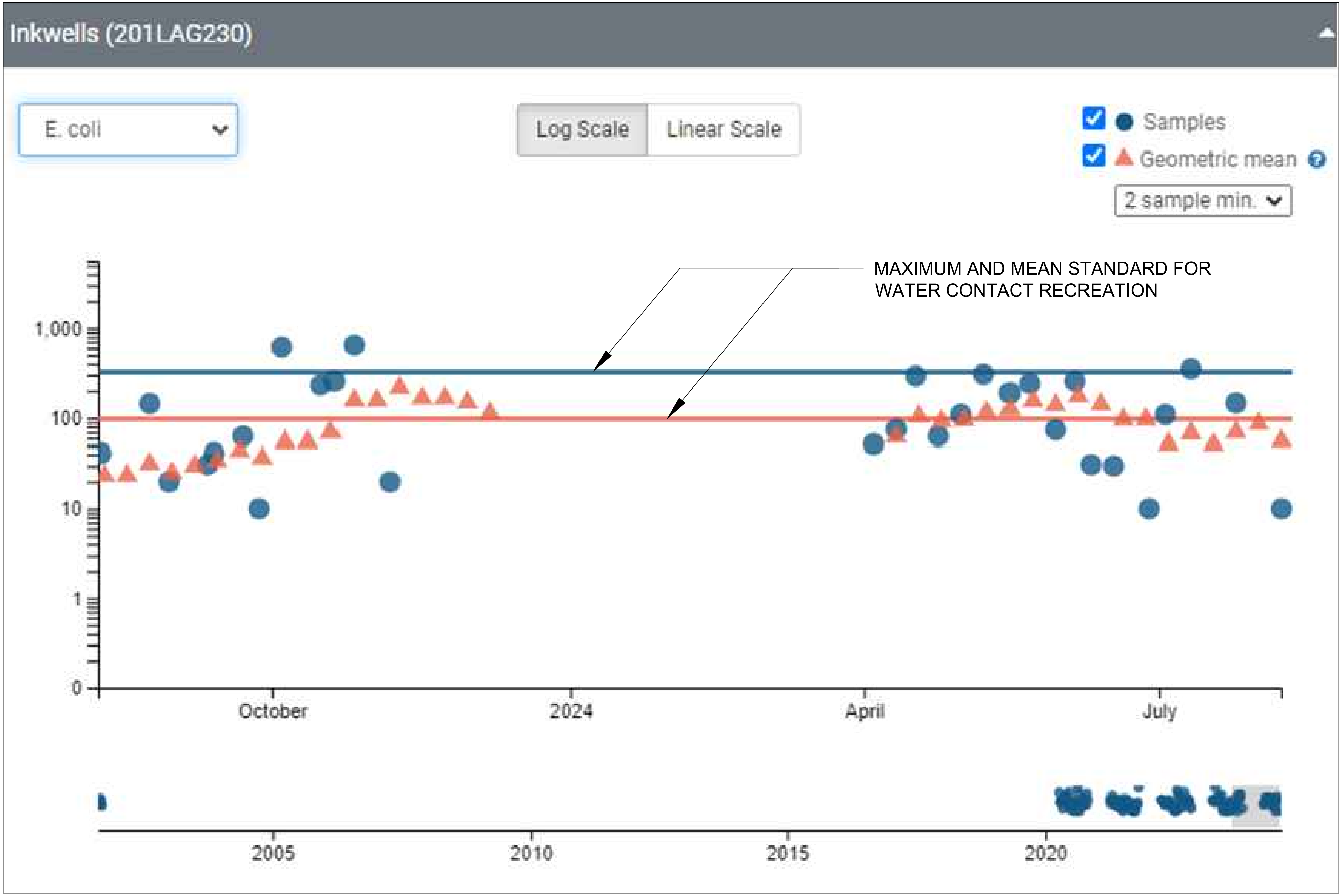
a. Agricultural Supply
b. Municipal and Domestic Supply
c. Freshwater Replenishment
d. Water Contact Recreation
e. Noncontact Water Recreation
f. Warm Fresh Water Habitat
g. Cold Fresh Water Habitat
h. Wildlife Habitat
i. Preservation of Rare and Endangered Species
j. Fish Migration
k. Fish Spawning

Many years of monitoring results have shown that Tomales Bay and its main tributaries, Lagunitas Creek, Walker Creek and Olema Creek, are impaired by pathogens, as reflected by high fecal coliform bacteria concentrations (Regional Water Board, July 2005). The presence of pathogens in the Bay and tributary streams poses potential health risks to shellfish consumers, recreational users and other water uses. Because of these conditions, these waters have been formally "listed" in accordance with Section 303(d) of the Federal Clean Water Act (CWA) as impaired water bodies. Septic systems in the Tomales Bay watershed are a potential contributor to the water quality impairment.

Water quality sampling of Woodacre Creek and local storm drains in recent years has shown elevated levels of coliform bacteria, nitrate, ammonia and surfactants, in some cases exceeding receiving water quality standards. These influences on water quality may be attributable to the high density of older septic systems combined with problematic drainage and soil conditions in Woodacre, especially in the Flats. Impacts on water quality locally can be carried downstream to Lagunitas Creek and eventually to Tomales Bay. **Figure 2-3** displays the results of bacteriological testing at the Ink Wells near the confluence of San Geronimo and Lagunitas Creeks, showing the fecal coliform levels consistently hovering above and below the established water quality standard for contract recreation uses.

To further investigate the potential sources of bacteriological impacts, a microbial source tracking study of Woodacre Creek and San Geronimo Creek was conducted in winter 2016 to summer 2017. This was a collaborative effort of the Marin County EHS, Marin Water, Tomales Bay Watershed Council, Woodacre/San Geronimo Wastewater Group, and the San Geronimo Valley Planning Group. The study included collection of water samples from three locations: (1) Woodacre Creek; (2) San Geronimo Creek (upstream) above confluence with Woodacre Creek; and (3) San Geronimo Creek (downstream) at Meadow Way Bridge. Samples were collected on four different dates, reflecting different streamflow conditions: wet weather (12/16/16; 2/15/17); spring (5/10/17), and dry summer (7/10/17.) Quantitative polymerase chain reaction (qPCR) analysis was used to detect the presence of host-specific bacteria from human, horse, ruminant, and dog *Bacteroides* markers. Study results showed positive evidence of human markers from (1) Woodacre Creek during all sample events, (2) upstream San Geronimo during wet season, and (3) San Geronimo Creek during wet and dry season samples. The project report presenting methodology and results is presented in **Appendix A**.

The Regional Water Board and Marin County EHS are committed to eliminating faulty septic systems and implementing various onsite wastewater management programs and projects to



WOODACRE WASTEWATER FEASIBILITY STUDY WOODACRE, CALIFORNIA	QUESTA ENGINEERING CORP. Civil, Environmental & Water Resources (510) 236-6114 FAX (510) 236-2423 questa@questaec.com P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807	Design: NH Drawn: ER Checked: NH Appr'd: NH

Sht.	Rev:	Date:	By:	Description:	App'd:

E.COLI SAMPLE RESULTS AT INK WELLS

Project: 2200054
Scale: AS NOTED
FIGURE: 2-3

address the water quality concerns in the Tomales Bay watershed. Under the CWA, the State is required to establish Total Maximum Daily Load (TMDLs) for those pollutants causing water quality impairments to ensure that impaired water bodies attain their beneficial uses. In compliance with the requirements of the CWA, in March 2005, the RWQCB issued its report *"Pathogens in Tomales Bay – Total Maximum Daily Load, Proposed Basin Plan and Staff Report".* The report: (a) documents the basis for the impairment finding: (b) establishes numeric targets for water quality needed to protect beneficial uses; (c) identifies the actual and potential pathogen sources in the watershed; (d) proposes a loading allocation amongst the various contributing pathogen sources to achieve the TMDL; (e) evaluates the linkage between sources and water quality targets; and (f) proposes an implementation plan for achievement of the TMDL goals. The pathogen limits for Tomales Bay and its tributaries are listed in **Table 2-2** below:

Table 2-2. Tomales Bay TMDL Pathogen Limits
(mL= milliliter)

WATERBODY	INDICATOR PARAMETER	TMDL[a,b]	
		Median/Log Mean	90th Percentile
Tomales Bay [c]	Fecal coliform	Median < 14 MPN/100mL	<43 MPN/100mL
Tomales Bay Tributaries [c]	Fecal coliform	Log mean <200 MPN/100 mL	< 400 MPN/100mL [c]

a. *Based on a minimum of no less than five samples equally spaced over a 30-day period.*
b. *Most Probable Number (MPN) is a statistical representation of the coliform test results.*
c. *All samples should be collected at knee-high depth*

The TMDL sets a target of zero discharge of human waste to the waters of Tomales Bay and its tributaries. This is based on the knowledge that human waste can be a significant source of pathogenic organisms, including viruses. Prohibition of human waste discharges into surface waters is consistent with existing water quality plans and policies.

In terms of implementation, the TMDL finds that septic systems that discharge to land in a manner consistent with accepted design standards (for new systems) or according to specific performance standards (for existing/repair systems) would be considered acceptable, providing that they are properly operated and maintained. Compliance with performance standards would also be expected to assure protection of groundwater resources (e.g., drinking water supplies), which can be impacted by improper siting, design, or operation of onsite sewage disposal systems.

SECTION 3:
EXISTING WASTEWATER TREATMENT AND DISPOSAL PRACTICES

OVERVIEW

There are no public sewers serving the Woodacre study area or other parts of the San Geronimo Valley. All properties in the study area rely on individual onsite septic systems for sanitary waste treatment and disposal. This typically includes a septic tank for collection and settling of solids, with some type of leaching system for disposal (percolation) of the liquid into the soil. Most of the properties in the area were developed prior to the adoption of current County Codes. Gravity systems are most common, although more recent development has included the use of advanced systems installations, such as mounded and pressure distribution disposal fields and advanced/supplemental treatment units.

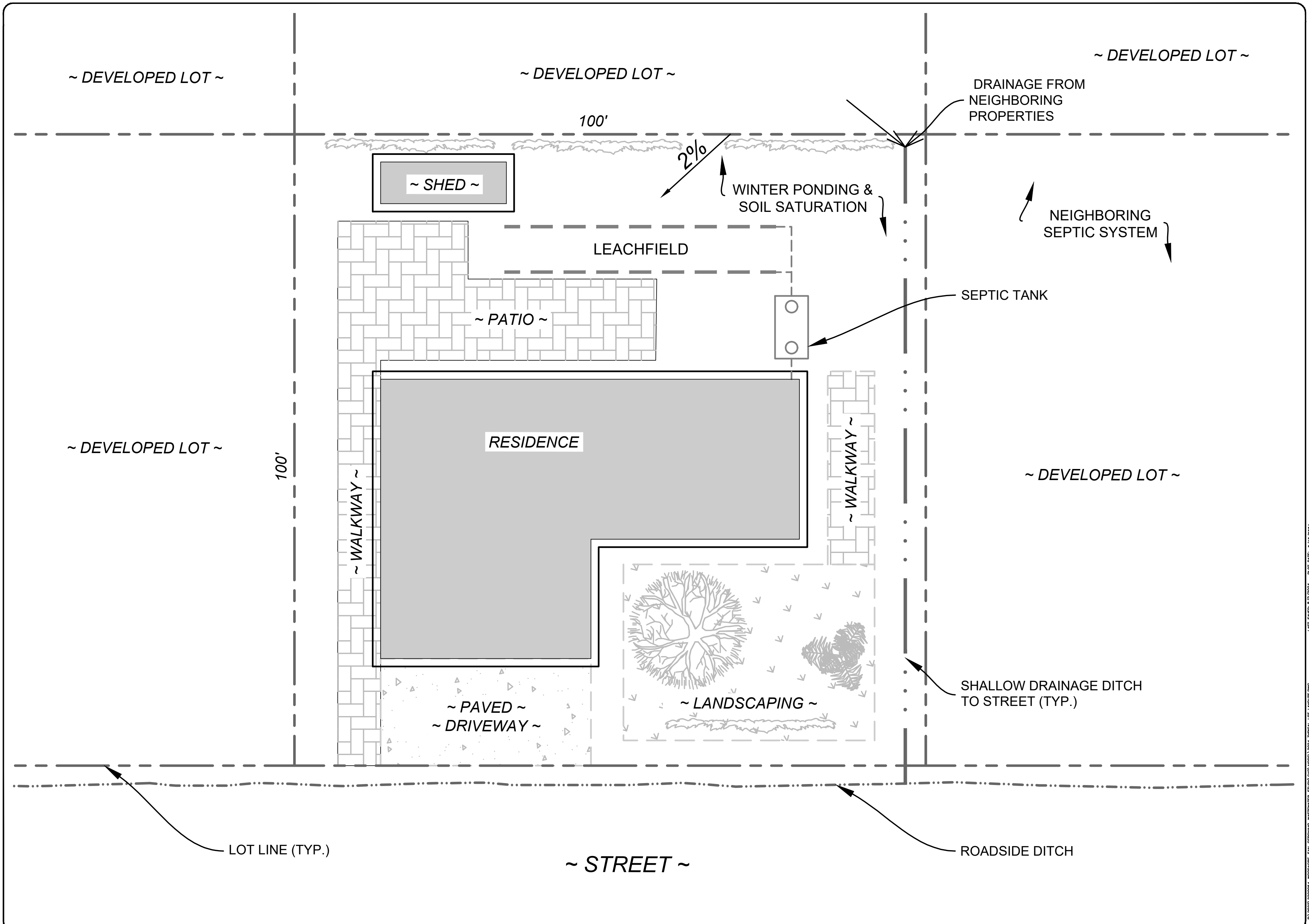
There are many existing septic systems in Woodacre with unknown construction features, indicating the likelihood of an antiquated or questionable design that differs significantly from modern codes and practices. The most recent review of County files as part of the current shows the following status of septic systems according to EHS classification:

- Class 1 – 1984 Code: 5%
- Class 2 – Post-1984 Repair: 23%
- Class 3 – Pre-1984 Permit: 15%
- Class 4 – No Documentation: 57%

In 2004-2005, voluntary (confidential) septic system inspections conducted as part of a County-wide outreach effort (“Septic Matters Program”) found roughly two-thirds of the systems inspected in Woodacre have marginal to unacceptable operating conditions due to many of the following conditions and factors related to system age, small size, additional living units, limited area, seasonal high groundwater and soil saturation, limited soil percolation and proximity to streams and local drainages.

File and field reviews conducted as part of the 2011 study of Woodacre Flats and updated as part of the current feasibility study revealed information consistent with the above findings. Many of the properties in the Study Area have very serious constraints for onsite sewage disposal. **Figure 3-1** illustrates the development conditions and associated sewage disposal constraints typical for a large percentage of the properties in the Woodacre Flats area. As indicated, the lot sizes are relatively small (generally about 10,000 square feet), with limited area available for septic system placement between buildings, driveways, walkways, landscaping and patio areas. The ground slopes are flat to gently sloping with relatively shallow soils, contributing to poor drainage and seasonal high groundwater conditions. Many property owners have installed drainage ditches, curtain drains and sumps to rid their yards of water ponding during the rainy season. These drainage systems provide a potential avenue for short-circuiting of sewage effluent into the local storm drain system (and subsequently downstream receiving waters) during certain times of the year. The close proximity between neighboring properties further complicates the local drainage situation and often presents additional setback conflicts for sewage disposal systems.

Another area of special concern is the group of homes that border Woodacre Creek. These properties typically have better soil and drainage conditions than the Flats area of Woodacre.



WOODACRE WASTEWATER FEASIBILITY STUDY
WOODACRE, CALIFORNIA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht:	Rev:	Date:	By:	Description:	App'd:

Design: NH/PP
Drawn: ML
Checked: PP
Appr'd: NH

TYPICAL ONSITE CONDITIONS
RAILROAD/CENTRAL AREA

Size
Project 2200054
Scale: AS NOTED
FIGURE: 3-1

However, in many cases the ability to provide suitable horizontal setback distance between the septic system and the edge of the creek is severely limited. **Figure 3-2** illustrates common creek-side situations in Woodacre, where small gravity flow systems (often seepage pits/beds) are located between the building and the creek and may provide setback distances of as little as 25 to 50 feet between the disposal area and the edge of the creek bank. Some creek-side properties have other available land that could be used effectively for sewage disposal with alternative/pumping systems in a way that would meet standard (100-foot) creek setback requirements; however, some properties lack sufficient and suitable land area to meet setback requirements.

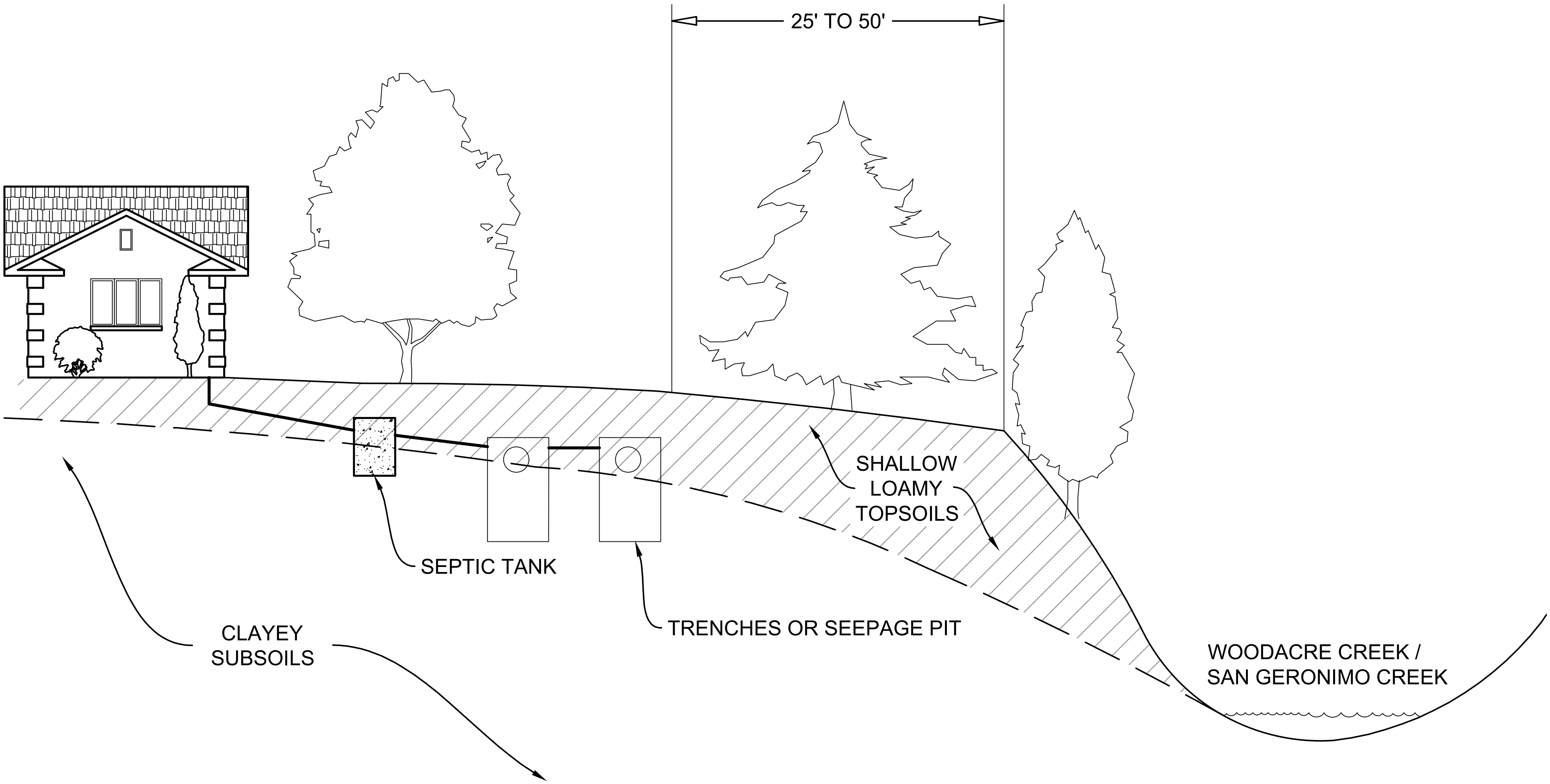
"SEPTIC MATTERS PROGRAM"

Individual septic system inspections were conducted in various parts of Marin County in the period of January 2004-August 2005 (by Kit Rosefield) and in winter of 2007-2008 (by Mike Treinen). A large number of these inspections were done in Woodacre. This work was funded by the County of Marin through grants received from the State Water Resources Control Board and the California Coastal Commission, and was termed the "Septic Matters Program". The overall goal of the program was to provide community education to homeowners through the completion of free and confidential third-party inspection and testing of septic systems.

The inspections were conducted on a voluntary basis, at the request of individual property owners, and the resulting information particular to any given property was kept confidential (between the inspector and the property owner). A total of 135 inspections were conducted County-wide, with nearly half (62) of them in Woodacre. The large number of inspections in Woodacre was as a result of active local encouragement to participate in the program. The inspections in Woodacre included many systems in the Flats area, but also other properties located in the upland areas, outside the limits of the current wastewater feasibility study.

The septic system inspections were conducted to assess the functioning status of individual systems following the general methodology contained in Marin County's "Septic System Performance Evaluation Guidelines". The work included review of permit file information, field inspection and measurements of the septic tank, leachfield system and key site features, and hydraulic load testing of the system. While the location and owners of inspected properties remained anonymous, the overall results of the inspections were compiled and presented to the County by Rosefield and Treinen, and provide a general overview of the functioning status and condition of septic systems in different parts of the County.

Table 3-1 presents a summary of the key findings as reported by Treinen (2008) for the County as a whole. A copy of the full report is provided in **Appendix B.** In the Woodacre area, Rosefield and Treinen encountered most of the problem conditions and issues noted in **Table 3-1**. In particular, they found many cases of marginal soils, high groundwater conditions, old and undocumented systems, gray water discharges, and a preponderance of small, "overdeveloped" lots, with minimal area provided for adequate onsite wastewater disposal. **Table 3-2** summarizes the information generated from the voluntary septic system inspections in Woodacre and San Geronimo. Overall, the Rosefield/Treinen surveys showed marginal to unacceptable operating conditions for about half to two-thirds of the septic systems inspected in these areas.



WOODACRE WASTEWATER FEASIBILITY STUDY
WOODACRE, CALIFORNIA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht.	Rev:	Date:	By:	Description:	App'd.

Design: NH/MW
Drawn: DI
Checked: MW
Appr'd: NH

TYPICAL ONSITE CONDITIONS
CREEKSIDE AREA

Size
Project 2200054
Scale: AS NOTED
FIGURE: 3-2

Table 3-1. Summary of Septic System Inspection Findings, Septic Matters Program*

Issue	Findings and Observations
1. System Age	Most systems estimated to be 30-50 years old. Many owners noted repairs had been done, most often without permits.
2. Small Parcels	In general, lot sizes were small, often ranging from 8,000 to 15,000 square feet. Many lots often overdeveloped with homes, garages, driveways, decks, pools and other hardscape, with limited space allowed for the septic system.
3. High Groundwater (GW)	Valley floor and flatter areas (such as Railroad Avenue in Woodacre) tend to have high seasonal GW, observed as high as 4 inches, and commonly 16-18 inches; pose flooding threat for septic tanks and leachfields that may be 3 to 6-feet deep.
4. Small Systems	Many systems smaller or substantially smaller than required under today's more scientifically based standards. Can contribute to faster accumulation of clogging bio-mat, reduced system lifespan and greater potential for hydraulic overload.
5. Marginal or Shallow Soils	Soils in many areas shallow or with marginal percolation, poorly suited for gravity systems, which is most commonly in use.
6. Additional Living Units	Secondary living units observed at 10-20% of the residences inspected, some existing without permits. This increases wastewater volume and stresses on existing systems.
7. Proximity to Waterways	Many systems closer to waterways than permitted by current code, with increased potential for contaminant transmission.
8. Graywater Discharges	Many homes found to have separate graywater discharges (laundry, showers, sinks) to the ground surface, ditches, or to unpermitted gravel filled sumps. This is done to relieve pressure on marginal or failing septic systems or occasionally by owners pro-actively reducing the load on their systems.
9. Limited or No Fail Safe Area	Most properties have limited or no system replacement area, especially if current set backs from wells, waterways and structures were to be enforced.
10. Restricted Access to Tanks	Development such as decks and pavement stones restrict some tanks for pumping and diagnosis; may contribute to less frequent or no pumping and diagnostic checks of those tanks.
11. Mosquito Breeding	Mosquito breeding noted in tanks and pump tanks with inadequate or poorly fitting concrete, fiberglass or wooden lids.
12. Unpermitted Repairs	High percentage of repairs (Kit Rosefield estimated 60%) have been made without permits, leading to questions of the adequacy of repair work and the maintenance of reasonable setbacks.
13. Pre-code Tanks	Some sub-standard septic tanks found, including redwood construction and bottomless tanks (e.g. function like cesspools).
14. Types of Repairs	Most common type of repair has been standard gravity leach lines, not necessarily suited to the soil and other site constraints. Some instances of non-standard systems, such as bottomless sand filters, mounds or advanced treatment units with subsurface drip dispersal (usually on steeper slopes). Non-standard systems generally appeared to be functioning properly and more appropriate for the observed site constraints. Non-standard repairs generally not favored by homeowners due to higher costs and large amount of space required; typically installed in connection with real estate transfer, refinancing, or home remodeling project.

*Trienen, 2008

Table 3-2. "Septic Matters" Inspection Results for Woodacre*

Category	Septic System Evaluation Factors	Results	
		# of Systems	% of Systems Inspected
Overall Status & Site Conditions	**Total systems inspected**	**62**	-
	Systems < 100 feet from a watercourse	55	90
	Systems with "satisfactory" or "good" overall rating	19	31
	Systems exhibiting one or more problem conditions	43	69
	Systems exhibiting high groundwater conditions	15	24
	Systems incorporating alternative treatment/dispersal	8	19
Septic Tank Status	Acceptable	35	56
	Unacceptable	15	24
	Unknown/ not Accessible	12	19
Disposal System Status	Acceptable	30	48
	Unacceptable	21	34
	Unknown/ not Accessible	12	19
Hydraulic Load Test Results	Good or Excellent	20	32
	Satisfactory or Marginal	8	13
	Poor or Failing	28	45
	Unknown/Not Accessible	6	10

*2004/05 and 2007/08

PERMIT FILE REVIEWS

As part of the 2011 wastewater study, Questa Engineering with assistance of Marin County EHS staff researched and reviewed septic system and related parcel information on file with Marin County for approximately 150 properties within the Woodacre Flats area. For the current study, additional permit file reviews were completed to encompass the additional 100 properties added to the prior Woodacre Flats study area. System permits, design drawings, correspondence and other file information were reviewed to determine the date of installation or of last repair, the technology or components of each system, compliance with County codes, and size of the residence or facility served. Out of approximately 250 developed properties in the Study Area files were found for 108 parcels (43%).

Figure 3-4 shows the location of the properties for which septic system records were found and reviewed. **Figure 3-4** also shows the locations of other properties in the Woodacre Flats area where field reviews were conducted as part of the 2011 wastewater study.

Information regarding the age of septic systems and an indication of new and repair system permitting work data show the following:

- **System Age.** Files show about 48% of septic systems in the Woodacre Study Area being more than 40 years old. It is likely that for those properties without permit information a greater percentage are more than 40 years old.

- **Repairs.** Files indicate about 56% of the septic system permit work in Woodacre (60 of 108) has been for system repairs.

- **Prevailing Code.** Permit information indicates about 65 percent of the septic systems (new/Class I and repair/Class II) were constructed under County septic system regulations in place since 1984; the other 35% with permit information occurred under previous regulations and would be considered Class III. A high percentage of septic systems for the remaining 142 properties without permit information (Class IV) were likely not installed in accordance with current practices and regulations.

Table 3-3 summarizes the wide range in the types and number of septic system technologies and designs used in the Woodacre as determined from review of permit information. About 75% of systems are standard gravity-fed leachfields and seepage pits/beds. About 20% consist of alternative treatment/disposal systems and 5% are unknown from permit data. Additionally, the remaining (approximately half of total) septic systems for properties in the study where permit files are lacking would fall in the category “unknown”, but likely consist of some type of gravity leachfield or seepage pit.

Table 3-3. Types of Onsite Wastewater Systems in Use

Type of System		Number of Systems
Gravity Leachfield		56
Seepage Pit/Seepage Bed		20
Alternative Systems	Mound System	8
	Pressure Distribution (PD) Leachfield	8
	Sand Filter/PD Leachfield	3
	Open Bottom Sand Filter	2
	PD Sand Trenches	1
	Supplemental Treatment w/PD Leachfield	2
	Supplemental Treatment & Drip Dispersal	-
Unknown		8
Total		108

ONSITE FIELD REVIEWS

As part of the 2011 wastewater study, field reviews were conducted by Questa for 33 properties in the Woodacre Flats area to assess the conditions and options for upgrading existing septic systems to an acceptable repair standard. The following briefly summarizes the work and findings from these onsite field reviews. Additional details can be found in the 2011 *Woodacre Flats Wastewater Feasibility Study*.

The field reviews were arranged (voluntarily) with willing property owners to make site-specific assessments of constraints and options for onsite system repair and upgrade on a representative number of properties in the study area. As previously noted, the parcels where field reviews were conducted are indicated in **Figure 3-3**.

The field reviews involved mapping and measuring various property features along with hand-auger borings for soil/groundwater observations. From this, an assessment was made of the apparent available area for onsite septic system upgrade on each parcel, and to identify and evaluate some of the main construction issues and constraints that would be involved with the implementation of onsite system upgrades. Aerial photos and Assessor Parcel Maps were used in some cases to supplement field observations regarding property size, boundaries between parcels, and setbacks to various landscape features.

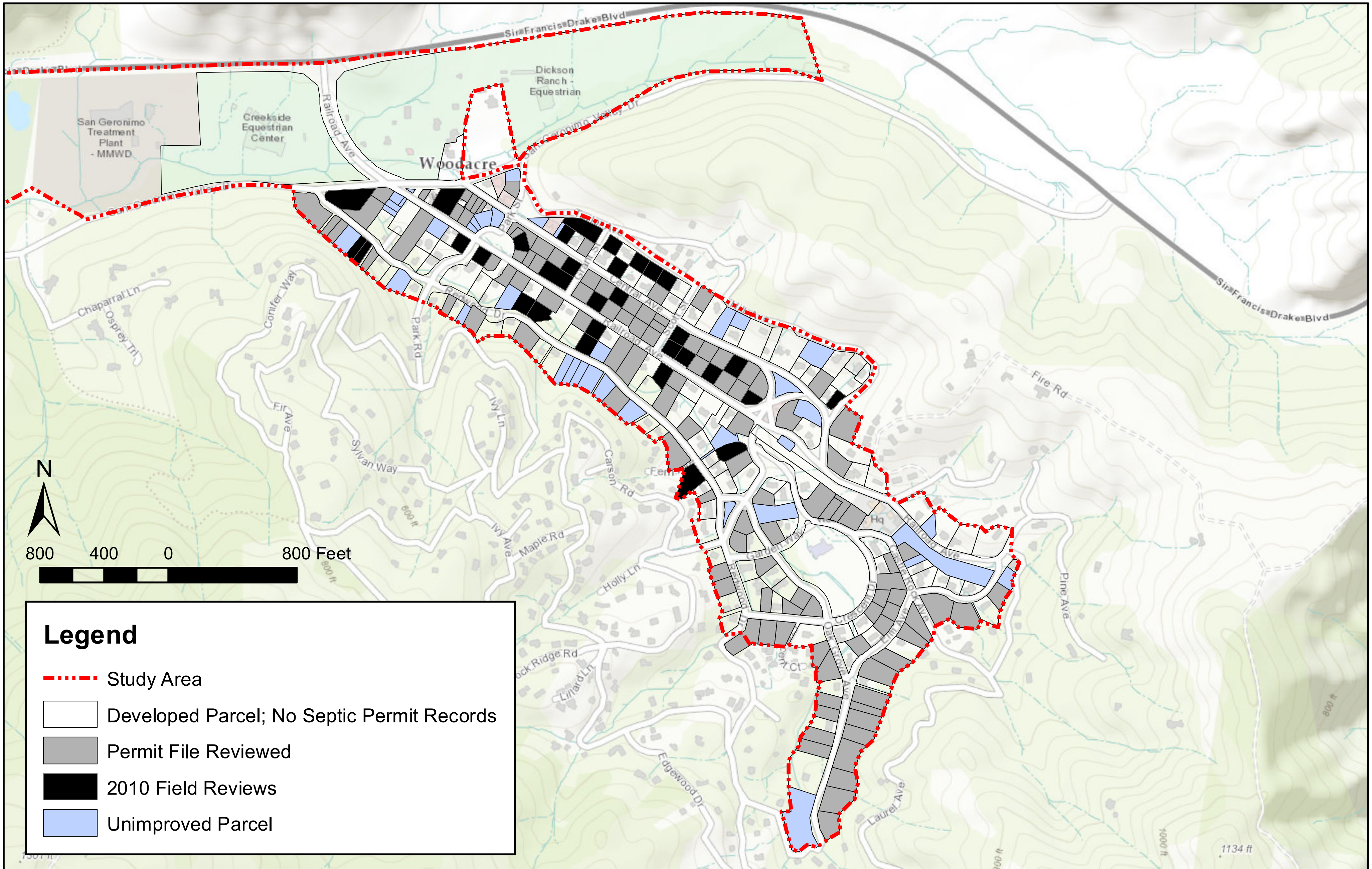
The results from the field reviews along with other background information on existing conditions and practices provided the basis for evaluating the feasibility and requirements for the onsite system upgrade and management program under consideration as an alternative in the 2011 study. Based on 33 properties reviewed, the results indicated the following categories of expected septic system upgrade, with respective percentages in each category noted:

- **Low Level** – This was assigned to properties having an existing Class I or Class II code system, where little or no repair or upgrade work would be anticipated. This included properties with mound systems, sand filters and pressure distribution leachfields, mostly permitted and installed within the last 10 to 15 years. Upgrade needs for these situations is assumed is assumed to be minor, related mostly to repair or replacement of various mechanical and electrical components and possibly drainage mitigation work. It would not include major changes to the existing system. (15% of properties)

- **Moderate Level** – This was assigned to properties having sufficient area and reasonably good soil and groundwater conditions that could accommodate relatively straight forward upgrades to either the treatment or disposal system, such as: (a) addition of a supplemental treatment unit along with drainage mitigation measures; or (b) expansion of disposal capacity with shallow pressure distribution trenches along with drainage mitigation measures. (12% of properties)

- **High Level -** This was assigned to properties having severe space limitations along with shallow soil/high groundwater conditions and/or drainage setback constraints requiring considerable work to implement a satisfactory onsite upgrade/repair. The type of upgrade/repair likely to be required for most of these situations would include: (a) supplemental/advanced treatment unit, often with UV disinfection; (b) drip dispersal, often with imported soil cover fill or raised beds; and (c) surface and subsurface drainage mitigation measures. Variances to standard setback requirements would be required for most properties in this category. (73% of properties)

Additional onsite field reviews were not conducted as part of the current wastewater study for the expanded number of properties in Woodacre. However, based on prevailing site conditions and review of permit information, the findings regarding the expected level of septic system upgrade requirements cited above were deemed a reasonable basis for estimating onsite system upgrade feasibility factors for the current study area.



DATE:	8/12/2024
PROJECT:	WOODACRE WW
PROJECT NO:	2200054
DRAWN:	DD
APPROVED:	NH

QUESTA ENGINEERING CORP

WOODACRE SEPTIC SYSTEM PERMIT AND FIELD REVIEWS

FIGURE 3-3

QUESTIONNAIRE SURVEY

Midway through the current study a Wastewater Questionnaire was developed and mailed by Questa to owners of the approximately 250 developed properties in Woodacre Flats and adjoining areas being studied for community wastewater improvements. The purpose of the survey was to obtain input directly from property owners about their experiences, knowledge, concerns, and views on existing septic systems and potential long-term wastewater management options for the community. The survey was voluntary, anonymous, and did not require identification of property owner name or address. A total of 80 completed questionnaires were returned, a 32% response rate.

The following table presents summarizes survey responses regarding current concerns about septic system (OWTS). A full breakdown of questionnaire responses is provided in **Appendix C.**

Table 3-4. Questionnaire Survey Results

Issue	Level of Concern (% of Respondents)	
	Low	Medium to High
OWTS Functioning Problems		
Normal year winter operation	59	41
High rainfall winter operation	46	54
Summer operation	80	20
OWTS Code Compliance/Functioning Concerns		
For possible selling/refinancing	51	48
For house/property improvements	48	52
OWTS Interference with Property Uses		
For current uses	67	33
For planned house/property improvements	48	52
Public Health/Water Quality Impacts		
Contamination in yards and drainages	42	58
Contamination in Woodacre/San Geronimo Creeks	36	64
Odors and other Nuisances	50	50

In response to questions about long-term wastewater alternatives for Woodacre, about 70 percent of the respondents indicated preference for some type of community wastewater facility. Alternatives providing a higher level of treatment and opportunities for recycling were favored over basic primary (septic tank) treatment with a community leachfield.

SECTION 4:
SERVICE AREA CHARACTERISTICS

SERVICE AREA

Wastewater improvement projects are planned and developed around a given geographical area termed the “service area”. The service area provides the basis for estimating wastewater facility requirements, project alternatives and costs. Delineating the service area is often an iterative process, whereby initial boundaries are assumed for feasibility analysis, and subsequently adjusted in response to findings, recommendations, and other factors, which is the case for this project.

The 2011 Wastewater Feasibility Study for Woodacre Flats addressed a service area encompassing approximately 150 predominantly residential parcels in the low-lying portions of Woodacre. The tentative service area extended from San Geronimo Valley Drive south along Railroad Ave, Central Ave, Taylor Ave, and Redwood Dr to about Castle Rock Ave. At the time, 150 parcels was judged to be about the upper limit of the community leachfield site being studied.

In response to interest from residents beyond Castle Rock Ave and with additional topographic data and other information now indicating greater potential leachfield capacity, the service area considered in the current study was expanded to include up to approximately 250 parcels, extending south past the Fire Station to include parcels on Castle Rock, Crescent, Elm and Oak Grove Ave (**Figure 4-1**). This would be the maximum extent of wastewater service; the actual adopted boundaries could end up being a smaller area.

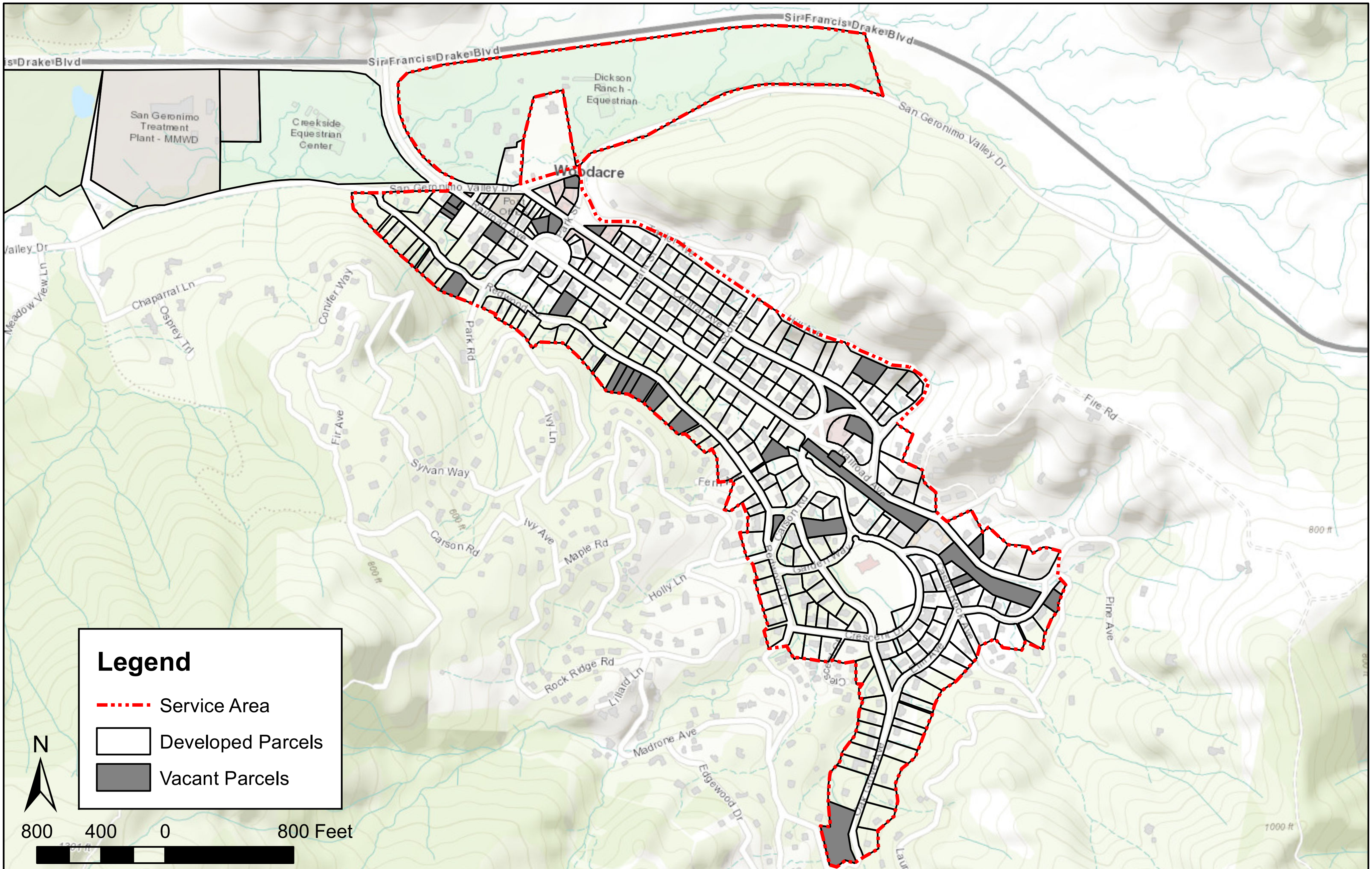
The approach to this project does not anticipate a condition or requirement for mandatory connection to community wastewater facilities for all properties in the service area or for any specific properties. It does, however, include the understanding that the facilities would be planned and implemented to serve existing developed properties within the designated service area, with possible allowance for a modest amount of expansion for low-incoming housing, child day care facilities or similar community needs.

There is varied property owner interest in connection to community wastewater facilities, as well as differing wastewater improvement needs from property to property. The type of wastewater collection system favored for the project (on-lot septic tanks with effluent only collection piping) lends itself to providing service to a mix of “connected” and “non-connected” properties along the sewer route. Recognizing this, cost estimates were developed for different numbers of connections within the overall maximum service area.

ESTIMATED WASTEWATER FLOWS

Wastewater Flow Factors

Information regarding wastewater is important in the assessment of required capacity of collection, treatment, and disposal facilities for community wastewater systems.



DATE:	5/18/2023
PROJECT:	WOODACRE WW
PROJECT NO:	2200054
DRAWN:	DD
APPROVED:	NH

QUESTA ENGINEERING CORP.

PRELIMINARY SERVICE AREA
WOODACRE WASTEWATER STUDY

FIGURE 4-1

- Collection system design requires consideration of peak flow conditions during the day,

- Wastewater treatment system design is based primarily on average daily flow, with hydraulic capacity for peak flows; fluctuations from day to day and during the day are normally addressed with flow equalization facilities (tank and pump) integrated ahead of the main treatment process unit.

- Land application-disposal facilities design varies depending on the method used. For example, leachfields that operate continuously throughout the year must be designed to handle peak flows during the period of maximum occupancy, usually determined on a weekly basis, and may be moderated by incorporation of flow equalization. Systems using irrigation for wastewater disposal/recycling are designed to regulate the daily discharge using storage reservoirs or the like, with the discharge matched to the vegetation requirements, soils and climatic conditions; the accumulated flow on a monthly or seasonal basis is typically the determining factor for irrigation systems.

Sewer systems may be vulnerable to infiltration of groundwater and inflow of surface water through joints and cracks in pipes and manholes. The amount of infiltration/inflow (I/I) depends on the groundwater and drainage conditions, the age and condition of the sewers, and the type of sewer design. Older conventional sewers are most notorious for experiencing high amounts of I/I; in newer installations I/I is more typically maintained below 10% of the sewage flow. For pressure sewers and effluent STEG/STEP sewers, I/I is essentially nil; this is because these types of collection systems don't include manholes and they utilize tightly sealed (or heat-fused) pressure pipe connections. Because of the known high groundwater conditions in the study area, an effluent STEG/STEP collection system is the recommended sewer alternative for Woodacre. **Appendix D** provides information on Effluent STEG/STEP sewers and their proposed application for Woodacre.

Unit Wastewater Flows

Estimated wastewater flows for the study were developed based on the assumed number of parcels to be served, the type of development on the those parcels, and review of typical reference data and monitoring information from other small community wastewater facilities.

The Woodacre service areas consist almost entirely of single-family residential parcels, with a few commercial uses. The commercial uses are mainly the types that generate wastewater volumes similar to or less than single family residences (e.g., deli, offices, shops, Post Office, small apartments). Wastewater flows for this feasibility study were estimated by applying a typical unit wastewater flow for residential use uniformly to all parcels in the service area.

Unit wastewater flows in gallons per day (gpd) per single family residence (or equivalent) were developed from review of actual daily and monthly flow data for three small community wastewater systems that have been in operation for the past 15 to 25 years: (1) French Ranch development, (2) Marshall Community Wastewater Facility, and (3) Lake Canyon Community Services District near Los Gatos in Santa Clara County. Monitoring data from these facilities indicates wastewater flows averaging less than 100 gpd up to about 150 gpd per residence.

Also to provide an additional local point of reference, we reviewed five years of winter water use data (2017-2022) for approximately 150 residences in the Woodacre study area, which were obtained from Marin Water District. Winter water use is a reasonable (conservative) indicator of sewage flow since irrigation and other outdoor seasonal uses are typically minimal in the winter. Average daily winter water use (per parcel) derived from 2-month water billing data are summarized in **Table 4-1** below. These data show water use (and inferred wastewater flow), to be very similar to the long-term wastewater flow monitoring data from Marshall, French Ranch and Lake Canyon community systems. Information on winter water use was also solicited in a questionnaire survey of residents and property owners in Woodacre, which indicated an average winter water use of 94 gpd per parcel.

Table 4-1. Woodacre Winter Water Use Data*
(150 parcels)

Year	December-January	February-March	Average Winter Use
2017-2018	124	111	118
2018-2019	129	90	110
2019-2020	158	109	134
2020-2021	127	136	132
2021-2022	98	97	98
Average	**127**	**109**	**118**

*Derived from 2-month billing records provided by Marin Water District

From the above information, an average unit wastewater flow of 135 gpd per parcel was determined to be an appropriate basis for estimating wastewater treatment and disposal system requirements. This is equivalent to an average flow of 55 gpd per person and occupancy of 2.45 persons per household, which is the average household occupancy in Marin County according to the 2020 census. As noted earlier, occupancy in Woodacre is reported at 2.28 persons per residence.

Using a unit flow estimate of 135 gpd per parcel, the resulting wastewater system flows for different levels of wastewater service connections in Woodacre are:

- 100 connections: 13,500 gpd
- 150 connections: 20,250 gpd
- 200 connections: 27,000 gpd
- 250 connections: 33,750 gpd

SECTION 5:
PROJECT ALTERNATIVES

INTRODUCTION

This section presents an analysis of each of the identified alternatives for the Woodacre Study Area. The analysis incorporates the results of recent field investigations and engineering studies conducted in 2023-2024, along with prior work done in connection with the 2011 study for Woodacre Flats. An overview of project alternatives is provided in **Figure 5-1** on an annotated map of the study area.

Maps and other reference materials are provided for each alternative, along with a description of key facilities, engineering feasibility, estimation of construction costs and a discussion of on-going operation and maintenance requirements and costs. Supporting technical information is provided in the appendices. **Section 6** presents a comparative review of the various treatment and disposal alternatives and identifies the "apparent best alternative".

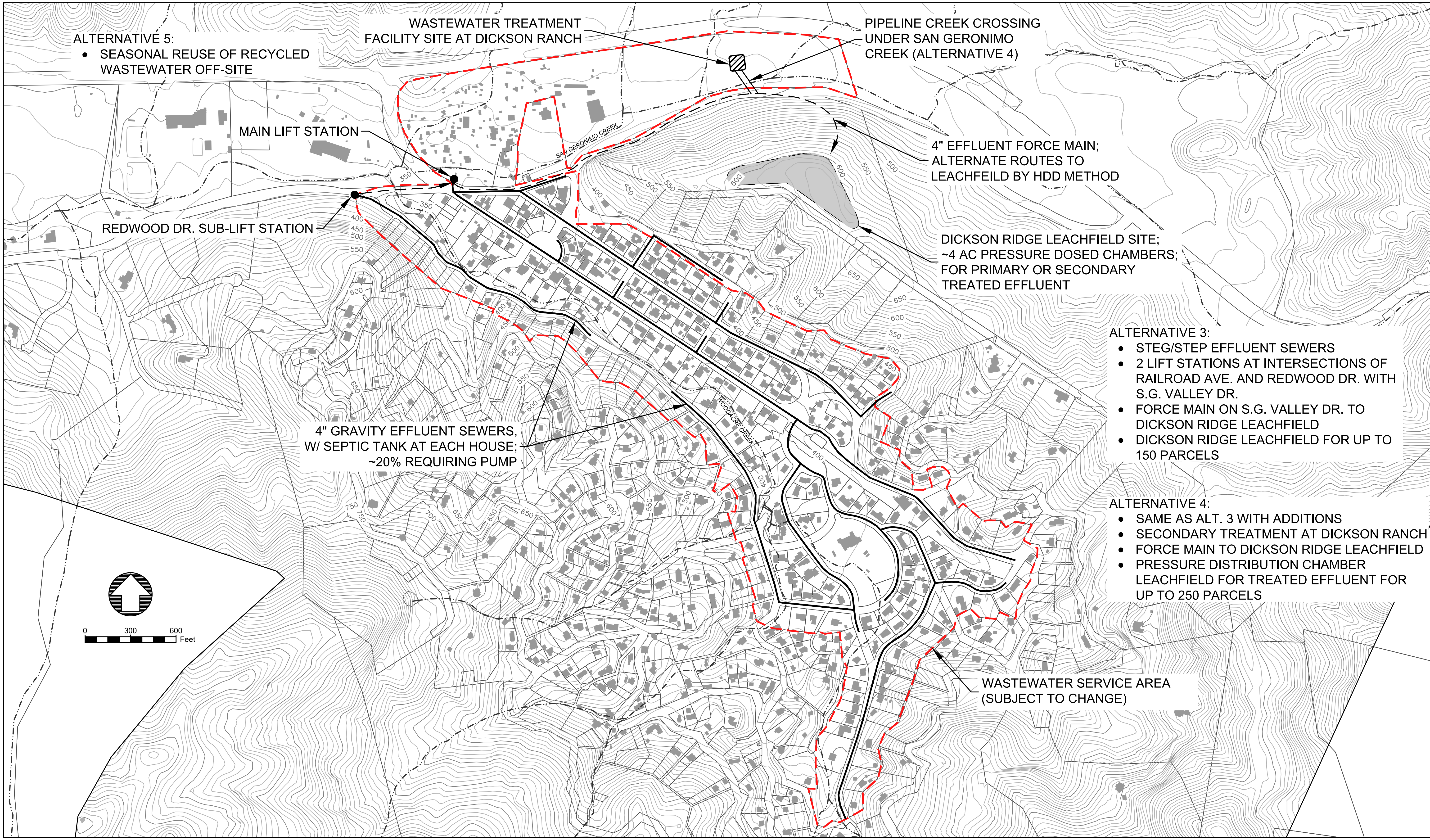
ALTERNATIVE 1 – NO PROJECT

Description

The No Project alternative, or status quo, is presented as a base case condition against which to judge other alternatives; however, no specific engineering evaluation has been made of this alternative. This alternative would provide for the continued use of onsite septic systems, with individual property owners responsible for maintenance and repair of their own systems. Permitting and regulatory responsibility would remain with the Marin County EHS and include oversight from the Regional Water Board. Correction of failing septic systems would normally be expected to occur under the following circumstances:

- As a direct result of abatement action taken by EHS for individual properties, sometimes in response to complaints;
- As a condition of sale at the time of property transfers;
- In connection with permits for building modifications; or
- By individual property owners on their own initiative.

Septic system repair work expected under this alternative might include, for example, replacement of existing substandard or failing septic systems with a new septic tank and disposal system. In most cases, an alternative system, such as a mound or advanced ("supplemental") treatment unit with drip dispersal or pressure distribution leachfield, would likely be required because of particularly poor site conditions for standard septic tank/leachfield systems. These conditions include the shallow soil depths, seasonal high groundwater, setback constraints, and limited available land area on mostly small parcels. Retrofitting houses with ultra-low flush toilets and other water conserving plumbing devices would also be a necessity for many houses to reduce the volume of wastewater to be disposed. New residential construction, building additions and second units would not be permissible except where site conditions can support the installation of an onsite system that conforms to current code requirements and/or the County's Remodel & Additions Policy.



Sht:	Rev:	Date:	By:	Description:	App'd:	

WOODACRE WASTEWATER FEASIBILITY STUDY

WOODACRE, CA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Design: NH
Drawn: ER
Checked: NH
Appr'd: NH

PROJECT ALTERNATIVES OVERVIEW

WOODACRE, CA

FIGURE

5-1

IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE – ADJUST ACCORDINGLY

PLOT STYLE: ---- PLOT DATE: 8/12/2024 LAST SAVED: 8/12/2024

Discussion

Over some period of time, the above-described efforts may lead to improved water quality and public health conditions in the community. But it is unreasonable to expect that the existing threat of water quality impact to Woodacre Creek, San Geronimo Creek and downstream receiving waters would be satisfactorily corrected. Under the No Project alternative, the possibility exists that Marin County EHS and/or the Regional Water Board would find it necessary at some point to undertake a systematic lot-by-lot inspection and abatement effort to mandate an upgrading of all septic systems to acceptable, modern standards. This could occur as a result of the implementation of the Tomales Bay Pathogens TMDL.

The TMDL requires that there be no discharge of human pathogens to Tomales Bay or its tributaries from septic systems. The TMDL further specifies that compliance with this requirement can be achieved by either: (a) documenting or bringing the septic system into conformance with Regional Water Board and County regulations for new construction; or (b) monitoring the septic system to verify compliance with the above "no pathogen discharge" performance standard. For existing septic systems in the watershed area found (or suspected) to be failing, the TMDL would require substantial upgrading (per Marin County Class II Repair Criteria), and ongoing monitoring of the new/replacement system under a County operating permit. However, the timing for implementing such corrective action is presently not specified.

As with other alternatives retaining onsite treatment with on-lot upgrades, there may be substantial yard disturbance and probable conflicts with existing or potential uses of the limited yard areas. In some cases, septic system upgrades may interfere with parking and require changes to landscaping.

Costs

Costs for the No Project alternative are best estimated from the existing expenses incurred by individual property owners in connection with upgrades or repair of their onsite wastewater systems associated with building remodel projects, property transfers or repairs. Typical costs range from about $30,000 to $40,000 on the low end up to as much as $90,000 or more, including soils testing, surveys, design, permitting and construction. Assuming most all systems require some alternative treatment components, the ongoing operation and maintenance requirements include service inspections, monitoring and reporting under the conditions of a County-issued Operating Permit, plus electrical usage, routine septic tank pump-outs, and replacement of parts and system components over the life of the system. Average annual operating maintenance costs typically range from about $500 to $1,500 for alternative onsite wastewater treatment systems, which includes the above items and annual County permit fees. For properties requiring multiple septic tank pump-outs during the winter to deal with saturated soils annual costs may be $2,000 or more.

ALTERNATIVE 2 - ONSITE SYSTEM UPGRADE AND MANAGEMENT PROGRAM

Description

This alternative would provide for inspection and as-needed upgrading of all existing septic systems in the study area, and formation of a septic system management authority to perform ongoing inspection, monitoring, and maintenance of these systems. Septic systems would need to be upgraded to a minimum set of standards, or determined to be in compliance with a minimum performance standard that would assure proper functioning and elimination of public health and water quality problems. The current standards of the Marin County EHS and the Regional Water Board would apply, with the possibility of adopting certain local modifications with agency concurrence. In general, all applicable siting criteria (i.e., soil depth, percolation, groundwater, slope requirements, etc.) would be considered to the greatest extent possible in evaluating and designing septic system upgrades.

On-lot septic system improvements under this alternative would be similar to those for the No Project alternative; i.e., replacement of substandard systems with new septic tanks, supplemental treatment units (e.g., sand filter, AdvanTex filter, aerobic treatment units) and new or expanded disposal fields, most likely using shallow pressure distribution, drip dispersal or raised/mounded beds to overcome high groundwater and soil constraints. Other alternative technologies that have merit would also be considered on a case-by-case basis.

Retrofitting houses with ultra-low flush toilets and other water conserving plumbing devices would be a necessity for many houses to reduce the volume of wastewater generated. Implementing simple graywater systems (e.g., clothes washer) would be of limited value during the wet season; however, it can be beneficial in: (a) reducing the overall loading of wastewater to the septic tank and disposal field. and (b) minimizing the deleterious effects of cleaning agents and shock hydraulic loadings on the biological processes in the septic tank and leachfield.

The specific siting and design criteria for each alternative technology would generally be in accordance with currently adopted standards of the County. However, there would be latitude to develop customized standards and design criteria specific to the Woodacre area. This might include, for example things like: (a) reduced wastewater flow sizing criteria; (b) selected area-wide setback variances; (c) sizing credit for graywater systems; (d) use of certain technologies; (e) modified design standards; and (f) allowance for shared sub-drains or other drainage measures. Adoption of customized local standards for Woodacre would require supporting rationale and would be subject to review and approval by the County and Regional Water Board.

Following septic system upgrading, a continuing inspection and monitoring program would be carried out by a public management authority. This would likely entail: (a) regular inspection of each system; (b) spot-check sampling of treatment systems; (c) water quality monitoring of Woodacre and San Geronimo Creeks and possibly other local drainages; (d) monitoring water levels and water quality at a series of groundwater monitoring wells to be installed; and (e) periodic reporting to the County and Regional Water Board on the inspection results and overall compliance with system performance, water quality and public health standards.

Regulatory Requirements and Policies

Criteria governing the siting and design of onsite sewage disposal facilities in the project area are contained in Marin County Sewage Disposal Regulations, which were developed and adopted in 1984 in conformance with the San Francisco Bay Regional Water Quality Control Board's 1979 *"Minimum Guidelines for the Control of Individual Wastewater Treatment and Disposal Systems"* ("Minimum Guidelines"). The County regulations have been updated a few times since 1984, mostly having to do with changes to accommodate the use of various alternative onsite wastewater technologies. In 2012 the State Water Resources Control Board adopted a statewide “Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems”, known as the State “OWTS Policy”. In 2014 the Regional Water Board formally incorporated the State OWTS Policy in their Basin Plan to replace the “Minimum Guidelines”. Under the provisions of the OWTS Policy, Marin County is currently in the process of preparing a Local Agency Management Program (LAMP) for approval by the Regional Water Board. The LAMP may include some changes to existing County regulations; however, the extent and specifics of any changes are not currently known.

The County regulations are oriented primarily toward individual septic tank - leachfield systems, but they also include provisions for the design and use of alternative technologies. Some of the key regulatory provisions contained in Marin County regulations for onsite wastewater systems are reviewed here.

Soil Depth. A minimum of 3 feet of soil depth is required below the leaching trenches (or bed). The soil within and below the leaching trenches must be permeable and of a suitable texture and structure for absorption of sewage effluent. Coarse sand and gravels are unacceptable due to the lack of fine soil particles for filtration and treatment; heavy clay soils, on the other hand, are generally unsuitable due to inadequate permeability.

Percolation Rates. The percolation rate for conventional leachfields and alternative disposal systems is required to be within the range of 1 to 120 minutes per inch (MPI). The percolation rate is the field-measured time for water level drop 1.0 inch in a standard percolation test hole. The percolation rate is used to establish an appropriate wastewater loading rate, which is then used for sizing the disposal field.

Depth to Groundwater. The required depth to groundwater, below the bottom of the leachfield trench varies according to the percolation rate, soil texture (particle size) and system type. For percolation rates of 5 to 60 MPI or where the soils have more than 15 percent silt plus clay fraction (“fines”), the required depth to groundwater is 3 feet (below trench bottom). A greater depth to groundwater is required for rapidly permeable soils where the soil texture lacks sufficient “fines” for treatment. For soils with a percolation rate between 1 and 4 MPI, the required depth to groundwater is 10 feet where there are 10 to 15% fines, and 20 feet where there are less than 10% fines. These depth requirements apply to disposal of septic tank effluent through conventional leaching trenches and may be reduced (to a minimum of two feet) if additional treatment or alternative disposal system design (e.g., mounds) are provided.

Setbacks from Wells and Watercourses. Required minimum setback distances between wastewater disposal fields and various water features are as follows:

- Water Wells 100'
- Springs 100'
- Natural Lake or Water Supply Reservoir 200' (from high-water line)
- Perennial Watercourses 100' (from edge of 10-year floodplain)
- Seasonal Streams and Wetlands 75' (from top of bank)
- Ephemeral Streams 50' (from top of bank

Marin County Regulations also specify minimum setback distances for other site features such as property lines, buildings, paved areas, cuts and embankments, and water lines. Variations in setback requirements are permitted in conjunction with certain alternative systems (e.g., sand filters), for system repairs, and under formal variance provisions. Additionally, Marin County Stream Conservation regulations require a 100-foot setback from streams in the San Geronimo Valley, regardless of whether the stream is perennial, intermittent, or ephemeral.

Disposal System Design. The standard disposal field design in Marin County is a trench system, 18-inches wide and ranging in depth from 2 to 8 feet. The system is sized according to the trench sidewall area and the wastewater loading rate determined from the percolation test results (see above). The design wastewater flow for a residential system is based on the number of bedrooms in the house, and a standard flow criterion of 150 gpd/bedroom, which may be reduced to 105 gpd/bedroom with the incorporation of low-flow plumbing fixtures.

Dual System Capacity. Individual wastewater disposal systems are required by Marin County regulations to have dual fields; i.e., a primary and back-up disposal field, each with 100% capacity, that operate on an alternating basis. The purpose is to extend the life of the disposal field. Normally, in such a system the flow is alternated between leachfields every six months. In many repair situations, dual capacity (and sometimes 100% capacity) cannot be provided; in such instances the disposal system is often designed to make maximum use of available suitable area.

It should be noted that the dual, 200% leachfield requirement dates to the provisions of the Regional Water Board's 1979 "Minimum Guidelines", which are no longer in force. The State OWTS Policy requirements cite only the need for a 100% primary disposal system and identification of a 100% reserve area for future installation. A change in County regulations away from the dual, 200% leachfield requirement is expected.

Operations and Monitoring. Alternative wastewater systems require monitoring of system operations, and submission of periodic reports to the County and/or Regional Water Board. The monitoring is intended to keep track of such things as wastewater flow rates and volumes, treatment effectiveness, disposal field performance and conditions, and downstream/downgradient water quality measurements at monitoring wells or surface drainage points. Quarterly monitoring and annual reporting requirements are typical for the first few years of system operation, declining to semi-annual or annual monitoring in subsequent years depending upon successful system performance. These requirements were adopted by the County in the early 2000s, and currently EHS receives several hundred monitoring reports annually providing valuable operating data on alternative OWTS in the County.

Repair System Requirements. As previously noted, for repair of existing septic systems, Marin County EHS attempts to achieve compliance with current regulations to the maximum extent practicable. However, full compliance with all code requirements is generally not possible. Heavy emphasis is given to case-by-case evaluation to achieve the best repair possible, considering the site limitations and environmental resources and public health issues at risk. **Table 5-1** lists tentative OWTS repair criteria and design assumptions that were developed for application in an onsite wastewater management program for Woodacre. They were developed during the initial wastewater feasibility study for Woodacre Flats in 2010 in consultation with EHS staff and reviewed with the Regional Water Board staff at that time.

Table 5-1: Example Repair Criteria
Woodacre Onsite Wastewater Management Program

ITEM	CRITERIA / DESIGN ASSUMPTION
Wastewater Design Flow	▪ Property owners responsible for installing ultra-low flush toilets and low flow fixtures; ▪ Assume design flow of 105 gpd/bedroom; ▪ Design flow of <105 gpd/bedroom if necessary due to dispersal area limitations and with additional monitoring requirements (per below).
Septic Tanks	▪ Existing concrete/fiberglass tanks of 1,200 gal or greater may be retained if found to be structurally sound, watertight and are upgraded with code compliant access risers. ▪ Effluent filters required for all new and upgraded tanks ▪ Setbacks to water and landscape features to be maintained as close as possible to code requirements; ▪ Setbacks to wells and springs - 50-ft minimum
Supplemental Treatment Units	▪ NSF Certification or equivalent technology verification required. ▪ Performance standard: Per standard EHS protocol*; for special/extreme creek encroachment situations, TMDL receiving water standard for fecal coliform at end of supplemental treatment process (i.e., dosing tank) or at groundwater monitoring wells adjacent to disposal field.
Dispersal System	▪ All reasonable dispersal technologies may be considered, including trenches, beds, mounds, drip dispersal; ▪ Design capacity – 100% of daily sewage flow; provide reserve area as feasible; ▪ Design loading rate: per soil characteristics and percolation rate; treatment credit for supplemental treatment OK per established sand filter design criteria; ▪ Setbacks to water and landscape features to be maintained as close as possible to code requirements; ▪ Setbacks to wells and springs - 100-ft minimum
Site Modifications	▪ Utilize curtain drains and surface drainage alteration wherever needed and feasible without impacts to/from other onsite systems or to surface waters; ▪ Soil excavation and replacement with sand fill – OK
Performance Monitoring	▪ Wastewater flow: Monitor from pump operations and/or water meter; require flow meter (or comparable device) and data logging for systems without 100% disposal capacity; ▪ Monitoring: water quality sampling required for coliform for special case systems at pump basin (following supplemental treatment), once per year; ▪ Visual inspection and maintenance once per year minimum; ▪ Remote alarm monitoring for identified high risk systems, e.g., creek encroachment with less than 100% disposal capacity.
Other Alternatives	▪ Holding tanks: May be required case-by-case to overcome extreme site limitations, such as soil/groundwater/drainage conditions or water course setbacks; ▪ Composting toilets: Not anticipated to be feasible or acceptable in high density residential area such as Woodacre. ▪ Graywater Systems: Case-by-case evaluation based on State Graywater Standards

*Includes operating permit with standard and site-specific inspection, testing, and reporting requirements

Feasibility Assessment

An assessment of onsite wastewater disposal feasibility for lots within the Woodacre study area was completed utilizing the repair criteria listed in **Table 5-1**. Background file information, to the extent available, was utilized for this assessment, along with results from the 2010 field reviews of a representative cross-section of properties in the Study Area. **Section 3** and **Appendix B** provide a summary of findings from the background file reviews and onsite field reviews of 33 developed parcels in the Study Area.

A key objective of the onsite field reviews was to assess the apparent available area for onsite septic system upgrade on each parcel, and to identify and evaluate some of the main construction issues and constraints that would be involved with the implementation of onsite system upgrades. As part of each site inspection, Questa's field review team made an assessment of the potential options for implementing an onsite system upgrade or repair taking into account the slope, soil, groundwater, drainage and area/setback factors. A specific design was not prepared for each property; instead, using best professional judgment each property was placed into one of three upgrade/repair categories based on the level of difficulty and associated work required as discussed in **Section 3**, briefly as follows:

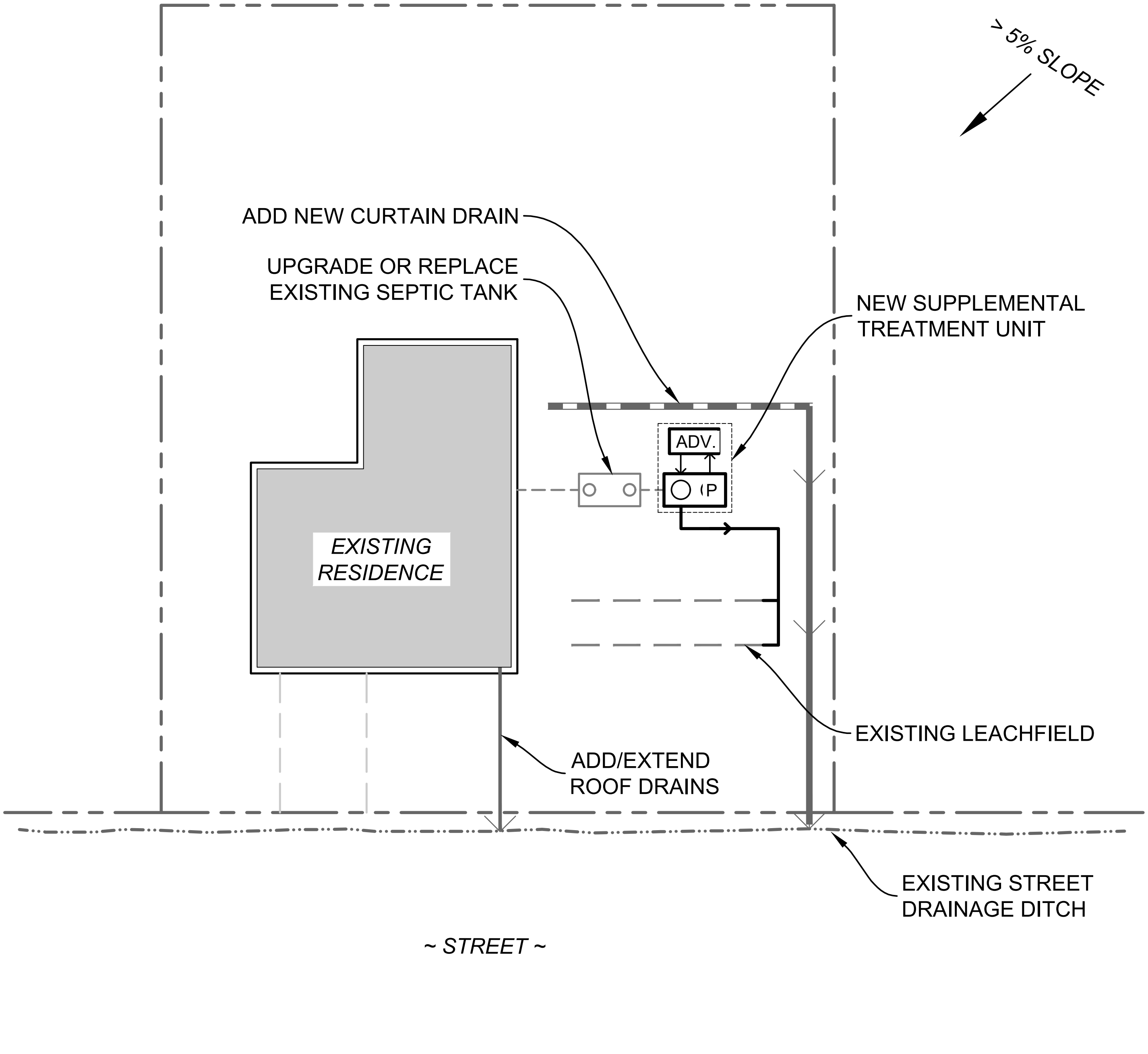
- **Low Level** – Applies to Class I and II systems. Upgrade work for these situations might include repair or replacement of various mechanical and electrical components and possibly drainage mitigation work. It would not include major changes to the existing system.

- **Moderate Level** – Applies mainly to Class III systems, for properties having sufficient area and reasonably good soil and groundwater conditions that could accommodate relatively straight forward upgrades to either the treatment or disposal system, such as: (a) addition of a supplemental treatment unit along with drainage mitigation measures; or (b) expansion of disposal capacity with shallow pressure distribution trenches along with drainage mitigation measures. **Figures 5-2** and **5-3** provide example (generic) site plans illustrating these types of septic system upgrades.

- **High Level –** Applies mainly to Class IV (undocumented) systems, for properties having severe space limitations along with shallow soil/high groundwater conditions and/or drainage setback constraints requiring considerable work to implement a satisfactory onsite upgrade/repair. **Figure 5-4** illustrates the type of upgrade/repair work likely for these situations.

Estimated Capital Costs

Based on the above information, costs estimates were developed for the various types of repair scenarios and then applied as shown in **Table 5-2** to obtain an overall estimate of total costs to upgrade existing onsite systems to an acceptable/functional repair status. The costs were developed based on Questa's experience with these types onsite system projects in Woodacre and elsewhere in Marin County, and included consultation with local contractors, manufacturers, and equipment suppliers. In addition to new construction items, the upgrade costs include allowance for electrical work, site restoration, permitting, and testing. The costs do not include an allowance for retrofitting of buildings with low-flow plumbing fixtures or appliances or for abandonment of existing septic tanks, which would be a separate homeowner responsibility. Cost allowances for contingencies, engineering, environmental, and related project



WOODACRE WASTEWATER FEASIBILITY STUDY
WOODACRE, CALIFORNIA

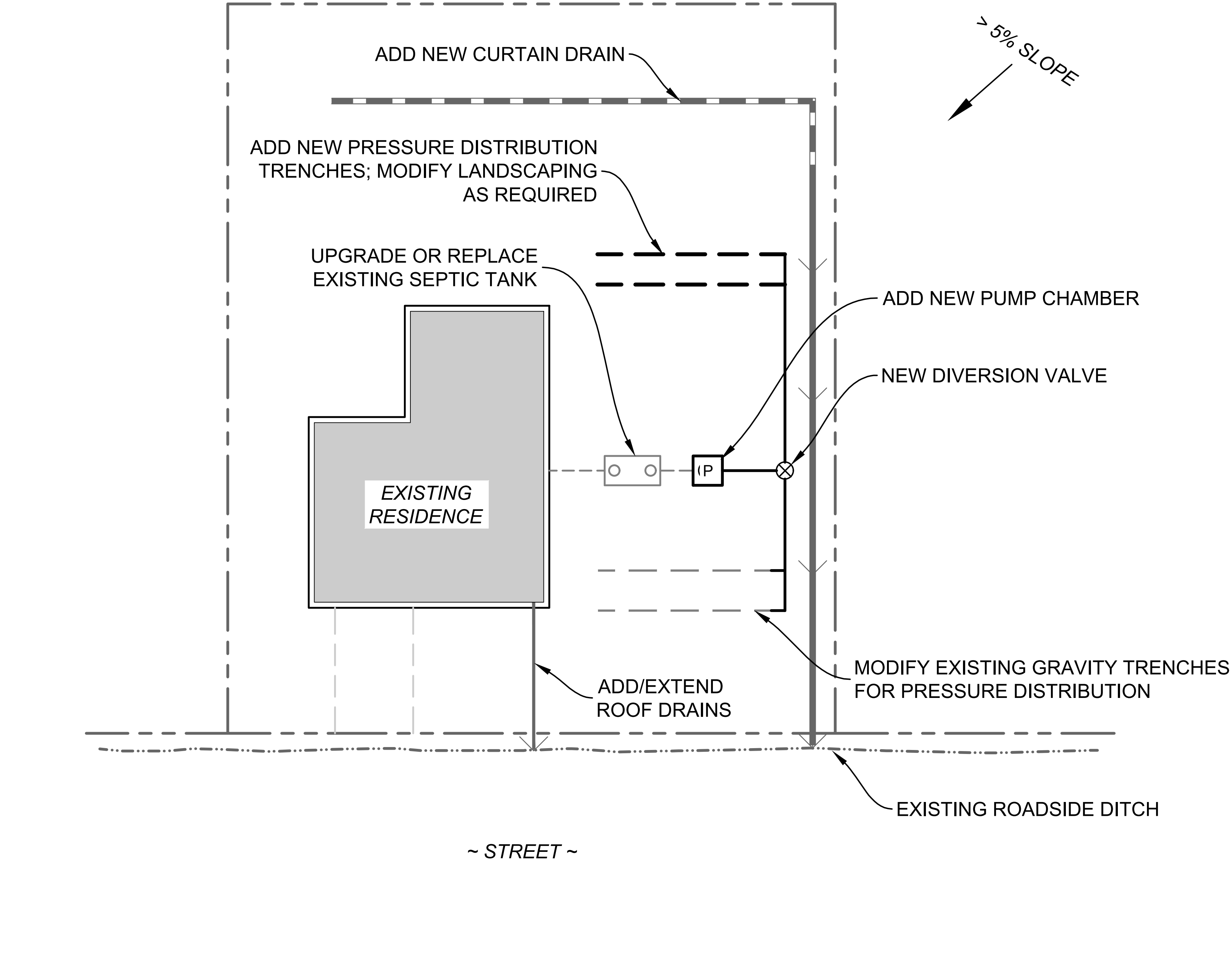
QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht.	Rev:	Date:	By:	Description:	App'd:

Design: NH/PP
Drawn: ML
Checked: PP
Appr'd: NH

ONSITE UPGRADE EXAMPLE
TREATMENT AND DRAINAGE

Size: D
Project: 2200054
Scale: AS NOTED
FIGURE: 5-2



WOODACRE WASTEWATER FEASIBILITY STUDY
WOODACRE, CALIFORNIA

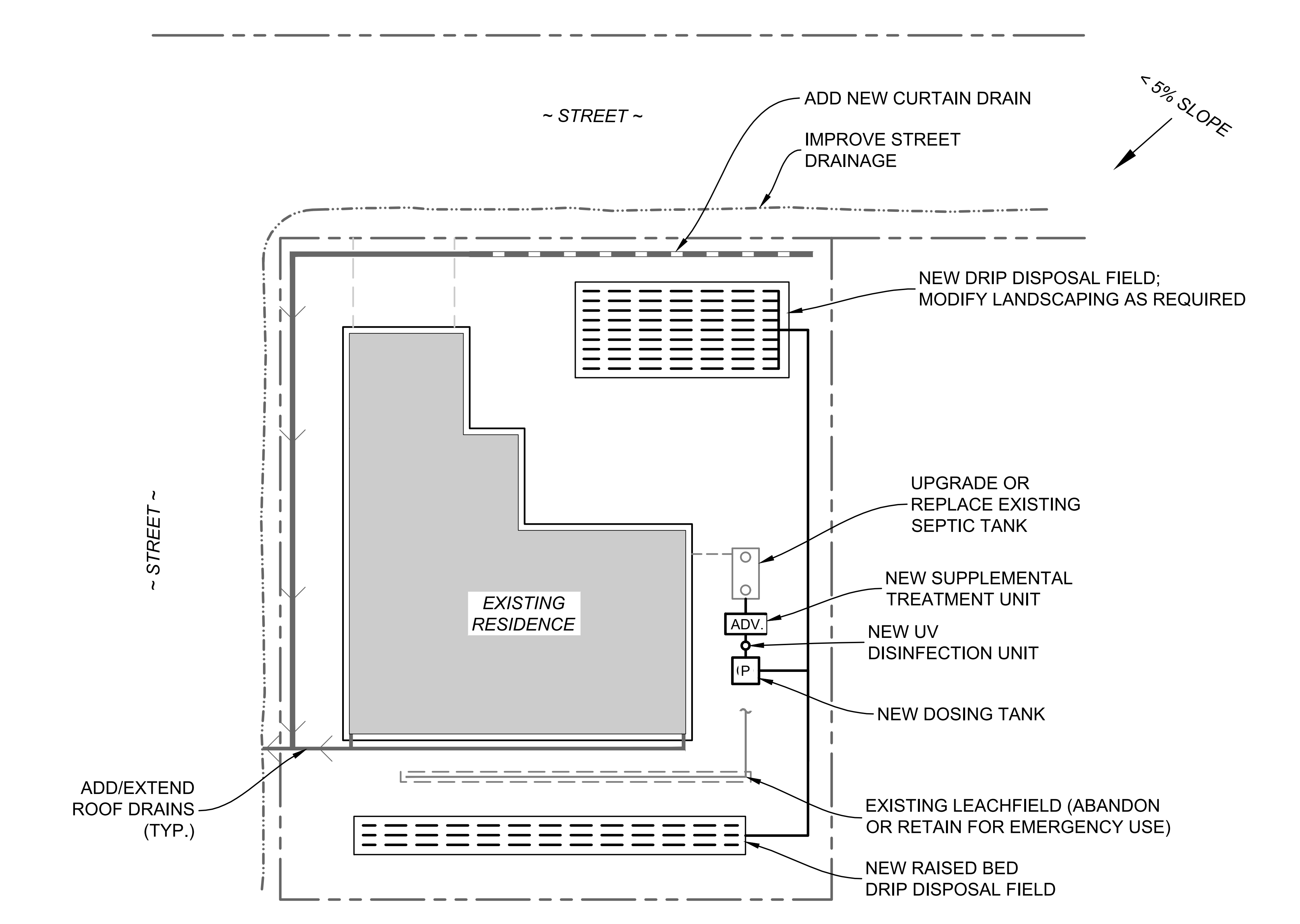
QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht.	Rev:	Date:	By:	Description:	App'd:

Design: NH/PP
Drawn: ML
Checked: PP
Appr'd: NH

ONSITE UPGRADE EXAMPLE
DISPOSAL FIELD AND DRAINAGE

Size: D
Project: 2200054
Scale: AS NOTED
FIGURE: 5-3



WOODACRE WASTEWATER FEASIBILITY STUDY
WOODACRE, CALIFORNIA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht.	Rev:	Date:	By:	Description:	App'd:

Design: NH/PP
Drawn: ML
Checked: PP
Appr'd: NH

ONSITE UPGRADE EXAMPLE
TREATMENT, DISPOSAL FIELD, & DRAINAGE

Size: D
Project: 2200054
Scale: AS NOTED
FIGURE: 5-4

implementation activities are accounted for as lump sum percentage items, rather than for individual systems.

Table 5-2. Estimated OWTS Upgrade-Replacement Costs – Project Alternative 2

Existing OWTS Status		Lot Breakdown		Estimated Cost for Class II Upgrade or Replacement			Average Cost ($)	Total Cost ($)
		% of Total	# of Lots	Low	Mod	High		
Class I	New permit since 1984	5	12	-	-	-	-	-
Class II	Post-1984 Repair	22	58	$5,000	$25,000	-	$10,000	$ 580,000
Class III	Pre-1984 permit	15	38	-	$25,000	$75,000	$50,000	$ 1,900,000
Class IV	Undocumented	62	142	-	$40,000	$90,000	$65,000	$ 9,230,000
	Sub-Total							$ 11,188,000
	Contingency at 20%							$ 2,237,600
	Sub-Total							$ 13,425,600
	Engineering & Environmental Studies @ 15%							$ 2,013,840
	Construction Management @ 10%							$ 1,342,560
	Project Administration, District Formation and Financing @ 5%							$ 671,280
	TOTAL ESTIMATED COST							**$ 17,453,280**
	AVE COST PER PARCEL (250)							**$ 69,813**

Operation and Maintenance

Following septic system upgrading, a continuing inspection and monitoring program would be carried out by a public maintenance authority; this is assumed to be a requirement of both the County and the Regional Water Board for implementation of the Tomales Bay Pathogens TMDL. This would be expected to entail the following routine items:

- Inspection of each system, normally once per year;
- Water quality sampling of the effluent from a representative number of treatment units; assume 20 percent of systems sampled each year and all systems sampled at least once every five years;
- Groundwater and surface water quality monitoring;
- Reporting water quality failures or malfunction of systems;
- Annual reporting to the County and Regional Water Board on the inspection results and overall compliance with water quality and system performance standards; and
- Periodic cleaning and pumping of septic tanks/treatment units, usually every 3 to 5 years;

There would be electrical costs associated with the operation of the advanced treatment systems, any UV disinfection units, and the pump systems used for dosing the pressure distribution and drip dispersal fields. Each property owner would be responsible for providing and maintaining electrical service. From time-to-time various system components (such as valves, UV light bulbs, pumps and float controls) would require repair or replacement. The need for this work would be determined by the maintenance authority; depending upon the complexity, the actual repair/replacement work could be done by the maintenance authority, a contractor or, possibly, the property owner.

Operation and Maintenance Costs

Annual operation and maintenance costs for the onsite management alternative are summarized in **Table 5-3**. The estimates are based on best professional judgment and experience with onsite system monitoring activities in Marin County and with other onsite wastewater management programs. As indicated, O&M costs for this alternative include district and program administration costs, labor and expenses to perform the necessary system inspections and reporting, an allowance for equipment and material costs associated with system maintenance and replacement, laboratory costs for water quality sampling and analysis, electrical costs for individual treatment/disposal system equipment (directly absorbed by property owners), and routine septic tank pump-outs. An allowance of 10% is included as a contingency. The total annual O&M cost for **Alternative 2** is estimated to be approximately $302,5000 for the full 250 parcels in the service area, or approximately $1,210 per parcel.

Table 5-3. Estimated Annual O&M Costs, Onsite Management Program

Items	Assumptions	Estimated Annual Cost ($)
District/Program Administration	Insurance, legal, financial, permits @ $500 per parcel	$ 125,000
On-lot System Inspection, Monitoring & Reporting	Annual inspection of all systems, remote monitoring, data compilation, annual reporting, as-needed engineering consultation @ $300 ea	$75,000
Maintenance	Equipment, materials, maintenance & replacement @ $200/yr each	$50,000
Laboratory & Expenses	Sampling 20% of individual treatment systems annually, surface and groundwater sampling, travel expenses and supplies	$25,000
Electrical*	Property owner expense for treatment & dispersal pumps and other electro-mechanical items @ $40/yr	Owner Cost
Septic Tank Pumping*	25% of tanks pumped annually @ $800 each	Owner Cost
	Subtotal	**$ 275,000**
	Contingencies (@ 10%)	$ 27,500
	TOTAL	**$ 302,500**
	ESTIMATED ANNUAL COST PER PARCEL	**$1,210**

*Individual property owner cost varies according to system type, occupancy and use.

ALTERNATIVE 3 – PRIMARY TREATMENT WITH COMMUNITY LEACHFIELD AT DICKSON RIDGE

Description

This alternative would provide for the construction of a central wastewater collection system for properties in Woodacre, leading to a community a leachfield system located on the wooded hillside of the nearby Dickson Ranch (**Figure 5-5).** The recommended collection system is a gravity effluent sewer, with individual septic tanks on each property draining to a network of small, 4” diameter collection lines terminating at a main lift station near the intersection of Railroad Ave and San Geronimo Valley Dr. From the lift station, effluent would be pumped in a 4” diameter force main to the community leachfield site. The identified area for a community leachfield is a wooded knoll on the north facing slope along the Fire Road ridgeline on the northeast side of Woodacre. The site has been explored and tested for soil suitability, groundwater, and percolation. It has also been surveyed to locate and map protected trees, slopes, drainages, and other potential constraints. The site is estimated to have sufficient capacity for approximately 8,800 lineal feet of leaching trench, with the preferred design being shallow (30” deep) pressure-distribution trenches using infiltrator chambers in place of drain rock.

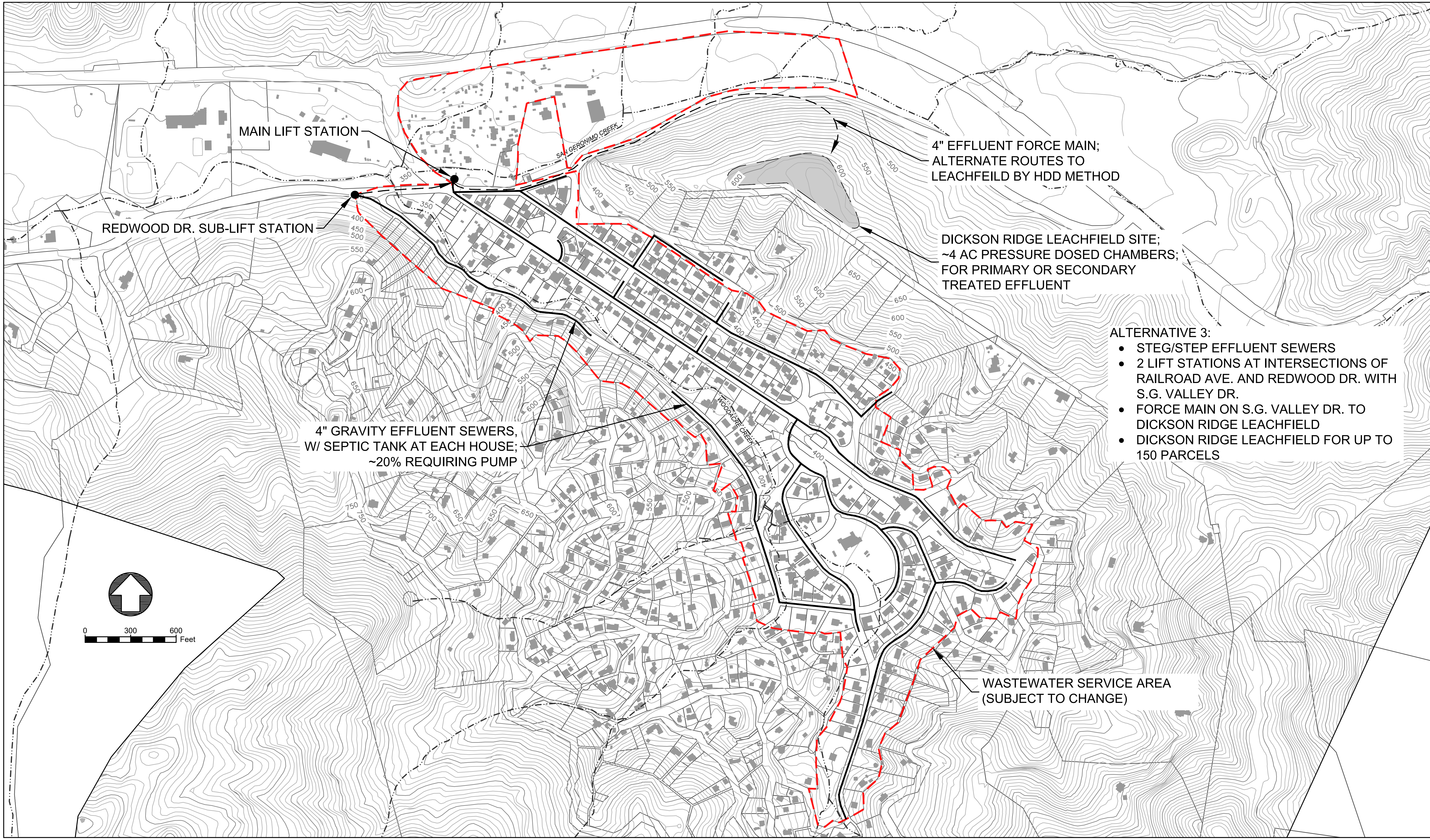
This alternative was initially developed in the 2011 Woodacre Flats study and provides a potential community wastewater solution to serve up to approximately 150 parcels, or about 60% of the properties in the Woodacre service area. Under this alternative, it is assumed that the remaining 40% of properties in the service area would continue with the status quo or potentially could be part of an onsite wastewater upgrade and management program, along the lines of **Alternative 2**. For the current study, this alternative was evaluated for service to 100 and 150 connections. The following describes and reviews the key elements of **Alternative 3**.

Collection System

Sewage collection would be provided by a gravity effluent sewer system, where primary treatment is provided by septic tanks on each property and only the liquid portion is collected for conveyance to the community wastewater disposal field. A detailed description of effluent sewer technology and its application in Woodacre is provided in **Appendix D**. The gentle grades in the lower parts of Woodacre are well suited to a gravity collection system and it is estimated that about 80% or more of the properties would able to connect by gravity; these are termed STEG connections, short for “septic tank effluent gravity”. Those properties situated below street level would generally require a pump unit located in the second compartment of the septic tank or in an adjacent pump tank; these are termed STEP connections, short for “septic tank effluent pump”.

Where they are found to be in acceptable condition and meet minimum standards, existing septic tanks would be retained at individual properties; it is estimated that about 25% of the existing septic tanks could be retained for continued use. New tanks would be installed on the other properties, and it would be the owner’s responsibility to have the existing tank properly abandoned and connect the house plumbing drains to the new tank.

The flow from both STEG and STEP units would be collected and conveyed in a network of 4-inch diameter pipes installed in the street, generally at a depth of 4 to 5 feet below grade and a minimum of one foot below water lines at any crossings. The collection system would terminate



WOODACRE WASTEWATER FEASIBILITY STUDY

WOODACRE, CA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht:	Rev:	Date:	By:	Description:	App'd:

Design: NH
Drawn: ER
Checked: NH
Appr'd: NH

ALTERNATIVE 3 - SEPTIC TANK EFFLUENT WITH COMMUNITY LEACHFIELD

WOODACRE, CA

FIGURE
5-5

IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE – ADJUST ACCORDINGLY

P:\2022\2200054_WOODACRE-SAN_GERONIMO_WASTEWATER_STUDY\CAD\MODEL\COLLECTION SYSTEM.DWG LAST SAVED: 8/12/2024 PLOT DATE: 8/12/2024 PLOT STYLE: ----

at a main lift station proposed to be located in the road shoulder on the northeast side of the Railroad Ave-San Geronimo Valley Road intersection. There would also be a small sub-lift station on the south side of San Geronimo Valley Dr near the foot of Redwood Dr to collect and pump effluent from the Redwood Dr properties over to the main lift station.

Lift Station and Force Main

The main lift station would consist of a large, buried fiberglass tank with duplex (2) submersible pumps sized with capacity to pump the septic tank effluent to the community leachfield site at Dickson Ridge. The electrical control system for the pumps would be housed in an adjacent enclosure; and there would also be a stationary standby generator for emergency use. There would be security fencing around the generator and electrical equipment. The buried pump tank would be 15,000 to 20,000 gallons capacity, with access risers and standard iron manhole covers at grade.

From the lift station, the effluent would be pumped in a 4” diameter high density polyethylene (HDPE) force main running easterly a distance of approximately 2,600 feet along San Geronimo Valley Dr, and then turning south and continuing uphill a distance of about 1,000 feet to the Dickson Ridge leachfield site. The force main pipe would be installed along the road and in the hillside section using horizontal directional drilling (HDD) methods. The total elevation gain from the main lift station to the leachfield site is approximately 280 feet. Preliminary design indicates the pumps would be 5 hp, sized to produce a flow rate of approximately 40 to 50 gpm against a total dynamic head of approximately 300 feet.

Wastewater Disposal

Wastewater disposal would be provided by a pressure distribution leachfield system located on a portion of a 3.5-acre wooded knoll on Dickson Ranch property, referred to as Dickson Ridge.

Site Conditions. Description of soil investigations, percolation testing and other field observations of the area are provided in **Appendix E**, which includes information from the 2011 Woodacre Flats study along with more extensive wet weather investigations conducted in 2023 for the current project. **Figure 5-6** is a map of the proposed Dickson Ridge leachfield area showing test locations, trees and other site features and the preliminary layout leaching trenches.

Briefly, field studies showed the following:

- **Soils.** Soil test pits in the proposed leachfield areas showed similar soil conditions, consisting of loam and sandy loam topsoils underlain by highly weathered sandstone to the depths explored.

- **Groundwater.** No groundwater or evidence of seasonal saturation was observed in any of the profiles during the wet weather investigations in February 2023. Antecedent rainfall from January 1st to February 7th when the field testing was conducted totaled 17.65 inches, an average of 0.46 inches per day.

- **Percolation**. Percolation test results at the proposed leachfield trench depth of 30 inches averaged just over 3 inches per hour (19 minutes per inch, MPI), which forms the basis for preliminary leachfield sizing. Percolation rates in the underlying weathered

WOODACRE WASTEWATER FEASIBILITY STUDY

WOODACRE, CA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht:	Rev:	Date:	By:	Description:	App'd:

Design: NH
Drawn: ER
Checked: NH
Appr'd: NH

DICKSON RIDGE LEACHFIELD AREA

FIGURE
5-6

sandstone were much slower and were determined not suitable for the use of deep leaching trenches.

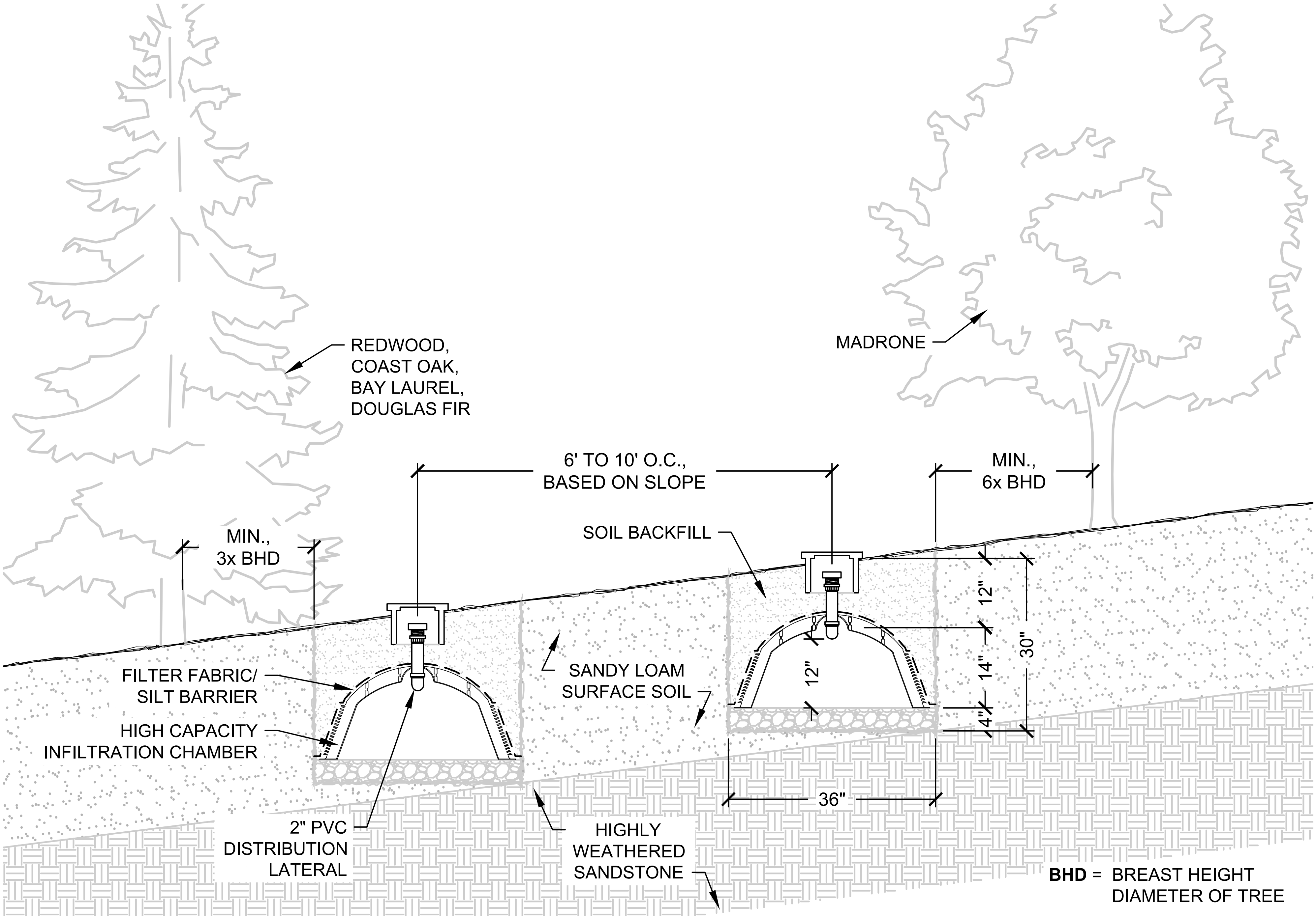
- **Drainages.** There are two identified seasonal streams, both more than 100 feet from the proposed leachfield area.

- **Vegetation.** A tree survey of the proposed leachfield area was conducted by a professional arborist (Arborscience), who assessed the site for the proposed use as a leachfield area, identified trees of concern and provided recommendations on tree protection. Arborscience's report is provided in **Appendix E**. A survey to identify and map all trees in the leachfield area was conducted by Questa and recommendations on setbacks from trees were followed in determining the preliminary leachfield layout shown in **Figure 5-5.**

Leachfield Plan. Based on the site conditions and project requirements, the leachfield plan developed for the Dickson Ridge site consists of the following:

- Design Wastewater Flows (30-day average)
  - ✓ 100 connections: 13,500 gpd
  - ✓ 150 connections: 20,250 gpd
- Total available trench length: 8,800 lf
- Pressure distribution trenches, 30 inches deep by 36 inches wide, integrated with infiltrator chambers as illustrated in **Figure 5-7.**
- Trench spacing varies from 6 to 12 feet based on ground slope per MCEHS requirements.
- Setbacks from trees per Arborscience recommendations:
  - ✓ 3 times breast height diameter (BHD) of trunk for redwoods, Douglas fir, bay laurel, and oak trees
  - ✓ 6 times BHD for madrone trees
- Pressure distribution provided by automatic dosing siphons in 2,500-gallon buried tanks located in an easement on the adjacent Marin Water District Fire Road right-of-way.
- Trench Capacity:
  - ✓ Effective infiltration area: 6 ft^2 per linear feet (lf) including 3 ft bottom area + (2) sidewalls at 1.5' each;
- Wastewater application rate: 0.67 gpd/ft^2 based on 19 MPI percolation rate (MCEHS criteria); to be adjusted based on additional percolation testing at time of design.
- Wastewater loading per lf of trench: (6 ft^2/lf) x (0.67 gpd/ft^2) = 4.0 gpd/lf
- Total trench required (100% field):
  - ✓ 100 connections: 13,500 gpd/4.0 gpd/lf = 3,375 lf
  - ✓ 150 connections: 20,250 gpd/4.0 gpd/lf = 5,063 lf
- Reserve leachfield area provided:
  - ✓ 100 connections: 3,375 lf = 100%
  - ✓ 150 connections: 8,800 – 5,063 = 3,737 lf = 74%

Nitrate Loading Analysis. Analysis of nitrate loading effects on groundwater quality from the proposed leachfield was completed and is provided in **Appendix F**. Nitrate analysis showed that for dispersal of primary-septic tank effluent: (a) a community leachfield for 100 connections or less would ensure compliance with Marin County 10 mg-N/L criterion for new wastewater systems in areas served by public water supply; (b) a community leachfield for 150 connections would exceed the resultant 10 mg-N/L criterion; however, as a repair/replacement system it



WOODACRE WASTEWATER FEASIBILITY STUDY

WOODACRE, CALIFORNIA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht:	Rev:	Date:	By:	Description:	App'd:

Design: NH
Drawn: MN
Checked: NH
Appr'd: NH

CHAMBER-PRESSURE DISTRIBUTION LEACHFIELD DETAIL

FIGURE 5-7

would be a substantial improvement over existing nitrate loading effects from marginal septic systems in Woodacre.

Additional Environmental Studies. Additional environmental studies would need to be conducted for biological surveys of the leachfield site to assess and determine impacts and mitigation measures that could affect the design and construction.

Fencing. The leachfield area including the installed trenches and dosing siphons would be fenced with typical farm fencing (barbed wire).

Vehicle Access. Vehicle access to the site would be by Fire Road (owned and maintained by Marin Water), and is not expected to require any improvements.

Land Acquisition/Lease. The land for the leachfield and the effluent force main to the site would have to be acquired through purchase or lease agreement from the Dickson Ranch family. The property owners have willingly granted access for field investigations and have indicated interest in cooperating with the community on the project.

Operation and Maintenance Requirements

The community collection and disposal facilities under **Alternative 3** would be owned and operated by the wastewater district formed as part of the project. The actual operations and maintenance work would be performed or overseen by a qualified wastewater treatment plant operator. Local maintenance contractors may be hired to perform routine inspection, maintenance, and monitoring activities. Operation and maintenance activities can be expected to include the following:

- **Facility Inspections, Maintenance and Operations.** This includes routine inspections and maintenance of the individual septic tanks and STEP units, collection system pipelines and valves, lift stations, leachfield dosing siphons and pipelines, and leachfield piping, trenches and valves, and all electrical/mechanical control equipment. Other maintenance work includes the pump-out and hauling of sewage solids from septic tanks (each owner’s responsibility), general upkeep of lift stations and leachfield areas, and periodic servicing or replacement of equipment. The inspection, maintenance and operations of the facilities would be conducted on an as needed basis; it would be facilitated by remote telemetry equipment for notification of alarm conditions. Some level of onsite inspection and/or maintenance work is likely to occur on a weekly basis or a few times a week.

- **Performance Monitoring.** The waste discharge permit for the community wastewater facilities would require routine monitoring of the disposal facilities to verify compliance with performance standards and proper operation. A formal monitoring and reporting program would be established by the Regional Water Board as a permit condition. This is anticipated to include monitoring of wastewater flow (daily), effluent quality, and disposal field conditions.

- **Receiving Water Quality Sampling.** There would likely be requirements for sampling and analysis of groundwater near and downgradient of the leachfield area. The expected parameters of interest would be nitrate, coliform bacteria and groundwater levels, typically on a quarterly basis. There are no surface waters near the Dickson Ridge leachfield site that would require monitoring.

- **Reporting.** The monitoring results would be summarized and submitted in monitoring reports (e.g., quarterly) to the Regional Water Board. An annual report would be prepared that presents the monitoring results, compares the results with the discharge requirements and performance objectives for the system, and discusses any problems, corrective actions, or other pertinent observations regarding operation of the system. It would also include results of an annual inspection of each individual septic tank and a log of tanks that required pumping.

Estimated Costs

Capital Costs

The estimated capital costs for **Alternative 3** are summarized in **Table 5-4** for assumed service for 100 and 150 properties in Woodacre. Itemized cost estimates including quantities and unit cost assumptions are provided in **Appendix D** (collection system) and **Appendix G** (disposal). The cost assumptions were developed through discussions with manufacturers, equipment suppliers, and local contractors, and through review of recent contractor bids for similar work in Marin County, where applicable. The bottom line in the table converts the total project costs to average cost per connection (100 and 150).

Table 5-4. Estimated Capital Cost – Alternative 3
Primary Septic Tank Treatment & Community Leachfield

Cost Item	Estimated Capital Costs ($)	
	100 Connections	**150 Connections**
Total Estimated Collection Cost	4,599,500	5,802,200
Total Estimated Disposal Cost	3,456,000	3,823,500
Total Estimated Project Cost	6,015,500	7,625,700
Estimated Cost Per Parcel	60,155	50,838

Operation and Maintenance Costs

The estimated annual operation and maintenance costs for **Alternative 3** are presented in **Table 5-5.** The O&M costs were estimated based on labor, equipment, materials and other expenses required to perform the necessary inspections, water quality sampling, data analysis, report preparation, pump-outs, and routine maintenance and equipment replacement for the community treatment and disposal facilities, as well as for the collection system and all individual STEG/STEP units served by the system. Also included are estimates of annual energy costs (electrical) for operation of the community treatment system and pumps. The electrical costs for individual STEP units at each property (estimated to be a few dollars per month) are not included. A 10% contingency allowance is also included. An additional cost that may be expected has not been estimated at this time would be annual payments to the Dickson Ranch family under a long-term lease agreement for the leachfield land area. The cost estimates were developed based on the expected operation and monitoring needs defined above, and using data and experience from monitoring and maintenance of other similar systems in Marin County and other Northern California communities, including the Marshall Community Wastewater System.

Table 5-5. Estimated Annual O&M Costs – Dickson Ridge Community Leachfield

Items	Assumptions	Estimated Annual O&M Cost ($)	
		100 Connections	150 Connections
District/Program Admin.	Insurance, legal, financial, permits	30,000	36,000
Inspection, Monitoring & Reporting	On-lot STEG/STEP systems, lift stations, disposal system; remote telemetry; monthly/annual reports; as-needed engineering	48,000	72,0000
Maintenance	Equipment, materials, maintenance & replacement; site maintenance; sewer cleaning	30,000	40,000
Laboratory & Expenses	Monthly disposal system monitoring, well sampling and analysis, travel expenses & supplies	12,000	15,000
Electrical	Lift Stations & Utilities	10,000	15,000
Septic Tank Pumping	Individual owner responsibility 25% at $800	Owner cost	Owner cost
	Subtotal	$130,000	$178,000
	Contingencies (@ 10%)	13,000	$17,800
	TOTAL	**$143,000**	**$195,800**
	ANNUAL COST PER PARCEL	**$1,430**	**$1,305,**

ALTERNATIVE 4 – SECONDARY TREATMENT WITH COMMUNITY LEACHFIELD AT DICKSON RIDGE

Description

This alternative would provide the same wastewater collection and disposal facilities as **Alternative 3** but would add a secondary wastewater treatment system ahead of the leachfield. The purpose of the secondary treatment system would be four-fold: (1) to decrease the amount of trench length required for disposal; (2) to expand the capacity of the system to be able to serve the entire 250 properties in the service area; (3) to improve the quality of wastewater discharged, in particular to minimize nitrate loading to the leachfield and watershed area; and (4) to provide a base level of treatment that would facilitate possible water recycling. The secondary treatment system would be located on the Dickson Ranch property, east of the main equestrian activities. Effluent would be pumped to the treatment plant directly from the main lift station at Railroad and San Geronimo Valley Dr. This would entail pipeline crossing under San Geronimo Creek installed with by trenchless horizontal directional drilling (HDD). The treated effluent would then be pumped back to the hillside leachfield site via a second pipeline crossing under the creek, also installed by HDD methods. The recommended treatment system is the

AdvanTex recirculating textile treatment system. The system utilizes a relatively passive biofiltration process, is designed to accept and treat septic tank effluent, and poses minimal visual, noise and odor impacts. Facilities and associated cost estimates were developed for three service area levels under this alternative: 150, 200 and 250 connections. This alternative is illustrated in **Figure 5-8.**

Collection System

Sewage collection would be provided (same as in **Alternative 3**) by a gravity effluent sewer system, where primary treatment is provided by septic tanks on each property (STEG and STEP units) and only the liquid portion is collected for conveyance to the community wastewater disposal field. A detailed description of effluent sewer technology and its application in Woodacre is provided in **Appendix D**.

The flow from both STEG and STEP units would be collected and conveyed in a network of 4-inch diameter pipes, terminating at a main lift station proposed to be located in the road shoulder on the northeast side of the Railroad Ave-San Geronimo Valley Road intersection. There would also be a small sub-lift station on the south side of San Geronimo Valley Dr near the foot of Redwood Dr to collect and pump effluent from the Redwood Dr properties over to the main lift station.

Lift Station and Force Main

The main lift station and force main would be the same as described for **Alternative 3**, with the key difference being that in **Alternative 4** the system would be designed to pump the collected septic tank effluent to a secondary wastewater treatment system to be located in one of the manure storage fields on the east end of the Dickson Ranch.

From the lift station, the effluent would be pumped in a 4” diameter high density polyethylene (HDPE) force main running easterly a distance of approximately 2,600 feet along San Geronimo Valley Dr, and then instead of turning south and uphill toward the leachfield site, the force main would turn north and go under San Geronimo Creek to the wastewater treatment site located in the field on the north side of the creek. The force main would be installed using HDD for the section along San Geronimo Valley Dr as well as for the crossing under the creek. The mapped sandstone formation that underlies this area is ideal for HDD, to be confirmed through geotechnical exploration during design. The elevation difference between the main lift station and the wastewater treatment site is approximately 30 feet, allowing the use of much smaller pumps (1 to 2 hp) than required under **Alternative 3**.

Wastewater Treatment

An advanced secondary wastewater treatment system, including nitrogen removal, will be installed on a portion of the Dickson Ranch east field as shown in **Figure 5-9**. The proposed treatment system will consist of an AdvanTex recirculating textile filter, using the AX-MAX design configuration, which integrates the recirculation-blend tanks with the filter pods in a stacked arrangement. The facilities layout in **Figure 5-9** is for a system with capacity for the entire Woodacre service area (250 connections). Manufacturer’s literature and a case study example of a similar community application in New York state is provided in **Appendix G**.

WOODACRE
WASTEWATER FEASIBILITY STUDY

WOODACRE, CALIFORNIA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht:	Rev:	Date:	By:	Description:	App'd:

Design: NH
Drawn: MN
Checked: NH
Appr'd: NH

ALTERNATIVE 4 - SECONDARY TREATMENT WITH COMMUNITY LEACHFIELD

WOODACRE, CALIFORNIA

FIGURE
5-8

Wastewater process is as follows. Primary effluent from the force main will flow into a buried 25,000-gallon pre-anoxic tank (i.e., large septic tank), and from there to a flow equalization (EQ) tank, which meters the flow into the AX-MAX treatment units, where the wastewater undergoes multiple passes through textile filter media for biological treatment and nitrogen removal. The final effluent from the AX-MAX collects in a large dosing/pump tank equipped with submersible pumps that pump the effluent to a force main under San Geronimo Creek and uphill to the Dickson Ridge leachfield site.

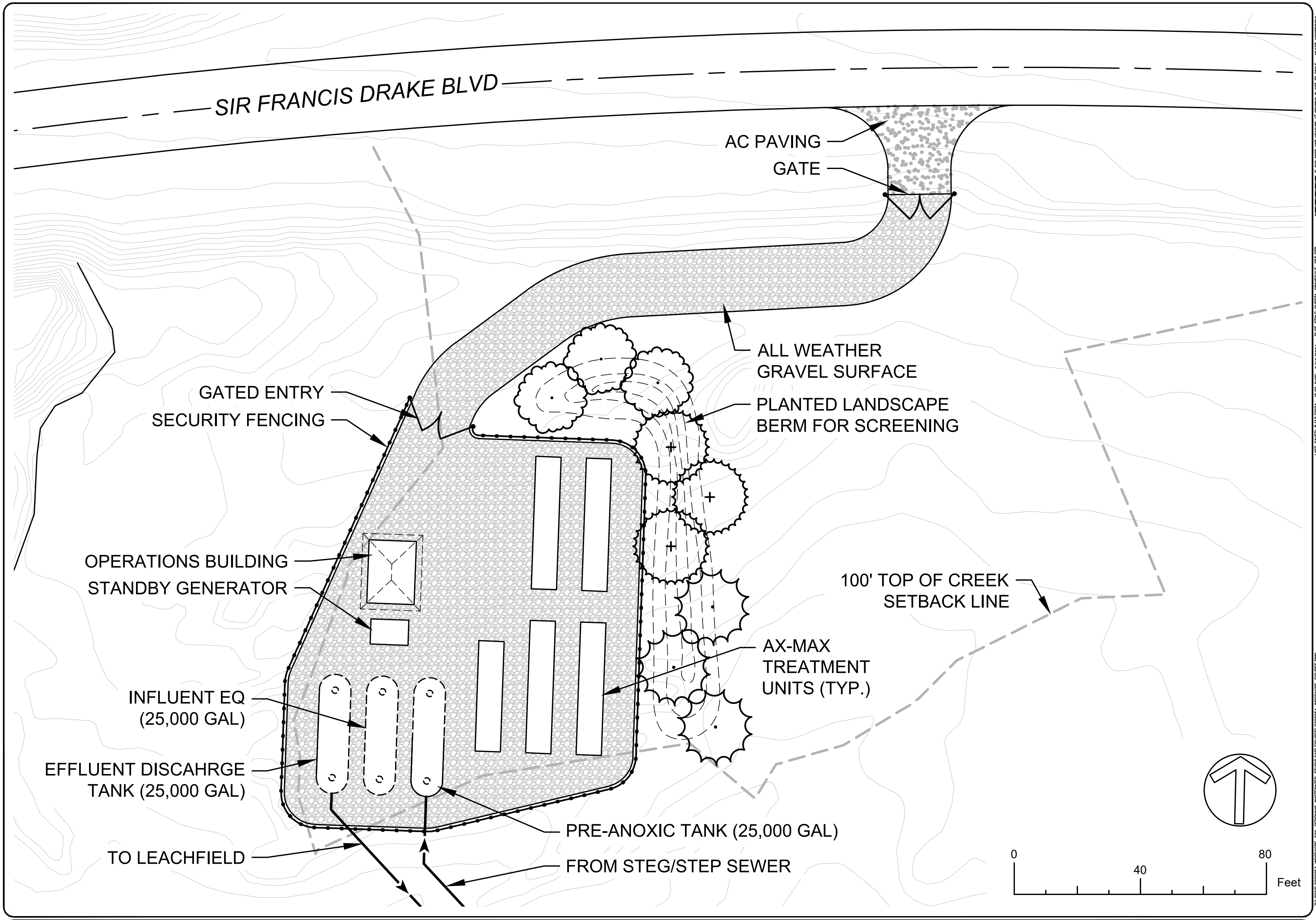
The AdvanTex treatment system will be designed with a recycle loop to direct a portion of the filtered water back through the pre-anoxic tank for enhanced denitrification. The target effluent quality for the system is to meet an average discharge limit of 30 mg-N/L or better.

The treatment site plan layout and details shown in **Figure 5-9** include the following:

- 25,000-gallon pre-anoxic tank to provide additional settling of incoming wastewater and anoxic conditions for denitrification of recycled filtrate;
- 25,000-gal EQ tank to absorb surges in flow and meter the wastewater flow into the treatment tanks at a relatively even rate;
- (5) AX-MAX treatment modules, four measuring 8-ft high by 8-ft wide and 42-ft long, and one at 35-ft in length;
- Recycle loop to direct a flow equal to approximately 100% of the daily forward flow back through the Pre-anoxic tank for enhanced denitrification;
- 25,000-gallon final effluent dosing tank (multiple, redundant pumps) for discharge of treated effluent to the leachfield area;
- Operations building for electrical control equipment and storage of tools, materials other spare parts, etc (approximately 200 to 300 square feet)
- Standby generator power to operate all treatment equipment;
- Telemetry control and monitoring system;
- Security fencing around the entire treatment facility with gated entry;
- All weather gravel surface; and
- Vegetated landscape berm for visual screening from Sir Francis Drake Blvd.

Wastewater Disposal

Wastewater disposal for **Alternative 4** would be by pressure-distribution leachfields at Dickson Ridge, the same as described and illustrated for **Alternative 3.** The difference would be in the sizing of the leachfield, which would be based on dispersal of secondary treated water rather than primary-septic tank effluent. The table below summarizes the leachfield calculations for Alternative 4 for three different service area sizes, 150, 200 and 250 connections.



WOODACRE
WASTEWATER FEASIBILITY STUDY
WOODACRE, CALIFORNIA

QUESTA ENGINEERING CORP.
Civil
Environmental
& Water Resources
(510) 236-6114
FAX (510) 236-2423
questa@questaec.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Sht:	Rev:	Date:	By:	Description:	App'd:

Design: NH
Drawn: MN
Checked: NH
Appr'd: NH

WATER & WASTEWATER FACILITIES LAYOUT PLAN
WOODACRE, CALIFORNIA

FIGURE
5-9

Leachfield Calculation Summary – Alternative 4

# of Connections	100	200	250
Design Flow, gpd	20, 250	27,000	33,750
Application Area (ft^2/lf)	6.0	6.0	6.0
Septic Tank Effluent Application Rate, gpd/ft^2	0.67	0.67	0.67
Enhanced Application Rate for Treated Wastewater, gpd/ft^2	1.35	1.36	1.35
Wastewater Loading Rate, gpd/lf	8.1	8.1	8.1
Total Trench Length Required - 100% field, lf	2,500	3,333	4,166
Total Trench Length Required – 200% field, lf	5,000	6,666	8,332
Total Available Trench Length, Dickson Ridge, lf	8,800	8,800	8,800
Percent of Available Trench Length Required	57%	76%	95%

Nitrate Loading Analysis. Analysis of nitrate loading effects on groundwater quality from the various service area/leachfield sizes under **Alternative 4** was completed and is provided in **Appendix F**. For dispersal of secondary-treated wastewater, a minimum effluent treatment level of 30 mg-N/L or better would ensure resultant percolating groundwater beneath the site does not exceed 10 mg-N/L, criterion adopted by Marin County Environmental Health Services for areas served by public water systems. Resultant groundwater nitrate concentrations for the three service area scenarios for different assumed effluent total nitrogen concentrations were as shown below.

Projected Groundwater Nitrate Concentration
Alternative 4 – Service Area Sizes

# of Connections	Effluent Total N Concentration		
	20 mg-N/L	25 mg-N/L	30 Mg-N/L
150	4.25	5.22	6.19
200	5.10	6.29	7.48
250	5.83	7.21	8.59

Operation and Maintenance Requirements

The wastewater collection, treatment and disposal facilities under **Alternative 4** would be owned and operated by the wastewater district formed as part of the project. The actual operations and maintenance work would be performed or overseen by a qualified wastewater treatment plant operator. Local maintenance contractors may be hired to perform routine inspection, maintenance, and monitoring activities. Operation and maintenance activities can be expected to include the same basic items as described for **Alternative 3**, with addition of work related to wastewater treatment operations.

- **Facility Inspections, Maintenance and Operations.** This includes routine inspections and maintenance of the individual septic tanks and STEP units, collection system pipelines and valves, lift stations, leachfield dosing siphons and pipelines, and leachfield piping, trenches and valves, and all electrical/mechanical control equipment. Other maintenance work includes the pump-out and hauling of sewage solids from septic tanks (each owner's responsibility), general upkeep of lift stations and leachfield areas, and periodic servicing or replacement of equipment. The inspection, maintenance and operations of the facilities would be conducted on an as needed basis; it would be facilitated by remote telemetry equipment for notification of alarm conditions. Some level of onsite inspection and/or maintenance work is likely to occur on a weekly basis or a few times a week.

Operation and maintenance of the wastewater treatment system would entail inspection and servicing of the pre-anoxic and EQ tanks and pumps, including tank condition, pump operations, valves, piping, float controls and alarms. Weekly inspection and servicing of AdvanTex treatment system per manufacturer recommendations, including tank/pump conditions, valves, vents, textile “pods”, recycle settings, and control system. Respond to alarms and emergency conditions and repair/replace equipment components as needed. General upkeep and maintenance of the treatment system area and landcaping.

- **Performance Monitoring.** The waste discharge permit for the community wastewater facilities would require routine monitoring of the treatment and disposal facilities to verify compliance with performance standards and proper operation. A formal monitoring and reporting program would be established by the Regional Water Board as a permit condition. This is anticipated to include monitoring of wastewater flow (daily), monthly influent and effluent quality sampling for various wastewater constituents, and water level measurements and general conditions of the disposal field.

- **Receiving Water Quality Sampling.** There would likely be requirements for sampling and analysis of groundwater near and downgradient of the leachfield area. The expected parameters of interest would be nitrate, coliform bacteria and groundwater levels, typically on a quarterly basis. There are no surface waters near the Dickson Ridge leachfield site that would require monitoring.

- **Reporting.** The monitoring results would be summarized and submitted in monitoring reports (e.g., quarterly) to the Regional Water Board. An annual report would be prepared that presents the monitoring results, compares the results with the discharge requirements and performance objectives for the system, and discusses any problems, corrective actions, or other pertinent observations regarding operation of the system. It would also include results of an annual inspection of each individual septic tank and a log of tanks that required pumping.

Estimated Costs

Capital Costs

The estimated capital costs for **Alternative 3** are summarized in **Table 5-4** for assumed service for 150, 200 and 250 properties in Woodacre. Itemized cost estimates including quantities and unit cost assumptions are provided in **Appendix D** (collection system) and **Appendix G** (treatment and disposal). The cost assumptions were developed through discussions with manufacturers, equipment suppliers, and local contractors, and through review of recent contractor bids for similar work in Marin County, where applicable. The bottom line in the table converts the total project costs to average cost per connection.

Table 5-6. Estimated Capital Cost – Alternative 4
Secondary Treatment - Community Leachfield

Cost Item	Estimated Capital Costs ($)		
	150 Connections	200 Connections	250 Connections
Total Estimated Collection Cost	5,802,200	7,726,700	9,031,700
Total Estimated Disposal Cost	3,167,500	3,808,000	4,312,000
Total Estimated Project Cost	8,969,700	11,534,700	13,343,700
Estimated Cost Per Parcel	59,798	57,674	53,375

Operation and Maintenance Costs

The estimated annual operation and maintenance costs for **Alternative 4** are presented in **Table 5-7.** The O&M costs were estimated based on labor, equipment, materials and other expenses required to perform the necessary inspections, water quality sampling, data analysis, report preparation, pump-outs, and routine maintenance and equipment replacement for the community treatment and disposal facilities, as well as for the collection system and all individual STEG/STEP units served by the system. Also included are estimates of annual energy costs (electrical) for operation of the community treatment system and pumps. A 10% contingency allowance is also included. An additional cost not estimated at this time would be annual payments to the Dickson Ranch family under a long-term lease agreement for the leachfield land area.

Table 5-7.
Estimated Annual O&M Costs – Secondary Treatment w/ Community Leachfield

Items	Assumptions	Estimated Annual O&M Cost ($)		
		150 Connections	200 Connections	250 Connections
District/Program Admin.	Insurance, legal, financial, permits	36,000	42,000	48,000
Inspection, Monitoring & Reporting	On-lot STEG/STEP systems, lift stations, treatment system, disposal system; remote telemetry; monthly/annual reports; as-needed engineering	80,000	90,000	100,000
Maintenance	Equipment, materials, maintenance & replacement; site maintenance; sewer cleaning	60,000	70,000	80,000
Laboratory & Expenses	Monthly treatment and disposal system monitoring, well sampling and analysis, travel expenses & supplies	18,000	18,000	18,000
Electrical & Utilities	Lift Stations & Treatment Plant	20,000	25,000	30,000
Septic Tank Pumping	Individual owner responsibility 25% at $200/yr	Owner cost	Owner cost	Owner cost
	Subtotal	$214,000	$245,000	$276,000
	Contingencies (@ 10%)	$21,400	$24,500	$27,600
	TOTAL	**$235,400**	**$269,500**	**$303,600**
	ANNUAL COST PER PARCEL	**$1,569**	**$1,348**	**$1,214,**

ALTERNATIVE 5 – WATER RECYCLING

This alternative considers the possibility of recycling some of the treated wastewater for irrigation or other approved uses. Several possible options and locations for water recycling were investigated as part of this study, but none were of a suitable size or location to be practical. As a result water recycling was not fully developed as a project alternative at this time. The possibility remains that water recycling could occur as a future addition or modification to the wastewater facilities and operations under **Alternative 4.** Following is a review of water recycling possibilities in the project area.

Existing Water Recycling

There are no existing uses of recycled water in the San Geronimo Valley project area and no existing or planned sources of supply within a reasonable distance. The two existing water recycling operations in Marin County, both about 15 to 20 miles from the project area, are: (1) the Las Gallinas Valley Water Recycling Facility, operated by MMWD and Las Gallinas Valley Sanitary District; and (2) the Novato Recycled Water Program, a collaboration between North Marin Water District and Novato Sanitary District. These programs supply recycled water primarily for turf and landscape irrigation at golf courses, schools, parks, cemeteries and large landscaped areas on commercial and public sites generally along the Highway 101 corridor between San Rafael and Novato. They also provide recycled water for pasture irrigation and wetland enhancement projects along the nearby baylands.

Potential Water Recycling Uses

Irrigation at Former Golf Course Clubhouse Parcel. The redevelopment of the former golf course clubhouse property anticipates landscape area of about 25,000 square feet that could be irrigated with recycled water. This represents a potential seasonal water demand of approximately 2,500 to 3,000 gpd.

Toilet Flushing in Public Restrooms. Disinfected tertiary treated water can be recycled for toilet flushing in public restrooms. Currently there are no public restrooms in the project vicinity with sufficient use and/or properly equipped to support this recycled water use. However, the future uses of the golf course clubhouse parcel is expected to include restroom(s) that could be supplied with recycled water for toilet flushing. Based on preliminary information about the future fire station at this site, daily recycled water use of toilet flushing is estimated to be on the order of 1,500 to 2,000 gpd.

Park, Open Space and Environmental Restoration Irrigation. Since the future uses of the former golf course are expected to include open space and habitat restoration, some level of irrigation could potentially be supplied from tertiary treated recycled water. This could include, for example: (a) trees or other vegetation dependent on irrigation, such as existing redwoods benefiting from historical irrigation of the adjacent golf course turf; and (c) special habitat restoration features, such as wet meadows requiring a dependable supply of supplemental water for seasonal saturation. No estimate of potential recycled water demand can be made at this time.

Nursery or Greenhouse Facility. A specialty nursery or greenhouse (e.g., for native plants), if included in future development plans at the former golf course property or elsewhere in the project vicinity, could be a candidate for use of recycled water. Daily water demand for nurseries and greenhouses is typically greater than for outdoor landscaping, depending on the type of plants, and can have an extended growing season and irrigation demand through the winter.

Temporary Irrigation for Plant Establishment. Temporary irrigation of restoration plantings may be required for a few to several years during the initial plant establishment period, regardless of long-term irrigation requirements. If restoration work is carried out over a multi-year period, this could be supplied by recycled water.

Other Nearby Irrigation Uses. There is the potential for significant irrigation of nearby playfields and landscaping at the Lagunitas Elementary School, located about 2 miles west of the Woodacre. The school property has about 5 acres irrigated of landscaping and turf grass that could potentially utilize recycled water. The cost of installing a new pipeline along Sir Francis Drake Boulevard ($2 million) would render the school's use of recycled water infeasible, unless paired with other recycled water uses on the former golf course site.

Potential Trucked Water Markets. Inclusion of a tap or other means of tanker-truck fill-up with recycled water could be included in a recycled water facility. Potential uses include:

- **Construction Water.** Grading and earthwork associated with construction requires water for dust control, soil compaction, vehicle cleaning, etc. The Dickson Ranch has some (relatively small) uses of water for dust control and manure management.

- **Sewer Cleaning.** Recycled water (minimum disinfected secondary treated) may be used for sewer cleaning (e.g., flushing). This is typically done by tanker-trucks equipped with high capacity power flushing equipment. Sewer cleaning is conducted year-round and performed on an annual basis in some municipal systems, such as the Ross Valley Sanitary District, the nearest municipal system in the project vicinity. This represents a potential future opportunity for use of recycled water, especially during the wet weather season when irrigation water demands would be minimal or absent.

Fire Suppression. Tertiary treated water can be used for firefighting. This would be a potential recycled water use that although incidental and occasional, would provide an emergency reservoir of water. With the proposed relocation of the County Fire Department facility in Woodacre to be former golf course property, the uses of recycled water for fire suppression, vehicle/equipment washing, and dual plumbing of the firehouse may be viable.

Roadside Irrigation. Seasonal irrigation of the road shoulders along Sir Francis Drake Boulevard could be done with recycled water as a fire protection measure.

Potential Integration of Woodacre Wastewater Facilities

Future integration of the Woodacre wastewater facilities into a water recycling program could be approached a few different ways:

1. By adding a disinfection system and supplying secondary recycled water for nearby irrigation or other approved uses.
2. By adding tertiary filtration and disinfection system to produce tertiary recycled water that could be used for additional uses.
3. By piping secondary treated water to an offsite location (e.g., the former clubhouse parcel) for tertiary filtration and recycling to meet water demands at that site.

SECTION 6: COMPARATIVE ANALYSIS OF PROJECT ALTERNATIVES

This section reviews the advantages and disadvantages of the various project alternatives with respect to regulatory compliance, environmental impacts, reliability, flexibility, resource utilization, land use and costs. A comparative summary and ranking is provided at the end of the section, along with identification of the "apparent best" alternative or alternatives.

REGULATORY COMPLIANCE

A primary goal of a wastewater facilities project in Woodacre would be to correct existing water quality, public health and nuisance problems, and bring wastewater disposal activities into compliance with accepted sanitary practices and environmental quality standards.

Alternative 1 (No Project) fails to achieve these objectives although, over a number of years, improvements in local water quality, public health, and sanitation conditions may occur. It is estimated that nearly 70% of the properties in the Woodacre study area, especially in the Woodarcre Flats area, are in serious conflict with current septic system standards and would have significant difficulty complying with County repair standards.

Alternative 2 would substantially reduce present water quality and public health issues and, as compared with the No Project option, would bring more of the existing onsite systems into conformance with accepted practices. Where this alternative falls short of meeting environmental health/water quality requirements would be in the heavy reliance on advanced treatment systems and variances for many of the properties in the service area, along with the need for continued monitoring and surveillance to document suitable system performance and compliance with water quality objectives. The need for advanced treatment systems results from the shallow soil and groundwater conditions combined with the land area/setback constraints due to the small lot sizes and high intensity of development.

Alternatives 3 would be expected to satisfy Marin County septic system repair requirements, but would have difficulty complying with Regional Water Board requirements for service to more than about 100 connections due to: (a) high resultant nitrogen loading effects from disposal of septic tank effluent; and (2) <100% reserve area for future leachfield replacement.

Alternative 4 would be expected to satisfy Marin County septic system repair requirements as well as waste discharge requirements established by the Regional Water Board. Each of these alternatives would meet standards for new construction, in terms of treatment technology, disposal area conditions and design requirements.

Alternative 5 would be designed to comply with California Water Recycling Criteria for unrestricted recycling uses, a higher environmental standard.

ENVIRONMENTAL IMPACTS

A complete environmental impact report would be prepared separately as the next step in facilities planning work toward a community wastewater project Woodacre. Provided here is a brief overview of the environmental issues posed by the different alternatives. This review is intended to assist in identification of the preferred alternative; it is not a substitute for the environmental documentation requirements of the California Environmental Quality Act.

Alternative 1 will include piecemeal upgrades and replacement of existing OWTS using both conventional and alternative treatment and disposal technologies, like existing practices. There will be increased use of pump systems, fill soil and drainage work, amounting to increases in the amount of land disturbance compared with current and historical practices. The general trend would be toward installing shallow disposal fields matched more closely with the high winter water table and limited depth of permeable soils. The negative impacts of the No Project alternative would be the lack of any comprehensive plan or schedule to bring about the upgrading of onsite systems, and the continued potential for existing impacts on public health and water quality to occur. Another negative aspect of this alternative would be the probable continuing need to revert to holding tanks and regular sewage hauling during the wet season for properties that have no viable on-lot options in high rainfall years.

Alternative 2 will largely eliminate the public health hazards from failing or poorly functioning septic systems through elimination of problematic systems, addition of individual advanced treatment units, and development of upgraded and improved means for onsite dispersal of the treated water. The institution of an onsite wastewater management program will provide the means for monitoring each system to oversee the protection of the local environment against wastewater impacts. The potential negative aspects of this plan would be the land disturbance required on individual properties to upgrade onsite systems. The importing of soil fill, removal of landscaping to make room for advanced treatment units, and raised bed dispersal systems will likely be objectionable in many instances. Conflicts with other uses of limited available land area would be a potentially significant issue. Also, similar to Alternative 1, there are still likely to be instances requiring holding tanks and regular sewage hauling during the wet season for some properties.

Alternatives 3 will pose environmental impacts related to the construction of a sewage collection system, lift stations, and community leachfield at the Dickson Ridge site. The collection system, utilizing small diameter piping, will generate impacts during the construction phase. A large percentage of the pipeline installation is amenable to use of horizontal directional drilling methods, which reduces street disruption and speeds the installation time. HDD installation is also feasible for the pipeline running from San Geronimo Valley Dr to the Dickson Ridge leachfield site. The recommended sewer option includes the use of STEP and STEG systems, which creates the continuing need for septic tank and pump maintenance on individual properties, along with routine septic tank cleaning (e.g., every few years). Pump failures and/or pipeline leaks or breaks would pose the potential for discharge of partially treated sewage to the environment if not properly mitigated through design and operational procedures.

Alternative 4 would have most of the same impacts described for **Alternative 3**, with additional impacts from the proposed secondary wastewater treatment plant. The selected location for the treatment plant is in a relatively isolated location in one of the fields on the east end of the Dickson Ranch, well away from any residences. It will be visible from Sir Francis Drake Blvd, however, since the proposed treatment system design consist of below ground or low-profile tanks and a small control building, it is likely not to be especially noticeable. It would be fenced and could be screened with a soil mound and vegetation to mitigate visual impacts. Noise levels would be low, but there would be regular activity at the site and routine maintenance running of a standby generator. Sewage odors would be minor based on the system design and further mitigated by the isolated location.

Installation of the leachfield at the Dickson Ridge site will entail removal of substantial number of dead and small trees. The larger trees designated for protection will remain and will be avoided through observance of horizontal construction setbacks in accordance with recommendations of a professional arborist who has surveyed the site (see Appendix E). The thick layer of forest litter (duff) in the proposed leachfield area will be pulled back for installation and returned for erosion protection following construction. The soils in the proposed leachfield area have been investigated found suitable for wastewater disposal for either primary or secondary treated wastewater. The arborist has expressed the opinion that the clearing of dead wood and understory along with the introduction of nutrient rich wastewater will be beneficial for the forest.

Alternative 5 would have most of the same environmental impacts as **Alternative 4**, but would provide beneficial uses of treated wastewater and, through seasonal diversion of wastewater for irrigation, would reduce the amount of energy otherwise required for year-round pumping of treated water to the Dickson Ridge leachfield site.

RELIABILITY

Reliability considerations relate to the ability to consistently meet wastewater treatment and disposal objectives and have adequate provisions for emergencies, malfunctions, extreme climatic conditions, or fluctuations in flow.

Alternative 1 would be rated poorly in terms of reliability. Options to correct existing septic system problems will be limited and costly. Some property owners will have extreme difficulty finding solutions that can assure reliable long-term performance because of shallow soil/groundwater conditions and space limitations. Without a concerted effort to systematically assess and upgrade existing systems, many systems will likely remain as is and a source of continuing public health and water quality concerns.

Alternative 2 represents a substantial improvement in reliability through the proposed implementation of an onsite inspection and maintenance program. However, the need to rely on many individual advanced treatment units, although feasible, will intensify the oversight and maintenance requirements, and affect the overall reliability of this alternative.

Alternatives 3, and **4** (Dickson Ridge Community Leachfield) both offer a high degree of reliability over present sewage disposal practices. In both cases the facilities would be capable of meeting State standards for wastewater treatment and disposal, including site suitability for wastewater disposal and built-in emergency and redundancy provisions for potential equipment failures, power outages, etc. **Alternative 4** would be superior to **Alternative 3** since it would include secondary wastewater treatment prior to disposal, reducing the dependence on the soil environment for absorption and treatment of wastewater and thus increasing the reliability of and operating life of the leachfield. The electrical and mechanical elements of the pumping system and the secondary treatment system would be subject to periodic malfunction. However, these aspects of the system are routinely monitored, maintained, repaired and replaced as necessary. On the other hand, damage to and/or decline in the performance of the soil absorption system is not easily remedied; which is a greater concern for septic tank effluent than for secondarily treated effluent.

Alternative 5 would provide the highest level of reliability as it would provide additional ways to disperse the treated wastewater during certain times of the year.

FLEXIBILITY

Flexibility of each alternative relates to the ability to accommodate future connections or building remodels from other Woodacre properties, to be expanded, and to provide recycling/reuse opportunities.

Alternatives 1 and **2** rate very low in terms of flexibility. As stated before, **Alternative 1** offers limited or poor solutions for existing developed properties, let alone assisting in the potential solution of other problems. By establishing a formal management program **Alternative 2** would introduce some additional flexibility for septic system upgrades not only for the properties addressed in the proposed service area, but for other properties in the adjoining areas of Woodacre as well.

Alternatives 3 and **4** would both provide significant flexibility to facilitate current and future upgrade of wastewater management practices in the Woodacre service area. The alternatives rank fairly close to one another on this issue. However, on balance, the greater flexibility would be offered by **Alternatives 4** because of the inclusion of secondary treatment facilities and greater capacity. This will preserve more of the land disposal capacity of the site for future connections, as compared with **Alternative 3**, which includes primary treatment. Also, with small modifications (e.g., disinfection system), the secondary treated water under **Alternative 4** could potentially be used locally for seasonal irrigation of pasture or open space areas in the future. **Alternative 5** would increase system flexibility by providing alternate and increased ways to utilize the treated wastewater.

RESOURCE UTILIZATION

Alternative 1 would create new energy requirements and resource demands only to the extent that individual actions are taken to upgrade existing septic systems with more modern treatment devices.

Alternative 2 would increase energy requirements in comparison with the No Project Alternative, since it assumes that a substantial number of properties would be served by an advanced treatment/dispersal system utilizing pumps and possibly UV disinfection and aeration units. There would also be increased usage of fossil fuels for **Alternative 2** as a result of the construction work for onsite system improvements, regular inspection and monitoring activities, and a somewhat higher rate of septic tank pump-outs that would likely occur with a management program in place.

Alternatives 3 and **4** would have increased energy requirements in comparison with **Alternatives 1** and **2**, because of the need to pump the wastewater uphill to the offsite community leachfield at the Dickson Ridge site. Additional energy use would be required for pumps and other equipment needed for secondary wastewater treatment facilities under **Alternative 4.** Pumping from the septic tank to the collection sewer would be required for an estimated 20% of the properties in the service area due to the terrain; the other 80% would be able to flow by gravity from the septic tank to collection lines. There would also be increased usage of fossil fuels for these alternatives as a result of the more extensive construction work for the community system improvements, and for ongoing inspection and maintenance activities.

Another resource utilization factor is the reuse of treated wastewater. This would be a positive environmental benefit of **Alternative 5**, which would put recycled wastewater to beneficial use. **Alternative 5** would also reduce the amount of energy required for year-round pumping of treated water uphill to the Dickson Ridge leachfield site.

LAND USE

This factor considers the impact of wastewater facilities on individual properties, public areas and other lands**.** **Alternative 2** would pose the biggest impact on individual properties in the service area through the need to modify and expand onsite wastewater systems on each property, affecting existing landscaping and other property improvements and activities. **Alternative 1** would have a similar effect, but not to the same degree. Neither of these alternatives would directly impact land uses elsewhere in Woodacre or surrounding areas. For **Alternatives 3**, **4** and **5**, the recommended sewer system approach (effluent STEG/STEP) would require the continued use and maintenance of individual septic tanks on each property, but the existing land area occupied by individual leachfields, and treatment units in some cases, could be used for other purposes.

With respect to offsite land uses, **Alternatives 3**, **4** and **5** would all involve the installation of sanitary sewers in the local streets, plus one or two lift stations in the community. They would all also include the installation and maintenance of a community leachfield at the Dickson Ridge site, a remote wooded area. **Alternatives 4** and **5** would both entail the construction and operation of a secondary wastewater treatment system at a proposed, relatively isolated site on the Dickson Ranch. Under **Alternative 5**, the use of treated wastewater for irrigation or other accepted recycling uses would generally be considered a positive land use impact.

COSTS

The estimated capital cost and operation and maintenance (O&M) cost for the various wastewater project alternatives are summarized in **Table 6-1.** based on information from **Section 5**. No firm estimates are given for the No Project Alternative or **Alternative 5** (water recycling). For ranking purposes, **Alternative 1** would be most similar to **Alternative 2**, and **Alternative 5** most similar to **Alternative 4.**

COMPARATIVE SUMMARY

An overall comparison is drawn here between the project alternatives, taking into consideration the various factors presented in the section. Numerical ratings were assigned to each alternative for each factor according to the following guidelines. Where projects were judged to be essentially equal for a given factor they were given the same score. Results are displayed in **Table 6-2**. The scoring was based on a combination of objective information (e.g., costs) and subjective best professional judgment. The scoring was based on a combination of objective information (e.g., costs) and subjective best professional judgment. The results are not an absolute determination of the best project alternative, which should be done with community review and input on the information provided in this report.

Table 6-1:
Cost Comparison of Alternatives

COST FACTOR	1 No Project	2 Onsite Upgrades & Mgt. Program	3 Primary Treatment Community Leachfield	4 Secondary Treatment Community Leachfield	5 Secondary Treatment Community Leachfield Seasonal Recycling
Service Area Capacity	-	250	150	250	250
Estimated Total Capital Cost	N/A	$ 17,453,280	$ 7,625,700	$13,343,700	Unknown
Capital Cost Per Parcel	0 to $90,000+	$ 69,813	$50,838	$53,375	Unknown
Annual O&M Cost	N/A	$302,500	$ 195,800	$ 303,600	Unknown
Annual O&M Per Parcel	0 to $2,000+	$1,210	$ 1,305	$1,214	Unknown
Cost Rank	**4***	**4**	**1**	**2**	**2****

*Assume "No Project" costs similar to Alternative 2
** Assume Recycling costs similar to Alternative 4

Note: lowest number equates to highest ranking

Regulatory Compliance

Project alternatives were evaluated with respect to their ability to meet public health and water quality standards, along with the level of standard applicable to the project. Projects were ranked in order of increasing environmental quality standards, and points were assigned according to rank, from 1 (minimum) to 5 maximum. The No Project alternative, which would have the greatest degree of non-compliance, was assigned the lowest ranking and point score. Increasingly higher environmental standards would be met by **Alternatives 2** through **5**, and they were ranked and scored accordingly.

Environmental Impacts

Projects were subjectively ranked in order of decreasing impacts on the natural environment and assigned points according to rank. The least impact project was assigned the highest score (5).

Reliability and Flexibility

Projects were subjectively ranked in order of increasing flexibility and reliability and assigned points according to rank. The most reliable/flexible project was assigned the highest score (5).

Resource Utilization0

Project alternatives were ranked in order of decreasing demands on natural resources, principally energy requirements, and assigned points according to rank. Wastewater reuse was also considered as a positive resource utilization factor; to account for this. Higher points correspond to projects with lower net resource demands.

Land Use

Project alternatives were subjectively ranked in order of decreasing impacts on land uses, based on the amount of land that would be converted or dedicated solely to wastewater treatment and/or disposal uses.

Costs

Project alternatives were ranked by costs, with scoring included for both capital costs and O&M costs to account for the importance of cost in ultimate project selection and implementation. **Alternative 1** (No Project) was ranked similar to **Alternative 2** on average, but with greater uncertainty. Costs to an individual property could be significantly higher than other community-based options depending on circumstances.

Apparent Best Alternative

This comparative analysis shows **Alternatives 4** and **5** to have the highest ranking among the alternatives evaluated and are identified as the “apparent best” alternatives for the Woodacre study area. Since **Alternative 5** has not been fully developed through this study, **Alternative 4** would be identified as the preferred alternative at this time. **Alternative 4** can be viewed and pursued as either a standalone project or as an initial step toward the development of **Alternative 5** should sufficient water recycling opportunities become viable in the future.

As noted before, this evaluation includes some degree of subjective professional judgment on the part of the consultant team. Community members or others may place different weight on the various evaluation factors which could alter the outcome. Also, the availability of funding could affect projects differently, which could in turn affect the actual cost to property owners and the cost comparison between project alternatives. For example, grant funds available specifically for water conservation/reuse may be projects could reduce the effective cost to property owners and elevate the status of **Alternative 5** with respect to costs.   Also, the results of formal environmental studies could provide additional information affecting the comparative ranking among the alternatives.

Table 6-2: Numerical Rating of Alternatives*

FACTOR	1 No Project	2 Onsite Upgrades & Mgt. Program (250)	3 Primary Treatment Community Leachfield (150)	4 Secondary Treatment to Community Leachfield (250)	5 Secondary Treatment Recycling & Community Leachfield (250)
Regulatory Compliance	1	2	3	4	5
Environmental Impacts	1	2	3	4	5
Reliability & Flexibility	1	2	3	4	5
Resource Utilization	5	4	2	2	3
Land Use	2	1	3	5	5
Capital Cost	1	1	5	4	3
O&M Cost	5	4	2	3	3
TOTAL	16	16	21	26	29
RANKING	5	6	3	2	1*

*Alternative not fully developed at this time.

SECTION 8: GOVERNANCE AND FINANCING

Governance

A public entity (District) would be required to assume responsibility for ownership and ongoing operation of any community facilities that are constructed. A public entity is also required to oversee the construction of the wastewater facility improvements, including the acquisition and management of funding for construction as well as for ongoing operation and maintenance. The public entity formed for ongoing operation and maintenance must be in place prior to initiation of project construction.

The present wastewater feasibility study and environmental studies are being conducted by the County of Marin, which has general authority for wastewater management throughout the unincorporated area of the County. Acting in this general capacity, the County has the authority to continue through the design and construction phase of the project, if this is desired.

Appendix H provides an overview of the potential options available along with some of the key considerations that may influence the local decision on an appropriate institutional arrangement for the community. The main options identified include: (a) creation of a new dependent district under the governing authority of the County Board of Supervisors; (b) creation of an independent district with a locally-elected board of directors; and (c) coverage/annexation under an existing independent district such as Marin Water District or Ross Valley Sanitation District. In general, all options presented are technically viable; the ultimate decision by the community would likely focus on issues of local autonomy, economics and possibly political or personal preferences. Preliminary analysis indicates the creation of a dependent district under the County of Marin, as followed for the Marshall Community Wastewater project, as the apparent best course of action.

Financing

Construction Financing

Grant Funding. Grant funds may potentially be available to help finance a portion of project implementation. Such funds could potentially be used to pay for administration, planning and design-related services, and construction costs. However, it is likely that any grant funds would only be able to cover a portion of the total costs. For example, in the Marshall Phase Community Wastewater Project, grant funds covered roughly half of the overall project costs.

Assessment District. The primary source of funding for implementation of the recommended community wastewater project would be provided through the formation of a local assessment district. This is one of the most common methods used to finance wastewater treatment systems and other public works projects. The assessments would be secured against the properties in the project service area that receive benefits from the facilities. The funds raised through this process would then be used to support low-interest loans and/or the sale of bonds to pay for the balance of the construction costs not covered by grants.

Ongoing Operation and Maintenance Fees

Once constructed, the project facilities would require ongoing operation and maintenance, the costs for which would be paid through the collection of fees or user charges from all properties served by the project. These fees are normally collected as part of the annual property tax bill. Estimated annual operation and maintenance costs are summarized Section 6, **Table 6-1**, indicating an annual per parcel cost of about $1,200 to $1,300 for the various alternatives. As discussed below, annual O&M fees would be established by ordinance for all property owners receiving wastewater services, and would normally be updated and approved annually by the Board of Supervisors (or District Board of Directors).

Ordinances

It is anticipated that project implementation would require adoption of two ordinances pertaining to the provision of wastewater service as noted below.

Wastewater Regulations Ordinance

The Wastewater Regulations Ordinance would be the basic document regulating the use of the community wastewater system, including such things as installation and connection of building sewers, installation of sewer laterals, maintenance of STEG and STEP units, permits and procedures for installation and connections to the system, discharge of waters and wastes into the system, construction standards, prohibitions, enforcement and other administrative issues.

Fee Ordinance

The fee ordinance would cover the fees charged to property owners receiving wastewater services, and is normally updated and approved annually by the Board of Supervisors (or District Board of Directors). It would, for example, address the method of determining the fees related to the administration of the wastewater facilities, including operating, maintaining, managing, upgrading, and replacing components of on-lot facilities, collection system, treatment plant and wastewater disposal field. It would also address the of method fee collection, which is normally via the property tax bill.

SECTION 9: REFERENCES

California Division of Mines and Geology. 1976. Geology of the San Geronimo Valley Area, Marin County, California. Geology for Planning in Central and Southeastern Marin County, California. OFR 76-2 S.F., Plate 1A. San Geronimo, Geology.

California Division of Mines and Geology. 1976. Interpretation of Relative Stability of Slopes the San Geronimo Valley Area, Marin County, California. Geology for Planning in Central and Southeastern Marin County, California. OFR 76-2 S.F., Plate 2A. San Geronimo, Slope Stability.

California Regional Water Quality Control Board, San Francisco Bay Region. July 8, 2005. Pathogens in Tomales Bay Watershed - Total Maximum Daily Load (TMDL). Proposed Basin Plan Amendment and Staff Report.

Crites, R. and G. Tchobanoglous. 1998. Small and Decentralized Wastewater Management Systems. WCB/McGraw Hill.

Marin County Environmental Health Services. File review of available septic system permit information for parcels in study area.

Marin County Environmental Health. Sewage Disposal Regulations. 2008
http://www.marincounty.org/depts/cd/divisions/environmental-health-services/septic-systems

State Water Resources Control Board. June 2009. Order No. 2009-0006-DWQ. General Waste Discharge Requirements for Landscape Irrigation Uses of Municipal Recycled Water http://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/docs/wqo_2009_0006_general_permit.pdf

State Water Resources Control Board. 2014. Order WQ 2014-0153-DWQ. General Waste Discharge Requirements for Small Domestic Wastewater Treatment Systems http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2014/wqo2014_0153_dwq.pdf

U.S. Department of Agriculture - Soil Conservation Service. March 1985. Soil Survey of Marin County, California.

U.S. Environmental Protection Agency. 2002. Onsite Wastewater Treatment Systems Manual

U.S. Department of the Interior - US Geological Survey. 2000. USGS geological map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma County, California